

Limited ESIA for Tambaredjo Oilfield Cyclic Steam Stimulation Project

Non-Technical Summary: Limited ESIA Report

November 2019 SRK Project Number: 550457

1. INTRODUCTION

Staatsolie Maatschappij Suriname N.V. (Staatsolie) operates three oilfields and three oil processing plants in the Saramacca District of Suriname.

Staatsolie aims to improve recovery of remaining oil from the operating Tambaredjo Oilfield by using Enhanced Oil Recovery (EOR) techniques. Following earlier implementation of a Polymer Flooding pilot project, Staatsolie proposes to implement a Cyclic Steam Stimulation (CSS) project in the Tambaredjo Oilfield (the project).

SRK Consulting (South Africa) (Pty) Ltd (SRK), a consultancy with extensive experience in Suriname, was appointed to undertake the Limited Environmental and Social Impact Assessment (ESIA) process required for the project.

See page 6 for details on how you can participate in the process.



2. GOVERNANCE FRAMEWORK

Suriname does not have an approved national environmental policy and there is no promulgated legislation dealing specifically with environmental management. However, environmental legislation is under development and guidelines for environmental assessment have been released. The Limited ESIA process for the proposed CSS project complies with the guidelines and other relevant legislation.

In addition to national regulatory requirements, the Limited ESIA process was guided by Good International Industry Practice (GIIP), notably standards and guidelines such as those prescribed by the World Bank Group for Bank-funded private sector development projects.

2.1 National Standards

The *Nationaal Instituut voor Milieu en Ontwikkeling in Suriname* (NIMOS) is responsible for the development of national environmental legislation and administers the environmental assessment process in Suriname.

A **draft Environmental Act**, most recently amended in 2016, has been developed as a framework law in response to the 1992 Rio declaration. The draft Act lays down rules for the conservation, management and protection of a sound environment within the framework of sustainable development. The draft Act has been under consideration by the Council of Ministers and The National Assembly (DNA) for some time and has not yet been promulgated. The Act has been submitted to Parliament as an initiative law (*initiatief wet*). Nevertheless, the principles in the draft Act provide guidance for conducting an ESIA in Suriname.

Draft EIA Regulations, to be promulgated under the Environmental Act once in force, have also been developed since 2003 and contain requirements for EIA processes and public participation. The draft EIA Regulations are still being amended and are not yet in force.

While there is currently no legislative basis for the assessment of environmental impacts of development proposals in Suriname, NIMOS has published Guidelines for Environmental Assessment (EA) in Suriname. The EA Guidelines will be applied by NIMOS as part of the project permitting process and project developers are expected to comply with the guidelines. NIMOS' *EA Guidelines Volume II: Mining*, also guided the ESIA.

Based on the Screening report compiled by Staatsolie, NIMOS advised that the project should follow a Category B path 2 process in terms of NIMOS's EA Guidelines, and requested that a Limited ESIA process be conducted and an Environmental Management and Monitoring Plan (EMMP), including impact assessment, be produced and submitted to NIMOS.

2.2 International Standards

SRK was guided by international standards and Good International Industry Practice (GIIP), notably the Performance Standards (PS) of the International Finance Corporation (IFC), in conducting the ESIA and associated public consultation and information disclosure process.

2.3 Corporate Requirements

Staatsolie has adopted procedures for protecting the environment which comply with international standards. An integrated Health, Safety, Environment and Quality (HSEQ) Policy and Management System is implemented across Staatsolie's operations to monitor effects on the health and safety of employees, contractors and affected communities, as well as impacts on the environment.

