Environmental and Social Impact Assessment for Water Supply Alternatives

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Executive Summary

Introduction

This report has been prepared in part to support the Tulu Moye Geothermal Operations (TMGO) Main Project, which is a multiphase development of up to 520 Megawatt of geothermal power. Specifically, this report describes work that has been carried out to assess the environmental and social impact (ESIA) of water supply alternative, hereafter referred to as 'the Project' (and distinctly separate from the TMGO Main Project). This Project ESIA has been undertaken to address both national and international regulatory requirements and environmental and social standards. The following sections describe the context of the Project ESIA with respect to the TMGO Main Project ESIA.

TMGO Overview

The TMGO Main Project involves the exploration, design, development, financing, construction, operation, and maintenance of a geothermal power plant to be located approximately 150 km south east of Addis Ababa in the Oromia region of Ethiopia. The power plant will be developed in a series of four phases over the next 7.5 years and is ultimately expected to have an output of up to 520 MW. The TMGO Main Project ESIA covers the exploration and production drilling (and well pads), supporting infrastructure (including access roads, quarries and pipelines), and the construction and operation of the power station to 100 MW. The latter includes details regarding turbines/generators, collection pipelines (wells to power station), cooling tower, discharge outlet, and wastewater treatment system.

The phasing of the TMGO Main Project is expected to be delivered in incremental additions of 50 MW, 100 MW, 100 MW, and 270 MW respectively to create 520 MW capacity overall, being completed in 2027. Construction of each phase is expected to take between 3 and 5 years depending on the generating capacity of that phase. However, between 2020 and 2025 there will be an overlap in the construction of phases, with 2 to 3 phases being constructed simultaneously in any one year. Once the TMGO Main Project is fully constructed in 2027, it is expected that it will have an operational life of approximately 25 years, dependent on the life of the geothermal resource. If the resource conditions remain favorable after 25 years, equipment can be refurbished or replaced at the end of their design life to upgrade and repair equipment to enable operation and generation to continue.

Project Summary

As with other geothermal operations, TMGO requires access to water resources. While the TMGO Main Project ESIA and permit assumed that sufficient groundwater resources would be available to meet the demands for both exploratory drilling and power plant operation within the Concession Area, recent investigations have failed to find sufficient groundwater within it. TMGO are therefore now exploring a range of alternative water supply sources outside of the permitted Concession Area with the latter being the subject of the Project ESIA process. This Project ESIA for water supply alternatives assesses the impact of the water requirements for Phase 1 of the TMGO Main Project and is supplementary to the TMGO Main Project ESIA.

In consultation with TMGO the water demands for normal drilling activities, emergency stand-by, power production, fire, and construction have been reviewed and a total demand of 35 L/s has been set as a peak demand for extraction from the environment. The preferred option for TMGO is to source water from a groundwater extraction to the south west of the town of Iteya with a secondary option to source water from the springs at Gora and Wareka to the south east of the

Concession Area. If the groundwater extraction to the south west of Iteya is not feasible, groundwater extraction closer to the Gora and Wareka springs will be considered although the specific location of the extraction has not yet been identified. Other options associated with extraction of water from Lake Koka or tankering of water to site have been discounted during the project scoping stage due to concerns around numbers of affected stakeholders and impacts of vehicle movements, respectively.

ESIA Objectives

Work undertaken for this Project ESIA includes:

1. Identifying the regulatory and financing requirements applicable to the Project (Section 2);
2. Describing the principal Project features and technical specifications (Section 4);
3. Summarizing the approach used to inform the design of the Project and assessment of alternatives and options for the Project (Sections 4 and 5);
4. Describing the E&S baseline of the Project in terms of key sensitivities and potential constraints on the construction, operation and maintenance, and decommissioning of the Project (Sections 7 and 8);
5. Assessing the potential impacts of the Project and Project-related activities on the environment (including hydrological, ecological and socio-economic resources (Sections 9, 10 and 11); and
6. Designing mitigation or enhancement measures to avoid, reduce or eliminate negative impacts to the environment (Sections 12 and 13).

Project Standards

This Project ESIA has been undertaken to address both national and international regulatory requirements and environmental and social standards and allow application of relevant good international industry practice (GIIP) to the Project operations. This includes standards and requirements associated with:

- National environmental and social laws and regulations;
- International Finance Corporation (IFC) Performance Standards, General Environmental Health and Safety (EHS) Guidelines (2007), and Industry Specific EHS Guidelines;
- ISO 45001 and 14000 requirements;
- International Labour Organization (ILO) Conventions.

ESIA Scoping

As part of the overall Project ESIA process (described in more detail in Section 3) a scoping exercise was undertaken, and agreed upon with TMGO, as described in Appendix A of this report. As part of this, a desktop review of the TMGO Main Project ESIA combined with a scoping field visit in July 2019 were used to identify scope and intent of the Project ESIA to be undertaken, relevant regulations, standards, and guidelines to be considered during the ESIA process, description of the alternatives reviewed and selected options, key potential impacts, and identification of further studies required.

ESIA is a process that functions most effectively when applied throughout the phases of project design, development, construction, operation, and decommissioning. The study reported in this Project ESIA has been undertaken early in the Project development process and as a result a number of water-supply options are still under consideration. Given this, a precautionary approach has been adopted for this assessment based on the consideration of two water supply options (outlined further in Section 5):

1. Extraction of groundwater from the Iteya site (the preferred option)
2. Extraction of waters from the Gora and/or Wareka springs

A potential third option is to extract groundwater from one or more sites closer to the springs. The locations and extraction quantities of such sites have not yet been defined. As a result, the specific impacts are uncertain. Nonetheless this option is likely to represent a combination of the impacts associated with the two options listed above and therefore it is not considered further in this assessment.

The scoping exercise identified a need for further specific stakeholder engagement with people and organizations who might be impacted by the Project (this was in addition to stakeholder engagement undertaken as part of the TMGO Main Project ESIA). It also identified the need for specific ecological and flow gauging surveys to assess the environmental baseline of the streams that the Gora and Wareka springs feed into.

The Project Area of Influence (AoI)

A single Project AoI has been identified which considered the spatial extent of potential social and environmental impacts. The Project AoI has included consideration of the community engagement process which focusses on the Hitosa district and is defined by the location of the proposed deep groundwater extraction at Iteya and the nearest water features on which it may have an impact. The Project AoI therefore considers the impacts of groundwater extraction and the impacts from the use of the Gora and Wareka spring waters. The Project AoI covers 15 Kebeles or Peasant Associations and one Seed Enterprise.

The AoI for the environmental impact assessment is the same as that used for the social impact assessment. The Project AoI does not include all areas potentially affected by groundwater draw-down from the wells. Once the results of the pump testing and groundwater investigation are known, the Project AoI will be reviewed. If areas outside of the presently defined Project AoI have the potential to be impacted by groundwater extraction, then these additional areas will be included and assessed as part of the Project ESIA as appropriate.

Stakeholder Engagement

Initial stakeholder engagement was undertaken for the TMGO Main Project in 2015 and in spring 2019. The results of this, plus the consultation studies undertaken in July 2019 and December 2019 for the Project, are reported in Section 6. Four categories of stakeholders were identified including for the water supply alternatives, namely:

- Government authorities,
- Water Supply Service (WSS) enterprises,
- people affected by the project and
- civil society organizations.

TMGO will need to communicate different information to each of these groups. Effective communication with local people who use the Gora and Wareka springs and streams, as well as the Boru Jawi and Hitosa WSS enterprises which extract water from the springs, are considered particularly important in this regard.

Stakeholder Comments on Water Supply Options

Specific discussions on the proposed water supply alternatives were held with various stakeholders during the July 2019 scoping visit to better understand their expectations and concerns. Stakeholders were informed about the two water supply options (groundwater and spring water) and were asked if they thought it was possible to share groundwater, or water from the Gora and Wareka springs, and under which conditions that would be possible. The stakeholders were also able to share their concerns and expectations of the Project. The various meetings revealed the following:

- There is broad support for the Project at a federal/regional level subject to appropriate permitting applications. There is also broad support at the local Woreda level, subject to an assessment of the benefits and costs of the Project and the agreement of the community. At all meetings the importance of community approval in securing access to available water sources and the need to avoid conflicts over water supply was stressed.

- The two community focus groups indicated that the local population expects the Project to provide clean drinking water, either from groundwater or spring water.

- WSS enterprises indicated that they are prepared to provide access to their water resources under the following conditions:

    - TMGO can provide a larger water pipeline (from 3 to 5 inch) and a new reservoir of 200 m^3.

    - TMGO can rebuild the catchment boxes, install a larger water pipeline, build a new water reservoir, and contribute to operations and maintenance costs.

These initial consultations were followed-up on in December 2019 with in-depth discussions with stakeholders to identify more detailed impacts and to propose practical mitigation measures. This included meetings with the Hitosa Woreda Bureau of Water and Energy, Hitosa Woreda Agriculture Office, Hitosa Woreda Health Office, Hitosa WSS enterprise, Boru Jawi WSS enterprise, residents of Shaki Sherara, residents of Iteya, residents of Tero Moye, and residents of Boneya Edo. Expectations and suggestions raised during the December 2019 consultations are described in Table 6.2 of Section 6.2. In general, consultees indicated that they would prefer water be extracted from Gora spring rather than Wareka because they thought there was more water available at Gora. They would also not

like to see water supplies to the community or farming irrigation downstream decrease, and they would like TMGO to contribute to improving water infrastructure.

Consultees did not object to the extraction of groundwater but warned that if groundwater is provided to some communities and not to others that this may lead to conflict.

Ecological and Environmental Baseline Studies

An ecological survey and stream flow gauging survey were undertaken in December 2019 to assess the environmental baseline for the watercourses that are fed by the Gora and Wareka springs.

The flows immediately downstream of the Gora and Wareka springs were measured, as were flows from two tributaries of the Wareka stream known as Ada and Le Kole. The stream flow gauging survey indicates that flows in the Gora and Wareka stream catchments are approximately double that of the currently recorded flows from the spring boxes themselves. This may be due to seasonal fluctuations (i.e., stream baseflow is higher in December shortly after the rainy season rather than at the end of the dry season) and/or that the streams are filled with groundwater baseflow outside of the locations of the spring boxes (assuming it is not surface water runoff from recent rainfall events in the catchment). There may be sufficient water for TMGO in the wider Gora and Wareka stream catchments, but the feasibility of this supply remains to be demonstrated and is outside the scope of this Project ESIA.

Ecological surveys were undertaken at 19 locations in the area of the Gora and Wareka springs and associated streams (13 within the Project AoI and 6 controls). This included habitat surveys and stream sampling. Samples of aquatic invertebrate indicator species were used to assess ecological water quality and the streams were shown to be of good water quality.

In general, the streams were found to support a range of common species typical of the local environment. However, sampling at four of the control sites outside of the Project AoI recorded four species listed in the International Union for Conservation of Nature (IUCN) Red Data Book as globally rare or threatened (3 frogs and a dragonfly). These species are also of national conservation importance and include three species categorized as Vulnerable by the IUCN; the fourth, the Somali Grassland Frog *Ptychadena nana*, is considered Endangered and has a highly restricted range. These watercourses (outside of the Project AoI) are expected to meet the criteria for Critical Habitat for the endangered frog, although given its preference for high altitude locations its range is not expected to extend to sites within the Project AoI. Additional species-specific surveys will be undertaken along Project-affected watercourses as part of implementing the Project Environmental and Social Management Plan (ESMP).

A qualitative understanding of baseline groundwater conditions was developed from a desktop review of existing reports and other related information. However, no pumping test reports and monitoring well records were available to determine aquifer units, transmissivities, or water quality. It is therefore not possible to quantitatively define the groundwater baseline at the present time. Social and environmental impact assessments for groundwater were performed against the qualitative baseline to the extent possible given the limited available information.

Social Impacts

Social impacts were assessed for both short term impacts related to the construction of the Project and longer-term impacts associated with the operation or water extraction. Key social impacts identified are the following:

1. Temporary land acquisition and resettlement impacts arising from the groundwater extraction option;

2. Permanent land acquisition and resettlement impacts arising from the groundwater extraction option;
3. Social conflicts over access to water arising from the groundwater extraction option;
4. Water shortages for current users arising from spring water extraction;
5. Land take and resettlement impacts arising from spring water extraction;
6. Impact on improving the sustainability of water supply systems (both spring and groundwater);
7. Impact on increasing the amount of water available in water supply systems (both options);
8. Impacts on community health and safety from construction activities (both options).

Of the impacts assessed above, six were considered Low to Moderate significance. Impact 4 was assessed as an impact of High Adverse Significance which may lead to conflict. Impact 3 could potentially be significant, but it cannot be fully assessed at this stage because groundwater pumping tests are not available to quantify the effects of groundwater drawdown around the extraction either near Iteya or closer to the springs. Nonetheless, if groundwater is provided to some communities and not others, this may also lead to social conflict.

Environmental Impacts

Temporary impacts of the Project include impacts associated with the construction of wells and pipelines from the springs/groundwater extraction area to the TMGO Main Project drilling site and discharge of groundwater to the environment during pump testing.

Long-term impacts associated with groundwater extraction will be assessed from pumping tests (which are not yet available from TMGO). Surface water extraction impacts have been evaluated based on expected TMGO demand from specific spring sites against levels that can reasonably be supplied without negatively impacting the environment. The Gora water zone management team has advised that up to 50% of the spring flow is available for water supply (to TMGO and other users), and that the remaining 50% should remain to preserve a water supply for down-stream users and to sustain environmental conditions. This approach to allocation however would exceed the requirements for EFlow calculations recommended by the World Bank Group, and thus the 50/50 allocation has been applied to the assessment for both the Gora and Wareka springs combined.

The following four impacts were assessed with respect to groundwater (Impact 1 and 2) and the springs (Impacts 3 and 4):

1. Pipeline construction damaging habitat and discharge of groundwater pumping test water discharged to watercourses.
2. Drawdown of springs and other groundwater-fed features that wildlife is dependent on as a result of groundwater extraction.
3. Pipeline construction damaging habitat from spring water extraction.
4. Ecological harm downstream of the springs coming from spring water extraction.

Impacts 1 and 3 relate to construction and were assessed as being adverse and of low significance because they can be managed through the existing ESMP and GIIP. Impact 4 was assessed as a high adverse impact for stream ecology because, although the endangered or threatened species were recorded upstream of the proposed extraction points outside of the Project AoI, the TMGO extraction as planned would mean that at least

50% of the spring flow (and potentially more) would not be available for the existing good ecological quality streams.

Impact 2 for the extraction of groundwater could not be assessed at this stage because reports on pumping tests and groundwater monitoring are not yet available. However, this impact has the potential to be significant.

Cumulative Impacts

Cumulative impacts and impact interactions are assessed in Section 11. The adverse effects to sensitive social and environmental receptors associated with the Project have the potential to be made worse by other changes to water supply and demand pressures given the already constrained nature of water resources in the Project AoI.

Water sources in the Project AoI have the potential to be affected by climate change. General predictions for Ethiopia suggest that there will be a slight increase in mean annual rainfall during the 2020s, with the occurrence of heavier rainfall events and flood and drought events likely to increase. It is also anticipated that there will be considerable geographic variation in rainfall amounts, particularly in regions of high or complex topography such as the Ethiopian Highlands. Reports also indicate that climate change may reduce Ethiopia's Gross Domestic Product (GDP) by up to 10% by 2045, primarily through impacts on agricultural productivity related to climate variability and drought. Key climate impacts identified for Ethiopia include reduced water quality and quantity and drying of wetlands and freshwater sources. More locally, data collected 30 km from Iteya has shown a nearly 40% reduction in rainfall over a period of 38 years, or about 10% per decade.

The Project AoI is currently water stressed, and water rationing is in place. Current conditions could be made worse by both the introduction of new, water intensive projects (e.g., to increase agricultural production) or as a result of local population growth and increased community water needs for drinking and sanitation purposes. This may already be the case, with, for example, the decline in the Gonde spring discharge rates being attributed to changes in upper catchment land management and changes in vegetation. This, coupled with local population growth rates of up to 14% per year, is currently affecting local water resource availability.

There are currently no planned industrial activities requiring water supply in the Project AoI, and the Arsi Water Office has stated that other than the TMGO Main Project, they are not aware of any other planned industrial or agricultural projects. TMGO are also not aware of any such planned projects.

Mitigation Measures

Mitigation measures for social and environmental impacts are described in the framework Social and Environmental Management and Monitoring Plans of Sections 12 and 13.

<u>Mitigation for Social Impacts</u>

For social impacts mitigations include reducing the Project footprint and its impact on the local population to the extent feasible. For example, TMGO plans to bury the pipeline, which will permanently limit land acquisition requirements. Although compensation for crops during the construction period will still be required, project affected persons can be compensated through the existing Resettlement Policy Framework (RPF). In this regard, a data gap currently exists in that more detailed design proposals including pipeline routes for the proposed extractions at Gora and Wareka springs are needed before a full impact assessment with mitigation, monitoring, and stakeholder engagement can take place.

Regarding stakeholder engagement it will be important to complete the engagement mechanisms by organizing public consultations and interviews with local authorities for adequate compensation and disclosure. These consultations and interviews will also be

documented as and when they occur. TMGO will also work with local WSS and water regulators to monitor and manage water resources. This will include improving water supply infrastructure for the local population.

Mitigation for Environmental Impacts

Given the developing nature of the water supply feasibility studies, an adaptive management approach has been adopted for the Project ESIA, notably with regard to the impact assessment, mitigation, management, and monitoring options. The ESMP will be updated as more information becomes available and the water supply option to be carried forward is confirmed. Monitoring programs are also proposed where supplementation of existing information is desirable. Should these programs highlight changes to the nature or significance of expected impacts, or the effectiveness of proposed mitigation, the proposed mitigation, management, and monitoring plans will be adapted to address those changes. Further information on the Project ESIA limitations is provided in Section 3.11.

Environmental impacts associated with discharge water and pipeline construction will be managed using GIIP under the current construction phase ESMP. This will include testing of water quality and assessment of environmental risks associated with the proposed discharge locations.

Operational environmental impacts will be mitigated by controlling extraction rates so that they do not exceed minimum environmental flows designed with species conservation objectives in mind. These flows should be determined based on the World Bank EFlow standards and agreed with the authorities (and any lenders) and monitored. Further surveys will also be undertaken to confirm that the threatened or endangered species (including the grassland frog) will be unaffected by the extraction.

The provision of compensatory water (to both downstream users and the aquatic environment) should also be considered during times of low rainfall and high-water demand. This would require an assessment and agreement with water regulators as to the extent of surplus water in the Gora and Wareka catchments which could be stored and provided to downstream users. A key point would be to agree with water regulators on how much can be extracted and at what time of year.

Water Resources - Groundwater Extraction

The potentially significant groundwater extraction impact on water resources will be assessed through testing and monitoring, which will include long term groundwater pumping tests (of a month duration or more, which is outside the scope of this study) with associated monitoring to determine the available aquifer resource and the impact of extraction on other water features such as springs and streams. The monitoring tasks are:

- A series of groundwater monitoring wells will be installed close to the pumping well to help determine the complexity of the underlying aquifer. These wells will enable aquifer transmissivity to be calculated and the impact of groundwater level drawdown to be quantified. These monitoring wells will be monitored before, during, and after a long-term pumping test. Year-long groundwater level monitoring will also be undertaken to determine seasonal variations in water levels and this will continue for the time groundwater is being extracted for Project purposes.

- Monitoring well and discharge water quality will be sampled at regular intervals (approximately weekly but this may vary depending on the stage of the test) during the long-term pumping test such that results will meet World Health Organization (WHO) Guidelines for Drinking Water Quality.

- Monitoring of nearby spring flow rates and water quality will be undertaken before, during, and after the long-term pumping test and this will continue for the time groundwater is being extracted for Project purposes.

Water Resources – Spring Extraction

For spring extraction, a wider water resource investigation (outside the scope of this study) will be undertaken to include Gora and Wareka catchments, groundwater, and define an overall water balance for the Project AoI. This study will also quantify the impacts of increasing water demand due, for example, to population growth and reductions in water supply relating to such factors as reduced rainfall and recharge resulting from climate change and changing land use.

- Long-term monitoring (for the lifetime of the Project) will be undertaken to measure quality and quantity of water from springs and watercourses in the Gora and Wareka catchments. This will, at a minimum, be done on a monthly basis to identify seasonal changes and long-term trends.
- Spring and stream water quality will be sampled at regular (weekly) intervals during the pilot tests. Samples will be tested to WHO Guidelines for Drinking Water Quality.
- Downstream water usage will be quantified by monthly flow measurements and through consultation with local water users to establish a catchment flow balance.
- A detailed assessment is required of the local distribution of the four rare and threatened species that were found outside the Project AoI during the December 2019 survey.

Information gaps remain with regard to the quantitative assessment of impact of groundwater extraction on local water resources (awaiting pumping test reports from the TMGO wells near Iteya). Downstream impacts to users of spring water at Wareka and Gora can also only be qualitatively assessed as information on consumption levels for irrigation and other purposes, which may vary through the year are not available. Left unmitigated, the groundwater extraction proposals create the potential for social conflicts regarding access to the water, and this would be considered a significant adverse impact. However, once the groundwater investigation impacts have been quantified (with pumping test data) and water quality data is available, it would be possible through further stakeholder engagement to reach agreements on water access that may enable the broad community support necessary.

Residual Impacts

With the effective implementation of mitigation (including that outlined above) residual negative impacts of the Project can be reduced to moderate levels of significance. This will, however, require extensive community consultation and agreement on extraction levels to enable social and ecological needs to still be met. The framework ESMP's provided within Sections 12 and 13 of this Project ESIA, including the mitigation measures outlined above, must be operationalized for this is achieved.

Abbreviations

AoI	Area of Influence
CEDAW	Convention on the Elimination of All forms of Discrimination Against Women
CLO	Community Liaison Officer
CMS	Conservation of Migratory Species of wild animals
CRC	Convention on the Rights of the Child
CSE	Conservation Strategy of Ethiopia
dB	Decibel
EBI	Ethiopia Biodiversity Institute
EHS	Environmental Health and Safety
EIA	Environmental Impact Assessment
EP	Equator Principles
EPFI	Equator Principles Financial Institutions
EPA	Environmental Protection Authority
E&S	Environmental and Social
ESAP	Environmental and Social Action Plan
ESF	Environmental and Social Framework
ESG	Environmental and Social Governance

ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESMS	Environmental and Social Management System
FAO	Food and Agriculture Organization of the United Nations
FDRE	Federal Democratic Republic of Ethiopia
FGD	Focus Group Discussion
g	Gram
GHG	Green House Gases
GIIP	Good International Industry Practice
GIS	Geographical Information System
GTP	Growth and Transformation Plan
HPR	House of Peoples' Representatives
IBA	Important Bird Area
IBAT	Integrated Biodiversity Assessment Tool
IFC	International Finance Corporation
ILO	International Labour Organisation
IUCN	International Union for Conservation of Nature
L/s	Liters per second
MoWIE	Ministry of Water, Irrigation and Energy

MW	Megawatt
ONRS	Oromia National Regional State
ORA	Oromia Roads Authority
PAP	Project Affected Person
PLC	Private Limited Company
RAP	Resettlement Action Plan
RDB	Red Data Book
RPF	Resettlement Policy Framework
SEP	Stakeholder Engagement Plan
UNFCCC	United Nations Framework Convention on Climate Change
VEC	Valued Environmental and Social Component
WBG	World Bank Group
WHO	World Health Organization
WSS	Water Supply Service
RG	Reykjavik Geothermal

Glossary

Geothermal power generation	Involves drilling deep production wells into the Earth's crust to harness the thermal energy contained in underground reservoirs of geothermal waters or steam.
Power plant	Second of the two main components of the geothermal power plant process, where the extracted steam is used to generate electricity.
Environmental and Social Impact Assessment (ESIA)	A forward-looking instrument that is able to proactively advise decision-makers on what might happen if a proposed activity is implemented. Impacts are changes that have environmental, political, economic, or social significance to society. Impacts may be positive or negative and may affect the environment, communities, human health and well-being, desired sustainability objectives, or a combination of these.
Biodiversity	Variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species, and of ecosystems.
Critical habitat	Critical habitats are areas with high biodiversity value, including (I) habitat of significant importance to Critically Endangered and/or Endangered species; (ii) habitat of significant importance to endemic and/or restricted-range species; (iii) habitat supporting globally significant concentrations of migratory species and/or congregatory species; (iv) highly threatened and/or unique ecosystems; and/or (v) areas associated with key evolutionary processes.
Exploration	Geothermal resource confirmation phase that can include surface studies, reconnaissance, exploration drilling, feasibility study and production phase ESIA.
Habitat	Terrestrial, freshwater, or marine geographical unit or airway that supports assemblages of living organisms and their interactions with the non-living environment
Hazardous waste	By-products of society that can pose a substantial or potential hazard to human health or the environment when improperly managed. Substances classified as hazardous wastes possess at least one of four characteristics—ignitability, corrosivity, reactivity, or toxicity— or appear on special lists.

Magnitude	The assessment of magnitude is undertaken in two steps. Firstly, the magnitude of potential impacts associated with the Project are categorized as positive or negative. Secondly, the positive or impacts are categorized as major, moderate, minor or negligible based on consideration of a number of parameters.
Pollution	Refers to both hazardous and non-hazardous pollutants in the solid, liquid, or gaseous forms, and is intended to include other forms such as nuisance odors, noise, vibration, radiation, electromagnetic energy, and the creation of potential visual impacts including light.
Production	Steam field and power plant development phase that can include production drilling and development of steam above ground system (SAGS) and power plant.
Sensitivity	The sensitivity of a receptor is determined based on the review of the population (including proximity / numbers / vulnerability), presence of biological features of the site and the surrounding area, soil, agricultural suitability, geology and geomorphology, proximity of aquifers and watercourses, existing air quality, presence of any archaeological features etc.
Significance	Significance of impact takes into account the interaction between the magnitude and sensitivity criteria.
Stakeholders	Stakeholders are persons or groups who are directly or indirectly affected by a project, as well as those who may have interests in a project or the ability to influence its outcome, either positively or negatively.
Baseline survey data	Initial collection of data which serves as a basis for comparison with the subsequently acquired data

1.0 INTRODUCTION

1.1 INTRODUCTION

This document is the Environmental and Social Impact Assessment (ESIA) of the proposed **Tulu Moye Geothermal Operations ("TMGO") Phase 1 Water Supply Project** (henceforth the "Project"). TMGO itself involves the multi-phase development of up to 520 Megawatt (MW) of geothermal power (described further below) with Phase 1 involving initial exploratory drilling works and the development of up to 50 MW of power. While TMGO has a large Concession Area for which a full ESIA has already been completed, a suitable source water has not yet been found within this area and as a result the Project will be located outside of this Concession Area near the town of Iteya and its nearby springs. The Project Area of Influence (AoI - detailed further later in this report in Section 4) is based on this new area. This Project ESIA focuses on those environmental and social (E&S) receptors within the Project AoI that could be affected by the proposed use of either groundwater or spring-fed water sources.

1.2 THE SCOPING AND ESIA STUDIES

The Project ESIA has been developed to help TMGO and its key stakeholders (including regulators and financing bodies) better understand material E&S constraints and opportunities associated with the provision of a robust and sufficient water-supply to TMGO Phase 1**.** It focuses on those options that have been agreed to be taken forward by TMGO and builds on, but does not replicate, the work already undertaken by TMGO and its consultants since 2014 on the TMGO Main Project ESIA. The scoping report[1] for this study is provided in Appendix A. The scoping study itself is based on a series of desktop studies, a site visit to key Project locations in July 2019 (including meetings with key stakeholders), and an initial permitting review. It is noted that during the July 2019 site visit the Ethiopian Regulatory Authorities confirmed that the development of an appropriate water supply is considered as part of the TMGO Main Project (permitted in 2018) and does not require a full regulatory ESIA. The scoping exercise was developed based on the existing TMGO Main Project ESIA, a field visit, and discussion with TMGO and stakeholders.

In addition to TMGO Main Project ESIA environmental surveys and stakeholder engagement were undertaken by Stantec in December 2019.These have further informed the environmental and social impact assessment recorded in this report.

1.3 STRUCTURE OF THIS REPORT

The report is structured as follows:

- Section 2.0 – Legislative and Policy Framework;
- Section 3.0 – ESIA Process;

[1] Stantec Consulting (2019): Final Tulu Moye Geothermal Development Project Scoping – Phase 1 Water Supply Alternative. Revision 2.

- Section 4.0 – Project Description;
- Section 5.0 – Project Alternatives;
- Section 6.0 – Stakeholder Engagement;
- Section 7.0 – Environmental Baseline
- Section 8.0 – Social-Economic Baseline
- Section 9.0 – Environmental Impact Assessment
- Section 10 – Social Impact Assessment
- Section 11 – Cumulative and Impact Interactions
- Section 12 – Environmental Management Plan
- Section 13 – Social Management Plan

2.0 REGULATORY AND FINANCING REQUIREMENTS

2.1 INTRODUCTION

TMGO is committed to meeting national and international regulatory requirements and environmental and social standards and applying relevant good international industry practice (GIIP) in its operations. This includes, but is not limited to, commitments to meeting the following:

- National environmental and social laws and regulations;
- International Finance Corporation (IFC) Performance Standards, General Environmental Health and Safety (EHS) Guidelines (2007), and Industry Specific EHS Guidelines;
- ISO 45001 and 14000 requirements;
- International Labor Organization (ILO) Conventions.

A detailed analysis of the overarching policy and legislative framework governing geothermal projects is contained in Section 4 of the TMGO Main Project ESIA, dated November 2017. The section below focuses on policy and legislation specific to the Project.

2.2 NATIONAL REGULATORY REQUIREMENTS

Constitutionally, the Federal Democratic Republic of Ethiopia (FDRE) comprises the Federal State and nine Regional States. Each of the Regional States is subdivided into Zones, which in turn are subdivided into Woredas (districts) which are the basic administration unit. Each Woreda is further subdivided into Kebeles (subdistricts) which are the smallest administrative unit. Each administrative unit has its own local government elected by the people. The highest legislative authority in Ethiopia is the House of Peoples' Representatives (HPR), which is responsible at the Federal Level for enacting laws and ratifying national policy standards. The Ethiopian Constitution confers equal recognition for both States and the Federal Government and the Constitution shows that States are independent both financially and structurally. The Constitution confers on executive, judicial, and legislative powers with the Regional Governments as it does the Federal one[2]. Duties and responsibilities of Regional States include planning, directing and developing social and economic development programs, as well as the protection of natural resources of their respective regions. A representation of the key controlling documents is shown in the Figure 2.1.

This Project ESIA includes specific consideration of those regulatory requirements to be met by the Project.

[2] Wondirad,Ameha, 'An Overview of the Ethiopian Legal System'

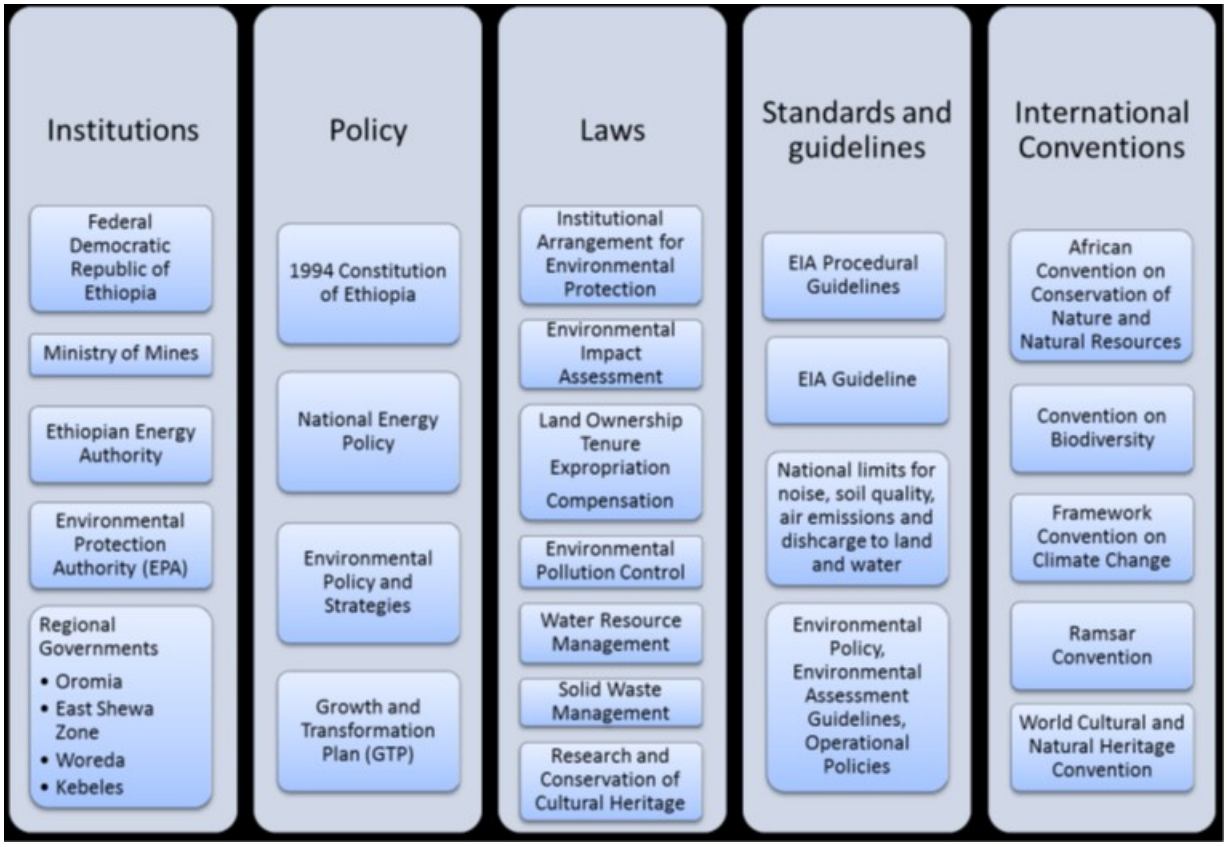


Figure 2.1: Key Controlling Institutions, Policies, Laws, Standards & Guidelines and International Conventions for the Project[3]

Key national-level documents of relevance to the Project are:

- **National Water Strategy of Ethiopia** (FDRE, 2001). Section 4.1.10 on Environment and Health Standards states that environmental conservation and protection will be treated as an integral part of "water resources projects", and that Environmental Impact Assessments (EIA's) are mandatory for all such projects. The strategy does not, however, provide a definition/threshold for a "water resources project' and consultation with regulators during this scoping study indicated that the relatively low volumes of water required did not qualify it as such a project.

- **Ethiopian Water Resources Management Proclamation No. 197/2000**. This states that persons constructing waterworks, supplying water, or transferring water which has been extracted from a water resource, shall require a permit.

Further regulatory requirements relevant to the Project are shown in Table 2.1 below:

[3] VSO (2017) Tulu Moye Geothermal Development Project - Phase I: Environmental and Social Impact Assessment, Section 4.1

Table 2.1: Key Regulatory Requirements

Requirement	Project Implications
Ethiopian Water Resources Management Policy (FDRE, 1999)	Where water is to be drawn from sources which are utilized by other stakeholders (e.g., local communities) and during periods of drought extraction may be restricted. Should the Project have been deemed a 'major water resource project' an EIA would have been required, although this was not the case. Wastewater should be controlled and treated to see that water bodies are not polluted.
National Water Strategy of Ethiopia (FDRE, 2001)	Where water resources are to be drawn from sources which are utilized by stakeholders (e.g., local communities) and during periods of drought extraction may be restricted. Where activities have adverse effects to aquatic environments (e.g., depletion of ground water resources) activities may not be supported.
Environmental Impact Assessment Proclamation No. 299/2002.	The Environmental Protection Agency (EPA) or relevant Regional environmental agencies may exempt projects from EIA that are deemed to have insignificant environmental impact". It was confirmed during the scoping study that a formal EIA is not required for the Project.
Environmental Pollution Control Proclamation No. 300/2002	Determines pollution emission limits in relation to water resources.
Solid Waste Management Proclamation No. 513/2007	Outlines requirements for management of construction including wastes. Construction permits shall be issued only when the contractor deposits a legally valid bond or any other instrument to secure environmentally sound disposal of construction debris or excavated earth. Potentially relevant to both Project drilling and development activities.
Ethiopian Water Resources Management Proclamation No. 197/2000	Describes application process for permits for water use, release or discharge of waste, and waterworks construction permits to be submitted to the Supervising Body. Also permits for polluted water (defined as sewage and industrial effluents including toxic water) wastewater discharge permits need to be obtained for discharge into water resources unless otherwise provided for in the regulations.
Ethiopian Water Resources Management Council of Ministers Regulations No. 115/2005	Details main permit requirements for different uses of water; construction works; wastewater discharge etc., including associated fees and charges to be paid for different uses of water. Charges payable are left to be determined by the Council of Ministers and issued in a subsequent regulation (Article 31.4).
Ethiopian Standard for Drinking Water (261/2001)	Specifies physical, chemical and bacteriological requirements for drinking/domestic water, largely based on the World Health Organization (WHO) Guidelines for Drinking Water Quality 2nd edition 1993 (most recent edition is 2011). The Project must see that any potable water supplied to workers or community meet these standards.
Oromia Bureau of Land & Environmental Protection Proclamation No. 147/2009	The Oromia Bureau of Land and Environmental Protection have a number of powers to resolve environmental conflict/disputes, undertake environmental auditing and prepare environmental standards and regulate their implementation.
Oromia Rural Land Use and Administration Proclamation No. 130/2007	Article 12 allows any private investor to have access to rural land and is obliged to plant indigenous trees on at least 2% of the given land. Investment land is determined in a way that protects the natural resources of the surrounding area. Rural land users are obliged to refrain from performing activities that cause damage to wetlands and springs. Rural land use in the vicinity of lakes, streams and springs that can cause devastation of natural resources and biodiversity are prohibited.
Environmental Impact Assessment Procedural Guidelines Series 1, EPA, 2003	The Environmental Impact Assessment Procedural Guidelines Series1 of November 2003 details the EIA Process as applicable to development projects (EPA, 2003). Schedule 1 of the guidelines lists projects which require full EIA and includes "Ground water development for industrial, agricultural or urban water supply of greater than 4,000 m^3/day" (Note: the requirements for Phase 1 of this Project are estimated to be 35 L/s, which is approximately 76% of the 4,000 m^3/day threshold.)

2.3 WATER EXTRACTION PERMIT REQUIREMENTS

2.3.1 Article 11 of the Ethiopian Water Resources Management Proclamation No. 197/2000

Article 11 of the Proclamation outlines the permits required for construction of waterworks; supplying of water; transferring water extracted from a water resource or received from another supplier; and release or discharge of waste into water resources unless otherwise provided for in the regulations for the implementation of the Proclamation. Applications for water use, discharge of wastewaters[4] and waterworks construction permits require submitting to the Supervising Body, the Oromia Regional Bureau of Water and Energy (FDRE, 2000). This organization has responsibility for issuing: i) Water Works Contractors Permits; ii) Water Use Permits and iii) Water Works Construction or Alteration Permits. Permits are issued within sixty (60) days from the receipt of the application where the permit does not violate another person's legitimate interest or where the activity does not result in pollution or cause harmful effects on the water resource and the environment[5].

The time limit of a water use permit is determined by the Supervising Body, and renewal is dependent on the permit holder observing the conditions, obligations and restrictions mentioned in the permit. The permit is also presumed to be cancelled if not renewed on time. Any permit application should detail the design and safety measures proposed along with a detailed study of the waterworks. It should also include the following information:

(a) name and permanent address of the applicant;
(b) location of the water resources and the intended place of use;
(c) intended use of the water resources;
(d) volume of water required monthly and annually;
(e) intended method and manner of use of the water resources;
(f) investment certificate (where appropriate);
(g) feasibility studies and maps reasonably required by the Supervising Body

2.3.2 Water Resources Management Regulation (115/2005)

This regulation is a further elaboration of the Water Resources Management Proclamation, which details the main requirements for the issuance of permits, as well as providing the conditions for the issuance, renewal, and revocation of such permits. The regulation also provides provisions for fees associated with application or permits as well as the requirements of water charges to be paid for different uses of water. Current fees need to be checked with the relevant authorities. The regulation does not require submission of water monitoring reports to the Ethiopian Government but entitles the Supervising Body to enter any land to inspect facilities and take samples of water and effluent. The driller of any water supply well has an obligation to submit a report to the Supervising Body regarding complete or incomplete water supply wells drilling performance within 30 days after the completion or incompletion thereof.

[4] Wastes are defined as any harmful matter introduced, released or discharged into any water body in any solid, liquid or gaseous form. Polluted Water includes sewage and industrial effluents including toxic water. Wastewater discharge permits need to be obtained to (amongst others) release or discharge effluent into water resources unless otherwise provided for in the regulations.

[5] The Federal Democratic Republic OF Ethiopia (2000) Proclamation No. 197/2000 Ethiopian Water Resources Management Proclamation (http://extwprlegs1.fao.org/docs/pdf/eth44004.pdf).

Subject to Article 11 of the Proclamation, no professional shall engage in the field of water works construction activity unless they have obtained a certificate of professional competence issued by the Supervising Body. Any contractor holding a certificate of professional competence shall, before entering into a contract with anybody pertaining to water works constructions, must first see that the Supervising Body has approved that such water works be constructed. The Supervising Body shall issue the certificate applied for in accordance with Article 23 of Regulation 115/2005 ten (10) days after receipt of the application after examining and ensuring that the applicant meets the standard issued by the directive or notify the applicant, in writing, of the rejection and the reasons thereof. Types of permit available include: i) Certificate of Professional Competence for Water Works, and ii) Certificate of Professional Competence for Water Engineering.

2.3.3 Current permitting Status

The current Phase 1 Project water supply options permitting status for groundwater and springs is described in Table 2.2 below.

Table 2.2: Phase 1 Project Water Supply Options Permitting Status for Groundwater and Springs

Water Supply Option	Permit requirements	Regulatory Body[6]	Current Status
Groundwater Drilling permit (inside concession)	Within the Geothermal operational concession zone, drilling permit not required as covered under main TMGO permit.	Federal Authority	TMGO facility permit includes for drilling for groundwater within the Concession Area.
Groundwater Drilling permit (outside concession)	Outside the concession zone, drilling permit is required Permit issuance 10 days after submission	Oromia Regional Bureau of Water and Energy	Drilling permit has been obtained for current sites
Ground Water Extraction Permit	Required Permit issuance 60 days after submission. Requires: Borehole completion report Environmental and social impact summary broad support from the community Letter of support from the Woreda	Oromia Regional Bureau of Water and Energy Woreda	Permit has not yet been applied for. Requirements need to be met. This study responds to these requirements.
Spring Water Extraction Permit	Permit issuance 60 days after submission. Requires: Water Impact/Management Report Environmental and social impact summary broad support from the community Letter of support from the Woreda	Oromia Regional Bureau of Water and Energy Woreda	Permit has not yet been applied for. Should a permit be required these requirements need to be met. This study responds to these requirements.

