Chapter 3: Baseline

EIA Espejo de Tarapacá

Region of Tarapacá, Chile

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3. BASELINE

3.1. Introduction

This chapter of the environmental impact study Project Espejo de Tarapacá, It has been carried out following the guidelines indicated in the DS 40/2012. This chapter gives a background to assess thes current conditions of the environmental components that make up the area of influence of the Project.

The description of the environment focuses on relieving necessary and essential information in order to subsequently evaluate the impacts that could be generated or presented on the components of the environment in the different PhaseS of the Project. Like this This document also relieves the importance of these components in their local and national context.

To facilitate analysis, this baseline is performed Sectioned In FunciSpatial context and the work associated with it. The sectors considered are:

- Pampa Sector
- Plateau Sector
- Underground Works Sector
- Underwater works Sector
- Sector Costa

3.2. Physical environment

3.2.1 Atmosphere

3.2.1.1 Methoeorology

i. Summary

The winds show predominantly well defined direction (predominantly S, SSE, SSW, SW, ESE and WSW in 66% of the time) presenting average speed of 2.33 m/s (with a maximum hourly speed of 11.9 m/s). EL air in this sector has good dispersion capacity, since the percentage of calm is low (0.1%).

ii. Methodology

Because the Project It will not generate effects on climate and meteorology, no area of direct or indirect influence is defined. However, your description is necessary to Evaluating impacts on other environmental components, as air quality

The characterization of the meteorology of the sector was made from the extraction of information of meteorological stations available in the environment of the area of location of the Project. The Central Indoor station, located approximately 40 km north of the sea water catchment area, was identified with speed and wind velocity variable records. In the Table 3-1 The characteristics of the station and the Figure 3-1 Its location in the area of the Project.

Table 3-1. Characteristics of the Central indoor weather station.

Station	COord. Utm This	Coord. Utm North	Registered Variables	Source
Central Interior	376,320	7.699,163	Wind speed and direction	SINCA

Source: Own Elaboration.

Figure 3-1. Central Indoor Weather Station location.

Source: Self-elaboration – Google Earth

iii. Results

In the Table 3-2 The meteorological variables obtained from the records of the Central indoor meteorological station are delivered in the period from December 2007 to March 2010.

Table 3-2. Meteorological Variables Station Central Interior (12/2007-03/2010).

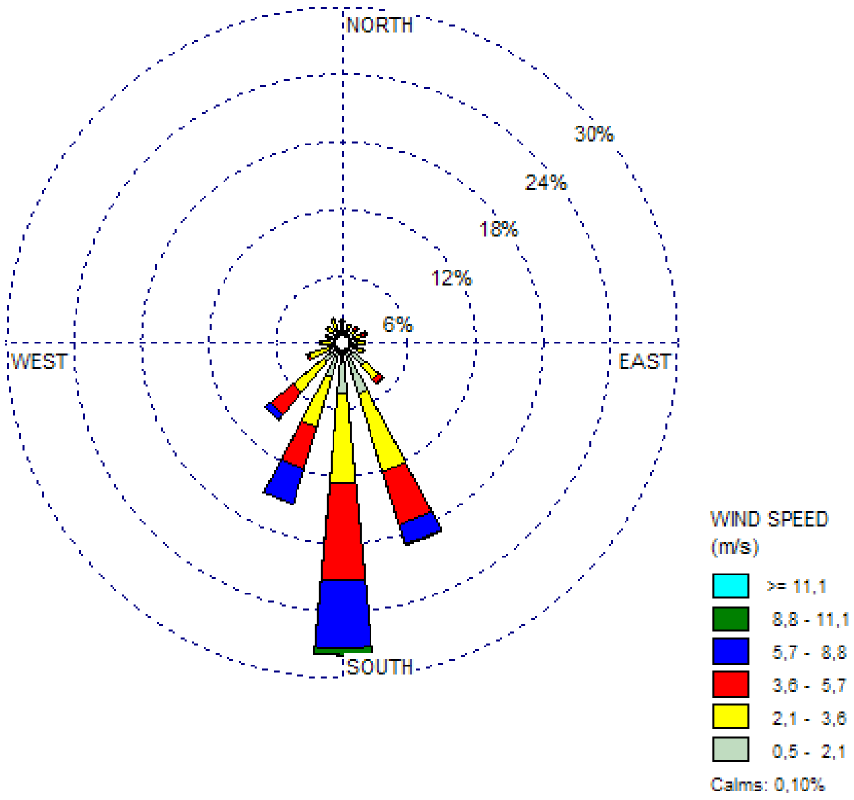
Variable	Value
Wind speed (m/s)	
Average period	3.22
Maximum Value	11.9
Minimum value	0.4
Percentage of calms[1]	0.10
Wind Direction	
AddressOrNIs PredominantlyS	S (23.29%), SSE (15.89%), SSW (12.63%)

Source: Self-elaboration

[1] Porcentaje de calma: porcentaje del tiempo en que la velocidad del viento es menor a 0,5 m/s.

The Figure 3-2 Presents the Wind Rose Accumulated for the period between The months of December 2007 to March 2010.

Figure 3-2. Rose of the winds inner Central station.



Source: Own elaboration-inner Central station.

The winds show predominantly well defined direction for the period of registration, presenting average speed of 3.22 m/s and a 0.1% of calms. The fact that the percentage of calm is low, indicates that the air in the area shows dispersion capacity. The maximum hourly speed of the wind recorded for this period is 11.9 m/s.

EL Wind in this sector has predominantly S, SSE management components, Ssw SW, ESE and WSW In the 66% of the time, indicating a very definite wind direction.

3.2.1.2 Air quality

i. Summary

None of the sectors in which the Project It is inserted in areas declared latent or saturated by a contaminant.

The sea water catchment area is characterized by the Punta de Lobos, Peak Point and ash landfill stations, which are approximately 40 km north of the Project, which indicate that the quality of the air in general is good, with the exception of the indicated in the Salt station Punta de Lobos, point where the limit of the norm in material is exceeded Particulate For the years 2009, 2010 and 2011.

ii. Objectives

The objective of this section is to establish a characterization of the air quality of the location area of the Project In relation to pollutants, as material Particulate and gases (MP10, SO_2No_2 and CO) With reference to the primary air quality standards in force.

iii. Methodology

For the characterization of this component will be consulted The information provided by the network of monitoring stations registered in the National Air Quality Information System (since). The stations closest to the area of the Project They correspond to the stations Salinas Punta de Lobos, point of maximum impact and landfill of ashes, all located to the south of the city of Iquique, to 40 km approximately of the area of the Project.

The characterization of the baseline air quality will be made for material Particulate Breathable and gases (MP10, SO_2No_2 and CO), corresponding to the pollutants monitored by the stations consulted. In relation to the MP2, 5 There are no baseline records in the sector, Reason, it They have estimated their concentrations as 50% of the MP10 measurements recorded in the Different stations[2].

The characterization of the air quality component will be made for the sector corresponding to the coastal sector where the catchment of seawater is located and The reservoir. In the Table 3-3 The characteristics of the stations considered and in the Figure 3-3 Its location in the area of the Project.

[2] Supuesto conservador en relación a lo indicado en el “Informe del Estado del Medio Ambiente 2011”, Capítulo 1.

Table 3-3. Stations MOnitoras.

Station	COord. Utm This	Coord. Utm North	Contaminants
Salina Punta de Lobos	377.221	7.706.012	MP10, not_2, Co SO_2
Maximum Impact point	377,444	7,700,770	MP10, not_2, Co SO_2
Ash Landfill	378,598	7,702,890	MP10

Source: Self-elaboration

Figure 3-3: Location of the EStaciones MOnitoras CDeity of the Tolre.

Source: Self-elaboration – Google Earth

a) Rules of CDeity of the Tolre

The standards applied for the analysis of the results correspond to the air quality standards in force in Chile, whose statistics and established limits are presented in the following table.

Table 3-4. Rules of CDeity of the Tolre.

Parameter	Standard	Unit	Period of application of the standard
Material Particulate Breathable (MP10)	150	Mg/m^3N	98 percentile of the daily arithmetic mean for one year
	50		Triannual arithmetic mean
Material Particulate Breathable (MP2, 5)	50	Mg/m^3N	98 percentile of the daily arithmetic mean for one year
	20		Triannual arithmetic mean
Nitrogen dioxide (NO_2)	400	Mg/m^3N	99 percentile of the hourly arithmetic mean for one year
	100		Triannual arithmetic mean
Carbon monoxide (CO)	30	mg/M^3N	99 percentile of the hourly arithmetic mean for one year
	10		99 percentile of the arithmetic mean of 8 hours for one year
Sulfur dioxide (SO_2)	250	Mg/m^3N	99 percentile of the daily arithmetic mean for one year
	80		Triannual arithmetic mean

Source: Self-elaboration

iv. Results

The sector where the Project It is not inserted or occupies part of areas declared latent or saturated by any contaminants. The following is a summary of the concentrations recorded in the stations considered.

Table 3-5. Summary of Air quality baseline.

Contaminant	Period	Concentration (M g/M^3)			Standard (M g/M^3)
		Salina Punta de Lobos	Maximum Impact point	Ash Landfill	
MP10	P98, 24 hours (2011)	289	41	39	150
	Yearly (2009-2011)	61	24	22	50
MP2 5	P98, 24 hours	145	21	20	50
	Annual	31	12	11	20
No_2	P99, 1 hour (2009-2011)	53	42	---	400
	Yearly (2009-2011)	10	5	---	100
Co	P99, 1 hour (2009-2011)	1,279	1,151	---	30,000

Contaminant	Period	Concentration (M g/M^3)			Standard (M g/M^3)
		Salina Punta de Lobos	Maximum Impact point	Ash Landfill	
	P99, 8 hours (2009-2011)	1,013	764	---	10,000
SO_2[6]	P99, 24 hours (2009-2011)	48	22	---	250
	Yearly (2009-2011)	22	9	---	80

Source: Self-elaboration

v. Conclusions

According to the results of this LOnline of bIt can be concluded that In general The Air quality ofL Coastal Sector Is good, because the primary standards of Air quality of Material Particulate And of the gases for which information is available, With the exception of the Punta de Lobos Salina Station, where the limit established by the concentration standard for material is exceeded Particulate Both in its annual value and 24 hours, in the period 2009-2011.

3.2.1.3 Noise and vibrations

i. Introduction

This document, Contains the Line study Of Base of the Components RUid and vibrations Of Project "*Espejo de Tarapacá*", which is Located Close to La Caleta San Marcos, Región de Tarapacá.

The area definition of INfluencia ADI For The ComponentS Noise and vibrations It is established based on the existence of human settlements that Is Could See Affected by an increase in sound pressure levels and vibrations due to the construction and Operation Of Project.

Because the Phases in study can involve an acoustic impact in the sensitive receivers near the project area, measurements were made of sound pressure level equivalent (Nps_{Eq}) and vibrations, within the ADI of the project, in eight (8) points classified as sensitive receptors. For this we saw the realization of two (2) campaigns of measurements that were carried out on 13 and 14 of November of 2013 and 21 of April of 2014. It is important to mention that the completion of the second campaign is carried out by a modification in the paths of access roads.

With the measurements carried out, a baseline record of the current noise levels and vibrations that are exposed to the Different points distributed in the CErcanías of the site where they Make'sn the Works contemplatedS For each of the PhaseS of the Project.

ii. Objectives

b) Objective GEneral

To obtain a baseline history of the sound pressure and vibration levels in the possible sectors affected by the construction and operation of the Project "*Espejo de Tarapacá*", in the communities close to the layout and facilities of the latter.

c) Objectives ESpecific

- Identify SENSIB receptorsThe future emissions of RUid and vibrations Produced by the ProjectGiveOf the area of influence (Sensitive sectors more Nearby).
- Perform equivalent sound pressure level measurements (Nps_{Eq}) and Vibration level[3] (L_V) in the points catalogAs sensitive receptors, Before the execution In the Phases construction, Operation and close this one.

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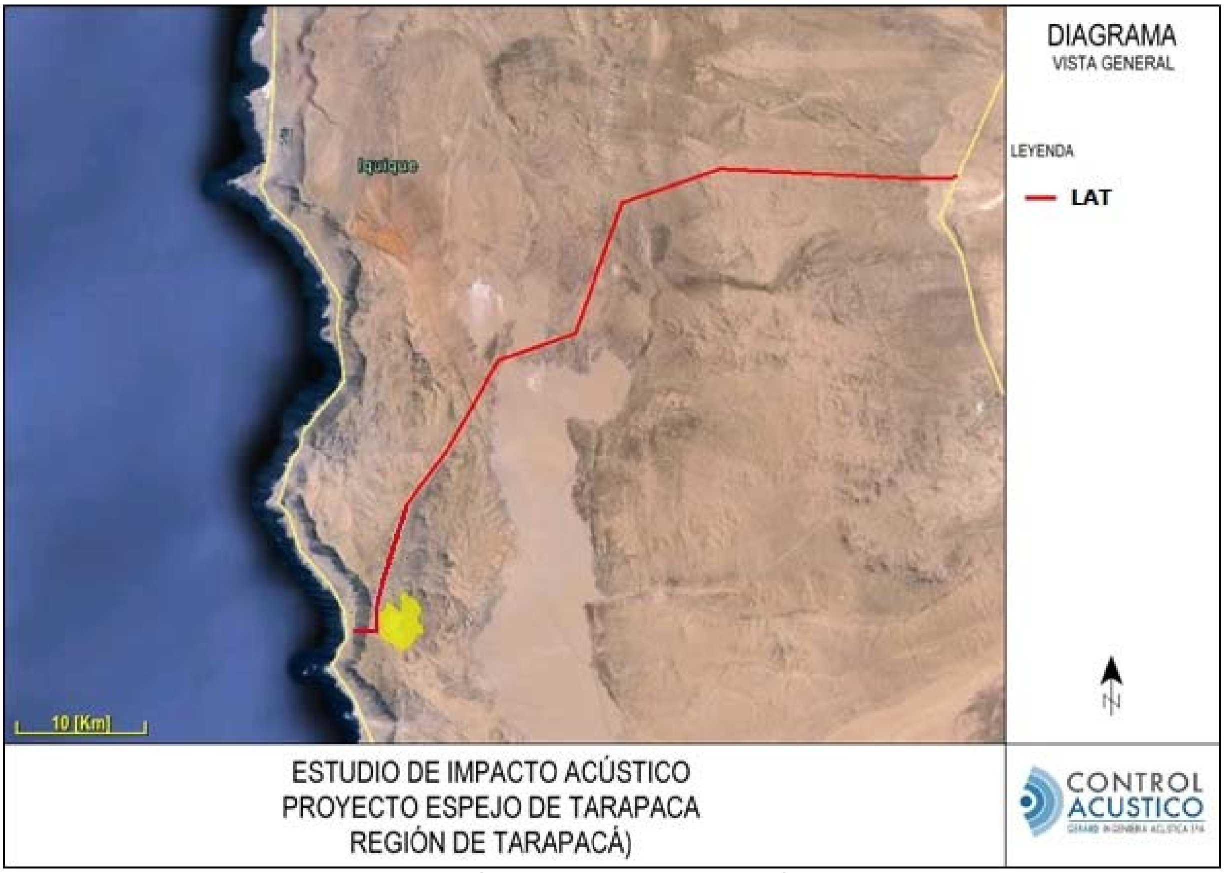
[3] L_V "*Level of Vibration*" (Nivel de Vibración)

- Establish the maximum permissible values stipulated in Supreme Decree No. 38/2011 of the Ministry of the Environment (DS N ° 38/2011 of the MMA).

iii. UCation and DTranscription of the Project

The Project It is located in the vicinity of Caleta San Marcos, about 100 km south of Iquique. This consists of The construction and operation of A hydraulic pumping plant, for the storage of electrical energy of the large North interconnected system (SING). In the Figure 3-4 Is Shows the location of the Project and its close surroundings.

Figure 3-4. Location of the project.



Elaboration: Gerard Acoustic Engineering Spa 2013.

iv. RegulationsS

d) Noise

Decree Supreme N º 38/2011 of the Ministry of the Environment (MMA)

The D. S. N º 38/2011 of the MMA, was published in the Official Journal of the Republic of Chile on June 12, 2012. The objective of this regulation is to protect the health of the community by establishing maximum levels of noise emission generated by the issuing sources such as productive, commercial, recreational and service activities, constructive tasks and Infrastructure elements that generate noise emissions to the community. They exclude from this, the circulation through networks of transport infrastructure (vehicular traffic, railway and maritime) air traffic, own activities of the residential use, systems of alarm and blasting.

This Regulation shall enter into force two (2) years after its publication in the Official journal. Without prejudice to the foregoing, Projects that enter the environmental Impact Assessment Service (SEIA) after its publication date, this standard will be applicable.

The measurements of the sound levels shall be carried out in accordance with article 16, where it is noted that the measuring equipment shall be located if possible, between 1.2 and 1.5 meters above the level of the floor and at 3.5 meters or more of any reflective structure in case of external measurements, and 1 metre or more of walls and approximately 1.5 meters of windows, in case of internal measurements.

The boundaries Maximums allowed by this regulation are associated with zoning according to the respective Territorial planning instrument (IPT). The Table 3-6 Presents the definitions for each zone:

Table 3-6. Description of USOS de SLure QErmitidos QAra CAda YouPo de ZOna.

Type of Zone	Description
Zone I	That area defined in the respective Territorial planning instrument and located within the urban boundary, which permits exclusively use of residential land or this use of soil and one of the following land uses: Public space and/or green area.
Zone II	That area defined in the respective Territorial planning instrument and located within the urban boundary, which also permits the use of zone I, equipment on any scale.
Zone III	That area defined in the respective Territorial planning instrument and located within the urban boundary, which allows in addition to the land uses of zone II, productive and/or infrastructure activities.
Zone IV	That area defined in the respective Territorial planning instrument and located within the urban boundary, which permits only land uses of productive and/or infrastructure activities.
Rural Area	That located outside the urban boundary established in the respective planning instrument.

Source: Supreme Decree No. 38/2011 of the Ministry of the Environment (MMA).

The corrected pressure levels (NPC) obtained from the emission of a noise-emitting source, measured in the place where the receiver is located, shall not exceed the values presented in the following table, COrrespondientes to the area where the receiver is located:

Table 3-7: Maximum permissible levels according to the decree Supreme N º 38/2011 MMA.

Type of Zone	Corrected sound pressure level (NPC). Maximum allowed [DB (A)]	
	Daytime period 7:00 to 21:00 hours	Night Period 21:00 to 7:00 hours
Zone I	55	45
Zone II	60	45
Zone III	65	50
Zone IV	70	70
Rural area	Lower level between background noise level + 10 [DB], and maximum NPC allowed for zone III	

Source: Supreme Decree No. 38/2011 of the Ministry of the Environment (MMA).

The criterion for rural areas will be applied in a day and night period independently.

e) Vibrations

FTA-VA — 90-1003-06 "Transit Noise and Vibration Assessment"

This regulation of Lto Federal Administration From TráTransit FTA of the United States, It regulates public transport systems and establishes a criterion for evaluating vibration levels associated with vehicular and underground rail traffic.

This standard identifies two (2) types of vibration impact, the first refers to the discomfort criterion, while the second to the damage criterion. The "annoyance" criterion is related to the vibration levels transmitted by soil whose influence and perception can generate "annoyance" in the affected humans. The evaluation indicators are based on the RMS vibration velocity, which has shown a better correlation with respect to the vibration sensitivity in the human body. Vibration speed Levels L_V are expressed in decibel units [DB] referenced to 1 [MIn/s] or with a V fighting shield to DB [Vdb]. In general, the human perception threshold is 65 [Vdb]. The nuisance criterion in turn is subdivided into a "General" criterion and a "detailed analysis". The general FTA criterion considers the number of daily vibratory events and classifies them into frequent, occasional and infrequent events.

- "Frequent events" are defined when more than 70 events occur per day.
- "Occasional events" are defined, when between 30 and 70 events per day occur.
- "Uncommon events" are defined when less than 30 events occur per day.

The evaluation indicators for the "General" discomfort criterion are presented in the Table 3-8 And different limits are established according to types of land uses, which are classified in: highly sensitive, residential and institutional.

Table 3-8: Impact criterion of VIbraciones transmitted on the ground.

Category Land use	Vibration impact Level [L_V] (Vdb Ref: 1 M in/s)		
	Frequent events[1]	Occasional events[2]	Unusual events[3]
Category 1: Buildings where are essential low vibration environments for internal operations (hospital Instrumental, research labs, Etc.)	65[4]	65[4]	65[4]
Category 2: Residences or buildings where people usually sleep.	72	75	80
Category 3: Primarily daytime institutional land uses (schools, churches, Etc.)	75	78	83

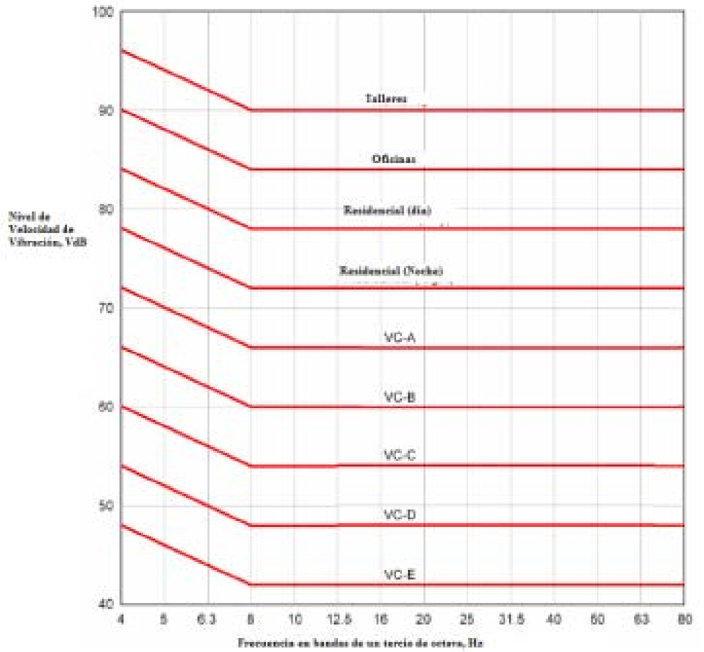
Notes:

[1] "Frequent events" is defined as events that occur over 70 events/day
[2] "Occasional events" are defined between 30 and 70 events/day
[3] "Uncommon events" are defined as events with an occurrence less than 30 events/day.
[4] This criterion is based on limit levels that are acceptable for moderately sensitive equipment such as optical microscopes. Vibration-sensitive manufacturing buildings should be evaluated with a more detailed analysis of levels. Ensuring low vibration levels within the same building requires a special design of ventilation and extraction systems.

Source: FTA.

The "Detailed analysis" criterion establishes that the evaluation indicators are established considering the RMS speed level [Vdb], without weighting and in a frequency range of 1-80 [Hz]. In the Figure 3-5 The impact curves proposed by the FTA are shown.

Figure 3-5. Impact criterion for detailed vibration analysis.



Source: FTA.

In relation to the "damage criterion", the FTA claims that it is exceptionally rare that the vibrations resulting from traffic and trains cause damage to buildings, including some kind of cosmetic damage. In addition, it claims that some kind of damage is unlikely to occur from vibrations, except when rail alignment occurs very close to building structures. The evaluation values established by the FTA for the least structural damage are 100 [Vdb] For fragile buildings and 95 [Vdb] for historic fragile buildings.

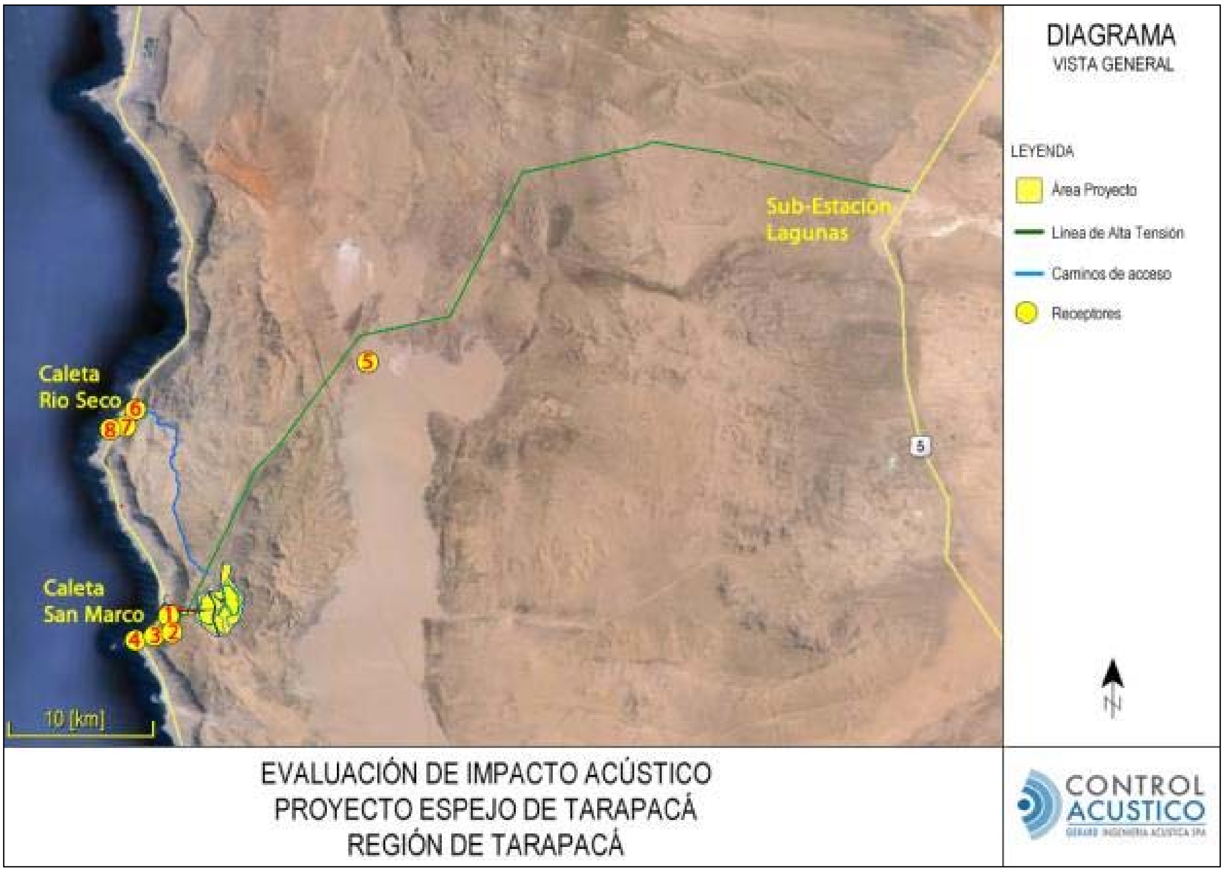
v. Measuring points

f) Location of QPoints MEdition

The location and description of the noise measurement points are then delivered And Vibrations.

The measuring points were selected according to the proximity with The future Noise generating sources and VIBRations within the area of influence of the Project, For the Phases construction, Operation and closing.

Figure 3-6. Location of the Points MEdition. View GEneral.



Elaboration: Gerard Acoustic Engineering Spa 2013.

Table 3-9. Location and DTranscription of QPoints MEdition.

Point	Description	Height [m]	Effective use	UTM coordinates Datum WGS 84 Spindle 19S	
				This	North
1	2-storey house located on the east side of Route 1, Caleta San Marcos.	1.5-4.0	Residential	383662	7665487
2	1-storey house located on the east side of Route 1, Caleta San Marcos.	1.5	Residential	383728	7665116
3	2-storey house located on the east side of Route 1, Caleta San Marcos.	1.5-4.0	Residential	383656	7664989
4	1-floor apartment located on the west side of Route 1, Caleta San Marcos.	1.5	Residential	383331	7664795
5	Offices and workshop owned by Mina Ternardita, Route A-750 Km 33 approx.	1.5	Industrial	396028	7683437

Note: coordinates obtained in terrain.

Below are pictures of the noise and Vibracio measurement pointsObtained in the B line campaignAse.

Figure 3-7. Photographs of the QPoints MEdition of RUid And VIbraciones.

Point 1

Point 2

Point 3

Point 4

Point 5

g) Zoning QPoints MEdition

All points are outside Of the urban area of the commune of Iquique, Therefore it is approved to Rural area according to D. S N º 38/2011 of the MMA.

In the Table 3-10 is presented A summary of The homologations corresponding to each measuring point:

Table 3-10. Zoning and NIveles MÁximos QErmisibles by NPC (DS No. 38/2011. MMA)For CAda QUnto.

Measuring point	Zoning according to DS N º 38/11 of the MMA	Daytime period	Night Period
		Maximum NPC allowed [DB (A)]	Maximum NPC allowed [DB (A)]
1 to 8	Rural Area	Lower level between background noise level + 10 [DB], and maximum NPC allowed for zone III	

Source: Self-elaboration

The table above shows that for both evaluation periods the maximum permissible levels will be set according to the lowest value between background noise level + 10 [DB], or the maximum permissible value for zone III. These values apply to the sources of noise defined in article 6, point 13 of DS No. 38/11 of the MMA.

vi. Methodology

h) Noise

- Between the 13th and 14th of November 2013 measurements of sound pressure level (NPS) were carried out in [DB (A)] slow, in daytime and night time, according to the applied norms. This was done at the points established as sensitive receivers near the future Project.
- To define the area of influence is considered the surface where you can see the population affected by the future emissions of Project, then the closest points are selected and a sufficient number of them are determined to encompass the whole of the evaluated sector. In this way five (5) measuring points were determined, which correspond to the sectors closest to the location of the Project.
- The duration of each noise measurement was subject to the difference shown in the values recorded every 5 minutes, until the reading is considered as stable (lower difference or equal That 2 [DB (A)] between each reading), according to the measurement procedure established in DS No. 38/2011. MMA.

- The Sonometer was located at 1,5 [m] on its vertical axis of the soil and, as far as possible, to 3,5 [m] of any reflective surface on its horizontal axis (walls, walls, windows).
- For the measurements an integrated Sonometer was usedAveraging Brand Larson Davis, model 831 Configured as type I (class I) according to IEC 61672-1:2002. The instrument was properly calibrated On the ground by the operator. In the Annex 3.1 Is They deliver the calibration certificates of each equipment used.

i) Vibration

- Vibration measurements were carried out at the same proposed points for noise, obtaining a Total of five (5) nearby points to the area Of Project.
- For the realization of the vibration logs, the stipulation of the FTA-VA-90-1003-06 was taken as a reference. Transit Noise and Vibration Assessment In the Federal Transit Administration FTA Of the United States, which stipulates in Chapter 11, point 1, the characterization of existing conditions of vibration.
- In this way, to document the environmental levels existing in the points mentioned above, a measurement was made for a continuous period of between 10 to 30 minutes, obtaining an average representative of the vibratory characteristics of each sector.
- The records obtained correspond to the level of aCeleración (Na) on [Db], Using FFT (Fast Fourier Transform) with window type Hanning, between 1 [Hz] and 100 [Hz], which are Transform To values of Speed VErP ticalArtícula (VVP) in [mm/Sec].

To obtain the particle velocity per frequency band The formula is used:

$$v = \frac{a}{2\,\pi\,f}$$

The Speed level ($Lv_{\text{Ref 1 [Microinch/s]}}$) is defined as:

$$Lv_{ref\frac{\mu\,pulgada}{s}} = 20\,log\left(\frac{v}{v_{ref}}\right)\;\;[dBv]$$

Where:

v : Speed in $\left[\frac{\mu\,pulgada}{s}\right]$

v_{ref} : Reference speed $\left(v_{ref} = 1\left[\frac{\mu\,pulgada}{s}\right]\right)$

- The measuring points were located outside the buildings identified as sensitive receptors. In cases where natural support points existed in the vicinity of the evaluated point, they were measured on these by applying wax to the respective support. On the other hand, in cases that did not have a natural support, the transducer was installed in a magnetized upright on a metal stake Inserted into the Earth.
- For the records a re-time analyzer was usedto the Mark Larson Davis Model 831 In conjunction with a vibration measuring kit.

vii. Results

j) Measurements of RUid

In this section the sound pressure level (NPS) values are given for all the points described above, and the main sources of noise present at the time of sampling are mentioned.

Daytime period

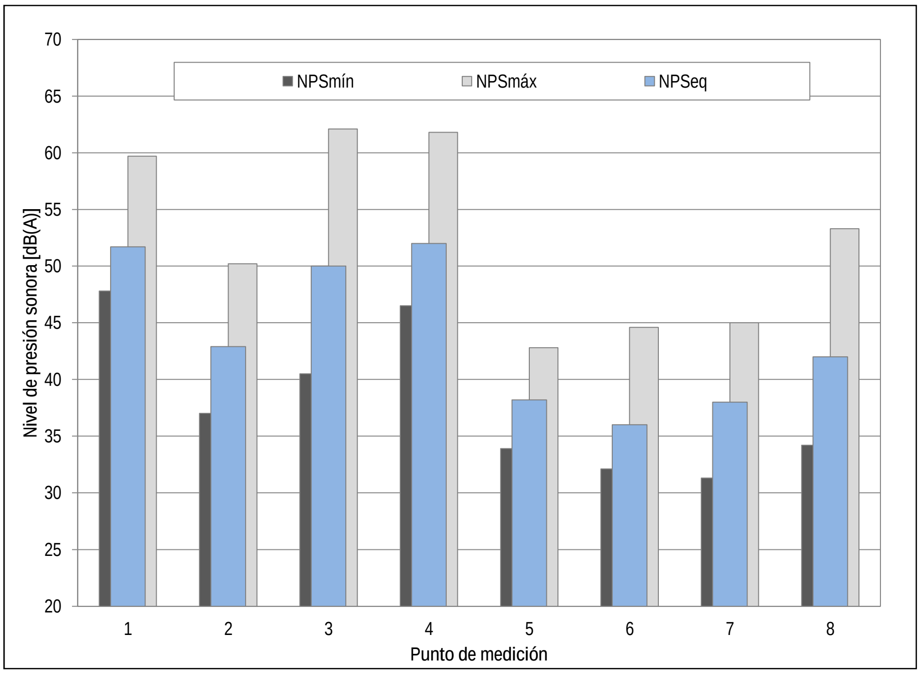
The following are given the values of Nps_{Eq} For the daytime period recorded during the campaign of baseline measurements, and the noise sources associated with them are described. At the time of the measurements the meteorological conditions were stable where the average temperature was 23 [º C] and wind speeds no higher than 2.7 [m/Sec]. In the Annex 3.1 The detail of each measurement carried out is given.

Table 3-11. Values of NpsIn [DB (A)]-Slow and FEffluent RUid QResents in the MEdition. Period DIurno.

Point	Daytime period			Noise sources	Measuring time
	Nps_{Eq} [DB (A)] *	Nps_{Min} [DB (A)]	Nps_{Max} [DB (A)]		
1	52	47.8	59.7	Swell, gulls, light wind, light and heavy vehicular traffic by Route 1.	12:05
2	43	37.0	50.2	Swell, gulls, light wind, home noise and light and heavy vehicular traffic by Route 1.	12:55
3	50	40.5	62.1	Swell, gulls, light wind and light and heavy vehicular traffic by Route 1.	13:20
4	52	46.5	61.8	Waves, gulls, light wind, fishing noise and vehicular traffic by Route 1 far away.	14:20
5	38	33.9	42.8	Noise from the mines inside the mine Tenardita.	17:15
6	36	32.1	44.6	Slight swell, vehicular transit by Route 1 far away and slight wind.	12:35
7	38	31.3	45.0	Vehicular transit by Route 1 and slight swell.	12:58
8	42	34.2	53.3	Vehicular transit by Route 1 and slight swell.	13:37

* Approximate value to the nearest integer.

Figure 3-8. Graphic Sound pressure levels NPS REgistrados In HOrario DIurno.



Elaboration: Gerard Acoustic Engineering Spa 2013.

As you can see in the Table 3-11 And The Figure 3-8 The equivalent sound pressure levels (Nps_{Eq}) for points 1, 3 and 4 show great stability, presenting variations of up to 2 [DB (A)] between them.

Points 6 to 8 show similar values between them noticing a small increase in the levels depending on the distances that they maintain to the sea and to the Route 1. Point 5 is where lower levels are present, and is due to their remoteness from sources with high noise levels such as high-traffic routes. The maximum levels are because of the tasks inside the Salt mine "Tenardita"And the minimums as in the other points are attributed to the noise caused by the action of the Wind.

Night Period

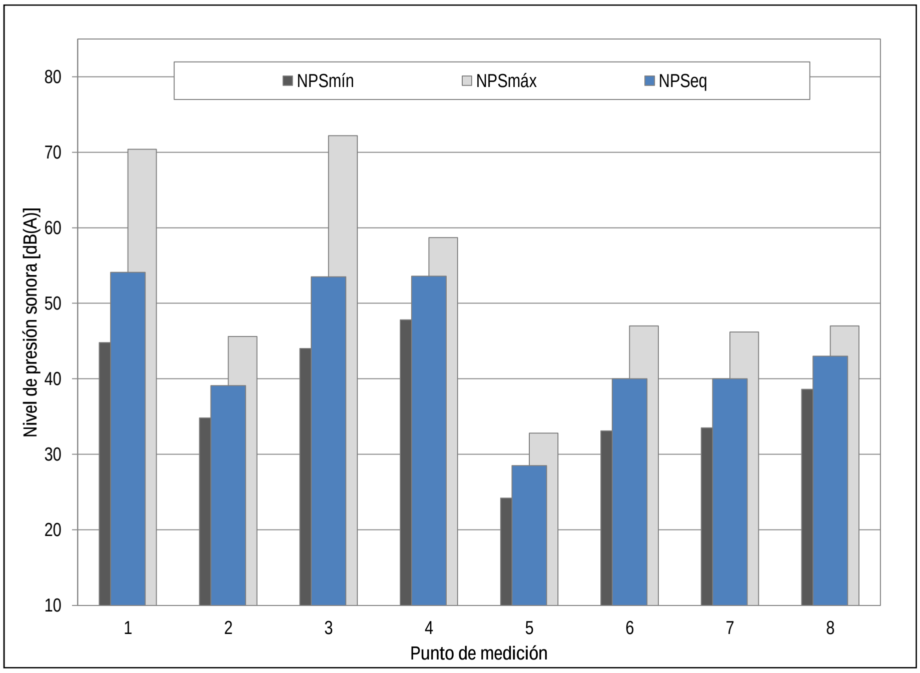
LTo Table 3-12 And Figure 3-9 Show the values for the night period of Nps_{Eq} Recorded during the measurement campaign and the noise sources associated with them. At the time of the measurements the meteorological conditions were stable having an average temperature of 17 [º C] and wind speed of 2.5 [m/Sec] During the night period. In the Annex 3.1 The detail of each measurement carried out is given.

Table 3-12: Values of NpsIn [DB (A)]-Slow and FEffluent RUid QReSentes in the MEdition. Period NOcturno.

Point	Night Period			Noise sources	Measuring time
	Nps_{Eq} [DB (A)] *	Nps_{Min} [DB (A)]	Nps_{Max} [DB (A)]		
1	54	44.8	70.4	Swell, poultry and truck transit Route 1.	23:40
2	39	34.8	45.6	Waves, distant gulls and transit of trucks by route 1.	0:10
3	54	44.0	72.2	Waves, gulls and transit of trucks by route 1.	0:50
4	54	47.8	58.7	Swell, truck Transit by Route 1 far away.	1:20
5	29	24.2	32.8	Light wind.	2:30
6	40	33.1	47.0	Slight swell, vehicular transit by Route 1 sporadically.	22:51
7	40	33.5	46.2	Slight swell, vehicular transit by Route 1 sporadically.	23:18
8	43	38.6	47.0	Slight swell, vehicular transit by Route 1 sporadically.	23:46

* Approximate value to the nearest integer.
Source: Self-elaboration

Figure 3-9. Graphic Sound pressure levels NPS REgistrados In HOrario NOcturno.



Elaboration: Gerard Acoustic Engineering Spa 2013.

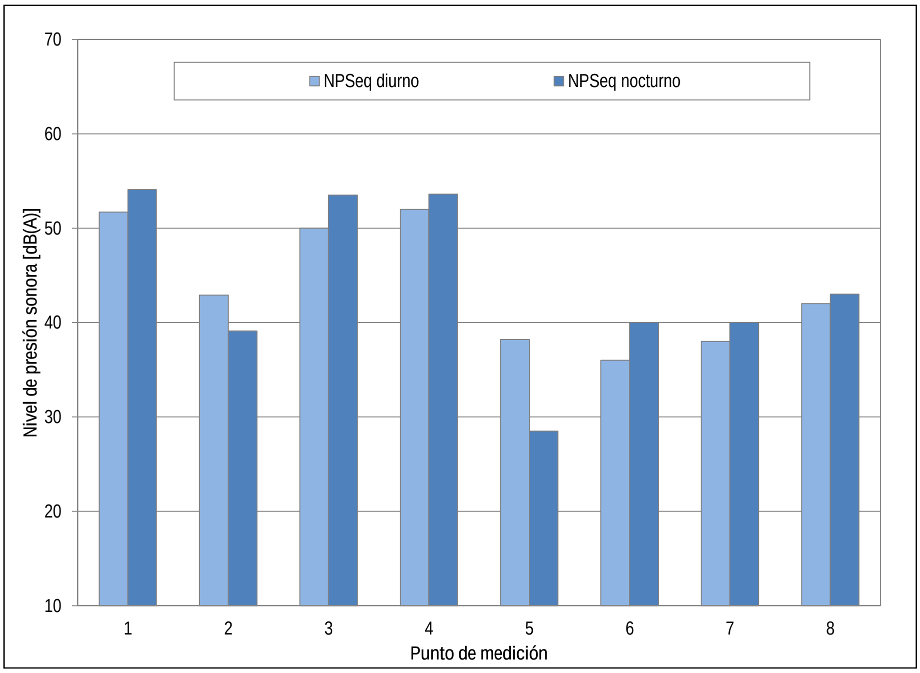
In the Table 3-12 And Figure 3-9, the equivalent sound pressure levels (Nps_{Eq}) Obtained have a similar behavior to the diurnal period, the minimums are attributable to the noise caused by the action of the wind, while the maximums are cause of the swell, gulls and mainly to the transit of trucks by route 1.

Points 6 to 8 have similar values, as they present similar acoustic conditions. Point 5 is where the lowest values are presented and because in this period there are no tasks inside the mine Tenardita. The maximum and minimum, at this point, values correspond to different wind speeds present at the time of measurement

Comparison between measurement periods

In The Figure 3-10 A comparison is presented Among the Sound pressure levels obtained for the Daytime and nocturnal Periods, Where you can appreciate The Level differences Between the two periods.

Figure 3-10. Graphic N comparisonlveles QResion SOnora OrBtenidos DUran the QEriodos DIurno and NOcturno.



Elaboration: Gerard Acoustic Engineering Spa 2013.

In the Figure 3-10 Shows that The levels obtained in the daytime and nocturnal periods, For points 1.3, 4, 6, 7 and 8 They are relatively stable but with a slight rise in the night period, this due to the rise of the mareA and the swell during the night.

Point 5 The one that has the biggest difference between the two periods, noting a drop in the night period because there are no tasks inside the mine next to the lower ACTividad human in the sector.

k) Measurement of VIbraciones

In the following table Is Present The vibration values obtained In Each point, in Day and night period. The results obtained show EL Speed Level (Lv) and The Vertical particle speed (VVP).

Table 3-13. Values of VElocidad QArtículas and NIvel VElocidad SEgun QEriodo MEdition.

Point	Daytime period		Night Period	
	VVP, [mm/Sec]	Lv, [Vdb]	VVP, [mm/Sec]	Lv, [Vdb]
1	1.02 e-02	52.1	9.60 E-03	51.5
2	1.01 e-02	52.0	9.99 E-03	51.9
3	1.01 e-02	52.0	9.92 e-03	51.8
4	1.02 e-02	52.1	9.76 E-03	51.7
5	1.01 e-02	52.0	1.00 e-02	51.9
6	2.05 e-02	58.1	1.34 e-02	54.4
7	1.30 e-02	54.2	1.52 e-02	53.2
8	E-02-1.99	56.0	1.17 e-02	53.2

Source: Self-elaboration

All the values obtained correspond to the natural vibrations of the soil in each sector, without the existence of external sources that could affect the registers. On the other hand, It can be determined that for all points the recorded values are below the perception threshold defined in the FTA-VA-90-1003-06 regulation which is 65 [Vdb].

l) Maximum QErmitidos

The maximum limits defined for each sampled point are presented in the present section. These values are determined according to the limits established in D. S. N º 38/2011 of the MMA, in relation to the type-approval described in the section g).

In the Table 3-14 The maximums allowed for each sampled point are delivered.

Table 3-14. Levels MÁximos QErmisibles by NPC (D. S. N º 38/2011. MMA).

Measuring point	Zoning according to DS N º 38/2011 of the MMA	Daytime period		Night Period	
		Baseline level Nps_{Eq} [DB (A)] *	Maximum NPC allowed [DB (A)]	Baseline level Nps_{Eq} [DB (A)] *	Maximum NPC allowed [DB (A)]
1	Rural Area	52	**62**	54	**50**
2		43	**53**	39	**49**
3		50	**60**	54	**50**
4		52	**62**	54	**50**

Measuring point	Zoning according to DS N ° 38/2011 of the MMA	Daytime period		Night Period	
		Baseline level Nps_{Eq} [DB (A)] *	Maximum NPC allowed [DB (A)]	Baseline level Nps_{Eq} [DB (A)] *	Maximum NPC allowed [DB (A)]
5		38	48	29	**39**
6	Rural Area	36	46	40	50
7		38	48	40	50
8		42	52	43	50

* Approximate value to the nearest integer.
Source: Self-elaboration

In the Table 3-14 It is appreciated that for the daytime period the maximum allowed varies between 46 And 62 [DB (A)], while for the night period these vary between 39 And 50 [DB (A)].

It can also be seen that the values obtained in the night period exceed the maximum levels allowed for points 1, 3 and 4, mainly due to the transit of trucks by route 1.

viii. Conclusions

Between 13 and 14 November 2013 And April 21, 2014 Baseline sound pressure and vibration level measurements were made in sensitive sectors near the site of the Project "*Espejo de Tarapacá*", which is Located Near to Caleta San Marcos, Región de Tarapacá, Obtaining five (5) sampling points of noise and vibrations that fully characterize these sectors.

The main sources of noise detected at the time of the measurements correspond to the noise Produced by wild birds, vehicular traffic on Route 1 and the breaking of the waves.

The values obtained vary between 36 And 52 [DB (A)] for the daytime period and between 29 And 54 [DB (A)] for the night period, presenting Only significant differences in point 5.

According to the values obtained from baseline and to the limits established in DS No. 38/2011 of the MMA for each evaluation point, the maximum permissible levels vary between 46 and 52 [DB (a)] for daytime and between 50 and 39 [db (a)] for night period.

In addition, basal vibration measurements were carried out during the same periods of measurement, which represent the characteristic conditions of each zone, not observing external events that influence the records. On the other hand, it can be determined that the records obtained for all the evaluation points are below the threshold of perception defined in the FTA-VA-90-1003-06 regulation which is 65 [Vdb].

Finally, these measurements faithfully represent the sound and vibrating environment of the sector and can be used in future evaluations where basal levels of noise and vibration are required.

ix. References

- IEC 61672-1:2002, electroacoustic – Sound Level meters – Part 1: Specifications.
- MMA Decree No. 38/2011: Sets generated noise standard for sources indicating, elaborated from the revision of the Decree n ° 146, of 1997, ministry Secretary General of the Republic.
- U.S. Federal Transit Administration report, Transit Noise and Vibration Impact Assessment, Edition May 2006.

x. Glossary

- **Decibel [DB]:** dimensionless unit used to express 10 times the logarithm of the ratio between a measured amount and a reference quantity.
- **Decibel to [DB (A)]:** It is the dimensionless unit used to express the sound pressure level, measured with the frequency weighting filter A.
- **Decibel c [DB (c)]:** It is the dimensionless unit used to express the sound pressure level, measured with the C frequency weighting filter.
- **Noise-emitting source:** Any activity, process, operation or device that generates, or can generate, noise emissions to the community.
- **Sound pressure level (NPS Or L_Q):** It is expressed in decibels [DB] and is defined by the following mathematical relation:

$$NPS = 20 \cdot \log_{10}\left(\frac{P_1}{P}\right)$$

Where:
P_1: Effective value of measured pressure
P : Effective value of the reference sound pressure, set at 2 × 10^{-5} [N/M^2]

- **Equivalent continuous sound pressure level (NPSeq, Or Leq):** It is that level of constant sound pressure, expressed in decibels A, which in the same time interval, contains the same total energy (or dose) as the measured noise.
- **Maximum sound pressure level (Nps_{Max}):** It is the highest NPS recorded during the measurement period, with slow response.
- **Minimum sound pressure level (Nps_{Min}):** is the NPS Lower recorded during the measurement period, with slow response.

- **Corrected sound pressure level (NPC):** Is that equivalent continuous sound pressure level, which resuLte To apply the measurement procedure and the corrections defined in DS N ° 38/2011 of the MMA.
- **Receiver:** Any person who lives, resides or remains in an enclosure, either a particular domicile or a workplace, which is or may be exposed to noise generated by an external noise-emitting source.
- **Slow response:** It's the Temporary response of the measuring instrument evaluating the average energy in a 1 second interval. When the instrument measures the sound pressure level with slow response, this level is called slow NPS. If the weighting filter A is also used, the level obtained is expressed in [DB (A)] slow.

3.2.1.4 Electromagnetic fields

i. Objectives

The purpose of this work is to present the measurements of the electrical field and of the magnetic field of existing industrial frequency prior to the installations of the project, to define the baseline in the populated sectors of Caleta San Marcos and Río Seco, and in the sector of Adduction. The characterization of the baseline is intended to document the situation prior to the execution of the project in the area of influence.

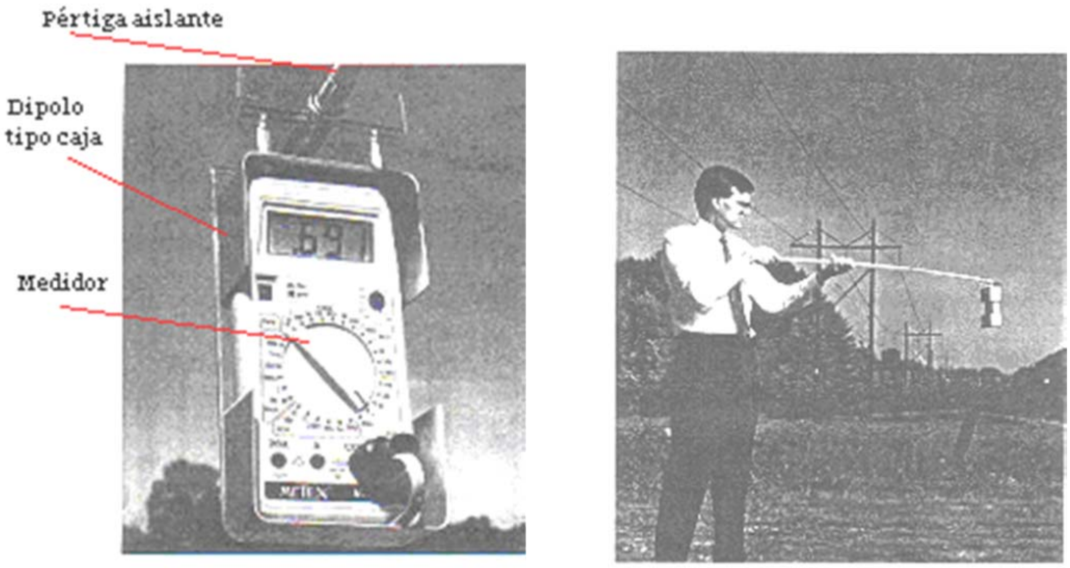
The measures were carried out on Sunday 27 April 2014, between 11:00 and 12:45 HPray. During the period of measurement, the climatic conditions were characterized by stable time, with pleasant temperature and little wind. The only source of electromagnetic fields detected, common to all the points of measurement, corresponds to a transmission line in medium voltage by means of which it is AbasTece of energy to the villages.

ii. Methodology

The electric field generated by high voltage installations, by the conductive nature of the industrial frequency terrain and the typical air conductors ' heights, is perpendicular to the terrain to an approximate height of 2 meters, so it is only necessary To know the vertical component of the electric field. The dipole box-type meters are designed with the dipole in a vertical direction. The value of the undisturbed electric field (i.e. the field that would exist in the absence of persons or objects) should be used; Also the human body is conductive, so that one is used Insulating Értiga to hold the measuring equipment avoiding altering the natural field.

The probe or electric field sensor, defined as "free-bodied", consists of a dipole shaped rectangular boxes, with dimensions of 7 by 20 centimeters. The detector is a digital voltmeter. The meter is calibrated to read the RMS value of the industrial frequency electrical field long from an electrical axis. The probe and the detector are inserted in the electric field with an insulating handle as the observer must be far enough away from the probe to prevent his own body proSummon disturbances of the field.

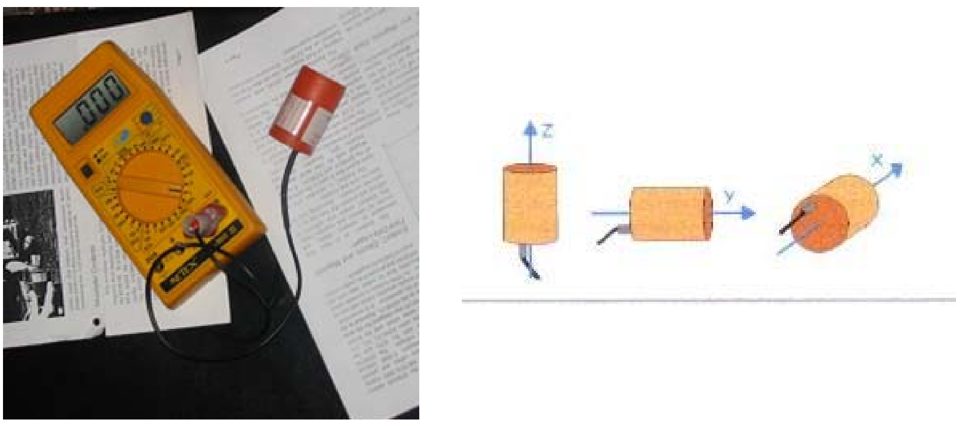
Figure 3-11. Meter and DIpolo DEtector CAmpo EElectrical USo of QÉrtiga ToInsulator Around.



On the contrary, the human body and the terrain are absolutely permeable to the magnetic field, so it is not necessary to isolate the magnetic probe, but if you need to know the three components of the field and evaluate VectorialmenYou the magnitude of the induction.

The magnetic field meter also consists of two parts, the probe or field sensor element and the meter, which processes the probe signal and indicates the RMS value of the magnetic induction on a digital display. The magnetic induction probe consists of an electrically shielded coil (Uniaxial sensor element) and resin-soaked.

Figure 3-12. Meter and Sensor UNixial CAmpo MAgnético at TBeef DIrecciones.



Source: Self-elaboration

The measurements are Complied with IEEE standard 644-1994[4]. The procedure established by the standard indicates that the fields should be measured 1 metre high above ground level. For the electric field, the probe is oriented to read the vertical component of the electric field. For the magnetic field the single-axis probe sensor modifies its position to measure in alternation in all three directions.

m) Sector Costa – Caleta San Marcos

The first set of measures was taken in the town of Caleta San Marcos, to the south exit of the town; The measures were carried out in the direction Poniente-Oriente, crossing the line and the inner road, as shown by the Figure 3-13.

Figure 3-13. Trajectory and sense of measure, Caleta San Marcos.

Source: Self-elaboration – Google Earth

n) Coast-Dry River Sector

The last set of measures was taken in the village of Rio Seco, at the north exit of the village; The measurements were carried out in the direction Poniente-Oriente, crossing the line from the berm of the main road, as shown in the following figure.

[4] IEEE Standard 644-1994 "IEEE Standard Procedure for Measurements of Power Frequency Electric and Magnetic Fields from AC Power Lines".

Figure 3-14. Trajectory and sense of measure, dry River.

Source: Self-elaboration – Google Earth

o) Underground Works Sector

The underground works sector is located about 550 m north of the San Marcos Cove, as shown by the Figure 3-15; The trajectory of measurement is from west to east, from the berm Orient of Route 1 to InterIOR, parallel to the marine takeover.

Figure 3-15. Underground works Sector and Electro-magnetic field measurement.

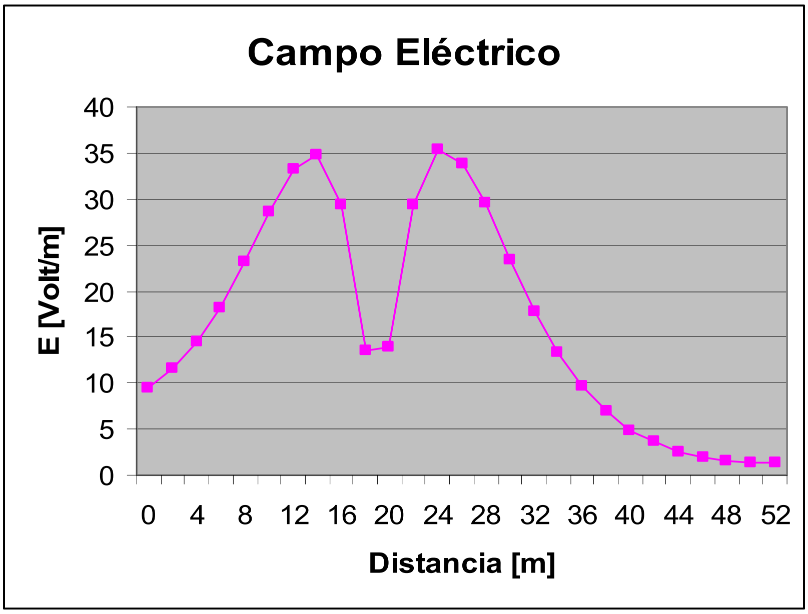
Source: Self-elaboration – Google Earth

iii. Results

p) Sector Costa – Caleta San Marcos

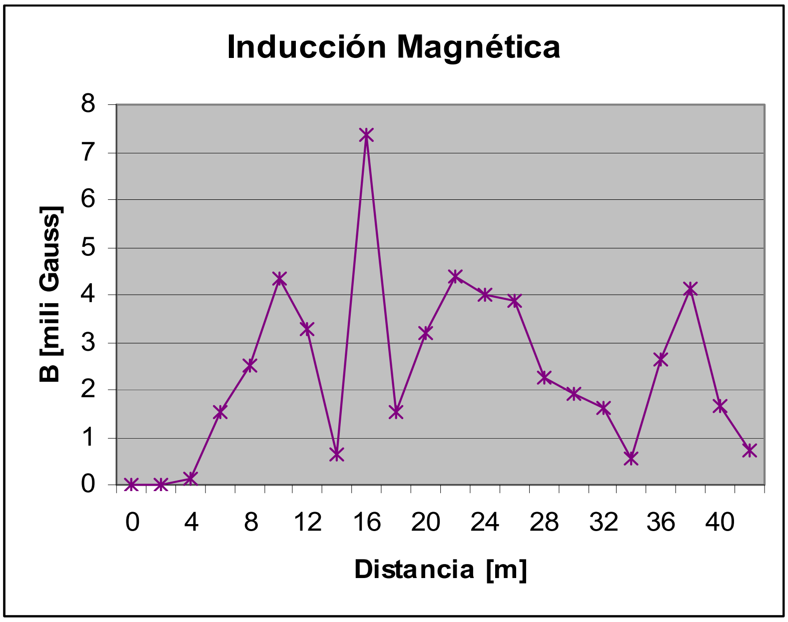
The measured values are shown in the graphs of the following figures:

Figure 3-16. Magnitude of CAmpo EElectrical MEdido at CFin San Marcos.



Source: Self-elaboration

Figure 3-17. Magnitude of magnetic induction measured in Caleta San Marcos.



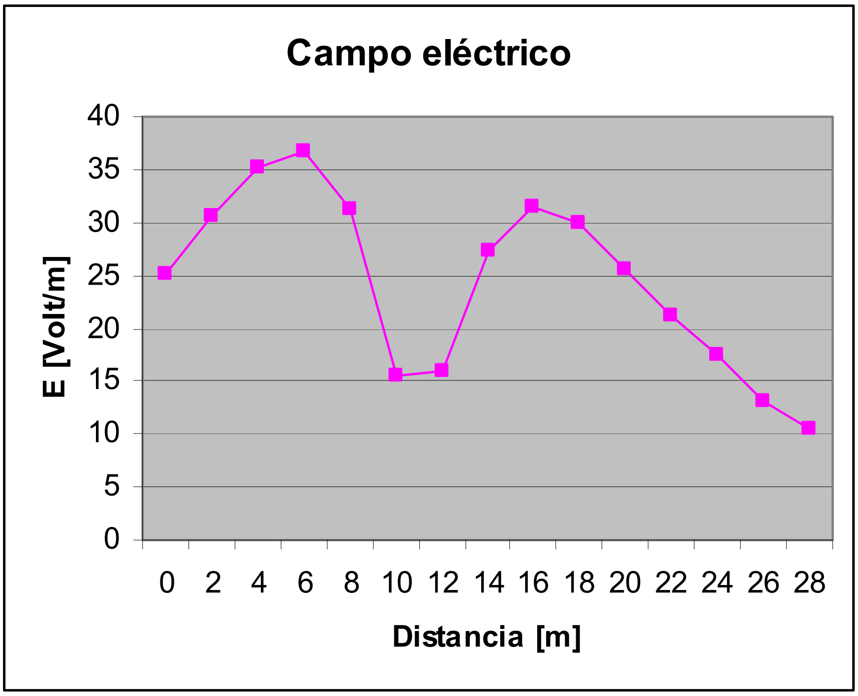
Source: Self-elaboration

- LElectric field Maxima are presented On both sides of the line; The maximum magnitude measured is 35.40 [Volt/M]; As it moves away from the line, the field decreases rapidly, so that at 20 m from the line axis, it is reduced to less than 10 [Volt/m]
- LA magnetic induction presents values with great dispersion; Since the magnetic field is produced by the current by the line, it means variability of consumptions; The maximum measured value was 7.38 [Mili Gauss]

q) Coast-Dry River Sector

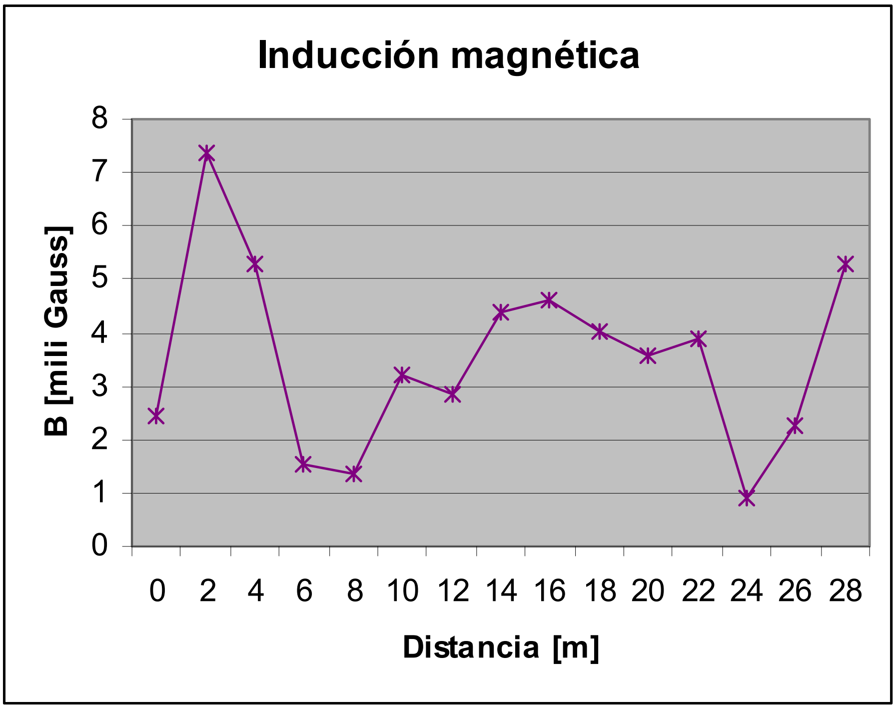
The measured values are shown in the graphs of the following figures:

Figure 3-18. Magnitude of CAmpo EElectrical MEdido at SEctor Dry River



Source: Self-elaboration

Figure 3-19. Magnitude of INducción MAgnética MEdida at SEctor ToProduction



Source: Self-elaboration

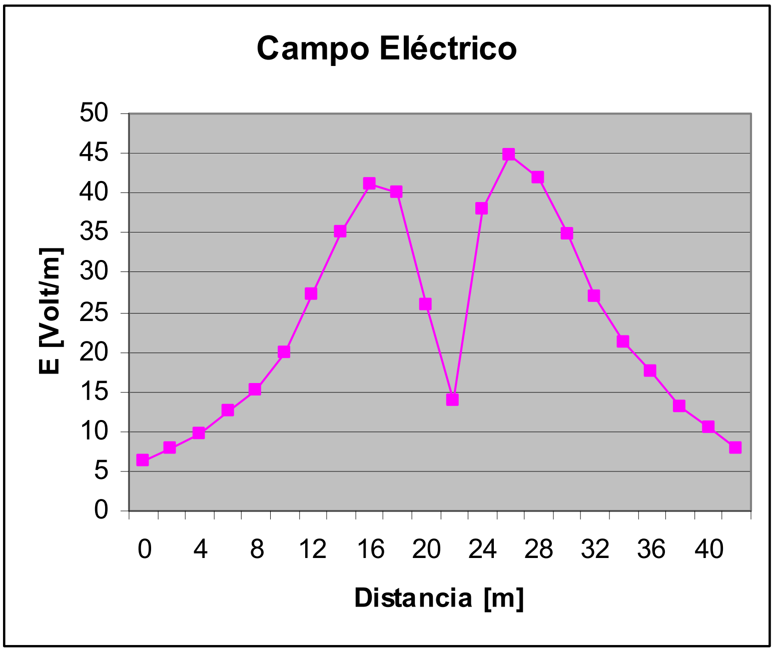
Guest reviews:

- The electrical field profile tends to be similar to the previous ones, however in this case it is affected by nearby buildings that produce a field attenuation, reaching a maximum value of 36.70 [Volt/M]; As they move away from the line, towards the buildings, the field now decreases faster.
- LA magnetic induction again presents values with great dispersion; The maximum measured value was 7.38 [Mili Gauss].

r) Underground Works Sector

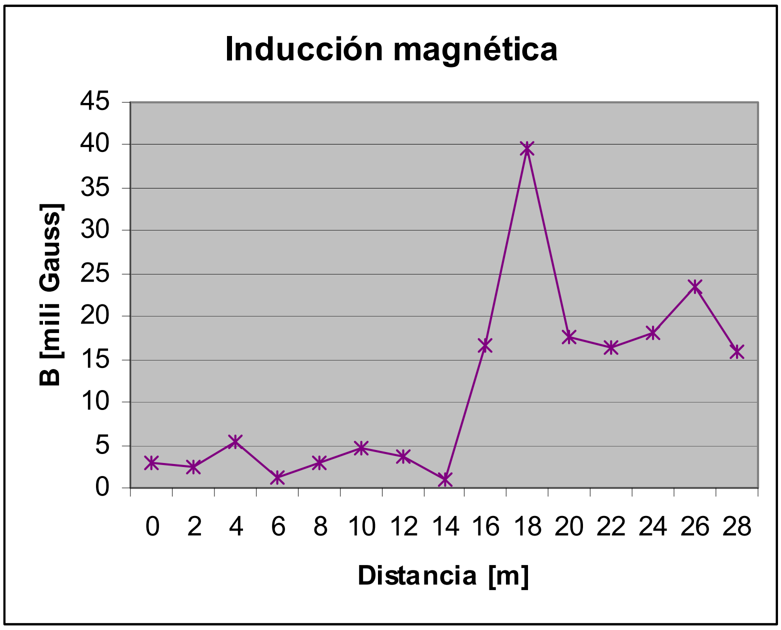
The measured values are shown in the graphs of the following figures:

Figure 3-20. Magnitude of CAmpo EElectrical MEdido at SEctor ToProduction



Source: Self-elaboration

Figure 3-21. Magnitude of INducción MAgnética MEdida at SEctor ToProduction



Source: Self-elaboration

- The electrical field profile is very similar to that found in Caleta San Marcos, with a difference in the maximum values, which are presented on both sides of the line; The maximum magnitude measured is 44.70 [Volt/M]; As it moves away from the line, the field decreases rapidly, so that at 20 m from the line axis, it is reduced to less than 10 [Volt/m]. The difference of values is justified by the height of the drivers, finding these at greater height in Caleta San Marcos.
- LA magnetic induction again presents values with great dispersion; The maximum measured value was 39.73 [Mili Gauss], which indicates that during the final time of the measurement (approximately 12:10 – 12:15 hours), one or more major consumptions are entered.

iv. Conclusions

SE has characterized the baseline, as regards the electric field and the magnetic field in the coastal sectors; Staying Defined by the following maximum values:

- electric field: 44.70 [Volt/M]
- Magnetic Induction: 39.73 [Mili Gauss]

It is determined that the area of influence of the agent (transmission line) is 20 m on each side of the line (total 40 m), defined mainly by the behavior of the electric field, since the variability of the magnetic field prevents to define precisely this parameter.

Although these maximum values are not present in populated areas, in Caleta San Marcos and in Rio Seco a little lower values were measured.

In Chile there is no specific regulation regarding limit values of low frequency electromagnetic fields admissible by humans. The main international reference is defined by the ICNIRP [1], an organism recognised by the World Health Organization as a specific reference in this area. The ICNIRP establishes the following limits:

Table 15. ICNIRP Limits of EXposición HUmana CAmpos ELectromagnéticos 50 Hz Public GEneral

ICNIRP limits of human exposure to electromagnetic fields of 50 Hz General public	
electric field[Volts/m]	magnetic field[Mili Gauss]
5,000	1,000

Source: Self-elaboration

It is concluded that the values measured at all locations are far below the limits stated above and therefore do not pose a risk to people's health.

3.2.1.5 Luminosity

i. Objectives

Identify the main light sources at the regional level by establishing their relationship with The observatories Astronomical Present in the territory.

ii. Methodology

A bibliographical review of various studies on the impact of luminosity on the environment was carried out, ESpecíficamente of the regulations present in Chile on light emissions.

In order to identify the areas with the greatest light emission, the nocturnal images arranged by NASA Earth Observatory/NOAA NGDC, which show the night sky from April and October 2012, which can also be viewed on Google Earth, to identify those areas that have a greater light emission, in relation to observatories and Project.

Information was also sought on the observatories present in the area of influence, that is to say the four regions in which the Project, by visiting the Internet pages of each of these observatories, Georreferenciando Your location by using the ArcGis software 10.

In this sense, an area of influence was defined at the Regional level, since the sensitivity of the observation instruments used in the observatories could be affected by luminous sources located to kilometers of distances.

iii. Results

s) Environmental regulations

Light pollution is the glare or brightness produced by the diffusion of artificial light, which decreases the darkness of the night causing the light of stars and other Astros to gradually fade and disappear. This phenomenon also hinders the work of astronomical observatories, so one of the measures to control light pollution is to reduce the amount of daylight that escapes to the sky.

Regarding the astronomical quality of the sky, from October 1, 1999 came into force the emission standard for the regulation of Light pollution (Supreme Decree n º 686 of December 7, 1998 of the Ministry of Economy, Promotion and reconstruction) , which establishes a legal framework for the protection of the quality of the sky, in the context of the environmental legislation.

The objective of the standard is to protect the astronomical quality of the skies in the regions of Antofagasta, Atacama and Coquimbo By regulating light pollution. The current astronomical quality of the above-mentioned skies is expected to be preserved and the future deterioration avoided.

The sources that must comply with this standard are called outdoor lighting, which corresponds to the lighting carried out with stable or sporadic installations, Dand open EnclosuresS, for nocturnal use, such as street lighting, ornamental and parks, lighting of sports and recreational facilities, signs, lighting of industrial facilities, safety, and exterior lighting of buildings and Condos. Not considered in this category The Lighting produced by natural gas or other fuels, that of the vehicleS, nor The lights emergeNcia for public safety.

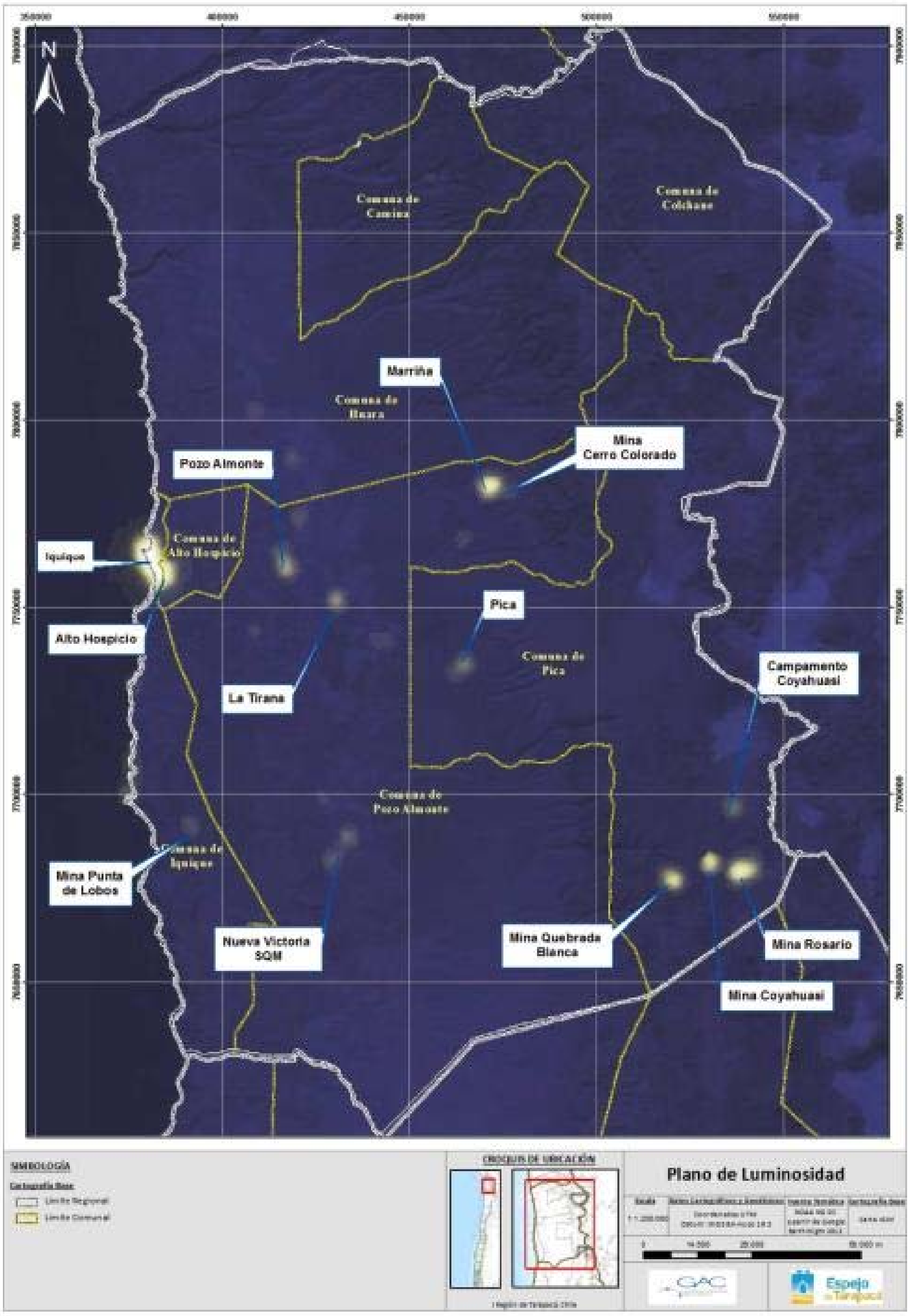
t) Main sources of light emission

As seen in the Figure 3-22, the main source of light emission comes from the lights of Iquique and Alto Hospital, being the area of greater Concentration Of the population in the region. Other populated centres such as Pozo Almonte, La Tirana and Mamiña, among others, also present a considerable luminosity.

Noteworthy is the Luminescence From the different F'sToEnas and mines present in the region, where the areas with important luminosity correspond to the Collahuasi mine, Quebrada Blanca mine, Rosario mine, Punta de Lobos mine, Cerro Colorado mine and the new Victoria iodine plant.

is observed in the Figure 3-22 In general, the region does not present light sources in most of the territory.

Figure 3-22. Sources of light emission from the region of Tarapacá.



Source: Own Elaboration.

u) Astronomical quality of the sky

Light pollution, whose most evident manifestation is the increase of the brightness of the night sky by reflection and diffusion of the light in the gases and particles of the air, provokes numerous and damaging effects Of Great Transcendence Being one of the most important Damage to nocturnal ecosystems and degradation of the sky Night.

EL north of Chile is worldwide Recognized As the best Area Of the southern hemisphere to make astronomical observations due to the transparency and clarity of its night skies.

Few places in the world have so many clear nights in the year to be able to observe the universe. It constitutes thus a unique patrimony that benefits its inhabitants, tourists, professionals and amateurs in the observation of this sky.

The installation of the observatories In Chile, due to The darkness and transparency of our skies, That can alzanzar more than 300 Clear Nights, The excellent atmospheric conditions have allowed COnsiderE To Chile as a strong candidate for future Projects astronomical they carry with them investment and work for the north of our country.

Observatories.

Observatories are not registered in the Regional territory of Tarapacá.

iv. Conclusions

In relation to the current regulations the region of Tarapacá does not present protection toLight pollution, but on the other hand it is not Sand identified astronomical observatories within the regional territory.

The analysis of the luminosity of the study area shows that most of the regional territory lacks important light sources. The main light sources identified correspond to the area of the city of Iquique and some mining operations.

v. References

- CONAMA, 1999. Application Manual, emission standard for the regulation of light pollution.
- Secretary General of the Republic, 1998. Emission standard for the regulation of light pollution

3.2.2 Lithosphere

3.2.2.1 Introduction

The following chapter gives a characterization of the geological components, geomorphology and geological risks of the baseline, in the area of influence of the Project, corresponding to the following sectors:

- Sector Underground works
- Sector Surface Works Coast
- Sector Underwater works (sector not considered for analysis)
- Sector Plateau
- Pampa Sector

3.2.2.2 Area of Influence

The area of influence comprises those sectors where the physical works and construction and operation activities of the Project, including all land where associated environmental impacts may be generated.

In the particular case of the components geology, geomorphology and risks it has been considered that the area of direct influence comprises the lands where the physical works of the Project, in this case the sectors of underground works, superficial coasts, Which include the coastal zone and cliff, and the sectors Plateau and Pampa, where the Power line and reservoirs.

3.2.2.3 Objective

The objective of this chapter is to characterize the geological, geomorphological and geological risk variables at the regional and local level of the site of the Project To establish the baseline of the physical environment of the area intended for Project Espejo de Tarapacá, based on the existing information and the observations made during the field visit.

3.2.2.1 Geology

i. <u>Methodology</u>

The characterization of the zone was carried out based on the information taken from previous studies in the area, of documents of public sources relative to the studied components, and complemented with two recognitions of ground (5 and 4 days), realized in October of the 2013, with the assistant in Geology Raúl Ugalde and in December of the 2013.

The working methodology for the present Project Included:

- A first stage of collecting bibliographic data related to geology. The description of this component for the area of influence of the Project It is based on a synthesis of the geological-structural context at the regional level, defined in the geological Charter of Chile, scale 1:1,000,000, elaborated by the SERNAGEOMIN.

At the local level, it is described according to the formations, sediments and/or strata present in each Sector, defined in the geological charts of the SERNAGEOMIN:

  - Quillagua Leaf, Letter geology of Chile N ° 51, Región de Tarapacá, scale 250,000, elaborated by Skarmeta M., Jorge; Marinovic S., Nicolas, 1981.
  - Map compilation geologic Area Quillagua-Salar Grande, región de Tarapacá, scale 1:100.000, elaborated by Quezada, A.; Vasquez, P.; Sepúlveda, F.; White, N.; Tomlinson, A, 2012.

- A second stage of characterization in the field consisting of two visits on site between 15 and 19 October 2013, and between 1 and 4 December. These visits were aimed at evaluating the geological conditions of the site, conducting the field study, in order to generate a geologic baseline report.
- A third stage of post-field cabinet work, for the analysis of the data taken on land and conclusions of the previous points.

ii. <u>Theoretical framework</u>

v) Geological framework

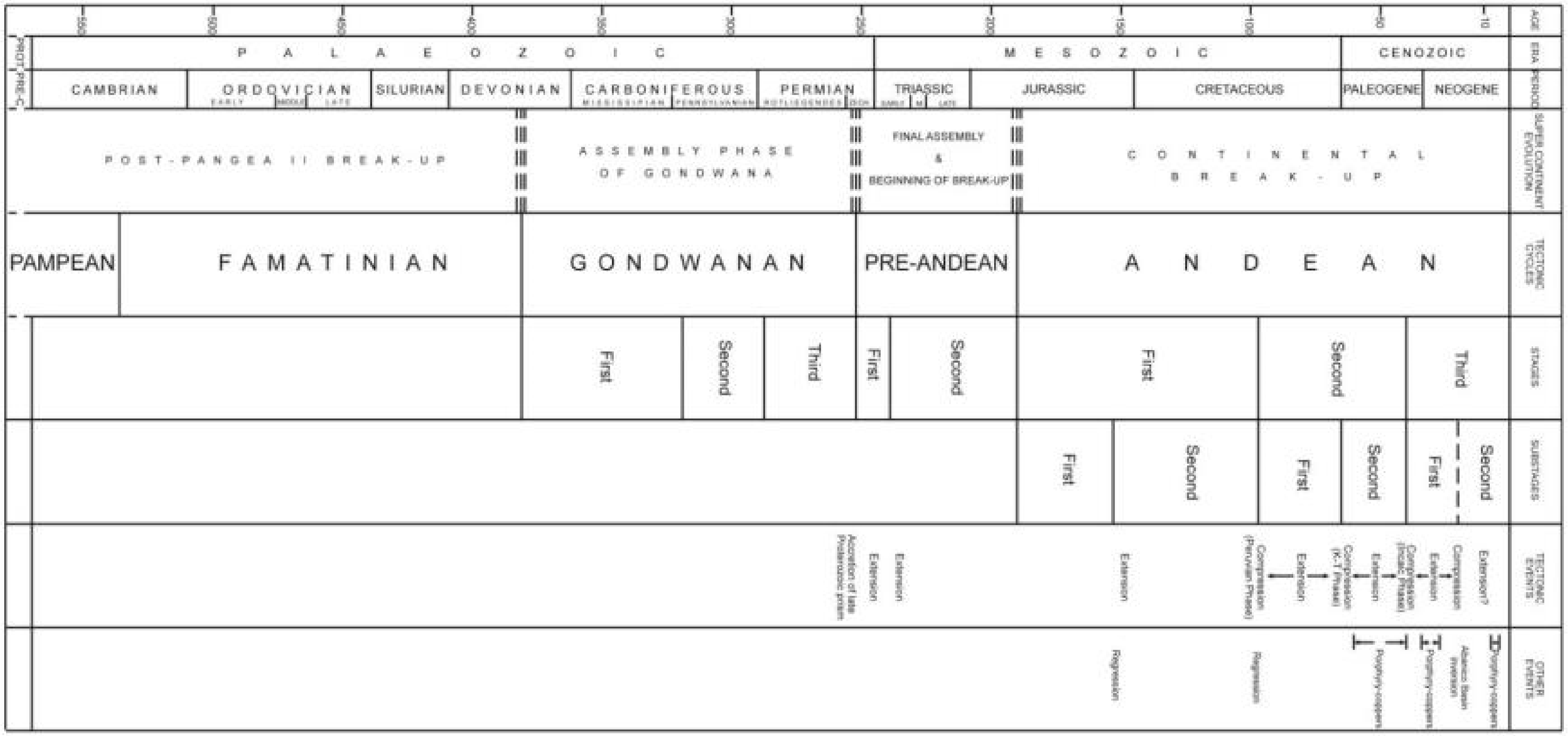
Northern Chile is a segment of the western margin of South America, which during most of its history was an active margin. From the late Proterozoic to the late Paleozoic the geological evolution was dominated by the accretion of land from the west, as well as a migration of the arc in the same direction. The post-Triassic evolution, in the north of Chile, has been characterized by a migration to the east of both the continental margin and the volcanic arc, which has been attributed to the erosion by subduction. The period comprising the Late Permian, Triassic and JurEarly Sico has been considered as an episode of No or very slow subduction activity on the continental margin, during which a totally different paleo-geographic organization developed, as well as a widely distributed magmatism. One can differentiate the major states in the evolution Tectono-stratigraphic of the Chilean Andes, and relate them with the episodes long documented in the Geological history (Jordan et al., 1983, 1997; Ramos, 1988; Ramos et al., 1986; Isacks, 1988):

1. Break Post-Pangea II
2. Gondwana Assembly
3. Break of Gondwana

Tectonic cycles in south-west South America are mainly, according to Mpodozis and Ramos (1990), Charrier et al. (2007), see Figure 3-23:

1. Pampeando (Late Proterozoic-early Cambrian)
2. Famatiniano (Late Cambrian-Early Devonian)
3. Gondwánico (Late Devonian-Permian)
4. Pre-Andean (Late Permian-early Jurassic)
5. Andean (Early Jurassic-present)

Figure 3-23. Cycles TEctónicos in the MArgen COntinental of South America.



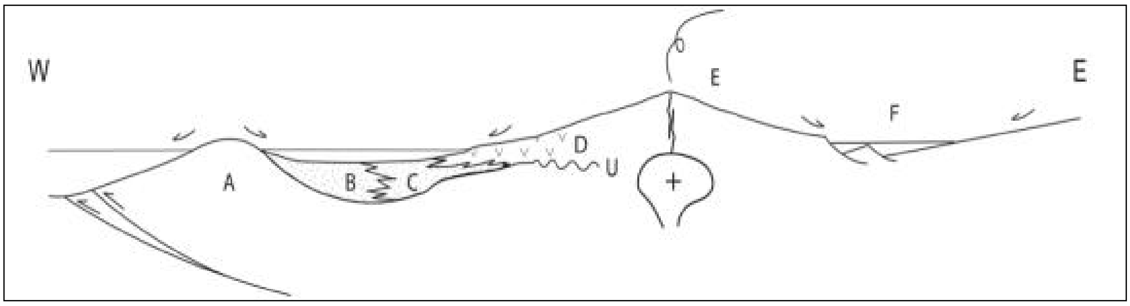
Source: Charrier et al. 2007

Gondwánico cycle in central-Northern Chile

Gondwánicas rocks are abundant in northern and central Chile. They correspond to rocks of active continental margin (late Devonian-Late Permian), of which it is possible to recognize from west to east (

- Figure 3-24):
  - Accretion prism
  - Forearc Basin (Turbidíticos deposits)
  - Platform deposits
  - Arc VolcanoIco
  - Continental Basin of extensional arc.

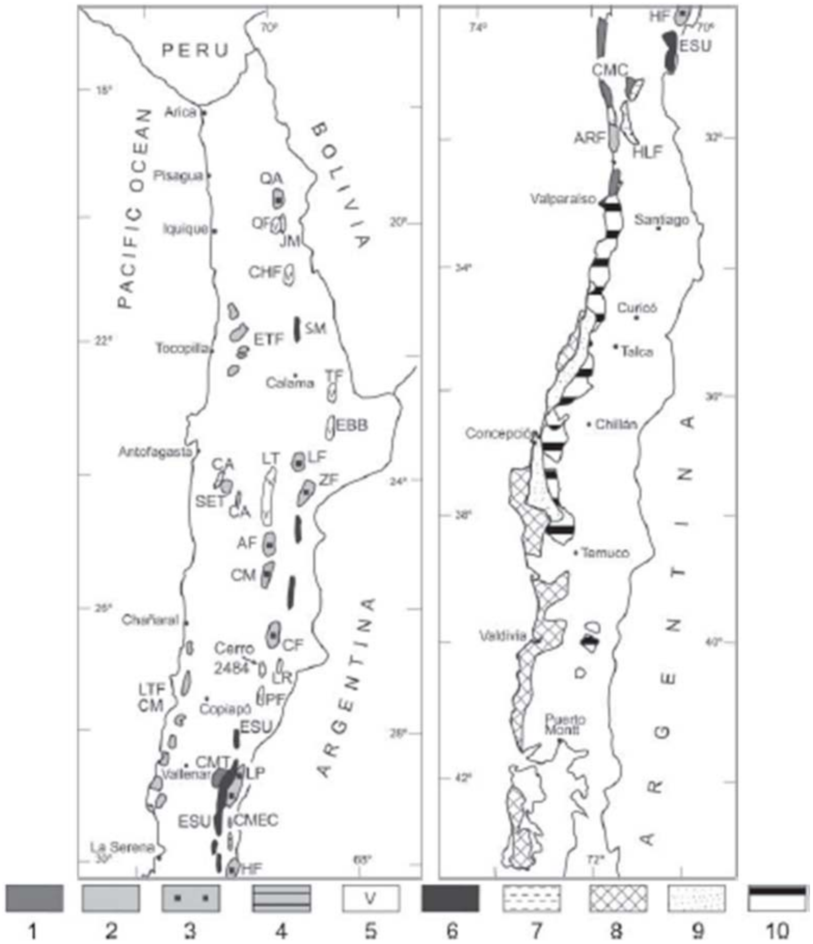
Figure 3-24. Scheme QAIeogeográfico de Carboniferous TArdío and the Permian TEmprano in the NOrte de Chile.



A: Accretion prism, B: Turbidíticos deposits, C: Continental shelf Deposits, D: Volcanic and Volcanoclásticas Deposits
E: Volcanic arc, F: extensional Transarco basin.
Source: Charrier et al., 2007

The outcroppings of the rocks of this cycle can be observed mainly in the Cordillera de la Costa, associated in the first case to the metamorphic units to the metamorphic complexes and the metasedimentary units of the western margin and in the Precordillera (Figure 3-25).

Figure 3-25. Location of ToBlooms of CIclo Gondwánico.



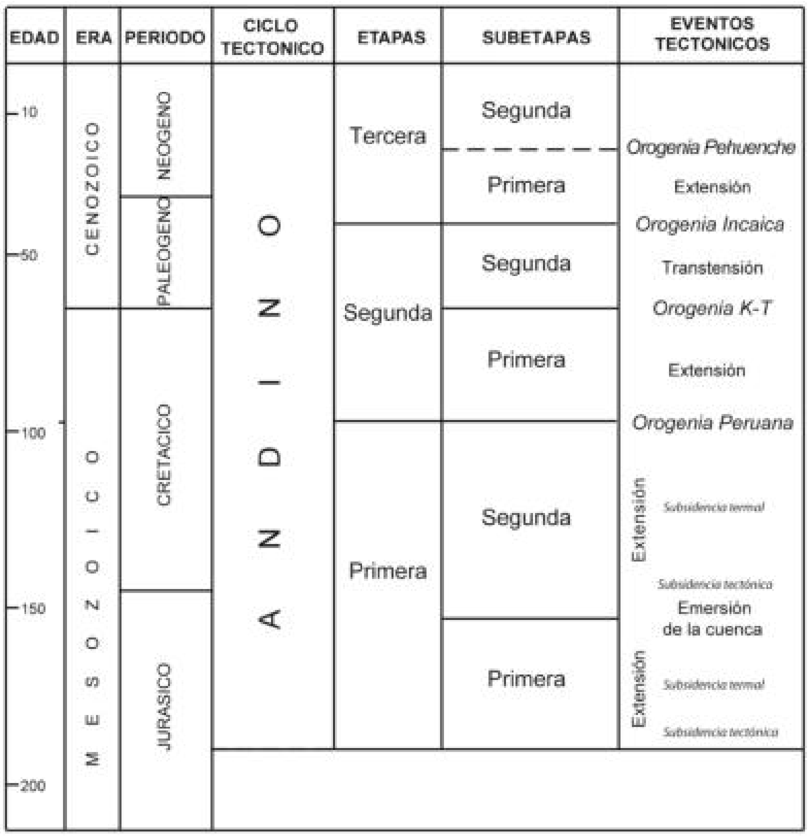
1: Complex metamorphic Choapa, 2: Formation the Toco, 3: Aroma Broken Formation, 4: Complex metamorphic the leghold trap, 5: Formation Quipisca, 6: Sierra of the Middle and Sierra Moreno, 7 formation Juan de Morales, 8: Western metamorphic series, 9: Metamorphic Oriental series, 10: Suite of the early late-Permian Carboniferous.
Source: Charrier et al., 2007

Andean cycle

The Cordillera de la Costa where the Project, it was developed during the Andean tectonic cycle, along the western margin of South America, through cortical shortening and magma addition, and presents geological formations that developed between the Lower Jurassic until the present, corresponding to the Last geological cycle in the Andean margin (Figure 3-26). This cycle has been divided into sub-stages, which are mainly three (Charrier et al., 2007, Figure 3-23, Figure 3-27):

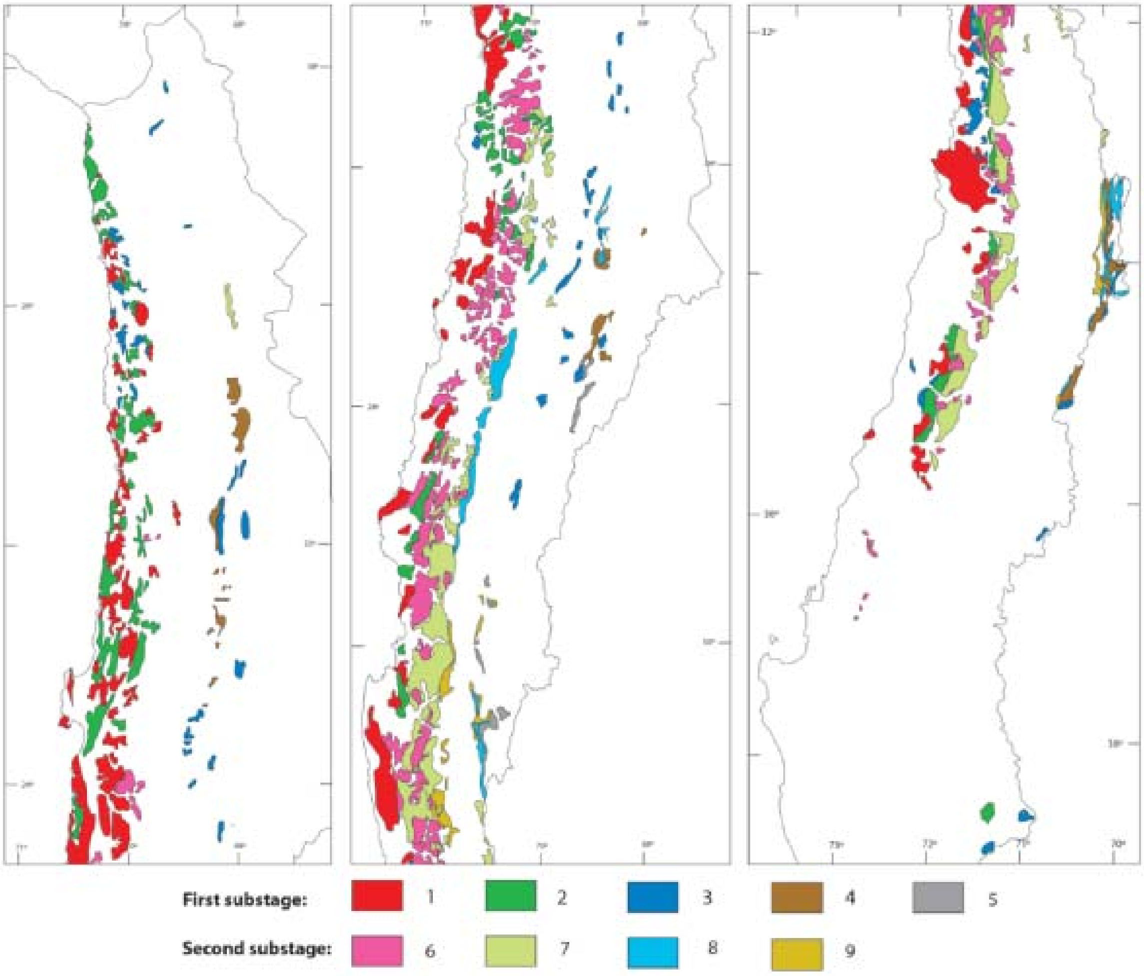
- Lower Jurassic-Lower Cretaceous: Dominated by an extensional regime along the magmatic arch
- Late Cretaceous-Eocene medium: After a period of high compression (Charrier et al. 2007), it maintains the same paleogeográficas conditions and its geochemical characteristics
- Late Eocene – present after the period of the Inca compressions (Charrier et al., 2007), is characteristic of the cyclical evolution of sedimentary deposits.

Figure 3-26. Andean tectonic cycle (lower Jurassic-present). Stages SUB-Stages and EVentos TEctónicos.



Source: Charrier et al. 2007

Figure 3-27. Location of Andean cycle outcroppings.



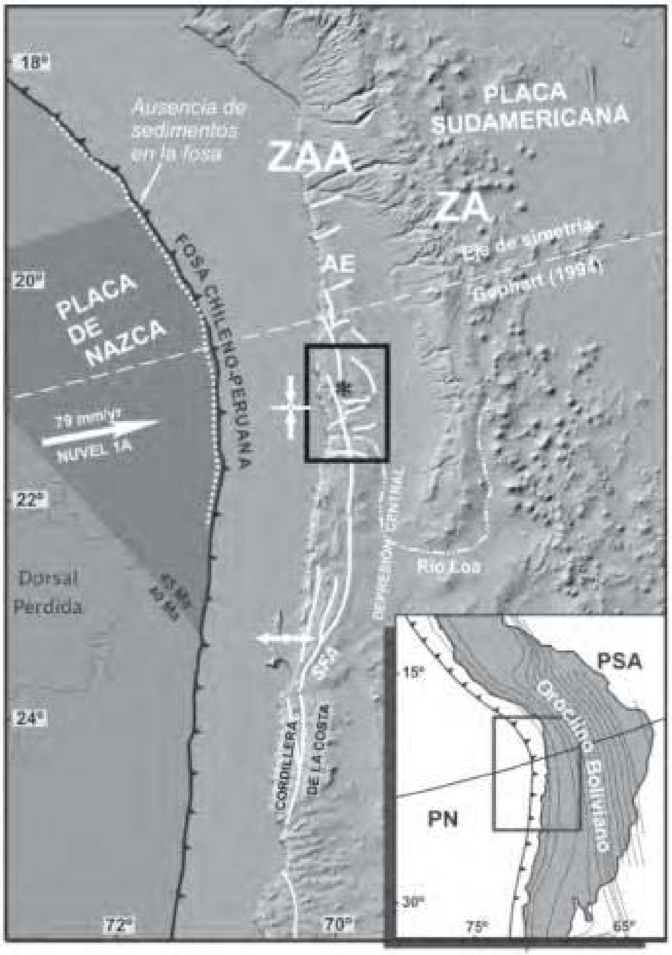
First substage unit (Late Jurassic to Kimmeridgiano): 1: Intrusive rocks, 2: Arch deposits, 3: After-arch marine deposits, 4: Continental after-arch deposits, 5: Kimmeridgianos deposits; And of the second substage (Kimmeridgiano up to the point): 6: Intrusive rocks, arch deposits, 8: After-arch marine deposits, 9: Continental after-arch deposits.
Source: Charrier et al., 2007

w) Structural framework

The current tectonic configuration in the western margin of South America is characterized by the subduction of the Nazca plate under the South American Plate. In the central Andes (17 ° to 22 °), this convergence is approximately 79 mm/year (Angermann et al., 1999) in the direction N74 ° E (Somoza, 1998). The Fossa is located at a distance of 70-110 km from the coastline and reaches a maximum depth of 8 km (Carrizo et al, 2008) (Figure 3-28). These conditions have been expressed in an intense shortening that has consequently developed the Andean Orógeno.

Figure 3-28. Settings REgional of the ZOna de COnvergencia of the north of Chile between 18 ° S and 26 ° S.

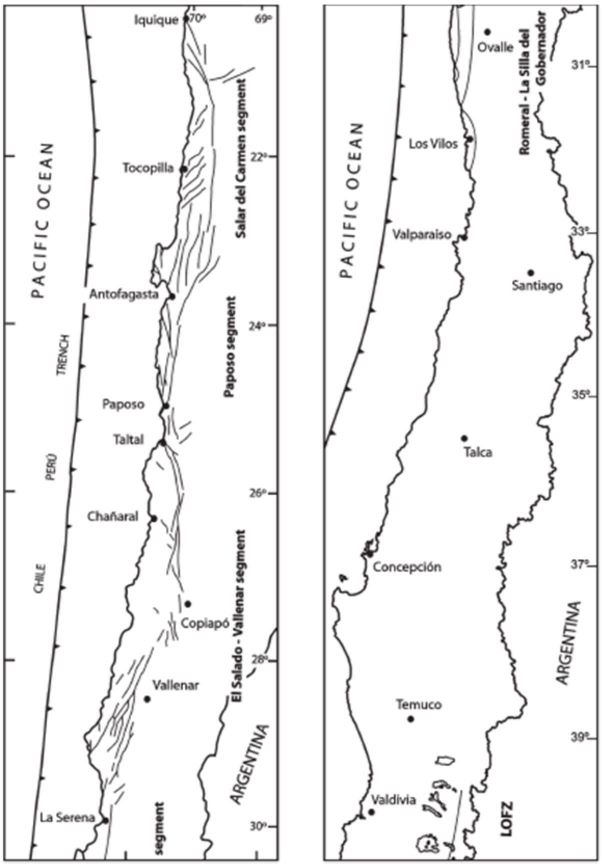
. Contexto geodinámico de la convergencia oblicua a lo largo del margen del norte de Chile. El relieve sobre el nivel del mar corresponde a un modelo numérico sombreado basado en SRTM90M. La flecha 1A indica la velocidad de convergencia del modelo NUVEL 1A según Angermann *et al.* (1999) y Somoza (1998). **ZA**: Zona del Arco; **ZAA**: Zona del Antearco; **AE**: Antearco Externo. Las líneas continuas blancas exponen las trazas principales del Sistema de fallas de Atacama (**SFA**). La línea segmentada blanca en la fosa indica la zona con ausencia de sedimento según Schweller *et al.* (1981). La diferencia de tonalidad de grises en la Placa Oceánica de Nazca indica el contorno de edad del fondo oceánico según Müller *et al.* (1997). Las flechas blancas indican los estilos de deformación del antearco. El rectángulo con borde negro indica el área en estudio y el asterisco indica la localización del Salar Grande. El recuadro inferior muestra un esquema de la arquitectura del Oroclino Boliviano; donde las líneas representan el plano de Wadati-Benioff según Cahill y Isacks (1992) y el eje de simetría del oroclino definido por Gephart (1994).



Source: Carrizo et al., 2008

The main feature morfoestructural in the north-central Chile in the area of the Cordillera de la Costa is the Atacama fault system (SFA). This system presents a set of escarpments and Subparallel lines with each other, oriented in parallel to the fossa (Carrizo et al., 2008). This has a north-south extension of the order of 1,000 km, extends From Iquique to Los Vilos (Figure 3-29).

Figure 3-29. Traces of the DIstintos SEgmentos of the Atacama fault zone.



Source: Charrier et al., 2007

x) Results Regional Geology

In the area of the Cordillera de la Costa, near the area of the Project, the oldest rocks correspond to rocks formed during the Gondwánico cycle in a context of active continental margin (

Figure 3-24).

Outcrops of Palaeozoic metasedimentary rocks are observed in isolation (Carrizo et al., 2008), which They correspond to schists micaceous, slates and Quartzites (DC4), of the Devonian belonging to the formation the Toco (Quezada et al, 2012, Figure 3-25Located about 30 km southeast of the Project.

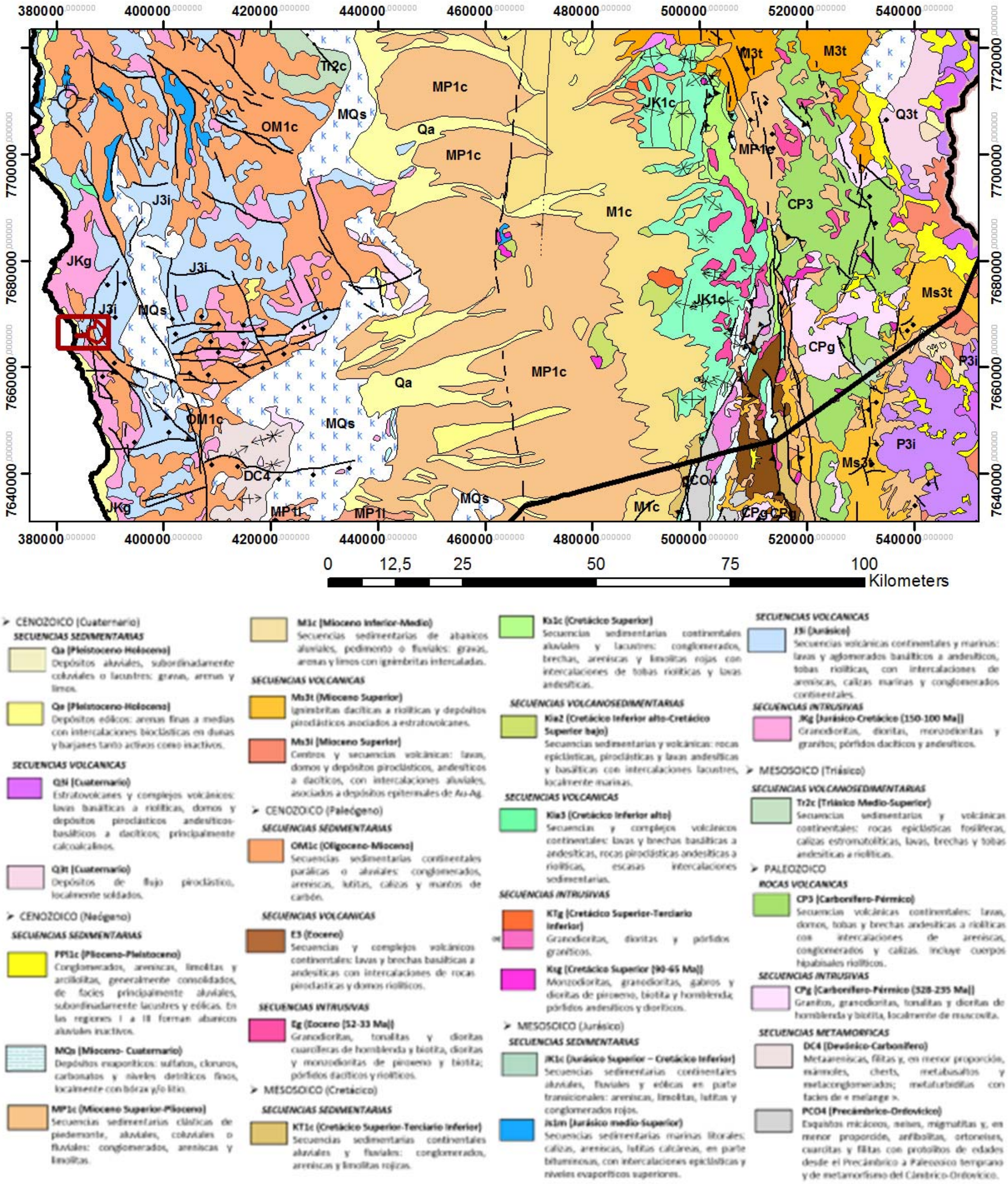
The Cordillera de la Costa in the vicinity of the Salar Grande, is formed by a basement mainly Mesozoic, composed of volcanic rocks (J3i, Kia3), Volcano-sedimentary (Tr2c) and intrusive (Jkg) mainly of age Jurassic-Cretaceous (Carrizo et Al., 2008) (Figure 3-30). This period is characterized by the development of an axis magmatic oriented approximately in north-south direction, with an associated Transarco basin (Blanco et al., 2012). The rocks of this magmatic arch include the volcanic rocks of the black formation (JLN) of age Sinemuriano-Kimmeridgiano composed mainly of lavas Andesiticas, Dacitas, rhyolites and gaps with sedimentary marine interlayers (Quezada et al, 2012), That emerges in the area of Project In angular discordance over the Paleozoic deposits, and the Intrusive Rocks Jurassic (Jkg), corresponding in the area of the Project To the intrusive complex Cerro Carrasco (JSSC).

On this basement is available, in a discordant manner, a clastic sedimentary coverage and evaporítica of variable power assigned to the Cenozoic. It highlights the continental sedimentary sequences of the Paleogene (OM1C), composed mainly of conglomerates and sandstones whose clasts come from the erosion of Mostly Jurassic basement (Figure 3-30). There are also evaporitic deposits of Miocene-quaternary Age (MQX), formed mainly by Halita and gypsum, which fill the basins of the Salar Grande, called, Bellavista and painted (Carrizo et al., 2008; Chong, 1988), and which are part, in the area of the Grande Salar de la formation Soledad (Bobenrieth, 1979), with a maximum power measurement of 120 m and a basement consisting mainly of sedimentary and volcanic rocks (Carrizo et al., 2008, Figure 3-30).

In the upper-middle Oligocene, are developed at the edge of the Andean foothills and the Pampa of Tamarugal erosion processes-accumulation of detrital materials (MP1c, M1c, Figure 3-30) derived from the relief generated during the orogenic Incan phase in the Upper Eocene, (Blanco et al., 2012). In the Cordillera de la Costa, the sedimentary processes, mainly alluvial, occurred from the upper Oligocene to the Pliocene, Characterized by the deposit of the high Hospice gravel Units (OPah) (Blanco et al., 2012).

Finally, from the Pleistocene-Holocene period to the present day, due to a climate change towards extreme aridity, Salt precipitation begins in the lower parts of the Pampa del Tamarugal And Occasionally alluvial floods generate subordinate deposits associated with major drainage (Blanco et al., 2012). During the Pleistocene to the Holocene, sE generate coastal marine deposits and deposits related to alluvial and colluvial cones (Qa) allocated to the Quaternary (Blanco et al., 2012, Carrizo et al., 2008, Figure 3-30).

Figure 3-30. Regional Geology COrrespondiente the 'sProject Area



Note: According to Chile's geological map, scale 1:1,000,000 Sernageomin. Red Square represents the site of the project.
Source: Own Elaboration.

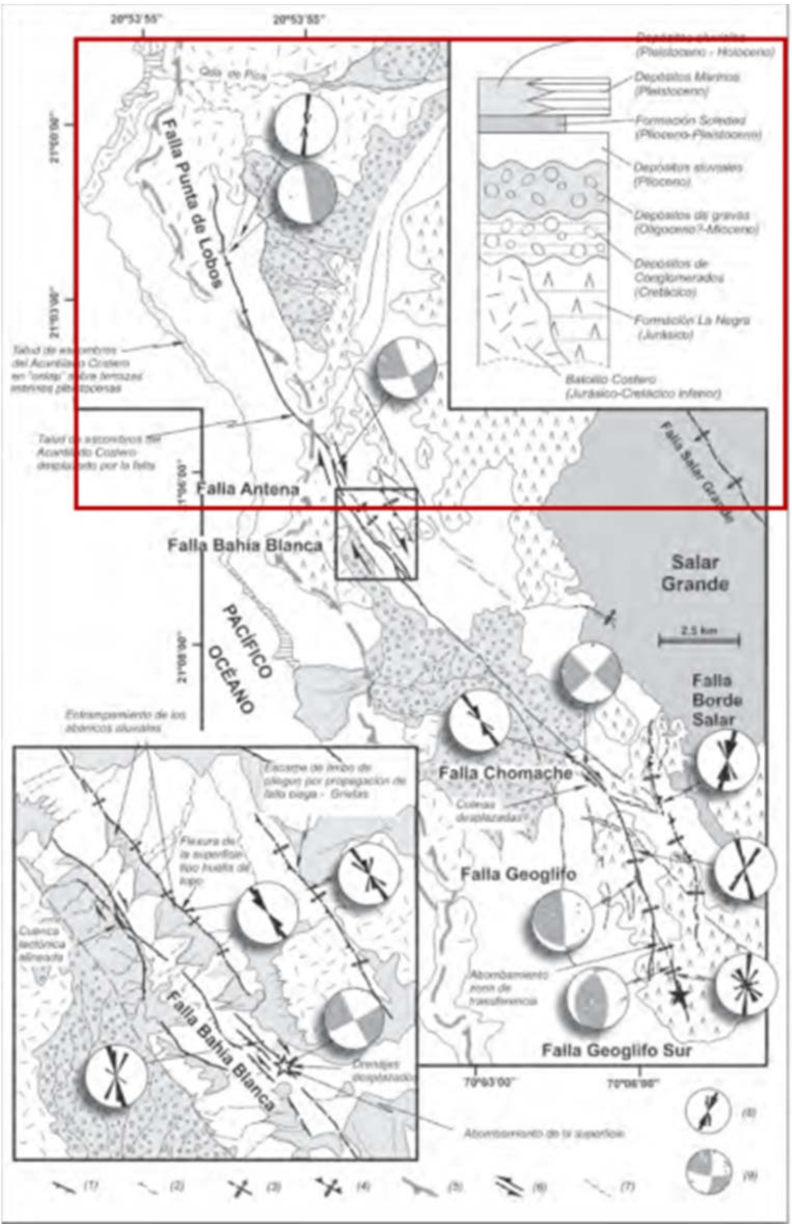
y) Structural geology

The area of the Project It is located at the north end of the SFA, where the traces vary from N-S to NNW-SSE.

The Project It is affected by the fault system antenna orientation N20 ° W and length of approximately 1.2 km, formed by a set of minor traces Subparallel to each other, arranged in an area of ~ 50-70 m wide, which displace a piedmont formed by deposits Alluvial Pliocenos (Carrizo et al., 2008, Figure 3-31). The fault plane is high angle (80 ° E-90 °) and has a dextral kinematics (Carrizo et al., 2008).

The area of the Project It is also affected by the Chomache fault, and more specifically, by the extreme North segment Punta de Lobos (Figure 3-31), orientation N30 °-75 ° W/90 °, with a length of 9.8 km and dextral kinematics; And in the south, by the segment Falla Blanca Bay in the area of the Project 2.2 km long and average N28 ° W, which displaces Aluvio-Lake deposits (paleosalar) of Miocene-Pliocena age and entraps the Pleistocene-Holocene alluvial systems (Carrizo et al., 2008).

Figure 3-31. Context EStructural in the ZProject Ona.



Structural map of the Fallas Chomache, Geoglifo, Geoglifo Sur and Verge Salar. The information comes from the detail mapping of the traces of the structures. 1. Fault escarpment indicating the descending block; 2. Escarpita indicating the descending block; 3. Asymmetrical crease escarpment by fault propagation; 4. creased Escarpment by reverse fault propagation; 5. Crest of the great coastal cliff; 6. Fault direction movement indicators; 7. Drainage; 8. Two-way rosette diagram of cracks; 9. Axes of infinitesimal deformation P-T.
Red Box: Location of the Project
Source: Carrizo et al., 2008

z) Local Geology

The Project It is located in different geological units presented in The Figure 3-44, performTo Based on the bibliographical collection and the field survey. The main units that dominate the area of study are the training Office Viz and the formation of the Black (Jurassic), the intrusive complex Cerro Carrasco and tertiary and quaternary deposits.

Quaternary deposits

The Quaternary deposits present in the area of the Project is toSignen to the Pleistocene-Holocene:

Saline deposits (PlHs):

They correspond to deposits of salts and/or gypsum with subordinated nitrates (Quezada et al., 2012, Sepúlveda et al., 2012 and Vásquez et al., 2012). They are in the Salar Grande and the Salar de Bellavista where passes the Electric transmission Line (Figure 3-32).

Figure 3-32. Deposits SAlinos (PlHs) in the ZProject Ona.

Source: Own Elaboration.

Ancient alluvial deposits (PlHa):

They are at the bottom of the streams of ravines, alluvial fans and hillsides. According to Quezada et al. (2012), are Constituted by blocks, gravels, Sands and silts Little consolidated, mainly composed by clasts angled with subangulosos of composition andesitic with interlayers of ashes that accumulate in the bottom of the channels. On a timely basis these deposits have a saline crust of varying thickness (Figure 3-33).

Figure 3-33. Crust SAlina in Los DEpósitos ToLuviales (PlHa) in the ZProject Ona.

Source: Own Elaboration.

In the Cordillera de la Costa, these deposits cover in paraconcordance and locally in a slightly angular discordance the high hospice gravels, and also the Jurassic and Cretaceous formations, as well as the intrusive bodies of both Period (Blanco et al., 2012).

Colluvial deposits (PlHc):

Quezada et al. (2012), describes these deposits as blocks, gravels and Sands Polimícticas, of Clasts Angled to Subangulosos of composition mainly andesitic Which lie at the foot of high sloping slopes (Figure 3-34Where it may constitute alluvial cones, and Filling Broken, with little transport, essentially gravitational. In the area of the Project, are located at the foot of the coastal cliff.

Figure 3-34. Deposits COluviales to be ENcuentran SWorking the Tunnel line, Al PCoastal Cliff ie.

Source: Own Elaboration.

Tertiary deposits

High Hospice Gravel (OPah, Miocene-Pleistocene)

They correspond to blocks, gravels of supported Matrix, of sand, silts and clays semiconsolidated and consolidated, clasts of alluvial origin, with interlayers of volcanic ashes, that present at times evaporitic levels (Quezada et al, 2012). The gravels present clasts Subangulosos with angled and are generally strongly cemented by salts and/or nitrates (Figure 3-35). are located in all sectors of the Project, mostly in the area of the Electric transmission Line.

Figure 3-35. Deposits of the GRavas of High Hospice.

Source: Own Elaboration.

They are in angular and erosive discordance over The Jurassic formations of the area, and in discordance over the Jurassic units (Blanco et al., 2012), and are partially covered in paraconcordance, and occasionally, with slight incision, by Pleistocene-Holocene alluvial deposits (PlHa), colluvial deposits (PlHc).

Cretaceous deposits

Intrusive rocks

- **Complex INtrusivo Montevideo, Kim (110-100 mya)**

Sepulveda et al. (2012), describes this complex composed of granites, Monzonitas and Granodioritas of amphibole and/or Biotita of fine grain and dioritas to Monzodioritas of medium to fine grain equigranulares to Porfídicas of Clinopyroxene.

This complex is located south of the east end of the Electric transmission Line In The Figure 3-44, but it is not located in the area of influence of the Project.

- **Suite of the Lower Cretaceous, Kig (128-127 Ma)**

It corresponds to diorite to diorite quartz of medium grain with pyroxene and locally amphibole, and Monzonitas, Monzonitas Cuarcíferas of Pyroxene and amphibole, of fine to medium grain, and associated porphyry (Sepúlveda et al., and Vásquez et al., 2012).

are located in the center of the top frame In the Figure 3-44, south of the layout of the Electric transmission Line, but it is not located in the area of influence of the Project.

Volcanosedimentarias Rocks

- **Formation Punta Barranco, KIPB (Berriasiano – Albiano**

Sepúlveda et al., (2012), describes this formation as a volcanosedimentaria sequence, composed of sandstones, conglomerates, volcanic gaps, and andesites Traquíticas. One distinguishes two facies, a volcanic facies (KIPB (a)) composed of reddish volcanic gaps with reddish brown and andesites traquíticas (Figure 3-36); and a sedimentary facies (KIPB (b)) composed of red and grey sandstones of medium grain, conglomerates with clasts of limestone and andesites traquíticas interspersed.

Figure 3-36. (a) Andesite TStunted, formation Punta Barranco (KIPB (a)), (b) sandstone ROjiza formation Punta Barranco (KIPB (b)).

To 

Source: Own Elaboration.

b  

Source: Own Elaboration.

This training is only found in the Sector of the Electric transmission Line, in the upper box and in the northeast part of the bottom box In the Figure 3-44. is located in the area of the Project Mainly the volcanic facies, and particularly andesites traquíticas with reddish matrix, of hornblende and Amphibole, with phenocrysts of PlagioclasImportant as.

Jurásic depositsOr

Intrusive rocks

- **Intrusive complex Cerro Carrasco, undifferentiated, JSCC (Upper Jurassic-Lower Cretaceous)**

Vasquez et al. (2012), estimates the age of this complex at about 160-151 Ma and distinguishes two facies: a first facies composed of Monzonitas quartz of amphibole and Biotita (JSSC (a)) and a second facies of diorite of two pyroxene and diorite of Amphibole and Biotita (JSSC (b)).

This complex is mainly in the entire coastal area and the coastal cliff in the Road and construction sectors (Figure 3-44), with a predominance of facies outliers JSSC (a).

In the area of the works, are mainly outcroppings of the facies Jssc (b), corresponding to massifs of Monzonitas Cuarcíferas of Amphibole and Biotita with trace of magnetite (Figure 3-37).

Figure 3-37: Monzonite CUarcífera ToNfíbola and BIotita, SWorking the LOnline of the tunnel, Sector of the works.

Source: Own Elaboration.

In this area, there are basaltic and andesitic dams that fit into the fractures of the monzonitas with a N10W direction, as well as the general alignment of the outliers of the intrusive complex (Figure 3-38). These dikes are dark grey to dark green, have plagioclase ores from 0.5 to 1.5 mm, amphibole and lower magnetite and pyrite.

Figure 3-38. Dams that intruyen the intrusive complex Cerro Carrasco: (a) andesitic dam, (b) Basalt dam with QIrita. Tunnel Sector.

To 

Source: Own Elaboration.

b 

Source: Own Elaboration.

In this area, there are basaltic and andesitic dams that fit into the fractures of the monzonitas with a N10W direction, as well as the general alignment of the outliers of the intrusive complex (Figure 3-39). These dikes are dark grey to dark green, have plagioclase ores from 0.5 to 1.5 mm, amphibole and lower magnetite and pyrite.

Figure 3-39. Dams that intruyen the intrusive complex Cerro Carrasco: (a) andesitic dam, (b) Basalt dam with pyrite. Tunnel Sector.

To 

b 

Source: Own Elaboration.

In the road Sector, the two facies are distinguished, which emerge from each side of the PathFigure 3-40).

Figure 3-40. Formation Punta Barranco in the Sector Camino: (a) Diorite of ToNfíbola and BlotITA (JSSC (b)), (b) Monzonitas CUarcífera ToNfíbola and Blotita (JSSC (a)).

To

b

Source: Own Elaboration.

Sedimentary rocks

- **Formation the Godo, Jmseg (Bajociano-Oxfordiano)**

It is defined by Vásquez et al., Sepúlveda et al., Blanco et al. (2012) as a marine sedimentary sequence, fosilífera, composed of calcareous shales with underwater volcanic rocks and limestone interlayers. It has a volcanic facies consisting of cushioned basalts and wet intrusion dams.

This training is located in the north of the lower picture In the Figure 3-44To The path of the Electric transmission Line.

Figure 3-41. Sequence FOsilífera of the formation the Godo in the Sector LOnline TRansmisión ELéctrica.

To  

Source: Own Elaboration.

- **Formation Caleta Lígate, JMCL (Bajociano)**

It corresponds to a marine sedimentary sequence, fosilífera, consisting of calcareous sandstones with mainly underwater volcanic intercalary (Vásquez et al., Sepúlveda et al., Blanco et al. (2012)). It presents a volcanic facies consisting of gaps, tuffs, basaltic lavas and cushioned basalt.

This training is located in the north of the Bottom Table of LTo Figure 3-44, west of the path of the Electric transmission Line.

Volcanosedimentarias Rocks

The Volcanosedimentarias rocks of the Jurassic correspond in the area of the Project To the formations the black and the formation office Viz. Orellana (2010), explains that these two formations can be runRationing for your age and lithology.

- **La Negra Formation, JLN (Sinemuriano-Kimmeridgiano)**

This formation, so named by García (1967) is described by Quezada et al. (2012) AS A sequence of lavas Andesiticas Porfídicas and Afaníticas partly Amigdaloidales, Dacitas, rhyolites, and gaps with sedimentary marine collations.

In the area of the Project The outcroppings are scarce, were mainly found lavas Andesiticas Porfídicas, and in lesser quantity tuffs and volcanic gaps (Figure 3-42).

Figure 3-42. La Negra Formation: (a) Lava ToNdesitica QOrfídica. (b) Gap VOlcánica. (c) Contact between LAva ToNdesiticas and TOba (left photograph), and ToBloom of ToNdesita (photography DErecha).

To

b

C

Source: Own Elaboration.

- **Training Office Viz, Jimov (Sinemuriano?-Bajociano)**

The Office Viz Formation was defined by Thomas (1970) as a massive and monotonous sequence of porfídicos basalts and andesitic-basaltic lavas (Orellana, 2010; Blanco et al., 2012). Vasquez et al. (2012) and Sepúlveda et al. (2012), describe it as a monotonous continental volcanic sequence consisting of andesites basaltic amigdaloidales (Figure 3-43), presenting in the vicinity of intrusive complexes a contact metamorphism evidenced by recrystallized biotite. The tonsils are a characteristic feature of this formation, presenting and varying sizes of millimeters to decimetres, and is composed primarily of silica, epidota and calcite, often found copper oxides and locally conforming geodes with quartz Crystalline and/or Chalcedony (Thomas 1970).

Orellana (2010) proposes a geological interpretation of these rocks, explaining that by presenting a composition with toleiticas-transitional affinities to Calcoalcalina (Kramer et al., 2005), these basalts and lavas Andesitic-Basaltic They were deposited in massive washes with subordinated pyroclastic activity, and that the absence of sea litofacies collations as well as the lack of typical marine depositing structures suggests a possible subaerial depositing environment.

The Training Office Viz presents outcroppings in the Sector of the Electric transmission Line, which are located in The Figure 3-44 In the upper box and in the northern part of the lower box (Figure 3-43).