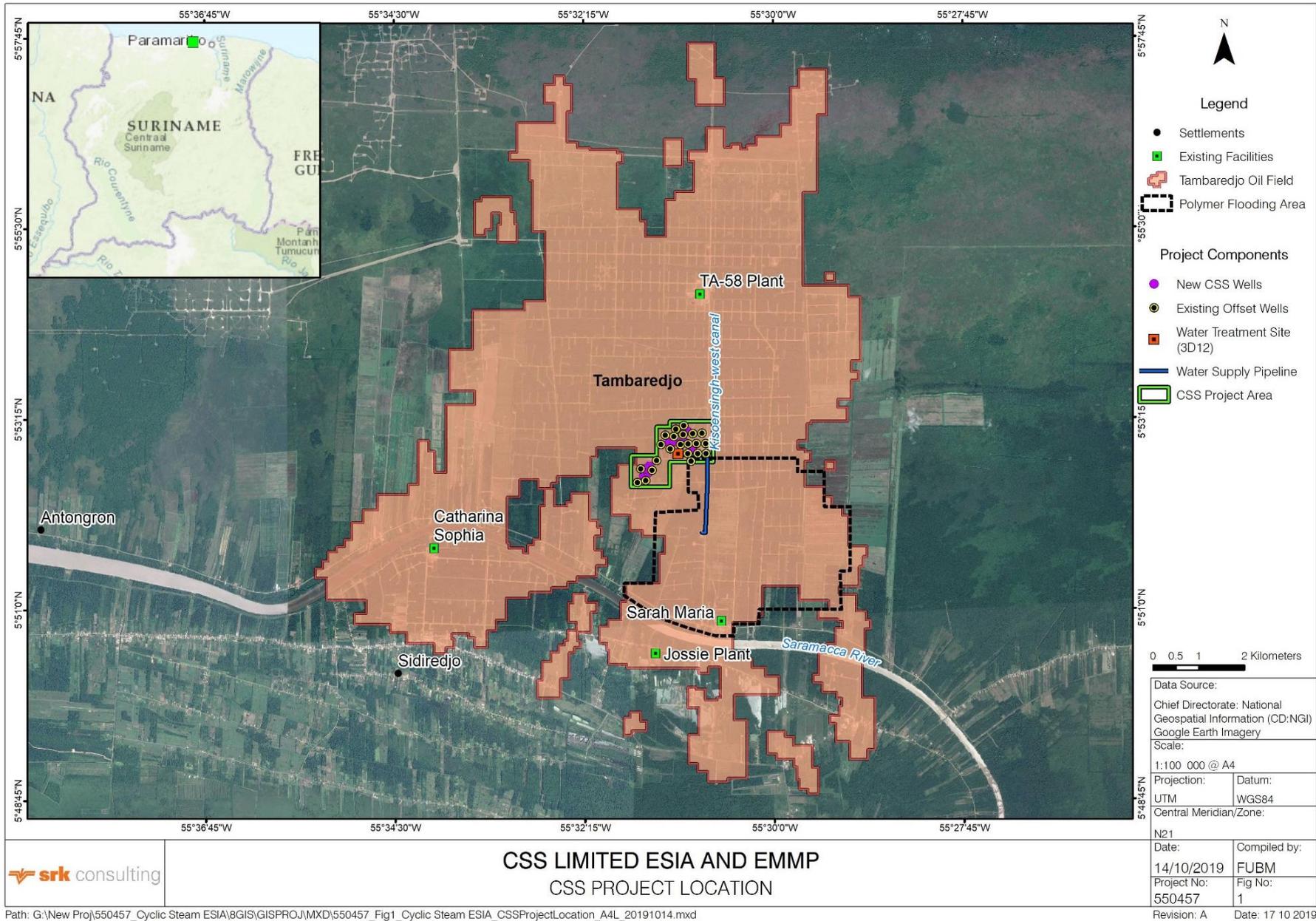


Figure 1: Location of the CSS project

3. THE ESIA PROCESS

The general approach to the Limited ESIA was guided by the requirements of NIMOS, as stipulated in the EA Guidelines (2009) and Guidance Note Environmental Assessment Process (2017), and international best practice.

The objectives of the ESIA are to:

- Document and contextualise the ecological baseline conditions of the study area and the socio-economic conditions of affected communities;
- Assess in detail the environmental and socio-economic impacts that may result from the project;
- Inform and obtain contributions from stakeholders, including relevant authorities and the public, and address their relevant issues and concerns;
- Identify environmental and social mitigation measures to address the impacts assessed; and
- Develop an Environmental and Social Management Plan (ESMP), based in part on the mitigation measures developed in the ESIA Report.

The Limited ESIA process consists of three phases: the Impact Assessment (*current phase*), Review and Finalisation and Decision-making phases. A summary of the Limited ESIA process is shown in Figure 2.