2.4 OTHER ETHIOPIAN COMMITMENTS

In addition to the above national commitments, Ethiopia is a signatory to a number of international commitments including, but not limited to, the following:

- **Rio Declaration** on Environment and Development (1992). Principles outlined within the declaration relate to sustainable development, including environmental degradation, stakeholder engagement and assessment of environmental impacts. In particular:

[6] Note that at the Zonal level there is no requirement for a permit, only at a regional level

- Principle 4 states; “In order to achieve sustainable development, environmental protection shall constitute an integral part of the development process and cannot be considered in isolation from it” (p.2).
- Principle 10 states; “Each individual shall have an opportunity to participate in the decision-making processes, facilitated by the widespread availability of information” (p.3).
- Principle 17 states; “Environmental impact assessment, as a national instrument, shall be undertaken for proposed activities that are likely to have a significant adverse impact on the environment and are subject to a decision of a competent national authority” (p.4).

- **African Convention on the Conservation of Nature and Natural Resources** the Convention was adopted on the 15th September 1968 and came into force on 16th June 1969. Signed by Ethiopia on 15th September 1968, the Convention reaffirms the importance of natural resources both renewable and non-renewable, particularly the soil, water, flora and fauna. The main objective is to facilitate sustainable use of the above resources. Contracting States recognize that it is important and urgent to accord a special protection to those animal and plant species that are threatened with extinction, or which may become so, and to the habitat necessary to their survival. It also identifies that the contracting States shall establish policies for conservation, utilization and development of underground and surface water, and shall endeavor to guarantee for their populations a sufficient and continuous supply of suitable water. The Revised Convention was signed by Ethiopia on June 1, 2004 and adopted on the March 7, 2017.
- **Convention on Biological Diversity** The purpose of this convention is to ensure the conservation and sustainable use of biodiversity. Ethiopia ratified the convention in July 1994 and Ethiopia Biodiversity Institute (EBI) is the national focal point to this Convention on Biological Diversity. The provisions of this Convention have been integrated in many laws of Ethiopia.
- **United Nations Framework Convention on Climate Change (UNFCCC)** is an international environmental treaty adopted on May 9, 1992 and came into force on March 21, 1994; Ethiopia ratified the UNFCCC on May 31, 1994. It is a “Rio Convention”, one of three adopted at the “Rio Earth Summit”, which took place between 3 and 14 June 1992. The primary purpose of the convention is to establish methods to minimize global warming, and particularly the emission of greenhouse gases. Currently, there are 197 Parties to the UNFCCC, including Ethiopia. Ministry of Environment and Forest is the national focal point for this Protocol.
- **The Convention Concerning the Protection of the World Cultural and Natural Heritage (the UNESCO World Heritage Convention)** was adopted in Paris, France in November 1972 and came into force in December 1975. Ethiopia is party to the UNESCO World Heritage Convention having ratified on 6 July 1997. The Convention is an international instrument that seeks to protect both cultural and natural heritage. Signatories agree to identify and nominate properties on their national territory to be considered for inscription on the World Heritage List, give details of how a property is protected and provide management plans for its upkeep. Ethiopia has eight sites of cultural heritage and one site of natural heritage. There are also six sites that are on the tentative list. None are affected by the Project.

2.5 INTERNATIONAL FINANCE REQUIREMENTS

2.5.1 IFC Performance Standards

International standards and expectations on management of contractors are primarily derived from the IFC (the private sector arm of the World Bank Group (WBG)), which has published environmental and social sustainability performance standards as outline below. The IFC classifies proposed projects into a series of categories, depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts.

While the TMGO Main Project itself would be considered a Category A project (requiring a full ESIA) the Project would most likely be considered a category B Project given that impacts will be local, standard, and readily mitigated. As such, a focused and proportional ESIA can be provided addressing issues of material concern only.

Performance Standard 1 (PS1) - Assessment and Management of Environmental and Social Risks and Impacts establishes the importance of (i) integrated assessment to identify the environmental and social impacts, risks, and opportunities of projects; (ii) effective community engagement through disclosure of project-related information and consultation with local communities on matters that directly affect them; and (iii) the client's management of environmental and social performance throughout the life of the project through the effective use of management systems. Relevant PS1 objectives are:

- To identify and evaluate environmental and social risks and impacts of the project;
- To adopt a mitigation hierarchy to anticipate and avoid, or where avoidance is not possible, minimize, and, where residual impacts remain, compensate/offset for risks and impacts to workers, affected communities, and the environment;
- To promote improved environmental and social performance of clients through the effective use of management systems;
- To ensure that grievances from affected communities and external communications from other stakeholders are responded to and managed appropriately; and
- To promote and provide means for adequate engagement with affected communities throughout the project cycle on issues that could potentially affect them and to ensure that relevant environmental and social information is disclosed and disseminated.

Performance Standard 2 (PS2) - **Labor and Working Conditions** requires the protection of the fundamental rights of workers, amongst other things, operators to train contractors who have direct responsibility for activities that affect environmental and social performance so that they have adequate knowledge and skills to perform their work. Given the significant contribution to TMGO's workforce made by contractors, maintaining labor and working conditions is a vital part of contractor management. Relevant PS2 objectives are:

- To promote the fair treatment, non-discrimination, and equal opportunity of workers;
- To establish, maintain, and improve the worker-management relationship;

- To promote compliance with national employment and labor laws;
- To protect workers, including vulnerable categories of workers such as children, migrant workers, workers engaged by third parties, and workers in the client's supply chain;
- To promote safe and healthy working conditions, and the health of workers; and
- To avoid the use of forced labor.

Performance Standard 3 (PS3) - Resource Efficiency and Pollution outlines a project-level approach to resource efficiency and pollution prevention and control in line with internationally disseminated technologies and practices. Relevant PS3 objectives are:

- To avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities;
- To promote more sustainable use of resources, including energy and water; and
- To reduce project-related greenhouse gas (GHG) emissions.

Performance Standard 4 (PS4) – Community Health, Safety, and Security addresses the client's responsibility to avoid or minimize the risks and impacts to community health, safety, and security that may arise from project related-activities, with particular attention to vulnerable groups. Relevant PS4 objectives are:

- To anticipate and avoid adverse impacts on the health and safety of affected communities during the project life from both routine and non-routine circumstances; and
- To ensure that the safeguarding or personnel and property is carried out in accordance with the relevant human rights principles and in a manner that avoids or minimizes risks to the Affected Communities.

Performance Standard 5 (PS5) - Land Acquisition and Involuntary Resettlement recognizes that project-related land acquisition and restrictions on land use can have adverse impacts on communities and persons that use this land. Construction of access roads and pipelines to transport water from source to the TMGO geothermal drilling site will require land take, however land will be restored above pipelines after construction has taken place. Relevant PS5 objectives are:

- To avoid, and when avoidance is not possible, minimize displacement by exploring alternative project designs;
- Avoid forced eviction;
- Avoid, or where avoidance is not possible, minimize adverse social and economic impacts from land acquisition or restrictions on land use by (i) providing compensation for loss of assets at replacement cost and (ii) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected;
- To improve, or restore, the livelihoods and standards of living of displaced persons; and

- To improve living conditions among physically displaced persons through the provision of adequate housing with security of tenure at resettlement sites.

Performance Standard 6 (PS6) – Biodiversity Conservation and Sustainable Management of Living Natural Resources recognizes that protecting and conserving biodiversity, maintaining ecosystem services, and sustainably managing living natural resources are fundamental to sustainable development. As water extraction and land take will be required to support the Project, there is potential for adverse effects to natural habitats and biodiversity. Relevant PS6 objectives are:

- protect and conserve biodiversity;
- maintain the benefits from ecosystem services; and
- promote the sustainable management of living natural resources through the adoption of practices that integrate conservation needs and development priorities.

Performance Standard 7 (PS7) – Indigenous Peoples recognizes that Indigenous Peoples, as social groups with identities that are distinct from mainstream groups in national societies, are often among the most marginalized and vulnerable segments of the population. The TMGO Main Project ESIA did not identify any Indigenous groups in or near the Concession Area, and given its proximity to the Project AoI the same is considered to apply to the Project (see **Error! Reference source not found.** in the next section). This standard is therefore not considered applicable.

Performance Standard 8 (PS8) - Cultural Heritage recognizes the importance of cultural heritage for current and future generations and is consistent with the Convention Concerning the Protection of World Cultural and Natural Heritage. Although there are no UNESCO Word Heritage sites within the Project AoI, there is potential for cultural heritage features to be encountered during construction. Relevant PS8 objectives are:

- To protect cultural heritage from the adverse impacts of project activities and support its preservation.
- To promote the equitable sharing of benefits from the use of cultural heritage.

To meet the requirements of the IFC performance standards, as part of the TMGO Main Project ESIA an Environmental and Social Action Plan (ESAP) has been developed that includes a specific commitment to *"Undertake studies to determine the potential impact of extraction and water use prior to extraction of water from deep wells"*[7]. The Project ESIA and separate groundwater investigation will specifically seek to address this ESAP issue.

2.5.2 WBG Environmental, Health and Safety General Guidelines

General Guidelines

The WBG EHS general guidelines are technical reference documents with general and industry-specific examples of GIIP. The guidelines provide issues and recommendation in a range of areas including:

- Environmental;

[7] Tulu Moye Geothermal Project – Environmental and Social Action Plan (August 2018), Page 1

- Occupational health and safety;
- Community health and safety;
- Construction and decommissioning.

The guidelines provide a technical reference source to support the implementation of the IFC Performance Standards within the Project.

Guidelines for Geothermal Power Generation

The WBG EHS Guidelines for Geothermal Power Generation are applicable to geothermal power generation activities such as exploration and reservoir evaluation, production field development, and power plant construction. The guidelines address EHS issues that may occur during geothermal exploration, construction and generation as well as EHS performance and monitoring indicators (e.g., for effluent and emissions). These specific guidelines are relevant to the TMGO Main Project but are not considered relevant to the Project.

2.6 OTHER REQUIREMENTS

2.6.1 Equator Principles

The Equator Principles (EPs) are a set of standards for determining, assessing, and managing social and environmental risk in project financing. The EPs are based on the IFC performance standards on social and environmental sustainability and on the WBG's EHS general guidelines. Equator Principles Financial Institutions (EPFIs) are committed to financing projects where the borrower can comply with social and environmental policies and procedures as outlined in EPs.

EP 2, requires TMGO to conduct an assessment of the relevant E&S risks and impacts of the Project. The assessment documentation, should outline measures to minimize, mitigate, and offset adverse impacts in a manner relevant and appropriate to the nature and scale of the project, including (where relevant) an ESIA. EP3 requires that the assessment should address compliance with the relevant country's laws, regulations and permits that are related to environmental and social issues.

The EPs also require that the borrower demonstrate effective stakeholder engagement as an ongoing process in a structured and culturally appropriate manner with affected communities and, where relevant, all stakeholders. For projects with potentially significant adverse impacts on affected communities, the borrower is expected to conduct an Informed Consultation and Participation process. EP5 requires that stakeholder engagement be free from external manipulation, interference, coercion, and intimidation. The borrower should account for, and document, the results of the stakeholder engagement process, including any actions agreed resulting from such process. For projects with environmental or social risks and adverse impacts, disclosure should occur early in the assessment process, in any event before the project construction commences, as well as during other phases of the project.

2.6.2 World Bank Environmental and Social (ESF) and Operational Policies (OP)

TMGO will be run as a public-private partnership with input from the Government of Ethiopia. To date that input has not required any access to World Bank (i.e. country) Finance per se, but if it did, given that the Project was initiated before the new World Bank ESF was introduced, it is likely that the former World Bank operational polices would be considered applicable. This will be confirmed during the ESIA but if any the following would be considered most relevant:

OP 4.01: Environmental Assessment This is intended to ensure that Bank-financed projects are environmentally sound and sustainable, and that decision-making is improved through appropriate analysis of actions and of their likely environmental impacts. This policy is triggered if a project is likely to have adverse environmental risks and impacts in its AoI. The Bank classifies a proposed project into one of four categories, depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts. While the TMGO project would be considered a Category A project (requiring a full ESIA), the Project would most likely be considered a Category B Project given that impacts will be local, standard, and readily mitigated. Therefore, a focused and proportional ESIA can be provided to address issues of material concern only.

OP 4.04: Natural Habitats recognizes that the conservation of natural habitats is essential to safeguard their unique biodiversity and to maintain environmental services and products for human society and for long-term sustainable development. The Bank therefore supports the protection, management, and restoration of natural habitats in its project financing, as well as policy dialogue and economic and sector work. The Bank supports, and expects borrowers to apply, a precautionary approach to natural resource management to ensure opportunities for environmentally sustainable development. Natural habitats are land and water areas where most of the original native plant and animal species are still present. Natural habitats comprise many types of terrestrial, freshwater, coastal, and marine ecosystems. They include areas lightly modified by human activities, but which retain their ecological functions and most native species. Specifically, the policy prohibits Bank support of projects that would lead to the significant loss or degradation of any Critical Natural Habitats, whose definition includes those natural habitats which are either:

- Legally protected,
- Officially proposed for protection, or
- Unprotected but of known high conservation value.

OP 4.11: Physical Cultural Resources aims at assisting countries to avoid or mitigate adverse impacts on physical cultural resources from development projects that it finances. The impacts on physical cultural resources resulting from project activities, including mitigating measures, may not contravene either the borrower's national legislation, or its obligations under relevant international environmental treaties and agreements. OP 4.11 on Physical Cultural Resources, considers the recommendations in Investment Lending Reform: Modernizing and Consolidating Operational Policies and Procedures. Given that some cultural resources may not be known or be visible, it is important that a project's potential impacts on cultural resources are considered at the earliest possible stages of project processing.

OP 4.12: Involuntary Resettlement identifies that involuntary resettlement under development projects, if unmitigated, often gives rise to severe economic, social, and environmental risks. These risks include:

- production systems are dismantled;
- people face impoverishment when their productive assets or income sources are lost;
- people are relocated to environments where their productive skills may be less applicable and the competition for resources greater;

- community institutions and social networks are weakened;
- kin groups are dispersed;
- cultural identity, traditional Authority, and the potential for mutual help are diminished or lost.

This policy includes safeguards to address and mitigate these impoverishment risks. This policy contributes to the World Bank's mission of poverty reduction and sustainable development by ensuring that the development process fully respects the dignity, human rights, economies, and cultures of affected people. For all projects that are proposed for Bank financing and affect people, the Bank requires the borrower to engage in a process of free, prior, and informed consultation. The World Bank provides project financing only where free, prior, and informed consultation results in broad community support to the Project Affected Person (PAP). Such Bank financed projects include measures to (a) avoid potentially adverse effects on the communities; or (b) when avoidance is not feasible, minimize, mitigate, or compensate for such effects. Bank-financed projects are also designed to ensure that the Affected People receive social and economic benefits that are culturally appropriate and gender and inter-generationally inclusive.

Use of a Resettlement Policy Framework (RPF) is suggested when displacement is anticipated although extent and locations are not known. Once defined, Resettlement Action Plan (RAP) is required in line with this OP, IFC PS5 and other standards as applicable, to ensure the process avoids involuntary displacement as possible. Livelihood Restoration Plan (LRP) is required in instances of economic displacement (e.g. for losses in earnings).

OP 17.50: Public Disclosure supports the decision making by the Borrower and Bank by allowing the public access to information on environmental and social aspects of projects. It is further mandated by other safeguard policies that have specific requirements should be disclosed and consulted with stakeholders. Consultation is regarded as a two-way process in which beneficiaries provide advice and input on the design of proposed projects that affect their lives and environment and promotes dialogue between governments, communities, NGOs and implementing agencies to discuss all aspects of the proposed project.

2.6.3 ILO Requirements

The ILO, is a United Nations organization that has developed numerous conventions outlining fundamental rights at work and providing internationally recognized guidance on standards for labor and working conditions. TMGO is committed to uphold these requirements.

2.6.4 Meridiam Group Requirements

The Meridiam Group are a key investor in TMGO and have a responsible investment process which is underpinned by the documents in Table 2.3 below.

Table 2.3 Meridiam Group Investor Requirements

Sustainable Development Charter	This reflects Meridiam's approach to investments and commits Meridiam to: • Apply the rules of good governance • Protect the environment • Respect fundamental rights and develop human capital

	• Meet the expectations of the community • Value the human capital of Meridiam
Approach to Responsible ESG Management	This outlines how environmental, social and governance (ESG) objectives are taken into account in Meridiam's investment and asset management process. There are more than 45 ESG conditions and criteria that are used to analyze investments, the main ESG Themes for the evaluation of investments are: • **Working Standards** (e.g., free from forced or compulsory labor practices); • **Laws and Regulation** (e.g., legal context and compliance); • **ESG Capacity** (e.g., client ESG policy and procedures); • **Environmental Issues** (e.g., impacts on nature protection areas and biodiversity); • **Social Issues** (e.g., interests of stakeholders); and • **Energy, Carbon and Climate** (e.g., contribution to fight against climate change).

3.0 ESIA PROCESS

This section summarizes the ESIA process undertaken for the Project. It outlines the scope of the ESIA and associated studies and provides a description of the general methodologies that have been used for both the collection of baseline data and the assessment of impacts. Where topic specific methodologies deviate from this generic process they are highlighted in the relevant sections.

3.1 OVERVIEW

ESIA is the process of systematically identifying, assessing and mitigating the potential effects of a project on the relevant social, ecological and physical environment (together socio-environmental elements) within which it is to be delivered. In so doing it acts as a planning tool to help project developers and regulators anticipate and address any significant project-related socio-environmental impacts (both impacts to and impacts from the project) and provides a framework for establishing project controls to manage and control project-related socio-environmental risks and impacts.

The Project ESIA has used the IFC Performance Standards on Environmental and Social Sustainability as an environmental and social regulatory framework against which to assess the Project. The IFC Performance Standards are the standards by which the majority of international project finance is assessed against and have become the benchmark for international project financing.

The IFC Performance Standards *"provide guidance on how to identify risks and impacts, and are designed to help avoid, mitigate and manage risks and impacts as a way of doing business in a sustainable way, including stakeholder engagement and disclosure obligations in relation to project-level activities."*[8]

The IFC Performance Standards therefore provide the overarching policy defining the E&S objectives and principles that guide the Project to achieve sound E&S performance provided in this Project ESIA. Further information on these standards and other key standards and regulations applicable to the Project are outlined in Section 2.

3.1.1 ESIA Objectives

The purpose of the ESIA is to:

- Identify the regulatory and financing requirements applicable to the Project;
- Describe the principal Project features and technical specifications;
- Summarize the approach used to inform the design the Project and assessment of alternatives and options for the Project;

[8] International Finance Corporation, World Bank Group (2012) Performance Standards on Environmental and Social Sustainability.

- Describe the E&S baseline of the Project in terms of key sensitivities and potential constraints on the construction, operation and maintenance, and decommissioning of the Project;
- Assess the potential impacts of the Project and Project-related activities on the environment (including hydrological, ecological and socio-economic resources); and
- Design mitigation or enhancement measures to avoid, reduce or eliminate negative impacts to the environment.

3.1.2 ESIA Steps

The key steps in an ESIA process can be considered in terms of phases as described below:

- Pre-study activities such as screening, preliminary assessment and scoping. This phase establishes the environmental and social considerations in advance of detailed studies;
- The ESIA study, which results in the identification and assessment of impacts. Integral to this study is the development of measures to mitigate and reduce or eliminate significant negative impacts; and
- The post-study stage, which includes steps undertaken for review and monitoring to see that mitigation measures are implemented, and that they are effective during construction and operations.

In general, the ESIA should proceed in parallel with (and feed into) other Project decision-making and design processes, enabling any issues identified to feed into Project improvements.

3.2 STAKEHOLDER ENGAGEMENT

Stakeholder engagement can help support building strong, constructive, and responsive relationships and enable successful management of a project's environmental and social impacts. Stakeholder engagement has been undertaken as part of the part of the Project ESIA and has built on that undertaken for the TMGO Main Project ESIA. This has been undertaken to satisfy IFC Performance Standards and the EP Standards (as outlined in Section 2.5 and 2.6, respectively) and to understand the potential for “broad community support” for the Project, as required by regulatory authorities.

Consultation has been ongoing since 2015 to discuss the wider proposed geothermal development, with specific consultation for the Project undertaken since 2019. Engagement during 2019 has included initial discussions with stakeholders during a site visit in July 2019 at the scoping stage of the Project ESIA and further consultation in December 2019 as part of the impact assessment stage. Stakeholders who were consulted during this time included government authorities at the Woreda level, local Water Supply Service (WSS) Enterprises and local residents.

The initial site visit in July 2019 was used to agree on the scope, methodologies, surveys, assessments and outputs of the Project ESIA with relevant stakeholders, with the second visit in December 2019 used to have more in depth discussions and identify detailed impacts and potential mitigation measures.

TMGO developed key social management plans, including a Stakeholder Engagement Plan (SEP) in 2017 which will be used to help manage stakeholder engagement and issues raised by

stakeholders. A comprehensive overview of stakeholder engagement undertaken as part of the Project ESIA and the SEP is outlined in Section 6.

3.3 PROJECT SCOPING

3.3.1 Overview

Defining the scope of the ESIA and the AoI of the Project are critical for an effective impact assessment process.

A scoping exercise was undertaken and agreed with TMGO, which is documented in Appendix A. The Scoping Report includes further information on:

- Scope and content of ESIA to be undertaken;
- Relevant regulations, standards and guidelines to be considered during the ESIA process;
- Description of the alternatives reviewed and selected options;
- Key potential impacts; and
- Further studies required.

For the purposes of this Project ESIA, the Project is considered as including all those actions and activities that are a necessary part of the development, including ancillary facilities without which the Project cannot proceed. These activities are described further in Section 4 of this report. Activities which are induced by the Project but which are not essential to its development and are undertaken by others are addressed under the section on Cumulative Effects (Section 11).

3.3.2 The Project AoI

The spatial scope or AoI for a project includes all areas that might be potentially affected by a project, or which study is necessary to understand the impacts of a project.

For this Project, the AoI has been define based on the IFC Performance Standards 1 definition which identifies that the AoI for a project should encompass, as appropriate:

- *"The area likely to be affected by: (i) the project and the client's activities and facilities that are directly owned, operated or managed (including by contractors) and that are a component of the project; (ii) impacts from unplanned but predictable developments caused by the project that may occur later or at a different location; or (iii) indirect project impacts on biodiversity or on ecosystem services upon which Affected Communities' livelihoods are dependent.(p.3)*
- *Associated facilities, which are facilities that are not funded as part of the project and that would not have been constructed or expanded if the project did not exist and without which the project would not be viable*[9]*.*

[9] Associated facilities may include railways, roads, captive power plants or transmission lines, pipelines, utilities, warehouses, and logistics terminals.

- *Cumulative impacts[10] that result from the incremental impact, on areas or resources used or directly impacted by the project, from other existing, planned or reasonably defined developments at the time the risks and impacts identification process is conducted."(p.4)*

The AoI assessed is depending upon the type of impact being considered and the attributes of the potentially affected receptors. For example, effects on archaeological features are typically confined to those areas physically disturbed by the construction works, whilst the effects of noise or visual intrusion can be experienced at some distance. In each case, however, the AoI includes all areas within which significant impacts are likely to occur taking into account the:

- physical extent of the proposed works, defined by the limits of land to be acquired or used (temporarily or permanently) by the Project; and
- nature of the baseline environment and manner in which impacts are likely to be propagated beyond the immediate area of land take required by the Project.

As noted in Section 1, the Project ESIA is intended to build on work that has already been undertaken for the TMGO Main Project ESIA and has not sought to replicate previous studies. The AoI for the Project ESIA has therefore focused on identifying E&S conditions of receptors with respect to water supply, which have the potential to be affected and lie out with the Concession Area.

At this stage, several springs and groundwater drilling targets have been identified for further exploration which lie outside of the Concession Area and include areas in proximity to the town of Iteya. Future proposals may also include extraction closer to nearby springs (as shown on Figure 4.6), however the exact locations of these extractions are not currently known. The Project may include extraction from nearby springs at Gora and Wareka and so they (and the surrounding communities) have been included within the AoI.

Given the potential unknowns associated with the location of water sources, the AoI has been determined through consultation with TMGO as a basis on which to begin to gather baseline data. The AoI however does not include areas which have the potential to be affected by groundwater drawdown from wells as the extent of this area is currently unknown. The AoI will therefore need to be reviewed once further hydrogeological studies such as pumping tests have been completed and reported.

Further details on the AoI for the TMGO Main ESIA and the Project ESIA are outlined in Section 4.2 and 4.5, respectively.

3.3.3 Associated Facilities

Associated Facilities are defined as those that are not a component of the project but that would not be constructed or expanded if the project did not exist and on whose existence the viability of the project depends; such facilities may be funded, owned, managed, constructed and operated by the project sponsor or separately from the project.

[10] Cumulative impacts are limited to those impacts generally recognized as important on the basis of scientific concerns and/or concerns from Affected Communities. Examples of cumulative impacts include: incremental contribution of gaseous emissions to an airshed; reduction of water flows in a watershed due to multiple withdrawals; increases in sediment loads to a watershed; interference with migratory routes or wildlife movement; or more traffic congestion and accidents due to increases in vehicular traffic on community roadways.

The TMGO Main Project and the Project are associated to the extent that the Project is an associated facility of the TMGO Main Project, but the converse is not true. This Project ESIA therefore considers the projects in that context. There are no other associated facilities of relevance to the Project.

3.3.4 Temporal Scope

The ESIA process takes into account all phases of Project development from initial site preparation, including any advance works, through construction, commissioning and operation, to decommissioning, restoration and after use (to the extent these latter three items can be understood at this time).

While the design lifetime of the Main TMGO Project is considered to be at least 30 years[11] the Project is only required in Phase 1 to support construction and operation activities; water demands are expected to be variable but lower after this time. Where appropriate the assessment considers the development of pertinent aspects of the baseline beyond this time and assesses the extent to which projected changes and trends influence impacts.

3.4 BASELINE STUDY AND METHODOLOGY

Baseline studies were undertaken for the TMGO Main Project ESIA and additional studies have been undertaken as part of the Project ESIA to provide data for areas where there are identified data gaps. Baseline studies have therefore predominantly focused on the area within the Project AoI that lie outside of the Concession Area. An overview of the baseline studies undertaken for the Project and their associated methodologies is outlined below, with further information provided within the relevant topic chapters.

3.4.1 Desk Studies and Geographical Information System

A desk-based review of existing studies and available information on the Project AoI was undertaken to help inform the scope of further baseline studies. This included a review of relevant hydrogeological studies and the Integrated Biodiversity Assessment Tool (IBAT) report to understand the baseline hydrogeological and ecological conditions within the Project AoI.

An aerial ‘walk over’ of the area surrounding the Project was also undertaken using aerial imagery from google earth to help understand and characterize baseline conditions, including land uses, watercourses, residential areas and roads. This data was used to help identify potential sensitive receptors and identify locations for future survey. Information gathered from aerial imagery was ground-truthed during site visits.

A Geographical Information System (GIS) has been used to interpret data collected and analyze and present relevant information on maps and charts of the study area. Information collected during the field surveys, together with the result of the desktop analysis were integrated into a geographic database to help understand the baseline conditions of the Project AoI and used to identify potential effects.

3.4.2 Topic Specific Studies

Each of the technical sections includes a summary of methodologies utilized for each of the E&S disciplines and provides criteria from which the current quality and importance of features

[11] This is based depended on the life of the geothermal resource and may be extended if conditions are still favorable.

can be evaluated. Where methods for certain analyses are particularly technical these are provided within the Appendix of the ESIA and should be read in conjunction with the relevant topic chapter for further details.

A good understanding of the baseline is the key factor to comprehend the nature and importance of Project impacts and in feeding back to Project design and routing / sitting decisions. Where specific methodologies have been used to develop the baseline data for the different disciplines, detailed information on these is provided within each section. These include the terrestrial/aquatic ecology study, stream flow gauging and stakeholder engagement to inform the socio-economic study (see Section 7 and 8 for further information).

3.5 IMPACT ASSESSMENT METHODOLOGY

3.5.1 General Considerations

The assessment of impacts is an iterative process that considers several key questions:

- Identification – how can the Project interfere with the environment and people, considering both the specific project-related activities that will be carried out, and the existing baseline conditions;
- Prediction – what will happen to the environment and people as a consequence of the potential impacts associated to the Project?
- Evaluation – does this impact matter? How important or significant is it? If it is not significant it is not considered further for mitigation.
- Mitigation – if it is significant can anything be done about it?
- Residual Impact – is it still significant?

Where significant residual impacts remain further options for mitigation may be considered and impacts re-assessed until they are as low as is technically and financially feasible for the Project and would be deemed to be within acceptable levels.

This section describes the general approach followed in the Project ESIA to address the above-mentioned questions, which will be adopted for the assessment of impacts related with the several disciplines under the each of the following topic areas:

- Physical Environment;
- Ecological Environment; and
- Socio-Economic.

Further detailed information on specific methodologies, in particular with regards to the significance criteria (and their derivation) applied for the assessment of impacts, is specified in the methodology section of each technical sections.

3.5.2 Impact Identification

A logical and systematic approach needs to be undertaken to impact identification, in order to see that the key issues are identified and classified into impact categories for further study. It

aims to take account of the important environmental/project impacts and interactions, making sure that indirect and cumulative effects, which may be potentially significant, are not inadvertently omitted.

For the Project, impact identification was carried out, as described above, during the scoping stage, based on the initial site visits and stakeholder consultation and the professional judgement of the people involved:

1. The specific Project-related activities that will be carried out in order to build and operate the Project were reviewed and potential sources of impact on each E&S topic were identified in relation to extraction from groundwater and spring sources, the following topics were considered:

Environmental

- Biodiversity and ecology
- Air quality
- Archaeology and cultural heritage
- Landscape and visual impacts
- Noise
- Geology and soil
- Water and hydrology
- Waste
- Traffic

Social

- Land take and resettlement
- Social conflicts over access to water because of groundwater extraction
- Water availability for current users of the springs
- Sustainability of the water supply service enterprises
- Impacts on community health and safety
- Improved water quality and quantity.

2. Taking into consideration the existing baseline conditions and the potential presence of sensitive receptors within the Project's AoI, an evaluation was carried out of how the Project will be likely to interfere with the environment and people, and a number of potential impacts were identified (impact identification) for each environmental compartment;

3. A preliminary assessment was carried out in order to decide, for each impact, whether:

- It has the potential to cause important consequences, in which case such impact was "scoped in", and will be further assessed in the respective technical sections ahead in the Project ESIA; or

- It is deemed minor or insignificant, in which case such impact was "scoped out" or removed from further assessment in the Project ESIA (see Scoping Report Appendix A for full rationale).

In the next phase, the "scoped in" impacts were analyzed in greater detail in accordance with terms of reference specifically as presented in the Scoping Report.

3.5.3 Impact Prediction

For all "scoped in" impacts, the Project ESIA attempts to predict what will happen, i.e., what changes (impacts) the Project-related activities will induce over the environmental and socio-economic components of the environment. This includes the potential size and characteristics of those impacts.

> *An impact is any change to a resource or receptor brought about by the presence of the Project component or by the execution of a project related activity*.

The adequate assessment and evaluation of the impacts and benefits associated with a Project necessitates the use of an approach that reduces the subjectivity involved in making such evaluations and as such helps accurately determine the significance of the predicted impact on, or benefit to, the surrounding natural and/or socio-economic environment.

> *The purpose of the impact assessment is to i) identify and evaluate the likely significance of project impacts on identified receptors and resources according to defined assessment criteria, ii) to develop and describe measures that will be taken to avoid, minimize, reduce or compensate for any potential negative environmental effects, and iii) to report the significance of the residual impacts that remain following mitigation.*

Once the impact characteristics are understood, they are used (in a manner specific to the resource/receptor in question) to assign each impact a magnitude. Magnitude essentially describes the degree of change that the impact is likely to impart upon the resource/receptor. Impacts can be positive or negative (adverse) and the magnitude of an impact can be described as *Negligible, Small, Medium or Large*.

Magnitude itself is a function of the following impact characteristics:

- **Type** – A descriptor indicating the relationship of the impact to the project (in terms of cause and effect). This includes direct impacts that result from a direct interaction between the project and a resource/receptor (e.g., between occupation of a plot of land and the habitats which are affected); indirect impacts that follow on from the direct interactions between the project and its environment as a result of subsequent interactions within the environment (e.g., viability of a species population resulting from loss of part of a habitat as a result of the project occupying a plot of land) and induced impacts that result from other activities (which are not part of the project) that happen as a consequence of the project (e.g., influx of camp followers resulting from the importation of a large project workforce).

- **Extent** – The "reach" of the impact (e.g., confined to a small area around the project footprint, projected for several kilometers, etc.).

- **Duration** – The time period over which a resource / receptor is affected. (Temporary, Short-term, Long term, permanent).
- **Scale** – The size of the impact (e.g., the size of the area damaged or impacted, the fraction of a resource that is lost or affected, etc.)
- **Frequency** – Measure of the constancy or periodicity of the impact.

An additional characteristic that pertains only to unplanned events (e.g., traffic accident, accidental. release of fuel, community riot, etc.) is likelihood. The likelihood of an unplanned event occurring is designated as:

- **Unlikely** – The event is unlikely but may occur at some time during normal operating conditions.
- **Possible** – The event is likely to occur at some time during normal operating conditions.
- **Likely** – The event will occur during normal operating conditions (i.e., it is essentially inevitable).

Likelihood is estimated on the basis of experience and/or evidence that such an outcome has previously occurred. It is important to note that likelihood is a measure of the degree to which the unplanned event is expected to occur, not the degree to which an impact or effect is expected to occur as a result of the unplanned event.

The magnitude of impacts takes into account the various dimensions of a particular impact in order to make a determination as to where the impact falls on the spectrum from negligible to large. Some impacts will result in changes to the environment that may be immeasurable, undetectable or within the range of normal natural variation. Such changes can be regarded as essentially having no impact and should be characterized as having a negligible magnitude.

In addition to characterizing the magnitude of impact, the other principal step necessary to assign significance for a given impact is to define the sensitivity/vulnerability/importance of the impacted resource/receptor which may be physical, biological, cultural or human. Where the resource is physical (for example, a water body) its quality, sensitivity to change and importance (on a local, national and international scale) are considered.

Where the resource/receptor is biological or cultural (for example, the marine environment or a coral reef), its importance (for example, its local, regional, national or international importance) and its sensitivity to the specific type of impact are considered. Where the receptor is human, the vulnerability of the individual, community or wider societal group is considered. Other factors may also be considered when characterizing sensitivity /vulnerability /importance, such as legal protection, government policy, stakeholder views and economic value.

The sensitivity/vulnerability/importance designations themselves are universally consistent, but the definitions for these designations will vary on a resource/receptor basis and include the following designations: low, medium, high.

3.5.4 Impact Evaluation: Significance

Once magnitude of impact and sensitivity/vulnerability/importance of resource/receptor have been characterized, the significance can be assigned for each impact. Table 3.1 below demonstrates the receptor sensitivity and the impact of the magnitude.

Table 3.1: Significance Matrix for Impact Assessment

Receptor sensitivity/vulnerability/importance	Impact Magnitude			
	Negligible	Small	Medium	Large
High	L	M	H	H
Moderate	VL	L	M	H
Minor or Low	VL	VL	L	M
Negligible or Very Low	VL	VL	VL	L

The following provides a context for defining significance.

- An impact of **negligible** (or “very low”) significance is one where a resource/receptor (including people) will essentially not be affected in any way by a particular activity or the predicted effect is deemed to be ‘imperceptible’ or is indistinguishable from natural background variations.

- An impact of **minor** (or “low”) significance is one where a resource/receptor will experience a noticeable effect, but the impact magnitude is sufficiently small (with or without mitigation) and/or the resource/receptor is of low sensitivity/ vulnerability/ importance. In either case, the magnitude should be well within applicable standards.

- An impact of **moderate** significance has an impact magnitude that is within applicable standards but falls somewhere in the range from a threshold below which the impact is minor, up to a level that might be just short of breaching a legal limit. Clearly, to design an activity so that its effects only just avoid breaking a law and/or cause a high impact is not best practice. The emphasis for moderate impacts is therefore on demonstrating that the impact has been reduced to a level that is as low as reasonably practicable (ALARP). This does not necessarily mean that impacts of moderate significance must be reduced to minor, but that moderate impacts are being managed effectively and efficiently.

- An impact of **high** significance is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors. An aim of an impact assessment is to get to a position where the project does not have any high residual impacts, certainly not ones that would endure into the long-term or extend over a large area. However, for some aspects there may be high residual impacts remaining even after practicable mitigation options have been exhausted (i.e., ALARP has been applied).

An example might be the visual impact of a facility. It is then the function of regulators and stakeholders to weigh such negative factors against the positive ones, such as employment, in coming to a decision on the project. Any negative impacts classified negligible (“very low”), minor (“low”) or “moderate” are generally considered not to be significant and are therefore typically managed through the application of GIIP or other generic mitigation, not requiring further specific mitigation. Any negative impacts classified as “high” are considered significant and require additional targeted/specific mitigation, management and inspection/monitoring to verify the efficacy of the mitigation in place and/or the need for additional mitigation to address such impacts.

3.5.5 Mitigation

Once the significance of a given impact has been characterized using the above processes, the next step is to evaluate what mitigation measures are warranted. In keeping with the Mitigation Hierarchy, the priority in mitigation is to first apply mitigation measures to the source of the impact (i.e., to avoid or reduce the magnitude of the impact from the associated project activity), and then to address the resultant effect to the resource/receptor via abatement or compensatory measures or offsets (i.e., to reduce the significance of the effect once reasonably practicable mitigations have been applied to reduce the impact magnitude). The approach taken to defining mitigation measures is based on a typical hierarchy of decisions and measures, as described below:

- Avoid at Source; Reduce at Source: avoiding or reducing at source through the design of the project (e.g., avoiding by siting or rerouting activity away from sensitive areas or reducing by restricting the working area or changing the time of the activity).
- Abate on Site: add something to the design to abate the impact (e.g., pollution control equipment, traffic controls, perimeter screening and landscaping).
- Abate at Receptor: if an impact cannot be abated onsite then control measures can be implemented off site (e.g., noise barriers to reduce noise impact at a nearby residence or fencing to prevent animals straying onto the site).
- Repair or Remedy: some impacts involve unavoidable damage to a resource (e.g. agricultural land and forestry due to creating access, work camps or materials storage areas) and these impacts can be addressed through repair, restoration or reinstatement measures.
- Compensate in Kind; Compensate Through Other Means: where other mitigation approaches are not possible or fully effective, then compensation for loss, damage and disturbance might be appropriate (e.g., planting to replace damaged vegetation, financial compensation for damaged crops or providing community facilities for loss of fisheries access, recreation and amenity space).

Compensation/offset is typically seen as a last resort but may be required in terms of local legislation (sometimes also independent of the significance of an impact). Compensation or offset does not, however, automatically make an impact ‘acceptable’ or excuse the need to consider other forms of mitigation as discussed in the hierarchy.

3.5.6 Assessing Residual Impacts

Following the development of technically and financially feasible and cost-effective mitigation, the Project ESIA team re-assessed the impacts. All residual significant impacts are described in the Project ESIA Report in terms of their overall significance. Where an impact is of more than minor significance the Project ESIA explains in greater detail how the mitigation hierarchy has been applied (and where appropriate the other mitigation options considered in the assessment and the reasons for their rejection) to reduce an impact to a level that is deemed to be acceptable.

Any residual high impacts, whether positive or negative, are considered to warrant substantial weight for those making decisions on the Project. Conditions will be expected to be imposed to see that negative impacts are strictly controlled and monitored and beneficial impacts are fully delivered. Residual moderate impacts are considered to be of lesser importance to making decisions, but still warrant careful attention to conditions regarding mitigation and monitoring, to

see that negative impacts are kept within levels deemed to be acceptable and to see that beneficial impacts are delivered. Impacts of Minor significance are identified as warranting little if any weight; mitigation will be achieved using normal good practice and monitoring will be expected to be carried out to confirm that impacts do not exceed predicted levels.

3.6 CUMULATIVE IMPACT ASSESSMENT

Cumulative impacts are defined as successive, incremental, and /or combined effects of a project or activity, accumulated with other projects or activities. IFC's cumulative impacts guidance, Good Practice Handbook - Cumulative Impact Assessment and Management: Guidance for Private Sector in Emerging Markets (IFC 2013) focuses on impacts to Valued Environmental and Social Components (VECs) such as

- Physical features, habitats, wildlife populations (e.g., biodiversity).
- Ecosystem services.
- Natural processes (e.g., water and nutrient cycles, microclimate).
- Social conditions (e.g., health, economics).
- Cultural aspects (e.g., traditional spiritual ceremonies).

Cumulative impacts in the Project AoI can potentially occur from the combined effects of other presently on-going or reasonably foreseeable future activities in the project area. A qualitative assessment of cumulative impacts can then be undertaken based on such information on potentially relevant activities taken and the judgment of the ESIA team.

3.7 TRANSBOUNDARY IMPACTS

Transboundary impacts are impacts that occur across political boundaries. They may arise because of the movement of an impacting item (such as waste) or because of an impact to a medium which is of a transboundary nature (such as atmospheric emissions). As the Project is located entirely within Ethiopia, and in consideration of Project activities, transboundary impacts are unlikely to occur. Transboundary impacts have therefore not been included within the scope of this Project ESIA.

3.8 MANAGEMENT AND MONITORING

Measures to mitigate negative impacts have been identified in this Project ESIA Report and the Project is committed to their implementation. These measures are set out in the Project Description and other chapters of the report and, to assist the reader, they have been brought together in an Impact summary table. An ESMP has been prepared to outline how the mitigation commitments will actually be delivered together with relevant monitoring, inspection, audit and reporting as per IFC Performance Standard 1.

3.9 IMPACT ASSESSMENT TEAM

The environmental and social consultants preparing the Project ESIA are Stantec, Earth Active, Insuco and Metaferia Consulting Engineers, with input from the Project geophysical engineers at TMGO. A summary of the consultancy firms which have been involved in the Project is

outlined below and the names of key team members and their associated roles and competencies is outlined in Table 3.2.

Stantec is a publicly listed global design firm and has had an established presence in Ethiopia for over 24 years. Stantec provide professional consulting in a range of areas including environmental sciences, planning, project management and engineering. Stantec provide independent, professional services to the offshore and onshore oil and gas and mining industries, port and terminal infrastructure developments, offshore and onshore renewable energy projects, and the transportation, power, and commercial sectors.

Earth Active (EA) is an environmental, social and governance (ESG) advisory business with globally recognized expertise in the identification, assessment, monitoring and management of environmental and social risks, impacts and opportunities. Work includes ongoing renewable energy and water-related work in both Ethiopia and neighboring Djibouti. EA specializes in project delivery, lenders due diligence and capacity building across the renewable energy, water, agriculture, and infrastructure sectors.