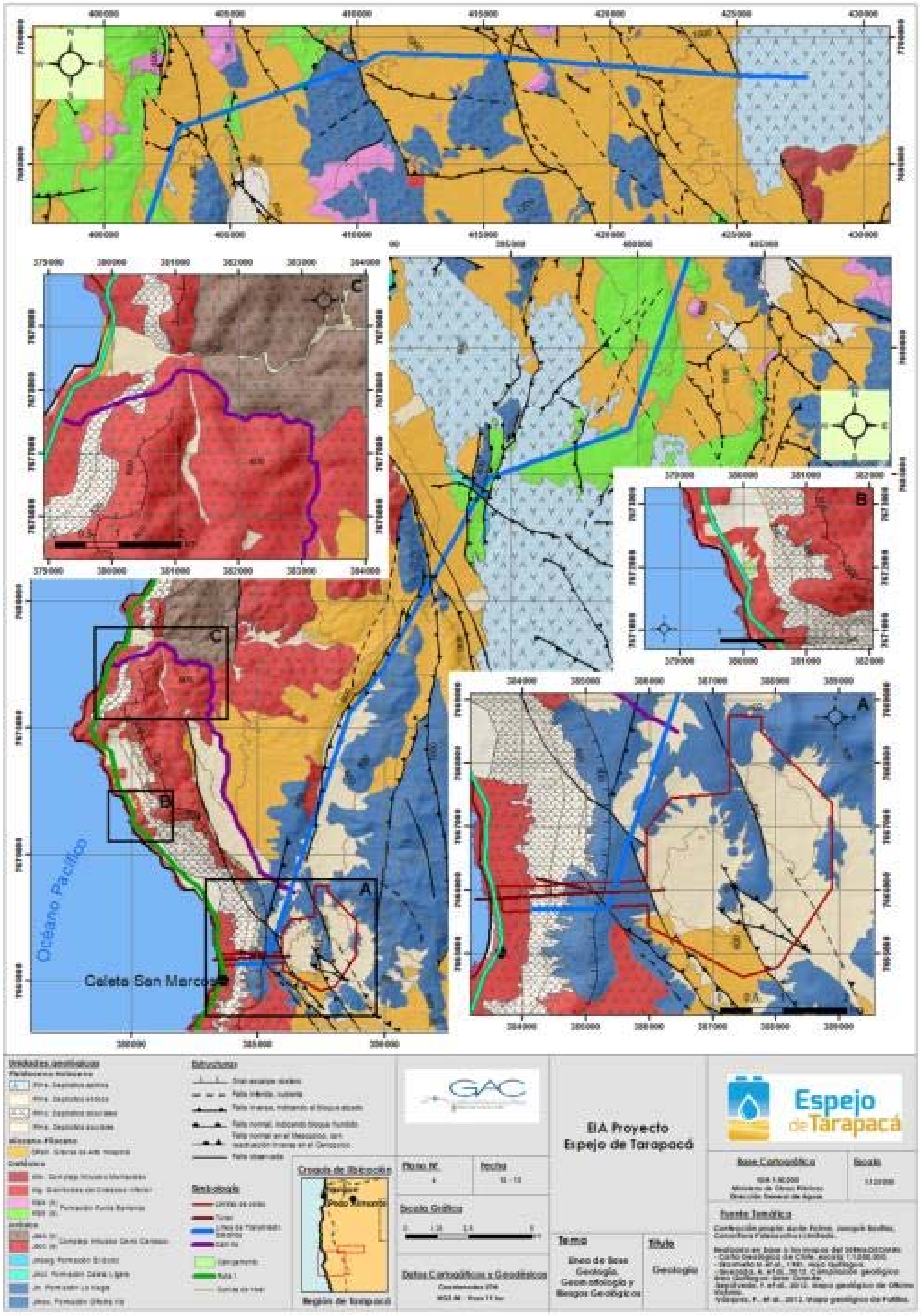
Figure 3-43. Andesite of the formation office Viz.

b

Source: Own Elaboration.

The geology of the Project is presented in The Figure 3-44 That comes next.

Figure 3-44. Geological map of the project area.



Source: Own Elaboration.

iii. Conclusions

- **Underground Works Sector**

In the construction sector, the coastal cliff presents Quaternary colluvial deposits from the erosion of the black formation outcrops present at its peak. The coastal plains, where it is located The Underground work, they are composed mainly of plutonic rock corresponding to the intrusive complex Cerro Carrasco, which is intruído by dikes andesitic and basaltic.

- **Surface Works Sector Costa**

The flood zone presents mostly alluvial quaternary deposits that fill the basins that will serve as reservoirs. The areas of greatest prominence correspond mainly to Andesiticas rocks of the La Negra formation. In this part of the Project, to the south are the high hospice gravels.

- **Plateau Sector**

In the road Sector, the coastal cliff presents Quaternary colluvial deposits from the erosion of the outcroppings of the intrusive Cerro Carrasco complex present at its peak. In the sector of the Cordillera de la Costa towards the construction sector, the route passes through the High hospice gravels and the Quaternary alluvial deposits.

- **Pampa Sector**

The Sector of the electrical laying It starts to the southwest in the intrusive complex Cerro Carrasco, and above the coastal cliff in La Negra formation. To the north, the outcroppings of high hospice gravel predominate. The route crosses the saline deposits of the Salar Grande and the Salar de Bellavista, and crosses in a timely manner the Jurassic outcroppings of the Office Viz and Cretaceous Formation of the Punta Barranco formation.

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3.2.2.2 Geomorphology

i. Methodology

The characterization of the zone was carried out based on the information taken from previous studies in the area, of documents of public sources relative to the studied components, and complemented with two recognitions of ground (5 and 4 days), realized in October with The Assistant in Geology Raúl Ugalde and December 2013.

The working methodology for the present Project Included:

- A first stage of collection of bibliographic data referring to the geomorphology of the area surrounding the Project, at the regional and local level. For this activity, cartographic and descriptive information was reviewed of the antecedents, geomorphologicals of the area of influence of the sectors of interest, whose main sources of information were the description of the general forms of the regional relief Mainly according to the existing bibliography (Börgel, 1983). At the local level, it is described from the specialized information, the interpretation of the height maps, the slopes, the satellite photo analysis and the field reconnaissance.
- A second stage of characterization in the field consisting of two visits on site between 15 and 19 October 2013 and between 1 and 4 December 2013. These visits were aimed at evaluating the geological conditions of the site, conducting the field study, in order to generate a geologic, geomorphologic and risk baseline report.
- A third stage of post-field cabinet work, for the analysis of the data taken on land and conclusions of the previous points.

ii. Theoretical framework

The Chilean relief is characterized by having four characteristic units that are: The coastal plains, the Cordillera de la Costa, the intermediate depression and the Cordillera de The Andes. These were systematized by Börgel (1983) in five large groups, locating the region of Tarapacá, together with the regions of Antofagasta and Atacama in the "Northern region of the desert Pampas and Cordilleras Prealtiplánicas ".

This group SIt is characterized by presenting a series of micro-regional units, which are from west to east: The coastal cliff, the coastal plains, the continental sedimentation plains, the Cordillera de la Costa and its internal depressions, the intermediate depression and its Pampa del Tamarugal, Los Pediplanos, Glacis and foothills, the Andean foothills, the Andes mountain range, and the Altiplano (Figure 3-45, Figure 3-46).

Figure 3-45. Relief of the region of Tarapacá. Cross-section E-W to latitude 23 ° S.

aa) The coastal cliff

The coastal cliff, is a common geomorphology of the north of Chile, corresponds to the abrupt fall of the Cordillera of the coast to the sea, forming a large cliff, whose average height is of 700 meters on the line of the coast (can reach 1,000 m). Paskoff (1978), attribute that great cliff with large vertical failures, appeared in the Upper Miocene, which have receded by effect of the marine erosion during a major transgression in the Pliocene medium to Superior. As it moves south it is degrading. South of the city of Iquique, a emerged marine terrace And it stands between the foot of the great cliff and the current coast (Paskoff, 1978).

bb) The Plains Coastal

The coastal plains extend between the sea and the Cordillera de la Costa, and are presented in a discontinuous and scarce form in the large north due to the uplifting of the northern coastline. They are presented in the form of terraces, very narrow in the north (not more than two kilometers where the city of Iquique is located) and its height can reach 300 M.A.S.L.

The coastal plains are partly the product of the slow movements of ascent and descent of coastal blocs that affected in a diverse way the littoral during the tertiary and the Quaternary (Errazuriz, 1998; Paskoff, 1978).

cc) The Cordillera de la Costa

The Cordillera de la Costa is located in front of the Chilean coastline, is one of the most important geomorphological features of Chile, extends from the south of Arica, to the peninsula of Taitao (XI region). This mountainous cordon reaches a length of 3,000 km, an average width of 30 to 50 km and a relative height of the hills of the order of 400 to 600 m. In the area of Iquique, up to the Loa River, the Cordillera de la Costa is presented as Isla Hills, Empinándose only a few hundred meters above the high plane of La Pampa. In this area, the topography appears little rough, with rel basinsEnadas and flattened Hills (Paskoff, 1978). Near the area of the Project One finds the Salar Grande, corresponding to a depression of the Cordillera de la Costa, which has an approximate dimensions of NS 50 km long, and 5-8 km wide.

dd) The intermediate depression

The intermediate depression corresponds to an NS stripe, of an average width of 60 km, which It extends delimited between the Cordillera de la Costa and the Cordillera de los Andes, from the northern boundary of the country to Puerto Montt (X region). It is characterized by its plain relief that has enabled the location of most of the Chilean cities, becoming the geomorphological trait that houses the majority of the populations. In the study area, highlights its extreme aridity with prevalence of a drainage system endorheic dry beds.

In the region of Tarapacá, it corresponds to the Pampa del Tamarugal and presents characteristics of enclosed plateau, between the Heights 600 m and 1,500 m of altitude, is presented as a coherent and uninterrupted, arid and almost flat territory. This Pampa has evolved from the tertiary to date, under the influence of block tectonics and a relative dominance of Flexuras Precordilleran (Börgel, 1983). The streams that descend from the inclined planes to the east burst into the central Pampa, depositing their alluvial detritus. Inside the Pampa some runoff is organizedlentos spasmodic, those that drain, with a endorheic character, the saline basins installed in the eastern slope of the Cordillera de la Costa. Near the east end of the Electric transmission Line Of Project, you will find the Salar de Bellavista, south prolongation of the painted salt, of a total surface of 17,080 miles^2.

ee) The Pediplanos, GLacis and QEdiments

In the Precordillera the structures of Pediplanos, correspond to inclined planes of direction NS, characteristic of the arid zones, that connect the Andean Cordillera with the Pampa of the Tamarugal. The strong erosion of the Cordillera de los Andes and the action of runoff have contributed large amounts of sedimentary material to this plane (fast, 1974).

ff) The Andean Foothills

The Precordillera is presented as a slightly inclined regular surface, with monoclinal geometry (Isacks, 1988). It presents heights varying from 1900-2300 to 3200-3700 m.A.S.L. from west to east, product of the development of a series of contractional structures, generating topographic levels of up to 800 m in the Central depression limit-Precordillera (Herrera, 2013).

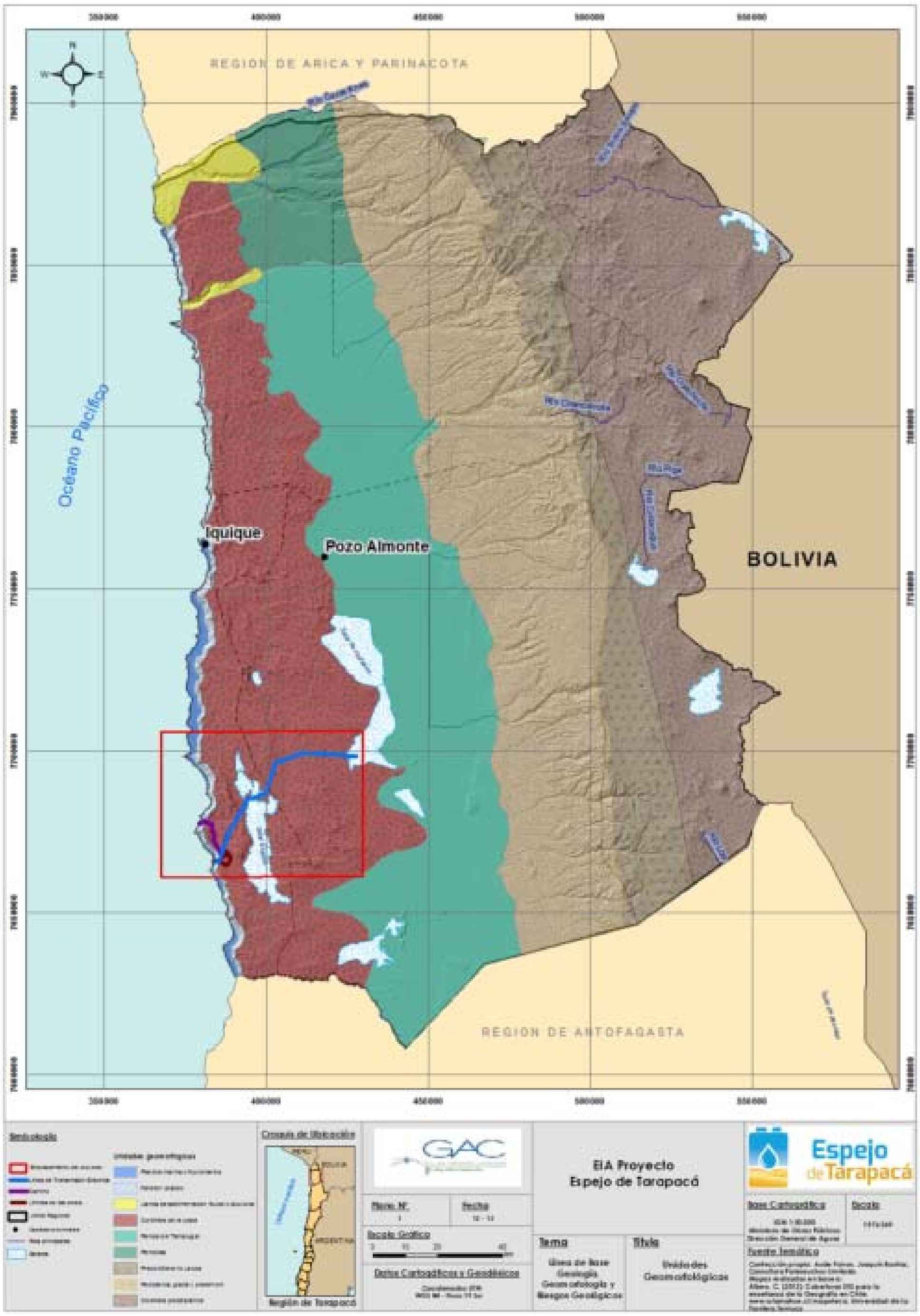
gg) The Andes mountain range

This mountain range is the main orographic feature of the country, formed by the lifting of materials during the tertiary, threaten either and fracturándose, creating areas of falles. In this region, it is characterized by an altitude of approximately 4,000 M.A.S.L., and a flat topography in height between the summits and the volcanoes of the region. The Cordillera de los Andes is also characterized in this region by its slightly pronounced inclination towards the west to heights of 2,500 m, where it comes into contact with the Pampa del Tamarugal.

hh) The Altiplano

The presence of basins or depressions intercordilleranas in the longitudinal sense divide the Cordillera de los Andes in an eastern strip where the Altiplano predominates with higher heights of 4,000 meters. It corresponds to an almost flat plateau that is located between the eastern and Western cordon of the Cordillera de los Andes, filled with volcanic materials and interspersed with alluvial deposits of both superficial and Napa runoff.

Figure 3-46. Units GEomorfológicas of the I region of Tarapacá (according to Börgel, 1983).



Source: Own Elaboration.

iii. Results

- **Underground Works Sector**

The geomorphological units present in this sector of the Project They are from west to east, coastal plains and coastal cliff, as can be seen in the Figure 3-47

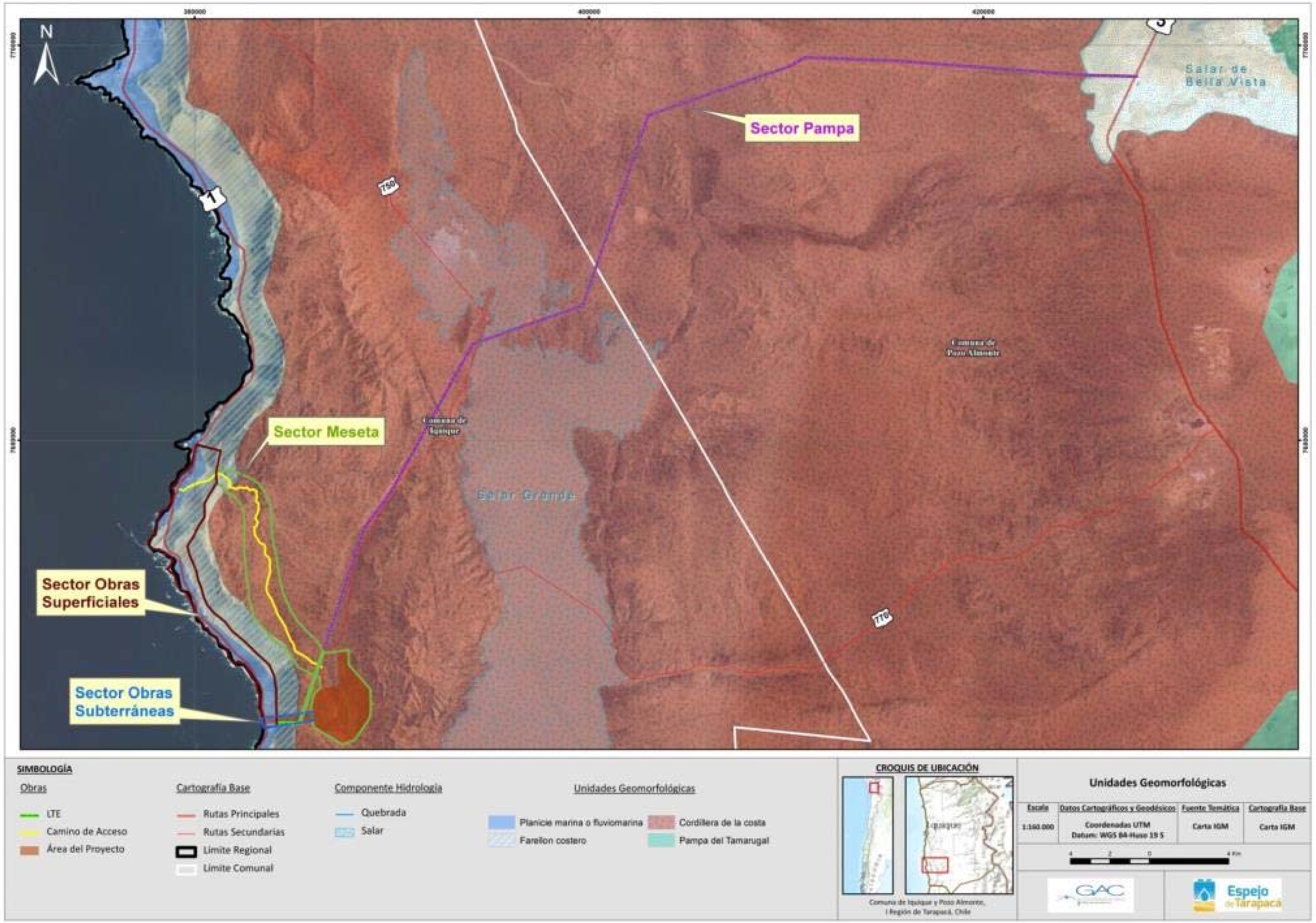
- **S Works SectorUperficiales Costa**

The geomorphologic unit present in this sector of the Project It is the coastal plain, as can be seen in The Figure 3-47 Attached.

- **Plateau Sector**

The geomorphologic unit present in this sector of the Project It is the Cordillera de la Costa, as can be seen in the Figure 3-47.

Figure 3-47: Units GEomorfológicas.



Source: Own Elaboration.

- **Pampa Sector**

The geomorphological units present in this sector of the Project They are from west to east, the coastal cliff and the Cordillera de la Costa in almost all its extent, as you can see in the Previous figure, where the electrical laying It crosses the Salar Grande in the Cordillera de la Costa and reaches at its extreme east the Salar de Bellavista in the Pampa del Tamarugal.

ii) Relief

- **Works Sector SuPerficiales Costa**

Zone Plains and Coastal cliff

In the area of the Project, the coastal plains are of little development, are presented with a width of approximately 600 meters, they correspond to terraces of abrasion between the Cordillera of the coast and the sea. The most notable geomorphologic unit in the area of Project It is the coastal cliff, which corresponds to a large cliff, direct product of the development of marine abrasion terraces due to changes in the sea level and reaches a height of approximately 700 meters (Figure 3-47, Figure 3-48 At the point of intersection between the tunnel and the area of Reservoir. The cliff is mainly present in this area, between 30 ° and 40 °, and in some parts of the slopes exceeding 45 °.

Figure 3-48. Photograph of the coastal cliff TOmada DEsde The Plains LItorales, SWorking the LOnline of the project Tunnel (left, east facing; right, south facing).

Source: Own Elaboration.

- **Sub Works SectorMarine**

In this sector it does not apply to evaluate this component.

- **Sector Plateau**

The Sector Plateau Reaches The 400 m high in the cliff and gradually reaching heights between 600 and 700 m towards The south of this sector.

The intrusive rocks that surface in the plains, have faceted ridges produced by fluvial and wind abrasion (Figure 3-49).

Figure 3-49. Process of ToBrasión, GRanodiorita Introducing CAntos FAcetados.

Source: Own Elaboration.

Cordillera de la Costa area

The Cordillera de la Costa is characterized by a terrain that usually consists of isolated, subrounded hills and highly rugged areas with relief generally low conforming one isPecie of Plateau Wavy. In this sector, there are two important Quaternary age depressions of 600 m (Figure 3-50), surrounded by isolated hills of Vo originLcánicos assigned to the Jurassic. These depressions correspond to the area of Reservoir Of Project.

Figure 3-50. Relief in ZOna DE REservorio of the project.

Source: Own Elaboration.

- **Sector Pampa**

The layout of the Electric transmission Line Of Project, it crosses the large salar, with flat relief and great amplitude, covered by saline deposits (Figure 3-51).

Figure 3-51. Salar Grande, Cordillera de la Costa, región de Tarapacá.

Source: Own Elaboration.

The zone is characterized by typical structures of arid deserts due to processes of wind and water erosion.

The area of the Project In the Cordillera de la Costa, it presents a landscape of type REG (Desert pavement) formed in part by the phenomenon of deflation by which the wind eroded the surfaces taking the finer particles to leave the thickest rocks (Figure 3-52).

Figure 3-52. Processes of ERosion EÓlica, FEnómenos DEflación.

Source: Own Elaboration.

There are slopes structures of soft surface and moderate slopes of Jurassic volcanic origin (Figure 3-53), mainly due to wind erosion, but also to the absence of plant cover, which allows when a rainy episode occurs, the ALteAssociated chemical ration is more pervasive in the rock.

These slopes present a linear erosion in the form of streams and paleocárcavas, serving as sediment reservoir available to be dragged into a future runoff event (Figure 3-53). The streams (rills) and their uLteThe evolution in gullies (gullies) are forms associated with concentrated surface runoff and characteristics of means susceptible to high rates of erosion, with scarce plant cover and very low organic matter content in soils (Calvo-cases, et al.,2011).

Figure 3-53. Structures of LOmajes that QThey resettle REgueros with REservorio SEdimentos FInos and MEdios.

Source: Own Elaboration.

On several occasions, the bedrock has dewatering cracks developed by drying the clay soil. The presence of dewatering cracks is a very good indicator of sediment exposure to subaerial conditions (Nichols, 2009). Clay-rich sediments are cohesive and particles tend to stick together when sediment dries. When water is lost, the volume reduces the groupings of clay minerals And these Are fragmented developing cracks in the surface (Figure 3-54).

Figure 3-54. Cracks of DEsecación.

Source: Own Elaboration.

In general, it can be concluded that the dominant geomorphological processes in the area are erosion, mostly windy and slightly watery.

Zona Pampa del Tamarugal

The Electric transmission Line At its extreme it reaches the boundary between the Cordillera de la Costa and the Pampa del Tamarugal, where the Salar de Bellavista is characterized, like the Salar Grande, to present a flat relief of very slight slope covered by saline deposits (Figure 3-55).

Figure 3-55. Salar de Bellavista, Pampa del Tamarugal, Region of Tarapacá.

jj) Altitude

- **Underground Works Sector**

The works Sector has heights lower than 50 meters in the area of the coastal plains that correspond to the western part of the Project, and a sharp elevation in the coastal cliff that forms a cliff up to approximately 800 m high.

- **Sector Works Underwater**

In this sector it does not apply to evaluate this component.

- **Sector Surface Works Coast**

This sector of works presents heights lower than 50 meters in the zone of the coastal plains, increases to its height as it approaches to the coastal cliff in the northwest part of this sector, presenting an approximate height of 600m.

- **Sector Plateau**

The Sector Plateau It crosses the coastal cliff by a ravine at an approximate height of 400 m, reaching gradually to the area of the reservoirs to An approximate height of 600 m, to a relief More Well flat.

- **Sector Pampa**

The Electric transmission Line It begins at the foot of the coastal cliff, crosses this perpendicularly to reach heights of 700 m, and then heads northeast in the Cordillera de la Costa, by a terrain presenting a rise in the topography progressive and smooth towards the East End where the Heights reach 1100 m.

kk) Earrings

The analysis of slope is carried out according to the classification of Araya et al., 1972; Young, 1975; Ferrando, 1993, and Messina, 2003. The following criteria are presented:

Table 3-16. Classification of QMesh.

Pendiente (grados)	Pendiente (%)	Concepto	Umbral Geomorfológico
0 - 2	0 – 4.5	Horizontal	Erosión nula a leve
2.1 – 5	4.6 – 11	Suave	Suave erosión leve, difusa. Shett wash. Inicio de regueras. Solifluxión fría.
5.1 – 10	11.1 – 22	Moderada	Erosión moderada a fuerte. Inicio erosión lineal. Rill wash o desarrollo de regueras.
10.1 – 20	22.1 – 44.5	Fuerte	Fuerte erosión intensa. Erosión lineal frecuente. Cárcavas incipientes.
20.1 - 30	44.6 – 67	Muy Fuerte	Moderadamente escarpada, cárcavas frecuentes. Movimientos en masa, reptación.
30.1 – 45	67.1 – 100	Escarpada	Coluvionamiento, solifluxión intensa.
> de 45	> de 100	Muy Escarpada a Acantilada	Desprendimiento y derrumbes. Corredores de derrubios frecuentes.

Fuente: Clasificación de Pendientes. Araya, Vergara y Borgel 1972; Young 1975; y Ferrando 1993. Modificada y presentada por MESINA 2003.

- **Underground Works Sector**

In this sector of the Project Presents the Higher slope, corresponding to the cliff of the coastal cliff, which presents in majority slopes above 30 °, reaching in several occasionsIt is slopes above 45 °, which indicates constant landslides and landslides, being also washout corridors.S Frequent.

- **Sub Works SectorMarine**

In this sector there is no Apply evaluate this component.

- **Works Sector SuPerficiales Costa**

In this sector of the Project There is a predominantly horizontal slope (0 °-2 °), which presents a null-to-mild erosion corresponding to the geomorphologic unit of the Littoral plateau. In the northern sector of these superficial works are pending Strong To Steep, as it is located in part Of Coastal cliff, characteristic for its Abrupt Earrings.

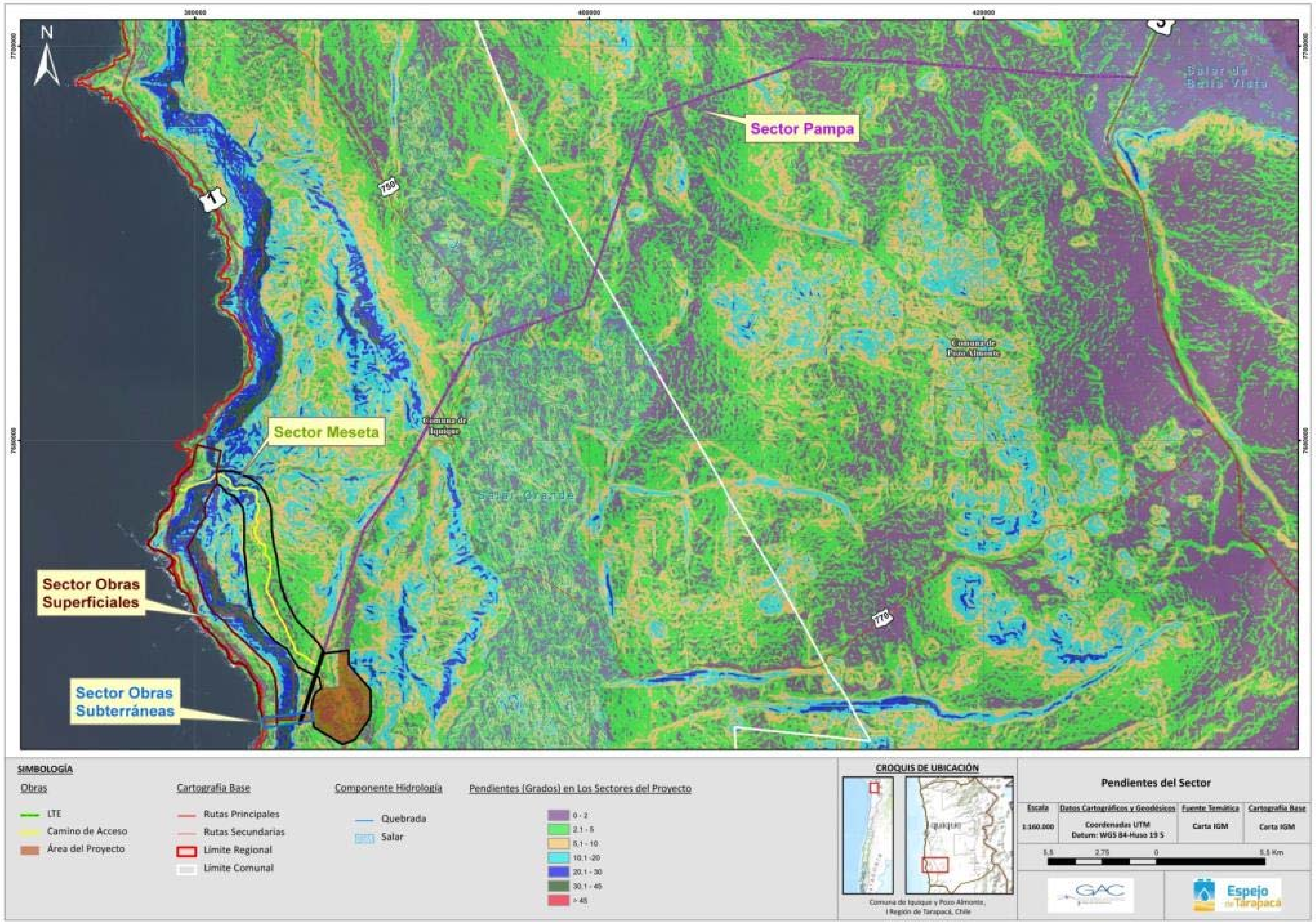
- **Sector Plateau**

The prevailing slopes in this sector of the Project They are from horizontal to mild in the southeastern part of this sector, located in the Cordillera de la Costa, with slopes from 0 ° to 5 °, indicating a horizontal or mild to moderate erosion, while in the northwestern part of this sector of the Project, more significant slopes are presented, of the Order of 10° to 30 °, because it is located in an area of hills prior to the coastal cliff.

- **Sector Pampa**

The Sector Pampa, corresponding to the plot DE The power line starts in the same sector where the Underground Works Sector, with steep slopes of the coastal cliff. During the first 14 km, the Electric transmission Line It borders hills of slopes moderate to strong. To the east end, there are mainly soft slopes (Up to 5 °) or moderate (5 °-10 °).

Figure 3-56. Map of PEntines Mirror Project of Tarapacá.



Source: Own Elaboration.

II) Orientation of LAderaS

- **Underground Works Sector**

In this sector of the Project are presented DIstintas orientations of slopes. But they mainly present a Orientation West and northwest corresponding to the cliff of the coastal cliff. In the upper part of the cliff you can see a cord with east-northeast orientation.

- **S Works SectorUbmarinas**

In this sector there is no Apply evaluate this component.

- **Works Sector Surface Coast**

The This sector In the Coastal Plain It presents a dominant orientation both east-northeast and west-northwest. In this sector, 2 transversal cords are evident in which the south and southeast orientation predominates.

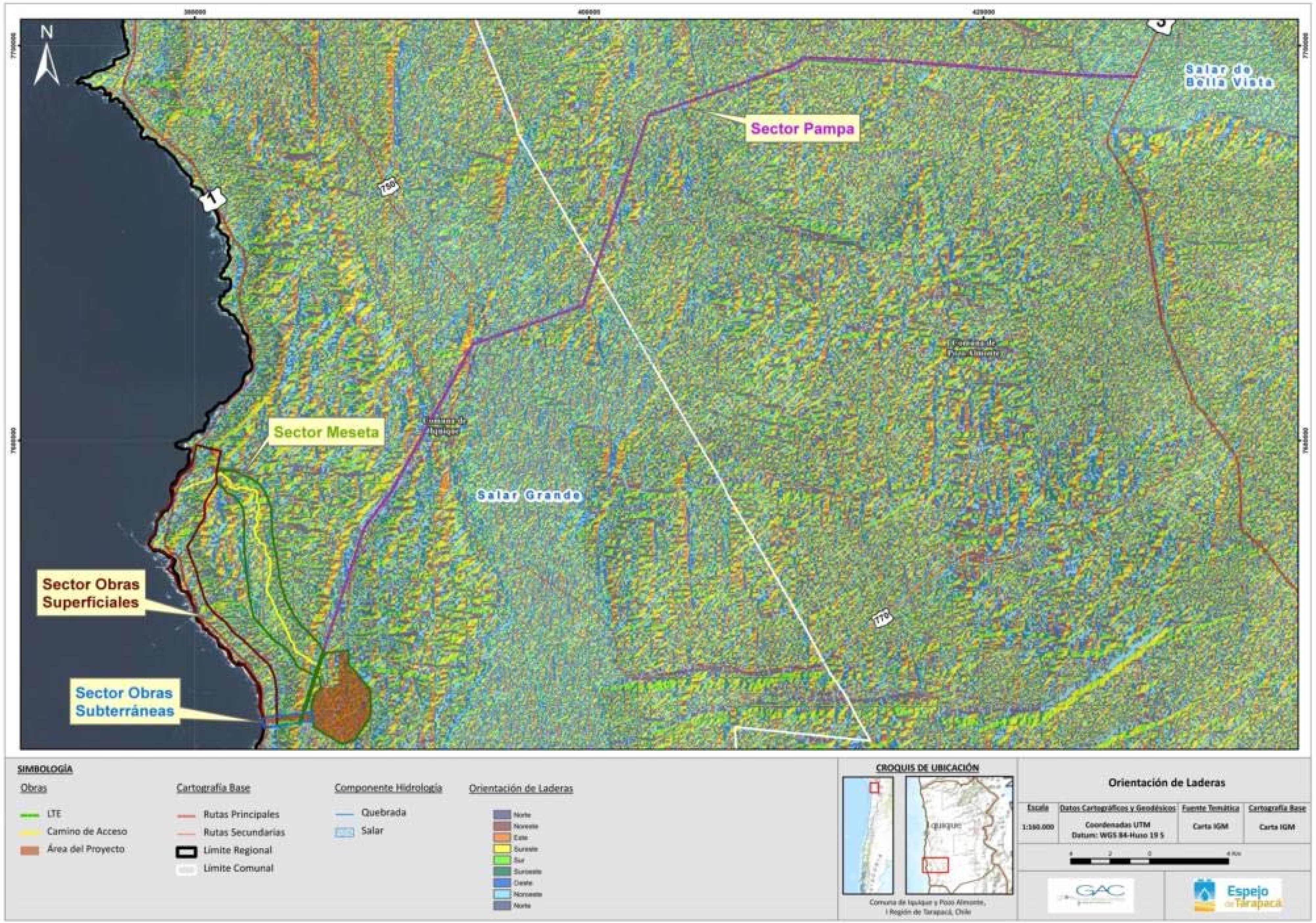
- **Sector Plateau**

Located in the heart of the Cordillera de la Costa, in LTo the north-east of this sector, it presents from both sides hills of orientation mainly this-sureBut also west-northwest, while in the rest of the area of this sector of Project, there is no clear preference for the guidelines.

- **Sector Pampa**

The Electric transmission Line It borders on the Cordillera de la Costa Cerros, presenting a mainly south-southeast orientation. No preferential orientation is noticed in the Salar areas due to the absence of relief in these parts.

Figure 3-57: L OrientationSidewalks in TARAPAC Mirror Project's



Source: Own Elaboration.

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3.2.2.3 Risks

i. Methodology

The characterization of the zone was carried out, based on the information taken from previous studies in the area, of documents of public sources related to the studied components, and complemented with two recognitions of ground (5 and 4 days), realized in October 2013 with the assistant in Geology Raúl Ugalde and December 2013.

The working methodology for the present Project Included:

- A first stage of the description of the risks derived from endogenous and exogenous causes. The first ones (seismicity and volcanism) of regional scope, based on expert report and existing antecedents. The latter, they say relation mainly with the occurrence of phenomena of mass removal, flows of detritus and fall of rocks. Its occurrence is restricted to the area of influence of the sectors of the Project.
- A second stage of characterization in the field consisting of two visits on site between 15 and 19 October 2013 and between 1 and 4 December 2013. These visits were aimed at evaluating the geological conditions of the site, conducting the field study, in order to generate a geologic, geomorphologic and risk baseline report.
- A third stage of post-field cabinet work, for the analysis of the data taken on land and conclusions of the previous points.

ii. Theoretical framework

Natural hazards are defined as the confrontation of the probability of occurrence of a danger (natural phenomenon) with the vulnerability of a geographical area, where there is an affectable system that can be human, economic or environmental. Examples of recurrent disasters in Chile include earthquakes, tsunamis, volcanic eruptions, droughts, urban and forest fires, mass removals, etc.

Natural hazards for the area of the Project are presented below.

mm) Endogenous risks

Seismic risk

Chile is one of the most seismic countries on the planet, on average, every ten years there is an earthquake of magnitude greater than 8 in some part of the territory. The level of seismicity is such that since 1962, there have been more than 4,000 earthquakes of magnitude greater than 5 (Madariaga, 1998). The largest earthquakes in Chile originate mainly in the Chilean-Peruvian oceanic fossa which corresponds to a subduction mechanism of the NAZCA plate under the South American Plate., at a distance from the coast that can vary between 100 and 200 km.

The Department of Geophysics of the University of Chile provides the national seismological service, which has seismic stations distributed throughout the country in order to monitor and catastrar the totality of earthquakes occurring in the national territory.

Tsunami risk

Chile is one of the main tsunami generators in the Pacific Ocean. Indeed, "tsunamigénicos" earthquakes are usually associated with subduction zones, and since many subduction zones are bordering the Pacific basin, the vast majority of tsunamis have occurred in the Pacific Ocean (http://www.snamchile.cl/, November 2013).

The characteristics of a tsunami on reaching the coast are based on the magnitude of the phenomenon that induces it; of the distance from its point of origin to the coast; Of the coastline configuration and the underwater topography.

The Hydrographic and oceanographic Service of the Navy (shoal), which started from the year 1997 the execution of the Project CITSU, which consists of the elaboration of tsunami flood charts for the coast of Chile, indicates that in extreme cases, sea level has risen to more than 15 m for tsunamis of distant origin and over 30 m for tsunamis detected near the epicentre of the earthquake and Preci SA that the flood can be extended to more than 300 m inland, covering extensive areas with water and rubble.

Volcanic risk

Chile presents 122 Geologically active volcanoes, of which 60 showed activity in the last centuries; And the country records 420 eruptions since the fifteenth century, including several of them of great magnitude.

LA network of volcanic surveillance of the SERNAGEOMIN, has a surveillance network based on the habilitation of a chain of observatories regional Volcanológicos What It allows to contribute to the security of the community before the occurrence of volcanic eruptions.

In the region of Tarapacá, a volcano is monitored by the SERNAGEOMIN Volcanic Surveillance network: The Isluga volcano, located in the province of El Tamarugal, in the commune of Colchane.

nn) Exogenous risks: Removals in MHandle

Exogenous risks are mainly related to the occurrence of mass-removal phenomena.

The processes of mass removal are defined as "processes of transport of slow or rapid mobilization material of certain volume of soil, rock or both, in various proportions, generated by a series of factors" (Hauser, 1993).

They are classified according to three main criteria:

- The speed of movement (slow or fast)
- The type of movement (mainly fall, slip or flow)
- The type of material you drag (rock, soil or debris)

Keefer (1984), establishes that the most abundant types of removals generated by earthquakes correspond to falls of rocks and landslides disaggregated of soils with slopes of slopes > 15 ° and sliding of rock with slopes ≥ 40 °, and secondarily landslides and Earth avalanches.

The following report has been reported on mass removal processes:

Mud and Alluvia flows

In the area of Tarapacá, detrital or Alluvia flows occur, as a result of high intensity rainfall occurring mainly in the winter period.

A flow of clay designates a mass movement of greater or lesser velocity, typical of non-cohesive materials, which act temporarily as a fluid, experiencing a continuous deformation and without presenting definite break surfaces (Hauser, 1993). These shallow movements can take place on slopes of low slopes (even less than 10 °) (Álvarez, 2006).

Detrital flows occur as a result of high intensity rainfall occurring mainly in the winter period, associated with abrupt relief areas, usually Devoid of vegetation and formed by volcanic, sedimentary and intrusive rocks, which are normally affected by weathering processes and/or superficial fracturing. This danger is concentrated both in the riverbeds of major and minor ravines and in the plains of Cordillera or foothills.

Although strong slopes and absence of vegetation seem almost always favorable characteristics to the generation of detrital flows, minor slopes Que does not exceed 15 ° or with COBertura Forestry can also develop these flows (Sauret, 1987).

Alluvial flows occur from the abrupt collapse of a glacial lake or sporadic Rain (Hauser, 1993). According to Hauser (1993), these flows are defined as local and sudden or torrent of relatively large and short-lived volume, overflowing riverbeds in dry valleys, in semi-arid zones, transporting an enormous load of mud and rocky fragments, Generally linked to very sporadic rains, of short duration and of great intensity. Slopes greater than 25 ° in the headwaters of the watersheds, are favorable for the development of flows or Alluvia (Hauser, 1993).

Erosion of slopes, formation of gullies

It is the geodynamic phenomenon that develops in the slopes and mostly in sloping terrains that have limited vegetal cover, in regions where the rains are seasonal and intense (Hauser, 1993).

These gullies are generally observed as furrows that form on the slopes of the hills by the runoff of the superficial waters downwards, dragging the fine material in its route.

Slides and Rock Falls

Landslides are removals of masses of rocks and soils that slide according to more or less net breakage surfaces in a straight or derived form. By overcoming the cut resistance, it generates movement of the material that moves separately from the set with the same speed in all its parts, preserving its structure and its original shape (Hauser, 1993).

Rock falls are fast movements, mobilizing more or less homogeneous rocky volumes in a vertical area or steep slope. They consist of the release, by gravity, of blocks of rocks. In the presence of an earthquake can be generated from fractured rocks, meteorizadas, low resistant, in areas where the slopes are greater or equal to 40 ° (Keefer, 1984).

According to Keefer (1984), slopes of angles greater than or equal to 15 °, in the presence of an earthquake, would be susceptible to generate landslides in translational type soil, and angles greater than or equal to 10 ° to generate rotational slides. In the case of rock slopes, slopes of angles greater than or equal to 35 ° could generate landslides, and in the presence of an earthquake, angles greater than or equal to 15 ° could generate massive rock slides or blocks (Keefer, 1984).

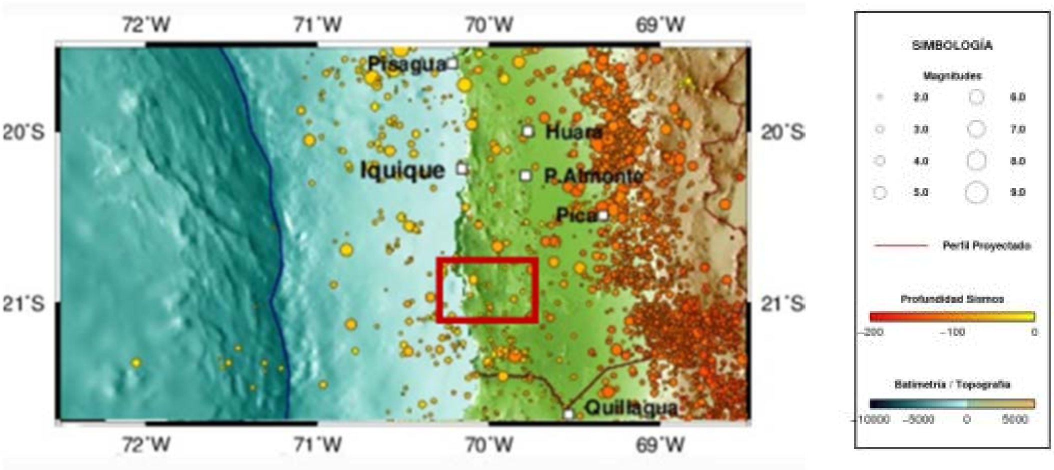
iii. Results

oo) Risk SÍsmico

The area of interest in this study, between 19 ° S and 22 ° S, is characterized by high seismic activity.

In the Figure 3-39 One can see the distribution of the epicenters of the earthquakes occurring in the southern part of the region of Tarapacá (between 19 ° S and 22 ° s) between the years 2000 and 2011. In general, the inter-plate earthquakes of magnitudes greater than 7.5 are located near the coast or in the sea, at depths that fluctuate between 10 and 100 Km. As the earthquakes get deeper into the interior of the continent, the magnitudes decrease, seldom sobrepBroiling magnitudes from 6.5 to 7.0.

Figure 3-58. Distribution of earthquakes in the area of the Project.



Red Box: Location of the Project

Source: Seismology Service of the University of Chile.

Among the strongest earthquakes registered since the year 1570, the Earthquakes of Iquique (1877, 2005) of the respective magnitude 8.5 and 7.8 and in the province of Tarapacá (1878) of magnitude 7.9 are outstanding (Table 3-17). This table gives an account of the vulnerability that the region presents to seismic risk, due to the high probability of occurrence of large-intensity earthquakes.In the future in this area.

Table 3-17. Earthquakes of MAgnitud MAyor or IGual to 7.0 in the region of Tarapacá (1570 to date).

Local date	local time	Latitude	Length	Magnitude Ms	Magnitude Mw	Depth (km)	Effect
24/08/1869	13:30	-19,600	-70,230	7.5	-	-	Tm
05/10/1871	5:00	-20,200	-70,170	7.3	-	-	T
09/05/1877	21:16	-19,600	-70,230	8.5	-	-	Td
23/01/1878	8:00	-20.000	-70.300	7.9	-	40	-
15/09/1911	08:10	-20,000	-72,000	7.3	-	-	-
23/02/1933	4:09	-20,000	-71,000	7.6	-	40	-
14/03/1943	14:37	-20,000	-69,500	7.2	-	150	-

Local date	local time	Latitude	Length	Magnitude Ms	Magnitude Mw	Depth (km)	Effect
01/12/1943	6:34	-21,000	-69,000	7.0	-	100	-
25/04/1949	9:54	-19,750	-69,000	7.3	-	110	-
29/05/1949	21:32	-22,000	-69,000	7.0	-	100	-
06/12/1953	22:05	-22,100	-68,700	7.4	-	128	-
08/01/1956	16:54	-19,000	-70,000	7.1	-	11	-
13/06/1959	20:12	-20,420	-69,000	7.5	-	83	-
21/12/1967	22:25	-21,800	-70,000	7.5	-	33	-
29/11/1976	21:40	-20,520	-68,919	7.3	-	82	-
08/08/1987	11:48	-19,000	-70,000	7.1	-	42	-
13/06/2005	18:44	-19,895	-69,125	7.8	7.8	108	-

Source: Seismological Service, University of Chile

T : Tsunami
Tm: Moderate Tsunami.
Td: Tsunami destroyer and Major.
-: no information.

The part of the Project Located in the relatively flat areas of the Cordillera de la Costa, it presents a low to zero seismic risk. However, the part of the Project Located on the coast and the coastal cliff, it presents a high seismic risk, not direct in relation to the destruction of works, but indirect by the generation of processes of removals in masses in areas of steep slope, as a consequence of such a seismic event, and/or the Occurrence of an eventual tsunami.

pp) Tsunami risk

is presented in the Figure below A compilation of the most notable tsunamis that occurred on the shores of the I region of Tarapacá, identifies 3 tsunamis that have generated various damage.

Table 3-18: History TTsunamis that ToFectaron the COstas of the I region of Tarapacá

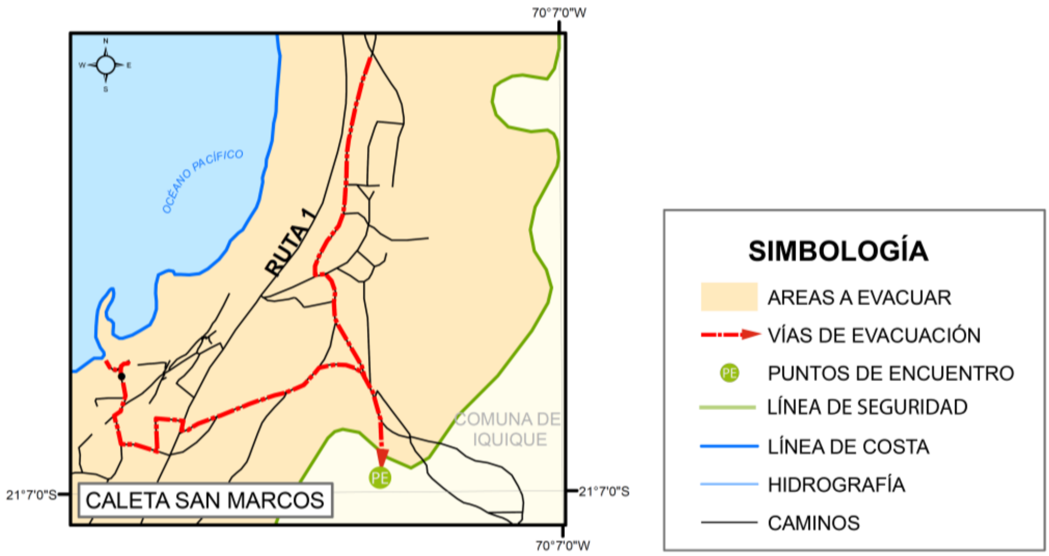
Area of location	Date	Epicentre of the earthquake		Tsunami degree	Magnitude of the quake (Richter)	Estimated length of displacement (km)	Maximum sea-level variation
		Latitude	Length				

Area of location	Date	Epicentre of the earthquake		Tsunami degree	Magnitude of the quake (Richter)	Estimated length of displacement (km)	Maximum sea-level variation
		Latitude	Length				
Arequipa and northern Chile between latitudes 16 ° S and 20 ° S	24-11-1604	18 ° S	71 ° S	-	8.7	415	16 meters in Arica
Arequipa and Northern Chile	13-08-1868	17.7 ° S	71.6 ° W	-	8.8	500	20 meters in Arica
Iquique to Antofagasta	09-05-1877	21.0 ° S	70.3 ° W	-	8.8	420	21 m in mussels

Source: Data from the Shoah

The Figure It presents the Plan of Civil protection against Tsunami of the Caleta San Marcos realized by the ONEMI in 2013, indicating that the floodable zone corresponds to the totality of the coastal plains, until the foot of the coastal cliff.

Figure 3-59. Plan of QCivil Environmental Protection to Tsunami – Caleta San Marcos.



FUENTE:	DISEÑO:
-Dirección regional de ONEMI Tarapacá	Oficina Nacional de Emergencias del Ministerio del Interior y Seguridad Pública.
-Comite comunal de protección civil y emergencias	NOTA:
-Ilustre Municipalidad de Iquique.	El plano de Caletas es solo una imagen de referencia.

The sectors of the Projects located on the coast (West road sectors, tunnel and Electric transmission Line) present a high Tsunami risk in the event of an earthquake of major magnitude in northern Chile.

qq) Volcanic risk

The nearest volcanoes in the area of the Project They are the Irruputuncu volcano and the Olca-Paruma volcano, both of which are located about 160 km east of the Project. The volcanic risk, by the remoteness of the volcanoes to the Project It's considered very unlikely.

rr) Risk by REmotion in MHandle

Risk of mud and alluvial fluxes

- **Sector Underground works**

In this sector, corresponding to the coastal cliff, presents A slope greater than 30 °, which is sufficient to provoke in case of rain, important detrital flows.

- **Sector Underwater works**

In this sector there is no Apply evaluate this component.

- **Sector Surface Works Coast**

In this sector, The coastal area With Slopes less than 15 °, indicating a very low risk. There is a high risk zone in the whole part of the cliff of the coastal cliff with slopes above 30 °, sufficient to provoke in case of rain important detrital flows.

The road sector presents a high risk when crossing the coastal cliff, because it is in a ravine with very strong or steep slopes.

- **Sector Plateau**

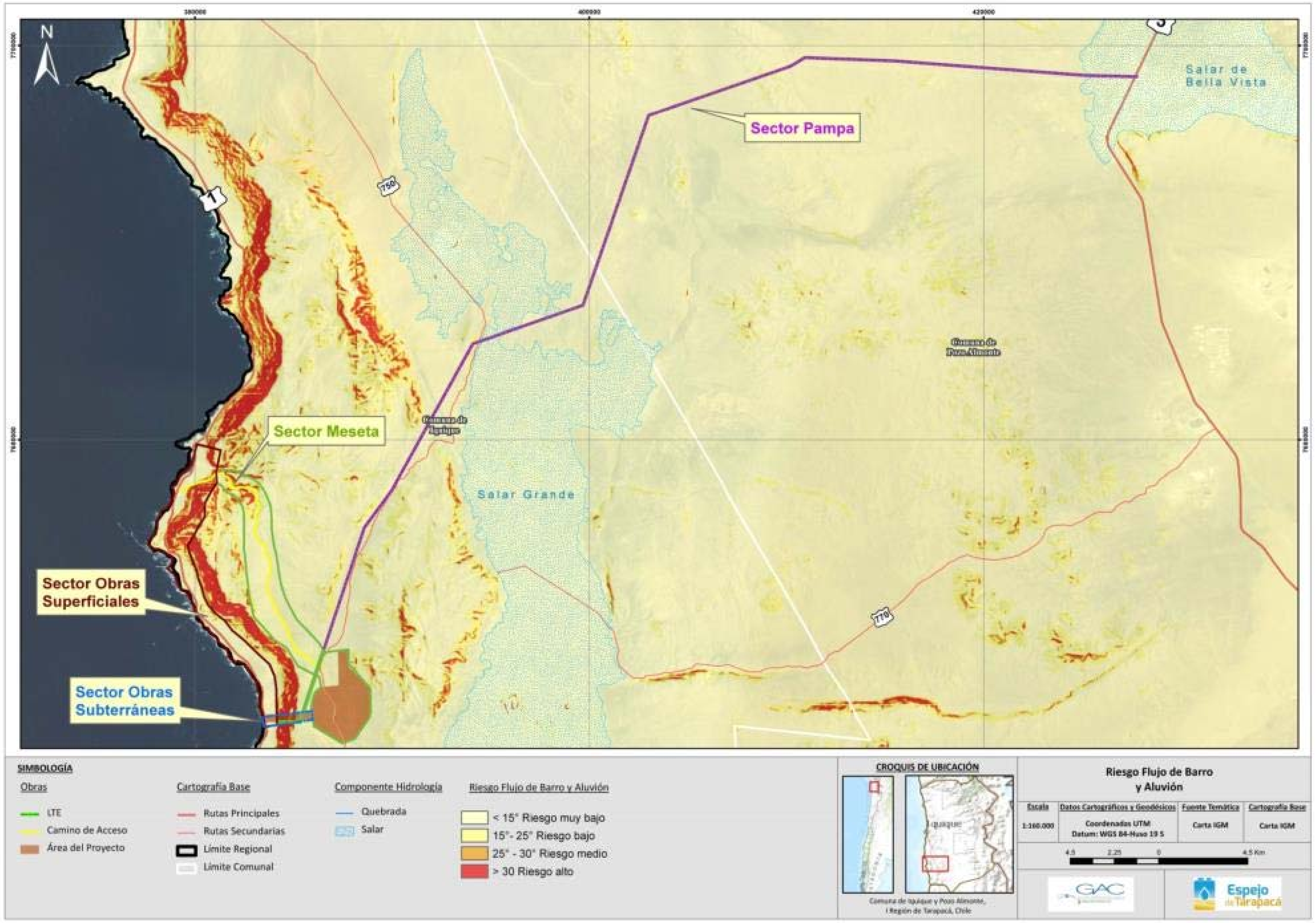
In the part of the Cordillera de la Costa, where the relief is relatively flat, the risk is mainly low to very low. However, because of the presence of hills in the northwestern part of this sector, the risk of mud and flood flows It happens to be from medium to high.

- **Sector Pampa**

The Electric transmission Line, at its west end it crosses the cliff and presents there a risk of high mud flow. In the rest of the path, the risk It's considered low to very low.

It is important to consider that the impact of an episode of mud flow in the coastal cliff over the coastal plains area could be important depending on the amount of material removed.

Figure 3-60. Risk of FLuxury of BArro and ToLuvión.



Source: Own Elaboration.

Erosion of slopes, formation of gullies

- **Sector Underground works**

In the area Of the cliff, the risk of erosion of slopes is very high, because there are superior slopes s 20 °, as shown by the Figure 3-62.

- **Sector Underwater works**

In this sector there is no Apply evaluate this component.

- **Sector Surface Works Coast**

In the Coastal area corresponding to this sector, where the slopes are null or very low, the risk of slope erosion is considered null or very low. However, in the northwestern part of these works the risk is heightened by being part of what is the coastal cliff, as shown by the Figure 3-62.

- **Sector Plateau**

In this sector, the risk is low in much of the Cordillera de la Costa, however this increases between medium to High, In the La Negra formation hills. These gullies are observed in this area as furrows that form in the slopes of the slopes by the runoff of the superficial waters downwards, dragging the fine material in its route (Figure 3-61).

Figure 3-61. Formation of CÁrcavas on the slopes of the slopes.

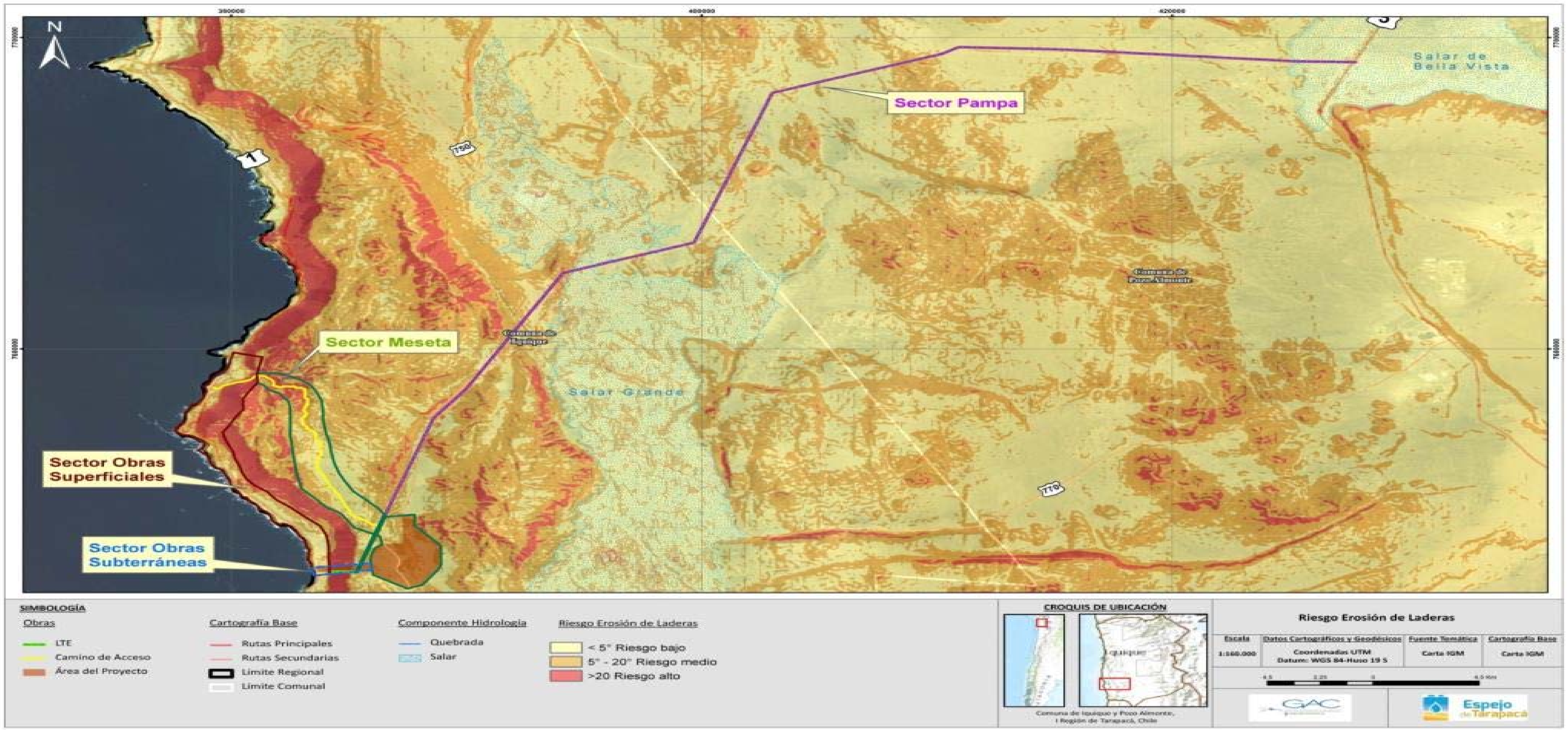
Source: Own Elaboration.

- **Sector Pampa**

The Electric transmission Line, presents in the first 15 km to the west in the Cordillera de la Costa a medium to high risk for presenting slopes above 5 °. In the rest of the path to the east, the flatter relief has slopes less than 5 °, representing a risk of EHalf-to-low side rosion

Figure 3-62: Risk Erosion of Laderas

Source: Own elaboration.



Landslides and rock falls

- **Sector Underground works**

The area of the coastal cliff in this sector has slopes greater than 20 ° and therefore they pose a high risk of soil sliding. Locally, the cliff has slopes exceeding 35 ° in this case presenting a high risk of landslide and rock. The risk of CAIda rock is present only in a local way in the coastal Cliff where slopes exceed 45 °.

- **Sector Underwater works**

In this sector does not apply to assess this component.

- **Sector Costa surface works**

In the coastal area risk is mainly low to present slopes below 10°, as well as on the road Sector, located in the Cordillera de la Costa. Locally, in areas of greatest slope corresponding to the hills that surround the two basins of reservoirs (10 ° - 20 °), the riesgo is considered as medium, as shown in the Figure 3-64.

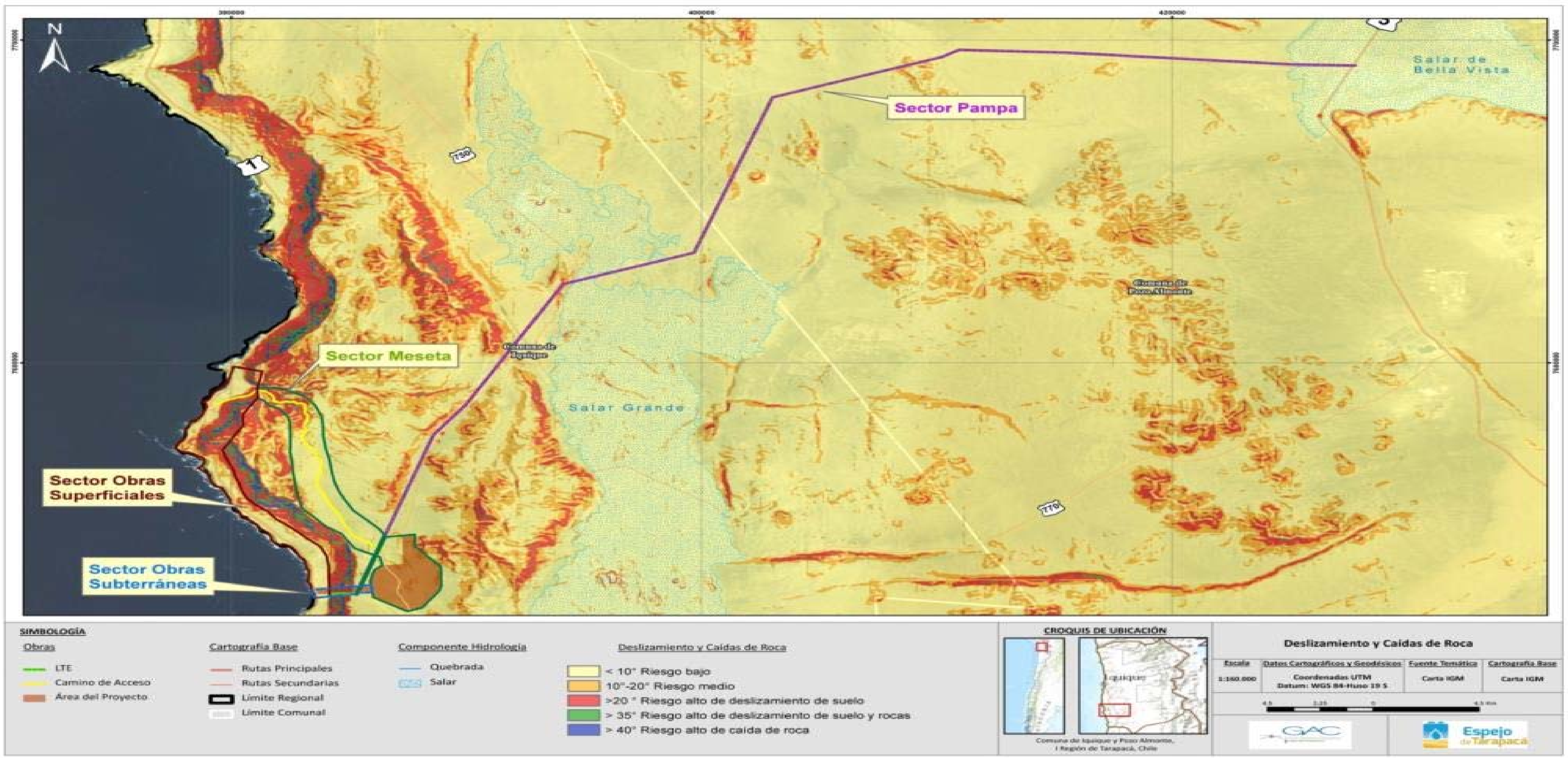
Is observed in the area of the Project at the foot of the coastal cliff moving volumes very vvariables of debris or rocks.

Figure 3-63. Photography of Deslizamiento in Ladera. Line ROja lindicates the Escarpe and the FROEs the Daddress of the Deslizamiento.

Source: Own elaboration.

Figure 3-64. Map of RSlip and fall of R iesgogeese Sector works surface Costa.

Source: Own elaboration.



- **Sector Plateau**

In this sector, located in the Cordillera de la Costa, the risk is mainly low by presenoutstanding tar below 10 °. Locally, in areas of greatest slope correspondiente to the formation of the Black Hills (10 °-30 °), the markeor it is considered as medium and high.

- **Sector Pampa**

The Sector electric transmission line in the Cordillera de la Costa presents a hazard mainly low to medium and borders cerro's higher (higher than 20 °) slope indicating a high risk of soil sliding. In the eastern part of the route slopes are less than 20 °, by the tAnto risk is low to medium.

iv. Conclusions

- **Underground works sector**
    - Seismic risk cannot be avoided and in this Region is important, therefore, the tsunami risk is considered likely in the case of occurrence of one earthquake in the area. The volcanic risk is considered unlikely.
    - The area of greatest risk is the coastal cliff, which by its very steep slopes, high risk of flow mud in case of sudden rain, a high risk of erosion of slopes and a high risk of landslide and rock fall.
    - The coastal area may be affected by the risk tsunami in the event of the occurrence of a major earthquake in the Region, and presents low risk of removal en masse by a flat relief.
- **Costa surface works sector**
    - Seismic risk cannot be avoided and in this Region is important, therefore, the tsunami risk is considered likely in the case of occurrence of one earthquake in the area. The volcanic risk is considered unlikely.
    - The area of greatest risk is the coastal cliff, which by its very steep slopes, high risk of flow mud in case of sudden rain, a high risk of erosion of slopes and a high risk of landslide and rock fall.
    - The coastal area may be affected by the risk tsunami in the event of the occurrence of a major earthquake in the Region, and presents low risk of removal en masse by a flat relief.
- **Sector plateau**
    - Seismic risk cannot be avoided and in this Region is important, therefore, the tsunami risk is considered likely in the case of occurrence of one earthquake in the area. The volcanic risk is considered unlikely.

- This sector, by having a flat relief in general risk of removal in mass bass, which becomes half in the Jurassic formation the Black Hills, which surround the two reservoir basins.

- **SECTor Pampa**
  - The sector of electrical lines, by having a flat relief in general risk of removal in mass bass, which becomes half in the Jurassic formation the Black Hills, which surround the two reservoir basins.
  - It is important to consider that under a regime of intense rainfall, as the Bolivian winter in summer time, the risk of mass removals increases significantly.
  - A possible seismic event of consideration, could potentially trigger the processes described above. Especially in the earthquakes associated with failures strike-slip in the region)e.g. Atacama-fault system), since due to its shallow depth may develop considerable acceleration of movement and become an element of risk.

v. References

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3.2.3 Continental hydrosphere

3.2.3.1 Hydrology

i. Objectives

Hydrologically characterize the area where is installed the Projectin relation to the basins and hydrological sub accounts and the availability of water resources, considering the elements that make up the water supply in the area of influence of the Project

ii. Methodology

The development of the present study were consulted reports, work and specific research related with Hydrology e Hydrogeology on the sector study, from which we have obtained the background indicating belowbeing the main source of information publications and material available on the website of the General direction of water[5] the Ministry of public works

Another source of information taken into account corresponds to studies and environmental impact assessments they are near the area of the Project.

The area of influence for this component is defined in relation to the sub-basins where is installed the Project.

iii. Results

ss) Regional hydrological framework

The Area of the Project is framed in the **Hydrographic zone: Rivers in flood of mixed regime in the semiarid zone of Chile,** This area located in norte grande of the country and part of the region of Atacama, is an area of excessive dryness, presenting with intermittent flow rivers throughout the year. Here the basins are conditioned by the relief, receiving its main contribution of altiplanic rainwater; in this way exorreicos hydrographic systems, with runoffs endorheic, sporadic, permanent, and systems are defined in this area arreicos.

The main basins are: River Lluta, Rio San Jose's AzapaBroken in VitorBroken shrimp, broken Camiña or Tana, broken Retamilla, Loa River.

According to the nature of the watershed and its power the military Geographic Institute (IGM) divided the area into the following units:

[5] http://www.dga.cl/Paginas/default.aspx

Table 3-19. Division of the Cuencas SEGUN RSystem (IGM).

Unit	Subunit
Exoreic basins	The northernmost transverse valleys
	The Loa River basin
Endorheic basins	Closed basins of the Puna
	Closed basins of middle elevations (Pampa del Tamarugal, Salar de Atacama, Salar de Punta Negra
Basins Dry of the coastal mountain range	-

Source: Military geographical Institute, 1984.

In relation to the above in the Table 3-19 the Project is inserted inside the units **Endorheic basins** (Pampa del Tamarugal) and **Basins Dry the Cordillera de la Costa**:

The Endorreic basin of the Pampa del Tamarugal It is one of the most extensive of chile comprises some 220 kilometers of length and 18.440 Km^2, is located from the quebrada de Tana to the North, to the Loa River. To the East, includes with its tributaries the slope West of the Andes mountain range, while to the West it covers the eastern slope of the mountain range of the coast. Hydrological resources they are highly variablesometimes from of streams that descend from the Andean heights and are fed at his bedside directly by the summer rainfall or from springs. From the mountains of the COSTA virtually no power, except in situations exceptional. The hydrological resources available in this area are going to feed the underground reservoir of the Pampa del Tamarugal.

The basins Dry they are located in the interior of the coastal mountain range and the coast of Tarapacá, where it is possible to identify numerous inactive basins or dry, where you stake salares them Grande and Soronal. Another feature of this area is the existence of watered down or sheds located at the foot of the Western skirt of the Cordillera de la Costa, at the foot of the cliff allowing human installation from remote time, between Iquique and Antofagasta most of these watering holes are linked to transverse faults of the Cordillera de la Costa, being inactive and signals that they There was a runoff, some They are still active but with very low flow.

tt) HydroLodge Local

- **Underground works sector**

From a climate point of view, the study area is characterized by its aridity, with high temperatures and evaporation rates considerable. In relation to the hydrological characteristics of the study area, highlights the absence of permanent rivers.

In relation to the sub-basins defined by the address geneeral de Aguas (DGA), within this sector the following are identified:

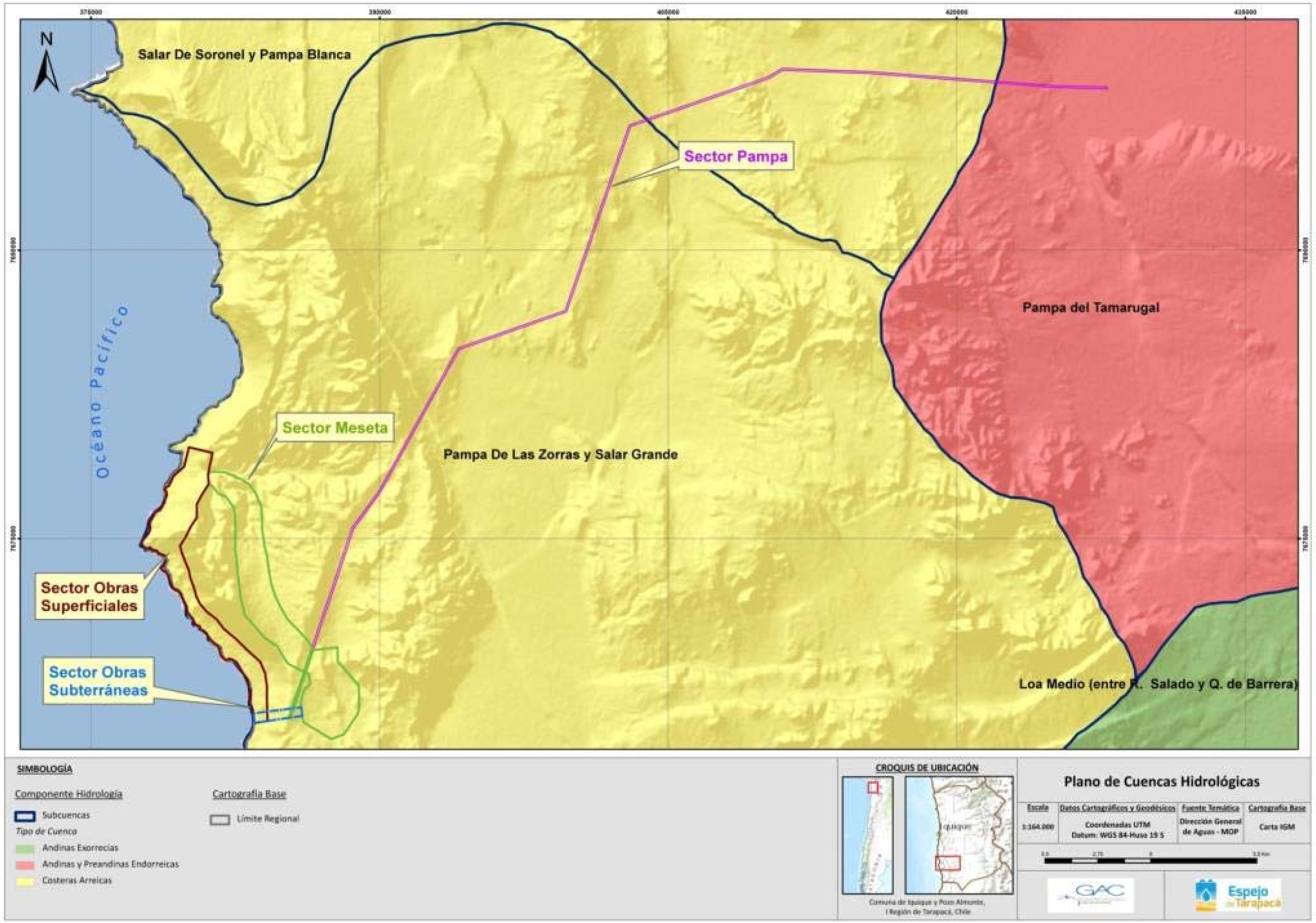
Table 3-20: Sub-basins Definidas by the DGA.

Basins	Sub-basins	Subsubcuencas
Coastal Dry (Coastal and Patache Loa)	Pampas foxes and Salar Grande	Pampas foxes and Salar Grande

Source: SNIT Tarapacá http://www.snit.cl/goretarapaca/index.php

In Figure 3-65 can be see the location of the Sub-basin Pampa of the foxes and Salar Grande, where this sector is located in the Project.

Figure 3-65: Basins and Sub-basins



Source: Own elaboration.

In relation to the water network in el area of influence is observed that there are only some intermittent streams located in the western end of the Cordillera de la Costa.

- **Sector works Superficiales coast**

From a climate point of view, the study area is characterized by its aridity, with high temperatures and evaporation rates considerable. In relation to the hydrological characteristics of the study area, highlights the absence of permanent rivers.

In relation to the sub-basins defined by the General water Directorate (DGA), within this sector the following are identified:

Table 3-21: Sub-basins Definidas by the DGA.

Basins	Sub-basins	Subsubcuencas
Coastal Dry (Coastal and Patache Loa)	Pampas foxes and Salar Grande	Pampas foxes and Salar Grande

Source: SNIT Tarapacá http://www.snit.cl/goretarapaca/index.php

In Figure 3-65 can be see the location of the Sub-basin Pampa of the foxes and Salar Grande, where this sector is located in the Project.

In relation to the water network in el area of influence is observed that there are only some intermittent streams located in the western end of the Cordillera de la Costa.

- **Sector plateau**

From a climate point of view, the study area is characterized by its aridity, with high temperatures and evaporation rates considerable. In relation to the hydrological characteristics of the study area, highlights the absence of permanent rivers.

In relation to the sub-basins defined by the General water Directorate (DGA), within this sector the following are identified:

Table 3-22: Sub-basins Definidas by the DGA.

Basins	Sub-basins	Subsubcuencas
Coastal Dry (Coastal and Patache Loa)	Pampas foxes and Salar Grande	Pampas foxes and Salar Grande

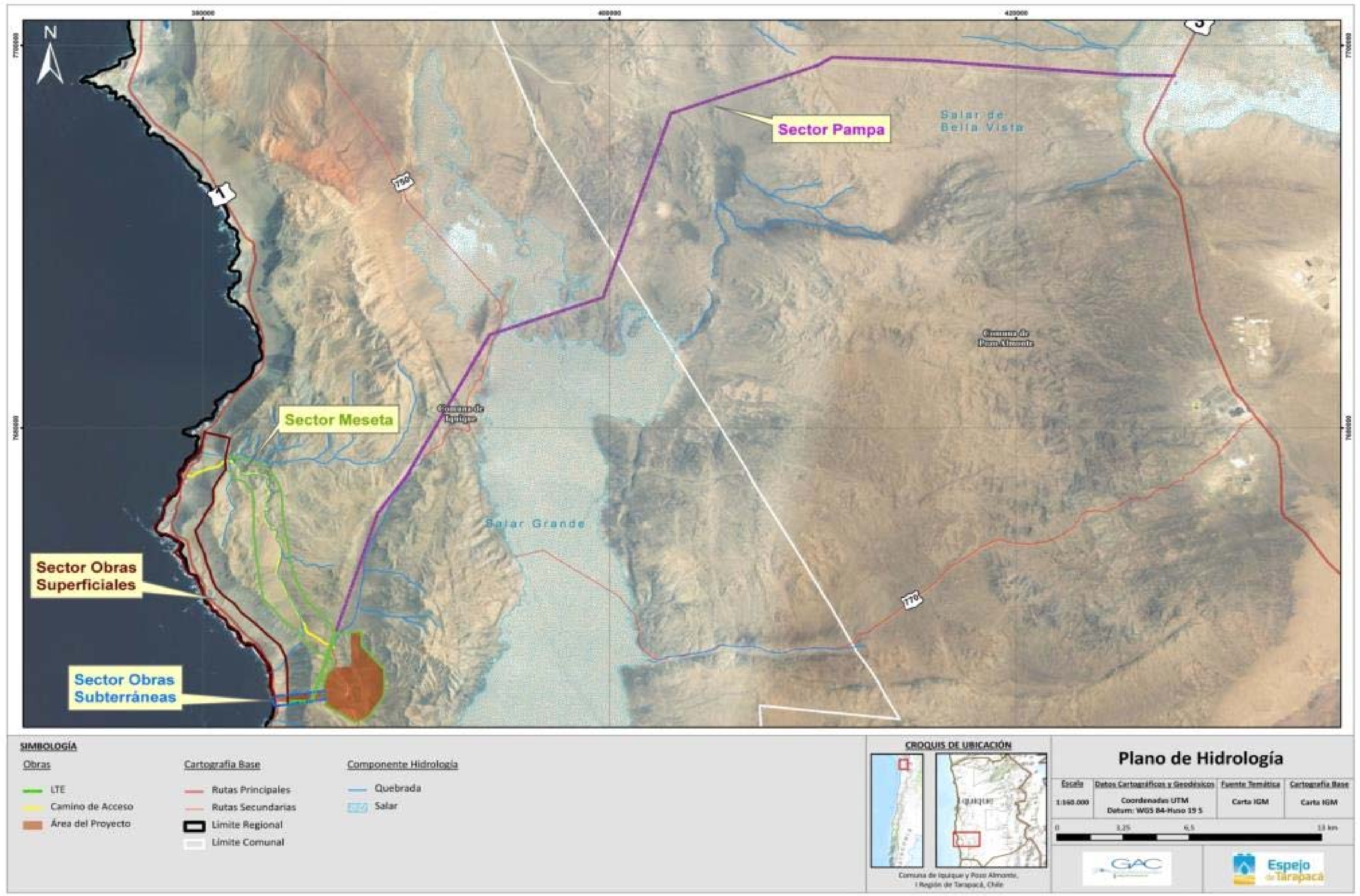
Source: SNIT Tarapacá http://www.snit.cl/goretarapaca/index.php

In Figure 3-65 can be see the location of the Sub-basin Pampa of the foxes and Salar Grande, where this sector is located in the Project.

In relation to the water network in the area of influence is observed Figure 3-66 that there are only some intermittent streams located in the extreme westernl of the Cordillera de la Costa.

Figure 3-66: Hydrology in the TOrea of the Project

Source: Own elaboration.



- **Sector Pampa**

From a climate point of view, the study area is characterized by its aridity, with high temperatures and evaporation rates considerable. In relation to the hydrological characteristics of the study area, highlights the absence of permanent rivers.

In relation to the sub-basins defined by the General water Directorate (DGA), within this sector the following are identified:

Table 3-23. Sub-basins defined by the DGA.

Basins	Sub-basins	Subsubcuencas
Coastal Dry (Coastal and Patache Loa)	Salt Lake Sornonel and Pampa Blanca	Salt Lake Sornonel and Pampa Blanca
	Pampas foxes and Salar Grande	Pampas foxes and Salar Grande
Andean and Preandinas Endorheic	Pampa del tamarugal	Pampa del tamarugal

Source: SNIT Tarapacá http://www.snit.cl/goretarapaca/index.php

In the Figure 3-65, You can see the location of the sub-basins of Salt Lake Soronel Pampa Blanca, Pampa of the foxes and large salt and Pampa del Tamarugal.

In relation to the water network in the area of influence is observed Figure 3-66 that there are only some localized intermittent streams in the extremo West of the Cordillera de la Costa, while in the East the Great Salt Lake is located.

The Great Salt Lake is an important reserve of sodium chloride, the extension of the hoya reaches 1,140 Km^{2,} with a 90 km n-s orientation axis length

iv. Conclusions

- **Underground works sector**

To istar inside a coastal basin arreicalt is hydrologically a zone characterized by the absence of surface water, that Yes, it cann evidence inactive and intermittent creeks with signs that in them there was runoff. These intermittent streams are usually activated in summer, where major rains occur in the Cordillera de los Andes. The dryness of this sector is also due to the features weather here is presenting, with high temperatures and evaporation, as well as low rainfall and runoff.

- **Sector works Superficiales coast**

This sector is located in a coastal basin arreica, by what is found in an area characterised by the absence of surface water courses, that Yes, is can reveal intermittent and inactive streams with signals that in them there was runoff. The intermittent streams are usually activated in summer, where major rains occur in the Cordillera de los Andes. Climatic characteristics, which generate high temperature and evaporation as well as low rainfall and runoff, condition the extreme aridity of the area of study.

- **Sector plateau**

This sector is located in a coastal basin arreica, by what is found in an area characterised by the absence of surface water courses, that Yes, is can reveal intermittent and inactive streams with signals that in them there was runoff. The intermittent streams are usually activated in summer, where major rains occur in the Cordillera de los Andes. The dryness of this sector is also due to the features weather here is presenting, with high temperatures and evaporation, as well as low rainfall and runoff.

- **Sector Pampa**

This sector It is located along 2 basins, with very different characteristics between the two, from West to East, is a coastal basin arreicacharacterized by the absence of surface water courses, and the Andean basin and Preandinas endorheic Pampa del Tamarugal, where the main water source corresponds to the aquifer that is located under the floor and that whose main tributaries come from the Cordillera de los Andes.

Climatic characteristics, which generate high temperature and evaporation as well as low rainfall and runoff, condition the extreme aridity of the area of study.

v. References

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3.2.3.2 Hydrogeology

i. Objectives

Hidrogeologicamente characterize the area where is installed the Projectin relation to the different permeabilities of the subsoil and the availability of groundwater resources in aquifers.

ii. Methodology

The development of this study, were consulted reports, work and specific research related to geology, hydrogeology and hydrology on the sector study, from which we have obtained the background that then is indicatebeing the main source of information publications and material available on the website of the General direction of water[6] the Ministry of public works

Another source of information taken into account corresponds to studies and environmental impact assessments that you can find near the area of the Project.

The area of influence for this component is defined in relation to the subprovince hydrogeological where you will install the Project.

iii. Results

uu) Regional hydrogeological framework

In the Tarapacá Region, it is possible to identify two hydrogeological provinces, the **Province Andean slope Pacific** and the **Province Altiplano**. The first province to turn it subclassed in **Subprovince Norte Grande**.

The Subprovince Norte Grande extends from the northern tip of chile to parallel 27 ° corresponding to a desert area net LS. This subprovince It features three distinguishable areas by the nature of its aquifers:

- The first located between 18° and 19 ° LS where you present channels transverse Highland-backed and exit to the sea. Aquifers are mainly constituted by fluvial Quaternary fillings of the river beds, with free layers and thickness not greater than 200 m.
- Second sector located between 19 ° c and 22° has as main the Pampa del Tamarugal aquifer system, it is stored in the vast and heterogeneous filling alluvial tertiary and Quaternary intermediate depression. It is estimated having a variable thickness of

[6] http://www.dga.cl/Paginas/default.aspx

between 300 and 700 m of which the first 100 to 300 m corresponds to filling alluvial Quaternary. The quality of the waters is closely linked to the origin of the food. One of the sources constitute the contributions of the streams of foothills, or mountain range along its channels carved into volcanic rock. On the other hand, there would be power by water from the Highlands, which you escurres through imbricas fractured and join to filling through faults in the basement, resulting in restricted areas of better quality water.

- Third sector located between 25 ° and 27° LS consists of the Atacama desert than with the exception of the Loa River (which slips out of mountains to the sea and has some aquifer systems), this sector is areic

vv) Local hydrogeology

- **Underground works sector**

In this sector the permeability presents a null hydrogeological significance with formations Jurassic-creTACICO of plutonic rocks e hypabyssal composed of intrusive granite and waterproof basement.

- **Sector works Superficiales coast**

In this sector the permeability presents a null hydrogeological significance with formations Jurassic-creTACICO of plutonic rocks e hypabyssal composed of intrusive granite and waterproof basement.

- **Sector plateau**

In relation to low or absent permeabilities are recognize two types. The first of hydrogeological significance very low, with formations of Jurassic deposits of volcanic rock composed of lava flows and deposits-presenting pirocla.plastics Rhyolite, deciticos, AndesiTicos and basaltic, associated with ancient volcanoes, who generally do not have water features. The second permeability presents a null hydrogeological significance with formations Jurassic-creTACICO of plutonic rocks e hypabyssal composed of intrusive granite and waterproof basement.

- **Sector Pampa**

The study area presents permeabilities primary and low or absent. In the case of the primary permeabilities (in a porous formation) presented hydrogeological significance high to medium, the (non-consolidated) Quaternary formations. These deposits not consolidated or fill correspond to sediments of alluvial, lacustrine fluvial, glacial origin, alluvial or wind, they have variable extension, usually layered aquifers. Permeability is variable as well as chemical quality. This type of permeability is present in the area where is located the Great Salt Lake and the sector of the Pampa del Tamarugal

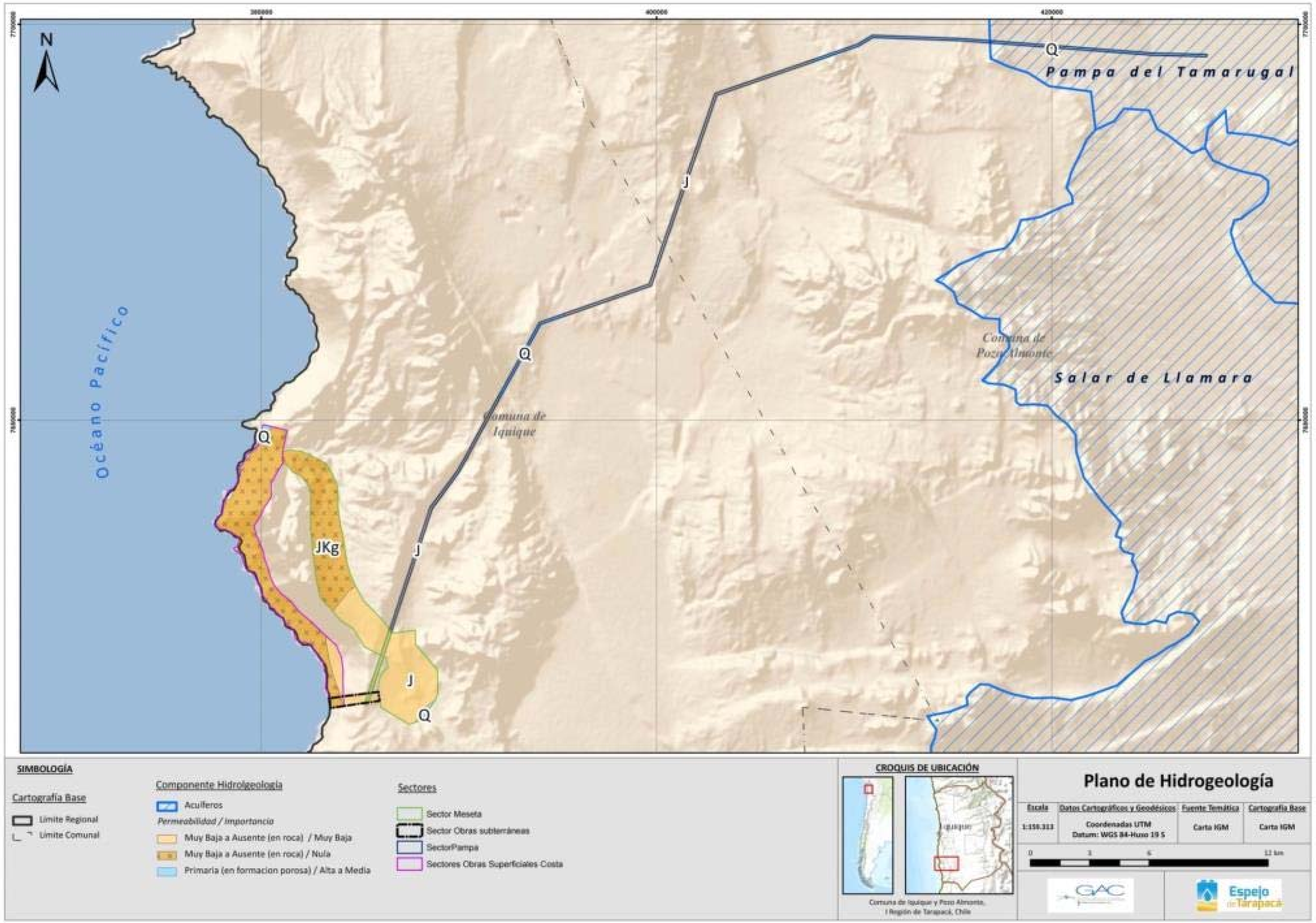
In relation to low or absent permeabilities is recognizedn two types. The first of very low hydrogeological significance, with formations of Jurassic deposits of volcanic rock composed of lava flows and deposits-presenting pyroclastic Rhyolite, deciticos, andesitic and basaltic, associated with ancient volcanoes, who generally do not have water features. Second permeability presents a null hydrogeological significance with formations Jurassic-creTACICO of plutonic rocks e hypabyssal composed of intrusive granite and waterproof basement

However it should be emphasized that de collected studies, there is no evidence of the presence of underground waterslines in the area of the Cordillera de la Costa. The only aquifer identified within the study area corresponds to the aquifer Pampa del Tamarugal, which according to the DGA 245 resolution of 2010 presents a constraint as constraint Area

According to other environmental impact studies reviewed in the area[7] the behavior of this aquifer has a dual operation, in the superficial part behaves as a shallow aquifer and in depth as a confined aquifer. The area of influence of this aquifer study presents a low relative permeability on the surface and a relative permeability medium in the deeper areas.

[7] Especialmente es Estudio de Impacto Ambiental de Proyecto Pampa Hermosa de SQM, aprobado en 2010.

Figure 3-67. Hydrogeology.



Source: Own elaboration.

iv. Conclusions

- **Underground works sector**

Present in this sector permeability is zero, with formations Jurassic-creTACICO of plutonic rocks e hypabyssal composed of intrusive granite and waterproof basement. What is related to the hydrological characteristics of non-existent channels, and climatic characteristics high temperatures and low rainfall, making this sector be identified because it is very arid and desert.

- **Sector works Superficiales coast**

In this sector the permeability presents hydrogeological significance, with formations waterproof. It that coupled with poor or non-existent surface runoff, make of this sector a place with shortage of fresh water. In addition to the climatic conditions that do not contribute with rainfall or temperatures to avoid the evaporacion the little water that presents the sector.

- **Sector plateau**

Present in this sector permeability is low or absent, of which two are differentiated types, Ivery low hydrogeological significance first, and second permeability presents a null hydrogeological significance. What if hydrological characteristics, non-existent channels, and climatic characteristics of high temperature and low rainfall, making this sector is identified to be very arid and desert.

- **Sector Pampa**

In this sector occurs predominantly absent and/or low permeability which two differentiated types, Ivery low hydrogeological significance first, and second permeability presents a null hydrogeological significance.

Areas with primary permeabilities associated sedimentary deposits exist, but nevertheless within the study area aquifers, are not identified this product of the geological conditions or product of the absence of recharge in areas with certain favourable for the underground storage characteristics. Only a small part of the area of influence is located on the aquifer of the Pampa del Tamarugal, however, this area has a low relative permeability at surface level.

v. References

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3.2.4 Hydrosphere Marina

i. Introduction

In order to complement and provide the environmental background to support the submission of an environmental impact study, and evidence compliance with the environmental regulations in force in the country, was characterized and evaluated a series of aspects and ecological attributes of biological communities (marine biodiversity), and described from a physical point of view (coastal dynamics), and chemical (water quality), the coastal environment in the study area. The study of biodiversity was conducted as requested by the community of San Marcos.

For these purposes, were developed for Navy baseline studies based on observations and field measurements in conditions of 2013 spring, summer and fall 2014, all of them with emphasis on the environmental assessment of the project Espejo de Tarapacá, which will be located in the coastal area of Caleta San Marcos, commune of Iquique, Tarapacá region. In this section a summary of the main is delivered istwo of these studies and in the Annex 3.2 It is detail and development of this component.

Coastal Dynamics was evaluated by experiences of current Eulerian, Lagrangian, coastal currents, dispersion with liners chemicals (rhodamine WT), wind, tide and waves. In particular, studied oceanographic conditions aimed to know the pattern of coastal circulation in Bay Chomache and the degree of interconnection between this and the adjoining waterfront (Caleta San Marcos), through experiences of Bottom Tracking with acoustic current profilers towed along the entire Bay Chomache.

Marine chemical medium was assessed in relation to its parent on the water quality and sediment inter and subtidal, with an important battery parameters and variables which allow to provide a comprehensive and up-to-date cadastre of these matrices. During the summer campaign was also characterized and evaluated the content of heavy metals in aquatic resources, specifically in the gastropod "crazy".

With respect to the biological component, developed studies and measurements to know the diversity of the communities in the coastal environment off the premises of the future project, inside of which are mentioned biological associations of sedimentary funds inter and subtidal)macroinfauna and epibiota), inter and subtidal () hard-bottom communitiesepibiota), wildlife fish (fish), coastal vertebrates including reptiles birds and mammals. In particular, the planktonic communities were also studied)Fito, zoo and Ichthyoplankton), on the basis of several methodological strategies, including surveys timely and intensive that they included the implementation of vital staining technique oriented to the visibility of the plankton in the area of interest.

ii. Scope and Objectives

The scope of this study were structured in consideration of the environmental legislation in force in our country. With regard to the aspects of marine surveys and studies, these were developed under strict compliance with the rules of the maritime authority and all the regulations for this type of tasks. Below are the main regulatory bodies referred to in the reause of this study:

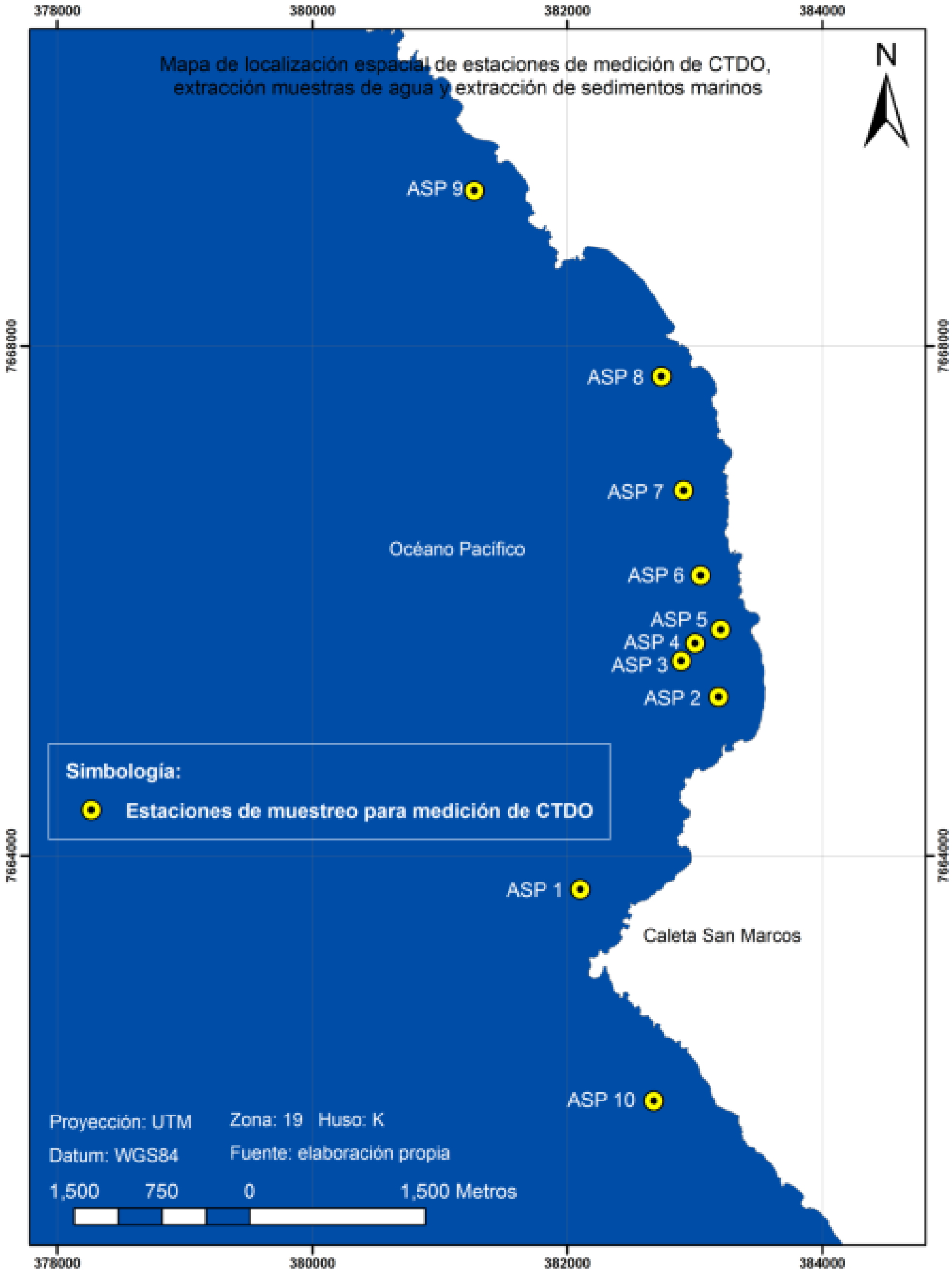
- Law on Bases of the environment 19,300, modified by the law No. 20.173.
- Regulation of the system of evaluation of environmental impact D.S. N ° 30/97 light, and its amendments, in what refers to gather information for the determination of the line base of the area of influence of the project, in the relevant.
- Methodological guide of sectoral technical review of environmental impact studies in the aquatic environment of national jurisdiction for projects covering " discharges of liquid waste, maritime ports and terminals or others".
- Corresponding to the D.S. N ° 711 DIRECTEMAR permits, and the tenure of current licences that credited the authorization for activities such as sailing, scuba diving, and others that are considered risk.
- Act 18.892/1989 and its amendments "General Law of fisheries and aquaculture".
- Supreme Decree No. 430 and no 461/95 of the Ministry of economy on research fishing permits.
- Instructions and publications SHOA, affable to this type of study. That is, SHOA Pub. 3201 (3rd Edition 2005), oceanographic N ° 1 instructions: technical specifications for Oceanographic analysis and measurements.

Thus, studies and surveys in the marine environment were executed under strict compliance with the rules and regulations for this kind of task, relating to the scope of safety of work at sea. Prior to the start of work, personal Enterprise Costasur He attended the dependencies of the port captaincy of Punta Patache to inform and coordinate sampling activities, and get information about the security measures suggested by this distribution during navigation to and from the sector of sampling.

In general, the objective is to describe the elements of the environment encountered in the area of influence of the future project, and thus provide the necessary background allowing to evaluate their potential impacts on the marine environment, and identify effects, characteristics or circumstances present in article 11 of the 19,300 law on Bases of the environment, which give origin to the need to present an environmental impact study. In particular, this study gives account also of all those features identified in the implementation of the project, that is, Bay area Chomache -Caleta San Marcos, in terms of its properties bio-Oceanographic.

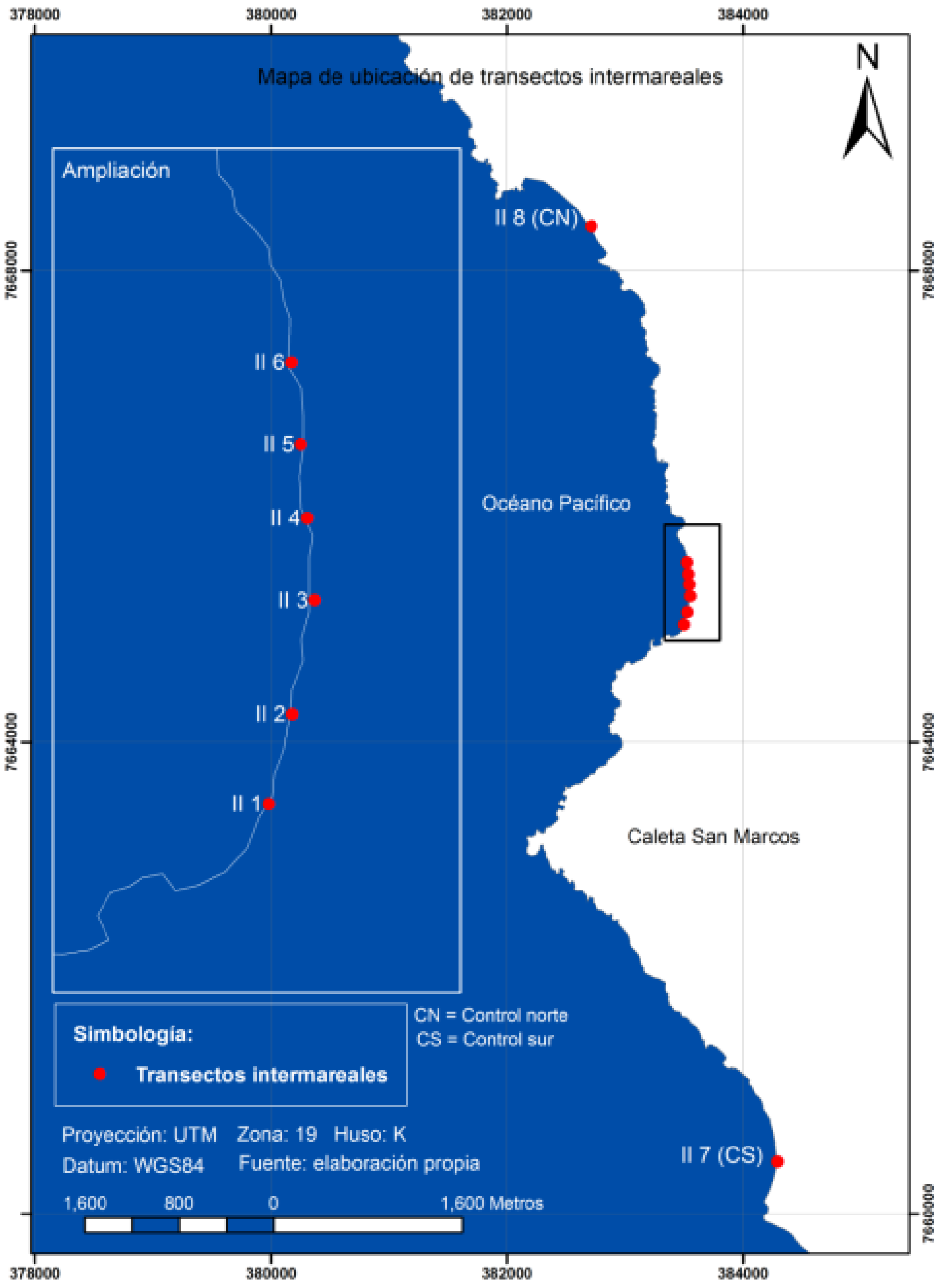
The study area corresponds to the coastal area of Bahia Chomache, where Caleta is located San Marcos, commune of Iquique, Tarapacá region. In the エラー! 参照元が見つかりません。 an image of the evaluated area spanning approximately nine linear kilometres of coastline is supplied.

Figure 3-68. Location Space de stations de measurement de CTDO, Removing samples water and Marine sediments. Campaign Spring 2013, summer and Autumn 2014.



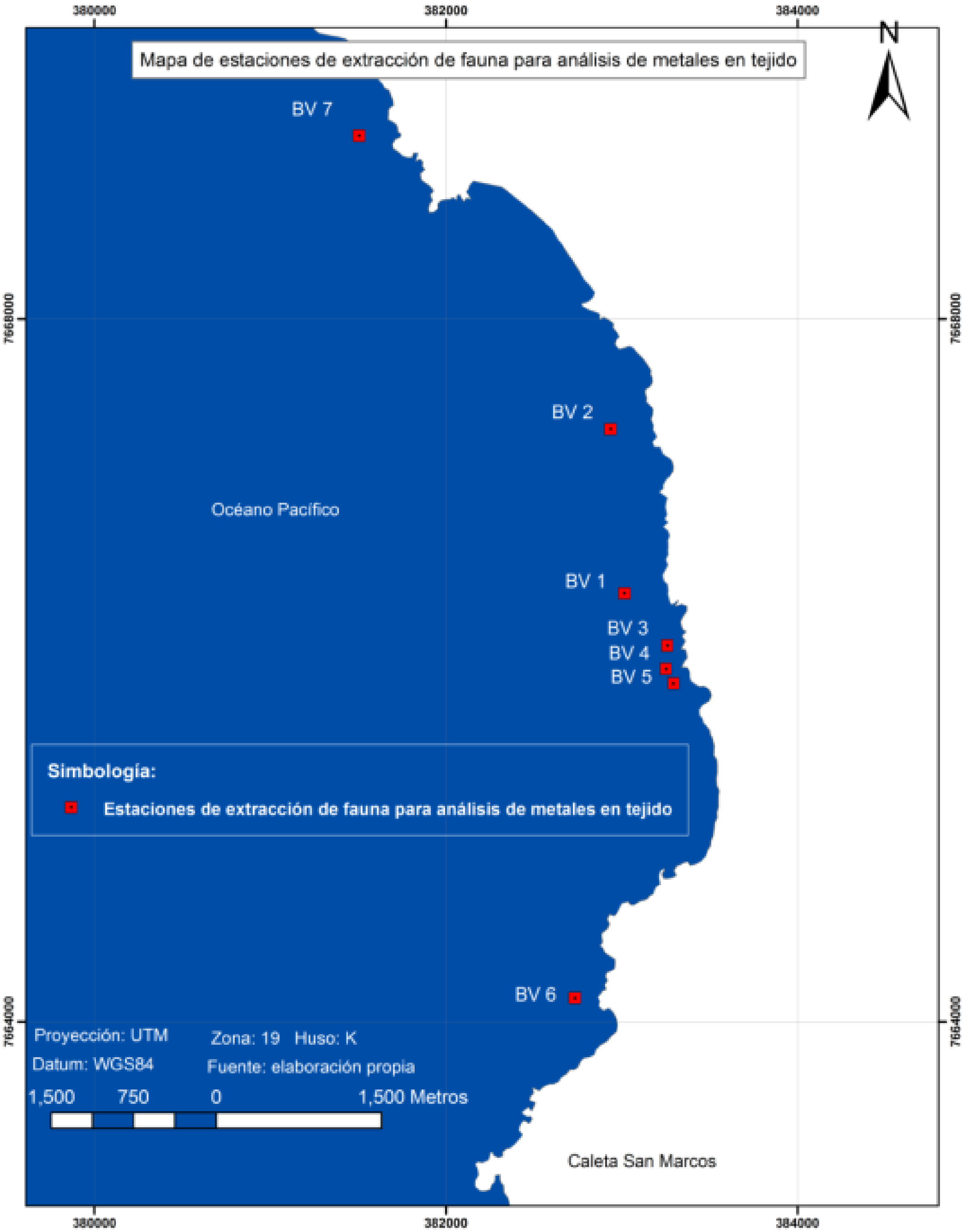
Source: Own elaboration.

Figure 3-69. Location dand intertidal transects en el Area d(e) study. Campaign Spring, summer and autumn 2014.



Source: Own elaboration.

Figure 3-70. Location Espacial's Ewalking (BV) of Extraccion of Fauna for TOnalysis of Metales in TEjido of the Gastropodo Concholepas concholepas. Summer 2014 campaign.



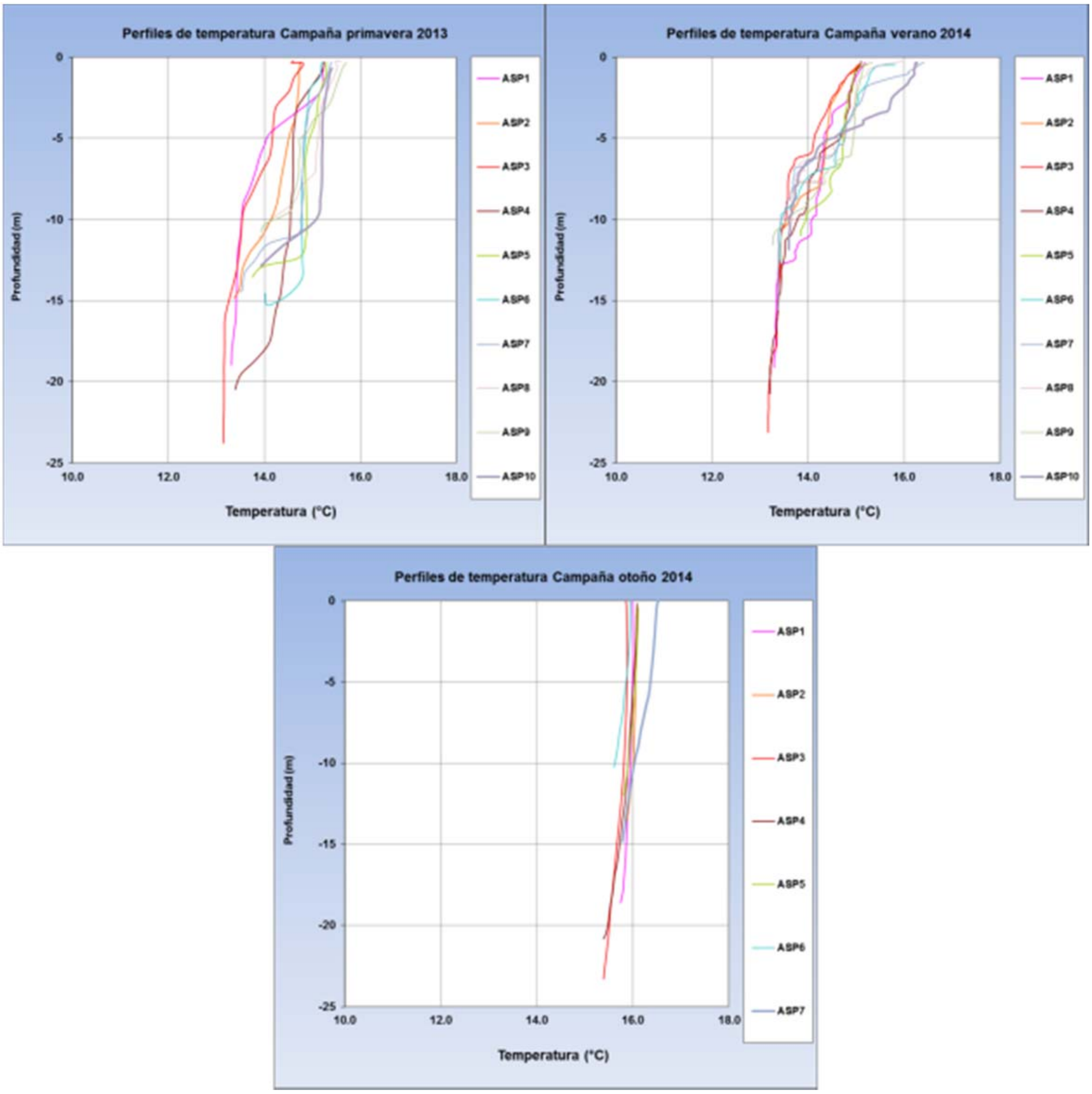
Source: Own elaboration.

iii. Results and discussion

The hydrographic conditions of the coastal edge of interest, evaluated by means of vertical profiles in three seasonal campaigns (Figure 3-71, Figure 3-72, Figure 3-73 and Figure 3-74), they reveal a dynamic behavior of the vertical structure of the water column throughout the evaluated period (spring 2013, 2014 summer and fall 2014), where the presence of coating mixture and any stratification)*e.g.* thermocline), are modulated or conditioned by the action of strong physical forces or forcing agents, every time that the evaluated area corresponds to a coastal sector exposed to the action of these agents such as wind and waves predominantly, the that it come preferably from the S-SW and W-SW, respectively, according to the oceanographic data collected within the scope of this baseline. For instance, in spring and autumn the thermal structure of the water column not evidenced statification showing almost homotermal between surface and bottom with a slight decreaseIt increases the depth, however, in summer thermal stratification was appreciated at some stations at surface level with the presence of a not-very-sharp thermocline and appreciated between surface and approximately 10-12 meters depth, very probably modulated by the greater incidence of solar radiation during this seasonal period; for his part, salinity presented a narrow range of variation during the spring and summer being almost homohalina, while in autumn this surface range fluctuated widely between 34.4 and 35.1PSU, then decrease in gradient to increase the depth of each sampling station. Dissolved oxygen (do), presented a similar behavior among the campaigns of spring and summer, as indicative of an important oxygenation values were recorded at the surface level (between 90-100% saturation), which then undergo a sudden decrease depending on the depth, approximately up to 10-15 m where minimum oxygen levels are reached coming to 0 mlO_2/L (0% saturation). The exception is observed during the campaign in fall 2014 in the medium and deep layers of the water column, because that does not register a total depletion of the oxygen concentration, staying up to 1.52 mlO_2/L - 26.79% saturation of oxygen in deeper stations.

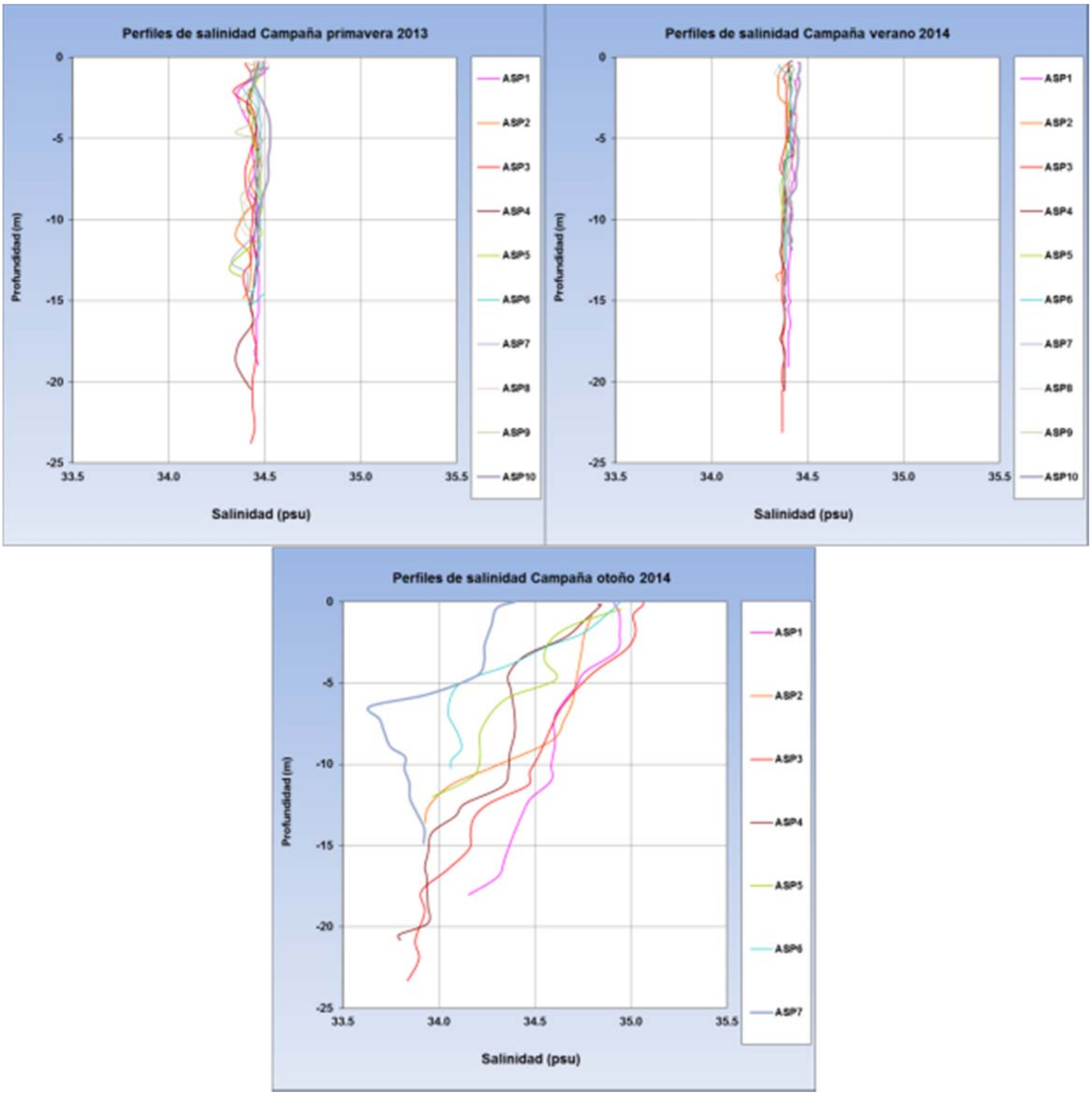
With respect to the levels of chlorophyll, the values recorded in spring were indicative of a high productivity of the water body, reaching a maximum registration of 26,28 ug/L (ppb), and were significantly higher than those obtained in summer)Figure 3-74), where there was a maximum of 11,77 ug/L. Chlorophyll, pH could not be measured during this season due to problems with sensors used instruments, however, this variable was evaluated in the field of the characterization of the planktonic communities, so its behavior is explained in this chapter of baseline marina (see biological oceanography chapter).

Figure 3-71. Campaign Primavera (2013)PAnel Ssuperior Iborder), Verano (2014)PAnel Ssuperior Derecho) and Otone (2014)PAnel Ibotto).



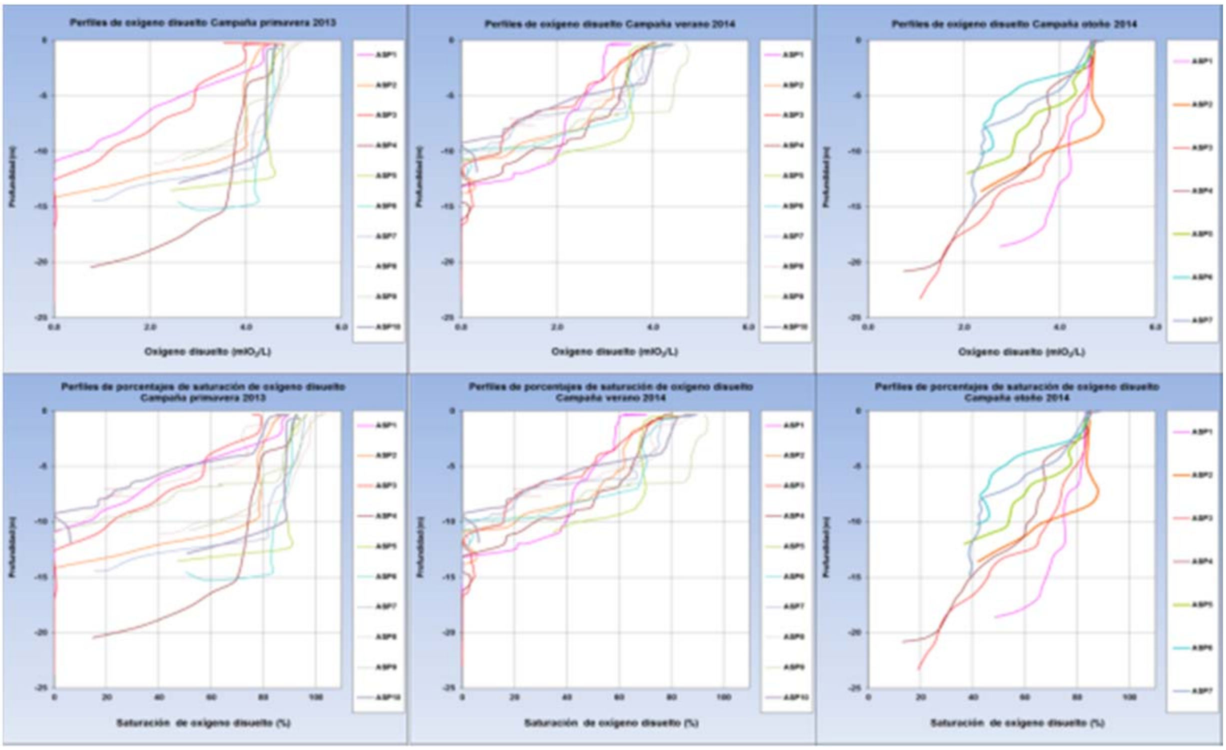
Source: Own elaboration.

Figure 3-72. Campaign Primavera (2013)PAnel Ssuperior Iborder), Verano (2014)PAnel Ssuperior Derecho) and Otone (2014)PAnel Ibotto).



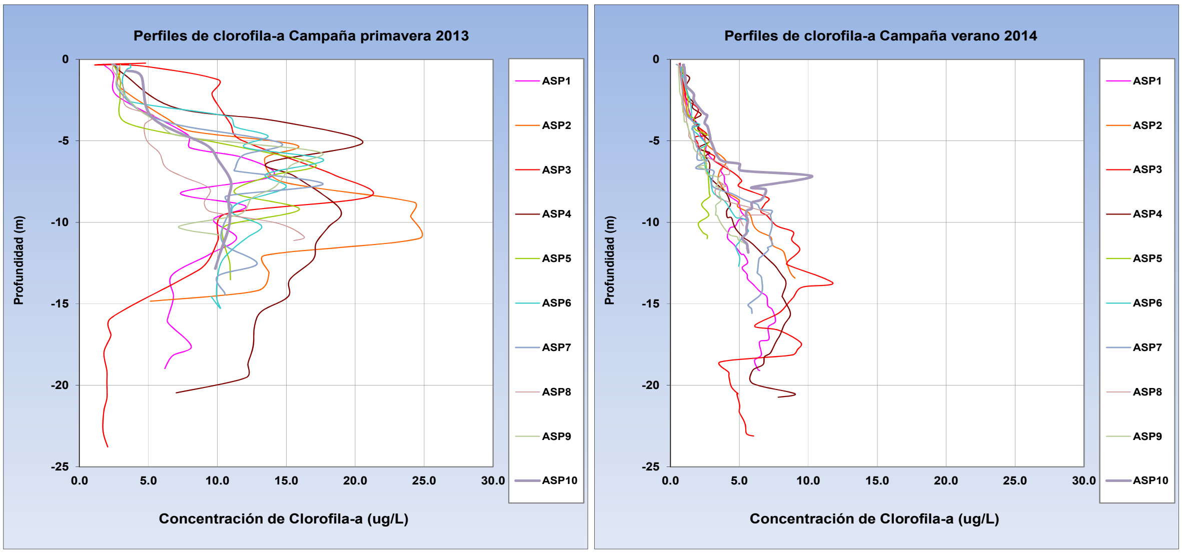
Source: Own elaboration.

Figure 3-73. Profiles Verticales of Oxigeno Disuelto and Saturacion. Campaign Primavera (2013)PAnel Iborder), Verano (2014)PAnel CCentral) and Otone (2014)PAnel Iborder).



Source: Own elaboration.

Figure 3-74. Perfiles Verticales of Clorofila-a campaign Primavera (2013)PAnel Iborder), Verano (2014)PAnel Derecho).



Source: Own elaboration.

The Table 3-24 and the Table 3-25 They provide a summary of the basic statistics of the water quality and marine sediments for seasonal campaigns executed in the scope of the present baseline of the project, and a detail of the concentrations of the analytes selected for evaluating the quality of the intertidal sediments and metals in biota.

