



**Government of Saint Lucia
Renewable Energy Sector Development Project
Environmental and Social Management Plan
Belle Plaine Site**

January 2025



Government of Saint Lucia

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Prepared for:

Government of Saint Lucia

Renewable Energy Sector Development Project

Prepared by:

Panorama Environmental, Inc.



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Executive Summary

ES.1 Overview

The Government of Saint Lucia has secured funding through the World Bank to implement the Renewable Energy Sector Development Project (RESDP). Geothermal exploration drilling is proposed within the southwestern region of the country at Fond St. Jacques, Belle Plaine, and Saltibus. The development objective of the RESDP is to inform the Government of Saint Lucia of the viability of its geothermal resource for electricity generation and strengthen the enabling environment to scale up clean energy investments with the private sector. The project is being implemented by a Project Implementation Unit (PIU) in the Department of Infrastructure, Ports and Transport (DIPT) of the Ministry of Infrastructure, Ports, Transport, Physical Development and Urban Renewal.

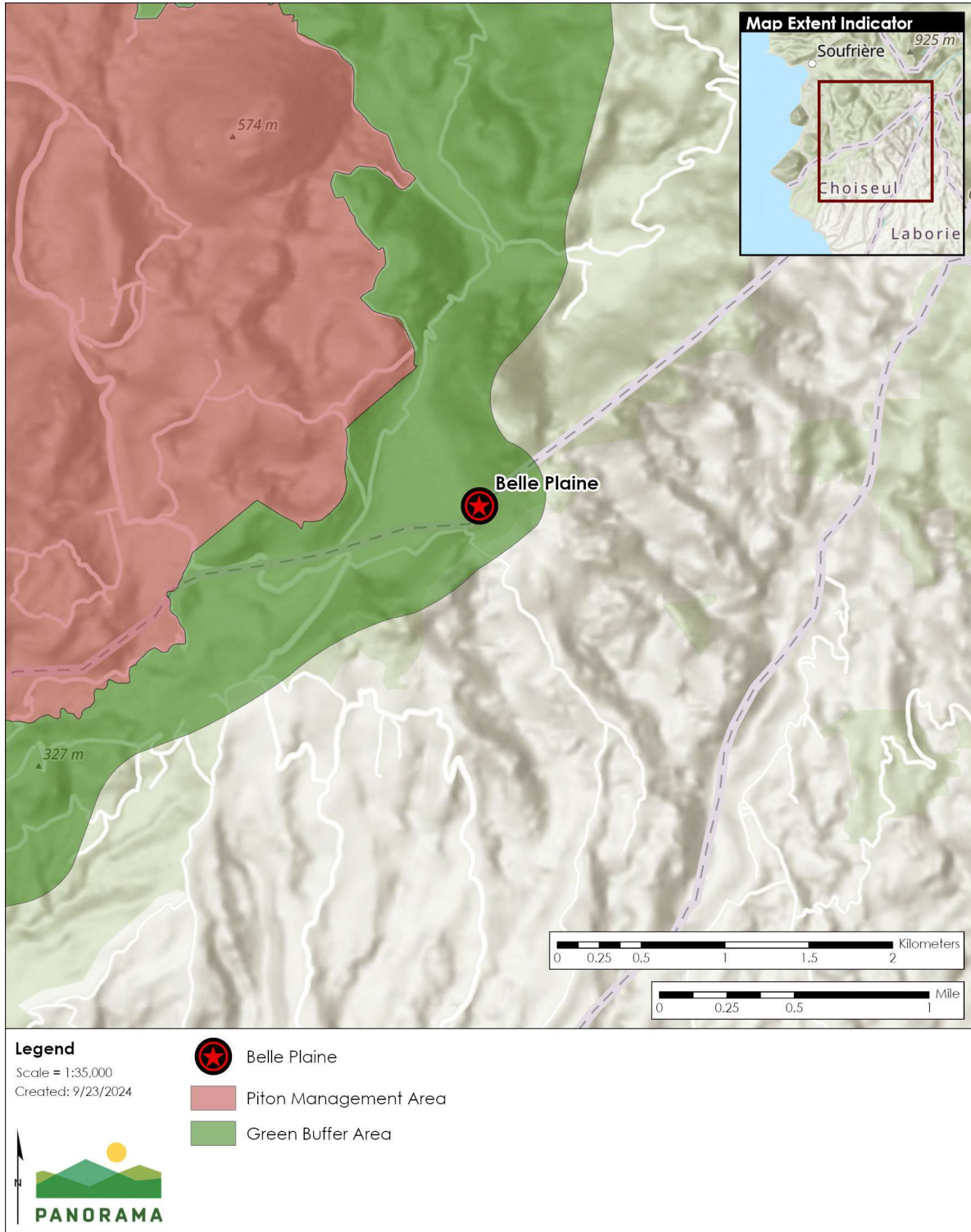
This Environmental and Social Management Plan (ESMP) was prepared for geothermal exploration drilling and testing at the Belle Plaine Site (project) in accordance World Bank guidance. Although three sites will be subject to geothermal investigation, this ESMP addresses the environmental and social mitigation and management requirements for Belle Plaine only. The Saltibus and Fond St. Jacques drilling areas are addressed in a separate ESMP.

ES.2 Environmental and Socio-economic Conditions

Panorama Environmental, Inc. has completed an Environmental and Social Impact Assessment and Summary Report to define the baseline environmental and socio-economic conditions in the project area. The Belle Plaine drilling site is generally characterized as agricultural land use with adjacent forested areas. The land identified for locating the Belle Plaine well pad is owned by a single individual and is currently used for agricultural development. The Belle Plaine access road would cross agricultural areas with several landowners. The Belle Plain well pad is located within the Piton Management Area (PMA) (Figure ES.1-1).

EXECUTIVE SUMMARY

Figure ES.1-1 Belle Plaine Site Location



ES.3 Key Findings of Stakeholder Engagement

During the ESIA scoping process, Panorama Environmental, Inc and the PIU held consultation meetings with governmental agencies and local stakeholder representatives. Ministers provided comments that generally reflected issues related to previous geothermal exploration in Saint Lucia. The Development Control Authority (DCA) provided comments on the ESIA Terms of Reference and topics covered in the ESIA. The Water Resources Management Authority (WRMA) and The Water and Sewerage Company Inc. (WASCO) expressed concerns about the use of water, drinking water infrastructure, and water quality. The Pitons Management Authority expressed concerns about any disturbance with the Green Buffer Zone that could affect the PMA. Local stakeholder representatives' comments included concerns about noise, geothermal hazards, dust control and job opportunities for the local community. Each of these issues was addressed in the ESIA and mitigation measures were defined consistent with World Bank guidance.

ES.4 Key Mitigation Measures

The ESIA has identified mitigation measures to reduce and avoid impacts associated with the project. The ESIA mitigation measures are listed in Table ES.4-1. This ESMP defines:

- Procedures for implementation of the mitigation measures in the ESIA
- Roles and responsibilities for mitigation implementation and reporting
- Costs for mitigation
- Institutional structure for oversight and management of the mitigation
- Capacity building requirements

ES.5 ESMP Organization

This ESMP is organized as follows:

- **Chapter 1: Introduction.** Provides an overview of the ESMP, background, and the proposed project.
- **Chapter 2: Mitigation Management and Monitoring Plan.** Includes the detailed mitigation measures, roles and responsibilities for implementing the measures, and reporting procedures.
- **Chapter 3: Roles and Responsibilities.** Outlines the roles and responsibilities of parties involved with direct implementation of mitigation measures or implementation oversight.
- **Chapter 4: Implementation and Verification Procedures.** Defines implementation phases and describes documentation procedures for implementing mitigation measures.
- **Chapter 5: Institutional Structure and Capacity Building.** Defines the institutional structure and capacity for the PIU and key actions for capacity building.

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Table ES.4-1 Summary of Mitigation Measures

Issues/Potential Impacts	Mitigation Measures
Environmental Mitigation Measures	
Water Resources (including Water Quality, Water Supply, Flooding, Hazardous Materials)	Water-1: Stormwater, Erosion, and Sediment Control Water-2: Drilling Effluent Management Water-3: Geothermal Brine Management Water-4: Blowout Prevention Water-5: Worker Latrine Management Water-6: Water Extraction Strategy Hazards-1: Hazardous Materials Management Plan Waste-1: Waste Management Plan
Air Quality (including Geothermal Emissions)	Air-1: Fugitive Dust Management Air-2: Construction Emissions Controls Air-3: Air Quality Monitoring and Noxious Gas Management Water-4: Blowout Prevention Safety-5: Emergency Response Plan
Geology and Soils (including Erosion and Topsoil Loss, Landslides and Mudflows)	Soils-1: Topsoil Preservation and Restoration Water-1: Stormwater, Erosion, and Sediment Control
Noise	Noise-1: Noise Abatement and Community Coordination Noise-2: Noise Control During Well Testing Social-3: Community Engagement and Sensitivity
Natural Habitats and Biodiversity	Biodiversity-1: Invasive Weed Control Biodiversity-2: Nesting Bird Avoidance and Impact Minimization
Archaeological and Cultural Resources	Cultural-1: Inadvertent Discovery of Cultural Resources Cultural-2: Worker Cultural Resources Sensitivity Training
Landscape and Visual Character	Landscape-1: Site Restoration
Traffic Circulation and Safety	Traffic-1: Traffic Control
Utilities and Communication Systems	Utilities-1: Protect Overhead Utility Lines
Hazards and Hazardous Materials	Hazards-1: Hazardous Materials Management Plan Hazards-2: Drill Cutting Characterization Water-2: Drilling Effluent Management Water-3: Geothermal Brine Management Water-4: Blowout Prevention Waste-1: Waste Management Plan Safety-5: Emergency Response Plan
Fires	Fires-1: Fire Prevention and Response Safety-1: Health and Safety Plan

EXECUTIVE SUMMARY

Issues/Potential Impacts	Mitigation Measures
Solid Waste	Waste-1: Waste Management Plan
Social Mitigation Measures	
Livelihoods	Social-1: Agricultural Production
Working Conditions and Equality	Social-2: Working Conditions and Equality Social-3: Community Engagement and Sensitivity
Health and Safety Mitigation Measures	
Worker Health and Safety	Safety-1: Health and Safety Plan Safety-2: Personal Protective Equipment Safety-3: First Aid and Emergency Response Equipment Safety-5 Emergency Response Plan Air-3: Air Quality Monitoring and Noxious Gas Management Hazards-1: Hazardous Materials Management Plan
Community Health and Safety	Safety-1: Health and Safety Plan Safety-4: Community Safety Safety-5: Emergency Response Plan Social-3: Community Engagement and Sensitivity Air-3: Air Quality Monitoring and Noxious Gas Management Traffic-1: Traffic Control Hazards-1: Hazardous Materials Management Plan

1 Introduction

1.1 Purpose

The Government of Saint Lucia proposes to conduct the Renewable Energy Sector Development Project (RESDP; project) to assess the feasibility of commercial development of geothermal resources in Saint Lucia. The project is being implemented by a Project Implementation Unit (PIU) in the Department of Infrastructure, Ports and Transport (DIPT) of the Ministry of Infrastructure, Ports, Transport, Physical Development and Urban Renewal. The purpose of this Environmental and Social Management Plan (ESMP) is to detail:

1. The measures to be taken during the implementation and closure of the project to eliminate or offset adverse environmental and social impacts, or to reduce them to acceptable levels; and
2. The actions needed to implement these measures during the construction, operation and closure of the proposed project.

This ESMP has been prepared consistent with World Bank guidance specified in the *World Bank Environmental and Social Framework* (World Bank 2017). Although three sites will be subject to geothermal investigation, this ESMP addresses the environmental and social mitigation and management requirements for Belle Plaine site only. The Saltibus and Fond St. Jacques drilling areas are addressed in a separate ESMP.