Insuco International Ltd (Insuco) is a consulting firm that has developed skills in the international social safeguards field (knowledge and expertise of international safeguards), particularly in projects operating in African contexts (infrastructure, energy, extraction, development aid, agriculture and agribusiness). Insuco's principal activities are social impact assessment, resettlement action planning, stakeholder mapping and engagement planning and local development planning.

Metaferia Consulting Engineers (MCE) of Ethiopia is a private limited company, which was established in 1990 and is one of the leading consulting engineering firms in Ethiopia. The firm has its head office in Addis Ababa and is recognized by the major funding agencies including the African Development Bank, the World Bank and the Arab Bank for Economic Development in Africa. It is also an active member of the Federation of African Consultants. MCE's principal activities include ESIA and environmental management, water supply and sanitation, livelihood studies and infrastructure development.

Table 3.2: ESIA Team Members

Name	Qualification	Specialization	Project Role
TMGO			
Aklilu Tekka	-	Geophysicist	Geophysicist
Aynalem Getachew	MA, BA	Culture, Environment and Sustainability	Environment and Social Manager
Stantec			
Giles Farrant	BSc, MSc, MA, AM ChPP, ChSci	Hydrogeology, Geochemistry and Project Management	Project Management and ESIA Report

Name	Qualification	Specialization	Project Role
Neil Cory	BSc, MEDes	Infrastructure, Environmental Services	ESIA Review
Luke Long	PhD	ESIA	ESIA Review
Michael Preston	MSc., R.P. Bio	Wildlife Biologist	ESIA Review
Earth Active			
Rob Evans	MA, MSc, MBA	ESIA	ESIA Report
Insuco International Ltd			
Mathilde Laval	MSc	Socio-economic Monitoring and Evaluation. Agronomy.	ESIA Report and Stakeholder Consultation
Aude Carro	MSc	Agro-economist and Natural Resource Management	ESIA Report and Stakeholder Consultation
Metaferia Consulting Engineers			
Aynalem Kassa	BA, MA	Economics	Socio-Economist, Livelihood Specialist, Financial and Economic
Melkamu Kifetew	BSc., MSc.	Biology, Environmental Science	Environmental Consultant
Demeke Kifile	PhD	Ecologist	Environmental Consultant

3.10 ETHIOPIAN EXPERT CERTIFICATION

Local staff with expert certification are as follows:

Melkamu Kifetew – Social and Environmental Impact Assessment License No. 11/1.1/3208/10.

Aynalem Kassa – Professional Economist III License No. PE/16 and Environment and Social Impact Assessment Studies as an Economic Affairs Analyst in the Category of Senior Consultant 11/1.1/4691/10.

3.11 ESIA LIMITATIONS

3.11.1 General Considerations

While the prediction of future effects and the effectiveness of mitigation includes a degree of uncertainty. Where necessary, the topic chapters describe the principal factors giving rise to uncertainty in the prediction of likely effects and the degree of the uncertainty.

Confidence in the predictions has been achieved by employing accepted assessment methodologies where appropriate. As a general principle, the Project ESIA has described credible, foreseeable events and their likely significant effects.

In order to facilitate decision-making, areas of uncertainty, data gaps and deficiencies, and additional work required during further stages of Project development have been highlighted within the Project ESIA report and mainly stem from the issues discussed below. Further limitations in preparing this Project ESIA are noted in each of topic chapters, as appropriate.

3.11.2 Accuracy, Depth of Detail and Gaps in Knowledge of the Existing Conditions

General information has been obtained for Ethiopia and the region through commonly accessed sources as well as the TMGO Main Project ESIA. The latter included various physical, geophysical, biological and social surveys in the study area performed by consultants with a detailed knowledge of the region. Substantial data has been gathered on socioeconomic conditions in the Project AoI. Surveys have been supplemented by information in the scientific literature, grey literature and government documents.

Despite these efforts some gaps in knowledge remain. In such cases, use has been made of information on similar environments or expert judgment, together with the application of a conservative approach to evaluating impact significance where appropriate. The extent to which such uncertainty influenced the impact assessment is addressed in the relevant sections of the Project ESIA Report.

3.11.3 Developing Design

ESIA is generally a process that interacts with design, but also relies on design data to provide the basis for impact assessment. This process functions most effectively when applied throughout the project phases of design, development, construction, operation, and decommissioning. The assessment reported in this document has been undertaken early in the Project development process and as a result a number of water-supply options are still under consideration.

Given the current uncertainties regarding the location from which the water supply will be sourced and associated infrastructure (such as pipes) requirements to transport water to the TMGO Main Project site, the approach for this Project ESIA has been to take a conservative view of likely residual impacts where firm predictions cannot be made. Standards of performance that the Project will meet and propose monitoring and contingency measures have been identified. Where the stage in design process results in uncertainty, which is material to the findings of the Project ESIA, this is clearly stated.

3.11.4 Accuracy of Impact Prediction and Effectiveness of Mitigation

The accuracy of impact prediction is affected by the issues discussed above, together with the prediction technique used. ESIA predictions can be made using methods ranging from qualitative assessment and expert judgement to quantitative modelling, with variable effects on the accuracy of predictions. Where assumptions have been made, the nature of any uncertainties that stem from these have been presented in the topic specific sections of the Project ESIA Report. In all instances, the significance criteria have been applied conservatively to see that the effectiveness of mitigation is not overestimated.

3.11.5 Managing Uncertainty

Managing residual uncertainty is a key role of the ESMP and the overall management approach. Impacts will be monitored, as will the effectiveness of mitigation. Where residual impacts are found to be unacceptably high and/or mitigation fails to achieve its objectives, corrective actions will be implemented.

4.0 PROJECT DESCRIPTION

4.1 INTRODUCTION

This section of the Project ESIA describes the Project and provides a:

- High level overview of the overall TMGO development which is intended to ultimately provide up to 520 MW of geothermal power through the multi-phase development of the asset.
- Detailed account of the initial exploratory drilling works and the development of up to 50 MW of power which is the subject of the specific water-resources requirements (the "Phase 1 Project").
- Specific focus on the proposed short-term water sourcing for the Phase 1 Project namely the use of groundwater extraction or the springs, which are currently being utilized by WSS enterprises.

4.2 TMGO OVERVIEW

4.2.1 Summary of the Main TMGO Project

TMGO involves the exploration, design, development, financing, construction, operation, and maintenance of a geothermal power plant to be located approximately 150 km south east of Addis Ababa in the Oromia region of Ethiopia. The power plant will be developed in a series of four phases over the next 7.5 years and is ultimately expected to have an output of up to 520 MW. The TMGO Main Project ESIA covers the exploration and production drilling (and well pads), supporting infrastructure (including access roads, quarries and pipelines) and the construction and operation of the power station to 100 MW. The latter includes details regarding turbines/generators, collection pipelines (wells to power station), cooling tower, discharge outlet, and wastewater treatment system.

The phasing of the Project is expected to be delivered in incremental additions of 50 MW, 100 MW, 100 MW, 270 MW respectively to create 520 MW capacity overall, being completed in 2027 (Table 4.1). Construction of each phase is expected to take between 3 and 5 years depending on the generating capacity of that phase. Between 2020 and 2025 there will also be an overlap between the phases, with 2 to 3 phases being constructed simultaneously in any one year. Once the Project is fully constructed in 2027, it is expected that it will have an operational life of approximately 25 years, dependent on the life of the geothermal resource. If the resource conditions are still favorable, equipment can be refurbished or replaced at the end of their design life to upgrade and repair equipment to enable operation and generation to continue.

Table 4.1: Development Phases of the TMGO Main Project

Phase		Year								
		2019	2020	2021	2022	2023	2024	2025	2026	2027
1	50 MW									
2	100 MW									
3	100 MW									
4	270 MW									

Further details on the TMGO Project (up to 100 MW) are provided in the TMGO Main Project ESIA. Details of the Phase 1 Project (with up to 50 MW power station) are provided in Section 4.4.

As with all geothermal operations, TMGO requires access to water resources. An initial water demand/supply options review was included in the May 2013 “Water Access Options Report” and this report’s conclusions have been progressively refined by TMGO since that date, with both demand figures and water supply options having changed considerably over this time. In addition, while the TMGO Main Project ESIA and permit assumed that sufficient groundwater resources would be available within the Concession Area to meet the demands for both exploratory drilling and power plant operation, recent investigations have failed to find sufficient groundwater within the Concession to date (see Figure 4.1 for overview of the Concession Area). TMGO are therefore now exploring a range of alternative water sources both within and outside of the permitted Concession Area with the latter being the subject of the current ESIA process.

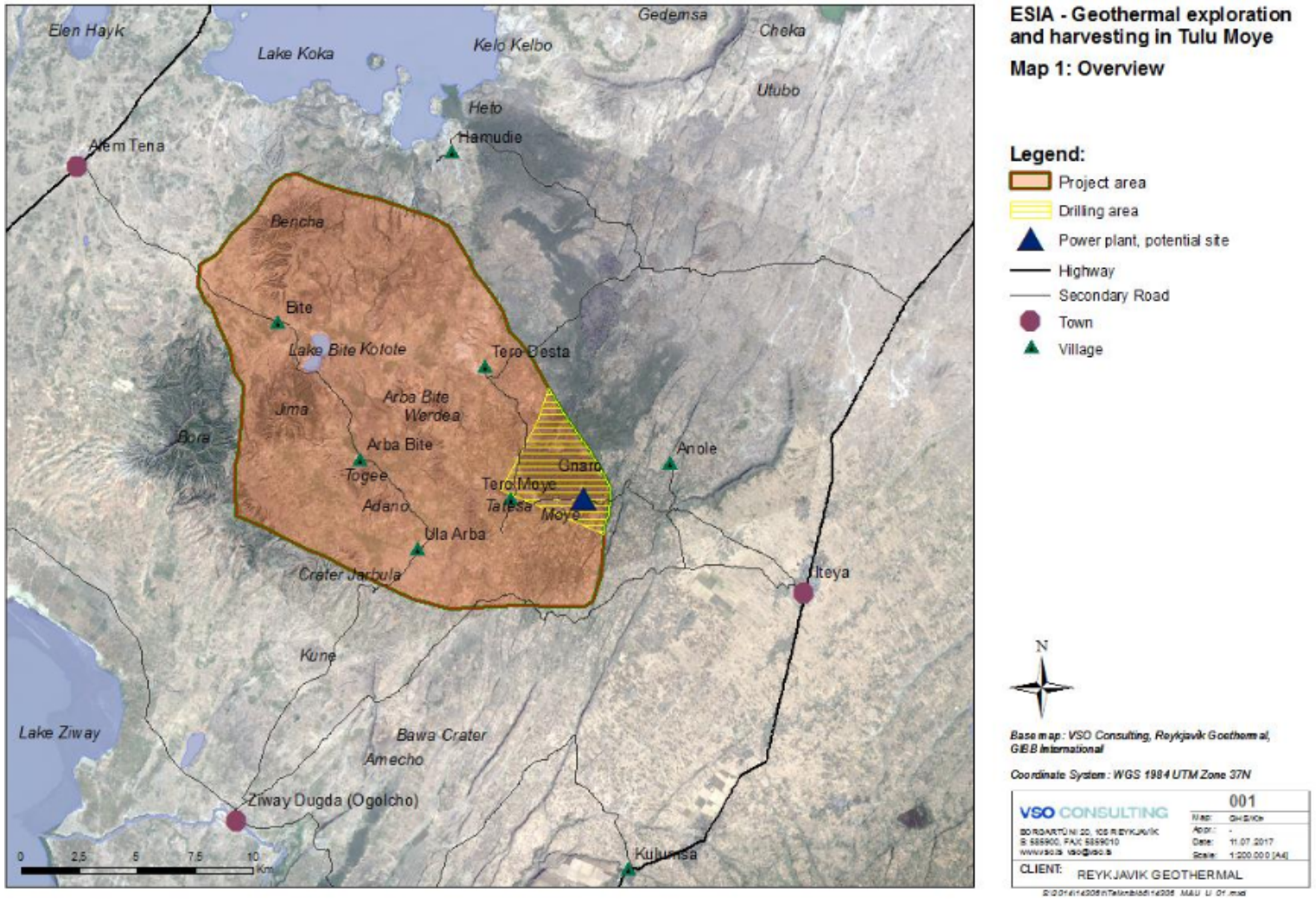


Figure 4.1: The Drilling Area within the larger Concession Area

4.2.2 TMGO Main Project AoI

The spatial scope or study area includes the activities and structures that will be assessed in the impact assessment, considering all the components of the project submitted by the proponent as well as their effects. To delimit the study area, reference should be made to the standards of the IFC. In paragraph 8 of Performance Standard 1 states that the elements to be considered in defining the project's AoI are determined as follows:

Where the project involves specifically identified physical elements, aspects, and facilities that are likely to generate impacts, environmental and social risks and impacts will be identified in the context of the project's area of influence. This area of influence encompasses, as appropriate:

- The area likely to be affected by: (i) the project and the client's activities and facilities that are directly owned, operated or managed (including by contractors) and that are a component of the project;14 (ii) impacts from unplanned but predictable developments caused by the project that may occur later or at a different location; or (iii) indirect project impacts on biodiversity or on ecosystem services upon which Affected Communities' livelihoods are dependent.

- Associated facilities, which are facilities that are not funded as part of the project and that would not have been constructed or expanded if the project did not exist and without which the project would not be viable

- Cumulative impacts that result from the incremental impact, on areas or resources used or directly impacted by the project, from other existing, planned or reasonably defined developments at the time the risks and impacts identification process is conducted.

(p.3 IFC, 2012)

In this sense, the study area must include the Project site and the AoI of E&S impacts related with the Project.

The AoI for the TMGO Main Project ESIA focusses on several potential drilling platforms which have been suggested in an area around the Gnaro lava field and two of which have been selected as primary targets (see Figure 4.2).

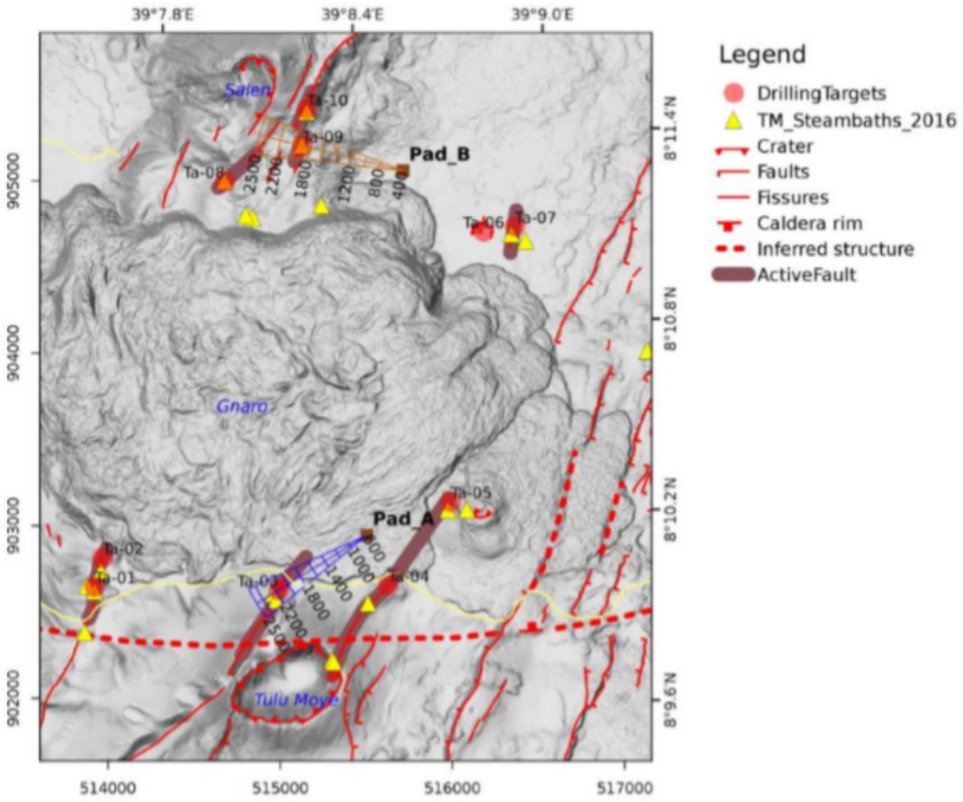


Figure 4.2: Directional Drilling Targets

As such the AoI considered within the TMGO Main Project ESIA included:

- Areas of immediate Project footprint due to exploration drilling: including areas required for construction of access roads to drill pads; drilling for water and water pipeline; 2+ drill pads (about 5,000 m^2 each) and possible injection site(s); about 500 to 600 m radius around each drill pad because of noise; lay-down area for materials and an area for a Power Station.

- Agricultural plots located around the Gnaro lava, also along the existing gravel road south of the Gnaro lava (from Highway #9 to the Project site) to be used by the Project for transportation of equipment and materials.

- Settlements in and around the Gnaro lava such as Tero Moye; Settlements located along Highway #9 (between and including Adama and Iteya, possibly Assela) off the main Highway #1. Area required for separation station and other installations to be determined at later stages of the Project development. Area required for transmission line(s), to be determined in later stages of development.

- Three Kebeles in and around the Drilling Area (Tero Moye, Anole and Tero Desta), that may feel the impact of the operation but may also benefit from employment and direct and indirect economic opportunities.

Details of the Project AoI are provided in Section 4.5.

4.2.3 TMGO Approach to Environmental and Social Management

TMGO is developing a corporate-level Environmental and Social Management System (ESMS) to be managed by the TMGO E&S Manager and supported by the Community Liaison Officer (CLO) as outlined below. The CLO is also responsible for collecting grievances from people affected by the project. The ESMS and its attendant plans are

proposed as “living documents” to be reviewed and updated regularly. The development of the TMGO ESMS is not within the scope of the Project ESIA, but it will provide a function and resources to manage and implement the mitigation measures against the identified project impacts.

Figure 4.3: TMGO PLC. Organizational Chart

TMGO management are responsible for providing adequate resources to establish, implement, maintain, and improve the ESMS. These include human resources and specialized skills, organizational infrastructure, technology and financial resources. Roles and responsibilities are currently being defined, documented and communicated to facilitate effective environmental and social management (Figure 4.3).

TMGO is developing an E&S policy appropriate to the nature, scale, and E&S impacts of its activities, products, and services. This will include a commitment to continual improvement and the prevention of pollution, as well as compliance with applicable regulatory and other requirements (see Section 2).

4.3 TMGO’S ESMS

TMGO’s ESMS will apply to the full scope of the exploration, construction, and operation of the organization. It will consider relevant WBG IFC guidelines, ISO 14001 requirements, and appropriate elements of other internationally recognized standards and best management practices. It will apply to all internal TMGO operations as well as third parties including:

- Parties to works contracts, including the engineer, and contractor.
- Implementing entities.
- Consultants and contractors engaged by TMGO within the life of the Tulu Moye Project.

The Tulu Moye Project ESMS is based on the following tiers outlined in Table 4.2 below.

Table 4.2: ESMS Tiers

Level 1	Tulu Moye Project Environmental and Social Policies and Commitments documents.

Project Description

Level 2		A suite of environmental management plans, which are implemented to support the continuing management and mitigation of the potential environmental and social impacts associated with Tulu Moye Project operations. Originally developed to support the ESIA process, these documents also play an active and continuing role as components of the Tulu Moye Project ESMS.
Level 3:		Standard operating procedures and other operational practices that will be established to support the Level 1 and 2 documents previously described, with emphasis on the management of those areas in which the ESIA process indicates that potentially significant E&S impacts are known to exist or are likely to occur in later phases of project life. The standard operating procedures are maintained separately in the TMGO Standard Operating Procedures Manual and are grouped to correspond to the planning area that they are primarily designed to support. These are:
Level 4		Internal memoranda, correspondence, environmental aspects specifications, regulatory requirements lists, monitoring data, reports, regulatory submittals, and other completed documents or records developed in response to regulatory requirements or resulting from the implementation of the Tulu Moye Project ESMP and its Level 2 and 3 support documents.

Associated plans, policies, and procedures have been developed as part of the TMGO Main Project ESIA and will be used to support the development and implementation of appropriate mitigation and monitoring for the Project.

4.4 THE PHASE 1 (50 MW) PROJECT WATER REQUIREMENTS

4.4.1 Project Overview

The Phase 1 Project involves the exploration, design, development, financing, construction, operation and maintenance of up to the initial 50 MW of geothermal power production within the Concession Area. Activities will include the development (and operation) of well pads and exploration and production drilling; collection pipelines (wells to power station; power station to 50 MW and associated turbines/generators, cooling tower, discharge outlet and wastewater treatment system and supporting infrastructure (including access roads, quarries and pipelines).

The section below provides a summary of current TMGO estimates of the required water demand for the Phase 1 works. The information has been obtained from consultation meetings held with TMGO on July 4, 2019 (meetings record in Scoping Report - Appendix A) and feedback on the initial draft scoping report. Figures should be considered indicative as several of the quantities are hard to estimate accurately and definitive quantities will only be obtained as Phase 1 progresses. In particular, further optimization of the water consumption of the power supply process is due to be undertaken during Phase 1 and may allow a reduction in these estimates. For example, condensed geothermal steam can be used for several purposes: as cooling water circulation and cooling for other auxiliary systems as needed, for emergency, special occasions and make-up water. However, in line with GIIP, a precautionary approach has been adopted and the impact assessment will be undertaken based on this scenario.

4.4.2 Normal Drilling Activities

During exploratory drilling, water is needed to cool the drill bit and wash drilling cuttings from the hole. Drilling is not a continuous process, and the water demand will periodically be curtailed when active drilling is not underway. These punctuations occur, for instance, when the drilling rig and drilling paraphernalia are being transferred between drill pad sites. The indicative average demand figure estimated for drilling a single exploratory well is 20 to 25 L/s with a peak demand of 50 L/s. There will be a 10,000 m^3 pond on site to circulate water back to the pond as much as possible, meaning that 50 L/s would not be needed continuously from the environment. During drilling water loss can happen, that would require some topping up. Therefore, the water supply demand from the environment for geothermal drilling purposes is set at an estimated 25 L/s.

4.4.3 Emergency Standby Requirements

In addition to the above, an emergency water supply of some 5,000 m^3 is required to enable the drillers to quench the exploratory hole if emergency stabilization of the borehole structure is required. This requirement will be supplied from storage tanks on the drill pad site. TMGO will also have a further 5,000 m^3, (10,000 m^3 total) of operational storage on the pad to manage short-term breaks in the water supply. As exploratory well drilling is not a continuous process it is planned to fill the quenching water stored at each drill site during periods when drilling is not on-going. For instance, a piped water supply with a capacity of 25 L/s will take nearly 5 days to fill the well pad storage of 10,000 m^3. This period is less than the time required to set-up for drilling at any drill pad site, and therefore the exploratory well drilling demand rather than quenching is likely to govern the water supply flow rate requirement. This is summarized in the Table 4.3 below.

Table 4.3: Summary of Drilling Demand Requirements

Item no.	Item Description	Estimated Water Demand	Units	Comments
1	Exploratory Well Drilling*	20 to 25	L/s	Mean demand per exploratory well.
		50	L/s	Peak demand per exploratory well.
2	Quenching	5,000	m^3	Emergency quenching water required to save or stabilize hole.

3	Pad Storage	5,000	m^3	Pad water storage required to manage breaks in water supply.

*Note that ground conditions encountered may also either reduce or increase the indicative estimates.

4.4.4 Power Production Requirements

Reykjavik Geothermal (RG) provided an estimate of the water supply for the geothermal power station of 40 to 60 L/s in November 2017, although it was initially unclear as to whether this was for Phase 1 or the TMGO Main Project. TMGO has since confirmed that around 35 L/s are required at peak demand for Phase 1 and some of this water can be provided from process water blowdown/condensate. Therefore, it is possible for the power plant to conduct normal operations with a supply of 5 L/s. Typically, about 32,500 m^3 per year (~1 L/s) is for supply to the powerhouse for sanitary water usage and service water assuming potable water will be provided by bottled water. The plan is to use bottled water for drinking, which is about 32,000 m^3 per year.

4.4.5 Firewater Requirements

The preferred design is to have a separate firewater tank that has an allocated storage for service water. Supplying water from the cooling tower basin is not preferred due to the presence of geothermal contaminants. A firewater tank is typically around 945 m^3, and if international standards are followed, it is required to have a water source that can refill the tank in 8 hours in case of an aftermath of an incident – meaning roughly 33 L/s peak demand (in some situations it may be possible to relax this criteria but this has yet to be confirmed). That said, the rest of water supply sources can be provided from process water blowdown/condensate. For average firewater demand the assumption is that having a firewater tank of 945 m^3 on site and using it for emergency 5 times a year gives 4,725 m^3 per year (< 1 L/s on average).

4.4.6 Construction Water Requirements

During the construction phase additional non-production water supply demands are required for dust suppression and for the washing, water treatment and sanitary requirements of the offices and site camp. This demand is expected to be about 1 L/s.

4.4.7 Summary of Water Requirements

Table 4.4 below summarizes TMGO's water demand requirements. The demand flow rate to be extracted from the environment (groundwater and/or springs) is defined by the peak firewater demand of 33 L/s. This also gives enough head room for other water demands such as recycled condensate water, drilling returns and onsite storage. If the average estimated demands for exploratory well drilling of 25 L/s is added to the power production requirement of 5 L/s, and the office and camp supply of 1 L/s, a total demand of 31 L/s is estimated, which is a little lower than the estimate for the peak firewater demand (see Table 4.4). Since these estimates are not exact and a conservative approach is taken, the firewater demand of 33 L/s can be rounded resulting in an estimated peak demand of 35 L/s.

Table 4.4: Summary of TMGO Phase 1 (to 50 MW) Water Demand

Item no.	Item Description	Estimated Water Demand*	Units	Comments
1	Exploratory Well Drilling	20 to 25	L/s	Mean demand per exploratory well.
		50	L/s	Peak demand per exploratory well.
2	Quenching	5,000	m^3	Emergency quenching water required to save or stabilize hole.
3	Pad Storage	5,000	m^3	Pad water storage required to manage breaks in water supply.

4	Power Production Requirements	35	L/s (for 1st 50 MW)	Water supply required for first 50 MW of geothermal power. Can be provided in part from process water blowdown/condensate.
		5	L/s	Average demand for normal operations.
5	Firewater	33	L/s	33 L/s peak demand over 8 hours not from condensate or drilling recycled water sources due to potential contaminants.
		< 1	L/s	Average annual demand.
6	Office and Camp Water and Sanitary Supply and dust suppression	1	L/s	Water supply for office and camp facilities, water treatment and sanitary requirements.

*Note that this does not include any provision of water to local communities.

4.5 PREFERRED PROJECT WATER SUPPLY OPTION

This section describes the options that are preferred by TMGO due to their proximity the TMGO Main Project (geothermal drilling and power plant), possible good water quality and potentially lower environmental and social impacts when compared with the alternatives described in Section 5.

4.5.1 Groundwater Supply Options

4.5.1.1 Previous Groundwater Studies

An initial water demand/supply options review was included in the May 2013 "Water Access Options Report[12]" and a well was drilled in the Concession Area based on the hydrological study done by RG[13], but came up dry. Since then several studies have been undertaken to better understand the potential for groundwater resources outside of the Concession Area towards the eastern escarpment. These have included the following:

- A desk study by AquaCon Engineering (ACE February 2019) to review potential groundwater supply areas. The work considered available geological and hydrogeological map data, available well inventories, a limited number of meteorological records and a detailed transient electromagnetic (TEM) survey undertaken by TMGO within the geothermal prospect area.
- Based on recommendations from the ACE report several vertical electrical resistivity soundings (VES) surveys were undertaken by ACE.
- A further assessment was then undertaken by Demis Alamirew (reported in April 2019), incorporating the VES results and covering the hydrogeological study area shown in Figure 4.4 below. This report summarizes the results of the VES geophysical surveys and provides a qualitative (preliminary) geological and hydrogeological conceptual model (limited to the proposed water supply area only). It also includes recommendations for well site selection, and a development priority.

In addition, Stantec's consultations with TMGO and the Iteya Water Board have also indicated that:

- two wells were successfully drilled approximately 20 years ago for village water supply to the south west of Tulu Moye. These well's yielded approximately 5 L/s (meeting with Iteya Water Board).

[12] Tulu Moye Geothermal Operations Plc. (2013): Water access options report.
[13] Reykjavik Geothermal (2018): Availability of drilling water Report No.: 17006-02 Tulu Moye.

- Wells drilled by the International Red Cross (IRC 01 to 03) in the general area were dry (see wells on Figure 5.2).

The IRC wells are also reported to be hot – i.e., -over 600°C. The current drilling site is, however, located between 8 and 20 km from these wells, and given the non-uniform nature of the local groundwaters, direct comparison between these sites may not be relevant.

4.5.1.2 TMGO Drilling

Further work to better understand the Project AoI hydrogeology, geology, and topography has been undertaken by TMGO. As part of this, several springs and groundwater drilling targets have been identified for further exploration[14]. Results include:

- Reviewing an initial well that was drilled close to the TMGO Project site in December 2018 (based on the initial hydrological study done by RG but prior to the studies outlined above[13]) but was found to be dry.

- A second exploration well was drilled and completed by TMGO in December 2019 close to the town of Iteya. Initial information indicated the presence of an unconfined shallow aquifer at about 40 m below ground level, with a deeper confined aquifer located 200 to 300 m below ground level. Further investigations are ongoing to assess available quantities and quality of water in the deep aquifer zone as well as the potential for extraction to impact other water features (e.g., springs) in the general area surrounding the Project. This work will include pumping tests which will help inform a quantitative assessment of the area potentially affected by groundwater extraction. Although quantities of water are not known, the site close to the town of Iteya is close to the eastern escarpment which receives relatively high rainfall compared to the IRC and borehole (BH) wells and however also has a high probability of being cold water (i.e., from rainfall not geothermal).

- It has not yet been demonstrated that one or more wells near Iteya can meet the Project water demand of 35 L/s and as a result, future proposals may include drilling closer to the springs (exact locations are to be determined). To address this, a detailed groundwater resource investigation is proposed with long term pumping tests at a rate similar to the Project demand. This will help identify whether the extraction will have significant negative social or environmental impacts and will include (but not be limited to) monitoring of the springs before, during, and after the test. This work is outside the scope of the present Project ESIA.

[14] Alamirew, D., 2019: Hydrogeological study and potential variations mapping and detailed geophysical investigation report around Iteya of Arsi zone of Oromiya region. Submitted for Tulu Moye Geothermal Company.

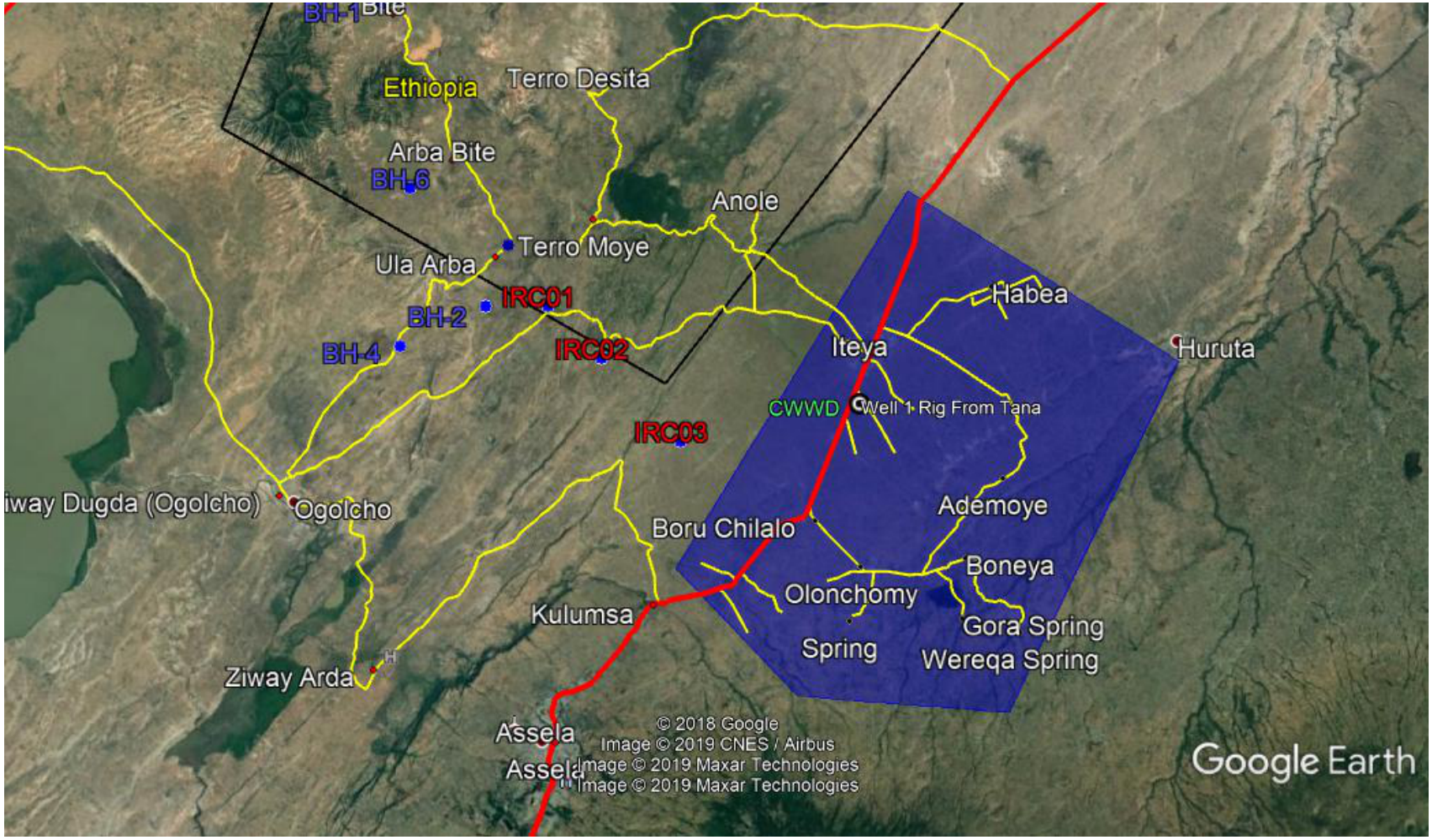


Figure 4.4: Demis Alamirew hydrogeological study area (blue shading) and the springs within it provided by TMGO.

4.5.2 Implications for the Project AoI

The extent of the drawdown from the individual wells and wellfield within the aquifer is not fully known but could extend 5 km or more from the wellfield dependent on the groundwater hydraulic conditions[15] and extraction rates. This could affect springs and ponds, as well as other water well and spring supplies, within the wider area including those indicated on Figure 4.5 below, which is taken from the Japan International Cooperation Agency (JICA) (2015) Report[16]. The springs closest to the proposed TMGO groundwater extraction are shown on Figure 4.6 with the nearest about 7.5 km away. Impacts of drawing down groundwater levels will ultimately need to be established by undertaking a long-term pumping test and measuring spring discharges and well water levels before, during and after the test.

The area shown in **Error! Reference source not found.** is the Project AoI with which to begin the stakeholder engagement (see TMGO Memo in Appendix C of the Scoping Report). It currently covers 15 Kebeles but does not include the potential areas affected by groundwater drawdown from the wells. The number 16 is not a Kebele, it is a seed enterprise (Yemrmr Zer Drjt) who work with local farmers. The Project AoI will be reviewed when pumping test become available; in the absence of a detail hydrogeological study the Project AoI should not be treated as a definitive radius of influence where the effects of drawdown from the TMGO extraction can be measured, but rather a practical area over which stakeholder engagement in relation to groundwater extraction can begin.

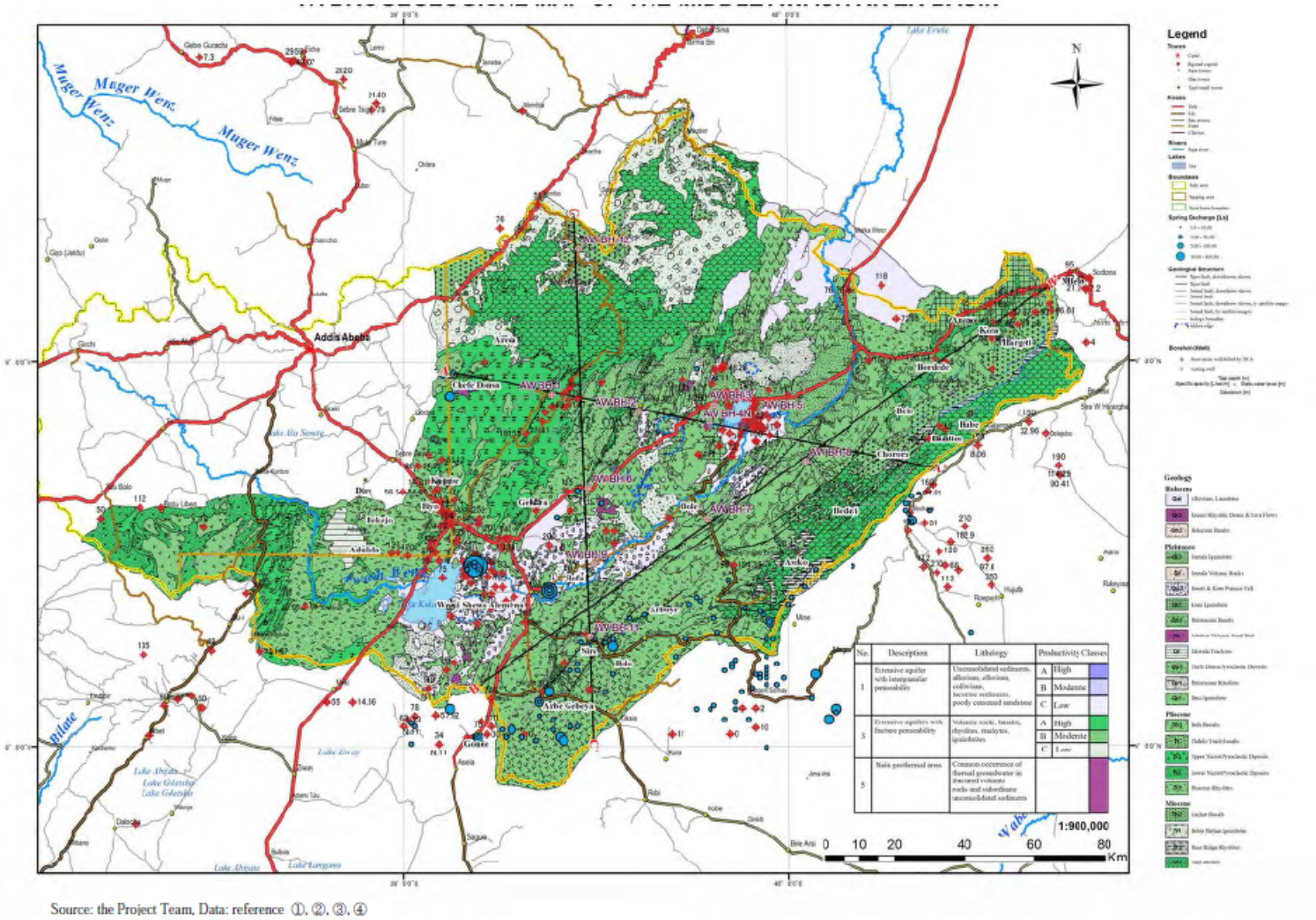
This stakeholder engagement is proposed to include the following activities:

- Determine if spring water quantities and quality are already being measured and recorded by any stakeholders. If this is not already being done, then TMGO will have to implement a baseline monitoring program themselves (this is outside of the Project ESIA scope defined here).

- Determine if there are any other groundwater extractions in the Project AoI,

Impacts from drilling and associated groundwater extraction (either real or perceived will be determined by the location and size of the extraction itself, as well as impacts associated with the development of any associated infrastructure (local pipelines, pumping stations, storage facilities and power supplies etc.). The latter can generally be managed through the implementation of the management systems already in place or planned by TMGO. Actual impacts associated with extraction will also be dependent upon the extent of the associated drawdown from individual wells and/or a wellfield. The extent of any such drawdown within the existing aquifers will be better determined on completion of pumping tests and once a coherent groundwater model has been developed. While the utilization of groundwater remains TMGO's preferred option due to its proximity to site and that there may be sufficient resource available not to impact other water users, the spring extraction option, remains a back-up option as outlined further below.

[15] Cashman, P. M., and Preene, M. (2001): Groundwater Lowering in Construction – A Practical Guide, pp 203 to 205.
[16] Japan International Cooperation Agency (Kokusai Kogyo Co., Ltd.) December (2015): The Project for Groundwater Resources Assessment in the Middle Awash River Basin in the Federal Democratic Republic of Ethiopia. Final Report.



