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Transdisciplinary improvement on an isolated living model

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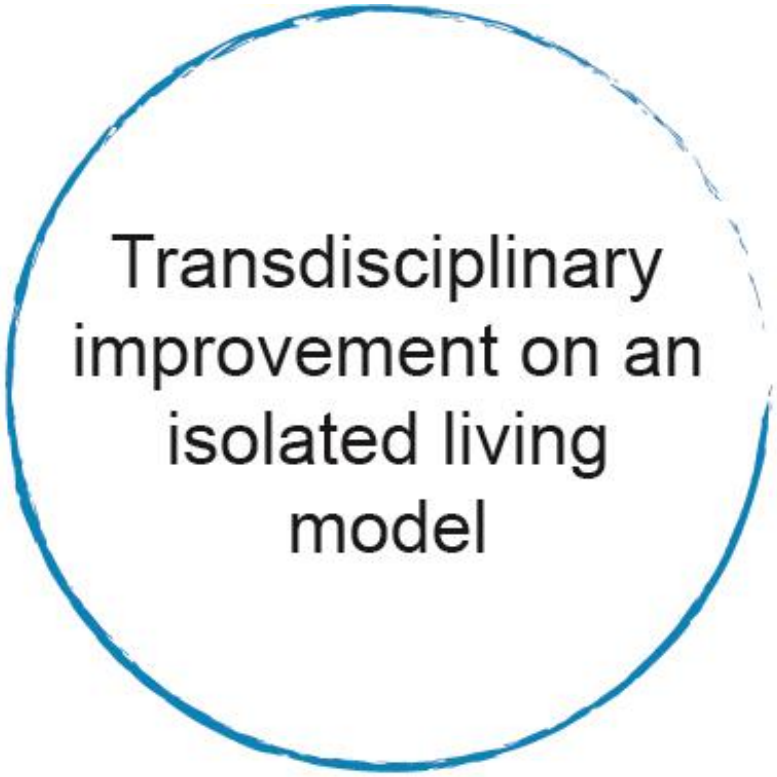
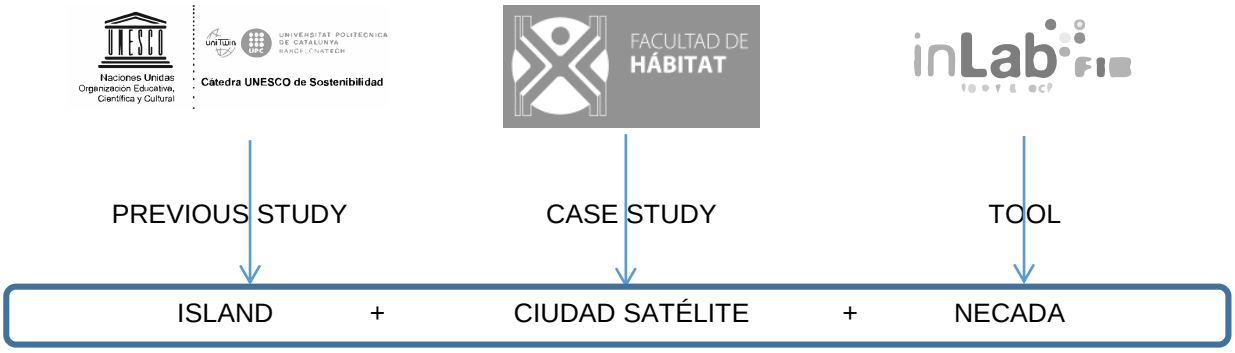


11. SUISTAINABLE CITIES AND COMMUNITIES.

Make cities and human settlements inclusive, safe, resilient and sustainable.

By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums.

The Global Goals for Sustainable development



Gràcies a la col·laboració entre la Catedra UNESCO de Sostenibilitat (Jordi Morató, Angel Gallegos), Universidad Autónoma de San Luis Potosí, Facultad del Habitat (Ricardo Villasís, Adrián Moreno, Marcela Lopez y Arturo Martinez) i Innlab (Pau Fonseca).

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INDEX

I. List of tables *iii*
II. List of figures *iv*
1. INTRODUCTION *1*
2. RESEARCH PROJECT *2*
2.1 Main objective 2
2.2 Specific objectives 2
2.3 State of art 2
2.4 Research questions 3
2.5 Scope of study 3
2.6 Required information 3
3. ISOLATED GROUPS. *4*
3.1 Definition 4
3.2 Importance 4
3.3 Concepts 4
3.4 Types of isolated groups. 8
3.5 Problems and solutions. 10
3.6 Resilience 11
3.7 Examples of islands going to self-sufficiency. 12
4. ENERGY EFFICIENCY *16*
4.1 Basic information 16
4.2 How can to save energy in buildings 17
5. EXISTING SIMULATION AND OPTIMIZATION PROGRAMS *18*
5.1 Non European Software 18
5.2 Recently Spanish Software 18
5.3 Mexico 20
6. NECADA: No Emissions CaD for Architecture *21*
7. CASE STUDY. *22*
7.1 The context. San Luis Potosí 22
7.2 The isolated core: Ciudad Satelite 28
7.3 Social involvement 39
8. SIMULATION WITH NECADA *40*
8.1 Methodology 40
8.2 Information used. 41
8.3 Results 44
8.4 Conclusion. 46
9. FUTURE LINES OF RESEARCH *46*
10. CONCLUSIONS OF THE PROJECT *46*

III. Bibliography *47*

IV. Anexes *49*

IV.I Future sustainable cities projects 49

IV. II Materials used in the simulation details. 49

IV. III Plan parcial desarrollo urbano de San Luis Potosí. 51

I. List of tables

Table 1 List of solutions for energy savings in buildings. Individuals Matter: Ways in which you can save energy where you live. Living in the Environment, Tyler Miller, Jr. Scott E.Spoolman. 17
Table 2 List of industrial parks. Secretaria Economica San Luis Potosi. 27
Table 3 Estudio de Riesgo, capítulo 2, Resumen ejecutivo de la manifestación de impacto ambiental. 32
Table 4 Sistema de Transporte Público Foráneo. Plan Parcial de Desarrollo Urbano de la Sección Sur Oriente de la Intersec-ción Formada por la Carretera Rioverde y el Libramiento de Cuota a Monterrey. 36
Table 5 Model names. Own work 44
Table 6 Energy needed of the models and cost. Own work. 44
Table 7 Cost of construction and maintainance. Own work..... 45
Table 8 Emision kCO2/year. Own work 45

II. List of figures

Figure 1 Relation between core areas, corridors and buffer zones. Own work..... 5
Figure 2 Equilibrium Theory of Island Biogeography: A Review, Angela D. Yu Simon A. Lei. 5
Figure 3 Colonization curve. Equilibrium Theory of Island Biogeography, McArthur and Wilson 1967 6
Figure 4 Size. Equilibrium Theory of Island Biogeography, McArthur and Wilson 1967. Own work. 6
Figure 5 Distance-extinction. Equilibrium Theory of Island Biogeography, McArthur and Wilson 1967. Own work. 6
Figure 6 Distance-immigration. Equilibrium Theory of Island Biogeography, McArthur and Wilson 1967. Own work. 7
Figure 7 Size-immigration. Equilibrium Theory of Island Biogeography, McArthur and Wilson 1967. Own work 7
Figure 8 Problem of conservation. Equilibrium Theory of Island Biogeography, McArthur and Wilson 1967. Own work..... 7
Figure 9 A map indicating all islands with a peak of 2000 m or higher. Larger islands are shaded, smaller islands are denoted, Williamson 1981 8
Figure 10 Sea level rise. NCA2014..... 8
Figure 11 Holling, C. S. 2001. Understanding the Complexity of Economic, Ecological, and Social Systems. Ostrom, Eli-nor. 2009. Beyond Markets and States: Polycentric Governance of Complex Economic Systems..... 12
Figure 12 Individuals Matter: Ways in which you can save energy where you live. Living in the Environment, Tyler Miller, Jr. Scott E.Spoolman. 17
Figure 13 Desktop version of Necada. Necada..... 21
Figure 14 Own work based in Alazne Gonzalez.Wikimedia Commons 22
Figure 15 State population. Perfiles Industriales del Estado de San Luis Potosí 2014. Own work 23
Figure 16 Ages of the population. Perfiles Industriales del Estado de San Luis Potosí 2014. Own work..... 23
Figure 17 Areas and population. Perfiles Industriales del Estado de San Luis Potosí 2014. Own work..... 24
Figure 18 Secretaría de Comunicaciones y Transportes de Gobierno del Estado de San Luis Potosí,2012 24
Figure 19 Secretaría de Comunicaciones y Transportes de Gobierno del Estado de San Luis Potosí,2012 25
Figure 20 Natural areas. Perfiles Industriales del Estado de San Luis Potosí 2014 25
Figure 21 Municipalities of the central zone. Perfiles Industriales del Estado de San Luis Potosí 2014..... 26
Figure 22 Main economic activities. Secretaria Economica San Luis Potosi 27
Figure 23 Emplacement Area of Study. Own work 28
Figure 24 Imagen extraída del Plan Municipal de Desarrollo Urbano de San Luis Potosí. Ubicación y cambio de uso de la zona deominada como Ciudad Satélite 33
Figure 25 Plano de problemática urbana. Plan Parcial de Desarrollo Urbano de la Sección Sur Oriente de la Intersec-ción Formada por la Carretera Rioverde y el Libramiento de Cuota a Monterrey..... 37
Figure 26 Zoning plan. Plan parcial de desarrollo urbano San Luis Potosí 40
Figure 27 Invies house model. South Facade. January. 14:00 h. Own work..... 40
Figure 28 Architectural plan. INVIES 41
Figure 29 Green roof system. Delta garden roof system with floorax. Membranas y soluciones. Mexico..... 42

Figure 30 Invies house model with cantilever. South Facade. January. 14:00 h. Own work 42
Figure 31 External insulation system. Weber system. Cype Ingenieros 42
Figure 32 Desktop mode. Necada 43
Figure 33 Necada cloud mode. Necada 43

“Transdisciplinary improvement on an isolated living model”
Research project by Carme Fonseca Casas

1. INTRODUCTION

This research is the result of several notable concerns to observe both communities in isolated towns and communities isolated by geophysical reasons.

Now, it is necessary to establish the needs and characteristics given in this inhabited nuclei areas to improve the quality of user’s life respecting the environment (using sustainable criteria). We are about 7 billion people; the vast majority living in cities, climate changes are showed in phenomena that make us rethink the way we live.

A great group of people live in vulnerable areas, it makes that many people are migrating to more stable areas, here also it must be taking into account the loss of intangible heritage; the study aims to be a structuring core of these converging aspects.

The 11 Goal of the Global Goals for Sustainable Development says that human settlements must be inclusive, safe, resilient and sustainable.

It is important to improve the quality of the settlements that we already have and to improve them with affordable technology making them more self-efficient.

Starting from a wide concept of island to understand the isolated cores from a different point of view.
Specific cases will be studied, focusing on poor isolated communities, which serves to reach a proposed model that optimizes and expands, as it will go incorporating new parameters.

This connects the reality of islands, with a real case study and uses a tool developed by the same university, linking different areas from the university and sharing knowledge between them. Each of the departments linked in this work has been relevant in different parts:

- UNESCO Chair on Sustainability: study about islands.
- Universidad del Habitat de San Luis Potosi: case study.
- Innlab: user experience with NECADA.

This work has worked hard to keep informed the different departments and to show the advantages of working together, being many times difficult to find the right language to talk between them.

In this master, I have learnt that if we want to change things we must rethink the way we are used to work; working with three different departments (architects, biologists and informatics) gives a transdisciplinary work and is more sustainable, improves knowledge using local sources and uses real stakeholders that can get direct benefit from this way of work.

The future line of this work would be to continue developing, trying the different solutions adopted for this core, improving the software and knowledge acquired.

Keywords: isolated core, community, transdisciplinary, vulnerable, self-efficient, NECADA.

2. RESEARCH PROJECT

2.1 Main objective

The research aimed at **understanding exactly the needs of the isolated nucleus in a sustainable manner.** Working together with three different departments to answer local needs to guide them to a path that will mark guidelines for the development of a core with social participation, using local materials with minimal ecological footprint, and this work will focus mainly on aspects of energy solutions. This study will be extended in the fields of telecommunications and water supply in the next studies.

