ANNEX 9
REPORT ON LAND USE AND SOIL QUALITY

CONTENTS

1 INTRODUCTION

This report contains the environmental information for the SOIL component, as well as a description of the soil series and phases that can be found in the area of the Project "Electricity Transmission Lines S/S Maitenes – S/S Alfalfal and Central Alfalfal II – S/S Alfalfal." Also presented herein are the classes of land use capacity, drainage and fruit tree suitability. As a complement to the above, land use is also described. This has been followed by a territorial analysis of the lands involved through a review of current regulations and legal provisions related to land use.

The Project will be constructed in the Colorado Canyon, which contains the Colorado River, and is located in the northeastern sector of the Municipality of San José de Maipo, in Cordillera Province of the Metropolitan Region of Santiago.

2 OBJECTIVES

The objectives of this study are to:

- Identify and characterize the land uses and land use capacities present in the Project area.
- Identify land use regulation in force in the Project area
- Identify potential impacts that the Project' construction and/or operation may generate on this environmental component
- Propose, where appropriate, Mitigation, Restoration and/or Compensation measures for the impacts identified

3 METHODOLOGY

A work methodology was developed to achieve the abovementioned objectives that combined office work with fieldwork, in the following sequence:

- Office Work 1: During this stage the Project area was studied, identifying the agro-ecological zone in which the new transmission lines, their access points, and possible approaches to the towers indicated in the Project would be located. Available edaphological (soil) and land use information was collected. Once this was analyzed and studied, the fieldwork was planned.
- Field work: Two on-site visits were made to walk along and observe from Route G-345 the vertices included in the planned transmission line. At all points possible the field workers approached the vertices, took photographs and noted the edaphological situation, complementing this information with a description of land use, the landscape and vegetation. Each of the observation points were located by GPS to establish their relation

to points on the transmission line. The Los Maitenes and Alfalfal substations were also visited, and the facilities toured.

- Office Work 2: Based on the work undertaken in the two preceding stages (Office Work 1 and Field Work), the team proceeded to carry out an analysis of all of the information obtained. The potential impacts that the Project's construction and operation could generate on soil resources were identified. To complement this, the territorial planning information was analyzed as well as the relation of these instruments to the Project. This report contains the results of the work undertaken in the three stages described above.

To identify and characterize the land uses and land use capacities of the Project area, the land was described from an edaphological perspective, taking into consideration the characteristics that enable the establishment and development of plant species, both natural and agricultural. Information on the descriptions of soils contained in the Agricultural Study of the Metropolitan Region (CIREN-CORFO, 1996) was used as base information. In particular, information related to the grouping of soils into series and phases was reviewed, along with the Land Use Capacity classification. Similar soil units denominated "Series" or "Associations" were characterized in terms of their material of origin, physical-chemical properties, horizon sequences and common limiting factors.

This information was complemented and verified by field visits conducted on December 7 and 14, 2008. At that time the field team visited the line, observing the location of the vertices from the road and/or entering properties when possible. In this way they were able to verify the existing correlation between the information provided by the Agrological Study and what was observed on the lands that could potentially be affected by the installation of the transmission towers. In addition, the field team described the current land uses, which included wild native vegetation, general wilderness, forests and/or agricultural areas.

The characterization of potentially affected lands was carried out taking into account the land's usage capacity, or its capacity for agricultural and/or livestock production; this is classification scheme indicates the land's relative adaptability to certain crops, as well as difficulties and/or risks that could be encountered when using those lands. Lands with limitations that can be corrected are classified according to permanent limitations or those that continue to present a risk of damage to the soil. There are eight conventional classes used to define Land Use Capacity, each designated with a roman numeral (I to VIII) and organized in increasing magnitude of the limitations to their use and risk of harm to that use.

To define the land use situation of the stretch on which the transmission lines will be located, the Metropolitan Santiago Master Plan of 1994 and its modifications were reviewed. It is important to note that the municipality of San José de Maipo has no land use plan in place, and therefore the abovementioned stretch will be analyzed in terms of the General Planning and Construction Ordinance (OGUC).

4 DEFINITION OF THE AREA OF INFLUENCE

For this component, the Area of Direct Influence (AID) was deemed to be the Project implementation zone, which is:

- The line from S/S Maitenes – S/S Alfalfal, 7.6 km long, and the 30-meter buffer zone.

- The Line between Central Alfalfal II – S/S Alfalfal, 9.5 km long, with its 40 meter buffer zone.
- The area of expansion of S/S Alfalfal.