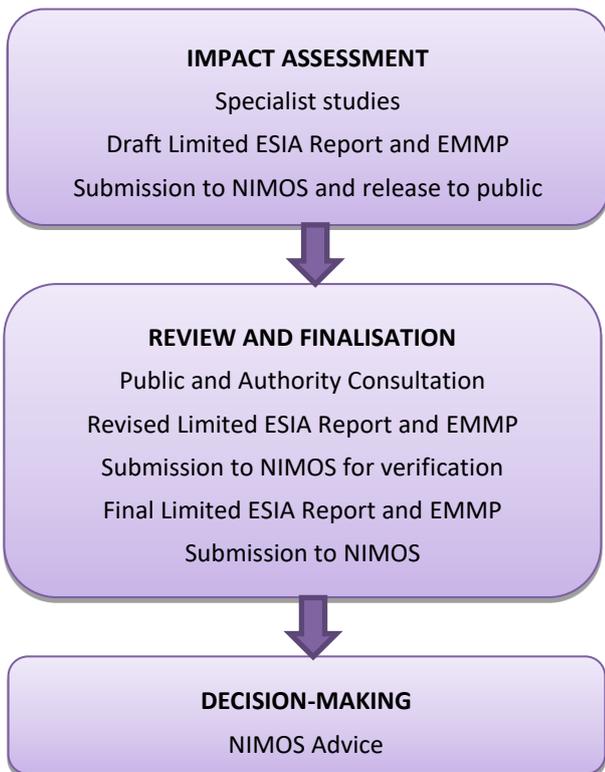


Figure 2: Schematic of Limited ESIA process

4. DESCRIPTION OF THE SITE AND ENVIRONMENT

The Tambaredjo Oil Field is located between the East-West Connection Road and the coast, and mostly north of the Saramacca River (see Figure 1).

The study area is located in the Young Coastal Plain of the Guiana Basin, on Holocene deposits of the Coronie Formation. The Young Coastal Plain is dominated by flat and low-lying swamps and marshes with clay soils at 1 - 1.5 m above mean sea level (amsl), on which a peat layer has developed.

The project is located in the central section of the Tambaredjo Oilfield and new wells will be embedded amongst the existing ~1 700 oil wells. The CSS project is located west of the south-north aligned Kisoensingh-west Canal, one of the main drainage features of the Tambaredjo Oilfield, and north-east of the Polymer Flooding project area. With the exception of existing oil production infrastructure, the project area is vacant and covered with modified secondary marsh **vegetation** with relatively low **faunal** diversity. The Tambaredjo Polder area has been substantially transformed by human activities (see Figure 3).

There are few significant sources of **air pollution** in the area. The TA-58 Crude Treatment Facility releases some atmospheric emissions. Other potential sources of air pollution include vehicles on unpaved roads and farming activities in surrounding areas. Air quality measurements taken around the project site showed that all measured pollutants are low and air quality is good.



Figure 3: Oil well along the road to TA-58

Noise levels are typical of rural areas, with daytime sound at ~46 dBA west of TA-58 (where there is little traffic) and ~66 dBA at Wayamboweg (with public traffic).

The Saramacca District has approximately 3 320 km² of coastal **wetlands**, of which 370 km² support mangrove forest. Surface water sampling during the rainy and dry seasons indicated that water quality had not significantly changed from measurements in 1999, and point to the TA-58, oil drilling and processing and use of insecticide as possible, but limited, sources of contamination.

The northern area supports important ecosystem goods and services, including the Coppename Monding **Nature Reserve** located ~10 km north of the project area, which is listed as a Wetland of International Importance (RAMSAR site).

The coastal plain of Suriname is underlain by three major **aquifers** within the Corantijn Group. Drinking water is abstracted ~12 km east of the project area at Tijgerkreek.

The project area is **not deemed sensitive** with regards to ecosystems and floral and faunal biodiversity.

Residential areas nearest to the project area are located along Gangaram Panday Road (~4 km to the south). Most families residing along the Gangaram Panday Road practise horticulture (domestic cultivation). Most farmland in the area lies fallow or has been abandoned. Public piped water infrastructure is being installed, but most households currently depend on rain water for drinking and household purposes.

No records of significant cultural or historical objects / spaces are known in the area.

5. PROJECT DESCRIPTION

Enhanced oil recovery (EOR) is the extraction of crude oil that cannot be extracted otherwise (from an oilfield). Three main EOR techniques are:

- *Gas*: Injection of gases into the reservoir to maintain reservoir pressure and displace (“drive”) more oil towards producer wells;
- *Thermal*: Injection of steam to heat the oil (e.g. through CSS), effectively making it easier to extract; and
- *Chemical*: Injection of chemicals (such as polymer) as dilute solutions to make the oil more mobile and/or increase the viscosity (“thickness”) of injection water phase, to “drive” more oil towards producer wells.