1.2 ESMP Contents

The ESMP includes the following:

- Mitigation measures required to avoid, minimize, or compensate for impacts based on the analysis in the Environmental and Social Impact Assessment (ESIA)
- Roles and responsibilities for implementation of the mitigation measures by the PIU, civil works contractor, and drilling contractor
- Procedures for implementing mitigation measures, including the required timing of mitigation implementation
- Procedures for routinely verifying, documenting, and reporting implementation of the ESMP
- Capacity building requirements
- Costs for implementing mitigation measures and the ESMP

1.3 Project Summary

The project is located in the Soufrière district of Saint Lucia. The project includes geothermal exploration drilling on a well pad in the Belle Plaine area as shown on Figure 1.3-1.

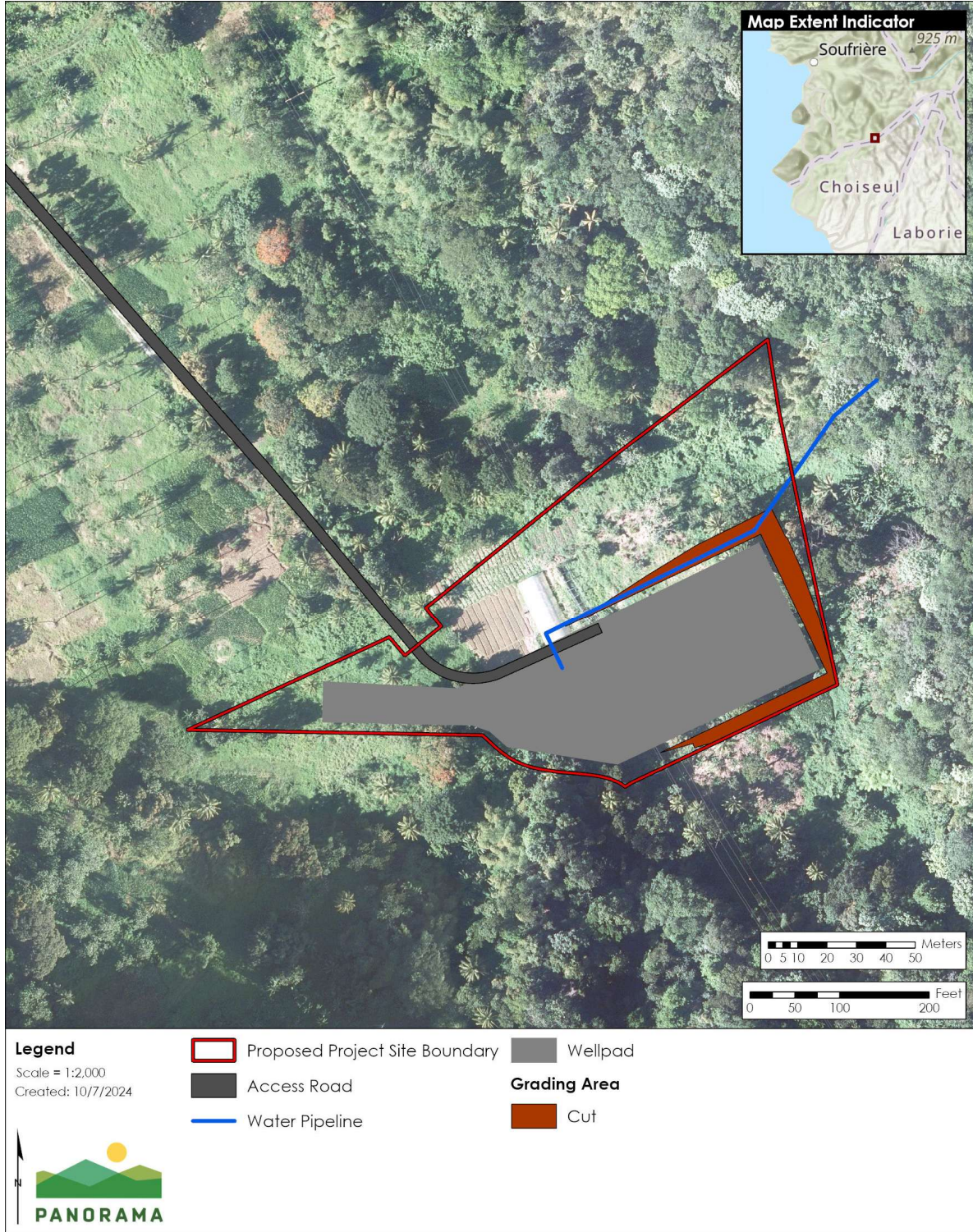
The project includes drilling a slim-hole geothermal well and testing the geothermal resources at the proposed Belle Plaine site. Slim-hole wells (3.78-inch bottom hole diameter) typically require less capital investment and cause less environmental and social impact than deep full-sized wells because they are drilled with smaller drill rigs on smaller well pads, drilling takes less time, and less fluid is produced. An exploratory drilling program using slim-hole wells is a cost-effective method for geothermal exploration.

The project would include the following activities and components, which are described in the ESIA:

- Access road improvements
- Equipment and material storage
- Well pad construction and water supply
- Well drilling
- Geothermal resource data collection and testing
- Site restoration following testing activities

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Figure 1.3-1 Belle Plaine Site Layout



Sources: Panorama 2024

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2 Mitigation Management and Monitoring Plan

2.1 Overview

The purpose of the Mitigation Management and Monitoring Plan is to identify mitigation measures to reduce impacts from the project consistent with the ESIA, describe the roles of participating parties and key personnel responsible for implementation the mitigation measures, and identify procedures to ensure that the mitigation measures are implemented adequately during all phases of construction.

Mitigation measures for the project are provided in Section 2.2. Parties responsible for implementing or overseeing implementation of mitigation measures, as well as their roles and responsibilities, are described in Section 3. Implementation and verification procedures are described in Section 4.

2.2 Mitigation Measures

2.2.1 Environmental Mitigation Measures

2.2.2 Table 2.2-1 (environmental), Social Health and Safety

2.2.3 Table 2.2-2 (social), and Health and Safety Mitigation Measures

Table 2.2-3 (health and safety) list the detailed mitigation measures, the impact that the mitigation measure is addressing, the party that is responsible for implementing the measures, and the timing of implementation. These parties include the civil contractor, drilling contractor, and PIU.

MITIGATION MANAGEMENT AND MONITORING PLAN

2.2.4 Environmental Mitigation Measures

Table 2.2-1 Environmental Mitigation Measures

Issues/Potential Impacts	Mitigation Measure	Responsible for Implementing	Timing of Requirements
Water Resources			
<ul style="list-style-type: none"> • Water Quality • Erosion and Topsoil Loss • Landslides and Mudflows 	<p>Water-1: Stormwater, Erosion, and Sediment Control</p> <p>Stormwater runoff and drainage shall be properly managed at all work areas using best management practices (BMPs) (e.g., procedural actions and/or material installations). BMPs and drainage systems shall be designed by the engineer to accommodate rapid rainfall events that can be expected in the region.</p> <p>The following procedures shall be implemented to prevent soil loss, erosion, and sediment transport in project areas:</p> <ul style="list-style-type: none"> • The well pad and access road shall be stabilized with crushed rock to prevent erosion • Sediment and erosion control BMPs shall be installed along the graded well pad slopes to prevent erosion consistent with the approved design plans. • Drainage shall be directed around the well pad to prevent stormwater from flowing onto the site. • Drainage shall be directed around the mud disposal pond to prevent stormwater from flowing into the pond. • Drainage channels shall be stabilized with crushed rock or stone. • Project activities shall be scheduled to avoid the heaviest rain season, to the extent possible. • Soil disturbance shall be limited to the minimum amount necessary. • All disturbed areas shall be stabilized as soon as possible (i.e., covered, compacted, or secured with BMP materials). • Project traffic shall be restricted to designated areas. • Pipelines shall be monitored for leaks and any leaks shall be repaired immediately. • Sediment shall be controlled and prevented from leaving disturbed project areas. 	<ul style="list-style-type: none"> • Civil Works Contractor responsible for implementing BMPs. • Drilling Contractor responsible for maintaining BMPs and conducting inspections. 	<ul style="list-style-type: none"> • During Civil Works • During Well Drilling • During Site Restoration

MITIGATION MANAGEMENT AND MONITORING PLAN

Issues/Potential Impacts	Mitigation Measure	Responsible for Implementing	Timing of Requirements
	<ul style="list-style-type: none"> All drainage channels and erosion control BMPs shall be properly inspected and maintained on a frequent basis to ensure they are functioning properly and any debris that causes backup or blockage of the drainage channels shall be removed. 		
<ul style="list-style-type: none"> Water Quality Hazards and Hazardous Materials 	<p>Water-2: Drilling Effluent Management</p> <p>All drilling fluids shall be contained within the lined mud pond. A minimum of 0.5 meter (1.6 feet) of freeboard shall be maintained on the mud pit to prevent overflow of any drilling effluent. The mud pit shall be covered to prevent rainfall from causing overflow to the pit. A barrier shall be installed along the perimeter of the mud pond to prevent stormwater from entering the mud pond. Drilling effluent shall not be discharged into the environment and shall be either reinjected to the geothermal well at the completion of drilling or shall be evaporated. Drilling fluid shall be reused to the extent feasible during drilling to conserve water.</p>	<ul style="list-style-type: none"> Drilling Contractor 	<ul style="list-style-type: none"> During Well Drilling
<ul style="list-style-type: none"> Water Quality Hazards and Hazardous Materials 	<p>Water-3: Geothermal Brine Management</p> <p>Any geothermal brine produced during well testing shall be discharged to either a pond lined with a temperature resistant and water-resistant membrane or to a storage tank. A minimum of 0.5 meter (1.6 feet) of freeboard shall be maintained on any pond used for brine discharge. Any brine pond shall be covered to reduce rainfall and shall have a temporary barrier to prevent rainfall from causing overflowing and discharge from the pond. There shall be no discharge from the pond to the environment.</p> <p>All brines produced during geothermal testing shall be reinjected to the geothermal well.</p>	<ul style="list-style-type: none"> Drilling Contractor 	<ul style="list-style-type: none"> During testing
<ul style="list-style-type: none"> Water Quality Air Quality Hazards and Hazardous Materials 	<p>Water-4: Blowout Prevention</p> <p>All drill rigs used during the exploration program shall be equipped with blowout prevention (BOP) equipment to prevent blowout if the geothermal resource is encountered.</p> <p>The drilling contractor or the drilling supervisor shall have experience in geothermal drilling. Drillers shall receive proper training for response to blowouts, should one occur.</p> <p>The drilling contractor shall prepare and implement an Emergency Blowout Well Control Plan. At a minimum, the plan shall address the following:</p> <ul style="list-style-type: none"> Proper use of BOP equipment that meets American Petroleum Institute (API) standard 53:2012 	<ul style="list-style-type: none"> Drilling Contractor 	<ul style="list-style-type: none"> During Well Drilling