2.2 Specific objectives

a. Outlining the parameters characterizing the isolated nuclei and problems (general information), types of isolated nuclei.
b. Focus on building, list of solutions used able to deliver electricity, water and food in situations of isolated cases focusing on housing units.
c. Comprehension of the isolated nuclei context analyzed, Ciudad Satélite, San Luis Potosí:
   - Reasons for its creation.
   - Localization: relation with the closed nuclei.
   - Population: social reality of the people who lives there, “satelitenses”.
   - Energy water and food needs to be satisfied.
   - Identification of areas of opportunity, abandoned spaces, unused spaces, excluded social groups and study their reintegration.
d. Model the different scenarios using NECADA.
e. Compare the results.

2.3 State of art

At a time when most of the population lives in inhabited areas of city size. This research study is the result of observing different geographically isolated cases and isolated cases by community organizations in densely occupied centers. It has made a thorough study of the islands, understood as physical area surrounded by water, they are just the 3% of the land area but they have 500-700% more species than continents, when the sea level will rise by the climate change, the 6-20% of the islands will be completely submerged, taking with them all their wealth.

The examples studied allows us to have a list of possible solutions for self-sufficiency for isolated nuclei. This study will be extended, in the future, to study cases of neighborhoods - groups of houses, which have adopted solutions that will lead them to their maximum self-sufficiency. The components analyzed are:

A. Supplies:
   a. Energy
   b. Water.
   c. Food
B. Telecommunications
C. Transports
D. Waste management
E. Social organization
F. Strengths and weaknesses (Immaterial heritage)

In this first phase, I will just analyze point. A.a. Supplies-Energy.

2.4 Research questions

The study of the parameters will lead us to give an answer to one crucial question:
How can we make it attractive to live in that space? Develop a pipeline of solutions.

In this regard, the investigation, once focused in San Luis Potosí, will focus on:

1. Opportunities of cultural, geographical and social level.
2. Study of the current global situation, who are the external stakeholders that may be interested in the core, what is what they want. How this has been solved in other isolated nuclei.
3. Improve the living model type.

The **main directions** of research are:

1. List of information to talk about the self-sufficiency of isolated nuclei, community level, island and isolated community.
2. Look for existing models.
3. List the possible existing solutions for self-sufficiency of water, energy and food.
4. Case study, Satellite City, San Luis Potosi, Mexico.
5. Proposals for a new method of performance, using a simulation model (NECADA).
6. Proposal of new building models.

2.5 Scope of study

a) Descriptive study: the process will need to parameterize the variables that make up the case study and to get an atlas that brings together different solutions taken in existing types.
b) Motion Technology: we want to obtain optimum results for the core model to ensure its preservation and at the same time use it as prototype and example to follow in other similar situations; this will be quantified and simulated using NECADA (UPC).
c) Impact on public policy: a proposal aims to give maximum satisfaction of all the stakeholders involved, this will make users provide feedback solution and at the same time increase the social fabric, making them love the space where they live.
d) Profitability: The result should be sustainable with all the processes needed to be self-sufficient, applicable to other geographic areas and serve as a basis for developing a simulation model for optimizing isolated nuclei. Making itself more interesting for new users, salable, for the government.
e) Transdisciplinary work: between the three departments involved in the project.

2.6 Required information

In relation to the satellite city we will need to have information from local maps, map of the project (10% built), construction features, environments topographic characteristics - morphological - social, energy needs, water and food, characteristics of users, work and how they live there.

3. ISOLATED GROUPS.

3.1 Definition

a) Piece of earth surrounded by water.

b) Isolated area well differentiated from the surround.

c) An appropriated area for living surrounded of an inappropriate area for living.

3.2 Importance

Islands are just the 3% of the emerged area of the earth but they have more than 500%-700% species per area unit than in continents. Undoubtedly, the islands are a global conservation priority. In the social and economic aspects, islands also play a strategic role in terms of sovereignty and the use of natural resources. Because of its location, the islands determine the Exclusive Economic Zone (EEZ) of many countries.

1/3 of threatened species of mammals, birds and amphibians worldwide, are located on islands (da Fonseca et. Al. 2006).

3.3 Concepts

We use the example of a population of woodpeckers in a primeval forest landscape where habitat availability is maximum.

Human activity entails reductions in the area of favorable habitat, and a first separation of the global population in a set of interconnected subpopulations remains.

We have a set of “metapopulations”: a set of "populations" of a species that inhabit a viable network of habitats placed sufficiently close to allow the dispersion between different "patches of habitat."

A set of favorable habitats separated by different habitats that show resistance to the presence of woodpeckers and that, being close enough; make up a network of habitat that holds a metapopulation. The habitat of areas too small to maintain a stable population serves as a feeding area for woodpeckers living in smaller islands; and it serves as well "stones to cross a puddle," that is, as small islands that facilitate the transition of individuals between the larger islands.

A transformation of the landscape ends to create more intense fragmentation problems: "core" areas remain too far apart they "sink" where the "islands" of habitat are too small to maintain a stable population that is resistant to front possible disruptions (Figure 1). For example, fire or drought could eliminate smaller towns, occupying favorable habitats, often of poorer quality.

Woodpeckers living in smaller islands need to invest more energy to get food. Because the population is smaller and more vulnerable, a disease or a drastic reduction of food resources can lead to local extinction.

The ecological network concept has inside the metapopulation concept; there are cores that are not able to keep a group of population stable.

The core areas, which are the major ecological habitats; the "buffer areas" which are strips of habitat "suboptimal" whose function is to cushion the impact of human activity on optimal habitats; and finally the "Greenways" or green corridors, which would function to interconnect optimal habitats.

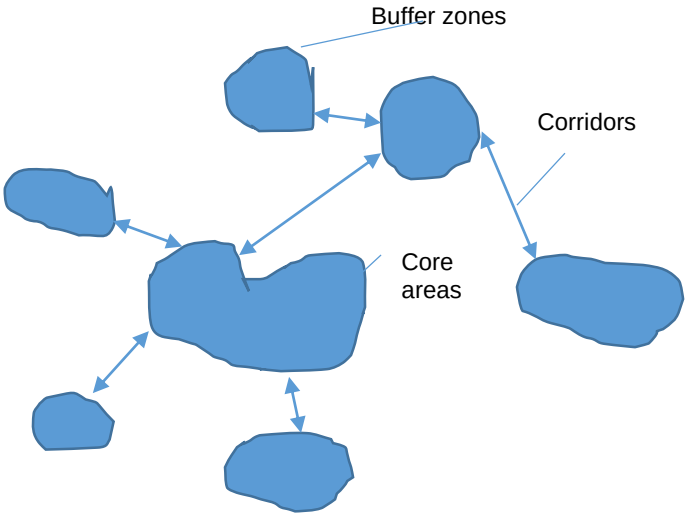

Figure 1 Relation between core areas, corridors and buffer zones. Own work.

Equilibrium Theory of Island Biogeography (ETIB) McArthur and Wilson. 1967.

There are two ways that islands can gain species: immigration or speciation.

These ways to increase the number of species are balanced in equilibrium condition for processes that lead to the extinction of species on the islands.

The processes involved in the ETIB are:

- Immigration: a propagule that arrives to an island not occupied by species.
- Immigration rate: number of new species arriving in an island unit time.
- Colonization: persistence of a relatively high immigrant species in an island.
- Settlement curve: Change in the number of species that occur in an island.
- Extinction: the disappearance of the species in an island.
- Extinction rate: number of species in an island disappear per unit time.
- Turn over: The number of species removed and replaced over a period.

The number of species seen in an island a dynamic balance between immigration and extinction, where immigration varies with the distance, and the origin and extinction vary with the size of the island. (Figure 2).

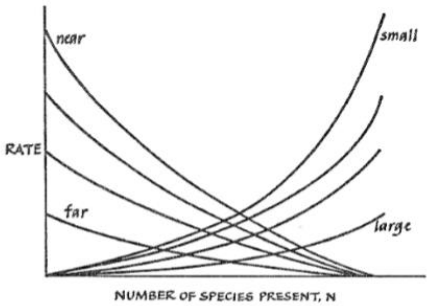

Figure 2 Equilibrium Theory of Island Biogeography: A Review, Angela D. Yu Simon A.

- Immigration rate decreases the higher the number of species present in the island.

- Immigration rate will be higher when the islands are close to the mainland than in isolated islands.

- Extinction rates will be higher the more species coexist in the island.

- The extinction rate will be lower in large islands.

- The balance between immigration and extinction rate determines the number of species that have an island in steady state (when rates are the same) and even the exchange rate of species St +1 = St + I – E (Figure 3)

Colonization curve (Figure 3): Temporal trend in the number of species present in the island. The theory posits that change is dynamic as the number of species maintains but species composition changes.

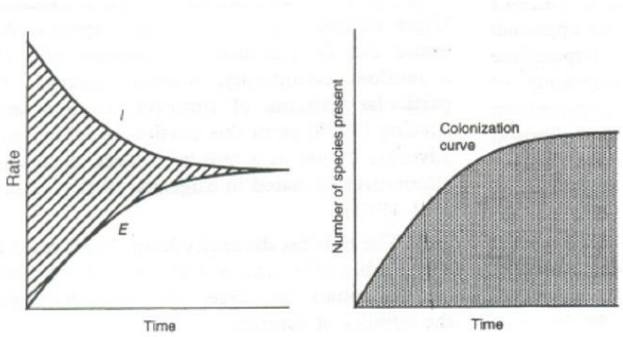

Figure 3 Colonization curve. Equilibrium Theory of Island Biogeography, McArthur and Wilson 1967

ETIB says:

Just the size of the island influences the extinction rate.

Supplementary immigration. (Figure 4).

Figure 4 Size. Equilibrium Theory of Island Biogeography, McArthur and Wilson 1967. Own work.

The isolation also affects the rate of extinction. *Rescue Effect*. (Figure 5).

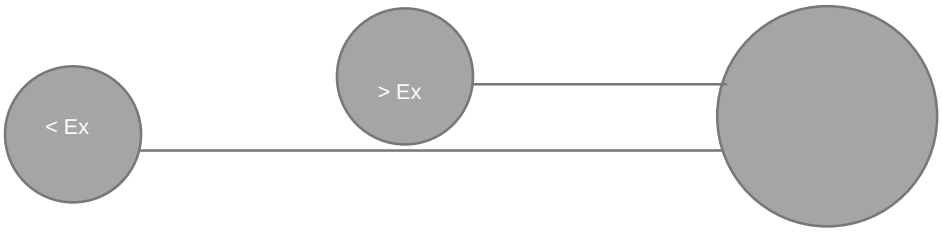

Figure 5 Distance-extinction. Equilibrium Theory of Island Biogeography, McArthur and Wilson 1967. Own work.

ETIB says:

Just the isolation influences the immigration rate. (Figure 6).

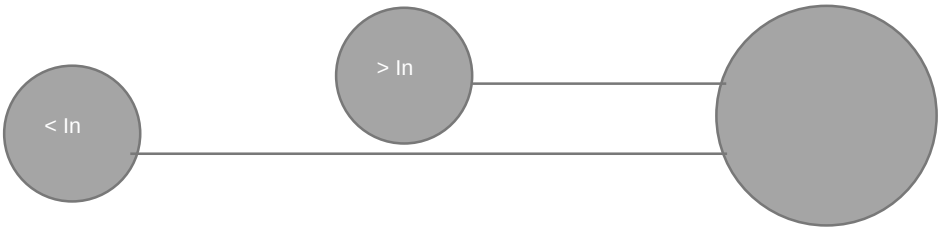

Figure 6 Distance-immigration. Equilibrium Theory of Island Biogeography, McArthur and Wilson 1967. Own work.

The size of the island influences the immigration rate. White effect. (Figure 7).

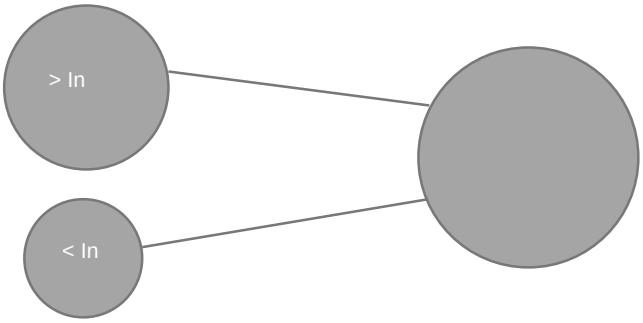

Figure 7 Size-immigration. Equilibrium Theory of Island Biogeography, McArthur and Wilson 1967. Own work

The vulnerability of the natural biota: it starts with a more or less full biological allocation, but it is a known fact that the biota of islands emerged from the ocean is disharmonious (Carlquist, 1974), missing species and whole groups that were unable to overcome the arm of the sea or the insular arm.

Relation between size of the island and distance to the continent and the problems of conservation of its biodiversity. (Figure 8)

The specificity of conservation problems: overexploitation "sinks" species, important infrastructure, insular specialty; technical challenge; political challenge; insular message.

