Executive Summary

EIA Espejo de Tarapacá

Region of Tarapacá, Chile

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1. PROJECT DESCRIPTION

1.1. General Overview

The Espejo de Tarapacá Project is a power generation project consisting of a reversible pumped storage power station located in the coastal sector of Caleta San Marcos, about 100 kilometers south of the city of Iquique, and its Transmission System to connect to the S/S Lagunas of the SING. The power station is located in the district of Iquique, and the transmission system covers the districts of Iquique and Pozo Almonte, Tarapacá Region.

The general operating principle of the plant includes pumping seawater during the day, using energy from solar power plants located in the vicinity of the Norte Grande Interconnected System (SING) mainline grid, storing it in a reservoir at higher elevation, and then, during the night, generating hydroelectricity by returning the water to the sea. In this way, production is achieved, which combines solar energy during the day with hydraulic energy during the night, ensuring a constant production that is able to adequately satisfy energy demand of third parties.

In order to achieve the above, three reversible Francis type turbines will be installed, which will be housed in a powerhouse cavern, and which, operating with solar energy, will elevate the seawater to a natural concavity located on a nearby the upper plateau, and during the night, operating in turbine mode, will use the water accumulated in the upper plateau to generate energy and then return it to the sea. Both the seawater intake system and the pipelines will be underground and bidirectional, i.e., the direction of the water flow will depend on whether it is pumped or turbined. The same tunnels and equipment will be used, not requiring different works for each mode of operation.

The estimated installed pumping capacity is 300 MW and the estimated installed generating capacity is up to 300 MW, with each reversible turbine having capacity of 100 MW. In the pumping mode, the plant will consume 2.28 GWh/day, annual average, pumping an average flow rate of 45 m3/s for 8 hours, and in the generation mode it will produce 1.75 GWh/day, annual average, discharging at an average flow rate of 28 m3/s. The energy will be injected into the Norte Grande Interconnected System (SING), at the Lagunas substation, through a 65 km long high voltage electric transmission line (LAT).

Although this is a pioneering project at a national level, the pumped storage-generation projects have vast international development, with around 510 hydraulic pumping stations in operation, distributed in places such as the United States, China, Japan and Europe, among others, the oldest being the one located in Switzerland, on the Aare River, operational since 1908. Additionally, in Japan, there is an operational plant similar to the one planned, since it also uses seawater for electricity generation.

The project will be developed in stages and the initial milestone is the installation of works, which is estimated to occur in mid-2015.

1.2. Description of the Parts and Physical Works of the Project

1.2.1 Permanent Works

1.2.1.1 Submarine Sector

Submarine Intake and Discharge: it is located approximately at -15,5 m.a.s.l. and it has a structure that surrounds it with a diameter of 16 m, total height of 6 m, solid cover of 10 m in diameter and the rest of the structure is made of screen reaching 16 m in diameter of the cage. The base has 1 m of concrete and a screen of 5 m high sits on it with plates of 1 cm to 5 cm distance each. The intake that will emerge to the underwater bottom from the lower tunnel is located approx. 340 m from the coast and it has a diameter of about 5 m.

1.2.1.2 Underground Sector

Lower tunnel: a tunnel of 1830 m approx., it is formed by 7 sections that connect the work of Intake and discharge with the powerhouse cavern. A 30-metre-long Lower Tunnel Gates Shaft will be implemented, which will allow for closing of the tunnel gates. The Lower Tunnel Gates shaft access window is developed from the surface; and the Lower Balance Stack, of hydro-pneumatic type, consists of a blind tunnel built from the lower tunnel, with a length of 152 m, a diameter of 5 m, 6 meters high and an approximate slope of 13%.

Powerhouse Cavern: it contains inside the generation (or pumping) equipment corresponding to the turbine-generators, the adduction shut-off valves and all auxiliary equipment. Armored steel trifurcations will be built in lower (discharge/generation) and upper (adduction/pumping) branches. The Transformer Cavern consists of an Access Cavern for the Transformers, lateral Caverns where the transformers and the cable galleries are located. A compact underground GIS electrical substation is planned, located in the upper part of the Cavern. Access to personnel, machinery, supplies and equipment will be through the Powerhouse Cavern Access Tunnel. The first section of the LAT is underground and runs through this access tunnel approximately 1 km.

Pressure Shaft: it corresponds to a vertical underground work through which water will circulate under pressure for the generation of energy. It is about 502 m long and 4.9 m in diameter. It connects the Upper Tunnel with the Armored Tunnel prior to the Powerhouse Cavern. Its construction considers a lining with concrete.

Upper Tunnel: this tunnel is located immediately after the powerhouse cavern towards the pressure shaft; it is approximately 850 m long, with an inclination of 13%. It also has an Upper Balance Stack. The Upper Tunnel corresponds to the tunnel that connects the pressure shaft with the Reservoir. Its approximate section is of 25 m2, with 5.6 m of height (floor to crown) and 5 m of width approx.

1.2.1.3 Coastal Sector

Operations Area located near Caleta San Marcos, it has an administration and control building, workshop and warehouse building, industrial waste yard and warehouse for temporary storage of hazardous wastes, waste water treatment plant (WWTP), access, parking lots, service roads.

Desalination Plant: next to the Operations Area, it will have a capacity to condition up to 5 l/s during the construction and operation phase of the project.

Works of Coastal Gates: The following accesses to the works are considered: Gate Shaft Surface Work; Access Window Portal to Gate Shaft; Access Tunnel Portal to Powerhouse cavern.

Deposit areas: they correspond to 2 deposits of 6 and 2 ha for the deposit of Excavation Material and Sand and Rock Excavation of Underground and Surface Works. It is planned to deposit the material in terraces.

North access road (Section Caleta Río Seco): This road considers the implementation of a new section and then the union with an existing track that will be improved. The first section corresponds to the first 2.5 km from route CH-1 towards the coastal cliffs, where the North Access road begins. This route will connect route CH-1 with route A-752, which from the coast has an approximate length of 15.3 km in total. 5 km of a new (planned) road through a bypass to the Reservoir are also considered.

Electric Lines: the construction of 4 electric lines in the Coastal Sector is considered, corresponding to the Medium Voltage Line to supply the Jobsite Facility and Operations Area (1,500 m); Medium Voltage Line to supply Camp; Medium Voltage Line, Jobsite Facility and Northern Access Road and a small part of the overhead section of the High Voltage Line of the Espejo de Tarapacá Project, which is subsequently developed in the plateau sector and mostly in the Pampa sector. The jobsite facilities will have 100-kVA back-up equipment.

1.2.1.4 Plateau Sector

Reservoir: it considers a reservoir located in two natural basins, called East and West Reservoirs respectively, both have a storage capacity of around 53,000,000 m^3 of water, considering its maximum operating level of 608.5 m and a water mirror at that level of 375 ha. These reservoirs will be interconnected through a Connection Channel of 275 m and 7.5 m wide at its base, which is divided into two branches, north and south, 216 m and 300 m long respectively, which allow for filling independently the two portions into which the West Reservoir is subdivided.

The reservoirs will be covered with a highly impermeable bituminous membrane of a minimum thickness of 2.5 mm and will be surrounded in its entire perimeter by dirt dikes of a variable height of up to 12 m and a width at its crown of 6 m where Project vehicles can circulate. The West Reservoir will be divided into two parts (North and South) with a separation dike of about 1,350 m long, 4 m wide at its crown. The North-West Reservoir has a Drainage Channel 133 m long and 5 m basal wide.

The **intake and discharge and portal works of the reservoir** will allow access to underground works.

Reservoir Control and Communication Area: it consists of a closed local control panel for the operation phase, which will be used to monitor plant operation parameters in situ. It includes an electrical connection, a surveillance camera, and protection structure for the equipment of approximately 2 m by 3 m and a perimeter fence. This installation is not for the use of personnel, but only for equipment.

Medium Voltage Line North Access Road – Reservoir: from the existing line parallel to route A-1, a new medium-voltage line will be installed towards the reservoir and the jobsite facilities in the sector.

Access roads and road improvement: the north access connects route CH-1 with route A-752. It has an approximate length of 21 km, formed by part of a new road (planned) and the rest will be an improvement of an existing road. A 0.7 km section of Route A-752 will be improved. It is considered a detour of this route towards the west in the sector of the reservoir, in a section of 5 km.

Deposit areas: There are three deposit areas identified as Deposits 1, 2 and 3, of 4.4 ha, 4.6 ha and 11 ha, respectively, for the deposit of Excavation Material and Sand and Rocks from the Underground and Surface Works. It is considered to deposit the material in terraces.

