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4 AREAS OF INFLUENCE

The area of influence of the Rumichaca - Pasto Divided Highway Project, San Juan Pedregal Segment, was defined, identified and delimited based on the terms of reference established for preparation of the Environmental Impact Assessment for construction of highways and/or tunnels, M-M-INA-02, Version No. 2, (ANLA, 2015), adopted by Ministry of the Environment and Sustainable Development (MADS for its acronym in Spanish) Resolution 751 of March 26, 2015.

The term 'area of influence' is understood as "such area where significant environmental impacts caused by project performance are evident on physical, biotic and socioeconomic components, in each component of such environment. The expression of these impacts must be objective and, to the extent possible, quantifiable, provided this is feasible, in line with methodologies available" (Ministry of the Environment and Sustainable Development - MADS, ANLA, 2014).

4.1 TECHNICAL CONSIDERATIONS

So as to define the area of influence of the Rumichaca - Pasto Divided Highway Project, San Juan Pedregal Segment, Concession Agreement under PPP Scheme No. 15 of 2015, consideration was given to the physical space to be occupied, whether permanently or temporarily, during construction of the entire road infrastructure, associated infrastructure, as well as adjacent spaces, performance of planned activities in the various stages according to project needs, requirements on use and exploitation of natural resources, abiotic, biotic and socioeconomic components, and the area where significant environmental impacts are evident, with a view to define one single limit on which components involved are analyzed.

The area of intervention of the Highway Project has an extension of 1.629,23 hectares located in the jurisdiction of the Municipalities of Ipiales, Contadero, Iles and Imués, in the Department of Nariño. The phases, stages and activities planned within the area are described hereunder in **Table 4.1**.

Table 4.1 Project Phases and Activities

PHASE	STAGE	ACTIVITIES
PRE-CONSTRUCTION	PRE-CONSTRUCTION	Land and right of way negotiation
		Contracting and training of staff
		Mobilization of construction materials, consumables, machinery, equipment and staff
	CONSTRUCTION	Installation and operation of temporary infrastructure (camps, asphalt, concrete and ground material plants)
		Operation and maintenance of machinery and/or equipment
		Clearing and cleaning
		Demolition and removal of existing infrastructure in areas to be intervened
		Land movements (excavations and fills)
		Construction and operation of debris and excavation material management zone (ZODME)

PHASE	STAGE	ACTIVITIES
		Construction of hydraulic works (includes occupation of waterways)
		Preparation of base, sub-base and surfacing
		Preparation of bearing layer (asphalt base)
		Foundation and piloting for bridges and overpasses
		Construction of superstructure for bridges and overpasses
		Construction of pedestrian bridges
		Treatment of slopes
		Meadowing and revegetation
		Installation of toll
ABANDONMENT AND FINAL RESTORATION (LINKED TO CONSTRUCTION ACTIVITY PHASE)		Dismantling of temporary facilities and camps
		Final cleanup of intervened areas
		Landscaping management

Source: GEOCOL CONSULTORES S.A., 2017

Requirements concerning use and exploitation of natural resources for the project pertain to:

- Surface water concession for strips in the Guáitara River (1 strip), Boquerón River (1 strip), La Humeadora Stream (1 strip), Moledores Stream (1 strip), San Francisco Stream (1 strip), El Macal Stream (1 strip), Sapuyes River (1 strip)
- Purchase of water for industrial and domestic use by aqueducts or companies having authorization, availability and storage capacity
- Discharge of wastewater after being treated at spraying and/or infiltration fields, delivery to third parties and discharge into surface sources over strips in the Guáitara River (2 strips), Boquerón River (1 strip), La Humeadora Stream (1 strip), Sapuyes River (1 strip)
- Forest exploitation per each vegetation cover
- Use of stone and aggregate materials (quarry or drag materials), purchased from authorized third parties, and material obtained from cut and fill operations
- Atmospheric emissions from the concrete, grinding and asphalt operation

In keeping with the foregoing, demarcation of the area of influence stems from the following criteria:

- Analysis of activities to be performed in the Rumichaca - Pasto Divided Highway Project, San Juan Pedregal Segment Project, such as the magnitude and type of technical intervention, design of works and impacts linked to each component (abiotic, biotic and socioeconomic)
- Main features of the environment where project activities are to be undertaken, as regards: extension, relief, climate, hydrology, vegetation cover, human settlements, communication roads and social infrastructure, in general, as determining factors of the type of ecosystems prevailing in the zone and, therefore, of the vulnerabilities that may arise with respect to performance of activities
- Identification of biophysical barriers that may help determine the extension of the physical and biotic area of influence
- Type and characteristics of probable impacts from the standpoint of their spatial and temporary scopes

4.2 DEFINITION, IDENTIFICATION AND DEMARCATION OF THE AREA OF INFLUENCE

The area of influence (hereinafter AI) for the physical - biotic group of components of the San Juan - Pedregal segment, encompasses a total of 4.040,72 hectares. It was defined from elements making up the physical and biotic environment. Thus, below is a description of elements considered for demarcation of the area of influence:

4.2.1 Abiotic Environment Area of Influence

The abiotic environment area of influence considered modifications to the natural forms of the terrain, acceleration of active and potentially active mass removal processes, generation and/or acceleration of erosive or deterioration processes of the terrain, and reduction and alteration of the surface and groundwater resource, as possible outcomes of highway project activities. The foregoing considered the synergy of these impacts with other components as well as their relevance for other areas, for instance, homogeneity of geological units, local water divides, changes to landscape perception, changes to local ecosystems and the social and cultural environment, to name a few (Gómez Orea, 2002).

In this regard, the area of influence of the physical environment is mainly delimited from the morfography of geomorphological units in the zone (changes of slope due to roads, drainages, which influence the distribution of physical processes), together with the impact that eventual mass movements could cause on the normal behavior of hydrosystems, especially downstream from the highway project in some sectors, up to the eastern boundary with the Guáitara River, relative to changes in water quality, potential impoundments in funneled waterways, avalanches and mudflows. Similarly, the boundary of said area towards the zone upstream from the highway project is mainly connected to potential impacts on drawdown of the groundwater resource and changes to the surface hydrological regime. At present, these changes are somehow associated with anthropic activities, such as rural district roads and/or crop plots, well-formed and delimited by live fences. Hence, the upper boundary defined for the area of influence is delimited in some cases by such edges.

Please find hereunder a detailed description of each component integrated in the physical analysis of the physical environment:

- **Geospheric Component**

From the geospheric component standpoint, the area of influence for the environmental impact assessment of the Rumichaca-Pasto highway, San Juan - Pedregal segment, is defined bearing in mind the predominant shapes of the terrain, slope inclination, drainage intensity, and existence and evolution of morphodynamic processes, among others. Based on observations made during field trips, together with the secondary information analysis, it was possible to define sectors where homogeneities typical of the lithospheric behavior may be attributed, which include rocky formations, unconsolidated dentritic bodies and ground water bodies (MADS y ANLA, 2015). These are described below:

- There is evidence of volcanic ash layers with a low degree of weathering and pyroclastic deposits in the jurisdiction of the El Rosal and San Juan rural districts of the Municipality of Ipiales; and in the rural districts of La Providencia, San Francisco, Aldea de María, El Capulí, El Culantro, Las Cuevas and the Inspection of Ospina Pérez in the Municipality of Contadero. Geomorphology and relief associated with such ashes consist of undulated terrain with denudational slopes.