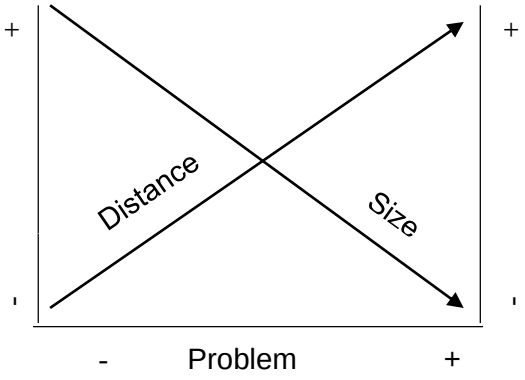

Figure 8 Problem of conservation. Equilibrium Theory of Island Biogeography, McArthur and Wilson 1967. Own work

3.4 Types of isolated groups.

After understanding the importance of the islands, I have extrapolated the concept of isolation to see what types of isolated cases exist and I have categorized these types of isolated communities.

a. Geographically isolated.

The **6 - 19%** of the **4447** islands would be **completely underwater**, under considered scenarios (1–6 m of sea level rise). (Figure 9).

Figure 9 A map indicating all islands with a peak of 2000 m or higher. Larger islands are shaded, smaller islands are denoted, Williamson 1981

Global sea level has risen by about 0,2 meters since reliable record keeping began in 1880. It is projected to rise another 0,3 m to 1,5 m by 2100. (Figure 10).

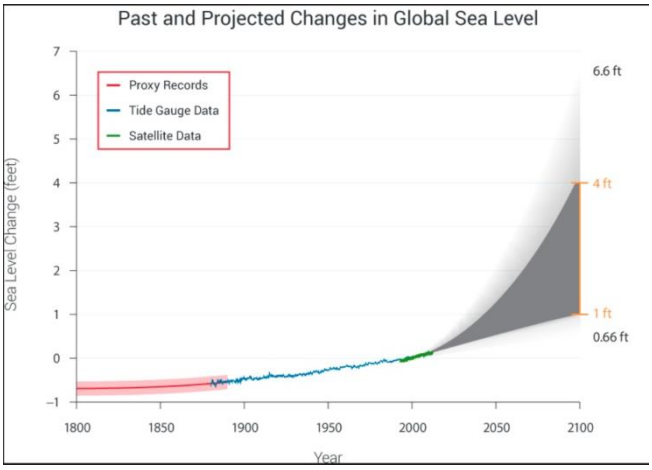

Figure 10 Sea level rise. NCA2014

At the eighth meeting of the Convention on Biological Diversity, Conference Of Parties 8 (Curitiba, Brazil, March 2006) it was reviewed the status of island biodiversity and adopted the first and only program of work focused exclusively on the uniqueness and fragility of insular biodiversity (decision VIII / 1). The overall objective of this program of work is the significant reduction of the loss biodiversity rate of the islands to 2010 and beyond, as a contribution to poverty alleviation and sustainable development of the islands, in particular small islands developing States.

The biodiversity of the islands is important:

- They are small towns and economies.
- Have a weak institutional capacity in both the public and private.
- They are far from international markets.
- Susceptibility to natural disasters and climate change (including especially the sea level rise due to climate change).
- Fragility of land and marine ecosystems.
- High cost of transport.
- Limited diversification of exploitation and exportation.
- Dependence on international markets, export concentration and volatilization of income.
- Vulnerability exogenous economic shocks.

2014 was the International Year of Small Island Developing States (IYSIDS).

They work hard to:

1. Create awareness of the value and uniqueness of island biodiversity in communities/ countries.
2. Celebrate and encourage investment in bright spots in island conservation and sustainable livelihoods from communities/ countries.
3. Engage your community to take action to support conservation and sustainable livelihoods.

The global island partnership is promoting actions for island conservation and sustainable livelihoods by inspiring leadership, catalyzing commitments and facilitating collaboration among all islands.

b. Cultural divergence.

Some communities want to preserve their culture and decide to reduce the contact with the outside culture. These communities are normally the more self-sufficiency ones that exist because they do not agree the way the world is going so they force their isolation.

Examples of these communities can be Amish in the United States, Maoris in New Zealand, Natives of West Canada, rom, monasteries, convents and transition towns.

c. Lack of supply.

It can be because the community settle in a place where there is lack of supply from the beginning or it can be because people start leaving the place and the company decides to cut the supply.

Examples of these communities can be towns that are living in places with difficulties to be reached like Caneto (Huesca), Ordis (Alt Empordá), Mal pas (Vall d'Aran).

3.5 Problems and solutions.

After categorizing the different isolated groups, I have seen that they have some problems related to their size and number of habitants; it is what determinates their availability of resources. Isolation will be different depending on the permeability of the limits of the area; fragility; limited human, natural and financial resources and less precipitation rate, that is shown in the water problem.

a. Collecting water: Malta, Cyprus

There are many Mediterranean islands using technology to collect and store rainwater from the roofs of the surface, of the earth or rock basins, jugs and pots, as well as more complex techniques such as underground dams.

In Malta, they are constructing new cisterns; in Cyprus, they have been using greenhouse water to irrigate crops.

b. Non-potable water, seawater, brackish water and treated wastewater: Marshall Island

Marshall Island is using seawater for toilet flushing; they have big problems for getting fresh drinking water. Another solution that they have adopted is to use brackish water for firefight, and the most recently solution they have adopted is to purify seawater using desalination technologies. For doing this, they have dual piping systems used to distribute seawater and fresh water.

Another use of seawater is for power generation and for filling pools. (Asian Development Bank, 2006)

To reuse treated wastewater, water recycling, you can cover the agricultural and garden irrigation; it can also be used in industrial processes, toilet flushing, and groundwater recharge, always depending on the level of treatment and quality of the source.

c. Transfer of water: Singapur, Mallorca, Rodas

For decades, Singapore, which does not have rivers, so does not have fresh water, has relied heavily on importing water from Malaysia to cover half of water consumption on the island. This has involved a dispute in the price of water resulting in a need to increase self-sufficiency in water supply. Water transfer from the mainland or from other islands is done by large tankers and in some cases people are going to look to other nearby water sources (Asian Development Bank, 2006)

Rhodes exports water to the islands of Symi, Halki and Santorini suffering water shortages.

In Mallorca, tankers transferred the water from the mainland to supply water in the season of 2 million visitors.

d. Desalination plant: Malta

In 2010 the 56% of Malta's potable water and 3,8% electricity was generated by a desalination plant. (National Statistics Office 2011).

e. Soil problems

The main soil problems of these isolated groups are desertification, erosion, contamination, waterproofing and variation in rainfall regime.

f. Social problems

In 2010 in the Mediterranean due to a severe shortage of water, it increased friction with the local population and the tourism authorities.

Hotels consume an average of 600 liters / person including golf course and water parks.

The increase in water salinity means more environmental degradation and fewer tourists.

g. Temperature problems, heat wave, wildfires

In August 1994 there were major fires in Tuscany, Corsica, Sardinia and France, as a consequence many campsites were evacuated.

In summer 1998, because of a major heat wave in Greece there were several deaths, this implied a negative publicity caused the number of tourists descended.

That year, in the British press, news were published counting cases of tourists staying in hotels trying to flee the intense heat of the beaches.

h. Health problems

In the Mediterranean, it is increasing the number of malaria cases and it is estimated to be in Spain in 2020.

Increased microbiological activity increases the incidence of salmonella, cholera, typhoid fever and infectious diseases.

i. Tourism

The solutions found are to extend the tourist season, to install air conditioning systems and increase the elderly tourists.

3.6 Resilience

"Islands will always be vulnerable. This will never change. However, they can do things to mitigate risk of being harmed by external shocks by increasing their resilience. Resilience is policy-induced. Vulnerability is inherent." Lino Briguglio

"SIDS (Small Island Developing States) are at a crossroads. They must recover themselves by building resilience and reducing vulnerability amid global change characterized by volatility, inequality and uncertainty. It is imperative that these states continue to undertake effective change management and targeted investments to cope with global shifts. In so doing, the principles of green growth will be essential to any such plans." Ambassador Skerritt-Andrew, Chair of the ACP committee of Ambassadors in Brussels.

"Small farmers and small island states will never compete on volume and price, so we must come together to produce larger volumes but also to identify high quality niche markets." Don Keith Amiel, Caribbean agribusiness association (Building resilience in small island economies: from vulnerabilities to opportunities. CTA Policy Brief).

It is important to consider these statements because Islands must be able to afford new situations and to adapt themselves to these new emerging scenarios.

As its showed in Figure 11, according to Holing's cycle, a small system is more resilient and more flexible because it can easily affect and adapt to different cycle even it collapse more often, the accumulation of previous cycle can be nourishment to the others.

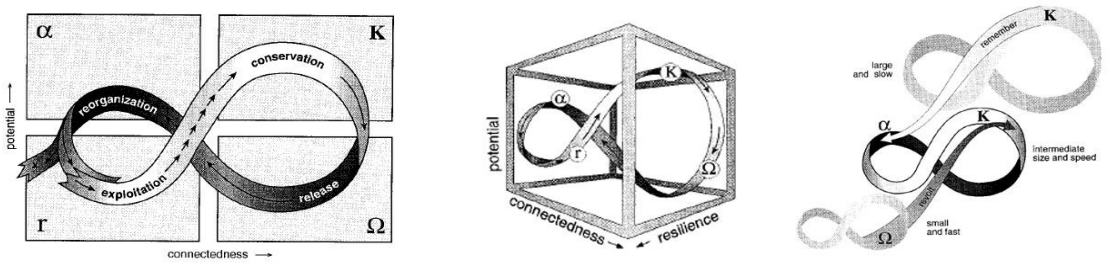

Figure 11 Holling, C. S. 2001. Understanding the Complexity of Economic, Ecological, and Social Systems. Ostrom, Eli-nor. 2009. Beyond Markets and States: Polycentric Governance of Complex Economic Systems

Elinor Ostrom in Polycentric Systems shows the size of the organizations, it is important for efficiency, medium organizations are more effective and perform well with less investment.

3.7 Examples of islands going to self-sufficiency.

a. Hawaii

This island is working hard to be in 2050 Sustainable, it has developed different lines to make Hawaii more self-sufficient and to reduce the dependence of importations.

Its area is 28.311 km2, a population of 1.362.000 hab and a density of 45,33 hab/km2

Is going to implement the "energy police: To enable native Hawaiians and the broader community working together to lead Hawai'i's effort to achieve energy self-sufficiency and sustainability"

1. *Mālama ʻāina: Respect and protect our native homelands.*
2. *Koʻo: Facilitate the use of diverse renewable energy resources.*
3. *Kūkulu pono: Design and build homes and communities that are energy efficient, self-sufficient and sustainable.*
4. *Kōkua nō i nā kahu: Provide energy efficiency, self-sufficiency, and sustainability opportunities to existing homesteaders and their communities.*
5. *Hoʻonaʻauao: Prepare and equip beneficiaries to promote a green, energy efficient lifestyle in and around communities.*

b. Samsø

This Danish Island has been working hard to achieve the goal of 80% self-sufficient efficiency.

It has an area of 112 km2, 3889 habitants and a density of 34,03 hab/km2.

Samsinger has done a private investment of €60 million in this island (70% of the total amount of investment needed to make this island self-sufficient. Nowadays Samsø exports wind-generated power and its CO2 emissions represent a negative figure: - 3,7 tons per year.

Samsø Energy Academy was established in the island in 2007 and part of its mission is to locate further energy savings and reductions in CO2, and draw attention to energy use on the island.

By 2050 Denmark wants to be 100% fossil fuel independent, Samsø 2.0 is a new initiative to help to achieve this goal, the academy believes it can be done faster-by 2030. Based on Samsø success, the Danish government has included Samsø on their national budget.

To achieve the goal of being a fossil free community, Samsø wants to:

- by 2020, renovate the existing building stock on Samsø (approximately 1,800 houses) to reduce their energy consumption---by 30% for private users and 5% for industry;
- develop a more flexible energy system to accommodate both solar and wind generation, and replace the 21 old wind turbines with new and more effective turbines;
- reduce the use of fossil fuel for home heating by replacing all oil-burning furnaces (758 houses on Samsø) with, e.g., wood pillar burners or heating pumps for buildings outside the district heating grid, and expand the existing coverage of the district heating grid, which runs on renewable energy;
- establish a facility to produce biogas for transportation (buses and ferries) and agricultural uses, which, preliminary estimations show Samsø capable of producing five million cubic meter of biogas per year;
- replace all gasoline cars with electric cars, which can be charged using the island's surplus electricity (the goal is that by 2020, 50% of the local car park will consist of electric cars, and 40-50% of the local heavy transportations will use bio fuel); and provide new tools to allow Samsingers to monitor their energy use.

c. El Hierro

This island is a Unesco Biosphere reserve since 2000, his area is 268,71 km2, there are 10.960 habitants and its density is 40,79 hab/km2. The origin of this island is volcanic.