1.2.1.5 Pampa Sector

In the Pampa sector, the High Voltage Line and its service road will be implemented. The LAT will have an extension of 65 km through the districts of Iquique and Pozo Almonte. It starts in the underground S/S GIS (planned by Espejo de Tarapacá), comes to the surface through the portal of the access tunnel to the powerhouse cavern, rests on a high voltage portal and a tower from where the coastal cliff rises and continues up the plateau and then the pampa to reach the S/S Lagunas of the Norte Grande Interconnected System, SING. It will have 202 towers, with a strip of right of way defined for each span. In the final section, approximately 600 meters before S/S Lagunas, an isolating substation for the connection of a future photovoltaic energy project is planned for a next stage of the Project. It will have a 67-km service road with an average width of 3.5 m.

1.2.2 Temporary Works

Jobsite Facilities: four jobsite facilities, three of which are in the coastal sector (Río Seco, Campamento and San Marcos) and the fourth in the plateau sector for the reservoir and LAT works.

Construction Roads: the main service roads add up to an approximate length of 3 km. Existing tracks are considered passable. The Reservoir sector is considered passable, prioritizing the existing tracks.

Construction personnel camp: capacity of 500 persons during construction, 7.5 km north of Caleta San Marcos, in an area of approximately 4 ha. The owner is currently leasing two houses in Caleta San Marcos.

Fixed jobsite facilities of the contractors: four Contractors' fixed jobsite facilities. The camp includes offices.

Work fronts: in addition to the jobsite facilities, there will be some container-type facilities equipped with offices, chemical toilets and areas for the deposit of materials and/or equipment, in areas of the tunnel portals, in the area of the reservoir connection channel and of mobile type in the High Voltage Transmission Line, the medium voltage line and the road that will connect Rio Seco with route A-752.

Explosive deposits: up to 3 explosive deposits on lands with 900 m^2 surface area.

Medium Voltage Electrical Transmission Lines (LMT): four medium voltage power lines (23 kV), one that goes up from Río Seco to the Reservoir, a branch that goes to the Jobsite Facilities of the North Access Road sector, one for the Camp and another for the San Marcos sector, with their corresponding transformers, connected to the local distribution company concessionaire's distribution line that runs parallel to route CH-1.

1.3. Description of the Construction Stage

The construction phase will last approximately 5 years and a workforce of 750 persons in shifts is estimated during its peak of activity.

1.3.1 Activities

1.3.1.1 Submarine Sector

An opening will be made in the seabed using the construction method called "Norwegian Lake Tap", which consists of building the exit of the tunnel underground, from inside the Lower Tunnel by dynamiting the last section. The material originated from the blasting will fall inside the tunnel in a cavity specifically arranged for this purpose, in order to keep the tunnel clear. When the explosion is carried out, the seawater will enter together with the material into the lower tunnel of the project.

To avoid the entrance of fish or any other elements present in the zone, the intake/discharge will be installed around this opening. A term of 6 months is estimated for its installation and assembly.

1.3.1.2 Underground Sector

The Underground Sector considers the construction of the Tunnels, Stacks and Adits, Powerhouse Cavern using the Drill & Blast system through conventional underground mining equipment on tires and shafts using the Raise Bore system. If required, according to structural requirements, concrete and steel armor will be used.

1.3.2 Coastal Sector

The Coastal sector includes most of the works and actions associated with the surface facilities, both temporary and permanent of the project. The construction of the buildings will be performed with metallic structures, concrete and wood, metallic or similar types. Land will be levelled when required and excavated to fix the foundations. For temporary works, prefabricated modules (wood or containers) will be mounted on wooden or concrete foundations. Materials, equipment and structures will be transported by trucks. Some works will require the use of cranes and heavy equipment. The activities associated with the construction of roads correspond to earthworks and compaction.

1.3.3 Plateau Sector

The main works correspond to the installation of the waterproofing membrane cover of the reservoir, the construction of exterior and divisional dikes, the construction of channels, as well as access to the Upper Tunnel and the works. The installation of the membrane will be performed in stages, starting with the preparation of the land, performing, as appropriate, sloping, compaction and filling for levelling. The dikes and channels will be built with heavy machinery and the required material will come from the excavations and earthworks.

1.3.4 Pampa Sector

The assembly of the metallic structures is considered for the towers of the high voltage line, which will be performed by means of mobile work fronts. In general, the foundations of the structures will be made of reinforced concrete. When the terrain and the design of the line allow it, the anchorage will be performed with the same material as the excavations. In cases where it is not possible to use concrete foundations, such as the case of firm rocks, special foundations will be used.

1.3.5 Supplies, Emissions, Effluents and Wastes.

Water: drinking water will be supplied by the desalination plant at a rate of 5 l/s. While the desalination plant is not operating, the supply will be contracted with authorized suppliers (drums or tanks).

Industrial water will be 1,200,000 l/day on all fronts, when the raise boring machine (RBM) is not operating, and 1,500,000 l/day on all fronts, when RBM is operating. Demand will be met with reuse, the desalination plant and purchases from third parties.

Electricity: the electrical supply will be made through the medium voltage lines indicated, and there will be 100 kVA Diesel generators located in each jobsite facility, to operate in cases of electrical system emergencies.

Fuels: a maximum consumption of 5,500 l/day has been considered for construction. Metal tanks with a total capacity of 12,000 liters are considered.

Explosives: 485,000 kg of explosives approximately are considered for underground works. In the case of emulsion, approximately 382,000 kg of explosives will be required.

Concrete and aggregates: 36,400 m^3 of concrete and 1,000 m3 of asphalt are estimated. It should be considered that a technical evaluation will be carried out on site in each section of the underground works to define the method of structural support, if the quality of the rock so requires.

It is estimated that 35,000 m^3 of gravel plus 24,000 m^3 of sand will be required. A large part of the material removed by surface and underground works is expected to be reused. If required, material can be purchased from an authorized third party.

Chemical supplies: the chemical supplies of largest consumption correspond to oils and grease, estimated in 58,240 l/month. Smaller quantities (less than 5 l/month) will be required for Diluents, Degreasers, Antisol and Mold Remover.

Table 1.1 Emissions, Releases and Wastes by Type, Approximate Quantity and Management Measures Considered by the Project. Construction Stage.

General	Emissions, Releases and Wastes	Quantity	Management
Emissions to the atmosphere	MP10 (ton)	2036,16	Particulate matter emissions will be controlled through periodic humidification on roads and work fronts. Combustion equipment and vehicles will be maintained periodically and will have, when appropriate, the required authorizations for their operation.
	MP2.5 (ton)	443,48	
	CO (ton)	673,57	
	NOX (ton)	2569,11	
	SO2 (ton)	18,48	
	HC (ton)	217,9	
	Noise	-	Noise emissions are associated with work fronts. Expected noise levels meet the standard
Liquids	Household liquid waste (waste water)	150 l/person/ day	In the case of the camp, particular sewage systems are considered for the collection of waste waters connected to the Waste Water Treatment Plant (WWTP) to cover the maximum monthly staff on site, considering a water supply of 150 l/person/day. Such a system will be implemented for both the Main Jobsite Facilities and the Reservoir Jobsite. Sanitary effluents will be treated to meet quality as per NCh 1.333 of. 1978 and stored in a 40 m3 tank to be used for road wetting.
Non-hazardous solids	Household solid wastes	500 kg/day	All waste of domestic origin will be accumulated in the jobsite facilities and from there will be transported to authorized places for final disposal.
	WWTP sludge	2700 kg/,month	They will be periodically collected and managed by authorized third parties.
	Industrial solid waste (cuttings of wood, reels, irons, cables, etc.)	92 ton/month	They will be stored in an orderly manner in the non-hazardous waste collection yard until they are sent to their final destination, which will depend on their potential recycling.
Hazardous solids	Oils, lubricants, greases, batteries, empty paint drums, printer toner, brushes, batteries, oil filters, contaminated gloves, etc.	0,95 ton/month	Stored in properly labeled and sealed drums, in a specially designated place for a safe temporary storage in the jobsite facilities in compliance with all relevant legislation

Source: Own Preparation

1.4. Description of the Operation Stage

The Project will capture seawater during the day through the underwater intake works, connected to the Lower Tunnel where the water will be conducted to the Powerhouse cavern. The pumping-generation equipment will be arranged in the Powerhouse cavern, 3 Francis type units, each with power capacity of 100 MW, both in pumping and generation mode, with their respective transformers and valves. Subsequently, the water will be pumped through the Pressure Shaft to the Upper Tunnel and the water will reach the Reservoir through the final work of the Upper Tunnel called Approach Channel.