MITIGATION MANAGEMENT AND MONITORING PLAN

Issues/Potential Impacts	Mitigation Measure	Responsible for Implementing	Timing of Requirements
	<ul style="list-style-type: none"> • Specific procedures for preventing and controlling an incidental blowout, such as using a blowout preventer stack and stocking material for quelling the blowout • Training requirements for all workers that may be exposed to a well blowout • Staffing requirements to ensure qualified individual(s) who are certified in well control and blowout response are present during all drilling operations including Well Control certification for Assistant Driller level and above (IWCF level 3 or equivalent Well cap Drillers level) and Night Tool Pushers and above (IWCF level 4 or Well cap Supervisors Level) • Blowout documentation and cleanup procedures 		
<ul style="list-style-type: none"> • Water Quality 	<p>Water-5: Worker Latrine Management</p> <p>The mobile worker latrine shall be serviced regularly to remove sanitary waste and maintain the latrine. All waste from the worker latrine shall be brought to a wastewater treatment facility for management. The worker training program shall include information on use of sanitary toilets.</p>	<ul style="list-style-type: none"> • Civil Works Contractor • Drilling Contractor 	<ul style="list-style-type: none"> • During Construction
<ul style="list-style-type: none"> • Water Supply 	<p>Water-6: Water Extraction Strategy</p> <p>The drilling contractor, in conjunction with the RESDP, shall develop a strategy for obtaining supplemental water supply by truck that does not disrupt the water supply for domestic and agricultural users. Water extraction for the project, including the locations of water pipelines and tanks, shall not deplete water reserves below levels that are required to supply the community. The RESDP and drilling contractor shall consult with Water and Sewerage Company of Saint Lucia (WASCO) and Water Resource Management Agency (WRMA) of Saint Lucia to define the location(s) and approach to supplemental water supply.</p>	<ul style="list-style-type: none"> • PIU to define strategy • Drilling Contractor to obtain supplemental water if needed 	<ul style="list-style-type: none"> • Before Construction • During Construction
Air Quality			
<ul style="list-style-type: none"> • Air Quality 	<p>Air-1: Fugitive Dust Management</p> <p>The following procedures shall be implemented where dry exposed soils are located in project areas:</p> <ul style="list-style-type: none"> • Water shall be applied to disturbed soils to prevent visible dust, to the extent that water is readily available. Water shall not be over applied so that it creates runoff that leaves the site. 	<ul style="list-style-type: none"> • Civil Contractor 	<ul style="list-style-type: none"> • During Civil Works • Restoration

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Issues/Potential Impacts	Mitigation Measure	Responsible for Implementing	Timing of Requirements
	<ul style="list-style-type: none"> • Vehicle speeds shall not exceed 25 kilometers (15 miles) per hour on unpaved surfaces. • Inactive areas shall be covered or otherwise stabilized to reduce the potential for wind transporting dust. • Disturbed areas shall be stabilized and restored once project activities are completed. 		
<ul style="list-style-type: none"> • Air Quality 	<p>Air-2: Construction Emissions Controls</p> <p>The construction contractors shall be responsible for ensuring all vehicles and equipment are properly operated and maintained according to the manufacturer’s specifications, and equipped with appropriate emission control devices (i.e., catalytic converters, etc.). Malfunctioning equipment shall be repaired immediately or removed from the site.</p>	<ul style="list-style-type: none"> • Civil Contractor • Drilling Contractor 	<ul style="list-style-type: none"> • During Civil Works and Well Drilling
<ul style="list-style-type: none"> • Air Quality • Worker Health and Safety • Community Health and Safety 	<p>Air-3: Air Quality Monitoring and Noxious Gas Management</p> <p>The drilling contractor shall be responsible for managing risks to workers and local communities from potentially harmful geothermal gas emissions (e.g., hydrogen sulphide, carbon dioxide, boron, arsenic, mercury, and bicarbonate) during well drilling and testing. At a minimum, the following procedures shall be implemented during drilling and testing activities:</p> <ul style="list-style-type: none"> • Well drilling or testing that could cause the release of potentially harmful geothermal gases shall not occur where the public could be put at undue risk. An appropriate geothermal gas hazard zone shall be established around well pad based on the risk of gas release from the drilling and testing activities. The hazard zone shall be marked with signs and communicated to the local community members. If occupied structures occur within the hazard zone, the occupants of those structures shall be relocated during drilling and testing activities. • Minimize the potential for gas release by using properly weighted drilling mud to keep the well from flowing or by implementing other well head abatement measures such as aerated drilling as a primary measure; BOP equipment are a secondary measure. • Install gas detection and monitoring devices during well drilling and testing activities, that are equipped with alarms that would be triggered if gas concentrations reach unsafe levels. • Autonomous respiratory equipment shall be provided in enclosed areas of the drill rig and shall be unlocked. Workers shall receive training in use of respiratory equipment. 	<ul style="list-style-type: none"> • Drilling Contractor 	<ul style="list-style-type: none"> • During Well Drilling and Testing

MITIGATION MANAGEMENT AND MONITORING PLAN

Issues/Potential Impacts	Mitigation Measure	Responsible for Implementing	Timing of Requirements
	<ul style="list-style-type: none"> The Health and Safety Plan shall specify safety procedures for potential exposure to geothermal gases and emergency response. The drilling contractor shall implement an air quality monitoring program to monitor air quality during well drilling and testing for signs of unsafe levels of potentially harmful geothermal gases using automated detection and alarm systems. If unsafe gas levels are detected, the area shall be evacuated and properly trained workers wearing appropriate PPE shall attempt to stop the release by shutting in the well according to the procedure in the Drilling contractor’s Well Control Manual including use of Blow-Out Preventers (during drilling) or a Master Valve (during testing). 		
Geology and Soils			
<ul style="list-style-type: none"> Erosion and Topsoil Loss 	<p>Soils-1: Topsoil Preservation and Restoration</p> <p>Topsoil shall be separated and stockpiled during the construction period. The topsoil stockpile shall be secured with plastic and BMP materials. Following construction, the topsoil shall be applied evenly to the site during the restoration process. Topsoil shall be collected and stored in loose mounds no higher than 3 meters high, using methods that minimize compaction. The topsoil shall be covered to prevent erosion and sediment transport. The topsoil storage area shall be signed or fenced for avoidance throughout the construction period. Topsoil shall be reapplied on the subsoils/restored site using loose tip and spread methods that retain the soil structure. No vehicles shall track over the soils during the reapplication process to avoid compaction.</p>	<ul style="list-style-type: none"> Civil Works Contractor 	<ul style="list-style-type: none"> During Initial Grading/ Stripping and Storage of Topsoil During Restoration
Noise			
<ul style="list-style-type: none"> Noise 	<p>Noise-1: Noise Abatement and Community Coordination</p> <p>Construction noise and the associated effects shall be reduced or minimized, to the extent possible, by implementing the following procedures:</p> <ul style="list-style-type: none"> Select quieter equipment and construction activities, whenever feasible; Ensure motorized vehicles and equipment are equipped with the greatest possible noise reduction parts, such as mufflers, silencers, insulators, and enclosures; Limit civil work activities to daytime hours (7:00 to 18:00); 	<ul style="list-style-type: none"> Civil Works Contractor Drilling Contractor noise monitoring PIU coordinate with residents and respond to 	<ul style="list-style-type: none"> Before Construction During Construction

MITIGATION MANAGEMENT AND MONITORING PLAN

Issues/Potential Impacts	Mitigation Measure	Responsible for Implementing	Timing of Requirements
	<ul style="list-style-type: none"> • Notify and coordinate with residents adjacent to project areas prior to construction to inform them of the possibility of temporary noise disruption, and how to report noise complaints; • If noise complaints are made during nighttime drilling activities, install noise attenuation barriers between the loudest operating equipment (e.g., air compressor or generator) and the sensitive receptor. • Implement a Noise Complaint Program to record and respond to noise complaints during construction. • Install a sound barrier between the well testing location and the sensitive receptors • Install continuous noise meters at the edge of the well pad and at a distance of approximately 100 meters from the well pad. Monitor noise levels throughout the duration of drilling and testing activities. 	noise complaints	
<ul style="list-style-type: none"> • Noise 	<p>Noise-2: Noise Control During Well Testing</p> <ul style="list-style-type: none"> • A drum silencer shall be used during well testing; • Venting of the resource shall be conducted as far from sensitive receptors as possible; • Community members within 500 meters of the well pad shall be notified about the testing activities to avoid alarm; • At least 2 weeks prior to testing activities that involve venting of the resource, notify community members within 200 meters of the well pad of the timeframe for testing and predicted noise level at their residence. Provide information on measures to reduce noise levels during the testing such as use of earplugs, noise canceling headphones or closure of windows. • Supply earplugs and noise canceling headphones to all residents within 200 meters of the well pad. • Provide notice to the Soufriere area of the planned timing of geothermal resource venting/testing to avoid community alarm 	<ul style="list-style-type: none"> • Drilling contractor • PIU notify community 	<ul style="list-style-type: none"> • Prior to Resource Venting
Natural Habitats and Biodiversity			
<ul style="list-style-type: none"> • Natural Habitats 	<p>Biodiversity-1: Invasive Weed Control</p>	<ul style="list-style-type: none"> • Drilling Contractor 	<ul style="list-style-type: none"> • During Construction

MITIGATION MANAGEMENT AND MONITORING PLAN

Issues/Potential Impacts	Mitigation Measure	Responsible for Implementing	Timing of Requirements
	The drill rig and any equipment from overseas shall be sanitized prior to arrival in Saint Lucia. The equipment shall be inspected at the port of entry to ensure it is free of caked mud and plant material.		
<ul style="list-style-type: none"> Nesting Birds 	<p>Biodiversity-2: Nesting Bird Avoidance and Impact Minimization</p> <p>Project activities shall be scheduled outside of the prime bird nesting season (March to August) to the extent feasible. If project civil works, drilling, or testing activities commence during the nesting bird season or if there is a work stoppage of more than 72 hours, a qualified biologist shall survey potentially suitable nesting habitat within 100 meters of the well pad for priority species birds. If active nests are identified, a qualified biologist shall monitor the nesting birds’ responses to the loudest level of construction noise for an appropriate duration. If the nesting birds show signs of disturbance that could result in nest failure, all work activities that disturb the birds shall be temporarily halted and visual and acoustic barriers shall be erected between the nesting location and work areas. Installation of any visual and acoustic barriers shall be overseen and approved by the qualified biologist. Monitoring is not required for continuous construction activities/noise as any birds that nest in the area would be assumed to be adapted to the on-going noise level.</p>	<ul style="list-style-type: none"> PIU 	<ul style="list-style-type: none"> Before Construction During the Nesting Season
Archaeological and Cultural Resources			
<ul style="list-style-type: none"> Archeological and Cultural Resources 	<p>Cultural-1: Inadvertent Discovery of Cultural Resources</p> <p>A Chance Find Management Plan shall be developed by the contractor prior to implementation of the work. The Chance Find Management Plan shall be developed in accordance with requirements for protection of cultural resources in St. Lucia as well as World Bank Environmental and Social Framework and shall address:</p> <ul style="list-style-type: none"> Steps for temporary work stoppage in the event of a potentially significant discovery Steps to protect chance finds from the impacts of further project activities Contractor code of conduct with worker training on how to respond to chance finds A monitoring system for implementation of the chance find procedure Relevant government authorities and indigenous groups to contact depending on the nature of the resource. 	<ul style="list-style-type: none"> Civil Works contractor to develop Chance Find Management Plan Civil Works Contractor to halt work in the event of a chance find PIU to contact archaeologist 	<ul style="list-style-type: none"> During Construction