This small island from the Canary Islands is one of the most self-sufficient.

El Hierro is not connected to any national network so the technicians have to guarantee a 100% production of energy.

The flow from the coast generates energy in the 11,5-megawatt turbine farm supporting the water desalination plants for the residents.

18.700 metric tons of yearly carbon dioxide emissions covered by the wind power and 40.000 barrels of oil will not be necessary anymore.

The excess of energy generated will be sold to get some profit between one to three million euros.

d. Scotland: Eigg island

This island is almost 100% self-sufficient.

It has an area of 31 km2, 83 habitants and a density of 2,7 hab/km2.

This place uses different systems to get enough energy to cover almost all the requirements of its residents, they use solar panels, wind turbines and hydroelectric systems, so this means that they get the 90 of its energy from renewable sources.

1997 is an important year because is when the residents made Eigg the first Scottish island owned by its inhabitants buying the land from its previous owner. To become a member of the residents' committee, any newcomer can be empowered after living in the island for more than six months. The system allows each inhabitant to have a say in the decision to install solar panels, wind turbines and other sustainable mechanism, so this is why some of the islanders, who are familiar with the logistics and technicalities of installing, claim renewables as the success of the island's electric scheme.

Its 31 square kilometers of area is covered with an electricity grid since the 1 of February of 2008, a $2,64 million project.

This grid is independent from the UK national grid, so the cost of this energy is higher than the cost on the mainland, so the residents must not use more than 5 kilowatts at a time, while the business have a limit of 10 kilowatts. This makes them to use the electricity in a more efficient way.

In advantage of their geographic location and harsh weather conditions, the island has an abundance of wind and sun energy so it has been able to put free heating into public spaces, churches and its community center.

e. Scotland: Eco village

1) Findhorn eco village is a community in the North of Scotland.
2) The beginning of this community where around 1962 in a Findhorn community.
3) 1985: they start being a low carbon eco village.
4) They have a wide variety of ecological techniques and this project has won different awards, in 1998 they won the UN Habitat Best Practice Designation.
5) They have a major center for adults that serves 14.000 visitors every year from 50 different countries.
6) Their ecological footprint is just the half of the national UK average ecological footprint.
7) They have 61 ecological buildings, in their beginnings, they constructed their first buildings using a recycled whisky barrel, they called these houses whisky barrelhouses.
8) They also have four wind turbines with a total capacity of 750 Kw; most of the electricity is used on their on-site, on their private grid. They are even exporting electricity.
9) They have a biological wastewater treatment; it is a natural non-chemical biological system that cleans their sewage.
10) They have organic food production, also using permaculture techniques; this provides the 70% of community fresh food requirements.
11) They use solar panels for hot water heating.
12) Since 2002 they have their own bank and local currency, it's called Eko currency, it was launched by Ekopia, £17.500 worth of Ekos are in circulation, , the equivalence is on a par with sterling i.e. 1 Eko = £1 = 1, 35 €.
13) They offer sustainability education over 33 countries.

f. Iceland

It has an area of 102.775 km2, a population of 329100 habitants and a density of 3,2 hab/km2.

It is located 320 km south of the North Pole. Most part of the island, three- fourths, consists of volcanoes, glaciers and hot springs and most of the people live in its capital city, Reykjavik. It has 20 active volcanoes.

Iceland Generates 99.5% of its Energy From Renewable Sources.

The 80% of Iceland houses and the production of vegetables in greenhouses are heat using the electricity supplied by the energy provided from the steam close to its surface and geo-thermal energy from superheated groundwater. This makes that, thanks to these two renew-able sources, Iceland supplies almost all of its electricity and three-fourths of its overall energy.

Now, 60% of its income is supplied by imported oil to run cars, some factories and fishing boat, because it has no fossil fuel deposits.

By 2050–2060, Iceland has plans to eliminate its dependence on non-renewable oil and to become the world's first country to run its economy entirely on renewable energy.

In 1970s, Bragi Arnason, a University of Iceland professor often called "Dr. Hydrogen," proposed that the country could eliminate its fossil fuel imports and strengthen its economy by using electricity produced by its ample geothermal, hydroelectric and wind power resources to decompose water into hydrogen and oxygen gases.

Exporting excess of hydrogen to other countries could be used also to help its economy.

In 2003, Royal Dutch Shell built and ran the world's first commercial hydrogen filling station opened in Reykjavik.

2003-2007 Daimler provided three prototype fuel-cell buses that where fueled by the station

In 2008, 10 Toyota Prius test vehicles where fueled by the station. First, they were converted to burn hydrogen in fuel cells.

Since 2008, even a whale watching boat has been partially powered by a hydrogen fuel cell.

Icelanders hope they will be able to run all cars, factories and ships just with hydrogen.

After seeing this success, UK has been working with Iceland in order to construct a 930-mile undersea cable to pump Iceland's geothermal energy to the UK.

There are some people concerned about this expansion. Saving Iceland, an environmental group has warned that recent studies show links between asthma and sulphur pollution from geothermal power plants.

They wrote on their site: "Those who promote large-scale geothermal energy production as green and environmentally friendly, are once again forced to face another backlash as a recent research suggests a direct link between sulphur pollution from the Hellisheiði geothermal plant and asthma among the inhabitants of Reykjavík."

Saving Iceland has also talked about the excess water and runoff that goes with geothermal projects; they say that this should be pumped back into the earth in order to prevent polluting impacts and the creation of lagoons containing a huge amount of polluting materials.

Although they have cheap electricity, there are just 11 electric cars due to the rugged landscape of the country and most of the population uses sport utility vehicles.

g. New Zealand: tokelau Islands

It is just 10 km2, a population of 1400 habitants and a density of 115 hab / km2 approximately.

Power Smart Solar, a private enterprise sets up on three atolls more than 4000 solar panels, 390 inverters and 1300 charge batteries that convert sunlight into electricity, store it and redistribute it. To achieve this a 6 million euros investment was needed.

Nowadays, 150% of its energy needs is covered 24 h a day just with solar panels. This also avoids the release of 950 tons of CO2 into the atmosphere each year.

All the components used are able to withstand the wild winds, like tropical cyclones, and also the highest temperatures and highest salinity oceanic climate characteristics.

Other archipelagoes like Tonga, Cool, Tuvalu and Samoa are developing similar initiatives.

4. ENERGY EFFICIENCY

4.1 Basic information

There are some basically things to be known about energy efficiency

The measure of how much useful work is accomplished by a particular input of energy into a system is called energy efficiency, or energy productivity.

Just the 16% of the United States energy used, ends up performing useful work. A 43% is unnecessarily wasted or 41% is unavoidably wasted, in total 84%, because of the second law of thermodynamics.

If we stop wasting almost half the energy we use we would get more energy, and this is the cheapest and quickest way to do it.

We can get energy from different resources.

Solar energy: passive active solar energy can be effective for heating water and buildings, and the costs related to the use of direct sunlight to high-temperature production are decreasing.

Electricity from water cycle: there are many environmental concerns and it is difficult to find suitable sites to get the energy that limits this option. Dams with water flowing over them, tidal flows and ocean waves are used for this.

Electricity from wind: this way to produce electricity is the least expensive and polluting option, when market prices included the environmental cost of energy resources.

Biomass: if this renewal resource is burnt faster than it is replenished, it produces a net gain in atmospheric greenhouse gases. The creation on biomass plantations degrades soul and biodiversity. Another additional problem derived of creating plantations for biofuel oil is the degradation of the soil and biodiversity and the increment of food prices and greenhouse gas emissions.

Geothermal: this renewal resource has the problem of limited locations where it can be exploited, it has a high potential for supplying many areas with heat and electricity with a low environmental impact.

Hydrogen: this is used as lot for powering cars and generating electricity.

4.2 How can to save energy in buildings

Designing and building for energy efficiency and retrofitting existing building could make us to save energy and money. 30-40% of energy used globally could be saved designing better according to an U.N 2007 study.

75% of heating costs can be saved when the building is well insulated and 20% if the building is well orientated getting the heat from the sun.

As existing buildings were not built with energy efficiency as a priority, we could retrofit them to save energy and money. Above we can see a list of solutions used in buildings to increase energy efficiency in buildings. (Table 1, Figure 12).

1. Insulate and plug leaks.	2. Heat houses more efficiently
3. Use energy-efficient windows	4. Heat water more efficiently.
5. Stop other heating and cooling losses	6. Use energy-efficient appliances
7. Use energy-efficient lighting	

Table 1 List of solutions for energy savings in buildings. Individuals Matter: Ways in which you can save energy where you live. Living in the Environment, Tyler Miller, Jr. Scott E.Spoolman.

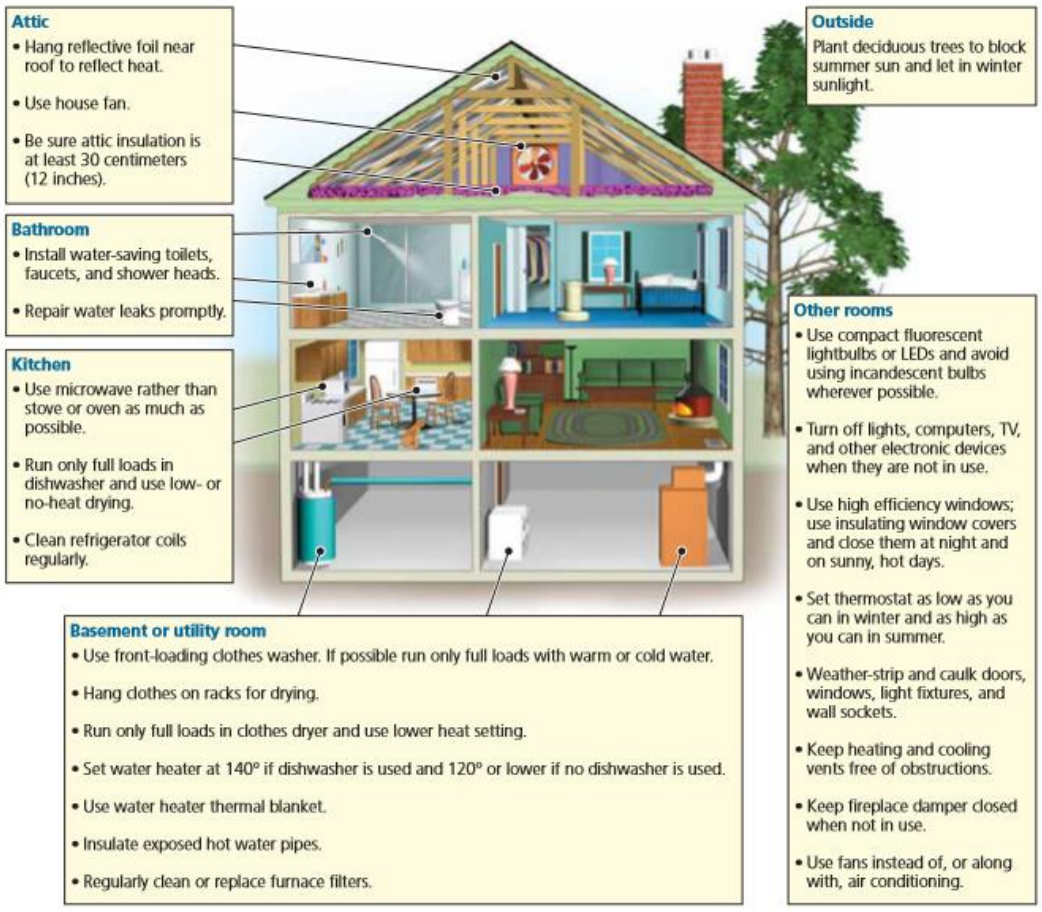

Figure 12 Individuals Matter: Ways in which you can save energy where you live. Living in the Environment, Tyler Miller, Jr. Scott E.Spoolman.

5. EXISTING SIMULATION AND OPTIMIZATION PROGRAMS

Many different software could be used for simulating energy efficiency in building design. How could be increased the quality of life just improving a little bit the buildings from Ciudad Satelite? Most of them based in general in the guidelines of the “American Society of Heating, Refrigerating and Air- Conditioning Engineers (ASHRAE, 2012) or “Chartered Institution of Building Services Engineers” (CIBSE, 2012)

There are so many different software, payment and free, to get the energy calculation that many times is difficult to know what is better to use, depending of the utility, rigor and exhaustive.