Subsequently, during the night, the water accumulated in the reservoir will be returned to the sea, by gravity, using the same works and equipment that were used for the intake and pumping, in this stage the water passing through the pumping-generation equipment makes this equipment now act as turbines with capacity of up to 300 MW, generating energy. This cycle will be daily, with the plant being able in exceptional cases to operate 24 hours continuously or even for 9.7 days in generation mode.

Routine inspections and maintenance will be carried out on underground works and maintenance of equipment in order to extend the lifespan of the project, as well as the High Voltage Electrical Transmission Line (LAT). The management and monitoring of the plant will be carried out from the Control Building.

The lifespan of the project is indefinite. On average, the workers considered for this phase will be 30, divided into three shifts. Occasionally, and for preventive maintenance of the plant, the maximum number of workers will be 50.

Main Supplies

Water: the drinking water will be supplied from the desalination plant and considers an approximate intake of 11 l/s of seawater, which will be subjected to processes of pre-treatment, filtration and reverse osmosis, generating a final maximum flow of approximately 5 l/s of desalinated water.

For electricity generation, a maximum intake of 45 m^3/s of seawater will be required (8 hours per day on average), which will be pumped only during the daytime hours, and will then be returned to the sea when the plant generates energy during the nighttime hours at an average rate of 28 m^3/s, reaching 56 m^3/s operating at full capacity.

Electricity: The facilities for the operation of the plant will have direct power supply from the project facilities.

Fuel: For this phase, the implementation of a tank to store fuels is considered in the facilities of the Project for the diesel engine of 500 kVA black start in cases of emergency in the SING.

The following table summarizes the emissions and wastes generated by the project, the estimated volumes and type of management they will receive.

Table 1.2 Emissions, Releases and Wastes by Type, Approximate Quantity and Management Measures Considered by the Project. Operation Stage

General	Emissions, Releases and Wastes	Quantity	Management
Emissions to the atmosphere	MP10 (ton)	17,75	Particulate matter emissions will be controlled through periodic wetting of roads and work fronts. Combustion equipment and vehicles will be maintained periodically and will have, when appropriate, the required authorizations for their operation.
	MP2.5 (ton)	8,28	
	CO (ton)	49,13	
	NOX (ton)	217,43	
	SO2 (ton)	0,36	
	HC (ton)	0,02	
Fields	Electromagnetic fields	-	The 23 kV line generates interferences due to the crown phenomenon, but of a much lower intensity than the limit established by the international regulations, so that it does not represent in general a problem for communications.
Liquids	Household liquid waste (waste water)	7,5 m^3/day	Specific sewage systems are considered for the collection of waste waters connected to Waste Water Treatment Plants (WWTP).
	Rejection brine desalination plant	18.000 m^3/month	It will be disposed in the sea through the work of intake and discharge.
Non-hazardous solids	Household solid wastes	50 kg/day	All household wastes will be accumulated in trash bins and from there they will be transported to authorized places for final disposal.
	WWTP sludge	180 kg/,month	They will be periodically collected and managed by authorized third parties.
	Industrial solid waste (cuttings of wood, reels, irons, cables, etc.)	200 kg/month	They will be stored in an orderly manner until they are sent to their final destination, which will depend on their recycling potential
Hazardous solids	Oils, lubricants, greases, batteries, empty paint drums, printer toner, brushes, batteries, oil filters, contaminated gloves, etc.	200 kg/month	Stored in properly labeled and sealed drums, in a specially designated place for a safe temporary storage in the jobsite facilities in compliance with all relevant legislation

Source: Own Preparation

1.5. Description of the Closure Stage

The lifespan of a hydropower plant is considered unlimited, so the project does not include an abandonment phase, but rather maintenance phases, which includes improvements of equipment or processes, or simply adjustments consistent with technological changes, where equipment will be reconditioned and upgraded from time to time.

In the event that the cessation of operations is required, together with the hiring of labor, the activities considered in the closure and abandonment phase are the dismantling or closure of the following works:

- Submarine Intake and Discharge
- Hydraulic Power Plant
- Power Transmission Lines

- Desalination Plant
- Reservoir
- Underground tunnels
-

2. AREA OF INFLUENCE AND BASELINE DESCRIPTION

The area of influence is defined below and a brief description is provided about the baseline of the components that could potentially be impacted by the project.

Component: Air quality

Area of influence: area including Caletas San Marcos and Río Seco and Tenardita Mine.

Brief description of the baseline: None of the sectors in which the Project will be located are in areas declared latent or saturated by any contaminant.

Component: Noise and Vibrations

Area of influence: 4 km around from the transmitter source. Within this radius there are sensitive receivers (Caletas San Marcos and Río Seco and Tenardita Mine).

Brief description of the baseline: The main sources of noise detected at the time of the measurements correspond to the noise produced by the interaction between the wind, vehicular traffic on Route 1 and the breaking of the waves. The values obtained vary between 36 and 52 [dB(A)] for the day period and between 29 and 54 [dB(A)] for the night period. On the other hand, it can be determined that the vibration records obtained for all the evaluation points are below the perception threshold defined in FTA-VA-90-1003-06 which is 65 [VdB].

Component: Electromagnetic fields

Area of influence: 20 m on each side of the line (total 40 m), defined mainly by the behavior of the electric field. In the case of radio interference, an area of influence of 10 meters is defined on each side of the medium-voltage line.

Brief description of the baseline: Values measured in all locations are well below the limits listed above and do not pose a health risk.

Component: Geomorphology

Area of influence: area of 50 meters around the works of the Project.

Brief description of the baseline: Underground Works Sector: The geomorphological units present in this sector are from west to east, Coastal Plains and Coastal Cliff. **Coastal Surface Works Sector**: The geomorphological unit corresponds to the Coastal Plain. **Plateau Sector**: The geomorphological unit present in this sector is the Cordillera de la Costa.

Component: Soils

Area of influence: area of 50 meters around the works of the Project

Brief description of the baseline: the identified soils presented a development of null to scarce, with predominance of thick materials, sandy textures and without presence of roots, of high erosion, many with presence of desert pavement; thin in depth; with presence of sediments, high in gravel and stones and excessive drainage.

Component: Quality of water and marine sediments

Area of influence: it will correspond to the maximum area determined by the limits of dispersion of the thermal plume, saline and suspended solids both on the surface and on the seabed.

Brief description of the baseline: A dynamic behavior of the vertical structure of the water column is revealed, where the presence of the mixing layer and possible stratifications are modulated by the action of important physical forces or forcing agents such as prevailing wind and waves, which preferably come from the S-SW and W-SW, respectively. The salinity is almost homohaline except for the autumn campaign when this surface range fluctuated widely between 34.4 and 35.1 psu, and then decreases in gradient. Dissolved oxygen (DO) presents an important oxygenation at surface level that then undergoes a sharp decrease depending on the depth up to 10-15 m (0% saturation). The levels of chlorophyll registered in spring were indicative of a high productivity of the water body and were noticeably higher than those obtained in summer. Water quality is good.

Component: Flora and terrestrial Vegetation

Area of influence: it covers the areas of jobsite facilities and development of project activities.

Brief description of the baseline: it is determined that there is no presence of vegetation which is worth its definition of absolute desert. Special interest was placed in the search for oasis of fog and tilandsias.

Component: Fauna

Area of influence: it considers 500 meters around the works of the project

Brief description of the baseline: Two fauna environments and a site of interest were recorded, corresponding to a nesting area of Oceanodroma markhami (sea swallow) on a section of the North Access Road. A total of 24 species were recorded, nine of which have some conservation status under current national legislation. Among them, the species Phyllodactylus gerrhopygus, Phalacrocorax bouganvillii, Pelecanoides garnotii and Leucophaeus modestus present categories that explicitly reflect a degree of threat.

Component: Biological oceanography

Area of influence: the maximum area determined by the limits of dispersion of the thermal plume, saline and suspended solids both on the surface and on the seabed

Brief description of the baseline: The results of the studies indicate that **the intertidal Epibiota of hard bottoms, as well as that of soft bottoms** (sand) is consistent with conditions and ranges

described in the literature. For the **subtidal bottom epibiota**, 6 different communities were identified, identifying 113 taxa. The specific richness recorded in all the communities is superior to other places of ecological importance on the Chilean coast. **Ictiofauna**: a total of 17 taxa were recorded, the most abundant being the bilagay, the burrito and the cabinza. Within **the subtidal Macrofauna of sedimentary bottoms**, local conditions of severe disturbance not attributable to anthropic action are evidenced. During the **coastal vertebrate** campaigns, 22 species were identified, some of them with conservation problems. The dominant **phytoplanktonic** taxa corresponded to the chain-forming diatoms Chaetoceros spp. and Eucampia sp. The diversity of **zooplankton** in the study area (e.g. species richness) was comparatively lower than in similar coastal areas of northern Chile.