- Pyroclastic deposits were observed in the jurisdiction of the San José de Quisnamuez rural district in the Municipality of Contadero, and in the rural districts of Alto El Rey, Urbano, Tablón Alto and Tablón Bajo in the Municipality of Iles. There is evidence of the formation of residual soils with thicknesses that may exceed 10 meters. This geological condition gives rise to the formation of denudational slopes with smoothed and softened topographies.
- Slightly consolidated pyroclastic flows outcrop in the jurisdiction of the rural districts of Tablón Alto and Tablón Bajo in the Municipality of Iles. Such geological condition gives rise to the generation of mountain slopes, with very strong to steep slopes. Owing to the high permeability of the materials, it is common to find subsurface water outcrops concentrated on both faces of cut slopes.
- Pyroclastic flows in the jurisdiction of the rural districts of El Rosario and El Porvenir in the Municipality of Iles, and in the rural district of Pilcuán in the Municipality of Imués, where it is possible to find the development of alluvial terraces linked to older stages of the Guáitara River. Geomorphology exhibits marked contrasts between mountainous slopes, volcanic plateaus and anthropic slopes, generated by mining activity, where mass removal processes develop (rotational landslides, involving alluvial materials, colluvium deposits and pyroclastic flows).
- Finally, massive lava deposits emerge in the jurisdiction of the Pilcuán rural district in the Municipality of Imués. The topography is sharp; V-shaped valleys are deep and narrow, associated with rocky scarps. Intensive fracturing enables the generation of wedges and flat faults.

In accordance with road designs, cut slopes are generated in this sector, with heights of up to 90 meters, where surface instability problems could arise. Nevertheless, in line with slope stabilization analyses, it is suggested to apply treatments by way of 3.00 meter wide berms every 12.00 m height in 3H:4V, and every 15.00 m in 1H:2V, so as to mitigate such potential processes. Likewise, fill slopes reach heights of up to 30 meters only in some specific sectors. Support from fills in low consistency soils may trigger stability problems and the production of inadmissible settlements (González de Vallejo, 2002).

Excavation slopes range from 3H/4V to 1H/2V, depending on the material's capacity and the height of the resulting slope. Most of the materials to be excavated in this segment are formed by tuffs of varied compactness and consistency, with the possibility of excavating them completely by mechanical means. Nevertheless, part of the excavation is done in andesites, with the slope becoming vertical in these zones at 1H/3V, thus making it necessary to excavate here via blasting with precut. Revegetation of most soil slopes has been determined as a sustainability measure, as well as the placement of guide screens with or without cable panel in higher rock cuts. Moreover, drainages are to be carried out in cuts expecting water inflows. Enhancement of the support terrain at the fills is proposed by scaling (CONSORCIO SH, 2016). In this regard, the threat[1] owing to terrain instability processes is deemed low to medium. Thus, the area of influence on the physical environment would not have to go beyond the limit of potential failure mechanisms of slopes generated, which in no case exceed a distance of 70 meters from the edge of the chamfers.

- **Hydric Component**

The physical environment area of influence considers the micro-watersheds associated with hydric resources intervening directly or indirectly with the project, bearing in mind the susceptibility or intrinsic predisposition

[1] Threat: Latent hazard for a physical event, whether of natural or induced origin, or caused by human action, accidentally (COLOMBIAN CONGRESS 2012)

of hydric resources to undergo damage or loss in projects of this nature (CGRTCA, 1999). Water intakes and riverbed occupation, together with construction of the infrastructure modifying the natural hydric water courses, entail changes and impacts on the natural dynamic of watersheds linked thereto (MADS, 2012). Hence, the minimum analysis unit regards the micro-watersheds associated with the project, particularly downstream from the design layout, where it establishes that the runoff direction defines the limits of this component in those sectors where there are no bodies of water or where the mouths are too far to be affected by impacts generated by the intervention of bodies of water crossing the project.

Besides that, upstream from the chamfer limit, no impacts are generated on the natural conditions of surface bodies of water crossing the project. Nevertheless, some cuts along the internal edge of the highway or overloads generated by fills and ZODMES could, to a certain extent, alter the hydrodynamic behavior of aquifers present in the region. Therefore, the area of influence of the physical environment integrates the points where groundwaters adjacent to the project are evidenced, including springs, piezometers and reservoirs, with a view to be evaluated from the standpoint of the assessment's hydrogeological component by way of integrating the analysis of supply, demand, vulnerability, makeup and availability of the ground hydric resource in the area.

4.2.2 Biotic Environment Area of Influence

From the biotic environment perspective, the area of influence was defined from analysis units, such as watersheds, ecosystems and territorial units. Given the high degree of fragmentation of the area under study and the impacts present, the following were defined as minimum analysis units: land covers, bodies of water, road network and sharp terrain changes. Criteria used to delimit the AI are detailed hereunder:

- **Vegetation cover**

Changes to vegetation covers were identified in the zones in the vicinity of the layout of the Rumichaca-Pasto divided highway, San Juan - Pedregal segment, whose presence is connected to fragmentation processes. This criterion acts as the limit for dispersion and colonization of various types of plants and animals, in addition to being biological barriers for impacts inherent in the project (**Photograph 4.1**).

Change of cover from dense forest to zones with crops and clean pastures

Forest plantations (Eucalyptus)

Open rocky grassland

Source: GEOCOL CONSULTORES S.A., 2017

· **Connectivity of wild fauna habitats**

Keeping in mind the relationship between wild fauna and vegetation covers, an identification was made of the distribution of groups with the greatest restriction to certain types of cover, corresponding to species of herpetofauna and non-flying and arboreal mammals, which may be affected to a greater extent by impacts generated by the project and by the distribution and structure of the vegetation. For enhanced mobility species, such as birds and bats, the distribution of movement corridors or zones where there may be concentration during reproductive or migration seasons, or enhanced flowering or fruiting periods, was considered (**Photograph 4.2**).

Photograph 4.1 Criterion of wild fauna habitat connectivity for defining the biotic area of influence (fauna mobility corridors)

Gallery forests

Lizard species associated with dense forests, *Stenocercus guentheri* (lizard)

Source: GEOCOL CONSULTORES S.A., 2017

· **Changes in geomorphology and presence of natural or artificial barriers**

Areas where geomorphology changes occur, determined by the presence of strong slopes, were identified. These may affect the distribution / concentration or structure of the vegetation and associated fauna, becoming limiting factors as far as the displacement of some particular species. Similarly, barriers to natural type fauna, such as drainages, vegetation transitions, open natural or artificial zones, such as roads (primary or secondary), or populated centers, were identified, which hinder the mobilization or colonization of species seeking to move away from disturbance sources (**Photograph 4.3**).