In the study “Contrasting the capabilities of building energy performance simulation programs“ made by Drury B. Crawleya, Jon W. Handb, Michae¨ l Kummertc, Brent T. Griffith (2005 and 2008) we can read a comparison of the software that exists until that time.

The point is, if we talk about groups of buildings there are less programs that analyzes this energy efficiency, we can analyze each building separately but to understand them as a group is more difficult, anyway there are some important advances going towards this direction.

In this line there are some of them that are interesting to mention.

5.1 Non European Software

There are some simulation and optimization programs developed outside Europe.

Adopt (Yi Zhang, 2013), DesignBuilder, TrnOpt (Wisconsin University, 2012), BeOpt (2012), OptEPlus (Laboratory, 2011) and GenOpt (2011).

5.2 Recently Spanish Software

a. URBILCA

This project was presented March 2015 in the Universitat Pompeu Fabra, Barcelona.

To get the program it took from July 2013 to December 2014, the total cost was 823.552,15 € and the European Regional Development Fund (ERDF) helped with 617.664,11 €.
The partners involved are:

- CIRCE – Centro de Investigación de Recursos y Consumos Energéticos,
- Cátedra UNESCO de Ciclo de Vida y Cambio Climático Escola Superior Comerç Internacional (ESCI) - Universitat Pompeu Fabra (UPF)
- NOBATEK – Centre de Ressources Technologiques
- LNEG – Laboratório Nacional de Energia e Geologia, I.P.
- EIGSI La Rochelle

It’s a project developed between France, Portugal and Spain.

It is a program to evaluate the “Impact assessment of the lifecycle and improving energy efficiency in urban areas”

The project is planned as UrbiLCA capitalization of approved projects SUDOE Interreg IV B Programme (2007-13) financed with FEDER funds in the field of urban development and sustainable building. These projects include the EnerBuiLCA "Life Cycle Assessment for Energy Efficiency in Buildings" (2011-12) project.

This project is the evolution of the project EnerBuiLCA to expand the spatial scale of life-cycle assessment, extending the system boundaries of the buildings to urban areas, designed as a

cluster of buildings and infrastructure (roads, roads, parking, water and energy supply, waste collection system, parks, etc.).

The most important of the project is the creation of mathematical models of processes and associated infrastructure life cycle of urban areas, including the main possible policy alternatives for the supply of water, electricity and fuels, the mobility of users, the architectural design of buildings and equipment, and the collection and treatment of effluents and waste.

The project is addressed by SUDOE territorial level, due to the similarity of urban models, construction solutions, materials used and climatic conditions in these regions, looking for common solutions for sustainable development in the construction sector in the SUDOE area.

Territorial Cooperation Program Sudoeste Europeo (SUDOE) supports regional development through co-financing transnational projects through the European Regional Development Fund (ERDF).

One of the main things they develop is the extend database they got because of this research. A compilation of five guides to good practice in different areas in order, all of them, to improve sustainability in urban areas.
The five guides are:

- Guide recommendations and best practices on technologies for collecting and treating waste. .
- Guidelines for sustainable water management in urban areas.
- Guide for sustainable urban mobility.
- Guide recommendations and best practices on energy facilities district.
- Guide recommendations and best practices on grading and earthwork.

b. URSOS

The project began in 2002, through an agreement between the University of Zaragoza (UNIZAR) through the Energy and Building Group (GEE) and the Institute for Diversification and Saving of Energy (IDAE), they generated a first fully functional version for the university community and by university spinoff "GEEZAR Solutions SL" that develop another improved version to offer to the commercial public.

This software calculates demands at the neighborhood level and evaluates the best configurations of roads, parcels, building forms, conditions, closures, etc.

Energy demands of all buildings involved in the development plan, using tables and graphs. Data is shown for individual building by type of building and global urbanization.

Own calculation methods as magnitudes enclosure (incident radiation, shading, etc.) intermediates energy calculations

Calculations incidents shadows on walls and any of its points may come from the horizon (topography of the environment), the building itself, nearby buildings or be caused by radiation locks designed ad hoc as are the eaves of the hollows of the facades.

Different solutions for the urban environment are evaluated, from purely energy to those relating to the quality of life and habitability for residents.

Sustainability values. These indicators are related to:

Building condition: energy production facilities, including the possibility of renewable. Type of soil used, use of recycled building materials for the construction process.

Street level: expected speed in road, power and street lighting luminance, presence and size of trees and seasonal foliage, tree species and quantification of the separation of spaces for different means of transport vehicles, pedestrians, bicycles, public transport and private.

Plot level: Presence of parkland, stay or sheets of water.

Overall level of urbanization: Posts on the mode of waste disposal, public coverage renewable, recycled or ecological in the process of urbanization, water saving and recycling in public areas and quantified presence utility materials as shops, transport links public and educational, sports, health and leisure centers.

Simulations of degraded areas and buildings for their energy improvements. Shares facades, highlighting gaps and facilities and the incidence of shadows in areas of narrow road.

Calculations of surfaces. Total, occupations of land, built surfaces and different values for the overall project or separated land uses are included.

1. Modeled neighborhood or urbanization level
2. Speed. Fast modeling, fast calculations, speed in obtaining results
3. Calculating U layered wall material.
4. Calculations shadows, shading viewers between buildings, shading overhangs, etc ...
5. Sustainability indicators

Something that must be taken into account is that both software are not open source, big groups of researches with important economic help have developed them; none of both optimizes to find the best solution between the available ones.

5.3 Mexico

In San Luis there's nothing similar in development of this kind of software.

The only group that is working towards something similar is DUIS (Desarrollos Urbanos Integrales Sustentables).

In order to align efforts with a common goal, and as part of a gender mainstreaming strategy, the Federal Government, through five Ministries and seven institutions of the public sector related to Housing and Urban Development, promoted the creation of group Promotion and Evaluation of Integrated Sustainable Urban Developments GPEDUIS®, with the Ministries of Finance, SEDESOL, SEMARNAT, SENER, economy and CONAVI, INFONAVIT, FOVISSSTE, BANOBRAS, FONADIN, PROMEXICO and SHF part.

This group has been working hard in the definition of eligibility criteria and evaluation of potential projects DUIS®, and guiding developers, consultants and authorities in this concept of sustainability.

DUIS are:

- Fully planned development areas that contribute to the territorial ordering of the states and municipalities and promote a more orderly, dense, just and sustainable urban development.
- Engine of regional development where housing, infrastructure, services, equipment, trade, education, health, industry, entertainment and other inputs, constitute the support for the development of strategic economic projects.
- Joint ventures in which federal, state and municipal governments, developers and landowners, who join existing urban centers participate.

Types of DUIS:

1. **Intra-Urban Projects**, which use the land available in existing cities by Re intelligent preferably local densification of existing cities where they can participate in municipal and state authorities and housing developers.
2. **Peri-Urban Project** generation serviced land with infrastructure development macro-lots with mixed land uses (housing, equipment, services, industry, etc.), preferably located in the vicinity of the existing city (extensions), where they can develop new communities with the participation of municipal and state authorities, Urban Developers (crackers) and housing developers and other real estate developers (industrial, commercial, etc.).

Therefore, as it showed they are not simulating and optimizing the existing social building park and some of them are not open source software or directed to a high income of money. This is another reason to use local software from UPC.

6. NECADA: No Emissions CaD for Architecture

It is an optimization software for sustainable architecture; it has been developed by researches from InLab FIB UPC and SummLab UPC.

This software is based on cloud infrastructure, it provides the optimum values for constructing a building or residential area according to various parameters and their associated impacts.

It needs to model in three dimensions (BIM Building Information Modelling), from the design, shape and building. The system gives different solutions depending the orientation of the building, the weather site and construction materials. This software takes into account different parameters like the transport, price of materials, assembly and disassembly. To achieve a design of nZEB (nearly Zero Energy Buildings) the system can optimize the whole life cycle of a building or urban area.

NECADA. Optimization Software for Sustainable Architecture is going to be present in the International Building Performance Simulation Association (IBPSA) that is taking place the first week of December 2015 in Hyderabad, India.

In this project, I have simulated using the pre.necada version, testing the desktop and online version. (Figure 13)

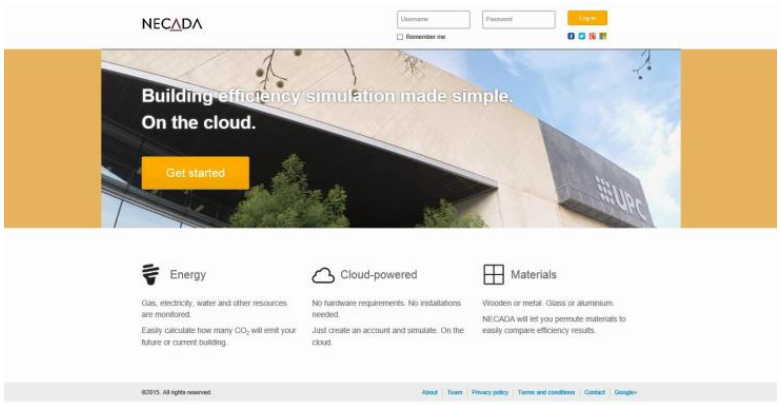

Figure 13 Desktop version of Necada. Necada

7. CASE STUDY.

7.1 The context. San Luis Potosí

San Luis Potosí is located in Mexico. It is equidistant from the three largest cities: Mexico D.F, Monterrey and Guadalajara. It is well connected by road and rail to major parts of the country, among others, the ports of Tampico and Veracruz in the Gulf of Mexico; Lazaro Cardenas, Manzanillo and Mazatlan on the Pacific Ocean, as well as the border cities of Brownsville, McAllen and Laredo, where a high percentage of foreign trade is done.

The state of San Luis Potosi has an area of 61.137 km2. It is located in the center of the country (Figure 14). The climate is dry and semi-dry, mainly, with an average annual temperature of 21 degrees Celsius, and an average annual rainfall of 950 mm.

Figure 14 Own work based in Alazne Gonzalez.Wikimedia Commons

It is located between the 21º09'30 '' south and 24º33'09 '' north latitude and 98º19'52 '' east and 102º17'51 'west longitude. It is crossed by the Tropic of Cancer.

The total population is 2,585,518 people, of which 51,3% are women and 48,7% men, according to the Census of Population and Housing 2010 is 64% in urban areas.

- *Geographical limits*

  North: Coahuila, Nuevo León, Tamaulipas y Zacatecas.

  South: Guanajuato, Hidalgo y Querétaro.

  East: Veracruz.

  West: Jalisco y Zacatecas.

- *Extension*

  Its land area is 62.304,74 km2., Equivalent to 3,22% of the land area.

- *Sea level*

  Their heights vary between 20 and 2.680 meters above sea level.

- *Population*

  As it is showed, the population has been increasing (Figure 15), most of the people is under 30 years old (Figure 16), and most of the people live in San Luis Potosí (Figure 17).