Component: Archaeology

Area of influence: Jobsite facility area of the Project and for the linear works a buffer of at least 30 meters on each side of it.

Brief description of the baseline: 23 points of archaeological interest were identified; three traces of indeterminate ascription lacking associated diagnostic material, probably historical, a lithic set of medium density identified as pre-Hispanic, four structures / milestones of subactual or indeterminate data, a historical cemetery of the saltpeter period and platforms and imprinting of the old railway. The remaining points correspond to landfills or accumulations of historical-subactual material, including the discovery of historical bottles and an accumulation of ore. No historical, anthropological or typical monuments are registered.

Component: Underwater Archaeology

Area of influence: installation area of the works of intake and discharge of the Project in the submarine sector

Brief description of the baseline: The research carried out concludes that no relevant indicators of findings were found for this component.

Component: Paleontology

Area of influence: determined by a buffer of 50 m around the works of the Project

Brief description of the baseline: The presence of coastal deposits was detected in the camp area, in the coastal end of the access road and in the reservoir sector, which are characterized by levels with quaternary coquina in all areas (very abundant remains of fossil invertebrates with different preservation qualities), in which the presence of bivalve and gastropod remains was observed. Remains of quaternary terrestrial gastropods of Gravas de Alta Hospicio were found on two levels. Additionally, the presence of fossil remains of Mesozoic marine invertebrates (corals and bivalves) was detected. There is a high probability that new fossil remains be discovered during construction activities.

Component: Landscape

Area of influence: geographical space delimited by the visual basins of the potential observers of the Project

Brief description of the baseline: the character of the landscape is determined by the dominance of abiotic attributes, specifically geomorphological and soil elements. Landscape forms are stable and persistent so there is no great uniqueness of landscape attributes. Anthropogenic interventions are very low, being mainly roads, power lines, substation and some villages, so the landscape retains its naturalness. Visibility conditions vary greatly between the coastal sector and the pampas.

Component: Protected areas

Area of influence: sector where project works will be located within the limits of the identified protected area, the Pampa del Tamarugal National Reserve, which is the arrival of the electric line to the Lagunas substation, located inside the reserve.

Brief description of the baseline: the closest protected area corresponds to the Pampa del Tamarugal National Reserve, specifically in the Lagunas substation sector. The main importance of this reserve is the presence of the Tamarugo tree which develops in an extremely arid environment feeding on groundwater.

Component: Tourism

Area of influence: Caleta Rio Seco and Caleta San Marcos correspond to the main tourist attractions of the area, while the main routes correspond to Route 1 and Route 5.

Brief description of the baseline: The tourist services developed in the region focus on the city of Iquique, the Humberstone and Santa Laura saltpeter, the Pica oasis, the Mamiña hot springs, the Altiplano salt flats and the Isluga Volcano National Park, all of them outside the project area of influence. In the Coastal sector, two tourist attractions are identified: San Marcos and the Rio Seco cove. In the Pampa sector, the Pampa del Tamarugal Reserve is identified in the Lagunas substation sector.

Component: Use of soil

Area of influence: an area of 50 meters around the works of the Project

Brief description of the baseline: Within the evaluated area 97% of the soil is unused, it corresponds to an area devoid of vegetation, desert, with soils of little to no development. The use of the remaining 3% of the surface area does not correspond mainly to residential use (houses in San Marcos and Río Seco), public spaces corresponding to the road system (Route 5, Route 1, via a-750 and A-770), sanitary infrastructure (drinking water tank) and energy (electric transmission line and substation Lagunas) and finally cultural equipment (ruins of the Bellavista saltpeter office and salt ponds in Río Seco).

Component: Economic and productive activities

Area of influence: San Marcos Cove

Brief description of the baseline: The main economic activity of the Region is mining. Trade and services represent the tertiary activities with the highest incidence. Fishing is another activity present in the region, both industrially and artisanal. Caleta Artisanal San Marcos is near the Project area, dedicated to the extraction of fish as well as mollusks and algae, this cove also has two AMERB (Areas of Management and Exploitation of Benthonic Resources) for the production and extraction of mollusks and algae and an aquaculture concession. Only one of the AMERB works actively and there is no aquaculture development in the Chomache Bay area.

Component: Infrastructure and equipment

Area of influence: those sections or sectors that will be intercepted by the project and/or may be affected by its vehicular flows. In this case, the area of influence of the project is defined by the towns of San Marcos and Río Seco, the Lagunas electrical substation and Routes 5 and 1.

Brief description of the baseline: The basic infrastructure and equipment is concentrated in the sectors of San Marcos, Rio Seco and Lagunas substation. The main road infrastructure corresponds to Route 5 and Route 1, of greater hierarchy. The energy infrastructure is provided by the Lagunas substation plus some electric transmission lines. Both the infrastructure and the equipment present in the area are of a rural nature, with basic services for the population of San Marcos and Río Seco. Drinking water is delivered by tank trucks.

Component: Human settlements (pampa and plateau sector)

Area of influence: Sectors adjacent to project works and activities, and development of economic activities and infrastructure.

Brief description of the baseline: No human groups are identified, only economic activities linked to mining and transport.

Component: Human settlements (coastal sector)

Area of influence: Human settlements close to project works. Human settlements more than 7 km from the camp, a defined place for housing workers and with the presence of basic services or basic infrastructure of roads and electricity network. Drinking water is delivered in tank trucks.

Brief description of the baseline: The coves of San Marcos and Río Seco are rural populated entities. They have accesses and regular public transportation. There are squatter type dwellings and others which have been regularized. The great majority of the inhabitants live from some activity linked to the sea and the exploitation of its resources (fishing, shellfish, and seaweed). Numerous social organizations are identified. An indigenous population was identified in Caleta San Marcos, of different ethnicities and without ancestral or cultural relations.

3. ENVIRONMENTAL IMPACT ASSESSMENT

The results of the impact evaluation indicate that the Project will generate "significant" impacts, associated with the components of terrestrial fauna, archaeological and paleontological heritage. These impacts are outlined below, by environmental factor.

Impact: "Affectation of nesting area of *Oceanodroma markhami*"

The site of interest *Oceanodroma markhami* nesting area is of very high relevance due to its fragility and the importance it has for the species.

In the Plateau and Coastal sectors, this impact on the Oceanodroma markhami species could occur during the construction phase due to activities involving land preparation, transport, relocation and construction of facilities. In the operation phase, the Oceanodroma markhami nesting area could be affected due to activities involving the transport of supplies, waste and personnel. In the closure phase, no sources of impacts are foreseen that imply impact on Oceanodroma markhami. In the Plateau and Coastal sectors, this impact could occur on the species Oceanodroma markhami (sea swallow), due to the alteration generated by construction activities and, to a lesser extent, those of operation (by transport).

This impact has been evaluated as negative and significant for the construction phase, while for the operation phase the impact has been evaluated as negative and of low significance.

Impact: "Loss of specimens from the reptile group"

The loss of specimens of the reptile group could occur during the construction phase, due to project activities involving land preparation, relocation, construction and assembly of structures and removal of facilities. During the operation phase, due to the transit of vehicles intended for maintenance and transport of personnel and during the closure phase for project activities involving earthworks and removal of facilities.

This impact has been evaluated as negative and significant for the construction phase, while for the operation and closure phases, the impact has been evaluated as negative and of low significance given the lower intensity of the activities to be carried on the surface.

Impact: "Intervention of archaeological sites".

The estimated impact for the 23 points of archaeological interest identified in the baseline is primary, as it is considered to be a direct consequence of the construction activities of the project. In addition, a possible secondary impact is foreseen, which is formed by derived actions, such as, for example, the transport of people and vehicles to and from the jobsite.

The affectation of archaeological points of interest identified will occur in the short term, i.e., during the construction phase. In order to minimize possible effects in the medium and long term, management and protection measures will be implemented at the most sensitive points of archaeological interest.

This impact has been assessed as negative and significant. This estimate reflects a general and global evaluation of the total of 23 identified points of archaeological interest, ranging from isolated findings to pre-Hispanic and historical archaeological sites.