5 LAND USE CAPACITIES

The lands in the Project's area of influence belong to the valley formed by the Maipo River and consist of soils of alluvial, colluvial and/or mixed origin. Miscellaneous rivers (MR) and Stratified alluvial terraces (TE) correspond to lands that are occasionally used for small scale agricultural production owing to their inherent capacity for retaining water and their mainly coarse textures.

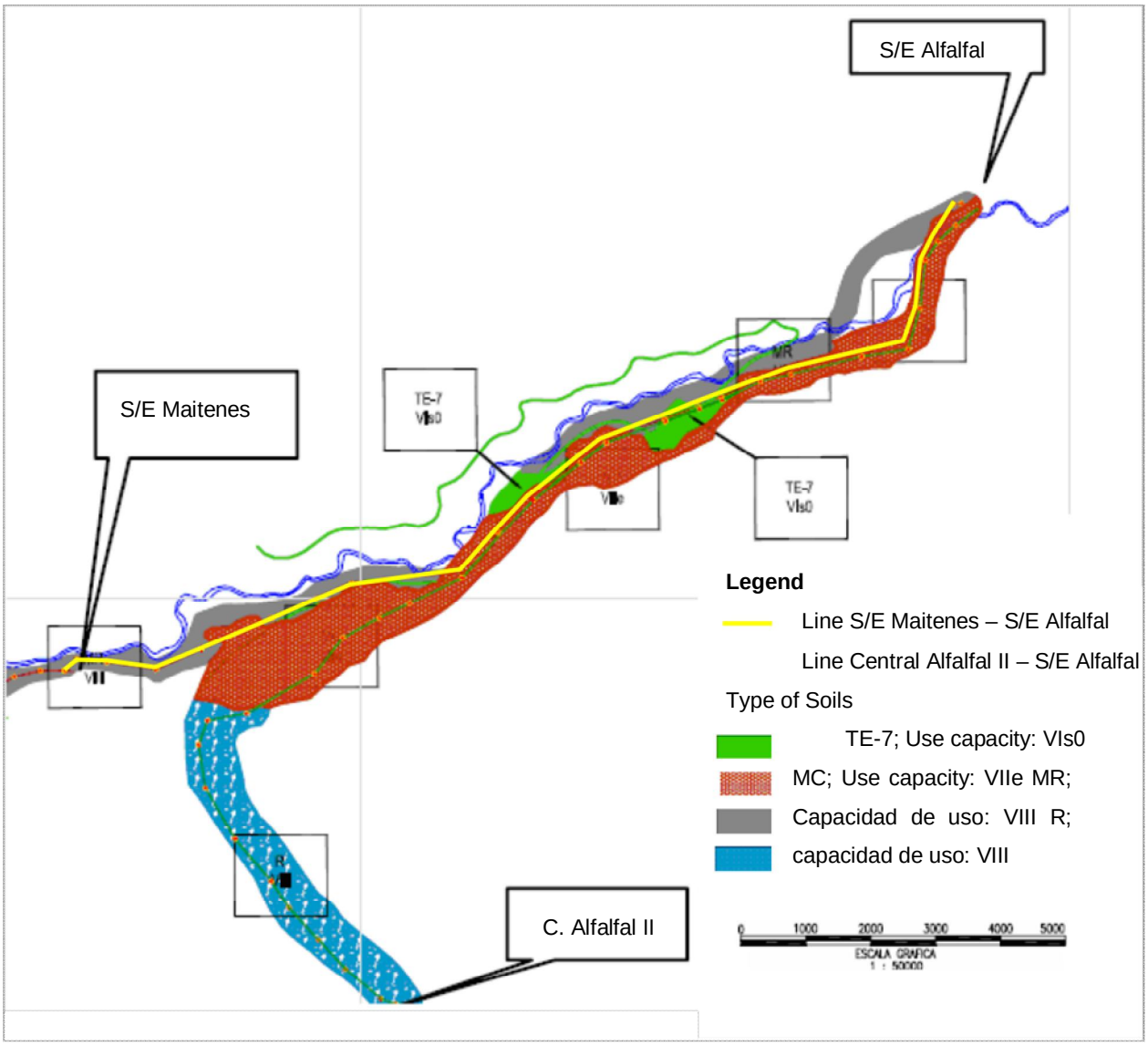
Based on information available in CIREN, the Project area includes three soil series, all located on hillsides and terraces formed by the Colorado River. Their land use capacities range from categories VI to VIII. Other areas identified have not been assigned a land use capacity as they correspond to the waterway itself.