With respect to the chemical quality of sea water, the following analytes showed concentrations below the detection limit of the respective methodology used by laboratory Hidrolab, in all or the vast majority of stations and depths analyzed three seasonal campaigns: settleable solids (< 0,1 ml/L), total suspended solids (< 5.0 mg/L), fecal coliforms (< 1.8 NMP / 100ml, only at the superficial level of some stations during the campaign in fall 2014 were quantifiable levels of fecal coliforms, with a) (point maximum of 23 MPN/100 mL), cadmium (< 0.001 mgCd/L), iron (< 0,002 mgFe/L), mercury (< 0.001 mgHg/L), and selenium (< 0.005 mgSe/L), lead presented levels < 0.01 mgPb/L in spring of 2013 and 2014 summer but showed measurable levels in fall 2014. "The levels reported by the analytical laboratory for total suspended solids, selenium and cadmium, allow classified as water body class 1 according to the reference values given in the"*Guide for the establishment of secondary standards for inland surface and marine environmental quality*", that is, of very good quality and suitable for the protection of the" aquatic communities and therefore suitable also for activities described in classes 2 and 3, i.e., desalination of water for human consumption, water suitable for the development of aquaculture, fisheries extractive, and suitable for activities port and navigation. Levels of Pb and some specific values of fecal coliforms allow to classify the body of water rated at class 2, i.e., good quality.

The comparison of quantifiable levels reported in this study, with the reference values given in the above Guide, shows that the waters of the study area can be classified preferably in the range of quality class 1 or 'very good quality", with respect to the concentrations of arsenic and aluminum; In addition, it can be classified also into category of quality class 2 with respect to the levels or concentrations of the following parameters, while the vast majority of them are preferably levels in the range of class 1, but with a few valueswithin class 2: fecal coliforms, lead, zinc, nickel, copper and chromium.

Importantly, the coastal sector evaluated features suitable for recreation with direct contact (which would be primarily limited to the summer season on the beach of Caleta San Marcos). In this sense, they presented values of reference in primary (Supreme Decree No. 144/08) water quality standard, and those parameters evaluated in this study comply with the limits imposed by this regulatory body, such is the case of arsenic cadmium, chrome, Mercury, lead, and pH.

With respect to the vertical variability in the distribution of the concentrations of different analytes chemicals evaluated for the quality of the water, it is possible to establish that only the turbidity showed statistically significant differences between strata, and throughout the rest of the analyte concentrations not recorded significant differences, which leaves out a body of water without greater variability among the evaluated strata (surface and bottom). However, analyzing the variability between seasonal campaigns (spring 2013 - 2014 summer - fall 2014; see Tabl (3-5), the trend shows that the majority of the analytes showed variation, such is the case of sulfate, arsenic, nickel and vanadium which recorded concentrations statistically superior in spring 2013 campaign; aluminum, chromium and zinc which presented levels significantly higher in the summer campaign of 2014; and calcium, chlorides and conductivity which were significantly higher during fall 2014 campaign; in the same year (autumn) it was noted that the BOD_5alkalinity, MOT, and turbidity were significantly lower than in other campaigns evaluated. Finally, copper and manganese in seawater did not manifest differences between campaigns.

Table 3-24. Statistics Basica's Cquality of the TOGua. Campaign Primavera 2013, Verano and Otone 2014.

Depth	Statistician	Chlorides	Sultato	Calcium	Conducti.	Alkalinity	Turbidity	Sun. Sedim.	SST	M. organic	BOD5	Fecal Col.	To the
		(mg Cl/L)	(mg SO4/L)	(mg Ca/L)	(us/cm)	(mg CaCO3/L)	(UNT)	(ml/L)	(mg/L)	(mg/L)	(mg/L)	(MPN/100 ml)	(mg to the / L)
		CAMPAIGN SPRING 2013											
Surface	Average	19756	2784	479	52085	119,3	1.87	< 0,1	< 5.0	12.1	2.4	< 1.8	0.017
	STDEV	171	61	50	450	1.8	0.37	0	0	2.7	0.5	0	0.018
	Min	19494	2700	325	51200	116,00	1.14	< 0,1	< 5.0	7.0	2.0	< 1.8	0.010
	Max	19994	2889	532	52700	122,00	2.90	< 0,1	< 5.0	15.0	3.0	< 1.8	0,087
Background	Average	19763	2791	454	52080	119,3	1.77	< 0,1	< 5.0	10.6	2.1	< 1.8	0,011
	STDEV	178	52	65	275	1.6	0.40	0	0	2.2	0.2	0	0.003
	Min	19494	2721	325	51300	117	1.16	< 0,1	< 5.0	7.0	2.0	< 1.8	0.010
	Max	19994	2922	536	52500	122	2.70	< 0,1	< 5.0	15.0	3.0	< 1.8	0.020
		CAMPAIGN SUMMER 2014											
Surface	Average	19774	2760	334,4	52275	125.5	0.62	< 0,1	< 5.0	10.5	2.3	< 1.8	0.042
	STDEV	141.6	18	15.9	299	2.9	0.15	0	0	2.01	0.47	0	0.017
	Min	19438	2696	301	51200	120	0.39	< 0,1	< 5.0	7.0	2	< 1.8	0.028
	Max	19951	2780	356	51700	131	0.99	< 0,1	< 5.0	13.0	3	< 1.8	0,098
Background	Average	19778	2762	333.5	52220	122	1.38	< 0,1	< 5.0	2.0	2.25	< 1.8	0.054
	STDEV	194	9	14.7	295	4.5	1.1	0	0	1.76	0.44	0	0.031
	Min	19455	2749	299	51400	112	0.31	< 0,1	< 5.0	7.0	2	< 1.8	0.020
	Max	20331	2782	367	52500	131	4.19	< 0,1	< 5.0	13.0	3	< 1.8	0,117
		CAMPAIGN FALL 2014											
Surface	Average	20591	2755	627	51295	99.8	0,566	< 0,1	< 5.0	9.7	< 2.0	2.87	0,0212
	STDEV	165,66	58,03	74.8	132	9.3	0,193	0	0	1.66	0	4.74	0,0051
	Min	20348	2723	494	51100	85.0	0,270	< 0,1	< 5.0	7.0	< 2.0	< 1.80	0.012
	Max	20845	2997,00	785	51700	122,0	1,150	< 0,1	< 5.0	13.0	< 2.0	23,00	0.03
Background	Average	20616	2712	634	51285	98.4	0,819	< 0,1	< 5.0	10	< 2.0	< 1.8	0,023
	STDEV	116	119	71.9	109	2.4	0,370	0	0	1.38	0	0	0.010
	Min	20348	2208	512	51100	94.0	0,370	< 0,1	< 5.0	7	< 2.0	< 1.8	0.012
	Max	20845	2760	760	51500	102.0	1,890	< 0,1	< 5.0	13	< 2.0	< 1.8	0,052

Depth	Statistician	Chlorides	Sultato	Calcium	Conducti.	Alkalinity	Turbidity	Sun. Sedim.	SST	M. organic	BOD5	Fecal Col.	To the
		(mg Cl/L)	(mg SO4/L)	(mg Ca/L)	(us/cm)	(mg CaCO3/L)	(UNT)	(ml/L)	(mg/L)	(mg/L)	(mg/L)	(MPN/100 ml)	(mg to the / L)
		CAMPAIGN SPRING 2013											
Surface	Average	0.002	< 0.001	0.007	0.005	< 0.002	< 0.001	< 0.001	0.005	< 0.010	< 0.005	0.054	0.022
	STDEV	0.0003	0	0.001	0.001	0	0	0	0.001	0	0	0.005	0.006
	Min	0.001	< 0.001	0.005	0.005	< 0.002	< 0.001	< 0.001	0.005	< 0.010	< 0.005	0,045	0,013
	Max	0.002	< 0.001	0.009	0.010	< 0.002	< 0.001	< 0.001	0.008	< 0.010	< 0.005	0.064	0.034
Background	Average	0.002	< 0.001	0.006	0.006	< 0.002	< 0.001	< 0.001	0.007	< 0.010	< 0.005	0,051	0.022
	STDEV	0.0006	0	0.001	0.003	0	0	0	0.005	0	0	0.006	0.004
	Min	0.001	< 0.001	0.005	0.005	< 0.002	< 0.001	< 0.001	0.005	< 0.010	< 0.005	0.042	0.014
	Max	0.003	< 0.001	0.007	0.017	< 0.002	< 0.001	< 0.001	0,024	< 0.010	< 0.005	0.065	0.031
		CAMPAIGN SUMMER 2014											
Surface	Average	0.002	< 0.001	0.008	0.005	< 0.002	< 0.001	< 0.001	< 0.005	< 0.010	< 0.005	0,049	0,057
	STDEV	0.001	0	0.002	0.001	0	0	0	0	0	0	0.008	0.009
	Min	0.001	< 0.001	0.005	0.005	< 0.002	< 0.001	< 0.001	< 0.005	< 0.010	< 0.005	0.031	0.044
	Max	0.007	< 0.001	0,011	0.009	< 0.002	< 0.001	< 0.001	< 0.005	< 0.010	< 0.005	0,071	0.076
Background	Average	0.002	< 0.001	0.009	0.006	< 0.002	< 0.001	0.001	< 0.005	< 0.010	< 0.005	0,048	0,052
	STDEV	0.001	0	0.002	0.001	0	0	0.0002	0	0	0	0.009	0.007
	Min	0.001	< 0.001	0.005	0.005	< 0.002	< 0.001	< 0.001	< 0.005	< 0.010	< 0.005	0.030	0.042
	Max	0.005	< 0.001	0.012	0.010	< 0.002	<	0.002	<	<	<	0.066	0,070

Depth	Statistician	Chlorides	Sultato	Calcium	Conducti.	Alkalinity	Turbidity	Sun. Sedim.	SST	M. organic	BOD5	Fecal Col.	To the
		(mg Cl/L)	(mg SO4/L)	(mg Ca/L)	(us/cm)	(mg CaCO3/L)	(UNT)	(ml/L)	(mg/L)	(mg/L)	(mg/L)	(MPN/100 ml)	(mg to the / L)
							0.001		0.005	0.010	0.005		
		CAMPAIGN FALL 2014											
Surface	Average	0,0017	< 0.001	< 0.005	0.005	< 0.002	< 0.001	< 0.001	0.005	0.025	< 0.005	0,032	0,032
	STDEV	0.0005	0	0	0.001	0	0	0	0.000	0.005	0	0.008	0.007
	Min	0.0010	< 0.001	< 0.005	0.005	< 0.002	< 0.001	< 0.001	0.005	0.015	< 0.005	0,021	0.015
	Max	0,0020	< 0.001	< 0.005	0.010	< 0.002	< 0.001	< 0.001	0.006	0,032	< 0.005	0.058	0,051
Background	Average	0,0018	< 0.001	< 0.005	0.006	< 0.002	< 0.001	0.003	< 0.005	0,023	< 0.005	0.039	0.036
	STDEV	0,0007	0	0	0.002	0	0	0.008	0	0.005	0	0.020	0,013
	Min	0.0010	< 0.001	< 0.005	0.005	< 0.002	< 0.001	< 0.001	< 0.005	0.017	< 0.005	0,019	0,019
	Max	0,0040	< 0.001	< 0.005	0.012	< 0.002	< 0.001	0.037	< 0.005	0.031	< 0.005	0.097	0,067

Note: S: surface; FON: background. Aluminum (to the), arsenic (As), cadmium (Cd), copper (Cu), chromium (Cr), iron (Fe), mercury (Hg), manganese (Mn), nickel (Ni), lead (Pb), selenium (Se), vanadium (V) and zinc (Zn). Source: elaboration of the consultant based on reported by analytical laboratory HIDROLAB.

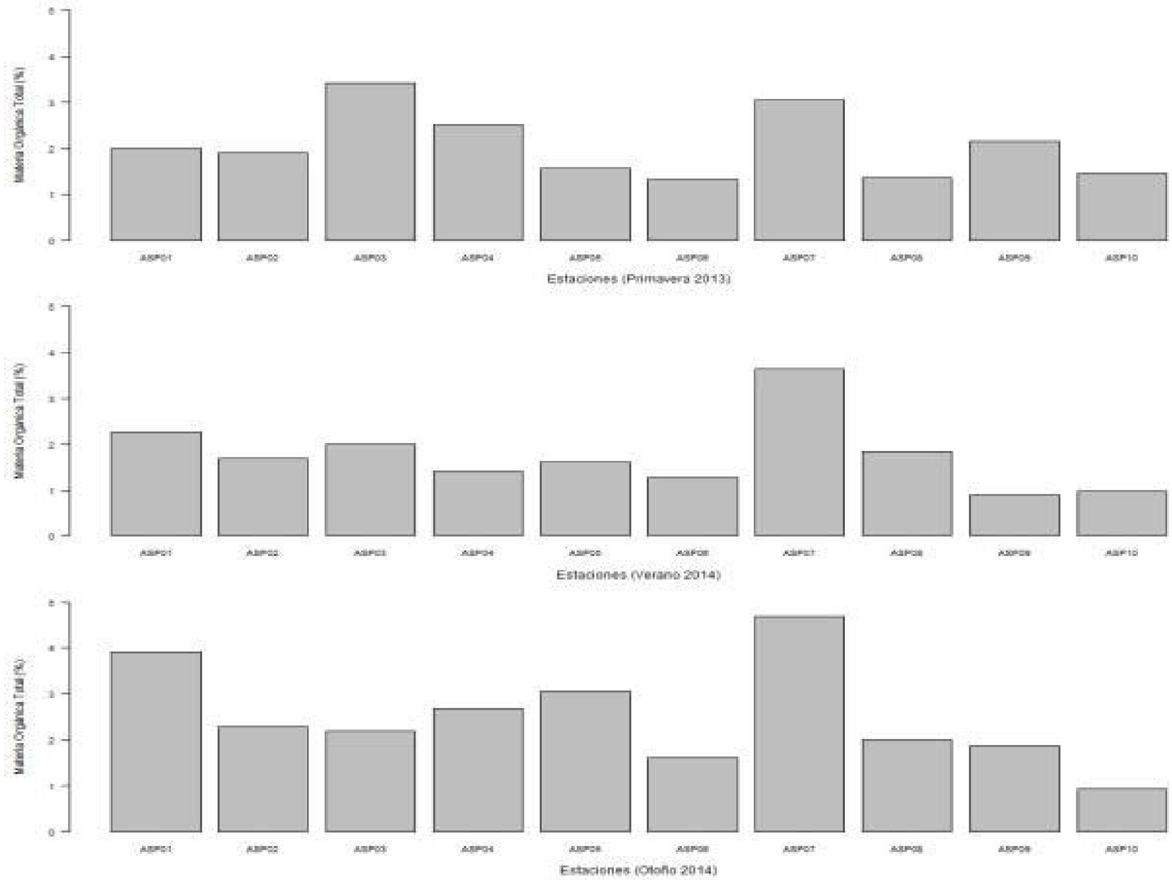
The subtidal sedimentary matrix evaluated in this respect baselineor of its textural properties Table 3-25showed an almost exclusive predominance of fraction arena, with insufficient representativeness of the silt fraction clay (2.8% in ASP3 during autumn maximum), and no presence of the fraction gravel in three seasonal campaigns. The textural classification of the fraction arena showed a wide variability between campaigns and seasons, fluctuating between very fine sand and very coarse sand. In relation to the total organic matter)Figure 3-75), the majority of the stations of the three seasonal campaigns exceeded the lower limit established by the Government of Ontario in Canada by 1% as the standard quality of sediments, but none exceeded the effects on biota limit by 10% in such legislation; at the same time, is not exceeded 9% limit established by the Undersecretary of fisheries and aquaculture (SUBPESCA) for aquaculture activities in marine sediments (only national legislation available for comparison purposes, reason by which the values of matter) organic obtained can be considered nenvironments. Similarly, the SUBPESCA established a limit of acceptability for the potential of oxide reduction fixed to the Normal electrode hydrogen (NHE) 50 MV, in this regard, the results indicate that of the total of evaluated points of the subtidal environment in the three seasonal campaigns)Figure 3-76), only three stations in spring are under this limit threshold, specifically ASP3, ASP4 and ASP7, which also recorded the highest concentration of organic matter during this campaign, and the rest of stations presents acceptable conditions of oxidation reduction under this criterion, with the sole exception of ASP3 station in autumn which also showed lower that standard or threshold limit values.

Table 3-25. Statisticians Granulometricos and Clasificacion Textural of the Sedimento Submareal.

Station	Campaign	Average (φ)	Selection (φ)	Selection	Textural classification
ASP1	Spring	1.00	1.37	Poorly selected	Coarse sand
	Summer	1.01	1.30	Poorly selected	Arena media
	Autumn	1.35	0.51	Moderately well selected	Arena media
ASP2	Spring	2.98	0.76	Moderately selected	Fine sand
	Summer	3.08	0.60	Moderately well selected	Very fine sand
	Autumn	2.98	0.62	Moderately well selected	Fine sand
ASP3	Spring	1.78	0.30	Very well selected	Arena media
	Summer	3.03	0.50	Moderately well selected	Very fine sand
	Autumn	2,74	0.43	Well selected	Fine sand
ASP4	Spring	1.07	1.63	Poorly selected	Arena media
	Summer	2.77	0.40	Well selected	Fine sand
	Autumn	2.53	0.55	Moderately well selected	Fine sand
ASP5	Spring	2.38	0.67	Moderately well selected	Fine sand
	Summer	2.08	1.15	Poorly selected	Fine sand
	Autumn	1.72	1.43	Poorly selected	Arena media
ASP6	Spring	2.48	0.48	Well selected	Fine sand
	Summer	2.42	0.63	Moderately well selected	Fine sand
	Autumn	3.43	0.51	Moderately well selected	Very fine sand
ASP7	Spring	0.14	1.42	Poorly selected	Coarse sand
	Summer	-0.16	1.18	Poorly selected	Very coarse sand
	Autumn	0.29	1.63	Poorly selected	Coarse sand
ASP8	Spring	1.48	0.48	Well selected	Arena media
	Summer	0.78	0.76	Moderately selected	Coarse sand
	Autumn	1.42	0.62	Moderately well selected	Arena media
ASP9	Spring	0.12	1.00	Poorly selected	Coarse sand
	Summer	2.37	0.51	Moderately well selected	Fine sand
	Autumn	2.10	0.51	Moderately well selected	Fine sand
ASP10	Spring	2.10	0.64	Moderately well selected	Fine sand
	Summer	-0.17	0.99	Moderately selected	Very coarse sand
	Autumn	-0.24	1.02	Poorly selected	Very coarse sand

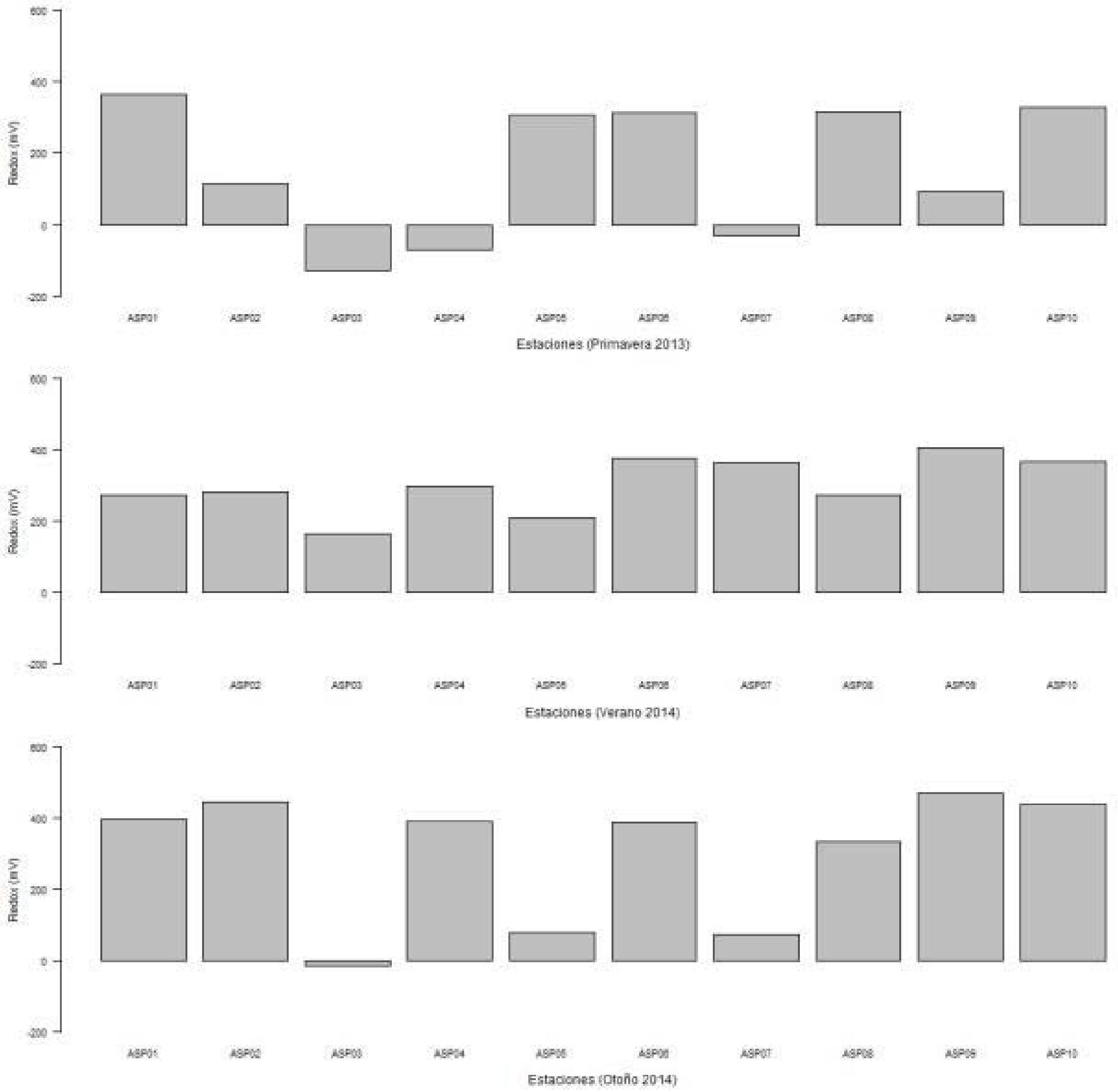
Source: Elaboration of the consultant.

Figure 3-75. M.O.T. s concentrationedimentos Submareales, by Estation and Campana of MI uestreo. Panel Ssuperior: Campana Primavera 2013; PAnel Mtop: Verano 2014 and PAnel Ibotto: Otone 2014.



Source: Own elaboration.

Figure 3-76. Levels Average dand Redox potential en subtidal sediments, por station and Campaign d(e) sampling. Panel Top: Spring 2013 campaign; Middle Panel: Summer 2014 and, Bottom panel: fall 2014.



Source: Own elaboration.

The vast majority of the metals tested in subtidal sediments (Table 3-28)showed concentrations lower than the limits set by the standards International consulted, and defined as adequate for the protection of marine aquatic life, such is the case of zinc, vanadium, lead, nickel, iron, total chromium and copper. In the case of arsenic and cadmium, several stations of the three campaigns of baseline (which highlights ASP3), recorded levels to above the threshold limit established by the Government of Canada ISQG/TEL)*Interim Marine Sediment Quality Guidelines*(: threshold level of effects on aquatic biota), and in the case of the mercury only 1 station showed this condition, however, none of the levels of these three elements was greater than the PEL limit)*probable effect levels*) or likely effects on aquatic biota. The analysis of the variability of the analyte by sampling station, warns a pattern or trend to grouping the greatest concentrations in the stations ASP2 and ASP3 in the vast majority of parameters evaluated during three campaigns of line base, such is the case of Zn, sulfates, Pb, Ni, Mn, Fe, Cr, Cd, V, Cu. ESTA condition could be associated in these stations, there was also the one most representative percentage relative's finest beans, which have a greater surface/volume ratio that allows them to have greater capability of adsorption of contaminants compared with sediments thicker, for example, ASP2 as ASP3 showed a size medium grain corresponding to very fine sand in the campaign summer, and especially ASP2 recorded the highest percentage of the sludge fraction in campaigns. For its part, the analysis between seasonal campaigns reveals that of the analytes tested only 12 total (sulfates, aluminum, arsenic, chromium, iron, mercury, manganese nickel, lead, zinc, mot and redox) had significantly different concentrations between spring 2013, 2014 summer and fall 2014, so the subtidal sedimentary environment showed significant changes between campaigns.

Table 3-26. Statistics Basic de lYou Analite evaluated pARA ldetermination de Quality dand subtidal sediments en el Area d(e) study. Campaign Spring 2013, summer and Autumn 2014.

Statistician	Moisture	Sulfate	To the	As	CD	CR	CU	Faith	Hg	MN	NI	PB	Is	V	Zn
	%	(mg SO4/L)	(mg to the / L)	(As mg/L)	(mg Cd/L)	(Cr mg/L)	(mg Cu/L)	(mg Fe/L)	(mg Hg/L)	(mg Mn/l.)	(mg Ni/L)	(mg Pb/L)	(mg be / L)	(mg l)	(mg Zn/L)
CAMPAIGN SPRING 2013															
Average	27.29	6.467	1860	3.88	0,750	6.1	-	2,691	0,023	27.6	0,850	0,296	0,1857	11.42	7.90
STDEV	3.51	669	947	2.93	0,698	3.5	-	1.572	0.001	12.60	0,580	0,161	0,089	9.40	2.41
Min	22.30	5.423	122	0,471	0,112	0,638	-	102	0,021	2.53	0.116	0,211	0,112	0,458	2.96
Max	34,90	7.581	3.084	11.30	2,520	10.9	-	5.884	0.025	41.9	1,970	0,714	0,385	30.5	11.4
CAMPAIGN OF SUMMER 2014															
Average	26.68	7.389	1,551	3.55	0,620	5.68	4.45	2004	0.043	35,04	1,303	0,478	0,156	10.12	8.78
STDEV	7.21	808	662	3.05	0,721	3.16	1,84	1,621	0,047	13.02	0,606	0,507	0,081	5.23	2.00
Min	7.38	5.903	393	0.70	0,023	1.39	2	54.5	0,021	9.31	0,656	0,214	0,107	4.13	5.59
Max	39,20	9.049	2.821	10.80	2,350	11.30	10.60	5.388	0,218	62,30	3,160	2,060	0,351	23.5	13.20
CAMPAIGN FALL 2014															
Average	28.36	6.370	444	6.20	0,799	10.29	3.69	4,451	0.028	50,22	1,605	0.935	0,158	16.64	12.90
STDEV	6.40	653	349	3.62	0,630	4.99	1.72	2,643	0,011	20.18	0,728	0,656	0.058	11.61	3.55
Min	19	5.303	176	1.69	0,228	1.97	0,847	485	0,023	8.83	0,268	0,229	0,115	2.41	5.79
Max	46,60	7.521	1.512	13.90	2,420	17.90	6.37	10.029	0.066	82,70	2,940	2,540	0,327	40.9	19.40

Note: aluminum (to the), arsenic (As), cadmium (Cd), copper (Cu), chromium (Cr), iron (Fe), mercury (Hg), manganese (Mn), nickel (Ni), lead (Pb), selenium (Se), vanadium (V) and zinc (Zn). Source: elaboration of the consultant based on the results reported by the laboratory HIDROLAB.

With respect to the chemical characterization of the intertidal sediments evaluated during summer and fall of 2014)Table 3-27), it is possible to establish that all elements or metals evaluated (n = 8), arsenic)Figure 3-77) recorded two specific values above (ISQG/TEL) regulations7,24 mg/kg) but less than the limit of probable effects on biota or PEL)41.6 mg/kg), and cadmium)Figure 3-78) presented the same condition for a sampling station (II 8 or Northern control;) ISQG/TEL 0.7 mg Cd/kg and PEL 4.2 mg Cd/kg level), and the rest of heavy metals tested showed levels below the limits established by the regulations consulted. The analysis of the variability of concentrations of heavy metals in intertidal sediments, shows significant differences between campaigns seasonal being significantly higher in fall campaign (with the exception of the mercury only presented) few quantifiable values). In terms of spatial variability, the maximum specific concentrations of metals evaluated in both campaigns, tended to occur preferentially in the transCTOs II 3 and II4 (fall campaign), and in II 8 during the summer.

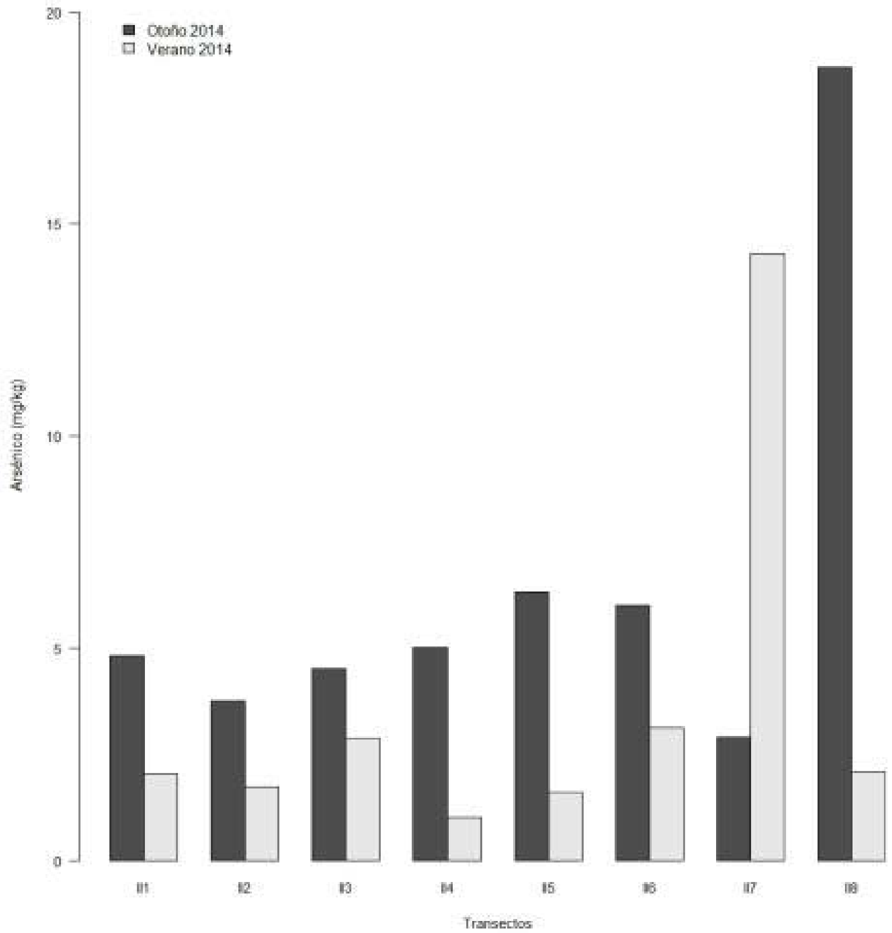
Table 3-27. Statistics Basic de Ito chemical quality dand intertidal sediments en el Area d(e) study. Campaign de summer 2014 and Autumn 2014.

Statistician	As	CD	CR	CU	Faith	Hg	PB	Zn
	(mg/Kg)	(mg/Kg)	(mg/Kg)	(mg/Kg)	(mg/Kg)	(mg/Kg)	(mg/Kg)	(mg/Kg)
CAMPAIGN SUMMER 2014								
Average	3.59	0,259	5.80	3.65	1705,4	0,027	0,280	8.73
STDEV	4.38	0.121	2.44	0.31	1407,3	0,011	0,132	1.43
Min	1.01	0,155	1.44	3.22	42.1	0.022	0,220	6.77
Max	14.30	0,517	9.32	4.22	3541	0.054	0,606	11.40
CAMPAIGN FALL 2014								
Average	6.51	0.556	15.54	4.88	4978,0	0.025	1,069	14.31
STDEV	5.05	0,101	3.04	0.66	1142,6	0.001	0,373	1.10
Min	2.90	0,373	9.65	3.91	3869	0,024	0,629	13.10
Max	18.70	0,735	19,00	5.89	6816	0.025	1,560	16.60

Source: elaboration of the consultant based on the results reported by the laboratory HIDROLAB.

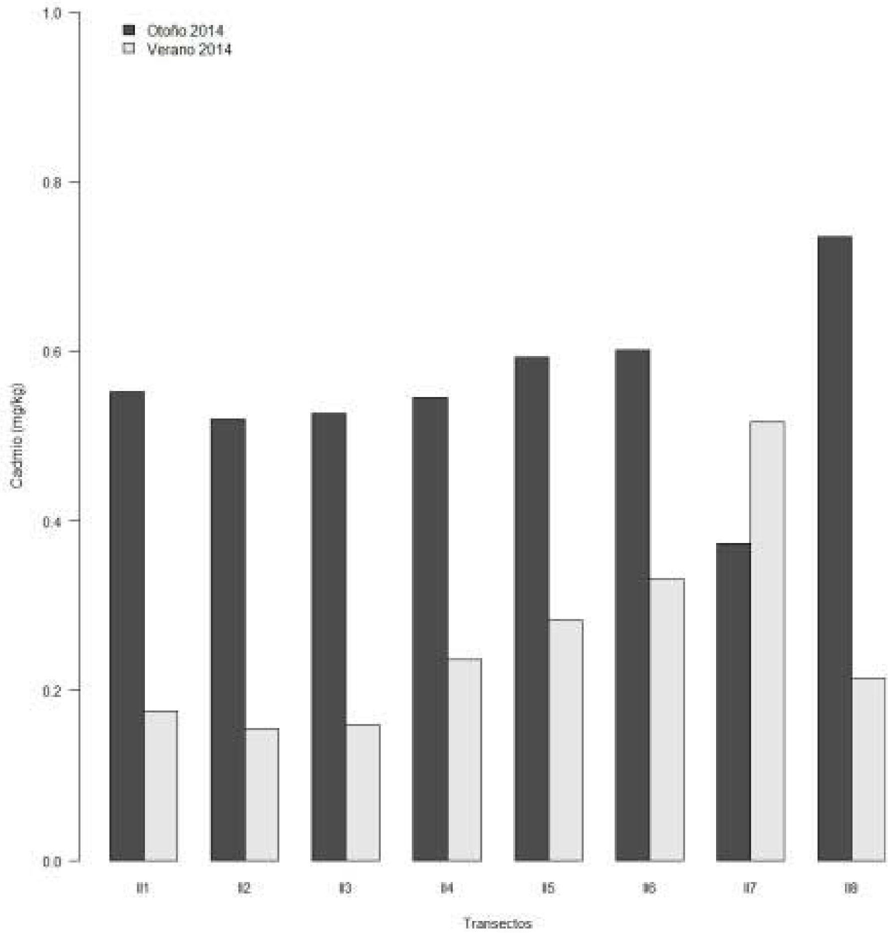
Note: arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), iron (Fe), mercury (Hg), lead (Pb), Zinc (Zn).

Figure 3-77. Concentration of TOrsenico in Sedimentos Intermareales by Estation of MI uestreo and Campana Estacional: Campana Verano 2014 and Otone 2014.



Source: Own elaboration.

Figure 3-78. Concentration of Cadmio in Sedimentos Intermareales by Estation of MI uestreo and Seasonal campaign: Summer campaign 2014 and Otone 2014.



Source: Own elaboration.

With respect to the concentrations of metals in tissues of aquatic () resourcesTable 3-28), specifically in the crazy resource)*Concholepas concholepas*), national and international references consulted indicate that concentrations of arsenic, chromium and mercury obtained in the campaign of summer sampling are normal and acceptable ranges for human consumption in all the analyzed samples; Moreover, cadmium levels exceeded the maximum limit set by the regulation 221/2002 of the Commission of European communities in Mexico for bivalve molluscs (although it must be taken into consideration that the analyses were performed in all samples in gastropods (mad)). The lead single it registered a point value (1 replica station BV2) exceeds the threshold established by the D.S. 977/1996, health regulations for food, and in the case of copper and zinc several tissue samples exceeded the limit established by the same regulatory body.

Table 3-28. Statistics Basica of the Concentracion of Metales in BIota in the E areaStudio.

Statistician	As	CD	CU	CR	Faith	Hg	PB	Zn
	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
Average	0.34	41,72	26.88	1.58	104.1	0.11	0,874	108,8
STDEV	0.58	84,08	15.75	1.03	61.4	0.11	0,818	190,9
Min	< 0.02	1.14	8.8	0.67	35.3	< 0.02	< 0.2	25.8
Max	1.77	280	66.1	4.10	209	0.38	2,320	762,0

Source: elaboration of the consultant.

3.2.4.2 Oceanography Biological (Diversity of marine communities)

i. Objectives

It then provides a summary of the main results of the studies of marine communities evaluated in the scope of this project in three seasonal campaigns: 2013 spring, summer and fall 2014.

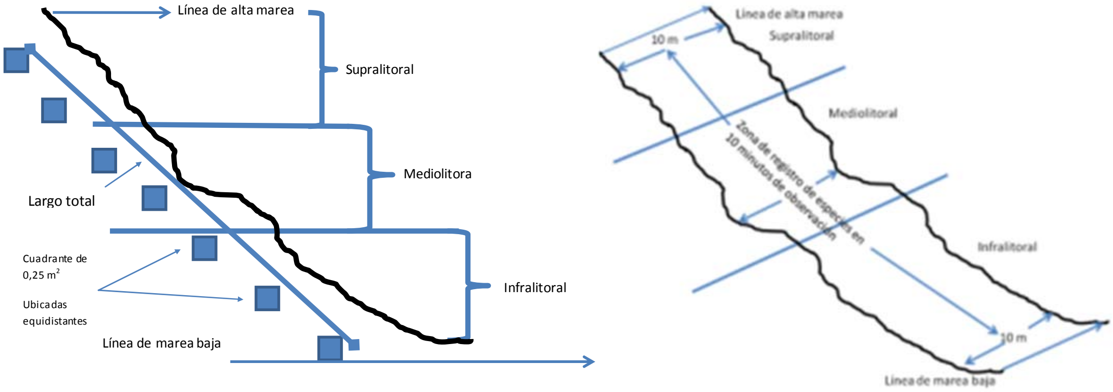
The details of this section are presented in the Annex 3.2 Chapter 4.

ii. Epibiohard-bottom intertidal Ta

- Methodology Epibiota of hard-bottom

This environment was assessed on the basis of 8 transects. In each one of them were 6 quadrants of 0.25 m^2 distributed in equidistant way between the strip of seaweed *Lessonia berteroana* (indicating the lower the infralittoral zone) and the supralitoral. In order to supplement the information generated through the evaluation with quadrants, was a qualitative identification of all the species present in each of the transects. For comparison purposes the identification area was bounded by a maximum width of 10 m and for a period of 10 minutes. Spring campaign surveys were carried out between 24 and 25 October 2013, the campaign of summer on January 23, 2014, and fall 2014 campaign was executed on 9 and 10 April. All campaigns were developed during low tide. Stations to describe the Rocky Intertidal communities is they were located in the rocky areas nearby to Caleta San Marcos, comprising approximately a total of 9 km of coastline, monitored through 6 stations of sampling and 2 controls. In the Figure 3-80 the spatial location of each transect sampling surrenders.

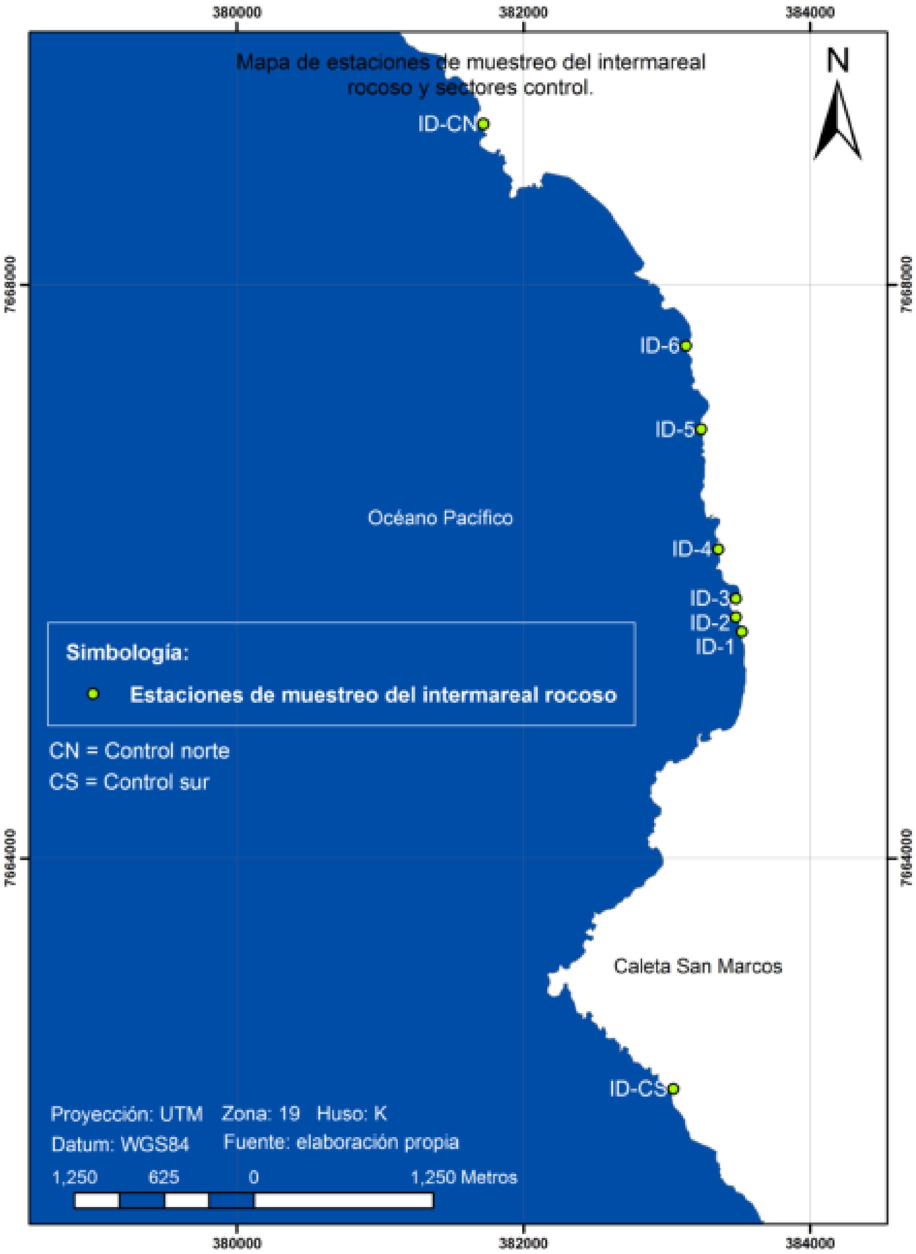
Figure 3-79. Location scheme of Cuadrantes and Transectos in Lline of COSTA



Left panel: schema location quadrants and division of the intertidal fringe, for the evaluation of the Rocky Intertidal biota. **Right panel:** esquema of the transect perpendicular to the coastline used for the inventory of species

Source: Own elaboration.

Figure 3-80. Available Intertidal transects of Fund hard, CS: Control South and CN: Northern control. Campaign Spring 2013, Veranor and ortone 2014.



Source: Own elaboration.

- Results and discussion Epibiota of hard-bottom

The Rocky Intertidal presented several species commonly described by several authors to Rocky Intertidal environments of the Chilean coast (Guiler 1959a, 1959b, Vasquez) *et to the.* 1998, Broitman *et to the*2011), noting a pattern of zonation similar to the pattern described in Stephenson & Stephenson (1972) for the rocky coasts around the world.

The three bells, the away Strip present species as the crustacean cirriped *J white,* small mollusks of the genus *Siphonaria* and litorinidos gastropods *Araucana Nodilittorina and Equinolittorina peruviana* (Figure 3-81), frequently recorded species in cracks or fissures in the intertidal area (Vasquez & Vega, 2004;) Broitman *at to the.,* 2011). the observed species are characterized by stay longer without water, presenting greater exposure to the Sun and as a result the effect of desiccation. Between seasonal campaigns there were no significant differences in terms of species richness, which may indicate the stability of these communities in the area.

The upper Strip presented characteristic of this area of the intertidal organisms in Rocky environments. Even though species composition was similar in the three campaigns, recorded a lower wealth during summer. This area It stands out for the presence of large patches of the taxa *N. scabrosus*, *J white and P. purpuratus* species dominant in media and upper levels of the intertidal Rocky from the Chilean coast (The differences recorded in the indices of diversity and richness of species between the different evaluated campaigns, shows some heterogeneity in the community structure present in the Rocky Intertidal area of the study area. These fluctuations may be due to multiple biotic factors (competition intra - specifies e inter - specified, predation, food availability, competition for space, etc.) and abiotic (temperature, salinity, wave, amplitude strength of) tide, etc.)Menge and Branch 2001).

, characteristicscurly as a microHabitat inhabited by numbersYou invertebrates such as gastropods of the geNero *Scurria* and *Siphonaria,* Seaweeds such as *Ulva* SP., *Gelidium* SP., *Colpomenia* sinuous, among others*.* All the species recorded in this area of the Rocky Intertidal area are broadly described by various authors as Vasquez and Vega (2004), Broitman *et to the.,)*2011) and Gaymer *et to the.* (2006, 2008).

The infralittoral fringe was that presented greater richness of species, among which the cirriped *N. scabrosus* and pink crustosa algae and *Corrallina officinalis* They presented greater abundances. Also highlights the low abundance of *Lessonia berteroana*, species that is characterized by a continuous strip in the lower area of the infralittoral, situation that is mainly due to exploitation through the technique of the barreteo, described by Vásquez (2007) in the Atacama region. Species *Tegula atra*, *Acanthopleura echinata*, *Siphonaria Monarch*, and *Helianthus Heliasther* are some of the most common taxa reported in the area, similar situation described by the above authors.

Is worth mentioning that the record total (94 taxa) species in the intertidal area of Caleta San Marcos was superior to those described by Gaymer *et to the.* (2006, 2008) and Broitman *et to the.* (2011) to Chañaral Island, the Marine Islands Choros-Damas, area reserve marine and coastal protected multiple uses big island of Atacama, the Temblador and el Arrayán.

Figure 3-81. Photograph of e. peruviana, Molusco Gastropodo Mas Numeroso of the Supralitoral of the Intermareal Rdiscovering in the TOrea of EStudio.

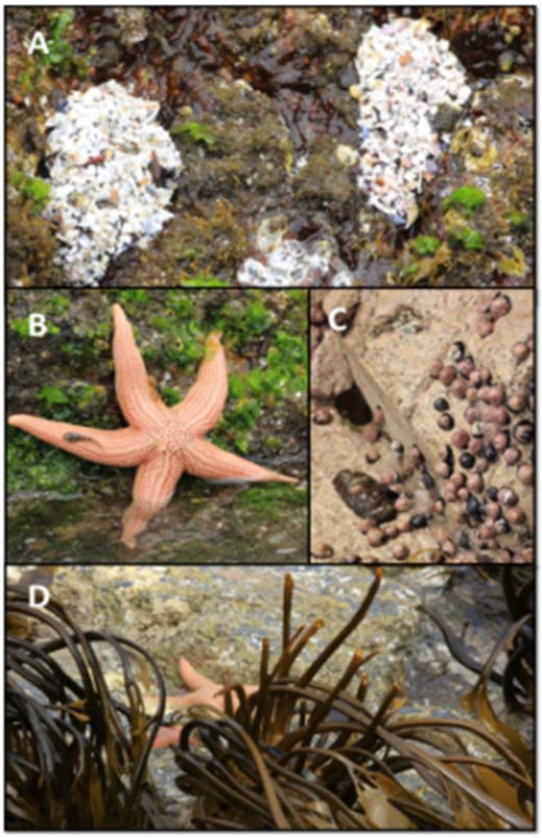
Source: Own elaboration.

Figure 3-82. Invertebrates Registrados in the ZONA Mediolitoral of the Intermareal Rdiscovering in Caleta San Marcos.

A) Cirriped *Jhelius white*(, B) gastropod *Stipa viridula,* (C) bivalve *Perumytilus purpuratus*(, D) algae *Ulva* spp. and (E) crustacean *Leptograpsus variegatus* (the latter was recorded in the qualitative assessment of the Rocky Intertidal).

Source: Own elaboration.

Figure 3-83. Invertebrates of the ZONA Infralitoral of the Intermareal Rdiscovering.



Actin *Oulactis concinnata*(B) equinodermo, *Stichaster striatus*C) gastropod snail *Tegula atra* and (D) Brown seaweed *Lessonia berteroana* (ex *Lessonia nigrescens*).

Source: Own elaboration.

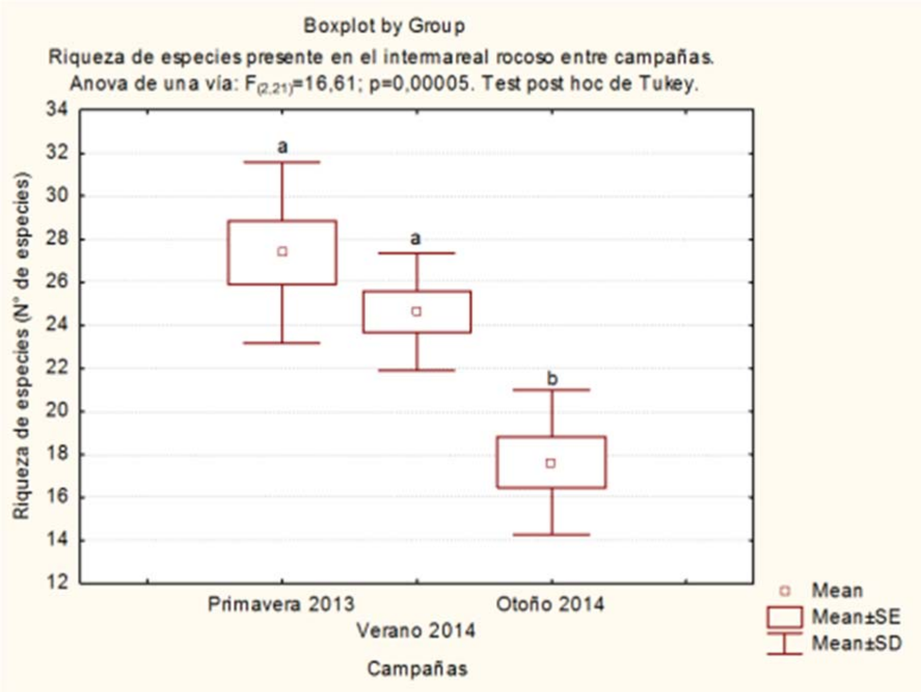
To compare species richness registered among all campaigns, found significant differences between spring and autumn (Tukey P = 0, 000174), and between summer and fall campaign (Tukey P = 0, 001861))Figure 3-84), condition that it is the least number of species recorded during the last campaign of autumn.

To compare the diversity (H') of sessile species were also observed significant differences between spring and summer campaigns (Tukey P = 0, 001851), due to the lower register during the campaign in spring 2013 and the variation in coverage betweenand both campaigns. They were no significant differences with respect to the autumn (2014)Figure 3-85)

Analyzing the diversity of mobile species, significant differences were observed between spring and summer campaign (Tukey P = 0,002668) and between spring and autumn (Tukey P =

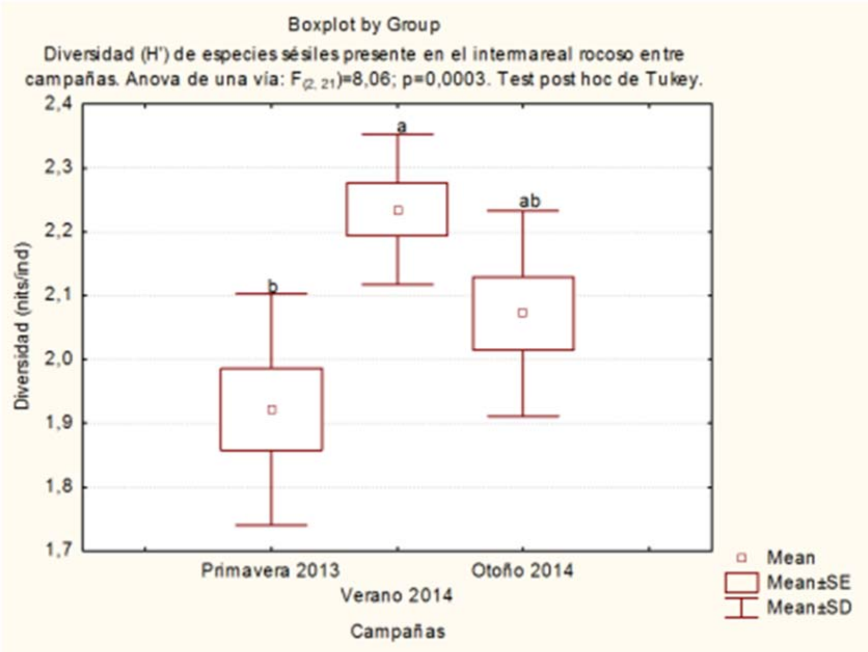
0,026667))Figure 3-86). This is mainly due to the higher register of taxa mobile during the spring of 2013 and also to greater wealth, especially snails litorinidos. Between summer and fall campaign were no differences remain between both campaigns very similar records.

Figure 3-84. Wealth of Species eetween campaigns (spring dand 2013, summer and Autumn dand 2014). Is Seen Significant differences eetween campaigns)Anova de una Via F $_{(2.21)}$= 16.61. P= 0,00005; Test Post Hoc de Tukey).



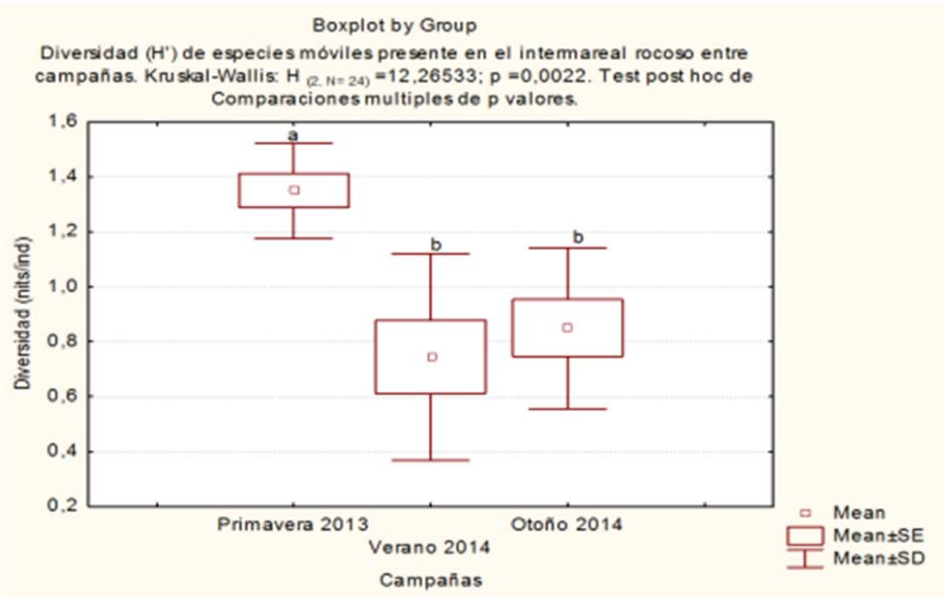
Source: Own elaboration.

Figure 3-85. Diversity de sessile species eetween Icampaign de spring dand 2013 and Summer d(e) 2014. Is Observed differences ebetween both Campañas (U test Z =-3, 04, P = 0, 002).



Source: Own elaboration.

Figure 3-86. Diversity de species Mobile eetween Icampaign de spring dand 2013 and Summer d(e) 2014. It noted significant differences ebetween both campaigns (U test Z = 3, 152, P = 0, 001).



Source: Own elaboration.

The differences recorded in the indices of diversity and richness of species between the different evaluated campaigns, shows some heterogeneity in the community structure present in the Rocky Intertidal area of the study area. These fluctuations may be due to multiple biotic factors (competition intra - specifies e inter - specified, predation, food availability, competition for space, etc.) and abiotic (temperature, salinity, wave, amplitude strength of) tide, etc.)Menge and Branch 2001).

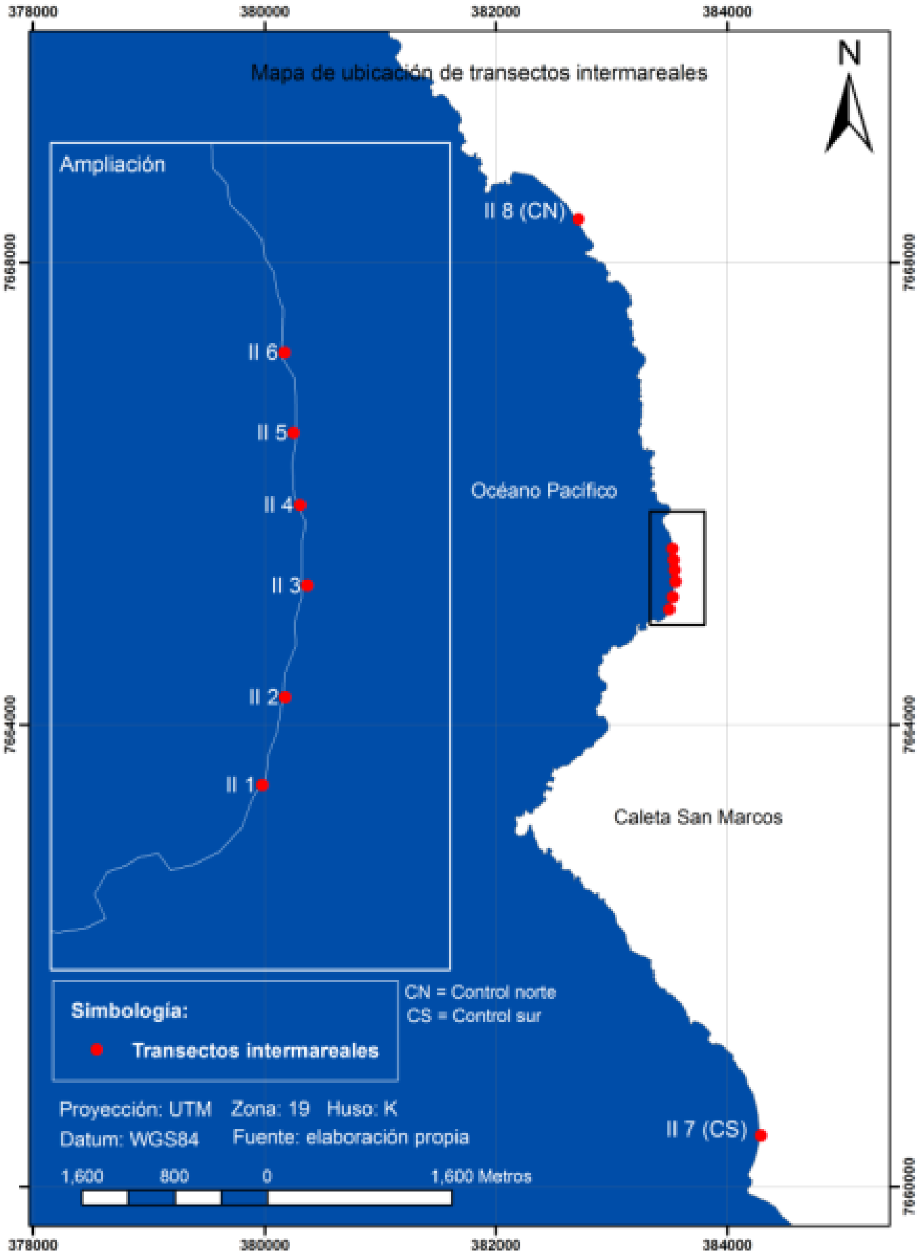
iii. Epibiota Intermareal of Funds Blandos

- Methodology Epibiota soft bottoms

The characterization of the intertidal community of soft bottom in sandy beaches located opposite the area where intends to build the project, we also carried out a transect as North control and other control South)Figure 3-87). The sampling area was characterized by the presence of a sandy beach with gravel sectors, Bolognese and large rocks.

The evaluation was carried out on the basis of 8 transects in which 9 samples were extracted: 3 in the upper zone, 3 in the middle and three in the lower area of the intertidal area. Spring sampling was carried out between 23 and 25 October 2013, the summer campaign was conducted between 24 and 28 January 2014 and the fall campaign was held on 6 and 7 April. All the muestreso were performed during low tide. 3 samples were collected at each level with a core of 0,01 m^2. Samples were sieved *in-situ* to be then stored in polyethylene bags properly tagged and fixed in alcohol diluted in seawater to 70%. The samples were transported to the laboratory where they were classified in the lowest taxonomic level possible as well as be counted and weighed using a cable with a sensitivity of 0.001 g. In addition, during the campaign of summer and fall 2014, is He made a qualitative sampling to determine the presence of *Ocypode gaudichaudii* (crab inhabiting the sandy beaches). In each transect was a count (a strip of 2 metres) of present Burrows from the high part of the intertidal area to lower.

Figure 3-87. Location Intertidal transects of Sedimentary funds in the TOrea of I am a student. Campaign Spring 2013 and Verano 2014.



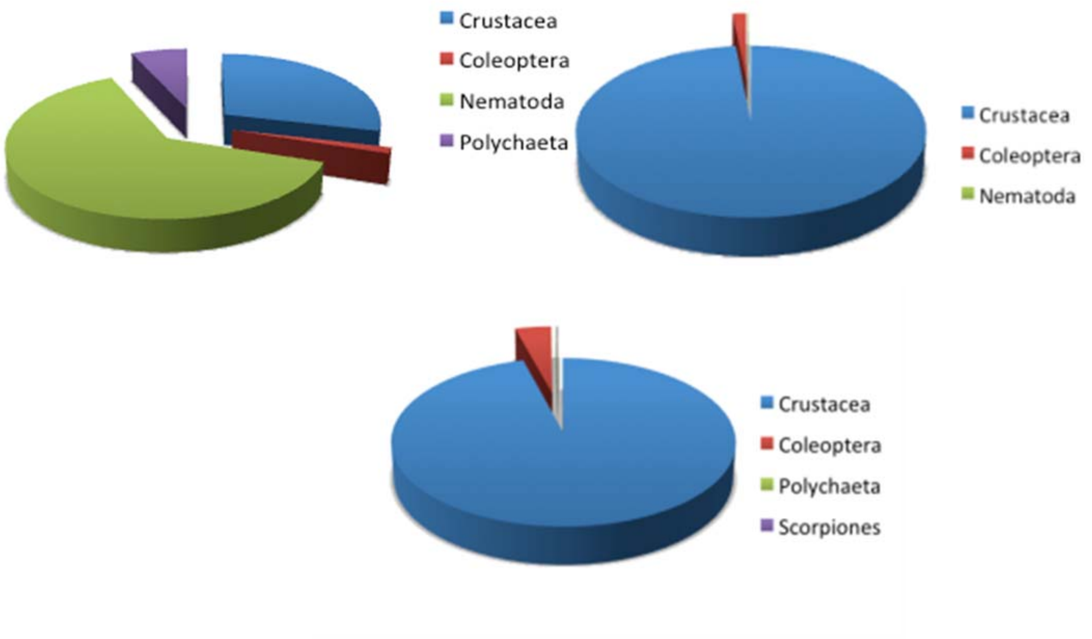
Source: Own elaboration.

From the matrix obtained from previous data analysis the following are listed and that are recommended by the maritime authority in the *Methodological guide of sectoral technical review of environmental impact studies in the aquatic environment, of national jurisdiction for projects that include "shock of liquid waste, maritime ports and terminals, or others*".

- Results and discussion Epibiota soft bottoms

Considering the three (3) seasons, won a total of 13 species in 8 transects evaluated, being the Group of nematodes, faunal group best represented during the spring (2013), and arthropods (crustaceans) during the summer and autumn campaigns (2014)Figure 3-88).

Figure 3-88. Distribution of the TObundancia by Gseminars Taxonomicos in the CCommunity of Infauna of the Intermareal of TORena of Caleta San Marcos.



Left panel: campaign spring 2013; **right panel:** campaign summer 2014; **Bottom panel**: campaign fall 2014.

Source: Own elaboration.

The observed species richness in the three campaigns It is within the range of number of species described in the literature for the Centre and North of Chile, finding most of the species that characterize the intertidal sand, both globally (Dahl, 1953) as to the North of Chile (Jaramillo, 1987). However, the absence of some typical inhabitants of the beaches of sand (as described by Jaramillo, 1987), can be determined by the physical characteristics of the sampled sectors, which generally corresponded to very narrow beaches whose sectors of sand they were flooded completely in times of high tide. This would also explain the presence of *E-analog* in some higher sampling stations along the intertidal zone evaluated.

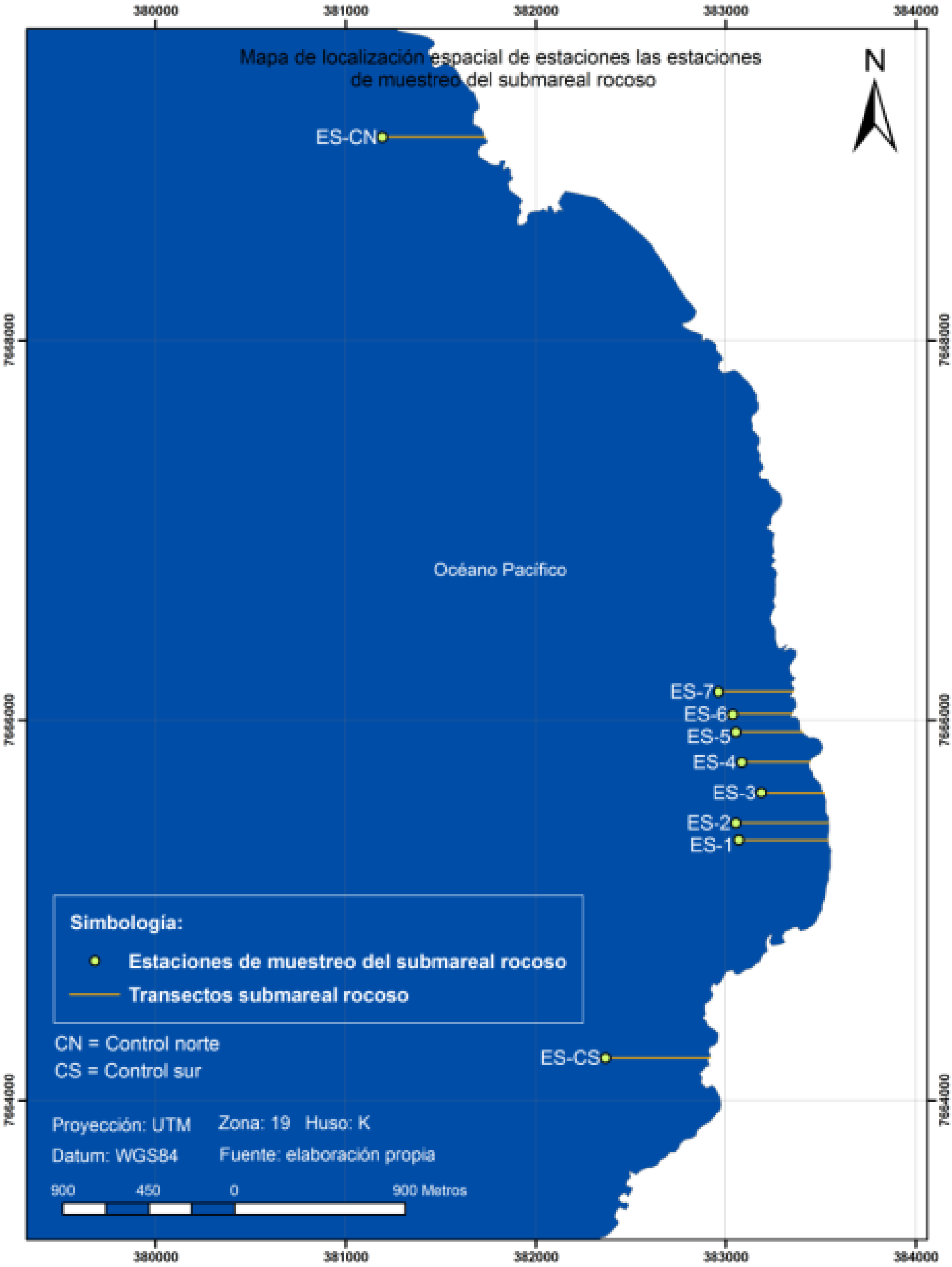
In accordance with the values of diversity, the eight transects sampled during the spring campaign present States of perturbation, and during the summer seven sampled transect present States of moderate disturbance and one conditions of severe disturbance. During the campaign in fall 2014, in accordance with the values of diversity and the criteria of Alcolado (1992), all sampling stations would be in severe disturbance conditions. However, the State of disturbance is a characteristic of the high dynamics of the sandy beaches situation. HardYou seasonal campaigns three communities were found in defaunado or semidefaunado, State reason why ABC curves were not performed. During the spring of species richness is similar to studies carried out in the North of Chile, however, shows a low presence of typical organisms in the upper area of the intertidal area, as *Phaleria maculata* and *Orchestoidea tuberculata* and the absence of *Ocypode guadichaudii*. In the summer of 2014 and 2014 autumn species richness was lower than that described for the North of Chile.

Based on the analysis of management nMDS it can be concluded that in spring II1 II2 and II3-II8 transects are presenting the greatest high degree of similarity, determined by the presence of Adenophorea and *Emerita analoga* within the community. During the summer II5-II2 and II3-II1 transects are presenting the greatest degree of similarity. Fall 2014 II1 and II4 stations are those that presented the greatest degree of similarity, while controls North and South (II7 and II8, respectively) were found to be different from the rest of the muestreales stations mainly due to the lower presence of *E analog* in the community.

iv. Epibiota of FOndo Submareal

The characterization of the subtidal epibiota was carried out on the basis of 9 transects, 7 of them distributed opposite the area where intends to locate the project, plus two points or stations control (a (s-CN) North and South of the area of study (ES-CS); Figure 3-89).

Figure 3-89. Location of the Transectos of the Submareal Caleta San Marcos. Campaign Primavera 2013, Verano and Otone 2014.



Source: Own elaboration.

- Epibiota underwater background methodology

In each transect were nineteen (19) sampling stations that were distributed in equidistant way each a meter of depth, and they were distributed between 18 and 1 m deep. In each one of the stations was developed an assessment by diving semi-autonomous using a quadrant of 0.25 m2, in which was recorded the depth, type of substrate (sand or rock), predominant community of the sector according to the classification developed by Stotz *et to the*. (Submitted), and all of the individuals of the taxa are mobile, and in the case of sessile biota quadrant had a grid of 100 points of intersection which determined the percentage of coverage of each of the species. The identification and quantification of the species was carried out *in-situ*, by marine biologists divers specialists. The spring campaign was carried out in two periods, the first from 26 to 28 October and the second between 11 December 10, both from the year 2013. At the same time, the summer campaign was carried out from 24 to 26 January 2014 and the fall campaign was conducted entRe the 7 and April 10, 2014.

- Results and discussion Bottom submarine

According to the methodology were made to identify 6 different communities in the subtidal in the study area: community of *Lessonia trabeculata* (LT), community of filter cloth (CF), community of bleached funds shallow and deep (CFBS and CFBP, respectively), soft bottoms (CFblandos) and a community of erect algae (CAE). The campaign of spring (2013) were recorded in 5 of the 6 mentioned communities, except to falls, which Yes was described during the summer campaign. During the summer (2014) the CFBS and CFBP communities were not recorded. The communities themselves that in the spring except the community of deep bleached funds were identified during autumn of 2014. These seasonal changes in thecommunities they may be due to the spatial sampling variation or seasonal variations in product of biotic and/or abiotic factors such as the temperature of water, competition for space, predation, availability of food, among others (Witman and Dayton 2001).

In the evaluation of the entire period (spring, summer and autumn), were described in total 113 *taxa* (see Table 3-29), which were the largest group of molluscs with 37 described species. At second order of importance (the number of) *taxa*), are crustaceans with 26 species, followed by the algae with 15 *taxa*. The rest of the species is distributed among echinoderms, porifera, cnidarians, annelids and chordates, situation that stays at each of the above communities.

Table 3-29. Listing of Especies Submareales, Registradas During the Evaluation of Primavera 2013, Verano and Otone 2014, San Marcos, Iquique.

Subtidal species			
Acanthopleura echinata	*Complex ceramiales*	*Mitrella unifasciata*	*Prisogaster niger*
Aeneator fontainei	*Concholepas concholepas*	*Mursia gaudichaudi*	*Propagurus gaudichaudi*
Aeolidia SP.	*Crassilabrum crassilabrum*	*Nassarius dentifer*	*Sicarius Pseudocorystes*

Subtidal species			
Anemonia alicemartinae	*Crepidula dilatata*	*Nassarius gayii*	*Pterygosquilla armata*
Antholoba achates	*Pink Crustosa*	*Odontodactylus* SP.	*Pyura chilensis*
Anthopleura hermaphroditica	*Demosponge white indet*	*Olive peruviana*	*Ralfsia* SP.
Anthothoe chilensis	*Demosponge salmon indet*	*White indeterminate Ophiuroidea*	*Renilla* SP.
Indeterminate Anthozoa	*Dendrymenia skottsbergii*	*Black indeterminate Ophiuroidea*	*Rhodymenia corallina*
Aplidium peruvianum	*Diaulula variolata*	*Indeterminate Opisthobranchia*	*Rhynchocinetes typus*
Arbacia spatuligera	*Dictyota kunthii*	*Oulactis concinnata*	*Romaleon polyodon*
Argopecten purpuratus	*Ectocarpus* SP.	Pagurus edwardsi	*Romanchella* SP.
Indeterminate Ascidiacea	*Eurypodius latreillei*	Pagurus spp.	*Scurria flat*
Aulacomya atra	*Fissurella cumingi*	Pagurus villosus	*Semimytilus algosus*
Austromegabalanus psittacus	Fissurella latimarginata	*Parantheopsis ocellata*	*Sinum cymba*
Balanus laevis	*Fissurella maximum*	*Paranthus niveus*	*Stichaster striatus*
Balanus spp.	*Fissurella peruviana*	*Patiria chilensis*	*Taliepus dentatus*
Blepharipoda SP.	*Indeterminate Gastropoda*	*Petrolisthes desmarestii*	*Tegula atra*
Blepharipoda SP.	*Gelidium* SP.	*Phaeophyta indet.*	*Mournful Tegula*
Calyptraea trochiformis	*Heliaster helianthus*	*Phidiana lottini*	*Tegula tridentata*
Cancer coronatus	*Hepatus chiliensis*	*Phragmatopoma* SP.	*Tetrapygus niger*
Milne-Edwards ' cancer	*Hydrozoan tubularido*	*Phymactis papillosa*	*Thais chocolata*
Chaetopleura benaventei	*Hildenbrandia* SP.	*Phymanthea pluvia*	*Tonicia* spp.
Chiton cumingsi	*Homolaspis flat*	*Pilumnoides perlatus*	*Tricolia macleani*
Chiton SP.	*Lessonia berteroana*	*Pisoides edwardsii*	*Ulva* SP.
Chiton SP1.	*Lessonia trabeculata*	*Polychaete tubicola indet white*	*Ulvella* SP.
Choromytilus chorus	*Loxechinus albus*	Indeterminate Polychaeta	*Xanthochorus* SP.
Cladophora SP.	*Luidia magellanica*	*Polychaeta tubicola indet.*	
Cladophoropsis herpestica	*Membranipora* spp. *(Bryozoan)*	*Priene rude*	
Clionopsis platei	*Meyenaster gelatinosus*	*Priene scabrum*	

Source: Elaboration of the consultant.

The FBS community It was dominated entirely by calcareous crustosas of pale pink algae. Mobile agencies with greater abundance were *Chaetopleura benaventei, Fissurella latimarginata* (black lapa), snail *Tegula atra* and the Hedgehog *Tetrapygus niger.* The FBP community community presented a similarity with the community of bleached bottoms, however, showed minor coverage of calcareous algae and greater relative abundance of *Hildenbrandia* SP. In addition individuals were observed in *Oculactis concinnata*, patches of *Aulacomya ater, Pyura chilensis* and other species such as *Antholoba achates*, *Anthothoe chilensis*. It also emphasizes in this community, large areas of bedrock free settlers sessile. The more mobile species were *Nassarius gayi*, *Mitrella unifasciata*, *Chiton* SP., *Pagurus* SP. and *Luidia magellanica*.

LT community was more frequent in transects located in the northern sector of the study area. The *taxa* most frequent corresponded to small gastropod molluscs as *M. unifasciata*, *N. gayi*, *Tricolia macleani* and *Nassarius dentifer*. Other common inhabitants were *Pagurus villosus* (hermit) and *Stichaster striatus* (starfish). Under the canopy of *L trabeculata* between fixing disks This seaweed, the bedrock was used mainly by species such as crustosas calcareous algae, *Gelidium* SP., complex ceramiales, *Hildenbrandia* SP., by the bivalve mollusc *A. ater*, the polychaete *Phragmatopom*to SP., the cirriped *Balanus laevis* and the sea *Pyura chilensis*.

The CF community arose mainly in the North of the study area, while in the South its presence was limited to the existence of patches in different depths. The substrate was primarily covered by filtering mollusks *A. ater* and *Choromytilus chorus*, in addition to the species of algae as *Hildenbrandia SP., Rhodymenia corallina*, and a pink crustosa seaweed.

The community of FBlandos arose in all evaluated transects and corresponds to the community more abundant in the study area. In transects located in the southern part of the coastal area evaluated occur intermittently at different depths, whereas in the transect is-4 was the only community. In the northern area of the evaluated area arose in the deeper areas. The most abundant species correspond to *N. gayi*, *Pagurus* SP. and *Pagurus villosus*.

The erect algae community She was present at the transects ES-CS, ES-4, ES-6, and s-CN, showing a bathymetric distribution between 10 to 3 meters of depth, with the exception of the ES-4 transect where found 17 meters. Notable for its most abundant algae *Gelidium* SP. and pink crustosa. Other present algae were ceramiales complex, *Hildenbrandia* SP. and *Dendrymenia skottsbergii*. Sessile invertebrates were scarce, these include *P. chilensis* and *Phragmatopoma* SP.

Specific wealth in all communities are superior to other places of ecological importance of the coast of Chile. The community of soft bottoms had a total record of 69 species, higher than what reported Gaymer *et to the.* (2006) in Isla Damas (33) *taxa*). The taxonomic groups and the majority of species described for this community they are similar to that recorded by Gaymer *et to the.* (2006).

Filtrants Community presented a richness of 87 for both campaigns, as described above by Gaymer *et to the.* (2006)which describes 10 *taxa*. One of the characteristics that differ with the designated by This author, it is the high abundance of species such as *A. atra*, *C. Chorus* and *Balanus* SP., very common situation in the North of Chile (Cancino & Becerra 1978). This would explain the difference in the richness of both sites, since Bivalves are characterized by being species bio-engineers (Jones *et to the*. 2012)creating structures that remain for long periods of time, promoting processes and ecosystem services, generating wealth effects specific, since they provide three-dimensional structures that provide shelter to a large amount of algae, invertebrates and fish (Thiel and Ullrich 2002, Prado and Castilla 2006).

The community of *Lessonia trabeculata* He presented a richness of 69 species widely surpassing the number of organisms present in other forests of *L trabeculata*, as for example those located in Damas island and Isla Chañaral, who recorded 23 and 21 *taxa*respectively (Gaymer *et to the.* 2006). Under the forest canopy of *L trabeculata*It was possible to appreciate that the bedrock was used mainly by species of the order Corallinales as the red, possibly belonging to the genus crustosas *Lithothamnium* and/or *Mesophyllum,* accompanied by other sessile organisms and dominated by small gastropods, among others, a situation similar to that described by various authors (Vasquez 2002, Vásquez and Vega 2004, Vásquez and Vega 2005, Gaymer *et to the*. 2006, Vásquez *et to the.* 2006).

The registered erect algae community was similar to that described by Stotz *et to the.* (*submitted*). Wealth (42) present in this community, was greater than that observed in other locations, such as Isla Damas and Chañaral Island, where it recorded a total of 4 and 13 species, respectively (Gaymer *et to the.* 2006). Within the community of erect algae, there was a greater abundance of the species *Gelidium* SP, pink Crustosa, *R. corallina*, complex ceramiales and *Hildenbrandia* SP. and in the mobile body, stands out the presence of *Mitrella* SP, *N gayii*, *S. striatus* and *F latimarginata* (Stotz *et to*l.*subbmited*, Gaymer *et to the.* 2006).

Bleached bottoms community was distributed between the 0 to 9 meters deep coinciding with records of Gaymer *et to the.* (2006). Specified in terms of richness is similar with the designated by the author, who describes to the locality of Isla Damas 11 species (area of San Marcos 10 *taxa*). This community was characterized by high abundances of calcareous crustosas of the order Corallinales, accompanied by gastropods as *T. atra* and *Fissurella* spp. (limpets), similar to that described by authors as Meneses (1993), Vásquez and Vega (2004), Vasquez *et to the.* (2006).

v. Ichthyofauna

- Methodology Ichthyofauna

Fish from the shallow Rocky subtidal populations were evaluated as semi-autonomous diving transects 9 (2 of them controls), these correspond to them in which is carried out the evaluation of subtidal communities)Figure 3-89). Each of the transects were travelled counting and identifying all the specimens that the diver could be observed, taking into account the conditions of visibility. During the campaign of spring (2013), the visibility was on average of 2 to 3 meters, and during the summer the media visibility was 5 meters. The spring campaign was carried out in two periods, the first from 26 to 28 October and the second between 11 December 10, both from the year 2013. At the same time, the summer campaign was carried out from 24 to 26 January 2014 and the fall campaign is dialledor between 7 and 10 April 2014. Also during the fall campaign was conducted an indirect assessment, What incorporated a new methodology consistent the installation of an underwater video camera in three communities: specifically in the community of *Lessonia trabeculata* (LT) that House was located at a depth of 10 meters, while in the community of filter cloth (CF) and in the community of soft bottoms are ranked 14 meters deep. In each one of them was a 60-minute film. Subsequently, in order to minimize bias produced by the diver at the time of the installation of the camera, analyzed the final 30 minutes of each filming, where was counted the total number of species (species richness), which was recorded in each community.

- Results and discussion Ichthyofauna

Among the three seasonal campaigns carried out in the study area, obtained a total 17 record *taxa* (

Table 3-30), where the most abundant were the bilagay and the burrito in the spring of 2013 and 2014 summer campaign, while the cabinza it was in fall 2014 campaign.

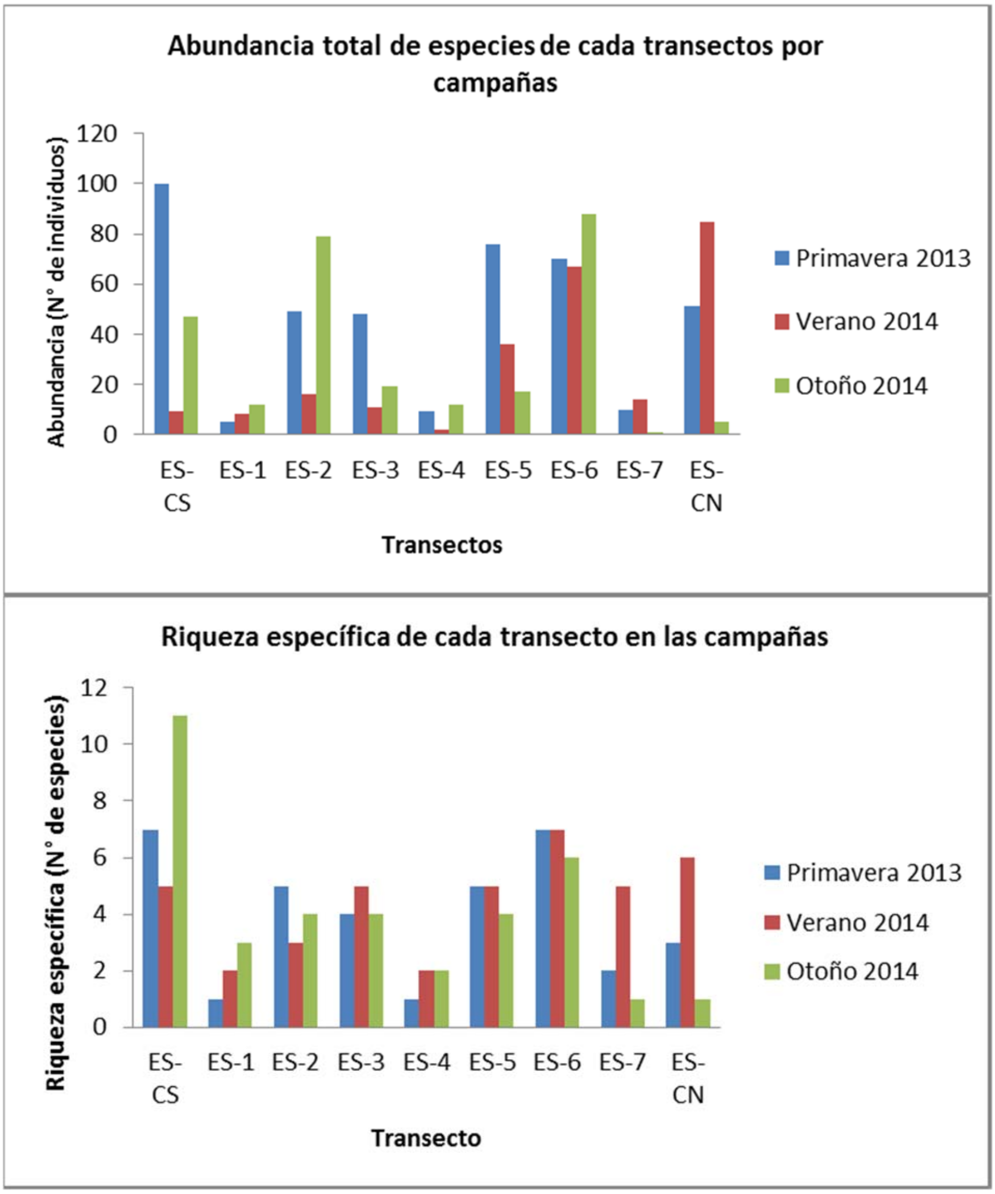
The species richness and abundance of the fish fauna presented in spring and summer a tendency to their older records in transects associated with rocky substrate with communities of *Lessonia trabeculata* (LT) and filtradore(CF) s as s-5 and s-6 ES-CS, while the minors were recorded in transects where dominated the sandy substrate with the community of fondos soft as s-1 and s-4. However, this pattern was observed during the autumn of 2014 campaign, because both the lower and higher specific wealth and abundance of the fish fauna, were recorded in transects where the bedrock was dominant.

Table 3-30. List of Species dand Fauna fish present eetween las three campaigns evaluated. The Symbol "+" represents Ito *Taxa* Identified through direct assessment and "#" IOnly Identificadas as con IIndirect assessment.

Common name	Scientific name	Spring 2013	Summer 2014	Fall 2014
Sea needle	*Leptonotus blainvilleanus*			+
Baunco	*Girella laevifrons*		+	+
Bilagay	*Cheilodactylus variegatus*	+	+	+
Tilefish	*Prolatilus jugularis*	+	+	+
Borrachilla	*Scartichthys spp.*	+	+	+
Burrito	*Chromis crusma*	+	+	+
Cabinza	*Isacia conceptionis*	+	+	+
Cabrilla	*Paralabrax humeralis*	+	+	+
Castañeta	*Nexilosus latifrons*		+	+
Piggy	*Congiopodus peruvianus*			+
Colorado conger	*Genypterus chilensis*		+	+
Jerguilla	*Aplodactylus punctatus*	+	+	#
DAB	*Paralichthys adspersus*		+	+
Plump	*Pinguipes chilensis*	+	+	+
White seabream	*Anisotremus scapularis*			#
Torito	*Hypsoblennius sordidus*	+		
Trombollito	*Helcogrammoides chilensis*	+	+	+

Source: Elaboration of the consultant.

Figure 3-90. Abundance (a) and Riqueza ESpecifica (b) of CADA Transecto in the Campanas Estacionales of Lline of BASE MArina. Lines on the graph indicates the trend recorded in each season.



Source: Own elaboration.

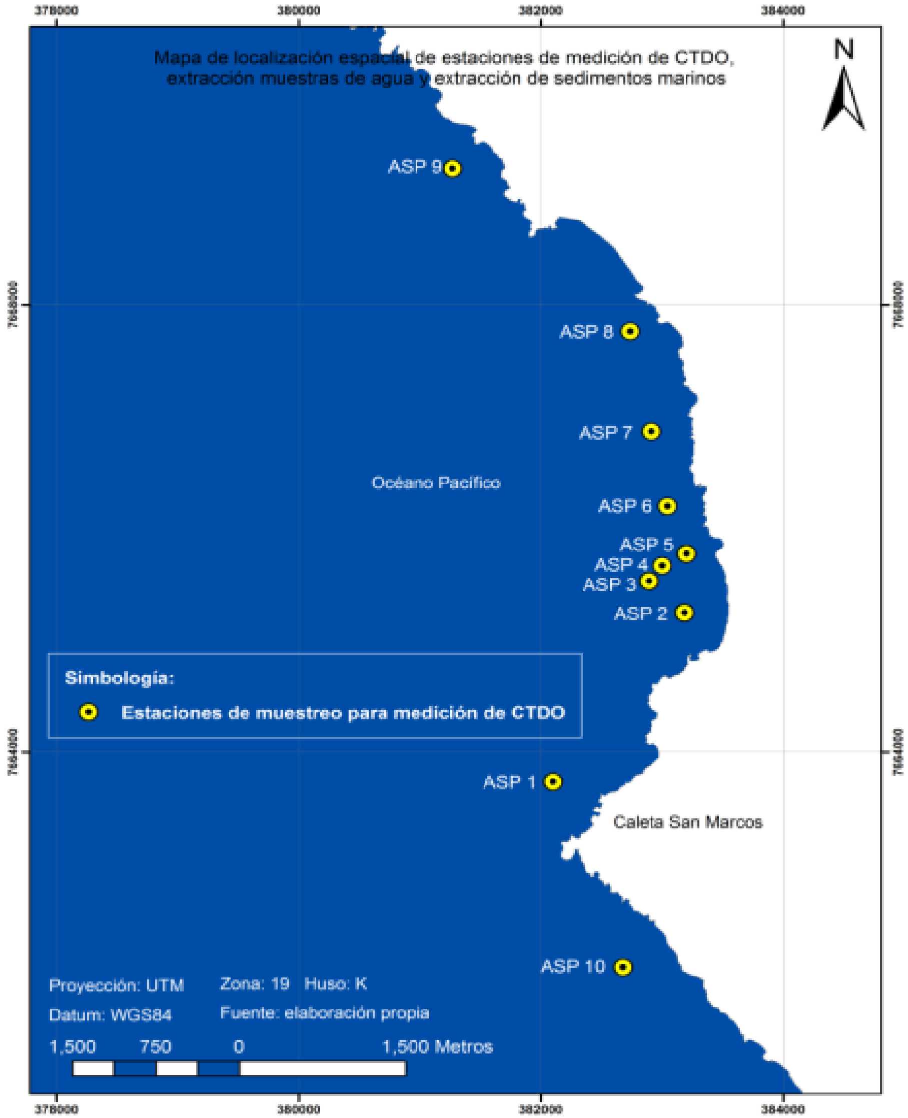
According to the hierarchical classification analysis based on the Bray-Curtis index, it was observed that the greatest similarity was 64% recorded between summer and spring of 2013 campaign of 2014, where the predominant factor of their resemblance was the abundance of 9 species that share both campaigns (Table 3-34). On the other hand, the lower similarity was 50% and was recorded between the former group (spring summer 2013-2014), and fall of 2014 campaign. This difference is mainly due to the greater number of species recorded in the last monitoring baseline (Table 3-34).

vi. Macrofauna Submareal of Fondos Sedimentarios

- Methodology Macrofauna sedimentary funds

For the study of representativa soft bottom communities were sampled a total of ten seasons)Figure 3-91), whose depth fluctuated between 11 and 24 m. Sediment samples were obtained by diving semi autonomous using a standard sampler (corer) allowing to extract sediment from an area of 0.01 m^2. Extracted 3 replicas in each season. The sampling of the spring campaign was carried out on October 25, 2013, and summer campaign sampling was performed 28 January 2014 and the Bell d(e) autumn on April 8, 2014.

Figure 3-91. Location Espacial's Eresorts of MEdition of Sedimentos Marinos for TOnalysis Biologico)Infauna Submareal). Campaign Primavera 2013, Verano and Otone 2014.



Source: Own elaboration.

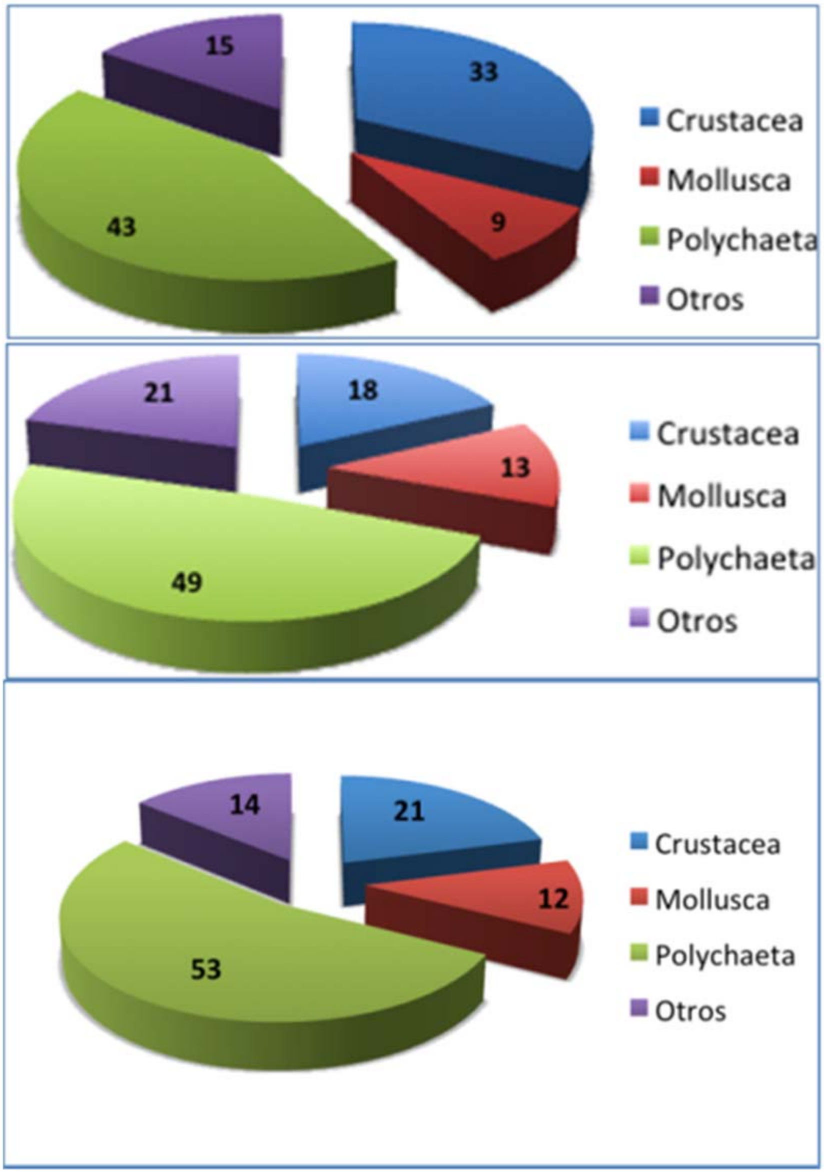
With arrays of data obtained earlier analysis the following are listed and that are recommended by the maritime authority in the *Methodological guide of sectoral technical review of environmental impact studies in the aquatic environment, of national jurisdiction for projects that include "discharge of liquid waste, of" maritime ports and terminals or other*". With respect to the analysis of ecological indexes (specific diversity, Equity Indices and species richness), the results obtained were compared with studies of Alcolado (1992) and Hendey (1977), both authors made a classification of levels of disturbance according to the indices of diversity. In addition are It carries out the estimation of the index AMBI (AZTI completo Marine Biotic Index, Borja *et to the.* 2012), which is based on the allocation of the taxa found in a sampling in five different ecological groups, which are based on the sensitivity of the species to the organic enrichment.

Another analysis are the curves ABC (abundance/biomass ratio); K-dominant curves are drawn from the distribution of the values of the abundance of species and the values of biomass of these as cumulative percentages, plotted on the shaft and against the logarithm of the ranking of species on the axis x. This method facilitates the determination of the levels of disturbance (pollution induced or otherwise) of representativa communities (Clarke & Warwick, 2001). The classification by stations (Cluster) and management by stations, this last analysis are also performed forto determine the similarity between the studied seasons.

- Results and discussion Macrofauna sedimentary funds

According to analyses, the groups with greater representation in the different campaigns and sampling stations were Polychaeta and Crustacea)Figure 3-92).

Figure 3-92. Analysis Porcentual of the GRtypes of Fauna Encontrados in the F communitiesOndo BLando in San Marcos.



Top panel: spring 2013 campaign; central panel: campaign summer 2014; bottom panel: campaign fall 2014.

Source: Own elaboration.

In the spring campaign, the biggest average abundance was contributed by the Nematoda, specifically by Adenophorea group, and the highest density was recorded at station ASP-1, product of the high presence of Nematoda. During the spring campaign the lowest density values were found in stations ASP-CN control (North), ASP-5 and ASP-8, during the summer campaign more low densities were found in ASP-CN and ASP-CS (South control) stations. In terms of species richness, in the spring a total of 46 taxa were identified, and the largest registry was obtained in ASP-2, while the lowest richness was observed in ASP-CN, ASP-8 and ASP-4 stations. The highest specific diversity was observed in the ASP-2 season and the lowest in ASP-1.

In the summer campaign 2014, 39 taxa, seven less than in spring 2013 campaign were identified. The greatest species richness was found in stations ASP-6 and ASP-7, while the lowest richness was observed in ASP-CS station. The highest specific diversity was observed in ASP-5 and ASP-7, and the lowest in ASP-CS and ASP-1 stations. In both stations Adenophorea dominated the community.

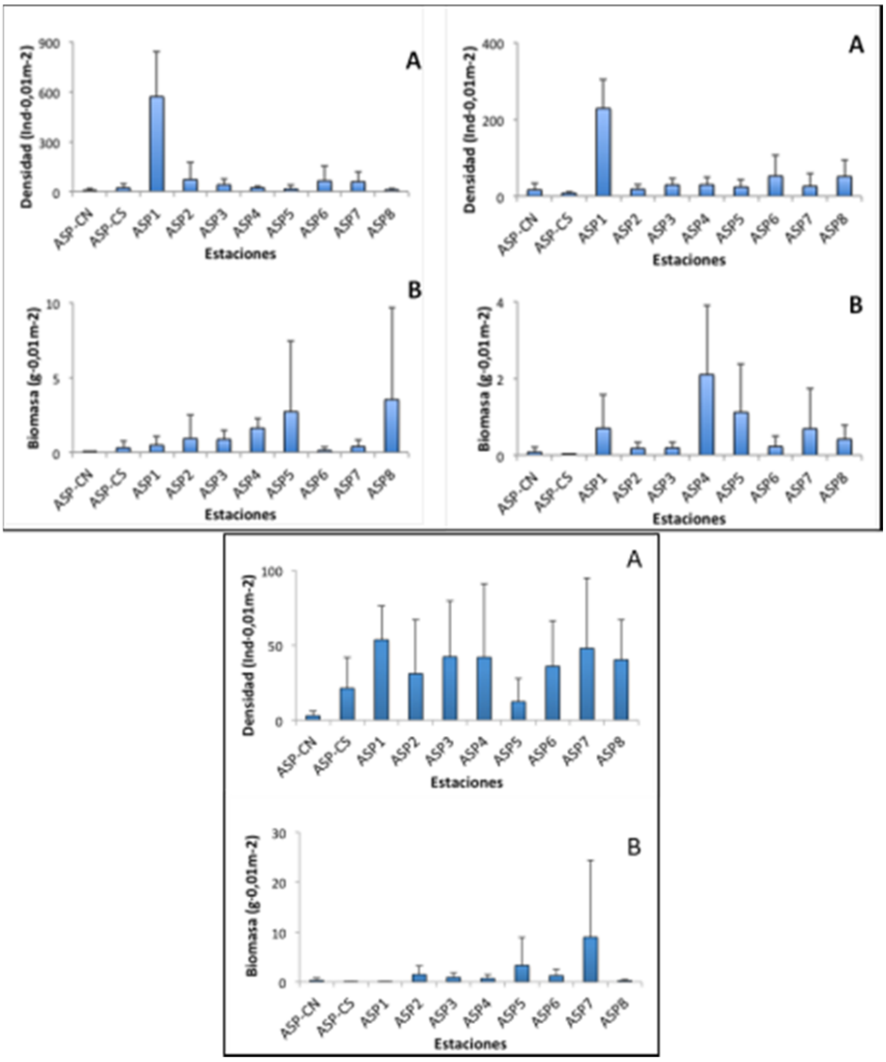
During the campaign in fall 2014 detected an incrementor in the richness, identified 43 *taxa*. The greatest species richness was found in ASP-7, ASP-3 and ASP-4, and the lowest in the North control station and southern control.

In terms of the total abundance of macroinfauna, in the three campaigns the highest density were observed associated with ASP-1 station, during the autumn of 2014 this increased abundance was associated to the polychaete *S. bombyx*, while in the past was a product of the high presence of the nematode Adenophorea.

Analyzing the results of the community in the three campaigns (Figure 3-93), you could see major differences between some of the sampling stations, demonstrating that some of them stations presented severe disturbance conditions, local character. That was the case of ASP-1 and ASP-CS stations. It is interesting to note that the ASP-1 station has shown severe disturbance conditions in the three campaigns carried out. The ASP-CS than during the campaign season Spring 2013 presented a high diversity of specificHowever, in the two following seasons appears strongly disturbed.

In the sector coastal evaluated No There would be anthropic character of industrial disturbances. Thus, it is likely that the observed differences may be due to disturbances caused by high exposure to the waves that the sectorthat may be influencing the differences observed at the level of sampling stations. Events of heavy seas could be causing disturbances continued, removing individuals from the sector, avoiding the stabilization of the community at the time and favouring the emergence of opportunistic species r-estrategas. In particular It should be discussed with detention which is happening at station ASP-1, since how they have shown him the three carried out campaigns, there is a condition of disturbance at the local level standing in the sector.

Figure 3-93. Abundance (Ind•0, 01 m-2) (A) and biomass (g•0, 01m - 2) (B) total of the macroinfauna found in each of the stations sampled in the communities of bottom soft San Marcos. The line bars represents the standard deviation.



Left panel: campaign spring 2013, right panel: summer 2014 campaign, bottom panel: campaign spring 2014.
Source: Own elaboration.

vii. Vertebrates Costeros

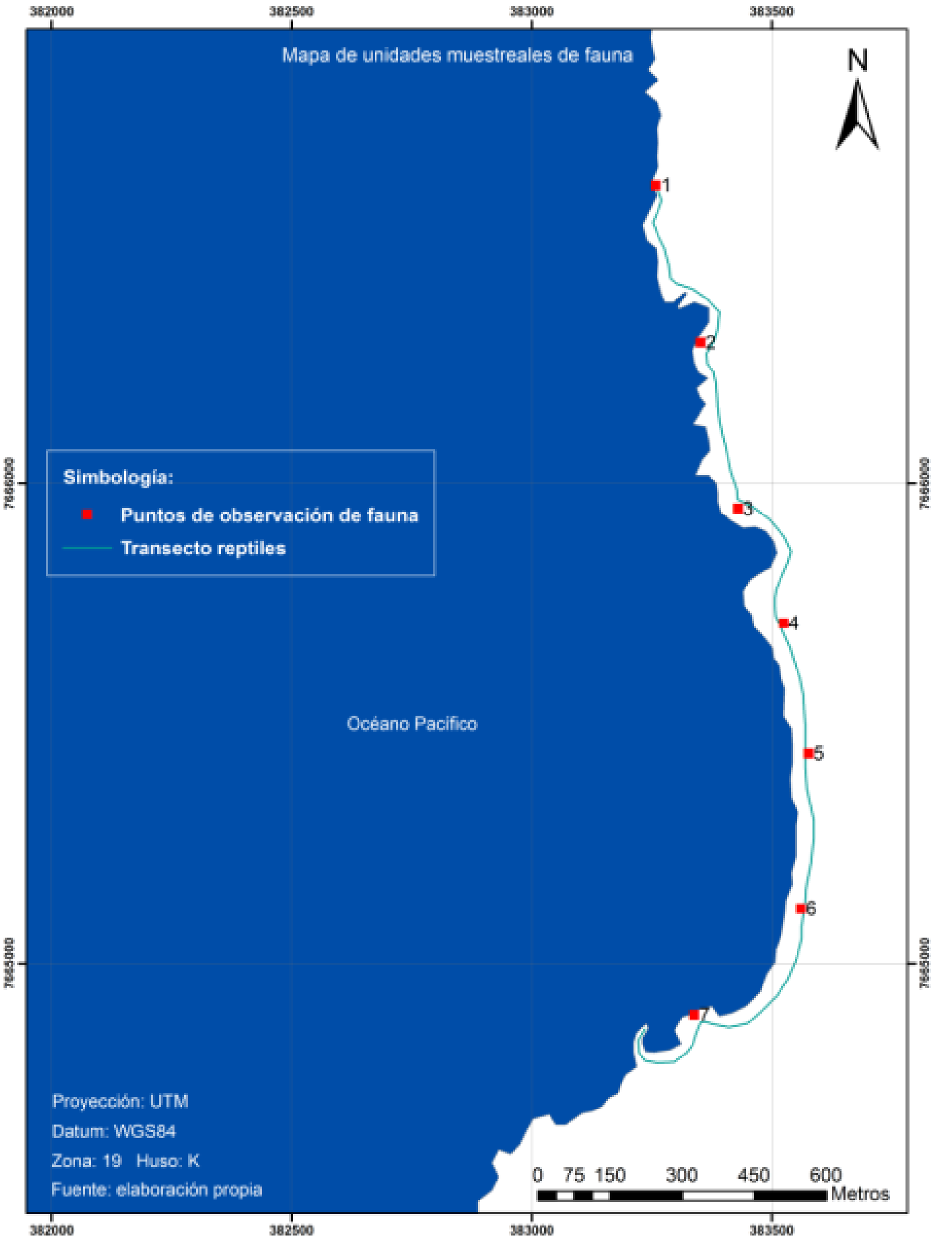
- Methodology Vertebrate coastal

Three (3) corresponding to conditions of spring 2013 field campaigns were conducted to characterize populations of birds, marine mammals and reptiles present in the study area, (24-26 October 2013), conditions of summer 2014 (25 to 27 January 2014) and conditions of autumn (6-10 April). Two were recognized in the study area environments:

1. Coastal environment: corresponds to areas ranging from the coastline (midpoint between high and low tide) up to 50 m offshore and ocean outside of it. It does not include coastal vegetation and the substrate was composed of sandy areas (Beach) and rocky areas in the form of blocks, boulders, Bolognese, among others.
2. Marine environment: corresponds to the sector which is bordered by the coastal environment towards offshore, and is absolutely inundated by sea water. It includes buoys, rocks and boats which are used as rest sites by wildlife.

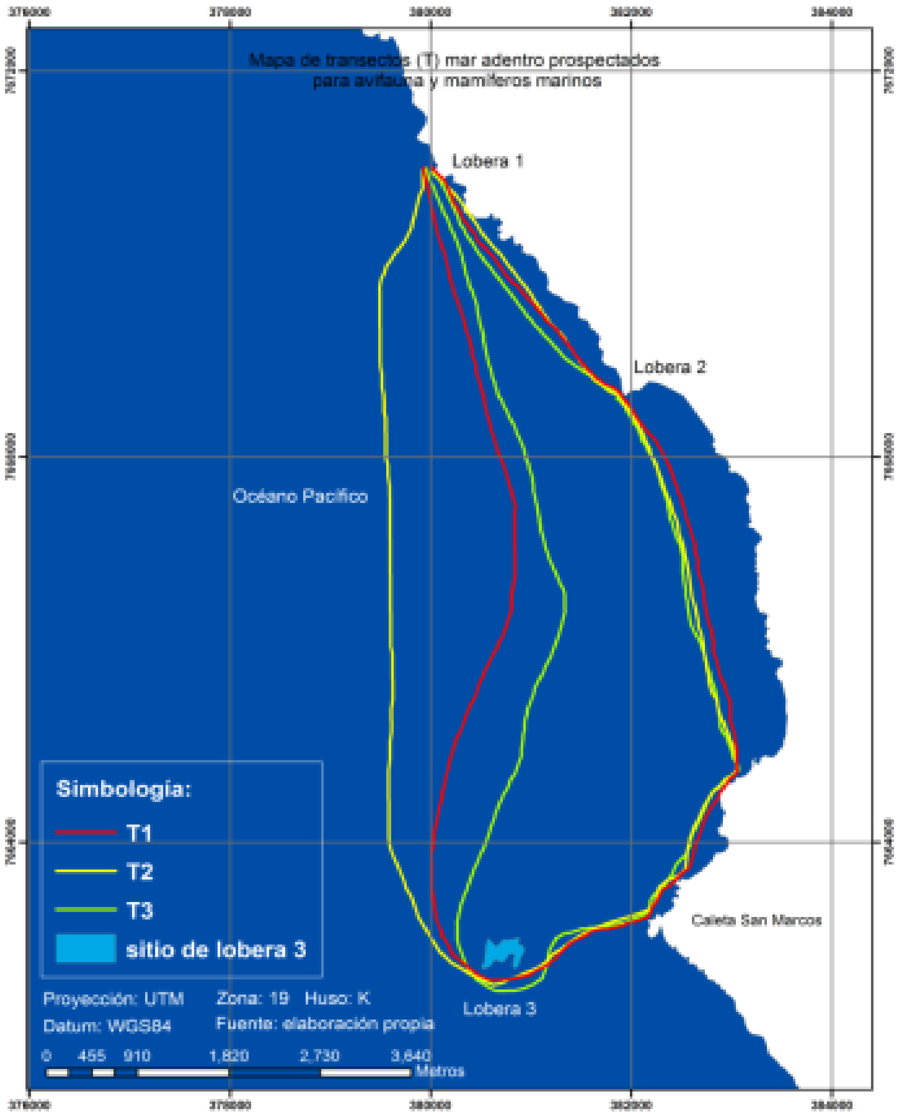
Settled eleven (11) sampling units of fauna, which associated with recognized in field environments. Of the total of sampling units, seven (7) corresponded to points of wildlife watching for birds and marine mammals (coastal environment), three (3) transects maritime for the observation of birds and mammals in the marine environment, and two (2) to transect to the evaluation of reptiles (coastal environment), see Figure 3-94 and Figure 3-95.

Figure 3-94. Sectors Coastal prospected for Avifauna and Marine mammals)POF) and Reptiles (Transect Blue line).



Source: Own elaboration.

Figure 3-95. Transects (T) Offshore prospect pARA birds and Marine mammals.



Source: Own elaboration.

In each campaign, the samplings were conducted between 07:30 and 20:30 hours, these being the peak hours of the groups of vertebrates present in the study area. All sampling units were geo-referenced field, and for each class of vertebrate was a different sampling methodology based on those outlined by Thompson *et to the*., 1988.

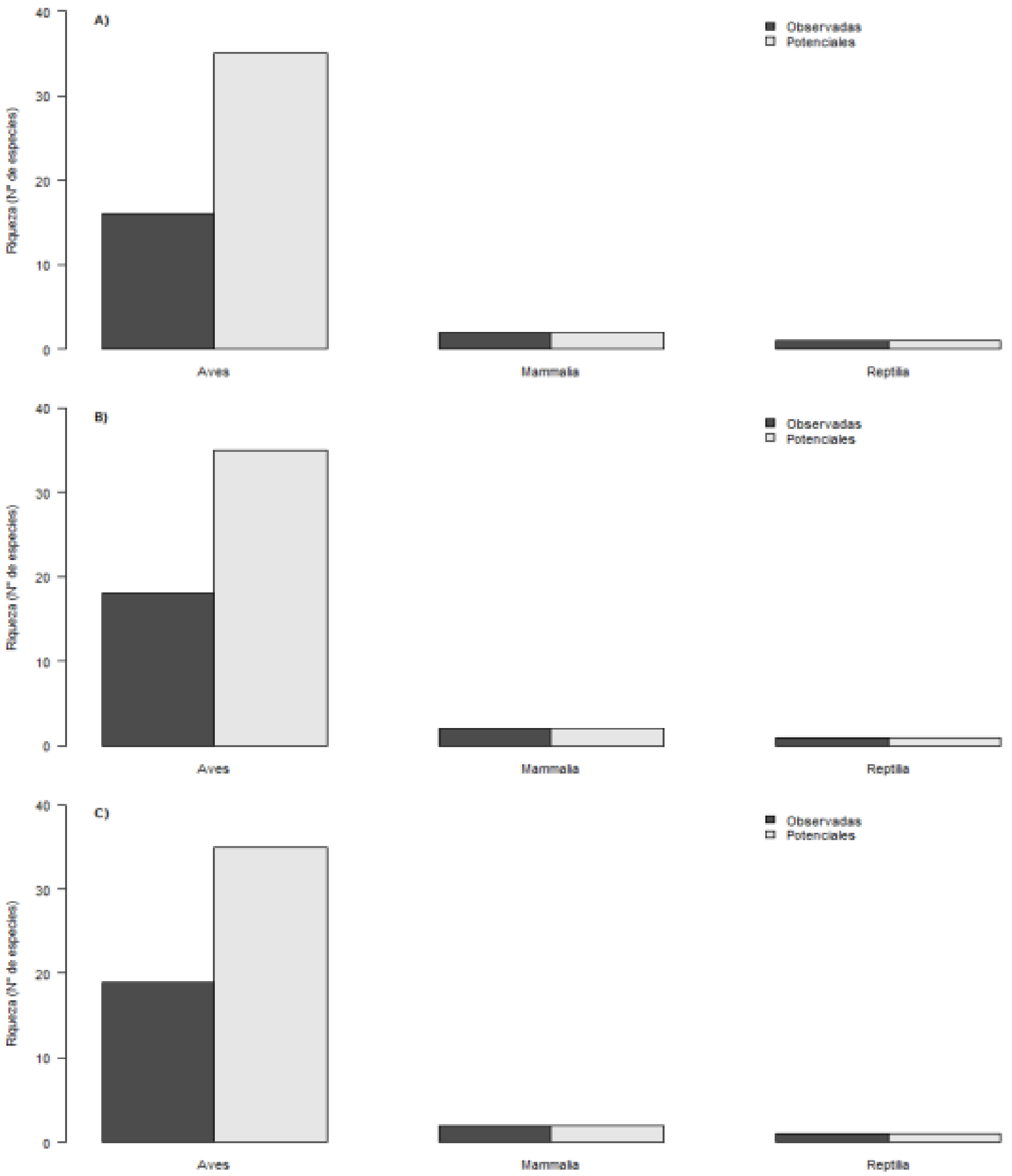
To set which category of conservation of each species, were the categories of current according to the Committee's classification of species (CCE) of the Ministry of environment (MMA): DS N ° 151/2007, light; DS N ° 50/2008, LIGHT; DS N ° 51/2008, LIGHT; DS NO. 23/2009, LIGHT; DS N ° 33/2012, MMA; DS N ° 42/2012, MMA; DS N ° 41/2012, MMA. Also included the current categories of conservation according to the regulation of the hunting Act 19.473 ° N (Decree N ° 05/98, MINAGRI), and the Red Book of the vertebrates of Chile (Glade, 1993). The updated not current categories by CCE exposed for ease of reference. Also used the classification of the International Union for conservation of nature (IUCN), for the category of conservation around the world.

- Results and discussion Vertebrate coastal

According to the bibliographic records collected, identified thirty-nine (39) vertebrate species with potential presence for the study area, which are made by: a reptile (1), in the category of conservation; Thirty-four (34) birds, six (6) classified under any category of conservation, and two (2) mammals, both species classified within any category of conservation according to legislation. During the campaign of spring 2013 were twenty (20) species of vertebrates, which are composed of two (2) species of reptiles,both in the category of conservation; Sixteen (16) species of birds, six (6) classified in a category of conservation and, two (2) mammals, both in the category of conservation. During the campaign of summer 2014 were recorded 21 species of vertebrates, which are composed of a (1) species of reptile conservation category; eighteen (18) species of birds, where five (5) of them are in any category of conservation and, two (2) species of mammals, both in State of conservation. Twenty-two (22) vertebrate species were recorded during the campaign in fall 2014which are composed of a (1) species of reptile conservation category; Nineteen (19) species of birds, where six (6) of them presented some category of conservation and, two (2) species of mammals, both in State of conservation.

In the Figure 3-96 compare the amount of *taxa* observed *versus* potential species, during the campaigns of spring 2013, 2014 summer and fall 2014. During three campaigns evaluated, It was able to identify 100% of reptiles and mammals described for the study area, obviously, These were classes that had higher proportion of potential species observed.

Figure 3-96. Comparison between potential and observed richness in San Marcos; A) spring 2013 campaign; (B) summer 2014 campaign; (C) fall 2014 campaign.



Source: Own elaboration.

Class birds was observed the 45.7% during the campaign in spring 2013, 51.4% in the campaign of summer 2014 and 54.3% during the campaign in fall 2014, of the total of potential birds for the study area. The tendency to see more birds during recent field campaigns, can be attributed to a large proportion of These potential species correspond to boreal migratory species that yes were present in the study area during summer or autumn, thus initiating its return to the hemisphere North.

viii. Communities Planctonicas

- Methodology Planktonic communities

The study of the planktonic communities (phyto and zooplankton) during the spring of 2013 campaign was carried out intensively during 5 days, by day and night samples from 18 to 22 November 2013, opportunity in which are sampled at a site where the adduction of water from the project will be located and a site co ntrol further South without influence of the project (to the South of Pta. Chomache). In both places the same amount of sampling points were stacked. During the summer of 2014 campaign executed on January 27, 2014, was held a day of punctual and stratified sampling in the same points of the spring campaign. Inthe Figure 3-97 the spatial location of sampling points of planktonic communities defined for the evaluation of its dynamic coastal surrenders.

Phytoplankton was quantified in two layers, surface and subsurface by vertical hauls of bottle Niskin (quantitative analysis) to a depth equal to half of the Secchi depth measured at each point (criteria established for) (define a stratum where the community is mostly concentrated phytoplanktonic (CF)). In addition vertical tows with a network of 40 µm of plot were performed to analyze the specific composition of the CF (qualitative analysis). The zooplankton (grouper and holoplancton) were captured using networks of 210 µm of plot. For the ooplancton surface was used a network (floating) epineustonica, zooplankton to subsurface depth was used for a network type bongo. And a WP-2 network with remote locking mechanism was used to obtain vertical samples at specific depths (stratified). Both networks were equipped with Hydro-Bios flowmeters to determine the volume of water filtered. Sets corresponded to drag simultaneous of the two types of networks (epineustonica and bongo) along transects of 500 m length. At the ends of each transect we obtained samples estratifdecades of zoo and phytoplankton by vertical hauls, as well as data of chemical variables of the water column from the surface to the bottom using a Profiler CTDO.

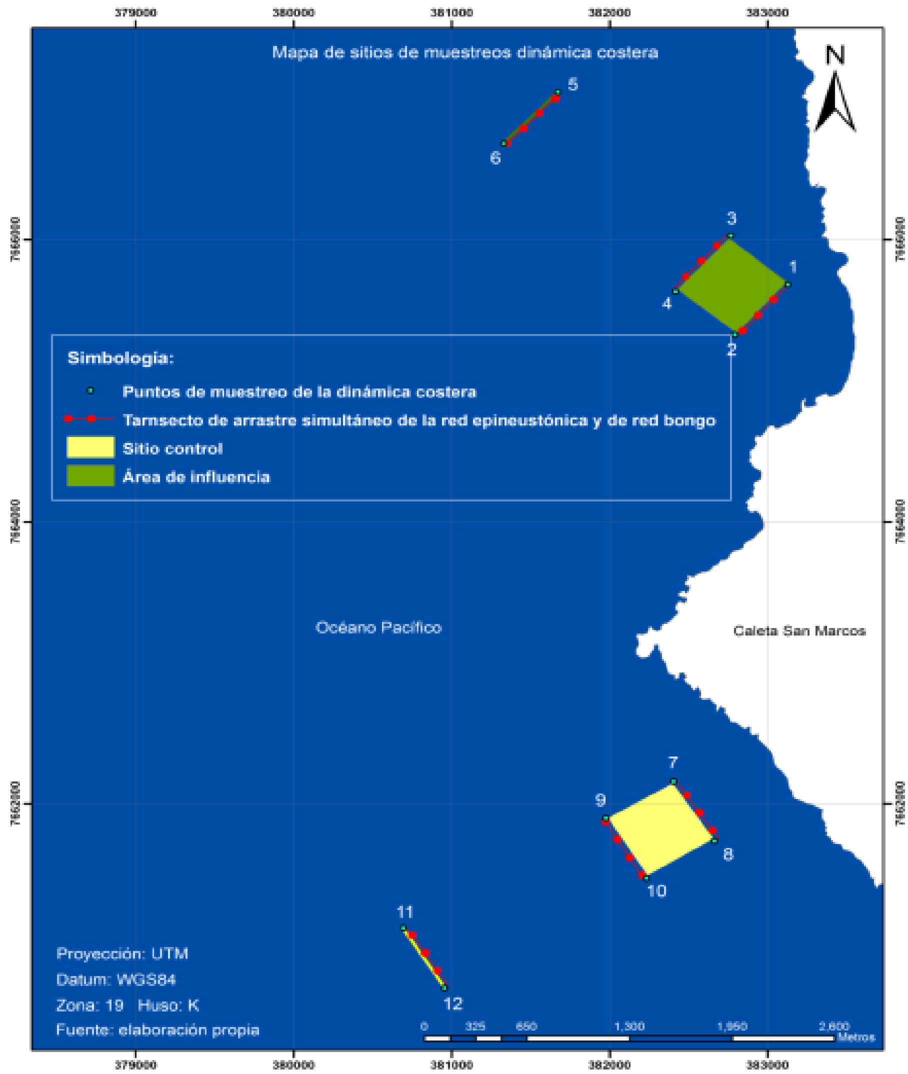
Nutrient and photosynthetic pigments

Chlorophyll-*to*feopigmentos and nutrients (nitrate, nitrite, ammonium, and phosphate) were quantified from surface and subsurface water samples obtained through a Niskin bottle. At all points (beginning and end of each transect) leaked 1 L of water through a system of porta Nalgene® filter and an electric vacuum pump. 47 mm diameter GF75 fiberglass filters were used Advantec®. The filtered water was kept in darkness and refrigerated for later analysis of nutrients, using reagents vials TNT Plus HACH brand for each nutrient. After filtering, filters GF75 were coated with aluminum foil to avoid its contact with light and kept frozen until its removal in a laboratory. An extraction was performed n cold with 90% acetone for 24 hours in the absence of light and chilled at 4 ° C. Then, there were the absorbance in a spectrophotometer model DR 3900 Hach® brand at 750 nm and 665 nm in normal and acidic conditions (10% HCL) to obtain the values of chlorophyll-a and feopigmentos (Holm-Hansen & Riemann 1978).

Vital staining

"Vital staining" method was used to estimate natural mortality of zooplankton with neutral Red, which has the advantage of dye the apparatus of Golgi bodies (Yáñez *et to the*(., 2012) and, after a time and subsequent laboratory analysis can be distinguished clearly, organisms that were dead or alive to the moment that the samples were extracted. The time of collecting the sample was added to 1 ml of neutral Red solution and after 1 h acting zooplankton samples were fixed with formalin at 10%.

Figure 3-97. Stations of Muestreo Intensivo for the Evaluation of the Dinamica Costera of the Comunidades Planctonicas During Primavera 2013.



Source: Own elaboration.

Green it lies in the area of influence of the project. Yellow is the site control (or without influence of the project). Each number in correlative represent points of stratified sampling of zooplankton with WP-2 network, and phytoplankton with Niskin bottle and manual network, in addition these points were profiles of temperature, salinity, pH, turbidity, fluorescence and Secchi depth and taken water samples for the analysis of nutrients, chlorophyll-a and feopigmentos. Also in both places each dotted red line corresponds to the length and position of the tra500 m areas of for simultaneous network epineustonica and the bongo net drag. These same points or stations used for the punctual characterization during summer 2014.

- Results and discussion Planktonic communities

Campaign spring 2013

Diatoms were the dominant phytoplankton taxa forming chains *Chaetoceros* spp. and *Eucampia* SP. The phytoplanktonic community showed signs of temporal variation in the short term, however, was not detected a pattern of vertical or horizontal structuring in each sampling site, so it can be inferred that the system was able to blend in the water column, since there is a stratification marked during the five days of study. Perform parametric statistical analysis (ANOVA), shows that there is a high variability by site and time, however, there is a more stable trend with greater abundances in the North site, while siteSouth is much more variable and dynamic. In terms of chlorophyll-a concentration, there was on average a high productivity, it should be noted that he was a notorious the feopigmentos increase in nocturnal surveys, which could indicate activity herbivorous Trophodynamics overnight. The day that registered increased phytoplankton biomass was the last day of sampling (day 3), suggesting the highly dynamic system during the first sampling, showing significant differences in the temporal component. Nutrients showed a tendency to increase asthey spent the days, where the 3 day presented values of nitrite, nitrate, and orthophosphate, indicating that high during the first few days phytoplankton biomass records was that used nutrients showing low concentrations.

In terms of zooplankton abundance more important category was the holoplancton, being the copepoda class the most representative, which highlights the abundances of species *Acartia tonsa* and *Paracalanus indicus*. The Phylum Annelida also had a high abundance of Larva *Rostraria* SP. Larva *Evadis* SP*. and* adults of the genus *Tomopteris* SP., *Platynereis* spp. and *Evadis* SP. In relation to organisms in the Meroplanctonicas category, the zoeae and Megalopa of braquiura class recorded the greater abundance. In addition, there was a high abundance of the Phylum Equinodermata, being the larva Pluteus (Sea Urchin larva) which recorded the greater abundance. There was a significant difference in terms of the sampling stratum factor, but in temporary factors (day/night) and space between the North and South sites. Ichthyoplankton category was represented by larvae and eggs of *Engraulis ringens* (and *Odontesthes regia*, Larva *Syciases sanguineus and* Larva *Gobiesox marmoratus.*

Both agencies meroplanctonicos as holoplanctonic abundances showed signs of a State of progression of an upwelling event at the time of sampling, where the flow of energy and biomass has been evidenced by low levels of nutrients, which indicates a higher phytoplankton biomass, which results in high abundances of the various components of the zooplankton, leaving in evidence the Trophodynamics of the studied system. However, statistically analyze the total abundance, found that significant differences between sites (North and South) and the time (days), there are no concluding that there would be an effect temporary short term, no space at this local level that could be structuring the zooplankton community during the spring period sampled. In terms of diversity, there were significant differences in the time factor, which may be closely related to the increase in the concentration of chlorophyll-*to* (resource availability), as well as nutrients analyzed, that could produce a change in the structure zooplanktonic mainly reflected in a change in the composition of the zooplankton community (i.e. the presence of herbivores and omnivores).