Photograph 4.2 Criterion concerning geomorphology changes and presence of natural or artificial barriers for definition of the biotic area of influence

Mountainous zones with strong slopes and roads with high traffic flow. Change of slope on the road leading to the populated center of the Municipality of Iles from the Juncal rural district, and road leading from the Panamericana Highway to the populated center of the Municipality of Iles

Source: GEOCOL CONSULTORES S.A., 2017

· **Hydrology and aquatic ecosystems**

The distribution of drainage networks and aquatic ecosystems relates to the distribution of plants and animals. Thus, any type of alteration on this component may have direct or indirect impact on both biotic groups (**Photograph 4.4**).

Photograph 4.3 Criterion concerning hydrology and aquatic ecosystems for definition of the biotic area of influence

Sapuyes River

Guáitara River

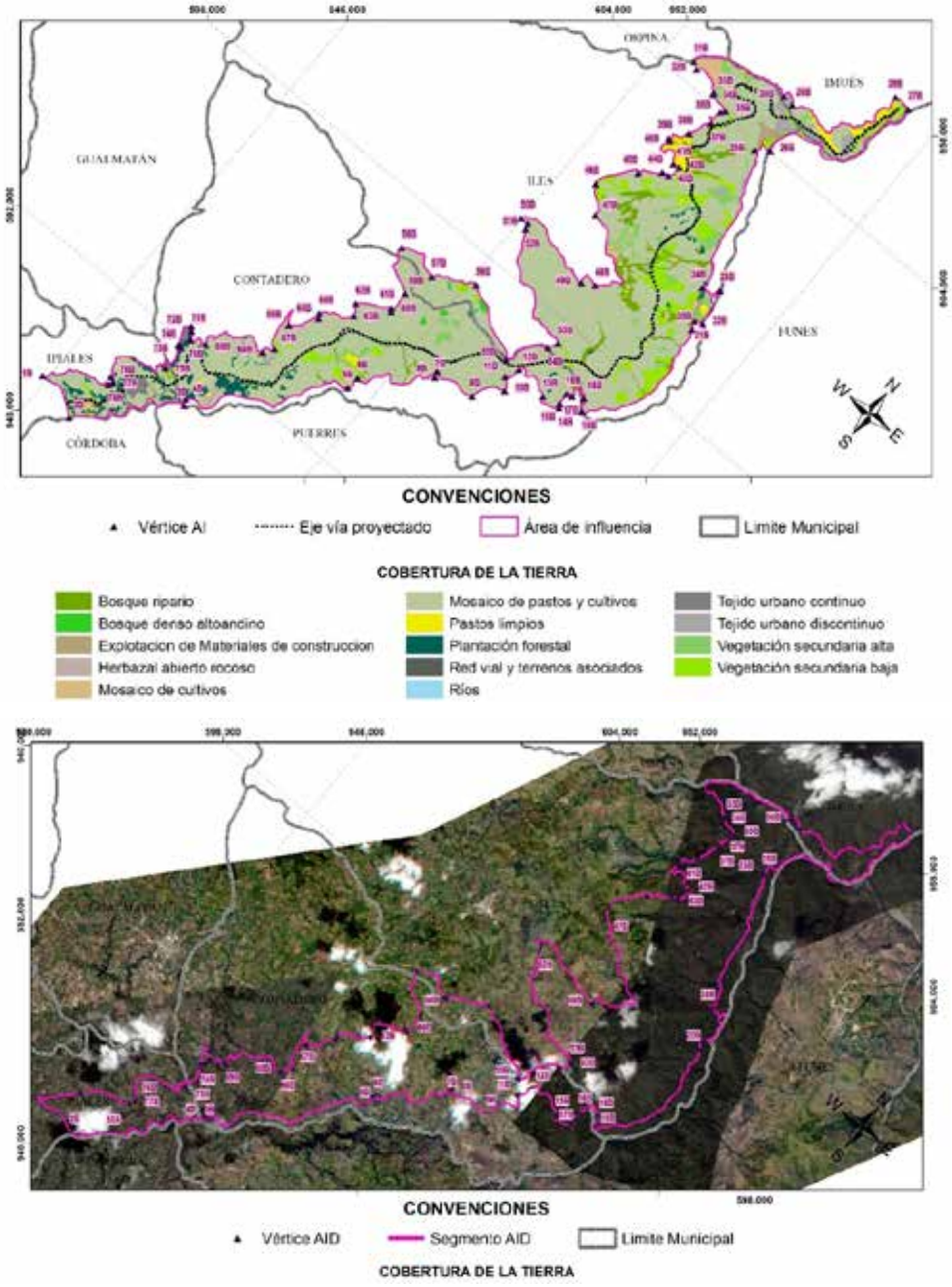
Lotic water bodies

Source: GEOCOL CONSULTORES S.A., 2017

4.2.3 Physical / Biotic Area of Influence

So as to describe the area of influence, 78 vertices, discriminated from the previously described physical or biotic criteria changes, were identified (**Figure 4.1**).

Figure 4.1 Physical / biotic area of influence



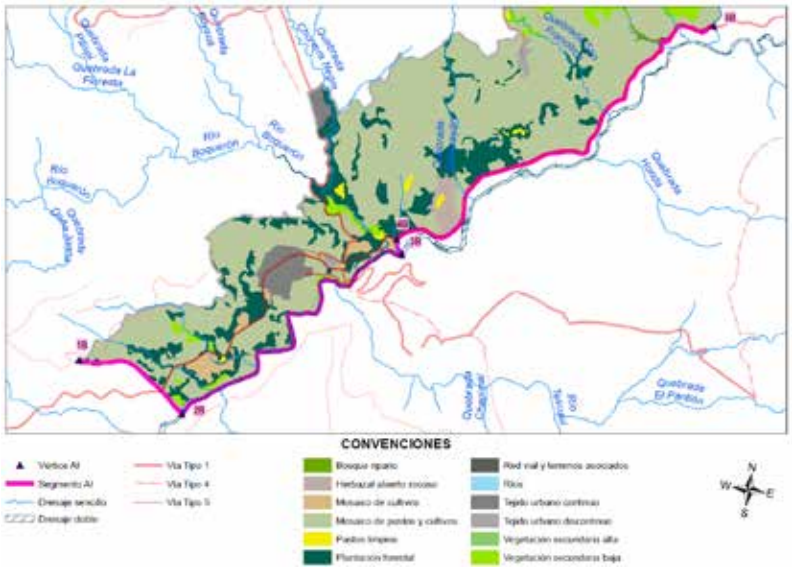
Source: GEOCOL CONSULTORES S.A., 2017 (Rapieye satellite image (2016) and Worldview (2015))

Following is the demarcation of the AI by segments of vertices for a better understanding thereof:

· **Vertex 1B - 5B (red line) segment**

This segment starts from an unpaved road (vertex 1B), continuing along the limit between the San Juan and Ipiales indigenous reservations (which in turn is the limit between the present EIA and the Ipiales - San Juan segment EIA), up to where it meets the Guáitara River (vertex 2B). This river is one of the main physical - biotic barriers, given its large flowrate and environmental representativeness of the entire study area. In vertex 3B, the AI takes a northeastern direction through secondary rural district roads and through the Panamericana Highway, up to vertex 5B. **Figure 4.2** shows the spatial location of this segment of the AI. Similarly, **Table 4.3** provides the detailed criteria defined in each vertex.