Impact: "Partial intervention of fossiliferous levels"

Given that fossils and the places where they are found are protected by the Ministry of National Monuments Law (17.288) and that their affectation is irreversible, the environmental valuation of this factor was determined to be high. However, none of the fossiliferous geological units are exclusive of the recognized sites in the project area of influence.

During the construction phase, all effects are caused by activities related to the intervention of the surface (earthworks or surface constructions) or depth (excavations) of the rocks carrying the fossil remains.

Sites will be intervened directly or indirectly by the works of the project. However, most of the fossiliferous levels that emerge at these sites are large and it has been corroborated that the works will not affect all of the outcrops of these fossiliferous levels. They are also found several kilometers from the project area of influence.

Bearing in mind the environmental assessment for this factor and the magnitude of the impact, it is evaluated as negative and significant.

Impact: "Affectation of basic services present in the area of influence".

The analysis of the potential impact on the supply and demand of basic services was carried out in the area of influence of the Project, corresponding to Coastal sector: Caleta San Marcos and Coastal sector: Caleta Río Seco. In the Coastal sector: Caleta Río Seco, only one potential impact was identified in the Construction Stage.

In the construction stage, the actions of the Project susceptible of causing the identified impact are the hiring of temporary labor, the installation of jobsites and camps, the transportation of materials, the construction and improvement of access roads. During the operational phase, activities that can generate impact are considerably reduced, and they are related to the hiring of labor for the maintenance of roads and the operation of the Hydroelectric Power Plant. These are isolated works that, in general, require fewer workers.

The impact on the construction phase of the project in the Coast: Caleta San Marcos sector is considered of low significance. In the operation phase the impact is considered Positive Significant.

The impact during construction on the Coastal sector: Caleta Río Seco sector is considered of low significance. In the operation phase, the occurrence of the impact is not considered.

4. REQUIREMENT FOR THE PROJECT TO ENTER THE SEIA

The Espejo de Tarapacá Project is required to enter the Environmental Impact Assessment System (SEIA), as established by Law N°19.300, article 8 and 10 letters b), c) and p), as well as by S.D. N° 40/2012 of the Ministry of the Environment, article 3 letters b), c) and p).

The Project is required to enter the SEIA with presentation of an EIA, by virtue of Article 11(b) of the LBGMA in relation to Article 6(b) of the SEIA Regulations, since it generates or presents effects, characteristics or circumstances that imply significant adverse effects on the quantity and quality of renewable natural resources, including soil, water and air. Specifically in relation to letter b) due to the affectation of nesting sites of the black sea swallow and the loss of specimens of the reptile group.

The Project is required to present an EIA to the SEIA in accordance with Article 11(f) of the LBGMA, in relation to Article 10, letter a) of the SEIA Regulations, since the Project will generate intervention of archaeological sites in the Coastal and Plateau sectors. Consequently, the Project must submit to the SEIA with presentation of an EIA.

4.1. POTENTIAL RISKS TO THE HEALTH OF THE POPULATION REFERRED TO IN ARTICLE 11(A) OF LAW 19.300.

The reason for submission of an EIA in the SEIA by the Project was explained above. The Espejo de Tarapacá Project did not submit to the SEIA based on the provisions of Article 11(a) of Law No. 19,300 in relation to Article 5 of the SEIA Regulations, since it does not generate or present effects, characteristics or circumstances that imply risks for the health of the population.

5. MITIGATION MEASURES PLAN AND MONITORING OF ENVIRONMENTAL VARIABLES

5.1. Environmental Impact Mitigation Measures

The measures proposed to mitigate significant adverse impacts resulting from the development of the Project on the fauna component are presented below.

Table 5-1. Fauna Measurement Plan

Environmental impact identified	Measure	Follow-up
Affectation of the nesting area of Oceanodroma markhami	Restriction on the start-up of construction of the northern access road in the area where remains of the Black Sea Swallow (Oceanodroma markhami) were found. Micro routing prior to construction.	The parameters to be monitored will be the presence of Oceanodroma markhami in the project area where nesting remains were found. The information gathered during the monitoring will be analyzed to avoid intervening in the nesting activity of the species in the sector. The monitoring will be annual during the first five years of operation.
Loss of specimens from the reptile group	Rescue and relocation plan for the species Liolaemus stolzmanni and Phyllodactylus gerrhopygus	-

Source: Own Preparation

Table 5-2. Archaeological Measures Plan. Impact "Intervention of Archaeological Sites""

Measure	Follow-up
It will consist of installing a vertical sign that informs about the finding with identification, warning about its legal protection. In cases where the findings are less than 30 m from the works, the finding will be fenced in during construction and then removed.	The presence of signs will be verified monthly at each control point and state of conservation of the same during construction to maintain and replace, if necessary, all the informative and safeguard signs installed.
The Archaeological Management Plan includes, based on the findings at the Camp site, a drill hole and the archaeological rescue of the findings. The Rescue will be implemented with an expanded excavation on the site in order to rescue the vulnerable material and prevent its deterioration, ensuring the safeguarding of the material in a definitive deposit (academic institution or museum), in accordance with the decision of the Council of National Monuments, CMN.	Report with results and proof of final destination of the materials collected.
Permanent archeological monitoring, an archeological specialist will be available during the entire construction phase of the project.	The inspection of specialists in protected historical and cultural heritage will be carried out on a monthly basis, while excavation and site preparation activities are ongoing for the installation of the project works. In the case of recording the progress of works involving excavations, it will be carried out daily by the site staff.
Training in the care of cultural heritage through induction and educational talks on the archaeological findings present in the project area and their due protection, to all those who enter the works for the first time.	Record of attendance to induction and educational talks.

Source: Own Preparation

Table 5-3. Paleontology Measures Plan. Impact "Partial Intervention of Fossiliferous Levels"

Measure	Follow-up
The paleontological rescue plan will be carried out before the start of the execution of the construction works, including the collection of significant samples by specialists, with the respective geographical and stratigraphic positioning, curing of the paleontological samples collected in the laboratory, preparation of a catalogue of samples and their addition to the collection or museum indicated by the CMN.	Application for corresponding authorizations and submission of compliance report to the Superintendence of Environment, with copy to the CMN, two months after completion of the construction phase.
Talks to promote the valuation of paleontological heritage to all those who enter the works for the first time.	Record of attendance to induction and evaluation talks

Source: Own Preparation

5.2. Voluntary measures: Monitoring of relevant variables

The project includes voluntary measures aimed at monitoring the evolution of relevant environmental variables, which, without being the object of significant impacts, should be followed up in order to verify that they evolve as forecasted. They correspond to the marine environment:

- Water quality component. Construction and operation phases
- Subtidal sediment quality component. Construction phase
- Intertidal sediment quality component. Construction phase
- Benthic communities. Construction and operation phases
- Planktonic communities. Construction phase
- Water quality for verification of dispersion model (T and OD). Operation Phase
- Water quality for verification of dispersion model (current dir.). Operation phase
- Subtidal sediment quality. Operation Phase
- Intertidal sediment quality. Operation Phase

The Project also includes the monitoring of the water quality in the Reservoir and the meteorological conditions of the site.

6. CONTINGENCY AND EMERGENCY PREVENTION PLAN

The Contingency and Emergency Prevention Plan identifies as potential risks from natural causes Mud and Avalanche Flows, Slides and Spills, Tsunami, Earthquakes and Swells and as potential risks of anthropogenic cause the Risk of spilling fuel, lubricants or hazardous substances into the sea, Risk of spillage of fuel, lubricants or hazardous substances on land, Fire in the area of works, Traffic accidents, Use of heavy equipment and machinery, Use of Transportation, storage and handling of explosives, Earthworks, Disassembly of equipment and Immersion risks.

For each of these situations, operating and/or management measures are defined that will allow for the situation to be managed avoiding impacts on the environment, people, equipment and facilities.

A contingency plan is proposed in the event of an increase in the temperature of discharge from the reservoir, associated with outages in the SING. The objective of contingency management is to protect the marine environment in the event that the discharge temperature differential is maintained over time and could fall in exceptional cases. For its implementation, it has been determined that the triggering limits are over 6°C in the field close to the surface and 4.5°C on the surface at 75 m from the discharge in the direction of AMERB B. In this case, the production capacity of the power plant in generation mode will be limited in order to stabilize the temperatures measured at sea within the accepted limits.

The emergency plan sets out the responsibilities, actions, and procedures, as well as the registration and communications systems that will be implemented in the event of an emergency at the plant.

7. PLAN FOR COMPLIANCE WITH APPLICABLE ENVIRONMENTAL LEGISLATION

The applicable environmental regulations and their means of compliance are presented below.