The diversity of the zooplankton in the area of study (e.g. species richness), was comparatively lower than in similar coastal areas of the North of Chile (Hidalgo *et to the.* 2005), however, the levels of wealth to some particular taxa are characteristic of a typical system of intense and permanent upwelling, What is reinforced in this study by the spatial heterogeneity of the composition and abundance of taxa. Such numbers have also been described for other equivalent areas during the same period of the year (Margalef, 1978, Palm & Rosales 1995, Warwick *et to the.* 200, palma *et to the.* 2006). high abundance of herbivorous zooplankton species *Centropagues brachiatus, Acartia tonsa* and *Paracalanus indicus* (Hidalgo *et to the.* 2010, 2012), it may be linked to the presence of diatoms of size medium but that form long chains in the study area. However, the presence of carnivores such as *Euchaeta marina* (Copepod) e Hydromedusas, given to know the ecological succession that is happening in the place, where, although there is a high primary production, carnivorous organisms are present, not in a great abundance, but with an important representativity than You may change the composition of plankton.

All abundance of zooplankton and Ichthyoplankton analyses were carried out with data from living organisms, since by using the technique of vital staining (Yáñez *et to the.* 2012), could obtain specific data than was actually alive at the time of sampling, and avoid the above estimate of abundance in the study site. This technique was quite effective, being the meroplanctonicos bodies and Ichthyoplankton which recorded higher natural mortalities, common situation in such a given organism that the dispersive phase and pre-reclutamiento often present high rates of mortality.

In general, levels of abundance for the phytoplankton as zooplanktonic taxa were heterogeneous or both between sampling points and the sampled strata parchosas type. This type of pattern has been detected previously for coastal areas of northern Chile, where the plankton can experience high variations at spatio-temporal scales comparable to this study (Hidalgo *et to the.* 2005, 2010, 2012, morales *et to the*. 2010, scribe & Morales 2012). The pattern of distribution of the meroplancton, for example, may be due to differences in patterns of circulation due to geographic features such as the presence of peninsulas and bays (Palm & Rosales 1995, Palma *et to the.* 2006).

A high percentage of the agencies belonging to the holoplancton zooplanktonic performs vertical displacements in the water column, which proposes are induced both by physical factors such as biological (Hidalgo *et to the.* 2005, scribe, 2007, Palm *et to the.* 2011, Manriquez *et to the.* 2012, Riquelme-Bugueño *et to the.* 2012, 2013). This behavior has also been demonstrated in several species (e.g. larvae of benthic invertebrates of commercial importance) meroplanctonicas (Poulin *et to the.* 2002, Palm *et to the.* 2011), thus promoting the survival and return to coastal environments from ocean areas. This particular pattern is demonstrated in this study to observe the presence of euphausiid and a greater abundance of eggs and larvae of fish (surface) epineustonica network during nocturnal surveys. The results of this study may suggest a distribution differential of plankton in the water column, in contrasting light conditions (i.e., day and night), resulting in a significant pattern at the time of its evaluation. In addition, the registration of a component estrucUral two site nearby North and South, would be more influenced by the geomorphology of the place as well as the characteristics of a highly productive system. The determination of these patterns is of great importance, mainly for those species that are functionally relevant in these ecosystems, because of its characteristic abundance levels (e.g. *Acartia tonsa, Paracalanus indicus*), its importance as indicators of particular stressors that may be affecting the community, or its economic potential importance to correspond to stages larval or juvenile resource of economic importance present in the study area) e.g. *Engraulis ringens, Odontesthes regia* molluscs larvae and larvae of sea urchin).

<u>Campaign summer 2014</u>

The phytoplanktonic community showed no signs of variation in wealth, and in abundance, however, if found spatial differences in composition (nMDS), in relation to the analyzed site (North-South), what can be the effect of the particular geography, already evidenced in the intensive sampling of spring. In terms of biomass phytoplankton (chlorophyll-a concentration), registered values higher in the surface layer, specifically on the North site. The feopigmentos had significantly higher values in the southern sector, which gives the dynamic signals the system during the time of sampling. Local (intra-site) no differences nor space reported nutrient values, and suggesting they were distributed relatively evenly among strata both sites at the time of sampling.

In terms of zooplankton abundance more important category was the holoplancton, being the copepoda class the most representative, which highlights the abundances of species *Acartia tonsa* and *Paracalanus indicus*. The Phylum Annelida also had a high abundance of Larva *Rostraria* SP. In relation to organisms in the Meroplanctonica category, the zoeae and Megalopa of braquiura class recorded the greater abundance. In addition there was a high abundance of the Phylum Equinodermata, being the larva Pluteus (Sea Urchin larva) which recorded the greater abundance. The zooplanktonic community showed no signs of variation in wealth, and in abundance. Ichthyoplankton category was represented by larvae and eggs of *Engraulis ringens* and *Odontesthes regia*, and larvae of *Prolatilus jugularis*. Both agencies meroplanctonicos as holoplanctonic abundances showed signs of a possible state of progression of an upwelling event at the time of sampling, in conjunction with a high phytoplankton biomass, which results in high abundances of the different components of the zooplankton (mainly herbivorous and omnivorous). In this regard, it is important to note the existence of a focus of upwelling in the South of the study area and close to the area of Chipana.

The application of the technique of vital staining again showed meroplanctonicos organisms and Ichthyoplankton were that recorded higher natural mortalities in the most superficial layers. In general, levels of abundance for the phytoplankton as zooplanktonic taxa were heterogeneous or parchosa type between the sites of sampling (North-South).

Terrestrial ecosystems

3.2.5 Soils

3.2.5.1 Methodology

i. <u>Classification of the Sscarves</u>

For the characterization of the types of soil, soil environmental assessment guide, 2011, use the "guideline study of soil" of the SAG recommended, which by kinds of capacity usage, you uniform criteria for the description and classification of different types of soil.

These classes are an ordering of the existing soils, which noted its relative adaptability to certain crops or predict their productive potential, according to critical or limiting attributes that present. Which is obtained from the study of its physical and chemical properties, fulfilling the criteria of the guideline of the SAG, and the identification of biological criteria, in the case of, which quality criteria can be inferred. Thus, the productive potential may be agricultural, forest or grassland, but also, when does not have these capabilities, the potencil can be based on the protection of hydrographic basins (water production) or for wildlife.

Use of capacity classes, are eight, designated with Roman numerals from I to VIII, sorted by increasing limitations. They are divided into soil arable from class I to IV and not arable, from class V to VIII (SAG, 2011).

In Table 3-31 shows a summary of the kinds of capabilities of use (CCUS) and associated productivity levels (Ferreira, 2004).

In order to classify soils according to kinds of capacity of use, the development of the work is performed in three stages:

1. First stage of Cabinet
2. Second stage of terrain.
3. Third stage of Cabinet.

Table 3-31. Classes of Ccapacity of UOS and Uses Aappropriate.

CCUS	Increase in the intensity of use →							
			Grazing		Cultivation			
	Wildlife and eco-tourism	Reforestation	Moderate	Intensive	Restricted	Moderate	Intensive	Very intensive
I	Suitable for all applications. For crop it just requires conservation practices							
II	Suitable for all applications. Simple conservation practices required for cultivation							
III	Suitable for all uses, more intensive conservation in farming practices							
IV	Suitable for various applications, restrictions for some crops							
V	Suitable for grazing, reforestation or development of wildlife							
VI	Suitable for extensive grazing, reforestation and wildlife							
VII	Suitable for reforestation, and generally unsuitable for grazing, wild life							
VIII	Suitable for conservation of wildlife or recreation, not suitable for farming, grazing or forest material							

Source: Ferreira (2004)

ii. First stage of Gabinete

The stage of initial Cabinet, corresponds to the identification of the different types of soil associated with the area of influence of the Project, through the compilation of bibliographic background)geographical, geomorphological and physico-chemical) available for the area and the identification of homogeneous soil units[8], of the area of influence of the Projectthrough geomorphologic photo interpretation or external indicators (earrings, geomorphology, hydrography, exposure, vegetation, etc.) about Google Earth platform or other available images (scale 1:10 000), in a GIS environment, for the construction of the Cartography base floors will be occupied in the next stage of land.

The area of influence for this component is defined as the area of projection of the associated works to the Projectconsidered for its determination, the establishment of the installation area, the existence of roads and likely maximum extension of the same scroll.

Finally, observation points on the homogeneous units of interest, identified at the proper scale for the process of characterization of the stage of land are assigned.It should be noted that homogeneous units correspond to a recognizable, differentiable and representable element at a thematic level on a certain scale. This means, that its characteristics are evident by direct observation or by correlation of characteristics and soil forming processes, such as the position of biogeographic and physiographic examples geological, geomorphological and pedogenesis, the which can be recognizable by interpreting fotoedafica, and do not necessarily imply for this unit should be a calicata or observation of the profi le.

iii. Second stage: land

In the stage of land characterized the Uopportunities Hidentified omogeneas or fotointerpretadas in the previous stage and validated These results. This characterization is performed under the same scale of photo-interpretation, assuming in this way to the observation points assigned to each unit homogeneous they are representative of the same.

If considered in land units identified in the previous stage are not homogeneous, proceed to add observation spot, points in those sectors generated questions and in sectors with characteristics not identified by photo-interpretation.

The description of the soil, develops on the basis of those characteristics or attributes that are necessary for determining the usability of a particular unit of soil class. In this way, the

[8] Unidades homogéneas de suelo, corresponde a la unidad mínima identificable a una escala adecuada.

immediate identification of the critical attribute, can be determined by itself only the kind of usability, independent of the rest of the attributes present less limiting features.

The main criteria that allow the classification of soils, according to SAG (2011) usability, correspond to features physical and chemical soil profile and morphological terrain, descending, sorted by relative incidence on classification, as follows:

- Kind of depth (cm)
- Kind of slope (%)
- Class and category of drainage
- Textural class
- Kind of rocky surface (% of stones and gravel %).
- Usable water
- Kind of erosion
- Kind of flood
- Kind of salinity
- Kinds of Sodality/alkalinity
- Class and category of Rocky subsurface (%)

For the characterization of homogeneous units, the observation point is identified and proceeds to characterize the soil, by sampling with Auger, realization of pits or road cuttings; obtaining pictures of the surface and the soil profile.

Field prospecting was carried out between 10 and 13, December, 2013.

iv. Third stage: Cabinet

This stage consists of tabulation and ordering of data collected in field, description and analysis of results. The description of the results and the projection of the observation points are analyzed on GIS environment, scale 1:10 000, to compare the kinds of usability estimated in the first stage and validate or correct homogenous units previously homogeneous identified.

3.2.5.2 Theoretical framework

i. Soils of the desert zone (18° to 29 ° LS LS)

a) Depression Intermedia-Pampa del Tamarugal (absolute desert)

From physiographic point of view, these areas are characterized by slightly undulating surfaces eroded; sectors with salts, carbonates and silica, with arid regime hard crusts and heat.

Within these soils, it is possible to find, soils with high salt content, scarcity of carbonates and abundance of sulfates and chlorides. Still, great part of salt flats described in the North of Chile, belonging to the Group of the rich in Ca and SO_4, with low presence of alkaline salt lakes (Risacher et al., 2003;) Luzio, 2010). This lack of alkalinity, is attributed to the abundance of S and deposition of dust from the gypsum-rich desert, where the oxidation of sulphur, produces SO_4 acidifying and reducing the content of carbonates. These soils have a surface crust sealed, extremely hard, formed by salts such as sulfates, chlorides and possibly carbonates. Signs of an incipient or non-existent soil evolution, and may qualify them as a succession of sedimentary layers.

In terms of biological, and chemical characteristics the electrical conductivity)CE) You can reach 500 m dS^{-1}, and pH in the crust can fluctuate between 8.5 and 8.9; the content of $CaCO_3$ It is less than 2%, which is low to approximately 70 cm, under this depth there are carbonate accumulations that can reach 10%. Organic matter is very low in the crust, usually less than 0.3%.

b) Coastal sector

Soils described in this area by Luzio (2010), considered a strip of coast that extends from the oceanic coastline up to approximately the line of maximum height of the Cordillera de la Costa, with a regime of arid and isothermal.

The Cordillera de la Costa, would be made up of marine sedimentary rocks and some intrusions of granitic rock. As to the most characteristic morphological features are the cliffs, colluvial formations, valleys with small water courses that go down to the sea and a coastline, consisting of marine terraces of low magnitude and development.

The Cordillera de la Costa drops steeply to the sea shaped cliffs hundreds of meters high, at the base of which forms a continuous succession of colluvium. So is structure a narrow coastal strip, formed by sedimentary deposits that give rise to few, narrow beaches of pebbles and sands. Some of these soils are formed by a succession of estratas, whether of marine origin (of rounded gravel) or colluvial (gravel angular, with a coarse sandy matrix). The presence of carbonates is frequent, and within the soluble cations dominates the Na^+.

Thin soils over a substrate formed by angular gravel that can deal with 80% by volume, characterized the Cordillera de la Costa.

3.2.5.3 Results

The study conducted during December 2013, between the Central depression of the Atacama desert and the coast, agreed to make the descriptions of homogeneous units (UH) described in the run-up to land, covering an area of study approximate 2.361 ha, due to which defined a buffer on the projection of the works. In addition, the study area has sectorized, according to geomorphological relative position and works in four sectors below:

- Sector orCosta surface Bras
- Sector coast underground works
- Sector plateau
- Sector Pampa

Thus the field validation study, was held by the allocation of points on homogeneous soil units and travel units between points.
Subsequently, descriptions taken in the field, to generate the correlation with the UH and determine kinds of capacity of use and make UH division between the above sectors are analyzed.

i. Rankings Interpretativas

Units of soil affected by the Projectthey were identified and validated according to characteristics fotointerpretadas and field data collection. After the analysis of descriptions, 9 reference soil units were identified:

- Aluvio - Colluvial fan unit
- Hills drive
- Broken Aluvio - Colluvial
- Cliff drive
- Plane Aluvio - Colluvial unit
- Unit of Salt Lake
- Slope of Washout
- Alluvial terrace drive
- Coastal terrace drive

These homogeneous soil units below in each sector:

Sector orBras Superficiales coast

En the coastal sector, the studied surface corresponds to 75.6 Ha, correspond to homogeneous soil units of coastal terrace, wash-out batter and hills, described below.

- **Terrace drive Litoral:** the unit is represented by the P01 and P21 observation points. Appropriate for soils formed by the joint action of continental and marine units. Simple, slightly inclined and complex slope, slightly undulating. With plithographic variable according to the sequence of stratification of materials.

  This unit has two variants:

  - UTL-1: Dominated by fine sands and silt textures; with loose dry consistency. Thin in depth, and with the presence of resistant massive limestone under 25cm.

- UTL-2: Dominates the texture sandy soil thick. With granite rock exposed in a high percentage of the surface and in sectors where soil of scarce development is observed, this is very thin.

- **Slope of Derrubio:** represented by the point of observation P02 correspond to a deposit aluvio-colluvial chaotic, very deep. Textured sandy soil and slope moderately wavy. Positioning range of the cliff unit.
- **Hills unit:** represented by the P20 observation points. It is a very thin soil, position of slope of Hill, and cone high colluvial, with simple earrings slope to complex in higher positions, being moderately wavy to strongly wavy. There are rocky outcrops in many variants and texture Sandy silt.

Units present in this sector are graphed in the Source**: Own elaboration.**

Figure **3-98** and geo-referenced of prospection on ground points in the Table 3-32. Individualization of the Ppoints of Prospeccion **in Terreno.**

Table 3-32. Individualization of the Ppoints of Prospeccion in Terreno.

ID observation points	This	North	Homogeneous soil unit	Type of analysis
P01	383808	7666568	Coastal terrace	Agrological in profile
P02	383908	7665880	Slope of Washout	Agrological in profile
P20	379468	7677498	Hills	Agrological in profile
P21	380072	7671905	Coastal terrace	Limiting surface reviews

Source: Own elaboration.

Figure 3-98. Sector works Superficiales Costa and Ppoints of Evaluation in Terreno.

Source: Own elaboration.

Characterization Morfologica

According to the descriptions of land, in the tabs below, the morphological characterization of the observation points shown associated with the UH identified in the study area. The main limitations are: high salinity, thick textures, excessive drainage, abundant Rocky concretions of carbonates of calcium and in some cases high.

Table 3-33. Point of observation P02, for the soils of the Region of Tarapacá

02 observation point	**Coordinates: Datum WGS 1984 spindle 19 384158 / 7665878**
E ° H of soil: dry	**Pendiente:Compleja > 8% (moderately wavy)**
General characteristics	Texture Sandy Francosa. Severe erosion (soil removed, with 80 to 100% bedrock exposed; Canaliculi, grooves, cracks; without gullies unit; with pedestals and pavement of 15 to 60% of surface erosion and vegetation cover). Effective depth less than 20 cm (very thin). Rocky surface of abundant to abundant (gravel > 85%; stone between 35% and 50%) and abundant gravel. Rocky subsurface very abundant (60% and more). Strongly calcareous with bubbles that form low foam. Without biological activity and decaying organic matter.
Depth estratas (cm)	**Features**
0-15	Horizon Francoso sandy, shallow by removal of the surface layer. Color 5YR 5/6, wet. Very thin and weak subangular blocks. Consistency soft dry and slightly wet adhesive non-adhesive in some sections and not plastic. Without vegetation, it is roots, with few observable fine pores.
> 15	Rock granite, massive, highly resistant stratum.

Source: Own elaboration.

Figure 3-99. Observation point 02

Observation point 02

Source: Field survey

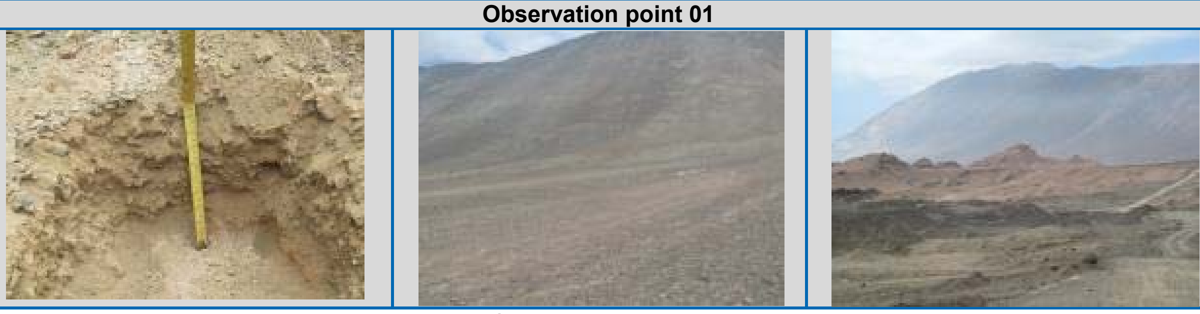
Table 3-34. Point of observation P01, for the soils of the Region of Tarapacá.

Observation point 01	Coordinates: Datum WGS 1984 spindle 19 383886/7666685
E ° H of soil: dry	**Pendiente:Compleja 3.5% (slightly wavy)**
General characteristics	Texture Francosa. Erosion of moderate to very severe (75% bedrock exposed; Canaliculi, grooves, cracks; without gullies in the unit; pavement erosion and without vegetation cover). Effective depth less than 27 cm (delgado). Rocky surface of light to hearty (40 to 85% gravel, stones between 5% and 15%) and abundant gravel. Strongly calcareous with bubbles that form low foam. Without biological activity and presence of organic matter.
Depth estratas (cm)	**Features**
0-25	Strategic Francosa. Color 7, 5YR 4/6, wet. Granular, weak, thin structure. Soft dry and wet consistency slightly adhesive and not plastic. Without vegetation, it is roots, with few observable fine pores.
> 27	Stratum of limestone, massive and resistant rock.

Source: Own elaboration.

Figure 3-100. Observation point 01

Observation point 01



Source: Field survey

Table 3-35. Observation point P21, for the soils of the Region of Tarapacá.

21 observation point	Coordinates: Datum WGS 1984 spindle 19 380072/7671905
E ° H of soil: dry	Descent: Simple 1.7% (slightly bent)
General characteristics	Sandy Francosa thick texture. Severe to very severe erosion (with a surface area > 80% of bedrock exposed to erosion, without vegetation pavement; mode without gullies on the unit). Effective depth of 7 cm (very thin). Very abundant superficial Rocky. Strongly calcareous with bubbles that form low foam. Without biological activity and presence of organic matter.

Depth estratas (cm)	**Features**
0 - 7	In the first 7 cm granite rock exposed, with one coverage of more than 80% of the surface is observed. Abundant in record and stones in weathering and presence of carbonates cementitious surface. Soil is loose in dry and non-adhesive and non plastic wet.
> 7	Massive granite rock

Source: Own elaboration.

Figure 3-101. Observation point 21

Observation point 21

Source: Field survey

Sector OBras Subterraneas coast

El underground works sector corresponds to homogeneous soil unit cliff and talus of Washout, described below, that occupy a surface projected from 72.7 has.

- **Cliff Drive:** It corresponds to geomorphologic unit, represented by the abrupt fall of the mountain range of the coast towards the sea, formed by rocks and thick textures with erosion by water and wind, leaving coastal sedimentary planes at its base.
- **Washout batter:** represented by the point of observation P02 correspond to a deposit aluvio-colluvial chaotic, very deep. Textured sandy soil and slope moderately wavy. Positioning range of the cliff unit.

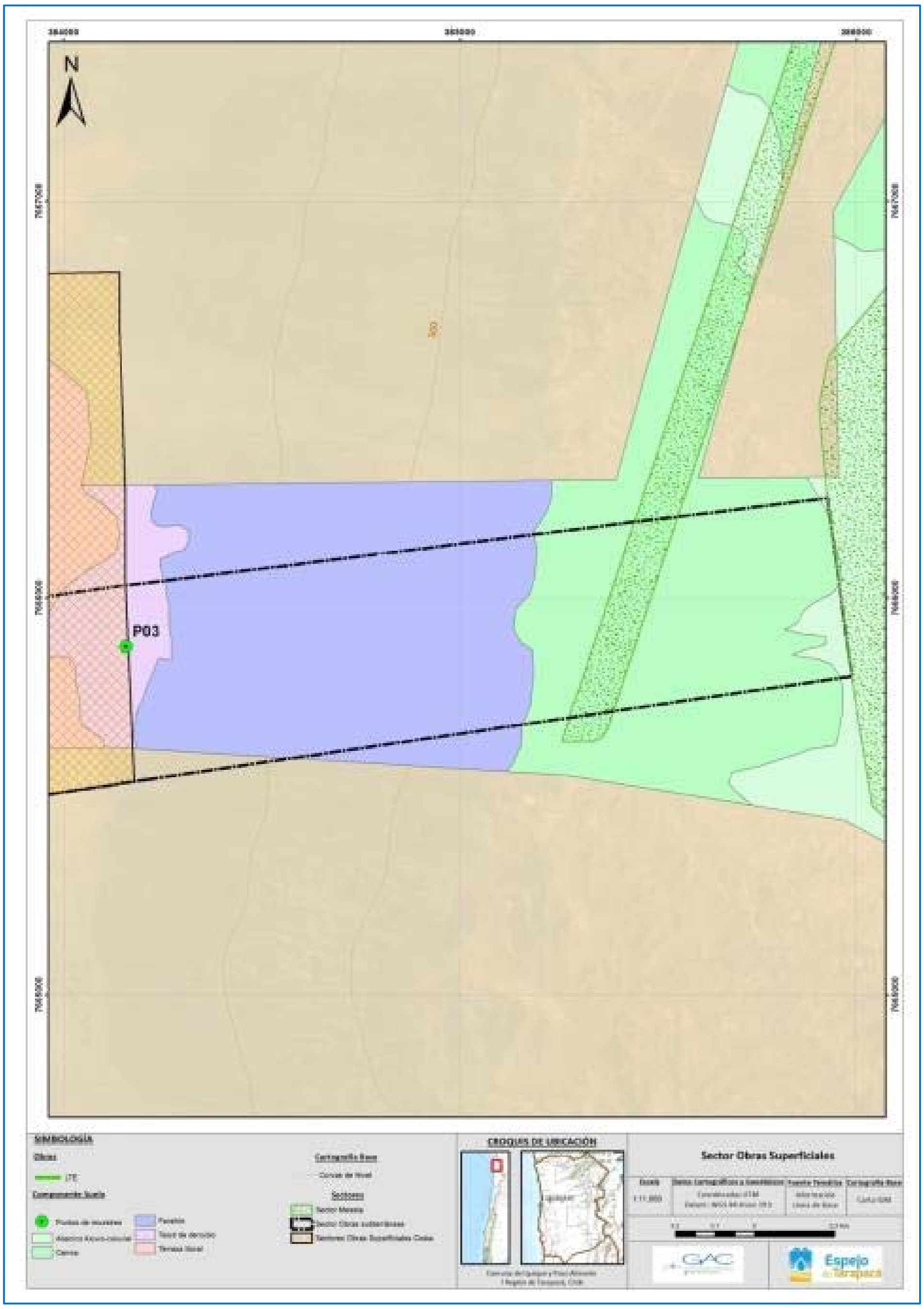
Presented units are graphed in the Figure 3-102 and geo-referenced of prospection on ground points in the Table 3-53.

Table 3-36. Individualization of the Ppoints of Prospeccion in Terreno.

ID observation points	This	North	Homogeneous soil unit	Type of analysis
P02	383908	7665880	Slope of Washout	Agrological in profile
P03	384158	7665878	Cliff	Agrological in profile

Source: Own elaboration.

Figure 3-102: Sector works Subterraneas COSTA and Ppoints of Evaluation in Terreno.



Source: Own elaboration.

Characterization Morfologica

According to the unidentifiedcontrol options of land, in the tabs below, the morphological characterization of the observation points shown associated with the UH identified in the study area. The main limitations are: high salinity, thick textures, excessive drainage, abundant Rocky concretions of carbonates of calcium and in some cases high.

Table 3-37. Point of observation P02, for the soils of the Region of Tarapacá.

02 observation point	**Coordinates: Datum WGS 1984 spindle 19 384158 / 7665878**
E ° H of soil: dry	**Pendiente:Compleja > 8% (moderately wavy)**
General characteristics	Texture Sandy Francosa. Severe erosion (soil removed, with 80 to 100% bedrock exposed; Canaliculi, grooves, cracks; without gullies unit; with pedestals and pavement of 15 to 60% of surface erosion and vegetation cover). Effective depth less than 20 cm (very thin). Rocky surface of abundant to abundant (gravel > 85%; stone between 35% and 50%) and abundant gravel. Rocky subsurface very abundant (60% and more). Strongly calcareous with bubbles that form low foam. Without biological activity and decaying organic matter.
Depth estratas (cm)	**Features**
0-15	Horizon Francoso sandy, shallow by removal of the surface layer. Color 5YR 5/6, wet. Very thin and weak subangular blocks. Consistency soft dry and slightly wet adhesive non-adhesive in some sections and not plastic. Without vegetation, it is roots, with few observable fine pores.
> 15	Rock granite, massive, highly resistant stratum.

Source: Own elaboration.

Figure 3-103: Observation point 02

Observation point 02		
		

Source: Field survey

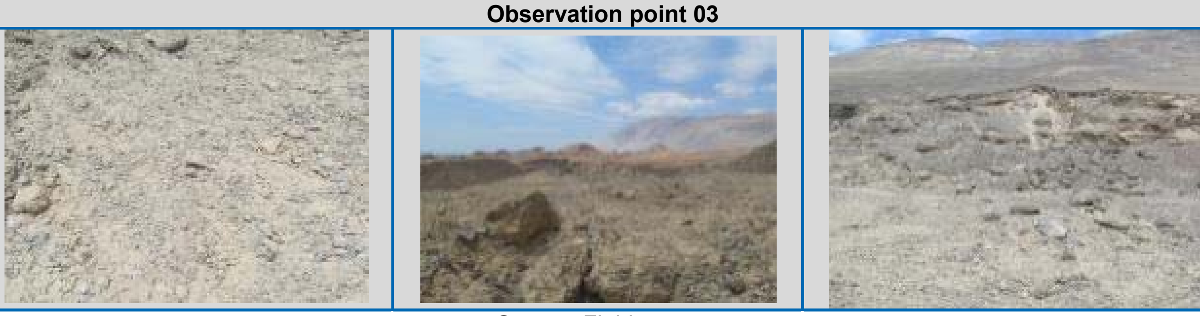
Table 3-38. Point of observation P03, for the soils of the Region of Tarapacá.

03 observation point	Coordinates: Datum WGS 1984 spindle 19 384158 / 7665878
E ° H of soil: dry	**Pendiente:Compleja 17.2% (strongly wavy)**
General characteristics	Sandy franc. Very severe erosion (sections removed soil, with 80% of bedrock exposed; Canaliculi, grooves, cracks; gullies form unit; with pavement for more than 60% of surface erosion and vegetation cover). Effective depth less than 20 cm (very thin). Rocky surface very abundant (gravel > 85%; stone > 50%) and abundant gravel. Moderately calcareous, with audible and visible excitement on contact with acid. Without biological activity and presence of organic matter. It corresponds to sedimentary soils, with high drag of stones, rocks and gravel incorporated from the cliff in the ground unit. Additionally identified one structure granular, weak and soft dry. Consistency in wet, slightly plastic and slightly adhesive

Source: Own elaboration.

Figure 3-104: Observation point 03

Observation point 03



Source: Field survey

Sector plateau

Ethe plateau, the studied surface sector n corresponds to 1062,9 Ha, which correspond to homogeneous soil units range Aluvio-Colluvial and hills, described below.

- **Unit Aluvio-colluvial fan:** The unit is represented by the P04, P05 and P07 P19 observation points. It corresponds to soils which presented variants of complex of slightly wavy slightly inclined simple earrings to greater than 30%, to fan location. With varying depths depending on the level of descent in that place.
- **Hills unit:** represented by the P6 observation points. It is a very thin soil, position of slope of Hill, and cone high colluvial, with simple earrings slope to complex in higher positions, being moderately wavy to strongly wavy. There are rocky outcrops in many variants and texture Sandy silt.

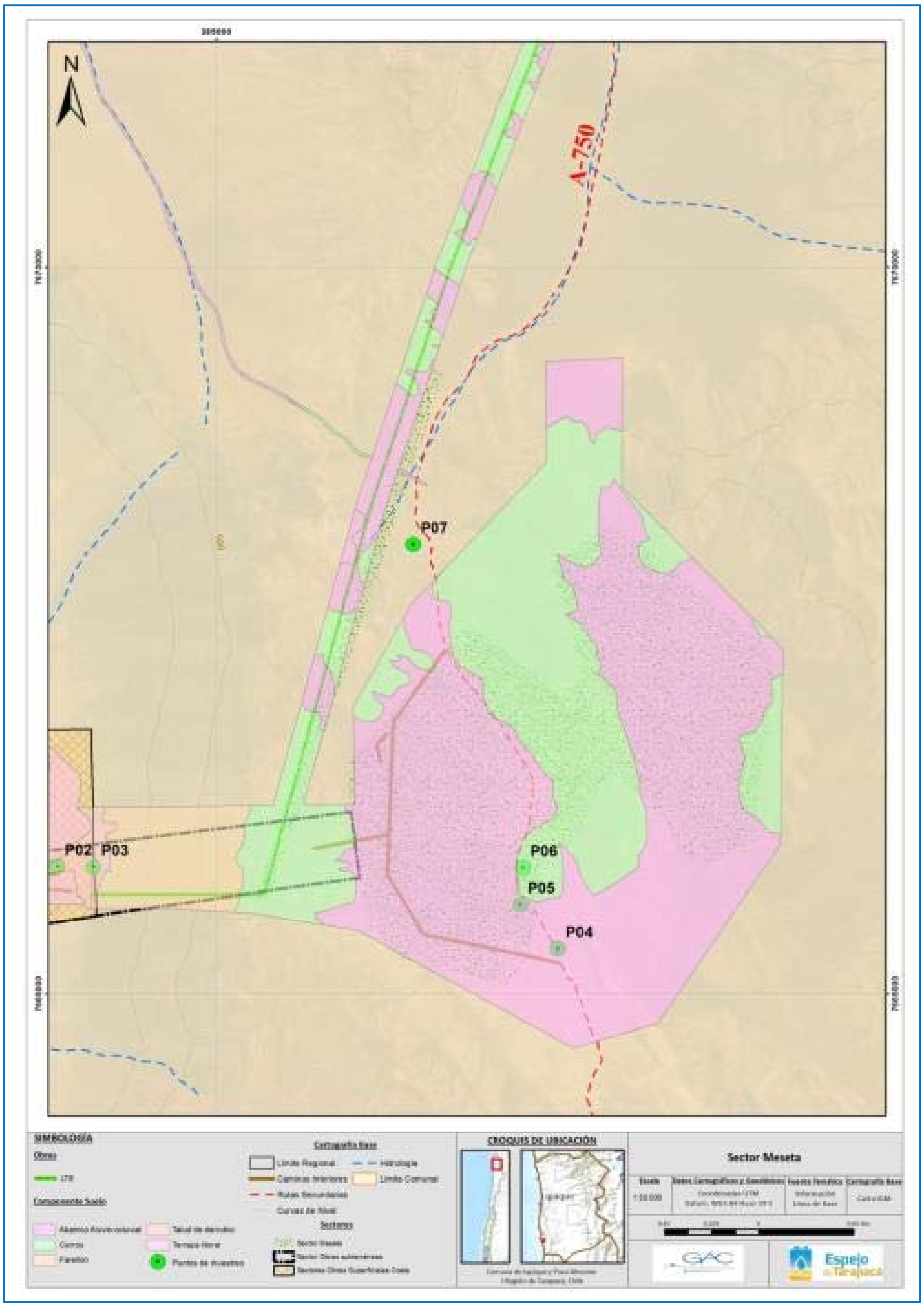
Presented units are graphed in the Figure 3-105 and geo-referenced of prospection on ground points in the Table 3-39.

Table 3-39. Individualization of the Ppoints of Prospeccion in Terreno.

ID observation points	This	North	Homogeneous soil unit	Type of analysis
P04	387354	7665312	Aluvio-colluvial fan	Agrological in profile
P05	387093	7665615	Aluvio-colluvial fan	Agrological in profile
P06	387110	7665873	Hills	Limiting surface reviews
P07	386357	7668094	Fan aluvio-colluvial and Hill	Agrological in profile
P19	383949	7671833	Aluvio-colluvial fan	Limiting surface reviews

Source: Own elaboration.

Figure 3-105. Sector plateau and Ppoints of Evaluation in Terreno.



Source: Own elaboration.

Characterization Morfologica

According to the descriptions of land, in the tabs below, the morphological characterization of the observation points shown associated with the UH identified in the study area. The main limitations are: high salinity, thick textures, excessive drainage, abundant Rocky concretions of carbonates of calcium and in some cases high.

Table 3-40. Point of observation P07, for the soils of the Region of Tarapacá.

07 observation point	**Coordinates: Datum WGS 1984 spindle 19 387110 7665873**
E ° H of soil: dry	**Descent: Complex 30 to 45% (rolling hills)**
General characteristics	Coarse sandy texture. Erosion with signs of severe to very severe (presence of canaliculi, grooves, crevices; without gullies in the unit; pedestals of erosion and vegetation cover). Effective depth less than 20 (very thin). Without rocky surface (< 10% gravel and < 5% of stones), but abundant gravel. Rocky subsurface abundant (35 to 60%).
Depth estratas (cm)	**Features**
0 - 10	Sandy, non-adhesive and non plastic floor. Strong granular structure. Slightly calcareous.
10 30	Strategic of stones (hornblende)
> 30	Sandy stratum. Strong, black colors, non-adhesive and plastic non granular structure.

Source: Own elaboration.

Figure 3-106. Observation point 07.

07 observation point

Source: Field survey

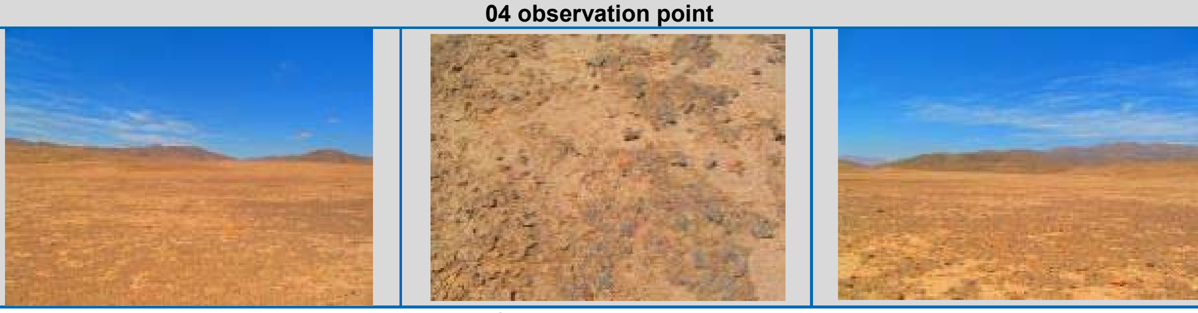
Table 3-41. Point of observation P04, for the soils of the Region of Tarapacá.

04 observation point	Coordinates: Datum WGS 1984 spindle 19 387353 7665312
E ° H of soil: dry	**Pendiente:Compleja 3 to < 5 (slightly wavy)**
General characteristics	Texture Sandy Francosa. Color 7.5 YR 4/6. Structure Granular strong, slightly plastic consistency and non adhesive; extremely hard dry. Signs of slight to very severe erosion (presence of some incipient pedestals, canaliculi, grooves, crevices; without gullies in the unit; and without vegetation cover). Effective depth of 20 to 40 cm (delgado). Without rocky surface (< 10% gravel and < 5% of stones). Rocky subsurface abundant (between 35 to 60%). Slightly calcareous.
Depth estratas (cm)	**Features**
0-10	Soil Sandy has. Color 7.5 YR 4/6. Structure of strong granules. Extremely hard dry; slightly plastic and adhesive not wet.

Source: Own elaboration.

Figure 3-107. Observation point 04.

04 observation point



Source: Field survey

Table 3-42. Puntor observation P05, for the soils of the Region of Tarapacá.

05 observation point	**Coordinates: Datum WGS 1984 spindle 19 387093 7665615**
E ° H of soil: dry	**Pendiente:Compleja 3 to < 5 (slightly wavy)**
General characteristics	Sandy franc. Signs of severe to very severe erosion (sheet erosion, with presence of canaliculi, grooves, crevices; without gullies in the unit; and without vegetation cover). Effective depth of 20 to 40 cm (delgado). Without rocky surface (< 10% gravel and < 5% of stones). First strategic not calcareous.
Depth estratas (cm)	**Features**
0 - 23	Estrata Franco clay Sandy. Reddish brown color 7, 5YR 4/6, wet. Structure of weak granules. Soft dry and wet consistency slightly adhesive and slightly plastic. Without vegetation, it is roots, with few observable fine pores.
> 23	Hard, soft, coating is not salt, it is not limestone, the acid reaction exhibits a greenish-yellow color

Source: Own elaboration.

Figure 3-108. Observation point 05.

05 observation point

Source: Field survey

Sector Pampa

Ethe Pampa, the studied surface sector n corresponds to 1179,6 Ha, which correspond to edaphic homogeneous units of flat Aluvio-colluvial, deposit Aluvio - Colluvial of background of broken, terrace, Salar of deposit evaporational and hills, described to continuation.

- **Flat unit Aluvio-Coluvial** represented by the observation points P13, P15, P16, P17, which corresponds to a very thin soil, originated in deposits aluvio-colluvial, in position of inclined plane with a slope of 1 to 8% (simple and complex slopes). They present a sequence of textures Sandy siltaccumulation of salts from the surface, forming a fragipan, soluble in water, extremely calcareous. Plithographic variable according to the sequence of stratification of materials.
- **Broken Aluvio-Coluvial:** Unit identified by P10 observation point. It corresponds to a unit made by entrainment of sediment by water. Leaving fragments of different sizes. In addition, it presents fragments angled, due feed colluvial attached terrace, by the low resistance of the material that composed it.
- **Unit range Aluvio-Coluvial:** The unit is represented by the P08 and P09 observation points. It corresponds to soils which presented variants of complex of slightly wavy slightly inclined simple earrings to greater than 30%, to fan location. With varying depths depending on the level of descent in that place.
- **Terrace drive TOluvial:** The unit is represented by the point of observation P10. With simple moderately inclined slope. Thin thin soil texture and depth.
- **Unit of Salt Lake:** The unit is represented by the P12 and P18 observation points. It corresponds to fine-grained sediments, predominantly the silts and clays. It has development of a rich in salts on the surface crust forming bone cementations of easily soluble salts.

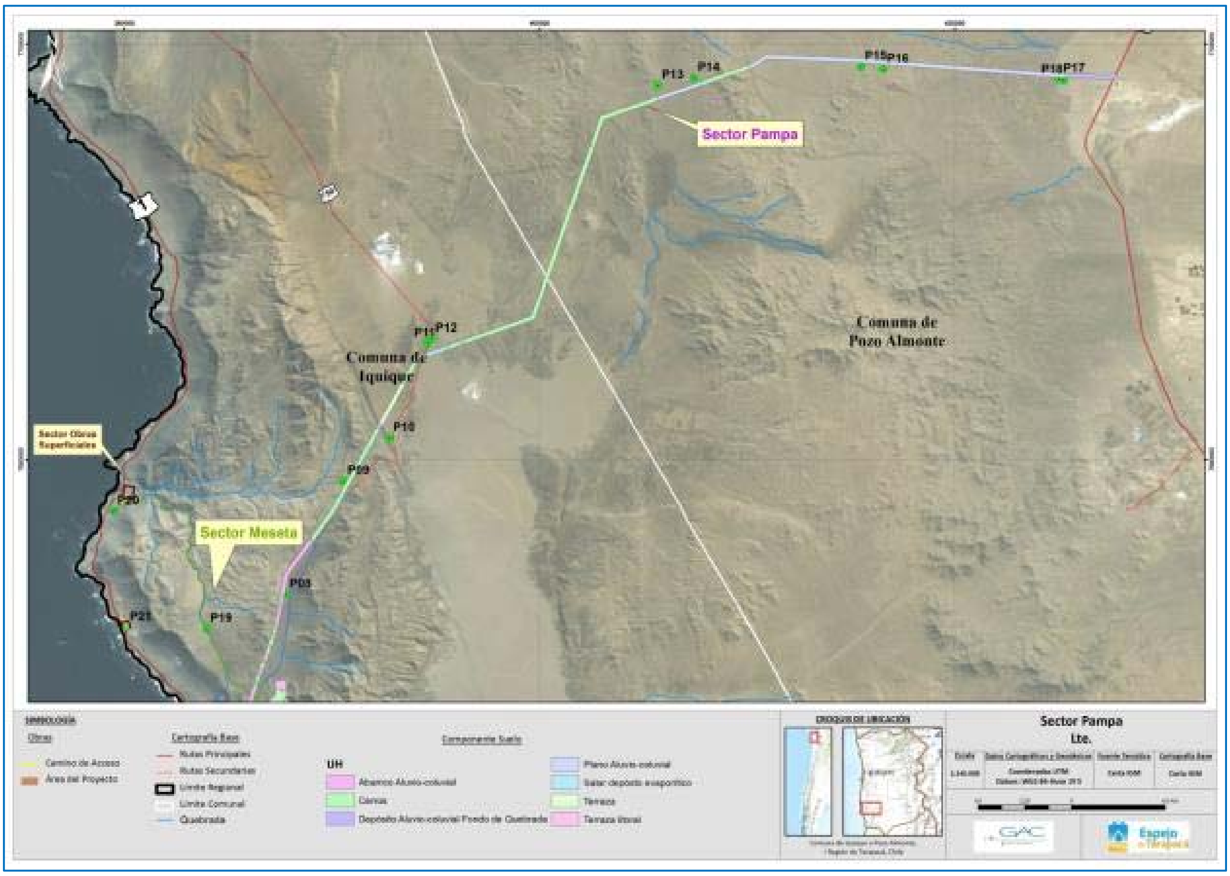
Presented units are graphed in the Figure 3-109 and geo-referenced of prospection on ground points in the Table 3-43.

Table 3-43. Individualization of the Ppoints of Prospeccion in Terreno.

ID observation	This	North	Homogeneous soil unit	Type of analysis
P08	387769	7673480	Fan aluvio-colluvial and Hill	Agrological in profile
P09	390560	7678946	Aluvio-colluvial fan	Limiting surface reviews
P10	392753	7681023	Alluvial terrace	Agrological in profile
P11	394606	7685587	Hills	Agrological in profile
P12	394791	7685815	Salar (deposit evaporational)	Agrological in profile
P13	405695	7698005	Flat aluvio-colluvial	Agrological in profile
P14	407434	7698371	Hills	Agrological in profile
P15	415485	7698927	Flat aluvio-colluvial	Limiting surface reviews
P16	416552	7698789	Flat aluvio-colluvial	Limiting surface reviews
P17	425029	7698327	Flat aluvio-colluvial	Agrological in profile
P18	425259	7698275	Salar (deposit evaporational)	Agrological in profile
P19	383949	7671833	Aluvio-colluvial fan	Limiting surface reviews
P20	379468	7677498	Hills	Limiting surface reviews
P21	380072	7671905	Coastal terrace	Agrological in profile

Source: Own elaboration.

Figure 3-109. Pampa sector and Ppoints of Evaluation in Terreno.



Source: Own elaboration.

Characterization Morfologica

According to the descriptions of land, in the tabs below, the morphological characterization of the observation points shown associated with the UH identified in the study area. The main limitations are: high salinity, thick textures, excessive drainage, abundant Rocky concretions of carbonates of calcium and in some cases high.

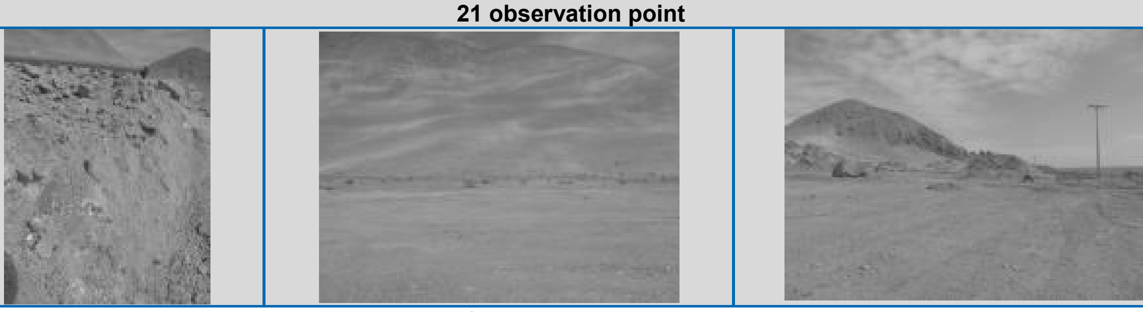
Table 3-44. Observation point P21, for the soils of the Region of Tarapacá

21 observation point	**Coordinates: Datum WGS 1984 spindle 19 380072/7671905**
E ° H of soil: dry	**Descent: Simple 1.7% (slightly bent)**
General characteristics	Sandy Francosa thick texture. Severe to very severe erosion (with a surface area > 80% of bedrock exposed to erosion, without vegetation pavement; mode without gullies on the unit). Effective depth of 7 cm (very thin). Very abundant superficial Rocky. Strongly calcareous with bubbles that form low foam. Without biological activity and presence of organic matter.
Depth estratas (cm)	**Features**
0 - 7	In the first 7 cm granite rock exposed, with one coverage of more than 80% of the surface is observed. Abundant in record and stones in weathering and presence of carbonates cementitious surface. Soil is loose in dry and non-adhesive and non plastic wet.
> 7	Massive granite rock

Source: Own elaboration.

Figure 3-110. Observation point 21

21 observation point



Source: Field survey

Table 3-45. Puntor observation P12 to the soils of the Region of Tarapacá

Observacion123 point	Coordinates: Datum WGS 1984 spindle 394791 19 / 7685814
E ° H of soil: dry	Descent: 3-5% (slightly wavy) complex
General characteristics	Soil of Great Salt Lake, where this soil is cast with very tough crusts and rock salt. Texture Sandy Francosa. Presence of gravel surface, cracks and without vegetation cover. Slightly calcareous, with slight effervescence. Without biological activity and organic matter. Identified soil sections, have reddish brown color 5YR 3/4, slightly plastic and non adhesive. Extraction allowed to obtain extremely hard, subangular blocks dry.

Source: Own elaboration.

Figure 3-111. Observation point 12.

12 observation point

Source: Field survey

Table 3-46. Observation point P11, for the soils of the Region of Tarapacá.

11 observation point	Coordinates: Datum WGS 1984 spindle 19 394606 / 7685587
E ° H of soil: dry	Pendiente:Compleja 8% to < 30% (moderately wavy to strongly wavy)
General characteristics	Sandy Francosa fine texture. Signs of moderate to very severe erosion (sheet erosion, with presence of canaliculi, grooves, crevices; without gullies in the unit; and without vegetation cover). Effective depth less than 20 cm (very thin). With moderate surface Rocky without Rocky, presence of stones between 15 even 35%, gravel in less than 10% of the surface and abundant gravel. Not calcareous, without biological activity and organic matter.
Depth estratas (cm)	**Features**
0 - 5	Strategic Sandy Francosa fine. Reddish brown color 7, 5YR 5/3, wet. Thin and weak subangular block structure. Consistency soft dry and wet non adhesive and not plastic. Without vegetation, it is roots, with few observable fine pores.
> 5	A layer of lime.

Source: Own elaboration.

Figure 3-112. Observation point 11.

11 observation point

Source: Field survey

Table 3-47. Observation point P10, for the soils of the Region of Tarapacá.

10 observation point	**Coordinates: Datum WGS 1984 spindle 19 392753 7681023**
E ° H of soil: dry	**Descent: Simple 8% to < 15% (moderately inclined)**
General characteristics	Fine Francosa texture. Signs of moderate to very severe erosion (sheet erosion, with presence of canaliculi, grooves, crevices; without gullies in the unit; and without vegetation cover). Effective depth less than 20 cm (very thin). With rocky surface stones and gravel.
Depth estratas (cm)	**Features**
0 - 5	Estrata fine Francosa. Reddish brown color 7, 5YR 5/3, wet. Weak subangular and angular block structure. Soft dry and wet consistency slightly adhesive and slightly plastic. Without vegetation, it is roots, with few observable fine pores.
> 5	Salt layer

Source: Own elaboration.

Figure 3-113. Observation point 10.

10 observation point

Source: Field survey

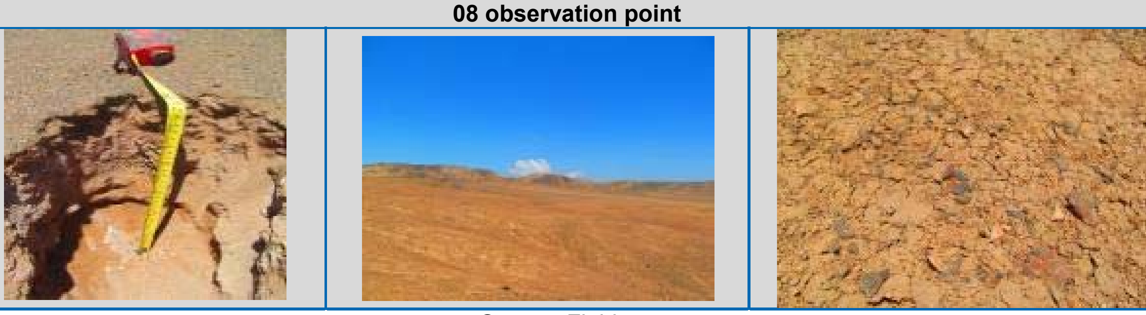
Table 3-48. Observation point P08, for the soils of the Region of Tarapacá.

08 observation point	Coordinates: Datum WGS 1984 spindle 19 387769 7673480
E ° H of soil: dry	**Descent: Simple**
General characteristics	Sandy franc. Signs of moderate to very severe erosion (sheet erosion, with presence of canaliculi, grooves, crevices; without gullies in the unit; and without vegetation cover). Effective depth of 20 to 40 cm (delgado). Without rocky surface (< 10% gravel and < 5% of stones). First strategic not calcareous.
Depth estratas (cm)	**Features**
0 - 8	Estrata Sandy Franco. Reddish brown color 7, 4/4-5YR wet. Weak angular block structure. Soft dry and wet consistency slightly adhesive and slightly plastic. Without vegetation, it is roots, with few observable fine pores.
8 15	Thin layer of soil mixed with lime, sandy loam texture. Weak angular block structure. Soft dry and wet consistency slightly adhesive and slightly plastic. Without vegetation, it is roots, with few observable fine pores.
15 29	Strategic Franco clay. Color 7, 5YR 4/4. Structure of weak, soft pellets in dry and in wet plastic and adhesive.
> 29	Hardened layer of salt

Source: Own elaboration.

Figure 3-114. Observation point 08.

08 observation point



Source: Field survey

Table 3-49. Observation point P18, for the soils of the Region of Tarapacá.

18 observation point	Coordinates: Datum WGS 1984 spindle 19 425956 7698458
E ° H of soil: dry	**Descent: simple**
General characteristics	Texture clay Sandy. Signs of slight to very severe erosion (presence of canaliculi, grooves, crevices; without gullies in the unit; pedestals of erosion and vegetation cover). Effective depth less than 20 (very thin). Without rocky surface (< 10% gravel and < 5% of stones), but concretions of salt. The subsurface layer is extremely hard. Extremely calcareous.
Depth estratas (cm)	**Features**
0 - 10	Soil clay Sandy. Extremely hard dry, adhesive and plastic wet. Strong and weak subangular block structure.
> 10	Concretions of salt

Source: Own elaboration.

Figure 3-115. Observation point 18.

18 observation point

Source: Field survey

Table 3-50. Point of observation P17, for the soils of the Region of Tarapacá.

17 observation point	**Coordinates: Datum WGS 1984 spindle 19 424642 7698524**
E ° H of soil: dry	**Pending: Complex 3 a < 5% (slightly wavy).**
General characteristics	Texture fine sandy soil. Signs of moderate to very severe erosion (sheet erosion, with presence of canaliculi, grooves, crevices; without gullies in the unit; presence of stairs, pedestals and erosion pavement; and without vegetation cover). Effective depth 17 cm (very thin). Without rocky surface (< 10% gravel and < 5% of stones). Without Rocky subsurface, but with concretions of salt. Extremely calcareous.
Depth estratas (cm)	**Features**
0 - 17	Strategic sandy soil. Reddish brown color 7, 4/4-5YR wet. Laminar cemented structure. Soft dry; non-adhesive and non plastic wet. With a first layer of soil laminar soft, followed by a strategic boundaries broken, where there were structures, with granular strong, loose soil and blocks strong extremely hard to loose. Soft non-adhesive and not plastic.

Source: Own elaboration.

Figure 3-116. Observation point 17.

17 observation point

Source: Field survey

Table 3-51. Point of observation P14, for the soils of the Region of Tarapacá.

14 observation point	Coordinates: Datum WGS 1984 spindle 19 407434/7698371
E ° H of soil: dry	**Descent: Simple slope**
General characteristics	Texture Sandy Francosa. Colour 5YR 3/4. The presence of weak subangular blocks, not plastic and non-adhesive. Signs of moderate to very severe erosion (sheet erosion, with presence of canaliculi, grooves, crevices; without gullies in the unit; and without vegetation cover). Effective depth less than 20 cm (very thin). With rocky surface of light to moderate (10-20% gravel and 15-35% of stones). Close to the surface of hard salt crust.
Depth estratas (cm)	**Features**
0-15	Color 5 YR 3/4 flooring. Weak subangular block structure. Consistency not plastic and adhesive not wet.

Source: Own elaboration.

Figure 3-117. Observation point 14.

14 observation point

Source: Field survey

Table 3-52. Point of observation P13, for the soils of the Region of Tarapacá.

12 observation point	**Coordinates: Datum WGS 1984 spindle 387769 19/7673480/terrain, calculating coordinates**
E ° H of soil: dry	**Slope: 1 a complex < 3% (almost flat)**
General characteristics	Sandy franc. With some signs of moderate to very severe erosion (with presence of some canaliculi, grooves, crevices; without gullies in the unit; and without vegetation cover). Effective depth less than 20 cm (very thin). Without rocky surface (< 10% gravel and < 5% of stones). Moderately calcareous.
Depth estratas (cm)	**Features**
> 20	Estrata Sandy Franco. Reddish brown color in 5YR 6/2, wet. Angular and subangular block structure. Consistence in wet slightly adhesive and plastic. Without vegetation, it is roots, with few observable fine pores.

Source: Own elaboration.

Figure 3-118. Observation point 13.

Observation point 13

Source: Survey on land.

Summary soil homogeneous units

In the Table 3-53 surfaces associated to each soil homogeneous unit identified in the study area, according to geomorphological unit and ability to kind of use for each of them are.

Table 3-53. Surfaces of homogeneous units Identificadas for the TOrea of EStudio.

<table>
<tr><th>Macro sectors of Division</th><th>Geomorphological unit</th><th>Homogeneous soil unit</th><th>CCUS</th></tr>
<tr><td rowspan="4">Sector plateau</td><td rowspan="2">Costa</td><td>Hills</td><td rowspan="4">VIII</td></tr>
<tr><td>Aluvio-colluvial fan</td></tr>
<tr><td rowspan="2">Coastal mountain range</td><td>Hills</td></tr>
<tr><td>Aluvio-colluvial fan</td></tr>
<tr><td rowspan="2">Sector underground works</td><td rowspan="2">Costa</td><td>Cliff</td><td rowspan="2">VIII</td></tr>
<tr><td>Slope of Washout</td></tr>
<tr><td rowspan="3">Sector works surface costa</td><td rowspan="3">Costa</td><td>Coastal terrace</td><td rowspan="3">VIII</td></tr>
<tr><td>Slope of Washout</td></tr>
<tr><td>Hills</td></tr>
<tr><td rowspan="9">Sector Pampa</td><td rowspan="2">The intermediate depression</td><td>Aluvio-colluvial plane</td><td rowspan="2">VIII</td></tr>
<tr><td>Aluvio-colluvial Quebrada Fund deposit</td></tr>
<tr><td rowspan="6">Coastal mountain range</td><td>Aluvio-colluvial fan</td><td rowspan="7">VIII</td></tr>
<tr><td>Terrace</td></tr>
<tr><td>Aluvio-colluvial plane</td></tr>
<tr><td>Salar deposit evaporational</td></tr>
<tr><td>Aluvio-colluvial Quebrada Fund deposit</td></tr>
<tr><td>Hills</td></tr>
<tr><td>Costa</td><td>Hills</td></tr>
</table>

3.2.5.4 Conclusions

In general terms, the identified soil They presented a development of NULL to scarce, with a predominance of thick materials, textures and sand without the presence of roots, high erosion, many with presence of desert pavement; thin in depth; with presence of layers of sediments, high in gravel and stones and excessive drainage. These features coupled with the difference in slopes and location, would reflect variations in features physico-chemical and geomorphological identified both bibliographic study and photointerpretation, and final validation field.

A classification is determined according to the previous features, Capacity of use VIII, for all units identifiedby corresponding to non-productive soils from the point of view of arable, but at the environmental level, in some cases compliant functions as a physical support to some living organisms if they are preserved.

3.2.5.5 References

- Luzio, w. (editor), 2010. Soils of Chile. Department of engineering and soil. Faculty of agronomic Sciences. University of Chile. 364 p.
- Ferreira, r. 2004. Environmental planning, theory and practice. São Paulo, Office of texts. 184 p.
- Agricultural and livestock service. 2011 guidelines for soil studies. 26 p.

3.2.6 Flora and vegetation

3.2.6.1 Introduction

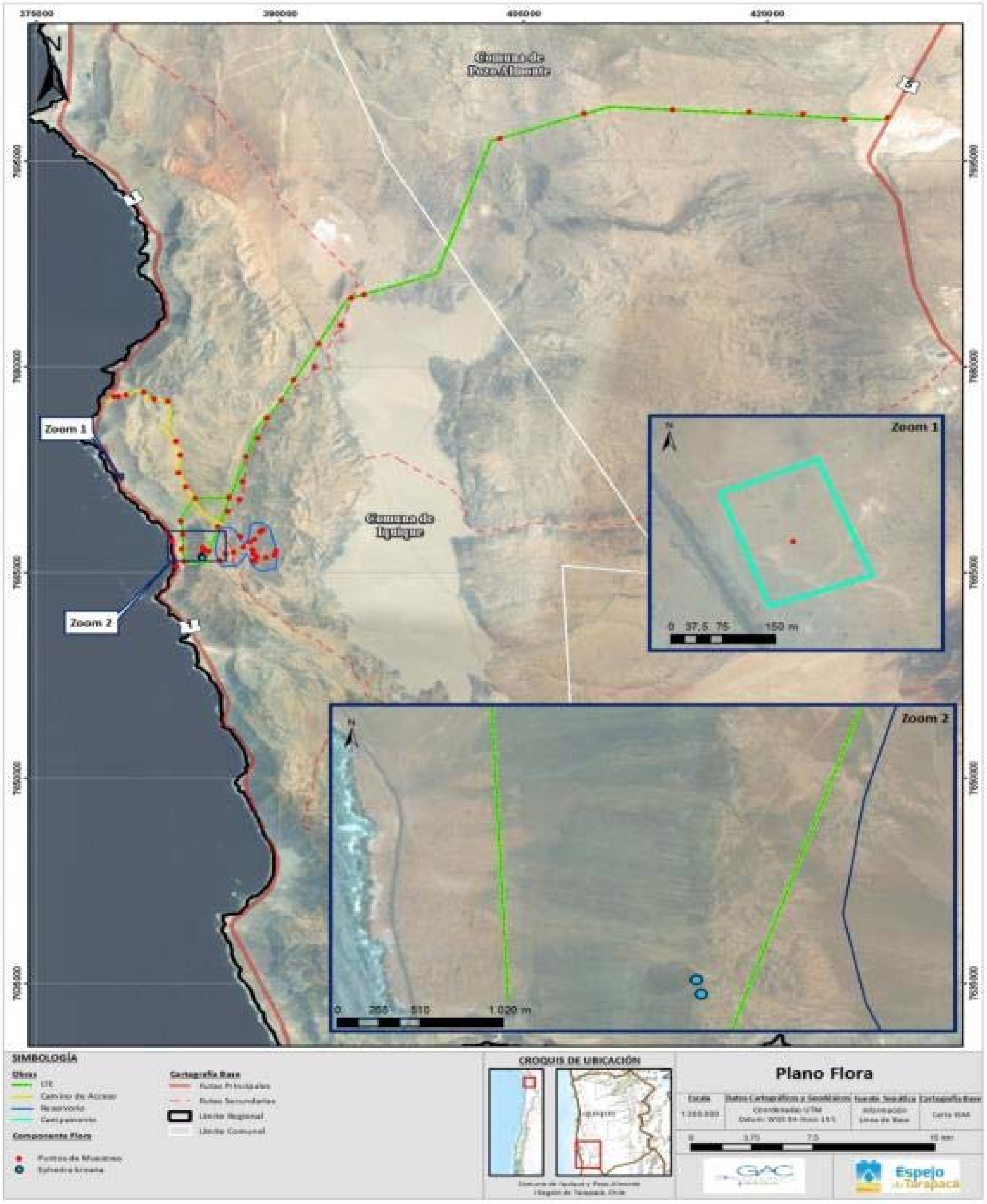
This topic provides the characterization of Baseline of the component of vegetation and flora that includes the construction of the Project ""Espejo de Tarapacá", based on two campaigns of land made between 19 and 23 August of 2013, and from 27 to 29 November 2013, in the Tarapacá region, 90 km to the South of the city of Iquique, in order to determine the current status of the flora and vegetation in the surroundings of the Project.

The general objective of this report consiste in the characterization of biotic systems, vegetation and flora, It develops at present in the study area.

As specific objectives arises establish and characterize the frame region in which is inserted the vegetation present in the study area, define and characterise the vegetation formations that are developed today, in addition to identify, delimit and characterize sites of vegetation Singularity within the area ofl ProjectIf they exist.

In relation to the flora, the objectives that arise are to identify the flora of the area of study and characterize the species who have problems dand conservation at the national level, as likewise those of ecological or scientific importance to stakeholders in the area of study associated to the Project.

Figure 3-119: Location TOrea of EStudio



Source: Own elaboration

3.2.6.2 Background Area of bibliographic

i. Regions, sub-regions and vegetation

According to the classification of Gajardo[9], the area of the Project inserted within the Region of the desert, and corresponds to a region that stretches from the northern end of the country to the Elqui River in Region IV.

While this desert Region is Pacific Western boundary, it is mostly the inner desert, with an average height of 1,500 m asl., covering the steep coastal cliffs, the mountain ranges of the Cordillera de la Costa, the great depressions Interior and the western slopes of the Cordillera de los Andes.

However, the characteristics of the relief generated local variations of the atmosphere, producing more or less distinguishable habitats that allow you to segregate the desert Region in four subregions plant. Of them, the Project overlaps in two subregions, which are detailed below:

a) Sub-region of the Absolute desert

Corresponds to the area of desert where rainfall is negligible and the water supply is located and comes from the presence of phreatic or occasional floods that descend from the tour. Except in very local conditions, plant life is absent in its entirety, its definition of absolute desert what is worth to him.

However, six vegetable formations, are recognized for this subregion where are two of them present in the study area:

b) Desert Interior

This formation, wide distribution, extends between the I and II region, lacks almost completely of life plant, except in very local conditions and in the presence of groundwater, where an Association of Brea-Grama manifests saltwater)*Tessaria absinthioides-Distichlis spicata*), particularly on sites with influence of high salinity waters.

This Association of Brea-grass saltwater is not exclusive training is widely distributed and appears practically in all formations of the desert region, always linked to sectors con the influence of brackish water.

From the point of view of vegetation this formation has been little studied, found few references.

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[9] Gajardo, R. 1993. La Vegetación Natural de Chile. Clasificación y Distribución Geográfica. Editorial Universitaria. 165 p.

c) Desert of the Salares and the Pampas

Its location corresponds to the presence of the great depressions of the wilderness, manifesting as a saline endorheic basins or stony. Has almost absolutely no plant life, found only in those places with water availability, which otherwise have been toLTERados by the influence of man. The only recognized vegetation are ruderal communities of *Tessaria absinthioides-Distichlis spicata*.

d) Sub-region of the coastal desert

This training extends lengthwise from the coast between the Region Antofagasta and North of the Coquimbo regioncovering the western slopes of the Cordillera de la Costa, from the level of the sea up to approximately 1,500 masl. Lplant life presents an outstanding development and, above all, a rich flora and large number of endemic species, due to the favourable action generated by the presence of frequent coastal fogs.

Three vegetable formations, are recognized for the subregion Just one of them It is present in the study area.

e) Coastal desert of Tocopilla

In response to the most extreme conditions in the area of the coastal desert, there is vegetation only in very localized environments, although it is necessary to take into account that there are many references of botanical studies. The community is present in *Eulychnia iquiquensis-Frankenia chilensis.*

Given the external conditions of the average overall, this training presents vegetation only in very localized environments.

ii. Apartments Vegetacionales

According to Luebert and Pliscoff (2006), the area of the Project would be located coinciding with four vegetation floors:

a) Coastal tropical desert scrub of *Nolana adansonii and Nolana lycioides*

Is distributed in the low coastal zone of the North of the region of Antofagasta and Tarapacá South, between 0 - 400 m corresponds to a very open scrubland which dominate locally *Nolana adansonii* and *Nolana lycioides*leaving large tracts of land discovered, even during rainy periods. There are very few published background, since studies have focused on floor altitudinal upper, in the area of mists, either do not refer clearly to the ecological position of species, so that the floristic composition is difficult to define (which arises is completely speculative) and plant communities have not been defined. These species are found as*: Nolana stenophylla*, *Malesherbia tocopillana*, *Nolana adansonii*, *Nolana clivicola*, *Nolana linearifolia*, *Nolana lycioides*, *Nolana peruviana* and *Solanum chilense.*

b) Indoor tropical desert with little vegetation

It is located in the desert pampa in the interior of the regions of Tarapaca and Antofagasta, between 200 and 2000 m of altitude. Corresponds to a zone that lacks almost completely of life plant, except in some sectors with the presence of brackish groundwater napa showing a halophytic dominated by *Tessaria absinthioides*. It is possible that there are more plant communities, but Botanical knowledge on these areas is little developed in Chile, so it is not available info on the floristic composition.

c) Coastal tropical desert with little vegetation

It is located in the coastal zone of the North of the region of Tarapaca between 0-900 meters, and correspond to land virtually devoid of vascular plants, where it is only possible to observe some enclaves of coastal vegetation in high mountain areas near the coast, where there is incidence of mists, where the characteristic species are *Tillandsia landbeckii* and *Tillandsia marconae* in sites located more to the North. There are very few data on the floristic composition and vegetation communities have not been defined. These species are found as*: Cryptantha filiformis, Heliotropium krauseanum, Nasa urens, Oxalis bulbocastanum, Tillandsia landbeckii and Tillandsia marconae.*

d) Tropical desert scrub inside of Atriplex atacamensis and Tessaria absinthioides

Is located in large pits salinas from the regions of Tarapaca and Antofagasta, corresponds a high scrub, dominated by the Bush's *Atriplex atacamensis* and *Tessaria absinthioides* and the grass *Distichlis spicata*. Their presence, associated to salars, is determined by the existence of a phreatic layer that provides enough humidity to make up the shortfall caused by the shortage of rainfall, it has been considered as a unit independent. Occasionally it is possible to observe the presence of thorny trees *Prosopis alba* and *Geoffroea decorticans*. It is possible to identify the following communities *Atriplex atacamensis*- *Tessaria absinthioides*, *Prosopis chilensis*-*Geoffroea decorticans* and *Tessaria absinthioides*-*Distichlis spicata.*

e) Coastal tropical desert scrub of *Breana and Eulychnia ephedra iquiquensis*

It is located in the hills North of Antofagasta, between 400 and coastal South of the region of Tarapacá and 1200 meters of altitude, corresponds to an open shrub extremely xeromorfico with succulent columnar, dominated by *Ephedra breana*, *Solanum chilense* and *Eulychnia iquiquensis*, with participation of shrubs *Frankenia chilensis*, *Nolana sedifolia*, *Lycium leiostemum* and herbaceous *Alstroemeria lutea*, *Camassia biflora*, *Oxalis bulbocastanum* and *Leucocoryne appendiculata*. The some sectors is also possible to see pure populations of

*Tillandsia landbeckii*in some cases covering large areas. Much of the territory of this floor vegetation does not present vegetation cover, which only develops in relief conditions favoring the condensation of the mists.

Table 3-54: Potential communities of the TORea (Luebert and Pliscoff, 2006).

Training	Floor vegetation	Communities	Floristic composition
Absolute desert	Indoor tropical desert with little vegetation	*Tessaria absinthioides-Distichlis spicata*	*Tessaria absinthioides*
			Distichlis spicata
	Coastal tropical desert with little vegetation		*Cryptantha filiformis*
			Heliotropium krauseanum
			NASA urens
			Oxalis bulbocastanum
			Tillandsia landbeckii
			Tillandsia marconae
Desert scrub	Coastal tropical desert scrub of *Nolana adansonii* and *Nolana lycioides*		*Nolana stenophylla*
			Malesherbia tocopillana
			Nolana adansonii
			Nolana clivicola
			Nolana linearifolia
			Nolana lycioides
			Nolana peruviana
			Solanum chilense
	Tropical desert scrub inside of *Atriplex atacamensis* and *Tessaria absinthioides*	*Atriplex atacamensis-Tessaria absinthioides*	*Atriplex atacamensis*
		Prosopis chilensis-Geoffroea decorticans	*Atriplex madariagae*
		Tessaria absinthioides-Distichlis spicata	*Baccharis juncea*
			Baccharis scandens
			Caesalpinia aphylla
			Distichlis scoparia
			Distichlis spicata

Training	Floor vegetation	Communities	Floristic composition
			Geoffroea decorticans
			Heliotropium curassavicum
			Lycium humile
			Prosopis alba
			Sarcocornia fruticosa
			Tessaria absinthioides
	Coastal tropical desert scrub of *Ephedra breana* and *Eulychnia iquiquensis*	*Eulychnia iquiquensi-Frankenia chilensis*	*Nolana balsamiflua*
		Tessaria absinthioides-Distichlis spicata	*Alstroemeria lutea*
			Alstroemeria violacea
			Argylia radiata
			Atriplex taltalensis
			Camassia biflora
			Cleome chilensis
			Ephedra breana
			Eulychnia aricensis
			Eulychnia iquiquensis
			Frankenia chilensis
			Heliotropium jaffuelii
			Leucocoryne appendiculata
			Lycium leiostemum
			Malesherbia tocopillana
			Nolana intonsa
			Nolana jaffuelii
			Nolana sedifolia
			Oxalis bulbocastanum
			Oxalis ornithopus
			Piqueria floribunda

Training	Floor vegetation	Communities	Floristic composition
			Solanum chilense
			Solanum brachyantherum
			Tillandsia landbeckii

Source: Luebert and Pliscoff (2006)

iii. Floristic composition

The two above mentioned ratings (Gajardo, 1992;) Luebert and Pliscoff, 2006) outlined some vegetal associations more or less (mostly coincidental) characteristics, with compositions floristic relatively well defined and, from a phytogeographic point of view, giving account of the communities potential of the area, and they are listed in the Table 3-55.

The list presentsonly can be considered of reference form since existing classifications are built in comparatively small scales of analysis so inevitably local manifestations of the vegetation, resulting in only the representative species are listed or appearing with some frequency are absorbed.

Table 3-55: Flora Potencial of the TORea SEGUN Formaciones and PISOs Vegetacionales.

Species	Plant training			Floor vegetation				
	Desert interior	Desert of the Salares and the Pampas	Coastal desert of Tocopilla	Indoor tropical desert with little vegetation	Coastal tropical desert with little vegetation	Coastal tropical desert scrub of *Nolana adansonii* and *Nolana lycioides*	Tropical desert scrub inside of *Atriplex atacamensis* and *Tessaria absinthioides*	Coastal tropical desert scrub of *Ephedra breana* and *Eulychnia iquiquensis*
Alstroemeria lutea								x
Alstroemeria violacea								x
Argylia radiata								x
Atriplex atacamensis							x	
Atriplex madariagae							x	
Atriplex taltalensis								x
Baccharis juncea							x	
Baccharis scandens							x	
Caesalpinia aphylla							x	
Calandrinia grandiflora			x					
Camassia biflora								x
Cassia brogniartii			x					
Cleome chilensis			x					x
Cryptantha filiformis					x			

Species	Plant training			Floor vegetation				
	Desert interior	Desert of the Salares and the Pampas	Coastal desert of Tocopilla	Indoor tropical desert with little vegetation	Coastal tropical desert with little vegetation	Coastal tropical desert scrub of *Nolana adansonii* and *Nolana lycioides*	Tropical desert scrub inside of *Atriplex atacamensis* and *Tessaria absinthioides*	Coastal tropical desert scrub of *Ephedra breana* and *Eulychnia iquiquensis*
Dinemandra ericoides			x					
Distichlis scoparia							x	
Distichlis spicata	x	x	x	x				
Ephedra breana								x
Eulychnia aricensis								x
Eulychnia iquiquensis			x					x
Frankenia chilensis			x					x
Geoffroea decorticans							x	
Heliotropium curassavicum							x	
Heliotropium jaffuelii								x
Heliotropium krauseanum					x			
Leucocoryne appendiculata								x
Lycium chanar			x					
Lycium humile							x	
Lycium leiostemum								x
Malesherbia humilis			x					
Malesherbia tocopillana						x		x
NASA urens					x			
Nolana adansonii						x		
Nolana balsamiflua								x
Nolana clivicola						x		
Nolana linearifolia						x		
Nolana intonsa								x
Nolana jajfuelii								x
Nolana lycioides						x		
Nolana peruviana						x		
Nolana sedifolia			x					x
Nolana stenophylla						x		
Oxalis bulbocastanum			x		x			x
Oxalis ornithopus								x
Piqueria floribunda								x

Species	Plant training			Floor vegetation				
	Desert interior	Desert of the Salares and the Pampas	Coastal desert of Tocopilla	Indoor tropical desert with little vegetation	Coastal tropical desert with little vegetation	Coastal tropical desert scrub of *Nolana adansonii* and *Nolana lycioides*	Tropical desert scrub inside of *Atriplex atacamensis* and *Tessaria absinthioides*	Coastal tropical desert scrub of *Ephedra breana* and *Eulychnia iquiquensis*
Prosopis alba							x	
Prosopis chilensis							x	
Sarcocornia fruticosa							x	
Sicyos bryonaefolius			x					
Solanum brachyantherum								x
Solanum chilense						x		x
Tessaria absinthioides	x	x	x	x			x	
Tillandsia landbeckii					x			x
Tillandsia marconae					x			

Source: Gajardo (1992) and Luebert and Pliscoff (2006)

iv. Oasis of Niebla

Under the influence of the camanchaca (coastal fog), develops a type of low vegetation which has been described in various ways according to different authors such as: formation of hills, fertile Strip, grassland in the desert and oasis of fog (Muñoz *et to the*2001), which correspond to important high-biodiversity local, endangered species and fragile ecosystems, which depend on mostly mist, the annual rainfall is extremely low (Cereceda *et to the*., 2008), so that climate change can be a major problem for these ecosystems.

These communities represent Islands separated by a hiperarido habitat devoid of vegetation. The degree of development and occurrence of species in them, depends on the behavior of the regime of rainfall and the increase in thickness of the layer of fog (300 to 1000 meters of altitude) phenomenon associated with El Niño (Pinto, 2010) events.

The camanchaca is formed kilometers from the coast of the Pacific Ocean, which moves towards the continent at altitudes between 500 and 1000 meters, as a compact mass of droplets of water and air (Cereceda et al., 2002). The impact in the first Region on a cliff near the coast at the same altitudes is forming fog advection (masses of warm air passing over cold soils, which cools the relative humidity and condensation causes), which displaces h ACIA inside climbing on the cliff, allowing the existence of vegetation.

In the first Region nine Oasis of fog are present: high Junin, Caleta Buena, Huantajaya, Huantaca and Punta Gruesa, Alto Patache, Altos high of Punta de Lobos, Pabellón de Pica and Altos de Chipana (CONAMA, 2008).

In general, all sectors with Oasis they agree on the shape of the coast, which they are in points with spacious bays in its southern part, with a mountain important in the South with summits of about 950 meters. This Mountain is the reason that makes the air mass moves the Interior due to the prevailing wind from the South and to condense water vapor forming the fog (Cereceda et al, 2002). Due to the absence of this geographical condition, it is considered that the areas where the Project they are not part of an Oasis of fog.

Figure 3-120: Oasis of fog

Source: Own elaboration

There is a type of vegetation that is characteristic of the areas of fog, both in Chile and Peru, this species corresponds to the Tillandsia known as clavel del aire, and that in the Tarapacá Region corresponds to *Tillandsia landbecki* mainly, *Tillandsia marconae and Tillandsia virescens*, the family of the Bromeliaceae (Cereceda et al, 1999).

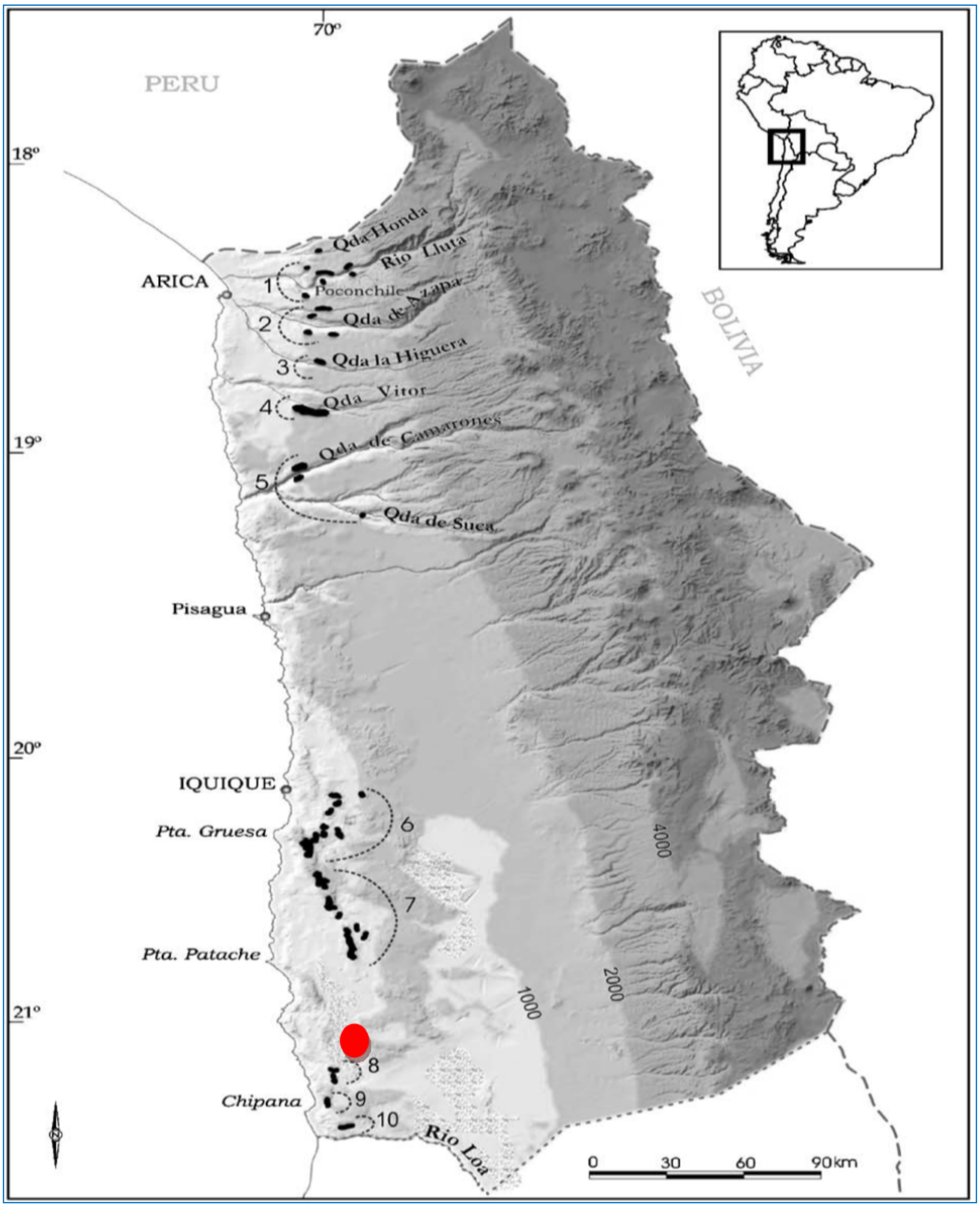
These communities generally are monospecific, which is distributed among them parallel and perpendicular to the penetration of the mists (Pinto et al, 2006).

Knowledge in Chile is limited and fragmented, where the southern boundary of Tillandsia is close to Iquique. These communities are not uncommon in the region and follow a distinct pattern of distribution associated with the existence of the corridors of fog associated along the coastal zone (Pinto et al, 2006).

There are many studies about this type of formations in the North and is not clear if its presence is an indicator of existence of fog, since there are many sectors, such as where is the Projectwhere there is fog and the species is not present.

As shown in the figure below, shows the distribution in the first region of the tillandsiales, do not coincide with the areas of the Project.

Figure 3-121: Location of Tillandsiales in the Region of Tarapacá



Symbology

Project Espejo de Tarapacá

Tillandsiales

Source: (Pinto et al, 2006).

3.2.6.3 Methodology

The elaboration of the baseline of this component consisted of three stages, the first considered review of bibliographic records relating to the environmental component, the second a visit to terrain and the third an analysis of the information gathered.

For the characterization of the vegetation component and flora they toured throughout the area of the Projectboth the wiring as the reservoir.

All this was drawn on the topographic plane, in turn overlaid on satellite images (Google Earth)which constitute the Cartographic base of analysis of these environmental components.

The description of the vegetation and associated flora was conducted through the characterization of points of observation in the areas where it will be located the Project.

i. <u>Collection of cartographic information</u>

In order to frame the Project in phytogeographical context, allowing you to recognize the potential vegetation of the area, was collected and analyzed information from two systems of classification of vegetation. These are:

- The cartography of Natural vegetation of Chile, classification and geographical distribution (Gajardo, 1993).
- Synopsis bioclimatic mapping and vegetation of Chile (Luebert and Pliscoff, 2006).
- In addition, and for the characterization of the vegetation of the area, available satellite images were selected (Google Earth) as a complement to the mosaic aerofotografico allowing to segregate different vegetation units.

ii. <u>Rising of vegetation</u>

To make the description of the vegetation was the interpretation of images, in order to segregate, according to morphological patterns, texture, color and tone, different areas and units recognizable, bearing in mind the size of the minimum unit cartografiable, in order to segregate homogeneous cartographic units appropriate to the scale of work.

Later, in the field, reviewed these areas correcting the classification and - to the extent possible - by checking the spatial limits of them. At the same time, these units of land use were described - in terms of vegetable formation, level of coverage and dominant species - according to the methodology currently used in the *Centre d´Etudes Phytosociologiques et Ecològiques Louis*

*Emberger*CNRS of Montpellier, France (Charter of occupation of land), adapted to the Chilean case by Etienne and Prado[10] and subsequently modified by the team of the Project known as native forest cadastre (CONAF-CONAMA-IBRD, 1997)which allows, basically, describe the vegetation through qualitative and quantitative variables and consistently define the current state of the vegetation, according to the dominant plant type and coverage by biological type

Additionally, and with the purpose of defining a criterion gradeLTEa certain ration area, It has rearranged the classification in order to recognize the origin of a certain coverage)).

Table 3-56).

Table 3-56. Criteria of classification of vegetation)Uso TOactual of the SSearch).

Origin	Plant training	Sub usage	Density	Coverage by biological type (%)			
				Trees	Shrubs	Herbs	Succulent
Modified environments	Devoid of vegetation	Urban area (cities, villages)	n.a.	< 10%	< 10%	< 10%	< 10%
		Industrial area (including mining)					
		Houses, sheds, camps					
		Roads (roads, railways, etc.)					
	With vegetation	Parks, Gardens, squares, etc.	n.a.	0 - 100%	0 - 100%	0 - 100%	0 - 100%
Intervened environments	Agricultural	Fruit trees	n.a.	-	-	-	-
		Crop/pasture					
	Planting of shrubs		n.a.	-	10-100%	-	-
	Forest plantation		n.a.	10-100%	-	-	-
	Mixed forest		Very	10 25%	0 -	0 -	0 - 100%
			Open	25-50%	0 -	0 -	0 - 100%
			Semi-	50-75%	0 -	0 -	0 - 100%
			Dense	>	0 -	0 -	0 - 100%
Natural environments	Meadows		n.a.	< 10%	< 10%	10 100%	< 10%
	Scrub (includes Andean steppes)		Very	< 10%	10 to	0 -	< 10%
			Open	< 10%	25 to	0 -	< 10%
			Semi-	< 10%	50 to	0 -	< 10%

[10] Etienne, M. y C. Prado. 1982. Descripción de la Vegetación Mediante la Cartografía de Ocupación de Tierras. Conceptos y Manual de Uso Práctico. Universidad de Chile. Fac. de Ciencias Agrarias, Veterinarias y Forestales. Ciencias Agrícolas Nº 10. 120 p.

Origin	Plant training	Sub usage	Density	Coverage by biological type (%)			
				Trees	Shrubs	Herbs	Succulent
			Dense	< 10%	75 to 100%	0 - 100%	< 10%
	Scrub with Succulents		Very	< 10%	10 to 25%	0 - 100%	> 10%
			Open	< 10%	25 to 50%	0 - 100%	> 10%
			Semi-	< 10%	50 to 75%	0 - 100%	> 10%
			Dense	< 10%	75 to 100%	0 - 100%	> 10%
	Formation of Succulents		n.a.	< 10%	< 10%	< 10%	> 10%
Natural environments	Native forest		Very	10 to 25%	0 - 100%	0 - 100%	-
			Open	25 to 50%	0 - 100%	0 - 100%	-
			Semi-	50 to 75%	0 - 100%	0 - 100%	-
			Dense	75 to 100%	0 - 100%	0 - 100%	-
	Wetlands (presence of water at surface)	Peat bogs	n.a.	< 10%	< 10%	< 10%	-
		Wetlands					
		Vegas					
		Scrublands					
	Without vegetation	Deserts	n.a.	< 10%	< 10%	< 10%	< 10%
		High peaks, snow and glaciers					
		Cliffs and rocky outcrops					
		Landslides, cave-ins, alluvium, cones					

n.a.: not applicable. Source: Modified from CONAF - CONAMA - IBRD, 1997.

iii. Lifting of Flora

For the determination of the flora, and parallel to the lifting of vegetation, the area is toured recognizing and registering all the species found, collecting samples of the species - in Herbarium and photographically - of dubious land classification.

iv. Processing of information

Worked on the identification of specimens and records of flora on the basis of appropriate taxonomic keys which was prepared a floristic area catalogue of the I am a studentindicating scientific name, taxonomic classification, and shape of growth)Zuloaga *et to the*. 2009). Also recorded the State of conservation of species registered According to the legislation in force (1st to 4th process MINSEGPRIt is 2007, 2008 and 2009; 5th to 9th process Ministerio of environment 2012). To identify native species originating in the country were consulted the DSupreme # ecreto68. As additional information is revised Benoît (1989) and Belmonte et to the. (1998).

At the same time and from the information collected in the field, information from the characterization of the vegetation was processed. Usually this procedure concludes with the development of a vegetation (or current coverage of the ground) plane, however, and as it will be seen later, in this case such mapping lacks absolute practicality, since it would represent a plane with a single land use.

3.2.6.4 Results

To validate the information obtained on-site has toured all of the study area. Therefore be prospected 68 points, which are detailed in the Table 3-57 below:

Table 3-57. Points of Reported observation andn field.

Sampling point	Ccoordinates (WGS 84 19 spindle)		Sampling point	Ccoordinates (WGS 84 19	
	North	This		North	This
A1	7666800	387731	A35	7668740	383906
A2	7667909	388762	A36	7667222	383316
A3	7668022	388910	A37	7677798	379788
A4	7667389	388434	A38	7677798	380045
A5	7666619	388297	A39	7677898	380507
A6	7666088	388569	A40	7678106	381607
A7	7666059	389158	A41	7677455	383091
A8	7666494	389761	A42	7674498	383591

Sampling point	Ccoordinates (WGS 84 19 spindle)		Sampling point	Ccoordinates (WGS 84 19	
	North	This		North	This
A9	7666255	389644	A43	7666542	385272
A10	7665741	388461	A44	7666535	385266
A11	7698160	427475	A45	7666490	385238
A12	7698008	424794	A46	7666347	385207
A13	7698433	422247	A47	7666140	385157
A14	7698570	418911	A48	7666044	385186
A15	7698718	414190	A49	7666671	385318
A16	7698452	408757	A50	7666438	387122
A17	7696632	403544	A51	7665840	386289
A18	7684998	394375	A52	7667572	387560
A19	7681660	392388	A53	7667159	388166
A20	7679006	390843	A54	7665836	388348
A21	7685237	395178	A55	7669396	386756
A22	7670465	386864	A56	7671571	387707
A23	7670302	387499	A57	7674731	388633
A24	7670357	384760	A58	7677540	390066
A25	7666672	385318	A59	7679963	392136
A26	7668293	386188	A60	7682993	393759
A27	7666500	385621	A61	7666677	383935
A28	7666330	386640	A62	7667225	383318
A29	7666345	388351	A63	7671211	384175
A30	7670403	386867	A64	7672240	383724
A31	7673400	387879	A65	7673543	383838
A32	7676231	389171	A66	7677600	382243
A33	7665758	384078	A67	7667885	383046
A34	7667717	384011	A68	7671987	380089

Source: Own elaboration

i. Vegetation of the TOrea of the Project

As a result of the observations made on land, it is mentioned that the Project is located mostly in the absolute wilderness, defined as an environment where there is a total absence of vegetation due to difficult weather conditions, product of negligible rainfall, where plant life is practically absent in much of its length, except under particular conditions, where some elements appear floristic, but with coverage as low (under 5%) that you fail to comply from a point of view ecosistemico, a plant formation.

The Project It is divided into the following sectors: Pampa, plateau, underground and surface works coast and underwater works.

Sector Pampa

The Pampa sector is located in the absolute wilderness, so the presence of plant species not found.

Figure 3-122. Sector Pampa.

Source: Terrain photography registration

Sector plateau

In this sector as in the former, no plants were found. In this area are the access roads from the coast towards the plateau, where it observed high presence of trash.

Figure 3-123: Sector Plateau.

Source: Terrain photography registration

<u>Underground works sector</u>

Due to the characteristics of the cliff (coastal)Figure 3-124) and their particular conditions of humidity and wind, in this sector develop some individuals of flora, which is almost marginal, as it was only found the presence of two species of *Breana ephedra.*

Figure 3-124: Sector of the coastal cliff.

Source: Terrain photography registration

Individuals of *Ephedra breana* (Figure 3-125) is specifically found in small creeks, where eventually with fog accumulates water and generate the possibility of germination.

Figure 3-125: Species Present in the Farellon Cestroi.

a) *Ephedra breana*

b) *Ephedra breana*

Source: Terrain photography registration

<u>Surface works sector</u>

The area of the Project It is present in the coastal zone (Figure 3-126), specifically in la Caleta San Marcos, is operated and high presence of trash. It ruled out the presence of vegetation.

Figure 3-126: Sector Surface works.

Source: Terrain photography registration

ii. Flora of the TOrea of the Project

In the area of the Project the presence was found dand three species in the sector ofcoastal Cliff I whose names, classification taxonomic, origin and way of life are presented in the table below:

Table 3-58. Vascular Flora species.

Division	Class	Family	Species	Common name	Origin	Form biological
Pinophyta	Gnetopsida	Ephedraceae	*Ephedra breana*	Pingo Pingo	Native	Bush

Source: Own elaboration

In the Table 3-59, the coordinates were located where the species present in the study area are:

Table 3-59. E coordinatesspecies Encontradas.

Species	Coordinates		No. individuals
	North	This	
Ephedra breana	7666139	385157	1
Ephedra breana	7666043	385186	1

Source: Own elaboration

iii. C categoryonservacion

In terms of the State of conservation of the flora and vegetation existing in the area of the Project, not found the presence of species with conservation problems.

3.2.6.5 Conclusionones

From gathering information (observation points) associated components flora and vegetation in areas associated to the Project Espejo de Tarapacádetermines that presence of vegetation there is no What is worth to him his ddream of absolute desert.

In the sector of the coastal cliff, due to the influence of the mist the presence of isolated species was found from *Ephedra breana.*

In relation to the State of conservation, and according to official listings, in the area of the project there were no species with conservation problems.

After reviewing the literature, distribution plans and the visits to the field, we will discard the area where the project is located corresponding to an Oasis of fog and possesses the presence of Tillandsiales in the sectors of the Project.

3.2.6.6 References

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3.2.7 Fauna

3.2.7.1 Introduction

This report exposes the results of the base of the component fauna developed for the Project "Espejo de Tarapacá", which consists of the construction and operation of ab hydraulic stationombeo in the communes of Iquique and Pozo Almonte (Province of) Iquique(, Tarapacá region).

The objective of the study fauna It was to characterize the State of the component prior to the execution of the Project (e) identify the presence of singularities that could impose conditions or restrictions on the execution.

It conducted an analysis of potential species Cabinet and a rear work of land, in the which techniques were implemented to the registration of birds, reptiles and mammalswith particular emphasis on potential species identified. In particular, a specific study on the possible presence of tern was small)*Sterna lorata*) in the area of the Project, which is presented in the Annex 3.3.

Gather information on terrain was carried out in two bells, executed with dates August 19-23, 2013 and on November 25-29, 2013. Both campaigns wasRon carried out by a specialist in the field of wildlife studies and support staff.

The information collected in the field was analyzed, classifying species registradas depending on its origin and category of conservation. Additionally, made findings were placed in context, through the construction of curves of accumulation of species, the spatial representation of the results and the review of specific literature for relevant species.

However, this document seeks to faithfully reflect the status of the component fauna at the time of carried out prospecting and inform about critical aspects for the implementation of the Project.

3.2.7.2 Methodology

i. <u>Cabinet Pre-Terreno</u>

Prior to the land campaign generated a list of potential species for the area, in order to guide the efforts on ground to corroborate his presence by adapting the techniques to implement. The sources of information listed below were:

a) Bibliographic references

Marked references were used in the Table 3-60 Other specific references used are detailed in paragraph References, at the end of this report.

Table 3-60. References Bibliograficas Used for determination of Fauna Potencial.

Class	Bibliographic references
Birds	Jaramillo (2003), Martinez & González (2004), Araya & Millie (2005).
Reptiles	Donoso-Barros (1966), Pincheira-Donoso & Núñez (2005), Vidal & Labra (2008).
Amphibians	CIS (1962), Veloso & Núñez (2003) and Vidal & Labra (2008).
Mammals	Riese (1973), courses (1996), Iriarte (2008) and Munoz-pedreros & Yánez (2009)

Source: Own elaboration

b) Studies of line BASE Davailable in the SEIA

We reviewed the environmental records of pprojects admitted to the SEIA, in order to include all those species previously recorded in the area that could have been excluded from the previous selection.

Specifically, they were considered pprojects since 2010, whose reference point coincide with a buffer of 50 kilometers around the area of study. The procedure used to obtain information, as well as the listing of Projectrevised s are presented in the

Table 3-61 and Table 3-62respectively.

Table 3-61. Procedure for obtaining of Information SEIA.

Stage	Activity	Result
1	Search of Projects online platform of the SEIA (Tarapacá Region, year 2010 onwards)	150 Projects
2	Filter by Projects with available reference location	150 Projects
3	Definition of an area buffer of 50 km around the area of study and selection of Projects within this	18 Projects
4	Selection of Projects with baseline available[11]	4 Projects

Source: Own elaboration

[11] Se consideraron sólo los Proyectos para los cuales se realizó trabajo de campo.

Table 3-62. Projects SEIA Utilizados as Ffont of Information.

Type	Name of the Project	Reference location	
		This	North
DAY	Atacama Solar 250 MW photovoltaic Park	453158	7733177
DAY	Exploitation in Isabel, Salar Grande salt tank	390522	7703247
DAY	Complex solar PV Pica 90 MW	447722	7722629
DAY	Lagoons 30 MW photovoltaic plant and line transmission 220 KV PFV Lagunas - lagoons SS/EE	452322	7685417

Source: Own elaboration

ii. Land activities

During the campaign of land was the determination of the environments of wildlife present in the area of I am a student, the establishment of sampling points, the identification of sites of interest to wildlife and the registration of this wildlife, according to a particular methodology for each class.

a) Determination of environments

A general survey of the area of study was conducted to identify the types of environments, in response to different types of environments to determine the existence of particular resources, which, in turn, defined the existence of different faunal assembliess.

The criteria used to determine and differentiate these environments was the presence and/or physiognomy of vegetation, the presence of water bodies and/or the magnitude of anthropogenic intervention.

Once defined the type and number environments, it was possible set the type and number of sampling points used for the registration of species in each environment.

b) Sampling points

Fauna (PMF) sampling points were established, according to the criteria listed below:

- Location within the study area.
- Representation of the different defined environments.
- Relatively uniform and proportional distribution in each environment.

In CAda PMF are appAron thes techniques correspondings for the registration of each one of the Groups target fauna, with the exception of the installation of waterholes, which were installed in points individuals who are designated properly in the

Table 3-68.

Each PMF was georeferenced by GPS in UTM, WGS 84 Datum coordinate system, Zone 19 South.

c) Sites of interest for Fauna

We analyzed the area in search of sites of interest to wildlife, understood as those who, according to the environmental context in which are embedded, have special features for the fauna of a sector, since they deliver conditions or difficult resources replace and/or present particular characteristics asocIADAS to certain species. These include outcrops of water used as watering, biological corridors, nesting sites of relevant species, among others.

d) Registration of fauna

The registration of the fauna present in the study area was carried out using different sampling techniques for each class:

Birds

- Transects:

Observation of fixed-width transects, in which a qualified observer recorded all birds seen or heard within an area determined by the length of the pedestrian journey undertaken at each point and a width of 30 meters on each side of the shaft were of progression.

Each transect was covered for a minimum of 10 minutes, using Carson 8 x 42 binoculars for the identification of species.

- Targeted search:

In response to the potential occurrence of nesting seabirds of interest in the area of the Project (eg. *Sterna lorata*, *Leucophaeus modestus*, *Oceanodroma markhami*), are pesquizo active presence of signs of reproduction as nests, eggs, feces, feathers, footprints, and ultimately remains, any element that was indicative of nesting.

Reptiles

- Transects:

Trails in which was recorded the presence of reptiles by visual evidence, within the limits given by the detection ability of the observer, which was estimated at 2.5 meters on each side of the line of torque progression werethe total of the study area.

- Directed search

In attention to habits of potential species for the study area, the realization of transects was supplemented with the guided search of reptiles in potential shelters. This consisted of lifting stones or scabs salinas and the search of copies or signs of presence (m(udas, footprints, etc) under these.

Amphibians

Since initial survey determined that the study area did not have characteristics appropriate for the existence of amphibians (bodies of water or minimum humidity conditions), not any particular effort was made to record species belonging to this group.

Mammals

Methodologies of sampling for mammals were divided into those used for the following groups: small mammals and macromamíferos.

The study of small mammals was carried out by means of the search for indirect evidence such as Burrows, fecas, skeletal remains in pellets.

To macromamíferos, on the other hand, the following techniques have been implemented:

- Camera traps

Camera traps were installed *Bushnell Trophy Cam HD®*, in sectors with adequate visibility. Fish was used canned as bait, which moved 5 meters from the camera.

Each trap was installed during the first day of ground and withdrew on the morning of the last day of land, remaining active during 4 nights in each campaign.

- Free comments

In addition, there were all the direct evidence and indirect (footprints, feces, hair, Burrows, etc.) to the specialists observed within the study area.

iii. Cabinet Post-field

a) Origin

It corresponds to the classification of species based on their origin biogeographic region. The categories and definitions that are used in the Table 3-63.

Table 3-63. Categories and definitions used for classification of fauna according to origin.

Category	Nomenclature	Definition
Native	N	Species native to the national territory; occupying an area without human intervention.
Endemic	E	Species whose distribution is limited to the national territory.
Introduced	I	Species not native to the country, whose presence responds to voluntary or involuntary intervention of man. They can be found in domestic or wild state.

Source: Own elaboration.

b) Category conservation

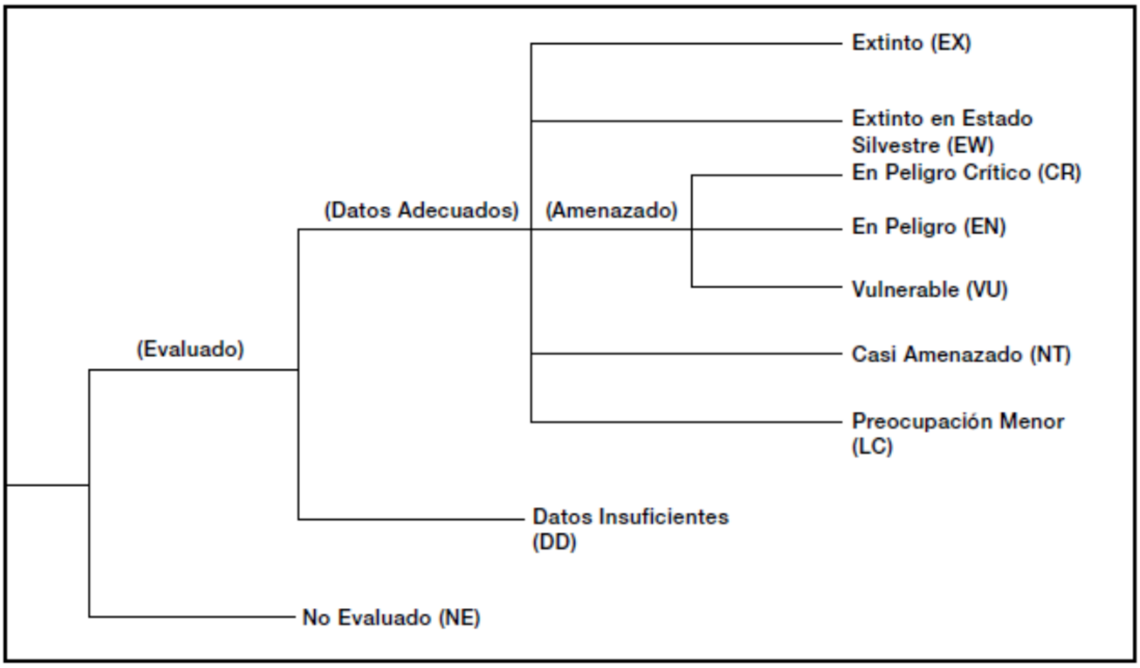
For the purposes of the present report and in accordance with the document "Priority for the purposes of the SEIA of classifications or categorizations of species of wild flora and fauna" (CONAMA, 2008), the reported categories were considered by the following sources of information:

- Regulation on classification of wild species (RCE) (DS75/2004) and processes 1-9º, oficializados through the DS151/2007, DS 50/2008, DS 51/2008, 23/2009 DS, DS33/2011, 2011 DS41, DS42/2011, DS19/2012 and DS13/2013.
- Hunting Act and its regulations (Law No. 19.473/1996 and DS 05/1998)

As indicated by the aforementioned document, is consideror as a final category from the current process of the CERs, or failing this, reported by the regulation of the hunting law.

In relation to them, it is worth mentioning that while traditionally have been considered all categories of conservation (i.e. Vulnerable, out of danger) as categories "of interest", a more recent approach discriminates between the different categories, according to This guidelines dictated by the IUCN)Figure 3-127). According to the above, thereafter will be the distinction between species conservation category and category of threat, being this last term that reflects a condition of relevance.

Figure 3-127. IUCN categories.



Source: IUCN, 2001

For purposes of processes 1 °, 2 °, 3 ° and 4 ° of the CERs, the categories of conservation are indicated in the Table 3-64.

Table 3-64. Categories of Conservacion for the Pprocesses 1 °, 2 °, 3 ° and 4 ° of the CERs.

Category	Nomenclature	Definition
Extinct	EX	When exhaustive surveys in their habitat known and/or expected, carried out in the appropriate opportunities and its historical distribution area, have not detected any individual in the wild.
In danger of extinction	EP	When he faces a very high risk of extinction.
Vulnerable	VU	When, and can not be classified in the category "Endangered species", faces a high risk of extinction.
Rare	RA	When their populations occupy a small geographical area, or are restricted to a very specific habitat that, itself, is scarce in nature. Also will be considered "Rare" that species that naturally present very low population densities, although it occupies one larger geographical area.

Category	Nomenclature	Definition
IUCN	IC	When there are well-founded assumptions of risk, there is no sufficient information to assign it to one of the previous categories of conservation.
Out of danger	FP	When it has been included in any of the categories outlined above and, currently, seen relatively safe for the adoption of effective conservation measures or in consideration to the threat that existed has ceased.

Source: DS75/2004

For purposes of the 5 th, 6 th and 7 th, 8° and 9° process of the CERs, the categories of consequentialrvacion are indicated in the Table 3-65.

Table 3-65: Categories of Conservation of the 5th, 6th, 7th, 8th and 9th Pprocess of the CERs

Category	Nomenclature	Definition
Extinct	EX	A taxon is extinct when there is no reasonable doubt that the last existing individual has died. It is presumed that a taxon is extinct when exhaustive surveys of its habitats, known and/or expected, at appropriate times (daily, seasonal, annual), and throughout its historical range, has not been able to detect a single individual. Surveys must be carried out in periods of time appropriate to the life cycle and ways of life of the taxon.
Extinct in the wild	EW	A taxon is extinct in the wild when it only survives in cultivation, in captivity or as population (or populations) naturalized completely out of its original distribution. It is presumed that a taxon is extinct in the wild when exhaustive surveys of its habitats, known and/or expected, at appropriate times (daily, seasonal, annual), and throughout its historical range, have not been able to detect a single individual. Surveys must be carried out in periods of time appropriate to the life cycle and ways of life of the taxon.
Critically endangered	CR	A taxon is critically endangered when the best available evidence indicates that it meets any of the criteria for critically endangered and, therefore, it is considered that it is facing an extremely high risk of extinction in the wild.
In danger	IN	A taxon is endangered when the best available evidence indicates that it meets any of the criteria for endangered and, therefore, it is considered that it is facing a very high risk of extinction in the wild.
Vulnerable	VU	A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria for Vulnerable and, therefore, it is considered that it is facing a high risk endangered in the wild.
Near threatened	NT	A taxon is near threatened when it has been evaluated according to the criteria and does not satisfy, at present, the criteria for critically endangered, endangered or Vulnerable; but it is close to meeting the criteria, or possibly fulfill, in the near future.

Category	Nomenclature	Definition
Least concern	LC	A taxon is least concern when, having been evaluated, does not meet any of the criteria that define the categories critically endangered, endangered, Vulnerable or near threatened. Included in this category of taxa abundant and widely distributed.
Data deficient	DD	A taxon is included in the data deficient category when there is adequate information to make a direct or indirect, assessment of its risk of extinction based on the distribution and/or population status. A taxon in this category can be well studied, and its biology be well-known, but lacking appropriate on its abundance and distribution data. Data deficient is therefore not a category of threat. To include a taxon in this category indicates that more information is required, and acknowledged the possibility that future research demDomingo to a classification of threatened might be appropriate.
Not evaluated	NE	A taxon is not evaluated when it has not been classified in relation to these criteria.

Source: IUCN, 2001

For the purposes of the regulation of the law of CAZA, conservation categories are indicated in the Table below:

Table 3-66. Categories of conservation of the regulation of the hunting Act.

Category	Nomenclature	Definition
In danger of extinction	EP	Species of wildlife exposed to the threat of disappearing, short-or medium-term national wildlife heritage.
Vulnerable	VU	Species of wildlife that being subject to a hunt or capture intensive, as having an existence associated with certain natural habitats which are still subject to a progressive process of destruction orLTEration, or due to their vital environmental pollution, or other causes, are undergoing a constant numeric recoil which can lead them to the danger of extinction.
Rare	R	Wildlife species whose population, either by having a geographical distribution very restricted because they were in the last stages of its process of natural extinction, they are and they have been scarce since time immemorial.
Poorly known	EC	Species of wildlife for which only has rudimentary and incomplete scientific knowledge to determine their correct conservation status.

Source: Hunting law N ° 19.473/1996

c) Curvas of accumulatedtion of Especies

The species accumulation curves are graphs that relate the sampling effort - typically expressed as time - with the accumulated wealth of species (Magurran, 2004). In normal, a curve has accelerated growth in the beginning, becoming asymptotic once reached the total number of species present in a given environment.

Based on records of land, built curves of accumulation of species for environments in which were 10 or more sampling points of fauna. On the horizontal axis are presented the points made in that environment, in chronological order; on the vertical axis, meanwhile, arose the accumulated wealth of species. It is used as maximum value of the axis, the number of potential species for such environment.

d) Index of Diversidad Biologica

The biological diversity of registered environments was measured by the Shannon-Wiener index (H'), which considers both the richness of species and their relative abundance. Its calculation followed the standard method:

$$\boxed{H' = -\sum_{i=1}^{R} p_i \ln p_i}$$

Where is R the richness of species, p_i It is the proportion of individuals belonging to the species *i* in the community, and the natural logarithm, usually used with the base 2.

3.2.7.3 Effort of Muestreo

Thes campaigns including lands by the present infOrme were between the days 19-23 agosto de 2013 and on November 25-29, 2013. These were led by the specialist in field studies of Wildlife, Mr. Rodrigo Silva Caballero[12]who was assisted in the November campaign by Mr. Mauricio Paredes Bustamante[13].

Each working day lasted approximately 10 hours effective, totaling around 150 man-hours of work in field (Table 3-(71).

A total of 29 points of sampling of fauna (PMF), was performed in every campaign of land totaling 58 PMF. The specific location of these, as well as the detail of the sampling effort (expressed in time, distance and shelters removed in each PMF) arises in the

Table 3-68 and the Table 3 73respectively.

In relation to the above, it should be noted that one of the premises of the location of the PMF was the relative homogeneity of the Assembly present in each of the environments, the characterization is based on a series of samples that reflect the behavior of the variables measured in the whole of the environment. This premise is particularly applicable to a homogeneous and little diverse environment as the interior desert.

[12] Licenciado en Medicina Veterinaria, Candidato a Magíster en Áreas silvestres y Conservación de la naturaleza.
[13] Médico Veterinario.

Table 3-67. Effort of MI uestreo (HH) Invertido in the Caracterizacion of Fauna.

Day	Field dates	N ° Professional/ Day	Hours /Day	Man hours /Day
1	19-08-2013	1	10	10
2	20-08-2013	1	10	10
3	21-08-2013	1	10	10
4	22-08-2013	1	10	10
5	23-08-2013	1	10	10
Subtotal (hours man / campaign)				50
6	25-11-2013	2	10	20
7	26-11-2013	2	10	20
8	27-11-2013	2	10	20
9	28-11-2013	2	10	20
10	29-11-2013	2	10	20
Subtotal (hours man / campaign)				100
Total (hour man)				150

Table 3-68. Location of the Ppoints of MI uestreo of Fauna.

TOgoSto-2013						NOViembre-2013					
Name	This	North	PMF	TRC	Sector	Name	This	North	PMF	TRC	Sector
PT1	387276	7665380	X		Plateau	PT30	425919	7698060	X		Pampa
PT2	388760	7667910	X	X	Plateau	PT31	423672	7698190	X	X	Pampa
PT3	389679	7666390	X		Plateau	PT32	420852	7698440	X		Pampa
PT4	427475	7698160	X		Pampa	PT33	416535	7698680	X		Pampa
PT5	424794	7698010	X		Pampa	PT34	412472	7698920	X		Pampa
PT6	422247	7698430	X		Pampa	PT35	410426	7699030	X		Pampa
PT7	418911	7698570	X		Pampa	PT36	406367	7697610	X		Pampa
PT8	414190	7698720	X		Pampa	PT37	381441	7678350	X		Plateau
PT9	408757	7698450	X	X	Pampa	PT38	379791	7677740	X	X	Costa
PT10	403544	7696630	X		Pampa	PT39	380637	7677930	X		Costa
PT11	394375	7685000	X		Pampa	PT40	383094	7677450	X		Plateau
PT12	392388	7681660	X		Pampa	PT41	383588	7674520	X		Plateau
PT13	390843	7679010	X	X	Pampa	PT42	384619	7670520	X		Plateau

TOgoSto-2013						NOViembre-2013					
Name	This	North	PMF	TRC	Sector	Name	This	North	PMF	TRC	Sector
PT14	395180	7685230	X		Pampa	PT43	385223	7665980	X		Underground works
PT15	385280	7666630	X		Plateau	PT44	385279	7666620	X		Plateau
PT16	386188	7668300	X		Plateau	PT45	387119	7666440	X		Plateau
PT17	385613	7666520	X		Plateau	PT46	386292	7665830	X		Plateau
PT18	386640	7666330	X	X	Plateau	PT47	387561	7667570	X		Plateau
PT19	387722	7666810	X		Plateau	PT48	388164	7667160	X		Plateau
PT20	388350	7666340	X		Plateau	PT49	388346	7665840	X		Plateau
PT21	386613	7667310	X		Plateau	PT50	386760	7669400	X	X	Pampa
PT22	386865	7670410	X		Pampa	PT51	387715	7671570	X		Pampa
PT23	387879	7673400	X		Pampa	PT52	388562	7674860	X		Pampa
PT24	389171	7676230	X		Pampa	PT53	390078	7677520	X	X	Pampa
PT25	384083	7665750	X		Underground works	PT54	391584	7680410	X		Pampa
PT26	384009	7667720	X		Costa	PT55	393204	7683280	X		Pampa
PT27	383654	7669120	X		Costa	PT56	383929	7666690	X		Costa
PT28	383311	7667220	X		Costa	PT57	383319	7667240	X		Costa
PT29	383624	7665420	X		Underground works	PT58	383056	7667890	X		Costa

Note: TRC = Camera traps

Source: Own elaboration

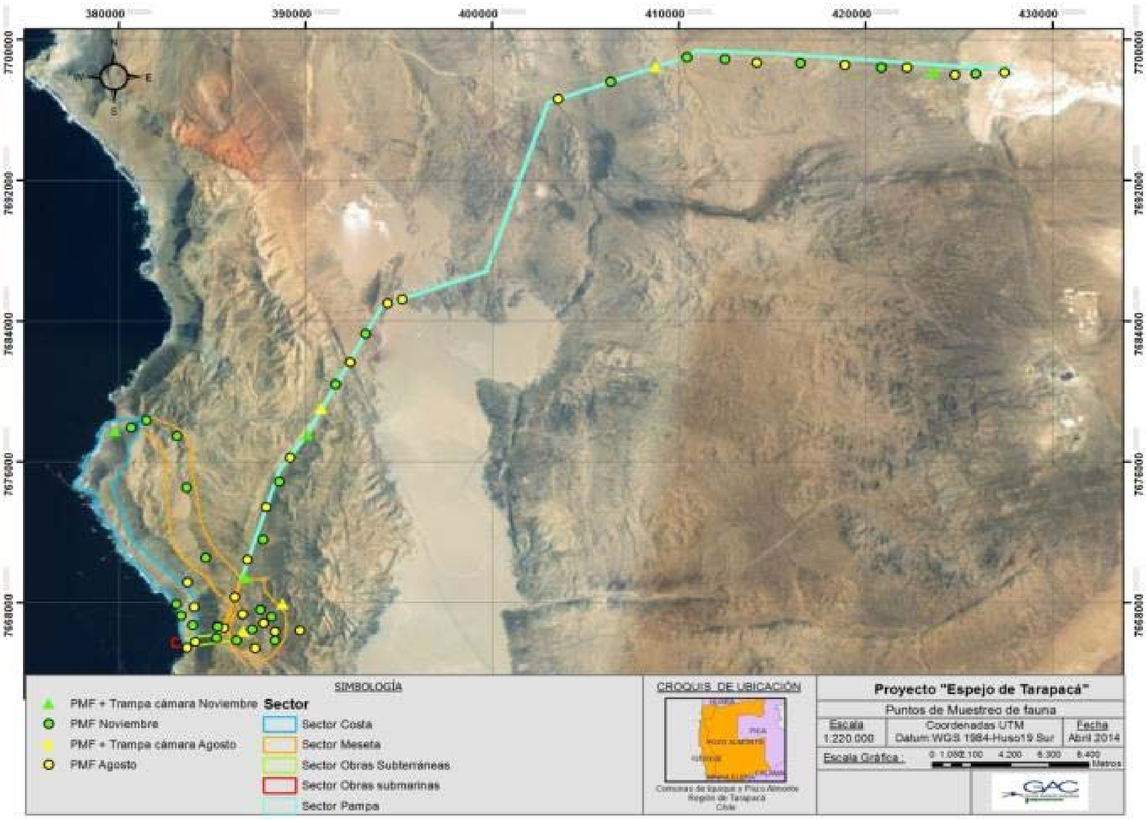
Table 3-69. Detail of the Esfuerzo of MI uestreo by PMF.

August 2013				November 2013			
Name	Time (minutes)	Distance (meters)	Removed stones	Name	Time (minutes)	Distance (meters)	Removed stones
PT1	30	600	20	PT30	30	700	11
PT2	40	300	16	PT31	20	800	2
PT3	30	600	20	PT32	25	800	24
PT4	20	400	5	PT33	40	800	22
PT5	20	500	10	PT34	25	700	39
PT6	15	400	10	PT35	15	600	19
PT7	20	600	75	PT36	20	400	20
PT8	15	400	20	PT37	15	0	0
PT9	25	600	14	PT38	30	0	0
PT10	10	600	20	PT39	20	150	46

August 2013				November 2013			
Name	Time (minutes)	Distance (meters)	Removed stones	Name	Time (minutes)	Distance (meters)	Removed stones
PT11	10	400	5	PT40	30	400	25
PT12	20	350	12	PT41	10	300	2
PT13	10	300	0	PT42	10	100	0
PT14	22	600	0	PT43	60	600	50
PT15	20	500	95	PT44	60	600	90
PT16	30	500	20	PT45	20	400	5
PT17	45	400	5	PT46	10	400	0
PT18	5	50	0	PT47	20	600	15
PT19	10	200	5	PT48	15	600	60
PT20	10	200	0	PT49	15	900	10
PT21	10	200	0	PT50	10	400	5
PT22	5	200	0	PT51	10	800	20
PT23	5	250	0	PT52	10	800	20
PT24	15	150	0	PT53	12	300	10
PT25	25	300	0	PT54	10	200	10
PT26	20	400	0	PT55	10	200	10
PT27	30	400	0	PT56	20	800	20
PT28	35	200	0	PT57	20	300	0
PT29	20	200	0	PT58	20	300	0
Total August	**572**	**10,800**	**352**	**Total November**	**612**	**13.950**	**535**

Source: Own elaboration

Figure 3-128. PMF in the TOthe project area.



Source: Own elaboration.

3.2.7.4 Results

i. Environments Identificados

Carried out a general survey of the study area, identified the presence of two environments for wildlife, corresponding to Absolute desert and coast.

a) Absolute desert

Environment widely represented in the environment, present in underground works sectors, plateau and Pampa. It is characterized by zero rainfall, leading to a total absence of vegetation; factors to which is added a high solar radiation and a large thermal oscillation.

All that determines the existence of a very productive environment, which is associated with a poor in terms of richness and abundance faunal community. However, there are notable exceptions, adapted to local conditions, such as reptiles *Liolaemus stolzmanni* and *Phyllodactylus gerrhopygus*. In addition, some species of seabirds use this environment for playback.

Figure 3-129. Environment for the Fauna "Absolute desert".

Source: Terrain photography registration

b) Costa

Environment only present in the coast sector, but continuous and abundant in the immediate surroundings. It is determined by the presence of the ocean and the resources it provides..

It is favourable to the existence of an abundant and diverse Assembly of birds, there are also reptiles strongly associated to the intertidal.

This environment is only present in the coast sector.

Figure 3-130. Environment for the Fauna 'Coast'.

Source: Terrain photography registration

ii. Potential wildlife

The analysis of potential wildlife, whereas the various sources of information detailed in the methodological section, throws the potential presence of 54 species, corresponding to 39 birds, 5 reptiles and 10 mammals. Do not identify amphibians that could potentially be present in the conditions prevailing in the area of the Project (Table 3-70).

Of the total of potential species, four are endemic. In terms of relevance product of its state of conservation, species highlights *Pandion haliaethus*, *Phalacrocorax bouganvillii, Sterna lorata, Inca tern, Leucophaeus modestus, Spheniscus humboldti, Pelecanoides garnotii, Phyllodactylus gerrhopygus, Lontra felina* and *Ctenomys robustus*Since all of them have categories that explicitly reflect a degree of threat.

Species *Sula variegata*, *Phalacrocorax gaimardi, Storm petrel, Oceanodroma Hornby, Liolaemus stolzmanni, Microlophus quadrivitatus, Microlophus tarapacensis, Microlophus theresioides, Pseudalopex griseus* and *Desmodus rotundus*Meanwhile, have categories that although it does not directly reflect a degree of threat, have been widely considered "of interest" within the framework of the SEIA.

Table 3-70. Potential species described for the study area.

Class	Scientific name	Common name	Origin	Category of conservation		Source of information	
				Hunting law	RCE	REF. BIBLIO.	SEIA
Birds	*Pandion haliaethus*	Eagle fish	N	VU	-	x	
	Cathartes aura	Red-headed Vulture	N	-	-	x	x
	Pelecanus thagus	Pelican	N	-	-	x	
	Sula variegata	Booby	N	IC	-	x	
	Phalacrocorax gaimardi	Lile	N	IC	-	x	
	Phalacrocorax bouganvillii	Guanay	N	VU	-	x	
	Phalacrocorax brasileanus	Yeco	N	-	-	x	
	Haematopus ater	Black pilpilen	N	-	-	x	
	Haematopus palliatus	Pilpilen	N	-	-	x	
	Tringa melanoleuca	Large yellow legs	N	-	-	x	
	Tringa flavipes	Yellow boy legs	N	-	-	x	
	Numenius phaeopus	Hudsonian	N	-	-	x	
	Calidris alba	Sanderling	N	-	-	x	
	Aphriza virgata	The breakers Beach	N	-	-	x	
	Calidris bairdii	Beach of Baird	N	-	-	x	
	Arenaria interpres	Beach Turnstone	N	-	-	x	
	Willet inornata	Big beach	N	-	-	x	
	Naped ground tyrant	Reddish neck tripletail	N	-	-	x	x
	Ground macloviana	Tontita tripletail	N	-	-	x	
	Cinclodes nigrofumosus	Coastal churrete	E	-	-	x	
	Sterna lorata	Small tern	N	IN	IN	x	
	Thalasseus elegans	Elegant tern	N	-	-	x	
	Sterna hirundinacea	South American tern	N	-	-	x	
	Sterna paradisaea	Arctic tern	N	-	-	x	
	Inca tern	Tern nun	N	VU	-	x	
	Leucophaeus modestus	Gaviota garuma	N	VU	-	x	x
	Leucophaes pipixcan	Franklin Gull	N	-	-	x	
	Larus dominicanus	Dominican Gull	N	-	-	x	
	Larus belcheri	Peruvian Seagull	N	-	-	x	
	Nycticorax nycticorax	Brown	N	-	-	x	
	Charadrius collaris	Plover necklace	N	-	-	x	

Class	Scientific name	Common name	Origin	Category of conservation		Source of information	
				Hunting law	RCE	REF. BIBLIO.	SEIA
	Charadrius semipalmatus	Semipalmated Plover	N	-	-	x	
	Charadrius Plover	Snowy Plover	N	-	-	x	
	Hirundo rustica	Bermeja swallow	N	-	-	x	
	Pygochelidon cyanoleuca	Back black tern	N	-	-	x	
	Spheniscus humboldti	Humboldt Penguin	N	-	VU	x	
	Pelecanoides garnotii	Yunco	N	VU	-	x	
	Oceanodroma markhami	Black tern	N	IC	-	x	
	Oceanodroma Hornby	Tern's Necklace	N	IC	-	x	
Reptiles	*Phyllodactylus gerrhopygus*	Salamanqueja of the great North	N	VU	-	x	
	Liolaemus stolzmanni[14]	Reiche Dragon	N	IC	-	x	x
	Microlophus quadrivittatus	Runner quad band	E	IC	-	x	
	Microlophus tarapacensis	Corridor of Tarapacá	E	IC	-	x	
	Microlophus theresioides	Teresa runner	E	R	-	x	
Mammals	*Lontra felina*	Chungungo	N	-	VU	x	
	Pseudalopex griseus	Grey Fox	N	IC	LC	x	x
	Abrothrix olivaceus	Olive mouse	N	-	-	x	
	Phyllotis magister	Large-eared mouse	N	-	-	x	
	Ctenomys robustus	Tuco tuco in the tamarugal	N	VU	-	x	
	Desmodus rotundus	Piuchén	N	R	-	x	
	Tadarida brasiliensis	Bat mouse tail	N	-	-	x	
	Histiotus macrotus	Greater long-eared bat	N	-	-	x	
	Myotis atacamensis	Bat ear mouse of North	N	-	-	x	
	Smoky bat	Schnabel bat	N	-	-	x	

[14] Esta especie fue denominada *Phrynosaura reichei* o *Liolaemus reichei* hasta Langstroth (2011), siendo clasificada por el Reglamento de la ley de Caza bajo este nombre. Por esta razón, se mantiene la categoría asignada en dicha ocasión.