MITIGATION MANAGEMENT AND MONITORING PLAN

Issues/Potential Impacts	Mitigation Measure	Responsible for Implementing	Timing of Requirements
	<p>At a minimum, the chance find procedure will require that in the event that cultural resources are discovered at the site of construction, the following procedures shall be instituted:</p> <ul style="list-style-type: none"> Discovery of historic-era or Amerindian archaeological resources requires that all construction activities shall immediately cease at the location of discovery and within 15 meters of the discovery. <p>The Contractor shall immediately contact an archaeologist to evaluate the find. If it is determined that the Project could damage a historical or Amerindian resource, construction shall cease in an area determined by the archaeologist until a management plan has been prepared and implemented to the satisfaction of the archaeologist. In consultation with PIU, the archaeologist will determine when construction can resume.</p>		
<ul style="list-style-type: none"> Archeological and Cultural Resources 	<p>Cultural-2: Worker Cultural Resource Sensitivity Training</p> <p>Workers shall be properly trained on identifying potential archeological and cultural resources that could be uncovered during construction, including procedures for reporting potential discoveries to the archeological monitor. If potential resources are discovered, they must be left in place or turned over to the archeological monitor for proper record keeping and cataloging. A training log shall be kept on the job site as a record of all training provided.</p>	<ul style="list-style-type: none"> PIU to provide training. Civil Works contractor to attend training and maintain log. 	<ul style="list-style-type: none"> Before Construction During Construction
Landscape and Visual Character			
<ul style="list-style-type: none"> Landscape and Visual Character 	<p>Landscape-1: Site Restoration</p> <p>The following restoration activities shall be completed following construction:</p> <ul style="list-style-type: none"> Prior to construction the contractor shall take photos of the well pad to document pre-construction conditions. The contractor shall restore grades on site to match pre-construction conditions. The proper restoration of the site shall be documented by the contractor in a post-construction report containing pre- and post-construction photos. All temporary stockpile and storage areas shall be recontoured to match pre-project conditions. Heavily compacted areas should be appropriately de-compacted to facilitate faster vegetation regrowth. 	<ul style="list-style-type: none"> Civil Works Contractor 	<ul style="list-style-type: none"> Before Construction After Restoration

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Issues/Potential Impacts	Mitigation Measure	Responsible for Implementing	Timing of Requirements
Traffic Circulation and Safety			
<ul style="list-style-type: none"> Traffic Circulation and Safety Community Health and Safety 	<p>Traffic-1: Traffic Control</p> <p>Proper traffic controls shall be in place during transport of large equipment to minimize impacts on traffic circulation and for traffic safety. If any road closures are necessary a Traffic Management Plan shall be developed and coordinated with local emergency responders to provide advance notification of temporary one way traffic or road closures. Traffic flaggers and pilot cars shall be used to safely transport equipment.</p> <p>The unpaved access road shall be stabilized with crushed stone per the plans and the turning apron to the paved road network shall be designed to accommodate the construction vehicle turning radius to the unpaved road. Signs shall be posted to warn drivers of slow-moving vehicles entering and exiting during deliveries.</p> <p>Local traffic laws and speed limits shall be followed at all times.</p>	<ul style="list-style-type: none"> Civil Works Contractor to stabilize access road, post signs, and obey traffic laws PIU to coordinate with emergency responders Drilling Contractor to develop Traffic Management Plan for mobilization of drill rig 	<ul style="list-style-type: none"> During Construction Before Drilling (for Traffic Management Plan, if needed)
Utilities and Communication Systems			
<ul style="list-style-type: none"> Utilities and Communication Systems 	<p>Utilities-1: Protect Overhead Utility Lines</p> <p>The drilling contractor shall identify and mark any overhead utility and communication lines that hang over access roads to ensure the lines are not inadvertently damaged during construction. A minimum of 1 meter of clearance shall be maintained between construction equipment and low-hanging lines. If the minimum clearance cannot be maintained, the contractor shall work with the applicable system providers to temporarily disconnect or reposition the lines for the duration of construction.</p>	<ul style="list-style-type: none"> Drilling Contractor 	<ul style="list-style-type: none"> Before and During Mobilization of Drilling Equipment
Hazards and Hazardous Materials			
<ul style="list-style-type: none"> Water Quality 	<p>Hazards-1: Hazardous Materials Management Plan</p> <p>The construction contractors shall prepare and implement a Hazardous Materials Management Plan. The Hazardous Materials Management shall identify proper</p>	<ul style="list-style-type: none"> Civil Works Contractor 	<ul style="list-style-type: none"> Before Construction

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Issues/Potential Impacts	Mitigation Measure	Responsible for Implementing	Timing of Requirements
<ul style="list-style-type: none"> • Hazards and Hazardous Materials • Worker Health and Safety • Community Health and Safety 	<p>management procedures for all hazardous materials and wastes that may be encountered during construction, including handling, labeling, transporting, and storing procedures. In addition, the Hazardous Materials Management Plan shall address the following:</p> <ul style="list-style-type: none"> • Non-toxic and biodegradable products will be used whenever possible. • Hazardous materials shall be transported and stored in appropriate containers with clearly visible labels. Hazardous materials shall be stored at least 100 feet from any downgradient drainage or within secondary containment capable of containing its entire volume. • Stormwater flows shall be directed away from hazardous material storage areas. • Equipment and work areas shall be regularly inspected for signs of leaks and spills. Spill containment and cleanup kits shall be available wherever hazardous materials are being used or stored. Any incidental spills or leaks shall be contained and cleaned up as soon as it is safe to do so. Any contaminated soil shall be collected and disposed of in an appropriate land fill. • Equipment refueling and maintenance shall be limited to designated areas at least 30 meters (100 feet) from any downgradient drainage. • All workers shall receive training on proper handling and storage of hazardous materials, as well as spill response and cleanup procedures, prior to working on the project site. 	<ul style="list-style-type: none"> • Drilling Contractor 	<ul style="list-style-type: none"> • During Construction
<ul style="list-style-type: none"> • Hazards and Hazardous Materials • Community Health and Safety 	<p>Hazards-2: Drill Cutting Characterization</p> <p>The material representing the residue of drilling operations (cuttings, drilling mud and additives) stored into the disposal pond at the drilling site must be characterized in its chemical composition so that it can be reused or disposed of in appropriate landfills. Testing should be conducted in accordance with St. Lucia’s waste management regulations. Materials that contain concentrations of hazardous materials in excess of St. Lucia and international standards for reuse or disposal at a standard landfill shall be treated as hazardous waste and properly disposed at the Deglos Sanitary Landfill, which can accept hazardous waste.</p>	<ul style="list-style-type: none"> • Drilling contractor • EMC 	<ul style="list-style-type: none"> • During drilling/logging
Fires			
<ul style="list-style-type: none"> • Fires 	<p>Fires-1: Fire Prevention and Response</p>	<ul style="list-style-type: none"> • Civil Contractor 	<ul style="list-style-type: none"> • During Construction

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Issues/Potential Impacts	Mitigation Measure	Responsible for Implementing	Timing of Requirements
	<p>Fire prevention and response equipment shall be available at the well pad, such as shovels, axes, and fire extinguishers. All workers shall be trained in proper fire prevention and response procedures prior to working on the site.</p> <p>Any smoking on site shall be restricted to barren areas away from ignitable or combustible material. Smoking waste shall be fully extinguished and disposed of appropriately.</p>	<ul style="list-style-type: none"> • Drilling Contractor 	
Solid Waste			
<ul style="list-style-type: none"> • Water Quality • Hazards and Hazardous Materials • Solid Waste 	<p>Waste-1: Waste Management Plan</p> <p>The construction contractors shall prepare and implement a Waste Management Plan. At a minimum, the plan shall address the sources of waste; waste minimization, reuse, and recycling opportunities; and waste collection, storage, and disposal procedures. The Waste Management Plan should distinguish between solid and liquid waste, as applicable, and include procedures for addressing waste that may be hazardous to health and the environment. In addition, the Waste Management Plan shall address the following:</p> <ul style="list-style-type: none"> • All food waste shall be contained in covered bins and disposed of on a frequent basis to avoid attracting wildlife. • Trash bins shall be accessible at all locations where waste is generated. • The project area shall be kept clean and free of litter and no litter shall be allowed to disperse to the surrounding area. • Solid waste shall be removed from the site and transported to a municipal landfill. • Waste shall not be dumped or buried in unauthorized areas or burned. • Human waste associated with the worker camp and latrines shall be properly contained and disposed of. <p>The construction contractors shall ensure all workers receive training on proper disposal of all waste prior to working on the project site.</p>	<ul style="list-style-type: none"> • Civil Works Contractor • Drilling Contractor 	<ul style="list-style-type: none"> • Before Construction • During Construction

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2.2.5 Social Health and Safety

Table 2.2-2 Social Mitigation Measures

Issues/Potential Impacts	Mitigation Measure	Responsible for Implementing	Timing of Requirements
<ul style="list-style-type: none"> Livelihoods 	<p>Social-1: Agriculture Production</p> <p>The limits of all access roads and well pads shall be clearly identified and marked, if necessary, to ensure impacts from ground disturbance are limited to approved properties and work areas.</p> <p>Where farmland and crops are impacted by the project, farm owners and farmworkers shall be compensated for the loss in pay and agriculture production for affected growing seasons in accordance with the Abbreviated - Resettlement Action Plan (A-RAP). Male and female farm owners and farmworkers shall be compensated for impacts to agriculture production equally.</p>	<ul style="list-style-type: none"> Civil Works Contractor mark limits of work areas PIU responsible for compensation under the A-RAP 	<ul style="list-style-type: none"> Before Construction
<ul style="list-style-type: none"> Working Conditions and Equality 	<p>Social-2: Working Conditions and Equality</p> <p>Employment opportunities created by the project shall be equally available to men and women. If locals are hired for construction jobs, job postings and/or notices shall be disseminated that foster participation from women and men. The RESDP shall include a preference for hiring from the project region in the civil works contract.</p> <p>The construction contractors shall provide safe and equal working conditions and comply with the World Bank’s social policies regarding age, gender, ethnicity, and religious equality. Workers shall be provided with:</p> <ul style="list-style-type: none"> Information on their rights regarding safety and payment prior to working on the site Gender-specific latrines at each project area that are maintained in a sanitary condition with adequate capacity Gender-specific sleeping quarters at the worker camp Clean drinking water at all times Adequate training for their position 	<ul style="list-style-type: none"> Civil Works Contractor Drilling Contractor PIU responsible for grievance redress and hiring preference in contract documents 	<ul style="list-style-type: none"> Prior to Construction preference for hiring During Construction

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Issues/Potential Impacts	Mitigation Measure	Responsible for Implementing	Timing of Requirements
	<p>Violence, sexual harassment, discrimination, and drug abuse shall not be tolerated. Workers engaging in such activities shall be dismissed immediately. Any concerns and complaints regarding workplace or community harassment shall be addressed with respect and due diligence by a grievance and redress committee designated by the RESDP; women shall be appointed to the grievance and redress committee. Workers and community members who issue concerns or complaints shall be protected from retaliation.</p> <p>Prior to working on the project site, all workers shall receive equality and harassment awareness training, for both workplace and community relations, in conjunction with other social trainings for the project.</p>		
<ul style="list-style-type: none"> • Working Conditions and Equality • Noise • Community Health and Safety 	<p>Social-3: Community Engagement and Sensitivity</p> <p>Pre-construction Meeting. Prior to the start of construction activities, the PIU shall hold a public meeting for the affected communities to explain the project activities, schedule, possible inconveniences that may be experienced during construction, and safety considerations associated with drilling operations (refer to Health and Safety-4). The affected communities shall be informed of how they can submit complaints about the project should they arise.</p> <p>Informational Signs. The PIU shall install an informational sign at the entrance of each project area to inform the public about the project, construction schedule, and important information about health and safety related to project activities, such as evacuation areas in the event of an emergency. The sign shall include procedures and contact information for submitting complaints about the project to the community liaison officer (CLO).</p> <p>Community Complaints. Complaints that relate to the requirements set forth in the ESIA shall be recorded and addressed as set forth in the Stakeholder Engagement Plan, and the underlying issue shall be corrected, to the extent feasible.</p> <p>Worker Sensitivity Training. The PIU shall prepare a social and community sensitivity training that would be provided to all workers. The</p>	<ul style="list-style-type: none"> • PIU hold meetings, install informational sign, address community complaints, and lead worker sensitivity training • Civil Works Contractor (attend training) • Drilling Contractor (attend training) 	<ul style="list-style-type: none"> • Before Construction • During Construction