Source: the Project Team, Data: reference ①, ②, ③, ④

Figure 4.5: Hydrogeological Map in the Middle Awash River Basin[16]

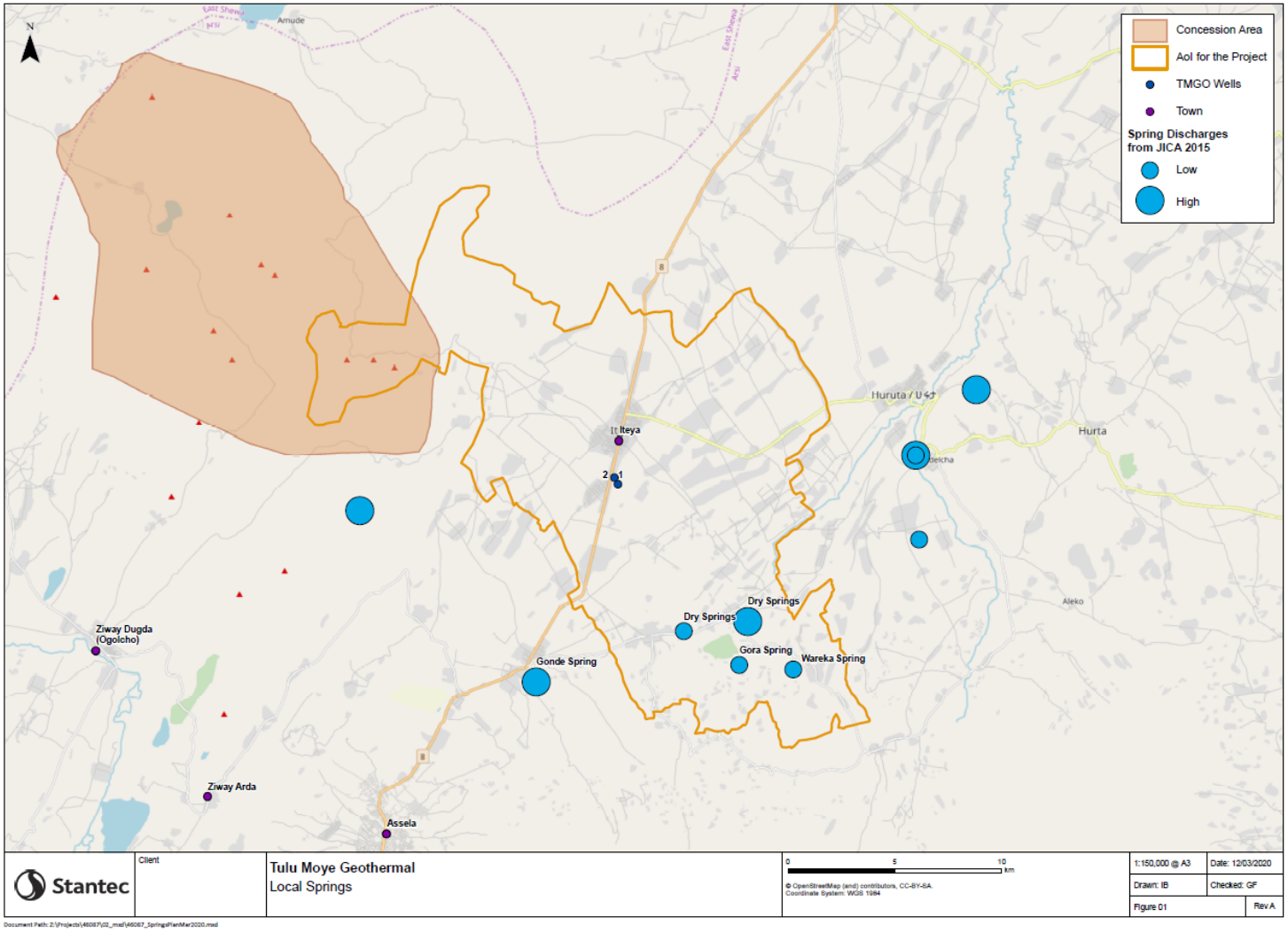


Figure 4.6: Springs Identified in the Project AoI according to JICA (2015)[16]

4.5.3 Use of Spring Waters

If existing groundwater does not provide adequate resources for the Phase 1 Project, TMGO are considering a back-up of developing a water supply from either the Wareka or the Gora springs located to the south of Iteya (see Figure 4.6). Within the Hitosa Woreda, piped water is currently provided to the local communities from the nearby springs by the following three WSS enterprises:

- **Boru Jawi WSS**: The enterprise provides piped water from the Wareka and Gora Springs to the four Kebeles of Boru Jawi, Boru Chilalo, Boneya Edo and Oda Jila. Through the process it supplies water to 1,600 yard connections and 41 collective waterpoints (20 functional in December 2019). Considering 100 households per waterpoint, the enterprise estimates that it supplies water to 3,600 households (19,280 persons).

- **Hitosa WSS**: The enterprise provides water to the town of Iteya. Iteya is the largest population center adjacent to the Concession Area and is currently supplied by an 8" pipeline from a large spring at Kuchura to the north east, and from further connection to the Wareka spring located to the south east of the town. The system captures water from the Wareka Spring (500 meters upstream the Boru Jawi catchment box) and supplies water to 7,000 yard connections and 162 collective waterpoints (each waterpoint is designed to serve at least 250 households).

- **Gonde WSS**: The enterprise provides piped water to Gonde and its surroundings. This enterprise was not interviewed during this scoping stage because its water system is not part of the water supply options identified by TMGO. However, an RG report[17] states that one of the source springs in Gonde is totally dry. The other one is supplying only 5 L/s of water. Due to the reduced flow, water is not piped to Terro Moye and Terro Desita Kebeles and the surrounding localities. Instead, a truck mounted tanker is sent once in every 3 to 4 days for home consumption for the community.

The Iteya water demand already substantially exceeds the combined Kuchura and Wareka spring supply. Currently, the town water supply is rationed, and residents receive water for 3 in 7 days each week with the WSS enterprises needing to organize rotas to manage the supply. Even during the rainy season, when the water demand stays relatively low, customers typically receive piped water every 3 or 4 days. During the dry season, as temporary waterpoints dry up, water demand increases drastically; and some customers only receive piped water once every 2 weeks particularly of villages in rural Kebele called Hula-Dawi. In this situation customers need to travel to Iteya to buy water from private connections or communal waterpoints.

In addition, during the rainy season, water users comment that the turbidity of piped water is very high and that "worms" can be observed in the water. Water-related diseases are perceived to increase during this period because the piped water is not effectively chlorinated by the WSS enterprise and users do not purify water themselves. Data collected in 2016[18] also found that 84% of the respondents living in Hitosa Woreda do not use any water purification methods.

4.5.3.1 Wareka Spring Option

The area from where this spring emanates has considerable space where seepage occurs and there is usable amount of water which flows into the Wareka River without being captured (TMGO pers comm). It could be possible to apply basic spring development methods to collect

[17] Availability of drilling water Report No.: 17006-02 Tulu Moye, Ethiopia Authors: Gestur Gíslason, Tadesse Mamo – A study report by Reykjavik Geothermal, June 2018.

[18] GIBB International, 2016, *Environmental Baseline Study report for Tulu Moye Geothermal Project*

water from this seepage area and use the water collected for example by routing it to an existing pipe. While improving pipeline efficiency will avoid interruption of water flow into the town, consideration must be given to the impact on downstream water users and wildlife. In addition, as the existing supply is already considered inadequate for Iteya, utilization by TMGO could lead to local conflicts with the community. Although this option will be considered in the impact assessment, considerable mitigation measures may be required.

4.5.3.2 Gora Spring Option

According to Demis Alamirew's report (April 2019), the Gora spring has a total flow of 40 L/s, and about 4 L/s are currently used by the community. The Zone water management team use a principle whereby 50% of the spring flow is available for water supply and the remaining 50% is released to preserve a water supply for down-stream users and to sustain the environmental conditions. Consequently, an estimated maximum surplus of 16 L/s is available from the Gora spring. Stantec undertook a visual inspection of the Gora spring on July 2, 2019, which confirmed the rainy season spring flow was of the order of 40 L/s, which supports the flow rates estimated by Demis Alamirew. However, it must be confirmed that the spring flow rate doesn't change significantly during the dry season. Although the Gora spring may not be able to meet the TMGO short-term peak water demand of 35 L/s, nor the average water demand of 25 L/s, a water supply can potentially be constructed on relatively short notice if environmental and social hurdles are addressed and this will be addressed in the Project ESIA.

4.5.4 Summary of Preferred Project Water Supply Options

Based on the work outlined above, the Project, which is the subject of this Project ESIA study is described as follows:

- The preferred option is 35 L/s sourced from groundwater extraction from wells to the south west of Iteya.
- As a possible alternative to groundwater extraction, additional previously uncaptured extraction at Wareka spring and up to 16 L/s of water from the Gora spring will be considered.

A potential third option is to extract groundwater from one or more sites closer to the springs. The locations and extraction quantities of such sites have not yet been defined. As a result, the specific impacts are uncertain. Nonetheless this option is likely to represent a combination of the impacts associated with the two options listed above and therefore it is not considered further in this assessment.

4.5.5 Project AoI

A single Project AoI has been identified which considered the spatial extent of potential social and environmental impacts. The Project AoI in relation to the Concession Area is presented in Figure 4.6. Figure 4.7 below shows the spatial extent of the Project AoI and the communities located within it. The community engagement process focusses on the Hitosa district and is defined by the location of the proposed TMGO deep groundwater extraction at Iteya and the nearest water features on which it may have an impact.

The Project AoI includes the anticipated extent of potential direct or indirect social impacts of the proposed project. The Project AoI has been determined by identify all the components of the project and their related sources of impacts that could influence the socio-economic environment.

The impacts of the Project can be direct, indirect and cumulative with other projects or activities:

- Direct impacts occur through a cause-and-effect relationship between a component of the Project and an element of the socio-economic environment. The direct impact for a given stakeholder refers to all the qualitative, quantitative and functional changes (negative or positive) that occur as a result of a project from its conception to its closure. It is these impacts that are assessed.

- Indirect impacts (e.g., viability of a species population resulting from loss of part of a habitat as a result of the project occupying a plot of land).

- Cumulative impacts are the result of a combination of impacts generated progressively by additional phases of the same project or by several projects that overlap in time (past, present or future) and space.

For each direct impact identified, related indirect and cumulative impacts will be considered. These indirect and cumulative impacts are often numerous, extend over many years and are the result of interrelationships that are often difficult to assess. Therefore, assessment of the cumulative impacts must be well constrained and possible to demonstrate.

The Project AoI is the same for the social and environmental impact assessment. This Project AoI combines the social impacts of groundwater extraction and the use of spring waters, which covers 15 Kebeles or Peasant Associations and one Seed Enterprise.

This Project AoI is also used to assess the impacts to environment since it includes the Gora and Wareka spring and the groundwater extraction location and pipeline. This Project AoI may not include areas potential affected by groundwater draw-down from the extraction wells. The area od drawdown can only be determined from pumping tests, the results of which are not yet available. Should it be identified that the area impacted by groundwater drawdown is outside the Project AoI then it will be re-evaluated.

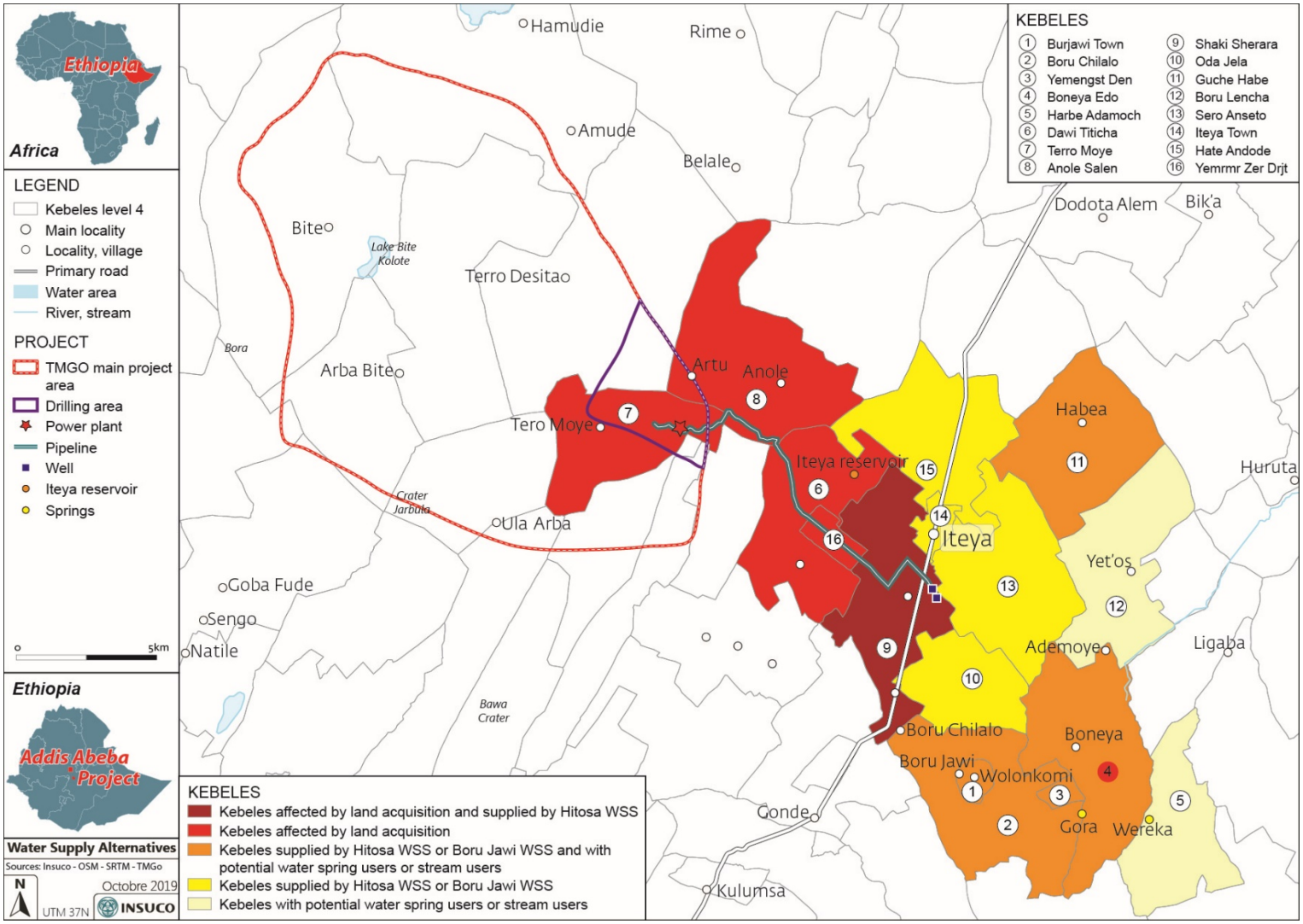


Figure 4.7: Area of Influence (as indicated by colored areas)

5.0 PROJECT ALTERNATIVES FOR PHASE 1 WATER SUPPLY OPTIONS

Several options have been considered by TMGO for water supply, including groundwater extraction, use of spring water, use of surface water from lakes, and tankers. Groundwater extraction and use of spring water are preferred by TMGO (see Section 4 above), however this section explains why these options are preferred over others as required by the ESIA “Analysis of Alternatives”.

5.1 USE OF SURFACE WATERS (LAKE KOKA)

The primary permanent surface water resource near the TMGO Main Project is Koka Lake. At an earlier stage consideration was given to piping of surface water resources from here, but this option has been discounted by TMGO due to concerns regarding the large number of stakeholders that could potentially be affected by this option.

5.2 TANKERED WATER

Tankered water could be used temporarily to support the borehole or spring options. Although tankerage is a simple engineering solution, it would require a significant number of vehicle movements which could result in E&S impacts including deterioration of road conditions, particularly during the rainy season. Given this, tankering was not taken forward as a primary water supply option.

6.0 STAKEHOLDER ENGAGEMENT

6.1 STAKEHOLDER IDENTIFICATION

Stakeholders are persons or groups who are directly or indirectly affected by a project and those with an interest in a project and/or the ability to influence its outcome, either positively or negatively.

6.1.1 Stakeholders related with the Project

Concerning the Project, five categories of stakeholders have been identified including: Project proponent, Government authorities, WSS enterprises, people affected by the project and civil society organizations. It seemed appropriate to distinguish different groups within the people affected by the project, knowing that TMGO will have to communicate different information to each of these groups.

Table 6.1: Stakeholders related with the Project

Stakeholder	Relevant roles for the Project
Project proponent	
TMGO	Project proponent. Responsible for the implementation of Environmental and Social policy measures
Government authorities	
Ministry of Environment, Forest and Climate Change (MoEFCC)	In charge of validating ESIA and monitoring the implementation of the ESMP
Ministry of Water, Irrigation and Energy (MoWIE)	In charge of the management of water resources, water supply and sanitation. In charge of delivering the Groundwater Drilling permit (inside concession) Mandated by MoEFCC to validate the ESIA for Water supply alternatives (that fall under their regulatory framework)
Oromia Regional Bureau of Water and Energy	In charge of delivering Groundwater Drilling permit (outside concession) and Water Extraction Permits In charge of ensuring a sustainable and adequate management of the sources, effective responsibility at the level of the Woredas
Arsi Zonal Bureau of Water and Energy	In charge of defining local priorities, designing and planning water supply engineering works in collaboration with the Woreda offices
Hitosa Woreda Bureau of Water and Energy	In charge of defining local priorities and designing water supply and sanitation systems in collaboration with the Zonal Bureau. Member of the boards of the WSS enterprises In charge of ensuring a sustainable and adequate management of the sources, by following the requests of the regional office when necessary
Hitosa Woreda Agriculture Office	In charge of assisting the preparation of cost estimation for affected properties and supporting the endeavors for restoration of displaced households' livelihoods In charge of supporting resettlement committees to perform their duties They have Kebele development agents who could act as an alternative relay for passing on TMGO information and bringing forward community requests.

Hitosa Woreda Health Office	Able to provide demographic and health data, updated and disaggregated by Kebeles In charge of ensuring that water in water supply systems is safe to drink (Proclamation no 661/2002 that sets out the procedure for supplying water for human use)
Kebele authorities	In charge of organizing community meetings, informing the public about the information TMGO wishes to share, supporting the valuation of assets and assisting vulnerable households.
Water Supply Service Enterprises	
Boru Jawi WSS enterprise	In charge of supplying water to the inhabitants of the four Kebeles of Boru Jawi, Boru Chilalo, Boneya Edo and Oda Jila. In charge of ensuring a sustainable and adequate management of the sources they are using for their WSS (Gora and Wareka springs)
Hitosa WSS enterprise	In charge of supplying water to the inhabitants of 48 Kebeles in 4 Woreda and 2 zones (including Iteya and the surroundings Kebeles) In charge of ensuring a sustainable and adequate management of the sources they are using for their WSS (Wareka and Kutchura springs)
People affected by the project	
People affected by land acquisition (drilling areas)	Communities living in the Kebeles of Tero Moye and Shaki Sherara.
People likely to be affected by restriction to water resources due to project activities.	Communities living in the Kebeles of Shaki Sherara, Buru Jawi, Boru Chilalo, Boneya Edo, Harbe Ademoch, Oda Jila, Guche Habe, Boru Lencha, Sero Anseto, Iteya, Hate Andode.
People affected by temporary displacement for the pipeline construction	For the Gourndwater: Communities living in the Kebeles of Tero Moye, Anole Salen, Dawi Guticha and Shaki Sherara. For the Springwater Option: It has to be defined with the project design. It should be the communities living in the Kebeles of Boru Chilalo, Oda Jila and Shaki Sherara.
Enterprises affected by temporary displacement for the pipeline construction	Yemrmr Zer Drjt, a seed enterprise working with local farmers Oromia Forest and Wildlife Enterprise (OFWE), government-owned organization in charge of managing a concession of forestland in the Oromia region
Water users affected by possible and/or perceived flow variation at the spring or downstream	Communities living in the Kebeles of Harbe Adamoch, Boneya Edo, Yemengst Den, Boru Chilalo, Boru Lencha and Sero Anseto.
Water users of the Boru Jawi WSS	Communities living in the Kebeles of Boru Jawi, Boru Chilalo, Boneya Edo and Oda Jila
Water users of the Hitosa WSS	Communities living in the town of Iteya and the surroundings Kebeles (Sero Anseto, Shaki Sherara, Hate Andode and Guche Habe)
Civil society organizations	
CSOs and NGOs in Hitosa Woreda	Protect the rights of the residents of the local community during project implementation. Possible collaboration during the implementation of the livelihood restoration plan.

Both WSS enterprises warrant a more detailed description (see below) as they are responsible for the management of the drinking water systems currently operating in the Project AoI and

could be actively involved in the management of the groundwater supply shared by TMGO with communities.

6.1.2 Hitosa WSS Enterprise

It was established in 1994 as a Grade 3 WSS, under the responsibility of the Arsi Zone Bureau of Water. In 2008, it grew in scale and became a Grade 2 WSS, now under the responsibility of the Oromia Regional Bureau of Water. Their Head office is in Iteya Town and they employ 38 permanent employees.

The Hitosa Water Board, responsible for overseeing the enterprise, is headed by an expert from the Oromia Region Water Bureau and composed of one representative of each administration plus two customer representatives. They are appointed for 2 years and can only take two mandates. The board validates work plans and budgets and monitors the performances of the enterprise based on monthly, quarterly, bi-annual and annual reports. Finances are audited annually by an external team of Woreda, Zone and Region Finance experts, and they follow the Government procurement rules.

Hitosa WSS supplies water to 48 Kebeles in 4 Woreda and 2 zones:

- Hitosa Woreda (Arsi Zone, 24 Keb.), including the town of Iteya and its surroundings Kebeles
- Dodota Woreda (Arsi Zone, 10 Keb.)
- Lode Hitosa Woreda (Arsi Zone, 5 Keb.)
- Adama Woreda (East Shazo Zone, 8 Keb.)

Its water supply solely relies on Wareka spring (5L/s exploited), 500 m upstream the Boru Jawi catchment box, and on Kutchura spring (19.4 L/s exploited, 8" pipeline), in Kutchura Kebele. The scheme was theoretically designed to supply 67,000 people with 25 litres per day and to cover 32 separate communities and three small towns[19]. Currently it supplies water to 7,000 yard-connections and 162 collective waterpoints (each designed to serve at least 250 households), providing water to at least 47,500 households. The water flow is not sufficient to distribute water to the entire network, so the enterprise organizes distribution by shifts.

6.1.3 Boru Jawi WSS Enterprise

Boru Jawi WSS was created in 2012. The area where it operated was previously under the Hitosa WSS. As a Grade 4 WSS, it reports to the Zone administration. The Board is composed of 9 members: eight customers representatives elected by communities and one Chairman appointed by the Arsi Zone Water Office. They are appointed for two years and can only take one mandate.

As for the Hitosa WSS, the Boru Jawi Water Board monitors the performance of the enterprise based on annual plans, budgets, monthly, quarterly and annual reports. They are subject to an external audit from the Woreda Finance Office every 2 years and they follow the Government procurement rules. They currently employ 15 staff.

Boru Jawi WSS supplies four Kebeles located in Hitosa Woreda: Boru Jawi, Oda Jila (which is a peasant association, not a Kebele), Boneya Edo and Boru Chilalo. Their distribution network relies on gravity and exploits Wareka spring (2.9 L/s exploited) and Gora spring (4L/s exploited).

[19] http://www.coolgeography.co.uk/gcsen/CRM_Water_LIC_Hitosa.php

There are approximately 1,600 customers with a yard connection and 41 water points, but only 20 are functional. Considering 100 households per water point, the company estimates that it provides water to 3,600 households (19,280 persons). This represents the water coverage of 68.4% of the population of these 4 Kebeles which have 5,872 households and 28,187 inhabitants (data from the Hitosa Woreda Health Office, 2019).

According to the WSS manager, water shortages are limited to Oda Jila and the enterprise does not need to implement water shifts like Hitosa WSS does. Moreover, it plans to connect an additional outlet of the Gora spring to the network in a few months to remedy the problem of water shortage in Oda Jila. However, according to the Woreda Water Office, the Boru Jawi WSS reservoir is only 25 m^3, which is insufficient to supply all its customers. And participants in the Boneya Edo focus group who are clients of the Boru Jawi WSS enterprise said they also have recurring problems with water shortages during the dry season.

6.2 STAKEHOLDER CONSULTATION

Stakeholder consultations have been conducted since 2015 to discuss the proposed geothermal development. Initial consultations have focused on project feasibility, stakeholder identification and the main concerns and opportunities for the ESIA of the TMGO Main Project. From 2015 to 2019, additional consultations were held with communities and local authorities, focusing on information sharing and stakeholder consultation on project status, impacts and mitigation measures, communication, consultation and grievance mechanisms and the livelihood restoration process.

6.2.1 Consultations Conducted During the Scoping Phase

With specific reference to the ESIA for the Project, discussions were held with various stakeholders during the July 2019 visit to collect their expectations and identify their concerns. One of the main objectives of the scoping exercise is to consult with various agencies and stakeholders to agree on the scope, methodologies, surveys, assessments and outputs of the Project ESIA. The agenda of the meetings is presented in the Scoping Report in Appendix A. Stakeholders were informed that TMGO was considering two water supply options: groundwater and spring water alternatives. They were asked if they thought it was possible to share groundwater, water from the Gora and Wareka springs and under which conditions. They were also able to share their fears and expectations of the Project. The conclusions of the various meetings are as follows:

- There is broad support for the project at a federal/regional level subject to appropriate permitting applications and support at a Woreda level. There is broad support at the local Woreda level, subject to an assessment of the benefits and disbenefits of the proposed water development and the agreement of the community. All stressed the importance of community approval in securing access to available water sources and the need to avoid any conflicts over water supply.

- The two community focus groups indicate that the local population expects the project to provide clean drinking water, either from groundwater or spring water.

- Discussions with the WSS enterprises have also revealed that they are prepared to provide access to their water resources under certain conditions. The Hitosa WSS enterprise is reluctant to share its access to the Wareka Spring but would share its pipeline if TMGO can provide a larger water pipeline (from 3 to 5 inch) and a new reservoir of 200 m^3. The Boru Jawi WSS enterprise would share the Wareka and Gora Springs if TMGO can rebuild the

catchment boxes, install a larger water pipeline, build a new water reservoir, and contribute to O&M costs.

6.2.2 Consultations Conducted During the Impact Assessment Phase

It was necessary to complement the interviews conducted during the scoping phase with in-depth discussions with stakeholders in order to identify more detailed impacts and propose practical mitigation measures. Therefore, a second field mission took place in December 2019. The agenda of this second visit can be found in the Appendix C of the Project ESIA Report. The conclusions and suggestions of the various stakeholders are summarized in the following table. The minutes of the meetings and attendance lists are annexed to the Project ESIA.

Table 6.2: Expectations and Suggestions of Various of Stakeholders

Stakeholder	Expectations and Suggestions
Hitosa Woreda Bureau of Water and Energy	- They are more in favor of TMGO exploiting Gora Spring than Wareka Spring, because it has a higher discharge (24 L/s vs 11-12 L/s according to their December 2019 measurements). - If TMGO wants to use Gora Spring, they need to provide a larger water reservoir to the Boru Jawi water supply system (from 25 m^3 to 100 m^3). The Water Office has already transmitted to TMGO a proposal in that sense. - If TMGO wants to use Wareka Spring, they could tap the water currently overflowing in the stream on Hitosa WSS network by repairing the leakage. - In any case, TMGO needs to see that water supply to communities will not decrease, and if possible, contribute to improving it.
Hitosa Woreda Agriculture Office	- The Project should benefit communities, as there is a severe water shortage situation in Hitosa Woreda. TMGO could increase water supply to community, and if there is enough groundwater, TMGO could develop small-scale irrigation schemes. - They have not been sufficiently informed about the land compensation process and want to be more involved in further stages of the TMGO project. They ask TMGO to keep their local agents informed. - TMGO should address all issues raised by the road compensation process before initiating the development of its water supply component.
Hitosa Woreda Health Office	- The Health Office had not yet been formally consulted by TMGO but asked to be involved. They remember that they are in charge of validating the quality of the water through the regional Laboratory in Adama. This validation is mandatory to start the implementation of any drinking water system. (Proclamation no 661/2002 defining the procedure for supplying water for human use). - They strongly recommended to avoid Wareka Spring, which is already under a lot of community pressure and has a very low yield, especially during the dry season. There may not be sufficient water for communities and TMGO and, if the overflow is reduced, this may provoke an outbreak of communicable diseases. - Gora spring has a much higher yield so there should not be any problem if the company wants to exploit this spring. Kaleta River is another option that has a considerably larger potential than Gora and Wareka. - If groundwater development is possible, it is the best option because it will provide an additional source of water from which the communities can also benefit. It will be difficult for communities to accept if TMGO supplies water to some communities and not others. - In any case, TMGO should look at the different options very carefully in close collaboration with the WSS Boards of Gonde, Boru Jawi and Hitosa.

	- They offer to support the development of TMGO community water supply by delivering awareness raising and trainings on home water treatment and hygiene, as well as latrines. They already run a Government WASH program routinely through their extension agents.
Hitosa WSS enterprise	- They would be happy to distribute TMGO water to communities using their network, if TMGO can provide a bigger water pipeline (from 3 to 5 inch) and a new reservoir of 200 m^3. - They cannot share sustainably the Wareka Spring, as already discussed with the company: the spring has a very low yield that declines during the dry season, and the potential is already 100% tapped. - As indicated by the Hitosa Woreda Water Office, there is a leakage on the Hitosa WSS catchment box (on the Wareka Spring). However, it is not a lot of water, and it contributes to supply a small-scale irrigation system downstream (27 ha in Keb. Harbe Adamoch, Etebe and Boneya Edo). Cutting this overflow by fixing the leakage is difficult, as water supply for downstream farmers would shrink. - Communities connected to Boru Jawi WSS will not agree with the exploitation of Gora spring by TMGO. There are already too many people in neighboring Kebeles hoping to secure their water supply from Gora spring. - Instead of looking at Wareka and Gora springs, TMGO could partner with them to develop alternative water sources that could be the following: 1. Groundwater around Boneya Edo in Wedetcha ground River (10 km from Iteya). A feasibility study proposing four boreholes was transmitted to TMGO. 2. Kaleta river (150 L/s of total discharge) located 25 km away from Iteya in Woreda Lode Hitosa, Kebele Tulu Yambo or Kutchura. They have identified the road, the source and 3 reservoir locations (1 Million m^3, 500,000 m^3, 200,000 m^3). They are now preparing to survey the pipeline trace. The water meets standard for consumption. They are seeking finance from the government, banks, NGOs to share the investment (850 Million Birr). They discussed this with TMGO to share the cost. They will provide the completed feasibility study with the investment plan once finalized. 3. Gudetcha spring (18.4 L/s exploited), located in Kutchura Kebele. They have done a feasibility study and found Government funding (Dodota Alem Water Supply system project, 5,7 Million Br). Now 85% of the network is already built. The spring will be connected to the Kutchura pipeline (7 km downstream of Kutchura spring). - In any case, TMGO should be working closely with the communities. If they do not address their needs and concerns properly the community will break their pipes for their livestock and human consumption.
Boru Jawi WSS enterprise	- They would like to be formally consulted by TMGO when the company has the results of the hydrological study and to receive a copy of the study. They will then consult the Board and community representatives (elders and influential people) to take a decision based on the study. - If the water source proposed is not adequate for both TMGO and communities, they will not share with TMGO. - Currently, Gora Spring has three outlets: one is already connected to the Boru Jawi WSS, another is planned to be connected on the network in a few months. The last outlet is kept for an irrigated perimeter in Kebele Boneya Edo that taps the overflow of Gora spring.
Residents of Shaki Sherara	- Currently they receive water through yard connections from the Hitosa WSS Enterprise (using the Wareka and the Kutchura Springs). They are very satisfied with the water service. The Water board works well, is active and communicates in a timely and efficient manner with them. - They are happy that TMGO found water in their Kebele and hope that the company will share groundwater with them. However, they do not expect this, as TMGO declared in a meeting that they would only share water with Tero Moye.

	- Wareka spring is not a suitable option because the debit is very low during the dry season. However, as long as their water supply doesn't diminish and they don't have to pay more for it, they don't mind TMGO using this spring. - TMGO has benefited the community so far by employing laborers for road construction, providing scholarships to five students and compensating the owners of the well areas. Focus group participants hope that the water component of the TMGO project will provide more temporary jobs in construction activities. - There is no community water management institution in this Kebele, but male FGD participants mentioned that three individuals played a key role in the resolution of a water conflict in the past: 1. Haji Ahemd (Kebele Head) 2. Geda Hunde (Elder) 3. Asefa Chengere (Elder and influential person)
Residents of Iteya	- Currently they receive water from the Hitosa WSS Enterprise (using the Wareka and the Kutchura Springs). They aren't very satisfied with the water service. There is no regular scheduling for the water shifts and water usually arrives at night. Sometimes they spend up to 1 month without water and have to buy bottled water. - They are not expecting TMGO to share groundwater, as the well area is far from the city. - If TMGO decides to exploit the Wareka spring, they expect to benefit from this development by increasing the water supply on Hitosa WSS. However, Wareka spring is not a sustainable option for TMGO: the yield is very low during the dry season and there is not enough water even for the current users. - In their opinion, Kaleta River is the best option available for TMGO and they hope the company can partner with Hitosa WSS to develop this new source.
Residents of Tero Moye	- Currently they receive water from the Gonde WSS Enterprise (using the Gonde Spring). They aren't satisfied with the water service and they are worried that Gonde spring will dry up. Only 2 of the 4 water points are functional, so some households have to travel 5 km per day to fetch water and this at night (when water is available) which is dangerous because of the hyena attacks. During the dry season, inhabitants receive water every 2 days, without a regular schedule. Finally, the technical issues can leave them without water for a while: for example, last spring they stayed without water for five months. - They know that TMGO is developing groundwater extraction to pipe water to their plant. They expect to benefit from this development as the company already committed during a meeting in this Kebele to share water with them if it is drinkable. They are waiting for the results of the laboratory tests. - Gonde WSS may not be the best distribution system to share TMGO's groundwater with them because they are dissatisfied with the company showing indicators of poor water supply management. - The Kebele has a Water Committee to manage water conflicts, which is composed of seven members elected by the community for a 3-year mandate. Two of these members are also part of the Gonde Water Board: 1. Haji Abo Ahmed (09.10.74.23.45) 2. Kidija Gemeda
Residents of Boneya Edo	- Currently they receive water from the Boru Jawi WSS Enterprise (using the Gora and Wareka Springs). They are very unsatisfied with the water service because they face regular shortage issues during the dry season, and they are not informed of the water shift scheduling. They would prefer to be covered by the Hitosa WSS again. - They had already heard about the TMGO project. Since their water supply is far from secure, if TMGO is willing to exploit the Wareka spring, they will first need to see that the communities' needs are fully met.

	- Two irrigated perimeters rely on Gora and Wareka springs with all available irrigated plots in use. The demand for irrigated land is high, and farmers downstream are hoping to be able to start irrigating their plots if the channel is extended. - They ask to be consulted again in meetings and focus groups to discuss the company's water supply plan. - Boneya Eda has two community representatives sitting at the Boru Jawi WSS Board but they are marginalized because they complain a lot about the cuts. For instance, they do not participate in the Board monthly meetings. Contact: Kabede Bejega (09.10.41.90.38) - A Water Committee association recognized by the Woreda. The Water Committee is also responsible for managing conflicts between farmers, accordance with the Government manual of operation for Water Committees. The Chairman is Sisay Guta (09.24.06.65.89)

6.3 COMMUNICATION MECHANISMS WITH STAKEHOLDERS

Effective participation is measured by how well a project takes into account the issues and concerns raised by PAP and other key stakeholders. It is mainly structured around two documents:

- **SEP** TMGO elaborated its SEP in 2017 considering that Stakeholder Engagement, including consultation and the disclosure of information, is a key element of project planning, development and implementation. Effective stakeholder engagement assists good design, builds strong relationships with local communities and reduces the potential for delays through the early identification of issues to be addressed as a project is progressing. The SEP identifies the stakeholders and proposes a stakeholder engagement plan, detailing the activities to be carried out before starting work and presenting more generally the mechanisms to be implemented during the implementation of the project. Before starting construction work, it was proposed to conduct one public meeting and three focus groups with affected communities, four roundtable meetings with local authorities, and NGOs. It was also recommended to keep the press informed by regular press releases. The main communication tool effectively used by TMGO since its onset is verbal communication, both formally during meetings, and informally during encounters or discussions with stakeholders passing by the company's office in Iteya. Although this medium appears well adapted to local customs and preferences, the consultants observed that the documentation of these meeting was partially defaulting. For instance, it seems that meeting minutes are not systematically established when a formal meeting is held. However, between September 2018 and August 2019, TMGO has archived the minutes of the following meetings: 4 meetings with local authorities and Woreda Offices and 9 community meetings with people affected by the project. The objectives were to present the project, share and discuss the process of land compensation for the road construction and to gather stakeholders' expectations. Meetings with stakeholders in December 2019 showed that the level of information provided to them remains insufficient and not all those affected by the project understood the process of land compensation activities.

- **Grievance redress mechanism**: TMGO grievance redress mechanism was formalized through its SEP in 2017. In practice PAPs can report grievances through the CLO or in person in the TMGO office in Iteya town. The CLO has taken part in relevant parts of the land acquisition process, thus gaining visibility with PAPs. Additionally, the team applying the socioeconomic survey in December 2018 shared information on the grievance mechanism with each affected household. Between November 2018 and December 2019 TMGO received 47 grievance forms, entered 42 grievances into its database and resolved 41

grievances. Of the 41 resolved grievances, 13 were found to be unsatisfactory by the applicant. Of these 13 unsatisfactory grievance resolution cases, 7 are PAPs seeking compensation for 15 years of lost farmland, in accordance with the compensation practices that TMGO implemented at the beginning of the process and which were modified at the request of the Hitosa Woreda Agriculture Office. On the other hand, a review of the grievance registry and database shows that the process is sometimes partially documented. Some resolved forms do not have the signature of the PAP or are incomplete. Claimant identification information should also include an identification number and telephone number.

As described above, stakeholder participation activities have been proposed in the SEP. They are defined according to the type of stakeholder (communities, companies, local authorities, central authorities) and the type of involvement requested (information, data collection, discussion of results, validation of strategies). During the implementation of the ESMP for the Project, the communication will focus on exchanges on the impacts associated with TMGO's water supply and the necessary mitigation measures. It will include the following activities:

One-on-One Interviews with Government officials and CSO:

A number of authorities play a key role in the implementation of the Project:

- the MoWIE - validates the ESIA;
- the Oromia Regional Bureau of Water and Energy - issues the Groundwater Drilling permit (outside concession) and Water Extraction Permits;
- the Hitosa Woreda Agriculture Office – is part of the Compensation Committee that prepares the cost estimation for affected properties; and,
- the Woreda Health Office - validates the water quality for human use.

It is essential to keep these authorities informed of the process and to share with them the identified impacts and proposed mitigation measures. These interviews have already taken place during the scoping mission and the impact assessment mission. It will be important to meet with new stakeholders to present the main results of the Project ESIA and see that there is consistency with the proposals. Available information on water quality and quantity should also be shared.

For each meeting, it is important to produce a report of the deliberations, photos and a list of contacts.

One-on-One Interviews with WSS enterprises:

Boru Jawi WSS enterprise and Hitosa WSS enterprise are responsible for providing drinking water to their users. TMGO has entered into negotiations with both enterprises to explore the possibility of using water use water from the Gora and Wareka springs.

They were met during the scoping mission and the impact assessment mission to identify their roles and responsibilities and their concerns about TMGO project. It will be interesting to meet them again to present the results of the hydrogeological study and discuss possible collaborations with TMGO. It will also be important to identify corporate governance manuals and propose possible governance improvements (if necessary).

For each meeting, it is important to produce a report of the deliberations.

FGD and public meetings with people affected by the projects:

People affected by the Project can be reached through different communication channels: radio broadcasts, public meetings, picture brochures, etc. Focus group participants said that few use the radio, and many do not yet have television because there is no electricity in their villages. For this reason, radio broadcasts do not seem to be a relevant means of communication and the communities consider that the best way to promote their engagement is to organize meetings through the Kebele head.

That is why during the implementation of the ESIA for the Project, two channels will be prioritized: focus group discussions to identify the concerns and expectations of the different groups of people affected by the Project (men, women, youth) and public meetings, that are the best tool to disseminate information at grass root levels as they allow for real time clarifications on misconceptions, misinformation and false perceptions and fears.

Focus Group Discussions (FGDs) are mainly composed of about 10 to 15 people with similar backgrounds or experiences. FGDs are led through by a moderator that stimulates discussion especially among quieter members of the group. Notice for meetings should be through the Kebele administration. FGDs have already taken place during the scoping mission and the impact assessment mission (i) to identify the concerns of the affected people, (ii) to crosscheck that the WSS enterprises are recognized by the population as having the right to negotiate in their name access to water resources and identify additional stakeholders that should be part of the negotiation process; (iii) to review the TMGO livelihood restoration experience during the access road construction analyzing the efficiency of the communication mechanisms and identifying concrete best practices to be replicated.

An important point is that although focus group participants in Shaki Sherara and Boneya Edo said that both men and women could participate in the mixed meetings, the consultants noted that in reality very few women participated in the mixed meetings. This is why it is strongly recommended to organize separate meetings between men and women to enable women to effectively participate in the process. This is even more important as women are responsible for fetching water.

For each meeting, it is important to produce a report of the deliberations, photos and a list of contacts.

Public meetings can be defined as meetings that are open to everyone with no restrictions on access. Due to unrestricted access, public meetings can have an attendance of more than one hundred persons. The key to such high attendance lies in adequate mobilization. These meetings will be an opportunity to share with the population TMGO’s commitments in terms of improving water supply. It will also be important to explain the conditions necessary for this sharing to be possible, in particular the potability of groundwater.

Finally, it would also be relevant to seek synergies with local public agents. Thus, during the December 2019 meeting, the Woreda Agriculture Office offered its services to disseminate TMGO information and to channel grievances through its network of Kebele-level development agents. In the same idea, the Woreda Health Office offered to support the development of TMGO community water supply by delivering awareness raising and trainings on home water treatment and hygiene, as well as latrines, through their extension agents.

7.0 ENVIRONMENTAL BASELINE

7.1 INTRODUCTION

The Concession Area is in the Main Ethiopian Rift, the northernmost part of the East African Rift System. The topography ranges in altitude from 1,900 metres above sea level (masl) to 2,300 masl and is approximately 150 km southeast of Addis Ababa. The Concession Area is characterized by active extensional tectonics and associated volcanic activities and includes two large freshwater bodies, Lake Koka to the north and Lake Ziway to the south (as shown on Figure 7.1). Impacts associated with developments within the Concession Area are addressed in the TMGO Main Project EISA. This Project ESIA focuses on areas outside of the Concession Area.

The location for the Project and the AoI for this Project ESIA (as discussed in previous sections) is illustrated in Figure 7.1.

7.2 CLIMATE AND RAINFALL

The climate of the area in which the Project is located is subtropical with an annual mean temperature of approximately 20°C. This area has two distinct seasons: 1) wet from June to September and 2) dry from October to May. Peak rainfall occurs in July and August, and there is considerable variation in rainfall between the highlands and the rift floor (see Figure 7.2).