Source: Own elaboration.

Identify potential species, some of particular interest given its conservation status or any interaction that could be developed with the Project. For each one of them held a brief literature review, which is presented below:

- **Small tern *(Sterna lorata)***

Chico terns or creaking)*Sterna lorata*) se Dist.ribuye associated with the current Humboldt, in coastal environments from Ecuador South to the Region of Antofagasta in Chile. In the countryThere are historical records to the mouth of the river Copiapó, in the Region of Atacama.

It is a species whose more southern populations (Chile) would present migratory movements during non-reproductive, reaching up to the Gulf of Guayaquil (Ecuador) in that period. On the coast of Chile viewed between August and April of each year, Although some authors postulate Some birds may be pelagic, i.e. live sea toin non-breeding season (Nuñez, 2009).

It feeds on small fish, particularly of anchovy)*Engraulis ringens*) and it also includes a percentage of krill)*Euphausia spp.*.) (Nuñez, 2009).

His areas of reproduction in Chile have been described by Goodall et to the. (1951), war (2003a and 2003b), Vilina (1998) and Malinarich (2012). The breeding season extends between October and February, with a maximum of eggs in November and December, although there is an asynchrony in the time of postura (pit et al., 1996).

On the coastal plains of Tarapacá nests consist of a small cup excavated in soil and containing no organic materials (Vilina, 1998). They lay one or two eggs and incubation lasts for 22 to 23 days. Eggs measure on average 31.4 x 23.9 mm, and are color to olive spots in shades of coffee (Goodall et al. 1951). Many eggs disappear and usually sorWhat a chicken is carried to term. The chick is pale grey, with small dark spots on the back. Like other members of the family Laridae are nidifugas birds, that is, they leave the nest a few days of birth. Usually, as other species associated with the Humboldt current, there is a suppression of reproduction during the years with phenomenon of The child (pit et al., 1996).

Among the natural predators of the young terns is included *Falco peregrinus*, *Cathartes aura* and *Pseudalopex spp.*. The species is threatened with extinction in Chile, in the endangered category, and the main threats include the loss of breeding habitat, in addition to a population decrease due to the collapse of the anchovy product of overfishing.

- **Gaviota garuma *(Leucophaeus modestus)***

The Seagull Garuma (*Leucophaeus modestus*) s(e) it distributes on the Pacific coast, sandy beaches, especially using Manta in Ecuador to Chiloé. Feeds mainly on sea fleas)*Emerita analoga*) but also includes fish and polychaetes. Beaches in their mode of feeding is similar to a knot (birds of the Family Scolopacidae), staying active during low tide; When it feeds on fish, and worms so dropping into a tailspin, but taking the food on the surface without submerging (pit et to the). 1996).

Playing in the desert, in areas devoid of vegetation and water, placing its colonies between 35 and 100 Km inland. Nesting usually occurs between November and January, the position of eggs, between 1 and 3 is done primarily in December. The nest is a depression in the ground without additional materials and one parent carries out the incubation while the other feeds on the coast, making a replacement every 24 hyou pray (usually at night).

Reproductive activity is markedly seasonal (Cikutovic et al., 1988) and there is no play in the years in which the fenomen developsor El Niño (Guerra et to the.) 1988).

For Goodall et to the. (1951) and Howell et to the. (1974) the effect of predation on the colonies of seagulls seems insignificant, although they mentioned that apart from humans there are four potential predators in nesting areas, which are the *Vultur gryphus, Cathartes aura, Falco peregrinus and Pseudalopex sp.*

- **Black tern *(Oceanodroma markhami)***

Black tern belongs to the family Hydrobatidae, a family of small birds and fragile in appearance, which live exclusively in the ocean. It is distributed along the Humboldt current, off the coast between Mexico and Chile.

Their breeding grounds are uncertain, however, since 1987 it is known that it nests in the Paracas peninsula, South of Peru (from the pit *et* to the. 1992). in Chile, has recently identified a nesting area, approachesapproximately 22 kilometers of Arica, on the top of the Gorge of Acha (Torres-Mura & Lemus 2013).

It is known that it reproduces annually. In Peru, the position of the eggs occurs between June and August, and the nests are occupied until late November or early December, when the fledglings they leave the nest (Jahncke 1994). In Chile, the reproduction seems to occur between March and June (Tower-Mura & Lemus 2013).

The nesting site recently found in northern Chile, is located in a place with tropical hiperarido, without precipitation and climate with an annual temperature of 19° c, without greater variations between winter and summer. The substrate is sandy, with patches of saltpeter and completely devoid of vegetation. The nests are located in a narrow ribbon of saltpeter, which goes from

West to East. The distance of the inner most colonies (to the East) is 15 km from the sea, 650 masl (Torres-Mura & Lemus 2013).

Between the months of March and may 2010 withdrew a total of 76 individuals found in different parts of the city of Iquique and Alto Hospicio, product of any collision related structures that emit light. On the other hand, have been delivered reports between the months of February and may 2010 for a total of close to 1,200 individuals rescued, all of them had impacted with lighting, both in the coastal edge and places equipment above the coastal mountain range where There are mines of exploitation of the Great Salt Lake located 89 kilometers south of the city e Iquique)Malinarich 2010).

- **Reiche Dragon *(Liolaemus stolzmanni)***

Reptile belonging to the genus Liolaemus, although given its morphological particularities and behavioural, was considered for a long time within the genus *Phrynosaura*. It is a species that inhabits the absolute desert environment, but that apparently is associated to *tillandsiales*[1] and oasis of fog. Its distribution is still poorly understood, however, recently described his presence at a number of sites between Guatalaya (near Iquique, Tarapacá Region) and Hornitos (Antofagasta Region), through a mainly coastal distribution with certain projections towards the inside.

- **Salamanqueja of the great North *(Phyllodactylus gerrhopygus)***

Reptile's nocturnal habits, which is distributed from the outskirts of Lima, Peru, to the sector of Paposo (Antofagasta Region). Occupies has preference by desert, but in Peru type habitat areas with abundant vegetation. Its diet is mainly composed of insects (Coleoptera, Diptera, Dermaptera and Crustacea).

iii. Recorded fauna by sector

Made an effort to sampling suitable for registration of potential species for el area of study, we identified a total of 24 species. The particular atmosphere is presented below.

a) Sector COSTA

[1] Formaciones vegetales compuestas por *Tillandsia* spp.

The area called Costa includes environments for wildlife coast and inland desert. He identified the presence of 19 species, corresponding to 18 birds and 1 reptile (Table 3-71 and Figure 3-131).

It's native species, of which 1 is also endemic. In terms of categories of conservation, species highlights, *Leucophaeus modestus* and *Pelecanoides garnotii,* It presents the category of Vulnerable, and species *Sula variegata, Oceanodroma markhami, Phalacrocorax gaimardi and Microlophus quadrivittatus* that you have the category inappropriately known.

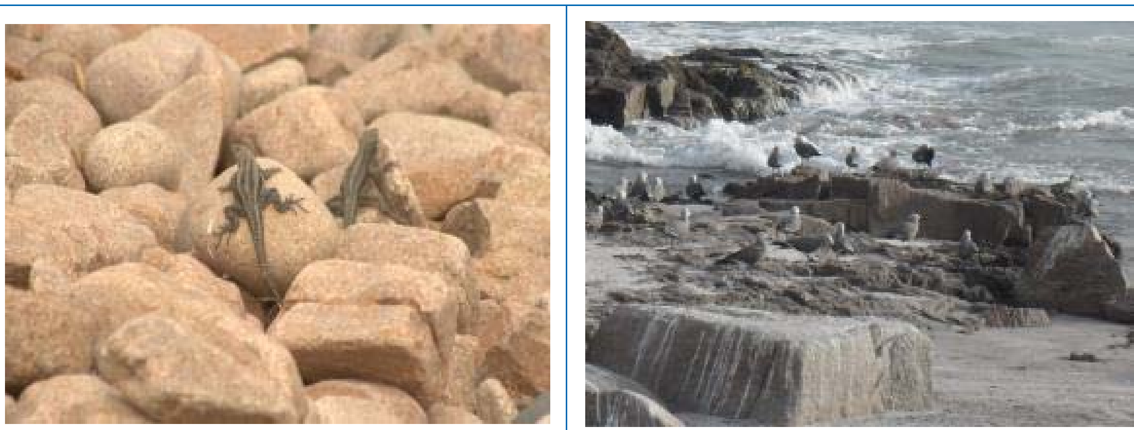
The contextualization of these findings is addressed in the paragraph 3.2.7.5iii.

Table 3-71. Species Registradas in the Sector Costa.

Class	Scientific name	Common name	Origin	Category of conservation	
				Hunting law	RCE
Birds	*Cathartes aura*	Vulture red head	N	-	-
	Ground macloviana	Tontita tripletail	N	-	-
	Pelecanus thagus	Pelican	N	-	-
	Sula variegata	Booby	N	IC	-
	Nycticorax nycticorax	Brown	N	-	-
	Phalacrocorax brasileanus	Yeco	N	-	-
	Haematopus palliatus	Pilpilen	N	-	-
	Haematopus ater	Black pilpilen	N	-	-
	Numenius phaeopus	Hudsonian	N	-	-
	Larus dominicanus	Dominican Gull	N	-	-
	Oceanodroma markhami	Black tern	N	IC	-
	Phalacrocorax gaimardi	Lile	N	IC	-
	Aphriza virgata	The breakers Beach	N	-	-
	Arenaria interpres	Beach Turnstone	N	-	-
	Leucophaeus modestus	Gaviota garuma	N	VU	-
	Larus belcheri	Peruvian Seagull	N	-	-
	Pelecanoides garnotii	Yunco	N	VU	-
	Pygochelidon cyanoleuca	Back black tern	N	-	-
Reptiles	*Microlophus quadrivittatus*	Runner quad band	E	IC	-

Source: Own elaboration.

Figure 3-131. Some of the Registros Rperformed in the coastal Sector. *Microlophus quadrivittatus* and *Leucophaeus modestus*.



Source: Photographic record field.

b) Underground works sector

The Underground works sector comprises environments coast and inland desert. He identified the presence of 13 species, corresponding to 11 birds and reptiles 2 (Table 3-72.

It's native species, of which 1 is also endemic. In terms of categories of conservation, species highlights *Phalacrocorax bouganvilli, Leucophaeus modestus, Pelecanoides garnotii* and *Phyllodactylus gerrhopygus* that you have the categoryIA from Vulnerable and the species *Microlophus quadrivittatus* having the category inappropriately known.

The contextualization of these findings is addressed in the paragraph 3.2.7.5iii.

Table 3-72. Species Registradas in the SEctor works Underground.

Class	Scientific name	Common name	Origin	Category of conservation	
				Hunting law	RCE
Birds	*Cathartes aura*	Vulture red head	N	-	-
	Naped ground tyrant	Reddish neck tripletail	N	-	-
	Haematopus palliatus	Pilpilen	N	-	-
	Numenius phaeopus	Hudsonian	N	-	-
	Larus dominicanus	Dominican Gull	N	-	-
	Phalacrocorax gaimardi	Lile	N	IC	-
	Leucophaeus modestus	Gaviota garuma	N	VU	-
	Larus belcheri	Peruvian Seagull	N	-	-
	Charadrius Plover	Snowy Plover	N	-	-

Class	Scientific name	Common name	Origin	Category of conservation	
				Hunting law	RCE
	Phalacrocorax bouganvillii	Guanay	N	VU	-
	Pelecanoides garnotii	Yunco	N	VU	-
Reptiles	*Microlophus quadrivittatus*	Runner quad band	E	IC	-
	Phyllodactylus gerrhopygus	Salamanqueja of the great North	N	VU	-

Source: Homemade

c) Sector plateau

The sector called Plateau covers only the desert interior. He identified the presence of 4 species, corresponding to 2 poultry and 2 reptiles (Table 3-73).

It's native species, of which one of them is endemic. In terms of categories of conservation, species highlights *Oceanodroma markhami* (Inadequately known), *Liolaemus stolzmanni* (Inadequately known) and *Gerrhopygus addition* (Vulnerable).

Table 3-73. Species Registradas in the SEctor plateau.

Class	Scientific name	Common name	Origin	Category of conservation	
				Hunting law	RCE
Birds	*Cathartes aura*	Vulture red head	N	-	-
	Oceanodroma markhami	Black tern	N	IC	-
Reptiles	*Liolaemus stolzmanni*	Stolzmann Dragon	E	IC	-
	Phyllodactylus gerrhopygus	Salamanqueja of the great North	N	VU	-

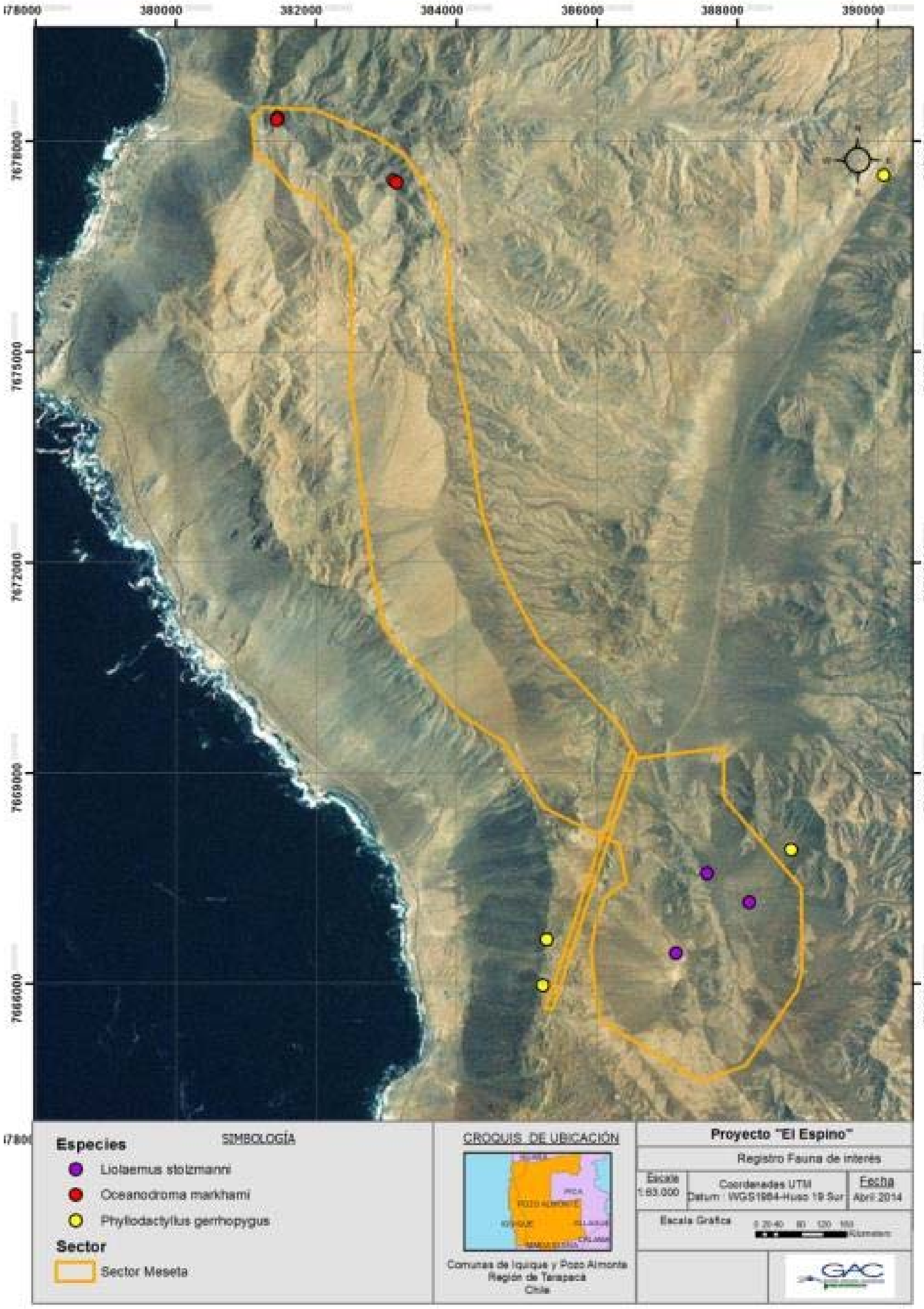
Source: Own elaboration.

Figure 3-132. Remains of *O markhami* Encontrados in SEctor plateau.

Source: Terrain photography registration.

Then in the Figure 3-133 the location of the records of fauna of interest present in the sector plateau are presented.

Figure 3-133. Fauna of Iinterest Presente in SEctor plateau.



Source: Own elaboration.

d) Sector PAMPA

The Pampa sector includes only the desert interior. In it is He identified the presence of 3 species, corresponding to 1 birds and reptiles 2 (Table 3-74)

It's native species, of which one of them is endemic. In terms of categories of conservation, species highlights *Liolaemus stolzmanni* (Inadequately known) and *Gerrhopygus addition* (Vulnerable).

The contextualization of these findings is addressed in the numerals 3.2.7.5iii

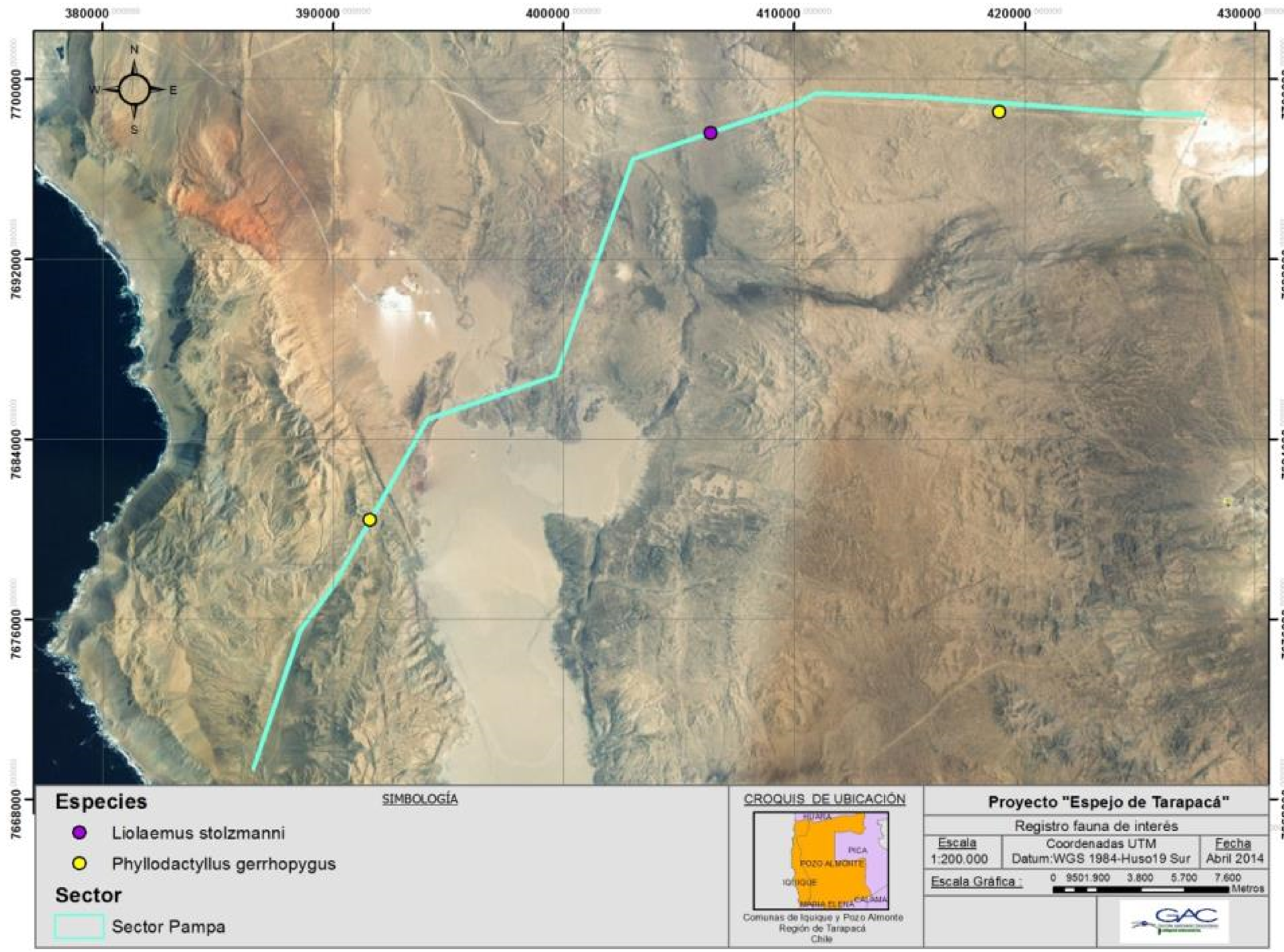
Table 3-74. Species Registradas in the Sector PAMPA.

Class	Scientific name	Common name	Origin	Category of conservation	
				Hunting law	RCE
Birds	*Cathartes aura*	Vulture red head	N	-	-
Reptiles	*Liolaemus stolzmanni*	Stolzmann Dragon	E	IC	-
	Phyllodactylus gerrhopygus	Salamanqueja of the great North	N	VU	-

Source: Own elaboration.

In Figure Figure 3-134 is the location records of fauna of interest present in the Pampa area.

Figure 3-134. Location of *L stolzmanni* and *P gerrhopygus* in SEctor Pampa.



Source: Own elaboration.

Figure 3-135. Main Hallazgos made in the SEctor PAMPA. Above, Liolaemus stolzmanni and Phyllodactylus gerrhopygus.

Source: Terrain photography registration

3.2.7.5 Analysis of Resultados

The following analysis considered the records obtained by friendly, beyond the limits of each sector of the project, because they make sense only when the unit under analysis makes biological sense.

i. Environments identified

There were two main rooms of fauna and although, given the design of the Projectone of them (Costa) is escasameNTE represented in the study area in relation to the other (absolute desert), both are widely represented in the immediate surroundings of the Project.

Accordingly, none of the identified environments represents a singular environment that some particular faunal Assembly is associated.

ii. Fauna Potencial

A total of 54 potential species identified, 24 were recorded in field (44.4%). This percentage is relatively high, if one takes into consideration that potential species listings often include species whose microhabitat is not necessarily present in the study area from a Project particular (eg. *Microlophus tarapacensis* and *Microlophus theresioides*).

This, it adds, the fact that much of the 54 species potential is associated with the environment of fauna 'Coast', which is sparsely represented in the study area. As it is expected that the smaller the sampled surface of certain environment, lower wealth registered in this, the fact that there has not been the totality of potential species for 'Coast' environment is perfectly intelligible.

Another aspect of interest, this time related to the atmosphere of "Inner desert" fauna, is the discovery of cryptic species (eg. *Gerrhopygus addition* and *Liolaemus stolzmanni*) and unpublished records (eg. *Oceanodroma markhami*). This allows, not yet having been registered all of the species potential, validate the results of the present study.

As for the possible nesting in the area of species *Sterna lorata* and *Leucophaeus modestus*It is worth mentioning that this was recorded having even made a directed search for signs that denotaran it.

For *Sterna lorata*, the sectors in which the Project approaching the coast do not present the optimal nesting characteristics, while they are subject to several sources of anthropic pressure that seem to preclude its occurrence. Furthermore, these results are coincident with the specific study on the subject commissioned by the holder, which is presented in the Annex 3.3.

For *Leucophaeus modestus*, although there were large concentrations of individuals on the coast, it was found that the species does not use the area of the Project for playback. These results are consistent with the general knowledge that is about the species, which limits playback to the provinces of Antofagasta and Tocopilla, región de Antofagasta.

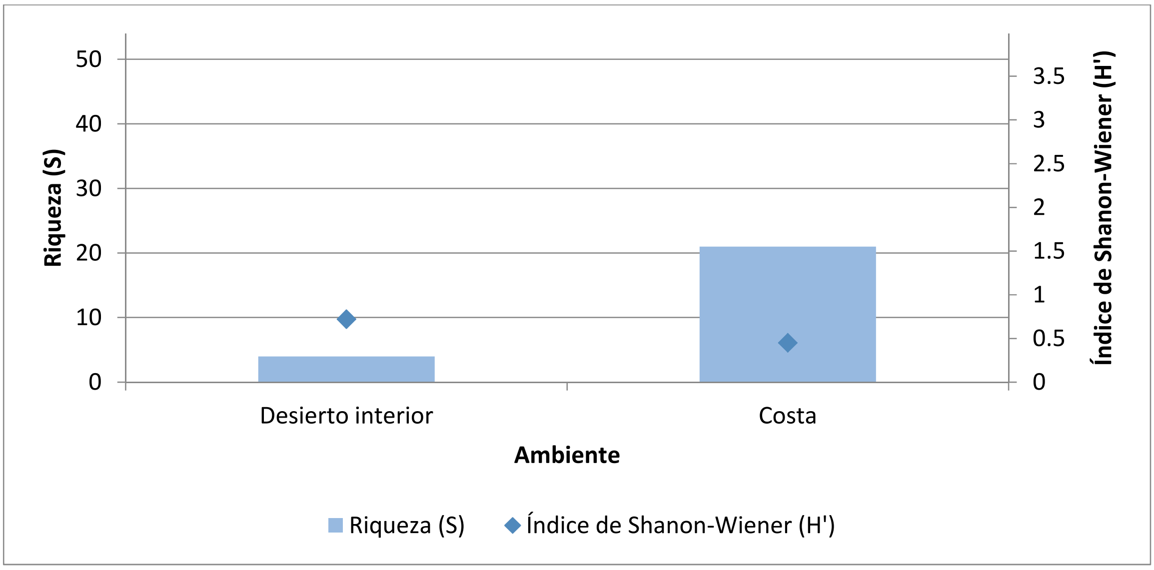
Regarding the non-registration of mammals, it should be noted that this is understandable given the low productivity of the study area. Rodents, for example, require of plant material for food, which is practically non-existent in the area of the Project.

iii. <u>Fauna Rregistered</u>

As for the fauna recorded in the environments present in the study area, it should be noted that richness was higher in Costa (S = 21) that in absolute desert (S = 4).

Although biological diversity was low in both environments, struck by the fact the upper value is presented in the absolute desert environment (H'= 0.72). This is explained by the relative evenness of the community associated with this environment; situation that contrasts with the absolute dominance of *Leucophaeus modestus* above the rest of the species on the coast environment)Figure 3-136).

Figure 3-136. Richness (S) and biological diversity index (H') for each environment fauna.



Source: Own elaboration.

iv. Sites of Iinterest for the Fauna

There was a single site of interest to wildlife ("reproduction Area of") *Oceanodroma markhami*""), which, in the light of history presented in the numeral 3.2.7.4iiIt is relevant.

As mentioned above, the first site of reproduction of the species was recently discovered in 1987 (Peninsula of Paracas, Peru), after which was speculated for a long time about the occurrence of nesting in Chile. To 2013 was informed about a site of nesting in the vicinity of Arica, which became the second place worldwide in which the reproduction of the species was confirmed.

Records of birds colliding both on the coast and in the interior of the province of Iquique gave account of the probable nesting of the species in the sector, however, no evidence had been documented.

The discovery of signs, which include nests with fresh footprints and remains of food, could well represent the discovery of a new site of reproduction for this species, which may be relevant (depending on the extent of the nesting) not only locally but also globally.

3.2.7.6 Conclusions

The design of this study - component bibliographic and field work - together with the implementation of techniques and an adequate sampling effort, allowed to properly characterize the componEnte fauna in the area of the Project.

In based on that work, there were two environments fauna and a site of interest, corresponding to a nesting area of *Oceanodroma markhami*,

There was a total of 24 species, of which nine have some category of conservation according to current national legislation. Within them, the species *Phyllodactylus gerrhopygus*, *Phalacrocorax bouganvillii, Pelecanoides garnotii* and *Leucophaeus modestus* they have categories that explicitly reflect a degree of threat

3.2.7.7 References

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3.3. Cultural Heritage

3.3.1 Archaeology Terrestrial

3.3.1.1 Objectives

The objectives of the present archaeological study are:

- Compilation of bibliographic information about the archaeological context of the study area.
- Identification of potential archaeological material in the area of direct impact of the Project, in the phases construction and operation.
- Recommendations aimed at the protection of the archaeological heritage, concordant with the Act No. 17,288 national monuments.

3.3.1.2 Methodology

First was a literature review looking for background information on the archaeological heritage in the study area, to which both public documents and literature was consulted.

Sources consulted:

- Database of EIA and day on the web site of the (environmental) assessment servicewww.sea.gob.cl).
- Online records of the Consejo de Monumentos Nacionales [2001-2013] (www.monumentos.cl).
- Specialist literature, including journals and archaeology national congresses proceedings.

The field work consisted of an archaeological survey pedestrian, by visual inspection, to cover the area of study through linear transects in the field, whose aim is to discover and locate the archaeological record on a defined area (Renfrew and Bahn, 2005). The work and the results set out in this section they correspond to the baseline, annex 3.9 report and 3.4 Annex complement complement baseline archaeological sector line of electricity transmission and underwater archaeology.

Figure 3-137. View GGeneral of the Area of study.

Is observed in Red the route of the projected in blue transmission line areas of the reservoir and the access road.
[Image satellite.] [Source: Google Earth 2013.]

The factors to be considered, which they affect the possibility of discovering archaeological sites are: the abundance and clustering, the obstrusividad, visibility and accessibility (Schiffer et al, 1978).

Abundance is related to the frequency of sites within a given space, and the grouping with the degree in which the sites are spatially aggregated. The obstrusividad is related to the sensitivity of a given archaeological material to be discovered by a specific technique. The visibility is related to the characteristics of the space to prospect and the difficulties of observation of materials (e.g. rocks, landslides of material, or the present vegetation). Accessibility relates to the existing conditions for power to theAnzar or enter a certain place and perform the required inspection.

In this case prospecting was carried out in a pedestrian way and oriented themselves to identify and record the presence of archaeological evidence.

The field work was conducted between 11 to 15 November and 16 December 19, 2013 by specialists in archeology Dafna Goldschmidt (Archaeologist), Paul Calfuqueo (LIC. in archaeology), Paula Urzúa (Archaeologist) and Jaie Michelow (LIC. in archaeology).

Land registration was carried out via notes field, digital photography and location by coordinates UTM Datum WGS 84 Thanks to use of equipment GPS Garmin GPSMAP 64s, Garmin ETrex, and HD Motion X GPS applications and GPS Tracks for iPad e iPhone.

3.3.1.3 Review Bibliografica

i. <u>General prehistoric background</u>

Human occupation in the area of Tarapaca data from very old days, registering from the archaic period, approximately makes 10 to 8 thousand years, in the stream of Tiliviche. There way of life focused on the hunting collection, adapted to a way of life of oasis. The coast, from the Western valleys of shrimp and Vitor was early occupied by lived characterized by burial tradition Chinchorro (7 to 4 thousand years old), while to the South, fishing communities developed a way of life clumps around the mouth of the Loa, hasjurisdic from about 4 thousand years ago (site Caleta Huelen 42) (Zlatar, 1983).

During the formative period local communities undergo a series of transformations, including the adoption of village life, the development of agriculture and pastoralism, as the emergence of new technologies (including pottery, management textile and mining knowledge). Is from this moment that tarapaquenos groups begin to develop its own identity, adapted to local resources and linked by transit and Exchange routes with the Highlands, the coast, the cultural node of Western valleys to the North and the oasis atacameños haci the South.

The local context is not strongly marked by the influence of the Tiwanaku cultural orbit, as they are other adjacent areas (Arica and San Pedro de Atacama), however, to shape up as an area of interdigitation, in which different influences cultural cross, it is possible to identify elements of this influence at the regional level. The disintegration of Tiwanaku as the core of interaction defines the beginning of the late intermediate period (1000-1400 A.d.), in which we observe the development of large towns (such as houses), and pukaras (including Camiña, Nama, Chumiza Jamajuga); smaller villages are observed in the coastal sector of Pisagua (Aguero, 2009).

The arrival of the Incas This territory has estimated about the year 1,400 of our era, incorporating the region into the cultural sphere of Tawantinsuyu and the imperial administration. The intervention Inca It is visible in the construction of roads, tambos, stores, among other evidence. This influence was relatively short in the context of prehistory, as it comes to an end in the year 1532, with the arrival of the Spanish conquistadores and the subsequent process of colonization under the Spanish Crown.

The development of archaeological work on the South coast of Iquique condition the type of information and background available for the study area. On the one hand there was systematic studies in the towns of Patache and hemp between 1965 and 1985 (Nuñez 1965, Moragas 1977, Núñez and Moragas 1977, and Nunez and Moragas 1983), as well as studies on towns such as low Molle, Face much and Cucufata, among others (Olmos and Sanhueza 1984).

On the other hand, in more recent years have resumed systematic investigations of the coast of Tarapacá, highlighting the Project Fondecyt 1080458 within which was conducted an intensive survey of the coast between Iquique and the Loa River, which realized more than a thousand cultural elements (Ajata-Mendez-Quirós, 2012), as well as the study of the coastal architecture (Urbina et al., 2009) and a Re-evaluation of the typologies of coastal ceramics (Uribe 2009).

Regarding coastal occupations, arises the presence of an occupational sequence from the archaic period to the intermediate late, with a greater presence of evidence during the formative period, which could be due to environmental conditions they favored human settlement (Moragas 2009).

Occupations in the coast of interfluve are strongly associated to the presence of the resource water, there is a relationship between the presence of watering holes and evidence of pre-Hispanic human occupations. Iquique and the mouth of the Loa include watering holes of Iquique, low Molle, Punta Gruesa, high cliff, Soronal and Punta de Lobos (Núñez and Varela 1967).

The first occupations of the southern coast of Iquique correspond to the archaic period, with harvesting hunter-gatherer populations, with an economy based mainly on the exploitation of marine resources (Moragas 2010); also emphasizing the practice of artificial mummification of the Chinchorro populations. "Classic Chichorro" evidence found in sites like low Molle 2, Chucumata, Patillos 2 (Olmos and Sanhueza 1984). On the other hand include archaic sites Caramucho-3 and hemp-1, which would be indicative of semi-permanent occupations in privileged spaces and desplazamietemporary cough to areas with fewer resources (Moragas 1995).

Then, during the formative period populations of maritime tradition received influences from the interior; resulting in the introduction of cultigens, ceramic, use of the loom and metallurgy (Moragas 2010), which is limited by the conditions of the environment. In the local coastal populations are elements from Chinchorro moments as instruments of maritime exploitation and turbans and coverage public, among others. The adoption of some of these innovations is evident in sites such as hemp-1 where there is presence of maize associated with ceramics. The largest coastal training evidence are located at the mouth of the Loa with the burials in tumuli (Caleta Huelen-10), but are less represented in the coast of interfluve (Moragas 1995).

For its part the mean period has little representation is this area (Moragas 2010), but although its influence is scarce has a long duration including the period of regional developments. Coastal evidence Tiwanaku correspond to a textile decor and tools for the consumption of hallucinogens in the cemetery hemp-3 of the phase IV (Moragas 1995).

The late intermediate period corresponds to the development of the Pica-Tarapacá complex between the quebrada de Camiña and lower Loa, constituting a socio-political unit consisting of two manors: Pica and Tarapacá; with a great agricultural productivity and a consequent increase in population and the emergence of villages. The greater exploitation of the coast took place during this period, some coastal settlements were colonies of oasis and Valley Interior, and others were of coastal groups that had contacts for barter or Exchange with the populations of the interior. On the coast somesites that demonstrate linkage with the interior corresponds to Patillos-1, the Green-1 cemetery and several sites found in the area of low Molle (Cemetery). There are also coastal sites without apparent influence Tiwanaku, as in the cemetery hemp-2 (phase V of the archeological district of hemp), in the Vicente Mena Creek and in the cemeteries of Chipana. Are also ancient finds from this period, such as that carried out by the settlers of the San Marcos Creek of bodies baled with polychrome listed textiles, apparently on behalf of a person that queri send them abroad (Moragas 1995).

Evidence of Inca presence on the coast son scarce. Patillos cemetery indicates the Incan influence within the population of coastal tradition, probably corresponds to Pica-Tarapacá population that receives the Incan influence from the inside. On the other hand, highlights the Incan influence more directly in the ceremonial burial of a girl in the Emerald Hill (silver in Huantajaya ore near) with presence of ceramic Cusco and inca Highlands, coca leaves, shells of Spondilus, among others foreign elements (Moragas 1995).

ii. Prehistoric background andspecific

Whereas the area where the works are instead of the Project on the coast, notably history archaeological sector of Chomache, that even though it is located south of the Caleta San Marcos is the closest area to archaeological evidence of the Project.

Chomache is a settlement located in a small projection into the sea, is located 3 km south of the Aguada of Punta de Lobos at the Cove San Marcos. Located 160m to the S-SW of site Chomache There is a panel of rock art with paintings. The site features with a conglomerate of five structures rectangurales, subrectangulares and squareoutside of which there is presence of garbage dumps (Urbina et al. 2009)

As mentioned above the occupations of the coast are related to interior spaces, like for example the oasis of Pica. Existed mobility routes that connected these spaces, which are associated with the presence of geoglyphs and apachetas or accumulations of stones.

An example of how the caravan routes connected the interior spaces with the Pacific coast is the route studied by Briones et al. (2005) corresponding to the transect Pica-Pintados-high Barraco. The authors suggest the hypothesis that the geoglyphs were among the 4,000 BC until the time of Inca influence, with a climax during the period of regional development the development of the complex Pica-Tarapacá (900-1450 A.d.) time which intensifies the traffic with the coast.

The geoglyphs known within the area close to the development of the Project they correspond to which are close to the Great Salt Lake with the sites called Salar Grande West, high Huanillos Sur-Este, Peninsula Hill, and Hill Peninsula South-East (Seta en. 1985).

iii. Background Historicos

Occupation in the historical time of the area close to the construction of the Project and complementary works focuses primarily on two sources:

e) Salinas de Río Seco:

The Río Seco Creek is located 80 km south of Iquique, salinas facilities operated since the end of the 19th century until 1958. The salt was extracted in salars of the coastal mountain range and it moved in wagons pulled by mules to the villages of shipment; in the caleta de Río Seco built a lift that moved the salt from the Great Salt Lake 18 km away. This situation changed when new investors installed grinding in the salar and Patillos Cove the port of embarkation in the mid-20th century. Now kept the Court drying and evaporation of salt, in addition to machineries (Moragas 2002) facilities. You can still see some vestiges in the location where the lift is intersected with the path projected from Río Seco to the reservoir area.

f) S facilitiesalitreras:

Between the last decades of the 19th century and early 20th century the saltpeter offices were very important to obtain the raw material for making fertilizer and explosives, until it was replaced by the nitrate obtained chemically. The systematic exploitation of the deposits of saltpetre in Tarapacá began between 1810 and 1812. Between 1850 and 1930, there were the "saltpeter" in the Pampa del Tamarugal and the Atacama deserts where they produced sodium nitrate from deposits of caliche (Calvo 2009).

Close to the area of the Projectapproximately 9 km north of where the transmission line intersects with route 5, are the remains of the nitrate Office Victoria. This office built between 1941 and 1944 in the grounds of the former offices Brac and Franka, using part of his constructions, and ceased their work in 1979 (Calvo 2009).

Former facilities Office Alliance, owners Mack Lean and Juan Williamson, and later NATO nitrate company, are located approximately 3 km north of the path electric transmission line close to route 5. Close to Buenaventura, Slavonia and Bellavista offices were also.

3.3.1.4 Results of field

Between 11 to 15 November and 16 December 19, 2013 was held the field visit in the Tarapacá region, the first campaign focused on the exploration of the interior sector West and coastal, parallel to the villages of San Marcos and Rio Seco the second campaign focused on interior sector included between the coastal cliff and route 5 North.

The inspected areas include:

- An area of reservoir
- Work area and tunnel of shock, of approximately 1.9 km in length (including an underground portion).
- Roads access
- Camp
- Transmission, approximately 65 km long line.

The sectors covered in this study are located in an area devoid of vegetation in the interior portion and sparse vegetation of xerophytic types in the coastal portion, characterized by sparse species and low-slung. Field corresponds to arid sediments characteristic of the Norte Grande, such as sand, gravel, abundant rocks at surface and occasional outcrops of salt type.

Figure 3-138: E areaStudio

Source: Own elaboration.

In the first place was a general appreciation of the site in order to obtain a characterization according to the following factors:

i. Accessibility

The study area comprises different sectors, one of them coastal, immediately accessible from route 1; the second sector and main, is located medial to the routes 1 and 5 North, corresponding to the sector of pampa, partly crossed by the route A-750, and finally, a third sector corresponds to Plains, means hillsides and a space of salar, between A-750 routes and 5 does not RTE, without formal Interior roads, accessible through the path of existing easement for a previous transmission line. The surface is irregular and variable slope, so the area is ccesible mostly by means of pedestrian access.

ii. Obstrusividad

The observed surfaces are unobstructed, without elements obstrusivos built, without cover vegetation, the soil is covered with a layer of sand of deposition wind, Pebble and a regular amount of highly fragmented Rocky nodules. The vegetation present specifically in the coastal sector, is made up of cacti and herbaceous xerophyte low-rise and partial coverage, which allows direct observation of the ground. Greater visual interference corresponds to the present vehicle tracks and the removal and aggregate accumulation observed in various sectors.

iii. Visibility

The visibility of the ground distance is of high quality, being able to spot a large area effectively. The visibility and medium findings in volume above the surface reaches up to 200 meters, still watching possible clear a person to this distance. As for the sight of the surface, using pedestrian traffic is evaluated observable up to 30 meters away.

iv. Abundance andgrupamiento

LWe registered points are dispersed and are for the most part composed of distant isolated findings. It failed to identify settlements, sites of rock art sites inside the study area or specific tasks.

Below are some examples of surface cover observed in the survey:

Table 3-75. Types of Cubierta Superficial Observados in the Prospeccion.

Image	Surface cover types
	Sandy's deposition wind

	Rocky nodules in surface
	Concretions salinas

Source: Own elaboration.

Archaeological prospecting was carried out as pedestrian following a path of transects linear adapted to the shape of the terrain, in way to inspect evenly cover the surface. The transects longitudinal were distributed in a network of between 50 and 120 metres away considering the particularities of specific area and the morphology of the land and theLTErations natural or anthropogenic.

The sectors covered in this study are as follows:

- Reservoir
- Area of operations and Discharge tunnel
- Access road
- Camp
- Transmission line

Figure 3-139. View Transectos R(ecorridos A) and B)..

Vapproximate ISTA of the transects ((A) areas of the reservoir and B) shock tunnel routes corresponding to the sectors. [Source:] Google Earth2013.]

The surface observed in areas A and B are presented prospectable in pedestrian way. The presence of vehicular traces was recorded along the route. The terrain of the area of the reservoir of furrowed by the vehicular route to-750 and the extreme west of the tunnel is adjacent to route 1. Is prospectó the area of the reservoir entirely, which is presented flat and trafficable, with optimum visibility, while projected tunnel was crossed at their ends, subtracting the segment which corresponds to the slope of the coastal cliff; the bottom segment corresponding to the tunnel is located in a sector currently toLTERADO by vehicle tracks and removal of aggregates.

Table 3-76. Views S(ectors A) and B).

Image	Description
	View of the average of the areas of the reservoir sector.
	View of the West reservoir area.
	Detail of vehicle traces to the inside of the reservoir area.

	Detail of aLTEration of the surface in the lower segment of the future gateway to cavern of machines.

Source: Own elaboration.

Figure 3-140. View Transectos R(ecorridos C) and (D)).

Approximate view of the transects (corresponding to the sectors C travels) access road and D) camp.
[Source:] Google Earth2013.]

Sector D, camp, is recorded prospectable in its entirety, is partly toLTErecent RADO by current activities of fishermen and seaweed fields, landfills and removal of aggregates. Sector C, equivalent to the path projected onto the Rio Seco Creek, was found prospectable for the most part, and can travel continuously 15 of the 16.4 total kilometres of its length, from the sector of the area of the reservoir up to a distance of 1 km from the coast; disruption is presented in the form of a steep slope and multiple landslides of rock. The coastal portion of the path corresponds to the levels of low-height of the coastal cliff, passable from the lower level, which is determined by the dry river Cove and three points of historical interest: Río Seco (in current use), the old cemetery Salina located in the coast to the West of route 1 and the ancient lift, formerly used for transportation of salt. Is the latter which sits adjacent to the projected path and overlap in a segment of 300 m.

Table 3-77. (View C sectors) and D).

Image	Description
	View of the sector of the camp.
	View of the sector of the camp.

	General view of the start of the road at the eastern end.
	View from the bottom of the dry River Gorge, coincident with the projected path.

Source: Own elaboration.

Table 3-78. C sectors views).

Image	Description
	View of the old salina.

	Detail of the saline pools.
	Detail of the old lift.
	View of the cemetery of Caleta Río Seco.

Source: Own elaboration.

Figure 3-141. View transects (tours and).

Overview of the sector E) transmission line, divided electrical lines projected into three segments, from East to West, pampa, salar and Cliff, in order to characterize in detail the total number of its extension.
[Source: Google] Earth2013.]

The proposed transmission line was prospectable almost in its entirety, whereas transects located on the design, slightly adapted to the particular characteristics of the terrain, and considering also a buffer of 30-50 meters of visibility direct visibility. The segment East, known as "pampa", is located in a plain extension, from the intersection with route 5 until an inflection in southern direction, which coincides with the presence of slopes and outstanding medium. The central segment, or "salt" coincides with an irregular sector, soft slopes and mid-rise, and crosses approximately 4 km on the Great Salt Lake, to the West end in the intersecion with the route A-750. The segment West or "Cliff" extends from the intersection with the A-750 route through soft and medium slopes to the area close to the areas of the reservoir, it is precisely in the portion closest to the coastal Cliff where the steep slopes they impede pedestrian traffic on the demarcated line. Should be noted that in the western sector corresponding to the cliff coastal, the route of the transmission line is visible in the still steep slope where direct access is not possible.

Table 3-79. View sectors E).

Image	Description
	View the current power line and the road to serfdom in the "pampa" sector.
	General view of the "pampa" sector and theLTEpresent rations by removal and accumulation of aggregates.
	Detail of salinas in the sector "salar" concretions

	View of the "Cliff" sector.

Source: Own elaboration.

As a result of the implemented archaeological survey was recorded the following archaeological finds.

Table 3-80. Archaeological finds.

Site/find	Description	Coordinates		Secondment	
		E	S		
1	Bottle	386470	7666591	Historical	
2	Bottle	382152	7677526	Historical	
3	Garbage dump	411611	7699415	Historical	

Site/find	Description	Coordinates		Secondment	
		E	S		
4	Garbage dump	411693	7699480	Historical	
5	Garbage dump	411688	7699294	Historical	
6	Garbage dump	390665	7679301	Historical	

Site/find	Description	Coordinates		Secondment	
		E	S		
7	Garbage dump	411629	7699378	Historical	
8	Structure	390420	7678942	Historical	
9	Nail	427448	7698436	Historical	

Site/find	Description	Coordinates		Secondment	
		E	S		
10	Cemetery	425134	7698522	Historical	 
11	Platform	424381	7698541	Historical	

Site/find	Description	Coordinates		Secondment	
		E	S		
12	Platform	423462	7698602	Historical	
13	Structure	404485	7697015	Undetermined	
14	Milestone	404929	7697219	Subactual	

Site/find	Description	Coordinates		Secondment	
		E	S		
15	Milestone	405762	7697424	Subactual	
16	Footprint	405732	7697419	Historical	 

Site/find	Description	Coordinates		Secondment	
		E	S		
17	Footprint	405946	7697479	Historical	
18	Ore	383158	7676859	Historical	

Site/find	Description	Coordinates		Secondment	
		E	S		
19	Site	380031	7672063	Prehispanic	 
20	Bottle	384168	7671305	Historical	

Site/find	Description	Coordinates		Secondment	
		E	S		
21	Garbage dump	384754	7670123	Undetermined	
22	Footprint	387518	7665621	Historical	
23	Structure	386817	7670128	Undetermined	

Source: Own elaboration.

The points of archaeological interest found include three segments of tracks troop of indeterminate, probably historical temporary secondment; These are multiple tracks of General characteristics of road Drover, which are all interrupted by current vehicle tracks and aLTEintensive portions, which is difficult to follow its extension; Note that none of the tracks was recorded surface associated archaeological material.

Other points of archaeological interest are circular structures or parapets; the lack of associated surface material hinders their chronological allegiance. In addition arise surface landmarks, accumulations of rocks, also lacking in diagnostic material, which are catalogued as subactuales.

Registered historical finds include a cemetery, close to the route 5 N, which is historical data and probably corresponds to the nearby nitrate; In addition, in the segment called "pampa" run designed, are recorded tracks and platforms for the former rail line. These are the most visible finds within the portion of the transmission line.

The only clearly pre-Hispanic material identified within the study area corresponds to a site with surface lithic material that lies within the sector of the camp projected. Was recorded exclusively material lytic not formatizadodispersed, which presents potential stratigraphic not disturbed areas, especially the adjacent to erratic blocks on the seaside terrace.

Figure 3-142. Image Complementaria of the SITE Prehispanico)H(allazgo n ° 19).

Figure 3-143. Image Complementaria of the P siterehispanico)H(allazgo n ° 19).

Figure 3-144. Extension of the Material Lítico Disperso in the SITE Prehispanico)H(allazgo n ° 19).

[Source: GPS-HD] Motion X]

Table 3-81: I pointsArchaeological interest

Image	Description
	Imprint of the railway line.
	General view of the visible traces in the "pampa" sector.
	Detail of the saltpeter cemetery.

	View of the saltpeter cemetery.

Source: Own elaboration.

3.3.1.5 Conclusions

Inside the study area was identified 23 points of archaeological interest; three tracks of lacking undetermined assignment of diagnostic material associated, probably historical, a lytic medium density set identified as the prehispánico, four data structures/milestones subactual or indeterminate, a historical cemetery of saltpeter time and platforms and imprints of the old railway. The remaining points correspond to garbage dumps or accumulations of historical material-subactualincluding the discovery of historic bottles and a mineral build-up.

Is not recorded in the database of the National Monuments Council monuments of historical, anthropological type or typical zones within the specific area of study or in immediate areas; It should be noted that the archaeological monuments are all those known or identified, by the only operation of law, without your express cataloging requirement.

To complement this study, is established in annex 3.4 complementary Base line of the project transmission line. It should be noted in these works, not is found relevant findings for this component.

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3.3.2 Underwater archaeology

The area selected for the location of the submarine sector of the project will occupy one area of approximately 0.03 has at a distance from the coast of 343 m in the sector of Bay Chomacheadjacent to la Caleta, San Marcos. Administratively, the sector belongs to the commune of Iquique, in the eponymous province of Ito I Tarapacá Region.

Geomorphologically the study area is integrated into the system of basins dry coastal desert characterized by the presence of a coastal cliff that extends for several kilometres of coastline, as a little abrupt cliff, stands out from its more northern counterpart by the presence of beaches and coastal terraces - the creeks Patache, hemp, Pintail ducks or San Marcos they are clear examples - and the absence of rivers or streams that reach the Sea (Diaz, Gonzalez and Nunez 1985:55). This Cliff is composed of granitic rocks of Cretaceous origin that delivered on the one hand the sea and, on the other hand, extends to the immediate range of the coast formed by marine volcanic and sedimentary rocks of Jurassic origin.

The coastline in this area is subject to the regime of prevailing winds from the S-SW and exposed to the strong currents of the OS. In this area, and the adjacent coast, tides are pronounced, with amplitude of 1 m average. However, despite this, this coastline is characterized by focus a high marine energy that makes the waves reach the coast with great force, causing progressive abrasion of marine terraces, and generating a Landscape coastal chaotic. Therefore, the coast is here characterized by low heavily beaten by the permanent waves, with the presence of numerous Bolognese and landslides of rocks that go into the sea by several meters.

Underwater archaeology in the extensive report is in annex 3.4.

Figure 3-145. The coastal sector in the area of the project concentrated permanently a strong dynamic that strongly influences the capricious coastal modeling.

As a source of resources for subsistence, this coastline has its greatest potential in numerous marine products: mollusks, crustaceans, and echinoderms that coexist in abundance with other vertebrate species both pelagic and benthic algae; which together with the rivers that bathe the sector, have made it a focus of attraction for human occupation since well early.

In this context, the project aimed at developing the proprietor will involve installation and operation in the Bay of a system of collection and discharge of seawater as a vital component for the operation of the Central hydraulic power generation. This intake is the beginning and end of a tunnel driving system to put this point in communication with the reservoir located at an altitude of 585 m /above sea level. In this way, the marine component shall consist of the following parts:

- Outgoing intake of 5 m diameter tunnel.
- Protection system consisting of a ring of concrete of 16 m in diameter and 1 m high anchored on the rock; concrete pillars anchored to the ring and a side gate of about 5 m in height; Center cap of 10 m in diameter, supported at the gate and on this cover, another gate of the same height as the previous.
- Section of tunnel 15 meters length and 71 ° incline connecting the external intake and the section of tunnel that leads to the cave of machines from which takes just pumping.

For the construction of the taking marina, will be held a perforation in the bed from the inside of the tunnel severing the last section in contact with the sea, building system known as "Norwegian shot".

3.3.2.1 Objectives

The elaboration of a body of background aims to contextualize, from the heritage point of view, the area of study, so that you can estimate whether it is an area of potential risk and how this would be affected by the development of the project. Considering that it precedes any archaeological activity, their results also allow to plan adequately further stages of in-situ observation and define with what intensity and under what techniques will be conducted.

3.3.2.2 Methodology

For the elaboration of the present body background It has considereddo the following type of documentary sources:

- Works of synthesis.
- Compendia or compilations.
- Documents (manuscripts or printed) file.
- Iconographic sources)primarily Cartographic).
- Previous archaeological papers published in specialized media.
- Previous archaeological work not published (reports/reports of research projects).
- Reports of preventive archaeology work carried out in the area.
- News in media of time.

3.3.2.3 Review Bibliografica

i. <u>Pre-Hispanic period</u>

Archaeological investigations on the southern coast of Iquique from from the 30s of the last century15, as well as the proliferation more recently the project that gave rise to preventive

[15] Véase en particular Moragas 1995.

surveys within the framework of the SEA16concentrated mainly in the Iquique-Patache stretch, have shown a high concentration of sites in the coast, logically settled around scarce water resources, focused on watercolors as low Molle, Iquique, high cliff, Punta Gruesa Patillos and closer to the project, in Punta de Lobos, Bay area Chomache and Soronal (Nuñez and Varela 1967-1968, Olmos and Sanhueza 1984, Moragas 1995, Moragas 1996, Larrain et al. 2001, 2004;) Ataja and Mendez -Quiroz 2012).

To date, unknown archaeological background relating to the Paleoindian, and until the early Holocene (10,000-7,000 B.c.), in the litoral of Tarapaca. Some authors do not rule out that this hiatus is due to a lack in systematic research in the coastal area, having shown potential sites for other sectors of the Atacama region, and relying on the presence of such sites in the South of the Peru, and in the coast of Taltal)Llagostera 2005; Santoro et to the. 2011).

The archaic (7000 BC-800 ad) period in the Iquique coast does not evince cultural manifestations until his late phase, phase V of Llagostera (3,000-2,000 BC:), with deposits distributed mainly in the sector of Patache-Patillos and the mouth of the Loa River. The relevant sites show a settlement pattern and relatively similar livelihood strategies, aimed at the exploitation of marine resources, through collecting, fishing and hunting marine, with later manifestations of "architecture that certain authors call maritime populations with architecture phenomena")Llagostera 2005: 131).

Patillos 1 to 13 sites show a settlement pattern based on semi-permanent camps, with cultural traits characterized by the presence of shell middens with skeletal remains of mammals and birds marine, elements of material culture and non-residential structures, that demonstrate a survival mode based on harvesting, fishing and hunting of marine resources, and may belong among the 4,000 and 1,000 AP) Santoro and Valenzuela 2006). Also, in the same sector, is evidence of the archaeological complex beach Canamo-punta Patache, where investigations have identified 15 and 34 sites respectively: phase district hemp I (2,500-1200 B.c.) is represented by the layers more deep in the large shell middens anamo 1 and 13. Patache E and J (6000-2000 BC) correspond to housing sites evidenced at the bottom of large shell middens by the incorporation of stone ("enclosures") structures. Culturally, this period is characterized by a traditional Instrumentation related to the exploitation of marine, which include hooks shell and cactus, weight of shell or stone; chips of quartz, projectile points; desconchadoresheaders of harpoons, bone whale baleen, knives semialunados, scrapers of quartz and basalt; Cantos rodados-hammers and stones to grind; Harpoon heads; useful and ornamental ropes of

[16] Puerto de embarque de sal en Patillos (Punta Lobos S.A.), complejo portuario para el mineral de cobre Compañía Minera Doña Inés de Collahuasi en Patache, terminal marítimo de Patache (TMP), y los proyectos ingresados en el SEIA: Puerto Cotitira, Central Patache S.A.

vegetable fiber and wool; carved wood, among others. Along with these materials, the presence in some places of seeds of carob tree and vegetation of medium aquifer (totoral, huiro, argentina) indicate a regular displacement of those populations towards the nearby cliffs and the Pampa del Tamarugal as another source of resources.

As for the funerary context, Patillos 2 site corresponds to a set of burial traits and cultural elements attributed to the Chinchorro culture, possibly having between 5,000 and 6,000 years old)Schaedel 1957, Núñez, 1969, Santoro and Valenzuela 2006:10): "deposit in dorsal decubitus, dyed red stark limbs, still bone reinforced with wooden rods, wrapped with fine twisted woolen yarns. Most of the skulls show deformation of annular type product of the use of turbans. As offerings associated bodies have been: spatulas and awls from bone, wood and bone Harpoon heads, strings of wool and vegetal fiber, desconchadores and beads necklace of shell, figurines, among other artifacts"(Moragas 1995:67).

At the mouth of the river Loa, on the terrace the Caleta site sits Huelen 42 (1,830 BC), village or camp-clumps comprised of housing structures of plant semi-circular stones with simple rows, associated with a deposit of waste preferably maritime origin and funeral burials under the inner floor, mortar composed of ashes of marine algae)Llagostera 1989: 70; 2005: 130; Tries, Méndez-Quiroz 2012: 44).

During the formative (800 BC-ad 1000), consisting of the coast between 200 and 860 ad (Ataja and Mendez-Quiroz 2012: 46), the maritime populations receiving influences of land Altiplano, although very moderate, and with them start new processes such as the introduction of pottery and the consumption of cultivated crops, phenomenon illustrated by the findings of ceramic coffee smooth homogeneous type (local and foreign) and maiz-calabaza (period agroceramico). However, aside from these contributions, the features of the maritime way of life, are preserved which is reflected in a set of elements of material culture that does not vary much with respect to the archaic.

On well documented sites of Patache-canamo, the formative period is the most represented period within the shell middens: Patache E, J, K, P, H, G, F, M, N, Q, L, B, contain layers with typical elements of this (Moragas 1996), the same time as hemp-1, phase II (860 BC) and III (200-300 A.d.) (Núñez and Moragas 1977).

The funeral process in this period also evolves to receive influences from the interior which are reflected in the mode of reburial of the body (side limbs semiflectadas), in the textile art (polychrome; grounds and different colors, referred to the indoor environments) and in the offerings, which incorporate different materials from the Highlands. In this context it is a burial found in the Patache G site, possibly can around the first millennium of our Era. (Moragas 1996:38-39).

The influence Tiwanaku (400-1200 A.d.), as the archaeological sites, are is weak on the coast. Is characterized by changes in the type of ceramic (shape, color/cooking and surface treatment: red, straight walls and bases) semiaplanadas), the treatment of the textile art and in the use of instruments of hallucinogenic inhalation, whose presence is always accompanied instrumental traditional employee at maritime exploitation (hooks, cactus, gathering shellfish, mesh bags desconchadores (or shopes, lines of cotton for fishing, etc.).

This intermediate period is represented in the sector by the deposits Patache L, B, C with (Moragas 1996), as well as in hemp 3, phase IV (760 A.d.): the latter corresponds to a cemetery of 23 cemeteries, whose material has the characteristics previously mentioned (Núñez and Moragas 1977).

Regional development Pica-Tarapacá (late intermediate period, 1000-1400) corresponds to a "colonization of the coast by manors of valleys and oases" (Moragas 1996), whose territory would have composed a single socio-political unit and whose economy is supported a strong component of agricultural, thus promoting its demographic expansion. During this period there is "intense movement of products from different ecological environments" (Moragas 1996:10), which meant trade between the coast and the interior: the coast came the surplus produced inside (theSquash, corn, beans, chili, etc.); from the coast brought seafood, salted fish, salt, guano, etc. The material culture during this period appears to be the result of a syncretism between ancestral traditions, with archaic traits (instrumental for maritime exploitation, notable among which are the remains of Wolf leather raft) and recent influences, Tiwanaku (instruments for hallucinogenic inhalation) and the complex Pica-Tarapaca, reflected in pottery (more elaborate forms; smoothed, trowelled, striated treatment), textile art complex of wool, and consumption and "import" of cultivated plants; where can be difficult to establish a chronological limit clear between them.

In the Bay of Chomache have been evidenced several sites dated to the intermediate late, these different kinds of being: panels with rock art, quadrangular enclosures and garbage dumps, whose study has allowed to reconstitute phases of occupation, and to outline a pattern cultural where the influences of the Highlands seem to coexist alongside maritime cultures pronounced, as the exploitation of marine resources or the iconography of panels, with marine species and manned rafts: Chomache 58, associated with sites Chomache 1, 51, 61 and 62 (hair, Gallardo and) Odone 2013).

From an archaeological point of view, these vessels only have been able to be shown on terrestrial sites, funeral context; being through other important contributions: the chroniclers and ethnographic investigations (Nunez 1986; Núñez and Contreras 2009). It should be noted in view of the present study, the constituent (organic) material of those boats returning very unlikely, in case of being shipwrecked, that they could have been preserved under water.

The period INKA It has left little mark on the coast: a aryballos found in the cemetery Patillos 1 it would be all the repertoire that represents this moment in the littoral)Schaedel 1957, 1965 Nunez, Nunez 1969).

Accordingly, the analysis of references and in the light of the findings made so far, it can be inferred that coast the Strip understood between Iquique, Chomache and the Loa consists of an old and long well evidenced pre-Hispanic human occupation, mostly from the formative period, with numerous coastal archaeological sites, with similar characteristics, some yet unpublished (Santoro and Valenzuela 2006:11).

ii. Geomorphological evolution of the coast and its impact on the population in the coastal area during the Prehispanic period

Regardless of the lack of systematic research that our coastline is characterized with higher allusion has already been made thatmainly to the end of the Pleistocene and early Holocene (Ota and Paskoff 1973; Mena 1995; Jackson and Prieto 1998; Jackson 2002: 34; Pine and Navarro 2005), it has been postulated for this moment in our past that the vacuum of information about early sites of coastal adaptation could be made in relation to the processes glacioeustaticos that occurred in late Pleistocene and early Holocene - research suggests to our shores a geographically uneven transgression, with a maximum level reached between 9,000 AP and AP 6,000-7,000, according to the regions, during the transition Exist, then back up to the current sea level (Mena 1995; Carabias 2001; Island *et to the*. 2012)-; geotectonic phenomena that influence variations in sea - and making more complex, if possible, their interpretation-which would mean a conjugated progressive flooding of the coastal landscape that would have submerged, and possibly preserved, some of the settlements of the Paleoindian and the early archaic (Nuñez *et to the.* 1994; Jackson and Prieto 1998; Carabias 2001), as happened in other American contexts (Faught 1992, TRC Environmental 2012: 17-47). This approach would exclude, *a priori*that are preserved under water sites of age the maximum marine transgression, which Yes are evident in the current coast.

However, the ability to keep early sites under water, poses another problem: the nature of the expected archaeological - shell middens, bones, lithic material-, returns that possibility very dependent on geological conditions and environmental optimum conservation, postulating some researchers the areas of estuary and deltaic, among others, would be more likely to provide these conditions (Stright 1995; TRC Environmental 2012: 141-145; Gusik and Faught 2011); While other authors estimate difficult to submerged sites to withstand the prevailing ocean dynamics in the Chilean coast (Jackson 2002).

Within this framework of discussion, it is worth adding that, until now, are not logged history of underwater archaeological sites in Chile associated with an early occupation, just as there are studies on changes in the configuration of the coastline, well by processes glacioeustaticos, either by geotectonic processes, applied to the area covered by the present report; reasons why it is not possible to issue a ruling for or against the application of these hypotheses.

iii. Historical period

In historical times, the sources refer to a fledgling maritime traffic in the area which would make centers as Arica, blanket and Iquique, noteworthy enclaves under the direct administration of the Viceroyalty of Peru. The coast of Iquique, this maritime activity possibly to put it there in connection with the extraction of guano that is documented since 1536 Isla Serrano and the immediately subsequent (1556) the silver mine of Huantajaya (Benavides, Pizzi and Valenzuela 1994:36). However, this coast was nothing more than a passage for ships that sailed for the colony between the ports of Penco (and later Valparaíso), Callao and Panama; route for which the anchorages of Coquimbo, Copiapó, Cobija and Pisagua they served as points of support.

Towards the year 1565, the area Chomache-Guanillo It is incorporated into the tenientazgo of Tarapacá, "political and administrative unit which stretched between the quebrada de Camarones North and Tocopilla to the South", being the Valley of Pica Hispanic administrative control of the southern sector of Tarapacá "header". The indigenous populations in the encomiendas of Pica and port Loa are progressively incorporated into the Hispanic economic system; on the coast the economic activities basically focus on traffic of dried and salted, fish a tribute paying coastal indigenous populations to supply centers habitacionais the altiplano and whose organization was controlled by local Hispanic officials in port Loa (hair, Gallardo and) Odone 2013: 59-60).

Bay Chomache and caleta Río Seco, as recorded on background, have had no activity of some importance to termI inando almost the 19th century:

"... in this place]Guanillo] loaded guano at the end of the revolution of 58. [...] There are no permanent inhabitants there. [...] The tip of Chomache located 5 miles to the North is completed by various rocks and cliffs that come out or up to more than one mile. They are visible as a result always burst the sea upon them. On the N. side of this point forms the coast a regular inlet known by Bay Chomache. Your berth is nine to thirteen fathoms near Earth. Uninhabited place." (García and García 1863: 19).""

Figure 3-146. Commercial map of Peru, by Gabriel Cueto, 1874. Detail which can be seen the main maritime defeats and the major ports/bays of the section Pisagua-Loa, at the start of the last quarter of the 19th century. Source: Bibliothèque Nationale de France, GED-2261.

The entrance of the 19th century is, however, an important new impetus for navigation in Chile since the opening of the maritime trade not only will extend the interest of some of the big commercial houses and foreign sailing companies settle in the country, but also by the emergence of other new Foundation)Couyoumdjian 2000). as well as during the first half of the ninth tenth century they will enter in scene international companies of navigation as the founded by William Wheelwright under the name of Pacific Steam Navigation Company (Le Dantec 2003:274-277, Calderón and Schlotfeldt 2001:321-322), Chilean ports, principally Valparaiso, turning into major enclaves within the trade routes on the South coast of the Pacific, in competition with as relevant as El Callao centres, main port during the Viceroyalty)Couyoumdjian 2000). Thus, the saltpetre exploitation become Iquique pier of this mineral product extracted in the region bound for Europe - the first shipment sent without passing through the port of callus occurred in 1830 (Benavides, Pizzi and Valenzuela 1994:43)-, and its importance as a port city will be reason for the installation of an agency of the Pacific Steam Navigation Company - the Peruvian authorities declared it higher in 1855 port (Bermudez 1963).

Locally, highlights from 1874, the implementation and the opening of three important Brazilian ports in the litoral of Tarapaca, the guano of the Peru South, which must compensate for the Peruvian Government the decay in the performance of the productions of the Chincha Islands, at the beginning of the Decade (Mendez-Quirós, Sanchez and Henríquez 2011).

This is how the ports of Pabellón de Pica, Punta de Lobos open almost simultaneously, following recognition of studies carried out by the engineer Thierry commissioned by the Peruvian Government, and Guanillodistanced respectively of the area under study of the report 23, 11.5 to 10.5 km, approximately. Under this consideration, it should be noted that part of the terrestrial archaeological survey developed within the framework of the project Espejo de Tarapaca was inserted in the vicinity of an area of historical guano exploitation, dating back to 1874 and the first half of the 20th century, extending between Punta de Lobos and caleta Río Seco: coastal sector of the reservoir (environmental management consultants 2014: fig. 3-146).

Since the Peruvian administration at the time in which the tarapaqueno territory joins the Chilean territory (1874-1879) and the guanero port of Punta de Lobos meet a relatively important activity, marked by the installation of an establishment Guano in caleta Río Seco, an establishment which has houses for employees, barracks for the pawns, tents for the Chinese workers, offices of the Administration, port authority, stores, as well as a desalination machine of water, which supplied also the establishment of Pabellón de Pica. A small fencenition also protected the interests of the management company of the loading of Guano. Railway lines connecting then the population with the guano in Punta de Lobos, where the material was extracted and embarked from three Springs, in bulk, through the hoses where passed the material to be loaded into boats or barges that would then supply ships anchored in dem ANDA guano)Zolezzi 1993; Mendez - Quirós, Sanchez and Henríquez 2011). The people counted in 1876 with more than 1,000 inhabitants.

The earthquake and tsunami of the 9 may 1877 that plague the coast between southern Peru and the Atacama desert does not have many consequences for the establishment to other ports such as flag of Pica, or mussels, completely destroyed. The main damage are recorded in the fleet of 15 ships of the guano that were then anchored and that the majority suffered mishaps of different amplitude to be catastrophic for two of them, the American boat Shamrock, and the Italian boat Maria Antoniettathat they sink, submerged by the departure of the sea caused by the strong earthquake)Lomnitz 1970; Barros 2010).

The other guanero important port, next to Punta de Lobos and Pabellón de Pica, was the of Guanillo (Zolezzi 1993; Sanchez, Mendez-Quirós and Henríquez 2009). The settlement was a town north of the tip, with homes and houses, administration and captaincy, Interior, hotels, judged, among others. at tip Guanillo the covaderas from which projected shipment of guano docks were situated. In the anchorage became arriving up to 20 vessels of different nationalities simultaneously in product demand, although mainly British. The history of the guanero port of Guanillo develops in parallel to other settlements: a first phase of exploitation of Peruvian export (1874-1879); exploitation of Chilean export (1879-early 20th century); and finally the operation aimed at the domestic market, with the installation of the National Fertilizer Company, in operation until the end of the 1960's.

High maritime traffic inherent to the development of this activity in the port of Guanillo, especially between 1874 and the end of the 1960's, it has resulted in the creation of a very busy sea route, connecting initially Callao with the settlements of the South (three Brazilian ports numbered between 40 and 60 ships sailing to the anchor in his fo ndeaderos), and then between these and the national ports; Valparaiso in particular.

The disaster affecting the coast on May 9, 1877 was also serious consequences for this southern-most guanero port, with complete of housing and port infrastructure destruction, as well as significant losses between vessels that were then anchored, many of them charged by full and ready for the sailing date. That night, the earthquake followed by tsunami, caused the sinking of vessels (table 1).

During the war of the Pacific, Guanillo it suffered the same fate as Pabellón de Pica. Twice, during the months of April and may 1879, the Chilean squad comprised vessels Blanco Encalada, O'Higgins, Chacabuco and Cochrane, with the purpose of annihilating the power the Peru, then supported on guano incomes, financial proceeds to systematic destruction of docks, and boats that resupplying ships of guano. Having been ordered to evacuate the berth before the attack, 27 Brazilian ships that anchored then, saved from destruction, therefore there were only small boats losses.

After passing the territory under Chilean administration, the guano of Tarapacá are managed by the national authorities. The activity continues, but in proportions that are decreasing as stated the saltpeter as fertilizer substituent and is settled the question of the profits generated by the guano of Tarapaca after the war of the Pacific, towards the end of the 19th century. Thus moving more North the main centres of port activity on this coast, on the northern coast of Iquique.

Even Thus, and in parallel, will remain a guano activity increasingly more artisan, the main centers of operation, both in other side points: Punta de Lobos, of course, but also in Bahia Chomache (Wiese 1950; Hair, Gallardo and Odone 2013: 60). From the Decade of 1940, the Chilean society of fertilizers, in response to the crisis suffered by the nitrate industry, and offering a new alternative to fertilizers and national agriculture market, will reopen the main establishments Brazilian free-tailed (Pabellón de Pica, Punta de Lobos, North Guanillo(, Mussels from the South, among others), rebuilding infrastructures (docks, lifts) and reorganizing an economic activity in terms of the time and a logical partner radically different from that prevailed in the 19th century)Wiese 1950, Mendez-Quirós, Sanchez and Henríquez 2011).

That is how the development of a strong economic activity in a portion of the coastline devoid of resources, resulted from the mid 19th century, an intensification of maritime traffic that caters major enclaves in which such activity focused .

Consequently, the flow of ships to be recorded in the sector since the 19th century product of all this activity, converts to the boat in one of the main elements to be considered in the historical period, allowing you to think a priori that this activity trade can contribute to enrich the archaeological heritage of this coastline. Considered thus, the wreck17 It stands in a type of archaeological site of special attention for the purposes of this study.

The tracking of documentary sources concerning the sector of Bay Chomache and its surrounding area at this time would then be oriented to obtain a list of shipwrecks in the area, throwing in the first instance not fewer claims (9) concentrates between Punta accidents Guanillo to the South and Punta Lobos by the North, which are chronologically linked to the last two centuries: the oldest documented (8) belong to the 19th century, while the more modern (1) is inserted in the 20th century.

Table 3-82: N ratioaufragios TOborne by the TOnalysis of the Fuent Documentales and Bibliograficas.

Name	Type	Year	Location	Cause	Sources
19th century					
Avonmore	Frigate	1877	Port Guanillo	Tsunami	Zolezzi 1993 Mercurio of Valparaíso, 17 may 1877
Conference	Frigate	1877	Port Guanillo	Tsunami	Zolezzi 1993 Mercurio of Valparaíso, 17 may 1877
Conway Castle	Frigate	1877	Port Guanillo	Tsunami	Zolezzi 1993 Mercurio of Valparaíso, 17 may 1877
Gabriel Castro	Boat to steam18	1877	Port Guanillo	Tsunami	Zolezzi 1993 Mercurio of Valparaíso, 17 may 1877
Geneva	Frigate	1877	Port Guanillo	Tsunami	Zolezzi 1993 Mercurio of Valparaíso, 17 may 1877
Maria	Barca	1877	Punta de	Tsunami	1901: 472 Vidal;

[17] Tecnicismo empleado en Arqueología para denominar a todo resto náufrago, sea un barco, partes de él o bien su mercancía.
[18] Otras fuentes reportan que se trataba de un pontón: diario *The Mercury*, edición del 30 agosto 1877.

Antonietta			Lobos		Zolezzi 1993
Shamrock	Barca	1877	Punta de Lobos	Tsunami	1901: 472 Vidal; Zolezzi 1993
¿?	Boats	1879	Port Guanillo	Armed action	Zolezzi 1993
20th century					
Tile	Steam	1923	Tip Chomache	Pilot error	Bascuñán et to the. 2011:783-784

Source: Own elaboration.

The analysis of the sources allows us to conclude that the reasons are cause of sinking of registered vessels are essentially three: natural agents constitute the main reason - 77.7% of the cases are related to the tsunami the 9 may 1877 –, followed by collision by pilot error and the fire that affects the oldest ship when it was sailing with a cargo of saltpeter from the port of Iquique to Antofagasta; and the collision in which, by human error, is wrapped with steamed America most modern ship.

3.3.2.4 Conclusions

Although the archaeological studies on the coast South of Iquique They demonstrate the existence of an occupation from the archaic period by groups of coastal adaptation that leverage combined terrestrial and marine resources What is found for development costero of the project by the found sites in ChomacheNo found no references to other possible findings under the water that are associated with human occupation of this sector in pre-Hispanic times.

In historical time, although one notes maritime activity during the colony, the same will not experience a real boom until the entry of the first half of the 19th century, when occurs the liberalization of trade and the development of the activity linked to the exploitation of the guano and the saltpeter. The consolidation of guano exploitation and its points of boarding camps, characterized to the study area with a maritime Dynamics not registered in other sectors of the coast: the study area is located roughly equidistant between anchorages of Tip Guanillo and Punta Lobos. On the one hand, this would explain that the most common site for this moment is the wreck; and, on the other hand, the documentary sources make referencemostly, to shipwrecks from the 19th century and earlier not, given that in this century is concentrates on this extractive activity and, in addition, the consolidation of the city of Iquique as a major port. In this way, It's possible understand the index of shipwrecks provided by sources and, secondly, Contextualising references obtained after the analysis of the historical documentation.

With regard to the position of registered documents references, the same sources provide guidelines which suggest that none of them entering the area of influence of the project: two foci of higher concentration of sites correspond to tip Guanillowith 6 references, and Punta Lobos 2;

While both total 88.9% of claims, we can say that the distance from each point to the area of influence of the project (10.5-11 Km) is sufficiently wide as to the development of the project could constitute a serious threat. 11.1% of the remaining references corresponds to the site (steam tile) associated with the name of Punta Chomachenearest point to the study area if it is occupied with other references, but separated from this about 3.5 Km, it also seems a distance large enough for construction of the tomaboca You can generate impact on the possible wreck.

As a result, although de lor exposed above we can deduce it there is no records relating to the existence of assets in their categories of historical monument, archaeological monument or typical zone in the area of influence ofl maritime sector project that allow *a priori* set up caution in the implementation of the same, This assessment could only be conclusive by the finding of such a situation through an archaeological survey. This framework reminds that, executing the works, any find It occurs in the course of engineering works should be communicated to the competent authority in order to comply with provisions of the regulations in force (law 17,288/1970, art. 26 and DS 484/1990, art. 23).

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3.3.3 Paleontology

3.3.3.1 Introduction

The This report corresponds to the characterization of the paleontological Heritage component in the area of the Project Central hydraulics of pumping Espejo de Tarapacásited on the outskirts of caleta San Marcos, commune of Iquique, Tarapacá Region.

This characterization is included under letter f.6 of article 12 of the regulation of evaluation of environmental impact (Supreme Decree No. 95 of 2001 of the Ministry Segpres), in order to determine if there is impact on the execution of the Project on the paleontological heritage, according to stipulated in (f) of article 11 of law 19,300/94 of the environment General Bases. Is noteworthy that both fossils and paleontological sites that they may be protected by law No 17,288/70 national monuments by the only Ministry of law and are the property of the State of Chile, while his speech is regulated to through the Supreme Decree No. 484/1990 (regulation on prospecting and/or anthropological, paleontological and archaeological excavations), as well as any damage that is ocasinAre on this heritage is penalized by the above regulations.

For the fulfilment of the above, we conducted a bibliographic and field review on the part of the M.Sc. in geology mention paleontology and DRA. in ecology and evolutionary biology, CarolIna S. Gutstein, and the Bachelor of Sciences mention of biology and Magister (c) in life sciences, Ana Valenzuela Toro, between days 15-19 October the 1 and 3 December 2013. We evaluated the entire area of the Project. Land, was in focus in the rocky outcrops that may contain paleontological objects (fossils) and their geological context information.

For the purpose of this report is considered the term "fossil" as any evidence of past geologic, prior to the Holocene (greater than 10,000 years before the present), which present a structure of organic or biological origin, or traces of their activity) plants, invertebrates, vertebrates, treads or traces; Carvalho, 2010). Fossilization occurs due to a concatenation of events through which an organism, a part of it, traces of his activity, metabolism or behavior, become part of the fossil record. In other words, the fossilization process covers ince the death of the body until the discovery of his remains in a geological formation of sedimentary origin)Holz and Simões2002).

On the other hand, volcanic or igneous rocks do not have, in general, potential fossil given the high temperatures involved in its formation process not allowing the preservation of biological remains)Tarbuck and Lutgens2005; Carvalho, 2010). It is important to highlight that occurs the process of fossilization, the rest, trace, you mold or contra-molde of the individual must be preserved throughout the process of diagenesis. This corresponds to the process by which sediments (sand, silt or clay) or the original magmatic material are consolidated, forming the rock. This takes place either by changes in temperature and pressure caused by the cooling, in the case of igneous rocks (of volcanic or magmatic origin), or the accumulation of layers of sediment and tectonism in the case of the sedimentary rocks. Given the high temperatures related to the genesis of igneous rocks, usually are not preserved fossils, then being sedimentary rocks have the potential fossil.

In order to define, delimit and characterize paleontological sites, team paleontologas undersigned presents the following report where a literature review and field area is made to intervene by the Project in the perspective of heritage paleontológico and of the existing legal framework (see annex 3.8).

3.3.3.2 Objectives

i. General objective

Identify the presence of paleontology (fossils) heritage in the area of influence of the Project.

ii. Specific objectives

- Characterize the paleontological component recognizing biological groups which are represented, plenty of them, extension on surface of the outcrops of interest, stratigraphic provenance of the fossil remains, uniqueness and meaning of registration, geographical location and identification by means of photographic record.
- On the basis of the scientific-cultural value that is recognized for paleontological objects recognized, propose measures for the protection of the paleontology heritage according to the legislation in force of national monuments 17,288/70 and D.S. N ° 484/1990.

3.3.3.3 Methodology

The study methodology is divided into two stages:

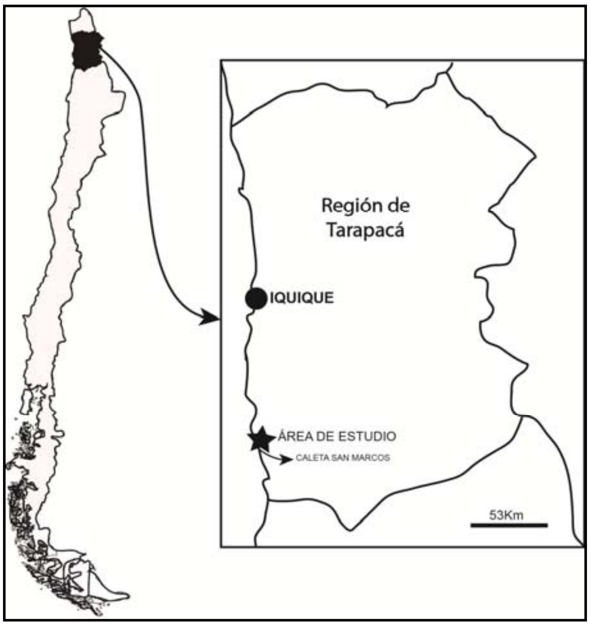
In a first stage was reviewed the available geological mapping of the area of influence)SERNAGEOMIN, National service of Geology and mining Sheet Santiago This is contrasted with the sector satellite photographs)Terrametrics©-Google Earth) with the aim of identifying previously available to the geological units that could represent a potential for palaeontological finds. All of the above, pointing to recognize these geological units in the on site inspection on the basis of its lithology and previously described fossil content. Those units which will be eventually intervened by the works corresponding to the empowerment of trunk roads, reservoirs, workshop areas and wineries, camps and access and location of towers and Winery's facilities were identified in According to the placurrent imetria of the Projectassessing the presence/absence of fossils.

The field work was carried out by Dr. Carolina S. Gutstein and the Bachelor and master's degree in biological sciences Ana Valenzuela Toro candidate, between 15 and 19 October and the 3 and the 5 of December 2013. To access the areas of the Project We used a 4 x 4 vehicle. Then, proceeded to a pedestrian visual inspection of the outcrops in the area of influence of the Projectas well as from the outcrops of rocks that were near points evaluated, in order to determine if these exposures are or no sedimentary rocks consistent with potentially fossiliferous units known for the area. Evaluated points were georeferenced in UTM (spindle 19K, WGS84 DATUM) coordinates.

i. Location and DeScription of the Project

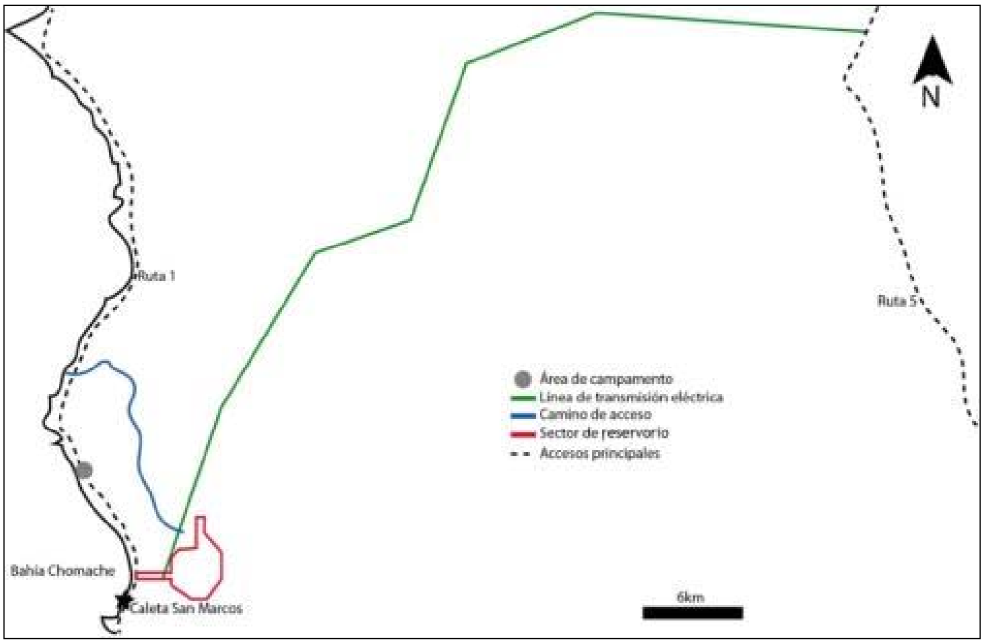
The sector's bookRiver, including facilities tasks, path of service, connection and approximation and canal zone) It lies to the NE of the San Marcos Creek, about 110 km to the South of the city of Iquique, along Route 1 in the Region of Tarapacá. Include also a planned tunnel, turbines and access located on the coastal cliff to the NE of the Cove. The camp area corresponds to a small rectangular area coastal (approximately 140 x 190 mm), located to the North of the main area of works between the following vertices (coordinates UTM, zone 19K): A, 379990, 97-7672063, 21; B, 380057, 7671884-00, 00; C, 380120, 08-7672116.75; and D, 380195, 00-7671934, 00. Additionally a path called access road, comprising a length of 20 Km approximate clinches address n-ne of Caleta San Marcos (see Figure 3-148), On the other hand, the sector intended for the construction of pique gate, slaughter, control, workshop, wine cellar and room facilities, are all concentrated in the coastal area approximately 1 km to the North of the mentioned Cove. Finally, the Project It is completed with the layout of a electric transmission line extending for about 70 km in direction NE from the reservoir area, reaching route 5 North, in the substation.

Figure 3-147. Diagram of the location of the Project in the Region of Tarapacá.



Source: Own elaboration.

Figure 3-148. Outline of facilities of the Project.



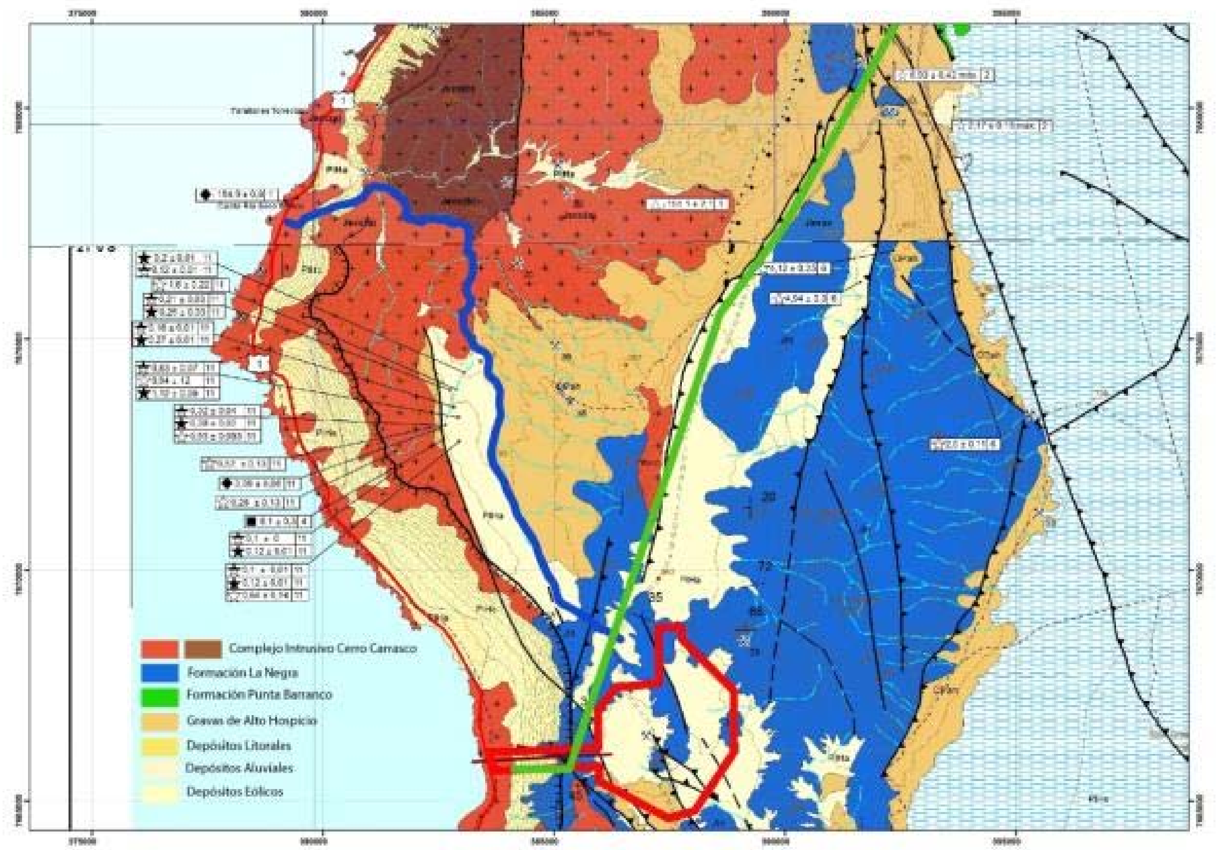
Source: Own elaboration.

3.3.3.4 Results

i. Area of geological context.

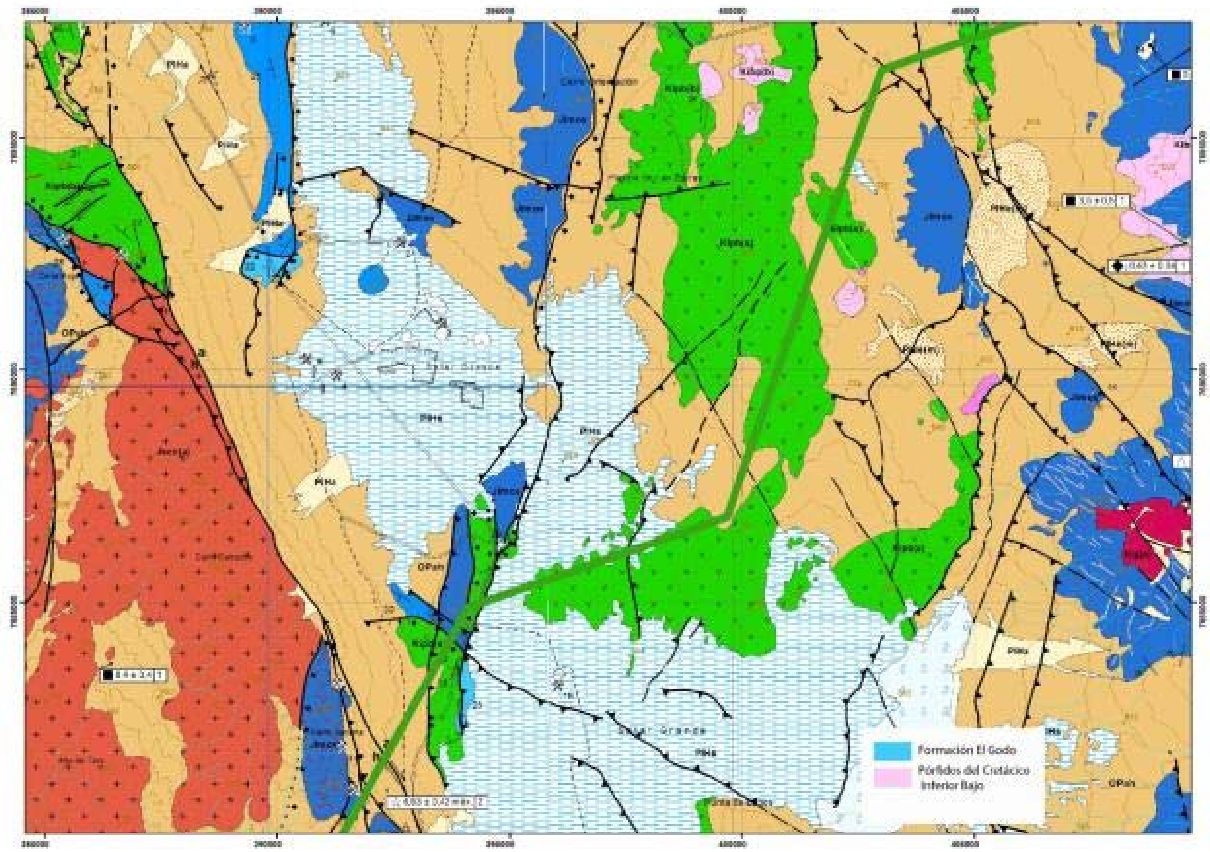
Based on the literature review and the field work was achieved to determine that in the area of the Project There is a predominance of the following units: training Office Viz, Forming the Goth, training La Negra, training tip Barranco, Cerro Carrasco intrusive complex, gravels of Alto Hospicio, ancient alluvial deposits, deposits colluvial and salt deposits. Additionally, identified the presence of coastal deposits in coastal areas of the Project. The descriptions of the units was taken from Quezada et to the., 2012 and Vasquez and Sepulveda, 2012.

Figure 3-149. The geological units present in the sector scheme of the Project. Blue line shows the path to the project; red line shows the outline of the reservoir sector and Green shows the layout of the electric transmission line. Modified from Quezada et to the. (2012).



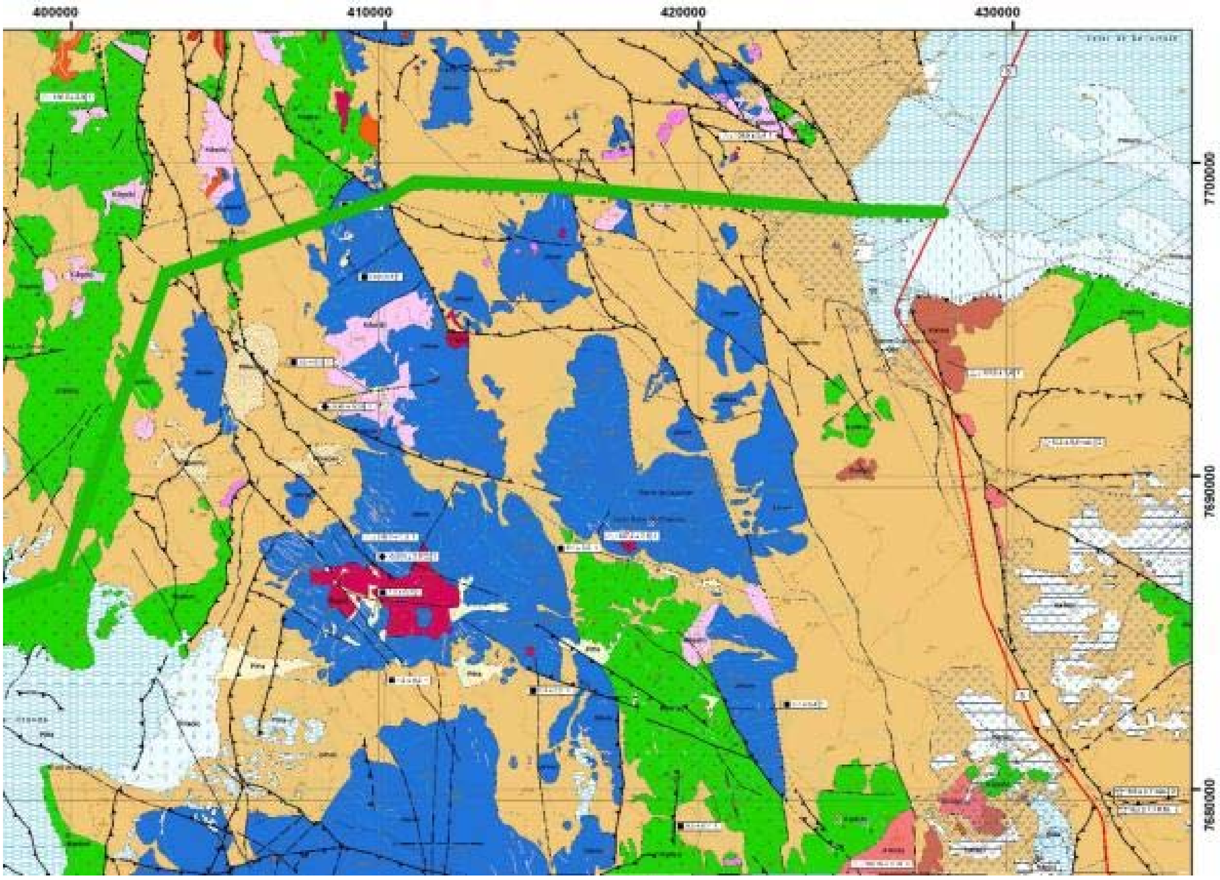
Source: Own elaboration.

Figure 3-150. Scheme of the geological units present in the electric transmission line (continued). The green line shows the continuation of the path of the transmission line electric. The colors assigned to each unit follow the criterion used in the Figure 3-149. Modified Sepulveda et to the. (2012).



Source: Own elaboration.

Figure 3-151. Scheme of the geological units present in the layout of power transmission (continued). The green line shows the continuation of the path of the electric transmission line. The colors assigned to each unit follow the criterion used in the Figure 3-149. Modified Sepulveda et to the. (2012).



Source: Own elaboration.

g) Training the Goth)Jmseg; Bajocian(-Oxfordian):

Corresponds to a sedimentary sequence marina, fossiliferous, composed by Shales limestones with intercalations of volcanic rocks underwater and limestone.

h) Training Office Viz (Jimov; Sinemurian?-Bajocian):

It corresponds to a monotonous continental volcanic sequence constituted by basaltic andesites amigdaloidales.

i) Complex Intrusive Cerro Carrasco, Indiferenciado)Statistical; Upper Jurassic):

Corresponds to quartz monzonite of CA and biotite; dioritas two pyroxenes; and dioritas of synmagmatic and epidote.

j) Training The black ()Jln; Sinemurian-Kimmeridgiano):

It corresponds to a sequence of lavas and gaps, with marine sedimentary collations. Volcanic rocks are of dark colors with solid stratification and lavas andesitic, porfiricas, tuffs and volcanic breccias. Within the Projectfew outliers were detected mainly in the sector NE being mainly composed of lavas andesitic.

k) Alto Hospicio gravels)OPah; Mioceno-Plioceno):

It corresponds to blocks, gravels, Sands, silts and clays semiconsolidadas and consolidated, clasts of alluvial origin, with intercalations of volcanic ash.

l) Deposits toluviales TOntiguos)PlHa; Exist):

They are blocks, gravel, sand and silt with intercalations of ashes that accumulate at the bottom of ravines, alluvial fans and hillsides. These deposits are formed by blocks, gravel, sand and silt composed of angular clasts and little consolidated to subangulosos of origin andesitic with collation of ashes. Within the area of the ProjectThese deposits are distributed in a limited way.

m) Deposits Coluviales (PlHc; Exist):

They correspond to the blocks, gravel and sand polimicticas with angular clasts to subangulosos (mainly of origin andesitic) deposited towards the foot of the slopes of steep slopes where alluvial cones can be constituted by filling streams. In the present Project This unit is located mainly at the foot of the coastal cliff.

n) Salt deposits (Holocene):

It corresponds to deposits of salts or plaster, with nitrates subordinarios of Quaternary origin.

o) Coastal deposits (Holocene):

It is an informal unit which corresponds to a heterogeneous set of sands, silts, coquina and cemented conglomerate which are carriers of macro fossil marine fauna include bivalve molluscs, gastropods, among others, assigning an age Pleistocena (Naranjo and Puig, 1984). This unit is not mapped in the study area (Quezada et al., 2012), however, was identified based on the presence of levels of coquina with different degree of cementation located mainly to a few tens of meters from the current coastline.

ii. Palaeontological context

In the sector intended for the implementation of the reservoir of seawater previous paleontological findings have not been reported.

However, reported findings of paleontological remains in the black the formation in the area south of the city of Taltal (región de Antofagasta; Naranjo and Puig (1984)). Abundant fossils of invertebrates are mentioned in the register among those who stand out brachiopodos as *Terebratula SP.;* Bivalve mollusks that include *Trigonia SP., Pleuromya SP., Lopha SP.* and *Vaugonia SP.;* molluscs gastropods: *Alloscomia SP., Nerita SP., Spirocirrus SP.,* ammonites among those included in *Arieticeras SP., Fanninoceras SP.* and *Ammonoidea indet.*; Balemnitidos indeterminate and Annelidos as it is *Serpula SP*[19].

In addition, as noted above, in the study area there is exposure of coastal deposits that had not been mapped previously. However, abundant remains of marine invertebrates that are assigned to this unit have been reported in the Region of Antofagasta (Naranjo and Puig, 1984), Atacama (Valenzuela-Toro et al., 2013)[20]; Herm1969; Ortlieb et al., 1997, 2003 among them are mainly located along the North Central Coast. In this sense, Rivadeneira and Carmona (2008) describe an Assembly macrobentonico from the late Pleistocene of Caleta Patillos (approximately 60 km to the South of Iquique), which mentions the presence of poliplacoforos, bivalve molluscs, gastropods; Barnacles; Echinoderms and decapods (Rivadeneira y Guzmán, 2008) PAG. 166) different to that currently found on the same latitude. Padilla previously and Elgueta (1992) have also recognized fossiliferous levels with Microfossils in the same locality.

Finally, in the formation the Godo, abundant remains of marine invertebrates have been reported (white et al., 2012).

3.3.3.5 Results of field

Below are most relevant control points evaluated in field with relevant observations:

[19] Más detalles en Fósiles de Formación La Negra en Naranjo y Puig (1984).
[20] Depósitos litorales equivalente a Estratos de Caldera, en base a la presencia de fauna homóloga.

Figure 3-152: Diagram showing control points made and referred to in the present report. Modified Google Earth.

Source: Own elaboration.

i. <u>Sector Reservorio and OBras TOnexas</u>

Below is a table summary of the results of land in Sector reservoir. She identifies 28 checkpoints leading in points 17 and 19 identified the presence of remains of terrestrial invertebrates of Quaternary age from the gravel of Alto Hospicio. Similarly, in paragraphs 23, 24 and 25 was determined the presence of levels of coquina with remains of bivalve molluscs and gastropods sailors of old Pleistocena.

Table 3-83. C pointscontrol in the TOrea of the Project.

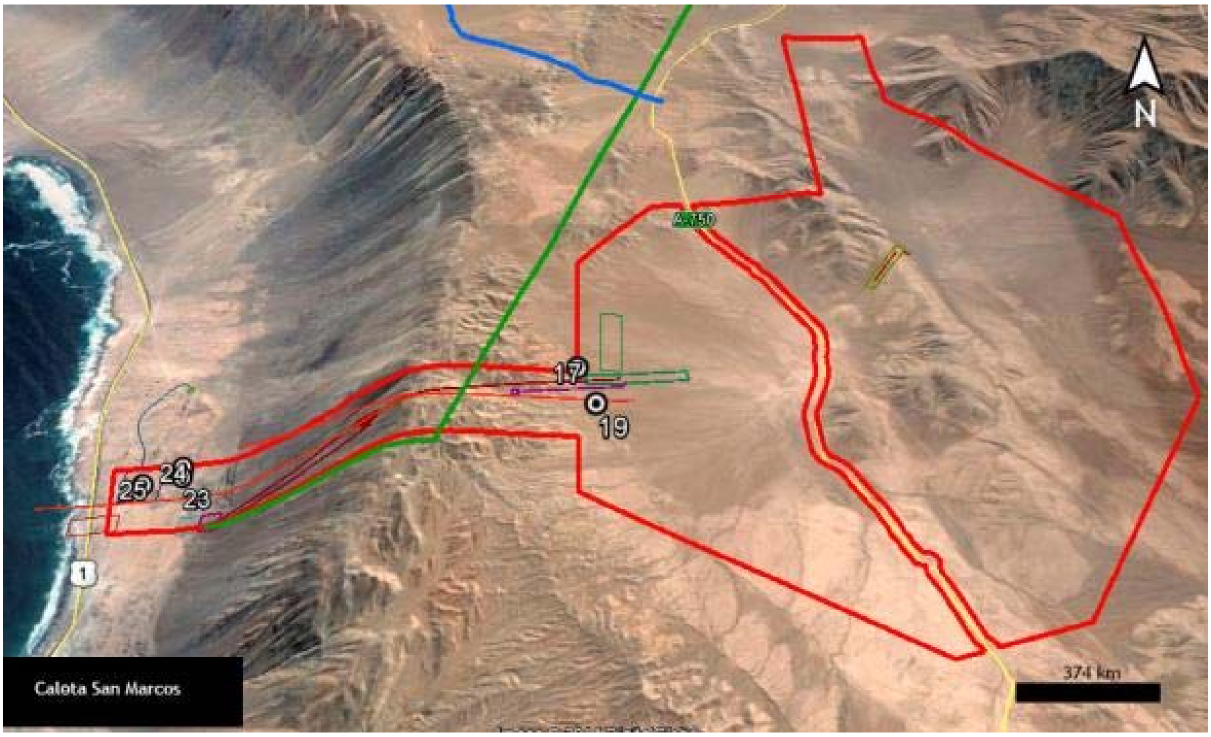
N ° control point	Geographic coordinates (WGS 84; spindle 19K)	Observations
1	386555.00 m E 7667406.00 m S	Limit of the Project, forming the black, view of floodplain, without near rocky outcrops. Paleontological finds were not performed.
2	387206.00 m E 7667226.00 m S	Training the black weathered lava outcrop. Paleontological finds were not performed.
3	387533.00 m E 7667190.00 m S	Training the black weathered lava outcrop. Paleontological finds were not performed.
4	387687.00 m E 7666342.00 m S	Training the black weathered lava outcrop. Paleontological finds were not performed.
5	387739.00 m E 7666838.00 m S	Outliers of lavas and igneous rocks of the black formation. Laminar levels without sandstone with crystals and CA. Paleontological finds were not performed.
6	387315.00 m E 7666060.00 m S	Outcrop of rocks, including andesiticsandstone and carbonate. Paleontological finds were not performed.
7	388679.00 m E 7666463.00 m S	Training the black volcanic rocks outcrop. Paleontological finds were not performed.
8	388129.00 m E 7667189.00 m S	Ground presence of sandstone, salt deposits brechosos and conglomerates, no fossils
9	387451.00 m E 7667567.00 m S	Outcrop of the black formation. Paleontological finds were not performed.
10	387870.00 m E 7664687.00 m S	High gravel outcrop weathered Hospice. Paleontological finds were not performed.
11	386840.00 m E 7664871.00 m S	High gravel outcrop weathered Hospice. Presence of blocks of lava, with intercalation of volcanic ash. Paleontological finds were not performed.
12	386815.00 m E 7666355.00 m S	Floodplain without rocky outcrops. Paleontological finds were not performed.
13	386210.00 m E 7667162.00 m S	Outcrop of the black formation. Paleontological finds were not performed.
14	385689.00 m E 7666833.00 m S	Upwelling of lava toLTEinlets with epidote belonging to the black formation. Paleontological finds were not performed.
15	385796.00 m E 7666483.00 m S	Outcrop of Quaternary levels semiconsolidados. Without fossils
16	385965.00 m E 7666091.00 m S	Alto Hospicio gravel outcrop. Paleontological finds were not performed.
17	385964.00 m E 7666096.00 m S	Alto Hospicio gravel outcrop. Presence of remains of invertebrates (molluscs gastropods terrestrial) Quaternary.
18	386021.00 m E 7665813.00 m S	Alto Hospicio gravel outcrop. Paleontological finds were not performed.
19	386055.00 m E 7665878.00 m S	Alto Hospicio gravel outcrop. Invertebrates (molluscs residues gastropods terrestrial) Quaternary on two levels.

N ° control point	Geographic coordinates (WGS 84; spindle 19K)	Observations
20	385179.00 m E 7666126.00 m S	Outcrop of the black formation. View of Caleta San Marcos. Paleontological finds were not performed.
21	384075.00 m E 7665828.00 m S	Alluvial deposits that are not consolidated, a highlyLTERados by human activity. Paleontological finds were not performed.
22	384212.00 m E 7665810.00 m S	Outcrop of granite intrusive rocks, biotite and CA. Paleontological finds were not performed.
23	383980.00 m E 7665930.00 m S	Outcrops of Quaternary coquina with presence of bivalve levels and gastropods Quaternary.
24	383971.00 m E 7665991.00 m S	Outcrops of Quaternary coquina with presence of bivalve levels and gastropods Quaternary.
25	383793.00 m E 7665886.00 m S	Outcrops of Quaternary coquina with presence of bivalve levels and gastropods Quaternary rocks intrusive contact.
26	383828.00 m E 7665844.00 m S	Outcrops of Quaternary coquina with presence of bivalve levels and gastropods Quaternary base intrusive contact
27	385182.00 m E 7665744.00 m S	Outcrop of the black formation. View of Caleta San Marcos
28	380081.96 m E 7671933.59 m S	Recent alluvial deposits without outliers.

Source: Own elaboration.

- Description of main points of control

Figure 3-153. Diagram showing the control points where paleontological (17, 19, 23, 24 and 25) were identified in the Sector of reservoir and associated works; referred to in the present report. The lines follow the same pattern of color above. Modified Google Earth.



Source: Own elaboration.

1 control point. Panoramic photo from the NO limit of the Project to the S p viewalluvial lanicie (ancient alluvial deposits)systems, which are not observed near rocky outcrops, or paleontological findings were made.

Figure 3-154. View towards the South of the area of the Project. The predominance of a plain of alluvial origin, without rocky outcrops can be seen.

Source: Own elaboration.

Control point 2-3-4-5-6-7-9-13-14-20. Outcrop of volcanic attributable to training the black. There are several outcrops of volcanic sequences of such training. There is a predominance of lava andesitic. Paleontological findings in any of the points mentioned here were not performed.

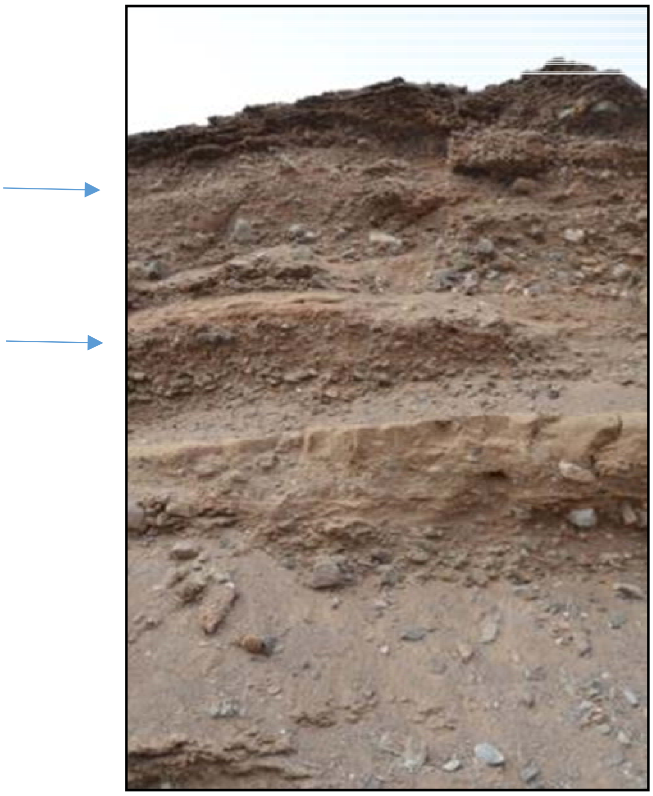
Point of control 8. Ground presence of sandstone, salt deposits brechosos and conglomerates, no fossils

Checkpoint 12. Floodplain without rocky outcrops. Paleontological finds were not performed.

Point of control 15. Outcrop of Quaternary levels semiconsolidados. Without fossils

Control points 10-11-16-17-18-19. Outcrops of gravel of Alto Hospicio, located mainly in the S end and is of the Project. Invertebrates (molluscs residues gastropods terrestrial) Quaternary on two levels (checkpoint 17 and 19).

Figure 3-155: View of Alto Hospicio gravel outcrop identified at the point of control 19 (386055.00 m E 7665878.00 m S). The blue arrows indicate the levels with GAstropodos terrestrial fossils.



Checkpoint 21. Outcrop of reddish granite intrusive rocks, biotite and CA.

Figure 3-156: Granite Rojizo.

Source: Own elaboration.

Checkpoint 22. Outcrop of reddish granite, biotite and CA intrusive rocks.

Control points 23-24-25-26-27. Outcrops of levels of coquina, which are underlying deposits colluvial and sobreyaciendo to the intrusive complex of Cerro CarrascoFigure 3-156).

Figure 3-157. View of a Nivel of Coquina Subyaciendo to Colluvial deposits.

Source: Own elaboration.

Two levels (with gradual contact between them) of coquina with remains of marine invertebrates were identified. The lower level is in contact with the Cerro Carrasco intrusive complex, presenting an array of very compacted and reddish coloration. The upper level is located on the above and corresponds to a coquina little compacted with remains of bivalve molluscs such as oysters, clams and scallops, mytilidos; indeterminate gastropods with different States of preservation.

Figure 3-158: In the foreground the cobble remnants of bivalve (clam) is observed with good state of preservation (probably from the top level). In the background there is a detail of lower level with coquina compacted with fragmentary remains of shell.

Source: Own elaboration.

Figure 3-159: Detail of coquina compacted with fragmentary remains of Bivalves.

Source: Own elaboration.

Figure 3-160: Detail of coquina compacted with remains of bivalves and gastropods indeterminate.

Source: Own elaboration.

Figure 3-161: Remains of Bivalves found in control 24 details (383971.00 m E 7665991.00 m S).

Source: Own elaboration.

Figure 3-162: Blocks of coquina with remains of marine invertebrates.

Source: Own elaboration.

Figure 3-163: Detail of coquina with remains of invertebrates such as *Argopecten* (to the Center).

Source: Own elaboration.

Figure 3-164: Block of coquina with remains of Bivalves.

Source: Own elaboration.

Point of control 28. Predominance of alluvial plain, without outliers. This area is mapped as intrusive complex of Cerro Carrasco, however there were no outliers of this unit and its geomorphological similarities and given that arise in the mISMA curve of level of the outcrops found in paragraphs 23, 24, 25, 26 and 27. There is a high probability of finding the same tanks with marine invertebrates that are found in both these points mentioned (to the South of the area of camp) as in caleta Patillos (to the North of the area of the camp) described by Rivadeneira and Carmona) 2008).

i. Layout electric transmission lineroad access and camp area

Here are the main points of control carried out on the Sector of the path of the electric transmission line, roads of access and service area of the camp. 47 checkpoints (from 29 to 76) was identified of which in sections 66, 67 and 70 was verified the presence of invertebrates of continental origin, presumably Quaternary age. In addition, in paragraphs 71, 73 and 75 identified remains of various marine invertebrates such as bivalves and gastropods of age Pleistocena.

Table 3-84: Points of Control Correspondientes to the LIine of Transmision Eelectric, Camino's TOaccessible and TOrea of the Campamento

N ° control point	Geographic coordinates (WGS 84; spindle 19K)	Observations
29	427082.00 m E 7698148.00 m S	Electrical transmission path home. Paleontological finds were not performed
30	424722.00 m E 7698140.00 m S	Point belonging to the layout of power transmission. Floodplain without rocky outcrops
31	423298.00 m E 7698493.00 m S	Point belonging to the layout of power transmission. Alto Hospicio gravel outcrop. Without findings of paleontological
32	421552.00 m E 7698715.00 m S	Point belonging to the layout of power transmission. Gravels of Alto Hospicio No upwelling were findings of paleontological remains
33	418979.00 m E 7698729.00 m S	Point belonging to the layout of power transmission. Rolled blocks of andesitic, attributable to training tip Barranco rocks. Sedimentary rocks are not observed
34	418683.00 m E 7698608.00 m S	Point belonging to the layout of power transmission. Attributable to training tip purple and reddish volcanic rocks outcrop
35	417559.00 m E 7698777.00 m S	Point belonging to the layout of power transmission. Outcrop of assignable andesitic rocks to the training Office Viz. Paleontological remains were not found
36	417477.00 m E 7698621.00 m S	Point belonging to the layout of power transmission. Floodplain without rocky outcrops

N ° control point	Geographic coordinates (WGS 84; spindle 19K)	Observations
37	415749.00 m E 7698825.00 m S	Point belonging to the layout of power transmission. Outcrop of rocks of volcanic origin assignable to the training Office Viz. Paleontological remains were not found
38	415483.00 m E 7698826.00 m S	Point belonging to the layout of power transmission. Outcrop of rocks volcanic, assignable to the training Office Viz without paleontological
39	413873.00 m E 7699022.00 m S	Point belonging to the layout of power transmission. Outcrop of volcanic rocks, andesitic, possibly of training tip ravine
40	413490.00 m E 7699103.00 m S	Point belonging to the layout of power transmission. Calicata with outcrop of gravels of Alto Hospicio, without paleontological
41	409845.00 m E 7698679.00 m S	Point belonging to the layout of power transmission. Outcrop of volcanic rocks that are assignable to the training Office Viz without paleontological
42	409630.00 m E 7698637.00 m S	Point belonging to the layout of power transmission. The training Office Viz without paleontological rolled blocks
43	385796.00 m E 7666483.00 m S	Point belonging to the layout of power transmission. Outcrop of volcanic rock not identified, without paleontological
44	407718.00 m E 7698180.00 m S	Point belonging to the layout of power transmission. Outcrop of volcanic rocks that are assignable to training tip
45	405265.00 m E 7697061.00 m S	Point belonging to the layout of power transmission. Outcrop of volcanic rocks that are assignable to training tip
46	407718.00 m E 7698180.00 m S	Point belonging to the layout of power transmission. Salt deposits
47	402197.00 m E 7693639.00 m S	Point belonging to the layout of power transmission. Outcrop of volcanic rocks that are assignable to training tip
48	401600.00 m E 7690000.00 m S	Point belonging to the layout of power transmission. Outcrop of rocks andesitic attributable to training tip ravine, without paleontological
49	395122.00 m E 7685376.00 m S	Point belonging to the layout of power transmission. Deposits evaporitic sobreyaciendo volcanic rocks presumably training tip ravine
50	394580.00 m E 7685636.00 m S	Point belonging to the layout of power transmission. Outcrop of assignable volcanic rocks a training tip ravine, paleontological findings
51	394038.00 m E 7684191.00 m S	Point belonging to the layout of power transmission. Outcrop of volcanic rocks of Gorge formation with evaporitic without paleontological deposits
52	393938.00 m E 7683576.00 m S	Point belonging to the layout of power transmission. Outcrop of volcanic rocks
53	393938.00 m E 7683613.00 m S	Point belonging to the layout of power transmission. Brechosa bioclastic limestone block. Remains of corals, gastropods, and fossil bivalve molluscs coming to training the Godo
54	392905.00 m E 7682683.00 m S	Point belonging to the layout of power transmission. Alto Hospicio gravels, without paleontological

N ° control point	Geographic coordinates (WGS 84; spindle 19K)	Observations
55	390598.00 m E 7678080.00 m S	Point belonging to the layout of power transmission. Outcrop of gravels of Alto Hospicio, without paleontological
56	389377.00 m E 7676368.00 m S	Point belonging to the layout of power transmission. Floodplain with assignable rolled blocks to the formation the black
57	387131.00 m E 7671622.00 m S	Point belonging to the layout of power transmission. Outcrop of rock from intrusive group Cerro Carrasco
58	383663.00 m E 7672639.00 m S	Point belongs to the route of the access road. Outcrop of gravels of Alto Hospicio, without paleontological
59	383720.00 m E 7672912.00 m S	Point belongs to the route of the access road. Alto Hospicio gravels, without paleontological
60	383648.00 m E 7674699.00 m S	Point belongs to the route of the access road. Hospice high gravel outcrop with the presence of assignable angular clasts to training the black, without paleontological
61	383234.00 m E 7674959.00 m S	Point belongs to the route of the access road. Outcrop of intrusive complex Hill Carrasco
62	383051.00 m E 7675621.00 m S	Point belongs to the route of the access road. Outcrop of intrusive complex Hill Carrasco
63	383169.00 m E 7675953.00 m S	Point belongs to the route of the access road. Outcrop of intrusive complex of Cerro Carrasco
64	382906.00 m E 7677501.00 m S	Point belongs to the route of the access road. Outcrop of intrusive complex of Cerro Carrasco
65	381974.00 m E 7677583.00 m S	Point belongs to the route of the access road. Outcrop of intrusive complex of Cerro Carrasco
66	381810.00 m E 7677825.00 m S	Point belongs to the route of the access road. Level with terrestrial gastropod mollusks belonging to gravel of Alto Hospicio
67	381749.00 m E 7677978.00 m S	Point belongs to the route of the access road. Level with terrestrial gastropod mollusks belonging to gravel of Alto Hospicio
68	386612.00 m E 7669148.00 m S	Point belonging to the layout of power transmission. Gravel outcrop of upper Hospice without fossils
69	380926.00 m E 7678567.00 m S	Point belongs to the route of the access road. Attributable to the Cerro Castillo intrusive complex volcanic rocks outcrop
70	380747.00 m E 7678601.00 m S	Point belongs to the route of the access road. Hospice high gravel outcrop with the presence of fossil gastropods continental on the spot and rolled of Quaternary age remains
71	380425.00 m E 7678207.00 m S	Point belongs to the route of the access road. Levels of coquina compacted with remains of turritelas, Fissurella, olive, Nasella, picorocos, Argopecten on-site and Cobbles with variable preservation status
72	380416.00 m E 7678180.00 m S	Point belongs to the route of the access road. Attributable to the Cerro Carrasco intrusive complex intrusive rocks outcrop

N ° control point	Geographic coordinates (WGS 84; spindle 19K)	Observations
73	380376.00 m E 7678067.00 m S	Point belongs to the route of the access road. Levels of coquina compacted with remains of turritelas and other indeterminate gastropods, in-situ and rolled with preserving variable States
74	380193.00 m E 7672155.00 m S	Point belonging to the area of the camp. Outcrop of intrusive rocks belonging to the Cerro Carrasco intrusive complex
75	380159.00 m E 7672120.00 m S	Point belonging to the area of the camp. Levels of coquina compacted with remains of turritelas and other indeterminate gastropods, in-situ and rolled with preserving variable States
76	380113.00 m E 7672014.00 m S	Point belonging to the area of the camp. Floodplain from Cobble Hill Carrasco intrusive complex blocks

Source: Own elaboration.

Figure 3-165. Description of Pcommitments Ppoints of Control.

Source: Own elaboration.

Figure 3-166. Diagram showing the control points where paleontological (66, 67, 70, 71, 73 and 75) were identified in the area of the access road; and in the path of the electric transmission line (point 53, below). The lines follow the same pattern of color above. Modified Google Earth.

Source: Own elaboration.

Control point 29, 30. Floodplain with salt deposits. Without palaeontological remains.

Figure 3-167. Floodplain without rocky outcrops. Salt deposits.

Source: Own elaboration.

Control point 31 and 32. Levels of Alto Hospicio gravel outcrop. Without palaeontological remains.

Figure 3-168. Alto Hospicio gravel detail.

Source: Own elaboration.

33 and 34 control point. Belonging to the training tip Barranco rocks.

Figure 3-169. View of rocks belonging to the training tip.

Source: Own elaboration.

35 and 36 control point. Predominance of floodplain with rocks pertenecienteas to the training Office Viz.

Figure 3-170. View Panoramica Planicie TOluvial with Rgeese TOsignables to the training Office Viz.

Source: Own elaboration.

37 and 38 control point. Rocks belonging to the training Office Viz.

Figure 3-171. Detail of the training Office Viz rocks.

Source: Own elaboration.

39 control point. Belonging to the training tip Barranco rocks.

Figure 3-172. View Panoramica with Rgeese TOsignables to the training tip.

Source: Own elaboration.

Checkpoint 40. High Hospic gravelsIO. Without palaeontological remains.

Figure 3-173. View of calicata where there are gravel of Alto Hospicio.

Source: Own elaboration.

Point 41, 42 and 43. Rocks belonging to the training Office Viz.

Figure 3-174. View the training Office Viz rolled rocks.

Control point 44, 45, 46, 47, 48, 49, 50 and 51. Several outcrops of rocks of the Training Tip ravine. The presence of evaporite deposits is observed.

Figure 3-175. View some of the outcrops of the formation point Barranco (left) and saline deposits (right), findings of paleontological remains.

52 control point. The training Office Viz rocks. Without photography. Paleontological finds were not performed.

53 control point. Remains of marine invertebrates including corals and molluscs indeterminate.

Figure 3-176. View rock bearing fossils (left) and block with remains of fossil corals (right) possibly belonging to the order Tabulata.

Figure 3-177. (continued). View rock bearing fossils (left) and block with remains of fossil corals (right) possibly belonging to the order Tabulata.

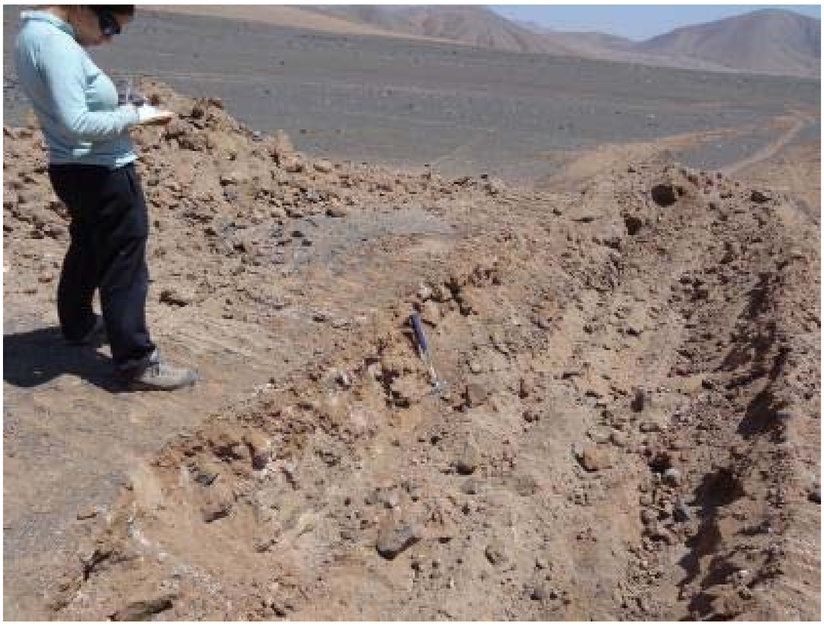
Figure 3-178. (continued). View rock bearing fossils (left) and block with remains of fossil corals (right) possibly belonging to the order Tabulata.