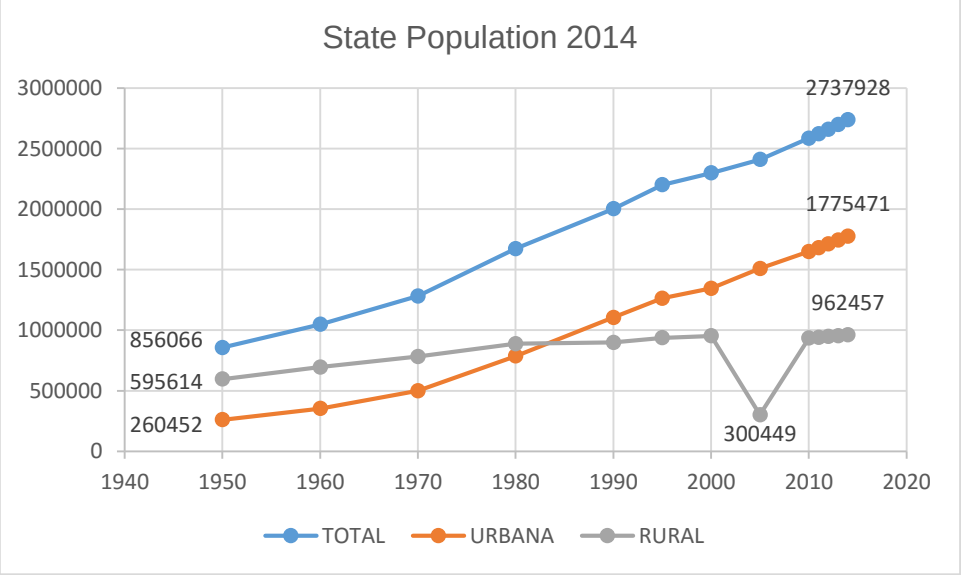

Figure 15 State population. Perfiles Industriales del Estado de San Luis Potosí 2014. Own work

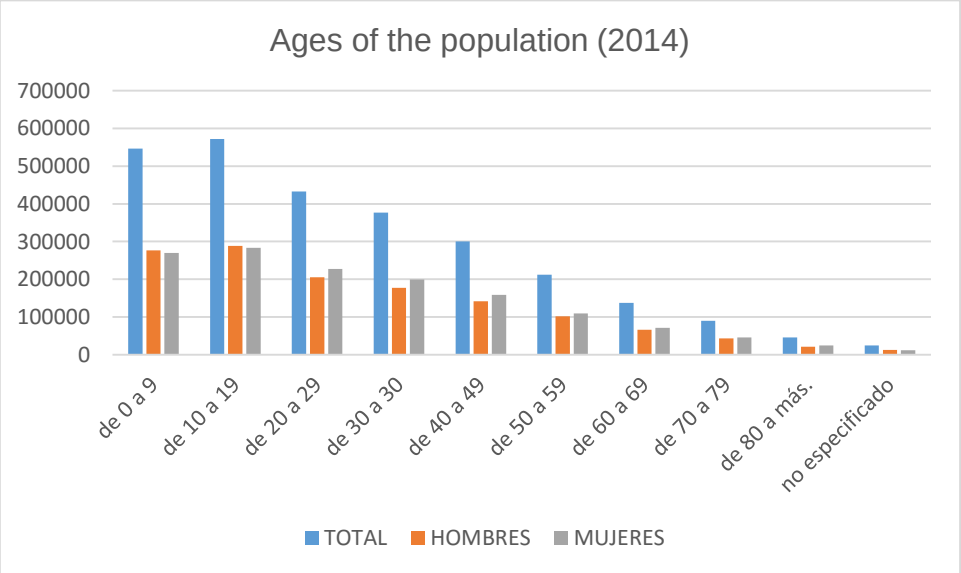

Figure 16 Ages of the population. Perfiles Industriales del Estado de San Luis Potosí 2014. Own work

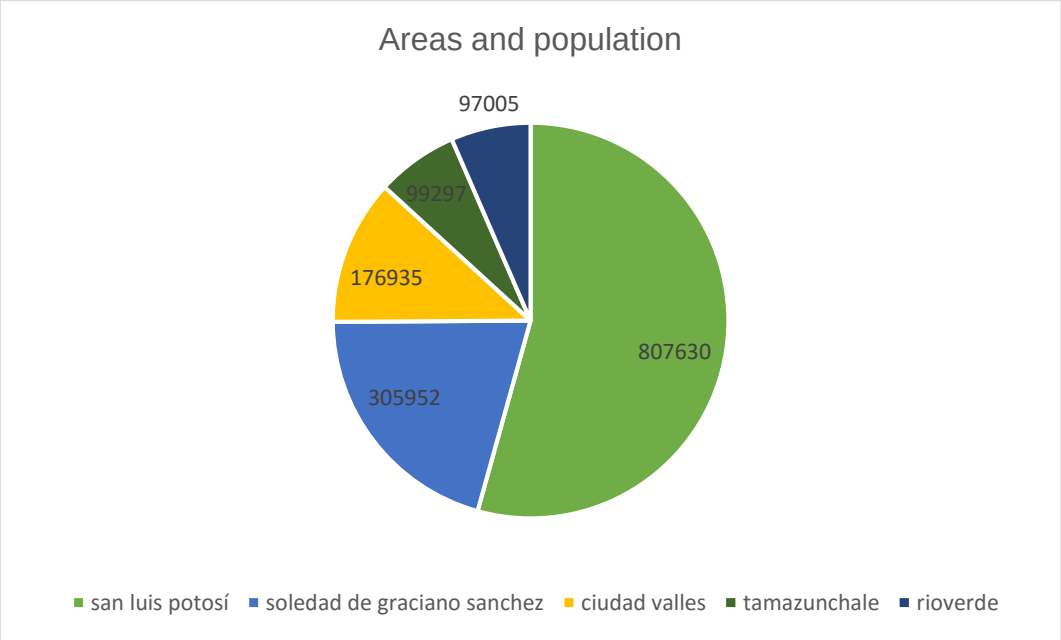

Figure 17 Areas and population. Perfiles Industriales del Estado de San Luis Potosí 2014. Own work.

- *National Highways*

  There are twelve Federal State Highways that go across San Luis Potosi (Figure 18), this shows the good communication of this place.

Figure 18 Secretaría de Comunicaciones y Transportes de Gobierno del Estado de San Luis Potosí,2012

- *State train lines*

  San Luis Potosi is connected by train to the United States of America border (Figure 19) and it is an important point of connection for national long distance products and raw materials.

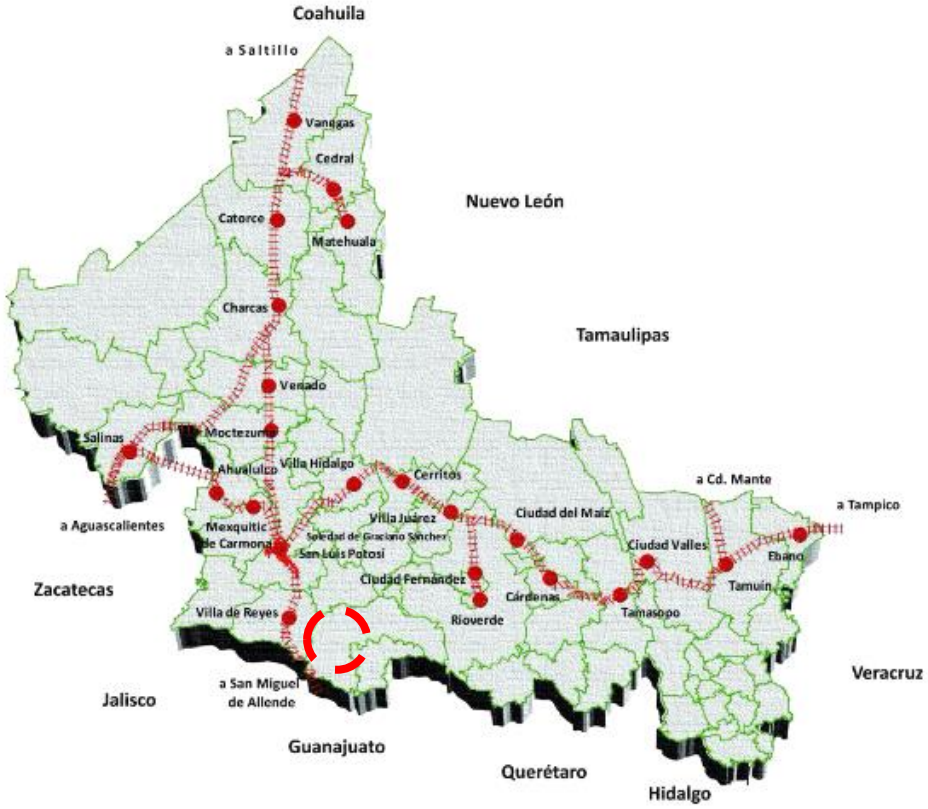

Figure 19 Secretaría de Comunicaciones y Transportes de Gobierno del Estado de San Luis Potosí,2012

- *Natural areas*

San Luis Potosi has four natural areas very different between them (Figure 20).

Figure 20 Natural areas. Perfiles Industriales del Estado de San Luis Potosí 2014

- *Municipalities of the central zone*

  This area (Figure 21) is occupied by the staff, is essentially industrial, commercial and services. Here 89,5% of the gross value of manufacturing output is generated. The main manufacturing subsectors are basic metal industries; transportation equipment manufacturing, power generation equipment and electrical appliances and food industry.

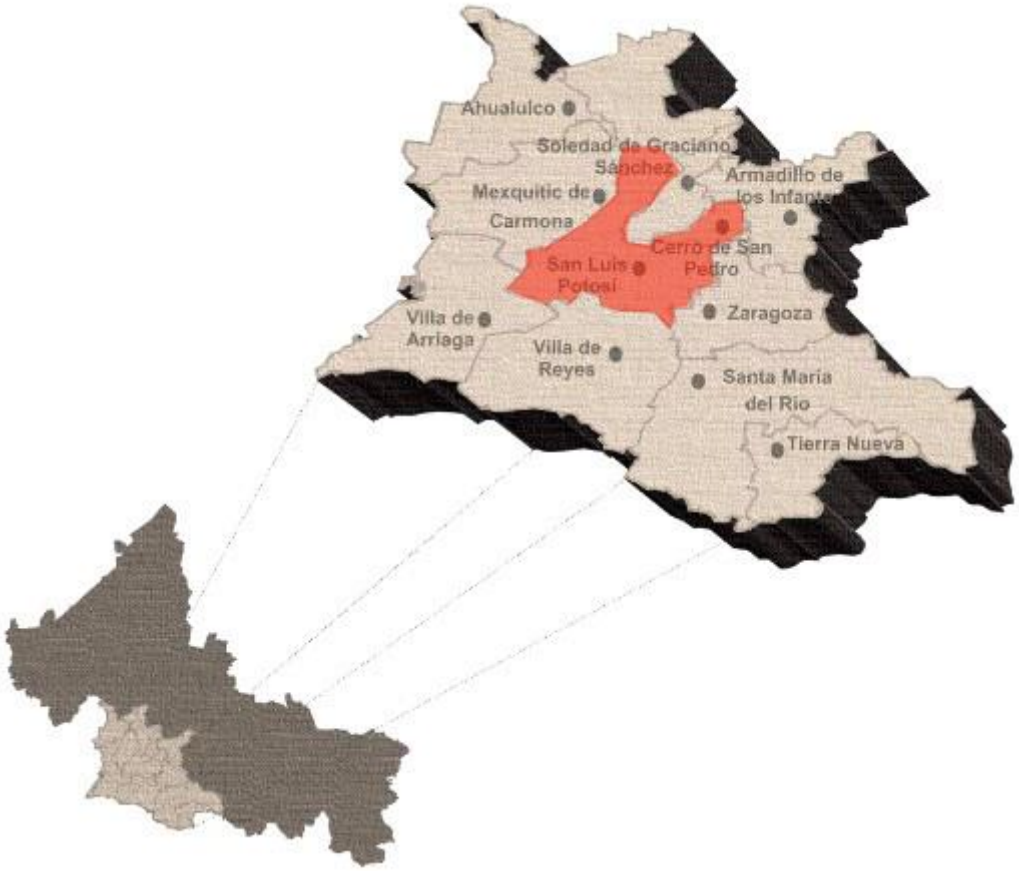

Figure 21 Municipalities of the central zone. Perfiles Industriales del Estado de San Luis Potosí 2014

- *Total surface area*

  Its land area is 8999,36 km2., Equivalent to 14,44% of the area of the state. Population (2014): 1.347318 hab. Density of population: 149,7 hab/ km2. 49,21% of the Total population.

- *Height above sea level*

  The heights of the downtown area vary between 1.640 and 2.160 meters above sea level

- *Main economic activity and products*

  Agriculture: green alfalfa, forage oats, sugar cane, onion, green pepper, corn, beans, grain and forage, orange, grass, sorgograno, soy, tomato and tuna. Livestock: beekeeping, poultry, cattle, goats, sheep and pigs. Mining copper, fluorspar, gold, silver, lead and zinc. Industry: household appliances, auto parts, cement, iron and steel, food preservation, sugar industry, machinery and electrical equipment, non-ferrous metals, cakes and tortillas. Services: storage, scientific and technical, communications, education, electricity, research, hospital, transport and tourism.

- *Economic activities*

  The main activities are trade (14,1%); real estate and rental furniture and intangible assets (12,5%) services; manufacture of machinery and equipment (10,5%); and construction (9,7%). Together they represent 46,8% of state GDP.

  The strategic sectors are government activities, agriculture, mining, manufacturing, construction, electricity, trade, transport, information media, financial services, real estate, professional, corporate and business address, business support services, educational services, health, leisure and temporary accommodation (Figure 22).