Figure 4.2 Area of influence from vertex 1B to vertex 5B



Source: GEOCOL CONSULTORES S.A. 2017

Table 4.2 Physical - biotic elements selected as criteria for demarcation of the area of influence between vertices 1B-5B

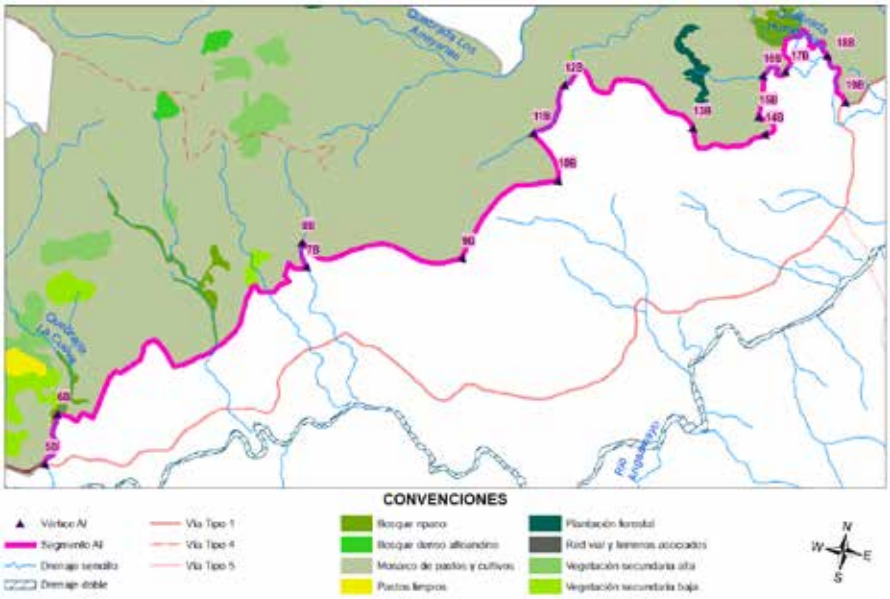
VERTEX	CRITERION
1B-2B	Limit between the San Juan and Ipiales indigenous reservations, PK 15+750
2B-3B	South north direction through the Guáitara River riverbed
3B-4B	Secondary road leading to the Panamericana Highway
4B-5B	Panamericana Highway in the San Juan - Pedregal direction, up to the La Cueva Stream. Zone with varying outcrops of groundwaters via springs and reservoirs, especially at the Aldea de María rural district

Source: GEOCOL CONSULTORES S.A., 2017

· **Vertex 5B - 19B segment**

This segment starts from vertex 5B at the La Cueva Stream, it takes a northeastern direction towards the rural district of Las Cuevas in the Municipality of Contadero, through the body of water and some rural district roads. These landscape elements act as a biological barrier, as they provide shelter to the fauna when faced with potential displacements. The AI limit continues through strong slope and cover changes until finding the Panamericana Highway at vertex 19B. **Figure 4.3** illustrates the spatial location of this segment of the AI. Similarly, **Table 4.4** includes the detailed criteria defined in each vertex.

Figure 4.3 Area of influence from vertex 5B to vertex 19B



Source: GEOCOL CONSULTORES S.A. 2017

Table 4.3 Physical - biotic elements selected as criteria for demarcation of the area of influence between vertices 5B- 19B

VERTEX	CRITERION
5B-6B	Upstream from the La Cueva Stream up to the crossing with the type two road leading to the Las Cuevas rural district
6B-7B	Rural district road, characterized by a change in totally steep to strongly inclined slopes; zone with diverse outcrops of groundwaters via springs and reservoirs
7B-8B	Live fence in slightly steep slopes; zone with diverse outcrops of groundwaters via springs and reservoirs
8B-9B	Secondary road in Ospina Pérez rural district; moderately to strongly steep inclination slopes; zone with diverse outcrops of groundwaters via springs and reservoirs
9B-10B	Secondary road leading from the Ospina Pérez rural district to the San José de Quisnamuez rural district; slightly steep to moderately inclined gradient slopes; zone with diverse outcrops of groundwaters via springs and reservoirs
10B-11B	Secondary road in the San José de Quisnamuez rural district; moderately inclined to slightly flat gradient slopes; zone with diverse outcrops of groundwaters via springs and reservoirs

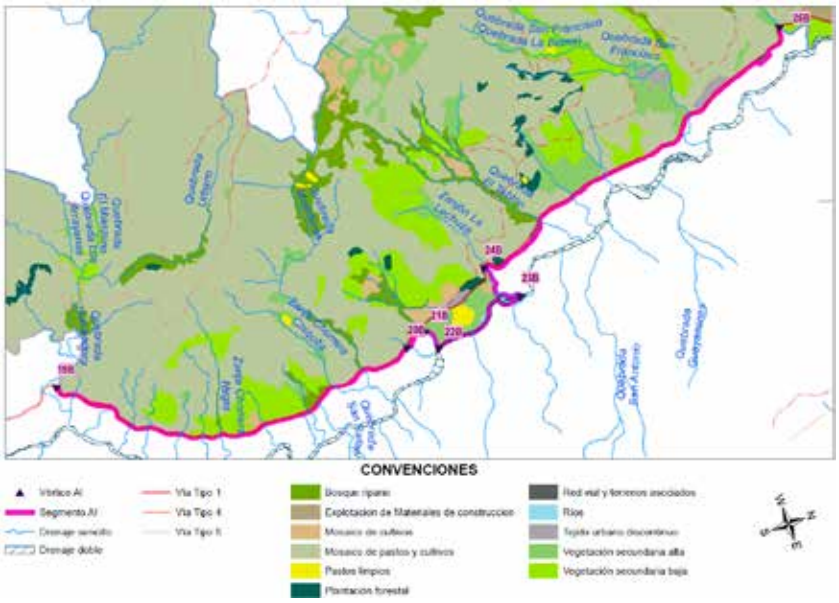
VERTEX	CRITERION
11B-12B	San José de Quisnamuez rural district secondary road; moderately inclined to slightly flat gradient slopes
12B-13B	San José de Quisnamuez rural district secondary road; moderately inclined to slightly flat gradient slopes
13B-14B	Change of slope; slightly to strongly steep slopes, and crop and grassland mosaic cover
14B-15B	Road leading to the populated center of the Municipality of Iles from the Juncal rural district
15B-16B	Live fence; slightly steep inclination slopes
16B-17B	Tributary of the La Humeadora Stream
17B-18B	Change of cover and slope; strongly inclined to strongly steep slopes
18B-19B	Change of cover and slope up to the Panamericana highway; strongly steep to completely steep slopes, in the vicinity of the Guáitara River

Source: GEOCOL CONSULTORES S.A. 2017

· **Vertex 19B - 25B segment**

This segment of the AI begins at vertex 19B on the Panamericana Highway, and continues over close to 3.72 km, until undergoing a change of cover, taking the boundary on the Guáitara River, which is the AI's most important biological barrier on the eastern side. The boundary on the river ends at the La Lechuza ditch to again take the Panamericana Highway at vertex 25B. It is possible to observe how this segment exhibits a contrast owing to the change in the inclination of the slope, which is segmented by the Panamericana Highway. **Figure 4.4** shows the spatial location of this segment of the AI. Similarly, **Table 4.5** includes the detailed criteria defined in each vertex.