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Issues/Potential Impacts	Mitigation Measure	Responsible for Implementing	Timing of Requirements
	<p>training shall be designed to inform all workers of the local customs, traditions, and community considerations for each area affected by the project. The construction contractors shall be responsible for providing the social and community sensitivity training to all workers prior to initiating work.</p>		

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2.2.6 Health and Safety Mitigation Measures

Table 2.2-3 Health and Safety Mitigation Measures

Issues/Potential Impacts	Mitigation Measure	Responsible for Implementing	Timing of Requirements
<ul style="list-style-type: none"> • Fires • Worker Health and Safety • Community Health and Safety 	<p>Safety-1: Health and Safety Plan</p> <p>The civil works and drilling contractors shall prepare and implement a Health and Safety Plan that addresses the applicable risks and prevention procedures applicable to each contractor’s work. At a minimum, the Health and Safety Plan shall address hazards that may be encountered during construction, including prevention and response procedures, for the following topics:</p> <ul style="list-style-type: none"> • General occupational hazards that may be encountered (e.g., moving machinery and motorized equipment, working at heights or in confined spaces, repetitive motions, falling objects, exposure to heat, loud noises, and hazardous materials, protective clothing); • Unique occupational hazards associated with drilling activities (e.g., exposure to potentially harmful geothermal gases, hot geothermal fluids and drilling materials, and hazards associated with a potential well blowout); • Minimum training requirements for operating vehicles, equipment, and machinery, in accordance with applicable laws and industry standards; • Fire prevention and response procedures, including compliance with Fires-1: Fire Prevention and Response; • Natural hazards that may be experienced during construction (e.g., hurricanes and tropical storms, landslides, earthquakes, volcanic eruptions, and flooding), including designated response procedures and evacuation areas for each project area that are consistent with the GoSL’s natural hazards and emergency response plans; • Biological hazards in the environment (e.g., dangerous or infectious insects, animals, and plants); • Disease risk and prevention (i.e., HIV/AIDs, etc.); • Community safety considerations (e.g., traffic, harmful geothermal gases, and unsafe areas); • Emergency preparedness and response procedures, including the locations of hospitals and medical services in the region in the event of an injury or medical emergency. 	<ul style="list-style-type: none"> • Civil Works Contractor • Drilling Contractor 	<ul style="list-style-type: none"> • Before Construction prepare plans • During Construction

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Issues/Potential Impacts	Mitigation Measure	Responsible for Implementing	Timing of Requirements
	<p>The construction contractors shall provide all workers with training on the contents of the Health and Safety Plan prior to working on the site. Refresher trainings shall be given on an occasional basis and before beginning work in new project areas.</p>		
<ul style="list-style-type: none"> • Worker Health and Safety 	<p>Safety-2: Personal Protective Equipment</p> <p>The construction contractors shall supply all workers with personal protective equipment (PPE), and ensure workers use the proper PPE during all work activities. At a minimum, PPE for workers shall include:</p> <ul style="list-style-type: none"> • Safety headgear • Steel toed boots • Safety glasses or impact-resistant eye protection • Ear protective devices • Harnesses for workers operating at heights • Respirators • Gloves • High visibility clothing or vests • Other specialized protective equipment for the drilling, welding, etc. <p>All PPE shall be properly fitted for each worker, including body size and gender, and workers shall be trained in the proper use of PPE, prior to working on the project site. PPE shall be effective in protecting worker health and safety from noise levels greater than 85 dBA. Respiratory equipment and air monitoring per Air-3 shall ensure workers are not exposed to hydrogen sulfide levels in excess of 20 ppm.</p>	<ul style="list-style-type: none"> • Civil Works Contractor • Drilling Contractor 	<ul style="list-style-type: none"> • During Construction
<ul style="list-style-type: none"> • Worker Health and Safety 	<p>Safety-3: First Aid and Emergency Response Equipment</p> <p>The construction contractors shall provide first aid training to all workers prior to working on the project. The construction contractors shall ensure all project sites are equipped with first aid and emergency response equipment.</p> <p>The drilling contractor shall ensure that adequate safety equipment is located at drilling sites and maintained in good working order, such as firefighting equipment, protective suits, respirators, and other breathing apparatuses.</p>	<ul style="list-style-type: none"> • Civil Works Contractor • Drilling Contractor 	<ul style="list-style-type: none"> • Before Construction • During Construction

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Issues/Potential Impacts	Mitigation Measure	Responsible for Implementing	Timing of Requirements
<ul style="list-style-type: none"> Community Health and Safety 	<p>Safety-4: Community Safety</p> <p>Communities that may be exposed to hazards from drilling activities (communities within 500 meters of well pads) shall be informed of the risks and provided information regarding emergency preparedness and response. If and where necessary at drilling areas, alarms shall be installed for major emergencies that could require evacuation, such as a well blowout or geothermal gas emission. Evacuation procedures during an alarm shall be communicated to community members during the Pre-construction Information Meeting and on applicable display panels (refer to Social-3).</p> <p>The construction contractors shall install temporary signs and fences around all unsafe areas to prevent members of the public from entering the areas. If installing fences is not feasible, the area shall be clearly identified as unsafe with signs and flagging.</p>	<ul style="list-style-type: none"> PIU Civil Works Contractor Drilling Contractor 	<ul style="list-style-type: none"> Before Construction PIU to communicate evacuation procedures During Construction install and maintain alarms, signs, and fences
<ul style="list-style-type: none"> Worker Health and Safety Community Health and Safety Air Quality Hazards and Hazardous Materials 	<p>Safety-5: Emergency Response Plan</p> <p>The drilling contractor shall prepare an Emergency Response Plan that includes:</p> <ul style="list-style-type: none"> A description of the project facilities with site plans identifying areas of potential hazards such as storage of hazardous materials, and description of hazardous activities conducted at the site such as production of geothermal brines and drilling activities that are in contact with the geothermal resource under pressure. Location and contact information for emergency service providers who are available to respond to an emergency and the nearest medical facility. A description of individuals on site responsible for responding to an emergency. A description of potential project emergency situations such as loss of well control, chemical spills, fire, hydrogen sulfide exposure, etc. For each hazard define the nature of the hazard, warning/detection systems used to identify the hazard, procedures to alert personnel of the hazard, and procedures to respond/address the hazard. Natural hazard response plans including procedures to shut down activities in the event of a hurricane. Evacuation plans, including meeting points and escape routes. 	<ul style="list-style-type: none"> Drilling Contractor 	<ul style="list-style-type: none"> Before Construction prepare plan During Construction implement plan as warranted

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Issues/Potential Impacts	Mitigation Measure	Responsible for Implementing	Timing of Requirements
	<ul style="list-style-type: none">• Training requirements for personnel, including procedures for emergency shutdown, handling of emergency equipment, spill prevention, first aid and rescue, fire response, and evacuation training. <p>The drilling contractor shall provide training for personnel working on the site consistent with the training requirements in the Emergency Response Plan.</p>		

2.3 Mitigation Plans

2.3.1 Table 2.3-1 includes a list of the required mitigation plans described in the detailed mitigation measures listed in Environmental Mitigation Measures

2.3.2 Table 2.2-1 (environmental), Social Health and Safety

2.3.3 Table 2.2-2 (social), and Health and Safety Mitigation Measures

Table 2.2-3 (health and safety). The contractor(s) responsible for preparing these plans is specified as applicable.

Table 2.3-1 Mitigation Plans

Plan Name	Applicable Measures	Civil Works Contractor?	Drilling Contractor?
Health and Safety Plan	Safety-1: Health and Safety Plan	Yes	Yes
	Air-3: Air Quality Monitoring and Noxious Gas Management	No	Yes
Emergency Blow Out Well Control Plan	Water-4: Blowout Prevention	No	Yes
Chance Find Management Plan	Cultural-1: Inadvertent Discovery of Cultural Resources	Yes	No
Hazardous Materials Management Plan	Hazards-1: Hazardous Materials Management Plan	Yes	Yes
Traffic Management Plan	Traffic-1: Traffic Control		
Waste Management Plan	Waste-1: Waste Management Plan	Yes	Yes
Emergency Response Plan	Safety-5: Emergency Response Plan	No	Yes
	Air-3: Air Quality Monitoring and Noxious Gas Management		

2.4 ESMP Implementation Cost

Table 2.4-1 defines the estimated costs for implementation of the mitigation measures included in this ESMP.

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Table 2.4-1 ESMP Implementation Costs for Belle Plaine

Implementation Requirements	Requirements with Direct Costs	Assumptions ^a	RESDP/PIU	Civil Contractor	Drilling Contractor	Total
Mitigation Measures						
Water-1: Stormwater, Erosion, and Sediment Control	<ul style="list-style-type: none"> Implement water quality procedures to prevent soil loss 	<ul style="list-style-type: none"> Install BMPs at start of civil works Install crushed rock at constructed access roads and drilling pads Quarterly maintenance Weekly inspection 	\$1,500	\$40,000	\$5,000	\$46,500
Water-2: Drilling Effluent Management	<ul style="list-style-type: none"> Manage and dispose of drilling effluent 	<ul style="list-style-type: none"> N/A – Standard procedure 				\$0
Water-3: Geothermal Brine Management	<ul style="list-style-type: none"> Manage and dispose of geothermal brine 	<ul style="list-style-type: none"> N/A – Standard procedure 				\$0
Water-4: Blowout Prevention	<ul style="list-style-type: none"> Use blow-out preventers 	<ul style="list-style-type: none"> N/A – Standard equipment included with drill rig 				\$0
Water-5: Worker Latrine Management	<ul style="list-style-type: none"> Manage and dispose of sanitary waste 	<ul style="list-style-type: none"> N/A – Standard procedure 				\$0
Water-6: Water Extraction Strategy	<ul style="list-style-type: none"> Coordinate with agencies about water source alternatives 	<ul style="list-style-type: none"> Assume trucking in water would not be necessary 			TBD	TBD
Air-1: Fugitive Dust Management	<ul style="list-style-type: none"> Prevent fugitive dust through water application during ground disturbance and stabilizing disturbed areas 	<ul style="list-style-type: none"> Assume one water truck and locally sourced water would be used by the civil workers contractor for up to 30 days 		\$5,000		\$5,000
Air-2: Construction Emissions Controls	<ul style="list-style-type: none"> Maintain and repair equipment according the manufacturer’s standard 	<ul style="list-style-type: none"> N/A – Standard procedure 				\$0

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Implementation Requirements	Requirements with Direct Costs	Assumptions ^a	RESDP/PIU	Civil Contractor	Drilling Contractor	Total
Air-3: Air Quality Monitoring and Noxious Gas Management	<ul style="list-style-type: none"> Install gas detection and monitoring devices during well drilling and testing activities 	<ul style="list-style-type: none"> Air meter and air analysis over course of project activities at Belle Plaine 			\$5,000	\$5,000
Soil-1: Topsoil Preservation and Restoration	<ul style="list-style-type: none"> Plastic sheeting to secure topsoil; reapply topsoil 	<ul style="list-style-type: none"> Equipment used to reapply topsoil would be available locally 		\$2,000		\$2,000
Noise-1: Noise Abatement and Community Coordination	<ul style="list-style-type: none"> Provide advanced notification to community members Install noise monitoring devices Install acoustic barriers between stationary equipment and sensitive receptors Monitor and respond to noise complaints 	<ul style="list-style-type: none"> Up to 2 noise barriers One noise monitoring device 	\$1,000		\$4,000	\$5,000
Noise 2: Noise Control During Well Testing	<ul style="list-style-type: none"> Provide advanced notification to community members Provide noise canceling devices Use a drum silencer 	<ul style="list-style-type: none"> Cost of noise canceling headphones/ devices estimated at \$500 Noise monitoring devices addressed under Noise-1 	\$500			\$500
Biodiversity-1: Invasive Weed Control	<ul style="list-style-type: none"> Sanitize equipment prior to entry in Saint Lucia 	<ul style="list-style-type: none"> N/A – Standard procedure 				\$0
Biodiversity-2: Nesting Bird Avoidance and Impact Minimization	<ul style="list-style-type: none"> Biologist survey and monitoring if necessary Possible implementation of visual and acoustic barriers 	<ul style="list-style-type: none"> Cost for survey Assumes no schedule impacts on construction 	\$3,000			\$3,000