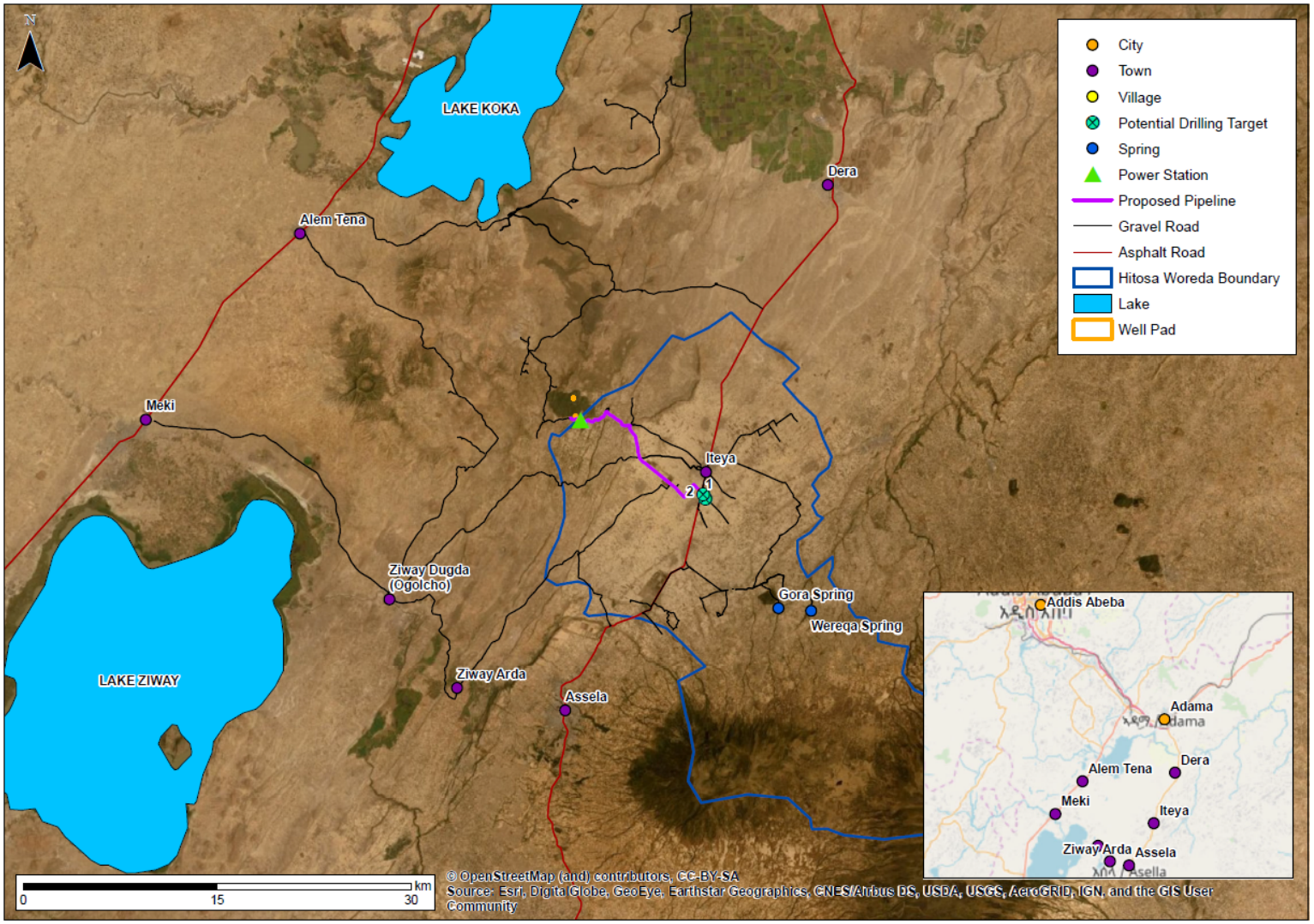


Figure 7.1: Project location with TMGO Proposed Power Station, Water Supply Pipeline and Groundwater Drilling Targets relative to Lake Ziway and Lake Koka.

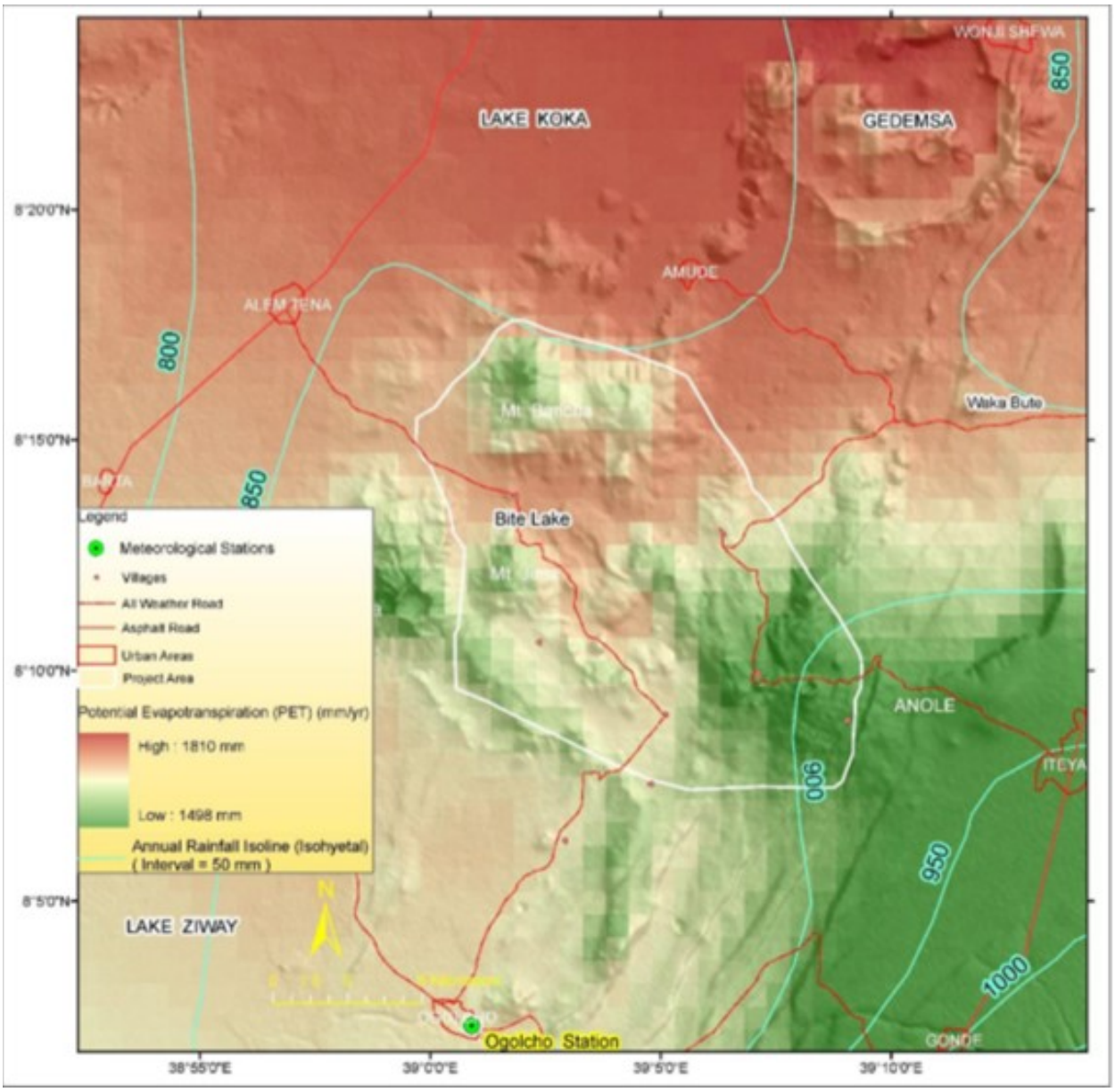


Figure 7.2: Annual rainfall depth (mm) at the Concession Area (GIBB International, 2015)

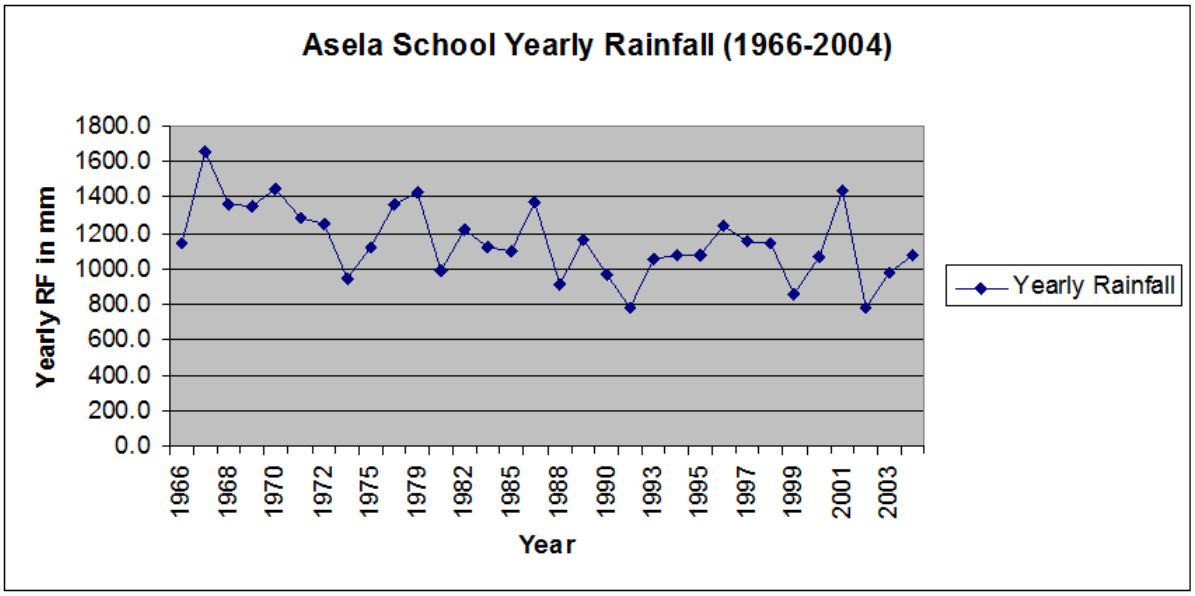


Figure 7.3: Average Yearly Rainfall (1966 – 2004) at Asela School (Source: Hydrogeology of the Ketar River basin, 2009)

There is limited rainfall data available from Asela school (approximately 30 km south of Iteya). This data has shown a nearly 40% reduction in rainfall over a period of 38 years, (i.e., a reduction of approximately 10% per decade – see Figure 7.3)[20]. Further work on rainfall and water recharge issues will be undertaken as part of the Project ESIA and the proposed Project groundwater investigation to understand implications for groundwater recharge and spring water flows. Note the main groundwater investigation is separate to the Project ESIA work presented here.

7.3 GEOLOGY AND SOILS

7.3.1 Geology

The Concession Area is located near the eastern margin of the Main Ethiopian Rift, in an area where tectonic and volcanic activities are concentrated. This area is generally characterized by intense Quaternary faulting and fracturing and three sets of faults have been mapped:

- NE – SW striking marginal normal faults;
- NW – SE to E – W trending trans-rift faults (extension), and;
- active NNE – SSW to N – S striking faults of the Wonji Fault Belt (WFB).

Thermal sites (vents) and tectonics follow the general NNE – SSW trend of the intensively and densely populated faults of the WFB. These all have implications for local groundwater conditions. The topography and geomorphology development is highly related to the geological

[20] Demis Alamirew's report April 2019

development and tectonic activity. Tulu Moye itself is a pyroclastic cone with last known eruption in 1900 AD (flank fissures with silicic lava flows), and the same fissures have also erupted prehistorical basaltic lava flows (Smithsonian Institution, 2016). The small crater at the bottom center of the cone is blanketed by a younger obsidian lava flow. More detailed work on the geology of the Project AoI and surrounding area will be undertaken as part of the proposed groundwater investigation in terms of the implications it has for groundwater (and spring water) flow and extraction.

7.3.2 Soils

Twelve major soil types are found in and around the Concession Area, namely Chromic Luvisols (LVx), Chromic Vertisols (VRx), Dystric Nitisols (NTd), Eutric Cambisols (CMe), Eutric Fluvisols (FLe), Eutric Regosols (RGe), Leptosols (LP), Lithosols (LI), Luvic Phaeozems (PH), Molic Andosols (ANm), Vertic Cambisols (CMv) and Vitric Andosols (ANv)[21]. Further work on the soils of the Project AoI and surrounding area will be undertaken in relation to the implications for rainwater infiltration and groundwater recharge as part of the separate groundwater investigation.

Although short term impacts could affect soils during pipeline installation, these impacts are expected to be minor and temporary in nature and will generally be addressed through existing TMGO processes.

Existing soil types are illustrated in Figure 7.4.

[21] Based on a soil map of Ethiopia prepared by Ministry of Agriculture

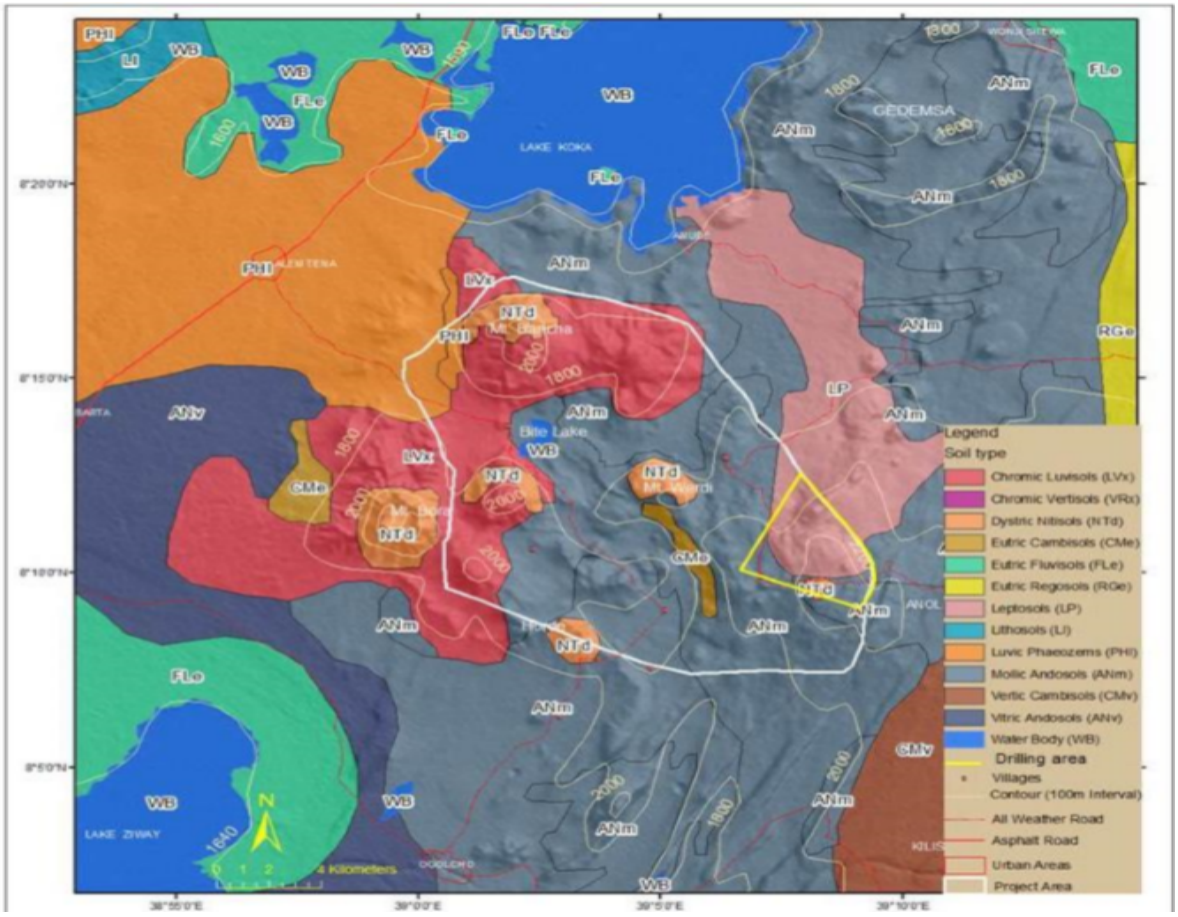


Figure 7.4: Soil Map of the Concession Area (GIBB International, 2015).

7.4 WATER RESOURCES

7.4.1 Groundwaters

The Project is in an area where localized volcanic ridges and depressions, due to trans-rift strike-slip faults, form localized alluvial fans and alluvial deposits of intermittent streams with small hydrogeological basins of shallow ground water. Floods and overland flow can recharge these so many of the aquifers are thought to be only temporary and subject to drying out. Groundwater quality also varies according to the underlying geological formation and period of the year.

Several productive boreholes for water supply have been identified in and near the Project, however following conversations with TMGO it is understood that only the two boreholes shown on Figure 7.6 have been progressed. Both shallow and deep groundwater resources have been found in the area (see also GIBB International, 2015). Water quality is influenced by the underlying geological formation and land uses and is also reported to vary with seasonal rainfall.

Groundwater flow direction in the area is mainly controlled by geological structures and partly by geomorphology. Most of the springs (see below) emerge along the trend of NE-SW at the foot of Mt. Chilalo (topographic break) and at the lithological contacts. Generally, groundwater flows from high gradient Arsi highland to the low gradient rift floor (Figure 7.5**)**, although this is highly affected by rift marginal normal faults and younger NNE-SSW and NW-SE faults. Groundwater flow in the local area is mainly controlled by geological structures.

The main source of recharge to groundwater in the area is rainfall in Arsi highlands. Structures, topography, and lithologies of the region control groundwater discharge. Groundwater discharge occurs as springs at the foot of the highlands and mainly as seepages on the rift valley. All lakes in the Main Ethiopian Rift are seepages (discharges) of the highlands recharge, although a greater volume of groundwater from the region joins the deeper circulation. The Project AoI and the surroundings have greater, deeper aquifers due to large volumes of recharge all along the structures starting from the highlands to the rift floor.

It may be possible that groundwater extraction at TMGOs wells near Iteya could be sustained with no negative social or environmental impacts but Stantec have yet to receive the pumping test report for this test from TMGO to validate this conclusion. It has not been demonstrated at this stage that the Project water demand of 35 L/s can be met by groundwater extraction. To demonstrate this and to identify whether the extraction will have significant negative social or environmental impacts will require a detail groundwater resource investigation with a long term pumping tests at the rate of the Project demand and should include but not be limited to monitoring of the springs before, during and after the test. This work is outside the scope of this Project ESIA.

7.4.2 Surface Waters

The Project is in the Awash and Lakes Region major basins. The area has low drainage density and the drainage pattern is highly dissected by intensive faulting. Drainage density is relatively higher at the Eastern rift escarpment and margin. The rivers (Keter and Meki) mostly follow the rift faulting alignments and the topographic gradient in the landscape (Figure 7.5).

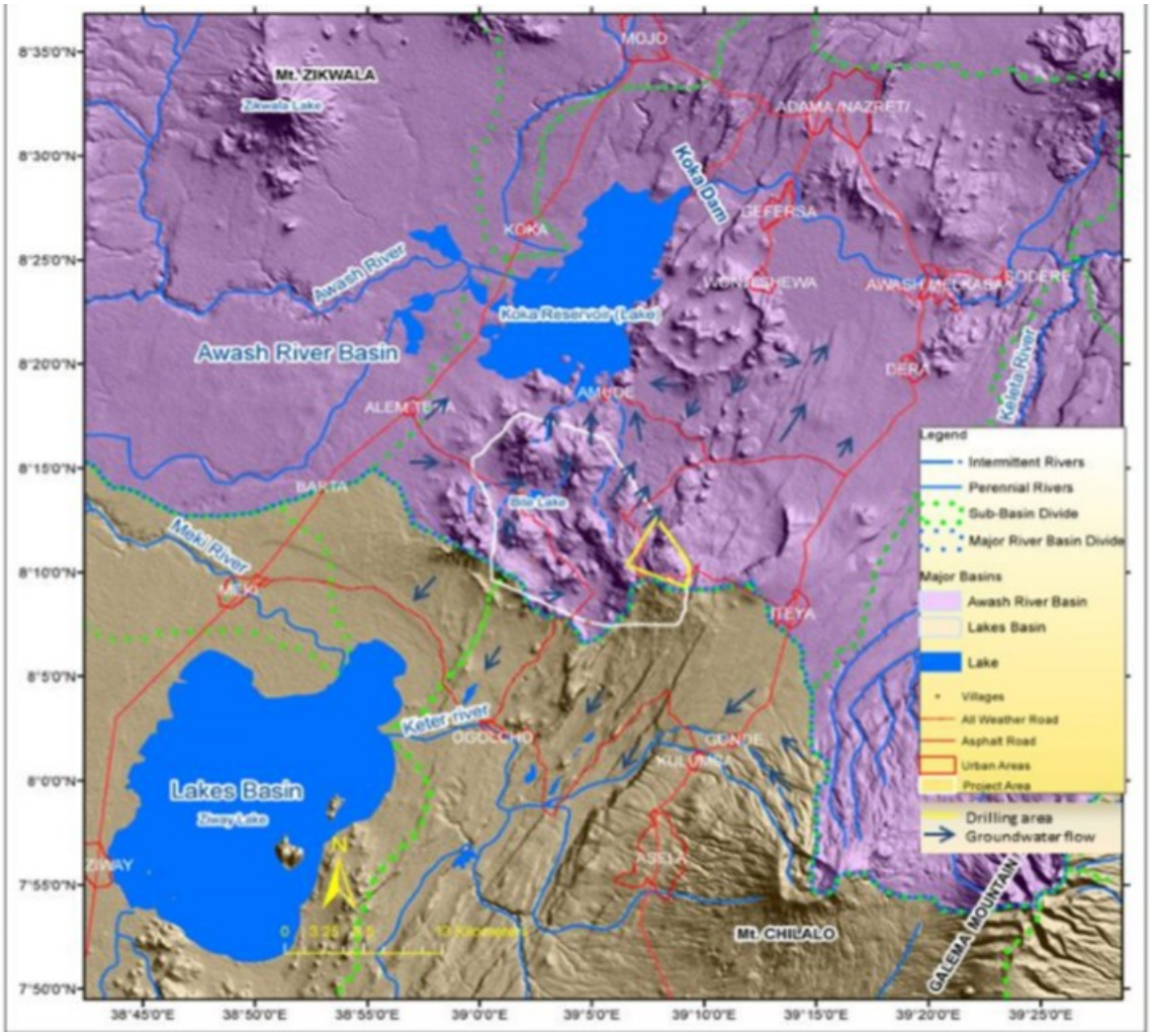


Figure 7.5: Water Features Ziway and Awash Catchments

The upper Awash basin, which includes Lake Koka, is in the Gurage Mountains and drains from west to east. The Main River Awash includes many perennial and intermittent tributary streams. The most southern part of the Concession Area is a part of the drainage basin of the Keter and Meki rivers, which run into Lake Ziway. Several runoff rivers gather into the Keter River. The river has a high gradient and is highly affected by the topographic profile which in turn is influenced by faulting. Lake Ziway is one of the Rift Valley Lakes, which are mainly distributed in the center of the low-profile valley and flat lands created by the rift. No perennial rivers are within the Concession Area but several intermittent ones run through the northern part of Concession Area. Within this Project area to the south east of Iteya number of spring fed perennial streams run to the Awash River, these include the Gora stream fed by the Gora spring and Wareka stream fed by the springs at Wareka including La Kole and Ada (see Figure 7.6 for locations) .

Limited further work on surface water resources has been undertaken as part of this Project ESIA and further work should also be done as part of a groundwater investigation to understand any implications of groundwater or spring water extraction on these resources. The results of

the stream flow gauging and ecology survey conducted in December 2019 are presented in Appendix B. The results of the December stream flow gauging survey are summarized in the table below along with the numbers reported in the Demis Alamirew Report[22].

Table 7.1: Summary of Stream Flow Gauging Results

Spring	Stream	Flow Rate as Reported from Demis Alamirew Report (L/s)	Measured Flow Rate in December 2019 (L/s)#
Gora	Gora Spring	40	Not Measured
Gora	Gora Stream	Not Measured	84
Wareka	Ada Stream	Not Measured	21
Wareka	Le Kole	Not Measured	5
Wareka	Wareka Spring	39 (Hitosa WSS‡: Spring 1: 15 total, 9 piped) (Boru Jawi WSS‡: Spring 2: 9 piped + 15 estimated excess)	95
Wareka	Total stream flow after confluence of Ada and Le Kole.	Not Measured	21
Wareka	Total stream flow after confluence of Ada, Le Kole and Wareka spring flows.	Not Measured	100

Results only likely to be ±20% accurate.
‡ The associated WSS is not specified in the Demis Alamirew report but is inferred by Stantec here.

Table 7.1 shows that flows measured in December 2019 are generally higher than those reported by Demis Alamirew. For example, the flow in the Gora stream was measured at 84 L/s downstream of the Gora spring which had a flow of 40 L/s. Likewise, the Wareka stream had a measured flow of 100 L/s compared to Wareka Spring 1 and 2 which were reported to have a combined flow of 39 L/s including 18 L/s that is already piped by WSS (see Table 7.1).

This greater catchment flow may be due to seasonal fluctuation (i.e., stream baseflow is higher in December shortly after the rainy season rather than at the end of the dry season) and/or that the streams are filled with groundwater baseflow outside of the locations of the spring boxes (assuming it is not surface water runoff from recent rainfall events in the catchment). A detailed water resource investigation is needed to quantify this reliably and this is beyond the scope of this Project ESIA.

[22] Demis Alamirew's report April 2019.

7.4.3 Springs

High discharge springs are located at the foot of Mt. Chillalo and several large springs occur along the eastern escarpment, both to the north east and south east of Iteya. Intakes from Wareka or Gora springs provides a potential water supply option for the Project. However, an RG report[23] states that one of the source springs in Gonde has dried out significantly since construction and the other one is supplying only 5 L/s. Gonde spring is located to the south east of Iteya and supplies the villages around the Concession Area. Conversely, attenuation of flow rates is less obvious in the larger springs but is nevertheless still likely to be occurring in most of the spring discharges.

A stream flow gauging survey was undertaken by MEC on behalf of Stantec in December 2019 (Appendix B). This has identified that the spring locations in the JICA (2015) study, and shown on Figure 7.6, were dry at the time of the survey and may only run during the rainy season. These are therefore not considered further as part of the impact assessment.

7.4.3.1 Gora Spring

As stated in Section 4.5.3.2 according to Demis Alamirew's report (April 2019), the Gora spring has a total flow of 40 L/s, and about 4 L/s are currently used by the community. The Zone water management team use a principle whereby 50% of the spring flow is available for water supply and the remaining 50% is released to preserve a water supply for down-stream users and to sustain the environmental conditions. This leaves a potential 16 L/s for use by TMGO.

A stream flow gauging measurement made in the Gora stream, which the Gora spring flows into, suggests that there is approximately 84 L/s in the stream (see Table 7.1), which suggests additional sources of water other than Gora spring itself. It is not clear whether this is due to seasonal fluctuation (i.e. stream baseflow is higher in December shortly after the rainy season than at the end of the dry season) and/or that the stream is filled with groundwater baseflow outside of the location of the spring boxes. A detail water resource investigation is needed to quantify this reliably and this is beyond the scope of this Project ESIA.

7.4.3.2 Wareka Springs

Hitosa and Boru Jawi WSS have spring boxes at Wareka springs to capture water for human consumption. Hitosa WSS currently extract about 9 L/s of a total 15 L/s at one spring which at 60% is already more than 50% limit required to provide environmental and downstream user allocation of the total spring output. Therefore, the use of this spring should not be considered further on environmental grounds.

The second spring box is for Boru Jawi WSS and is thought to have a total flow of 24 L/s, of which 9 L/s is already piped by the WWS (see Table 7.1). Of the 24 L/s, 50% (12 L/s) should be for environmental and downstream user flow, which would leave a potential 3 L/s for TMGO use.

Impacts of extraction from Wareka and Gora springs are further assessed in Section 9 of this report. Hydrological studies on springs should also form a key element of the separate water resource investigation.

[23] Availability of drilling water Report No.: 17006-02 Tulu Moye, Ethiopia Authors: Gestur Gíslason, Tadesse Mamo – A study report by Reykjavik Geothermal, June 2018.

Environmental Baseline

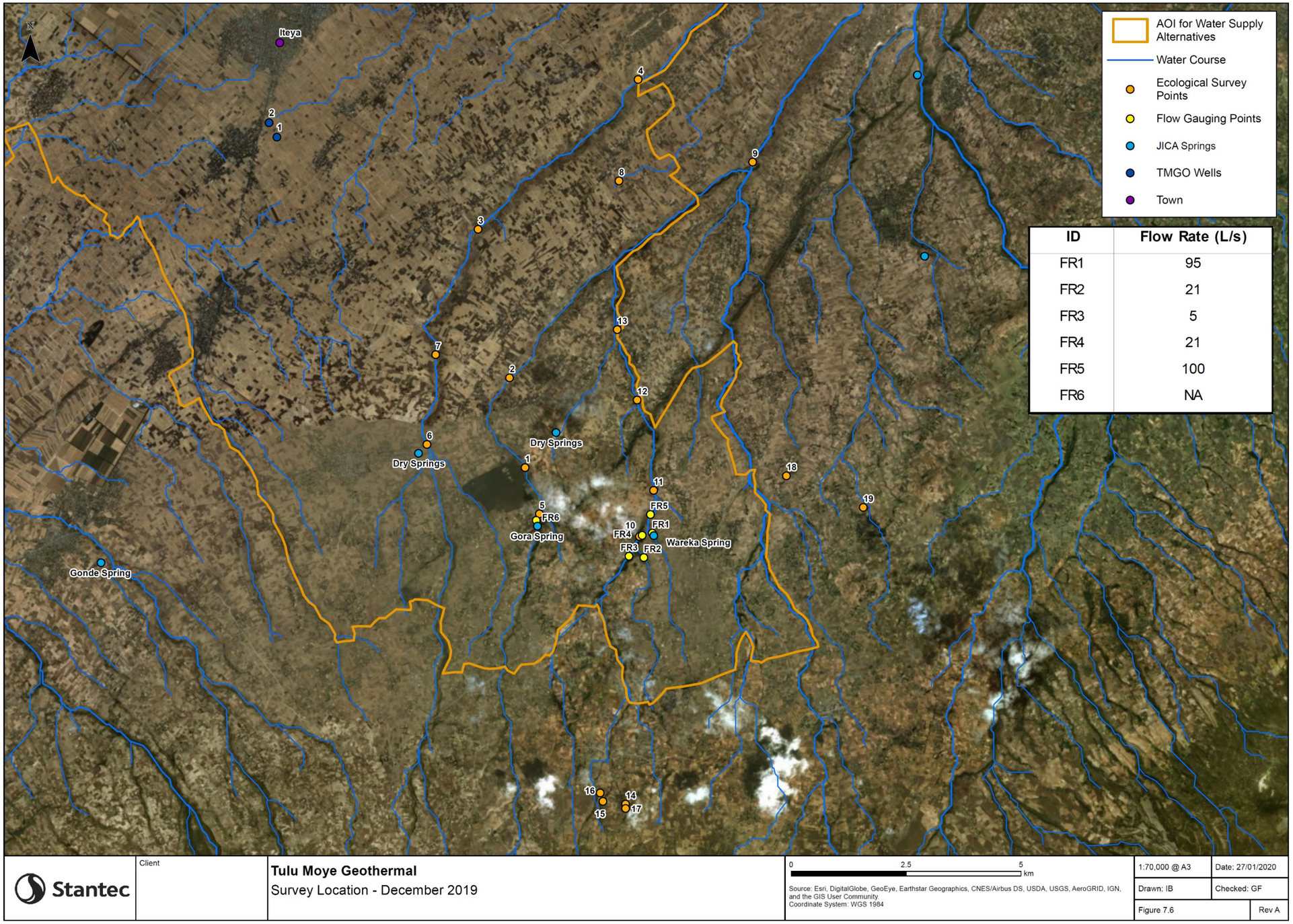


Figure 7.6: Locations of Springs, Stream Flow Gauging and Ecological Survey Points

7.4.4 Water Quality

Local water quality is affected by volcano-tectonic activities. Spatial variation in the ionic concentration of groundwater and surface water systems in the region are due to rock-water interaction (dissolution, adsorption, precipitation, etc.), groundwater residence time, geomorphological setting, and climate. Fertilizers added on farmlands also cause pollution in this regard. The total dissolved solids (TDS) increase from the highland to the rift valley following the regional groundwater directions towards areas of low rainfall and high evaporation and groundwater residence time. In contrast with the rift valley waters, the highland waters are more homogeneous in their chemical composition and are characterized by low TDS (varying often from 50 to 1,200 mg/L).

Highland waters are primarily dominated by Ca-Mg bicarbonates, although a few waters in some locations have high SO4 content. The rift valley waters are mainly of a Na-bicarbonate type with very high TDS (varying in a wide range between 200 and 73,015 mg/L) and high in fluoride. The escarpment waters are a mixture of the two with moderate TDS. The high fluoride in the rift is related to the dominance of acid volcanics and high temperature in geothermal fields associated with high CO2 out gassing incorporating fluorine. In view of the general similarity of rock types drained by streams and rivers in the highland volcanic region, the major ion chemistry of surface waters is not significantly different from the shallow groundwater system of the same region. The groundwater tends to change from HCO3 to SO4 and then Cl type from the main Ethiopian rift to the Afar in the direction of regional surface water and groundwater flow directions and decreases in altitude.

Unlike the highland lakes and rivers, the rift lakes have exceptionally high ionic concentration with extreme variability both in the TDS and type of major ions. The closed basin and terminal lakes attain the highest salinity, alkalinity, and fluoride concentrations as a result of subsequent evaporation. The dominant cation in almost all rift lakes is Na^{+}. A few waters in major urban centers have high nitrate concentrations, indicating anthropogenic pollution[24].

Chemical analysis from several water sampling sites in the Concession Area reported in the TMGO Main Project ESIA indicate that the groundwater has signs of geothermal influence. Based on the silica and fluoride concentration it can be surmised that the water can be used as a cooling agent for the drilling and operation of the geothermal power plant, but drinking water that complies with quality standards will need to be obtained from another source.

No information on the quality of groundwater from the TMGO wells near Iteya have been provided to Stantec. Therefore, it is not possible to comment on the impact the use of this water will have from a water quality point of view.

Ecological surveys of the streams issuing from the springs indicate that the water is fresh and no obvious signs of pollution were observed other than local people washing their clothes or watering their cattle. Water ecology invertebrate sampling indicates that water at Gora and Wareka is of good quality.

Chemical analytical studies of the spring water lie outside the scope of this Project ESIA but should be included as part of a separate water resource investigation particularly if TMGO is to provide water for human consumption where determinants like fluoride are important.

[24] VSO (2017) Tulu Moye Geothermal Development Project - Phase I: Environmental and Social Impact Assessment, Section 14.4.3 Water resources and water quality.

7.5 ECOLOGY

7.5.1 Protected Areas

There are no protected areas (National Parks, Wildlife /Game Reserves, wildlife sanctuaries) within 10 km of the Project AoI. The Lake Koka and Lake Ziway Important Bird Areas (IBAs) are approximately 12 km and 24 km from the Project AoI, respectively, and are not expected to be affected by the Project. The nearest National Park is Abidjatta-Shalla which is located more than 70 km south west of the Project.

7.5.2 Habitat Overview

Most of the Project AoI is modified habitat with agricultural land and grassland and areas of eucalyptus plantation. This has replaced the natural vegetation of the wider area which is the dry evergreen Afromontane forest and grassland complex[25], a mix of primary and secondary woodlands, wooded grasslands, and highland grasslands. Common plant species in the natural habitats include *Juniperus procera, Olea europaea cuspidata, Podocarpus falcatus, Prunus africana, Ekebergia capensis, and Celtis Africana,* with shrubs including *Carissa spinarum, Rosa abyssinica, Euclea divinorum, and Dodonaea angustifolia,* but in general agricultural species now dominate the inventory. Dominant land uses include regenerating land, natural forest, scrubland, grazing land, cultivated land, and settlement, although more valuable habitats are found along watercourses. A brief description of the common modified habitats present in the Project AoI are summarized in Table 7.2 and illustrated in Figure 7.7 and

Figure 7.8.

[25] *Atlas of Potential Vegetation of Ethiopia*, Friis et al, 2010

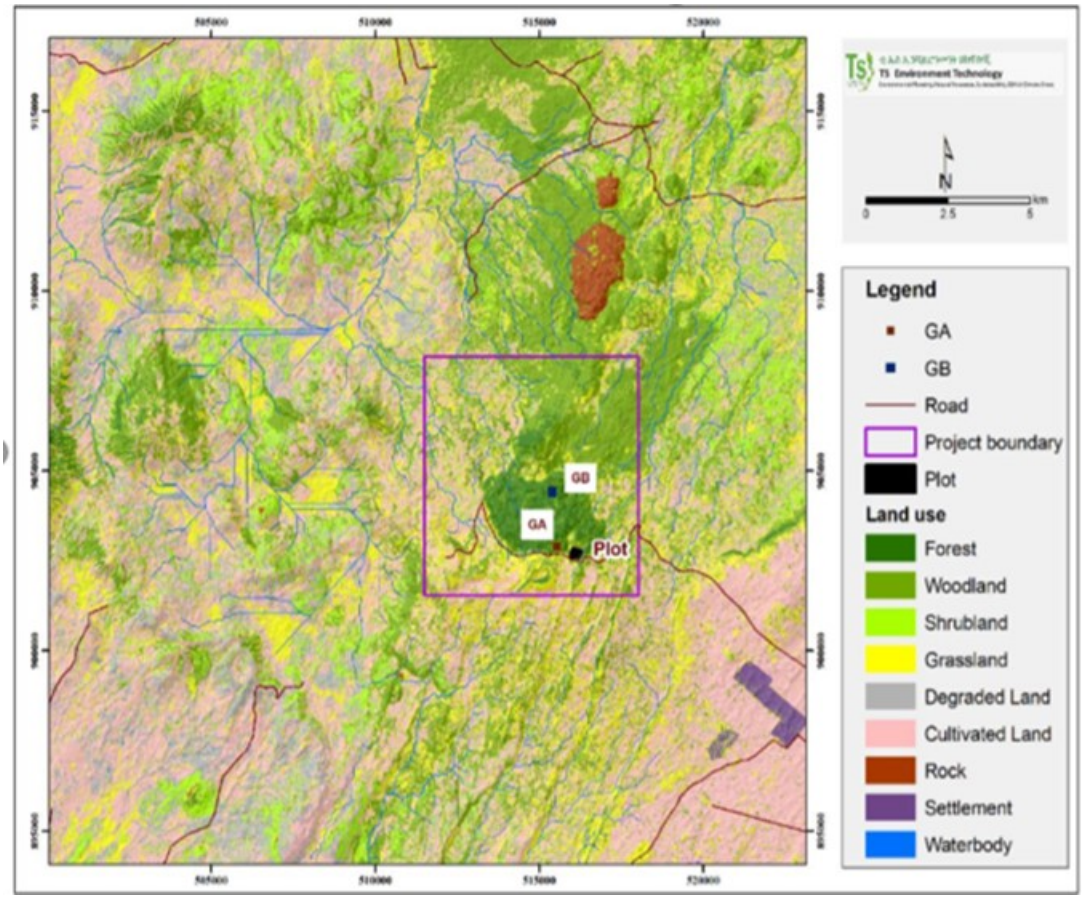


Figure 7.7: Habitat types in and around the Concession Area.

Table 7.2: Summary of Modified Habitats

Habitat	Description
Regenerating woodland	In many parts of the TMGO Main Project AoI *Juniperus procera* is in a stage of regeneration. This regrowth is primarily in areas that were originally deforested but have been rehabilitated through area closure in recent decades. Between patches of juniper, *Festuca* grasses were found growing. If the area is protected from direct human and livestock influence, it is likely that secondary forest could develop once again.
Grazing land	This habitat is being used for livestock grazing and is covered with short grasses and herbs (e.g., *Cyanodon dactylon, Eragrostis sp., Festuca sp., Pennisteum sp., Cyperus dichroostachyus*) and the herb *Chamaecrista mimosoides*. In some areas, grazing land is found adjacent to scrubland vegetation in which case livestock could get into the forest vegetation and graze the ground vegetation, which could affect seedlings and saplings that contribute to the future survival of the forests.
Cultivated land	Crops are the dominant land cover type during the growing season (June to December). At other times of the year the land remains bare. Some natural vegetation is found adjacent to the cultivated land as well as isolated trees on farmland, indicates that the farmland was developed through conversion of scrubland. *Olea europaea cuspidata, Acacia abyssinica,* and *Acacia seyal* are some of the trees on farmland. Farmers plant *Agave sisalana (Agavaceae*) as live fence around their compound. *Opuntia ficus-indica (Cactaceae*) is planted by some farmers on their crop.

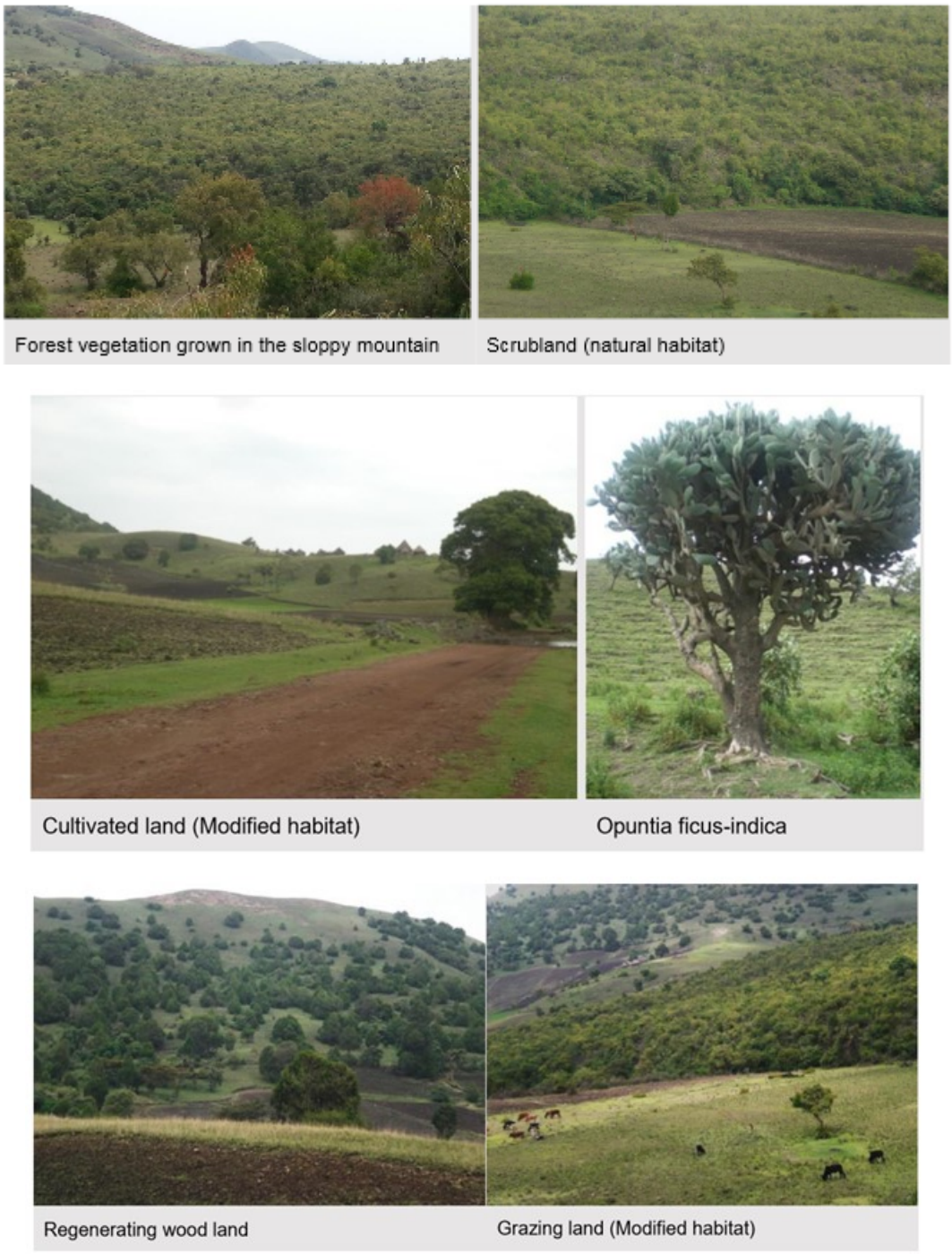


Figure 7.8: Natural and modified habitat type in and around the Concession Area

7.5.3 Notable Plants

One hundred and twenty species of plants from 63 families have been recorded within the TMGO Main Project ESIA. These include 34 trees, 20 shrubs, 43 herbs, 8 grasses, 6 ferns, 2 sedges, and 7 climbers. All are listed as least concern (LC) by IUCN[26]. Dominant species include:

- **Trees**: Juniperus procera, Olea europaea subsp cuspidata, Rhus retinorrhoea, Olinia rochetiana, and Pittosporum viridiflorum are the most frequently documented tree species in the study area.
- **Shrubs**: Clutia abyssinica, Myrsine africana, Maytenus arbutifolia, Clerodendron myricoides, Osyris quadripartita and Euclea schimperi are the common shrubs. Erica arborea is found on slopes at higher altitude.
- **Ground layer** Commelina forskaolii and Senecio lyratus and the grasses Cyanodon dactylon, Aristida adscensionis, Melinis repens, and Festuca abyssinica are mostly found covering the ground layer.
- **Climbers:** Clematis hirusuta and Jasminum grandiflorum are the most common climber species.