Figure 4.4 Area of influence from vertex 19B to vertex 25B



Source: GEOCOL CONSULTORES S.A. 2017

Table 4.4 Physical - biotic elements selected as criteria for demarcation of the area of influence between vertices 19B - 25B

VERTEX	CRITERION
19B-20B	Panamericana Highway in the San Juan - Pedregal direction; change of cover from road network to low secondary vegetation. Change of slope gradient
20B-21B	Edge of cover designated as low secondary vegetation up to the direct tributary of the Guáitara River
21B-22B	Downstream from the Guáitara River tributary
22B-23B	Guáitara River up to the La Lechuza ditch
23B-24B	Upstream from the La Lechuza ditch
24B-25B	Panamericana Highway in the San Juan - Pedregal direction, up to the El Macal Stream. Change of slope gradient

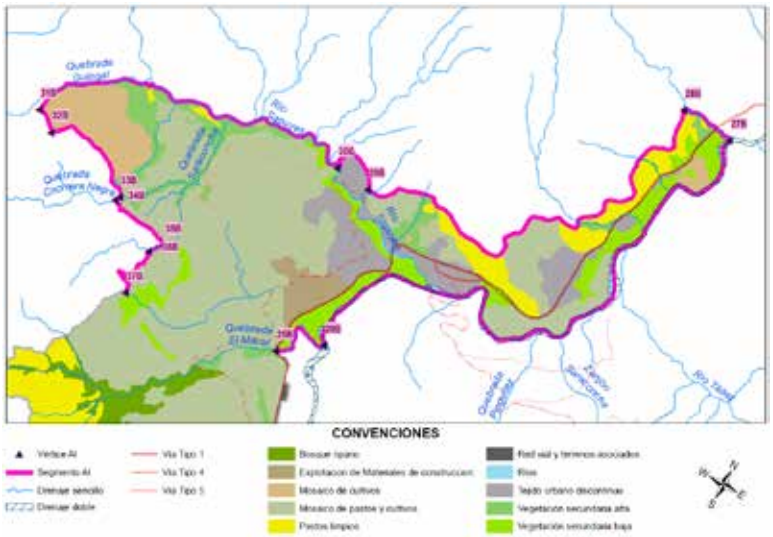
Source: GEOCOL CONSULTORES S.A. 2017

· **Vertex 25B - 37B segment**

This segment begins at vertex 25B in the El Macal Stream, close to the populated center of the Pilcuán rural district, and continues on the left bank of the Guáitara River, until finding a direct tributary, after passing by Pilcuán. From there, the AI takes a western course on the same tributary, to then go towards the south, due to changes of slope and cover. On vertex 30B, the AI continues on the Sapuyes River, the Guingal, Chorrera Negra and Saraconcha Streams. These bodies of water and their associated vegetation are biotic elements,

which enable curbing project-generated environmental impacts, in addition to being markers for setting up changes in the zone's diversity. Lastly, the segment continues over changes of cover and slope in the vicinity of vertex 37B. **Figure 4.5** shows the spatial location of this segment of the AI. Likewise, **Table 4.6** includes the detailed criteria defined in each vertex.

Figure 4.5 Area of influence from vertex 25B to vertex 37B



Source: GEOCOL CONSULTORES S.A. 2017

Table 4.5 Physical - biotic elements selected as criteria for demarcation of the area of influence between vertices 25B - 37B

VERTEX	CRITERION
25B-26B	Downstream from the El Macal Stream
26B-27B	Left bank of the Guáitara River up to its confluence with a direct tributary of the same river
27B-28B	Guáitara River tributary after the populated center of the Pilcuán rural district
28B-29B	Change of cover and slope up to the rural district of Silamag. Slopes having slightly steep to completely steep inclinations >100%, where several groundwater outcrops are located via springs[2] and anthropic upwellings[3]
29B-30B	Change of pasture and crop mosaic cover. Several groundwater outcrops are located via springs and anthropic upwellings
30B-31B	Upstream from the Sapuyes River up to the Guingal Stream

[2] Spring: Place where water emerges naturally from a rock or from the soil, and flows towards the surface or towards a body of surface water (WMO and UNESCO 2012)

[3] Anthropic upwelling: The inventory includes other hydrogeological points that mainly correspond to other groundwater intake forms, such as drainage ditches, regular or irregular shape excavations that cut the water table, geotechnical works that may have intercepted groundwater and generated a water outcrop, to name a few. Strictly speaking, it should not be used as a synonym of spring, as it typically indicates an anthropic work, without this necessarily meaning a natural upwelling

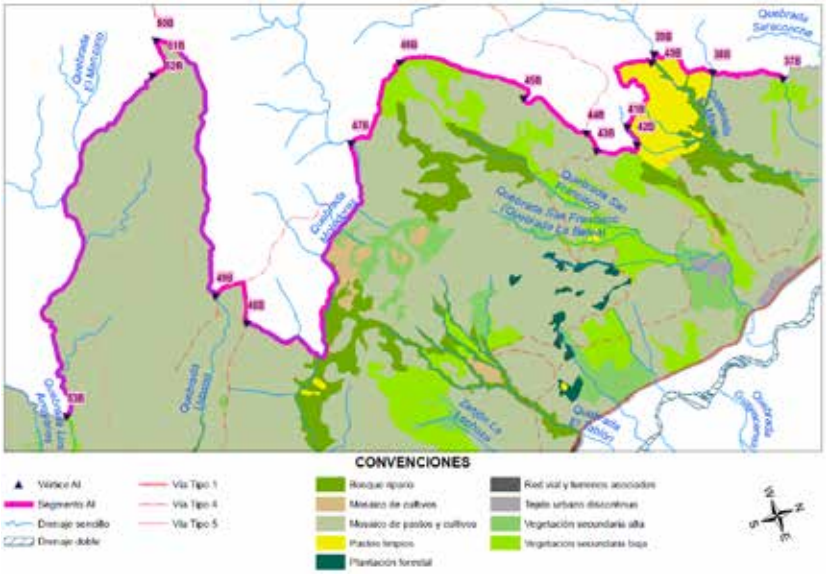
VERTEX	CRITERION
31B-32B	Change of cover to low secondary vegetation
32B-33B	Rural district path up to the Chorrera Negra Stream; slopes with moderately steep to completely steel inclinations
33B-34B	Downstream from the Chorrera Negra Stream
34B-35B	Change of cover and slope, continuing to the Saraconcha Stream; high part of completely steep slopes
35B-36B	Downstream from the Saraconcha Stream; high part of completely steep slopes
36B-37B	Changes of slope; strongly inclined to completely steep slopes