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Implementation Requirements	Requirements with Direct Costs	Assumptions ^a	RESDP/PIU	Civil Contractor	Drilling Contractor	Total
Cultural-1: Inadvertent Discovery of Cultural Resources	<ul style="list-style-type: none"> Costs include an on-call cultural specialist for responding to discoveries Costs to avoid, record, or treat would be dependent on various unknown factors 	<ul style="list-style-type: none"> Assumes 1 cultural resource discovered and treated Assumes no schedule impacts on construction 	\$4,000			\$4,000
Cultural-2: Worker Cultural Resource Sensitivity Training	<ul style="list-style-type: none"> Provide archeological and cultural resources training to workers 	<ul style="list-style-type: none"> Refer to Worker Induction Training components in following section 				\$0
Landscape-1: Site Restoration	<ul style="list-style-type: none"> Document pre-construction conditions Stockpile and store topsoil Recontour and de-compact disturbed areas 	<ul style="list-style-type: none"> Civil contractor would document pre-construction conditions and store topsoil Civil contractor would perform restoration Does not include the cost of crops (included in A-RAP) 		\$25,000		\$25,000
Traffic-1: Traffic Control	<ul style="list-style-type: none"> Safety control project traffic 	<ul style="list-style-type: none"> Drilling Contractor will prepare Traffic Management Plan PIU will coordinate with emergency responders 	\$500		\$2,500	\$3,000
Utilities-1: Protect Overhead Utility Lines	<ul style="list-style-type: none"> Relocation of utilities would be at the cost of the project 	<ul style="list-style-type: none"> No conflicts have been identified; therefore, no cost is currently assumed 				\$0
Hazards-1: Hazardous Materials Management Plan	<ul style="list-style-type: none"> Preparing/reviewing a Hazardous Materials Management Plan 	<ul style="list-style-type: none"> Assumes minimal coordination and comments on draft plans 		\$3,000	\$4,000	\$6,000
	<ul style="list-style-type: none"> Worker training 	<ul style="list-style-type: none"> Refer to Worker Induction Training components in following section 				\$0

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Implementation Requirements	Requirements with Direct Costs	Assumptions ^a	RESDP/PIU	Civil Contractor	Drilling Contractor	Total
	<ul style="list-style-type: none"> Use non-toxic and biodegradable drilling mud where feasible 	<ul style="list-style-type: none"> N/A – Standard procedure 				\$0
	<ul style="list-style-type: none"> Embank reserve pits if drilling mud contains foams 	<ul style="list-style-type: none"> N/A – Standard procedure 				\$0
	<ul style="list-style-type: none"> Install containment berms and redirect stormwater flows around hazardous material storage sites 	<ul style="list-style-type: none"> N/A – Part of construction 				\$0
Hazards-2: Drill Cutting Characterization	<ul style="list-style-type: none"> Test geothermal drill cuttings for hazardous properties 	<ul style="list-style-type: none"> Testing costs 			\$7,000	\$7,000
	<ul style="list-style-type: none"> Re-use or bury non-toxic drill cuttings as appropriate 	<ul style="list-style-type: none"> N/A – Standard procedure 				\$0
	<ul style="list-style-type: none"> Transport of any hazardous drill cuttings to designated landfill 	<ul style="list-style-type: none"> Waste disposed at designated hazardous materials landfill (costs are an estimate as the volume is not knowable) 			\$10,000 (actual costs depends on volume)	\$10,000
Fires-1: Fire Prevention and Response	<ul style="list-style-type: none"> Provide fire prevention and response equipment at each work site, such as shovels, axes, fire extinguishers, and dedicated water tanks 	<ul style="list-style-type: none"> N/A – Standard procedure 				\$0
Waste-1: Waste Management Plan	<ul style="list-style-type: none"> Prepare a Waste Management Plan for solid waste Store and dispose of solid waste at an appropriate facility 	<ul style="list-style-type: none"> Assumes minimal coordination and comments on draft plans Waste disposed weekly at a municipal landfill 		\$1,500	\$3,000	\$4,500
Social-1: Agriculture Production	<ul style="list-style-type: none"> Provide compensation for farmers where farmland and crops are impacted by the project 	<ul style="list-style-type: none"> The cost is determined in the A-RAP 	See A-RAP ^b			See A-RAP ^b

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Implementation Requirements	Requirements with Direct Costs	Assumptions ^a	RESDP/PIU	Civil Contractor	Drilling Contractor	Total
Social-2: Working Conditions and Equality	<ul style="list-style-type: none"> Provide information to workers regarding their rights on safety and payment; and provide training to workers for their position 	<ul style="list-style-type: none"> Refer to Worker Induction Training components in following section 				\$0
Social-3: Community Engagement and Sensitivity	<ul style="list-style-type: none"> Hold public meetings with the affected communities Install an informational sign at the entrance of each project area Train workers 	<ul style="list-style-type: none"> Assume three, two-hour public meetings will be held with affected community (one before construction occurs and two during or after construction). Costs for meetings are assumed to be \$1,000 per meeting with 3 meets total. Signs are expected to cost \$3,000 overall Refer to Worker Induction Training components in following section 	\$6,000			\$6,000
Safety-1: Health and Safety Plan	<ul style="list-style-type: none"> Prepare and implement a Health and Safety Plan with all required elements 	<ul style="list-style-type: none"> Drilling contractor plan would include greater hazards, risk management strategies, and emergency response procedures 		\$3,000	\$5,000	\$7,000
Safety-2: Personal Protective Equipment	<ul style="list-style-type: none"> Provide personal protective equipment 	<ul style="list-style-type: none"> N/A – Standard procedure 				\$0
Safety-3: First Aid and Emergency Response Equipment	<ul style="list-style-type: none"> Provide First Aid and safety equipment 	<ul style="list-style-type: none"> N/A – Standard procedure 				\$0
Safety-4: Community Safety	<ul style="list-style-type: none"> No cost measure 	<ul style="list-style-type: none"> No cost measure 				\$0
Safety-5: Emergency Response Plan	<ul style="list-style-type: none"> Prepare Emergency Response Plan 	<ul style="list-style-type: none"> Drilling contractor will prepare the ERP 			\$5,000	\$5,000

MITIGATION MANAGEMENT AND MONITORING PLAN

Implementation Requirements	Requirements with Direct Costs	Assumptions ^a	RESDP/PIU	Civil Contractor	Drilling Contractor	Total
<i>Mitigation Measures Subtotal ^b</i>			<i>\$18,500</i>	<i>\$79,500</i>	<i>\$50,500</i>	<i>\$148,500</i>
Worker Training ^c						
Worker Induction Training	<ul style="list-style-type: none"> Sanitary waste management (Water-5) 	<ul style="list-style-type: none"> Standard procedure; assume no additional cost 				
	<ul style="list-style-type: none"> Cultural resources sensitivity, awareness, and discover procedures (Cultural-1 and Cultural-2) 	<ul style="list-style-type: none"> PIU would prepare the training content and provide the training separately to the civil and drilling workers 	\$2,000			\$2,000
	<ul style="list-style-type: none"> Hazardous material handling, storage, cleanup, and disposal (Hazards-1) 	<ul style="list-style-type: none"> Standard procedure; assume no additional cost 				
	<ul style="list-style-type: none"> Fire prevention and response procedures (Fires-1) 	<ul style="list-style-type: none"> Standard procedure; assume no additional cost 				
	<ul style="list-style-type: none"> Wast management and disposal procedures (Waste-1) 	<ul style="list-style-type: none"> Standard procedure; assume no additional cost 				
	<ul style="list-style-type: none"> Worker equality and harassment awareness training (Social-2) 	<ul style="list-style-type: none"> PIU would prepare the training content and provide the training separately to the civil and drilling workers 	\$500			\$500
	<ul style="list-style-type: none"> Social and community sensitivity training (Social-3) 	<ul style="list-style-type: none"> PIU would prepare the training content and provide the training separately to the civil and drilling workers 	\$500			\$500
	<ul style="list-style-type: none"> Minimum training requirements for operating vehicles, equipment, and machinery (Safety-1) 	<ul style="list-style-type: none"> Standard procedure; assume no additional cost 				
	<ul style="list-style-type: none"> Contents of the contractor Health and Safety Plans (Safety-1) 	<ul style="list-style-type: none"> Standard procedure; assume no additional cost 				

MITIGATION MANAGEMENT AND MONITORING PLAN

Implementation Requirements	Requirements with Direct Costs	Assumptions ^a	RESDP/PIU	Civil Contractor	Drilling Contractor	Total
	<ul style="list-style-type: none"> PPE use and fitting procedures (Safety-2) 	<ul style="list-style-type: none"> Standard procedure; assume no additional cost 				
	<ul style="list-style-type: none"> First aid and emergency response training (Safety-3) 	<ul style="list-style-type: none"> Standard procedure; assume no additional cost 				
	<ul style="list-style-type: none"> Drilling safety and blowout prevention/response (Water-4); respiratory equipment training and drilling specific PPE (Air-3); drilling contractor Emergency Response Plan procedures (Safety-5) 	<ul style="list-style-type: none"> Applies to drilling contractor only Standard procedure; assume no additional cost 				
<i>Worker Training Subtotal</i>			<i>\$3,000</i>			<i>\$3,000</i>
Monitoring						
On-site Compliance Inspection and Monitoring	<ul style="list-style-type: none"> RESDP Monitor – Inspect construction sites (approx. weekly) 	<ul style="list-style-type: none"> Weekly RESDP inspections during drilling and monthly during civil works Contractor will hire an environmental specialist to conduct routine inspections during construction 	\$10,000	\$15,000	\$20,000	\$45,000
Reporting and Documentation	<ul style="list-style-type: none"> Prepare/review Pre- and Post-Construction Audit Reports, Monthly Compliance Reports, and Quarterly Monitoring Reports 	<ul style="list-style-type: none"> Prepare/review Pre- and Post-Construction Audit Reports, Monthly Compliance Reports, and Biannually Monitoring Reports 	\$5,000	\$10,000	\$8,000	\$23,000
Grievance and Redress Mechanisms	<ul style="list-style-type: none"> Redress grievances from community members, if needed 	<ul style="list-style-type: none"> N/A – It is assumed that this will be within the duties of RESDP and addressing grievances will not have a direct cost. 				\$0

MITIGATION MANAGEMENT AND MONITORING PLAN

Implementation Requirements	Requirements with Direct Costs	Assumptions ^a	RESDP/PIU	Civil Contractor	Drilling Contractor	Total
Emergency Response/Cleanup Environmental	<ul style="list-style-type: none"> Respond to emergencies and clean up hazardous material spills, if needed 	<ul style="list-style-type: none"> No spills are anticipated 				\$0
<i>Monitoring Subtotal</i>			<i>\$15,000</i>	<i>\$25,000</i>	<i>\$28,000</i>	<i>\$68,000</i>
Stakeholder Engagement						
Stakeholder Engagement	<ul style="list-style-type: none"> Meetings and consultations with the community Educational materials for the community 	Assumes regular coordination with the community throughout the geothermal exploration phase. Assumes use of a consultant to assist with public outreach efforts	\$30,000			\$30,000
<i>Stakeholder Engagement Subtotal</i>			<i>\$30,000</i>			<i>\$30,000</i>
Project Total ^b			\$66,500	\$104,500	\$78,500	\$249,500

Notes:

- ^a Standard procedures and tasks that would be included with contractor construction contracts are identified in project mitigation measures and this table. Costs associated with these tasks are considered to be a standard construction cost and would not require additional funds associated with mitigation implementation.
- ^b Cost for A-RAP is not included. Refer to A-RAP for cost details.
- ^c Worker training elements from the mitigation measures are compiled into a separate section. Mitigation measures with training components are cross referenced. It is expected that separate worker induction training would be provided to the civil contractor workers and the drilling contractor workers.