Table 7-1. General Environmental Regulations Applicable to the Project.

Regulations	Means of compliance
Supreme Decree Nº 1.150 Political Constitution of the Republic of Chile	The constitutional guarantee is respected through compliance with current environmental legislation that requires the entry of the project into the SEIA, and recognition of the institutional formalities created for this purpose. In this sense, when the project is submitted to the SEIA, the obligations indicated are fulfilled, because the State, in the use of its powers and through its administrative bodies, with competence in the matter, will evaluate the project environmentally, ensuring that the right to live in an environment free of pollution is not affected.
Law Nº 19.300 Law of General Bases of the Environment	The Project Owner complies with the provisions of Law No. 19,300, by registering with the Environmental Assessment System (SEIA) through this EIA. In turn, the purpose of entering the SEIA is to evaluate its impact prior to its implementation, as provided in Article 8. As for the compliance indicator, the latter will be the RCA, and Espejo de Tarapacá SpA will proceed to what is established in the same, allowing the State to inspect it and thus ensure that the right to live in an environment free of pollution is not affected.
Supreme Decree No. 40/12 MMA, Regulation of the Environmental Impact Assessment System	The Project Owner is within the typologies that require mandatory entry to the SEIA. In addition, it generates effects whose forecast and evaluation, in accordance with articles 6 to 10 of the Regulation, require the submittal of an Environmental Impact Assessment or Study. The EIA presented by Espejo de Tarapacá SpA, deals with these effects, through the measures described in article 97 and subsequent articles. All of the above, with the purpose of submitting the Project to the environmental assessment and qualification in the SEIA, aiming at obtaining a favorable Environmental Qualification Resolution (RCA).
Resolution No. 1518/13 SMA, establishes the consolidated, coordinated and systematized text of Resolution No. 574 of 2012. Requires information to the owners of	If favorable RCA is obtained, it shall be uploaded to the platform http://snifa.sma.gob.cl/SistemaRCA within 15 working days from the date of notification.

Regulations	Means of compliance
projects that have a favorable RCA; instructing the form and mode of presentation.	The compliance indicator, understood as a means of verification, is made up of the register provided as proof by the platform set up for such purposes by the Superintendence of the Environment.
Resolution No. 844/12 SMA, issues and instructs general rules on submission of conditions, commitments and measures established in environmental qualification resolutions	

Source: Own Preparation

Table 7-2. Specific Environmental Regulations Applicable to the Project

Regulations	Means of compliance
Air	
S.D. Nº 144/61 MINSAL, establishes standards to avoid fumes or atmospheric pollutants of any nature.	The Project has incorporated emission control measures into its design, which allows it to adequately mitigate the impacts resulting from the construction and operation of the Project. Particulate matter released during the construction phase is mitigated through road wetting, mixing processes, and transfer of materials. Truck bodies will be sealed to prevent material from falling. Windbreak meshes will be used at the jobsites. Atmospheric emissions generated in combustion engines will be minimized by rigorous maintenance of the equipment, which will have their permits up to date. During the Operation Phase of the Project, emissions into the atmosphere will correspond to gases resulting from the circulation of vehicles. To mitigate this effect, vehicle travel speeds will be restricted and they will be required to keep technical revisions up to date.
S.D. Nº 20/13 MMA, Establishes Primary Quality Standard for Breathable Particulate Material MP-10, especially the values that define emergency situations.	The Project has incorporated emission control measures into its design, which allows for adequate control of the impacts resulting from the construction and operation of the Project. Wetting of roads throughout construction is considered. Likewise, engines and machinery will be periodically reviewed and adjusted in order to minimize emissions generated by incomplete and inefficient combustion.
S.D. Nº 12/11 MMA, Primary Environmental Quality Standard for Fine Breathable Particulate Material MP 2,5	The Project has incorporated emission control measures into its design, which allows for adequate control of the impacts resulting from the construction and operation of the Project. Wetting of roads throughout construction is considered. Likewise, engines and machinery will be periodically reviewed and adjusted in order to minimize emissions generated by incomplete and inefficient combustion.
S.D. Nº 114/02 SEGPRES, Primary Air Quality Standard for Nitrogen Dioxide (NO_2)	The Owner shall comply with these regulations, trying to perform adequate maintenance of equipment, machinery and vehicles to be used during the construction and operation stage, so as to minimize atmospheric emissions. A duly updated record of such activities will be kept.
S.D. Nº 115/02 SEGPRES, Primary Air Quality Standard for Carbon Monoxide (CO)	
S.D. Nº 4/94 MTT, Establishes contaminant emission standards applicable to motor vehicles and establishes procedures for their control.	The emission standards shall be complied with and all motor vehicles involved in the development of the project shall be required to comply with these standards during all phases of the project, which shall be verified by means of an up-to-date technical inspection and gas emissions certificate. An up-to-date register shall be kept, the responsibility of which shall lie with the site manager. It will indicate the license plate number of the authorized vehicles, in accordance with the previous paragraph.
S.D. Nº 75/97 MTT Establishes conditions for the transport of loads that indicate	
S.D. Nº54/94 MTT, Emission standard for medium motor vehicles that indicate	

Regulations	Means of compliance
S.D. Nº55/94 MTT, Emission standard for heavy motor vehicles that indicate	In addition, the owner shall require that the transport of bulk materials through urban areas be carried out with the loading section of lorries covered with tarpaulins, in order to prevent the dispersion of dust and the fall of materials.
S.D. Nº138/05 MINSAL, Establishes an obligation to report emissions that indicate	The Owner will declare these emissions annually, through the RETC System of the Ministry of the Environment, web portal to enter the different sectorial systems of declaration in force. The compliance indicator, understood as a means of verification, is made up of the declaration register associated with the portal mentioned above.
Liquid Wastes	
S. D. Nº594/00 MINSAL, Regulation on basic sanitary and environmental conditions in workplaces.	By means of contractual clauses, the supplier of the chemical toilets will be responsible for carrying out all the necessary steps to guarantee the sanitary cleaning of the area where they were located. With respect to the WWTP, this EIA provides the background for the granting of PAS 138, which describes the technical and environmental characteristics of wastewater management and plant operation. Once the favorable RCA is obtained, the permit will be processed by the Health SEREMI.
S.D. Nº90/00 SEGPRES, Emission Standard for the regulation of contaminants associated with the discharge of liquid wastes to marine and continental surface waters.	The discharge of water from the Desalination Plant will take place outside the Coastal Protection Zone, thus applying the maximum concentration limits established in Table 5 of the standard under analysis. The Project's Environmental Vigilance Plan provides for monitoring measures, the reporting and compliance of which will allow the accreditation of compliance in situ.
Drinking water and waste waters	
NCh N°409/1 Of 2005 INN Chilean Drinking Water Standard	Since drinking water is purchased from third parties during the construction phase, it will be purchased from companies that have a valid authorization resolution, whose registry will be available to the inspection authority. The drinking water produced in a desalination plant will have the quality indicated.
S.D. Nº236/26 Min. of Hygiene, Assistance, Prevision and Work, General Regulations of Particular Sewers, Septic Tanks, Filtering Chambers, Contact Chambers, Absorbent Chambers and Household Latrines.	The treatment system and other works required for the management and disposal of waste waters shall comply with each of the requirements stipulated in this decree, there being a record of the parameters set by the same. For such purposes, the technical and formal contents of PAS 138 are presented in the Sectoral Environmental Permits Chapter.
D.F.L N°1/89 MINSAL, Establishes matters that require express sanitary authorization.	This EIA provides the technical and formal background information for the granting of PAS 138, where the technical-environmental characteristics are described regarding wastewater management and plant operation. Once the favorable RCA is obtained, the sectoral processing of the permit will proceed before Health SEREMI.
S.D. N° 735/69 MINSAL, Regulation of water services intended for human consumption	The supply of drinking water shall be sufficient, easily accessible and available at any time to its workers with a minimum supply of 150 liters of water per person/day. The system of treatment and distribution of drinking water will ensure, at all events, the potability of the water for consumption. The drinking water treatment and distribution system will have the applicable sectorial permits, especially that of article 71 letter a) and of the final paragraph, both of the Health Code, in relation to D.F.L Nº 1/89 of the Ministry of Health (which require express sanitary authorization).
S.D. N°4/09 SEGPRES, Regulations for the Management of Sludge from Waste Water Treatment Plants	The WWTP will have an engineering project approved by the corresponding health authority, as required by Article 9 of the Regulation. The sludge generated in the WWTP will be periodically removed by a third party with express sanitary authorization for this purpose. By means of contractual clauses, the Owner shall require the contractor