Source: GEOCOL CONSULTORES S.A. 2017

- **Vertex 37B - 53B segment**

Vertex 37B of the AI is located at the change of cover and slope, and continues towards the south by the Saraconcha Stream riverbed, to then continue through the change of cover close to the Macal Stream. From the latter point, the segment takes various elements from the landscape, such as rural district roads, streams and changes of cover, until reaching vertex 53B at the El Manzano Stream. **Figure 4.6** illustrates the spatial location of this segment of the AI. Similarly, **Table 4.7** includes detailed criteria defined in each.

Figure 4.6 Area of influence from vertex 37B to vertex 53B



Source: GEOCOL CONSULTORES S.A. 2017

Table 4.6 Physical - biotic elements selected as criteria for demarcation of the area of influence between vertices 37B-53B

VERTEX	CRITERION
37B-38B	Change of cover and slope, continuing to the Saraconcha Stream; completely steep to strongly inclined slopes
38B-39B	Change of cover and slope; strongly inclined to moderately inclined slopes
39B-40B	El Macal Stream
40B-41B	Change of cover from clean pastures to open rocky pastures, steep; moderately inclined to strongly inclined slopes
41B-42B	Direct tributary of the Macal Stream
42B-43B	High part of the mountain range
43B-44B	Road leading from the Panamericana Highway to the populated center of the Municipality of Iles
44B-45B	Rural district path; strongly inclined to moderately inclined slopes
45B-46B	Change of dense and inclined forest cover; strongly inclined to slightly steep slopes; several groundwater outcrops are located via springs and anthropic upwellings
46B-47B	Gravel road at Loma Alta rural district ; several groundwater outcrops are located via springs and anthropic upwellings

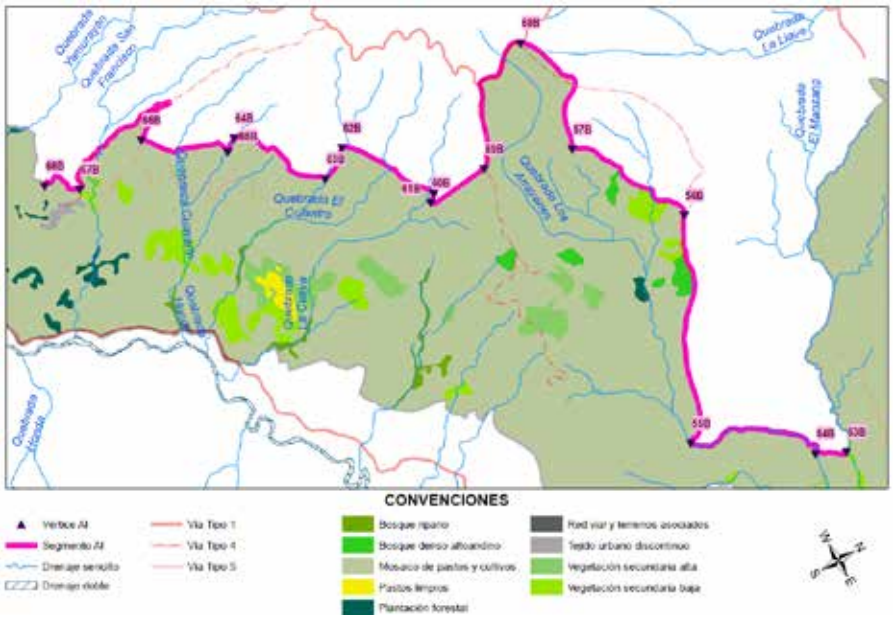
VERTEX	CRITERION
47B-48B	Moledores Stream; several groundwater outcrops are located via springs and anthropic upwellings
48B-49B	Gravel road at the Tamburán rural district
49B-50B	Urbano Stream
50B-51B	Rural district path
51B-52B	Change of cover and presence of live fences
52B-53B	Left bank, El Manzano Stream

Source: GEOCOL CONSULTORES S.A., 2017

· **Vertex 53B - 68B segment**

This segment begins at vertex 53B, the El Manzano Stream, and continues through the change of covers, until running into the Los Arrayanes Stream; upstream it takes the road connecting the Yarqui rural district and the populated center of the Municipality of Iles. At this segment, the boundaries of the AI are defined from the presence of rural district paths, which will be used by the project to access the layout. Likewise, in some areas, it was delimited from changes of covers and water courses, such as the Las Cuevas, Culantro and Cuayarín Streams. **Figure 4.7** shows the spatial location of this segment of the AI. Similarly, **Table 4.8** includes the detailed criteria defined in each vertex.

Figure 4.7 Area of influence from vertex 53B to vertex 68B



Source: GEOCOL CONSULTORES S.A., 2017

Table 4.7 Physical - biotic elements selected as criteria for demarcation of the area of influence between vertices 53B - 68B

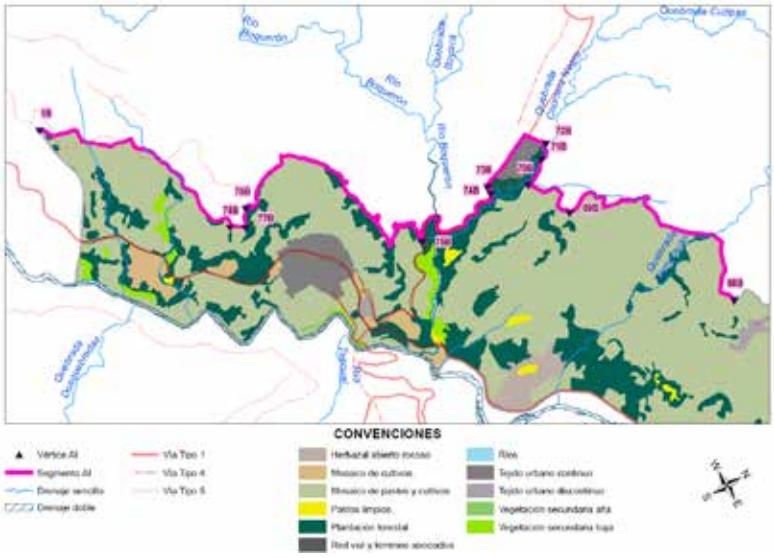
VERTEX	CRITERION
53B-54B	Changes of covers and live fences
54B-55B	Upstream from the Los Arrayanes Stream; slopes with strongly inclined and slightly steep gradients
55B-56B	Secondary road connecting the Yarqui rural district with the populated center of the Municipality of Iles; slopes with strongly inclined and slightly steep gradients; several groundwater outcrops are located via springs and reservoirs
56B-57B	Live fences; slopes with strongly inclined and slightly steep gradients
57B-58B	Yarqui rural district path; slopes with slightly inclined to strongly inclined gradients
58B-59B	Road connecting the populated center of Gualmatán with Iles at the Iscuazan rural district; slopes with slightly inclined to strongly inclined gradients
59B-60B	Live fences and change of cover; slopes with strongly inclined and slightly steep gradients; several groundwater outcrops are located via springs and reservoirs
60B-61B	La Cueva Stream
61B-62B	Live fences and change of cover; slopes with strongly inclined and slightly steep gradients
62B-63B	Downstream from a direct tributary of the Culantro Stream
63B-64B	Live fences and change of cover; slopes with strongly inclined and slightly steep gradients
64B-65B	Downstream from a direct tributary of the Cuayarín Stream
65B-66B	Live fences and change of cover; slopes with strongly inclined and slightly steep gradients
66B-67B	Rural district path connecting the El Capulí rural district and the village of María; slopes with strongly inclined and slightly steep gradients
67B-68B	Live fences and change of cover