One endemic species, *Impatiens rothii* (LC) (*Balsaminaceae*), has been recorded. According to the Flora of Ethiopia and Eritrea (Edwards et al. 2000), this species is common throughout the central plateau of Ethiopia in damp, open, and shaded areas in montane forests, ravines, forest margins, stream margins, margins of marshland, wet fallow fields and grasslands, and moist evergreen shrub.

7.5.4 Invasive species

Several invasive species were recorded in the TMGO Main Project ESIA Rapid Biodiversity Study Report (TS Environment Technology, 2017) but may in fact be natural components of the vegetation of Ethiopia. These include:

- *Senna didymobotrya* is found in the montane wooded grassland, evergreen thicket and bushland, riparian or in disturbed places in Wollega, Wello, Shewa, Arsi and Sidamo area.
- *Dodonaea angustifolia* is a natural component of upland forest and bushland and grassland, secondary forest and scrub but also has the potential to invade recently cleared forest area and overgrazed land.
- *Opuntia ficus-indica* an introduced species that has widely naturalized in Ethiopia. In some areas (e.g., in Tigray) farmers plant it for its edible fruit. The flowers are an important source of nectar for honey production.
- *Nicotiana glauca* may be cultivated around homesteads or growing along roadsides.

[26] *Osyris lanceolata* which was described in the dry season biodiversity report as cited in the CITES appendix, is a synonym of *Osyris quadripartita*. Because of the extreme variability of the leaf and size of the species, some of the former collections were recognized as separate species (Hedberg and Edwards, 1989). However, *Osyris quadripartita* is the only species of the genus *Osyris* known to occur in the Flora of Ethiopia. In Ethiopia, *Osyris quadripartita* is common in gallery forest, *Juniperus, Podocarpus*, *Combretum* and *Dodonea* woodland, Erica scrub, *Commiphora* scrub, on rocky slopes, degraded woodland and scrub, at altitudes 1600 m to 2900 m (Hedberg and Edwards, 1989)

7.5.5 Fauna: Mammals

Thirty-nine mammal species from 20 families have been recorded from in and around the Concession Area, of which most are common species and listed by IUCN as LC. One species is considered internationally notable, namely: **leopard: (*Panthera pardus*)** which is IUCN Critically Endangered. Four other species are listed in Class B of the African Convention on the Conservation of Nature and Natural Resources (The Algiers Convention), and are protected, but may be hunted, killed, captured or collected under special license. These are **Klipspringer, Oribi, Grivet monkey and Aardvark**. Aardvark is also recognized by the Ethiopian Wildlife Development, Conservation, and Utilization Council of Ministers Regulations as a Protected Species with females and juveniles specifically protected. None of these less common species have been recorded within the TMGO Main Project AoI.

7.5.6 Fauna: Birds

Eighty-one bird species have been recorded during surveys from within the Concession Area, of which most are categorized as Least Concern (LC) by IUCN. Notable species include:

- two palearctic migrants (Barn Swallow and Eurasian Hoopoe) and two Intra-African migrants.
- five species endemic to Ethiopia and Eritrea (Wattled Ibis, Abyssinian Slaty-Flycatcher, White-winged Cliff-Chat, Ethiopian Oriole, and Black-winged Lovebird)
- one North East African endemic, Rüppell's Weaver, which occurs in Ethiopia, Eritrea, Northern Somalia and Djibouti.

Fifteen other bird species have also been reported in secondary data. These include several palearctic migrants during the European winter (e.g. Black Kite, Common Kestrel, Tawny Eagle, Pied Wheatear, Isabeline Wheatear, and Grey Wagtail). These are all IUCN LC species. More notable are White-backed Vulture, Hooded Vulture, and Ruppell's Vulture which are all Critically Endangered (CR), Lappet-faced Vulture, which is EN, and Pallid Harrier which is Near Threatened (NT). None of these have been recorded in the TMGO Main Project AoI and previous sightings may have been linked to opportunistic scavenging or flyovers within the local area.

7.5.7 Reptiles and Amphibians

Forty-one species of reptile and amphibian have been recorded within the Concession Area including 12 frogs, 12 lizards, 15 snakes, and 2 terrapins/tortoises. Of these seven lizards, 11 snakes, and 1 tortoise are data deficient and the rest are not listed on the IUCN red list.

During the December 2019 ecological survey three rare or threatened frog species were recorded outside the Project AoI but within the broader area of the springs. These included the Somali Grassland Frog Ptychadena nana (IUCN Endangered (EN)), the Shoa Forest Treefrog Leptopelis ragazzii (IUCN Vulnerable (VU)), and the Kouni Valley Striped Frog Paracassina kounhiensis (IUCN VU). All three species were recorded during the "control" surveys in high altitude areas upstream of the Project AoI (see below and Appendix B).

7.5.8 Ecosystem Services

Most of the habitats within the TMGO Main Project AoI are heavily modified and little natural vegetation remains. Increasing pressure for agricultural land and human populations are further reducing forest vegetation, and wood collected from the forest is used for construction and fuel.

Some searching for medicinal plants and wild fruit remains, and the importance of vegetation in soil and water conservation measures is critical. Tree cutting for fuel wood, charcoal, and construction, and cattle grazing inside the forest, is affecting the regeneration capacity of some woody species, despite the common practice in the Oromo tradition to gather under the canopy of Ficus tree and discuss social issues. This tradition has helped the maintenance of such trees on farm and grazing lands but the absence of any buffer area between farmland and forest area is allowing farmers to easily expand their farmland into the forest.

7.5.9 December 2019 Habitat and Ecological Survey

Specific aquatic/streamside habitat and flora and fauna surveys were undertaken along the watercourses fed by the Gora and Woreka springs in December 2019. A detailed summary of these surveys is provided in Appendix B; the 19 survey points sampled are illustrated in Figure 7.2.

Habitats along the streams were generally well vegetated with species common in the wider unfarmed landscape, compared to surrounding lands that consisted primarily of agricultural and grazing land. Commonly recorded vegetation included *Juniperus procera, Eucalyptus, Croton macrostachyus, Podocarpus falcatus, Solanum marginatum, Cynodon dactylon and Chioris gayana*, but no rare or threatened plant species were recorded.

In-stream sampling of the watercourses revealed little aquatic vegetation, with records restricted to algae, stonewort, chara, and mosses growing as clumps on rocks. A range of invertebrates were however recorded, including crayfish, shrimps, beetles, and mayfly, caddisfly and stonefly. These species are indicative of good water quality as would be expected given their proximity to the springs.

Two types of habitat were recorded, with differences in species recorded between the habitat types shown in Table 7.3.

Table 7.3: Summary of Observed Species at Each Survey Location

Habitat Subset	Sample sites	Bankside plant species	In-stream species
Both	All	***Trees*** *Juniperus procera, Olea europaea, Ficus vasta Ficus sycomorus, Cussonia arborea Rhus lancea and Eucalyptus sp* **Grasses** *Aristida sp, Chioris gayana kunth, Cynodon dactylon* and *Festuca sp*	Stonewort, beetles, caddis fly, plankton algae and chara
1	1, 2, 5, 6, 7, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19	**Shrubs:** *Dodonea angustifolia, Buddleja polystachya and Carissa spinarum* **Tree** *Croton macrostachyus*	Mayfly, Dragonflies, Eels, Stone fly,
2	3, 4, 8 ,9	**Shrubs:** *Maytenus senegalenis, Osyris lanceolate, Rhus natalenis*	Mosses, Leeches, Liverworts,

Four rare or threatened species were confirmed at control sites (although not within the Project AoI) during the surveys as follows:

- The IUCN Red Data Book (RDB) Endangered frog *Ptychadena nana*
- The IUCN RDB Vulnerable frogs *Leptopelis regazzii* and *Paracassina kounhiensis*,

- The IUCN RDB Vulnerable dragonfly *Pseudagrion kaffinum*

All 4 species were found at sampling points 14, 15, 16, and 17. Of these, the EN status of the Somali Grassland Frog means that these locations are likely Critical Habitat for this species (although it is outside of the Project AoI and is located at a higher altitude than the springs and streams being considered for the Project). Further assessment is however required of the distribution of this species, and the three IUCN Vulnerable species.

7.5.9.1 Aquatic Indicator Species

Surveys of aquatic invertebrate species from kick samples indicated that the water is of good quality.

7.5.9.2 Rare and Endangered Species

Four rare or threatened species were confirmed during the surveys upstream of the Project AoI as follows:

- The IUCN RDB Endangered Somali Grassland Frog *Ptychadena nana*
- The IUCN RDB Vulnerable frogs *Leptopelis regazzii, Paracassina kounhiensis*,
- The IUCN RDB Vulnerable dragonfly *Pseudagrion kaffinum*

All 4 species found at all 4 sampling points (14,15,16,17) on Figure 7.6. Of these the EN status of the Somali Grassland Frog is expected to qualify the location as Critical Habitat for this species. None of these species were however found within the Project AoI.

8.0 SOCIO-ECONOMIC BASELINE

8.1 METHODOLOGY

A socio-economic baseline survey was conducted for TMGO's Main Project in 2016 and updated in spring 2019. The work was undertaken to obtain information on local demographic and socio-economic trends within the TMGO Main Project AoI. In the 2019 baseline, six sample Kebeles were selected randomly for household sampling. A total of 1,590 sampled households were surveyed using a mix of quantitative and qualitative approaches, structured surveys and interviews. Twelve focus group discussions were held with men and women and five Key Informant Interviews were also conducted. Personal observations and pictures were also made.

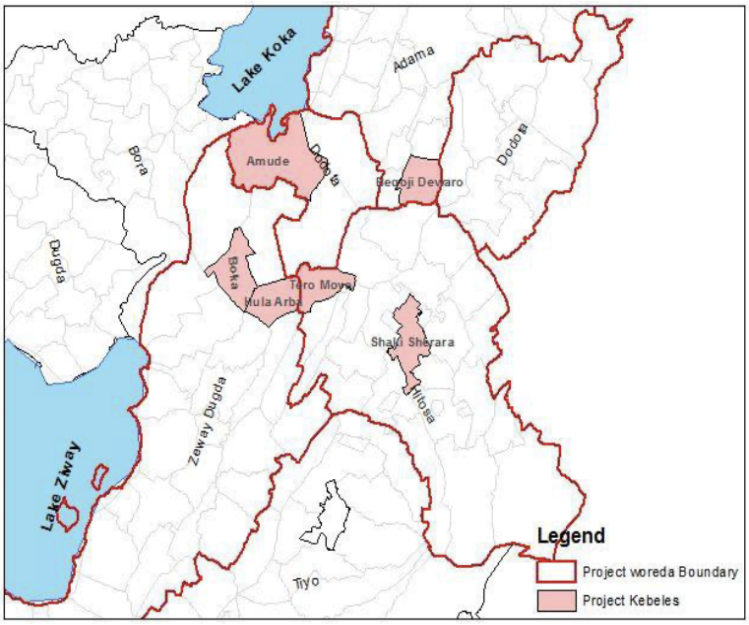


Figure 8.1: Study area for the socio-economic surveys conducted in Spring 2019

Two Kebeles sampled in 2019 (Shaki Sherara and Tero Moye) are in the path of the planned groundwater supply pipe and the other four Kebeles (Ammude, Boka, Hula Arba, Dewarro) are adjacent to the AoI of the Project. Thus, the TMGO Main Project baseline has collected data in an area similar to that of the Project. In order not to mobilize the population for a new survey, it was therefore considered relevant to rely on the socio-economic data from the TMGO Main Project baseline for the Project baseline. Existing quantitative data were supplemented by qualitative data collection through focus groups with water resource users.

The socio-economic baseline for this Project ESIA was therefore conducted as follows:

- review of the 2016 and Spring 2019 baselines of the Main TMGO Project
- conducting interviews with authorities and focus groups discussions with users of springs, rivers and drinking water systems.

8.2 DEMOGRAPHIC, RELIGIOUS AND ETHNIC CHARACTERISTICS

Around 87% of households living in the TMGO Main Project AoI are headed by male and 13% are headed by female. This value is relatively low compared to the national average of 25% of households headed by female according to the 2016 Ethiopia Demographic and Health Survey (2016 EDHS).

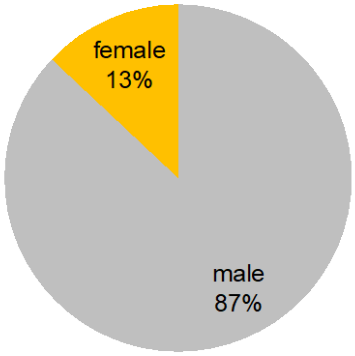


Figure 8.2: Gender of heads of household

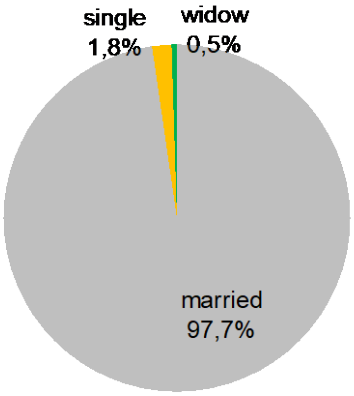


Figure 8.3: Marital status of heads of household

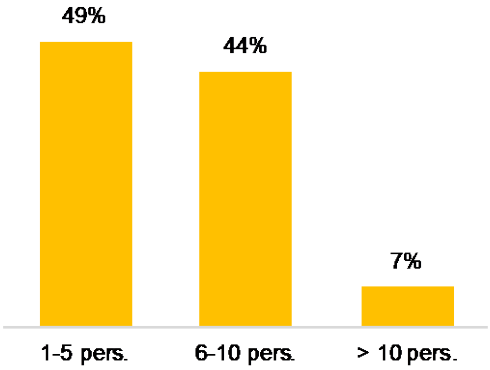


Figure 8.4: Family size

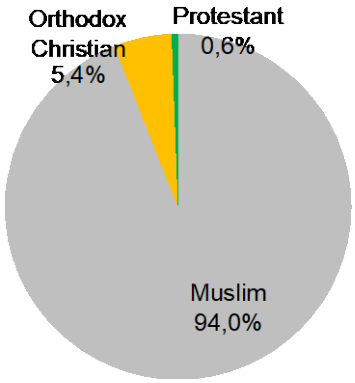


Figure 8.5: Household religions

The female-headed households are usually cases of widowed women or those that are divorced. However, some of the women declared as heads of household appear to be married, given that 97.7% of heads of household are married. 1.8% are single and the remaining 0.5% are widowed. Data indicate a higher proportion of married heads of household than the national statistics, which show 4% of the rural population to be single (EDHS 2016). It also shows that 44 % of heads of household are between 21 and 35 years old, and 38% between 36 and 50 years old. Less than 2% of households are headed by persons over 65 years of age.

Family size is defined as the size of related members sharing a common roof. The data shows that 49 % of households have a family of less than five members and 44% of households report a family size ranging between five to ten members. Only 7% of respondents have a family of more than 10 individuals. The average family size is six people, which is more than the national average of 5.1 for rural families (urban family size is 3.9).

Islam is the predominant religion and account for 94% of the population, 5.4% are Orthodox Christians and 0.6% are Protestant living exclusively in Shaki Sherera. Afan-Oromo is a dominant language and is spoken by about 86% of the population. Fourteen % of the survey respondents also speak both Amharic and Afan-Oromo.

Oromia is inhabited chiefly by two main ethnic groups that cover 85% of the regional population: Oromo (88%) and Amhara (7%). The Oromo people are divided into two major branches: the Borana Oromo and Barentu Oromo. Borana is further divided into Mech and Tulama. Barentu is further divided into Hanbana, Borana, Arsi, Ittu and Karayu. The Oromo people in the TMGO Main Project AoI are mostly Barentu. The Oromo are the dominant group in the TMGO Main Project AoI, but they are not considered, nor do they consider themselves, as Indigenous. The existing TMGO Main Project ESIA identifies that there are no Indigenous people living in the TMGO Main Project AoI and no Camel-herding nomads have been reported to travel through the area[27].

8.3 HOUSING CONDITIONS

Sixty-four % of the houses are made with grass roof and mud walls, 31% are made with iron roof and mud walls and 5% with iron roof and block walls. Iron roofs represent an investment to improve living conditions: they are more numerous in the more accessible areas such as Sheka Sherara. On the contrary, the more isolated Kebeles like Boka or Tero Moye have almost only houses with grass roofs. Seventy seven % of households indicated that they considered their housing to be "suitable" for living, 16% said their housing was "not suitable" and a small proportion (7%) rated their housing as very good.

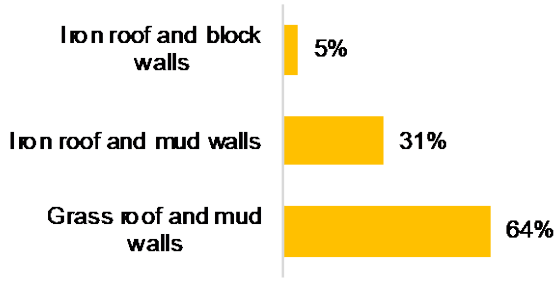


Figure 8.6: House types

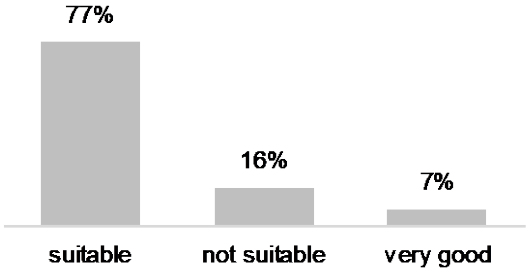


Figure 8.7: Valuation of the house by its occupants

With regard to sanitary facilities, 44% of households use open space, 46% use traditional latrines. Only 10% of households have improved and ventilated latrines and all of them are concentrated in Shaki Sherara. Dewarro and Boka (which had the highest proportion of houses with grass roofs) are also the Kebeles with the highest proportion of open defecation. This situation of low availability of sanitary facilities is reflected in household reports: 79% of respondents consider their sanitary facilities to be unsatisfactory.

During the 2019 baseline, respondents were also asked to list their main sources of energy for lighting and cooking purposes. It was identified that 59 % of the households use kerosene and

[27] *VSO (2017) Tulu Moye Geothermal Development Project - Phase I: Environmental and Social Impact Assessment, Section 7.9.2 Indigenous Peoples*

53% use hand-held battery for lighting. Data shows that 14% reported that they use solar lantern and 14% of households have access to grid connected electricity. Grid electricity is only available in Shaki Sherara and Ammude.

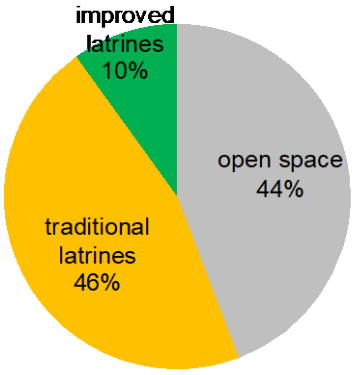


Figure 8.8: Sanitary facilities

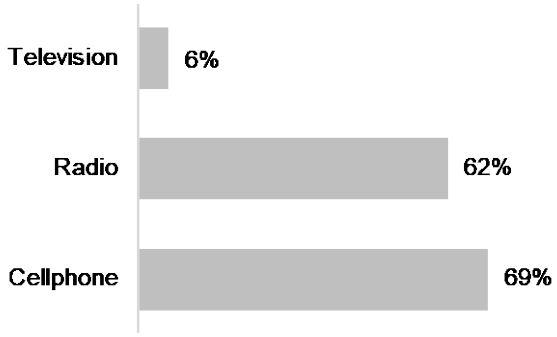


Figure 8.9: Communication equipment

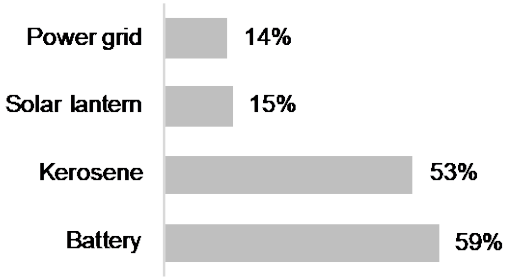


Figure 8.10: Energy sources for lighting

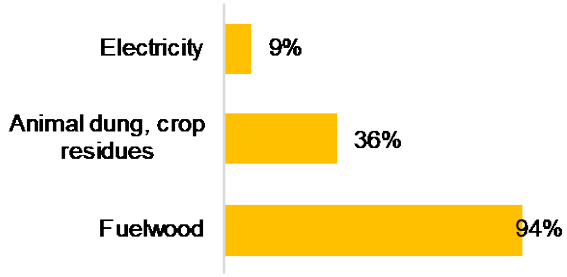


Figure 8.11: Energy sources for cooking

Finally, it is also relevant to identify the equipment in the houses and in particular the equipment for communication (television, radio and telephone). It was identified that 69 % of households have a mobile phone, 62% have a radio and only 6% have television. The cellphone ownership rate in the local area is higher than the national average (56%). However, this value hides a significant difference between urban and rural rates with 88% in urban areas, and only 47% in rural areas. Regarding television ownership, it is concentrated in Ammude and Shaki Sherara as these are the only Kebeles that have grid power service. Nevertheless, television ownership remains very low overall.

Woody biomass is largely the main source of cooking and is used by 94% of households. It is followed by animal dung and crop residue, which are used by 36% of households. Electricity is only used by 9% of households. Electricity is mainly used in Shaki Sherara as it is located near the town of Iteya. Animal dung is mainly used as an energy source in Tero Moye.

8.4 LIVELIHOODS, LAND AND INCOME

The TMGO Main Project baseline study found that agricultural practice is a major livelihood strategy for households and 53% of households are engaged in crop production, while 47%

practice mixed farming. About 28% of households are engaged in fishing and 7% in petty trade. Additional livelihood strategies include collection of firewood (10%), daily labor (11%), carpenter and masonry (5%).

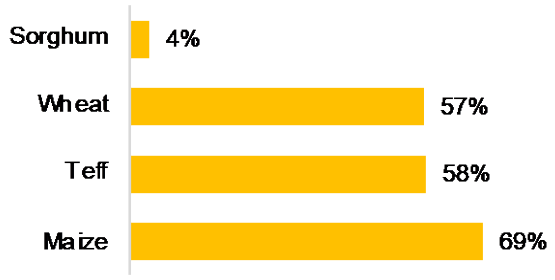


Figure 8.12: Crop production

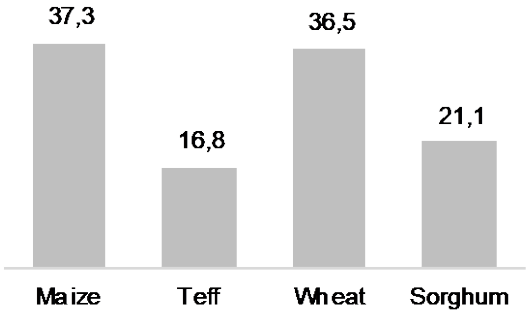


Figure 8.13: Crop yields

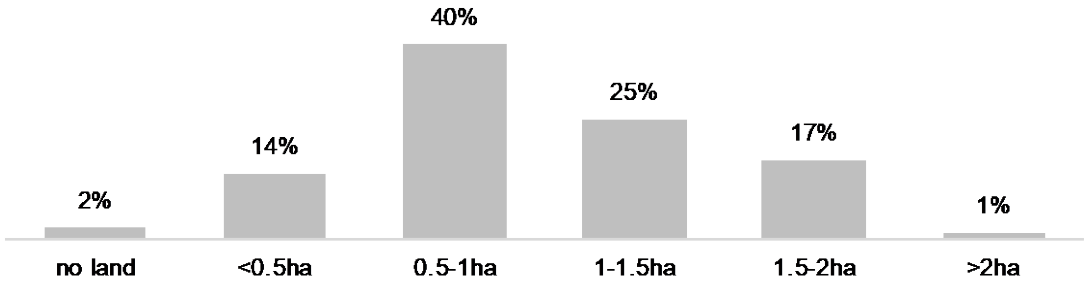


Figure 8.14: Landholding size

In agriculture, the main crops are cereals, and among the cereals, households grow mainly maize (69%), teff (58%) and wheat (57%). These cereals are most often grown in association on the same plot of land. It was identified that Four 4% of households also grow sorghum in association with beans: these households are from Ammude and Shaki Sherara. According to 2018 data from the Iteya Woreda Agriculture Office, maize and wheat yields are similar (37.3 qt/ha and 36.5 qt/ha respectively). Teff and sorghum yields are significantly lower (16.8 qt/ha and 21.1 qt/ha respectively)[28]. These yields are slightly higher than the national averages of 15.6 qt/ha for teff and 33.9 qt/ha for maize. In terms of plot size, the majority of households have very small plots that have acquired through inheritance from family for two thirds of them or from the government for one third of them. Of those who own land, 23% have land certification.

Fifty-six of respondents in the TMGO Main Project AoI have less than 1 hectare and 99% have less than 2 hectares. It is important to note that among them, 2% of households have no land for farming. Landless individuals practice farming through renting or sharecropping to grow crops while engaging in non-agricultural activities. In order to increase agricultural yields, on small plots, households are accustomed to using chemical fertilizers. 85% of households use chemical fertilizers but the quantities used remain limited since 72% of households use less than 100 kg of chemical fertilizers per year on all their plots. The high price of inputs limits their use.

[28] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5758922/

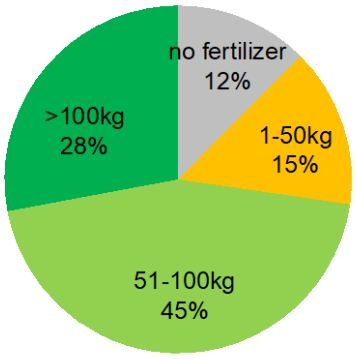


Figure 8.15: Fertilizer use

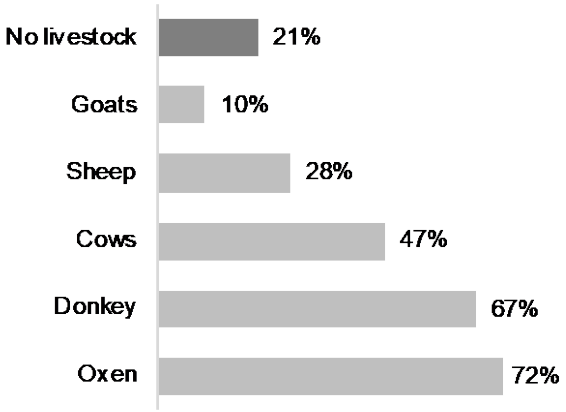


Figure 8.16: Livestock

Livestock is also a household livelihood. Seventy-two of households own oxen for ploughing and 67% own donkeys for transport. Nearly half of the households also have cows for milk, meat and plough ox production. A smaller part of households has sheep and goats: they are mainly concentrated in Hula Arba, Tero Moye and Boka, which are isolated and rural Kebeles. Finally, 21% of the respondents do not own livestock: most of them live in Shaki Sherara, the Kebele with the most fertile and productive land. Some households therefore only practice agriculture and not livestock farming. However, the contrary is not true: no household depends exclusively on livestock for its livelihood. It was identified that 52 % of livestock owners said that lack of water was the major challenge in the region and 37% said that lack of feed was another problem for livestock.

Households that live mainly from agriculture have to cope with the vagaries of the climate and limited means of production (in particular very small plots of land) and their incomes are modest. In the period 2017/2018 (Ethiopian calendar 2009), 63% of households had an income between 5,001 and 15,000 ETB. On the other hand, 57% of the respondents had spent between 2,000 and 8,000 ETB on the consumption of various goods. The wealth status of households is that about 35% are poor and 27% very poor. Food insecurity remains a crucial challenge due to erratic rainfall, shortage of land, crop pest and disease and low input application. As a result, a significant number of households (72%) only eat twice a day during nine months of the year.

Finally, it is important to analyze the savings and loan system of the local population. It was identified that 80% of households do not have a bank account. Two-thirds of respondents with bank accounts live in Shaki Sherara because they are close to the city of Iteya (which has financial institutions) and because their incomes are higher than those of other Kebeles. In the remaining Kebeles, very few households have bank accounts. When households need credit, they usually do not go to the bank, but rely most often on family, neighbors or friends. This may be due to the bank's lending requirement, which entails non-movable collateral and a 30 per cent contribution. Since most households do not have bank collateral, banks are less likely to lend to farmers who take their homes as collateral.

Another system of loan and mutual aid is the Iddir. Iddir is a traditional Ethiopian system of mutual aid. Respondents indicated that Iddir plays a key role in sudden financial difficulties such as death or illness. When someone has a serious problem, the Iddirs provide the money collected from members.

8.5 EDUCATION AND HEALTH

It was identified that 65% of the male population and 62% of the female population attended at least primary education. However only 20% of the male population and 10% of the female population attended at least High School. This is largely due to the lack of nearby secondary schools and the refusal of parents to send their children to secondary school away from home. In addition, parents cannot always afford to cover the housing and other living expenses of children who have to move to the nearby town to attend high school. Some respondents mentioned that they did not want to send their children, especially girls, to the nearby town for fear of being exposed to early sexual practices and unwanted pregnancies. Finally, only 3% of the male population and 1% of the female population continued these studies after high school.

The literacy rate of the population in the TMGO Main Project AoI is significantly lower than the national average with 58% of the population literate (compared to 79% nationally). The literacy rate in the study area is much higher among men (60%) than among women (42%). These rates are below the national averages of 87% for men and 71% for women. Faced with a population with a high rate of illiteracy, it will be essential to propose mechanisms for community participation through meetings, discussion groups and the distribution of pictorial material.

Considering health issues, malaria and acute watery diarrhea (AWD) known locally as "Atet" are the main diseases reported. Malaria is a more common problem in the Kebele Ammude, which is located on the shores of Lake Koka, a favorable site for Anopheles reproduction. Data collected in 2016[29] also found that 84% of the respondents living in Hitosa Woreda do not use any water purification methods, what can explain the high prevalence of waterborne diseases. Other diseases identified as problematic include cancer and HIV/AIDS. HIV/AIDS was the least prevalent in the region, yet it has received a great deal of attention from health posts and centers. This is largely due to the availability of donor funds for HIV/AIDS-related activities. Health community centers also provide child vaccination, oral rehydration solution (ORS), family planning, consultation for pregnant women, awareness raising on sanitation and toilet construction, guidance on use of mosquito net and prevention of acute watery diarrhea (AWD).

8.6 ACCESS TO WATER

The issue of access to water is at the center of this Project ESIA, which is why this part of the socio-economic baseline has been the subject of special attention and detailed analysis.

8.6.1 Water demand

Water in the Hitosa Woreda is used exclusively for domestic and agriculture purposes. Currently, there are no industrial activities requiring water supply and the Arsi Water Office stated that, other than the TMGO Project itself, no additional industrial or agricultural projects are planned for the next years.

Domestic water uses include drinking, food preparation, bathing, washing clothes and dishes, and flushing toilets. The current (2019) population of Hitosa is 175,134 people, Iteya being the largest population center adjacent to the Concession Area with about 20,000 inhabitants. For this population it is estimated a water demand for the Woreda of around 2,627 m^3 per day[30].

[29] GIBB International, 2016, Environmental Baseline Study report for Tulu Moye Geothermal Project

[30] To define future water demand, the Ethiopian Administration usually estimates the population by applying a population growth factor of 2.9% per year.

Current estimated water demand disaggregated by Kebele is provided in Scoping Report (see Appendix A).

The existing domestic water demand will be further exacerbated by population growth. National population growth rates are approximately 2.9% per year, although consultations with the Water Board in Iteya indicated the surrounding Woreda may have grown by as much as 14% per year. Even if the lower value is correct, the growth rate will have a significant impact on water supply options. Consequently, it is anticipated that Iteya town, let alone the surrounding Woreda, will increasingly compete with TMGO for spring supplies, including ones developed by TMGO. This topic is explored further in the social Impact assessment.

In addition to domestic water use, two irrigated perimeters rely on Gora and Wareka springs:

- A perimeter in Kebele Ademogne, connected to Gora stream cultivated by 60 households from Ademogne and one household from Boneya Edo. The perimeter surface is unknown, but it is larger than the perimeter in Boneya Edo: it can be estimated at about 30 ha. It is a traditional scheme started in the 1980s and improved by an NGO (the Canadian Lutheran World Relief) that financed a concrete irrigation channel in 2016

- Another one in Boneya Edo Kebele, connected to Wareka stream cultivated by 50 households and measuring 20 ha. It is also a traditional scheme started in the 80s which received a concrete irrigation channel in 2017 by another NGO. The channel is connected downstream of Hitosa and Boru Jawi WSS outlets on Wareka stream. Users did not know how much water goes to the channel but so far, they have not faced water shortage on the irrigation scheme, and still some water is flowing to the downstream Kebeles

Farmers grow potatoes and onions with irrigation during the dry season. During the rainy season they grow barley, wheat and beans without irrigation. Participants estimated that onion and potatoes, their main cash crops, provided about two third of their annual income.

Channels are still under the contractor warrantee of 3 years. Then the responsibility for their maintenance will be transferred to a Water Committee association, which is recognized by the Woreda. The Water Committee is also responsible for managing conflicts between farmers, accordance with the Government manual of operation for Water Committees.

8.6.2 Water Sources

The 2016 baseline includes valuable quantitative data on drinking water options in the western part of the Hitosa Woreda (Anolle Sallan, Danisa, Nurtuba Denbi, Tero Moye and Walarigi) that are presented below. Water sources within the Woreda vary between seasons. During the dry season (October-May) the population depends mainly on piped water for domestic water. Within the Hitosa Woreda, piped water is provided by the Boru Jawi WSS enterprises, the Hitosa WSS enterprise and the Gonde WSS enterprise.

People living near the eastern escarpment (Kebeles of Harbe Adamogne, Boneya Edo or Boru Chilalo) also seek water directly from springs and streams. During the rainy season (June-September), the population still uses piped water, springs and streams, but also has access to additional water alternatives such as temporary water surfaces (ponds and rivers), shallow wells and rainwater collection. As shown in Figure 8.17, piped water is a key option throughout the year that is only marginally supplemented by rainwater harvesting and temporary surface water during the rainy season.

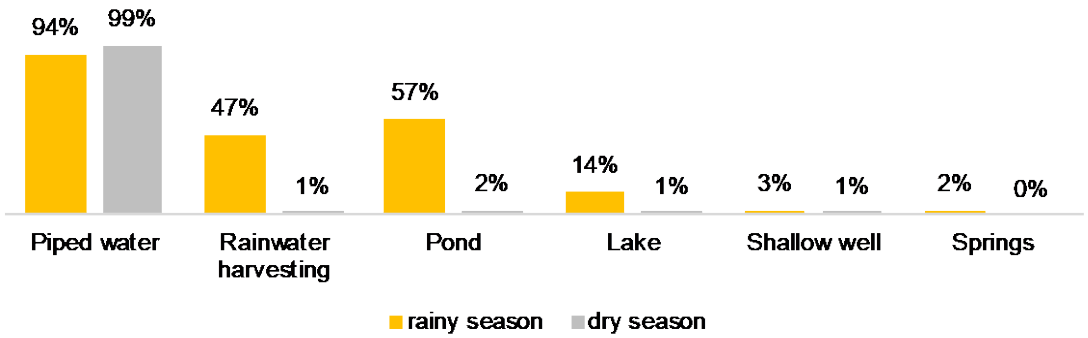


Figure 8.17: Drinking water sources used by communities (Data from 2016 baseline)

With regard to distance to water source for human use, the 2019 baseline provides interesting data. It was identified that 26 % of respondents indicated that they travel more than 3 km to fetch water, which corresponds to more than one-hour round trip. It was also identified that 59 % of respondents travel between 1 and 3 km (between 20 min and one-hour round trip). Finally, 15% of respondents say they travel less than 1 km to fetch water. This value is well below the national average, where 25% of people travel less than 30 minutes to fetch water.

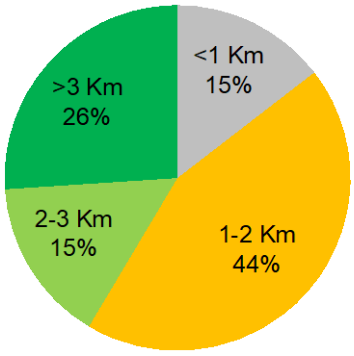


Figure 8.18: Distance to water sources

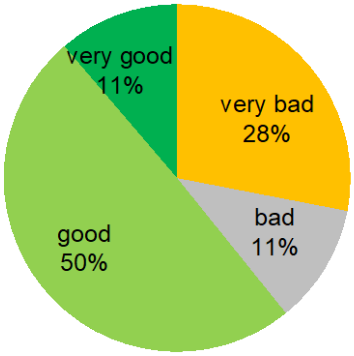


Figure 8.19: Subjective assessment of water quality

During the 2019 baseline, participants were also asked to report quality of water in four categories: very good, good, bad and very bad. Of the respondents, 61%consider the water to be good or very good quality. Thirty-nine % of the respondents consider the water to be of poor or very poor quality: these people all lived in the Ammude and Dewarro Kebeles. It should be remembered that the inhabitants of Ammude mainly use Lake Koka which shows signs of pollution and is covered by algae. This is why 65% of the Kebele population uses water after boiling it to avoid water-borne diseases. It is also important to understand that water quality problems are partly due to the lack of cleaning of community water points and to construction defects such as the lack of fencing around the water point, the absence of a drainage channel and the too small concrete floor around the water point.

Figure 8.20: Queue to access water at a Hula Arba water point (picture from 2019 baseline)

Focus group participants from all Kebeles consistently explained that water shortage for human and animal is a life-threatening problem in their locality. However, participants from Shaki Sherara mentioned that water availability in their locality is better than in other Kebeles, because they are located in semi-urban areas. However, they also indicated that there is an inadequate distribution during the dry season, which forced them to travel up to 3 hours to the nearby town of Iteya to buy water.

8.6.3 Water Supply Schemes Operating in the Concession Area

At the federal Level, the Ministry of Water, Energy and Irrigation is responsible for the planning and construction of water supply schemes. This competence is then transferred to the regional/zonal level: The Zonal Water Office is responsible for the design and planning of engineering works in collaboration with the Woreda Water Office. Once built, infrastructure is handed over to WSS enterprises which are responsible for the maintenance, operation and improvement of the water supply system as defined in Proclamation no 78/2004 (establishment of Urban Water Supply and Sewerage Service enterprise of the Oromia Regional State) and Regulation 40/2004 (establishment of Urban Water Supply and Sewerage Service Enterprise Regulation). The WSS enterprise's customers pay for water by volume and the water price is negotiated between the different stakeholders (the Water administration, the WSS enterprise and the customer' representatives).

8.6.3.1 The Boru Jawi Water Supply Scheme

As described in the Stakeholder Engagement (Section 6), the Boru Jawi WSS enterprise provides piped water from the Wareka and Gora Springs to three Kebeles (Boru Jawi, Boneya Edo and Boru Chilalo) and a peasant association (Oda Jila). There are approximately 1,600 customers with a yard connection and 41 water points, but only 20 are functional. Considering 100 households per water point, the company estimates that it provides water to 3,600 households. According to the Woreda Water Office, the current WSS reservoir of 25 m^3 is insufficient to provide water service to all customers. Boru Jawi WSS manager considers that water shortages are concentrated in Oda Jila. However, the residents of Boneya Edo said they also have frequent water shortage problems which they believe are not due to lack of water at the springs but to poor management of the system by the enterprise.

The Kebele of Boneya Edo has been studied in more detail to illustrate the situation of the Boru Jawi WSS.

In Boneya Edo, less than half of the 2,247 households are connected to the Boru Jawi WSS: sixty households have their own yard pipes and about 1,000 households had water through collection points. Households connected to the network face regular shortage issues during the dry season. In general, they spend 2-3 days without water per week, but it can go up to 1-2 weeks, water usually coming at night. In general, Boneya Edo residents are very unsatisfied with the Boru Jawi water service because they face regular shortage issues during the dry season, and they are not informed of the water shift scheduling. They would prefer to be covered by the Hitosa WSS again.

The quality of the water is good, except during the rainy season when it gets muddy. The approximately 1,200 households not customers of the WSS fetch water from Wareka stream (a 1h round trip by walk), or Gora stream (a 35 min round trip by walk). During shortage periods, all households fetch water from these streams. All households, connected or not, use also Gora and Wareka springs to do their laundry during the dry season (it's too muddy during the rainy season), as well as to water livestock all around the year.

8.6.3.2 The Hitosa Water Supply Scheme

As described in the Stakeholder Engagement Section, the Hitosa WSS Enterprise provides water to 48 Kebeles in 4 Woreda, including the town of Iteya and its surroundings Kebeles. The system captures water from the Kutchura and Wareka Springs. Currently it supplies water to 7,000 yard-connections and 162 collective waterpoints (each designed to serve at least 250 households). The water flow is not sufficient to distribute water to the entire network, so the enterprise organizes distribution by shifts.

In order to illustrate the situation of the Hitosa system, the residents of two Kebeles were asked about their situation: Shaki Sherara and Iteya.

In Shaki Sherara, during the dry season (8-9 months/year), water distribution is interrupted for 2.5 days per week. The schedule is well known and households store water the day before. There can also be interruption of up to two weeks in one year for maintenance reasons (pipe leaking, etc.). The water quality is good, but it gets muddy during the rainy season. If there is an extended interruption, they buy water from other water connections in Iteya (2Birr/Jeri can, which is twice as expensive as the sale price in Keb. Shaki Sherara). In general, they are very satisfied with the water service. The Water board works well, is active and communicates in a timely and efficient manner with them.