Regulations	Means of compliance
	to comply with these Regulations. In addition, there shall be a register evidencing the removal of the sludge and its frequency, which shall be available to the inspection authority.
Solid Wastes	
D.F.L N° 725/61 Health Code	Non-hazardous industrial wastes will only be stored in a salvage yard, which corresponds to a specially conditioned area (area with compacted soil and fenced) in the Project facilities. Those generated in work fronts will be transported daily to these salvage yards, which will have the technical and formal requirements indicated in PAS 140. Hazardous wastes generated during the construction phase shall be stored in accordance with the provisions of D.S. No. 148/2003, in a storage warehouse specially prepared for such purposes, in accordance with the technical and environmental requirements of PAS 142. Prior to the start of activities, a statement will be submitted to the Health Authority indicating the quantity and quality of industrial wastes generated, clearly differentiating hazardous industrial wastes.
S.D. Nº 594/00 MINSAL, Regulation on basic sanitary and environmental conditions in workplaces.	
S.D. Nº148/03 MINSAL, Health Regulations on the Management of Hazardous Wastes	Hazardous wastes generated during the construction phase will be stored in warehouses located in the waste management areas of the Project facilities for which PAS 142 is requested, the technical and formal contents of which are presented in the respective chapter. These warehouses shall comply with the design measures and requirements contained in Title IV (Articles 29 et seq.) of the Regulations in question. They shall have signage in accordance with Chilean Standard NCh 2.190 Of 93.
Hazardous Substances	
S.D Nº78/09 MINSAL, Regulation on the Storage of Hazardous Substances	The warehouses will have a dividing wall when the type of substances requires it. They will have proper ventilation and signage. When the quantity of hazardous substances to be stored exceeds 10 flammable tons or 12 tons of another class of non-flammable hazardous substances, the owner will process the corresponding sanitary authorization according to the requirement of Article 5 of the standard under analysis.
S.D Nº298/95 MTT, Regulates the transport of dangerous cargo on streets and roads	Given that the Project includes the transportation of fuel and explosives, the owner will request prior authorization from Carabineros de Chile. Vehicles of less than 15 years of age will be used in the transportation, and they will be required to comply with the corresponding technical revisions. Likewise, the rules contained in Articles 7 and following of the Regulations shall be observed in stowage, unloading and handling.
S.D. Nº 209/06 MINSAL, Sets toxicity values of substances for the effects of health regulations on hazardous waste management	Hazardous wastes shall be classified according to this standard, where applicable. Their classification will allow determining the scope of application of the S.D. Nº 148/04 in situ.
Territorial Planning	
D.F.L N° 458/76 MINVU, General Law of Urbanism and Constructions	The owner shall apply to the competent Authority for the necessary building permits for the works of the Project, submitting all the background information established in the regulations.
S.D. N°47/92 MINVU, General Ordinance of the Law of Urbanism and Constructions	The Technical Industrial Qualification will be processed, whose technical and formal contents are accompanied in this EIA through the request of the statement of article 161 of S.D. N°40/2012. Once environmentally qualified, the sectorial authorization will be obtained, operating as a means of verification the respective Sanitary Resolution.
Noise	
S.D. Nº 38/12 MMA, Establishes standard for the emission of noises generated by	The standard is met in evaluated receivers.

Regulations	Means of compliance
sources that indicates, prepared from the revision of Decree Nº 146, of 1997, of the Ministry of Secretariat General of the Presidency.	
Fuels and Equipment	
S.D. Nº 160/09 MINECON, Safety regulations for facilities and operations of production and refining, transport, storage, distribution and supply of liquid fuels.	The tank shall comply with the design, construction and operation requirements of Title IV of this Regulation. In addition, the owner shall proceed to registration and certification in accordance with the technical requirements established by the Superintendency of Electricity and Fuel in Ex. Res. No. 1146-2008 or the one that replaces it. Finally, in the event of any accident, the Superintendency and the environmental authority shall be informed in accordance with the rules and procedures of articles 32 and following of this Regulatory body.
Roads and Transport	
D.F.L N°850/98 MOP, Establishes the consolidated, coordinated and systematized text of Law No. 15,840 of 1964, Organic Law of the Ministry of Public Works, and D.F.L No. 206 of 1960, Law on Roads.	To control the weight of the load, a record will be kept of the guides for dispatching the load to be transported, indicating the trip made, date and time, and the associated truck, indicating its license plate number. In the event that overweight and/or oversized equipment needs to be transported, the owner shall request the corresponding authorizations from the Regional Direction of Roads. If third party transportation is required, such authorization shall be required by the owner. In cases where crossing or access to public roads is required, the owner shall request authorization from the Directorate of Roads, in accordance with the provisions of Articles 42 and 40 respectively.
S.D. Nº158/80 MOP, Establishes Axle Weight Limits and Total Gross Weight Limits	The owner, through its contractors, will comply with the maximum dimensions for the circulation of vehicles on public roads, as well as with the maximum weight of vehicles that can circulate on public roads. The corresponding permits will be requested when a load exceeding the maximum weight limits established in the applicable regulations is required to be transported.
S.D. Nº75/87 MTT, Establishes Conditions for the Transport of Cargoes that indicates	Contractor companies will be required to transport materials that prevent their dispersion into the air and to this end they should consider fully and effectively covering materials with appropriate sized tarpaulins, or other system so as to achieve this objective.
Resolution Nº 1/95 MTT, Establishes maximum dimensions to vehicles that indicates	The trucks to be used in the Project will conform to the maximum dimensions established in this regulation. The corresponding permits will be requested when it is required to transport a load that exceeds the maximum weight limits established in the applicable regulations.
Marine Environment	
S.D Nº430/92 MINECON, Establishes the consolidated, coordinated and systematized text of Law No. 18,892 of 1989, as amended, General Law on Fishing and Aquaculture.	The owner will take all the measures of protection and security provided by the rule, so as not to incur in the criminal type established in Article 136 of this legal body.
S.D. Nº1/92 Min. of Defense, Regulations for the Control of Aquatic Contamination	Compliance with the standard under analysis is directly related to the application for PAS 115, which technical and formal contents are enclosed for environmental assessment. The facilities associated with the discharge of seawater, its location and characteristics, as well as the characteristics of the place of discharge and of the receiving marine environment, are part of the content of the aforementioned permit. Once the innocuousness of the water to be discharged has been environmentally proven, prior to obtaining the PAS in the SEIA, it will be processed by the sector before DIRECTEMAR. On the other hand, the EIA is accompanied by an Emergency Plan, complying with the aforementioned standard, the contents of which are

Regulations	Means of compliance
	presented in Chapter 11 "Risk prevention and accident control measures".
S.D Nº296/86 MINREL, Enacts the Agreement for the Protection of the Environment and the Coastal Zone of the Southeast Pacific	The sea discharge corresponds to the same water captured for power generation in the hydroelectric plant. The Project Description explains this system, which considers a Desalination Plant to treat seawater. Notwithstanding the foregoing, the Project considers periodic monitoring at individualized sampling points in the Marine Environment Monitoring Plan, included in the EIA, in annex 9.1.
National Monuments	
Law Nº 17.288 Legislation on National Monuments	If on the occasion of the excavations to be carried out or any other work to be carried out during the construction and operation stages of the Project - both on land and at sea - any archaeological site or site with cultural value not identified in the baseline is discovered, the owner commits to interrupt the work that gave rise to the finding and immediately inform the Provincial Governor, Carabineros of Chile and the Council of National Monuments, in order to adopt the necessary measures for the conservation of the site.
Ex. Decree Nº 311/99 MINEDUC, Declares Historical Monument Underwater Heritage that indicates, which is older than 50 years	
Protection of Terrestrial Fauna	
Law No. 19.473 Replaces Text of Law No. 4.601 on Hunting and Article 609 of the Civil Code	Prior to the construction of the Project, the owner will carry out a Rescue and Relocation Plan for the species Liolaemus Stolzmanni and Phyllodactylus gerrhopygus. For the foregoing, PAS 146 of D.S Nº 40/2012 MMA is requested, in chapter 10. Together with the foregoing, the Owner shall instruct and prohibit his workers and contractors from hunting in all places where the project will be developed.
S.D. N° 5/98 MINAGRI, Hunting Law Regulations	
Protection of marine fauna	
Ex. Decree Nº 225/95 MINECON, Establishes a ban on hydro-biological resources that indicates	A talk will be given to the staff regarding the biological importance of marine species and their conservation. Workers will be warned that non-compliance with species protection regulations is punishable by law and will not be permitted by the owner.
Ex. Decree Nº 1.892/09 MINECON, Establishes an extractive ban for the common sea lion resource in the area and period that indicates	A talk will be given to the staff regarding the biological importance of marine species and their conservation. Workers will be warned that non-compliance with species protection regulations is punishable by law and will not be permitted by the company.
S.D. Nº179/08 MINECON, Establishes a prohibition on the capture of cetacean species indicated in waters under national jurisdiction.	A talk will be given to the staff regarding the biological importance of marine species and their conservation. Workers will be warned that non-compliance with species protection regulations is punishable by law and will not be permitted by the company.
Law Nº 20.293 Protects cetaceans and introduces modifications to Law Nº 18.892 General Law of Fishing and Aquaculture.	A talk will be given to the staff regarding the biological importance of marine species and their conservation. Workers will be warned that non-compliance with species protection regulations is punishable by law and will not be permitted by the company.