3 Roles and Responsibilities

This section outlines the roles and responsibilities of parties involved with direct implementation of mitigation measures or implementation oversight.

3.1 Department of Sustainable Development

The PIU within the DIPT is responsible for managing the overall project. The construction contractors and PIU will employ environmental and health and safety (EHS) professionals to oversee implementation of the ESMP.

3.1.1 Expert on Environment Health and Safety

The PIU will oversee the project during all construction phases and ensure that mitigation measures are implemented correctly. The PIU expert on EHS shall be responsible for verifying that the mitigation measures are implemented adequately. The EHS expert shall have relevant experience monitoring construction on projects that have World Bank funding and mitigation compliance components. The qualified candidate should also have experience with environmental compliance on projects involving drilling. The EHS expert shall become familiar with mitigation measure requirements and ESMP procedures for the project. The EHS expert shall serve as the monitor for the PIU and shall be the key contact person regarding compliance with mitigation measures. The EHS expert shall be responsible for:

- Acting as the key point of contact for contractors and oversight agencies regarding compliance with mitigation measures
- Verifying project compliance with mitigation measure requirements through auditing and field inspection
- Providing direction to contractors regarding mitigation measure interpretation and ESMP procedures
- Issuing notices of non-compliance (addressed in Section 4.5.2) to contractors if they do not comply with mitigation measures or environmental laws
- Overseeing any rehabilitation of environmental damage that may occur

3.1.2 Community Liaison Officer

The RESDP/PIU Community Liaison Officer (CLO) will be responsible for coordinating with the local community and verifying the socio-economic measures in the ESMP are properly

ROLES AND RESPONSIBILITIES

implemented. The CLO serves as the point of contact for the local community and for workers should a social issue arise during project implementation. The CLO is responsible for:

- Activating a project phone number and email address for local residents and community members to contact if they have grievances with the project (address in Section 4.7), and acting as the key point of contact to resolve project grievances
- Acting as the point of contact for filing of any worker grievances and responding to worker grievances
- Verifying project implementation of socio-economic mitigation measures

3.2 Project Steering Committee

The project is subject to oversight from agencies with stake in the project or who are responsible for enforcing environmental laws. The RESDP PIU will establish a Project Steering Committee (PSC) that will guide the project implementation. The PSC will be responsible for ensuring the smooth execution of project activities and for the successful accomplishment of project objectives. The PSC will meet monthly to review project implementation and performance. The PSC shall include representative from the following agencies (addressed in the Resettlement Policy Framework):

- Representative of the RESDP PIU;
- Representatives of the Development Control Authority:
 - The Authorized Officer or his/her representative;
 - Commissioner of Crown lands or his/her representative;
 - Quantity Surveyor;
 - Valuation Surveyor.
- Social Transformation Officers for each of the affected communities;
- Member of a recognized community-based organization
- Representative of the Department of Agriculture, Forestry, Natural Resources and Cooperatives.

3.3 Contractors

Project contractors are responsible for complying with all mitigation measure requirements and ESMP procedures, and for ensuring that contracts and construction plans for the project meet all design requirements identified in the mitigation measures.

3.3.1 Drilling Services Contractor

A drilling services contractor will be contracted to perform the physical drilling and sampling at well sites. The drilling services contractor shall be responsible for implementing applicable mitigation measures identified in **Error! Reference source not found.** The drilling services contractor will be required to retain a qualified EHS Officer and comply with reporting requirements defined in this section.

ROLES AND RESPONSIBILITIES

3.3.2 Civil Works Contractor

A civil contractor will be contracted to prepare roads leading to the site and construct spur roads to the well pads, construct the well pads, and construct the storage area. The civil contractor shall be responsible for implementing applicable mitigation measure requirements identified in **Error! Reference source not found.**. The civil contractor will need to retain a qualified EHS Officer and comply with reporting requirements defined in this section.

3.3.3 Construction Contractor EHS Officers

Each construction contractor is responsible for retaining an EHS Officer to oversee compliance with mitigation measures applicable to their scope of work. The construction contractors are responsible for selecting EHS Officers with the necessary skills, experience, and availability to perform their duties adequately. Necessary qualifications include previous experience monitoring the implementation of mitigation measures on a project of similar scope and scale. Experience complying with World Bank environmental requirements is preferred. Construction contractors shall ensure their EHS Officers have completed all necessary EHS training prior to the project. EHS Officers will be responsible for the day-to-day implementation of mitigation measure requirements identified in **Error! Reference source not found.**. EHS Officers will be responsible for:

- Acting as the key point of contact for the RESDP EHS expert, as well as oversight agencies if applicable, regarding compliance with mitigation measures
- Ensuring that all personnel including subcontractors have received environmental training prior to work on the project site and have been informed of mitigation measures and their associated responsibilities when working
- Ensuring that all personnel comply with mitigation measures
- Inspecting active work sites on a daily basis, and documenting compliance through completion of a daily compliance checklist and photographs (addressed in Section 4.2)
- Preparing required reports and managing compliance documentation during all phases of construction (addressed in Section 4.2)
- Ensuring that compliance documentation is complete and available for RESDP or oversight agency auditing
- Managing any rehabilitation of environmental damage that may have occurred

ROLES AND RESPONSIBILITIES

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4 Implementation and Verification Procedures

4.1 Implementation Phases

Mitigation measure requirements, as well as implementation and verification procedures, are applicable during one or more of three construction phases. Implementation phases include:

- Prior to construction
- During construction, drilling, and well testing
- Following construction (e.g., Restoration)

Implementation phases for mitigation measure requirements are identified in **Error! Reference source not found.** Implementation phases for ESMP procedure requirements are identified in this section.

4.2 Auditing

4.2.1 Pre-Construction Audit Report

Civil Works EHS Officer shall survey the project site prior to construction to document the condition of the project areas. The Civil Works EHS Officer will prepare a pre-construction report that documents the detailed status of the project work area prior to project activities. The pre-construction audit report shall include:

- Description of the work area
- Areas that should be avoided to the extent feasible (e.g., forest land)
- Photographs of the work area and important feature from multiple angles if necessary

The pre-construction audit report and photographs will be compared to site conditions following construction to determine the adequacy of restoration.

4.2.2 Construction Audit Report

The RESDP EHS expert shall visit the site weekly during civil works and drilling (or more frequently if needed) to verify compliance at the site. Oversight agencies may also visit the site on an as needed basis at any time. An audit report documenting compliance with all applicable construction mitigation measures shall be prepared at the completion of each site visit.

4.2.3 Post-Construction Audit Report

The RESDP EHS expert shall visit the project site following construction to document the condition of the work area and sensitive areas adjacent to the work area. Any issues shall be documented in a post-construction audit report prepared by the RESDP EHS expert. Any issues identified with the condition of the work sites shall be addressed by the responsible contractor to the satisfaction of the RESDP.

4.3 Monitoring Frequency

Contractor EHS Officers would be on site on a daily basis or otherwise defined in the mitigation measures to inspect active work sites and verify compliance with all applicable mitigation measures for the work phase. The RESDP EHS Officer shall monitor the site on a weekly basis during drilling and civil works. More frequent monitoring may be conducted if needed to ensure compliance with the mitigation measures and resolution of any issues that are noted.

4.4 Compliance Reporting

4.4.1 Weekly Compliance Checklists

Contractor EHS Officers shall complete a daily compliance checklist each day that work occurs in the field. Photographs will be attached to the checklist to document work activities.

4.4.2 Monthly Compliance Reports

Contractor EHS Officers shall prepare and submit a monthly compliance report to the RESDP EHS expert to document construction and compliance activities completed during the month, and to track the resolution of any issues that may have occurred. The reports should include the following information for the period:

- Summary of completed construction activities
- Estimate of remaining construction and schedule
- Summary of compliance activities
- Updated list of all EHS incidents that occurred during the project
- Follow up information from any past issues that are still being resolved
- Photographs of project activities

4.4.3 Biannual Compliance Reports

The RESDP shall prepare and submit a biannual compliance report to the World Bank to document construction and compliance activities completed during the period, and to track the resolution of any issues that may have occurred. The RESDP will use daily compliance checklists and monthly reports prepared by the construction contractors to develop the biannual report.

IMPLEMENTATION AND VERIFICATION PROCEDURES

The RESDP EHS expert shall be responsible for reviewing and submitting the biannual reports to applicable oversight agencies. The reports should include the following information for the period:

- Summary of completed construction activities
- Estimate of remaining construction and schedule
- Summary of compliance activities
- Contractor's implementation activities
- RESDP's and agency oversight activities (i.e., site visits)
- Updated list of all EHS incidents that occurred during the project, including attached notices of non-compliance that were issued
- Follow up information from any past issues that are still being resolved
- Photographs of project activities

4.5 Contractor Training

4.5.1 Environmental Responsibilities

Contractors are required to train workers on the environmental requirements for the project as a whole, as well as how to comply with applicable mitigation measure requirements when completing their work. In addition to general environmental awareness training, specific environmental training requirements are identified in **Error! Reference source not found..** Training logs shall be maintained at the project site.

4.5.2 Health and Safety Training

Contractors are required to ensure their workers are adequately trained on health and safety requirements prior to beginning work on the project. In addition to applicable worker safety laws, mitigation measures identify specific health and safety requirements that each contractor must comply with. Health and safety training requirements are identified in **Error! Reference source not found..**

4.6 Incidents

4.6.1 Incident Reports

Contractor EHS Officers are responsible for preparing and submitting incidents reports to the RESDP EHS expert within 72 hours from discovery of the incident. EHS Officers shall maintain a complete project record of incidents associated with their contract scope of work. The record shall be regularly updated and included with monthly reports submitted to the RESDP.

Examples of EHS incidents include:

- Fires
- Accidents or "near miss" events

IMPLEMENTATION AND VERIFICATION PROCEDURES

- Hazardous material spills that contaminate soil or water resources
- Improvement orders or notices issued by oversight agencies
- Non-compliance with mitigation measures

At a minimum, EHS incident reports should include:

- Dates the incident occurred and was discovered, if different
- Description of the incident
- Mitigation measures or environmental laws that were violated
- Parties present during the event
- Corrective actions taken to remedy the issue and prevent it from recurring
- Any remaining actions that are required to correct the situation, such as rehabilitation

4.6.2 Notices of Non-Compliance

If any issues with compliance are discovered by the RESDP EHS expert, the observing party shall submit a written notice of non-compliance to the alternate party and contractors that documents the issue and presents preliminary corrective actions, if applicable. Notices of non-compliance shall include the following information:

- Dates the issue occurred and was discovered, if different
- Description of the issue
- Mitigation measures or environmental laws that were violated
- Parties present during the event
- Description of corrective actions taken
- Description of any necessary follow up actions or longer-term rehabilitation requirements if environmental damage occurred

4.6.3 Corrective Actions

Contractors are responsible for responding to and addressing notices of non-compliance in a timely manner and to the satisfaction of the RESDP EHS expert. Contractors will be responsible for the rehabilitation costs and work effort associated with any environmental damage that may occur due to non-compliance with mitigation measures and environmental laws.