In Iteya, the majority of the 4,500 households have yard connections, others go to the water collection points. during the dry season the network suffers regular and severe shortage of water. The schedule depends on the area within the city and neighboring Kebeles. Customers receive water once to twice a week without a regular planning and water usually arrives at night. Water service can sometimes be interrupted for two weeks or even a month, forcing people to buy bottled water or go to fetch water to the Boru River (19 km away, between Sero and Ada Moya Kebeles). The quality of the water is good, but it gets muddy during the rainy season.

8.6.3.3 The Gonde Water Supply System

The Gonde WSS Enterprise provides piped water to Gonde and its surroundings. This enterprise was not interviewed because its water system is not part of the water supply options identified by TMGO.

However, it is important to note that the Gonde system is responsible for supplying water to Tero Moye. It is a system that could therefore facilitate the distribution of water from the TMGO wells to the Tero Moye communities. For this reason, the communities of Tero Moye were asked to evaluate the water service proposed by the Gonde WSS enterprise.

The four hamlets of Tero Moye Kebele have a water collection point, but only half of them are functional. Inhabitants of hamlets without functioning water points travel 4-5 km every day to fetch their water from the two other hamlets in the Kebele. As water usually comes at night, these travels can be dangerous. FGD participants mentioned villagers attacked by hyenas. During the dry season, there isn't enough water to supply the entire network so Gonde WSS organizes shifts. In Tero Moye, inhabitants receive water every 2 days, without a regular schedule. The minority of households who own tanks can store enough water for two days, while the majority has to go fetch water in Iteya (13 km away) or Gonde spring (20 km away, 10 hours round trip by foot). Shortage due to technical issues can last for several weeks, and FGD participants mentioned that last spring they stayed without water for five months.

In general, Tero Moye residents have several subjects of complaint regarding the WSS enterprise. First, in their opinion the shift system is not applied properly, and they feel like they receive less water than they are supposed to. Secondly, when a pipe is broken Gonde WSS employees take up to 3 weeks to repair because the enterprise lacks vehicles to address these issues in a timely manner. Finally, the Board is not responsive enough. Indeed, the Kebele Water Committee has raised the above-mentioned issues numerous times, without results.

Considering this situation, Gonde WSS would need a major capacity building program to be able to serve as a distribution network to share TMGO's groundwater with Tero Moye communities.

8.6.4 Social Perceptions Regarding Water

Water is considered as one of the main issues for the population and the administration and they perceive that water springs are drying up, even though there is no available historical record to support this perception. Water availability in the dry season is a particular concern to the majority of rural populations. According to the TMGO Main Project Social Baseline, 97% of the respondents consider shortage of water one of the major problems of the TMGO Main Project AoI.

The focus group discussion held with the communities shows that social conflicts over water resources are already numerous and that it will be essential to implement important mechanisms for community involvement. The communities cited the following conflicts:

- Conflicts between the inhabitants of Tero Moye and the inhabitants of Iteya or communities nearby Gonde spring are common during the dry season, as the latter sometime won't sell water to Tero Moye communities.

- There is a large-scale conflict between communities of the two Woredas supplied by Gonde WSS, Eyo and Hitosa, regarding the quantities of water shared. Communities of Eyo, located upstream of Hitosa, sometime damage the pipe to cut Hitosa water supply.

- Hitosa WSS consumers have also a long history of water conflicts. One FGD participant mentioned a conflict between Hitosa WSS and Sero Ankato Kebele, located around 4 km away from Iteya, because a pipe was going through their Kebele without distributing water to them. To protest, the inhabitants of the Kebele cut the pipe. The conflict was resolved

through discussions with Hitosa WSS, with the intervention of the Woreda Administration. The community was represented by its elders. The Hitosa WSS increased the number of shifts to integrate this Kebele into the network.

- In the town of Iteya, conflicts between users are still common during the dry season. As some area receive water, and some not, long queues form in the areas supplied and the water price increases up to 3 Br/Jeri can. Communities, each represented by a Kebele Water Committee, regularly consult the Woreda administration regarding these conflicts. Water Committees are composed of three representatives designated by the community of their Kebele and serve as voluntary liaising agents with the WSS to see that there is prompt resolution of technical issues, manage water-related conflicts within their community and represent their community in conflicts opposing them to outsiders.

However, stakeholder engagement meetings held from July to December 2019 indicate that there is broad support for the Project at a federal/regional level subject to appropriate permitting applications and support at a Woreda level. There is broad support at the local/Woreda level, subject to an assessment of the benefits and disbenefits of the proposed development and the agreement of the community. The local and regional administrations both stressed the importance of community approval in securing access to available water sources and the need to avoid any conflicts over water supply.

Discussions with the WSS Enterprises also found that they are prepared to provide access to their resources with certain conditions. For example:

- The Hitosa WSS enterprise is reluctant to share its access to the Wareka Spring but would share its water pipeline if TMGO can provide a bigger water pipeline (from 3 to 5 inch) and a new reservoir of 200 m3. He would also be pleased to develop with TMGO the use of other water sources such as Kaleta river (150 L/s of total discharge) located 25 km away from Iteya in Woreda Lode Hitosa or Gudetcha spring (18.4 L/s exploited), located in Kutchura Kebele.

- The Boru Jawi WSS enterprise could agree to share if TMGO hydrogeological study shows that the spring water extraction by TMGO does not jeopardize community water supply service. They would share the Wareka and Gora Springs if TMGO can rebuild the catchment boxes, install a bigger water pipeline, build a new water reservoir, and contribute to Operation and Maintenance costs.

One of the problems that remains is if TMGO wants to negotiate the use of the Gora and Wareka sources, it is important to know which organization TMGO should contact. The answer is not necessarily obvious. According to the Woreda Water Board the management of springs is the responsibility of the Regional Water Bureau which delegates to the Woreda Water Office. The Woreda Water Office itself delegates responsibility to the Boards of the WSS Enterprises. With regard to the allocation of corporate responsibility for sources, according to the Hitosa WSS enterprise Manager, Wareka spring falls under the management of Hitosa WSS, although Boru Jawi WSS also takes water from Wareka spring. Gora spring is under the management of Boru Jawi WSS. However, according to the Boru Jawi WSS Manager, Boru Jawi WSS is responsible for the management of both Wareka spring - but only their branch of the spring, not Hitosa WSS's branch (the two branches meet downstream) – and Gora spring.

9.0 ENVIRONMENTAL IMPACT ASSESSMENT

Potential impacts are to be expected during the three phases of the Project: construction, operation, and closure. A summary of the main environmental impacts is provided below for each of the water supply options. This assessment does not include the potential areas affected by groundwater drawdown from the wells. These areas will be defined when the pumping test results realized by TMGO are available. Once the size of the area potentially affected by groundwater extraction is determined, it will be included in the assessment.

9.1 METHODOLOGY

The Project Scoping Study concluded that many of the potential environmental impacts associated with these options are either short term (e.g., noise during pipeline construction) or not considered significant. For those impacts that are present, these will be managed by TMGO through the application of Good International Industry Practice (as per the TMGO Management Plans for the TMGO Main Project). As such, and following a proportionate assessment approach, they are not considered further here.

This section (and the associated impact mitigation section in Section 12) focusses on impacts associated with the long-term extraction of water from either groundwater, the springs, or the spring-fed streams. This includes impacts to the water resources themselves (although further work is needed to understand groundwater drawdown from the wells) and the flora and fauna associated with those water resources. Social use of water resources is addressed in Sections 8 and 10.

Impact significance (both positive and negative) has been determined and mitigation measures are proposed. Further details on the impact assessment process are provided in Section 3.5

9.1.1 Temporary Impacts

Temporary impacts of the proposed project include impacts associated with the construction of pipelines from the springs/groundwater extraction area to the drilling site and discharge of groundwater to the environment during testing.

Impacts associated with drilling are generally considered low significance. The exception is discharge of groundwater to the surface environment during testing which could lead to contamination of surface water and/or erosion due to water flow. Such impacts should be avoided or managed through the application of GIIP. If GIIP is followed, the impact is likely to be of low significance because discharges will be localized and can be managed and mitigated at the point of discharge.

Impacts of pipeline construction are considered low significance, especially given the small footprint of the pipeline and its expected route along the existing roads and/or across farmland and other modified habitats of low ecological value. Significant adverse impacts are not expected on biodiversity as a result of these works.

Both of these impacts can be managed under the current construction phase ESMP.

9.1.2 Long-term Impacts

Long-term impacts associated with groundwater extraction will be assessed from pumping tests (for which no data or reports are yet available from TMGO).

Deep groundwater is not considered a particularly sensitive receptor from an ecological point of view due to its depth below the surface, therefore no significant adverse local impacts are expected if appropriate mitigation is put in place to monitor and manage the extraction process. This should include measures to avoid cross contamination of shallow groundwater or surface water resources should the deep groundwater quality be found to be poor. Conversely, if groundwater quality is found to be of good quality, the water could be used to benefit wildlife as well as people. The risk of this ecological damage from the discharge of poor quality water is however considered low if GIIP is applied.

Deep groundwater extraction has the potential to have a negative impact on unconfined shallow aquifers, springs, and streams that lie above the deeper groundwater. The deep groundwater could create a cone of depression and could result in the depletion of surface water features and consequential ecological damage. However, it is not possible to assess this potential impact until valid pumping tests and associated monitoring have been completed.

Other operational environmental impacts associated with extraction of deep groundwater resources are not expected to be significant if impacts to water resource management is successfully addressed (as discussed above). Impacts associated with ongoing extraction operations (e.g., associated with maintenance of the pumping facilities) will be managed through the application of GIIP.

9.2 IMPACTS

A summary of the main environmental impacts for each of the water supply options is summarized in Table 9.2. Decommissioning impacts are not considered here because it is assumed that water usage and habitats will be returned to their baseline condition following the completion of water withdrawals. Also, this assessment does not yet include areas affected by groundwater drawdown from the wells that will be defined once the pumping test results are available from TMGO. Until this information becomes available, this impact is assumed to be potentially significant.

9.2.1 Temporary Impacts - Groundwater Extraction at Iteya and (Impact 1)

Temporary environmental impacts associated with construction of the water pipelines to the groundwater extraction site are considered to be of low significance given the very small footprint of the pipeline and it's expected route along the existing roads and/or across farmland and other modified habitats of low ecological value.

Discharged groundwater to the surface environment during testing should be avoided or managed through application of GIIP. The risks of contamination to surface water and erosion due to water flow should be considered. If GIIP is followed, the impact is likely to be of low significance because discharges will be localized and be managed and mitigated at the point of discharge. These impacts can be managed under the current construction phase ESMP.

We can evaluate the impact indicators as follows:

- Spatial extent- The spatial scope of the impact will be limited to the pipeline that measures between 15 and 20 km long.

- Duration- The impact will be limited to the construction phase for the pipeline area because the pipeline will be buried at a depth of 1.5 meters, and lands can therefore be returned to its owners at the end of the construction phase.

- Magnitude- Given the very small footprint of the pipeline and its expected route along the existing roads and/or across farmland and other modified habitats of low ecological value the magnitude is expected to be low.

- Probability of likelihood- The likelihood is high. This impact has already occurred since the land acquisition process has already taken place.

9.2.2 Long-term Impacts – Drawdown of springs and other groundwater fed features that wildlife is dependent on (Impact 2)

This impact cannot be assessed until valid groundwater pumping test and water resource monitoring has be completed. However, this impact has the potential to be significant.

9.2.3 Temporary Impact - Construction of Pipelines to Springs (Impact 3)

Temporary environmental impacts associated with construction of the water pipelines to the springs are considered to be of low significance given the very small footprint of the pipeline and its expected route along the existing roads and/or across farmland and other modified habitats of low ecological value.

Discharged groundwater to the surface environment during testing should be avoided or managed through application of GIIP. The risks of contamination to surface water and erosion due to water flow should be considered. If GIIP is followed, the impact is likely to be of low significance because discharges will be localized and be managed and mitigated at the point of discharge.

Both of these impacts can be managed under the current construction phase ESMP.

We can evaluate the impact indicators as follows:

- Spatial extent- The design of the pipe is not yet defined but it should be about 20-25 km long. The spatial scope of the impact will be limited to the pipeline footprint and therefore is assessed as low.

- Duration- The impact will be limited to the construction phase for the pipeline area because the pipeline will be buried, and lands would be restored to its previous conditions or better conditions for agricultural development before temporarily occupation, and then return to the owners at the end of the construction phase.

- Magnitude- Given the very small footprint of the pipeline and its expected route along the existing roads and/or across farmland and other modified habitats of low ecological value the magnitude is expected to be low.

- Likelihood of occurrence- The likelihood of occurrence is high. This impact will have to take place in order for the project to be carried out.

9.2.4 Long-term Impacts - Ecological harm at and downstream of the springs coming from spring water extraction (Impact 4)

Surface water extraction impacts have been evaluated based on expected TMGO demand from specific spring sites against levels that can reasonably be supplied without negatively impacting the environment. The Gora Water Zone Management team advises that up to 50% of the spring flow is available for water supply (by TMGO and other users) but that the remaining 50% should remain to preserve a water supply for down-stream users and to sustain the environmental conditions. This approach would exceed the requirements for EFlow[31] calculations recommended by the World Bank Group. Since the Gora Water Zone Management limits are considered more conservative, these have been applied to the assessment for both the Gora and the Wareka springs.

As shown in Table 9.1, extracting 35 L/s from Gora and Wareka springs will leave a deficit of 16 L/s for down-stream users and sustainability of environmental conditions (assuming 50% of the spring flow is for this purpose). Given the existing good quality of the watercourses and the size of the extractions (both locally and from TMGO), in absence of mitigation, the impact is expected to be highly negative on downstream environmental receptors and would therefore be significant.

We can then evaluate the impact indicators as follows:

- Spatial extent- The spatial extent of the impact will be high since extraction will impact the water features and ecology downstream of the springs.
- Duration- The impact will continuous during the operational phases.
- Magnitude- The magnitude of this impact is expected to be high because extracting 35 L/s from Gora and Wareka springs will leave a deficit of 16 L/s for down-stream users and sustainability of environmental conditions (assuming 50% of the spring flow is for this purpose).

[31] See WBG Good Practice Handbook - Environmental Flows for Hydropower Projects 2018

Table 9.1: TMGO Project Water Demand and Impact on the Surface Water Environment

Source	Total Resource (L/s)	Current Consumption by Other Users (L/s)	Total Quantity less WSS and local consumption (L/s)	Total Quantity less WSS, local consumption, and allowance for environment and downstream users (L/s)
Groundwater extraction near Iteya.	To be confirmed.	0	Cannot be assessed until valid groundwater pumping test and water resource monitoring has be completed.	
Gora Spring	40#	4 Currently used by the community.	36	16
Wareka Spring 1	15	9 Hitosa WSS‡	6	0
Wareka Spring 2	24	9 Boru Jawi WSS‡:	15	3
Total	**79**	**22**	**60**	**19**
Total less TMGO demand of 35 L/s	**47**	**-**	**25**	**-16**

Demis Alamirew's report April 2019

‡ The associated WSS is not specified in the Demis Alamirew report but is inferred by Stantec here. Results only likely to be ±20% accurate.

Table 9.2: Summary of Environmental Impacts

Impact Description	Positive/ negative	Project stage	Impact assessment				Impact Significance
			Spatial extent	Duration	Magnitude	Likelihood	
IMPACTS IN RELATION TO THE GROUNDWATER EXTRACTION OPTION							
Impact 1 – Pipeline construction damaging habitat and discharge of pumping test water discharged to watercourses.	Negative	Construction	Low	Continuous during construction	Low	Likely	Low
Impact 2 – Drawdown of springs and other groundwater fed features that wildlife is dependent on.	Cannot be assessed until valid groundwater pumping test and water resource monitoring has be completed. However, this impact has the potential to be significant.						
IMPACTS IN RELATION TO THE SPRINGWATER EXTRACTION OPTION							
Impact 3 – Pipeline construction damaging habitat from spring water extraction	Negative	Construction	Low	Continuous during operation	Low	Likely	Low
Impact 4 – Ecological harm at and downstream of the springs coming from spring water extraction	Negative	Construction, operation	High	Continuous during operation	High	Possible (to be reviewed with additional hydrology data)	High

9.3 MITIGATION

Short-term impacts will be mitigated through the application of GIIP, including effective stakeholder engagement, and no further mitigation is proposed at this stage.

In relation to the long-term impacts of groundwater extraction, mitigation measures cannot be specified until the impacts of groundwater extraction have been quantified with valid groundwater pumping test(s) and water resource monitoring. However, if the extraction impacts are shown to be significant this may be managed with an EFlow approach to maintain sufficient water for ecology.

Extraction from the Gora and Wareka springs and associated watercourses could have a significant negative impact if the “ecological flow” or “EFlow” (the volume of stream flow needed to maintain a healthy aquatic ecosystem) is not maintained appropriately. The EFlows approach (as adopted by the World Bank Group[31] differs from earlier concepts of "Minimum Flow” in that it recognizes within- and between-year flow variability is essential to maintaining healthy watercourses as opposed to the use of prescribed but constant minimum flows that do not account for some species that thrive in wetter years and others in drier years. EFlows should therefore be a subset of the natural flow regime of the watercourse, taking into account intra- and inter-annual variability.

Should extraction levels enable the local watercourses to retain the 50% limit level set by the local WSS, impacts on local EFlow are expected to be of moderate negative significance. Should they exceed this level however, unmitigated impacts could be of high negative significance. In the case of high significance, an Environmental Flows Management Plan (EFMP) would be required to help reduce impacts to acceptable levels. The EFMP would describe the activities needed to implement, monitor, and review the EFlows and clearly define TMGO responsibilities and key performance indicators for addressing them.

In addition to the general EFlow management process outlined above, should the threatened and /or endangered species recorded in the ecological survey control area (notably the Somali Grassland Frog) be found to be present in and around the project watercourses, further mitigation would be required to so that no net loss of conservation value to these species (or in the case of the Somali Grassland Frog, a net gain) occurs. A Biodiversity Action Plan for these species may be needed.

Additional work should also include a quantitative assessment of downstream user demand so that an overall catchment flow balance can be developed. If flow that is surplus to requirements can be identified, this could be stored to offset the impact of TMGO impacts and maintain good environmental status within the watercourses.

9.4 RESIDUAL IMPACTS

With the effective implementation of the mitigation outlined above, residual adverse impacts of TMGO’s proposed water extraction activities are expected to be reduced to a moderate level of significance.

10.0 SOCIAL IMPACT ASSESSMENT

Potential impacts are to be expected during the three phases of the Project: construction, operation and closure. A summary of the main social impacts is provided in the following paragraphs for each of the water supply options. This preliminary assessment does not include the potential areas affected by groundwater draw-down from the wells. These areas will be defined when the pumping test results realized by TMGO are available. Once the size of the area potentially affected by groundwater extraction is determined, it could be included in the social study. The impact assessment methodology is described in more detail in Section 3.5.

10.1 SOCIAL IMPACTS

Potential impacts are to be expected during the Project construction, operation and decommissioning. A summary of the main social impacts is provided in the following section for each of the water supply options and summarized in the Table 10.1. This assessment does not yet include potential areas affected by groundwater drawdown from the wells which will be defined when the pumping test results realized by TMGO are available.

10.1.1 Impact 1- Temporary land acquisition and resettlement impacts coming from the groundwater extraction option

The footprint associated with temporary land acquisition for the groundwater extraction includes the area of the pipeline that connects the wells to the TMGO Main Project drilling area. The estimated size of the pipeline area is 15 km long situated in the Kebeles of Shaki Sherara, Dawi Guticha, Anole Salen and Tero Moye.

TMGO has already acquired the land for the construction of the pipeline during the land acquisition process for the rehabilitation of the access road. in 2018-2019 through a Livelihood Restoration Plan[32]. This process is detailed in the section on mitigation measures (Section 13.2). It led to the acquisition of 15.51 hectares of farmland and grassland impacting around 146 owners and users of these lands and 12 ha acquired from the Concession Area of the Oromian Forest and Wildlife Enterprise (OFWE). Since the Project is located in a rural agricultural region, most of the potentially affected properties are land, food crops, cash crops and trees.

[32] *TMGO Livelihood Restoration Plan, July 2019, prepared by DELPHOS International*

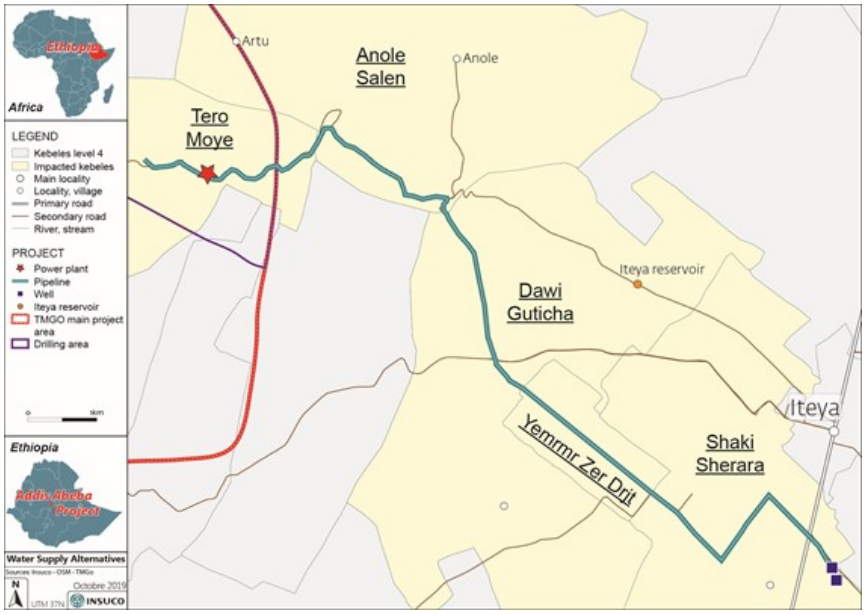


Figure 10.1: Groundwater Pipeline Project Footprint

In the pipeline area (see Figure 10.1) TMGO is planning to bury the water pipeline along an existing access road that TMGO is rehabilitating. It was planned to bury the pipe at a depth of 1.5 meters to allow farmers to cultivate over the pipe. Therefore, this area should be impacted during the construction phase and the land will be returned during the operation phase. So, the affected people will temporarily lose access to their land.

We can evaluate the impact indicators as follows:

- Spatial extent- The spatial scope of the impact will be limited to the pipeline that measures between 15 and 20 km long.
- Duration- The impact will be limited to the construction phase for the pipeline area because the pipeline will be buried at a depth of 1.5 meters, and lands can therefore be returned to its owners at the end of the construction phase.
- Magnitude- The magnitude of this impact can be high since people will lose part of their land. Most of the affected properties should be land, crops and trees and buildings could be affected. According to the LRP developed by TMGO in 2019 for the construction of the road and the pipeline[33], 2,078 trees, 6 houses and shops and 42 fences would be impacted.
- Probability of likelihood- The likelihood is high. This impact has already occurred since the land acquisition process has already taken place.

[33] The LRP doesn‘t distinguish between the assets impacted by the road and those impacted by the pipeline.

10.1.2 Impact 2- Permanent land acquisition and resettlement impacts coming from the groundwater extraction option

The footprint associated with permanent land acquisition and resettlement impacts for the groundwater extraction includes the area of the wells and water extraction infrastructure, and some specific spots in the area of the pipeline that connects the wells to the TMGO Main Project drilling area.

In the well areas, TMGO will occupy the land for the Project duration. The acquisition will be permanent even if a return of the land could be proposed at the Project closure. According to TMGO land has already been acquired[34] for the two water drilling areas based on the national and international requirements. Both water drilling areas measure 800 m^2 each one and are situated in the Shaki Sherara Kebele.

In the pipeline area, the LRP identifies that 6 houses and shops will have to be destroyed and rebuilt. These specific PAPs still had ample properties adjacent to the affected land on which to rebuild their houses and shops in better conditions without moving to a new site. As such, according to the LRP, no physical displacement has been caused, which allows TMGO to carry out only livelihood restoration measures without having to conduct a resettlement process[35].

We can evaluate the impact indicators as follows:

- Spatial extent- The spatial scope of the impact will be limited to the well areas and 6 buildings along the pipeline.
- Duration- The impact will be continuous during the construction and operation phases.
- Magnitude- The magnitude of this impact can be high since people will lose part of their land. Most of the affected properties were land, food crops, cash crops and trees. No buildings were affected.
- Likelihood of occurrence- The likelihood of occurrence is high. This impact has already occurred since the land acquisition process has already taken place.

10.1.3 Impact 3- Social conflicts over access to water coming from the groundwater extraction option

The use of previously un-accessed groundwater is likely to have less direct social consequences than any of the other options considered and is the preferred option for TMGO. However, the people living in the Kebele of Shaki Sherara (groundwater drilling area) and Tero Moye (TMGO Main Project drilling area) have been informed that TMGO is looking for groundwater in the region and TMGO has committed to share water with Tero Moye communities, if it is suitable for drinking.

The populations along the pipeline (Kebeles of Shaki Sherara, Dawi Guticha and Anole Salen) are also likely to request water and similar demands may appear from other communities. This

[34] *No specific information on that procedure were shared.*

[35] *A RAP is for projects that include the destruction of private housings and involve physical and economic displacement. An LRP is for projects involving economic displacement only.*

risk having TMGO entangled in a role of a drinking water delivery institution which is not the company's area of expertise. Lessons learned from similar projects in Africa show that communities along a pipeline do not receive water, they tend to sabotage the pipeline and install illegal connections to access water, and these expectations will need to be carefully managed. Actual water demands for surrounding Kebeles is presented in Figure 10.2.

Although TMGO plans to share extracted water (if suitable) regardless of flow rates from the wells, this community supply may be temporarily interrupted when TMGO demand is at its peak. TMGO will need to be careful to limit the frequency and duration of supply interruptions in order to substantially improve water access. The terms of service interruption will be discussed and validated with the communities.

TMGO have already organized meetings with stakeholders (administrative authorities and community) to communicate on the process that will be followed before sharing groundwater. The water flow will be monitored, and the extracted water will be sent to a laboratory to study its composition and temperature. The results will be presented to the community. If the water is not safe to drink, it will not be shared with the community.

Two additional situations could create social tensions over access to water:

- If the groundwater is not drinkable.
- If the population perceives that the flow of local springs is decreasing due to groundwater extraction by TMGO. The closest springs to the water extraction area are the Gonde, Gora and Wareka springs, located 9 to 12 km away. If these sources dry up, the population may consider that water no longer reaches the sources because of TMGO's groundwater extraction. This perspective may or may not have a scientific basis but will create social conflicts.

Although this impact has the potential to be significant but it cannot be assessed further without a valid groundwater pumping test and water resource monitoring. Therefore, this impact is not assessed further at this stage.

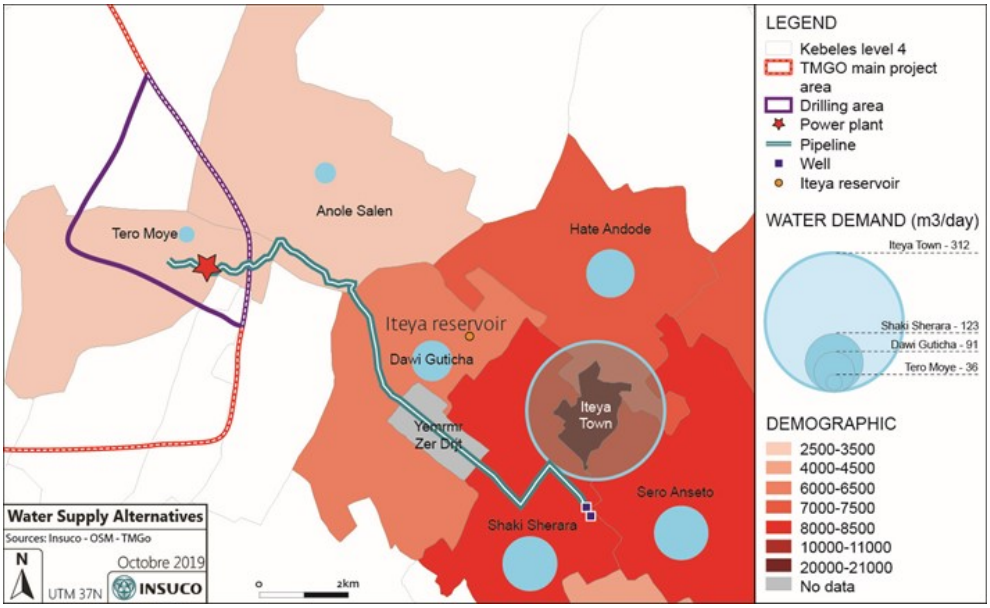


Figure 10.2 : Actual water demand along the projected pipeline (Source: Woreda Health Office)

10.1.4 Impact 4- Water shortages for current users coming from spring water extraction

If existing groundwater does not provide adequate resources for the Phase 1 Project, TMGO is considering a back-up plan based on the development of a water supply from either the Wareka or the Gora springs located to the south of Iteya. However, stakeholders said that the Wareka spring was already at its limit of use and that it would not be sustainable for TMGO to connect to it. Regarding the sharing of the Gora spring, stakeholders are waiting for the results of the hydrogeological study to make a decision.

If TMGO could use the Gora and/or Wareka Springs, as described in the previous sections the Gora and Wareka springs are already used by two water supply schemes: the Boru Jawi WSS that provides piped water from the Wareka and Gora Springs to the four Kebeles of Boru Jawi, Boru Chilalo, Boneya Edo and Oda Jila and the Hitosa WSS that provides water to the town of Iteya and the surroundings Kebeles. These springs also provide water to two irrigated perimeters, making it possible to cultivate around 60 hectares. In addition, people living around or downstream of the Wareka and Gora springs use water directly from springs or rivers to obtain drinking water, water for animals and to wash clothes.

TMGO is considering the option of capturing part of the spring water, which will reduce the volume of water available to other users. The affected users (as presented on Figure 10.3) could be:

- Downstream water users because the volume of water captured by TMGO, Boru Jawi WSS and Hitosa WSS should increase and the remaining flow in the river will decrease, in particular the farmers of the irrigated schemes in Boneya Edo and in Adamagne,

- Users of the Boru Jawi WSS and the Hitosa WSS because the water available in the water supply system will have to be shared with TMGO.

We can then evaluate the impact indicators as follows:

- Spatial extent- The spatial extent of the impact will be high. It includes at least the Kebeles supplied by Hitosa WSS and Boru Jawi WSS and the Kebeles downstream of the Gora and Wareka springs (especially Boneya Edo and Adamagne).
- Duration- The impact will continuous during the construction and operation phases.
- Magnitude- The magnitude of this impact could be high because water shortage is already a major problem for the area. If TMGO operations lead to water shortages for users, social conflict could be significant and TMGO operations could be jeopardized.
- Likelihood of occurrence- The likelihood of occurrence requires additional data to be assessed: the key technical question is if it is feasible to use the Wareka and/or the Gora springs on a sustainable way, knowing TMGO needs. For the moment it has be considered as possible.

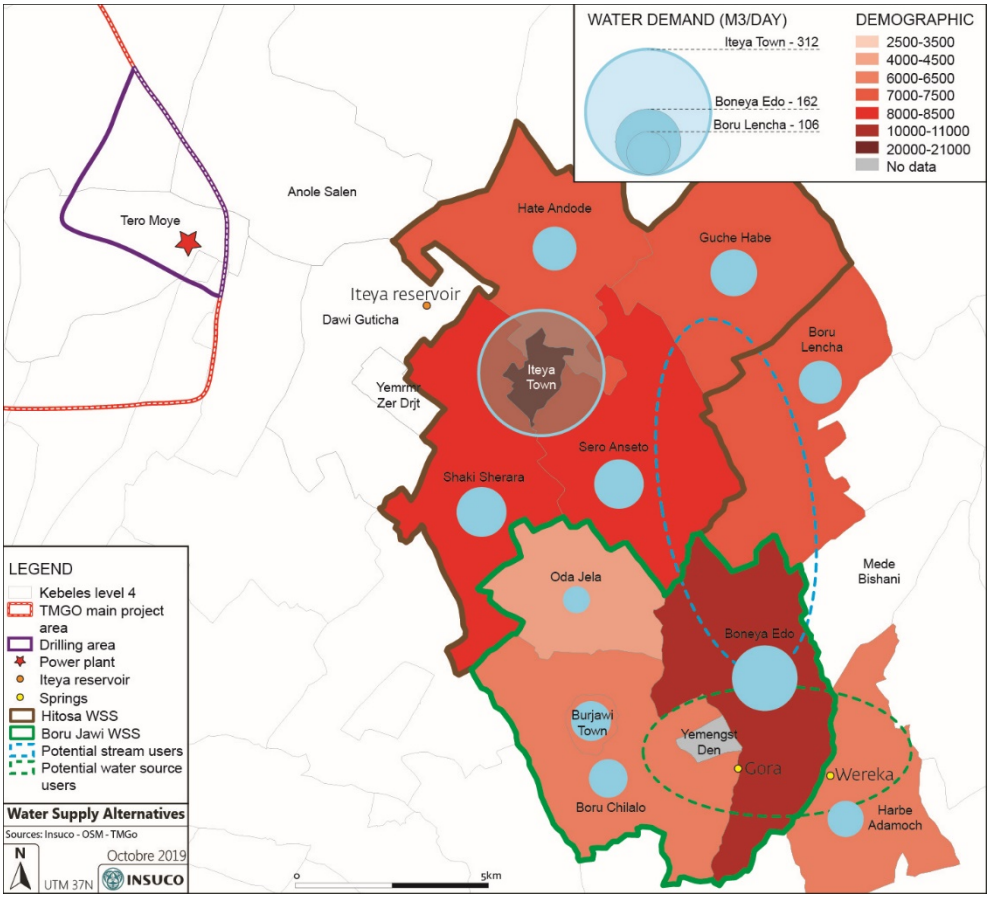


Figure 10.3: Potential water users affected by the spring water option

10.1.5 Impact 5- Land acquisition, temporary land access and resettlement impacts coming from spring water extraction

TMGO plan to build its own pipeline from the springs to the TMGO Main Project drilling area for its activity and to upgrade part of existing water systems for the community. The TMGO pipeline will connect the TMGO Main Project site to the Gora and Wareka springs, 21 km and 23 km as the crow flies respectively from the TMGO drilling area.

During the construction stage, TMGO will probably have to occupy a 5 to 10 meters pipeline corridor. Since the Project is located in a rural agricultural region, most of the affected properties should be land, food crops and trees and PAPs who are on the proposed project footprint will have to be part of a resettlement process. It is also recommended to acquire an easement where the pipeline will be laid.

The water pipelines will be buried at a depth of 1.5 meters to allow farmers to cultivate over the pipe. Therefore, this area should be temporarily impacted during the construction phase and the land could be returned to its owner during the operation phase.

Tree roots rarely reach more than 1.5 meters deep[36], so it could be possible to plant trees above the pipe, however it seems more prudent to avoid this in order to facilitate access to the pipe in the event of a water system repair. However, the Project is an area with a large majority of annual crops and few trees. This impact will therefore be limited.

We can evaluate the impact indicators as follows:

- Spatial extent- The design of the pipe is not yet defined but it should be about 20-25 km long. The spatial scope of the impact will be limited to the pipeline footprint.
- Duration- The impact will be limited to the construction phase for the pipeline area because the pipeline will be buried, and lands would be restored to its previous conditions or better conditions for agricultural development before temporarily occupation, and then return to the owners at the end of the construction phase.
- Magnitude- The magnitude of this impact can be high since people will lose part of their land. Most of the affected properties should be land, food crops, cash crops and trees. Buildings should be avoidable.
- Likelihood of occurrence- The likelihood of occurrence is high. This impact will have to take place in order for the project to be carried out.

10.1.6 Impact 6- Impact on improving the sustainability of water supply systems

It is likely that the upgrade of water supply systems will lead to greater financial revenues for WSS for the following reasons. The improvement of the service should lead to an increase in the number of users and therefore an increase in companies' revenue collection. Increased revenue collection will help the water enterprise to be sustainable in terms of meeting their own operational cost.

We can evaluate the impact indicators as follows:

[36] DRENOU, Christophe (2006). Les racines, face cachée des arbres. Forêt privée française. 335 pages.

- Spatial extent- The spatial scope of the impact will be high: it will include the Kebeles supplied by the WSS enterprises.
- Duration- The impact will last during the construction and the operation phases and could remain after the TMGO closure.
- Magnitude- Corporate sustainability depends on many factors, and the opportunity presented by the TMGO water project is just one of many factors that will see that there is greater sustainability of the WSS enterprises and their water systems. This is why the magnitude is conservatively assessed as low.
- Likelihood of occurrence- The likelihood of occurrence is possible. On the one hand, it has not yet been defined the improvements to the water systems that TMGO could finance. On the other hand, an improvement of the system should lead to more customers and thus more income, but in case of bad management this will not be the case.

10.1.7 Impact 7- Impact on increasing the amount of water available in water supply systems

In both options, TMGO wants to improve people's access to water, knowing that in the case of groundwater, it will be necessary for the water to be proven to be drinkable. In fact, TMGO is expected to propose projects to improve the amount of water available in the water systems. Increased availability of water will relieve women from the burden of fetching water and thereby give them an opportunity to engage in development activities.

It is important to emphasize that TMGO will hand over the management of the systems to the existing WSS enterprises. WSS enterprises will continue to be responsible for the community's water supply, so they will retain liability for water quality and will be responsible of ensuring appropriate chlorination to avoid borne disease.

We can evaluate the impact indicators as follows:

- Spatial extent- The spatial scope of the impact will be high: it will include the Kebeles supplied by the WSS enterprises.
- Duration- The impact will last during the construction and the operation phases and could remain after the TMGO closure.
- Magnitude- TMGO is committed to improving access to water in communities but has not yet clearly defined which improvements will be funded. This is why the magnitude is conservatively assessed as low.
- Likelihood of occurrence- The likelihood of occurrence is possible. An improvement of the system should lead to more water, but in case of bad management this will not be the case.

10.1.8 Impact 8- Additional impacts on community health and safety from construction activities

Impacts on community health and safety have already been specifically addressed in previous impacts related to access to water and no other specific serious negative impacts on community

health and safety are anticipated as a result of the construction and operation of the TMGO water project except some additional impacts from construction activities.

There is potential hazard risk from open trenches in the vicinity of populated areas during the construction phase that will be mitigated by appropriate warnings and fencing. Health impacts related specifically to the water supply solution and associated with air, noise, visual impact and dust emissions on the community is also expected to be insignificant, short term (during the pipeline construction phase) and localized in the 5-10 m pipeline corridor.

We can evaluate the impact indicators as follows:

- Spatial extent- The spatial scope of the impact will be low and limited to the pipeline footprint.
- Duration- The impact will last during the construction phase.
- Magnitude- The magnitude of this impact can be high in case of accident.
- Likelihood of occurrence- The likelihood of occurrence is low.

Table 10.1: Summary of Social Impacts

Impact Description	Positive/ negative	Project stage	Impact assessment				Impact Significance
			Spatial extent	Duration	Magnitude	Likelihood	
IMPACTS IN RELATION TO THE GROUNDWATER EXTRACTION OPTION							
Impact 1- Temporary land acquisition and resettlement impacts coming from the groundwater extraction option	Negative	Construction	Low	Continuous during operation	High	Likely	Moderate
Impact 2- Permanent land acquisition and resettlement impacts coming from the groundwater extraction option	Negative	Construction, operation	Low	Continuous during operation	High	Likely	Moderate
Impact 3- Social conflicts over access to water coming from the groundwater extraction option	Cannot be assessed until valid groundwater pumping test and water resource monitoring has be completed. However, there is a potential impact of significance if groundwater extraction draws down water levels in water features such as springs being used by the local population.						
IMPACTS IN RELATION TO THE SPRINGWATER EXTRACTION OPTION							
Impact 4- Water shortages for current users coming from spring water extraction	Negative	Construction, operation	High	Continuous during operation	High	Possible	High
Impact 5- Land take and resettlement impacts coming from spring water extraction	Negative	Construction	Low	Continuous during the construction	High	Likely	Moderate
IMPACTS IN COMMON TO BOTH OPTIONS							
Impact 6- Impact on improving the sustainability of water supply systems	Positive	Construction, operation	High	Continuous during operation	Moderate	Unlikely	Moderate
Impact 7- Impact on increasing the amount of water available in water supply systems	Positive	Construction, operation	High	Continuous during operation	Low	Unlikely	Low
Impact 8- Additional impacts on community health and safety from construction activities	Negative	Construction	Low	Continuous during operation	High	Unlikely	Low

11.0 CUMULATIVE IMPACTS AND IMPACT INTERACTIONS

11.1 OVERVIEW

Potential adverse effects to sensitive social and environmental receptors associated with the Project have the potential to be made worse by other changes to water supply and demand pressures given the already constrained nature of water resources in the local area. Known or readily fore-seeable future changes which may impact water resources availability and have cumulative effects on water resources are highlighted below. The IFC WBG Good Practice Handbook on Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets was used to guide the cumulative impacts and impact interactions section.[37]

11.2 WATER SUPPLY

Water sources in the local area have the potential to be affected by future climate change. General predictions for Ethiopia suggest that while there might be a slight increase in mean annual rainfall over the next ten years, heavier rainfall, flood and drought events are likely to increase[38].

Reports also indicate that climate change may reduce Ethiopia's GDP up to 10% by 2045, primarily through impacts on agricultural productivity related to climate variability and drought[39]. Key climate impacts identified for Ethiopia include reduced water quality and quantity and drying of wetlands and freshwater sources[39].

More locally as noted in Section 7.2, local rainfall data collected 30km from Iteya has shown a nearly 40% reduction in rainfall over a period of 38 years, which equates to a reduction of 10% per decade.

11.3 WATER USE

The Project is located in an area which is already water stressed and there is water rationing in place. This situation could be made worse by both the introduction of new, water intensive projects (e.g. to increase agricultural production) or as a result of local population growth and increased community water needs for drinking and sanitation purposes. This appears to be already the case, with the decline in the Gonde spring discharge rates being reported as being due to changes in upper catchment land management and vegetation changes, and this coupled with locally population growth rates of up to 14% per year (see Section 8.6) is already affecting local water resource availability.

There are, however, no currently planned industrial activities requiring water supply in the Project AoI, and the Arsi Water Office stated that, other than the TMGO Project itself, they are not aware of any industrial or agricultural projects planned for the next years. TMGO are also no aware of any such projects.

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[37] https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/publications/publications_handbook_cumulativeimpactassessment

[38] Simane, B., Hunachew, B., Deressa, W., Kumie, A., Berhane, K., and Samet, J. (2016) Review of Climate Change and Health in Ethiopia: Status and Gap Analysis https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5578710/

[39] Climate Risk Profile: Ethiopia (2016) https://www.climatelinks.org/resources/climate-change-risk-profile-ethiopia

12.0 ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN

TMGO is committed to developing an ESMP for the Project. The sections below provide an indicative framework as far as it can be defined at the present time, and this will be built on as the project progresses.