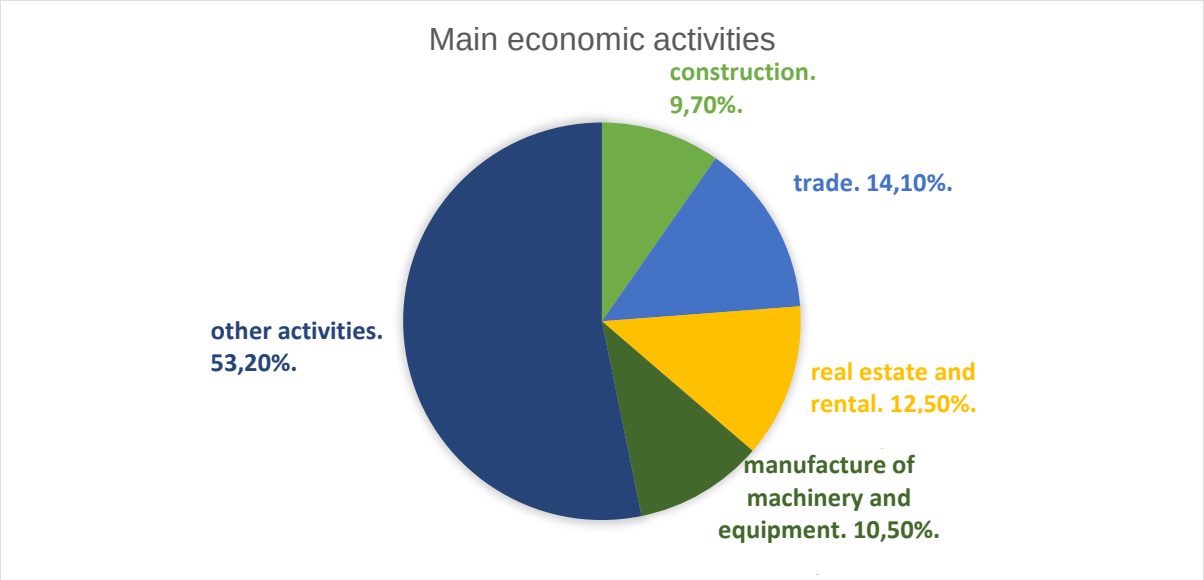

Figure 22 Main economic activities. Secretaria Economica San Luis Potosi

In the area of productive infrastructure, the state has 17 industrial parks and / or technological (Table 2).

• Zona Industrial de San Luis Potosí	• Parque Industrial Tres Naciones
• Zona Industrial del Potosí	• Parque Industrial de Fundidores
• Zona Industrial de Villa de Reyes	• Parque Industrial Pueblo Viejo
• Integra, Parque Industrial de Proveedores	• Millennium Industrial Park
• Zona Industrial de Matehuala, SLP	• Impulso Parque Industrial
• Parque Industrial de Ébano, SLP	• World Trade Center Industrial
• Parque Industrial de Ciudad Valles, SLP	• Parque Industrial Logistik
• Parque Industrial del Acero Inoxidable	• Parque Industrial Provincia de Arroyos
• Zona Industrial de San Luis Potosí	• Interzona Parque Industrial

Table 2 List of industrial parks. Secretaria Economica San Luis Potosi.

According to the Statistical Yearbook and geographically by state 2013, the state of San Luis Potosi had, in 2012, with a road length of 11.580 km, 1234, 7 km of railways, national airport, an international airport and 15 aerodrome.

According to the Doing Business report, published by the World Bank (WB) and the International Finance Corporation (IFC), which ranks economies for ease of doing business, the city of San Luis Potosi occupies the 4th place in cities analyzed in Mexico, unlike the previous report which ranked 5th.

Moreover, the disaggregate indicator shows that San Luis Potosi occupies 6th place for opening a business, the 7th regarding the management of construction permits, 8th in property registration and the 19th in enforcing contracts .

7.2 The isolated core: Ciudad Satelite

- *Basic data*

Ciudad Satelite is an urbanization that is located 16 km from the metropolitan area of San Luis Potosi, San Luis on the road - Rioverde and 10 kilometers from the industrial zone (Figure 23), now has no direct communication. It was started late 2006 with the “Plan parcial de desarrollo urbano” under the slogan "the lower the cost of land, the greater the benefit for local families" (SEP, 2007)

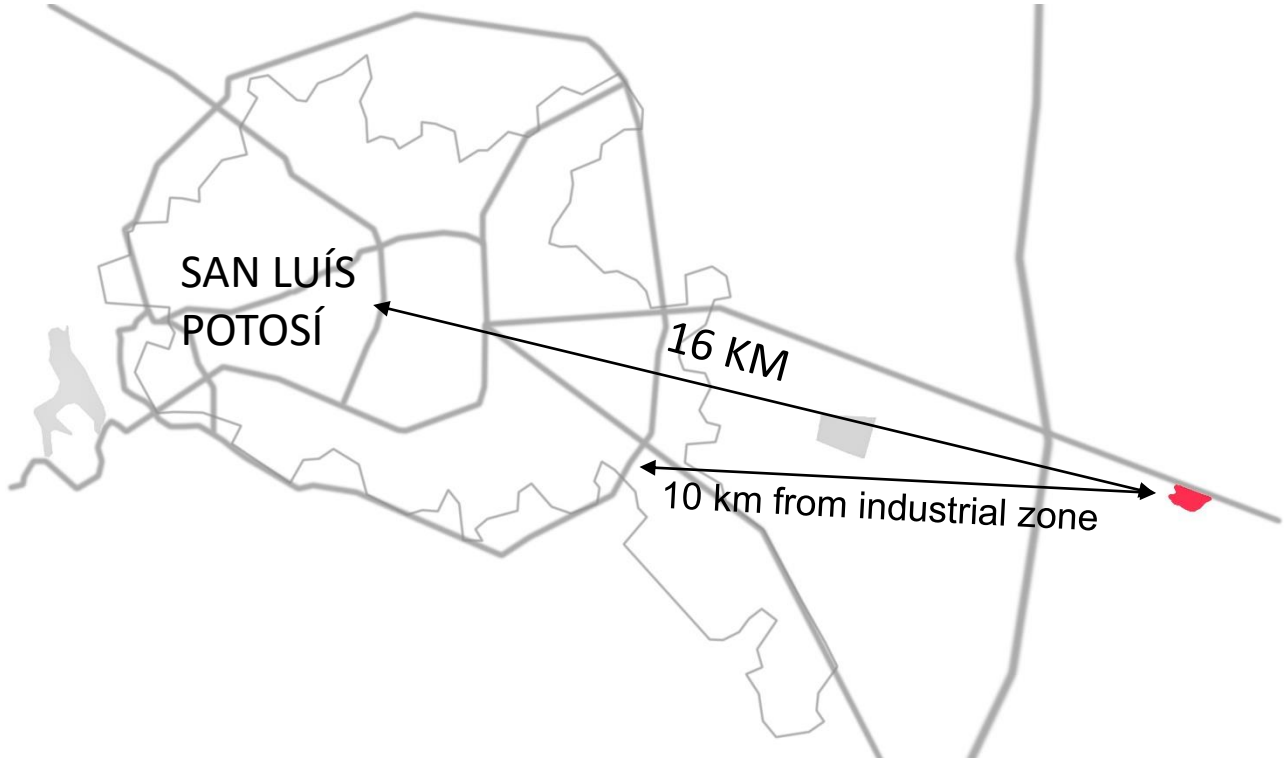

Figure 23 Emplacement Area of Study. Own work

The complex is an extension of 1000 hectares, 700 housing (30.000 homes in total) and 300 for industrial use. According to the partial plan "town" was to be completed in 2015, but now it lives only 7.8% of the targeted population (132.000 people).

This is reflected in just 5 macrolots developed and sparsely populated, which does not compensate for the investment made in public services and equipment.

According to 2013 data, more than half of the families came to Satellite City between 2008 and 2010 and over 80% of these are owners of the house.

The most are nuclear families (74%) and they are comprised between 3 and 4 members (54,3%).

Most of the men are employed (62%) while most of the women are engaged in household chores (60%).

The family income is less than 3.000 pesos per month. (160€)

In 2007 a development program was designed, it had everything to make Ciudad Satelite a perfect city to live in, but nowadays, almost nothing has been done.

The governor at that time left large debts in the administration that implied that the develoment was much slower than the desired and reflected in the schedule.

It consists of 10 facilities provided.

INVIES: INstituto de VIvienda del EStado is the main agency working in Ciudad Satelite.

Mission: Promote quality housing and sustainable in order to promote full and personal development of “potosinas” families, primarily those with lower incomes who are in marginalization and vulnerability; by managing and implementing of accessible financing schemes to obtain housing or to improve and / or expand existing ones.

Vision: Be the guiding principle of the policies and actions of housing statewide, in coordination with agencies and authorities in the sector, strengthen the supply of quality housing and sustainable, creating the necessary conditions through legal, honest and transparent resource management agency “potosina” available for all to have access to decent housing.

Objectives:

- Find alternative income for achieving the goals of the Housing Institute in the State sources.
- Promote and manage financing mechanisms for construction, purchase and improvement of housing for those who are not subject to traditional loans.
- Contribute to land management and promote the development and promotion of economic and social housing in the State.
- Strengthen the Housing Institute in the State as the lead agency of the policies and actions of housing.

Strategies:

- Manage public resources in the three levels of government to promote housing stock.
- To promote the delivery of housing stock in the form of improvement, expansion of comprehensive and / or construction of housing, with joint supervision of the local authority where the action is carried out so that it does not suffer changes. Promote the culture of payment to encourage self-help social housing in municipalities and communities.
- Implementing financing schemes accessible for people with low incomes.
- Administrative simplification in the field of housing developments.

- *History highlights*

  According to information obtained from the partial Plan document, it comes to the area of the Varela Cuenca a flood zone where indications are temporalis settlements.

1000 AC colonization by Mesoamerican groups who built towns and cities, are beginning to leave the land or Cliff Villa de Reyes and Portezuelo.

Nomadic people occupy 1200 AC the land, arrival of the Spaniards.

The group that inhabited the area now known as San Luis Valley or the Great Tunal was named specifically as Guachichil

1583 Diego de la Magdalena, pacifier monk reaches the area of the current state capital, sits a group of indigenous “guachichiles” advantage of the existence of springs and ponds and fertile place. A makeshift chapel dedicated to Santa Vera Cruz, where today the Chapel of Loreto is located stands at this site. At the beginning, this population was not stable.

1587 Mexquitic reached Hispanics, northwest of the capital, where the mestizo captain Miguel Caldera, a group of Franciscans and other Spaniards concluded peace with the natives and founded the Franciscan convent.

1591, May 14. Thanks to the efforts of Fray Diego of the Magdalena and Captain Caldera, the capitulations of Viceroy Velasco with the city of Tlaxcala to send 400 tlaxcaltecas to settle in the land of chichimecas families were signed, which allowed to populate the 1,591 indigenous tlaxcaltecas northern New Spain

1591, November 2, a group is based in San Luis.

1592, March 2. The rich mines of San Pedro, making it one of the most important centers of attention of his time, attracting a number of adventurers, prospectors, miners and important lords who sought to found fortune. The wildness of the area, its complicated topography and water shortages hampered the possibility of growing or establishing, so immediately the valley where the monastery was used and put San Luis to install companies benefit, establish homes and orchards, defined this area as a place of supply.

1542 first foundation of peaceful Indian village of Santa Maria del Rio. With various times of occupation because of the attacks and the constant and ongoing riots from Indian insurgents.

1560 Fray Guillermo Santa Maria drew streets in a place called San Francisco, did not persisted.
1569 foundation of the military prison, population was formally established.

1569 August. The first mayor appointed Viceroy Juan de Onate.

1592, November 3. Foundation of the village of San Luis de Mexquitic. The Indians and tlaxcaltecas guachichiles were displaced to the current neighborhoods of Santiago and Tlaxcala, who at first had been occupied by settlers.

Decade of the 60's. Construction of the Federal Highway 70, which join San Luis Pocoughed in the first place with Ríoverde, having as final destination the city of Tampico and the other end to the town of Jalpa in the state of Zacatecas, passing Aguascalientes.

Quickly becoming an important hub not only state but nationally, which allowed fast access and easy circulation throughout the state of San Luis Potosi in the L-direction East - West.

- *Climate*

The Valley of San Luis Potosi is located in the Mexican Plateau, geographical unit characterized by being located between the Sierra Madre Oriental and Sierra Madre Occidental. It presents considerable altitude ranging from 1,650 to 2,100 meters above sea level; geographic situation influences that are arid climates character, since the aforementioned mountain ranges act as barriers to the humid winds; particularly the Sierra Madre Oriental, which stops moisture from the Gulf of Mexico.

Tempered with warm dry summer, 7-14º Temperature.
Semi-temperate climate with warm summer variation of 14 to 18 ° temperature.