Figure 3-179. View of indeterminate invertebrate fossil-bearing rock.

Figure 3-180. View fossil-bearing rocks. Notice prints attributable to choral scleractinian corals (above).

Checkpoint 54 and 55. High gravel outcrop Hospice without palaeontological remains.

Figure 3-181: View gravels of Alto Hospicio.



56 control point. The formation of the black rocks.

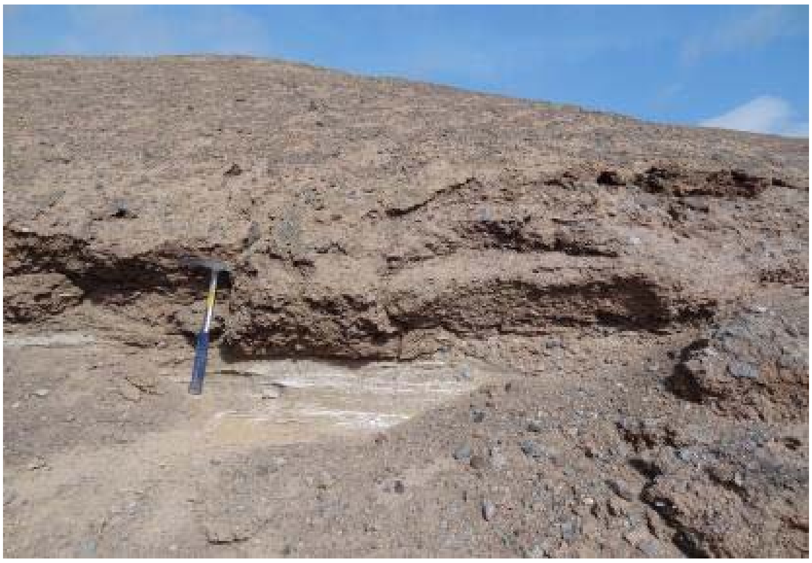
Figure 3-182. View attributable to the formation of the Black Rock.

Checkpoint 57, 61, 62, 63, 64, 6569 and 72. Several outcrops of the intrusive complex of Cerro Carrasco.

Figure 3-183. View of the outcrop of the intrusive complex of Cerro Carrasco.

58 control point59, 6066, 68-70 and 74. Alto Hospicio deposits. Without palaeontological remains.

Figure 3-184. View of the outcrop of the gravels of Alto Hospicio.



Checkpoint 67. Remains of continental gastropods, In Situ and rolled, with preservation of regular to bad.

Figure 3-185. View of levels of gravel of Alto Hospicio with remains of continental invertebrates (left). The blue arrow shows the level with fossils. Detail of cobble fossils found (right).

71 control point. Remains of invertebrates

Figure 3-186. View gravels of Alto Hospicio with fossils (above left). Remains of terrestrial gastropods found In Situ detail (above right and below).

Points control 73 and 75. Remains of marine invertebrates. In situ and rolled with variable preservation status.

Figure 3-187. View level carrier of fossils (blue arrow in the photo above left). Detail of coquina with remains of different invertebrates with different state of preservation (photo top right and bottom). Found fossil shellfish include clams, turritelas and at least two species of gastropods.

Point of control 76. Intrusive complex of Cerro Carrasco.

Figure 3-188. View of outcrop of rocks assignable to the intrusive complex of Cerro Carrasco.

3.3.3.6 Conclusions

This report aims to achieve a characterization of the paleontological component in the area of the Project.

Our work of visual inspection and review of the available bibliographic information concluded the identification of the geological units present in the area of the Project (Training Office Viz, training Hill ravine, training La Negra, complex Hill Carrasco, gravels of Alto Hospicio, deposits colluvial and alluvial deposits old) where not performed paleontological finds.

Additionally detected the presence of coastal deposits in the area of the camp, at the coastal end of the road access and the sector's reservoir, which is characterized by present, in all areas, levels with Quaternary coquina (abundant remains of invertebrates fossil with different qualities of preservation).

These levels are not mapped by bibliographic literature available in the area of the camp or the coastal end of the area ofl reservoir (e.g. Quezada et al., 2012) that are partially covered by the Colluvial deposits. During the inspection on site at these levels, it was found the presence of remains of bivalves and gastropods, of Quaternary age which is consistent with specimens reported by Rivadeneira and Carmona (2008). However, under that part of the points described here are not mapped or mentioned in the literature, increases the relative importance of the discovery since it increases the possibility of extension of the levels reported by Rivadeneira and Carmona (2008) and also the possibility of making new records for science.

In the same way, were found remains of gasQuaternary terrestrial tropodos of the gravels of high Hospice in two levels in paragraphs 17 and 19 (the reservoir area) and at a level of 67 and 71 control point (access road). These fossils are mapped or previously mentioned in the literature.

Additionally, detected the presence of fossils of Mesozoic marine invertebrates attributable to the training the Godo (Bajocian-Oxfordiano). This unit is defined as a marina, fossiliferous sedimentary sequence. In that unit were found remains of corals (presumably assignable to the order Tabulata and Escleractinea) and various indeterminate bivalve molluscs with preservation of regulating bad state. In the particular case of the remains of coral, these have a special relevance due to scarce fossil of this type of animal in Chile. In the context of the Project, this fossiliferous unit extends tangentially in a sector of the layout of the electric transmission lineThere is high probability that during construction activities, new fossils are discovered, because there are mapped other outcrops near this unit with an orientation NW-SE, suggesting that this unit (Fm. The Goth) subyacería to Fm. tip ravine, and can be reached during the excavations in this sector of the electric transmission line.

Based on these findings, we believe that the realization of works considered by the Project (excavation and earth moving) will affect paleontological (possibility of extraction, stratigraphic decontextualization, destruction of the carrier level). Thus, we suggest the implementation of a rescue plan (collection of paleontological samples representative of the fossiliferous levels, well as their geographical and geological context) with the purpose of generating a reference collection that consider the variables of diversity of taxa as well as preserving, in each of the individual sectors here, which must be deposited in a defined institution bythe National Monuments Council. CABE highlight that the collection of paleontological samples is carried out under the figure of rescue and is approved by the CMN by submitting an order sectoral (PAS 132) referred to in article 20 of the regulation on excavations or anthropological, paleontological and archaeological prospecting (484 Supreme Decree of 1990). The rescue plan should be performed prior to the implementation of the Project by qualified professionals (paleontologists).

Whereas geological units (fossil-bearing) can be extended in levels lower, below other units and not viewable in a baseline survey, on the other hand, there is possibility that during the activities of construction, new fossils are found by what we do need to have a plan of monitoring (supervision of works to prevent damage paleontological) of works that include removal of Earth and-or excavations in these specific areas (points 17, 19 (23, 24, 25, 26 and the area of the camp). Monitoring must sr done by trained professional (paleontologist) and its periodicity to be determined according to the plan and progress of works.

Similarly, we consider timely the realization of talks of induction to the paleontological subject to all workers linked to the movement of Earth and excavations in general.

3.3.3.7 References

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3.4. Landscape

3.4.1 Objectives

Determine if the area will be located where the Project presents landscape value in relation to their biophysical, aesthetic and structural characteristics through the evaluation of visual quality, whereas observers who may have visual access to the Project

3.4.2 Methodology

The evaluation methodology the landscape value is based on the guidance published by the service of environmental assessment in October 2013 called "Landscape value in the SEIA," whose stages are shown in the Figure 3-189.

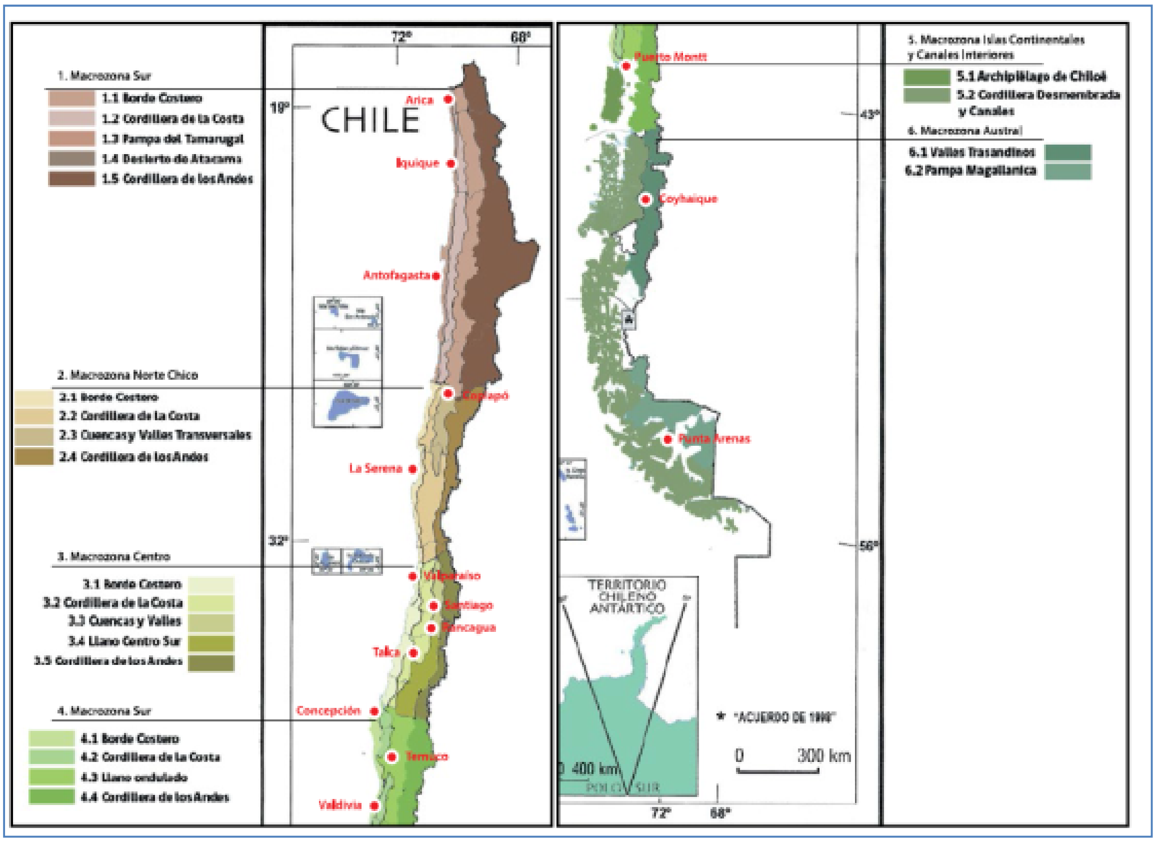
Figure 3-189. Stages Metodologicas.

Source: Own elaboration.

This methodology presents three stages, the first stage corresponds to a **Basic characterisation of the Paisaje**carried out through the bibliographic analysis of landscape of the Macrozone and sub-area studies (Figure 3-190) in that lies the Project, singularizando the biophysical attributes of the landscape in order to establish the character of the landscape, which refers to that recognizable identity in a particular landscape, which arises from the perception of a pattern associated with the combination of its biophysical, aesthetic and structural attributes which make it unique and differ from other landscapes. The character of the landscape allows you to systematize those key components for the assessment of the attributes of the landscape.

In the absence of references about the landscape value of the Macrozone North and its sub-areas is a description of the aesthetic and structural characteristics of the landscape through the information contained in the ground campaign performed during the days 10, 11 and 12 December 2013.

Figure 3-190. Macrozonas and subzones of landscape in Chile.



Source: SEIA, 2013.

The second stage comprises the **Delimitation of the TOarea of influence specified in the Project**for this is:

- **Determine the points of observation**, which correspond to the sectors with greater visual access to a regular observer where it is possible a panoramic view of the landscape whereas roads (of average daily intensity of circulation), panoramic viewpoints and urban areas.
- **Delimitation of the basins Visuales,** using the tools of the information systems geographic (GIS) for the calculation of the visibility or Viewshed, taking into consideration the terrain, the height of the vegetation and buildings as well as the height of the observer. For this to be used as parameter maximum visual scope of 3,500 meters distance, since from that distance the observer is no longer clearly perceive a particular object.
- **Analysis of Intervisibilidad.** The intervisibilidad It is defined in relation to the sum and overlay of Visual observers of landscape basins.
- **Identification of landscape units,** Recognizing portions of the territory which have a homogeneous appearance resulting from the combination of its visual attributes.

Finally, the last stage is in the **Determination of the Calidad Visual landscape**, for it is necessary:

- **Characterization of Visual attributes.** Once identified and defined the landscape units are proceeds to deepen in the characterization of their biophysical attributes and describe their aesthetic and structural attributes.
- **Evaluation of the Visual quality of the landscape**performed on the weighting of the Visual attributes that constitute its character, for which tables are used below:

Table 3-85. Visual of the landscape according to attributes biophysicists, structural and aesthetic quality, ZONA NOrte GRande.

Attribute	Outstanding	High	Media	Low
Biophysical				
Relief	Mountain, volcano, or pending, rocky outcrop over 30%	Hill or hill descent Island about 30%	Hill or Hill Island slopes between 15% and 30%	Valley, low slope 15%
Soil	High roughness	Low roughness	Average roughness	
Water	The presence of water, any abundance, with vegetation and quality clear or transparent	Presence of water any wealth, bank vegetation and any quality		
Vegetation	Presence with any permanent cover any stratum and high diversity	Presence with any coverage, occasional or seasonal, any stratum and media diversity	Presence with any coverage, occasional or seasonal, any stratum and low diversity	Absence of vegetation
Fauna	The presence of high and high diversity	Media presence and media diversity	Media presence and low diversity	the presence null (no visible fauna)
Snow	Presence with any coverage and permanent temporality	Presence with any coverage and seasonal timing		
Structural				

<table>
<tr><th>Attribute</th><th>Outstanding</th><th>High</th><th>Media</th><th>Low</th></tr>
<tr><td rowspan="2">Landscape diversity</td><td rowspan="2">High heterogeneity and high uniqueness</td><td rowspan="2">High heterogeneity and half Singularity</td><td>Heterogeneity, middle and middle uniqueness; Low heterogeneity and half Singularity</td><td rowspan="2">Low heterogeneity and null Singularity</td></tr>
<tr><td>Low heterogeneity and half Singularity</td></tr>
<tr><td>Naturalness</td><td>No human quality</td><td>Low human quality</td><td>Average human quality</td><td>High human quality</td></tr>
<tr><th colspan="5">Aesthetic</th></tr>
<tr><td>Form</td><td>High diversity</td><td colspan="2">Media-diversity</td><td>High diversity</td></tr>
<tr><td rowspan="3">Color</td><td rowspan="3">High diversity and high contrast</td><td rowspan="3">High diversity and contrast medium</td><td>Media diversity and contrast medium</td><td rowspan="3">Low diversity and low contrast</td></tr>
<tr><td>Media diversity and low contrast</td></tr>
<tr><td>Low diversity and high contrast</td></tr>
<tr><td rowspan="2">Texture</td><td>grain thickness and high diversity</td><td></td><td>Grain medium and high diversity</td><td rowspan="2">Fine-grained and low diversity</td></tr>
<tr><td></td><td></td><td>Fine-grained and media diversity</td></tr>
</table>

Source: SEIA, 2013.

- Categories of Visual quality, determined once the visual quality of the landscape units determine a category of visual quality according to their weights. These categories are:

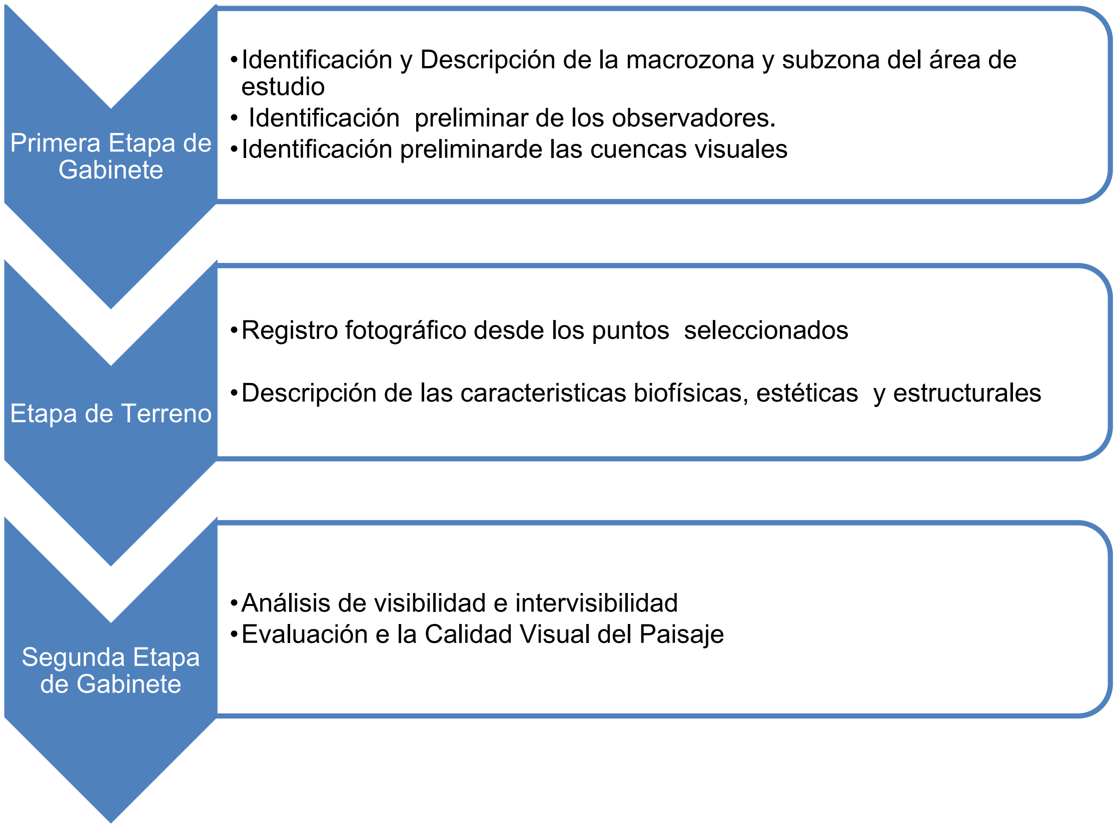
Table 3-86. Categories of Visual quality.

Quality	Score
Outstanding quality	They are considered landscapes of outstanding quality those where one or more of their Visual attributes were valued as important, transforming into the elements that allow to recognize an outstanding condition in the landscape.
High quality	They are considered high quality landscapes those landscapes where most of their attributes are recognized as high quality, with outstanding features. If more than 50% of the attributes are valued in high category, then the landscape has this condition. Similarly, if the attributes in equal amounts in the categories high and average are valued and any attribute in the low category, then the landscape presents a high visual quality
Medium quality	Medium quality landscapes those whose attributes are valued as common or recurrent, if more than 50% of the attributes are valued in the middle class is considered, then the landscape has a medium visual quality. Also, if they are valued attributes in the categories high and average in equal amounts and an attribute in the low category, then landscape presents a visual medium quality
Low quality	Landscapes of low quality is considered those that contain very little variety of attributes and also these are valued in low quality. If more than 50% of the attributes they are valued in the low visual category, then the landscape assumes this condition of low visual quality. Also, if they are valued attributes in equal quantity in the categories medium and low, and no attributes in the high category, the landscape presents a low visual quality.

Source: SEIA, 2013.

In the Figure 3-191, follows the scheme of work, highlighting the stage of ground made on 10, 11 and 12 of December of the year 2013.

Figure 3-191. Scheme Working.



Source: Own elaboration.

3.4.3 Theoretical framework

3.4.3.1 Landscape macrozone.

Depending on the location of the Projectthe macrozone of landscape where it is inserted the large North Macrozone and specifically the subzones of costal border, coastal and Pampa del Tamarugal. In this sector there are still studies related to the landscape still environmental assessment service has developed some assumptions regarding the nature of the present landscape

i. Landscape of the big North macrozone

The Macrozonificacion allows to recognize the character of the landscape, determined by the dominant characteristics of its biophysical attributes of preliminary and general way. Below the assumptions that are applied to this macrozone are defined:

- The character of the landscape is determined by the dominance of abiotic attributes, from the extensive presence of desert areas defined by the geological and geomorphological components. It is characterized by a high purity and low anthropic presence.
- In general, the landscape forms are stable and persistent. This condition occurs primarily in the Strip defined as intermediate depression. North of the river Loa (sub-area Pampa del Tamarugal) formal and spatial continuity is interrupted by streams, oasis and some thorny forest formations. South of the Loa (sub-area desert of Atacama), horizontality and homogeneity is a predominant factor. In this framework, are landscape units as the oasis of San Pedro de Atacama, the Cordillera de Domeyko or the Valley of the Moon, along with unique sectors such asSalares, small creeks and small water bodies.
- In subarea waterfront landscape forms become irregular, with the eventual presence of plains of greater visual range allowing the development of homogeneous areas and landscape units, characterized generally by human occupation.
- Weather conditions are generally stable. The factor of change or transformation of the landscape seasonally is minimal.
  The conditions of seasonality that stand out most in terms of landscape components are the phenomena of winter Altiplano - located on the edge of the Northeast, activating the endorheic basins with rainfall in the summer months - and desert flowery, which appear areas remaining toward the southern limit, usually between August and September when winter precipitation are generated.
- The climatic stability conditions favor the development of land, in terms of visibility and movement activities.
- Determine the conditions of visibility, intervisibilidad and extent of Visual basins
- in general a high degree of exposure of the territory. Only in the area of coastal visibility is reduced by any episodes of haze and cloud cover.
- Biotic components are concentrated in units of landscape and unique landscape specific areas, generating high-contrast situations in Visual and formal terms with respect to its homogeneous environment.
- The concentration of population and land uses generates homogeneous zones scattered among themselves, whether cities, rural areas or productive areas related to mining.

3.4.4 Results

3.4.4.1 Basic landscape characterization

The landscape surrounding the project is desert and is characterized by barrenness and paucity of biotic elements. The most important elements of the landscape corresponds to the physical characteristics determined by the geomorphological units present in the area corresponding to the coastal plain, coastal cliff, mountain range of the coast and the intermediate depression, thus as the Pacific Ocean. These landscape features in addition to the different colors of the soil that vary between the range of yellow and coffee and in the sector of the Great Salt Lake joins the white colour of the coAfter salt from the soil that are also predominant in the sector of the Pampa del Tamarugal.

In relation to anthropogenic contributions to the character of the landscape, the most remarkable are the ruins of the old nitrate, located in the pampa del tamarugal, where still shown the location of the ancient sites and residential areas, which give the landscape a impression of desolation. The only populated area identified in this area corresponds to the town of Victoria, representing a visual appeal that highlights on the scenic background with its buildings of different shapes and colors.

In the sector of the coast the small coves and urbanization that is generated in your environment are picturesquely, above all because of the effect that is generated before the enormity of the coastal Cliff which frames the landscape in this area.

Another sector that has been modified anthropically corresponds to the Great Salt Lake where salt mining-related activities currently being developed.

i. <u>Subzones of landscape</u>

Coastal edge: in relation to the relief, this area is characterized by a coastal plain with presence of rocky outcrops covering in some sectors from the foot of the coastal cliff to the shore with different sectors dominated by systems dunarios, the slopes of This sector do not exceed 20%. To the East, the most impressive geomorphological element of this area corresponds to the coastal cliff, this almost vertically, of approximately 800 m.a.s.l., with slopes exceeding 50% exerts influence on the landscape that is generated in the plain, forming a barrier that frames the cSTA and its forms, making its visual impact lower. The cliff gives way to an area in height with minor slopes between 40 and 10% is observed where the presence of ancient waterways, whose forms have been smooth due to erosion.

In relation to the predominant orientation corresponds to the Northwest by what the landscape presents a good brightness without cloud cover. The soil presents a medium rough surface appearance, product of the dominance of the sands and rocks that have been shed from the rocky outcrops or have been transformed due to erosion. The pprincipal body of water present is estarea corresponds to the ocean pacifico, that stands out with its clean waters. Biotic elements are scarce and almost null, except for some coastal birds.

Structurally speaking, the landscape is homogeneous, because there is not much diversity of Visual attributes, therefore, and due to the extensive described features along the coastline of the region of Tarapaca, the landscape of this area is fairly unique. Product of the low area anthropization predominates the condition of naturalness on the dominant desert landscape, the main interventions in the landscape corresponds to small settlements (Caleta San Marcos and Rio Seco) and route 1 which presents a relatively high traffic flow.

In relation to the forms present in this area, the predominance of the curved lines on straight planes, with the exception of areas where product of rocks forms predominate lines and right angles, to analyze the shape of this coastal Cliff could compare with the of a large rectangle. The main contrasts of colours that occur is this area is configured by three elements: the ocean, sand and rocks, these last two elements give the landscape of different textures depending on the type of rock and the particle size of the sand, being predominant colors q(e) ranging from the range of yellow to red in conditions without cloud cover. Product of the influence of the coastal cliff, the area tends to be under a layer of clouds that make highlight the darker tones to see areas with colors in the range of green and grey.

Coastal mountain range: In relation to the relief of this area presents two distinct elements: a mountainous area comprising two cords, one to the West near the coastal Cliff (800 meters above sea level approximately) and other higher eastward (1,200 meters above sea level approximately), and follows distinguishable is the basin of the Salar Grande, located in between of these two mountain ranges, from which come down old broken salar.

The roughness of the ground conditions are determined by the presence of the Great Salt Lake and its extensive crust salt which in some areas is covered by a layer of sand, to the more mountainous areas is also soil is covered by arenas with presence of rocks that have been shed from sectors higher. Except for the occasional sighting of some birds biotic elements and bodies of water are completely absent.

In relation to the attributes of the landscape of it can establish that the landscape is fairly homogeneous, since identified only some important features, however the presence and location of salar makes that the area is very unique, because it is the only Salt Lake area. The naturalness of this area is interrupted by the presence of 3 mines engaged in the extraction of salt where you can see, apart from the facilities of large operations, white mounds of salt. From these mines is a constant flow of trucks that travel the route A-750, from these trucks ACn grains of salt that have covered almost completely on this route, mimetizandola in a sense with your environment.

In relation to identifiable forms in this landscape in the area of mountain chains, the irregular and curved lines that tend to follow the forms of streams and in sand forms generated by the wind are predominant. In the sector salar there is a pattern determined forms product of irregular shapes and lines that are generated by the crusts of salt. Previously identified areas presented at the same time two main colors, in the sector salar the dominant colour is white while in the mountain ranges the colors are yellow, naranyou and cafes. All these colors combine pleasantly for the view that along with the diversity of textures present in the area soften the landscape forms.

Pampa del tamarugal*:* The main physical feature of this area is given by the plain that develops from the mountain range of the coast towards depression intermediate slopes not exceeding 20%. In general we see that the soil presents a rather rough surface of the crusts of key minerals in the area Salar Bellavistathat are covered by sands. inside of this unit do not they seemed great ways that highlight inside the pampa since everything tends to be rather flat.

The permanent presence of tamarugos as main biotic element endows the landscape of a greater contrast, allowing also to have sightings of wildlife, especially small birds and reptiles, these trees are mainly scattered in the area existing areas with a greater population more towards the interior of the pampa. Within this area visible bodies of water, are not identified so the dryness of the soil is a characteristic feature of the landscape of this area, which contrasts greatly with the presence of tamarugos.

The structure of the landscape presents the dominance of a single element in the entire area, the plains of the pampa. The presence of tamarugos generates that the landscape is unique within the desert context in which it is located, but nearby there are areas with a greater presence of this tree, so it is not a unique attribute of the area.

At first glance that the landscape is rather natural character, but a closer view of the environment leaves seen the trail of the development of nitrate activity in the area is observed either by land movements, the remains of buildings and ancient sites. The presence human also is reflected in the existence of the town of Victoria and route 5 which presents a flow vehicles relatively high, being the anthropic elements that stand out most in the area.

In relation to the aesthetic attributes of the landscape, not they seemed to many forms and existing ones are predominantly linear as the road and the linear power present in the area, buildings in the area in the sector of Victoria are the main elements that add square shapes the landscape. In relation to the range of colors have the predominant colors in the range of the yellow and orange product of the characteristics of the soil, however the colors that bring the tamarugo trees stand out above this Fund, as well as also the various colors of ls homes Victoria.

3.4.4.2 Identification of the Observadores

Following the parameters established in the methodology within the study area the following were identified:

Table 3-87. Observers in the TOrea of EStudio.

Name	This	North	Type	Commune
Dry river Cove	379054.00	7677561.00	Urban/residential	Iquique
Caleta San Marcos[21]	383343.00 383660.00	7664765.00 76644939.00	Urban/residential	Iquique
Route 5	429208.00 426276.00	7701582.00 7695221.00	Roads	Pozo al Monte
Route 1	380819.53 383393.34	7680635.40 7662169.83	Roads	Iquique
Route A-750	392946.84 388565.04	7688484.79 7662911.54	Roads	Iquique

Source: Development propia.

In relation to the residential areas identified two populated centre, Calera Rio Seco and Caleta San Marcos. These small coves counts with a permanent population that do not exceed 100 people, this number becomes folded into the summer seasons when they arrive vacationers (from Iquique mainly) camping in the surrounding beaches.

Busiest routes identified in the area are, on the one hand, the route 5 in the sector of the Pampa del Tamarugal, where a flow is given told trucks mainly, followed by buses and private cars. On the other hand, route 1 also presents a steady stream coming from the city of Iquique, the airport or from the South, from the city of Antofagasta, being the most common buses and private cars. Another route considered observer was the route A-750, which boasts a flow low, mainly of trucks.

[21] La caleta se encuentra dividida en dos sectores San Marcos Bajo correspondiente al sector de la Caleta y área residencial, y San Marcos Alto donde se ubica una segunda área residencial.

3.4.4.3 Analysis of Visistability and Intervisibilidad

i. Visibility

For the analysis of the visibility that there is from a point or path of observation it is necessary to determine the visual basin, which gives an idea of the areas that are visible from that point or path. In the case of points and routes selected for this study Visual basins were as follows:

San Marcos

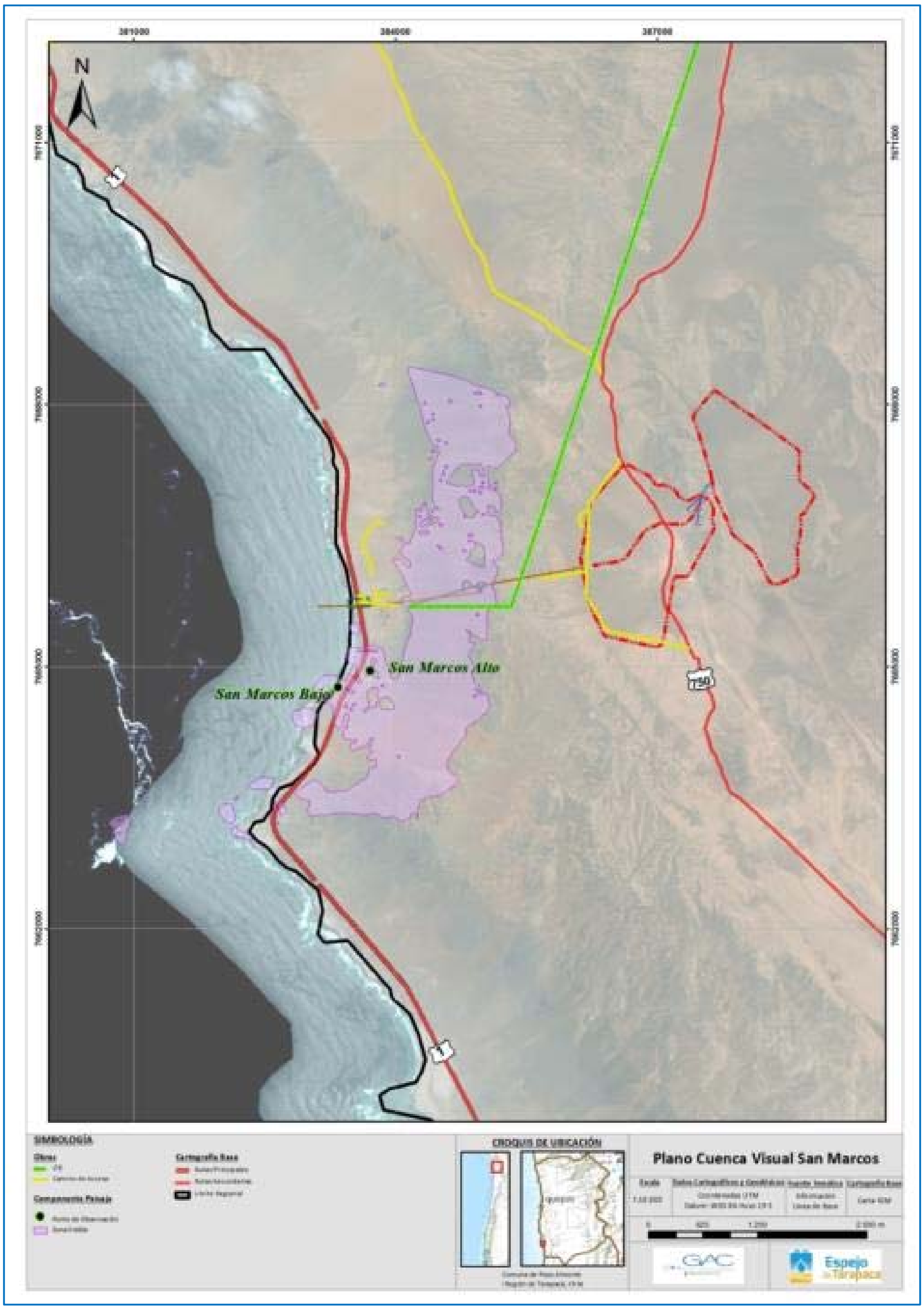
To be surrounded by rocky outcrops visible elements of the landscape from the selected points correspond mainly to the coastal cliff, spatially to the Northeast.

These rocky outcrops also hinder the visibility of the beach and part of the coast. The view towards the Pacific Ocean itself is not affected product of its size, since it covers all the vision towards the Western horizon.

Characteristics of visual basin:

- Shape: the layout of this visual basin Observer product features an elongated shape.
- View type: the elongated shape of this visual basin allows panoramic views of the landscape.
- Size: since it is a route and the kilometres remaining as an observer visual basin is a large size.
- Compactness: this visual basin areas exist within many areas of shadow or hidden areas.

Figure 3-192. Visual basin from San Marcos.



Source: Own elaboration.

Dry river

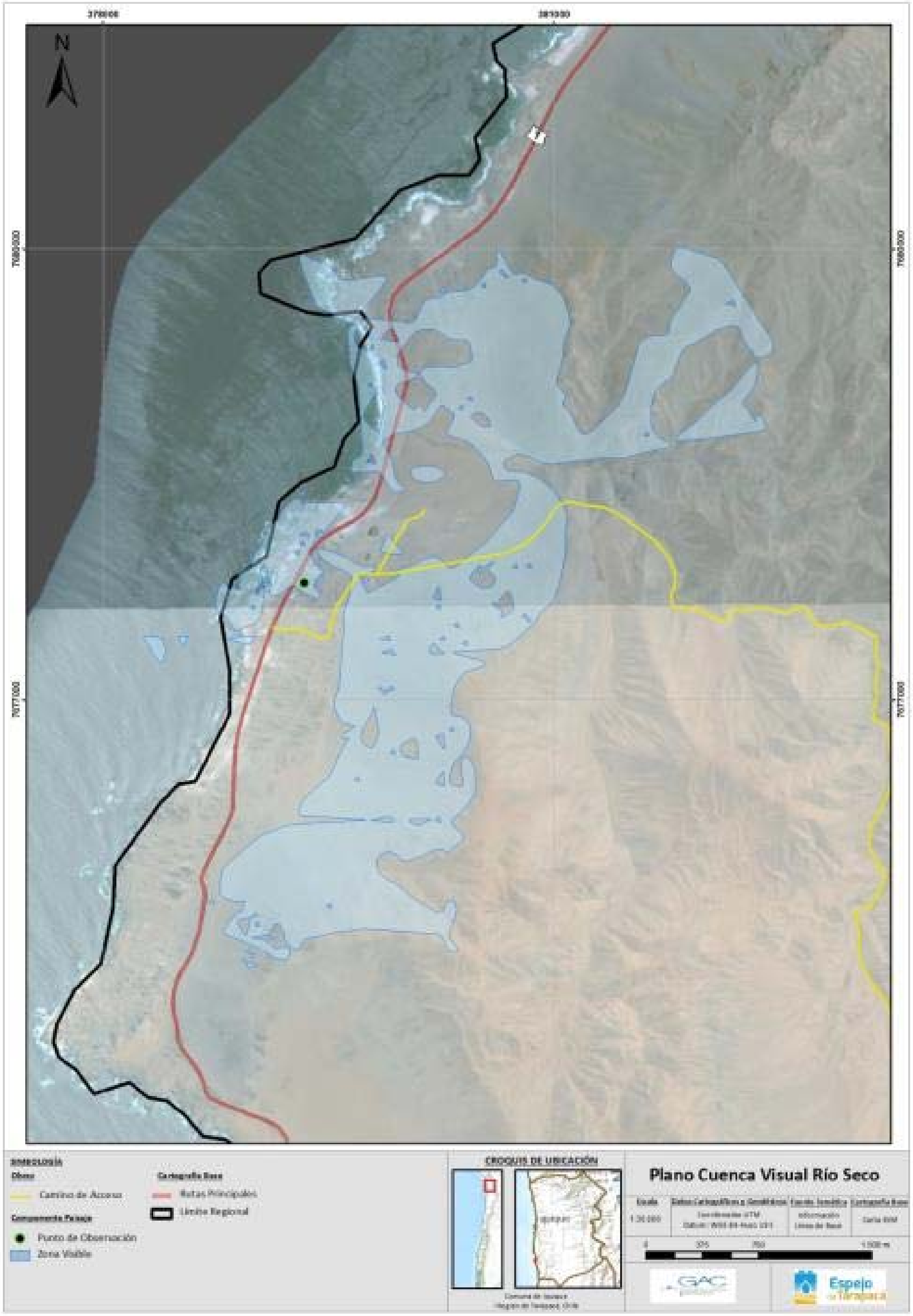
They are surrounded by rocky outcrops, the visible elements of the landscape from the selected point correspond mainly to the coastal cliff, both to the Northeast and Southeast.

These rocky outcrops also hinder the visibility of the beach and part of the coast. The view towards the Pacific Ocean itself is not affected product of its size, since it covers all the vision towards the Western horizon.

Characteristics of visual basin:

- Shape: the layout of this visual basin Observer product features an elongated shape.
- View type: the elongated shape of this visual basin allows panoramic views of the landscape.
- Size: since it is a route and the kilometres remaining as an observer visual basin is a large size.
- Compactness: this visual basin areas exist within many areas of shadow or hidden areas.

Figure 3-193. Visual basin from Dry river.



Source: Own elaboration.

Route 5

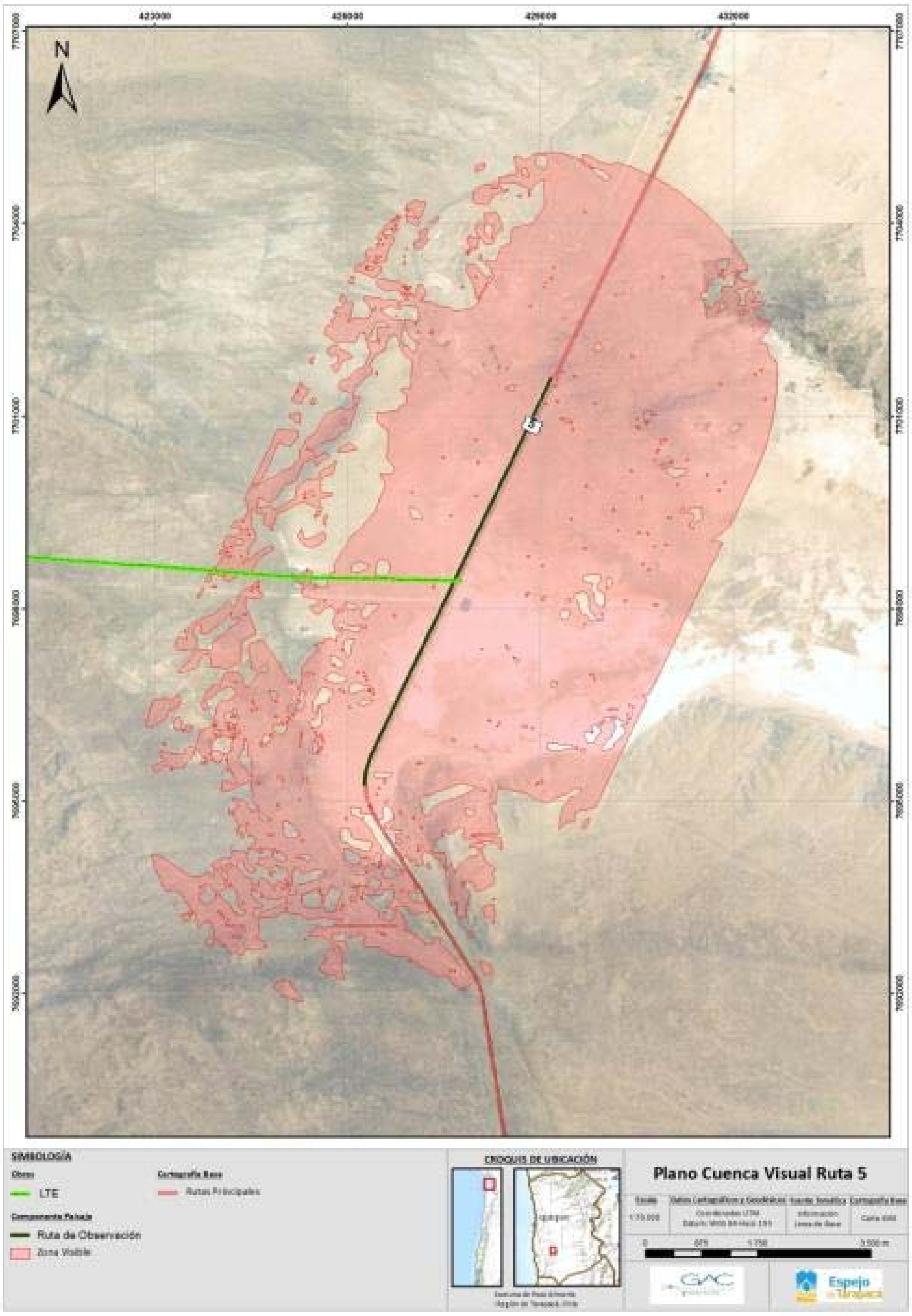
Visual route basin reaches maximum vision considered in this study of 3,500 metres, this is the product of low in some sectors the presence of elements of the relief that hamper visibility from the road.

Towards the Northwest and Southwest there are larger areas without visibility product of the hills that are generated by the descent of the mountain range of the coast towards the intermediate depression.

Characteristics of visual basin:

- Form: product of the disposition of this observer visual basin presents an elongated and oval shape.
- View type: the elongated shape of this visual basin allows panoramic views of the landscape.
- Size: since it is a route and the kilometres remaining as an observer visual basin is a large size.
- Compactness: this visual basin areas exist within many areas of shadow or hidden areas.

Figure 3-194. Visual basin from route 5.



Source: Own elaboration.

Route 1

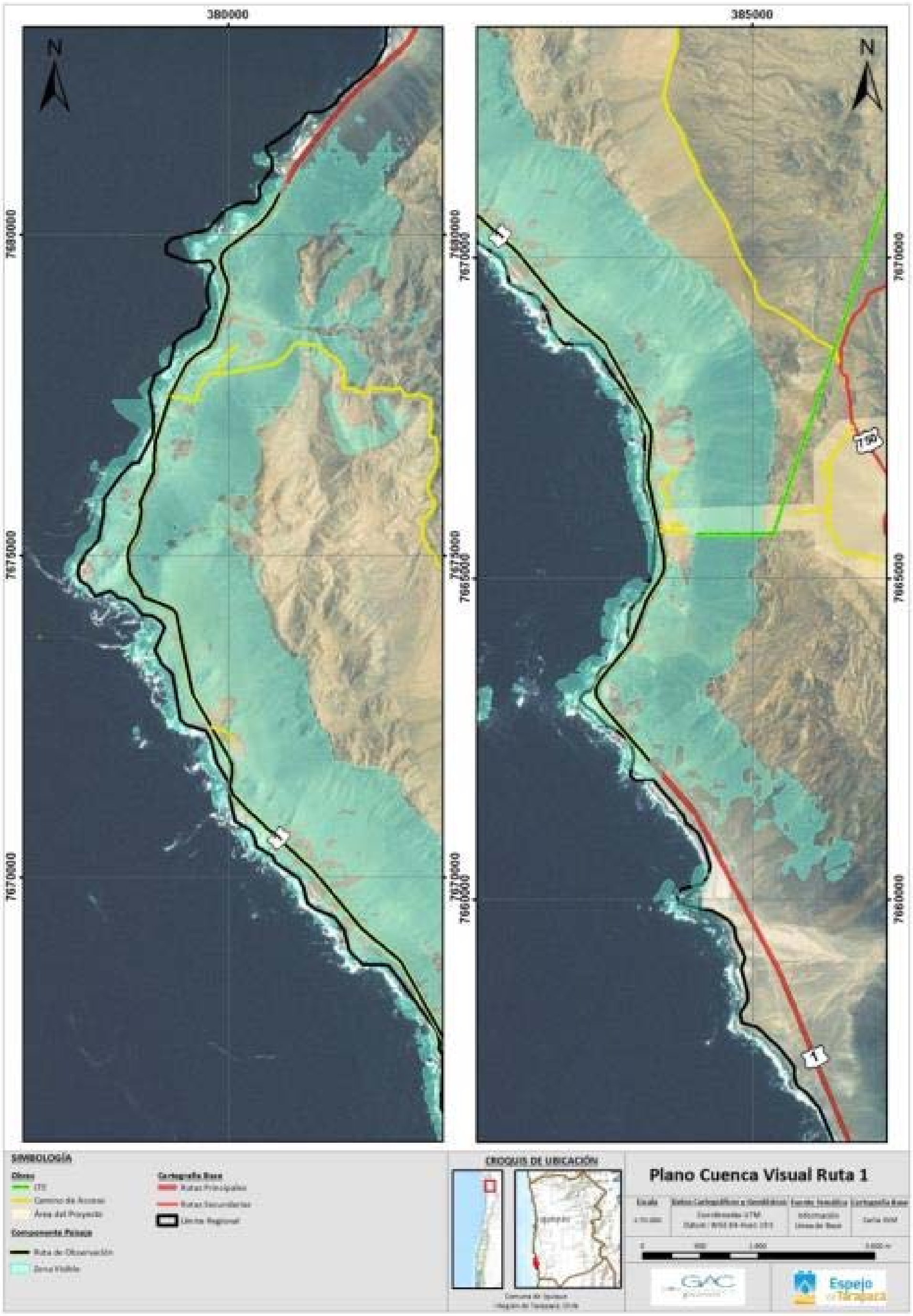
Along this route there are rocky outcrops that generate broken views of the coast and the planificie coast, being the element of the landscape that better displayed the cliff towards the Northwest and Southwest.

Ocean Pacific also it is possible to view from this route, covering much of the view toward the Western horizon.

Characteristics of visual basin:

- Shape: the layout of this visual basin Observer product features an elongated shape.
- View type: the elongated shape of this visual basin allows panoramic views of the landscape.
- Size: since it is a route and the kilometres remaining as an observer visual basin is a large size.
- Compactness: this visual basin areas exist within many areas of shadow or hidden areas.

Figure 3-195. Visual basin from route 1.



Source: Own elaboration.

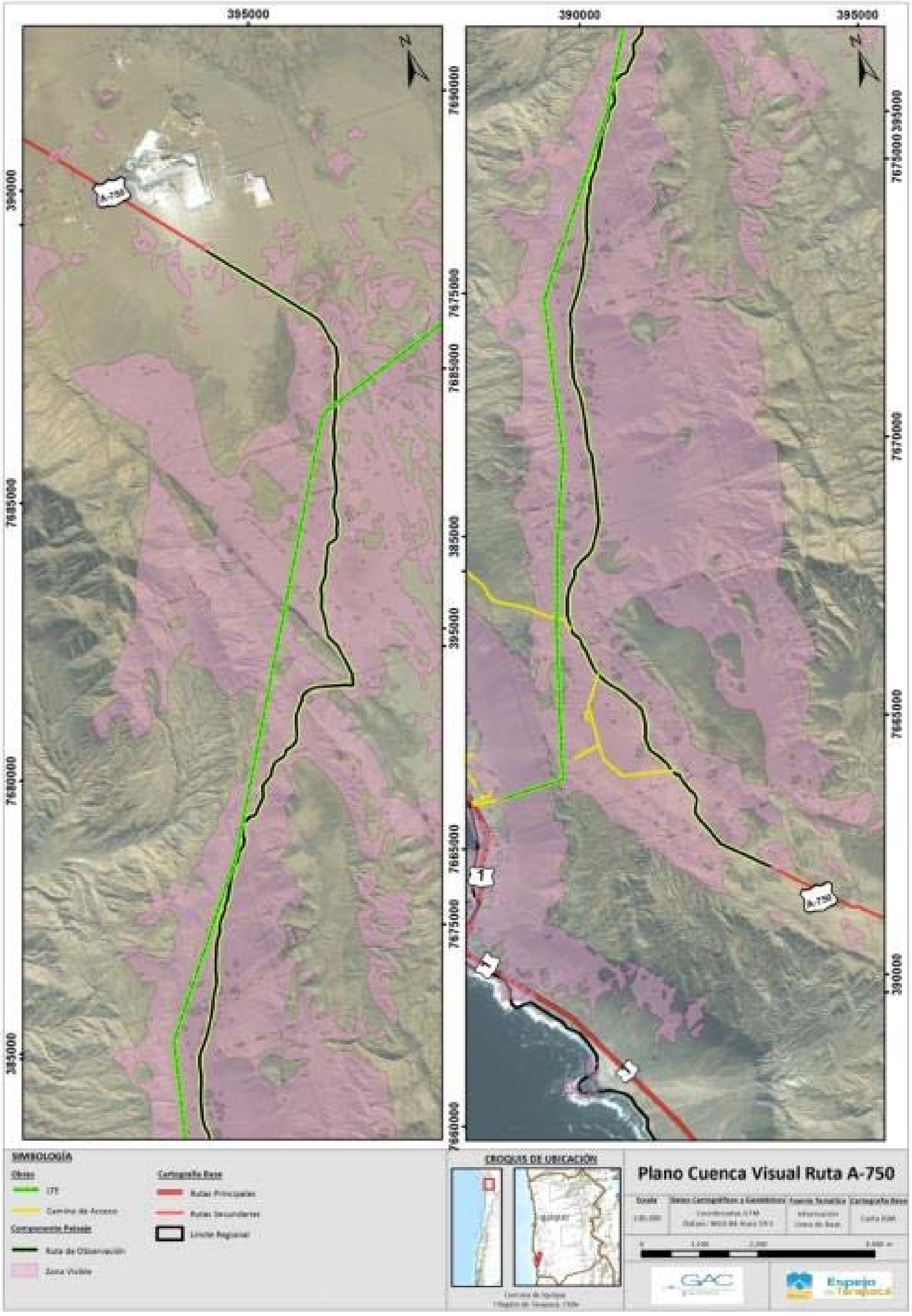
Route A-750

Along this route there are great panoramic views of the mountain ranges that are generated in the coastal mountain range and the river basins that are generated between these laces, within the recognized major watersheds is the basin of the Salar Grande The vegetation in this area is rather scarce and sightings of wildlife are limited to the presence of some coastal birds

Characteristics of visual basin:

- Shape: the layout of this visual basin Observer product features an elongated shape.
- View type: the elongated shape of this visual basin allows panoramic views of the landscape.
- Size: since it is a route and the kilometres remaining as an observer visual basin is a large size.
- Compactness: within this visual basin there are many shaded areas or hidden areas.

Figure 3-196 Visual basin from route A-750

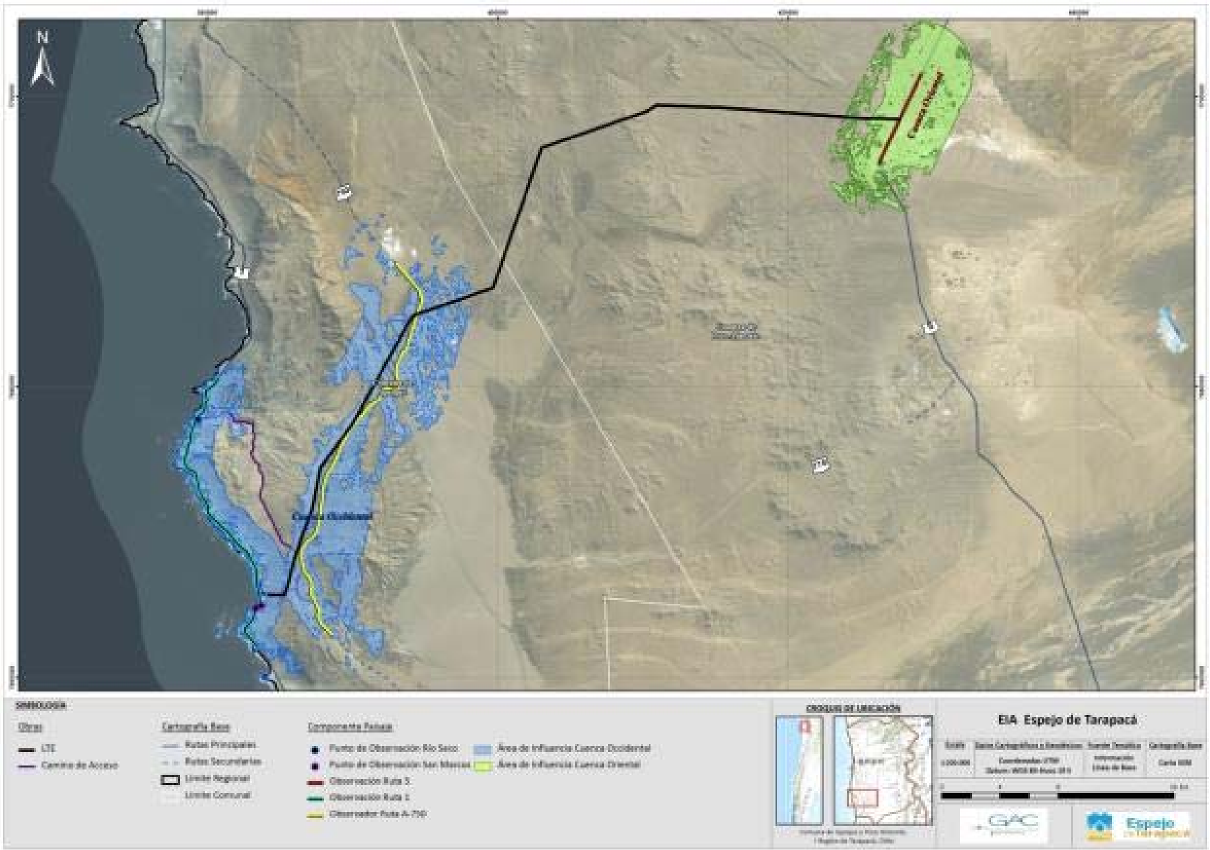


Source: Own elaboration.

ii. Intervisimerchantability and TOrea of Influencia

To determine the area of influence of the project an analysis of intervisibilidad, i.e. overlapped the Visual basins of points and observation routes identified, which in this case resulted in two Visual basins, the first located between the coastal sector and the coastal mountain rangefollowing route 1 and A-750which was named as basin Western and the second corresponding to the visual basin of route 5 in the sector of the Pampa del Tamarugal, named basin Visual Eastern (Figure 3-197).

Figure 3-197. Area of influence of the landscape.



Source: Own elaboration.

3.4.4.4 Definition of the Uopportunities for landscape

Analysis of the influence of landscape area settled 5 landscape units which are described below:

i. Unit 1 coastal edge

This unit, belonging to the coastal sub-area is located in the coastal sector of the commune of Iquique and encompasses the area from the beach up to the limits of the cliff coast, forming a long stretch that runs parallel to route 1, in relation to the characteristics biophysical can be set:

- Relief: This area is characterized by a coastal plain with presence of rocky outcrops covering in some sectors from the foot of the coastal cliff to the coast with aLTEsectors dominated by systems dunarios, rnancia earrings in this sector do not exceed 20%.
- Water: Pprincipal body of water present is this zone corresponds to the Oceano Pacifico that stands out with its clean waters.
- Vegetation: the vegetation is absent in this area.
- Fauna: The main fauna in this area corresponds to the coastal birds that can be seen in the you require from the beaches.

In relation to the structural characteristics can be set as follows:

- Landscape: the landscape is homogeneous because there is not much diversity of Visual attributes, therefore, and due to the extensive and repetitive of the biophysical characteristics, along the coastline of the region of Tarapacá landscape is a little unique.
- Naturalness: product of the low area anthropization predominates the condition of naturalness on the dominant coastal desert landscape, the main interventions in the landscape corresponds to small settlements (Caletas San Marcos and Rio Seco) and Route 1 which presents a relatively high traffic flow.

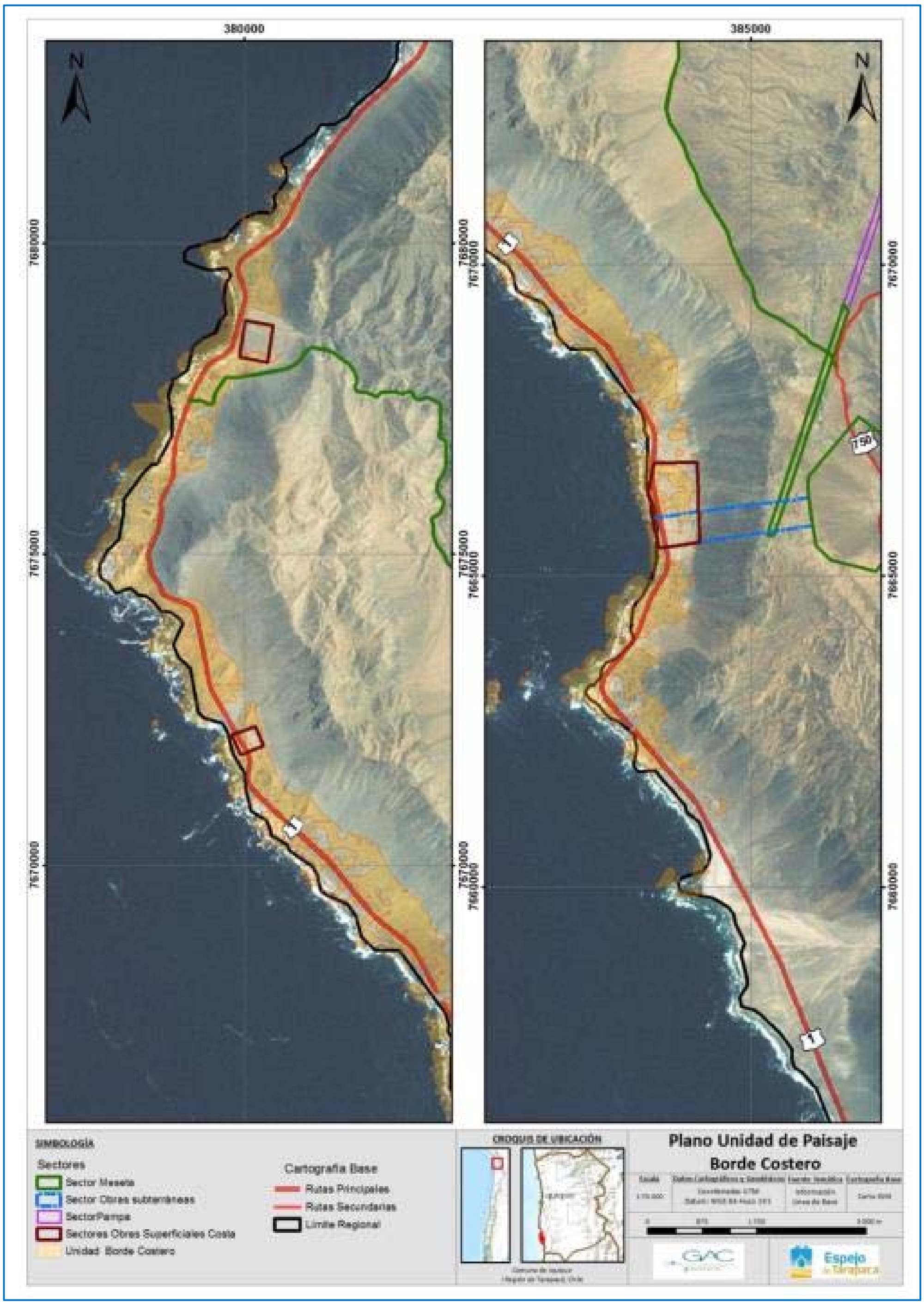
The aesthetic attributes of the landscape can be characterized in the following way:

- Shape: in relation to the forms present in this area the predominance of the curved lines on straight planes, with the exception of areas dominated by rocks forms product lines and right angles.
- Color: the main contrasts of colours that occur is this area this set of three elements the ocean, rocks and Sands, being predominant colors ranging from the range of yellow to red in clear tones, with some sectors where predominantly gray colors in various shades, especially in rocky areas.
- Texture: sands and rocks give the landscape of different textures depending on the type of rock and sand that in some sectors is very fine granulometry (usually in areas of dunes), and other thicker, forming several reservoirs along with gravels, which give the landscape of a mainly rough texture.

Figure 3-198. Photographs of the unit.

Source: Terrain photography registration.

Figure 3-199. Coastal edge landscape unit.



Source: Own elaboration.

ii. Unit 2 coastal cliff

This unit, belonging to the coastal sub-area is located in the coastal sector of the commune of Iquique and covers the area from limit the slope of the coastal Cliff area to the highest visible area in the same way geomorphological.

The biophysical features of this unit are:

- Highlights: this almost vertically presents heights of approximately 800 m.a.s.l., with slopes exceeding 50%, forming a great wall that stands out for its grandeur.
- Water: There are no bodies of water in this unit
- Vegetation: the vegetation is absent in this area.
- Fauna: there are occasional sightings of shorebirds flying unit

In relation to the structural characteristics can be set as follows:

- Landscape: the landscape is homogeneo because there is not much diversity of Visual attributes, therefore, and due to the extensive and repetitive of the biophysical characteristics, along the coastline of the region of Tarapaca, the landscape is fairly singular
- Naturalness: product of the almost non-existent anthropization of the area is dominated by the condition of naturalness on the landscape. There are some minor interventions such as quarries and tracks which interrupt the continuity of the form.

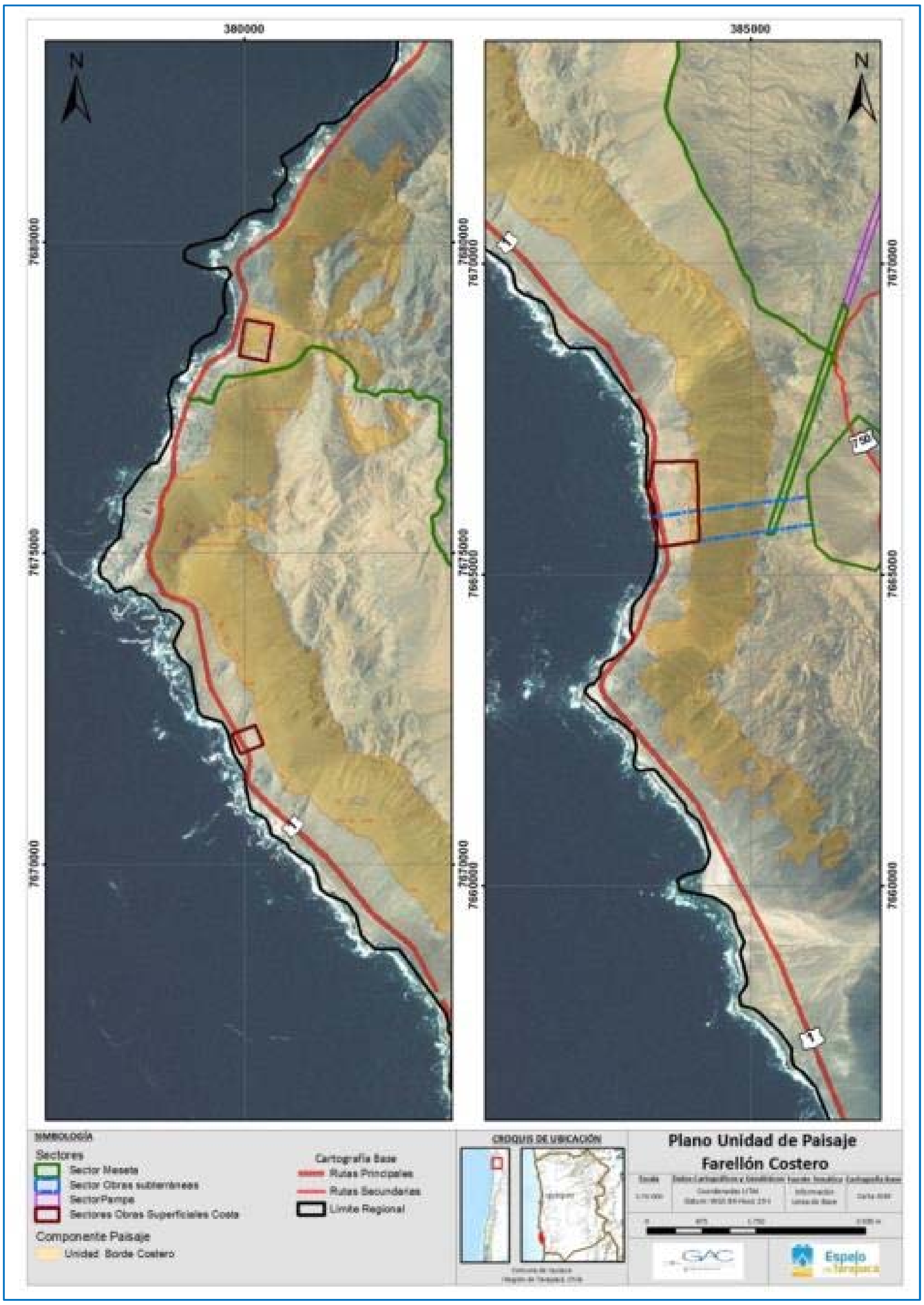
The aesthetic attributes of the landscape can be characterized in the following way:

- Shape: is identified the coastal cliff with the geometric shape of the rectangle, and the cones containing with numerous triangles whose base is at the foot of the slope.
- Color: in this unit there is a low contrast of colors as these are within the range of the yellow and Red shades mainly clear, the major contrast of color are given due to the climatic conditions of partial cloud cover where you In addition the range of green and gray colors.
- Texture: the coastal Cliff area is mainly covered with sand and small gravel, forming in some areas small fields dunarios. However the presence of outcrops rocos and rocks that have fallen off of them give the landscape of an average roughness.

Figure 3-200. Photographs of the unit.

Source: Terrain photography registration.

Figure 3-201. Coastal Cliff drive.



Source: Own elaboration.

iii. Unit 3 mountain range

This unit, belonging to the Pampa del Tamarugal sub-zone is located in the area of the intermediate depression in the commune of Pozo Almonte and covers an area of mountainous semi bordering the area corresponding to the Salar Bellavista.

The biophysical features of this unit are:

- Relief: it corresponds to a small mountain range slopes which have heights ranging from 950 to 1150 meters above sea level, bordering the Southwest limit of the salar de Bellavista, which is sandwiched with the slopes that descend from the mountain range of the coast towards the pampa del tamarugal , with slopes between 20 and 40%
- Water: There are no bodies of water in this unit
- Vegetation: the vegetation is absent in this area.
- Fauna: Wildlife sightings were not recorded in this area

In relation to the structural characteristics can be set as follows:

- Landscape: the landscape is pretty homogeneo because there is not much diversity of Visual attributes, is also common in the area
- Naturalness: Although the landscape seems to have a natural look a more detailed view sample as saltpeter offices Alliance, Bellavista and Buenaventura activities were the main shapers of the landscape forms, these being. interventions over the ruins of these offices the major vestiges of human action in the area.

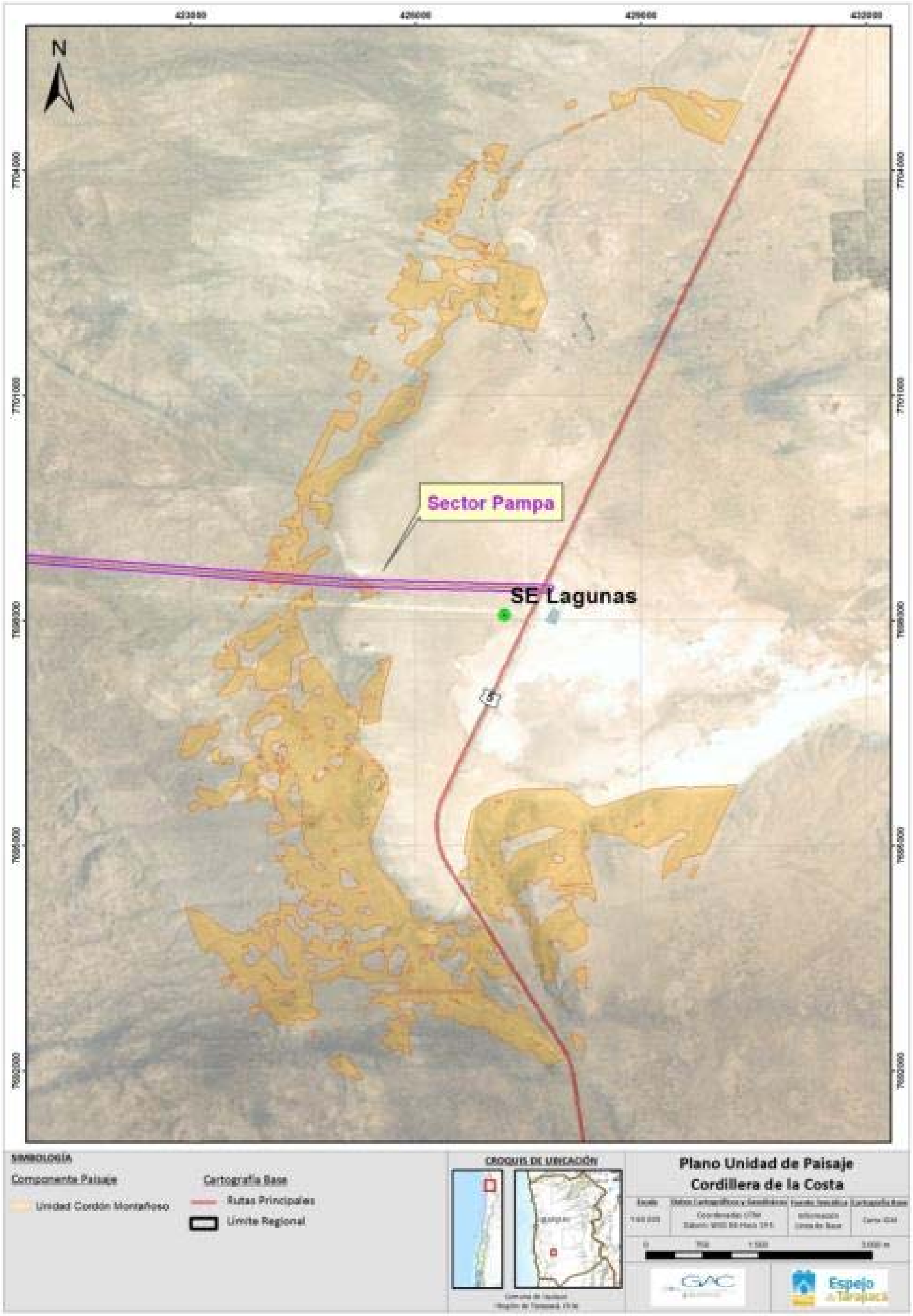
The aesthetic attributes of the landscape can be characterized in the following way:

- Shape: the main recognizable shapes in the landscape are the curved lines that develop on flat straight lines that generate shapes of the hills.
- Color: the dominant colors in this area vary in the range of the yellow and red with very little contrast between the elements of the landscape, the presence of gravel, sand and salt shores generated that the texture of the soil is very rough.

Figure 3-202. Unit Mountain range

Source: Terrain photography registration.

Figure 3-203. Mountain unit.



Source: Own elaboration.

iv. Unit 4 Pampa del Tamarugal

This unit, belonging to the Pampa del Tamarugal sub-zone is located in the sector of the intermediate depression in the commune of pozo Almonte.

The biophysical features of this unit are:

- Relief: The main physical feature of this area is given by the plain that develops from the mountain range of the coast towards the depression intermediate slopes not exceeding 20%
- Water: bodies of water in the area are not identified
- Vegetation: the only species that is identified in the area corresponds to the tamarugo are concentrated in the Northeast sector of the unit, in the rest of the unit plant species are not identified
- Fauna: Wildlife sightings were not recorded in this area

In relation to the structural characteristics can be set as follows:

- Landscape diversity: the structure of the landscape is homogeneous due to the dominance of a single element in the entire area, the plains of the pampa.
- Naturalness: on the landscape there are big intervrather than route 5, S encionesubestacion Lakes and some tracks that are on the pampa, yet the naturalness of the landscape is dominant.

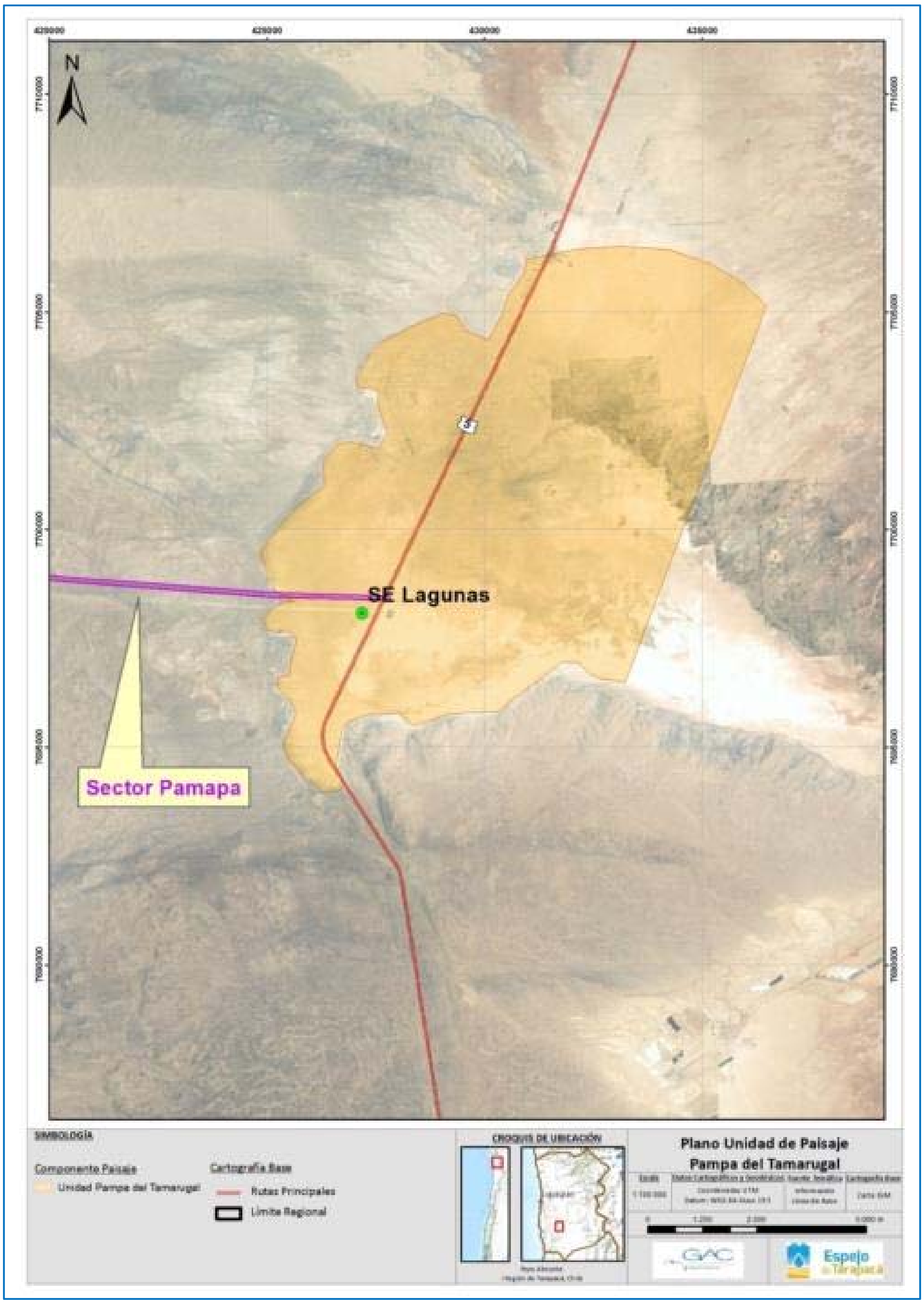
The aesthetic attributes of the landscape can be characterized in the following way:

- Form: to be one area flat pride themselves not large forms, the main forms correspond to lines that are given by the road and power lines coming to the Subestacion lagoons.
- Color: the colors area presents colors predominantly in the range of the yellow and orange product of the soil characteristics accompanied by typical white crust on the surface of a Salt Lake.
- Textures: roughness is predominant in this area not only by the sands are by layers of salt and minerals that were formed long ago giving way to the salar de Bellavista.

Figure 3-204. Photographs of the unit.

Source: Terrain photography registration.

Figure 3-205. Pampa del Tamarugal unit.



Source: Own elaboration.

v. Unit 5 coastal mountain range

This unit, belonging to the subzone coastal mountain range is located in the sector of the mountain range of the coast in the town of Iquique.

- Relief: it corresponds to a small hilly cardon slopes which have heights ranging from 580 to 1100 meters above sea level, which takes place between the coastal plain and the intermediate depression. Within this area, one of the most important morphological features is the presence of ancient basins where it stands out the basin of the Great Salt Lake. In this sector you can find slopes between 10 and 50%
- Water: There are no bodies of water in this unit
- Vegetation: the vegetation is absent in this area
- Fauna: in the area some sightings of shorebirds can be seen

In relation to the structural characteristics can be set as follows:

- Landscape: the landscape is homogeneous because there is not much diversity of Visual attributes, therefore and due to the extensive and repetitive the biophysical characteristics of the landscape is little unique.
- Naturalness: product of the low area anthropization predominates the condition of naturalness on the dominant coastal desert landscape, the main interventions in the landscape corresponds to the route A-750, 770 - route and some other tracks made by vehicles. There is also a small mining task called Tenardita

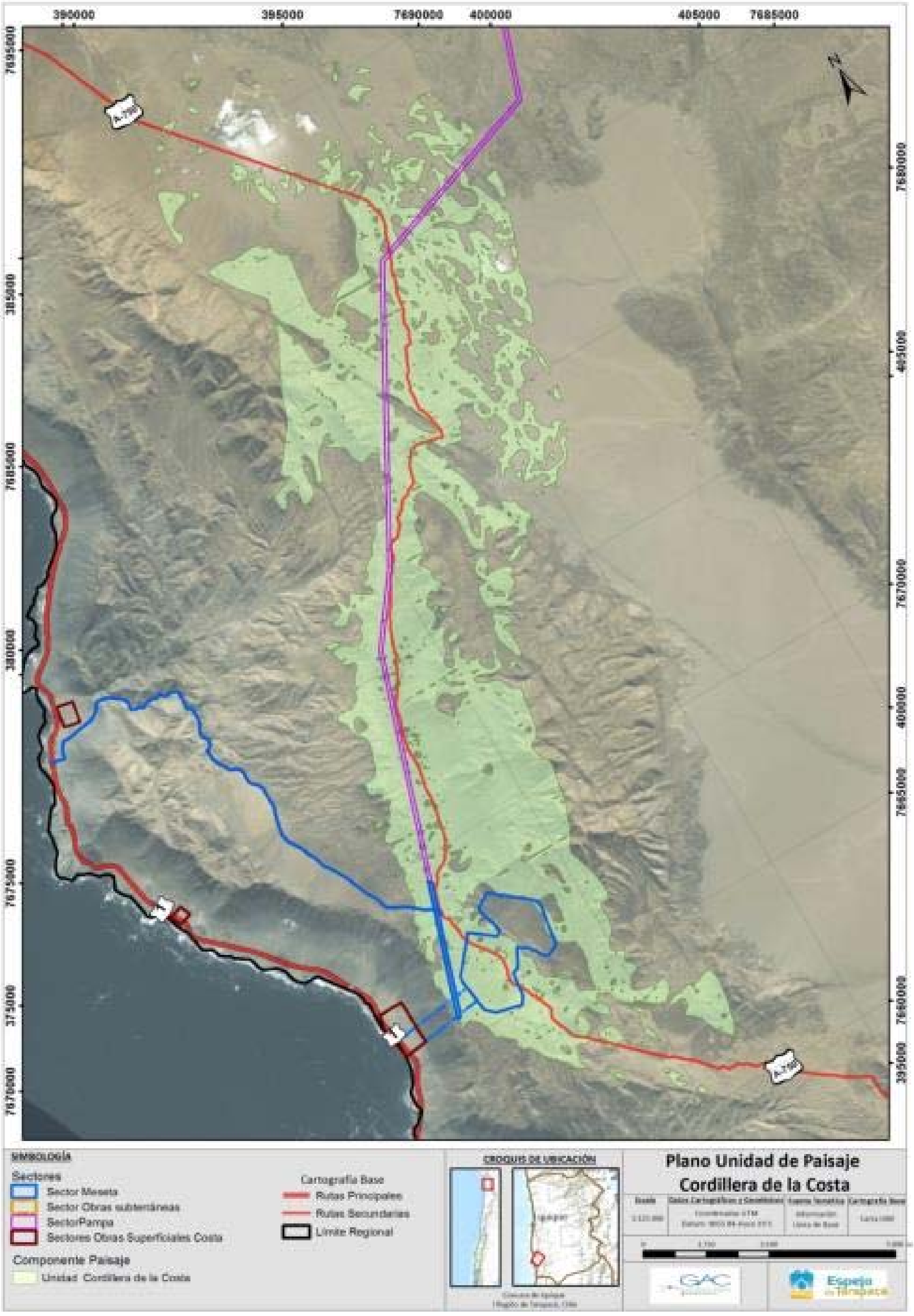
The aesthetic attributes of the landscape can be characterized in the following way:

- Shape: the main recognizable shapes in the landscape are the curved lines that develop on straight planes formed by mountain ranges. You can also recognize some forms triangules of the generation of cones
- Color: the dominant colors in this area vary in the range of yellow and coffee with very little contrast between the elements of the landscape
- Texture: it is area is mainly covered in sand and small gravel, forming in some areas small fields dunarios. However the presence of outcrops rocos and rocks that have fallen off of them give the landscape of an average roughness.

Figure 3-206: Pictures of the unit

Source: Terrain photography registration.

Figure 3-207 Landscape coastal unit



Source: Own elaboration.

3.4.4.5 Analysis of Visual quality

In relation to the analysis of visual quality, the Table 3-88 Displays the results of the assessment of the bio-physical, aesthetic and structural characteristics of the landscape.

Table 3-88. Visual quality of the landscape units.

Attribute	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5
Biophysical					
Relief	Media	Outstanding	Media	Low	Media
Soil	High	High	High	Outstanding	High
Water	High	-	-	-	-
Vegetation	Low	Low	Low	Media	Low
Fauna	Media	Low	Low	Low	Low
Structural					
Landscape diversity	Media	High	Low	Media	Media
Naturalness	Media	High	Low	Media	Media
Aesthetic					
Form	Media	Low	Low	Low	Low
Color	Media	Media	Low	Low	Low
Texture	-	-	-	-	-
Dominant quality	**Media**	**Outstanding**	**Low**	**Outstanding**	**Low**

Source: Own elaboration.

As you can be seen in the Table 3-88, the landscape units present a visual quality mainly Media-Low, already What its attributes are considered as common or recurrent macrozonal landscape context. The low diversity of landscape elements as well as the absence of biotic elements and water cause the landscape to be uninteresting.

Units who presented outstanding attributes, the coastal Cliff drive and the pampa del tamarugal unit, corresponds to a single biophysical attribute that stands out from the rest, in the case of the first corresponds to the relief and in the case of the second floor.

3.4.5 Conclusions

In relation to the analyzed landscape is established that the character of the landscape is determined by the dominance of the abiotic attributes, specifically of the geomorphologic elements and soil. The landscape forms are stable and persistent so the not exists a great uniqueness of attributes of the landscape. Anthropic interventions are very low, these being mainly roads, power lines, substation and some villages, so the landscape preserves its naturalness.

Visibility conditions vary greatly between the coastal sector, of the coastal mountain range and the pampa, the first visibility conditions are conditioned to the forms of relief, that generate broken views of the landscape, while in the second and third broad basins Visual generating a high degree of exposure of the territory are generated.

In relation to the types of landscapes identified, two units were outstanding, one by the altitude, shape and location of the relief of the coastal cliff, and the other by the high degree of roughness of its soil, in the pampa del tamarugal, representing typical landscape desert of northern Chile, especially by the presence of salt flats.

Despite this, the sum of the bio-physical, aesthetic and structural features that give character to the landscape, determined that the area of influence of the landscape presents a moderate landscape value or underdetermining that for the most part it's a common landscape in the region, with few outstanding visual attractions.

3.4.6 References

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3.5. Priority sites and protected areas

3.5.1 Objectives

Identify and describe protected areas and priority sites within the area of influence of the Project, permitiendor ecosistemita-cultural vision the area in which it is to be installed the Project.

3.5.2 Methodology

Is They considered the digital coverage arranged by the Ministry of the environment (year 2013)identifying the areas of wetlands, priority sites for conservation, Ramsar sites, Areas protected by the State, private protected Areas, properties for conservation, biosphere reserves, ecological preservation Areas and present hunting ban Areas the region where it will be located in the Projectidentifying and characterizing those who are linked with the Project in the area of influence

Also mention is made of the priority sites for conservation, taking into account the recognized by the Ministry of the environment on the basis of regional biodiversity conservation strategies.

The area of influence was defined on the basis of a 3 km buffer for all the works of the Projectwithin this area are considered protected Areas and priority sites that fall within that area. The establishment of this area allows not only to identify those areas operated on the surface for the Project, but that allows to establish those that might be compromised due to its proximity possibly alterations of the quality product air or the issuance of noise. Is withsidera also other protected areas and priority sites close to the Project for power establish a vision more ecosystem-culture of the environment in which is Insert the Project

3.5.3 Theoretical framework

The protected areas are sectors delimited geographically than, due to its wealth of natural and cultural they have been classified as relevant to your care, seeking its protection, preservation and conservation of attributes through different instruments.

Shall be understood as protected areas all areas with environmental relevance and that are under some kind of legal protection, including those of the national service of Areas protected by the State (SNASPE), ecological preservation areas, areas of prohibition of hunting, estate tax earmarked for conservation, marine parks, biosphere reserves, RAMSAR sites, among others.

In the Table 3-89 mentioned all the types of protected areas in Chilethat they are recognized by environmental impact assessment system, considered under official protection.

Table 3-89. List of category and Legal source of Areas protected, Reconocidas by the environmental impact assessment system.

Category of protected Area	Legal source
National reserve	Law 19,300, article 10
	D.S. No. 531/67 Foreign Ministry
National Park	Law 19,300, article 10
	D.S. No. 531/67 Foreign Ministry
	D.S. 4.363/31 Ministry of lands and colonization
	D.L. No. 1939/77 (article 21)
Reservation of unspoilt regions	Law 19,300, article 10
	D.S. No. 531/67 Foreign Ministry
Natural Monument	Law 19,300, article 10
	D.S. No. 531/67 Foreign Ministry
Nature sanctuary	Law 19,300, article 10
	Law No 17,288/70 of national monuments (article 31)
Marine parks	Law 19,300, article 10
	Supreme Decree 430/91 Ministry of economy and development (article 3 letter d)
Marine reserves	Law 19,300, article 10
	Supreme Decree 430/91 Ministry of economy and development (article 2 No. 43)
Forest reserve	D.S. 4.363/31 Ministry of lands and colonization (article 10)
	D.L. No. 1939/77 (article 21)
Historical monuments	Law No 17,288/70 of national monuments (article 12)
Typical or picturesque zones	Law No 17,288/70 of national monuments (article 30)
Areas or centres of national tourist interest	Decree-Law No. 1.224/75
Historic conservation areas	D.F.L. No. 458/75 Ministry of housing and urban development (article 60)
Ecological preservation areas contained in the instruments of	D.F.L. No. 458/75 General Law of urban development and construction, and D.S. N ° 47/92 Ministry of housing and urban development, General town planning and constructions Ordinance and its modifications.
According to existing OGUC Areas of natural or Cultural heritage resource	

Category of protected Area	Legal source
Wetlands of international importance, especially as waterfowl habitat.	D.S. No. 771/81 Ministry of Foreign Affairs
Aquifers which feed on vegas and wetlands in the Tarapaca and	D.F.L. Nº 1,122/81 (water code), section 63
Property tax allocated by the Ministry of national property, for purposes of	D.L. No. 1939/77, articles 1, 19 and 56
Marine and coastal protected areas	D.S. No. 827/95 Foreign Ministry
	D.F.L. No. 340/60 Ministry of defence
	D.F.L. Nº 2.222/78 Ministry of defence
	Supreme Decree No. 475/94 Ministry of defence

Source: Ministry of the environment[22].

There are also other areas with protection that do not constitute protected areas for purposes of the SEIA, which are the districts of conservation of soil, forests and water, attractions historical scientific, protection Areas for the conservation of the richness Tourism, Areas of indigenous development and the Areas of prohibition of hunting. This last category was considered given that we identified two areas within the area of influence of the Project.

In addition I will be evaluatedyou priority sites for Conservacion in the environmental impact assessment systemwhich are terrestrial, marine and coastal areas of high value for conservation and sustainable use of its biodiversity, which are identified by their contribution to ecosystem representation and its uniqueness.

This section seeks to identify and characterize the Protected Areas and priority sites in the area of the Project.

3.5.4 Results

3.5.4.1 Protected areas

Within the region there are a number of protected areas highlighting the national parks Volcano Isluga and Salar de Huasco, both located in the high plains of the region sector. The Salar de HutoSCO is also recognized as well national protected nature sanctuary and Ramsar site. Both parks feature a variety of species both flora and fauna representing the Chilean altiplano.

[22] http://www.e-seia.cl/informacion_seia/usuarios_externos/informacion_componentes_ambientales/indice.php

Another protected area highlightsda It corresponds to the Pampa del Tamarugal, which emphasizes the presence so much of fauna and flora despite the extreme aridity.

Product of their long history related to nitrate and ancient religious traditions the region has 57 landmarks that seeks to protect the culture of this region, highlighting the Humberstone and Santa Laura saltpeter offices, as well as the Churches of various peoples.

In the Table 3-90 There is the number of protected areas in the region of Tarapacá and protected areas that are hedgesas to the area where they develop the Project.

Table 3-90. Areas protected from the Region of Tarapacá.

Category of protected Area	Protected areas Regional	Protected areas in the area of influence
National reserve	1	1
National Park	2	0
Reservation of unspoilt regions	0	0
Natural Monument	0	0
Nature sanctuary	3	0
Marine parks	0	0
Marine reserves	0	0
Forest reserve	0	0
Historical monuments	57	0
Typical or picturesque zones	4	0
Areas or centres of national tourist interest	2	0
Historic conservation areas	0	0
Ecological preservation areas contained in the instruments of Territorial Planning	2	0
Wetlands of international importance (sites Ramsar)	1	0
Aquifers which feed on vegas and wetlands in the Tarapaca and Antofagasta regions	37	0
Property tax allocated by the Ministry of national property.	4	0
Marine and coastal protected areas	0	0

Source: Own elaboration.

- **Sector Pampa**

Within its area of influence, this sector presents a protected area called the Reserva Nacional Pampa del Tamarugal, described below:

i. National reserves

- **Pampa del tamarugal**

This national reserve administered by Conaf, located 75 Km into the interior of Iquique and 22 km south of Pozo Almonte. With a surface of 100.650 has. Sector La Tirana and the Pintados and Bellavista, Sector is divided into three lots, the sector of Zapiga in the comuna of Huara, both in the commune of Pozo Almonte.

The main flora is made up of the species known as the Tamarugo)*Prosopis tamarugo*) of the order of the legumes and the GENero Prosopis. More than 10 meters up to find napa that it has a double root system, with tap root able to get underground. It reaches 15 meters in height with trunks of nearly 1 meter in diameter. The fruit is a short, approx 25 mm thick legume. It flowers between the months of September to November and they are pollinated by Hymenoptera insects.

In addition, it is possible to find Prosopis alba (Mesquite, Prosopis strombulifera (Fortune) and Prosopis Burkati (Chulki) belonging to the same genus.

Other vegetation are *Atriplex atacamensis* (Cachiyuyo), *You fallto thepinito aphylla* (Broom), *Tessaria absinthiodes* (Brea or Sorona), *Atriplex sp* (Pillaya) and the *Distchlis spicata* (Salt grasses), among the most representative, the latter stands out for its vertical growth because of the saline soil condition.

The desert conditions, do not allow an abundant biodiversity, however, thanks to the formed ecosystem environment the Tamarugo, It is possible to find 18 species of birds, highlighting the bird of the Tamarugo)*Cornistrorum tamarugensis*) with the presence of September to February to the interior of the reserve. In addition to hawks, owls, smallen and other birds of prey. Always present is the vulture red head)*Cathartes aura*).

The most representative mammals are the culpeo and grey Fox, along with rodents such as the long-eared leaf)*Phyllotis Darwin*) and mouse (Andean)*Abriotix Olivaceus*), the Tuco Tuco del Tamarugal)*Ctenomys robustus*) currently in category of conservation V, although local data indicate that it is possible that it is in danger of extinction, since that it has not been registered for several years. It is important to point out to the jackfruit, one of the few existing in Chile marsupials in this case corresponds to the *Thylamis pallidiior*It is very similar to a mouse has large eyes, nocturnal behavior, and despite being marsupial has no bag, males reaching 11 cm excluding the tail, feeds on insects and shown from September to February. It is also possible to identify at least two species of bats, which serves as a biological controllers and some theories point out that they can make in the pollination of the mesquite.

In cultural aspects, are important groups of geoglyphs in Cerro Pintado, as well as archaeological sites in Aragon and Tiliviche and the ruins of saltpeter.

Figure 3-208. Pampa del Tamarugal national book.

Source: Conaf (http://www.conaf.cl/)

3.5.4.2 Protected areas Cercanas to the Project

i. Monuments Historicos

The landmarks closest to the study area corresponds to the geoglyphs of Pintados (21 Km to the North) and the properties of the former Office nitrate Iris (12 Km to the South).

- **Geoglyphs of Pintados:**

Located 96 km from Iquique and in the commune of Pozo Almonte, declarados Historical monument (D.S. 5591 year 1969)they are cave manifestations pre-Hispanic dating back to the IX century AD, it is located on a slope of 45 ° of tilt hills approximately and 5 Km in length that identifies 66 panels or sets of 384 anthropomorphic, Zoomorphic and geometric figures large size, some of them reaching a length of 100 m. According to archaeologists these geoglyphs represent a mysterious and enigmatic, past that relates to artistic expressions, signs or shrines linked to the cult of the hills and fertile. TO the same time, they served as a guide to the great caravans that came from the Highlands. Proof of this are the traces of the paths that were part of the system of routes, why were people accompanied by a good amount of flames crossing the Pampa del Tamarugal to connect the coast with the valleys, ravines and the Highlands.

Figure 3-209. Pintados geoglyphs.

Source: Conaf.

- **Properties of the Ex Oficin Salitrera Iris:**

Declared historical monument (D.S. 706 of year 1990), nitrate Iris office building began the year 1910 society Astoreca and Quiroga, Quiroga Urruticoechea families invested and Fidel Astoreca P. Iris was transferred to the transnational Dutch DSM, mining division, who has installed in its terrain a modern plant producing iodine. She currently coexist the task yodera and elements of the former camp and area industrial nitrate industry. This monument includes the management House, Chapel and kiosk:

- House Administration: built in pine wood with the architecture of these buildings, in English style, characterized by a main facade surrounded by a corridor and an elsewhere on the second floor.
- The square kiosk built in metal and wooden decorations.
- Chapel: built in oregon pine, a single nave with a small bell to symmetrical tower under the access mode.

Despite not being protected as a national monument, Iris has other buildings of interest such as the grocery store that retains part of its Bookshelf, the Maestranza bullring, which retains one of its machines, pool (in poor condition) and some of the homes of employees.

ii. National property protected

Within protected areas close to the Project the closest national protected property is high Patache (16 Km to the Northwest):

- **Alto Patache**

Also known as Oasis of mist, is a good national protected, awarded in concession by the Ministry of national property to the Pontifical Catholic University of Chile in 2007, for the purpose of conservation, research, education and sustainable development of their resources. It is approximately located 65 km. to the South of the city of Iquique, and includes coastal plains, coastal cliff and coastal mountain range sectors. The surface of the land corresponds to 1.114 hectares, in the find a fog oasis, located in the absolute wilderness. Its high-value bio-cultural highlights. epresenta an ecosystem pampean with high ecological importance due to the presence of endemic species, such as beetles, reptiles and flowerES.

The site contains vestiges of the old cazadora-r communityecolectora that inhabited the area between 6,300 to 8,000 years B.C. The objective of the Cawarding is the development of basic and applied science.

Figure 3-210. Alto Patache.

Source: Ministry of national monuments.

3.5.4.3 Priority sites for conservation in the environmental impact assessment systemCercanos to the Project.

Priority sites for conservation are terrestrial, marine or costal areas of high value for conservation and sustainable use of biodiversity, are identified by their contribution to ecosystem representation, by its uniqueness ecological or constitute a habitat for threatened species, inter alia, to its management, conservation, protection or restoration.

These sites are listed as part of the Convention on biological diversity for the year 1994, from which were developed biodiversity strategies for each region of the country, establishing a list of priority sites at the regional level (338 places), of which We selected 68 at the national level in order to concentrate efforts for their protection, among which (to date) 4 have been regulated under official protection.

The law Nº 20.417, which incorporates a number of changes to the law Nº 19,300 came into effect in 2010. Among them, amending article 11 which determines the effects, characteristics or circumstances by which a Project You must undergo the evaluation system of environmental impact assessment of environmental impact (EIA). En_particular the letter d) joins the SEIA by EIA, as the cause of income when it Specifies that the location of the Project It is in or next to priority sites.

In the area close to the Project It is possible to identify the two priority sites selected for this region: Punta Patache (27 Km to the Northwest) and Bay Chipana (8 km to the South), however neither of these is located within the area of influence of the Project.

- **Punta Patache**

It includes a coastal marine environment, with the presence of marine mammals, especially species with conservation problems, it also presents a high diversity of local and migratory marine birds.

This sector represents an important example of vertebrate fauna aquatic in the region, particularly species with conservation problems. Punta Patache, is located in an area of high presence of Projects of industrial development, artisanal fishery and recreational activities.

In ecological terms, corresponds to a coastal ecosystem of singular importance. Its considerable projection into the sea, in conjunction with the Oceanographic phenomena occurring there, generates a zone of upwelling, which for its wealth of nutrients triggers a great productivity marina, with complex food chains. All this explains and allows the existence of an interesting and unusual biodiversity, which is characterized mainly by its rich fauna diversity, being the most abundant groups of local and migratory marine birds species, and colonies reproductive and common seals)*Otaria flavescens*), fine sea lions)*Arctocephalus australis*), and families () sea otters*Lontra felina*).

Currently, the State of conservation of some birds and marine mammals that inhabit this sector is worrying. For example, According to the Rules of classification of species, the Penguin's Humboldt (*Spheniscus humboldtiy*), the chungungo)*Lontra felina*) isn State "Vulnerable". Other 'vulnerable' species are the guanay)*Phalacrocorax bouganvillii*) and the gaviota garuma)*Larus modestus*). TO"OME species are in a State of"Inadequately known"as the (booby)*Sula variegata*) and the lile)*Phalacrocorax gaimardi*).

- **Bay Chipana**

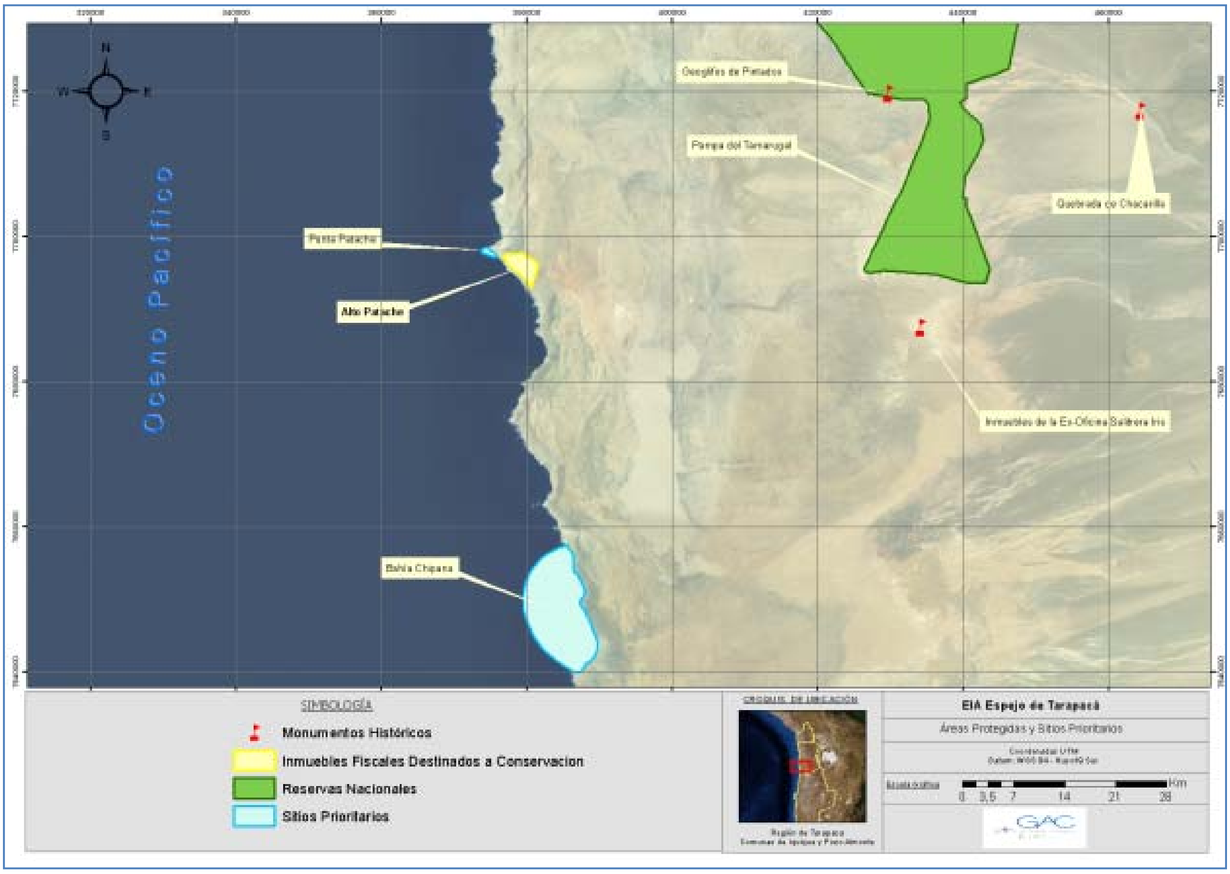
It comprises a marine coastal environment, with an area of high biological productivity and reproduction, spawning and recruitment of pelagic marine species is highlighted by the presence of the phenomenon of upwelling marine.

The contribution of nutrients, product of the upwelling, transforma the sector in highly productive. The lack of power allows the stratification of the water column in which plankton occurs, so it also stratified and abundant. Both features transform the sector in one of the main focuses of coastal fish reproduction in the region. In the sector they spawn normally and produced juveniles of different fish such as anchovy and silverside.

The birds existing in the sector, include the breeding of the small tern)*Sterna lorata*) species "endangered" and uses the sands between the beach and the slopes of the coastal hills to nest. In addition, this Bay, is the only point of Chile with the permanent presence of green turtle)*Chelonia mydas*)

With respect to the environmental issues associated with this sector, strong existing pressure on hydro-biological, mainly of artisanal, semi-industrial and industrial fishery resources can cause a collapse in the localized stocks of pelagic resources approaching the coastline.

Figure 3-211. Sites and protected areas Prioritarios in Athe project area.



Source: Own elaboration.

3.5.5 Conclusions

The Tarapacá Region boasts a wide variety of Protected Areas that seek to ensure biological diversity, preserve nature and conserve environmental heritage under official protection. Most of these are in the high plains of the region sector, protecting fauna and flora, as well as the water resources of the area. Product of long history and cultural development of the region, also boasts several landmarks linked above all to the era of saltpeter.

In relation to the Project, the closest protected area corresponds to the Reserva Nacional Pampa del Tamarugal, especificamente in the sector of the Subestacion lagoons. The main importance of this reserve is the presence of the Tamarugo which takes place in an atmosphere of extreme aridity feeding on groundwater

Other protected areas that are en the surroundings of the Projectoutside of the area of influence, they are historical monuments geoglyphs of Pintados 21 km and Ex nitrate Iris 12 km and the well national protected high Patache located 16 km.

In relation to the priority sites for biodiversity conservation, Tarapacá region boasts two sites recognized by the SEIA both are located in the vicinity of the Project Punta Patache 27 km and Bay Chipana 8 km, both areas represent a marine coastal environment of vital importance to certain birds and mammals. In addition the presence of zones of upwelling sea generates an area of high biological productivity and reproduction, spawning and recruitment of pelagic marine species.

In relation to the results, the Pampa del Tamarugal national reserve is characterized by the presence of the Tamarugo mainly, however still the presence of little fauna, the area of the Project within this protected area corresponds to the dependencies of the substation lagoons, where failure to observe tamarugo trees.

3.5.6 References

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3.6. Attractive natural or cultural

3.6.1 Objectives

3.6.1.1 General

Identify and caracterizar tourism on the basis of the natural or cultural attractions associated with the Area of influence of the Project.

3.6.1.2 Objectives Especific

- Identify and characterize the tourist offer, including attractions, tourist plant, activities, routes or tours that are on the area of influence of the Project.
- Define and describe what the actual demand of the tourist attractions more relevant and inserts in the area of influence of the Project.

3.6.2 Methodology

Methodological work developed from the collection of bibliographic information concerning tourist activity scale regional, communal and Local, referring to documents generated by affable organisms to matter

Main sources of informationmay be appointed on: the land management (PRC, PRDU, etc.) plans and instruments of community development as (P)ladecos, Pladeturs), the information provided by Sernatur as a cadastre of attractions, community studies, tourism, Plan Regional policyis for development agenciesTico, identification of priority areas for tourism, or zones ZOIT between others. Statistical information of the statistics National Institute especially yearbooks of tourism and other studies concerning quantification and characterization of tourist demand.

Also the information is taken into consideration concerning protected areas within the study area, for which available information CONAF and the Ministry of national property was consulted

Additionally was an uprising in the field, which took place days 9,10 and 11 December 2013, performing direct consultations in the municipalities of Iquique and Pozo Almonte, specifically the tourist offices and tourist offices SERNATUR-dependent gathering information of offer you available tourist services and plant Tourism, as well as attraction to community and regional levels (brochures), and statistics of tourism demand in the area.

3.6.3 Results

3.6.3.1 Regional Tourism

The Tarapacá Region, presents different tourist scenarios that relate to the diversity of territories and landscapes cake can be found in it, besides the natural beauty, this region has a long history which has given it a rich culture and a enormous winning traditions.

The various geographical areas of this region are tourist attractions, very different, for example in the area of the coastal plains this region boasts different beaches and fishing coves, being the most important city in this area, the city of Iquique, boasts of a wide range of tourist, where museums and heritage buildings located in the old town are the main attractions, as well as the beaches of its Waterfront.

In the mountain range of the COSTA and depression intermediate the main attractions are the saltpeter offices as Ex nitrate offices of Humberstone and Santa Laura, declared World Heritage site. It is also possible to visit the Reserva Nacional Pampa del Tamarugal located in the middle of the Desierto of TOtacama. Rock art is not out of scenarios because they still remain vestiges of ancestors who inhabited this territory thanks to geoglyphs, petroglyphs and pictographs, located in different areas. In this area are locations with folk traditions, such as Tirana, others considered as an oasis in the middle of the desert as Pica, renowned for its tropical fruits. This area is recognized by the tourists to others by the existence of hot springs.

The sector of the mountain range of the TONDES and the Highlands has as main attractions the Volcán Isluga National Park, National Park salt Huasco, which highlights a unique landscape of flora and fauna.

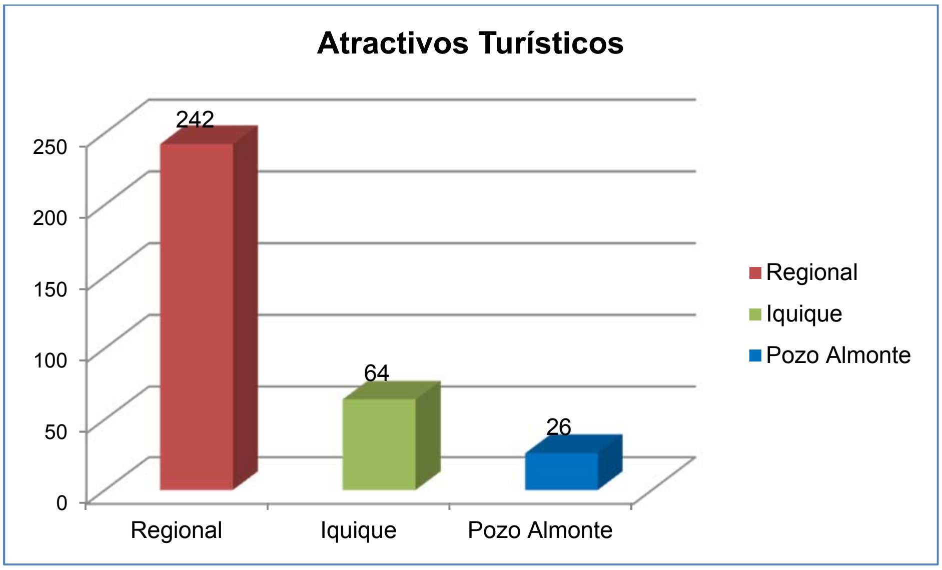
Sports tambien stand out in the area, one of the main is paragliding, while sports on the coast can be named the surfing, windsurfing, Bodyboarding, kayaking, among others.

According to data from the Sernatur during the year 2012 to establishments of tourist accommodation in the region of Tarapacá received 58.493 foreigners which represents 1.34% of foreigners registered at the national level, generating 118.310 overnights. In relation to domestic tourists were recorded a total of 255.071 arrivals to accommodation facilities which represents 5.74% of the total recorded at the national level, while the overnight stays reached 483.728 tourists Chilean, being these mostly coming from the Metropolitan Region.

In relation to settlements accommodation Sernatur recorded a total of 158, having of 7.555 beds.

Sernatur studies show that the Region of Tarapaca has 242 tourist attractions of different categories. The communes of Iquique and Pozo Almonte have 64 and 26 attractions respectively, being the category natural attractions, the most common, especially those located on the coast, other attractions include the museums or manifestations Cultural, these being the most buildings located in the city of Iquique. This town concentrates other attractions as events scheduled, concentrating several festivals, carnivals and tros cultural events between the months of January and February.

Figure 3-212. The number of tourist attractions in the communes of Iquique and Pozo Almonte.



Source: Own elaboration.

In relationship connectivity and accessibility, the region of Tarapaca has:

- Diego Aracena airport in Iquique, which connects with Bolivia, Paraguay, Brazil, Peru and Argentina, as well as the rest of the country.
- Step border Pisiga, in the commune of Colchane
- Port system linking it with the Pacific Ocean
- Route 5 North Panamerica and an extensive road network that connects the towns of this region

3.6.3.2 In the Area of E-tourismStudio

i. <u>Attractions Turisticos</u>

Within the study area are identified three tourist attractions important, the Caleta San Marcos and La Reserva Natural Pampa del Tamarugal. However in the area near the following attractions are recognized:

Table 3-91. Attractive Turisticos in the TOrea of EStudio.

Name	Hierarchy	Category	Seasonality	Tourism demand	Property	Locality	Commune
Salar Grande	Local	Natural site	Throughout the year	Local, Regional,	Private	Salar Grande	Iquique
Beach Chomache	Local	Natural site	Throughout the year	Local	Public	San Marcos	Iquique
Beach Ike-Ike	Regional	Natural site	Throughout the year	Local, Regional,	Public	San Marcos	Iquique
Caleta San Marcos	Local	Natural site	Throughout the year	Local, Regional,	Public-private	Caleta San Marcos	Iquique
Dry river Cove	Regional	Natural site	Throughout the year	Local, Regional,	Public	Dry river Cove	Iquique
Salar de Bellavista	Regional	Natural site	Throughout the year	Crazy, Regional	Public	Bellavista	Pozo Almonte
Pampa del Tamarugal national book	National	Natural site	Throughout the year	Crazy, Regional, national	Public	Pampa del tamarugal	Pozo Almonte

Source: Sernatur, 2012.

However the most important attractions of the area correspondsn a:

- **Sector works Superficial Costa**

Caleta San Marcos

Caleta San Marcos, tourist activity is related to the arrival of vacationers during the summer season, which are from mainly urban of Iquique and the commune of Calama.

This Spa is used mostly during the summer period, which causes the development of trade to the retail food sales and associated services. This situation generates an economic dynamism in the town, allowing the diversification of local economic sources, which in most parts of the year are dedicated to the extraction of marine resources.

The newly arrived families rented sectors to install their tents, tradition which is very common on the coast of the commune of Iquique. In terms of the existing infrastructure for such services, notably the Cove does not have potable water or sewage and trash is removed by municipal trucks, which can not pass often as necessary for the withdrawal of the amount of trash generated by holiday-makers, which it triggers significant health problems for the town.

Finally, the absence of an efficient energy system has meant a limitation to the rise of tourism, which has been subject any possibility of development to energy supply.

Near the Cove are recognized following caletas Beach Chomache located next to la Caleta Beach and San Marcos Ike-ike, which is a 7 km beach with almost warm waters and a remarkable desert landscape, the Ike-Ike Beach, popularly known as beach Peruana It is a vast space, and has practically no rocks.

Figure 3-213. Photos and pictures of la Caleta San Marcos.


Caleta San Marcos and its beach


San Marcos Bajo

Source: record Photo terreno.

Caleta dry river

River SECO is a town located 91 kilometers south of Iquique. Its history is linked to the export of salt, of which it is still possible to appreciate the ruins that gave rise and splendor to the Cove, as well as decanting pools. The cemetery, located at the end of the Sergeant Carlos Peralta Avenue, with graves dating back to 1800, an attractive Museum and a reconstructed blacksmith shop dating back to 1875 is also present.

According to the collected information, andl name of the Río Seco Creek comes from an aquifer stream that emptied the town, leaving a dry and Sandy testimony where hundreds of homes are now installed mostly by fishermen.

The last Manager of Río Seco was Alfredo Campaña in 1943, then Huanillos was the place chosen for the production of salt.

One of the must-see sites are places where ever Chinese slaves were forced to remove guano, which was accumulated in the huge rocks and steep slopes bordering the coast, a site where many of them died by the precarious conditions of work and safety.

In the Decade of the 80s, Río Seco was again repopulated by about 115 fishing craft and gatherers of shellfish, mostly from Tongoy Cove located in the region of Coquimbo.

Currently, there are 40 fishermen who are still tied to the fishing craft and more than 25 dedicated to collecting kelp, areas of great development over the past years.

It makes more than 6 years that was enabled a spring to enhance artisanal fishing, gastronomy and tourism associated with its beaches.

Figure 3-214. Photos and pictures of la Caleta San Marcos.


Dry river


Caleta Rio Seco and ancient salt pools

Source: Registror fotografico in terreno.

- **Sector Plateau**

This sector does not presented tourist attractions.

- **Sector Pampa**

Pampa del tamarugal

The Pampa del Tamarugal is a plain located in the Tarapacá Region, Chile. There are a hundred villages and nitrate scattered across the plain, being its centre the town of La Tirana. In addition, this plain has reserves of water in the basement.

The Pampa del Tamarugal national reserve is located in pampa del Tamarugal, on the communes of Huara and Pozo Almonte, with a surface superior to the 100.000 It has. It is one of the most valuable and impressive tamarugo forest environments in the driest desert in the world.

The main attraction of this unit is the fact that despite found in an area climate classified as desert absolute, you can find wooded formations corresponding to species of the genus Prosopis. These features, combined with low humidity, which generates an extremely clear atmosphere, the presence of salt lakes and the vastness of the desert are its main natural beauties.

Of the three sectors that make up the reserve Pampa del Tamarugal, the nearest sector is the Pintados, where also is the Salar de Bellavista, located to the South of the Salar de Pintados

Within these 1.535 were 549 foreign nationals and visitors of Chilean nationality, in relation to the statistics of Conaf visitation during the year 2012 this reserve received 2,084 visitors.

Figure 3-215. Pampa of Tamarugal Sector substation Lakes photos.

Tamarugo trees plantations

Salt Lake Bellavista

Source: Photographic register terreno.

Salar Grande

It is located 89 km from Iquique and 26 km from the port of Patillos, in a depression of the Cordillera de la Costa. Characterized by large mountains of sodium chloride, mineral being removed, this place being the largest mine of common salt in the world open pit.

Its dimensions tolcanzan about the 5-8 Km wide by 40 in length, with an average depth of 100 meters.

The Salar GRande is a major source of salt for domestic consumption and for export to North America and Japan, being the most famous mining Punta de Lobos.

Figure 3-216. Salar Grande pictures.


Salar Grande and slaughter mining


Shores of salt

Source: record Photo terreno.

ii. Services Turisticos

In relation to the offer of tourist services in the area, according to the records of Sernatur in the villages of San Marcos and Rio Seco there services accommodation, food or tour operators.

During the field visit checked in la Caleta San Marcos does not exiSten any services, mWhile that at the Cove River SEco there are two small food premises that are dedicated to the marketing of seafood products, onall breaded seafood, which are located on the side of route 1.

Any kind of tourist service was identified in the sector of the Pampa del Tamarugal.

In relationship operators tourist, eSTOS are mainly located in the city of Iquique and the ofr servicesecen are divided into six lines: city tour by Iquique, to the Pampa Calichera (ex Humberstone and Santa Laura offices), visits archeological sites, visit to the oasis and hot springs, visits to the Highlands and trips to Arica or San Pedro de Atacama

iii. A routeaccessible

The following access routes were identified in relation to the tourist attractions located in the area of study:

Table 3-92. Paths to the tourist sectors.

Role	Name	Tourist attractions	Hierarchy	Commune
Route 5	Longitudinal Norte, Sector Quillagua - whose	Pampa del Tamarugal national book	National/Internacional	Pozo Almonte
Route 1	Iquique-Rio Loa – Taltal - crossing route 5 (the tar), Sector: Iquique-Rio Loa	Caleta Caleta San Marcos river dry	Interregional	Iquique
A 750	Cross route 1 (patillos Caleta) - Salar Grande	Salar Grande	Communal	Iquique

Source: Own elaboration.

In relation to the vitos identified access, the most used corresponds to the route 5. TO the sides of this road you can see the ruins of various nitrate and the area corresponding to the Pampa del Tamarugal. Limportance of this pathway for the development of tourism is related to rather with regional tourism which local tourism since it uses to move towards Iquique or within the region where the best known tourist areas of the region of Tara PACAas well as to leave the region both towards Arica to Antofagasta. Within the sclose to the S Ectorubestacion Lsome not of identified signs of desk review attractions present in the area or areas to be able to stop to appreciate the landscape.

Por other party, route 1 responds rather local tourist demand, especially for families visiting during the summer the beaches in the coastal sector either during the day or for camping during long days, a very common practice in the area, especially of persons resident in Iquique. Another benefit of this route for the development of tourism is its coverage since it connects the Tarapacá region with the Antofagasta Region allowing the exchange of tourists. Along this route it is possible to view tourist signage that identifies locations and the beaches along the coast.

The RUTA to-750 which corresponds to the main route of access to the SAlar GRande is mainly used by trucks carrying salt from the mines that are located in the. Tourist use of This route is apparently low, product of the movement of trucks. In the route no observable signs of tourist information ni areas suitable for stopping to observe the salt.

iv. Attractions Turisticos Ppotential

- **Sector Pampa**

Close to the Subestacion lagoons are the ruins of two nitrate plants: Bellavista Office and Office Buenaventura, these saltpeter offices were selected along with others to be declared national historical heritage, according to a diagnosis prepared by Committee on culture and heritage of the Regional Council together with the help of the Museum Corporation of nitrate and the Undersecretary of Regional development financing.

Within this study is priorizor the importance of the saltpeter offices registered office Bellavista at number 13 and the Buenaventura Office position 14[23].

Figure 3-217. Photographs Offices Saltpeter

Cemetery Office nitrate Bellavista | Ruins Office Bellavista

Source: Terrain photography registration.

v. Areas Turisticas Prioritarias

The SERNATUR defines the priority tourist Areas as presenting a current or potential development in the field of tourism and in which the sectoral management should focus on the national territory.

In this sense the Tarapacá region has 6 priority tourist areas:

- Book Natural Pampa del Tamarugal
- RN volcano Isulga - Salar de Surire m-n
- Huara-Chumiza-high Tarapacá
- Salt lakes of Huasco and Coposa
- Nitrate and Oasis of Tarapacá
- Coast of Iquique

[23] http://diarioelnortino.cl/tag/oficina-bellavista/

In this respect the Project It is located on two areas in the sector of the coast throughout the coast of Iquique and in the sector of la pampa in nitrate and Tarapacá Oasis area.

vi. Touristic events

Dakar

The main event in the North of the country is the Dakar, which creates a great incentive for the displacement of large canidentity of tourists and visitors.

In the case of the Dakar, this off-road event, since her arrival in Chile 2009 year, has generated a significant impact on the tourism industry, in the Region of Tarapacá, when visitors decide to stay in the city of Iquique.

Figure 3-218. Tour Dakar since 2009

Tour Dakar 2009 year

Route Dakar 2010 year

Tour Dakar 2011 year

Tour Dakar year 2012

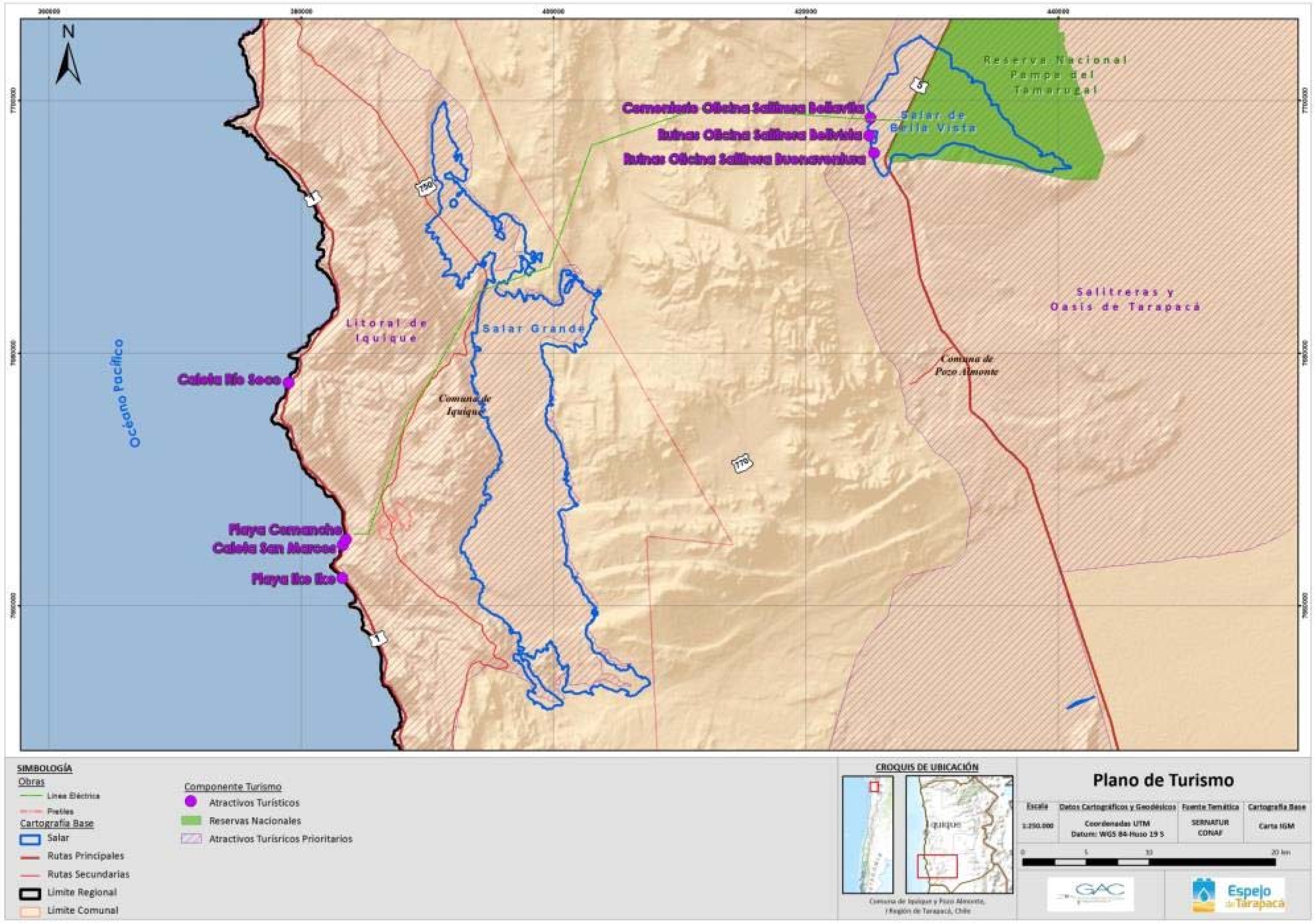
Tour Dakar year 2013

Tour Dakar year 2014

Tour Dakar year 2015
Source: www.Dakar.com

Travel event Dakar is different each time, underway since 2009. The Chile is quite extensive, surpassing the 1,000 kilometres in national territory, sometimes from the Region of Valparaíso or from the Region of Atacama northward.

Figure 3-219. Tourist attractions in the TOarea of study.



Source: Own elaboration.