Source: GEOCOL CONSULTORES S.A., 2017

- **Vertex 68B - 1B segment**

The last segment of the AI begins at vertex 68B and is defined by changes in the cover, which extend up to the gravel roads of the San Francisco rural district, moving ahead on this road until connecting with the Chorrera Negra Stream, close to the populated center of the Municipality of Contadero. At vertex 72B, the AI goes by the roads of the municipal capital and leaves the populated center to connect to the road leading to the rural district of San Juan. From this last point, the boundary continues over cover changes (forest plantations) and rural district roads, up to the boundary between the indigenous reservations of San Juan and Ipiales at vertex 1B. **Figure 4.8** shows the spatial location of this segment of the AI. Similarly, **Table 4.9** includes the detailed criteria defined in each vertex.

Figure 4.8 Area of influence from vertex 68B to vertex 1B



Source: GEOCOL CONSULTORES S.A., 2017

Table 4.8 Physical - biotic elements selected as criteria for demarcation of the area of influence between vertices 68B - 1B

VERTEX	CRITERION
68B-69B	Rural district paths and cover changes; slopes with strongly inclined and slightly steep gradients; several groundwater outcrops are located via springs and reservoirs
69B-70B	Live fences and change of cover; slopes with strongly inclined and slightly steep gradients
70B-71B	Gravel road at the San Francisco rural district; slopes with slightly steep to slightly flat gradients
71B-72B	Chorrera Negra Stream close to the populated center of the Municipality of Contadero
72B-73B	Internal roads of the populated center of the Municipality of Contadero; slopes with slightly steep to slightly flat gradients
73B-74B	Change of urban fabric cover to forest plantation; slopes with strongly inclined and slightly steep gradients
74B-75B	Main road leading to the populated center of the Municipality of Contadero up to the populated center of San Juan; slopes with strongly inclined to strongly steep gradients
75B-76B	Change of cover from road network to forest plantation; slopes with strongly steep to strongly inclined gradients
76B-77B	Rural district path close to a fragment of low secondary vegetation
77B-78B	Live fences and change of cover
78B-1B	Gravel road up to the El Rosal rural district up to the boundary between the San Juan and Ipiales indigenous reservations; slopes with strongly inclined to slightly steep gradients

Source: GEOCOL CONSULTORES S.A., 2017

4.2.4 Socioeconomic Area of Influence

In consideration of Terms of Reference M-M-INA-02, sanctioned by Resolution 0751 of March 26, 2015 for preparation of the environmental impact assessment - EIA - used to perform this study, the area of influence is defined as the area where there is evidence of significant impacts caused by performance of the project, which may vary from one component to the other. Hence, the socioeconomic area of influence is proposed starting from the physical-biotic area of influence.

The definition of the socioeconomic area of influence considers those impacts that may be caused on the environment's components, in such a way that the minimum analysis unit included in this assessment are such territorial units embedded in the physical and biotic area of influence, given that there is evidence pointing to their existence as the minimum political and administrative subdivision of the municipality. Therefore, potential socioeconomic impacts will take place on demographic, spatial, economic, cultural, and organizational-political components of clusters in these territorial units, which independently have a population, infrastructure, economic activities and community organization.

It must be noted that a preliminary area of influence was initially established to define the socioeconomic area of influence, bearing in mind information on the scope of the project, relevance of impacts thereof and information on the territory, available both at the archives of Concesionaria Vial Unión del Sur and at official sources, such as Basic Land Use Plans, Municipal Development Plans, Ministry of the Interior certification confirming the presence of ethnic communities (Resolutions 434 and 432 of May 9, 2017) and National Statistics Department (DANE for its acronym in Spanish). At a later time, after approaching municipal authorities and influential communities, it is possible to define and pinpoint the final socioeconomic area of influence with the territorial units listed in **Table 4.10**.

Table 4.9 Territorial units of the project's area of influence

MAJOR TERRITORIAL UNITS	MINOR TERRITORIAL UNITS	AREA (ha)	CRITERION TYPE OF INTERVENTION
IPIALES	Boquerón	684,58	Layout and camp
	San Juan	3238,45	Layout, ZODMES and camp
CONTADERO	Aldea de María	2264,28	Layout and ZODMES
	El Capulí	1865,74	Layout and ZODMES
	El Culantro	1241,19	Layout and ZODMES
	El Juncal	3917,16	Physical - biotic influence
	El Manzano	1020,74	ZODMES
	El Rosal de San Francisco	491,94	ZODMES
	I.P. Ospina Pérez	1898,57	Layout and ZODMES
	Iscuazán	2409,42	ZODME
	La Providencia	1548,01	Layout and ZODMES
	Las Cuevas	980,50	ZODMES
	Las Delicias	1828,68	Layout and ZODMES
	San Andrés	897,75	Layout and ZODMES
	San Francisco	898,54	Layout and ZODMES
	San José de Quisnamuez	2738,31	Layout and ZODMES