12.1 TEMPORARY IMPACTS

Impacts associated with discharge water and pipeline construction (Impacts 1 and 3 in Table 9.2) will be managed using GIIP under the current construction phase ESMP. This will include testing of water quality and assessment of environmental risks associated with the proposed discharge locations.

Information gaps such as a more detailed design proposal are to be developed for pipeline routes for the proposed extractions at Gora and Wareka or alternative groundwater extraction locations closer to the springs.

12.2 LONG-TERM IMPACTS

Due to uncertainty in the magnitude of environmental impacts associated with the extraction of 35 L/s from the springs and/or groundwater (Impacts 2 and 4 in Table 9.2), impacts will be monitored and an adaptive management approach will be developed and implemented (e.g., through reduced extraction). The provision of compensatory water to downstream users or to the environment during times of low rainfall and high-water demand will also be considered, although this would require an assessment as to the extent of surplus water in the Gora and Wareka catchments which could be stored and provided to downstream users and agreement with the water regulators. A key point would be to agree with the water regulators on how much can be extracted and when, and to develop an EFlow Management Plan should this approach be adopted. A Biodiversity Action Plan will also be developed should this approach be adopted and the rare or endemic species found in the sampling control area are encountered within the Project AoI.

Proposals for monitoring are outlined below.

12.2.1 Groundwater Extraction

For Impact 2 (groundwater extraction) this will include long term groundwater pumping tests with associated monitoring to determine the available aquifer resource and the impact of extraction on other water features such as springs and streams. These monitoring tasks are:

- A series of groundwater monitoring wells will be installed close to the pumping well to help determine the complexity of the underlying aquifer. These wells will enable aquifer transmissivity to be calculated and the impact of groundwater level drawdown to be quantified. These monitoring wells will be monitored before, during, and after a long-term pumping test. Year-long groundwater level monitoring will also be undertaken to determine seasonal variations in water levels and this will continue for the time groundwater is being extracted for Project purposes.

- Monitoring well and discharge water quality will be sampled at regular intervals (approximately weekly but this may vary depending on the stage of the test) during the long-term pumping test whereby results meet WHO Guidelines for Drinking Water Quality.

- Monitoring of nearby spring flow rates and water quality will be undertaken before, during, and after the long-term pumping test and this will continue for the time groundwater is being extracted for Project purposes.

12.2.2 Extraction from Springs

For Impact 4 (Spring extraction) a wider water resource investigation will be undertaken to include groundwater, the Gora and Wareka catchments, and define an overall water balance for the Project AoI. This study will quantify the impacts of increasing water demand due, for example, to population growth and reductions in water supply relating to such factors as reduced rainfall and recharge resulting from climate change and changing land use.

The impacts of extraction will be mitigated by monitoring of water levels and reducing extraction rates should they fall below a level agreed with the water regulators. This could be managed using the EFlow methodology as defined by the World Bank. The provision of compensatory water to downstream users or to the environment during times of low rainfall and high-water demand will also be considered, although this would require an assessment as to the extent of surplus water in the Gora and Wareka catchments which could be stored and provided to downstream users and agreement with the water regulators that enable stream EFlows to be maintained. A key point would be to agree with them how much can be extracted and at what time of year

- Long-term monitoring (for the lifetime of the Project) will be undertaken to measure quality and quantity of water from springs and watercourses in the Gora and Wareka catchments. This will, as a minimum, be done on a monthly basis to identify seasonal changes and long-term trends.

- Spring and stream water quality will be sampled at regular (weekly) intervals during the long-term pumping test whereby results meet WHO Guidelines for Drinking Water Quality.

- Downstream water usage will be quantified by monthly flow measurements and through consultation with local water users to establish a catchment flow balance.

- Further assessment is required of the local distribution of the four rare and threatened species that were confirmed outside of the Project AoI during the December 2019 survey.

13.0 SOCIAL MANAGEMENT PLAN

13.1 METHODOLOGY FOR MITIGATION AND ASSESSMENT OF RESIDUAL IMPACTS

The purpose of impact assessment is to see that project decisions are made in full knowledge of their impact on stakeholders but also to identify measures that can be taken to see that these impacts are as low as possible from a technical and financial point of view. To do this, it is necessary to identify the sectors where severe impacts could occur, then to collaborate with the entire project team to identify practical and economic ways to best mitigate them.

When a severe impact is identified, solutions will be considered according to a mitigation hierarchy:

- Avoid- eliminate the source of impact, for example by moving part of the Project to avoid a sensitive site
- Reduce- reduce the source of impact, for example by reducing dust emitted during construction work
- Rehabilitate/repair- repair damage after impact, for example by revegetating an area damaged during construction
- Compensate- replace a lost or damaged resource with a different resource of equivalent value.

13.2 SOCIAL MITIGATION MEASURES

13.2.1 Mitigation measures for Impacts 1 and 2- Land acquisition and resettlement impacts coming from the groundwater extraction option

TMGO plans to bury the pipeline, which will limit land acquisition and compensation for crops during the construction period. This is a relevant measure given that the Project AoI has a high population density and that there is significant pressure on land. TMGO has also already developed a Resettlement Policy Framework (RPF) which highlights key resettlement planning actions from design through implementation of infrastructure activities. It spells out roles and responsibilities within TMGO and partners, including Project Management Consultants, to enable proper coordination while considering project design, resettlement action plan, construction, and implementation timelines.

TMGO has also already conducted a livelihood restoration process with people affected by the rehabilitation of the 15 km access road from Iteya to the drilling area, including the pipeline area. TMGO has realized a valuation of assets and elaborated an LRP: the land acquisition sums to 15.51 ha of grassland and farmland claimed by 146 individual PAP and 12 ha acquired from the Concession Area of the OFWE. There are also 48 PAPs with structures that will be affected by the Project, including 6 houses and small shops and 42 fences. As detailed in the entitlement matrix, they received monetary compensation for the cost of land and construction. However, these specific PAPs still had ample properties adjacent to the affected land on which to rebuild

their houses and fences in better conditions without moving to a new site and as such, according to the LRP, no physical displacement has been caused. Finally, an LRP budget of 150,000 USD (4,350,000 ETB) has already been allocated by TMGO for the affected persons.

As per National regulation[40], a Compensation Committee was established at the level of Hitosa Woreda in September 2018, with the responsibility of implementing the compensation process and managing grievances. Specifically, it is in charge of informing communities, valuating the compensation amounts to pay, carrying out the census of impacted properties and goods, and facilitating the payment process. Regarding grievances, the Committee is responsible for assessing grievances, forming special commissions to investigate and arbitrating the need for additional compensation or mitigation measures. The Committee includes the Bureau of the District Land Administration, the Bureau of Environment and Climate Change protection the Bureau of Wildlife Protection Development, the Bureau of Agricultural Development, TMGO Environmental and Social Manager, TMGO Community Liaison Officer and heads of Kebeles. Heads of the Kebeles impacted represent their community in the Committee on a rotating basis, only attending meetings that were relevant to their Kebele and supporting the census process.

Project affected people have already received individual compensation for loss of trees, loss of structures and loss of communal land with productive value. However, there has been some lack of communication resulting in several PAPs being dissatisfied with the compensation. In Tero Moye, FGD participants mentioned that only their head of Kebele was involved in the compensation committee and that the latter did not properly inform the rest of the population of the decisions taken, in particular on the compensation modalities. However, TMGO organized two public consultations in Tero Moye: one before and one after the inventory of affected properties. During these public consultations the compensation system was presented and discussed. Given the level of dissatisfaction of the people met, it is recommended to continue the disclosure of project information during the construction and operation phase. Farmers are also worried that the road construction will cause erosion. Signs of erosion and damages due to floods have already appeared during the last rainy season along the road. Agriculture Officers recommend that TMGO implement preventive conservation activities to protect the land along the road against erosion and floods.

Similarly, the Hitosa Woreda Agriculture Officers consider that they were not sufficiently involved in the decision-making of the Committee. One of their colleagues was participating in the committee and was responsible for estimating yields and market prices of crops in the affected areas. However, it also took important decisions with the rest of the Committee without informing its hierarchy, such as increasing the official compensation from 10 years of losses to 15 years of crop/grass losses, which didn't follow the regulation and set a precedent that the Bureau of Agriculture finally did not accept. Thus, TMGO compensated PAPs of the wells drilled in the Anole for 15 years of crop losses and then had to return to the 10 years of losses for the rest of the compensated PAPs. Although the company has explained the reasons for this change to PAPs, this has created significant discontentment and as of December 2019 some PAPs were still claiming the five years of difference. It is therefore recommended that TMGO inform the entire hierarchy in the future when taking major decisions. Officers also suggest that Development Agents placed by the Agriculture Office in each Kebele, will play a key role in facilitating the compensation and grievance process. Finally, the Agriculture Office recommends that TMGO address all the issues that have arisen from the road compensation process before initiating the development of its water supply component.

To see that the compensation process is satisfactorily finalized, TMGO will conduct a follow-up survey with the PAPs and particularly verify that the people whose homes were affected by the

[40] *Proclamation No. 455/2005 on Expropriation of Land Holdings for Public Purposes and Payment of Compensation*

project were able to rebuild a new structure with the compensation received. TMGO will also begin the implementation of the planned livelihood restoration programs and monitor the PAPs to confirm that their livelihoods are restored.

13.2.2 Mitigation measures for Impact 3- Social conflicts over access to water coming from the groundwater extraction option

Regarding this impact, the mitigation strategy will address the following aspects:

1) *Monitoring the areas potential affected by groundwater draw-down from the wells*

At this time information is not available on the areas potentially affected by the possible decrease in spring flows due to groundwater extraction. This is an essential point from both an environmental and social point of view and will be integrated into the ESMP monitoring system. This will include the collection of data on: (i) well water quality and quantity to monitor groundwater potability; and (ii) the flow rate of springs within the Project AoI of the dug wells. This area must be defined by hydrogeological studies and monitored during the pumping test.

2) *Improving access to water for communities as collective compensation for the groundwater project*

To secure local approval and avoid water conflict, it is likely that TMGO will provide potable water (the deep underground water still has to be tested for quality level) to the population for the duration of the TMGO project, especially to the villages in the drilling zone and those located along the water pipeline. TMGO has already proposed an agreement to the people in Tero Moye. It is also necessary to define the proposal that will be made to the populations along the pipeline. A fair and transparent agreement will have to be proposed to the Kebeles of Dawi Guticha, Anole Salen and Shaki Sherara to prevent dissatisfied people from damaging the water pipe. It is recommended to establish two or three community water points along the pipeline to secure local approval and to prevent people from damaging the pipeline to access water illegally. It will be necessary to take these waterpoints into account when calculating the flow of water to be shared with the community.

If the groundwater is potable and TMGO decide to share the water, it will probably have to build a number of facilities to provide water to the population. In this sense, it will need to work with the stakeholders to define the water supply system for the communities and the entity responsible for its operation and maintenance.

The following aspects will be addressed at the design stage:

- TMGO will agree on the estimated volume of water available for each stakeholder and the type of water supply with the Arsi Zonal Bureau of Water and Energy, the Hitosa Woreda bureau of water and energy and the local communities. TMGO could arrange the installation of a connection to an existing water system if it appears to be feasible, the construction of a yard connection system or the installation of several collective waterpoints along the water pipeline.

- TMGO will also ask to the Arsi Zonal Bureau of Water and Energy and the Hitosa Woreda bureau of water and energy to propose an entity responsible for operation and maintenance of the new water installations, as defined in Proclamation no 78/2004 (establishment of Urban Water Supply and Sewerage Service enterprise of the Oromia Regional State) and Regulation 40/2004 (establishment of Urban Water Supply and Sewerage Service Enterprise Regulation). This entity can be an existing WSS enterprise that would increase its scope of action or it can be an enterprise created specifically to manage the groundwater supply system for the populations. It is important to remember that until now WSS enterprises manage spring systems, but none manages groundwater systems. In any case, the WSS enterprise in charge of the groundwater supply should present to the population the

conditions of access to water services, with particular care in the proposed pricing scheme. It is recommended that TMGO support the WSS enterprise in this task to confirm that the proposed price is fair and that the public is satisfied with the process, and in the formulation of a water supply system management manual with the participation of the stakeholders, without forgetting vulnerable groups (in particular divorced women and widows). The formulation of this tool will help confirm that the stakeholders have understood and agree with the Project. The manual will also be essential to enable transparent management of the system and thus its sustainability.

3) Ensuring mechanisms for stakeholder information and engagement

It will be key to implement information disclosure and grievance mechanisms that have been described in the Stakeholder Engagement section of this report. But stakeholder engagement mechanisms will also include communication strategies on the data collected. The understanding by the local communities of the work and process implemented to extract the water deserves to be considered and maybe communicated according to the findings from the stakeholders meeting and engagement.

- Information on well water quality and quantity will be shared with the administrative authorities and the population with access to water from the Project. TMGO will distribute information brochures in Oromian to administrative authorities and leaders (men and women) to explain the analysis methodology to test water quality, present the hired laboratories and explain the results obtained. It is also relevant to define how often and how long Community supply could be temporarily interrupted when TMGO demand is at its pick, and to communicate it to the stakeholders (community and authorities).

- Source flow information should be managed with caution as a decrease in flow could have causes external to the Project. It will be mainly shared with the authorities at the zonal and Woreda level. In case of a critical decrease in flow, additional studies will be required to identify the causes and groundwater extraction will be stopped. It is also recommended to elaborate a contingency plan in case people perceive TMGO is overusing the supply leading to e.g., springs drying up. Irrespective of whether any changes are independent of TMGO activities, this plan will have to respond to local perceptions to avoid water conflicts.

13.2.3 Mitigation measures for Impact 4- Water shortages for current users coming from spring water extraction

TMGO hired a hydrogeologist expert (Demis Alamirew) in 2019 to collect data on both springs and estimate the volume of water that can be captured without significantly impacting downstream water users and wildlife. The report asserts that the Wareka and Gora springs have good flow all year round, although stakeholders consider that the exploitation of the Wareka Spring by TMGO is not sustainable. The information detailed in this report may allow TMGO to correctly size the catchment boxes to limit environmental impacts and provide a basis for the technical feasibility of the Project. This data will also be shared with WSS and downstream communities (Boneya Edo, Adamagne, Harbe Adamoch, Yemengst Den, and Boru Lencha). Finally, it will be essential to integrate the collection of downstream flow data into the ESMP monitoring system and to communicate the results periodically to the authorities and populations.

With respect to the impact on WSS users, the WSS enterprises have asked TMGO to improve the current systems by increasing the size of the pipelines and the water reservoirs. The

proposed sizing would allow part of the water to be allocated to TMGO and part of the water to improve service to current users. This would not only be a mitigation measure, but also a local social development measure. The sizing of the updated systems will depend on the actual volume of water available at the Gora and Wareka springs.

To mitigate impact 4, TMGO will develop the following activities:

- Sharing the results of the hydrogeological study and the catchment box sizing with the administrative authorities and users of the sources and systems.
- Developing and signing an agreement with the WSS enterprises and water regulators to define roles and responsibilities of each stakeholder in the upgrade, the operation and maintenance of the water system.
- Sharing the conditions to have access to the springs and to the water supply schemes with the affected population.
- Monitoring the water flow of both springs during TMGO project duration and sharing results with the stakeholders. Elaborating a contingency plan in case people perceive TMGO is overusing the springs. Irrespective of whether any changes are dependent of TMGO activities, this plan will have to respond to local perceptions to avoid water conflicts. Assessing impacts to local cultural heritage associated with the springs and defining mitigation strategy necessary.

13.2.4 Mitigation measures for Impact 5- Land take and resettlement impacts coming from spring water extraction

The mitigation strategy will be the same as the one presented for the groundwater extraction option. TMGO plans to bury the pipeline, which will limit land acquisition to the construction period. This is a relevant measure given that the Project AoI has a high population density and that there is significant pressure on land. It is also recommended that the Project footprint avoid public or private infrastructure, which will allow TMGO to implement only livelihood restoration measures without having to conduct a resettlement process.

An LRP will have to be elaborated and valuation of assets will be realized to support people affected by the spring water project and to mitigate project related displacement impacts. Compensation will be done before project commencement. TMGO has already developed a RPF, that will be the guidelines to develop the LRP. To mitigate impact 5, TMGO will develop the following activities:

- TMGO will define and validate the pipeline footprint from the sources to the drilling area, avoiding public and private infrastructures as much as possible.
- Once the pipeline footprint will be defined, a pre-inventory will be conducted to determine the approximate number of PAPs and estimate the LRP budget based on the compensations already completed by TMGO. This information will be part of the Livelihood Restoration Plan.
- TMGO will conduct the compensation process by activating the existing compensation Committee and strengthening stakeholder engagement using the mechanisms proposed in the stakeholder engagement section of this Project ESIA and aligned with the 2017 Stakeholder Engagement Plan. In particular, it will be important to complete the engagement mechanisms organizing public consultations and interviews with local authorities to enable adequate compensation and disclosure. All these activities will be adequately documented.

13.2.5 Improvement measures for Impact 6- Impact on improving the sustainability of water supply systems

As described in the previous section, it is likely that the upgrade of water supply systems will lead to greater financial revenues for WSS. However, to secure a higher positive impact, TMGO will include good management, good governance and anti-corruption clauses in the agreement signed with the WSS enterprises. It would be interesting for TMGO to meet regularly with the companies to support them in the management of the water supply service and to finance trainings if needed.

13.2.6 Improvement measures for Impact 7- Impact on increasing the amount of water available in water supply systems

TMGO is expected to propose projects to improve the amount of water available in the water systems. In order to see that the increase in the volume of water actually leads to an improvement in the living conditions of the population, TMGO will offer enterprises and local authorities a training and support program. This program will be formulated in close collaboration with stakeholders to see that it is relevant. It would enable TMGO to collaborate with key entities in the event of water-related social conflicts.

13.2.7 Mitigation measures for Impact 8- Additional impacts on community health and safety from construction activities

There is potential hazard risk from open trenches in the vicinity of populated areas and health impacts associated with air, noise, visual impact and dust emission during the construction phase. These impacts will be mitigated by appropriate warnings and fencing, spraying the construction area to avoid dust and implementing construction activities at times agreed with the population to minimize the impact of noise pollution.

13.3 MONITORING AND EVALUATION OF THE SOCIAL MITIGATION MEASURES

Impact Description	Project stage	Impact Significance	Mitigation or improvement measures	Monitoring Indicator	Sources of verification
IMPACTS IN RELATION TO THE GROUNDWATER EXTRACTION OPTION					
Impact 1- Temporary land acquisition and resettlement impacts coming from the groundwater extraction option	Construction	Moderate	To finalize the livelihood restoration process	<u>Progress monitoring:</u> # of PAPs participating in the livelihood restoration program % of compensation been made.	TMGO activity reports TMGO follow-up survey TMGO ESIA M&E reports

Impact Description	Project stage	Impact Significance	Mitigation or improvement measures	Monitoring Indicator	Sources of verification
				Outcome monitoring: % of land restored to its owners in similar or better conditions % of impacted people's livelihood is restored.	
Impact 2- Permanent land acquisition and resettlement impacts coming from the groundwater extraction option	Construction, operation	Moderate	To finalize the livelihood restoration process	Progress monitoring: # of PAPs participating in the livelihood restoration program % of compensation been made. Outcome monitoring: % of impacted people's livelihood is restored	TMGO activity reports TMGO follow-up survey TMGO ESIA M&E reports
Impact 3- Social conflicts over access to water coming from the groundwater extraction option	Construction, operation	High	Monitoring the areas potential affected by groundwater draw-down from the wells Sharing information with the affected population. Improving access to water for communities	Progress monitoring: Variability of the spring flow rates # of PAPs using groundwater % of PAPs satisfied with the water service Outcome monitoring: # of demonstrations, social conflicts in the area	TMGO activity reports TMGO follow-up survey TMGO ESIA M&E reports
IMPACTS IN RELATION TO THE SPRINGWATER EXTRACTION OPTION					

Impact Description	Project stage	Impact Significance	Mitigation or improvement measures	Monitoring Indicator	Sources of verification
Impact 4- Water shortages for current users coming from spring water extraction	Construction, operation	High	Improving access to water for communities and defining roles and responsibilities in the upgrade, the operation and maintenance of the water system. Sharing information with the affected population. Monitoring the water flow of both springs.	Progress monitoring: Variability of the spring flow rates # of PAPs using water supply systems % of PAPs satisfied with the water service Outcome monitoring: # of demonstrations, social conflicts in the area	TMGO activity reports TMGO follow-up survey TMGO ESIA M&E reports
Impact 5- Land take and resettlement impacts coming from spring water extraction	Construction	Moderate	To implement a livelihood restoration process	Progress monitoring: # of PAPs participating in the livelihood restoration program % of compensation been made. Outcome monitoring: % of land restored to its owners in similar or better conditions % of impacted people's livelihood is restored	TMGO activity reports TMGO follow-up survey TMGO ESIA M&E reports
IMPACTS IN RELATION TO BOTH OPTIONS					
Impact 6- Impact on improving the sustainability of water supply systems	Construction, operation	Moderate	To promote good practice in the management of the WSS enterprises	Progress monitoring: # of meetings realized with the WSS enterprises	WSS reports TMGO activity reports

Impact Description	Project stage	Impact Significance	Mitigation or improvement measures	Monitoring Indicator	Sources of verification
				Outcome monitoring: Annual net benefits of the WSS enterprises % of PAPs satisfied with the water supply system	TMGO follow-up survey TMGO ESIA M&E reports
Impact 7- Impact on increasing the amount of water available in water supply systems	Construction, operation	Low	To propose a training program to the WSS enterprises	Progress monitoring: # of trainings realized with the enterprises Outcome monitoring: % of PAPs satisfied with the water supply system	TMGO activity reports TMGO follow-up survey TMGO ESIA M&E reports
Impact 8- Additional impacts on community health and safety from construction activities	Construction	Low	Defining warnings and fencing, spraying the construction area agreeing construction horary	Progress monitoring: # of fences and warnings Outcome monitoring: # of accidents of community habitants	TMGO activity reports TMGO follow-up survey TMGO ESIA M&E reports

14.0 REFERENCES

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APPENDICES

Appendix A Environmental and Social Impact Assessment Scoping Report for Phase 1 Water Supply Alternatives

Appendix B Environmental and Ecological Monitoring Survey Report

B.1 INTRODUCTION

This report presents the results of ecological surveys and flow gauging carried out at Wareka and Gora areas, Iteya Woreda, Arsi Zone, Oromia Regional State, Ethiopia. The ecological survey was carried out for nine days, beginning on December 17, 2019, by Metaferia Consulting Engineers. The survey involved collecting baseline information on the hydrological conditions of the streams to:

- Help understand how flows could be affected by water extraction from nearby springs and ground water
- Identify and to help understand which species have the potential to be impacted by changes to the streams
- Identify and record surrounding land uses and water extraction that may be taking place along the streams to understand for who and what the water from the streams is being used for and how users may be impacted by changes to water flows.

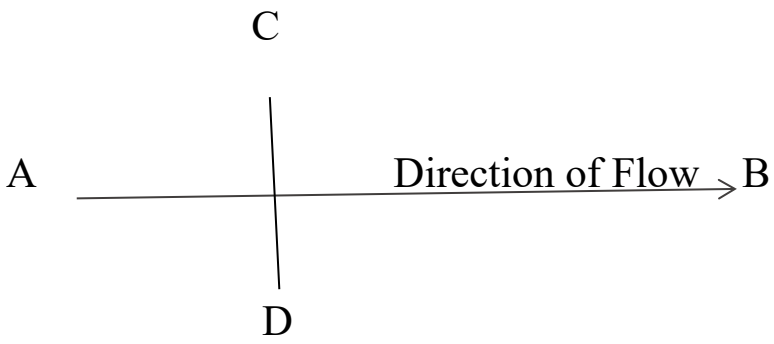
B.2 STREAM FLOW GAUGING

Spot measurements were taken from the streams issuing from the Gora and Wareka spring areas. The locations where flow measurements were made are illustrated in Figure B.1. As the measurements were taken in the dry season they are likely to be representative of dry weather flow or baseflow.

B.2.1 Methodology for Stream Flow

Where possible, flow gauging was undertaken using the following steps:

1) Select a straight reach of the stream and measure up to 10 m distance between two points A and B (see diagram below):

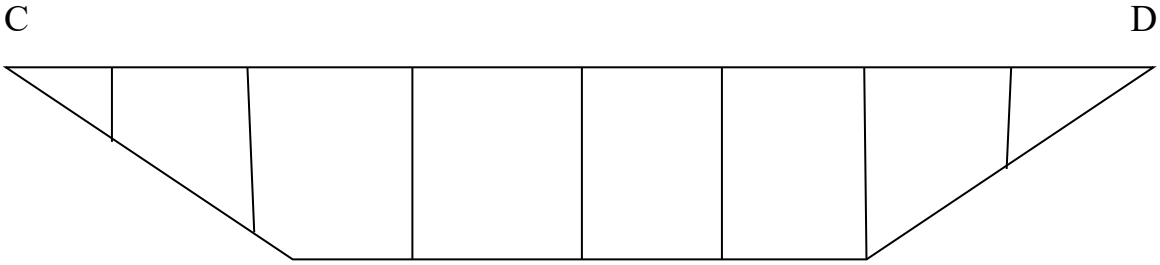


2) Use a buoyant object that can easily float on water. Drop the object at A and time how long it takes to reach point B.

3) Repeat Step 2 three to four times and record the average transit time.

4) Divide the distance from A to B by the average time to calculate flow velocity.

5) Select a convenient place along A to B for cross section. Measure depths at convenient points along the cross section and take the average depth and calculate the cross-sectional area.



6) The product of flow velocity from Step 4 and the flow area in Step 5 is the flow in m^3/s or L/s.

B.2.2 Results of Stream Flow Gauging

Steam flow gauging was undertaken for the Wareka stream with Gora spring/Gora stream in December 2019.

Gora Spring and Gora Stream

The stream associated with Gora springs is Gora stream[41]. The stream is thought to be perennial based on discussion with local people, and its flow rate was recorded as 84 L/s on 23rd December 2019. The channels of the stream were very irregular, which made precise measurements of flow difficult to obtain.

The use of the stream for watering livestock and sanitation was observed and confirmed through discussions with local people. There are also cash crops like potato production by farmers in the survey area (along Gora Stream) and water is extracted for this purpose, although it was not possible to determine what amount. Discussions with local people brought to Metaferia's attention that activities that involve more extraction of the water in the Gora area will not be welcomed by the community as the stream is extensively and intensively used for irrigation.

Wareka Spring and Associated Streams

Measurements were made on December 22, 2019 in three streams from springs in the Wareka spring area (the Wareka spring itself), Ada stream, Le Kole stream, after the confluence of the Ada and Le Kole streams, and Wareka stream downstream of where Ada, Le Kole, and Wareka converge. Based on discussion with local people the streams are thought to be perennial.

The use of the stream for watering livestock and sanitation (washing clothes) was observed and confirmed through discussions with local people. No sign of extraction was visible on the side of the streams (other than the spring boxes for the WSS).

The results of the flow gauging are summarized in the Table B.1.

[41] Sometimes the Gora stream is called Boneya stream. However, in this Project ESIA Gora stream is used for consistency.

Table B.1: Summary of Stream Flow Gauging Results

Spring	Stream	Measured Flow Rate (L/s)
Gora	Gora Stream	84
Wareka	Ada Stream	21
Wareka	Le Kole	5
Wareka	Wareka Spring	95
Wareka Confluence 1	Total stream flow downstream of confluence of Ada and Le Kole streams.	21
Wareka Confluence 2	Total stream flow downstream of confluence of Ada and Le Kole streams and Wareka Spring.	100

The flow balances provided above in the Wareka spring area do not sum precisely (e.g., Ada Stream (21 L/s) plus Le Kole (5 L/s) does not equal 21 L/s). This suggests that the measurement technique is at best ±20% accurate, with variation likely due to challenges of measuring stream the cross-section and flow rate in irregular channels.

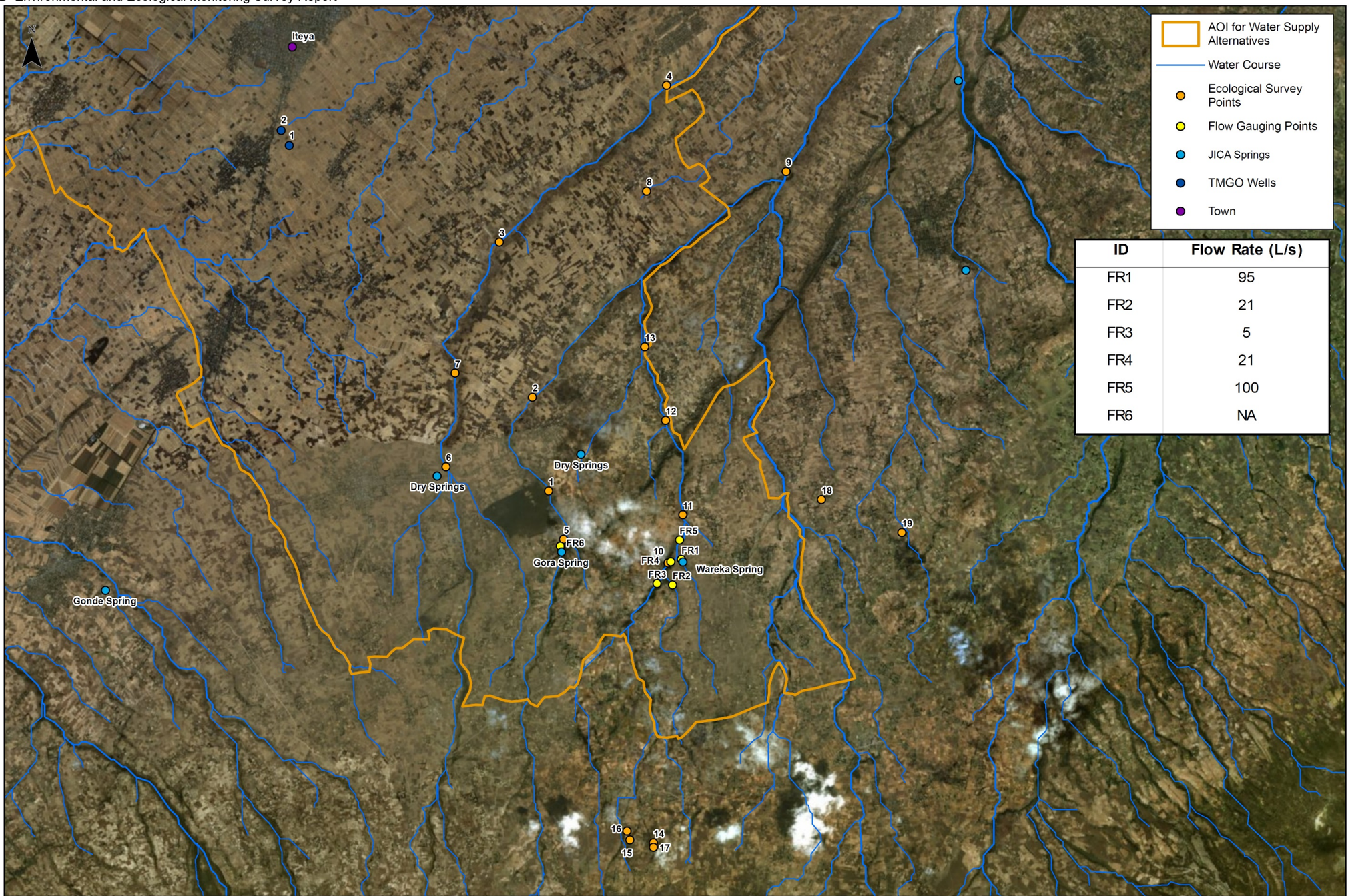


Figure B.1: Locations of Springs, Stream Flow Gauging and Ecological Survey Points

B.3 ECOLOGICAL SURVEY

B.3.1 Introduction

An initial list of rare or endangered species that could be present in and around the Project AoI was developed based on information held within the International Biodiversity Assessment Tool (IBAT) [42] database. This identified the potential for the following IUCN Red Data Book Critically Endangered, Endangered or Vulnerable species to be present within the Project AoI (Table B.2).

Table B.2: List of Potential IUCN Red Data Book Critically Endangered, Endangered or Vulnerable species within the Project AoI

Common Name	Latin Name	Status
Fish		
Cyprinid Fish	Labeobarbus ethiopicus	EN
Amphibians		
Somali Grassland Frog	Ptychadena nana	EN
Shoa Forest Treefrog	Leptopelis ragazzii	VU
Kouni Valley Striped Frog	Paracassina kounhiensis	VU
Birds		
Hooded Vulture	Necrosyrtes monachus	CR
White-backed Vulture	Gyps africanus	CR
Rappell's Vulture	Gyps rueppelli	CR
White-headed Vulture	Trigonoceps occipitalis	CR
Egyptian Vulture	Neophron percnopterus	EN
Lappet-faced Vulture	Torgos tracheliotos	EN
Steppe Eagle	Aquila nipalensis	EN
Saker Falcon	Falco cherrug	EN
Northern Bald Ibis	Geronticus eremita	EN
Basra Reed-warbler	Acrocephalus griseldis	EN
Maccoa Duck	Oxyura maccoa	VU
Blue-winged Goose	Cyanochen cyanoptera	VU
Common Pochard	Aythya ferina	VU
Northern Ground-hornbill	Bucorvus abyssinicus	VU
European Turtle-dove	Streptopelia turtur	VU
Black Crowned-crane	Balearica pavonina	VU
Wattled Crane	Bugeranus carunculatus	VU
Tawny Eagle	Aquila rapax	VU
Eastern Imperial Eagle	Aquila heliaca	VU
Martial Eagle	Polemaetus bellicosus	VU
Secretarybird	Sagittarius serpentarius	VU
Insects		
Dragonflies	Notogomphus ruppeli	EN
	Atoconeura aethiopica	VU
	Crenigomphus abyssinicus	VU
	Crenigomphus denticulatus	VU

[42] https://www.ibat-alliance.org/

	Pseudagrion guichardi	VU
	Pseudagrion kaffinum	VU
Mammals		
Ethiopian Wolf	Canis simensis	EN
Bale Shrew	Crocidura bottegoides	EN
Mountain Reedbuck	Redunca fulvorufula	EN
Mountain Nyala	Tragelaphus buxtoni	EN
Lucina's Shrew	Crocidura lucina	VU
Hippopotamus	Hippopotamus amphibius	VU
Black-clawed Brush-furred Rat	Lophuromys melanonyx	VU
Nikolaus's Mouse	Megadendromus nikolausi	VU
Scott's Mouse-eared Bat	Myotis scotti	VU
Leopard	Panthera pardus	VU
Bat sp	Otomops harrisoni	VU

Two (VU) plant species were also recorded, namely *Eriocaulon aethiopicum* and *Hygrophila asteracanthoides*

B.3.2 Field Survey Methodology

Ground truthing of this initial list was carried out over a period of nine days starting on December 17, 2019. The work was carried out by Metaferia Consulting Engineers, with a focus on the habitats and species present in and around the springs of the Project AoI and their associated streams. The locations of the ecological survey points are shown on Figure B.1.

Before commencing the surveys, aerial images from Google Earth were used to identify habitats and land uses around the survey points. During the survey, species observations were documents and the survey points were assessed for their general suitability for protected species of concern.

During the surveys, invertebrate sampling was undertaken within the streams using a “kick sampling” technique to identify and record invertebrates present and to provide an indication of water quality. At each survey point a sampling net was placed downstream of the surveyor and the stream bed and any loose rocks were agitated for three minutes. Each invertebrate species (and the number of each species) collected in the net after this time was documented in the field, and samples were preserved and taken back to a lab for analysis. Water quality at each location was determined based on the species present in accordance with Table B.3.

Table B.3: Aquatic Indicator Species

Group	Water Quality
Mayflies, Stoneflies, Riverbug, Caddisflies or Sedgeflies	Good
Crayfish, Dragonflies	
Mayflies, Stoneflies, Caddisflies or Sedge flies	
Snails, Caddisflies or Sedge flies, Mussels, Gammarids, Dragonflies	
Bugs, Beetles, Caddisflies or Sedgeflies, Craneflies/Black flies, Flatworms	
Mayflies, Alderflies, Leeches Water mites	
Snails, Cockles, Leeches, Hog louse	
Midges	
Worms	Poor

During the surveys local people were asked to help identify animal species they have seen in or using the nearby streams, and to help understand what the streams are used for by local people. These discussions highlighted that activities that involve more extraction of the water in the Gora area will not be welcomed by the community as the stream is extensively used for irrigation.

B.3.3 General Results

The locations of 19 survey points are illustrated on Figure B.1 (13 within the Project AoI and 6 controls).

Land uses around the streams predominantly comprised of agricultural and grazing land, with juniper and Eucalyptus trees common. Streams were typically located in well vegetated habitats that were common in the wider landscape. Commonly recorded vegetation included *Juniperus procera, Eucalyptus, Croton macrostachyus, Podocarpus falcatus, Solanum marginatum, Cynodon dactylon and Chioris gayana*.

Based on the habitats present, it was determined that none of the vulnerable or endangered bird species in the IBAT list, and few of the mammals, would be expected to rely on the aquatic and marginal habitats supported by the springs and streams of the Project AoI or be affected by a decline in water levels. As a result, a refined list of potentially affected RDB species is provided in Table B.4.

Table B.4: Refined List of Potential RDB Species

Common Name	Latin Name	Status
Amphibians		
Somali Grassland Frog	Ptychadena nana	EN
Shoa Forest Treefrog	Leptopelis ragazzii	VU
Kouni Valley Striped Frog	Paracassina kounhiensis	VU

Common Name	Latin Name	Status
Insects		
Dragonflies	Notogomphus ruppeli	EN
	Atoconeura aethiopica	VU
	Crenigomphus abyssinicus	VU
	Crenigomphus denticulatus	VU
	Pseudagrion guichardi	VU
	Pseudagrion kaffinum	VU
Mammals		
Bale Shrew	Crocidura bottegoides	EN
Lucina's Shrew	Crocidura lucina	VU
Black-clawed Brush-furred Rat	Lophuromys melanonyx	VU
Nikolaus's Mouse	Megadendromus nikolausi	VU
Scott's Mouse-eared Bat	Myotis scotti	VU
Bat sp	Otomops harrisoni	VU

The presence of the amphibians *Leptopelis regazzii*, *Ptychadena nana*, and *Paracassina kounhiensis*, as well as the dragonfly *Pseudagrion kaffinum*, was confirmed in watercourses upstream of the Project AoI (the control sites) during the surveys. These are all protected species as described below. Specific mitigation may be required to prevent impacts to these species. No bat species were observed in the area during the surveys.

During the in-stream sampling watercourses were found to support little aquatic vegetation, with records restricted to algae, stonewort, chara, and mosses growing in clumps on rocks. A range of invertebrates were however recorded, including crayfish, shrimps, beetles and mayfly, caddisfly and stonefly. These species are indicative of good water quality based on the categorization in Table B.3, as would be expected given their proximity to the springs.

Two sets of habitat types were recorded, with differences in species recorded between the habitat types shown in Table B.4 below.

Table B.5: Summary of Observed Species at Each Survey Location

Habitat Subset	Sample sites	Bankside plant species	In-stream species
1 and 2		***Trees*** *Juniperus procera, Olea europaea, Ficus vasta Ficus sycomorus, Cussonia arborea Rhus lancea and Eucalyptus sp* **Grasses** *Aristida sp, Chioris gayana kunth, Cynodon dactylon* and *Festuca sp*	Stonewort, beetles, caddis fly, plankton algae and chara
1	1, 2, 5, 6, 7, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19	**Shrubs:** *Dodonea angustifolia, Buddleja polystachya and Carissa spinarum* **Tree** *Croton macrostachyus*	Mayfly, Dragonflies, Eels, Stone fly,
2	3, 4, 8 ,9	**Shrubs:** *Maytenus senegalenis, Osyris lanceolate, Rhus natalenis*	Mosses, Leeches, Liverworts,

B.3.4 Rare and Endangered Species

Four rare or threatened species were confirmed at control sites during the surveys as follows:

- The IUCN RDB Endangered Somali Grassland Frog *Ptychadena nana*

- The IUCN RDB Vulnerable frogs *Leptopelis regazzii* and *Paracassina kounhiensis*,
- The IUCN RDB Vulnerable dragonfly *Pseudagrion kaffinum*

All 4 species found at all 4 sampling points (14,15,16,17) on Figure B.1. Of these the EN status of the Somali Grassland Habitat is expected to qualify the location as **Critical Habitat for this species.** Further assessment is also required of the local distribution of the other IUCN Vulnerable species.

Somali Grassland Frog (*Ptychadena nana)* www.iucnredlist.org/species/58512/16953411

This frog is endemic to Ethiopia and is only known with certainty from its type locality in Dida'a in the Arsi Mountains near the Project site. A similar (or potentially the same) species has also been recorded from the Bale Mountains and possibly another from south of Ketama, west of the Rift Valley. Each of these areas is considered to comprise one threat-defined location. Although it is likely to occur more widely on the eastern side of the Ethiopian plateau, it is considered likely to be at fewer than five locations within its current range which, when taken as a proxy for extent of occurrences estimated to be 20 km^2 as per the adjacent map (Figure B.2).

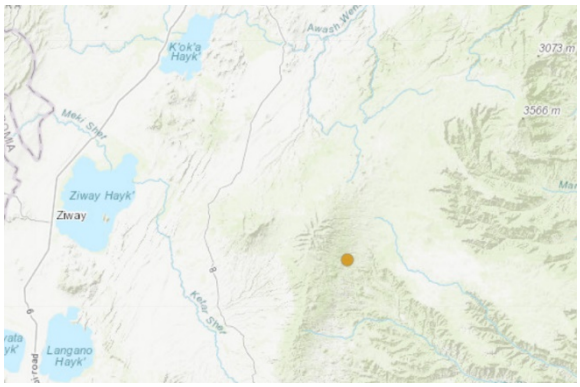


Figure B.2: Known Range of the Somali Grassland Frog (*Ptychadena nana)*

Surveys completed in 2010 in the Arsi and Bale areas suggest that this frog is locally abundant and while its population is not considered to be severely fragmented it is listed as Endangered given its small extent of occurrence. The species occurs in montane grassland at around 2,000-3,000 masl and has been found near streams, in cattle grazing fields, in mosaics of cropland, trees, shrubs, grassland and other natural vegetation, and in roadside pools in rural towns and villages (A Mengistu 2012). Its occurrence in altered habitats suggests that it has a degree of tolerance to habitat disturbance, although probably not to more intense urbanization or to intensification of use of agricultural chemicals in fields. It is thought to breed by larval development in water, and thus loss of water habitat is considered a threat along with mechanized agriculture, urbanization, and pollution of aquatic habitats by agricultural chemicals. The species is not known from any protected areas and more information is needed on its distribution, natural history, and tolerance to threats.

Appendix C Report of the Stakeholder Engagement Mission 16 to 20th December 2019