3.6.4 Conclusions

- **Sector Costa surface works**

In relation to the study area is set there two important tourist attractionswhich are the San Marcos Creek and the Río Seco Creek. However, tour operators and the services they offer are not oriented to these sectors, but more to the city of Iquique, the nitrate Humberstone and Santa Laura, the oasis of Pica and Mamiña hot springs, salt lakes them of the Altiplano and the Volcán Isluga National Park.

Conclusion gets even if it is true, the study area presents an enormous potential for the development of tourism, mainly by the presence of varied attractions and conditions of connectivity, this activity is not well developed above all in the field of tourism services and tourism infrastructure (signage and viewpoints), since the main attraction used are the beaches that respond to local demand, during the summer season.

- **Sector Plateau**

Tourism in the region of Tarapacá is strongly determined by its natural attractions and cultural heritages, generating tourist attractions that are scattered throughout the regional territory. The nerve center of the development of this activity is the city of Iquique, that focus is not only a large percentage of the available tourist services but also a wide variety of attractions highlighting its beaches and historic buildings, the that Diego Aracena joins a good connectivity given its proximity to the international airport.

Particularly this sector has no attractions or tourist services, but nonetheless the study area presents an enormous potential for the development of tourism, mainly by the presence of varied attractions and conditions of connectivity, this activity is not well developed above all in the field of tourism services and tourism infrastructure (signage and viewpoints), since the main attraction used are the beaches that respond to a demand local, during the summer season.

- **Sector Pampa**

In relation to the area of e.Studio is established that there is a major tourist attraction, the Reservation Pampa of the Tamarugto the sector of the substationsome of the information gathered is established that tourism is not fully exploited, since the main tourist activity is local and seasonal demand in the case of the two creeks, which corresponds to the visits to the beaches close to the villages during the summer season, still a custom in the area camping season on these beaches and along the coast. A tourist plant for the development of this activity is not identified nor. Pampa del tamarugal analyzed sector does not present any type of tourism development, since the area corresponding to the Reserva Nacional Pampa del Tamarugal more visited and exploited is far to the North.

In relation to the tour operators and the services they offer, establishes that the study area is not part of their tours, which are oriented to the city of Iquique, the nitrate Humberstone and Santa Laura, the oasis of Pica and Mamiña hot springs, salt lakes them of the Altiplano and the Volcán Isluga National Park.

While the study area does not have a great tourist development, this is recognized by Sernatur in some sectors as priority tourist Areas, in view of the identified attractions and this connectivity. In relation to this topic is set there are three roads that give access to all the tourist attractions identified, which are route 5 in the sector of the Pampa del Tamarugal, route 1 and route A-750 in the sector of the coast and Great Salt Lake.

Beyond the attractions identified both by Sernatur the municipalities, within the study area identified two attractions that may be of interest to the region, it is the ruins of the saltpeter Bellavista and Buenaventura, and activity related to the Dakar.

In conclusion is obtained which is true What the study area presents an enormous potential for the development of tourism, mainly due to the presence of varied attractions and conditions of connectivity, this activity is not well developed especially in the field of tourism services and tourism infrastructure (signage and viewpoints), since the main attraction used are the beaches that respond to local demand, during the summer season.

3.6.5 References

- National Forestry Corporation (CONAF), 2013. Statistics visitors unit SNASPE by 2013.
- Municipality of Iquique, 2008. Community development 2008-2015 plan
- Regional Government of Tarapacá, 2010. Diagnostic territory fishermen, Document work N ° 4, analysis of reality Regional. Region and territory series
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3.7. Use of the territory

3.7.1 Use of soil

3.7.1.1 Objectives

Describe and analyze the current land use and land use potential in the area where is installed the Projectto contextualize the use of the territory in the area you selected.

3.7.1.2 Methodology

According to the guide published by the SEIA, entitled "Guide for the description of the use of the territory in the SEIA" (2013) are established the following uses of land pursuant to the OGUC:

Table 3-93. Types and subtypes of land use.

Type of land use	Sub type or class
Residential	Housing
	Welcome Home
	Building or room for hosting
Productive activities	Industry
	Agriculture
	Livestock
	Forestry
	Fishing and hunting
	Mining and quarrying
Equipment	Scientist
	Trade
	Cult
	Culture
	Sport
	Education
	Spacing

Type of land use	Sub type or class
	Bless you
	Security
	Services
	Social and community
Infrastructure	Transport
	Health
	Energy
	Telecommunications
Green area	Park
	Plaza
	Area Free
Public space	Public square
	Public green area
	Road system

Source: SEIA, 2013.

In relation to the coverage of soil applied to areas that do not have a use the categories established by the study of native forest by Conaf and Conama which establishes the following categories are used:

- Bodies of water
- Snow and glaciers
- Areas without vegetation
- Wetlands
- Forests
- Grasslands and Shrublands

Used as the basis of the information, the study of use of native forest cadastre[24] whose final report was published in 1999 and has been updated by each region during the last time. This

[24] http://sit.conaf.cl/

information will be supplemented with a photo-interpretation from Google Earth and also complemented the information in the chapter of flora and vegetation.

For the suel usability informationor is the report from the floor of this line component used as source of information of base, which determines the capabilities of use through surveys on land.

The processing of information as well as maps were made with the ArcGis 10 software.0.

For this component was defined an area of influence of 100 meters about the works, that refers to the area defined for the component soilswith which this section is complemented.

3.7.1.3 Theoretical framework

p) Ability to use soil

The system's capacity of Use Flooring, it is a technical classification which has as aims to establish the relevant characteristics of a soil, allowing to choose the combination of crops and management practices that allow for the appropriate use of land, on a sustainable basis, without risk of erosion, in addition ES the starting point in the development of soil and water conservation plans.

Land use capability classes are eight, identified with Roman numerals (I-VIII), which express the growing degree of limitations or riespermanent soil gOS. The first four classes identify arable soils (I-IV) and the not arable (V-VIII). These classes adds a subclass that correspond to 4 letters (e, w, s, cl) that accompany the numbers and that represent the key issues that affect the soil.

The Guide for the description of the use of the territory in the SEIA, establishes the following criteria to define different classes of land use.

Table 3-94. Kinds of capacity of Uso of SSearch.

Kinds of capacity of use	Description	Critical attributes
Arable soils		
Class I	They have few limitations that restrict their use. The yields obtained, using suitable practices of cultivation and management, are high in relation to the area. For agricultural use, simple management practices are needed in order to maintain productivity.	There is no attribute critical for treated soil with the following characteristics: • Flat or almost flat floors. • Deep. • Without rocky surface and • subsurface. • Medium textures. • Well drained. • No apparent slight erosion.
Class II	They have slight limitations that pYou may affect the development of crops, so it may require some conservation practices. The most common restrictions are: slopes up to 5%, no less than 70 cm or moderate drainage depth.	• Floors gently sloping or slightly wavy. • Moderately deep. • Medium textures, which can vary to extremes more clayey or sandy than the previous class. • Moderate drainage. • Slightly stony in the profile. • Slight erosion.
Class III	They are limited to tillage in the case of soils with slopes close to 8% or by up to 15% of rocky surface. It may also be limited rooting for species with deep roots. The soils of this kind require psoil conservation practical.	• Moderately inclined or gently rolling. • Slightly stony and burdensome • Slightly deep. • Fine textures to thick. • Imperfect drainage. • Moderate Rocky in the profile. • Moderate erosion. • Frequent flooding. • Slightly sodic. • Slightly saline.

Kinds of capacity of use	Description	Critical attributes
Class IV	Land that can present risk of erosion by earrings, so it requires in the tillage of the soil conservation practices. These soils are the last category of arable soils without great risks of erosion with proper management. Even though they may have other limitations, slopes up to 15% possess either a not more than 40 cm depth.	• Strongly inclined or moderately wavy. • Abundant rocky surface. • Thin. • Fine textures to very thick. • Imperfect drainage • Moderate Rocky in the profile. Moderate erosion. • Frequent floods. • Moderate sodium. • Moderately saline.
Not arable soils		
Class V	Soils flooded with presence of plant characteristics of hydromorphic species. They usually correspond to SP soils, without sufficient dimension to evacuate excess water. They usually present a waterproof stratum as e.g. a horizon placico or a clay stratum. It regularly presents a higher stratum with high content of organic matter (over 20%)	• Poorly drained to very poorly drained, with permanent flooding.
Class VI	When the restrictive parameter is the slope correspond to soils not suitable for tillage. Its normal use is livestock and forestry, except when been classified in this category by salinity conditions (> 4 dS/m), situation in which their use is given by the adaptability of certain species to saline soils.	• Moderately steep or slopes. • Abundant rocky surface. • Deep to thin. • Fine textures to very thick. • Excessively drained. • Abundant Rocky in profile • Severe erosion. • Strongly sodic • Very saline
Class VII	They are soils with very severe limitations that make them unsuitable for crops. Its	• Steep or hills. • Very thin.

Kinds of capacity of use	Description	Critical attributes
	basic use is grazing and logging. Soils restrictions are more severe than in the class VI.	• Very abundant Rocky • surface • Fine textures to very thick. • Excessively drained. • Very severe erosion. • Very frequent floods. • Very strongly sodium. • Extremely saline.
Class VIII	It corresponds to soils without value agricultural, livestock and forestry. Its use is limited only to the wildlife, recreation or protection of hydrographic basins.	• Two or more critical attributes of Class VII at the same time.

Source: SEIA, 2013.

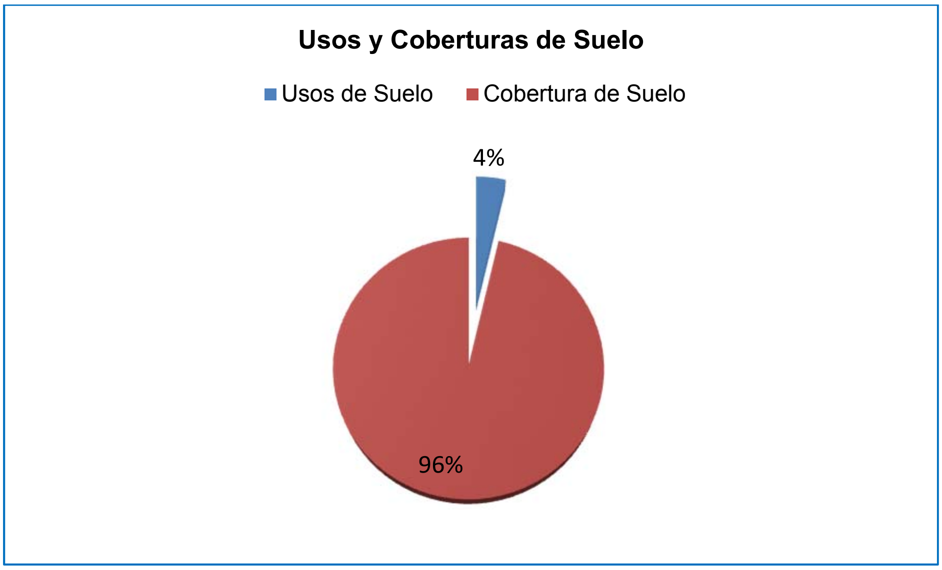
3.7.1.4 Results

i. Use and land cover

It is a mainly rural area, the identified land uses are very dispersed in the defined study area and correspond mainly to residential use (houses in San Marcos and Rio Seco), public spaces corresponding to the system Road (route 5, route 1, via a-750 and A-770), health infrastructure (potable water Cup) and energy)electric transmission line and Subestacion Lakes) and finally equipping of culture (ruins of the nitrate Office Bellavista) and Salt River dry pools.

The rest of the study area does not use, and therefore presents a coverage, which in this case is of deprived Areas of Vegetacion, which covers 96% (4194.00 hectares) of the analyzed surface.

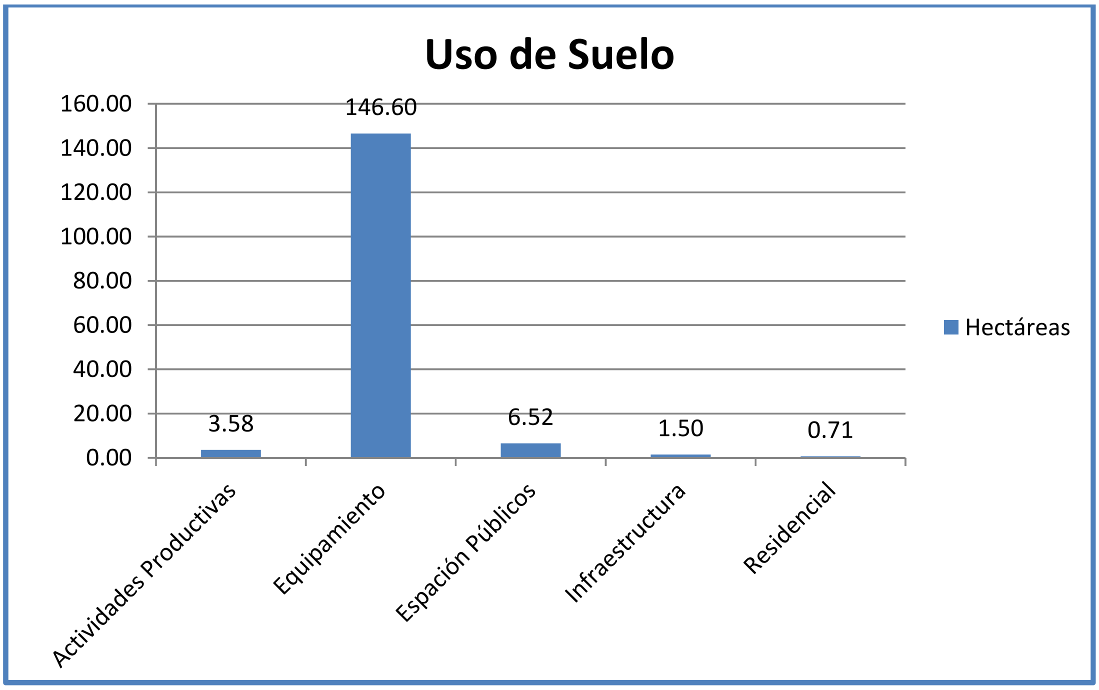
Figure 3-220. Percentages of UOS and COverture of SSearch.



Source: Own elaboration.

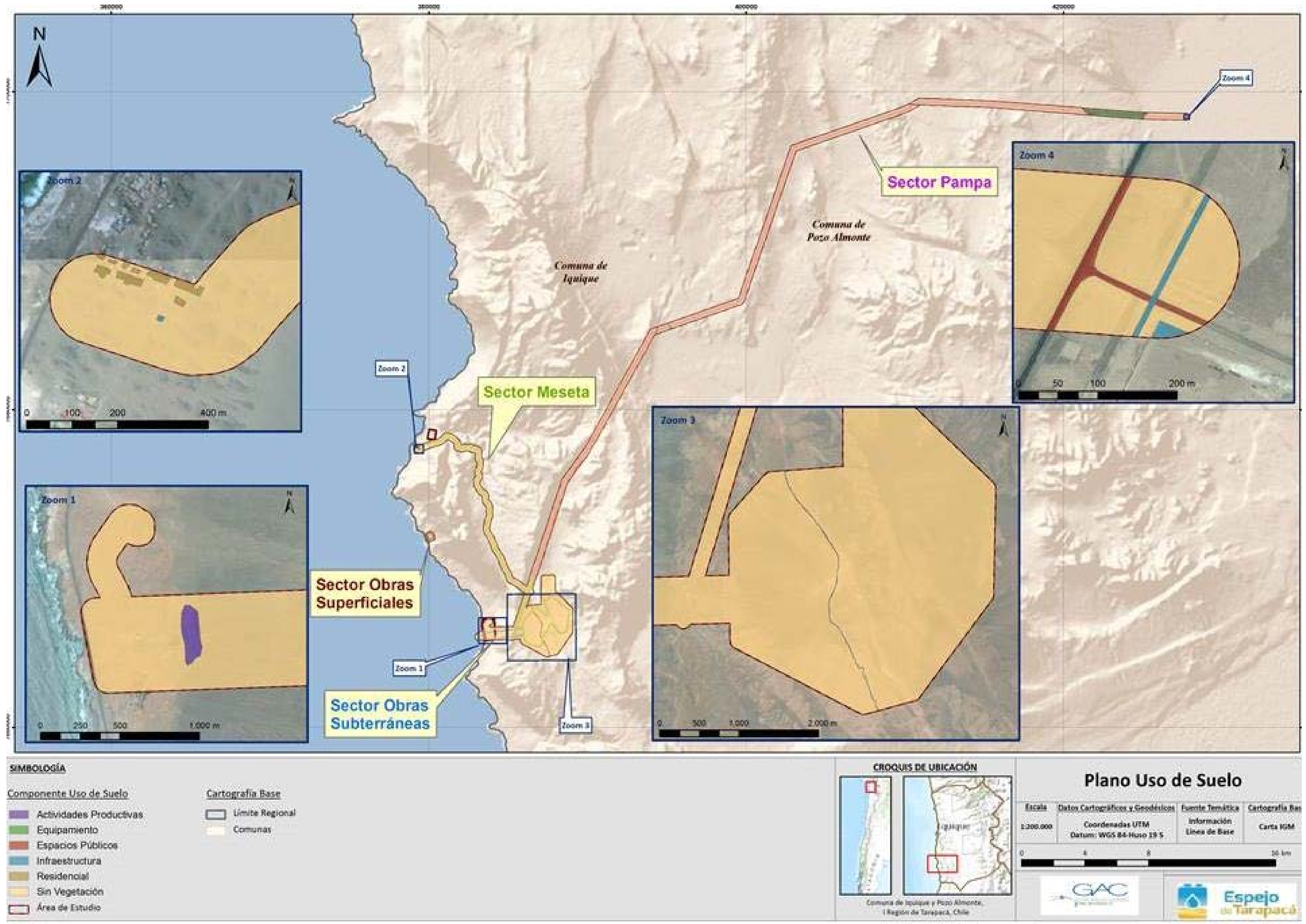
In relation to the surfaces of the identified land uses, the graph below shows data)Figure 3-221). The productive activities cover the 0.08% of the surface catastrada. the equipment covers the 3.37% of the area studied, being the greater surface area which covers the area of the former nitrate Office Bellavista. Public spaces they reach 0.15% of the surface, while the use of infrastructure and the uso residential presented a 0.03 and 0.02% respectively.

Figure 3-221. Surfaces of Uso of SSearch.



Source: Own elaboration.

Figure 3-222: Use and soil cover in the TOrea of EStudio.



Source: Own elaboration.

- **Sector Underground works**

This sector is located in an area surface possessing a public spacescorresponding mainly to route 1as evidenced by the attached figure.

- **Sector Surface works Costa**

In this sector is located on the coastal plain, where is located an residential area in the northern part of this sector, in addition to roads for public spaces.

- **Sector Plateaus**

This sector is located in an area devoid of vegetation and public spaces.

- **Sector Pampa.**

In this sector of Pampa arise public spaces corresponding to Route 5, at the height of the Subestacion lagoons of Transelec.

ii. Ability to use soil

Analysis of the capacity of land use by the chapter of soils indicates that 100% of the surface analyses has an ability to use class VIII, which corresponde to soils without value agricultural, livestock and forestry, whose use is limited only to the wildlife, recreation or protection of hydrographic basins.

3.7.1.5 Conclusions

- **Sector Works Underground**

This sector is characterized by the small area belonging public spaces, only appearing in this sector, route 1, one of the main routes in the region.

It is a desert area without water availability, uses that man can give to this area are quite limited, residential use as well as the productive activities and infrastructure occupy very low surfaces and are concentrated in the coastal sector as in the sector of the pampa del tamarugal are where related to the existence of important roads such as route 5 and route 1.

In conclusion, the climatic conditions and water restrictions, represents a limiting factor for the development of human activity within the study area.

- **Sector Costa surface works**

In this sector is located on the coastal plain, where is located an residential area in the northern part of this sector, as well as public spaces corresponding to the route 1, the main road axis of the area.

It is a desert area without water availability, uses that man can give to this area are quite limited, residential use as well as the productive activities and infrastructure occupy very low surfaces and are concentrated in the coastal sector as in the sector of the pampa del tamarugal are where related to the existence of important roads such as route 5 and route 1.

In conclusion, the climatic conditions and water restrictions, represents a limiting factor for the development of human activity within the study area.

- **Sector Plateau**

This sector is located in an area devoid of vegetation and public spaces.

It is a desert area without water availability, uses that man can give to this area are quite limited, residential use as well as the productive activities and infrastructure occupy very low surfaces and are concentrated in the coastal sector as in the sector of the pampa del tamarugal are where related to the existence of important roads such as route 5 and route 1.

In conclusion, the climatic conditions and water restrictions, represents a limiting factor for the development of human activity within the study area.

- **Sector Pampa**

In this sector of Pampa for public spaces are presented to route 5, at the height of the Subestacion lagoons of Transelec.

It is a desert area without water availability, uses that man can give to this area are quite limited, residential use as well as the productive activities and infrastructure occupy very low surfaces and are concentrated in the coastal sector as in the sector of the pampa del tamarugal are where related to the existence of important roads such as route 5 and route 1.

In conclusion, the climatic conditions and water restrictions, represents a limiting factor for the development of human activity within the study area.

3.7.1.6 References

- Environmental assessment (SEIA) service, 2013. Guide for the description of the use of the territory in the SEIA.

- Service agricultural livestock (SAG), 2011. Guideline for study of soil. Protection Division of renewable natural resources

3.7.2 Territorial planning instruments

3.7.2.1 Objectives

Identify existing instruments of territorial planning in the area of influence, which relate directly with the Project, characterizing the zoning through which passes the Project.

3.7.2.2 Methodology

The analysis of the present Territorial planning instruments in the Region Tarapacá, and specifically in the involved communes, they correspond to the communes of Iquique and the commune of Pozo Almonte.

Search all planning instruments available for the involved municipalities, was carried out through the national archives of instruments of Territorial Planning of the Urban Observatory[25] the regional regional of the Ministry of housing and urban development and the regional governments. Once done, those instruments in force and normative, differed as well to summarize and synthesize the available information.

3.7.2.3 Results

i. <u>Territorial planning instruments</u>

The instruments of territorial governing the communes and the region where the Project, are listed in the Table 3-95 then.

Table 3-95. Instruments toplicables to the TOrea of the Project.

Instrument	Administrative unit	Entry into force
Regional urban development plan	Tarapacá region	1997
Communal regulatory plan	Commune of Iquique	25 / 11 / 1981 (modified on 11-04-2007)
Communal regulatory plan	Commune of Pozo Almonte	15-05-1984

Source: Urban Observatory, MINVU.

The Regional Plan of urban development of the Region of Tarapaca was conceived before the separation of the regions of Arica and Parinacota region of Tarapacá, so a new Plan is under

[25] http://www.observatoriourbano.cl/ipt/busca_decreto.asp

preparation. While the new plan is not carried out, the previous one remains in force. However, this Plan is oriented only to urban areas, so it does not apply to the area of this project.

LWe communal regulatory plans of the communes of Iquique and Pozo Almonte govern the urban area and main town of those territories. The Project is located in a rural area, Therefore they are not instruments that regulate its use.

In addition, uin existed Plan regulator intercommunal coastal of the Region of Tarapaca plan presented on 3 December 2012, and which was subsequently withdrawn by that is not valid.

3.7.2.4 Conclusions

The communes of Iquique and Pozo Almonte have regulatory plans to force since the Decade of the 1980s, withoutmbargo areas throttlestos by eSTOS They include urban areas, so it does not correspond to the areas where to develop the Project.

In relation to this area of the Project It establishes itself as a rural area.

3.7.2.5 References

- Municipality of Iquique, 2007. Local Ordinance, communal regulatory Plan of Iquique.
- Municipality of Pozo Almonte, 1984. Local Ordinance, communal regulatory Plan of Pozo al Monte.

3.7.3 Economic activities

3.7.3.1 Objectives

Characterize the main economic activities taking place in the area of the Project, as a form of ID.torify shapes in use the territory.

3.7.3.2 Methodology

The main methodology used to obtain this information in economic activities, is performed through a search for information on pages Web municipalities and regional Governments, reviewing the explanatory memoirs of territorial planning instruments and development strategies. You also review of regional and community newspapers.
As a secondary form of information is a photo-interpretation from Google Earth® to identify specific areas where they develop the economic activities (mining and Agriculture), directly related with the Project.

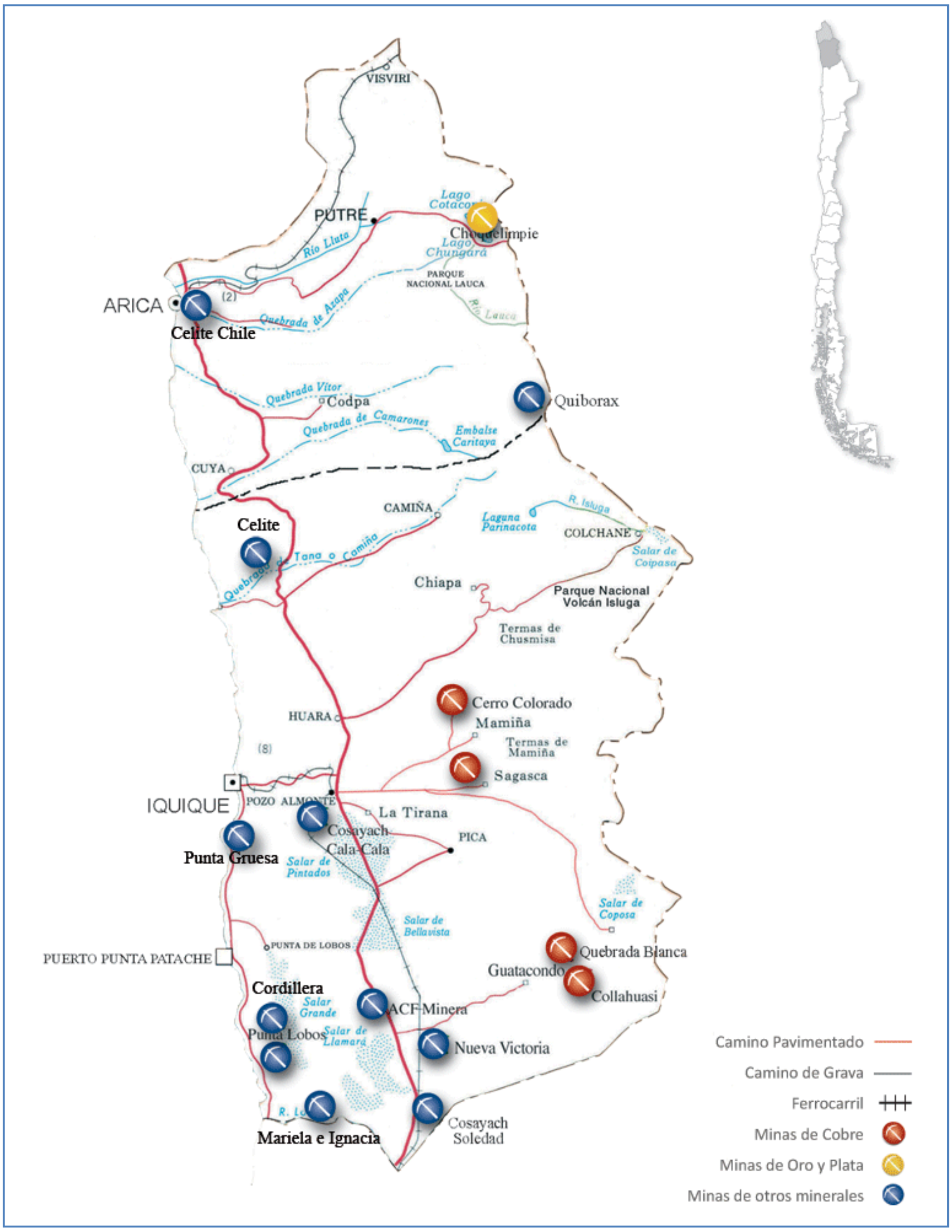
3.7.3.3 Results

Lto the region's economy relies mainly on the extraction of natural resources, especially mining and fishing.

Although economic activity in the Region of Tarapacá has traditionally been related to the exploitation of salt, at the end of the 1990s the situation was changing in favour of copper. Copper is extracted in Quebrada Blanca and Doña Inés de Collahuasiwhich came into full production in 1999. In non-metallic mining, the main product in volume is the sodium chloride (common salt), extracted from the Great Salt Lake, the salt mine open pit the world's largest with 280 Km^2 nearly pure crystalline body (98.5%), here s(e) removing more than six million tonnes a year.

It is also important the production of nitrate and iodine extracted by the recycling of old saltpeter offices in Huara and Pozo Almonte and new offices as Yumbes.

Figure 3-223. Mining Region of Tarapacá.



Source: http://www.mineriachile.com

In relation to fisheries, it is divided in industrial fisheries and small-scale fisheries. The first is devoted to the extraction of anchovy, horse mackerel, mackerel and sardine. The fishing is dedicated to the extraction of the peclt is like the anchovy, sardine, mackerel and cod, while species of molluscs and crustaceans extracted are: Octopus, snail, limpet, Mussel, clam, other extracted species are sea urchins and Piures and algae include the Chascón or black huiro and the Huiro stick. Aquaculture also takes place in this region, cultivating the oysters from the North[26].

The trade is important, because the region is the step of Chilean products towards the countries of the North (Peru and Bolivia) and Brazil, due to the existing interoceanic corridor. ZOFRI (free zone of Iquique), has caused the progress of commercial development, especially in the sale of cars and technology products, something very attractive to large numbers of Chileans.

Agriculture and livestock are almost nil, due to the aridity of the land. However, there are certain crops in areas of streams, especially olives, citrus and mangoes, as well as the cattle of llamas.

According to data from the National Institute of statistics for efirst quarter of the year 2013, the sectors that concentrated employment were firstly the sectore activitiess side, followed by the the tertiary sector activities and finally the activities of the primary sector.

In relation to exports of a total of 689,0 million dollars in exports, 8.0 correspond to the agroforestry sector, 616,3 mining and industry 61.2. Where the main destination of exports was Asia, and Oceania, America and in third place in Europe.

According to the indicator of Regional economic activity (INACER), which recorded a growth of 5.4%, the sector that most affected the growth of the indicator was mining, explained by an increase in the metal mining activity. The second sector that positively affected the INACER variation was trade, restaurants and hotels, by the positive variation of the Zona Franca, wholesale trade and retail trade sales. The electricity, Gas and water sector recorded the third positive impact, due to an increase in the generation and distribution of electricity in the period. ORos sectors contributed favorably to the dynamism of the indicator were social, personal services and municipal land, transport and communications, construction, fishing and housing property. Financial services and business had no significant impact on economic activity.

The manufacturing industry reduced its activity mainly due to the decrease in the sub-sectors of manufacturing products from plastics, fishing industry and production of basic chemicals.

i. Economic activities in the TOrea of Influenciadel Pproject

Within the area of influence of Project two economic activities, mining (non-metallic) and (fishing) are identified.

[26] http://www.mardeChile.cl/index.php?option=com_content&task=view&id=66&Itemid=31

q) Punta de Lobos

In the case of the first activity is recognized mine Punta Lobos, dedicated to the extraction of sodium chloride. The mine belongs to the k + s group, dedicated to the global supply of fertilizers and salt. Among the products that are generated from this mine they may be appointed: Salt Chemistry, salt for de-icing, Industrial salt, salt textile and salt for human consumption (Lions brand).

Figure 3-224. Activities Eattendant Salar Grande.

Source: Terrain photography registration.

r) Caleta San Marcos

In the case of the second identified activity, in the area of influence of the Project La Caleta is identified San Marcos, whose representation before the authorities is under the Union independent fishermen, divers, fishermen and helpers of Caleta San Marcos.

The Sernapesca data[27] (2013) they indicate that this Cove has 27 vessels with 188 fishermen between seaweed fields (114), owners (28), divers (74) and fishermen (69).

This Caleta has, with two management area of benthic resources (AMERB), Sector A dedicated to the species Loco-Lapa - Hedgehog and Sector B dedicated to the species Loco-Lapa - Hedgehog-Huiro negro-Huiro stick (both in monitoring).

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[27] http://www.sernapesca.cl

With respect to the activity of aquaculture in the Caleta San Marcos, is recognizedCEN five existing concessions (Table 3-96) according to the article 3 º transient of the law 20.434, which modified the LGPA, establishing the continuity of the concessions that were not operacion16 between January 1, 2006 and December 31, 2011.

In this way, while currently not recorded the development of eSTA activity, also these concessions are empowered to operate at any time.

According to the data of the Subpesca[28] There are also 2 applications of concessions in processing.

Table 3-96. Concessions aquaculture Caleta San Marcos.

Holder	Area (Ha)	Species	Type of grant	State
Crops Coquimbo S.A.	10.0	Mussels; North oyster	Water and Fund	Award
Pantoja and Martinez Ltda. (Panmar)	24.99	Chascon or black Huiro; North oyster	Water and Fund	Award
Corp. Private development U Arturo Prat (Prat U.)	20.99	North oyster	Water and Fund	Award
Corp. Private development U Arturo Prat Cordunap	27.55	North oyster	Water and Fund	Award
CFSP S.T.T. Art. BUZ. Sea u helpers Caleta San Marcos	7.14	Mussels; North oyster	Water and Fondo	Award
Julio Antonio Segovia Daponte	24	Molluscs	Water and Fund	Request
PAblo Andres Mery Concha	25	Molluscs	Water and Fondo	Request

Source: www.subpesca.CL.

[28] http://www.subpesca.cl/institucional/602/w3-channel.html

Figure 3-225. Activities andattendant Caleta San Marcos.

	
Spring Cove San Marcos	Collection of algae

Source: Terrain photography registration.

s) Dry river Cove

Another fisherman's Cove that is identified in the study area is the dry river Cove, which according to data of the Sernapesca[29] cuentto 133 Seaweed fields, 9 shipowners, 17 divers and 15 fishermen, there are 8 boats. There are two trade unions, the Union of independent workers of shellfish divers, helpers and related of Caleta Rio Seco and the Union of independent workers of Caleta Río Seco gatherers of algae in this Cove.

This Cove has two areas of management of benthic resources (AMERB) others the first so-called river dry Sector A, dedicated to the: loco, lapa, hedgehog and locote, (currently no management plan) and the second one called river dry Sector B, dedicated: crazy, lapa, hedgehog and locote, Octopus, clams, culungue, huro black and huiro stick (currently at follow-up)both in charge of the Trade Union of workers independent of the Caleta Río Seco

According to the data of the Subpesca[30] There are also two applications of leaseon This Cove aquacultureas shown in the following table.

[29] http://www.sernapesca.cl
[30] http://www.subpesca.cl/institucional/602/w3-channel.html

Table 3-97. Cove aquaculture concessions Dry river.

Holder	Area (Ha)	Species	Type of grant	State
Marine culture sea Golden Ltda.	40	fishes	Water and Fund	Request
Marine culture sea Golden Ltda.	40	Fish	Water and Fund	Request

Figure 3-226. Activities andattendant Caleta Río Seco.

Entry Cove dry river

Jetty area

Source: Terrain photography registration.

3.7.3.4 Conclusions

The main economic activity of the Region of Tarapacá It is mining, especially mining metallizing of copper, non-metallic mining, especially of sodium chloride also has importance at the regional level, concentrating in addition the greatest amount of exports.

After mining, trade and services account for tertiary activities with greater impact on the regional economy, within this trade that takes place in the Zona Franca is vitally important.

Activities silvoagropecuarian They are limited by weather conditions I have water to the region, however this activity takes place in some valleys and oases that have water resources.

Fishing is another activity present in the region develops both industrially as artisanal. Near the area of the Project San Marcos, dedicated is located the craft Caleta both extraction of fish molluscs and algae, this Cove has two AMERB for the production and extraction of molluscs and algae.

3.7.3.5 References

- CIPTAR, 2012. Line of the economic Base of the Region of Tarapacá, economic development and productive of Tarapacá".
- INE, 2013. Regional economic report 2013, April-June.
- Regional Government of Tarapacá, 2011. Regional development strategy Period 2011-2020.
- Regional Government of Tarapacá, 2010. Diagnostic territory fishermen, Document work N ° 4, analysis of reality Regional. Region and territory series

3.7.4 Infrastructure and equipment

3.7.4.1 Objective

Identify the relevant constructions of infrastructure and equipment in the study area

3.7.4.2 Methodology

Based on the analysis of topographic plans military geographical Institute, as well as information collected in the registers of the competent authorities (Ministry of health, Ministry of education, Ministry of energy, Ministry of public works, etc.) , and history captured during field campaigns, it has collected information concerning elements of infrastructure and equipment that interact with the design of the Project.

As a reference in addition Google images are used Earthin order to be able to recognize and locate, using photo-interpretation that infrastructure and equipment that are connected with the Project.

3.7.4.3 Results

i. <u>Infrastructure</u>

Is understood as infrastructure that designed human realization that support for the development of other activities and operation, necessary in the structural organization of cities and companies

t) Roadway infrastructure

Since the Project It is located in a rural area, the routes that were located within the study area correspond to those shown in the table below:

Table 3-98. Road network in the area of study.

Role	Name	Length (Km)	Hierarchy	Commune
Route 5	Longitudinal North, Sector Quillagua -Whose	326.68	National	Pozo Almonte
Route 1	Iquique-Rio Loa – Taltal - crossing route 5 (the tar), Sector: Iquique-Rio Loa	143.24	Regional	Iquique
A 750	Cross route 1 (patillos Caleta) - Salar Grande	84.61	Local	Iquique
A-770	Cross route 1 (lagoons) crossing A-750	51.99	Local	Iquique - Pozo Almonte

Source: Dirección de Vialidad, MOP[31].

u) Energy infrastructureEthics

The energy infrastructure in the area of study given by power lines, substations and generating stations that connect to the system interconnected North big comprising the regions of Arica and Parinacota, Tarapaca and Antofagasta

In relation to the energy infrastructure in the areof study may be appointed:

- **Power lines:** Detailed power lines were identified within the study area in the Table 3-99, most of these are connected to the substation lagoons.

Table 3-99. Electrical vines in the TOarea of study.

Name	Power KV	Owner	Electrical system
Tarapacá -Lagoons	220	TRANSELEC North	SING
Lagoons - Pozo Almonte	220	CL	SING
Cruise - lagoons N1	220	CL	SING
Cruise - lagoons N2	220	TRANSELEC North	SING
CoLLahuasi -Lagoons	220	Mining CoLLahuasi	SING

Source: CDEC-SING 2011 Statistical Yearbook.

- **Electrical substations:** In the single study area of identify the electrical substation.

[31] http://www.vialidad.cl/areasdevialidad/gestionvial/Paginas/Homologacion.aspx

Table 3-100. Electrical substations in the study Area.

Name	Owner	Power KV	Electrical system	This	North
Lagoons	TRANSELEC North	220	SING	427798	769803

Source: CDEC-SING 2011 Statistical Yearbook.

Figure 3-227. Diagram interconnected system of the great North.

Source: CDEC-SING 2011 Statistical Yearbook.

v) Infrastructure ESpacio PHall

In relation to public spaces, tAnto the town of San Marcos as a Río Seco have a small square that features of playgrounds and luminaire (solar).

Table 3-101. Spaces Publicos.

Name	Type	This	North
San Marcos	Public square	383676	7665140
Dry river	Public square	379272	7677852

Source: Own elaboration.

Figure 3-228. Spaces Publicos.

Piazza San Marco

Plaza Río Seco

Source: Terrain photography registration

w) Infrastructure Portuaria

Identifies two inlets of fishermen in the study area, the first corresponds to the caleta San Marcos that counts with a small Pier and an area workshops and for the sale of the products of the sea. The Cove River Seco dusoibe of a small jetty and an area of workshops for fishermen, as well as of sale.

Table 3-102. Port infrastructure

Name	Type	This	North
San Marcos	Caleta	383235	7664793
Dry river	Caleta	379013	7677651

Source: Own elaboration.

Figure 3-229. Infrastructure Portuaria.

Embarcadero Cove San Marcos

Workshops area Caleta San Marcos

Embarcadero Cove dry river

C workshopsfin Dry river

x) Health infrastructure

The town of Río Seco has a reone hundredrural drinking water system inaugurated regardlesslocated on the outskirts of the town, that includes a large pool of 100 m^3, a hut of chlorination, 1600 meters of pipe fitting as red distribution, aimed at 121 home-based start-ups. The feeding system is performs through wells to the respective pond trucks, replacing the distribution House by House[32].

Figure 3-230. Health infrastructure.

Source: Terrain photography registration

ii. Equipment

Equipment can be understood as the set of buildings and spaces, mainly for public use, which are activities complementary to those of room and work, either, that welfare services are provided to the population social support and economic activities. The most important equipment is include educational equipment and health equipment.

[32] http://www.massnoticias.cl/tag/caleta-rio-seco/

y) Educational equipment

Within the 2 communes considered for the location of the Project, the databases of the Ministry of education[33], listed a total of 67 educational establishments in Iquique and pozo Almonte 11located in the communal territory. Most of these establishments are concentrated in the town of Iquique, dominated by subsidized private schools which taught the three educational levels (pre-school, basic and average) 78 establishments only one is located within the area of influence of the Project: Annex school Thilda Portillo Olivares, which provides only basic education and preschool Caleta San Marcos.

Table 3-103. Establishments Educacionales in the TOrea of EStudio.

RDB	Name	Dependency	Level	Commune	Area	This	North
12542	Annex school Thilda Portillo Olivares	Municipal	Basic	Iquique	Rural	383693	7664869

Source: Own elaboration.

Figure 3-231. St. Mark's school.

Source: Terrain photography registration

[33] http://www.mime.mineduc.cl/

z) Health equipment

In the 2 communes considered by the Project, listed a total of 16 welfare establishments in Iquique, and 5 in Pozo Almonte, located throughout the Community territory, according to data from the Ministry of health[34]. Of these 21 farms only one is within the area of influence of the Project:

Table 3-104. Health equipment in Area of EStudio.

Code	Type	Name	Dependency	Commune	This	North
02-4013	Rural health post	Rural health Posta San Marcos	Municipal	Iquique	389703	7664889

Source: Own elaboration.

Figure 3-232: Posta de San Marcos

Source: Terrain photography registration

aa) Equipment sports

Both the town of San Marcos as a Río Seco have a f Courtufootball as a sport equipment located at the coordinates:

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[34] http://intradeis.minsal.cl/Mapas/

Table 3-105. Equipment Deportivo.

Name	This	North
San Marcos	383676.40	7665140.25
Dry river	379272.53	7677852.35

Source: Own elaboration.

Both courts consist of a platform of land with metal arches.

Figure 3-233. Football courts.

Soccer in San Marcos

Soccer field in dry river

Source: Terrain photography registration

bb) C equipmentulto

The towns of San Marcos as a Río Seco have two chapels Catholic as cult equipment

Table 3-106. C equipmentulto.

Name	This	North
Chapel San Marcos, San Marcos	383679	7665015
Chapel Maria Auxiliadora, dry river	379249	7677673

Source: Own elaboration.

Figure 3-234. Chapels.

San Marcos Chapel | Maria Auxiliadora Chapel

Source: Terrain photography registration.

3.7.4.4 Conclusions

The identification of the infrastructure and equipment in the study area Sample What eSTA focuses on sectors of San Marcos, Rio Seco and substation lagoons, being infrastructure and basic equipment mainly.

The main roads in the area corresponds to the route 5 and route 1, being senior in the area routes. Other important infrastructure is the energy that develops in the area of the substation lagoons, latter being more some power transmission lines in the area major.

In relation to the community infrastructure exist in the towns of San Marcos and Rio Seco two-seater with playgrounds and two shrines for religious services. In relation to the equipment, only the city of San Marcos has an educational establishment and a rural health facility.

As you can be seen, cadastre carried out both the infrastructure and the equipment present in the area is rural character, presented basic services for the population of San Marcos and Río Seco.

3.7.4.5 References

- CDEC-SING 2011, operation Statistical Yearbook
- Regional Government of Tarapacá, 2011. Regional development strategy Periodo 2011-2020.
- Regional Government of Tarapacá, 2010. Diagnostic territory fishermen, Document work N ° 4, analysis of reality Regional. Region and territory series.

3.8. Half human

3.8.1 Introduction

In the present section are delivered the results of the characterization of the human environment component to the area of the mirror project of Tarapacá, pursuant to article 11 of the Law 19,300 of Bases General of the environment, regulation of the system of Environmental assessment referred to systems of life and customs of human groups, and its amendments in 2013 through Decree 40.

The main objective is to characterize and describe the five dimensions of the average human in the area of influence of the project Espejo de Tarapaca, on the basis of provisions of the regulation of the system of environmental assessment, using both primary sources as secondary information.

3.8.2 Definition of Areas of influence

The definition and content associated with the Area of influence is included in Article 18 of the regulation of the system of environmental assessment, where it is established that in the baseline it shall describe the Area of influence of the project, whereas the relevant potential environmental impacts on each component.

In this way, to the component half human, sand evaluated the presence of human groups[35], villages or towns in areas adjacent or close to the works of the project, which could be affected by the actions of this one, both in its phase construction and operation. Thus, para to later assess the impacts generated by the project, three criteria have been defined to define the area of influence in different areas where the project materialize his works and activities:

- **Settlements or groups humans close to the works of the project.** Human settlements are considered you are closer of each one of the works and activities project (use of roads, transportation and camp workers, among others).
- **Areas linked to the development of economic activities or traditional use.** Immediately adjacent sectors are considered areas of development of physical works or

[35]Artículo 7: “se entenderá por comunidades humanas o grupos humanos a todo conjunto de personas que comparte un territorio, en el que interactúan permanentemente, dando origen a un sistema de vida formado por relaciones sociales, económicas y culturales, que eventualmente tienden a generar tradiciones, intereses comunitarios y sentimientos de arraigo”.

activities which do not present a room of people, but which are used by human groups for the development of economic activities, thus presenting a intensive or extensive use of the space.

- **Areas with presence of goods, equipment, services, or basic infrastructure which are used by human groups that can be affected (access, connectivity, travel times) by the works and activities of the project.**

This mode, defined three areas established as areas of influence, defining inclusion from the consideration of the newly exposed criteria. These in turn correspond to the sectorization performed for the chapter of baseline, namely: Sector Pampa, Plateau Sector and Sector Costa.

Therefore, human groups were considered according to the criteria set out earlier, according to the potential effects that each of the works involving the construction of the project. It should be noted that the sector of Pampa and plateau was considered jointly since the population and territorial characteristics in the case of this project are similar. In this way, we considered three works that could produce effects on the local population:

- Reservoir, which considers a flooded area.
- Road to transport construction material to the works of the reservoir, which considered traffic and works.
- High line voltage (LAT), associated with possible harm due to vibration, noise, and works.

Additionally, in the coast sector, there are four works or activities, namely:

- Work on the project (room of machines, pipes, etc.).
- Road, which begins in the area of Caleta Río Seco.
- Camp for the works.
- Discharge of water by the action of the project in the surrounding villages.

It is from these conditions, that defined a buffer or area for each of the sectors, namely:

<u>Pampa sector and Mcomputer:</u>

- A kilometer from the limits of the flooded area reservoir.
- One hundred meters on each side of the new road (between the top of the cliff coastal and the reservoir).
- Two hundred meters on each side of the LAT.

<u>Sector Costa:</u>

- One hundred meters on each side of the new road)eetween the connection with route 1 and the top of the coastal Cliff)
- 1.5 kilometres from the works of the project.

- Adjacent sectors to the obrasdestinadas to the camp and service deliveryproviders and basic infrastructure.

Following these criteria, and as has pointed out two areas were identified with the presence of human groups that could potentially be affected by the project, the What correspond to the caleta San Marcos, located within 1.5 km of the work, and the caleta Río Seco, which is less than 100 metres from the beginning of the new road. In this way, below the detail of the sectors included in the area of influence:

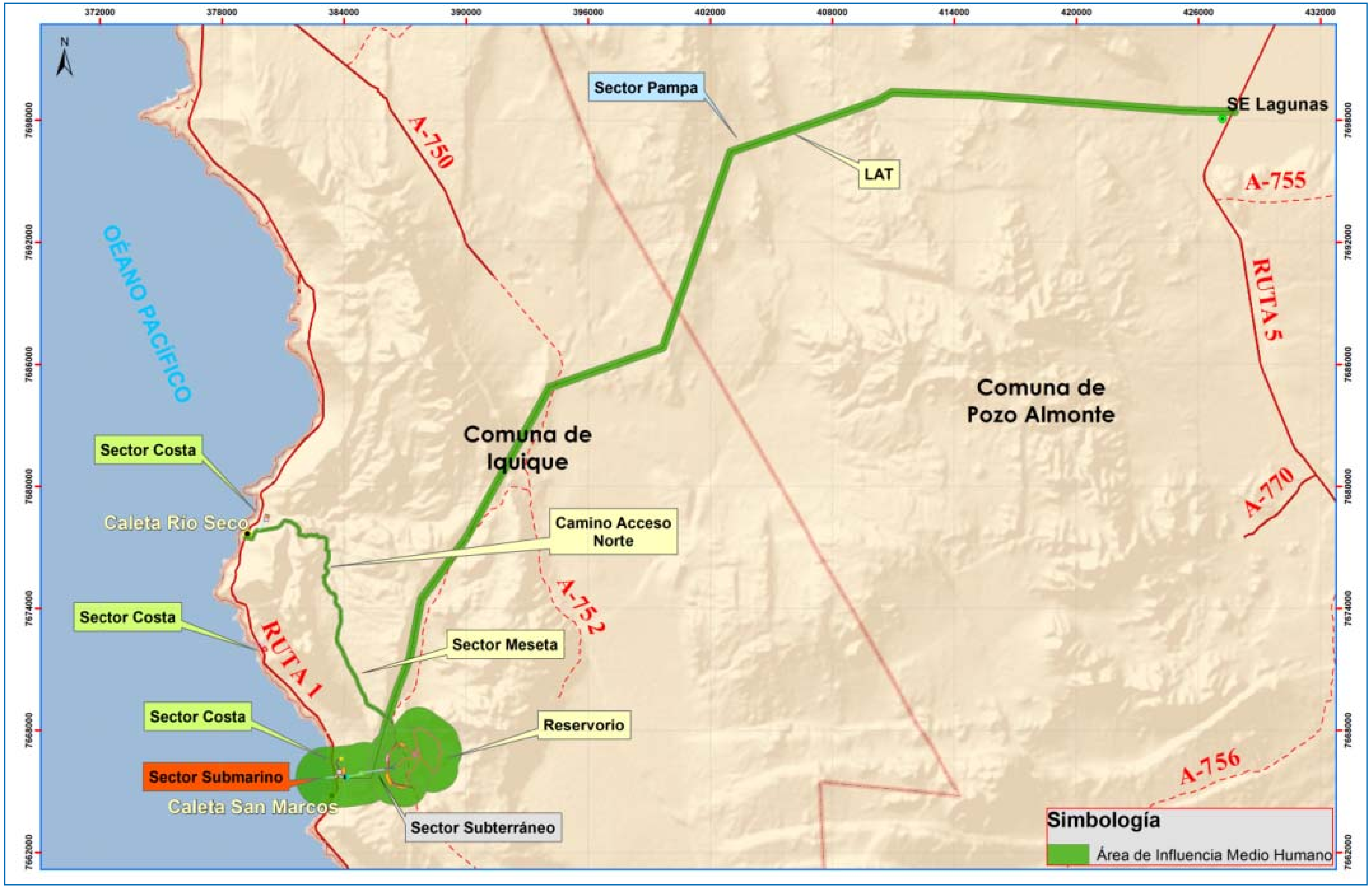
Table 3-107. Area of influence (AI) half human component.

<table>
<tr><th>Sector AI</th><th>Inclusion criteria</th><th>Human groups</th><th>Works</th><th>Buffer</th></tr>
<tr><td rowspan="3">Pampa and plateau areas</td><td rowspan="3">Adjacent sectors works and things to do of the project, and development of economic activities and infrastructure.</td><td rowspan="3">Did not identify the presence of human groups; Yes activities related to mining, specifically the transfer of trucks, and the improvement of the route A-750 by the MOP.</td><td>Reservoir</td><td>1 km to the limits of the flood</td></tr>
<tr><td>New road</td><td>100 metres on each side of the road</td></tr>
<tr><td>LAT</td><td>200 meters on each side line</td></tr>
<tr><td rowspan="3">Sector Costa</td><td rowspan="3">Works of the project near human settlements.

Human settlements near places defined for the accommodation of workers and with presence of services and basic infrastructure.</td><td rowspan="3">Caleta which brings together a significant numeror mariscadores divers, pescadores and other that are dedicated to the extraction and drying of huiro. On the other hand, in the areas of free access adjacent to the Creek and in the AMERB is observed the transit of boats working in these areas.</td><td>New road</td><td>100 metres on each side of the road</td></tr>
<tr><td>Accommodation and provision of basic services for camp</td><td>Caleta de San Marcos and dry river</td></tr>
<tr><td>Cconstruction of works for the operation of the project (tasks, Pique, valves, pipes, machine room)</td><td>1.5 km from the boundary of the works</td></tr>
</table>

Source: Own elaboration.

Figure 3-235. Area of influence.



Source: Own elaboration.

3.8.3 Methodology

They have been considered for the elaboration of the baseline of the average human, the dimensions recommended by the environmental authority[36]to assess the significant systems of life and customs of the human groups change. These dimensions say relationship with the basic characteristics of the population, its composition, projections and trends, as well as their conditions of housing, education and health. In addition, variables associated both with the predominant economic activities with local identity, customs and practices of the population settled in the area of influence of the project are considered.

Also designed a qualitative methodology that would be capable of approaching the local reality from background starting from: (i) secondary sources; and (ii) primary sources based on field work, which is complemented with the use of quantitative tools through software REDATAM + G4, with which relevant information with respect to the areas of influence of the project from the Census of population and housing in 2002 from the National Institute of statistics (INE) was processed.

It should be noted that the level of detail needed to quantitatively characterize the populated entities defined in the area of influence, is delivered by the censuses of population and housing carried out by INE. It is necessary to indicate at this point that the date of writing of this document, are not released databases Census applied the year 2012, so it there is updated information to this level of requirement.

Therefore, even though there are population projections, these are available only at the regional level and communal level, but not at the level of towns. The statistical information presented that is why based on census data for 2002 for the description at the level of townscontrasting it with the information collected in the field. On the other hand, for the characterization of Caleta San Marcos includes quantitative data delivered by the Espejo de Tarapacáobtained in cadastre carried out to the homes in the village, in the month of February of 2014.

3.8.4 Compilation of information

Data collection instruments on ground fall within the qualitative methodology and developed directly in the work done field, considering mainly the technique of interviews semi-structured with the local population, used with each one of the humanindividual s, and ethnographic

[36]CONAMA: *Guía de Criterios para Evaluar la Alteración Significativa de los Sistemas de Vida y Costumbres de Grupos Humanos, en Proyectos o Actividades que Ingresan al Sistema de Evaluación de Impacto Ambiental (SEIA).* Gobierno de Chile, Comisión Nacional del Medio Ambiente, 2006.

observation with emphasis on populated areas categorized as part of the area of influence of the project. In the Annex 3.5 presents details of the interviews in the field. In addition, secondary sources of information of the type of bibliographic and documentary, using reviewed quantitative information that is expressed through the municipal census, administrative data management or others, which put in relief the general characterization of the area of influence of the project, in addition to the revision of contingent cartography.

With respect to interviews, interviewed a total of 28 people, 13 of them representatives of different institutions and organizations of the towns that are within the area of influence of the project, such as leaders of organizations of Caleta San Marcos and personal and dry river school and Rural Health of Caleta Posta San Marcos. Organizations considered in this survey were: Board of neighbors San Marcos and Board of neighbors Río Seco, San Marcos Housing Committee, Committee of Rural drinking water of Rio Seco, Union of divers and fishermen of San Marcos, Union of seaweed fields of San Frames and Union of divers and seaweed fields of Río Seco. Both Caleta San Marcos in Rio Seco, gave special emphasis to the interviews to people directly engaged in activitiesIt is related to the exploitation and processing of marine resources, interviewing 10 people employed in this field. Of the total respondents, 11 are women and 17 are men.

In order to meet territorial aspects, be consulted secondary information availableboth in the communal Development Plan, in the diagnosis of the territory Los Pescadores Regional Government of Tarapacá, which particularly focuses on the villages of San Marcos and Río Seco.

Interviews collected freely the perceptions of each interviewee from the delivery of project general information, whereas their main topics of interest, at the same time that emphasis was given to the characterisation of each of the dimensions of the human environment, depending on its scope of action. Is usedor as base a pattern of interviews, responding to the type definition semi structured, which is understood as those "guided by a set of questions and issues to explore, but not the exact wording and order of questions is predetermined." This open and informal interview process is similar, but different from an informal conversation. The researcher and the interviewed they talk in a way that is a mix of conversation and inserted questions"[37].

In this sense it deals withn the main social and demographic variables the sectors identified, contained in the area of influence of the project, as well as the productive activities and its link with styles of life, traditions and customs of the local population. Sand they characterize the main

[37] Miguel Valles. “Las Entrevistas Cualitativas”, en Cuadernos Nº 32. Centro de Investigaciones Sociológicas, Madrid, 2002. Págs. 38-39.

attributes of its population, housing, education, health, productive activities, uses and practice cultureLes. In addition, to these community groups are identified and described sites of cultural significance, according to the information collected in the field.

Gathering information was carried out in three field campaigns, the first two between 25 and 29 November 2013, and between 21 and 24 January 2014. The third campaign was carried out from 1 to 3 July 2014.

3.8.5 Results

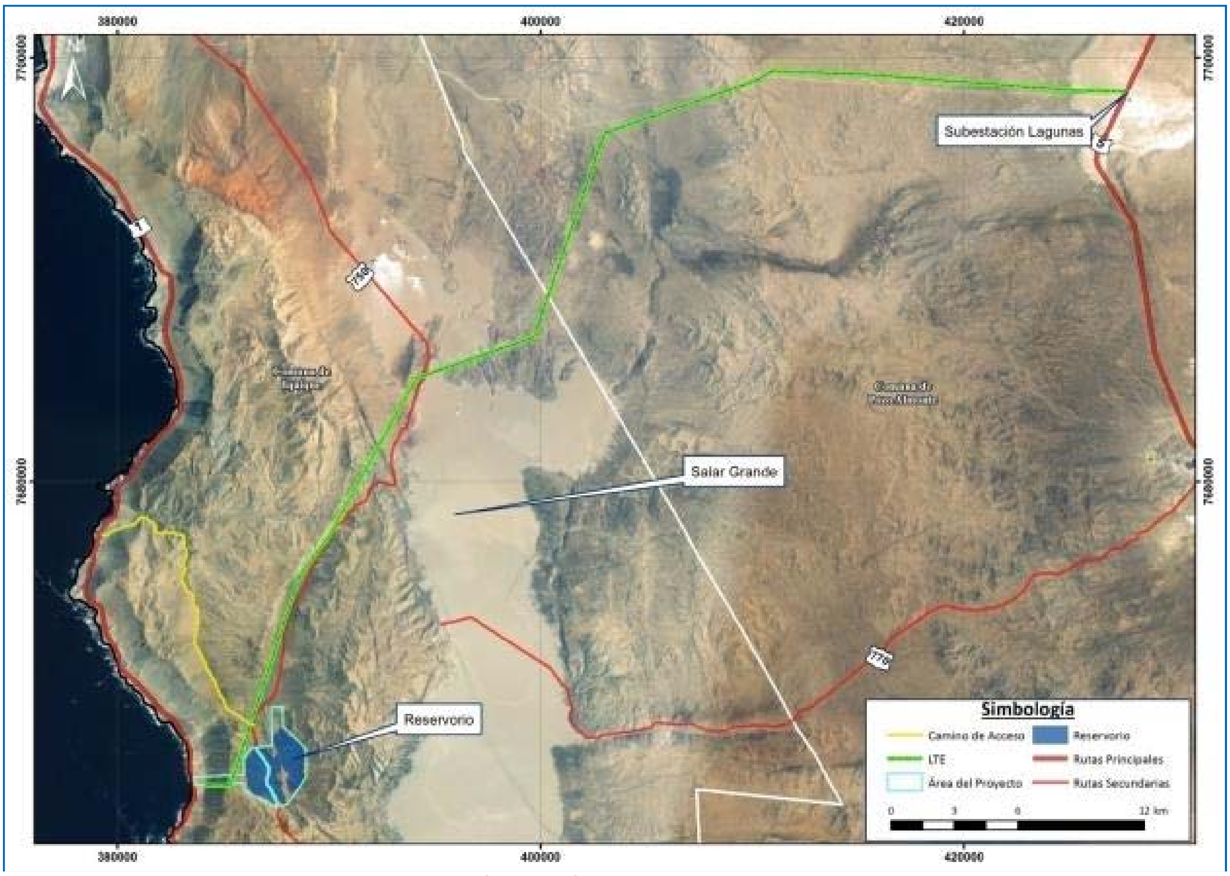
3.8.5.1 Pampa and plateau areas

i. Geographic dimension

cc) Location

The area that we'll discuss corresponding to the Pampa and plateau areas. It is located in the Region of Tarapacá, province of Iquique, in the communes of Iquique and Pozo Almonte. The area starts approximately 2.5 kilometers east of Caleta San Marcos, on the coastal cliff, where the reservoir, which is part of the work on the project is required. The area continues northward, following the route of the electric transmission line associated with the project, in a way almost parallel to the A-750 route up to 5.5 km north of the junction between routes A-750 & A-770, which line theconduction of the project goes to the East, in the direction of the RUTA 5 to connect to the UPSstation gaps.

Figure 3-236. Map of Uocation.



Source: Own elaboration.

dd) Stocking

The area does not have human settlements, due to the desert climate, so the only present population is comprised of the workmanship used in mining operations in the area, such as Punta de Lobos, Kainite, mines TenarditaKLA, hope and Bernadette.

Figure 3-237. Mina Punta de Lobos.

Source: Terrain photography registration

ee) Transport and Conectividad

The route A-750 is a busy mainly by trucks carrying loads from mining companies in the area of the Great Salt Lake. The vehicular traffic by the RUTA to-750 and the Interior area roads is composed by truck freight and trucks belonging to different companies related to mining activities. Route 5 has a greater traffic volume to be busy for trucks, buses, vans and cars that are directed toward different parts of the country through the Pan-American Highway.

Figure 3-238. Map Rutero

Source: MOP road

Figure 3-239. Transit of Camiones by route A-750.

Source: Terrain photography registration

The route A-750 is avia pavimentadto that extends from the mines in the Great Salt Lake to Puerto Patillos where shipment of salt port terminal.

Southwest of the junction between thes routes A-750 and A-770, the RUTA to-750 is a dirt road that is being improved by the MOP. Also in the area of influence is a large number of dirt roads of varying levels of quality by which can move double traction vehicles. Route 5, at the height of the Subestacion Lakes is a one-way paved driveway.

According to information from the volume of transit of the national census of the MOP for the year 2012, the Transito annual daily average This route is approximately 1,000 vehicles. In the section that goes from route 1 to the fork victory is 1,100 vehicles, which has involved a decrease of 3.3% with respect to the measurement of the year 2011. Most of the vehicles that move are trailers for 67,39% of the total, followed by trucks by 15.21%, while trucks account for a percentage close to 3%.

En the section that goes from Fork victory toward the Great Salt Lake, has an average of 995 vehicles, which has involved a decrease of 4.65% with respect to the measurement of the year 2011. Many vehicles are trailers with 74,26%, followed by trucks with a 12.53%. Trucks represent a percentage close to 3%.

Figure 3-240. Route A-750.

Source: Terrain photography registration

ii. Dimension Demographic

ff) Population

The Pampa and plateau sectors did not have population registered in the Census of population and housing in 2002. Today is It has a very low population density composed entirely by workers of the mining companies and the Ministry of Works public (MOP), who are carrying out improvement of routes. The presence of human settlements in the area of influence were detected in field.

iii. Dimension Anthropological

gg) History

The sectors of Pampa and plateau hasn a history linked to the mining of salt and saltpeter, activity that defines this area. DSince the shortage of water resources in the Atacama desert, the driest of the world, la human presence isTa fundamentally linked to this activity, both of mines in operation as former offices and their respective cemeteries.

Figure 3-241. Ruins of Office Bellavista.

Source: Terrain photography registration

hh) Indigenous peoples

According to information gathered in the field and information of CONADI, this area of influence does not record indigenous population.

Additionalmind, and According to the record of indigenous communities of CONADI (2013) indigenous communities are not logged legally constituted in the commune of Iquique. Meanwhile, in Pozo Almonte Yes are indigenous communities, which are located in areas of the pre-mountain range and therefore away from the area defined for the project.

ii) Sites of Icrucial Historica and/or Clunch

In the area of influence was detected the presence of numerous foundations corresponding to the lifeline connecting the Office of Rio Seco, of holding company Punta de Lobos located in the Salar Grande, with dry river, on the coast, where was loaded salt in boats. The company's exploitation Punta de Lobos ran until the early 1950's, and the vestiges of the lifeline and the Office of Rio Seco as testimony of its boom.

Figure 3-242. Lifeline Foundation.

Source: Terrain photography registration

Also be identified the cemetery of the Bellavista Officelocated in the vicinity of the substation Lagoons. The cemetery, although it seems to be abandoned, still receives the visit of some people carrying paper crowns to their deceased, especially the November 1.

Figure 3-243. Cemetery Office Bellavista.

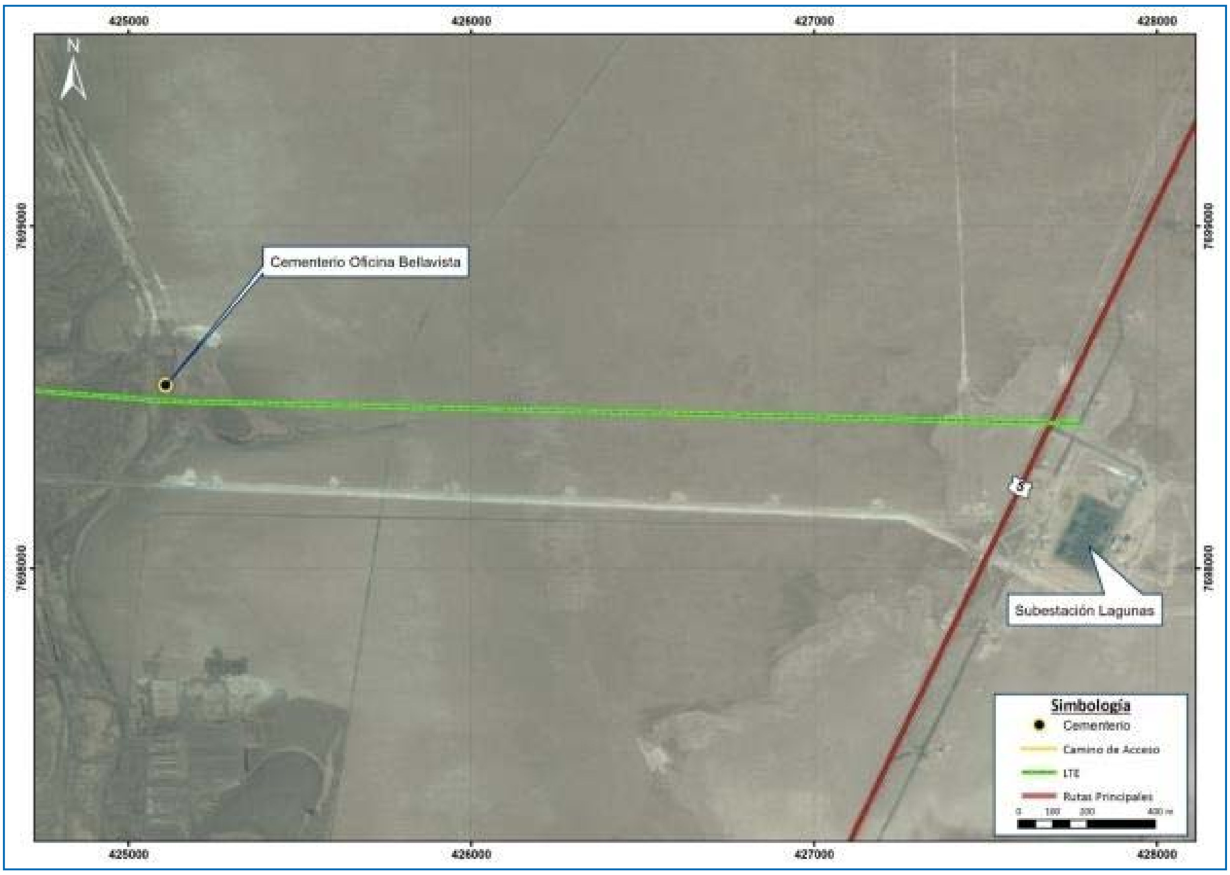
Source: Terrain photography registration

Table 3-108. Location sites of Icrucial Historica and/or Clunch, Area of influence.

Name	UTM coordinates Datum WGS 84, zone 19 South		Approximate distance from the project (in meters)
	E	N	
Cemetery Office Bellavista	425107	7698535	44 meters

Source: GAC

Figure 3-244. Location of cemetery Office Bellavista.



Source: GAC

iv. Socio-economic dimension

Although not be indentificor no human settlement in the area of influence, there is a human presence in the area linked to the different salt mines in the Great Salt Lakebeing the main activity economic sector the linked to mining. In addition, was observed in field, in the month of November 2013, the presence of the Ministry of public works (MOP), entity that is carrying out the improvement of routes of the sector.

Table 3-109. Location TOctivities EEconomic and Roads, Area Influencia.

Name	UTM coordinates Datum WGS 84, zone 19 South		Approximate distance from the project (in meters)
	E	N	
Punta de Lobos	391729	7690200	5938
Tenardita	396095	7683439	2062
Kainite	390885	7689591	5613
Installing MOP (to November 28, 2013)	391512	7679074	560

Source: GAC

v. Dimension Basic Social Welfare

jj) Education

To not count on human settlements and the unique presence of workers linked to the mining, the area of influence does not possess educational establishments.

kk) Bless you

By not having human settlements, the area of influence does not have health facilities, being the rural San Marcos BBS and Chanavayitawhich has an ambulance, nearest settlements in case of emergency. La posta San Marcos is located more than one kilometre away in a straight line from the works of the project, while Chanavayita It is more than 11 kilometres in a straight line from the caleta Río Seco.

ll) Housing

Homes in the area were not detected.

mm) Basic services

The presence of basic services in the area of influence were not detected which is directly linked to the absence of human settlements in this area.

3.8.5.2 Coast area: Caleta San Marcos

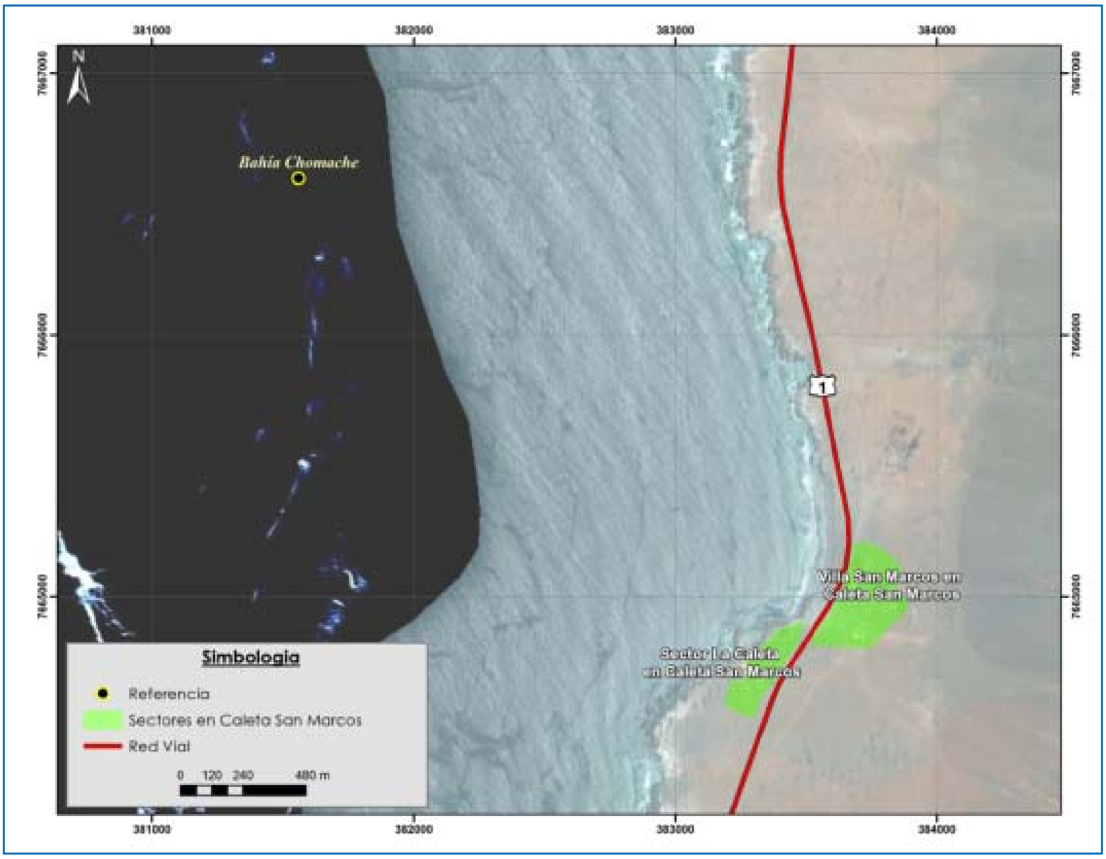
i. Geographic dimension

nn) Location

La Caleta San Marcos is located in the Region of Tarapacá, province of Iquique, in the commune of Iquique and form part of the rural area of the commune.

Considered by the INE as a rural populated entitySan Marcos is located on the coast, at km 305 - 1, route to the South and Southeast of the Bay Chomache. In this sector the coastal plain is extremely narrow, almost non-existent, with a pronounced coastal cliff or cliff parallel to the coast, and which links the coastal plain with the upper plateau of the Cordillera de la Costa.

Figure 3-245. View Aerea, Caleta San Marcos.



Source: GAC

With respect to the nearest towns, Caleta San Marcos is located towards the South of the Caleta Río Seco, 14 km approximately - 1 and 108 kilometers route South of the city of Iquique. La Caleta is located to the South of la Caleta, 25 linear kilometers, Chipana, and 35 kilometers, the complex customs El Loa. In this complex, works a Control police station that attends to Caleta San Marcos. Residents of la Caleta San Marcos have access to most of the services in the city of Iquique.

Figure 3-246. Map of Ulocations and VIAS in TOaccessible, Caleta San Marcos.

Source: GAC

The main and only path to la Caleta San Marcos is the route A-1, joining the litoral of Tarapaca and Antofagasta regions, from Iquique by North to Antofagasta to the South. The route is paved, one via and in good condition. In the Region of Tarapacá route has a length of 143 kilometers, from the city of Iquique to the Customs complex of the Loa. To January 2014, in the Iquique -

Diego Aracena airport, stretch work for the construction of dual carriageway is underway. It should be noted that the implementation of route A-1, during the every of 1990, allowed to join isolated coves, substantially improving their quality of life through a better connectivity and accessibility.

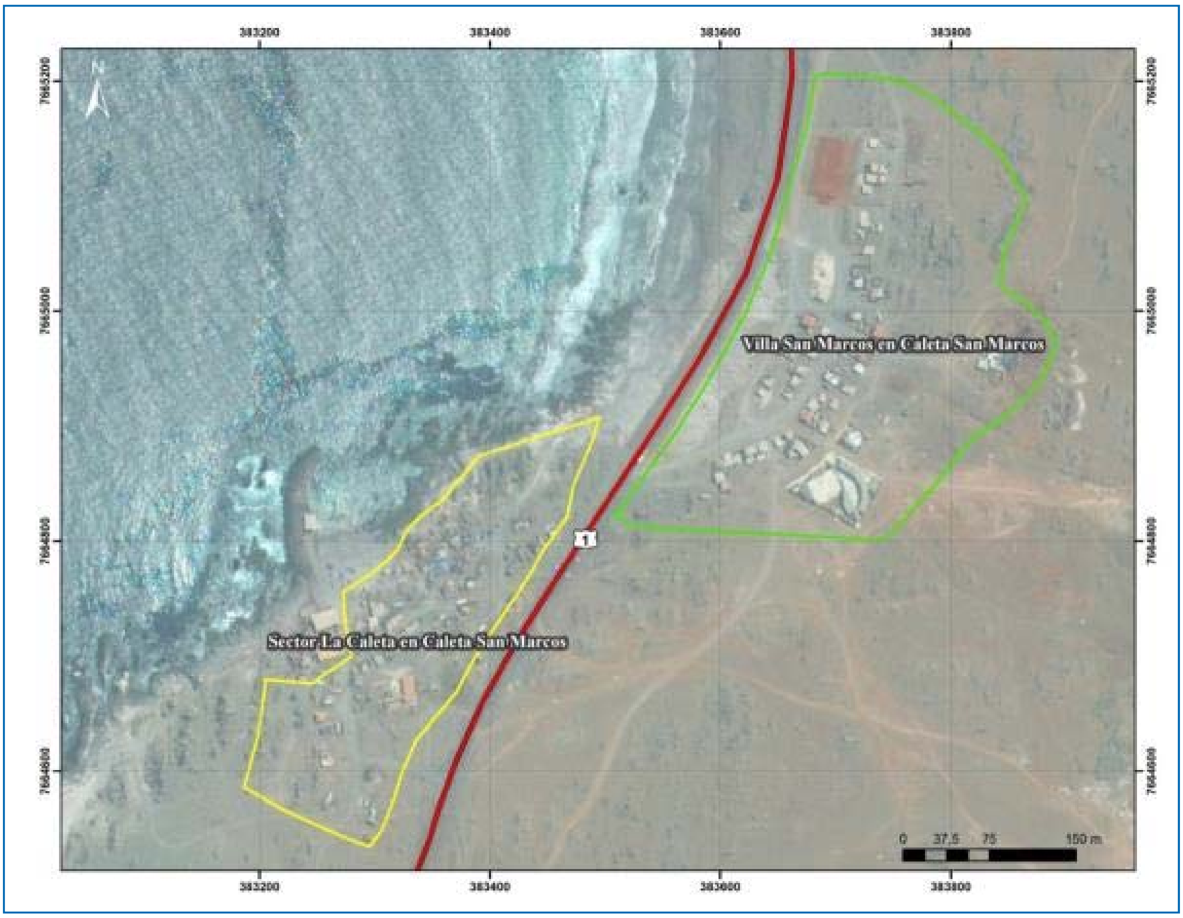
According to the volume of traffic information delivered by the national censuses of the MOP Plan for 2012, the annual average daily traffic What they pass through the RUTA A-1 in the section that goes from Iquique up to Tocopilla, is of 2.189 vehicles, among which most are cars, 33,14% followed by vans with 32,77%.

Figure 3-247. Route A-1, Caleta San Marcos.

Source: Terrain photography registration

From route A-1 there are joint paths to access Caleta San Marcos. The internal roads of the hamlet are ground and are in regular condition.

Figure 3-248. Aerial view CAlles and Sectors of Caleta San Marcos.



Source: GAC

Figure 3-249. Street IInterior, San Marcos.

Source: Terrain photography registration

oo) Stocking

La Caleta San Marcos is located originally on grounds of national assets and is currently organized into two sectors: "La Caleta", oldest and sector aledaño to the caleta of divers and fishermen, which correspond to Thomas not regularized, and "the other side" or "Villa San Marco", located to the East of the route A - 1, sector in which we have built new buildings of the Cove, with regularized land and where plans to install the population who currently lives in "La Caleta". Both sectors are located adjacent to route A-1 and their accesses are done through this route.

The sector of La Caleta was populated on a permanent basis from the Decade of 1980, and its articulator axis is the Cove of divers and fishermen, so houses are concentrated around the caleta, between it and the path A-1. The dwellings of the sector are distributed according to the place of origin of the families, mostly from the region of Coquimbo, who are distinguished from Iquique minority. South of the sector of La Caleta are located most of the homes of those who come from Los Vilos and northward, are the homes of most of the people from Coquimbo. The boundary between both sectors is given by the warehouse which is located on the main street of La Caleta sector.

"La Caleta" sector is the only declared camp by SERVIU according to cadastre carried out on 2011, according to the definition of camp used by the Ministry of housing. The housing in this sector, according to the information collected in the interviews, have eviction notice, delivered by the maritime governance, since they correspond to irregular land outlets located in the strip of 80 meters from the highest line tide. Administration of this section is the responsibility of the maritime authority which grants right of use through concessions maritims.

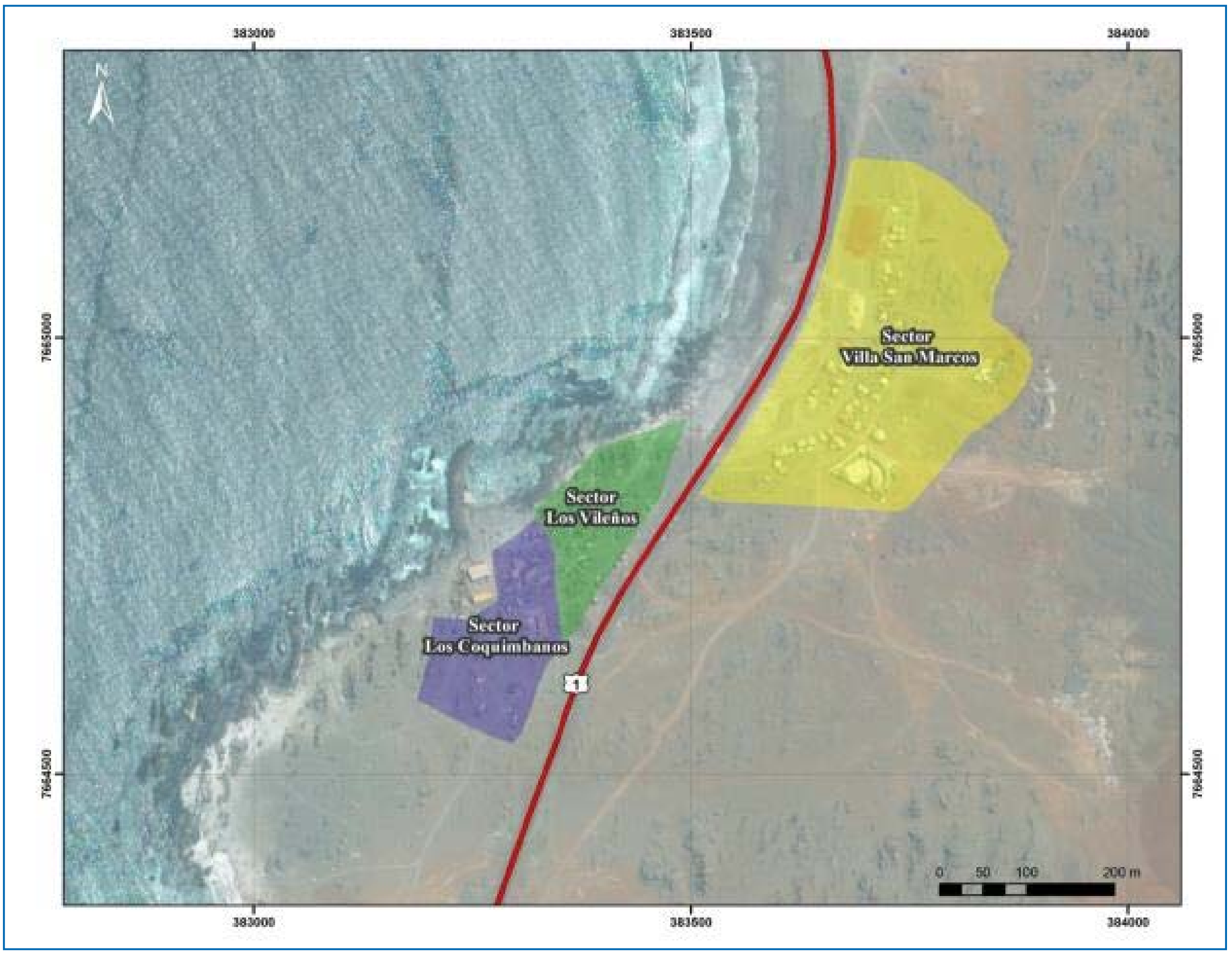
Figure 3-250. Caleta San Marcos.

Source: Terrain photography registration

"The other side,"Villa San Marco", is located east of route A - 1, sector in which they have built new buildings of the caleta and where plans to install to the population that currently lives on"La Caleta". For that it complied Since 2008 a Housing Committee composed of 35 members. Member families are awarded a grant through a direct allocation during a visit made by former President Piñera. The project "Committee of housing entrepreneurs of San Marcos' (official name) has had some complications and has taken more time to run's predicted. The project will be divided into two stages, the first will build 7 homes in "own place", i.e., in lands where the partners are already owners beginning in March of the year 2014. The second stage includes building28 homes on land that belongs to Bienes national and that it is currently being transferred to SERVIU, the land is located to the South of the new school, is expected to begin construction in October 2014. Most of the families who make up the Committee live in sector West of the Cove or coastal sector which today is considered as an irregular terrain.

In the sector known as "Lto Cfin"would be only the buildings of the business"O.K."and the Union of fishermen of San Marcos, with a maritime award.

Figure 3-251. Sectors, Caleta San Marcos.



Source: GAC

In the case of the populated sector located to the East of the route to - 1, this is ordered from a street parallel to route A-1. The most recent occupation has mainly with housing of solid material and new installations of the educational establishment and the rural health post. The first homes to be inducted into the sector, correspond to the houses located in the vicinity of the plant of huiro situated in the North of the town, but those located in "Villa San Marco", i.e. close to the school and the rural health post they are inhabited by families who According to the interviews carried out in the field, moved the sector of La Caleta and built their homes in this new area, in search of more space and better habitability conditions in comparison to the sector of La Caleta and according to the request of maritime governance. These lands belonged to national property, to be transferred to each farelocated Milia.

Caleta San Marcos closest project works Espejo de Tarapacá It is located to the North of the town, to the East of route A-1 and correspond to underground works (tunnel, cavern of machines) and the gateway to these, more buildings of administrative use (offices). Currently, the existence was recorded in the area in which these works are projected, of stockpiles of material (Earth) which, according to the information gathered in the field, corresponds to residues of the arrangement of the a-1 route works long ago. To your vez, there was a micro-garbage dump, which is occasionally used as a repository of mollusc shells and major home appliances. On the other hand, in the area north of the town that adjoins the area of land-based site, a processing plant algae and houses for the workers of this is located.

Figure 3-252. View gathering Material.

Source: Terrain photography registration

Finally, el populated San Marcos is undoubtedly characterized by its coastal imprint and the mobility of a population which is mainly engaged in activities related to the sea and who is accustomed to having an extensive use of the space, on the one hand, because for decades the divers roamed the country in search of resources and, On the other hand, because the territory covering is broad, mainly when are the usual dive sites scarces resources. His occupation has been marked by the presence and production of marine resources that attracted to the divers, which were making increasingly longer stays. In this context, un key moment was the establishment of the General Law of fisheries and aquaculture of 1991 which required the registration of divers and fishermen in a given region, to assign quotas for the extraction of resources, what has changed the custom of divers visit the country from North to South in search of more required resources in the market. This, among others phenomena, It has made the population settles in Caleta San Marcos. However, it is important to note that the permanent occupation of the site, It began gradually during the past thirty years.

pp) Transport and Conectividad

With regard to public transport, the population of la Caleta, as well as the coastal sector - except the Greens - South of Iquique, uses the "caletero" bus, bus that travels through the RA UTA-1, passing through all the villages from Chipana North to Iquique, twice a day. The bus starts at Chipana, arriving at Caleta San Marcos at 7:15 in the morning and joined the majority of the villages arriving to the city of Iquique approximately at 9:30 o'clock. In Iquique bus Martinez ends its journey in the streets with Zegersone block from the market of Iquique. From that same point, return to the creeks to 17:00 hours. The tour is done from Monday to Saturday, varying schedule of return of Iquique weekend, from the city at 16:00. The value of the ticket varies depending on the travel section. For Caleta San Marcos the cost of the ticket is $950, existing tariff differential for students ($250) and seniors ($500). In summer it increases demand for the caletero bus, due to its use by tourists. This creates a problem since that remains the mypassenger capacity that can transport the bus.

At the same time, the population has interprovincial buses that regularly pass by the a-1 route to Iquique and Antofagasta, Tocopilla, however, the value of the ticket is considerably greater than for the public transportation, fluctuating between the $3,000 to $5,000. Although these travel all day usually are not used by the local population because of its high cost.

San Marcos residents, according to interviews conducted in the field, considered transit regulate poor flow. Perception improves access to mobilization in comparison with what happened before the construction of the Pedro Galleguillos tunnel in 1994, situated to the North of Tocopilla as an alternative to the slope Paquicaconnecting the flow of vehicles from Antofagasta to Iquique by route - 1, when the Creek was characterized for being a town isolated and difficult to access. Today, however, is still a matter of concern, especially for the families of young people who must continue their education of middle schools in Iquique, being the distance and lack of transport - specifically compatible timetables - one of the causes that hinder access to education.

The bus caletero, as interprovincial buses, are expected in the whereabouts arranged in route A-1. Eventually, the caletero bus enters the sectors of la Caleta, depending on the request of the passenger, without additional cost.

The population is mobilized by private vehicle, which has an important part of the inhabitants of the Cove, but avoid using such vehicles for long trips, as the to Iquique, because of the cost in benzine that this implies, or also has recourse to the will of those who pass through the route, mainly Lightweight and cargo vehicles.

ii. Dimension Demographic

qq) Population

According to data from the Census of population and housing in the year 2002, the Caleta San Marcos had that year a population of 141 inhabitants, of whom 87 were men (61.7%) and 54 women (38.3%) so the masculinity index was of 161,1 indicating that there were 161.1 men for every 100 women in the village.

Table 3-110. Population by SExo, Caleta San Marcos.

Categories	Cases
Man	87
Woman	54
Total	141

Source: Census of population and housing 2002, INE

On the structure changes in age structure of the population, using the census data of 2002, the highest proportion of men from la caleta focused in the adult age group (between 25 to 44 years). As you can see in the figure that follows, las outgoing that highlightsBAn in the pyramid of population of Caleta San Marcos mostrABAn that existIA a higher proportion of adult men age work, which is in accordance with the main activity of the caleta - diving, fishing and collecting kelp - preferably made by men. It also reveals a dynamic present in the Creek the year 2002, which aimed at the occupation of this temporarily by some of the divers and fishermen who came to the Creek for a season, determined by the work at sea. In this context, resided temporarily - with a double residence - men who worked for periods at the Cove depending on the availability of marine resources, and whose families lived permanently in others inidades, as for example, Iquique, Alto Hospicio, or even further afield[38].

According to the data released by the 2002 census, Irate of aging of Caleta San Marcos, understood as the degree of ageing of the population, was 2.8 for that year. I.e., there were 2.8 persons older than 65 per 100 inhabitants. It is possible to add that young people had a rate of 22 and the adult population rate of 75.2. The concentration of the population in the age groups categorized as adults it is possible to observe in the figure below:

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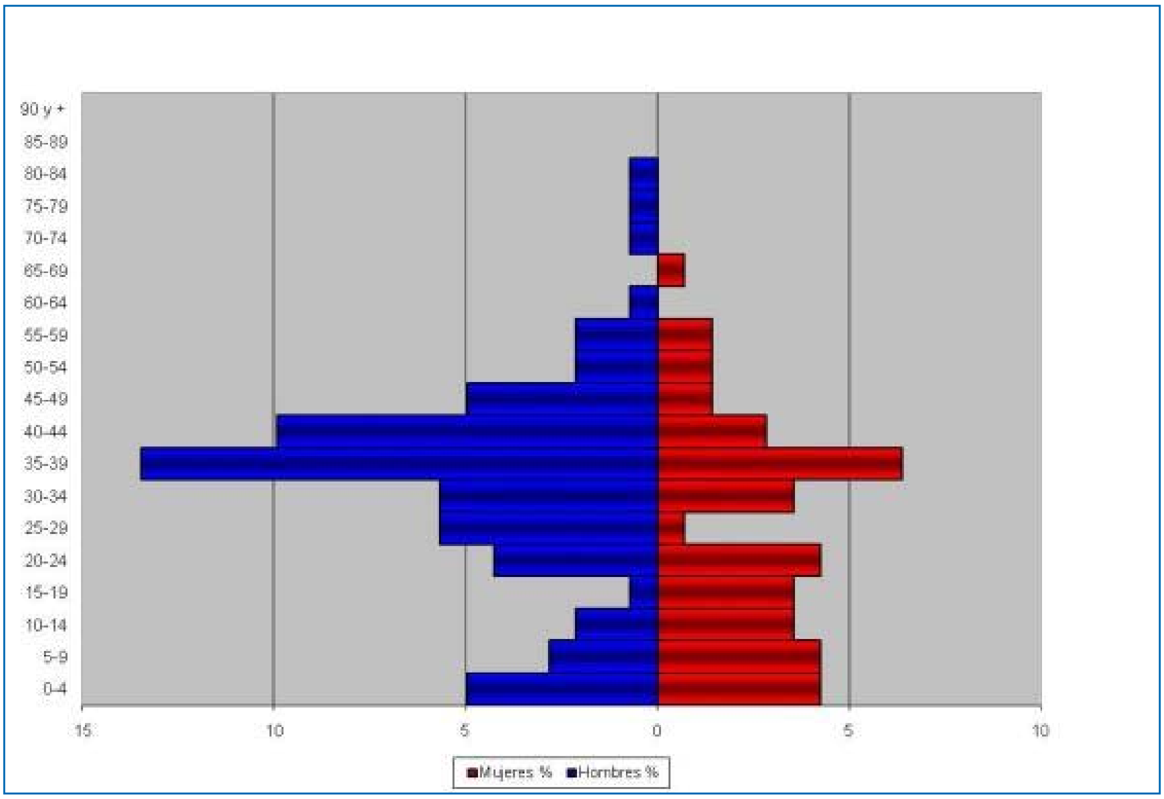
[38] En el Censo de Población y Vivienda del 2002 (Censo de Hecho), las personas fueron censadas en el lugar que pasaron la noche de referencia del Censo. En los Censos de Hecho, se pregunta por “las personas que alojaron aquí anoche”, no por las personas que residen habitualmente, lo que permite considerar a la población “flotante” que pueda estar en un lugar.

Figure 3-253. Pyramid of Poblation by Gseminars of EDad and SExo, Caleta San Marcos.



Source: Own elaboration based on data from the Census of population and housing 2002, INE.

According to the information collected in the field, Caleta San Marcos has experienced a sustained growth of its population since its formation, as well as of the data presented in the 2002 census. The Board of neighbors of San Marcos 300 people estimated the number of inhabitants of la Caleta, which would double the figures delivered by the 2002 census. The formation of the settlement is given by the permanent and temporary residence people in la Caleta, either by divers and fishermen coming to the Cove to work occasionally or tourists, with one higher proportion of families who have settled and who reside permanently in the village. The increase of the population estimated at more than 300 people defines Caleta San Marcos as village, rural entity with more than 300 inhabitants.

According to information provided by the survey carried out by the company Espejo de Tarapacáheld in February 2014, is now the town of Caleta San Marcos is about 345 people, 282 of whom reside so permanently in the town.

rr) Migration

According to the 2002 census, only 23.4% of the population registered that year, was born in the commune of Iquique, while a larger share - 75.9% - said to have been born in another commune in the country. These data enable graph high mobility that gave birth to Caleta San Marcos, due to the dynamics of people working at sea - especially prior to the enactment of the General Law of fisheries and aquaculture the year 1991 — who in search of marine resources are mobilized by various coves along the country.

Table 3-111. Place of Nacimiento SEGUN SExo, Caleta San Marcos.

Place or commune of birth	The Encuestado sex		Total
	Man	Woman	
In this commune	18	15	33
In another commune	69	38	107
Ignored	0	1	1
Total	87	54	141

Source: Census of population and housing 2002, INE.

To analyze in detail the migration processes in Caleta San Marcos, we see the diversity of origins who make up the Creek in 2002. According to the Census of population and housing, 24.1% of the population was born in the region of Tarapacá. The highest proportion of residents came primarily with 43.3%, in the region of Coquimbo, of which 49.2% had been born in the commune of Los Vilos and 21.3% in the commune of Coquimbo. Both the coming population of Los Vilos and Coquimbo have a sharp and strong presence in the Cove, which fe possible corroborate field, where "the distinguished Vilenos"and"the Coquimbanos".

On the other hand, the Metropolitan Region contributed 6.4% of residents in the town, the Region of Atacama 5% while the Maule and Araucanía regions contributed 4.3% of the population each. To a lesser extent, immigration was also recorded from the regions of Valparaiso, Biobío, Antofagasta, Arica and Parinacota and Los Lagos.

Table 3-112. Place or Comuna's Nacimiento by SExo, Caleta San Marcos.

Commune code or country of birth	The Encuestado sex		Total
	Man	Woman	
Los Vilos	20	10	30
Santiago	2	1	3
Iquique	18	15	33

Commune code or country of birth	The Encuestado sex		Total
	Man	Woman	
Quilpué	0	1	1
Ignored	1	1	2
Conception	0	1	1
Coquimbo	9	4	13
San Miguel	1	0	1
Copiapo	4	0	4
Temuco	2	2	4
Monte Patria	2	0	2
Combarbalá	1	0	1
Los Angeles	0	1	1
Ovalle	2	0	2
La Serena	4	1	5
Quintero	1	1	2
Puente Alto	0	2	2
Calama	1	1	2
Talca	0	1	1
Melipilla	1	0	1
Pica	0	1	1
The Queen	1	0	1
I took	0	1	1
Cinnamon	1	0	1
Arica	1	1	2
Parral	1	0	1
Rio Hurtado	1	1	2
Purranque	0	1	1
Freirina	0	1	1

Commune code or country of birth	The Encuestado sex		Total
	Man	Woman	
La Ligua	1	0	1
Illapel	2	1	3
Lota	1	0	1
Taltal	1	0	1
Antofagasta	1	0	1
Vicuña	1	0	1
Valparaiso	1	0	1
New Imperial	1	1	2
Florida	1	0	1
Linares	2	2	4
Vallenar	0	2	2
Limache	1	0	1
Total	87	54	141

Source: Census of population and housing 2002, INE.

In the year 2002, when asked by the place or commune of residence in 1997, it is possible to observe that only 18.8% resided elsewhere. This indicates that probably a significant proportion of the population resided permanently at the Cove or in other towns in the municipality, such as the city of Iquique and Alto Hospicio[39], with 81.2% of inhabitants declared reside the year 2002 in the commune of Iquique. At this point, it is important to note that according to the 2002 census there was in la Caleta a high proportion of floating population, which was at the Cove for labour reasons and seasonally, which is determined by the marine resources available. In this context, there is population that maintains a dual residence - as noted above - settling at the Cove during the days of work and having their first home in Iquique, Alto Hospicio.

It should be noted that this dynamic recorded in the 2002 census has declined and that a significant proportion of the population is now established at the Cove, which is reflected in the

[39] El año 2004 Alto Hospicio es declarada comuna, separándose de la comuna de Iquique; por lo que el Censo 2002 incluye Alto Hospicio en el territorio comunal de Iquique.

survey carried out by the company Espejo de Tarapacáwhich determines that 82 per cent of the registered population resides permanently in la Caleta.

Table 3-113. Commune of Rbeing 1997, Caleta San Marcos.

Commune or place residence in 1997	The Encuestado sex		Total
	Man	Woman	
In this commune	66	38	104
In another commune	14	10	24
Total	80	48	128

Source: Census of population and housing 2002, INE.

Por orTRA part, to review the data provided by the Census 2002, 8.6% of the total declared reside in any commune of the Metropolitan Region, 3.9% of the population in the Region of Coquimbo, 2.3% in the Region of Antofagasta, and 1.6% in the Atacama Region, while a 0.8% declared live in communes in the regions of Valparaiso , Araucania and Lakes the in 1997. Below is the detail of the data related to the commune of residence in 1997.

Table 3-114. Place or Comuna's Rbeing in 1997 by SExo, Caleta San Marcos

Code municipality or country residence 1997	The Encuestado sex		Total
	Man	Woman	
Iquique	66	38	104
Santiago	3	8	11
Coquimbo	5	0	5
Calama	0	1	1
Quintero	1	0	1
Boiler	1	0	1
Maria Elena	1	0	1
Copiapo	1	0	1
Antofagasta	1	0	1
New Imperial	0	1	1

Code municipality or country residence 1997	The Encuestado sex		Total
	Man	Woman	
Castro	1	0	1
Total	80	48	128

Source: Census of population and housing 2002, INE.

It is important to note that the rise of the huiro has encouraged the arrival of foreign population in the area, in search of job opportunities. Specifically in Caleta San Marcos, is Bolivian and Colombian, population which is not reflected in the 2002 census, as it is a phenomenon that has occurred gradually since about five years ago. In the case of the Bolivian population, there is a significant number of people working in the processing plant of Huiro who reside permanently in the Cove in housing associated with this plant. On the other hand, there is a luxury considerable of foreigners coming to the sector by the collection of the huiro, working in coastal areas adjacent to the Creek - along the coast south of Iquique - either by day or settling temporarily in some American, then return to Iquique or A LTO Hospice, place of permanent residence.

In the case of the young population of la Caleta, does not register a high mobility of young people who leave the Cove for higher studies or work; According to the identified field a significant number of young people remains at the Cove and is dedicated to the activity of extraction of the huiro.

According to information provided by the survey carried out by the company Espejo de Tarapacá, It is possible to point out that they currently reside in San Marcos 38 people of Bolivian descent and Colombian-born 2.

ss) Illiteracy

In relation to the level of illiteracy, the census data from 2002 show that only 1.7% over 10 years residents didn't know read and write, group conformated only by men, which corresponds to 2.6% of the total number of men from the village.

Table 3-115. Illiteracy by SExo, Caleta San Marcos.

Can read and write	The Encuestado sex		Total
	Man	Woman	
Yes	74	42	116
No	2	0	2
Total	76	42	118

Source: Census of population and housing 2002, INE.

iii. Dimension Anthropological

tt) History and identity GGeneral of the Norte Grande

The first pre-Columbian occupation of the coastal area to the South of the province of Iquique, was the Chinchorro culture that developed during the archaic period (5000 BC - 2000 BC). Its development was part of a process of specialization which encompassed the coast of northern Chile and southern Peru, approximately from ILO Antofagasta, area characterized by its coast desert and arid but very rich in marine resources such as fish, shellfish, seals and birds. Proof of this wealth, is that the hammocks were mainly devoted to fishing and hunting, being so specialized collectors in marine resources which had a different set of tools, including the Fishhook cactus Thorn and Harpoon in different ways tips for capturing different prey. At the end of the designated period, was developed in the same sector the Chango culture which spanned the coast of the ofierto of Atacama to Coquimbo, area that corresponds to a narrow coastal strip flanked to the East by the Cordillera de la Costa and the desert, and to the West by the Pacific Ocean, bathed by the Humboldt current. This cold ocean current generated until today a variety of fauna and flora marina in the region and, in climatic terms, does not allow the formation of rain-producing high clouds. However, all the moisture that is gradually created by the maritime breezes, parked along the steep coastal, creating a characteristic climatic phenomenon in the litor(l) which is known as "camanchaca", heavy fog that makes possible the presence of very rich coastal ecosystems with high biodiversity in some stretches of the desert coast. This, explains that the monkeys were not only hunters and fishermen, but also marine experts of high mobility, which was favoured by the use of rafts of sea lion leather, tough and agile craft that allowed high sea fishing. Later, around the year 1000 DC and up to today, is He called the area a new occupation by culture Aymara. Peoples Aymara that make up the culture of the same name, are currently scattered throughout different ecological floors of a vast area comprising the area surrounding Lake Titicaca on the Bolivian altiplano, large northern Chile and northwestern Argentina. In Chile, the Aymara they are located in the regions of Arica and Parinacota, Tarapaca and Antofagasta, in three ecological floors: in the altiplano and puna, on the 3800 meters above sea level, in the mountains and high valleys of the foothills and in the valleys low and cities of northern Chile, as well as in mining centres, on the coast and in the more distant cities. Despite the foregoing, towards 1470 culture Aymara It is incorporated into the Empire INKA o TawantinsuyuIt encompassed a vast and diverse territory, from the sierra North of Ecuador to the Maipo River in Chile and the Pacific Ocean to the eastern slope of the Andes. In these vast domains, the Inkas they had access to different resources so different and contrasting environments, being its religious and secular capital, Cuzco, the Center from which emerged the paths to the four regions of the Empire: Chinchaysuyu, Kontisuyu, Olmec and Antisuyu. To the North was the Kuntisuyu, to the East was the Antisuyu, to the West the Chinchasuyu, while to the South, the territories now comprising part of Bolivia, northwestern Argentina and Chile even more to the South of the Maipo River, formed the Olmec. The main interest of the INKA by the Olmec and preferably by the Chilean territory, it was anchored in its mineral wealth. An example of this, is that the exploitation of mineral resources was carried out through the system inkaico mita or shift work that should serve different communities subject to the Empire. In the central zone of Chile, exploited the gold and silver, while in arid and semi-arid north were ores of copper, which were mostly transported raw to the metallurgical centers specialized in northwestern Argentina, although they also existed casting and production centres of tools in the national territory[40].

The arrival of the Spaniards in 1532, when comes to the Incathe current province of Iquique and its coast become part of the Viceroyalty of Peru (1539-1821). In this period and agreement by the Peruvian historian Carlos Donoso Rojas[41], activity in the area did not vary mostly after the Spanish conquest at least until 1556, began the exploitation of silver ore of Huantajaya. To 1670, the mine's Huantajaya located in the current area of Pica, you know a bonanza stage when Juan de Loayza rediscovers the silver ore. Loayza gives account of this discovery to the naturalist and engineer military French Amadeo Frézier, who arrive at Iquique in 1713 aboard ship "Saint Joseph", noting in her blog that the rediscovery of silver mines in Huantajaya It gives hope of riches to the sagging zone of Iquique which had no more than 100 inhabitants. However and notwithstanding the good wishes, the role of Iquique would be limited only to be port of debarkation of workers and adventurers, and discharge of products destined for ore of Huantajayafocusing the business in the own site. Thus the village of Iquique, at that time, failed to "Silver port" function since an important part of the ore extracted was led directly to Carangas, where it was coined, by then sending overland to Arica, where they were the real cases of the Viceroyalty of the Peru. Likewise, Rojas Donoso noted that while Huantajaya He received thousands of people wishing for a fortune, the activity of the nascent port of Iquique was limited to shipping to Arica from brea to rub the Sheepskin of the Quicksilver and the skins, dried fish and guano, exploited in isla Serrano by a group of Indians and black slaves . The cause of this limited commercial perspective aimed at the small number of inhabitants residing in the port enclave during much of the colonial period, which is denoted in insufficient productivity of the village and the meager contribution of this real boxes . Proof of this is that you whereas the apset ten of Iquique, Arica and stings to the Treasury of the King, in 1785 the port contributed little more than twenty percent of the total; in 1793 the contribution would fall to the fifteen and in 1804 to only seven percent of the total raised, noting as well that with the exception of guano

[40] Museo de Arte Precolombino, Culturas Americanas, Pueblos originarios de Chile.
[41] Donoso Rojas, Carlos, *El Puerto de Iquique en tiempos de administración peruana*, Revista Historia, Instituto de Historia, Pontificia Universidad Católica de Chile, Vol. 36, 2003, Santiago, p.124.

and fishing activity, towards the end of the 18th century the area of the current province of Iquique did not show increased commercial activity.

This lack will be maintained at the outbreak of the Peruvian in 1821 independence process, not to have permanent authorities and restrict trade as a result of inherited economic contraction of the war of independence against Spain. However, the resurgence of Iquique began already in 1828 when the Peruvian Government allowed the export of deforestation of Huantajaya and then the President La Mar authorized Juan Alba to exploit and export salitre, in Exchange for paying a tax of four percent on exported quintal. Since 1830, the success of both initiatives made possible restoration of the customs, export of nitrate, an economic boom generated by the sale of saltpeter, and the slight increase in the number of inhabitants of Iquique. In the same decade, will discover guano on the coast of Antofagasta, rico fertilizer required by Bolivia as a fertilizer for agriculture. The discovery and its multiple applications, the Chilean Government ecidio send a Commission Explorer to recognize the potential of Brazilian deposits in the area. These objectives are corroborated in 1842, when by law he declares of Chilean property to the guano to the South of the Bay of mussels (23 ° South latitude). At the same time, Chile began to issue permits to private entrepreneurs for loading guano in the vicinity of mussels, i.e. further north of the defined border, suggesting that the Chilean claims were not completely satisfied. Against the above, the Bolivian authorities, also guards of the Peruvian Government, resolved to discontinue operations carried out in the area of mussels by Chilean businessmen. The Government of Chile responded by sending troops, later conflict was resolved to both countries signing the Treaty of limits whereby a formula of consensus are welcome. It is so in agreement to the Treaty of 1866, the parallel 24 ° is fixed as a border between the two countries and establishes the creation of an economic zone shared between the parallel 23 ° and 25 °, as it is also punishable to taxes coming from the exploitation of guano and my nerales is distributed byequal parts between the two countries.

Is taking into account the above, that Iquique and the surrounding area, since 1845 and as a minor port, featured several outstanding franchises by the Peruvian Government as that was reflected in the improvement of local infrastructure and the increase in the number of inhabitants, process that was confirmed in 1855 with the appointment of Iquique as a major port, and later with a new appointment as deposit and transit port for Bolivia, announcing the construction of a new customs and a fiscal Pier, and the opening of a route cut to get to the city from the high plateau country[42]. Also, the nitrate boom encouraged growth of Iquique which village, was declared a city in 1866 and later, Capital of the province of Tarapacá in the Department of

[42] Donoso Rojas, Carlos, en *El Puerto de Iquique en tiempos de administración peruana*,…Ibíd.p.134.

Moquegua. On December 1, 1868, with the creation of the new province Litoral of Tarapaca Iquique became Capital of the province of Tarapacá, as ratified in February 1875 territorial reorganization[43].

But the growth of the city of Iquique and the increased activity around the extraction, sale and transfer of saltpeter, the differences between the U.S. border in the area increased. It is thus that the Chilean miners José Santos Ossa and Francisco Puelma they obtained a concession from the Bolivian Government and began the exploitation of saltpeter in the Salar del Carmen, forming the society operating the desert of Atacama, direct predecessor to the Cia. de Salitres and Antofagasta railway. These two new factors of wealth - nitrate and silver - boosted by a massive process of Chilean companies in Bolivian territory, into the desert as well as the coast, a strategic area economically, it aroused the interests individuals of some Chileans. This situation worried authorities bolifickian and Peruvian, concern that precipitated the signing of a secret treaty between the two countries in 1873, at the same time that motivated the Peruvian interest in economic wealth which they had in the desert, which resulted in the nationalization of nitrate of Tarapacá and consequent expropriation of the existing nitrate, mostly Chilean-owned. In 1874, Chile and Bolivia signed a new border treaty, in which Chile maintained the limit in the 24th parallel, but renounced their rights to lands located to the North of this line. In the same way, was established as a condition of cothe Bolivian Government to desist from new tax Chilean companies located between 23 ° and 25 ° for a period of ten years to avoid the consequent auctioning of these plementaria. However, the problems continued and in 1878 the Bolivian President Hilarion Daza established a new tax on the exportation of saltpeter, violating the agreement with the Chilean Government. Then he decided to take control of the Chilean nitrate, while the GOP was doing the same in Tarapacá, thus bursting the war of the Pacific (1878-1883).

In February 1879 and through the occupation of Antofagasta, Chile, he manages to avoid the auction of the Chilean nitrate what motivates the Declaration of war of Bolivia. However the entry in war of Bolivia, at the end of November the Chilean troops take control of the Peruvian port of Iquique which at the end of the war and since 1883, happens to be part officially of the Chilean territory as well as the rest of the Region in the coast of Tara here. Under the Chilean administration, the economic strength of the area already known, continued to grow incentivated by the development of the nitrate industry now in the hands of mainly of private English and Chilean. In addition, Chile took control of the Bolivian coastal and, temporarily, the Peruvian provinces of Tacna and Arica. However, the plebiscite that would determine the fate of both provinces not held, which fostered a rapid and active Chilean colonization of the territories which

[43] Ibíd., p.153.

at the same time, resulted in the deterioration of relations between the two Nations. In 1929, a diplomatic agreement estimated that administration of Arica would remain in the hands of Chile and Tacn in the Peru, as also determined the line of still-existing border between the two countries. Finally, and as a result of the conflict that Chile took with both neighboring countries, Peru and Bolivia, the country was now a territory of about 180,000 square kilometers, a population of approximately 100,000 and was in possession of a based mineral wealth mainly in the development of the nitrate industry as well as from the extraction of guano and copper.

The coastal area to the South of the province of Iquique shows its occupation linked to maritime activities with settlements on the coast of inlets of fishermen and transport of minerals, metal, non-metal and chemical ports. It is possible to also observe the development of extractive activities, such as the extraction of Red guano to the North and South of Caleta San Marcos.

uu) History reA cientsettlement Cove in San Marcos

San Marcos Creek, during the 1980's and part of the 1990s, was, according to interviews in the field, a sector occupied seasonally by divers mariscadores and fishermen who settled temporarily in place during the period of extraction of resources. The men traveled daily from Iquique either settled in tents during the time of work, coming from further afield.

At the end of the Decade of 1980 he settled to live permanently the first family in San Marcos, from Linares. In search of a better passing, the sector of San Marcos was considered "a mine which was exploited", by the marine resources that had. One of the main obstacles to reside at the Cove was the isolation and the lack of fresh water. What is now route a-1, then was a dirt road where he sometimes spent only a vehicle during the week. In the words of one of the first permanent inhabitants, at the Cove "there nad"." This isolation was even reflected in the media transmitting in the area: two radio stations, a Peruvian and other Bolivian. Was possible to listen to National Radio of Huanuni, Bolivia and later the first television channels that were also corresponded to Peruvian and Bolivian stations. For power supplies, the family should walk to Rio Seco, to buy sugar, bread and other basic food. Travel to Iquique meant to allocate up to 4 days before returning, so the inhabitants of the Cove were organized into "seasons", stopping at coves to walk to San Marcos.

At that time, the Fort was the extraction of clam or taca, the men who came to work in the sea were a time and they were returning to their places of origin. One of the oldest people living today in la Caleta, came daily from Iquique in pickup truck to work, When the sea conditions so made it. At that time, the largest number of people came from Iquique.

For the resident family, there were moments of difficulty during that period, especially due to the lack of water. Once that is over them the resource, climbed up the Hill to wait to spot any vehicle that daunted by the solitary road. To see him come, fell and crossed a thick cord along the way so that the vehicle was stopped. In doing so, the family explained that they were without water and since then, the driver began to bring water whenever he visited the place.

In the 1990s, it began to become a greater number of people. There was a gentleman who called "Fight of dogs", since placing a poster with the legend dogs "Let me water" or "Let me cigars". At that time, he spent a single truck, the brand of cigarettes Lucky Strike. The truck brought water, appealing to the goodwill of the driver. In addition to the dirt road, the difficulty of the transit of trucks had relationship with the passage of the Cuesta La spoon. Nobody explained is how was the slope, which currently has a tunnel which avoids it and that allows the connection between Antofagasta and Iquique and therefore to all the bays located via route A-1 in that stretch. Later military began to occupy the area for exercise and to see that there were people at the Cove, began to buy seafood. One of the officers managed the delivery of water by a smaller proportion truck once a week, taking sometimes also food. In those years, already three to four families inhabited permanently the Cove.

Prior to this, people who were in the area were at the Cove and went to beach IkeIke, 120 Beach km from Iquique to February of 2014 was prioritized by the Ministry of national property to a development plan of initiatives that promote sustainable tourism[44]. Seeing families installed, there began to be a greater flow of people, even going to travel to the Cove. At the beginning of the 1990s, the Octopus and the Locate they were the most checked-out resources. Attracted by the abundance of marine products and low exploitation, from 1995 started the arrival of a greater number of people, especially of the Coquimbo Region. At that time, already resided at the Cove about ten families. Who began to settle, arrived in the Cove thanks to a friend or acquaintance who warned about the good productivity of the sector. Several men worked at the Cove without their families, who gradually began to come, first only in summer periods, then installed sostanding in the settlement, using tents and rucos. Some of them had already traveled elsewhere on the coast of the region, as IKE IKE or the Greens, in a dynamic of its own men's sea of traffic in different areas of the coast. This nomadic life remained strongly until the implementation of the General Law of fisheries and aquaculture of 1991, forcing fishermen and divers to submit their work only in the region in which they were enrolled.

The Decade of the 1990s is remembered by the inhabitants of the Cove as an era of great solidarity and commitment, since people shared different instances of everyday life. For example, the inhabitants of la Caleta made a tennis court, with trucks carrying a harsh land, that compactaba until the consistency of the clay courts. Began to carry out Championships of tennis,

[44] Información extraída de: http://impresa.elmercurio.com/Pages/NewsDetail.aspx?dt=2014-02-03&dtB=03-02-2014%200:00:00&PaginaId=6&bodyid=3, página consultada el 3 de febrero de 2014.

involving residents of the Cove and inhabitants of Chipana and dry river. At that time arrived tourists, particularly backpackers, who began to enlist to play tennis and soccer, which was practiced in a mixed manner. At the same time brisca Championships were held and celebrated the birthdays of all the inhabitants of la Caleta. At that time there were only two houses, used by roads during the construction of route A-1, others were rucos and tents. At the headquarters of the Union of fishermen and divers, dances, were organized until the headquarters became a school. This happened in the year 1993, when creating the school of an frames in a room shared by the Union. Only in the year 2011, the school moved to new offices located "on the other side", on the East side of route A-1.

In conclusion, the origins of the inhabitants of la Caleta San Marcos, are diverse: come from the South of Chile, in cities as far away as Talca and Linares, and also of the Region of Coquimbo, Coquimbo, Los Vilos locations and Tongoy. Likewise, a major contingent of the population is a native of Iquique and Alto Hospicio. The diverse backgrounds not they conflict with belonging and identification with San Marcos, with an identity "nated", which is in turn related to identification with the sea and with the construction of the settlement and achieving milestones such as the construction of the school and the post of Rural Health inaugurated in 2012.

vv) Resources Nnatural, Iidentity of the Hombre in the MAR

According to the information gathered in the field, the relationship between the population of the San Marcos Creek with the natural resources of the marine environment is deep and close as the town life revolves around the sea and the resources that are found there. The vast majority of the inhabitants live from any activity linked to the sea and the exploitation of their resources, whether diving, fishing or collecting fish, shellfish and algae, processing such products, for example the crabs, or selling them.

The deep knowledge of the environment of the fishermen and divers allows them to observe their changes. An exemplary case is the belief that when the pilpilen flies to the North Sea will be turbulent next day. This belief is based on the fact that by consuming seafood the pilpilenes move away when coming South currents are very strong for what migrate northward in search of calmer places for gathering shellfish. Children however, do not share that belief at all and prefer to consult the weather conditions over the Internet.

According to the experience of scuba divers the seabed varies constantly by what a resource that was in a particular place may have been moved to another. That's that for the different sectors of diving you should be working constantly, because to let go long without descending, the seabed will no longer have the same features that recalled the diver. Different signals can help the diver to diagnose areas of diving, as for example, the color of the seabedWhat When it is white it means the absence of resources, while being black indicates the presence of mussels and therefore will appear sooner or later the crazy there in search of food.

The presence of algae is strongly related to the existence of fish, this due to the processes of rotting algae that make possible the creation of food for pelagic fish, as well as a suitable system for playback. The indiscriminate extraction of algae affects this cycle, so it both in pelagic fish (or edge) as semipelagicos (for example, croaker, mullet), they affect the decrease of this resource and therefore also alters the ecosystem.

In the particular case of the Caleta San Marcos could be detected, through various interviews in the field, a concern for the environment linked to prevent overexploitation of the resources to allow its reproduction and thus ensure the presence of sea life for the future. However the practice of "barreteo", which consists of cutting down the huiro rocks, has crowded due to the high price of the huiro which has strengthened the overexploitation and the decrease of this resource. Being the natural habitat of other marine resources, over-exploitation of the huiro puts at risk the presence of benthic resources. The San Marcos Creek has with an Area Management and exploitation of benthic resources (AMERB). The use of the AMERB has the purpose of maintain a controlled exploitation allowing that there live algae that provide habitat for reproduction of seafood. It is as well as greater exploitation areas correspond to the areas of free access while the AMERB is mainly used when resources are scarce. It is important to note that in the single AMERB resources can be minedos by members of the Trade Union.

It should be noted that the gatherers of algae, which are also mariscadores divers, express one more developed consciousness on the exploitation of the huiro. This means for example the harvesting of mature huiro, not the huiro that is still growing, preferring to let it grow until you get a size suitable for sale, nor what is found under rocks, since they serve as habitat for feeding and Rep production of seafood.

Mariscadores divers, they also work with a similar logic to be sold, the seafood must comply with a certain caliber so say that smaller resources are not removed by divers.

In contrast they observed the overexploitation of marine resources in their environment. On the one hand by the large fisheries that practise fishing by dragging or maritime resources, which broadly prey of improperly even fishing in areas prohibited by law. On the other hand, by the large influx of people who collect huiro, attracted by its value in the market. This is how it has reached people from other cities, such as Iquique, and even from other countries, mainly Bolivians. QuieNES have no knowledge about the exploitation of the resources as its fundamental role for the presence of seafood, and the algae tend to collect huiro intensively, i.e. collecting without discrimination all the huiro present in the coastal edges without leaving, for example, the huiro that is starting to grow. However, divers believe that the huiro will be soon a cycle due to their overexploitation since not to collect one sufficient amount of seaweed to generate an interesting entryThis activity will decrease. According to the interviewees, the persons who have arrived in the area behind the huiro, and in the majority of cases have a history linked to the sea, will leave once the resource ceases to be economically attractive.

On the other hand, it is noteworthy that the divers and fishermen they have had a change of approach to their pecuniary income. In the past, until the 1990s, revenues were managed in day to day, While today people save to buy things like car or House, investing in education for the children or in general to improve their living conditions and be more connecteds new technologies of communication. Another change relates to the increase of self-care of the fishermen who, in the past, boarded boats with lower safety standards, the that could represent a danger when working.

ww)Description Activities

Three productive activities related to the extraction of marine resources are practiced in San Marcos: diving, fishing, and the collection of huiro. Mariscadores divers go boating from 8:00 o'clock in the morning on a good day, since when the sea has greater waves do not work since it becomes dangerous when working on the rocks where resources, in addition to the water is more turbid are what trouble Ta even more work. The exploitation is carried out within the area which stretches from Punta Lobos North to Punta Blanca in the South, mainly in the southern area between Sa Frames and white tip. Usually divers return to the pier at about 16:00 hours after about four hours of operation.

To collect the resources the diver down to the depth in which lives the mollusk that is seeking and use the "dog", which is a hook that allows you to take off the appeal of stone, and a "chinguillo", network which may accumulate up to 50 kilos of shellfish. For working divers use a hose of between 100 and 200 meters connected to a compressor of air in the boat and a Hookah allowing the regular diver air flow. The diver working at a distance of between 30 and 40 metres from the boat and to a depth that varies according to the exploited resource. To a depth of 15 meters the diver can work unlimited time while deeper the diver must calculate the times and stages of decompression necessary to return to the surface.

Figure 3-254. "Dog", Htool Utilizada for the Extraccion of MSurly.

Source: Terrain photography registration

To fill the chinguillo, the diver sends a signal to the wizard in the pot through a rope so that resources go up to the boat, which represents a difficult task considering that you must remove from the water and deposited in the pot up to 50 kilos of resources so general mind each attendee has developed a technique that facilitates this task. Once uploaded to the boat seafood is peeling and the chinguillo returned to the diver. The Octopus, main source of income along with the crazy when the resource is not in veda, was between 1990 and 1995 the main resource extracted in the location who disappeared for 10 years, after the phenomenon of the child in 1997 and 1998, before reappearing in the area until about three years ago. The Octopus is trapped in the caves where he lives, and whose presence can be detected with the remains of your meal. The difficulty of fishing for Octopus, which lies between 6 and 7 metres deep, lies in the ability of the diver to catch on the first try the Octopus with a "click", a long hook. In the case of the Hedgehog, this is collected with the help of a glove to avoid injury caused by their spines.

The number of people dedicated to diving to remove marine resources has stalled, from about five years ago, since young people have not wanted to perform this activity, devoted to the collection of huiro, partly by being easier to extract but mainly by its high price in comparison to the seafood (taking into account not only the value per kilo but also the time required for the extraction of resources).

Figure 3-255. HCoupler for the Buceo and the Rextraction of Msurly, Pulpos and Ecurls.

Source: Terrain photography registration

Fishermen Meanwhile are minority, since success in this activity is less than mariscadores divers. Your work schedule is different since they leave by boat between 18:30 and 21:00 hours, being the schedule in which the fish are fed. In the case of the cojinova and the meagre a network - which has a value of $56,000 - is used with 100 meters of rope about 15 meters of depth. This network is collected at the end of fishing where a person pulls rope bottom which inside lead sheets that allow the net from sinking while another person pulls the cutop GDR inside which corks that allow the network extends to float under water. Just as the catch - but to a lesser extent - Blacktail combers and sometimes gold. By the size of the network, it can be crossed by smaller fish so only cojinovas of two or more kilos, conger of between 3 and 15 kilos and 800 grams groupers are caught. Conger eel, which lies between 25 and 60 meters in depth, are exploited by a 2 km line, which is located about 1.5 kilometers a hook every meter in addition to swivels. To attract the cngrio a fish is pulled into the sea and will subsequently releasing bait slowly. The young eels die almost instantaneously to fish for what cannot be returned even if they are not interesting for the angler, however can be consumed by the fishermen in soup or fried.

Another important production activity, and that it has taken importance gradually during the past seven years due to its high price and its presence throughout the year, is the collection of huiro. The main reason for its importance in the local economy due to the explosion of its price from worth between $50 and $70 per kilo for three years worth $350 the a kilo currently. There are two ways to collect that resource, boathouses or "barreteando". The first way to collect that resource is the most common and consists of collecting the huiro that appears every morning floating in the dry dock. If it is difficult to access uses a 'Spider', hooks tied to a string, which allows you to pull out the huiro to the shore.

Figure 3-256. "Spider", Htool Utilizada for the Rextraction of Huiro.

Source: Terrain photography registration

The other way of collecting huiro, is the "l barreteo", that began with the rise of the extraction of huiro a couple of years ago, refers to the collection of the huiro which grows on the rocks and that can be extracted is destroncado thanks to "Jimmy".

Figure 3-257. "Jimmy", Htool Utilizada for the Extraccion of Huiro.

Source: Terrain photography registration

The huiro can also be extracted in boats, collecting algae that float in the sea or in pools that are located on the shores of beaches among the rocks. Some use rafts, which may accumulate up to 100 kilograms of huiro, preferably the Black huiro, kind of more profitable than the stick huiro huiro and the huiro Macrocystis. It should be noted that it It allows to collect the huiro stranded people who have a permit artisanal fisheries register (RPA) delivered by Sernapescawhich provides the method of extraction of the huiro, via aground huiro collection.