4.7 Grievance and Redress mechanism

A Grievances Redress Committee (GRC) will manage concerns and complaints raised by project affected persons (PAPs) within the communities affected by the project. The RESDP has appointed a community liaison officer (CLO) to conduct stakeholder outreach and respond to any grievances or complaints that may arise. The CLO will act as the key point of contact to resolve project grievances from construction workers, local residents, and community members. The CLO will be responsible for addressing project grievances and directing contractors to make any appropriate change to their work. The contractor shall take reasonable action to

IMPLEMENTATION AND VERIFICATION PROCEDURES

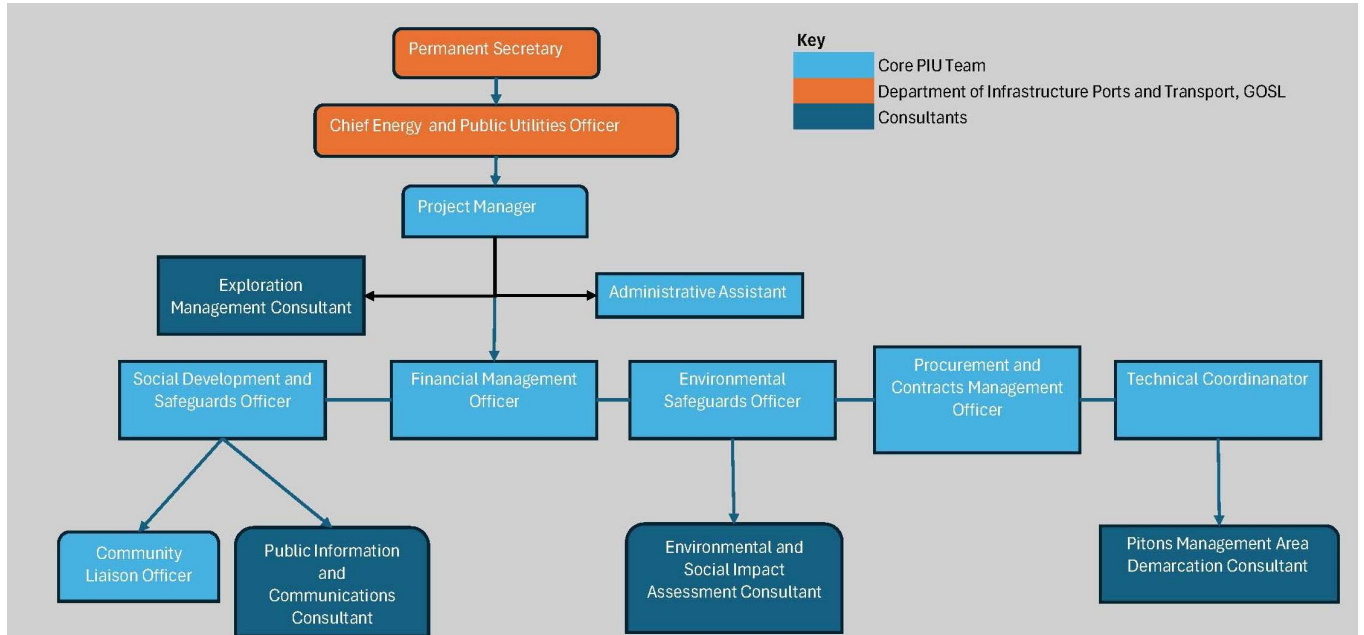
address grievances as required by local laws. Contractor EHS Officers will also act as points of contact for local residents or workers that express grievances at the project site. If grievances are expressed in the field, the receiving EHS Officer is responsible for notifying the RESDP within 48 hours of receipt.

5 Institutional Capacity and Capacity Building

5.1 Institutional Structure

This Section outlines the institutional and management arrangements designed to effectively implement the mitigation measures for the project. The geothermal exploration project will be implemented by several contractor teams including the Civil Works contractor and Drilling contractor. The management structure for implementation of the ESMP within the RESDP is illustrated in Figure 5.1-1.

Figure 5.1-1 RESDP Management Structure



5.2 Institutional Constraints and Concerns

5.2.1 Training

Environmental and social training is required prior to civil works and prior to drilling activities consistent with the requirements of the mitigation measures in the ESMP.

5.2.2 Equipment

A full list of equipment required for implementation of the project and ESMP mitigation measures will be included in the Request for Proposals for civil works and drilling and testing.

INSTITUTIONAL CAPACITY AND CAPACITY BUILDING

The selected contractors will be responsible for providing the necessary equipment to implement the mitigation measures.

5.3 Key Actions for Capacity Building

5.3.1 Labor

The RESDP has hired a Social Development and Safeguards Officer, Community Liaison Officer, and Environmental Safeguards Officer to manage the environmental commitments of the project. Contract labor is provided by the Engineering Management Consultant, Environmental and Social Impact Assessment Consultant, and Public Information and Communications Consultant to support the RESDP.

5.3.2 Trainings

Technical experts at the RESDP will receive in the field training by working side-by-side with drilling contractor experts during drilling. In the field training may be organized by topics, which include:

- Geothermal well design
- Geothermal well monitoring (using gages, software for logging the well, taking samples)
- Well testing (surface and belowground well testing instruments, short- and long-term testing, injectivity, interpretation methods)
- Geothermal reservoir modeling and software
- Power plant design

5.3.3 Equipment Procurement

Several pieces of equipment would need to be acquired prior to project initiation. In addition to the equipment needed to monitor noise levels, analyze air quality, and analyze soil samples and log the wells, the following pieces of equipment would be necessary for the project:

- Carbon dioxide and hydrogen sulfide measurement instruments
- Noise moitor
- Chemical analysis field kit
- Liquid and gas sampling devices
- Flame ionization detector for gas chromatography equipment

INSTITUTIONAL CAPACITY AND CAPACITY BUILDING

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APPENDIX A

Civil Works Contractor EHS Officer Daily Compliance Checklist

CIVIL WORKS CONTRACTOR EHS OFFICER DAILY COMPLIANCE CHECKLIST

Project:	Renewable Energy Sector Development Project
Project Site:	
Date-Time:	
EHS Officer:	

Mitigation Measures by Implementation Phase	Compliance Status			Remarks
	Full Compliance	Corrections Required	n/a	
Before Construction				
Water-1: Stormwater, Erosion, and Sediment Control	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Water-5: Water Supply System Protection	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Water-6: Water Extraction Strategy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Soils-1: Topsoil Preservation and Restoration	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Noise-1: Noise Abatement and Community Coordination	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Biodiversity-2 Nesting Bird Avoidance and Impact Minimization	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Landscape-1: Site Restoration	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Traffic-1: Traffic Control	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Traffic-2: Road Hazard Avoidance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Hazards-1: Hazardous Materials Management Plan	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

CIVIL WORKS CONTRACTOR EHS OFFICER DAILY COMPLIANCE CHECKLIST

Mitigation Measures by Implementation Phase	Compliance Status			Remarks
	Full Compliance	Corrections Required	n/a	
Waste-1: Waste Management Plan	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Social-1: Agriculture Production	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Social-3: Community Engagement and Sensitivity	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Safety-1: Health and Safety Plan	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Safety-2: Personal Protective Equipment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Safety-3: First Aid and Emergency Response Equipment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Safety-4: Community Safety	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
During Construction				
Water-1: Stormwater, Erosion, and Sediment Control	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Water-5: Water Supply System Protection	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Air-1: Fugitive Dust Management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Air-2: Construction Emission Controls	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Soils-1: Topsoil Preservation and Restoration	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Noise-1: Noise Abatement and Community Coordination	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Biodiversity-1: Invasive Weed Control	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

CIVIL WORKS CONTRACTOR EHS OFFICER DAILY COMPLIANCE CHECKLIST

Mitigation Measures by Implementation Phase	Compliance Status			Remarks
	Full Compliance	Corrections Required	n/a	
Cultural-1: Inadvertent Discovery of Cultural Resources	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Traffic-1: Traffic Control	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Hazards-1: Hazardous Materials Management Plan	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Fires-1: Fire Prevention and Response	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Waste-1: Waste Management Plan	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Social-2: Working Conditions and Equality	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Social-3: Community Engagement and Sensitivity	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Safety-1: Health and Safety Plan	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Safety-2: Personal Protective Equipment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Safety-3: First Aid and Emergency Response Equipment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Safety-4: Community Safety	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
After Construction				
Water-1: Stormwater, Erosion, and Sediment Control	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Air-1: Fugitive Dust Management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Soils-1: Topsoil Preservation and Restoration	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Social-1: Agriculture Production	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

CIVIL WORKS CONTRACTOR EHS OFFICER DAILY COMPLIANCE CHECKLIST

Mitigation Measures by Implementation Phase	Compliance Status			Remarks
	Full Compliance	Corrections Required	n/a	
Landscape-1: Site Restoration	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

CIVIL WORKS CONTRACTOR EHS OFFICER DAILY COMPLIANCE CHECKLIST

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APPENDIX B

Drilling Contractor EHS Officer Daily Compliance Checklist

DRILLING CONTRACTOR EHS OFFICER DAILY COMPLIANCE CHECKLIST

Project:	Renewable Energy Sector Development Project
Project Site:	
Date-Time:	
EHS Officer:	

Mitigation Measures by Implementation Phase	Compliance Status			Remarks
	Full Compliance	Corrections Required	n/a	
Before Construction				
Water-1: Stormwater, Erosion, and Sediment Control	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Water-5: Water Supply System Protection	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Water-6: Water Extraction Strategy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Noise-1: Noise Abatement and Community Coordination	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Biodiversity-2 Nesting Bird Avoidance and Impact Minimization	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Traffic-1: Traffic Control	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Traffic-2: Road Hazard Avoidance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Utilities-1: Protect Overhead Utilities Lines	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Hazards-1: Hazardous Materials Management Plan	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

DRILLING CONTRACTOR EHS OFFICER DAILY COMPLIANCE CHECKLIST

Mitigation Measures by Implementation Phase	Compliance Status			Remarks
	Full Compliance	Corrections Required	n/a	
Waste-1: Waste Management Plan	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Social-3: Community Engagement and Sensitivity	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Safety-1: Health and Safety Plan	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Safety-2: Personal Protective Equipment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Safety-3: First Aid and Emergency Response Equipment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Safety-4: Community Safety	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Safety-5: Emergency Response Plan	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
During Construction				
Water-1: Stormwater, Erosion, and Sediment Control	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Water-2: Drilling Effluent Management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Water-3: Geothermal Brine Management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Water-4: Blowout Prevention	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Water-5: Water Supply System Protection	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Water-6: Water Extraction Strategy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Air-2: Construction Emission Controls	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Air-3: Air Quality Monitoring and Noxious Gas Management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

DRILLING CONTRACTOR EHS OFFICER DAILY COMPLIANCE CHECKLIST

Mitigation Measures by Implementation Phase	Compliance Status			Remarks
	Full Compliance	Corrections Required	n/a	
Noise-1: Noise Abatement and Community Coordination	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Biodiversity-1: Invasive Weed Control	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Traffic-1: Traffic Control	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Utilities-1: Protect Overhead Utilities Lines	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Hazards-1: Hazardous Materials Management Plan	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Hazards-2: Drill Cutting Characterization	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Fires-1: Fire Prevention and Response	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Waste-1: Waste Management Plan	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Social-2: Working Conditions and Equality	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Social-3: Community Engagement and Sensitivity	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Safety-1: Health and Safety Plan	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Safety-2: Personal Protective Equipment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Safety-3: First Aid and Emergency Response Equipment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Safety-4: Community Safety	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
After Construction				
Water-1: Stormwater, Erosion, and Sediment Control	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

DRILLING CONTRACTOR EHS OFFICER DAILY COMPLIANCE CHECKLIST

Mitigation Measures by Implementation Phase	Compliance Status			Remarks
	Full Compliance	Corrections Required	n/a	
Water-5: Water Supply System Protection	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Social-1: Agriculture Production	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	