The types of soils identified are:

- Miscellaneous colluvial
- Miscellaneous river
- Stratified alluvial terraces (TE-7)

The location of different kinds of soils and land uses in the Project area can be observed in the following figure.

Figure 1: Soil series and land use capacities in the Project area



Source: Prepared by the authors.

5.1 Miscellaneous soils

Miscellaneous soils include the variations Miscellaneous colluvial (MC) and Miscellaneous river (MR), which are described below.

5.1.1 Miscellaneous colluvial (MC)

These are broken, rocky lands that form fans in middle and lower hillsides and mountainsides. They consist of unconsolidated gravel, stones, and rocks strewn haphazardly, with a matrix that is fine sand to sandy-loam in texture. They are classified as:

- Land use capacity: VIIe

- Drainage class: 5
- Irrigation class: 6
- Fruit suitability: E
- Erosion: 1
- Agricultural Suitability: 7

5.1.2 Miscellaneous river (MR)

These correspond to lands on a recent alluvial terrace, with little soil profile development and a high content of gravel and rocks and scant shrub vegetation. These are classified as:

- Land use capacity: VIII
- Drainage class: 6
- Irrigation class: 6
- Fruit suitability: E
- Erosion: 0
- Agricultural suitability: 8

5.2 Stratified alluvial terraces (TE)

These correspond to stratified soils located on recently formed terraces of rivers, streams and watercourses in the Metropolitan Region.

5.2.1 TE-7

This category corresponds to thin, flat stratified, sandy textured soils with moderate surface rocks and excessive drainage, and subject to occasional flooding. They are classified as:

- Land use capacity: VIs0
- Drainage class: 6
- Irrigation category: 5
- Fruit suitability: E
- Erosion: 0
- Agricultural suitability: 6

5.3 Summary

Based on the review and analysis of information collected about the zone, three soil types were identified among the soil series defined and miscellaneous soils. These are outlined below:

Table 1. Soils identified in the Project area

Soil	Phase	Land use capacity	Drainage class	Irrigation category	Fruit suit-ability	Erosion	Agric. suit-ability
Miscellaneous colluvial	MC	VIIe	5	6	E	1	7
Miscellaneous river	MR	VIII	6	6	E	0	8
Stratified alluvial terraces	TE – 7	VIs0	6	5	E	0	6

Source: Prepared by the authors, based on information from CIREN-CORFO (1996).

In all of the soils identified, severe limitations to usage can be observed, mainly owing to their low development and low water retention, excessively steep slopes, low soil depth and excessive rockiness, among other aspects.

6 AGRICULTURAL LAND USE

The municipality of San José de Maipo has a total of 12,800 inhabitants and covers an area of 4,989 km2, occupying close to 90% of the area of Cordillera Province, and more than 30% of the total area of the Metropolitan Region.

The municipality is situated in the upper Maipo River basin, the principal water basin in the Metropolitan Region. Because of the extensiveness of the upper Maipo basin, the area houses the main water reserves of the Metropolitan Region. At the same time it is a major flora and fauna reserve. Its scenic landscape and proximity to the city of Santiago have enabled the development of tourism in the municipality in all seasons of the year as well.

Both in the past and today, the area has also hosted large-scale mining operations, initially related to gold, silver and copper, but today mainly based on extraction of non-metallic minerals such as limestone and gypsum.

In all, 73% of the municipality's territory consists of high mountain lands, where soil development as such is virtually absent, except for a relatively undeveloped rocky substrate. The remaining 27% corresponds to an area of 122,079 ha, in which the soil evidences varying degrees of development. The land area with its corresponding uses is presented in the table below.

Table 2. Land use in the Municipality of San José de Maipo

Land Use	Area (ha)	Percentage
Annual and perennial crops	736	0.60%
Forage	446	0.36%
Fallow land	170	0.14%
Improved grasslands	743	0.61%
Natural grasslands	14,452	11.84%
Forestry plantations	273	0.22%

Native forest	26,722	21.89%
Scrubland	77,891	63.80%
Infrastructure	647	0.53%
Land Use	**Area (ha)**	**Percentage**
Total land	**122,080**	**100.00%**

Source: Prepared by the authors based on information from the Agriculture, Livestock and Forestry census (2007).

As the table above shows, the main land uses in the municipality are scrubland, native forest and natural grasslands, in decreasing order of importance. Scrubland occupies 64%, followed by native forest with 22%, and natural grasslands with 12%.