Based on EOR screening, the Tambaredjo Central Area is suited to EOR processes such as CSS.

The CSS process entails the injection of up to 200 tons of steam per day into the reservoir down a well for ~20 days, followed by a soaking period of ~10 days during which the well is sealed and the oil becomes less viscous, and subsequent extraction of the oil from the same well for ~1 year, before the cycle is repeated. Two injections cycles are planned for this project. Ten CSS wells will be injected sequentially, as one steam generator will be used and moved from well to well.

The project includes the:

- Construction and operation of a water treatment plant;
- Drilling of 10 new CSS wells;

- Construction of production flow lines connecting to existing infrastructure;
- Construction of water supply and fuel (crude oil) pipelines for steam generation; and
- Construction / extension of access roads within the oilfield.

The CSS process requires up to 1 260 barrels/day of water for ~2 years, abstracted from the Saramacca River and supplied via the Polymer Flooding project infrastructure. Power will be obtained from mobile generators.

Produced fluid¹ extracted from production wells is conveyed to the TA-58 crude treatment plant for separation and treatment. The treated produced water is then discharged into the Saramacca River.

After completion of the two steam injection cycles, wells may be subject to additional steam injection cycles and/or other subsequent EOR methods. Failing that, wells will continue producing as regular cold production wells while economically viable.

It is expected that the project will provide jobs for 30 people during construction, while existing Staatsolie staff and/or contractors will operate the project.

6. ALTERNATIVES

During the planning phases, Staatsolie considered and evaluated a number of alternatives relating to:

- EOR techniques;
- Water supply; and
- Power supply.

Other EOR techniques are being assessed by Staatsolie in separate studies. Only one option for water and energy supply is deemed feasible.

7. STAKEHOLDER ENGAGEMENT

Stakeholder engagement is a key component of the ESIA process and is being undertaken in compliance with GIPP and NIMOS guidelines.

Stakeholder engagement activities during the Limited ESIA process are outlined in Table 1.

Table 1: Stakeholder engagement activities

Activity	Date
Release ESIA Report and EMMP for public comment period	13 November 2019
Public comment period	until 13 December 2019
Public meeting	28 November 2019
Compile Issues and Responses Summary, finalise ESIA Report	December 2019 / January 2020

¹ Mix of oil, water and gas.

8. ASSESSMENT OF POTENTIAL IMPACTS

Groundwater and geochemical specialist input was provided to investigate key potential direct, indirect and cumulative impacts.

The impact assessment is further based on a number of recent specialist studies for the proposed Saramacca Power Plant and the Polymer Flooding project in the Tambaredjo Oilfield, which provide SRK with a detailed understanding of air quality, noise, surface water quality, terrestrial ecology and social aspects.

The significance of the anticipated impact was rated without and with recommended mitigation measures. Key potential impacts are summarised below.

- The predicted **air quality** impacts due to combustion of fuel for the steam generator are expected to be *insignificant*, based on prior modelling of air quality impacts for the proposed Saramacca Power Plant and measured baseline concentration of pollutants in the region, which are very low.
- The predicted **surface water** impact due to contamination during construction as well as abstraction of water and discharge of treated effluent into the Saramacca River is deemed to be of *very low* significance. Produced water is treated prior to discharge and no impact on other users abstracting water from the Saramacca River is expected.
- The predicted **groundwater** impacts due to contamination during construction and possible thermal alteration of the chemical characteristics of groundwater are *insignificant*. The vertical extent of the modelled thermal plume only extends into the base of the overlying sand layer and any minimal changes in the brackish and freshwater aquifers due to the CSS process are too low to effect thermal changes of groundwater chemistry.

Cumulative impacts may derive from existing oil production in the Tambaredjo Oilfield and associated discharge of produced water to the Saramacca River, and planned projects including Polymer Flooding and the proposed Saramacca Power Plant. Cumulative impacts include a reduction in surface water quality and habitat due to vegetation clearing.

Noise, socio-economic, visual and traffic impacts are minor or insignificant impacts associated with the CSS project.

A number of mitigation and monitoring measures have been identified to avoid, minimise and manage potential environmental impacts associated with the proposed CSS project. These are presented in the EMMP.