Regardless of the method of extraction, the huiro must be subsequently dried around 4 days, in bales of between 20 and 25 pounds, to be subsequently sold to a processing plant, usually in San Marcos or Río Seco.

Figure 3-258. Wrapping and Secado of Huiro, SEctor La Curva.

Source: Terrain photography registration

To facilitate the work and for safety reason collectors usually work two to four people. This is due in part because the two activities related to this work which on the one hand consists of extracting the resource and on the other hand, pull the seaweed to the shore to dry the huiro in bales. In addition, working group can prevent accidents related to work at sea and on the shores as for example become buried in the sand.

Another phenomenon linked to the extraction of the huiro is that "who rises first picks up more". This means that around 6:30 hours you start out early collectors of huiro by collecting bigger and better algae mientrso during the course of the day the presence of resource decreases due to the amount of people who perform the same activity. It is due to that that if you don't leave early, some decide to give the day lost and no longer work. Huiro collectors generally work half a day but on good days working all day except when the tide is collected. Unlike the divers, huiro collectors are favored by rough seas because this phenomenon makes to the slipways, which correspond to the coast associated points of diving due to its forming Rocky, are filled with algae.

xx) Indigenous peoples

As already noted, in the study area, settlement existed in pre-Columbian times, the presence of the Chinchorro culture and Changos.

With regard to the indigenous in the sector at present, according to the 2002 census, in Caleta San Marcos was identified only one inhabitant which has seconded to an indigenous people, in this case to the Atacama ethnic group, representing 0.7% of the population. It should be noted that the 2002 census not collected the allegiance of the population ethnic diaguita, which was recognized by the Chilean State the year 2006, under the Government of Michelle Bachelet, so there is no record of this ethnic group in the 2002 census.

Table 3-116. Belonging to Pction Indigenas by SExo, Caleta San Marcos.

Membership of indigenous peoples or indigenous	The Encuestado sex		Total
	Man	Woman	
Atacama	1	0	1
None of the above	86	54	140
Total	87	54	141

Source: Census of population and housing 2002, INE.

Considering such background, it was necessary to carry out a survey of information aimed at the characterization of the indigenous subject in San Marcos as an update of the census information.

On the one hand, according to CONADI (2013) records in the sector of San Marcos community or indigenous associations, unregistered which corresponds with the information collected in the field with the local population and territorial, functional, and professional organizations of the town leaders.

In this way, a total of 19 indigenous individuals corresponding to five family groups were identified in San Marcos. Below is the detail of the identified family groups[45].

[45] Para efectos del presente documento se resguarda la identidad de los entrevistados y de las familias identificadas, por lo que éstas serán denominadas por letras del alfabeto en forma correlativa, partiendo por la A.

A family

This family group It is composed of three persons, spouses and child of spouse, so it belongs to a family of assembled type[46] you make up a nuclear household in which identifies a member which he ascribed to ethnic Mapuche, specifically the head of household, who received by CONADI indigenous accreditation in 2010. The head of household was born in Puerto Montt, but lived great part of his life in Chiloé, taking descent Huilliche by his maternal grandparents. Since the Group Huilliche It is not considered as Indian village by the Law 19.253, was ascribed to the mapuche ethnic group. Six years ago, living permanently in San Marcos, since previously live in Arica and Iquique.

The main activity carried out is fishing, which complemented sporadically with activities related to the construction. In that sense, he has received specific benefits because of their indigenous quality, the award of a project of acquisition of a boat of fiberglass for the development of small-scale fishing activities being the most relevant.

It should be noted that this family, according to own statement, does not perform ritual or ceremonial practices associated with the mapuche worldview, while not set properly ethnic links with other indigenous individuals from the village, not establishing social relations aimed at the development of collective practices of indigenous base, or economic with these individuals.

Family B

This family group is composed of seven people; both spouses, four children (two men and two women) and a daughter-in-law; so it is up to a family of assembled type that make up a home multinuclearwith a primary conjugal core complete with children, and a core marital child without children. Of them, five people are autoadscriben as mapuches, counting all of them with the corresponding accreditation by CONADI, which include the spouse of the primary core (from 2010) and their four children (all from 2008). The origin of the link with the indigenous theme goes back to the spouse's grandparents, who lived in the commune of Carahue in the IX Region of the Araucanía, while she is a native of the IV Region of Coquimbo, which moved to San Marcos around the year 2001 together with their children.

The spouse of the primary core develops economic activity of algae harvesting as one of their children who, for purposes of this study, is classified as the spouse of the secondary nucleus. Compared to the rest of the children, a man and a woman are students, while a woman is

[46]La familia ensamblada para este caso se define como aquellas en las que al menos un hijo pertenece a una unión anterior de uno o de ambos cónyuges.

without occupation. Of them, two have permanent residence in San Marcos and one residence of sporadic type.

The main motivation of the indigenous quality in this case is related to benefits, specifically in the field of education through indigenous scholarship. Thus, two of the children have been beneficiaries with the aforementioned scholarship, while they have not received production support associated to the activity carried out by two of its members linked to the collection of algae.

As in the first case described, according to does own statement this family ritual or ceremonial practices associated with the mapuche, at the same time worldview that does not establish links properly ethnic with the other indigenous local individuals, not establishing social relationships that point to the property collective indigenous base, nor economic practices with these individuals.

Family C

This family group is composed of only one person, which corresponds to a family of type nuclear monoparental male that it is a one-man home with semi-permanent residence. This person ascribes to the mapuche ethnic group, having the corresponding accreditation by CONADI in 1998 approximately.

He was born in the commune of Galvarino in the community Juan Huenchuleo of Llufquentuebeing his father of mapuche origin. Of This sector moved at the age of six years to Santiago, and later settled in the city of Los Vilos, arriving to the caleta de San Marcos in 1976 at approximately.

By the mother's family received the teachings to develop activities related to the sea, specifically referring to diving, and this is the activity that is currently developing, not having received specific benefits associated with their quality indigenous by the State.

It should be noted that the head of household concerns a strong roots with the territory of origin, which periodically visit to learn more of his family's roots and the mapuche culture. In addition, it should be noted that it remains a partial knowledge of the Mapudungun learned in childhood. However, ritual or ceremonial practices associated with the mapuche worldview does not perform in the the locality participating sporadically in some festivities from their community of origin, and has not established social relations aimed at the development of collective or economic practices of indigenous base with other Mapuche individuals from the town.

Family D

This family group is made up of two people, both spouses, comprising a nuclear family, constituting a nuclear household: a household in which the head of household autoadscribe ethnic Diaguita, not counting with the respective accreditation of CONADI. He was born in the sector of Rio Hurtado, located in the commune of the same name in the IV Region of Coquimbo, and from there emigrated to Vivre form nomadic to settle in the city of Los Vilos, reaching the town of San Marcos to settle permanently in the year 1995 indigenous roots come from the father's family, which originated in the city of Vallenar, III Region of Atacama.

The main economic activity that develops is diving, which has for 32 years, and it has not been a beneficiary of State projects based on their autoadscripcion Diaguita. In addition it is necessary to point out that according to own statement do not perform ritual or ceremonial practices associated to the diaguita worldview, as well as do not set properly ethnic links with other indigenous individuals from the village, not establishing social relations aimed at the development of collective indigenous base, nor economic practices with these individuals.

Family E

This family group is composed of nineteen people, comprising a home multinuclear with established permanent residence a main core and three secondary nuclei distributed as follows:

- a core of conjugal type complete with children, corresponding the type of nuclear family.
- two side cores of type spousal complete with children, one corresponding to the type of blended family and another to the type of nuclear family.
- a secondary core type spousal single-parent female with childrencorresponding to the type of single-parent nuclear family.

Eleven members of these family groups conform to the mapuche ethnic group, with the origin the link with the indigenous theme the maternal grandmother of the spouse of the primary core feature, according to the information available, with formal accreditation by CONADI.

On the other hand, it should be noted that at the time of the study (June 2014), it is observed that before people identified not they perform a ritual or ceremonial practices associated with the mapuche worldview, as well as they do not establish actual ethnic links with other indigenous individuals from the village, not establishing social relations aimed at the development of collective or economic practices of indigenous base with these individuals.

yy) Religion and Festivities

Caleta San Marcos is possible to observe that they have presence within the territory the Catholic Church through the Chapel St. mark; and the Evangelical Church through the headquarters of the Methodist Church Pentecostat the and of the Church Christ lives.

Figure 3-259: Headquarters of Pentecostal Methodist Church, San Marcos.

Source: Terrain photography registration

The San Marcos chapel was inaugurated in November of 2004, and its construction was financed with the funds provided by the Housing Foundation of the Hogar de Cristo. It masses are held every Saturday officiated by a from deacon of the Cathedral of Iquique, and which involves between four to six people actively.

The Temple of the Pentecostal Methodist Church opened in January 2014 with meetings officiated by a pastor from the Congregation itself headquartered in Iquique, which realized on Saturday permanently and which involves around ten people in a stable way, while the day Sunday held Bible studies for children.

Finally, the headquarters of the Cristo Vive Church was built during 2011 with bi-weekly frequency meetings day Saturday, in which he performed a ceremony for children and one for adults. In this church are about three people on a permanent basis.

On the other hand, in Caleta San Marcos are collectively celebrated national holidays, Christmas and new year festivities. For Christmas and new year both Fiestas Patrias celebration is carried out on the premises of the former school, located in the sector of "La Caleta", and they are organized by the neighborhood Council, with the support of the community.

Fiestas PATRIAS the past two years has been organized the clandestine the Fonda on September 19 at night. Participants pay a fee for the payment of the benzine to the functioning of the electricity generator and the fonda operates in the former school, dancing and food.

For the feast of Christmas is celebrated with the children of the village, and delivered gifts to all children under 15 years. Usually the municipality delivery presents and candy bags are mainly given. Moms come together for this festival and organized activities for children.

The festivity of new year is celebrated at the Cove by the burning of numerous puppets with the intention of celebrating the end of one cycle and the beginning of a new. This is done to the midnight and later, a celebration takes place in the former school, which lasts until the morning of the first day of the year.

At the Cove is also the burning of monkeys is a Northern tradition that consists of burning a snowman, to leave behind the bad last year and best way to start the new year.

It should be noted that you for the holidays and end of year festivities, a significant number of families from the caleta travels to their localities of origin to visit and share with their families, so the number of people who remain is reduced considerably in the Cove.

A feast of great relevance at the Cove is the celebration of San Pedro, Patron of fishermen, on the day of his birthday, 29 June. The year 2013, after seven years, the celebration was accompanied by a religious dance of Iquique, invited by the neighborhood Council and the Union of independent workers, artisanal fishermen, divers, fishermen and helpers of Caleta San Marcos. For the celebration is decorated the Cove and their boats and sea conditions permitting, the procession is carried out by sea. The celebrations include a mass anda celebration in the evening.

Figure 3-260. San Pedro, Caleta San Marcos.

Source: Terrain photography registration

So too, in Caleta San Marcos held April 25 San Marcos, with a mass in the chapel of la Caleta (San Marcos Chapel). This celebracion is hosted by faithful Catholics that they involve activities and ceremonies officiated in the chapel. On some occasions, this date was held with a dance open to all the community.

During the summer of soccer tournaments, are played with different categories according to the age, and involving sports clubs of various coves. The Championship is organized by the Sports Club of San Marcos.

A feast of great relevance at the Cove, was the celebration of Carnival in summer, party which was not held for at least five years, PEro that was carried out in 2014. Held the last two weeks of February, the summer Carnival of yesteryear competitions were made by partnerships, as for example, sports, board games, building sandcastles, choice of Queen, among others. The celebration of this Carnival was very expected by the community, involving not only permanent residents of the caleta, but also the members of the family who remained during the rest of the year living in the places of origin of the sanmarquinos, and coming visit in the summer holidays. Alliances were organized by place of origin and were distinguished by designating different colRes. The cessation of this celebration was due to the emergence of disagreements in the development of the Carnival, so it was decided to suspend it.

zz) Social organizations

With regard to the associativity neighbors, Caleta San Marcos has the following:

- Junta de Vecinos
- Union of fishermen
- Committee on housing
- Sports Club
- Union of seaweed fields
- Rural drinking water Committee[47]

The San Marcos neighborhood Council has 160 registered members. They are actively involved around 20 people and carry out regular meetings, usually every two months. It also convenes extraordinary meetings if you have to deal with any topic in particular. The Board of neighbors of San Marcos belongs to the communal Union meetings of neighbors coast south, comprising meetings of neighbours of the various coves South of Iquique. They meet once a month, rotating meetings in different bays. The Board of neighbors does not have Head office, more they use the former school as a meeting place.

It should be noted that the Junta de Vecinos, when necessary, works in conjunction with other organizations such as the Union of fishermen or Sports Club, for the Organization of events.

An organization of importance in the area is the Union of independent workers, artisanal fishermen, divers, fishermen and helpers of Caleta San Marcos. The Organization has 45 members belonging to Caleta, San Marcos and is composed mainly of mariscadores divers and helpers, although some also engaged in fishing. In this sense, the majority of members has tuition both to dive for fish. This registration or permit the delivery the Patache port captain, who has jurisdiction over the Cove. The requirements for obtainingThis license consist basically in a medical examination, stating the health of the worker to perform these tasks. The Union regulates Management Areas of benthonic resources extraction. In the delivered log by Sernapesca, the Union has with the Management Areas of benthic resources San Marcos A (Decree N ° 46 of 2003 and Decree No. 420 of 2009, both from the Undersecretary of Navy) and San Marcos B (Decree No. 36 of 2003 and Decree N ° 419 of 2009, both from the Undersecretary of the Navy), between the two covering an area of 75.4 hectares.

The exploited AMERB corresponds to San Marcos B which has a greater stretch (66.25 HA). To remove the resource are assigned quotas according to the demand of the companies that buy it. At the Cove, there are people who serve as intermediaries, mainly the Union President until

[47]Esta organización se describe en el apartado dedicado a la Dimensión Bienestar Social Básico.

January 2014, to make contacts with different purchasers of molluscs. These are from different parts of the country, selling the product so buyers of Iquique as Colonel or to other towns in the South. As an example, in this period there is demand from large, and in total you can reach out about 20,000 kg per day to process. It may be sold by unit or by performance, i.e. the sale of seafood per kilogram of seafood without the shell. The large they are purchased by a plant Procesadora of Iquique, who goes to the Cove to find the product.

The Union applied for a project for the construction of a shellfish processing plant, project that he won and that already have the facilities of the plant, only missing permission or health certification.

Some of the problems that the Union identifies in the area with respect to its activity, are the centralism, regulation and control of the extraction of marine products and the implementation of the new law on fishing. With respect to centralism, notes that regulations imposed on the workers of the sea are governed by the conditions and situation of the coast of the South of the country. In this regard, point out that the realities are different for different South weather and sea conditions, so the requirements for the extraction of molluscs or even the veds applied to these, should be different depending on each area. On the other hand, the regulation and control of larger vessels, such as launches "Suzuki", which are considered to be artisanal but that charged up to 50 tons through mechanical extraction systems, is a matter of concern, because of repeatedly extract resources within the corresponding mile exclusively to the "Boatmen". In this context, it should be noted that concerns there are for the new Fisheries Act, which among other things, allows "drilling" a mile, using the withULTA between the parties. If there were no consensus among these, is consulted to the Zonal Council, where there is a greater representativity of the industrialists.

It should be noted that the President of the Union of Fishermen's La Caleta San Marcos, until January 2014, Zonal Director of fisheries, instance that has no power with the new Fisheries Act was operative, only consultative. The resolutions are now carried out by a technical Committee. However, the composition of the Council is given by seven representatives of industrial fishing and two representatives of artisanal fisheries.

On the other hand, the Union fishing la Caleta San Marcos, belongs to the Federation of Trade Union of independent workers of artisanal fishermen and divers cultivators of the Region de Tarapaca, which includes all trade unions in the Region, from Pisagua by NOrte, up to Chipana to the South.

Recently a second trade union organization was formalized under the name of Union of seaweed fields and Apnea divers, specifically in the month of April of the year 2014. This organization has a total of 62 members to June 2014, giving representation to an estimated 90 families approximately. One of the main achievements have been awarded this organization is the get by SERNAPESCA work permits for partners who were not regularized.

Work area which have authorized make collecting kelp goes along the coastline to the North from the Loa River up to Chanavaya from the South, having a section of greater use, ranging from El Sombrero by North to Boca del Diablo and Castle to the South.

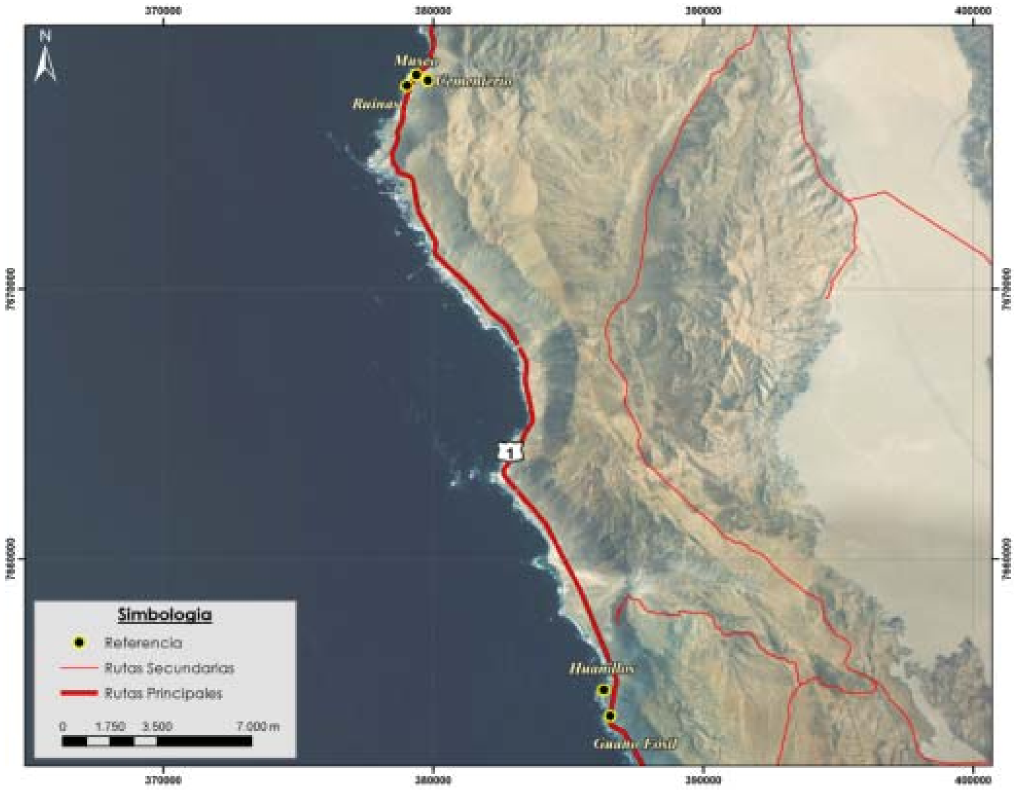
Caleta San Marcos also has a Housing Committee, functional organization which brings together 35 partners. As indicated already in the geographical dimension, the Committee se formed from dthe year 2008, then, with around 20 people. The official name of the Committee is "Entrepreneurs San Marcos Housing Committee" and waiting during the year 2014 to run projects of construction of their homes in the area of Villa San Marcos, although to June 2014, its validity was expired, by what were to request an extension to the Serviu to continue with the formal processing. Most of the families who make up the Committee live in sector West of the Cove or coastal sector which today is considered as an irregular terrain.

Club Deportivo San Marcos It occupies the soccer field located in the eastern sector of the route A-1, usually organizing matches between members and residents of the Cove. As already noted, are organized sporting events, and football in the summer Championships with different teams.

aaa) Sites of Importance Historica and/or Clunch

In relation to the sites of the area, we can highlight the ruins and cemetery of Huanilloslocated a11 kilometers south of la Caleta San Marcos, a place visited by the inhabitants of the Caleta, mainly to the "Castle", housing where he was the administrator of, at that time, port.

Figure 3-261. Sites of Icrucial Historica and/or Clunch, Caleta San Marcos.



Source: GAC

The richness of the guanera of Huanillos It began to be exploited on a large scale in the Decade of the seventies of the 19th century. On the occasion of the war of the Pacific were hamstrung exploitation and boarding operations, and Chinese workers were transferred to other guano from the Peru. The information describes synthetically the extraction procedures and form of life of Huanillos. In this sense, it is designated as contaban with rudimentary equipment to distill and purify the sea waters through boilers. Even though Huanillos It began as guanera before 1830, changing times and before the exhaustion of the resource derived as salt port, and believed that by 1900 was built the railway, carrying salt from the huge salar, the Salinas from Punta de Lobos, distant about 40 kilometers to the nor-East, up to the port in Huanillos. In this period, which is built the "Castle", a building erected by the Administrator then, Don Fredy campaign.

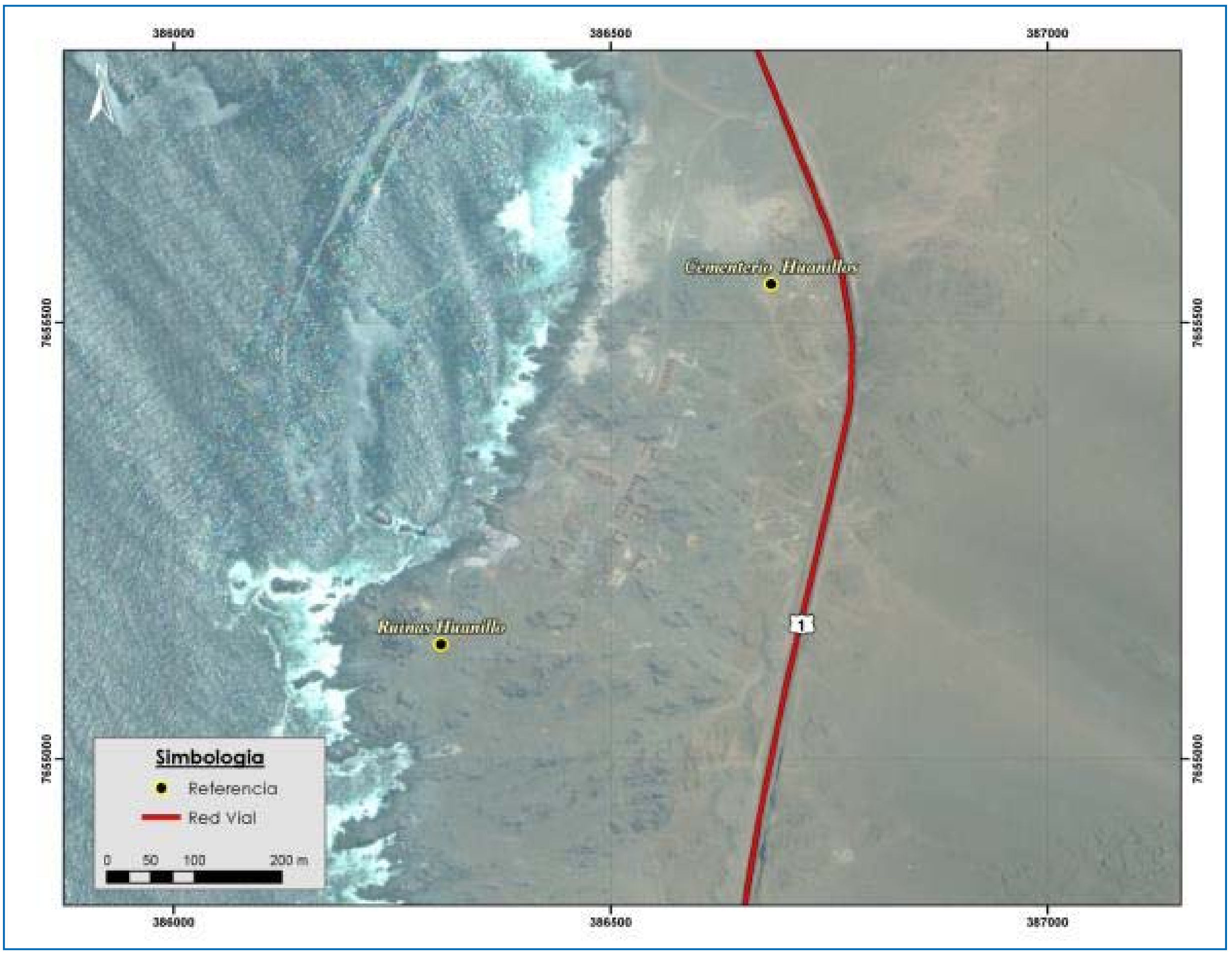
Figure 3-262. "Castle", Huanillos.

Source: Terrain photography registration

However, the poor condition of the port, little deep in its draft and the difficult conditions for the loading of ships, affect to the Compañía of Exploitation Punta de Lobos move plants to Caleta Patillos, what currently is only 50 kilometers from the city of Iquique, closing the gates of Huanillos[48].

[48] Información extraída de la página web http://www.pura.cl/huanillo.htm

Figure 3-263. Location of cemetery and ruins, Huanillos.



Source: Own elaboration based on information collected in the field

Should be noted as a site of cultural significance an animita located north of Caleta San Marcos, by the route A-1. The animita, expression of popular religion, is a memorial dedicated to a person who died in an automobile accident, which according to the information gathered in the field, showed the isolation and lack of resources in a case of emergency the nated population lives.

Figure 3-264. Animita San Marcos.

Source: Photographic record field

bbb) Main Preocupaciones Ciudadanas

With respect to the concerns citizens referred to the project and that they could be detected in the field, the main relates the water returned to the sea during the nights by the project, in the phase operation. The concern of many people is that if the water is not returned in the same conditions in which the sea is, it could create a negative impact to the Cove. The greatest fear relates to the temperature that water will be returned since it could raise the temperature of sea water, which would profoundly affect life marina recreating a phenomenon that the Cove residents associated with the El Niño. The concern therefore lies in the possibility that the project negatively affects marine resources, which represent the source of income (e) the inhabitants of the Cove. Related to the same topic, one end of the AMERB-B of the Union of the caleta is located close to the point of restitution of the water from the project by what fishermen consider that due to sea currents could be the first place to be impacted, which represents another concern, particularly for the Union of independent workers of San Marcos.

On the other hand, nated identity, the feelingsENTO's roots in the town, It is based on two main axes, the productive activities related to the sea and the diverse origin of the inhabitants of the town. The productive activities related to the sea are essential at the Cove, due not only to the technical and practical knowledge developed by years of work but its characteristics, i.e. where the workers are independent and have therefore a grador freedom to decide not to go to work or work the number of hours considered sufficient. The diverse origin of the inhabitants of Caleta

San Marcos, many of which come from coastal towns of Coquimbo and Los Vilos, is also an element considered cOMO key in the town since its residents see as a local characteristic the capacity to welcome and integrate into the community people coming from different parts of the country. In this context, is an issue of relevance and concern of the population, all the situations that relate to the sea, whether of natural character as conditioned by the human being, which may threaten or alter its basal condition.

iv. Socio-economic dimension

ccc) Population Economically Awill e Inactiva

According to the 2002 census, the economically active population (EAP) of Caleta San Marcos corresponded to that year, 67.3% of the population 15 years and over. Of this total, 91.9% is male, with 58.8% working income, while 39.7% was not working, but employment. Only 1.5% - representing a single person - he was looking for work, having worked before. On the other hand, only 8.1 per cent of the economically active population was female, with 83.3% working income.

Table 3-117. Population Economicamente TOwill by SExo, Caleta San Marcos.

Employment status prior week	The Encuestado sex		Total
	Man	Woman	
Working for income	40	5	45
Without work, but have job	27	1	28
Looking for work, having worked before	1	0	1
Total EAP	68	6	74

Source: Census of population and housing 2002, INE.

According to the data released by the 2002 census, we can observe that at that time the occupation of the economically active population corresponded to a 13.5% salaried workers, 82.4% self-employed, 2.7% to domestic service workers and 1.4% employers.

Note, both in the labour situation of the population economically active, as in the occupational category, the high percentage of working men who were out of work, but with employment and workers on their own, which is in accordance with the Labor dynamics of main work in la Caleta, referred to the work at sea.

Table 3-118. Category oroccupational by SExo, Caleta San Marcos.

In this work it is or was	The Encuestado sex		Total
	Man	Woman	
Salaried worker	7	3	10
Domestic worker	1	1	2
Self-employed worker	59	2	61
Employer, entrepreneur, or pattern	1	0	1
Total	68	6	74

Source: Census of population and housing 2002, INE

With respect to the economically inactive population (PEI), for the year 2002 this corresponded to a 32.7%, compared to total population 15 years and older, and as is usual, with a high proportion of women in this category (86.1%), which were mostly engaged to chores at home (70.9% of all women in the PEI). For its part, the men reached the 2002, 13.8% of the population not economically active, with a similar proportion in different work situations (a case of person studying, a retiree or annuitant case and a case o)RA situation) highlighting the situation of disabled permanent work, with two cases. It should be noted that the total of PEI, a 59.5% was in chores in your home the week prior to the completion of the census process in 2002, followed in importance by retirees with 15.7%; and students, with a 14.9%.

Table 3-119. Population Economicamente Inactivated by SExo, Caleta San Marcos.

Employment status prior week	The Encuestado sex		Total
	Man	Woman	
In your household chores.	0	22	22
Studying	1	2	3
Retiree or annuitant	1	0	1
Permanent unable to work	2	0	2
Another situation	1	7	8
Total PNEA	5	31	36

Source: Census of population and housing 2002, INE.

According to the information collected in the field, many of the local women are currently participating the economy home to working on the collection of huiro, the processing of shellfish, in school and in the stores of Caleta San Marcos.

ddd) Economic activities

The reality reflected by the census data of 2002 shows that at that time, 77% of the economically active population worked in the primary sector, in its entirety in fishing and service linked to fishing activities, being formed by 98.2% for men. The secondary sector represented 1.4% of economic activities and was composed of a single male person who worked in the building. The tertiary sector accounted for 20.3% of economic activities and was composed of 73.3% men, still trade at the retail main activity the sector with 60% while a 6.7%, corresponding to a single person of the female sex, was devoted to education.

Table 3-120. Main TOctivities Eattendant for SExo, Caleta San Marcos

Code of economic activity (ISIC Rev. 3 to two digits)	The Encuestado sex		Total
	Man	Woman	
Fishing, operation of hatcheries fish and fish farms, fishing-related services	56	1	57
Primary sector	56	1	57
Construction	1	0	1
Secondary sector	1	0	1
Trade to the retail except trade of motor vehicles and motorcycles; repair of personal and household goods	8	1	9
Teaching	0	1	1
Other tertiary Sector	3	3	6
Tertiary sector	11	5	15
Total	68	6	74

Source: Census of population and housing 2002, INE.

During the years 2013 and 2014 San Marcos remains the trend presented in the 2002 census, with the extractive activity in the sea as the main economic activity of the town. In this context, the activities of diving, fishing and gathering of huiro are the main economic activities of Caleta San Marcos, to which one must add cleaning and preparation for the sale of some products from the sea and drying, / machining and export of huiro. The tertiary sector is represented by activities related to trade to the retail, there five stores at the Cove.

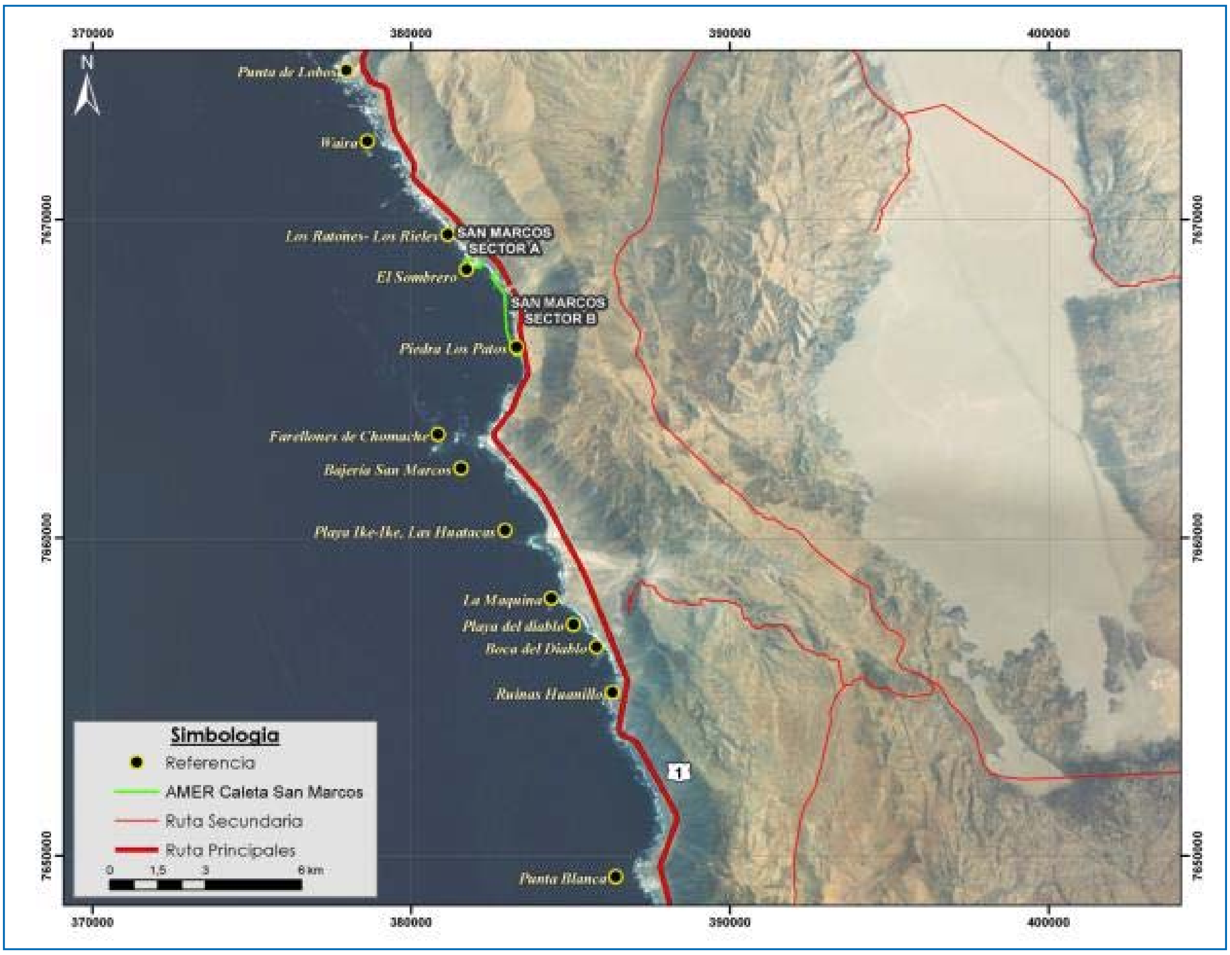
So much for the activity of fishing and diving, used boats, which must have registration and permission given in the Patache port, by the port captain's Office, which are controlled by the Navy in March. Use the pot means buying benzine to get to some point of resource extraction, by a value that varies from 5,000 pesos to reach nearby, up to the 25,000 pesos, to more remote places.

The call"macrozone"exploitation of benthic resources extends from Punta de Lobos to the North to Punta Blanca South, 5 kilometres to the North of" Chipana. Between Punta de Lobos and whitetip are areas particularly used for Dive and collect algae, called Waira, Mice, Rails, hat, Bajeria of San Marcos, the Huatacas, The Maquina, the Devil's mouth and Huanillos from North to South. In addition areas allowed to exploit marine resources correspond the AMERB-A and B AMERB, areas of rockery and at a distance of between 50 and 100 meters from the beaches from d(e) a depth of 15 meters.

In terms of the exploitation of the AMERB, according to data provided by the report of follow-up of Sernapesca, the AMERB-A is not being exploited. In the case of the AMERB-B, according to the information of Sernapesca, 126,692 tons of sticky authorized by Sernapesca 10.7 tons were extracted for the period 2012-2013 (until September 30, 2013). 213,782 tons of sea urchin authorized by Sernapesca for the period 2012-2013, were 5 tonnes until September 30, 2013, to be extracted in its entirety in 2013. 189,641 tons of crazy authorized by Sernapesca 23 tons were extracted for the period 2012-2013 (until September 30, 2013). The detail and official sources of these figures is present in the Annex 3.6. Quantities of resources extracted in the AMERB by the Union of San Marcos are lower than the amounts authorized by Sernapesca. However, those levels of extraction related use that given by the Union to the AMERB which, according to the interview with the President of the Union of divers and fishermen of San Marcos, essentially consists of controlling an area where can be play marine resources (algae and shellfish mainly). The main areas used by divers and fishermen of San Marcos correspond to the areas of free access while the AMERB correspond to a space that allows the reproduction of the resources, which are extracted mainly when OS resources are scarce in the areas of free access.

On the other hand, lformation of dry dock of algae depends on the type of mainstream, which determines the place where aground algae. Currents are seasonal, so in general, it is possible to note that in summer, between the months of November to February, there is a mainstream heading north to South, making it prone to algae varen in certain places, which "they correspond to spaces or"caletones"." In winter, the current changes and stranding elsewhere settle. Change in currents and their address, also determine the underwater visibility, which is difficult, for example, to be the most murky waters.

Figure 3-265. Areas of diving, Rextraction of TOLGAs and AMERB, San Marcos.



Source: GAC

As for the pESCA, activity a few inhabitants of the village, the fish extracted present in the sector are the cojinova with a value of 2,500 pesos per kilo, the Comber, having a value of 1,300 pesos per kilogram, black eel that has a value of 1,300 pesos per kilo and colorado eel that has a value of 2,000 pesos per kilo, but that is less in the area. Fishing is a more insecure than the diving activity because there is the risk of not fishing any pproduct, However, on a good day you can get to catch up to 300 fish.

Mariscadores divers collected mainly octopus and crazy, when these resources are not in veda, the two resources that generate more revenue. The loco has a value of 2,000 pesos per kilo, but closed between 1 February and 30 June. Tambien is extracted Locate that has a value of between 100 and 150 pesos per kilo; kilo woolly shoe with a value of approximately 180 pesos;

crab that is processed before being sold; hedgehog with a value of 40 pesos each unit; and Octopus, which has decreased its presence in the area, each of which have their own vedas.

Working boat, earnings are divided between the owner of the boat, the diver and the wizard. Existin three formats of distribution; first, If the wizard is the owner of the boat is distributed the money in parts equal between the wizard and the plunger; in the second case, when the diver is the owner of the boat, the diver and Assistant earn 40% each while left 20% to the boat; Finally if the owner of the boat is neither Wizard nor the diver, the owner of the boat and the wizard receive 30% each, While the diver receives a 40%. The extracted resources are usually sold to intermediaries who send products to other parts of the country or other countries. En some cases, You can sell it directly to any restaurant of Iquique or a booth of the fair in the same city. Overall products are sold more expensive while less intermediaries exist between fishermen and the final buyer.

Figure 3-266. Wizard of Buzo, San Marcos.

Source: Terrain photography registration

The extraction of huiro has always existed among the people who live off the sea. However, This activity was marginal as it had a value very low so it was not desired by divers and fishermen and was well exploited by the women, to the to be collected on the shores of the sea, to supplement the income of the household economy. During the last 10 years they have opened up processing plants of huiro in the sector, to facilitate the sale of the extracted product was gradually increasing the importance of this resource. The explosion of the extraction of huiro started in 2010 when he started an increase in the price of the alga from 50 to 350 pesos per kilo in three years. The high price that has the huiro has led to that the vast majority of the local population engaged in the harvesting of seaweed. Even mariscadores divers have been dedicating to the collection of that product, as for instance cDiver Assistant OMO, can earn between $25,000 and $30,000 for an output of work, while that you can earn the same amount collected huiro during the morning. This is because, according to interviews in the field, "money rules" for what is the value of marine resources that determines whate product is worked. For long periods the most desired resources were Octopus and crazy but now the huiro has become the central resource for local revenues.

That high price, next to its extraction facilities and low investment needed compared to expenditures that involve leaving boat has made younger and more and more people from the Cove to work the huiro albeit in some cases way complementari to the income of mariscadores divers. Working alone, people can be drawn around 100 kilos per day, although usually working couple picking up to 300 kilos a day.

In la Caleta San Marcos, is an open huiro processing plant about six years ago, by an inhabitant of the town, once it had begun to increase the huiro market. This company employs approximately 17 people, in most Bolivian workers. The plant buys huiro to collectors and plants of Chipana and Rio Seco to process it and sell it to different regional and international companies for example to China, who are the main buyers in the region. During the second half of the year 2013, Iplant purchaseBA the black huiro, the best-selling subsequentlybetween 350 and 370 pesos per kilo; the huiro stick between 310 and 330 pesos per kilo while to the huiro Macrocystisthe less sold and which needs more filtration, has a value of 57 pesos per kilo. On the other hand, during the first half of the year 2014 the value of the black huiro and huiro stick reaches, on average, Iyou 200 pesos. All collector who wants to sell the plant huiro need to have a permit register fishing craft (RPA) delivered by Sernapesca. The RPA is associated with a key that allows you to check over the Internet if the person has right to sell huiro, otherwise the plant will risk fines during one of the inspections of Sernapesca which are carried out on an average of three times a week. If necessary the owner pays, known people, a truck to bring the huiro to the plant. The huiro arrives usually dry, but When is wet, alga loses value to be worth one-third of its dry value because of the significant decline of the once-dry weight. The drying process is important to prevent the formation of fungus in bags of 50 kg which are eventually sold and for avoid that does not bind in the machines that they cut the seaweed.

Figure 3-267. Plant Procesadora of Huiro, San Marcos.

Source: Terrain photography registration

The plant also performs a process of filtration of the purchased huiro to remove debris and sand that come along with the algae, this is how a filtered ton of huiro removed around 100 kilos of waste. This process, which produces around ten tons per day, is made both to the dry huiro the huiro already bruised for other plants to reach a higher level of purity and be more attractive to international buyers as well as add value to the product. In this way the plant finally sells two types of cuts, one called ¾ (which hasabout the size of a thumb) that is sold to 670 pesos per kilo and the "9-10", a fine cut, for export that has a value of between 760 and 800 pesos per kilo. A truck coming from Iquique which must pay 180,000 pesos for the trip is used to sell the processed huiro. For the cost of the trip are usually brought two conteiner of 26 tons, since the truck charged the same price for bringing one or two conteiner. The huiro finally arrives abroad where it is processed to extract the alginate that has a value of 30,000 pesos per kilo and is used for products of beauties, inks and many other products.

On the other hand, it should be noted that en the AMERB of San Marcos sector there are different aquaculture Awards, 7 of which have already been granted (one of which was delivered the Union of San Marcos) while the others are still in the application process or with approved project application process. However until no other concessionsinches has been exploited.

v. Dimension Basic Social Welfare

eee) Education

Caleta San Marcos works basic school Annex school Thilda Portillo Olivaresbetter known as school San Marcos, which teaches pre basic education and basic education, from first to eighth grade, with multi-grade rooms. It is a rural settlement of municipal unit, administered by the Municipal Corporation for Social Development (COMPUTABLES), through its Directorate of education.

The year 2013 it had an enrollment of 61 students, which has increased during the last years and which in turn is variable, since a proportion of pupils whose families reside on a temporary basis at the Cove or in adjacent sectors. This is reflected in the number of enrolled at the beginning of the year 2013, which reached 51 students, joining during the year, 10 more students. This trend is maintained for the year 2014 since enrollment in the aforementioned school reached a total of 73 students.

The majority of children who attend the establishment are Caleta San Marcos, also taking students of Río Seco, Playa Ikelke and Chipana. The municipality provides from year 2011 mobilization for students from Río Seco, Ikelke, Chipana and surrounding areas, bus that transports also to the teachers of the establishment, who live in Iquique.

Figure 3-268. Transport andSCOLAR school San Marcos.

Source: Terrain photography registration

The school was founded in 1993 in the sector of La Caleta, at a headquarters of the fishermen's Union. By spending the time were fitted out rooms and bathrooms, infrastructure of wood, which exists and is used by the community. The year 2011 are installed in the new premises of the school, after a long process of obtaining land through national assets and funds for the construction of the establishment, led by the head of the school at the time, Mr Mario Corrales. With contributions from the Regional Government, through the National Fund for Regional Development (FNDR), the city of Iquique built the new school which boasts a library, a computer room, a dining room, nursing, a multi-purpose Court and classrooms. In addition, it has enabled two departments for the accommodation of teachers and direction, which are occasionally used. It should be noted that the library was donated by the mining company "Doña Inés de" Collahuasi"." Of the old school, was the emblem of the school developed using the technique of mosaic, which was installed at the entrance of the new settlement.

Figure 3-269. Emblem school Caleta San Marcos.

Source: Terrain photography registration

The school has sixteen workers of plant: ten teachers, an Assistant of preschoola patio, two auxiliary Assistant, a chauffeur and a manipulator of food; more support of a dupla psychosocial working once a week with the students of the school.

At the end of the 8th year of basic education, seeks tuition for students in the educational establishments of the city of Iquique, mainly in technical schools. Schools traditionally attended by the students of the school San Marcos are Liceo Luis Cruz Martinez and the Liceo Libertador Bernardo O'Higgins, the first imparts technical education and the second humanities education.

To study at Iquique, students must reside in homes of relatives or find accommodation whether rented, in boarding schools or opting to households that receive students of rural areas. There is a boarding school for women called women home Ururiadministered by JUNAEB, which receives women of the region of Tarapaca Iquique which will continue their studies. Another mode is offered by the Association of young Christians, in where families receive young students, giving them food and accommodation, in return for remuneration given by the Association. This move presents a difficulty for the continuity of studies, since it is not easy to find accommodation and involves a high cost to the families. This is compounded by the adjustment problems that young people, suffer from the change that means living toreflected in the family and inserted in a big city. Likewise, the option of moving daily is problematic for not having free transportation, in addition to the distance, implying a high cost to travel to the city.

According to information gathered in the field, the year 2012 only 50% of the students continued their studies in Iquique, with one proportion of not less than students who were withdrawn during the year. After finishing high school, a continuous low proportion in higher education. A significant proportion returned to the town to work in the collection of the huiro or other activities associated with the sea.

Note that since 2011 the school San Marcos provides education preschool, with an average of 14 children. The inclusion of education pre-school at the school, responded to a need in the community, due to the large number of children in la Caleta, had no access to education preschool on a permanent basis.

Figure 3-270: School San Marcos.

Source: Terrain photography registration

In addition to the pre-school education delivered by the school, in Caleta San Marcos the Integra Foundation implements the garden on Wheels program, which consists of the visit to the Cove once a week from a nursery educator and an entertainer, in a mobile equipped with mat educational wasteland, who in part-time work with children between 2 and 4 years of age. In San Marcos, the program operates day Monday morning, on the premises of the old school.

Figure 3-271. Mobile Garden on wheels in Caleta San Marcos.

Source: Terrain photography registration

With respect to the results of the national system of evaluation of results of learning SIMCE, the establishment has for 2012 assessment to the 2nd Basic, measuring the development of the communicative competence, with emphasis on understanding reading students [49] ; and measurement to the 4 th Basic, which evaluates the reading comprehension, math and history, geography and social sciences. Following are the results of the school in both tests:

Table 3-121. SIMCE averages Establecimientos Educacionales RUrals Comuna's Iquique.

Name of the establishment	RBD	Dependency	Area	BASIC 2ND 2012	BASIC 4TH 2012		
				LEC	LEC	MAT	HIS

[49] Agencia de Calidad de la Educación, Resultados para docentes y directivos, 2º Educación Básica, SIMCE 2012.

Annex school Thilda Portillo Olivares	12542	Municipal	Rural	255	252	254	270
Annex school Manuel Castro Ramos	10916	Municipal	Rural	220	235	269	232

Source: Own elaboration based on SIMCE 2012

Comparing the results of the school of la Caleta San Marcos, "annex school Thilda Portillo Olivares", with the school farm of Iquique"Annex school Manuel Castro Ramos"in the SIMCE test of 2 ° and 4 ° basic in 2012, you can see that the results obtained in 2nd Basic in the reading test they are superior 35 points to Another rural school of the commune of Iquique and in the case of 4 ° basic they are superior, in reading and history, not so in 4° basic math test case in which the school of Caleta San Marcos scored 15 points less.

San Marcos school implements various programmes, both of the Ministry of education and the educational foundation ColltoHuasi (FEC). This last entity signed an agreement with the school San Marcos to develop the programme "enhancing School", whose purpose is to improve the quality of education in vulnerable schools, through training and delivery of support materials. The program was implemented during the years 2009 to 2013, and was renewed 2013 for four years more. Within the programs implemented by the Ministry of education, is the links program, which has problems for its implementation by the poor connectivity of the signal of Internet.

In relation to the basic services in the educational establishment, it is possible to mention that it has electricity through generator oil and water through truck tanks. In relation to electricity the school has not been benefiting from the implementation of the household mains running in San Marcos from January 2014, since the terrain in which it is located is located in concession from the Ministry of property National benefit of the I.M. of Iquique, and June 2014 this situation was regularized.

fff) Bless you

La Posta health Rural Caleta San Marcosopened in 2012, is in charge of delivering health services to the populations of San Marcos, Rio Seco and Chipana representing, according to the physician responsible for the Rural Posta, a population of about 800 people, since the first two localities have with around 300 inhabitants, While the third has about 150 inhabitants. During the summer the population increases and doubles the average of assisted persons, due to the arrival of relatives of the local population and tourists. During the year, the post serves on average between 10 and 15 people daily. The medical care are made in the posta, an infrastructure that has three years and reemplazo Rural medical station that was in the old school of the Cove. He has four box, two of attention, a procedure in the event of accidents and a resuscitation room.

Figure 3-272. Rural Health, Caleta Posta San Marcos.

Source: Terrain photography registration

The post receives a round monthly medical, the third week of each month, to which goesn a midwife, a nurse, a psychologist, a nutritionist and a social worker from the clinic surgeon Guzman of Iquique.

Opening hours of the post is Monday through Friday from 8:00 to 16:30 hours, a doctor and two paramedics, and Saturday from 8:00 to 12:00 hours, by a paramedic. Outside those hours, and including Sunday, a paramedic attends only emergencies. In case of more serious accidents, the posta function is to stabilize the patient while they contact the Rural clinic of Chanavayita that it has an ambulance to transport the person to the Hospital in Iquique.

Dental care are carried out by the Mobile Dental clinic that goes twice a month to the Cove. During these visits served between four and eight people requesting the identity document and a document evidencing that the person are registered in FONASA.

One of the problems that has had the post is related to their supply of water and electricity. In terms of electricity, it has an own engine and solar panels that work with a weekly cost equivalent to 1,500 litres of oil, and receive drinking water through the municipality through truck tanks. Field which is located also is concession by the Ministry of national property to the I.M. from Iquique, so it has the same problermatica the school in relation to the availability of electricity by ELIQSA.

As for monitoring of the local population, the posta performs well child, cardiovascular problems and older adults control Control programs. The most common attentions by the adult population include trauma shoulders and knees problems linked to fishing, diving and collection of huiro. In the case of older adults is quite common that they suffer from hypertension. Also notes the existence of some cases of alcoholism, But no Register no severe case related to drugs.

ggg) Housing

With respect to housing, from the data provided by the Census of population and housing 2002, we can point in Caleta San Marcos the most inhabitants lived in houses, with 52%. In addition, dwellings were mainly own, representing 84 per cent of the total. Only 6% of the homes in the town were free, as well as leased dwellings, while 4% corresponded to housing by work or service.

It should be noted that the number of homes grew exponentially, almost tripling dwellings registered by the 2002 census. According to the survey carried out by the company Espejo de Tarapacáthe town of San Marcos has the year 2014 132 homes. Of this total, 73 belong to the sector of "La Caleta" and 59 to the eastern sector of the Creek or "Villa San Marco". On the other hand, the construction of a total of 35 homes is projected for the year 2014 "in the sector of"Villa San Marco", whose owners are partners of the"Entrepreneurs San Marcos Housing Committee"those who live today mostly "La Caleta" sector.

Table 3-122. Types of Vhousing SEGUN Pproperty, Caleta San Marcos

Type of housing	Home ownership					Total
	Own (fully paid)	Own (pay period)	Leased	By work or service	Free	
House	20	1	2	1	2	26
Improves, shack	13	0	0	0	1	14
Ranch, hut	8	0	1	1	0	10
Total	41	1	3	2	3	50

Source: Census of population and housing 2002, INE.

In terms of materials of exterior walls, in 2002, dwellings had mainly with walls made from materials considered to be acceptable according to the designed index by the CASEN, 92%, while the remaining 8% corresponded to materials considered as recoverable.

Table 3-123. P materialaredes Exteriores, Caleta San Marcos.

Categories	Cases

Categories	Cases
Concrete, stone	2
Brick	1
Structured panels, block (prefabricated)	3
Wood or wall covering	39
Internit	1
Adobe, clay empajado	4
Total	50

NSA:22

Source: Census of population and housing 2002, INE.

With respect to the material of the roof deck, 46% corresponded to a material considered acceptable while 56% of materials used in the ceilings correspond to recoverable materials, such as the phonolite.

Table 3-124. Material of Cubierta of the Techo, Caleta San Marcos.

Categories	Cases
Shingles (wood, asphalt)	3
Zinc	12
Pizarreño	8
Phonolite	27
Total	50

NSA: 22

Source: Census of population and housing 2002, INE.

In the town, the majority of floor materials, 62%, corresponding to the recoverable materials, while 38% of the materials were acceptable.

Table 3-125. Material of PISO, Caleta San Marcos.

Categories	Cases

Categories	Cases
Ceramic tile floor	6
Siding (wood)	7
Cement tiles	6
Plastics)flexit(, linoleum, etc.)	17
Radier	14
Total	50

NSA: 22

Source: Census of population and housing 2002, INE.

From the materials used for the construction of housing, in terms of exterior walls, ceilings and floors, we can observe that in 2002 the index of materiality of Caleta San Marcos was considered as recoverable. That reality corresponds to what was observed on ground in the town, where most of the homes in the sector of "La Caleta" are wood or partition with zinc, pizarreño ceilings and phonolite. On the other hand, the homes in the eastern sector of San Marcos, are mostly solids, for example, of prefabricated blocks housing. This sector, as already mentioned above, corresponds to the place where the members of the Committee on housing built their new homes through the project's Serviu along with a roof for Chile.

hhh) Basic services

Caleta San Marcos, according to data provided by the Census 2002, 56% of the homes did not have electricity, while 18% had access to the service through the public and 26 per cent thanks to a generator itself or community.

Table 3-126. Origin of the Electricidad, Caleta San Marcos.

Categories	Cases
Public network (Cia. electricity)	9
Generator itself or community	13
It has no	28
Total	50

NSA: 22

Source: Census of population and housing 2002, INE.

Despite census data, it should be noted that according to what was observed in the work of terrain, until the year 2013, Caleta San Marcos did not have electricity delivered by the public network, supplying through generator itself and Community situation that has been modified to starting from January of 2014, date in which the electric company ELIQSA implemented in San Marcos the rural electrification project Coves South of Iquique, ""which involved the construction of about 100 kilometers of medium voltage line with funding from the Regional Government. This project allowed to supply electric power to the Muslim familiesADEs of Caramucho, Chanavaya, Rior dry, ChipanaSan Marcos and the Loa""[50].

In this context, access to electricity differs in each sector identified in San Marcos. Even before the implementation of the grid, in the sector of "La Caleta", households supplied electricity through own generators, while towards the East of route A-1, in "Villa San Marco" ran until early 2014 a community generator based on oil, delivering both dwellings and street lighting, power ofSDE the 18 hours to the 24 hours approximately. However, after the implementation of the network of electrical energy in the sector of Villa San Marcos, the vast majority of homes are connected to the network while the connection of households was slow because of delays involving the certification process n of the installations with the SEC. Administration of community generator, as used in "Villa San Marco", was performed by two inhabitants sector, who were responsible for the maintenance and operation of the system. To make this work, not cancelling the cost d monthly light, which equaled approximately $45,000.

Thus, the sector East of the town today has availability of electricity during the twenty-four hours a day, the seven days of the week, although they have due to get some cuts partial due service This still is in a stage of implementation in the Creek and other nearby creeks, so it is necessary to suspend the service to carry out the relevant works. Similarly, the implementation of the power supply has meant significant savings in associated costs with community generator set the average monthly cost for housing was of $180,000, which has declined with the new system to a monthly average of $30,000 for each home.

The implementation of the mains in the area of Villa San Marcos implied that the designated community generator should become the main source of electriciDad for the sector from "the Cfin"" or sector West of San Marcos, benefiting a total of 45 homes with permanent residents, with a significant decline at domestic level by electricity costs associated with the purchase of fuel. Thus, June 2014 there is a fee of $1,500 per day for each housing connected to the generator community, which implies a cost of approximately $1,900,000 monthly generator operation in total, well below the $8,000,000, which had cost the set of these 45 homes with permanent residents who own generators separately used average monthly.

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[50] Recuperado el 10 de julio de 2014, de http://www.eliqsa.cl/clientehogar/publicaciones/Paginas/ELIQSAanunciainversionespor3194millonespara2014.aspx

With regard to access to drinking water for human consumption, while the 2002 census indicates that you for that year, the totality of households were connected to the public network, the information collected in the field, says that the water supply is performed by tank truck and there is no supply or sewerage network. The truck is facilitated by the city of Iquique, while water is purchased by residents to drinking water, water Highland company. Water gate in Iquique by purchasing "vouchers" with an approximate cost of 1,000 peSOS per cu metreBico, which are delivered in the municipality, to the cistern, 30,000 truck litres, move and distribute the resource. According to the survey carried out by the company Espejo de Tarapacáthe population consumes an average of 176.907 liters of water per month, with a daily average of 5.896,9 litres.

It should be note that en summer increases the demand for water, which creates problems in the supply. So too, there are delays in its distribution, by problems of the truck either mechanical or errors of logistics, what proDuce discomfort in the population.

Because of these needs is that it was established in Caleta San Marcos a Committee of Rural drinking water which is June 2014 awaiting the resolution that grants legal personality to the Organization, which has 40 members initially but with projections in the short term increase your coverage to new members. One of the main projects that the Committee has proposed is the install a glass of water in the eastern sector of San Marcos with a capacity of 100,000 litres, that has a chlorination and filtration system to enable a distribution network with arra individual nques for each dwelling with Associates.

However, the leadership of the Committee estimates that the total capacity of the Cup reaches to supply service to homes only for a day, by what becomes necessary complement this system with another that allows the resource availability on a permanent basis.

Table 3-127. Origin of the TOGua, Caleta San Marcos.

Categories	Cases
Public network (Cia. drinking water)	50
Total	50

NSA: 22

Source: Census of population and housing 2002, INE.

With respect to the availability of water in the home, the 2002 census indicated that 78% had water piped inside the House, while 22% had it outside the dwelling but within the site.

Table 3-128. C wateraneria, Caleta San Marcos.

Categories	Cases
Inside the House	39
Outside the House, within the site	11
Total	50

NSA: 22

Source: Census of population and housing 2002, INE.

According to the 2002 census, en ratio to the availability of toilets in the town solid waste management was carried out mainly through sewer by 32%. 18% of households had septic, while 20% had drawer on cesspool, a 6% chemical bath and 22 per cent had no toilet service availability.

It should be noted, that according to information gathered in the field, in San Marcos dominates drawer on cesspool and septic use, there is no sewerage system. At the same time, the sector of La Caleta, by the smallness of terrain, the high population density and the increase of people in summer, suffers an overload, causing discomfort and health problems.

Table 3-129. Availability of Service Higiene, Caleta San Marcos.

Categories	Cases
Connected to sewerage	17
Connected to septic tank	9
Drawer on cesspool	10
Chemist	3
It has no	11
Total	50

NSA: 22

Source: Census of population and housing 2002, INE.

Based on census data from 2002, the index of sanitation, which corresponds to the intersection of the variables of toilet facilities and the location of water in relation to housing, was acceptable, however according to the observations made in the field are It failed to detect that the Caleta San Marcos had a toilet service deficit.

Across levels of materiality, sanitation and housing type, we get that in 2002 the index overall housing quality in Caleta San Marcos was unrecoverable.

Table 3-130. Table of contents Global quality housing, Caleta San Marcos

Index	Dimension	Category
Type of housing	Type of housing	Unrecoverable
	Index type of housing	Unrecoverable
Materiality	Materiality walls	Acceptable
	Materiality floor	Recoverable
	Materiality ceiling	Recoverable
	Index of materiality	Recoverable
Sanitation	Availability of water	Acceptable
	Availability of toilet facilities	Deficit
	Index of sanitation	Deficit
Global quality	Table of contents Global quality of housing	Unrecoverable

Source: Own elaboration based on data from the Census of population and housing 2002, INE

According to the information collected in the field, estto above situation corresponds toun the old sectoro la Caleta while the new sector, to the East of route A-1, has acceptable housing, construction onlyLida with septic tanks.

3.8.5.3 Sector Costa: Caleta dry river

i. <u>Geographic dimension</u>

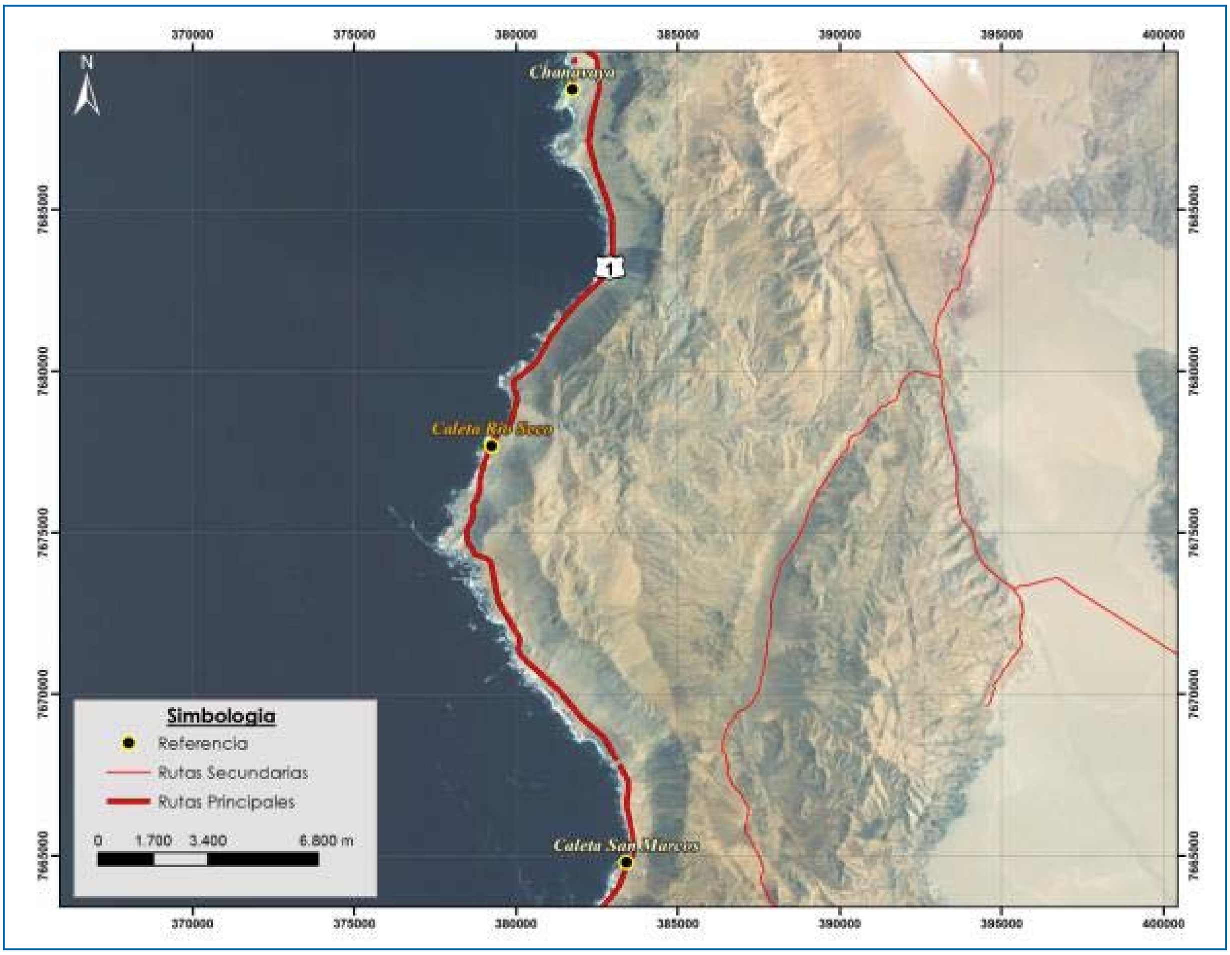
iii) Location

Dry river It is located in the Region of Tarapacá, province of Iquique, in the commune of Iquique. Dry river belongs to the rural area of the municipality, and is located south of the communal capital, the city of Iquique. Considered by the INE as Hamlet, Río Seco is located on the coast, at kilometer 320 of route A-1, to the East of the route. As well as Cove San Marcos, is located on the coast, to the North of Punta de Lobos, prominence of the littoral shelf, which is a geographic landmark of importance in the area[51]. The geographical characteristics of the coastal plain in this sector are similar to those described in Caleta San Marcos, forming part of the same territorial unit, sharing an extremely narrow plain, with a pronounced coastal cliff that reaches the 800 meters of altitude and that links the coastal plain with the upper plateau of the Cordillera de la Costa. In Río Seco is one of the highest points of this cliff, with over 800 metres of altitude.

With respect to the nearest villages, Caleta is located to the North Chanavaya and the sector known as Pica Pavilion, which has aledaño to route A-1 an inn offering lunch to the users of the path. To the South, 14 kilometers is Caleta San Marcos. Of the city of Iquique, the Caleta Río Seco is located 95 kilometers, this city being the main source of services of la Caleta. It should be noted that there was the fisherwoman La Caleta, which corresponded to a sporadic settlement, today without inhabitants South of the Río Seco Caleta. On the other hand, there are homes isolated South of the Cove, dedicated to the extraction of huiro, of a temporary nature and where people reside permanently in the town of Rio Seco.

[51] Punta de Lobos es la referencia geográfica para delimitar las áreas de trabajo de buzos y pescadores, así como también es un sector conocido por la extracción de guano fósil.

Figure 3-273. Map of Uocation, Río Seco.



Source: GAC

The main and only access to Río Seco route is route a-1, that connects the litoral of Tarapaca and Antofagasta regions, from Iquique by North to Antofagasta to the South. The route is paved, one via and in good condition. As noted in the baseline of Caleta San Marcos, on the route to - 1 being performed works for the construction of dual carriageway, in the section corresponding to the access South of the city of Iquique. The implementation of route A-1 allowed to join isolated coves to the cities of Iquique and Antofagasta through better connectivity andaccessibility.

Within the village, Río Seco has dirt roads in regular condition, with the exception of the main street located in the sector of Río Seco old or children of Rio Seco, which is cobbled.

According to the volume of traffic information delivered by the national censuses of the MOP Plan for the year 2012, transit Unia daily averagel passing by the RUTA A-1 in the section that goes from Iquique to Tocopilla, is 2.189 vehicles, among which most are cars, 33,14% followed by vans with 32,77%.

Figure 3-274. Calle Pprincipal Sector dry river oldDry river.

Source: Terrain photography registration

jjj) Stocking

During the 20th century, Rio Seco underwent two types of occupation: the first linked to the exploitation of the salt and the second, the exploitation of marine resources. According to interviews conducted at the salt Museum, from the mid-19th century dry river was an important port of shipment of salt, which functioned as such until the mid-1950. At that time, closes river dry as the center of operations of the holding company of salt, and produced an exodus of people to different cities of the country, especially to Iquique. This new scenario, then only a person is living in Río Seco. Subsequently, Rio Seco is occupied by divers and fishermen, who sought favorable places to the marine resource exploitation. In the 1980's they began to settle permanently the first families of divers and fishermen, in turn, initiates a return of some of the inhabitants of river dry salt extraction period, those who return to recover their former homes and settle in the village.

In this context, different sectors, among which are the children of dry river or Río Seco old sector, are recognized in the village the sector of Los Pescadores or fishermen rise and the sector of Rio Seco Alto.

The children of dry river or Río Seco old sector is located to the North of the populous sector and corresponds to the settlement of the former office of the salt exploitation company, which its distribution was an "L". Today is inhabited largely by former inhabitants of the village, mostly retired people, whose families live in Iquique and come to the village on weekends.

The sector of Los Pescadores or fishermen rise, is inhabited by divers, fishers, and gatherers, who occupied the Cove from the Decade of 1980, in which they have their houses and titles.

The sector of Río Seco Alto, also known as Los Corrales is located south of the populated sector and belongs to Iquique families who have their second homes in the hamlet, dealing them a recreational purpose.

Figure 3-275. Sectors dry old, fishermen and Alto Río Seco River, Río Seco.

Source: GAC

Figure 3-276. High sector dry riverDry river.

Source: Terrain photography registration

In addition, to the West of route A-1, on the coast, dependencies of the Union of fishermen divers of Rio Seco, is located near its pier and close to the ruins of the old work of salt exploitation company.

Figure 3-277. Union of Mariscadores dry river diversDry river.

Source: Terrain photography registration

LRiver dry land tenure corresponds mostly to land private, delivered by national assets in different processes for the award. In the case of the inhabitants of Rio Seco old sector, many of them should buy land of their former homes, while in the case of the inhabitants of the sector Los Pescadores, this land of 200 square meters were delivered by goods National, in a process of resettlement that it experienced between the years 1999 and 2000 propitiated for maritime governance, between 1993 and 1994 asked the population leave the sector of the Creek, according to the regulations remove the dwellings located within 80 meters from the coast. In that area there were only shellfish divers Union facilities.

Is in this context that at the beginning of the month of July of the year 2014 is held the formal title to a total of fourteen families who dealt with the granting by a period of eight years, which joined other 35 families who had already received its title in 2006.

Figure 3-278. Street in the CFSP SectortoDores, Rio Seco.

Source: Terrain photography registration

It should be noted that in Rio Seco the nearest project work corresponds to the construction of an access road linking route a-1 with plateau and Pampa sector. Currently, in the vicinity of the area in which this work is projected, identified the existence of infrastructure of the Committee of Rural drinking water (the Cup storing drinking water from the village), a lightweight material, which was uninhabited house, and the cemetery of Río Seco.

kkk) Transport and Conectividad

With regard to public transport, the population of Río Seco, as well as the town of Caleta San Marcos and the coastal sector of the South of Iquique, uses the "caletero" bus, which passes through all the villages from Chipana towards the North. The caletero bus frequency is daily, with a tour of ida, moving to 7:30 in the morning by Río Seco, and a return journey, which It starts at 17:00 from the Market of Iquique. The tour is done from Monday to Saturday, varying schedule of return of Iquique weekend, from the city at 16:00. The value of the ticket is $950, existing fare differential for students ($250) and Seniors ($500). As noted above, in summer the caletero bus demand rises considerably, by tourists who use the service to go to the beaches in the South of Iquique.

It should be noted that, according to interviews in the field, a significant proportion of inhabitants of Rio Seco, has particular vehicle, which is led by the free trade zone. Who don't have private car use the caletero bus, or you gathered with neighbors to be transported. As in the rest of the creeks, by route a-1, passing interprovincial buses to Iquique and Tocopilla, Antofagasta, however, the value of the ticket is considerably greater than for the public transportation, fluctuating between the $3,000 to $5,000. In addition, do not stop regularly inthe whereabouts of the creeks, being uncertain use.

ii. Dimension Demographic

III) Population

According to data from the Census of population and housing in the year 2002, Rio Seco had that year a population of 71 inhabitants, of whom 42 were men (59.2%) and 29 women (40.8%) so the rate of masculinity was 144,8 indicating that there was a higher proportion of men over women in the hamlet.

Table 3-131. Population by sex, Dry river

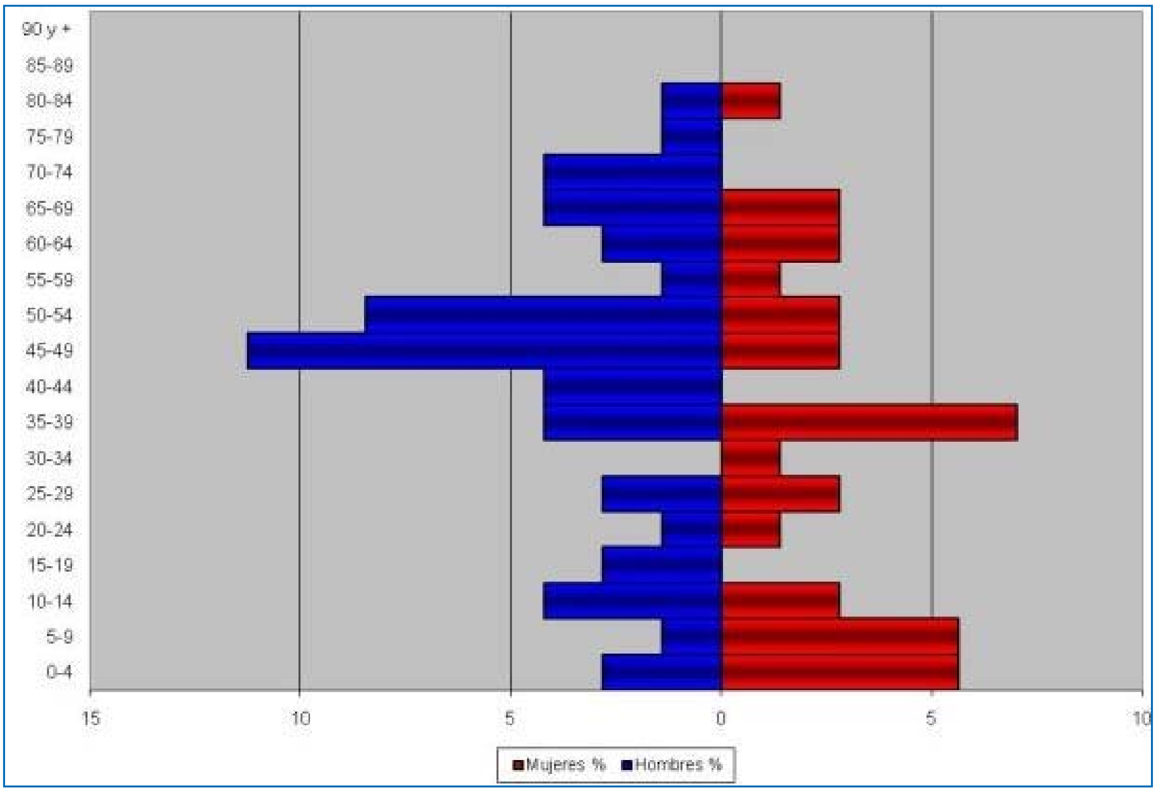
Categories	Cases
Man	42
Woman	29
Total	71

Source: Census of population and housing 2002, INE

As shown in the figure presented below, existIA the year 2002 a higher proportion of adult men age work, which correspondIA the main economic activity in Rio Seco, diving and collecting kelp.

Also, the data delivered by the 2002 census, was calculated for that year Irate of aging of Caleta Río Seco, understood as the degree of ageing of the population, What was of 15.5. i.e., there were 15.5 people over 65 for every 100 inhabitants. It is possible to add that young people had a rate of 22.5 and the adult population rate of 62.

Figure 3-279. Pyramid of Poblation by Gseminars of Age and SExo, Dry river.



Source: Own elaboration based on data from the Census of population and housing 2002, INE.

According to the information collected in the field, Rio Seco has had a population growth sustained over time and that still today, due to constant immigration of people attracted by the exploitation of resources, mainly the huiro. On the other hand, pointed out that young people of Río Seco largely remain in the hamlet, with fewer young people migrating to the cities. The increase of population in Rio Dry is verified by the post of Rural Health of San Marcos, which estimated at 300 inhabitants approximately, the number of people who liven in the town.

mmm) Migration

According to the 2002 census, 59.2% of the population registered that year, was born in the commune of Iquique, while a 40.8% stated they were born in another commune in the country. These data allow graphing the information collected in the field in which you expressor to the demographic composition of river dry is mixed comprised an Iquique population linked to river dry by his past as a port of salt and a more recent population to be instalor in the Cove during the past 30 years, mainly being divers attracted by the high presence of resources in the area.

Table 3-132. Place of birth according to SExo, Dry river.

Place or commune of birth	The Encuestado sex		Total
	Man	Woman	
In this commune	21	21	42
In another commune	21	8	29
Total	42	29	71

Source: Census of population and housing 2002, INE.

To analyze in detail the processes of migration in river dry in accordance with the Census of population and housing 2002, We can observe that in the Region of Tarapacá was born a 62% of the population, while Ito Coquimbo Region contributed the majority of the population having been born elsewhere region with a 15.5%. The Antofagasta Region contributed 7% and the Metropolitan Region a 4.2%. An equal percentage, an individual, existed from inhabitants of the Region of Atacama, de Los Ríos, Araucania, Bío-Bío, Valparaíso, Arica and Parinacota, Libertador Bernardo O'Higgins and a person who was unaware of his town of birth with a 1.4% each.

Table 3-133. Place or Comuna's Nacimiento by SExo, Caleta Dry river.

Commune code or country of birth	The Encuestado sex		Total
	Man	Woman	
Valdivia	1	0	1
Iquique	21	21	42
Curacaví	1	0	1
Calama	1	1	2
Pozo Almonte	1	1	2
Los Vilos	1	1	2
Providence	1	0	1
Las Condes	0	1	1
Coquimbo	4	0	4
Huasco	0	1	1
Mussels	1	0	1
New Imperial	1	0	1

Commune code or country of birth	The Encuestado sex		Total
	Man	Woman	
Colonel	1	0	1
Valparaiso	0	1	1
Antofagasta	2	0	2
Ovalle	1	1	2
The fig tree	1	0	1
Ignored	1	0	1
La Serena	1	0	1
Vicuña	1	0	1
Arica	0	1	1
RENGO	1	0	1
Total	42	29	71

Source: Census of population and housing 2002, INE.

In 2002, when asked by the place or commune of residence year 1997, is possible to observe that a 89.2% lived that year in the commune of Iquique while 9.2% lived in another commune and 1.5%, which corresponds to an individual lived in another country.

Table 3-134. Commune of Rbeing 1997, Dry river.

Commune or place residence in 1997	The Encuestado sex		Total
	Man	Woman	
In this commune	33	25	58
In another commune	6	0	6
In another country	1	0	1
Total	42	29	65

Source: Census of population and housing 2002, INE.

To analyse in detail the place or commune of residence in 1997, according to census data by 89.2% of the inhabitants lived in the commune of Iquique while that Region of Each troop-Coquimbo and Tarapacá 3.1% as the amount of people who ignored in that commune resided in that year. There is the case, corresponding to 1.5%, a person living in France in 1997.

Table 3-135. Place or commune of Rbeing in 1997 by SExo, Caleta Dry river.

Code municipality or country residence 1997	The Encuestado sex		Total
	Man	Woman	
Iquique	33	25	58
Coquimbo	1	0	1
Ignored	2	0	2
France	1	0	1
Pozo Almonte	2	0	2
La Serena	1	0	1
Total	40	25	65

Source: Census of population and housing 2002, INE.

According to the information it collectsda on land, the population is constituted by people of different origin. The population living in the old part of Río Secois formed by families who in the past were linked to the port of salt that was in place, so in many cases it's people of third age or that he has returned to Rio Seco, from cities like Iquique and Alto Hospicio. On the other hand, sector Los Pescadores is divers and fishermen largely coming from Tongoy and other locations the region IV, similar to the situation Caleta San Marcos. TOYes, there is a proportion of the population that lives temporarily residing in second housing, which only come the weekends or for holidays. As already noted, has also reached population attracted by extraction of huiro, coming from cities like Iquique and Alto Hospicio, as well as other countries, such as Bolivia.

nnn) Illiteracy

In relation to the level of illiteracy, the census data of 2002 show a 13.8% over 10 years in Rio Seco inhabitants did not know read and write, group formed by 55.6% by men and women 44,4%. Of the total of men of Rio Seco, el 12.5% did not know read and write, and all women, 16% was in this situation.

Table 3-136. Illiteracy by gender, Río Seco.

Can read and write	The Encuestado sex		Total
	Man	Woman	
Yes	35	21	56
No	5	4	9

Total	40	25	65

Source: Census of population and housing 2002, INE.

iii. Dimension Anthropological

ooo) History RBrookings's TOsettlement in Rio Seco

According to interviews conducted at the salt Museum, Rio Seco It was founded in 1895 as a port for bagging and shipping salt for the company of exploitation Punta Lobos, to Huanillosoperating as such until 1950 and 1956 respectively.

Figure 3-280. Ruins of the company holding Punta de Lobos, Río Seco.

Source: Terrain photography registration

During that time salt was transported from the Great Salt Lake in carts along a path of difficult access, until they built a lift of fierro carrying salt, up the cliff from the coast up to the Office of Rio Secolocated at Salt Lake.

Figure 3-281. Lifeline Foundation company exploitation Punta de Lobos, dry river.

Source: Terrain photography registration

Figure 3-282. Ruins Office dry river, Salar Grande.

Source: Rphotographic record field

The company's exploitation Punta de Lobos extracted two types of salt: sea salt and salt from the salt. The sea salt was treated in punts for its extraction, which still exist in the sector adjacent to the offices of the Union of fishermen, as in the part of one of the two piers used in time, one for people and another for charging.

In the current field of Alto Río Seco is They located the pens of animals, reason why the sector is also known as "pens". Livestock was brought by boat and unloaded at sea so the animals swim to the shore where they were arreados to the paddock. Twice a month he wasn animals for the inhabitants of Rio Seco and half calf was delivered to each family during the Festival, celebrations It wasn performeds on the Beach the Devil's mouth.

From that time, in Dry river are only the remains of some infrastructures production type and the walls of adobe houses in the old part of the current Creek. The salt Museum, place where was located past the bakery is situated in this sector Office. During its operation as office companyDry river used tokens and store system to pay and supply their workers, the same way that saltpeter offices.

It should be noted, that pIt revio to the war of the Pacific, Peru already exploited productive sector. Punta Lobos was an area exploitation of fossil guano. This exploitation occurred partly because of the presence of slaves coming from China, brought boat, in where 2,000 people who departed from AsIA survived around 500. Already in the guano harvesting operations, ornot of punishment applied to the slave systemsfor example, to be surprised to smoking opium, was the use headband Wolf marked inside leather with the phrase "So Vice is punished"the that is it tied wet front, then exposing people to the Sun, so that the headband is dried and tightens. Other existing punishment was exput them in the Sun on the cliff so it would serve of example and warning all the slaves. Punta de Lobos found a pavilion of execution, and bodies then they were buried in a mass grave in the cemetery of Río Seco. According to bibliographic records, during that kind of abuseMacau Chinese, from slaves, joined the Chilean battalion commanded by Quinti Vulcanon Quintana in the war of the Pacificfico.

Figure 3-283. View Aerea Dry river and Punta de Lobos.

Source: GAC

ppp) Indigenous peoples

According to information setin the Census of population and housing in 2002, This area of influence does not record indigenous population, which is complemented with the information collected in field and confirmed the census information, during campaigns carried out in 2013 and 2014 from interviews with Presidents of leading organizations, both territorial and trade, of the sector. The following table shows the total population of Río Seco without ascribed to indigenous peoples.

Table 3-137. Belonging to Pction Indigenas by SExoDry river.

Membership of indigenous peoples or indigenous	The Encuestado sex		Total
	Man	Woman	
None of the above	42	29	71
Total	42	29	71

Source: Census of population and housing 2002, INE.

qqq) Festivities

In addition to the festivals of end of year, Christmas and independence day, Rio Seco has different festivities, religious festivities and the anniversary of the town.

One of the religious festivals which are held is the feast of the Virgin, organized by a devoted owner of a Holy imagewho is the host of the event (e) to dinner to invited religious dance groups and the community. The virgins verenadas they are the Virgin Carmen and María Auxiliadora. In the same way held San Lorenzo, who has two images in Rio Seco, making patent the mining past of the area; and San Pedro, party where divers take advantage of to remove the image of the Saint in boat. In addition, the mass is performed in the Maria Auxiliadora Chapel, every Saturday at 17:00 by a priest who attends the Cove from Iquique.

In February, for the birthday of the Cove, he is the Summer Festival, where past editions there was a parade of children and young of the Cove, I chose the Queen of Rio Seco and artists are invited to dance, lighting up the night with candles. The next day it is customary to make a party where people throw is painting and challas, in addition to dress up with clothes and dresses of the opposite sex, together with all the inhabitants of the Cove to finish with the burning of a monkey in which the face is stuck in the per Sona who has had a bad year to call the goodluck. The monkey is released to the sea, followed by young people swimming, until is it completely burned out or away too. It should be noted, that this activity not took place the year 2013 due to the death of a young man from the Cove that organized and motivated people to make this type of festivities.

rrr) Social organizations

Dry river has a Board of neighbors, a syndicate of divers and fishermen, with the Organization "Hijos de Río Seco", a Committee of Rural drinking water and a Sports Club.

The Junta de Vecinos is mainly engaged to territorial issues and the improvement of the Creek, as for example with the Gestion of the installation of electricity through public lighting in mid-2013. The Board does not have its own office so the meetings are they perform at the House of one of the inhabitants of the fishing sector. Approximately, the Organization recorded 40 partners, number that has been growing the past few years.

The withoutdicato self-employed fishermen divers related helpers of Caleta Río Seco, has 25 members, 4 of thes are women who are engaged in the collection of the huiro. The Trade Union It manages the exploitation of the AMERB, the correct operation of the same Union and promotes economic development through the construction of a shellfish processing plant two years ago, pending permission from health, and obtaining a hectare to build a processing plant algae through national assets.

The 'Sons of Río Seco' organization is constituted as a mutual Corporation, "Corporation Mutual Center children of Río Seco". Account with its own headquarters and was originally formed in 1990 to regularize land titles of the houses located in the old part of the village, but once resolved the problem of the land, today, they are still participating and promoviewing activities referred to the rescue of the culture and history of Río Seco. In is line, have been nominated to various competitive funds for these activities.

Figure 3-284. Children of dry river headquarters.

Source: Rphotographic record field

On the other hand, Río Seco has a Committee of Rural drinking water recently, constituted in charge of managing the purchase and subsequent distribution of water resources, through a glass of 100,000 liter water which serves to supply water the Cove. Finally, Río Seco has a

Sports Club which is managing its legal personalitywhich organizes pf artidosufootball with neighbouring coves.

sss) Sites of historical or cultural importance

Río Seco is a salt Museum, founded by Luis Covarrubias in 1999 and run by his widow Inés Fernández with the help of their children. The Museum shows an exhibition of numerous objects linked to the nitrate boom and the pre-Columbian past of the area. It lies metres from the Museum the infrastructure of a smithy dating back to 1895.

Figure 3-285. Museum of salt, Rio Seco.

Source: Rphotographic record field

Figure 3-286. Workshop blacksmith, dry river.

Source: Rphotographic record field

Another site of historical and cultural significance is the cemetery of Rio Seco, which was founded in the time of the Punta de Lobos salt company. Currently, is not in operation, being a desire on the part of the community, regularizing their situation through its perimeter closing and obtaining the relevant permits. It should be noted that the cemetery is visited regularly by family of the deceased. In addition, en the cemetery is the tomb of Carlos Enrique Peralta Castillo, character officially declared hero of the town have been veteran and fighter in the Pacific war of 1879. He participated in the battles of Tacna, Chorrillo, Miraflores, and Los Angeles, and received four medals for merits in these battles. Upon dissolution of his battalion received an allocation of special warfare and settled in Rio Seco, place where he worked in operations for the exploitation of salt and lived until his death, at the age of 62.

Figure 3-287. Dry river cemetery.

Source: Rphotographic record field

iv. Socio-economic dimension

ttt) Population economically Awill e Inactiva

According to the Census of population and housing 2002, the economically active population (EAP) of Río Seco corresponded to that year, 50.9% of the population 15 years and over. Of this total, 85.7% was male, with 87.5% working income, while 8.3% was not working, but taking employment. Only 3.6% - representing a single male person - was looking for work, having worked before. On the other hand, only 14.3 per cent of the economically active population was female, with all working income.

Table 3-138. Population andconomicamente TOwill by SExo, Dry river.

Employment status prior week	The Encuestado sex		Total
	Man	Woman	
Working for income	21	4	25
Without work, but have job	2	0	2
Looking for work, having worked before	1	0	1
Total EAP	24	4	28

Source: Census of population and housing 2002, INE.

According to census data, we can see that at that time the occupation of the economically active population corresponded to 7.1% to salaried workers and 92.9% workers on their own.

Table 3-139. Category Ooccupational by SExo, Dry river.

In this work it is or was	The Encuestado sex		Total
	Man	Woman	
Salaried worker	2	0	2
Self-employed worker	22	4	26
Total	24	4	28

Source: Census of population and housing 2002, INE

This fact coincides with the dynamics of workers linked to the diving and collecting kelp, i.e. self-employed persons.

In regards to the economically inactive population (PEI), for the year 2002, this corresponded to 49.1%, in relation to the total population 15 years and over. It was composed of 55.6% by women, of which 80% were engaged in their household chores. Meanwhile, the men reached the 2002, 44.4% of the economically inactive population composed mostly by retirees, with a 75%, and a 16.7% of students, only two people who found themselves in this situation in 2002. It should be noted that total PEI, a 44.5% was in your home chores the semna prior to the completion of the census process in 2002, followed in importance by retirees with 37%, by people in another situation with 11.1% and 7.4% students.

Table 3-140. Population Economicamente Inactivated by SExo, Dry river.

Employment status prior week	The Encuestado sex		Total
	Man	Woman	
In your household chores.	0	12	12
Studying	2	0	2
Retiree or annuitant	9	1	10
Another situation	1	2	3
Total PEI	12	15	27

Source: Census of population and housing 2002, INE.

The economically inactive population of Río Seco, according to the information collected in the field, is composed mainly by home owners and retirees, mainly in the old sector of the Creek. In some cases the women help to their husbands to collect huiro or self-employed in their collection. So also, the caleta women work in the processing of shellfish, through its cleansing for subsequent sale.

uuu) Economic activities

Reality reflected by the census data of 2002 shows that at that time, 71.4% of the economically active population worked in the primary sector, mostly dedicated to fishing and activities linked to fishing with a 95% Service, being formed in his all men, and in the case of a woman to the forestry, logging and related service activities, corresponding to 5%. The secondary sector accounted for 7.1% of economic activities and was comprised of two persons of male sex who worked on a case in the manufacture e substances and chemicals and in the other case, in the manufacture of other types of transportation equipment. The tertiary sector accounted for 21.4% of economic activities and was formed by 50% by men, still trade at the retail the main activity of the sector with a 66.7%, composed of 50% for women, while a 16.7%, corresponding to a single female person, focused on the activities related to hotels and restaurants and un16, 6%, corresponding to a single male person, was devoted to other activities of the tertiary Sector.

Table 3-141. Main Activities Eattendant for SExo, Dry river.

Code of economic activity (ISIC Rev. 3 to two digits)	The Encuestado sex		Total
	Man	Woman	
Forestry, logging and related service activities	0	1	1
Fishing, operation of hatcheries fish and fish farms, fishing-related services	19	0	19
Primary sector	19	1	20
Manufacture of chemical products and substances	1	0	1
Manufacture of other transport equipment	1	0	1
Secondary sector	2	0	2
Trade to the retail except trade of motor vehicles and motorcycles; repair of personal and household goods	2	2	4
Hotels and restaurants	0	1	1
Other tertiary Sector	1	0	1
Tertiary sector	3	3	6

Code of economic activity (ISIC Rev. 3 to two digits)	The Encuestado sex		Total
	Man	Woman	
Total	24	4	28

Source: Census of population and housing 2002, INE.

Currently, Imain activity productive-economic de Río Seco It is linked to the sea. Of According to the Union of divers and fishermen huiro collection is the activity with greater role, builds upNdo around 80% of the economically active population, that is also reflected in the greater number of young people that you have decided to collect the seaweed rather than learn to dive, tol be the resource of higher profitability, taking into account its price and ease of collection in comparison to the extraction of seafood.

On the other hand, currently the Union members work primarily in the activity of divingas divers or divers Assistant. The Union has three Areas of management of benthic resources (A)MERB), the that you have a guard hired by the Union, which oversees them. When it is possible to work with them, twelve vessels belonging to members of the Trade Union, do so while free extraction areas are generally worked through three and four ships of the Union.

The rise of the huiro favoured the installation three plantprocessing s of huiro in the town, which today operates only one. However, the Trade Union of Rio Seco projects build a fourth plant processing. The plant in operation subsequently for sale its production to the processing plant located north of Caleta San Marcos to be exported.

On the other hand, the Union of Rio Seco has the performance of a seafood processing plant in folder and the purchase of a refrigerated truck, in order to increase the added value of the production at the Cove to generate revenue and latertourism development and to supply local restaurants.

Other economic activities are emerging, highlighting trade linked to the tertiary sector, with the presence to the retail, represented in stores and the sale of food (empanadas).

v. Dimension Basic Social Welfare

vvv) Education

To complete their studies the children and young Río Seco attend, until eighth grade, to the Basic school Annex school Thilda Portillo Olivares administered by COMPUTABLES and located in Caleta San Marcos. To go to the school, the students are transported through a bus provided by the municipality of Iquique. To continue their studies, they should go to the city of Iquique.

www) Bless you

The inhabitants of Rio Seco attend the San Marcos-based Rural health clinic to be cared for in the event of problems or specific accidents or round it medical held the third week of each month, which is attended by a midwife, a nurse, a psychologist, a nutritionist and a social worker. In the event of a more serious accident the population prefers, according to interviews conducted in the field, go to the Rural health post of Chanavayita, It has an ambulance which allows you to move a patient to the Hospital in Iquique.

xxx) Housing

With respect to housing, from the data provided by the Census of population and housing 2002, we note that in Rio Seco 53.3% of the population resided in houses while a 36.7% resided in emergency homes. In addition, dwellings were mainly own, representing 70% of the total. 16.7% of the homes in the town were free, while 13.3% corresponded to housing by work or service.

It should be noted that the number of homes in the 2002 census are far from those observed in the field. For ease of reference, the Committee on Rural drinking water accounted for 130 meters of consumption of drinking water, with a coverage of almost all of the houses (with the exception of three houses that are in condition of socket). This would indicate an increase of 400% with respect to the number of dwellings surveyed the 2002. It is important to mention that the year 2006 the inhabitants of the fishing sector received their titles, year in which began the construction of their houses.

However it is still possible to see a deficit in housing matters, which is expressed in the Constitution of the Villa Esperanza Housing Committee which had a total of 32 partners initially, but that it currently has 27 of them.

Table 3-142. Types of Vhousing SEGUN Pproperty, Dry river.

Type of housing	Home ownership				Total
	Propia(pagada totalmente)	Own (pay period)	By work or service	Free	
House	8	3	2	3	16
Improves, shack	8	0	1	2	11
Ranch, hut	1	0	0	0	1
Another type of private home	1	0	1	0	2
Total	18	3	4	5	30

Source: Census of population and housing 2002, INE.

In terms of materials of exterior walls, in 2002, dwellings had mainly with walls made from materials considered to be acceptable according to the designed index by the CASEN, 90%, while a 6.7% corresponded to materials considered as recoverable and 3.3%, corresponding to a single dwelling, irreplaceable materials.

Table 3-143. Material of Paredes Exteriores, Dry river.

Categories	Cases
Concrete, stone	3
Structured panels, block (prefabricated)	2
Wood or wall covering	22
Adobe, clay empajado	2
(Tin, cardboard, plastic, waste etc)	1
Total	30

NSA: 92

Source: Census of population and housing 2002, INE.

With respect to the material of the roof deck, 80% corresponded to a material considered acceptable while 16.7% of materials used in the ceilings correspond to recoverable materials and 3.3% to irrecoverable material.

Table 3-144. Material of Cubierta of the TECHO, Dry river.

Categories	Cases
Shingles (wood, asphalt)	3
Zinc	11
Pizarreño	10
Phonolite	5
(Tin, cardboard, plastic, waste etc)	1
Total	30

NSA: 92

Source: Census of population and housing 2002, INE.

In the town, most flooring materials, 43.3%, correspond to acceptable materials, while 40% of the materials were recovered and a 16.7% to irrecoverable material.

Table 3-145. Material of PISO, Dry river.

Categories	Cases
Ceramic tile floor	2
Siding (wood)	3
Cement tiles	3
Plastics)flexit(, linoleum, etc.)	5
Radier	12
Earth	5
Total	30

NSA: 92

Source: Census of population and housing 2002, INE.

From the materials used for the construction of housing, in terms of exterior walls, ceilings and floors, we can observe that in 2002 the index of materiality of Río Seco was regarded as acceptable.

That reality corresponds to that observed in the field, where most of the homes in the Los Pescadores, Alto Río Seco and the old sector of the Cove are built of solid materials.

yyy) Basic services

In Dry river, according to the data provided by the Census of 2002, the 267% of dwellings had no electricity, while a 20percent had access to the service through the public and a 53.3% Thanks to a generator itself or community.

Table 3-146. Origin of the Electricidad, Dry river.

Categories	Cases
Public network (Cia. electricity)	6
Generator itself or community	16
It has no	8
Total	30

NSA: 92. Source: Census of population and housing 2002, INE.

In the middle of 2013 the vast majority of homes in the Cove, which had a title that would allow the installation of a meter, were connected to electricity through public lighting. The electric company Eliqsa It is responsible for providing that service with a value of approximately 10,000 pesos a month. Light account must be paid in Iquique every two months even if there is a system to pay in advance for electricity consumption. This change has been important in the Cove since having to deal with engines to generate electricity, the inhabitants of the Cove could spend untilmore than 10,000 pesos a day, reducing the costs of consumption.

With regard to access to drinking water for human consumption, while the 2002 census indicates that you for the year 2002, 83.4% of households were connected to the public networkhistory collected in the field, it is possible to indicate that prior to the installation of the Rural drinking water Committee, much of the population is supplied by truck to thejIBE.

Table 3-147. Othey govern aGua, Dry river.

Categories	Cases
Public network (Cia. drinking water)	25
Well or Ferris wheel	1
Shed, River, estuary	4
Total	30

NSA: 92. Source: Census of population and housing 2002, INE.

With respect to the availability of water in the home, the 2002 census indicated that 83.4% had water piped inside the House, while 3.3 percent had it outside the dwelling but within the site and a 13.3% did not have water piped.

Table 3-148. Water by Caneria, Dry river.

Categories	Cases
Inside the House	25
Outside the House, within the site	1
It has no	4
Total	30

NSA: 92

Source: Census of population and housing 2002, INE.

The current system of supplying water of Rio Seco is administered by the Committee of Rural drinking water in the town. That organizationAccording to the information collected in the field, He is in charge of buying the water needed to fill a glass of water with a capacity of 100,000 litres, which is distributed twice a week, between an hour and an hora and media, Monday and Friday, being already installed and running, a network of drinking water distribution system. The water It is transported the town through a truck provided by the municipality. For the moment The water It is bought from the Highlands water company, at a price of 1,015 pesos meter cubic of water. However, the water would be in the future provided by a desalination plant located in Chanavayitabeing in a stage of transition. The problem with this supply It is that the plant has a capacity of exceeding your sales production so rises the cost of operationthe plant on, which It would be partly funded by Rio Seco, Camacha31,000 to 77,000 weights do a tank truck loading. It should be noted that the Committee of Rural drinking waterthey are in talks with the direction of works Hydraulic to review the tariff issue.

In relation to the availability of toilets, in the town solid waste management was carried out mainly through drawer on cesspool by 40%. 30% of households had sewer, while 20% had septic and 20% had no availabority of toilet service. It should be noted that in field work, it was found that currently Cove has no sewer system, so most homes boast cesspool and septic.

Table 3-149. Availability of Service Hproducts, Dry river.

Categories	Cases
Connected to sewerage	9
Connected to septic tank	6
Drawer on cesspool	12
It has no	3
Total	30

NSA: 92

Source: Census of population and housing 2002, INE.

Based on census data from 2002, the index of sanitation, which corresponds to the intersection of the variables of toilet facilities and the location of water in relation to housing, was Deficitario due to the predominance of drawer on cesspool in Rio Seco.

Across levels of materiality, sanitation and housing type, we get that in 2002 the Global quality index of the housing in Rio Seco was recoverable.

Table 3-150. Table of contents Global quality housing, Dry river.

<table>
<tr><th>Index</th><th>Dimension</th><th>Category</th></tr>
<tr><td rowspan="2">Type of housing</td><td>Type of housing</td><td>Acceptable</td></tr>
<tr><td>Index type of housing</td><td>Acceptable</td></tr>
<tr><td rowspan="4">Materiality</td><td>Materiality walls</td><td>Acceptable</td></tr>
<tr><td>Materiality floor</td><td>Acceptable</td></tr>
<tr><td>Materiality ceiling</td><td>Acceptable</td></tr>
<tr><td>Index of materiality</td><td>Acceptable</td></tr>
<tr><td rowspan="3">Sanitation</td><td>Availability of water</td><td>Acceptable</td></tr>
<tr><td>Availability of toilet facilities</td><td>Deficit</td></tr>
<tr><td>Index of sanitation</td><td>Deficit</td></tr>
<tr><td>Global quality</td><td>Table of contents Global quality of housing</td><td>Recoverable</td></tr>
</table>

Source: Own elaboration based on data from the Census of population and housing 2002, INE

3.8.6 Conclusions

The characterization of the main demographic, social, economic and socio-cultural aspects of the human milieu, was carried out in relation to the territories identified as an area of influence of the project, defined in three sectors: Sector Pampa and plateau, Coast area: Caleta San Marcos and Sector Costa: Caleta dry river. It should be noted that you for the characterization of the human Middle baseline, Sector Pampa and the plateau Sector were characterized as a whole, due to their similar characteristics and the non-existence of human settlements. On the other hand, the coast sector was subdivided inRe two populated entities, whose characterization warranted an individual description.

General, the main findings of the baseline are the following:

Pampa and S sectorEctor plateau

The sectors defined as Pampa and plateau are located in the Tarapacá region, on thes communes Iquique and Pozo Almonte. In the area not be He identified the presence of human settlements. The population existing in these sectors corresponds to employees of mining companies, linked to the exploitation of salt, in the Great Salt Lake. The identified companies, include the eompany minera Punta de Lobos, Tenardita and Kainite.

The main route of access to the area is the route to - 750, that is in fair condition of coStates and has a flow vehicle compound trucking of freight and trucks belonging to different companies related to mining activities

In the area s can be identifieditios of historical importance, as the foundations ofl lifeline of the Holding company Punta de Loboswhich ran until 1956, and eCemetery of the former Office l Nitrate Bellavista.

To not count on human settlements and the unique presence of workers linked to the mining, the area of influence has no schools, health services, housing and Neither basic services.

Coast area: Caleta San Marcos

La Caleta San Marcos is located in the Region of Tarapacá, province of Iquique, in the commune of Iquique and part of the rural area of the commune. Is It is on the coast, at km 305 of route A-1, to the South and Southeast of the Bay Chomache, 108 kilometers to the South of the city of Iquique.

The main and only access to the San Marcos Creek route is route A-1, joining the litoral of Tarapaca and Antofagasta regions, from Iquique by the North to Antofagasta to the South. The route is paved, one via and in good condition. The Interior of the Cove roads are Earth.

With regard to public transport, the population of the Cove, as well as most of the coastal sector of the South of Iquique, uses the "caletero" bus, bus that travels through the route A-1, passing through all the villages from Chipana until Iquique, dos twice a day (one way and return), of Monday to Saturday. In addition, the population is mobilized by private car or interprovincial buses.

Caleta San Marcos is currently distributed in two sectors: "La Caleta", oldest and sector aledaño to the caleta of divers and fishermen, which corresponds to intakes not regularized; and "Villa San Marco" or "the other side", located to the East of the route A - 1, sector in which new buildings of la caleta, regularized land have been built and where plans to install the population who currently lives in "La Caleta". Both sectors are located adjacent to route A-1.

Relative to the population of the town, sccording to the Census of population and housing in the year 2002, the Caleta San Marcos had that year a population of 141 inhabitants, of whom 87 were men (61.7%) and 54 women (38.3%). The highest proportion of men registered that year, is directly related to the extractive activity carried out in the sea.

Notably, during the last decade, Caleta San Marcos has experienced a sustained growth of its population. According to the survey carried out by the company Espejo de Tarapacá, the town of Caleta San Marcos is 345 people, which would double the figures delivered by the 2002 census.

The formation of the settlement is given by the permanent and temporary residence of people at the Cove, with one higher proportion of families who have settled and who reside permanently in the town. In quantitative terms, andl the company registry Espejo de Tarapacá records to 282 of 345 people, as permanent residents, which is equivalent to 82% of the total population. On the other hand, en recent years, the rise of the huiro encouraged the arrival of foreign population in the area, in search of job opportunities. Specifically in Caleta San Marcos, Bolivian and Colombian population resides.

From a historical perspective, loccupation of the zocoastal na South of the current PIquique rovincia has been determined by the marina specialization since pre-Columbian times. The vestiges of the chinchorro culture and chango culture designated as human has occupied these lands, rich in marine such as fish, shellfish, sea lions and birds, becoming specialized collectors of these resources. Currently, this specialization is the main productive activity of the populations that inhabit the coastline, specifically Caleta San Marcos.

For a time prolonged, Caleta San Marcos was a sector occupied seasonally by divers mariscadores and fishermen who settled temporarily in place during the extraction of resources. During the 1980's and 1990's, gradually settled to live permanently divers mariscadores and fishermen and their families. The main difficulties of the families who began to settle in the Cove were isolation and the lack of fresh water. What is now route a-1, then was a dirt road where he occasionally spent only a vehicle.

The origins of the inhabitants of la Caleta San Marcos, are diverse: come from the South of Chile, in cities as far away as Talca and Linares, as also of the Coquimbo region, of the communes Coquimbo and Los Vilos. Likewise, a major contingent of the population is a native of Iquique and Alto Hospicio. Different origins are not contrasted with belonging and identification with San Marcos, with identity "nated", which is in turn related to identification with the sea and with the construction of the settlement.

Notably, lrelationship that has the population of the caleta San Marcos with the natural resources of the marine environment is deep and close as the town life revolves around the sea and the resources that are found there. The vast majority of the inhabitants live from any activity linked to the sea and the exploitation of its resources: whether it is scuba diving, fishing or collecting fish, shellfish and algae; whether processing such products, for example the crabs, or selling them. The population of the Cove that works at sea has a knowledge of the environment, incorporating a cyclic vision of its reproduction. Thus it is also concerned about its conservation and sustainability, related mainly to avoid the over-exploitation of resources to allow its reproduction and thus ensure the presence of life for the future marina.

Caleta San Marcos are collectively celebrated national holidays, Christmas and new year festivities. For Christmas and new year both Fiestas Patrias celebration is carried out on the premises of the former school, located in the sector of "La Caleta", and they are organized by the Junta de Vecinos.

The religious holiday of utmost importance, is the celebration of San Pedro, Patron of fishermen, on the day of his birthday, 29 June. The year 2013, after seven years, the celebration was accompanied by a religious dance of Iquique, invited by the neighborhood Council and the Union of independent workers, artisanal fishermen, divers, fishermen and helpers of Caleta San Marcos. For the celebration is decorated the Cove and their boats and sea conditions permitting, the procession is carried out by sea. The celebrations include a mass and na celebration in the evening.

In la Caleta San Marcos there are various social organizations: the JunMt neighbour Caleta San Marcos, which It has 160 members registered and approximately 20 partners involved actively; the Union of self-employed artisan fishermen, divers, fishermen and helpers of Caleta San MarcosWhat has 45 partners assets; the Vivien CommitteeIt gives entrepreneurs of San Marcos, to has 35 members inscribedyou and was formed in 2008; the seaweed fields and Apnea divers, Union formed the year 2014; the Committee of Rural drinking water, which is waiting for the resolution that grants legal personality; and the Club Deportivo San MarcosWhat It organizes sporting events involving both inhabitants of San Marcos, and neighbouring coves.

In relation to the presence of indigenous population, in Caleta San Marcos were identified 19 people who conform to some indigenous people (mostly to the Mapuche and to a lesser extent to the diaguita), corresponding to 5.5% of the total population. The existence of organizations or communities of indigenous character at the Cove was identified. Also special cultural links, an ancient tradition with the natural resources of the sector to maintain or develop activities carried out on the occasion of their indigenous status that are a manifestation of their worldview.

With respect to productive activities, as already noted, lextractive activity in the sea it is of greater importance in the town. Diving activities, fishing and gathering of huiro are the main economic activities of Caleta San Marcos, to which one must add cleaning and preparation for the sale of some products of the sea, and drying, / machining and export of huiro.

The identified area of exploitation of benthic resources extends from Punta de Lobos North to Punta Blanca South, 5 kilometres north of Chipana. Between Punta de Lobos and whitetip are different areas particularly used for diving and collecting seaweed. The most important: Waira, Mice, Rails, hat, Bajeria San Marcos, the Huatacas, The machine, the Devil's mouth and Huanillos from North to South. In addition, members of the trade union handle a Area of Management of resources (benthic)AMERB). The importance of the AMERB lies in the possibility of having a controlled space of exploitation, allowing to ensure the reproduction of living aquatic species.

It should be noted that lavailability of marine resources, demand and market value determine which product is extracted. Mariscadores divers collected mainly octopus and crazy, when these resources are not in veda, being those that generate revenue. The main products are insane, the Locate, choro shoe, the crabthe hedgehog. Working boat, earnings are divided between the owner of the boat, the diver and the wizard, there are different forms of distribution.

The extraction of the huiro had an increase from 2010 is increased when the price of algae, rising 50 to 350 pesos per kilo in three years. The high price that has the huiro has led to a large number of people engaged in this work and has become an important resource paRA local revenues. En some cases This activity is complementary to the entry of mariscadores divers. Working alone, people can be drawn around 100 kilos per day, although usually working couple picking up to 300 kilos a day. The black huiro is the most demanded, by its greatest value. Also removed the bat-huiro and the huiro Macrocystis. To sell huiro to a processing plant every collector needs to have a permit register fishing craft (RPA) delivered by Sernapesca. In la Caleta San Marcos is a processing plant huiro buy from collectors and plants of Chipana and Río Seco, and sold to different regional and international companies.

There are different in the sector of the San Marcos AMERB aquaculture Awards, 7 of which have already been granted. The rest are still in the application process or with approved project application process. Up to July 2014, none of the concessions had been exploited.

With respect to the Basic Social Welfare, cfin San Marcos account with elementary school annex school Thilda Portillo Olivares, better known as school San Marcos. She teaches pre basic education and basic education, from first to eighth grade, with multi-grade rooms. It is a rural settlement of municipal unit, administered by the Municipal Corporation for Social Development (COMPUTABLES), through its Directorate of education. The majority of children who attend the establishment are Caleta San Marcos, also taking students of Río Seco, Playa IKE IKE and Chipana. At the end of the 8th year of basic education, seeks tuition for students in the educational establishments of the city of Iquique, mainly in technical schools. In Iquique, students must reside in homes of relatives or find accommodation whether rented, in boarding schools or opting to households that receive students from rural areas.

San Marcos has a post of Rural Health, inaugurated in 2012. Is in charge of delivering health services to the populations of San Marcos, Rio Seco and Chipanaserving a total of 800 people about.

As for electricity, the eastern sector of the town has such service 24 hours a day seven days a week since the installation of the electricity from the company Eliqsa. Implementation of light in this sector allowed the community engine transfer to the sector of the Creek to deliver light to 45 homes with permanent residents.

The supply of drinking water is done by truck tank and there is no mains supply. The truck is facilitated by the city of Iquique, while water is purchased by residents to the Highlands Water drinking water company. There are problems with the distribution the water, which sometimes does not reach the Cove on the stipulated dates. Notably, the formation of the Committee of Rural drinking water, which has projected the installation of a glass of water for the distribution of the resource. San Marcos is dominated by the use of drawer on cesspool and septic.

Coast area: Caleta dry river

Dry river It is located in the Region of Tarapacá, province of Iquique, in the commune of Iquique and is part of the rural area of the commune. Is It is located on the coast, 3 km20 of route A-1, 95 kilometers to the South of the city of Iquique.

The main and only path to the Cove Dry river is the route A-1. The route is paved, one via and in good condition. The Interior roadspray of the Cove are of Earth, with the exception of the main street located in the sector of Río Seco ancient, which is cobbled.

Dry river was formed as a village, first as a settlement linked to the company's exploitation Punta de Lobos (until the 1950s) and subsequently as a Cove of divers, fishers, and gatherers, from the Decade of 1980.

Currently, the distribution of the settlement distinguishes different sectors: the sector of the sons of Río Seco River dry or old, located north of the populous sector; the sector of Los Pescadores or rise of the fishermen, in which they have their homes and title divers and fishermen who occupied the Cove from the Decade of 1980; and the sector of Rio Seco Alto, also known as Los Corrales, located south of the populated sector and belonging to families who have their second homes in the hamlet, dealing them a recreational purpose.

With regard to public transport, the dynamics of the population of the Cove, It is similar to that experienced in San Marcos, using mainly the vehicle particular and the "caletero" bus.

According to the Census of population and housing of the year 2002, Dry river teathat year the ICC 71 inhabitants, of whom 42 were men (59.2%) and 29 Women)40.8%). The highest proportion of men registered that year, is directly related to the extractive activity carried out in the sea. As in San Marcos, Rio Seco It has experienced a growthbreach sustained its population, particularly by the arrival of people interested in the huiro collection.

A significant proportion of inhabitants residing in Rio Seco comes from the IV Region, mainly of Tongoy.

A vital aspect in the dry river is his past as a port and the Punta de Lobos exploitation company office. As a testimony of that era, are sites of relevance, such as the ruins of the infrastructure of the company, as the cemetery of the village, which currently can not be occupied as such, does not have the necessary permissions.

In Dry river is celebrate religious festivals such as the feast of the Virgen, San Lorenzo and San Pedro. En eStas three festivals, processions, which counted with the participation of Chinese dances are performed. Another important event is the anniversary of the town, with guest artists, challa, burning of monkeys, among other activities

At the same time, there are various social organizations in Rio Seco: Board of neighbors, a syndicate of divers and fishermen, the Organization "Hijos de Río Seco", a Committee of Rural drinking water and a Sports Club.

With regard to the presence of indigenous population, in Caleta Río Seco the existence of organizations or indigenous communities, as well as nor people that signatory to any indigenous people was not recorded.

It should be noted, that as in San Marcos and most of populations that inhabit the coastal, en today, the specialization and I work on tasks of the sea, constitutes an of the mainES activityES productives of Dry river. Currently, lactivity huiro collection It is of greater importance in the town. The higher profitability of the resource by its high price and extraction facilities, have been favored in its extraction and procesING, exist in Río Seco three plaNTAS huiro, being only an active processing.

On the other hand, members of the trade union handle three Areas of Management of resources (benthic)AMERB), which are looked after by a guard employed by the Union.

In relation to the Basic Social Welfare, access to education, students of Río Seco must go to elementary school annex school Thilda Portillo Olivares cSan fin Marcos. With regard to access to health, go to the Rural health post of San Marcos, or failing that to the of Chanavayita.

The supply of drinking water is done through the Rural drinking water Committee, While electricity is delivered through laying power provided by the company Eliqsa. For the disposal of excreta predominant use of drawer on cesspool and septic.

3.9. Projects with RCA in the area

3.9.1 Objectives

Mention all the Projects that have resolution of environmental qualification, even when they are close to the area where they develop the Project

3.9.2 Methodology

To identify the Projects environmentally approved close to the Project We used the search service of Projects environmental impact assessment service[52], where you can access the records of the Projects, by performing a search by Region, being possible to download such information in KMZ format.

A search was conducted of Projectapproved s from the year 2007 to November 2013whereas those Projects that were found in an area of influence of 3 kilometres of the Project

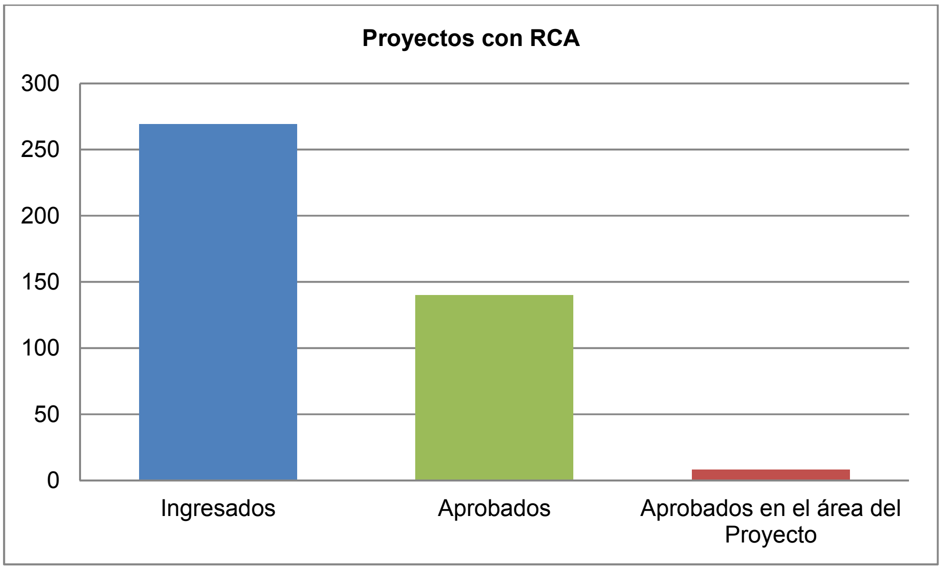
3.9.3 Results

Within the study area were identified 8 Projects approved between the year 2007 and 2013.

These Projects are located mainly in the sector of la Caleta San Marcos, being mainly related to fisheries and aquaculture. It is worth mentioning that aquaculture concessions are not in use.

[52] http://seia.sea.gob.cl/busqueda/buscarProyecto.php

Figure 3-288. Projects admitted to the SEIA in the Region of Tarapacá.



Source: SEIA, 2014.

The pprojects identified in the study area is muestran in the Table 3-151 and Figure 3-289. Greater detail as regards the characteristics of each one of these projects is presented in the Annex 3.7.

Table 3-151. Projects with RCA.

N °	Name	Holder	Investment ($MMU)	Presentation date	Date RCA	Productive sector	Life expectancy (years)	Description
1	DAY extraction aggregates for Improvement of route A-760, Dm 13.500,000 Dm. 34.400,000, and other ways. Former Industry - Office Victoria, commune of Pozo Almonte, the Tamarugal, región De Tarapacá province	Constructora SALFA S.A.	0,1980	14-Dec-11	10-APR-12	Other	0.8	The project corresponds to the extraction of aggregates in the commune of Pozo Almonte, specifically on the inner edge of the Pampa del Tamarugal national reserve. Considered a total area of 4 hectares, 3 of them for exploitation aggregates, with a total volume of extraction of 45,000 m3 of material (4,500 m3/month) over a period of 10 months.
2	DAY conservation draught Caleta San Marcos	Ministry of public works	3,5382	10-nov-10	09-mar-12	Hydraulic infrastructure	20	The project will be implemented in the commune of Iquique, sector Caleta San Marcos, approximately 105 kilometers south of the city of Iquique in the Bay of Chomache. The removal of approximately 7,500 m3 of marine sediment accumulated in excess in an area of 2,147 m2 is considered. Afterwards, will be a dredging of maintenance of same characteristics every 5 years, so it should be extracted a total of 37,000 m3 of multicyclone.

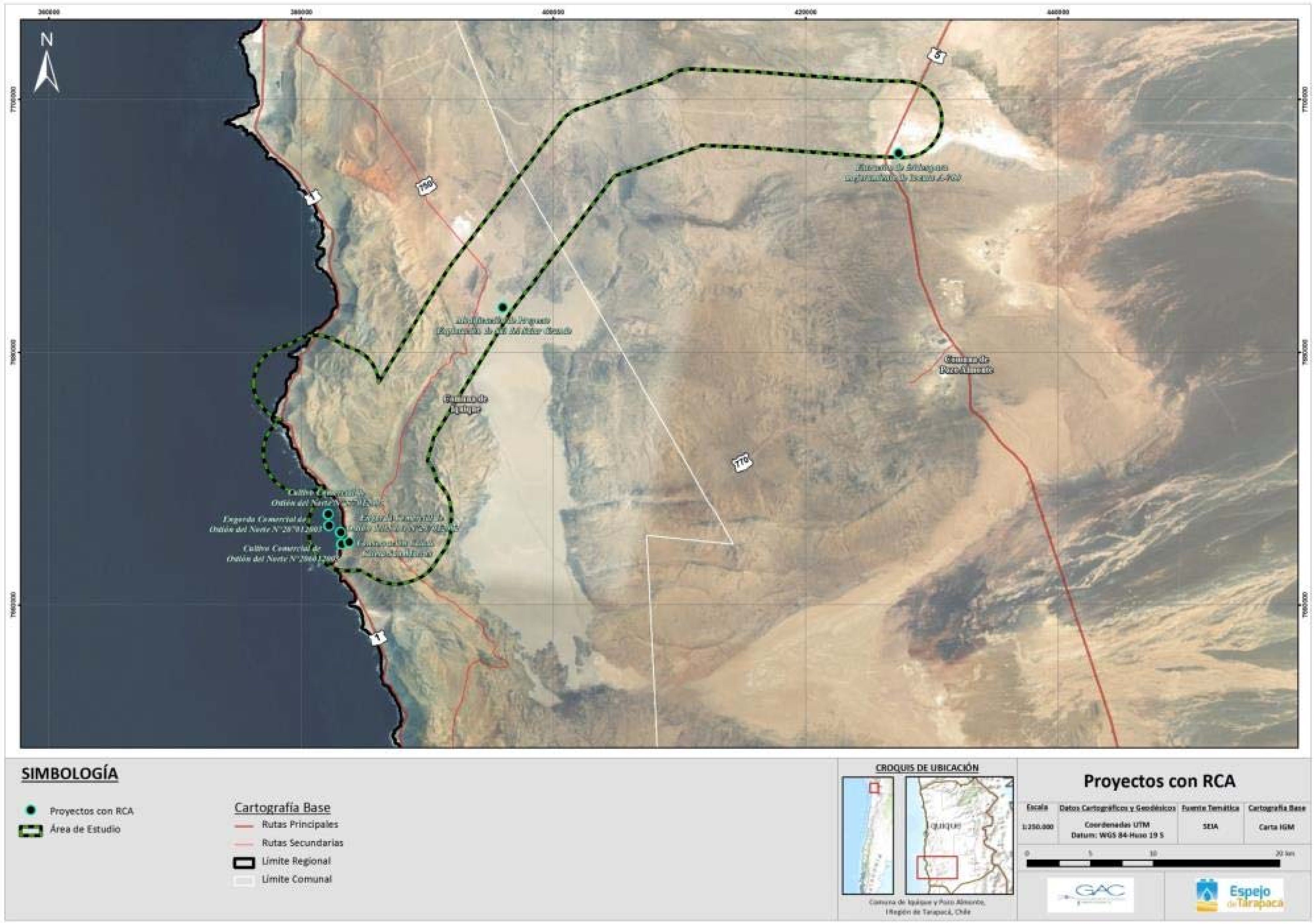
N °	Name	Holder	Investment ($MMU)	Presentation date	Date RCA	Productive sector	Life expectancy (years)	Description
3	Modification of project exploitation of salt of the Salar big day	Compañía Minera Andes Chile SCM	10,1832	15-oct-09	13-Apr-10	Mining	15	The project corresponds to a modification of the project of mining company mountain range "Exploitation of salt of the Salar Grande", currently in operation, through which it has an authorization of exploitation of 1,000,000 tons per year of salt. The modification consists in increasing the level of production from 1,000,000 to 3,000,000 tons per year ton/year.
4	DAY commercial cultivation of oysters from the North)Argopecten purpuratus) And Huiro (black)Lessonia nigrescens) In the Sector of Caleta San Marcos, Iquique - Region I (application No. 207012005)	PANMAR LIMITED COMPANY	0,2500	06-jul-09	20-nov-09	Fisheries and aquaculture	30	The project consists in the installation, commissioning and subsequent operation of a center of culture in the sea for grow-out commercial seed oysters from the North and newly germinated plants (seedlings) of the black huiro resource. Installation of the Culture Center will be located on a surface portion of water and bottom of sea, in the area called Caleta de San Marcos.

N °	Name	Holder	Investment ($MMU)	Presentation date	Date RCA	Productive sector	Life expectancy (years)	Description
5	DAY commercial cultivation of oyster Cove North of San Marcos, Iquique - Region I (application No. 207012003)	Private corporation for the development of the UNAP	0,2700	13-may-09	05-sep-09	Fisheries and aquaculture	30	The project consists of the installation and subsequent operation of a center of culture in the sea for the engornda commercial seed oysters from the North. Installation of the Culture Center will be located on a portion of water and bottom of sea, in the North of Caleta San Marcos.
6	DAY fattening oysters from the North in the area of Caleta San Marcos, Iquique - Region I (application No. 207012002)	Private corporation for the development of the UNAP	0,3500	13-may-09	25-sep-09	Fisheries and aquaculture	30	The project consists of the installation and subsequent operation of a center of culture in the sea for commercial seeds of North Oyster fattening. Installation of the culture Centre will be sited on a portion DEA Gua and bottom of sea, in the northern part of the San Marcos Creek.
7	DAY commercial oyster culture of the North in the area of Caleta San Marcos, Iquique - Region I (application No. 206012005)	Juan Domingo Bruna Bruna	0,1400	06-mar-08	17-jul-08	Fisheries and aquaculture	30	The project consists of the installation and subsequent operation of a center of culture in the sea for commercial seeds of North Oyster fattening. Installation of the Center culture will be sited on a portion of water and bottom of sea, in the area called Caleta San Marcos, located 110 Km to the South of the coastal of Iquique.

N °	Name	Holder	Investment ($MMU)	Presentation date	Date RCA	Productive sector	Life expectancy (years)	Description
8	DAY grow commercial scallop from the North in the area of Caleta San Marcos, Iquique - Region I (application No. 206012006)	Raul Edson channels Zabala	0,3200	06-mar-08	17-jul-08	Fisheries and aquaculture	30	The project consists of the installation and subsequent operation of a center of culture in the sea for commercial seeds of North Oyster fattening. Installation of the Center culture will be sited on a portion of water and bottom of sea, in the area called Caleta San Marcos, located 90 Km to the South of the coastal of Iquique.
9	EIA of new quarry area victory	SQM S.A.	14.400.00	24-09-07	22-may-08	Mining	11	The project is located in the commune of Pozo Almonte and consists in the incorporation of 140,01 km2 of new areas of mine to sustain the current production of iodine plant new victory.

Source: SEIA, 2014.

Figure 3-289. Projects with RCA in the study Area.



Source: Own elaboration.

3.9.4 Conclusions

- **SECTor works surface Costa**

In the area study only 5 were identified pprojects. These pprojects are vinculadosa to the activity of fishing and aquaculture developed in la Caleta San Marcos, highlighting fattening oysters in the North.

- **SECTor PAMPA**

The pprojects identified in this sector are 3, Improvement of the route A-760, Modification of Project Exploitation of large Salt Lake salt and new quarry area victory. Most of these are industrial nature, or are linked to the accessibility of these industrial areas (as it is the case of the improvement of routes).

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