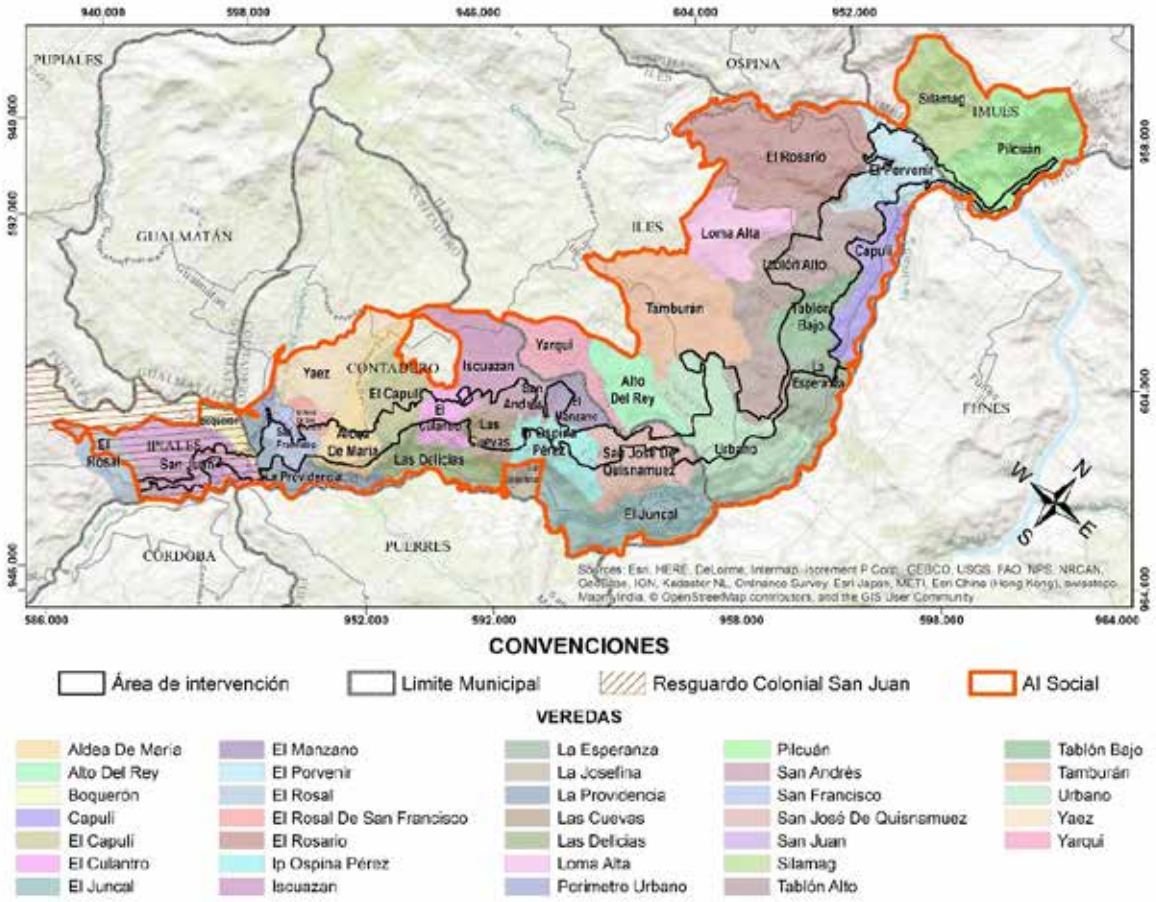
MAJOR TERRITORIAL UNITS	MINOR TERRITORIAL UNITS	AREA (ha)	CRITERION TYPE OF INTERVENTION
	Urban perimeter	288,82	EIA 1B intervention area and physical - biotic area of influence
ILES	Alto del Rey	2046,46	Layout
	Capulí	2073,69	ZODMES
	El Porvenir	2611,91	Camp, layout and ZODMES
	El Rosario	6876,46	Layout
	La Esperanza	2435,04	ZODMES
	Loma Alta	2752,77	Physical - biotic influence
	Tablón Alto	6062,98	Layout and ZODMES
	Tablón Bajo	1846,64	Layout and ZODMES
	Tamburán	5078,96	ZODMES
	Urbano	4896,44	Camp, layout and ZODMES
	Yarqui	2034,58	Physical - biotic area of influence
IMUÉS	Pilcuán La Recta	4992,03	Layout and ZODMES
	Pilcuán Viejo		Layout
	Silamác	3354,73	Physical - biotic area of influence

Source: GEOCOL CONSULTORES S. A., 2017

The total socioeconomic area of influence covers 75.345,21 ha, which encompasses the summation of all the areas in the minor territorial units.

Keeping in mind that the physical and biotic area is where the highway's layout is located, as well as the specific zones of interest where ZODMES are to be executed, camps and other activities related to the road project, in addition to possible support areas and locations where exploitation of natural resources is foreseen, the socioeconomic area of influence extends up to where important impacts will emerge and up to where foreseen impacts will go beyond the expected impacts, so it comprises the complete territorial units of zones where such activities will be performed, as depicted in **Figure 4.9**.

Figure 4.9 Socioeconomic Area of Influence



Source: GEOCOL CONSULTORES S. A., 2017

As illustrated in **Table 4.10** and pursuant to the Ipiales Land Use Plan - POT for its acronym in Spanish - the territorial units of San Juan, Boquerón and El Rosal are found in the area of influence. Nevertheless, these are in turn part of the *Resguardo de San Juan* (indigenous reservation), a territorial unit that is a special status legal and sociopolitical institution, made up of one or more indigenous communities, which enjoy the benefits of private property by holding a collective title deed. They own their territory and are governed by an autonomous organization protected by the indigenous jurisdiction and their own regulatory system for management of the territory and of their internal life (Article 21, Decree 2164 of 1995)[4]. In view of the foregoing and considering the territorial and political autonomy of the indigenous reservation, the boundary of the area of influence to the southwest applies from the boundary of the San Juan indigenous reservation with the *Resguardo Colonial* of Ipiales, at the level of the El Rosal rural district. By the same token, characterization of the San Juan, Boquerón and El Rosal territorial units is undertaken from the scope of the indigenous reservation territory, according to the information gathered in the Prior Consultation process and

[4] http://www.mininterior.gov.co/content/resguardo-indigena

in keeping with requests made by their main authority, Governor Polivio Rosales, should this area be characterized under the approach of territoriality. **(See Social Attachment: Minutes from meeting with professionals at the *Resguardo San Juan* (indigenous reservation) and governor certification).**

On the other hand, **Figure 4.9** shows that the rural districts of Iscuazán, El Culantro, El Capulí and Aldea de María, which are part of the physical, biotic and socioeconomic area of influence, given the activities to be performed in each, completely surround the rural district of El Contaderito. Thus, it would seem that the latter is also part of the socioeconomic area of influence. Nevertheless, it is clear that no activities or resource exploitation or accesses to project areas are considered in this territorial unit, and neither are impacts therefrom envisaged. Hence, El Contaderito is not part of the physical-biotic area of influence or the socioeconomic area of influence.

Another aspect to be taken into account is that the rural districts of San Francisco and El Rosal de San Francisco, in line with the Land Use Study of the Municipality of Contadero, have a defined political division and emerge as independent territories with duly established community action boards. However, upon going to the zone in both territorial units, communities were recognized as one territory, indicating that they are all San Francisco. They made clear that the rural district was distributed into sectors when rural district aqueducts were built years back, so as to enable installation of their irrigation districts, but not to divide it. They stressed that they continue to be one single rural district and requested that no separate meetings or activities be proposed, since all rural district sectors and both community boards work hand in hand and do everything together (See **Attachment**: San Francisco meeting minutes). In view of the foregoing, two community participation guidelines were prepared with both rural districts as one single territorial unit, only differentiating population data for the demographic component.