Land uses involved in the Project correspond primarily to zones with natural vegetation, most of which are covered with native species that are part of the sclerophyllous formation of Central Chile (scrubland, native forest, and natural grasslands). Occasionally it is possible to find introduced species growing wild, as well as some cultivated crops.

The vegetation that covers the section of land running between S/S Maitenes and S/S Alfalfal is described below:

Table 3 Formations and/or species present in the section between S/S Maitenes and S/S Alfalfal

Location	Formation and/or species present*
Tower 23	quillay, bollen, pimiento
From Tower 23 to in front of Tower 34 (next to the Colorado River)	bollen, cactus, quillay and acacia
From Tower 34 to Torre 40 (both near the Colorado River)	alfalfa
In front of Tower 40 (near the Colorado River)	quillay, colliguay, bollen, cactus, romerillo
In front of Tower 42 (near the Colorado River)	acacia, quillay, bacaris, palqui
S/S Alfalfal Sector	quillay, maitén, bollen and olmo can be found in the surrounding area.

*__Scientific names__: quillay (*Quillaja saponaria*); romerillo (*Baccharis linearis*); acacia (*Acacia caven*); palqui (*Cestrum parqui)*; colliguay (*Colliguaya odorifera*); maitén (*Maytenus boaria)*; bollén (*Kageneckia oblonga);* cactus *(Echinopsis chiloensis ssp);* olmo *(Ulmus minor);* alfalfa (Medicago sativa); pimiento (Schinus molle).

Source: Prepared by the authors.

As the table above shows, land use here prioritizes wilderness protection, with only a small percentage of land used for livestock production, in the form of planted alfalfa fields.

Figure 2 Native forest and scrubland

Source: Prepared by the authors.

7 LAND USE REGULATION

In general terms, the Project is governed by the provisions of the General Planning and Construction Ordinance (OGUC) and the Metropolitan Santiago Master Plan (PRMS).

It is important to note that the municipality of San José de Maipo currently has no planning instrument that regulates land use within the territory, but is governed by the provisions of the General Planning and Construction Ordinance (OGUC).

7.1 General Planning and Construction Ordinance (OGUC)

This instrument enables the classification the different types of infrastructure involved in the Project, as well as limitations on the use of underlying land.

Article 2.1.29 classifies electricity transmission lines as energy infrastructure, and the same Article prevents the erection of constructions of any kind in the buffer strips or zones of these lines (Article 5.1.9).

The same Article 2.1.29 refers to land use planning instruments for rural areas, affirming that these kinds of installations shall always be permitted and the only requirements or conditions that may be imposed on them relate to the siting of the facilities and buildings required for this type of land use.

The Article also indicates that the distribution networks, communication networks, residential services and in general the footprints of this infrastructure will be understood to be always permitted

and shall be subject to the provisions established by the corresponding agencies. The land use planning instrument must recognize the buffer zones or strips set out in current legal provisions and maintain them as green spaces, roadways, or for other uses allowed by the aforementioned legal provisions.

At the same time, it also defines the buffer strip or radius (in its classification of zones or land uses generated by human activity or intervention, under which high voltage towers are included), as an area of risk because of the potential danger to human settlements (Article 2.1.17).

In relation to the land uses identified in the PRMS, the Plan only refers to Buffer Zones for resources of natural value (Article 2.1.18), and defines these as ocean, lake, and river shorelines, national parks, national reserves, natural monuments, high peaks and all natural areas or specific features that are protected under current legislation. In these sectors, it indicates that no-build or restricted-build zones will be established.

7.2 Metropolitan Santiago Master Plan

The land use situation in the Project area is governed by the Metropolitan Santiago Master Plan (PRMS), enacted in 1994. The lads are classified as Areas of Natural Value, and specifically Areas of Ecological Preservation.

In these Areas activities that are permitted include those that ensure the permanence of natural values. Uses are therefore limited to scientific, educational, recreational, sporting, and touristic ends, and only the minimal facilities and/or buildings necessary to accommodate those uses are permitted.

The provisions that will govern these activities and their complementary uses, such as safety installations, communication equipment, health and commercial facilities, and public parking, will be defined by the SEREMI (Metropolitan Region Secretary) of the Ministry of Housing and Urbanism in each case, taking into account the specific features and relevant studies approved by the corresponding agencies.

8 IDENTIFICATION AND ASSSESSMENT OF IMPACTS

Given the characteristics of the Project and the area in which it will be located, the impacts associated with the soil component will occur mainly during the construction phase.