Table 2 below summarises:

- The impacts assessed in the Limited ESIA; and

- Their significance before and following the implementation of essential mitigation measures, on which the significance rating is based.

Potential negative impacts are shaded in reds, benefits are shaded in greens

Table 2: Summary of impacts

Impact	Significance rating	
	Before mitigation	After mitigation
Air quality: Impaired human health from increased ambient pollutant concentrations	Very Low	Insignificant
Noise: Increased noise levels along access roads	Very Low	Very Low
Surface Water: Contamination and abstraction	Very Low	Very Low
Groundwater: Contamination of groundwater	Very Low	Very Low
Ecology: Vegetation clearance and habitat loss	Very Low	Very Low
Socio-economic: Employment and impact on adjacent communities	Insignificant	Insignificant
Visual: Change in visual quality and sense of place	Insignificant	Insignificant
Traffic: Increased number of vehicles	Insignificant	Insignificant

Scope 3 emission of greenhouse gases through the subsequent combustion of the extracted oil, estimated at ~255 400 t CO₂-e, will dominate the project’s contribution to climate change. Direct contributions to GHG emissions from the steam generator (~40 000 t CO₂-e), other electricity and fuel use by the project and possibly methane leaking from wells and pipelines are expected to be comparatively small. Due to the higher energy input required for steam generation and higher oil production per well compared to conventional (cold) production, the CSS project has a significantly higher carbon footprint relative to conventional production.

Key essential recommendations / mitigation measures are:

- Implement the EMMP to guide design, construction, operation and decommissioning activities and to provide a framework for the ongoing assessment of environmental performance;
- Ensure that well-casing and cementing meets best practice methods and Staatsolie standards to prevent thermal losses into the upper layers (aquifers) above the oil reservoir;
- Manage injection pressures to ensure that steam is not chased / forced beyond the confines of the oil reservoir;

- Treat produced water before discharge;
- Limit and phase vegetation clearance and the construction footprint to what is essential;
- Monitor groundwater quality and temperature;
- Ensure that the appropriate personnel and sufficient resources are allocated to expedite implementation of the EMMP;
- Ensure adequate response mechanisms are in place and corrective action is taken to address any instances of non-compliance with standard management measures or procedures;
- Maintain lines of communication with the local communities in the vicinity of the Tambaredjo Oilfield. Ensure that local communities are aware of the Staatsolie grievance mechanism and how to utilise it. Maintain a complaints registry and investigation procedure to ensure that all grievances are adequately addressed; and
- Compile and implement a detailed Emergency Response Plan prior to commencing with the CSS

project, setting out roles, responsibilities and procedures to address all potential incidents.

9. CONCLUSIONS

This draft Limited ESIA Report has identified and assessed the potential impacts associated with the proposed Staatsolie CSS project at the Tambaredjo Oilfield and shown that potential impacts are acceptable.

The project entails trade-offs between social, environmental and economic costs and benefits. The trade-offs are documented in the report, which assesses environmental impacts and benefits and compares these to the No-Go alternative.

There are a number of minor or less significant impacts associated with the project. If recommended mitigation measures are adopted, these impacts are not expected to be significant nor long-term.

HOW YOU CAN YOU PARTICIPATE IN THE EIA PROCESS

The Limited ESIA Report is not a final report and may be amended based on comments received from stakeholders. As such, stakeholders are invited to participate in the ESIA process by commenting on the ESIA Report, registering on the project database and/or attending a public meeting:

REVIEW THE REPORT

Copies of the complete report are available for public review at the following venues:

- NIMOS;
- Office of the Saramacca District Commissioner at Groningen; and
- SRK's website: www.srk.co.za – click on the 'Recent Publications' and then 'Public Documents' links.

ATTEND A MEETING

A **Public Meeting** will be held where the information presented in the ESIA Report will be discussed and additional concerns and issues can be raised with the environmental consultants and the project team on **28 November 2019**.

REGISTER ON THE DATABASE OR PROVIDE YOUR OPINION

Register or send written comment to:

SRK Consulting:

Contact person: **Sue Reuther**

E-mail: sreuther@srk.co.za

Tel: + 27 21 659 3060 Fax: +27 21 685 7105

Staatsolie:

Contact person: **Farina Ila Hibaks**

E-mail: Fllahibaks@staatsolie.com

Tel: +597 375222 extension 66761

Comments must reach one of the above contact persons **no later than 13 December 2019**.