Source: Own Preparation

Table 7.3. Sectoral Environmental Permits (PAS) Applicable to the Project

PAS	Description	Request
PAS 115	Permit to introduce or discharge harmful or hazardous materials, energy or substances of any species into waters under national jurisdiction.	The Project includes the discharge of seawater in the power generation process.
		The project considers the installation of a desalination plant, whose effluent will consist of rejection brine that will be discharged to the sea.
PAS 119	Permit to carry out research fishing	The Project needs to carry out exploratory type of research fishing to monitor the condition of populations of hydro-biological species.

PAS	Description	Request
PAS 126	Permit for the construction, repair, modification and extension of any facility designed to manage sludge from wastewater treatment plants.	The project requires the granting of this sectoral permit since activated sludge will be generated from 3 wastewater treatment plants.
PAS 132	Permit to carry out archaeological, anthropological and paleontological excavations.	The project requires this sectorial environmental permit since works will be carried out in areas where there are archeological findings.
		The project requires this sectorial environmental permit since works will be carried out in areas where there are paleontological findings.
PAS 138	Permit for the construction, repair, modification and extension of any public or private work intended for the evacuation, treatment or final disposal of drains, wastewater of any nature.	The project will generate wastewater that will be managed through a particular sewage system, connected to 3 modular plants of activated sludge type.
PAS 139	Permit for the construction, repair, modification and extension of any public or private work intended for the evacuation, treatment or final disposal of industrial or mining wastes.	The project considers the installation of a desalination plant, whose effluent will consist of rejection brine that will be discharged to the sea.
		The project includes the installation of 2 concrete plants, located in the San Marcos and Reservoir jobsite facilities, which will have sectors for washing the discharging chutes and mixing drums of the trucks used.
PAS 140	Permit for the construction, repair, modification and extension of any rubbish and waste treatment plant of any kind or for the installation of any place intended for the accumulation, selection, industrialization, trade or final disposal of rubbish and wastes of any kind.	The project includes the temporary storage of non-hazardous household and industrial wastes.
		The project includes the implementation of 5 stockpiles of excavation material, whose main objective is to collect the wastes from the extracted sand and rocks and the excess materials from the excavations and surface works carried out.
PAS 142	Permit for any site intended for the storage of hazardous wastes	The project includes the temporary storage of hazardous wastes.
PAS 146	Permit for the hunting or capture of specimens of animals of protected species for research purposes, for the establishment of breeding centers or farms and for the sustainable use of the resource.	The project includes the capture of specimens of protected species for the implementation of the Rescue and Relocation Plan for specimens belonging to this group.
PAS 155	Permit for the construction of certain hydraulic works	The project includes for its operation to implement works whose storage capacity will be greater than fifty thousand cubic meters and the associated aqueducts will have a flow greater than two cubic meters per second.
PAS 157	Permit to carry out regularization works or defense of natural watercourses.	The Project requires the granting of this mixed sectorial environmental permit, due to the fact that it must have the approval of the General Water Directorate (DGA) for the affectation of two natural ravines by the development of a new planned road.
PAS 160	Permit to subdivide and develop rural land or for constructions outside urban limits.	The project considers the construction of works located outside urban limits.

Source: Own Preparation

8. RELATIONSHIP BETWEEN THE PROJECT AND REGIONAL AND DISTRICT DEVELOPMENT POLICIES AND PLANS

At the regional level, the "EIA Espejo de Tarapacá" project is part of an investment project based on the generation of energy through the use of Non-Conventional Renewable Energies (NCRE), the energy generated will be contributed to the Norte Grande Interconnected System (SING).

According to the above, it can be concluded that in relation to the Policies, Plans and Programs of Regional and District Development, the project will:

- Contribute to the sustainability of the region's water resources with the 5 l/s desalination plant to supply the project and Caleta San Marcos.
- Encourage the development of a public awareness of environmental protection, delivering environmental information to the community, and participatory monitoring.
- Contribute to the improvement of people's quality of life, with job training and hiring of local labor and drinking water to Caleta San Marcos.
- Improve the availability of utilities by injecting 1.75 GWh/day of electricity into the Lagunas substation of SING and desalination plant.
- Evaluate the Project environmentally and propose the necessary measures to avoid impacts.
- Collaborate with information on key components of biodiversity in the sector through baseline studies presented in the EIA.
- Contribute to the exercise of involving civil society in participation in environmental issues.

In conclusion, the project is consistent with the instruments analyzed, inserting itself in a harmonious way with its strategic guidelines and objectives, especially with regard to favoring the development of renewable energies in the region and contributing to the building of a public awareness of environmental protection. Its contribution to the sustainable development of the local economy should be unleashed through the viability of NCRE. It will also facilitate the development of local companies and productive growth of industry because of the inclusion of energy in the Norte Grande Interconnected System (SING). In Caleta San Marcos, it will contribute to the diversification of economic activities by constantly providing drinking water as part of the Project's commitments. The Project is positively related to various aspects of the instruments reviewed and does not override any of the regional and district guidelines, orientations and strategies considered in this analysis.

9. VOLUNTARY ENVIRONMENTAL COMMITMENTS

The project considers the following voluntary environmental commitments.

Technical Support on Marine Issues: a marine consultant selected by the community will be made available to the community, with the objective of supporting the reading and understanding of the marine environmental studies generated by the owner. The hiring of the consultant will be extensive for the entire evaluation period up to 30 days following the issuance of the Resolution of Environmental Qualification.

Participatory Monitoring: As has been done so far, the conduct of marine studies or monitoring and their results will be communicated in due course to the Union of Independent Workers, Shellfish Divers and Helpers of Caleta de San Marcos, and the Neighborhood Council. The previous notice will be sent to the legal representatives of the Independent Workers Union, Shellfish Divers and Helpers of Caleta de San Marcos; and of the Neighbors Council, in written form, with at least 5 days of anticipation.

Working group: Working group discussions will take place in Caleta San Marcos, at least every six months during the construction phase, promoting open and transparent dialogue with the Community of Caleta San Marcos.

Desalination Plant Infrastructure: infrastructure will be provided for the plant, which will deliver up to 50 m^3/day of desalinated water in Caleta San Marcos. The costs of production, distribution and disinfection will be the responsibility of the Community. The delivery of the desalinated water will take place within 3 months following the completion of the construction of the Desalination Plant, provided they have the necessary infrastructure and in coordination with the Rural Drinking Water Committee of Caleta San Marcos or the equivalent body.

Installation of tourist lookouts: two tourist lookouts will be installed, one overlooking the reservoir and the other in the north access road sector overlooking the sea, in order to enhance the new landscape generated by the seawater reservoir of the "Espejo de Tarapacá" project. Additionally, tourist signs will be installed in the Cemetery sector to better identify this area of heritage interest.

10. PRELIMINARY ACTIONS AND NEGOTIATIONS

The owner initiated a relationship with the community of Caleta San Marcos in 2012, which has grown and prospered, currently existing a working group and a marine environment commission with the community, through which the community has made requirements to the company for additional studies and the company has been providing project information and environmental studies. The owner carried out a door-to-door information delivery activity, invited the community to visit the Reservoir site, in addition to providing newsletters and installing mailboxes for receiving questions, suggestions and complaints, and publishing news on three community bulletin boards located in Caleta San Marcos. As a result of this process, the community now has a advising for marine environmental issues, provided by a consultant chosen by them and financed by the company up until 30 days after the Resolution of Environmental Qualification is issued. Finally, it is worth mentioning that two work plans with the community were executed to discuss and forecast its future, within a framework of transparency and good faith, without compromising the community's independence regarding its opinion about the Project.