8.1 Construction phase

8.1.1 Analysis of the environmental impact

Most of the Project area is located on land having land use capacities VI, VII and VIII, of little interest from an agricultural perspective but containing tree and scrub vegetation. This plant cover plays a crucial role in protecting the existing features of the soil, especially in areas with steep slopes.

As the Project includes pruning in accordance with forestry standards, which is also in accordance with regulation NSEG 5 En 71, an effort will be made to prevent the creation of bare land. This will prevent erosion due to climatic conditions, mainly precipitation.

8.1.2 Summary of environmental impact

In accordance with the characteristics of the soil resource presented for the area analyzed, the impact that will be generated on this component is related to the loss of land area in the area in which the tower foundations will be installed. The valuation and analysis of this is presented below.

Table 4 Valuation matrix for impacts. Land use and soil quality component. Construction Phase

MEDIUM: Physical		COMPONENT: Land use and soil quality					
ACTIVITIES	IMPACT	LOCATION	VALUATION				
			Ca	Re	Te	Ti	Mg
▪ Earth moving ▪ Construction of foundations	IS1: Removal and loss of soil surface area in the areas in which the foundations are sited.	Sites of Project's tower foundations	-	Irr	Per	Dir	Ba

VALUATION CRITERIA: Ca= Character [Positive (+), Negative (-)]; Re= Reversibility [Reversible (Rev), Recoverable (Rec), Unrecoverable (Irr)]; Te= Timeframe [Temporary (Te), Permanent (Per)]; Ti=Type [Direct (Dir), Indirect (Ind), Synergistic (Sin), Cumulative (Acu)]; Mg= Magnitude [High (Al), Medium (Me), Low (Ba)].[1]

Source: Prepared by the authors.

IS1: Removal and loss of soil surface in the areas of the tower foundations

As shown by the information presented in this Annex, an approximately 3 kilometer section of the line to be built between the Alfalfal II Power Plant and S/S Alfalfal is near the Aucayes Stream, where the soil resources consist of a much unevolved rocky matrix. A very thin incipient stratum of soil can be distinguished there that is not more than 3 cm thick. In the context of the resource being analyzed, owing to the virtual absence of soil suitable for agricultural use in that sector this area has been excluded from the assessment of this impact.

As a result, the impact of soil removal and loss of surface area associated with the construction of the tower foundations (derived from earth moving activities) will be more noticeable in flat areas that do have more evolved soil resources and a thicker stratum (up to 15 cm). However, in those sectors the soil use capacity reaches, in the best case, type VI, which means it could be used but with limitations, for forestry and/or grazing activities.

Notwithstanding the above, it is important to note that the Project intends to limit the areas in which the foundations will be built, in order to minimize the area of intervention and prevent undermining this resource unnecessarily, as well as the surrounding vegetation.

[1] Translator's note: All abbreviations and classification codes have been left in their original Spanish format.

These interventions will be of limited scope and will affect a total area of 0.9 ha approximately, considering the 61 towers in the line.

Therefore, this impact has been deemed to be *negative* owing to the effective loss of the resource, *irreversible* and *permanent,* as once the earth is moved and the foundations built, the soil will be lost. The type of impact is *direct* and its magnitude is *low*, as the surface area that will be lost will be limited in scope and area.

It is important to note that the areas associated with the S/S Alfalfal have not been taken into account, as this sector is already intensely affected by human activity.

In summary, this impact has been classified as MINOR NEGATIVE.

8.2 Operational phase

Among other activities, the operation of the Project includes the periodic pruning of the buffer zone, which is intended to comply with electricity regulations without damaging the existing vegetation in this sector. Based on information presented in Annex 2, this activity will be carried out in certain areas in accordance with forestry standards, in order to avoid cutting plant species in the buffer zone and may even foster improved vigor among those species.

Permanently maintaining plant cover in the Project area (pruning will allow this) prevents the soil from being exposed to erosive agents and therefore preserves soil quality. Therefore, the operation of the Project should not lead to the alteration of land use capacities originally identified (see Annex 9). From this perspective, it is deemed that the operation of the Project will not produce significant effects on this resource.

In summary, no impacts on the soil component have been identified for the Project's operational phase.

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[1] Based on information presented in Chapter 1, each tower will occupy an area of approximately 12x12 m. However, the effective area that the four foundations of each tower will occupy is even less: 13 m^2 (considering four foundations 1.8x1.8 m, which correspond to the anchored block that will be established on the transmission line running from the Alfalfal II Power Plant to the S/S Alfalfal).