Between May and October, waterspouts occur with strong flush and hail.
In the months of August and September, rainfalls of 60 mm are given daily.
The average annual temperature in the study area is 16º C to 18º C; the annual average rainfall is 350 mm per year.

- *Topography*

The topography of the study area or polygon corresponds to the system topoformas Plain Rocky Flat, which has a position and geological features in the northwest-southwest axis, these are alluvial.

The land has a lower slope of 2%. The soil depth varies from 0 to 0.90 meters, due to the outcrop of rock material in some areas. The condition and vegetation cover is midrange and alluvial lithology.

- *Edafology*

Soil layers present in the land:

Litosol Eutrico (Ie), covers approximately 34,3% of the surface.

Xerosol Háplico (Xn), covers approximately 9,4% of the surface.

Phaeozem Háplico (Hn), covers approximately 44,5% of the surface.

Phaeozem Luvic (Hi), covers approximately 11,8% of the surface.

In the study area, the groundwater level from the nearest well (IPICYT-1) is located 150 m deep into the volcanic rock. The contact between volcanic rock and alluvial fan (sandy deposits with silts and clays) is located 60 meters deep so it is considered that the effects of the removal will have no effect in this material sedimentary area Polygon Study.

According to the geotechnical study, the level of groundwater was not detected in any of the areas where polls were held, and there are no significant changes in moisture in the material at different depths.

- *Hidrology*

In the project area affecting five watersheds, given the characteristics of the area, it is considered that runoff are driven by their own roads of development, when the capabilities of these permit, otherwise the pipes will be made considering supplementation with a storm sewer system. The total area of the basin is 40,43 km2.

In the area two temporary streams Arroyo Varela and Independence are presented, the first of which leads generated runoff during the rainy season in the top of the plain (the area east side) to the dam Varela and the other comes from the areas located north of the ground and its runoff flows towards the plain within the property, where there are temporary agricultural land, place where the waters spread and infiltrate quickly.

Dam Varela, has an area of 4,5 hectares, with a screen of 4 meters high, which determines a storage capacity of approximately 150.000 m3.

Varela Arroyo currents are distributed in a narrow range and disperse east of the Valley of San Luis Potosi, disappearing formal flow to 3 km southwest of the curtain.

- *Subterranean hidrology*

  The study area presents an unconfined aquifer, whose depth ranges from 110 to 120 meters. The behavior of this aquifer piezo metric for 1997 shows the static level elevation with a concentric behavior towards the city of San Luis Potosi, being the higher value curve in this area with 1750 meters.

- *Flora*

  Crasicaule microphyll scrub and desert scrub, which has an 80% coverage of the surface. (Table 3).

Area	**Actual use**
411	Forest area covered with scrub vegetation type crasicaule.
392	Forest area covered with scrub vegetation, type microphyll, desert.
189	Agricultural land surface Temporary.
6	Area Presa Varela.

Table 3 Estudio de Riesgo, capítulo 2, Resumen ejecutivo de la manifestación de impacto ambiental.

- *Territorial fitness*

  Agricultural activities and associated with urban infrastructure are more directly related to the physical and environmental conditions of the territory. However, although other human activities have a direct or indirect relationship with the floor, it is considered that the three identified uses are those with the most direct links to this resource. (Figure 24).

  This assessment of competency is defined in the Municipal Urban Development Plan, which is the benchmark or higher level of planning, is the derived and which is responsible for defining the destination and use of the territory. So based on the modification to the Plan and to comply with the guidelines and strategies in the raised plan, this area is defined as area Building.

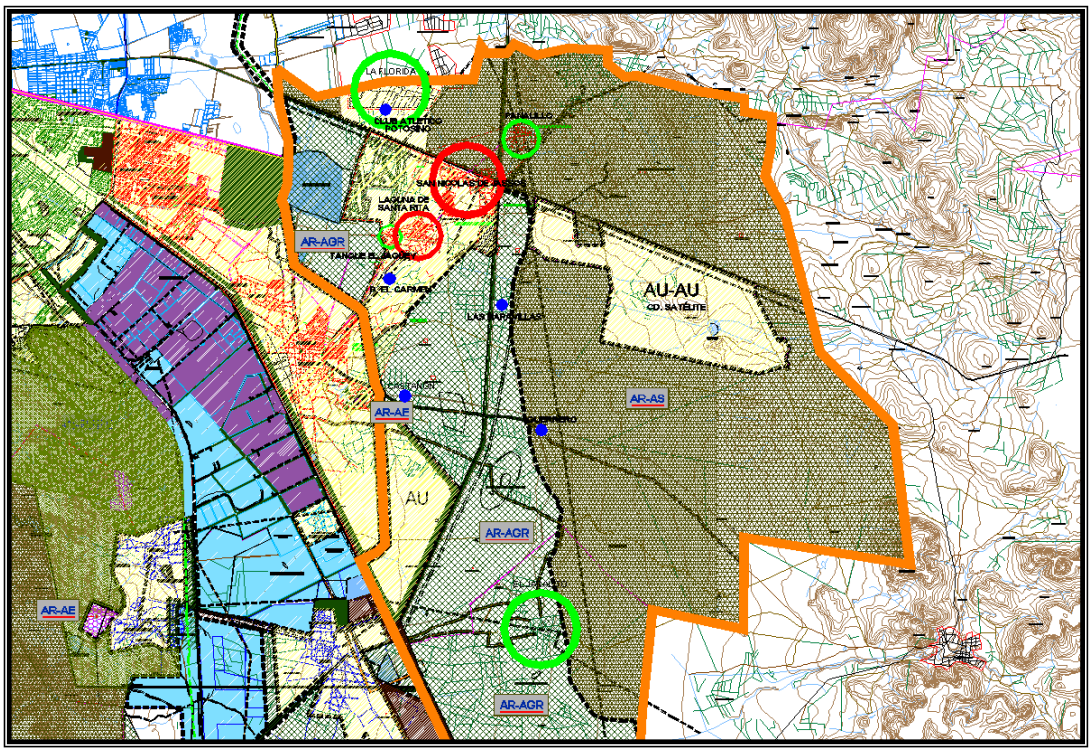

Figure 24 Imagen extraída del Plan Municipal de Desarrollo Urbano de San Luis Potosí. Ubicación y cambio de uso de la zona deominada como Ciudad Satélite

- *Agricultural fitness*

  According to the above-mentioned studies, the content of organic matter and soil nutrients biochemical indicate that this is a little suitable land for agriculture. Except for a small part that is located around the dam and creek Varela, being even in this questionable feasibility of the use of low expectations in the input-output relationship.

  As low rainfall and the presence of exploitable natural elements, large areas to support a small number of animals are defined, so the activity is not profitable, placing the study area in the range of less favorable for development this activity.

- *Urban fitness*

  The field does not possess a sufficient level of fitness as agriculture or livestock to consider their exploitation. Introducing appropriate topographic and geological conditions and the vicinity of important circulations of regional and state level, to have some of the basic services, water (through the construction of a well) and wiring (which runs parallel to the carretera Federal 70) based on the Municipal Urban Development Plan, which recognizes it as developable area and defines this land as one with the full aptitude to become an urban area. Because of the benefits, it presents for the creation and installation of the project.

- *Risks*

  In the area, there are no environmental risks associated with geological hazards, volcanic and seismic risks. The Varela stream and various channels that channel water into the dam are present in the area.

  The territory has a varied topography in the lower part, including within its boundaries two hills and south, a small valley. It is in the bed of the stream that has a high risk of slopes by erosion caused by the passage of water. Throughout the runoff and stream, flooding could also occur as rising storms can produce hydrodynamic forces capable of causing accidents in built-up areas by direct action of water or erosion and landslides on the banks of the stream.
  Another risk identified is that soil moisture is presented in the lower parts of the study area, which could damage buildings.

  The risks arising from human activities are currently the greatest impact at the site of study, mainly related to the roads that delimit the Federal Highway 70 stretch-Rioverde San Luis Potosi and Monterrey warrant for being transit routes with heavy and constant flow. From them, they come noise, emissions and the risk of a traffic accident or spill of hazardous substances.
  External risks indirectly affect the estate of study, including pollution. The watershed that supplies San Luis Potosi, by the contribution of industrial waste, illegal waste dumps found in the nearby town of La Pila and the emissions from smelters. To lessen the impact of these risk factors, it is advisable to place a buffer zone on the boundaries of the study area.

- *Size and population distribution*

  The immediate reference population is mainly of the inhabitants of the 11 neighboring towns within the polygon of study "Geographical Context Satellite Town" as defined in the Municipal Urban Development Plan of San Luis Potosi.

  - Laguna de Santa Rita
  - San Nicolás de Jassos
  - Panalillo
  - La Florida
  - Tanque el Jagüey
  - Maravillas
  - El Castañón
  - El Jaralito
  - Rancho El Carmen
  - Club Potosino
  - El Guerrero

  In 1990 the population of the immediate context amounted to 4,503 inhabitants which represents 0,85% of the municipal population (523.733 inhabitants). The amount of population amounted to 6.126 people by the year 2000. This makes up 0.91% of the municipal population (670.532 inhabitants).

The model of economic development of San Luis Potosi has presented in the past three years, a development of its sectors, combined with each trigger an industrial, tourist, commercial and service synergy.

- *Economic aspect*

  Most of the industry in the state is concentrated in the capital, whose conditions concentrate greater population and therefore a holding of more than 70% of gross domestic product that is integrated across the state

  The strong influence of the state capital in the economic development of the state stimulates and promotes the integration of self-sufficient urban spaces. In the coming years they will be favored by the increasing openness of industries with high employment impact. Thus, changes in the socioeconomic and demographic cycles must be seen in this new stage of economic development of San Luis Potosi.

- *Infrastructure*

  Federal Highway No 70 in its stretch-Rioverde San Luis Potosi directly communicates the study area with the urban area of San Luis Potosi and Soledad de Graciano Sánchez. Similarly the bypass road east in the stretch Federal Mexico-Piedras Negras (No 57) connects the property with the industrial zone. Therefore, there is fluid polygon linking the study with the main urban centers and the main area of job openings statewide.

- *Water*

  The study area does not have, at the time, the infrastructure of drinking water for human consumption. However, within the study area it is in the process of digging a well for drinking water, which are extracted 40lts / s with possibility of doubling this extraction

- *Urban equipment*

  The existing street furniture around is in good condition, especially the Education subsystem and in the area of Health there are certain shortcomings in relation to the retention of medical personnel within schools and nursing homes too, but there are other facilities in fair condition. The main deficits were observed in the equipment for Culture, Communications, Security and Transportation, these facilities do not exist nor has a facility that meets the needs of the population.

- *Roads*

  Carretera Federal n70. Carretera Federal n.57.

- *Public transport*

  The mobility of the roads: federal not free. 70, section "San Luis-Ríoverde" fee and the issuance of Matehuala and its interface with the federal free road no. 57, will be of vital importance for accessibility in the **Polígono de Estudio.** There is no public transport service in the area (Table 4).

PUBLIC SISTEM TRANSPORT			
COMPANY	ROUTE	DESTINATION	FREQUENCY
Transportes Vencedor ETN Transpais Estrella Blanca Autobuses Frontera	Paso Foráneo terminal	* San Luís Potosí - Rio Verde. San Luís - Tampico. San Luís – Cd Valles.	30'-60'.

Table 4 Sistema de Transporte Público Foráneo. Plan Parcial de Desarrollo Urbano de la Sección Sur Oriente de la Intersec-ción Formada por la Carretera Rioverde y el Libramiento de Cuota a Monterrey.

The link to these roads is of interest because the population will have better opportunities to link with the capital and other significant population centers.

On the other hand, in relation to the urban transport service provided to this area it is lacking, so that the Foreign Service remains the most useful. There is a lack of new urban transport routes.

- *Urban problems*

Mainly surface runoff water and Varela should retain prey. The bed of the Varela stream is heavily eroded and may submit slides. Throughout this it was also identified a fault being possible cracking.

- *Socioeconomic problems*

The problems of the economically active population (EAP) focuses on determining the requirements of equipment, infrastructure and services by income. Those with higher incomes at 6 monthly minimum wages have increased access to infrastructure, equipment and services. By contrast, the population earning less than 2 minimum wages are largely such privilege. This is a problem and a challenge for public administrations maintaining the same commitment to provide services to the entire population regardless of stratum.

- *Equipment's*

  - Lack of equipment near the study area.
  - Limited facilities in the towns of Laguna de Santa Rita, San Nicolas de Jassos, Ja-Ralito, the Panalillo, Florida and the Jagüey tank, mainly related to culture, transport and health.

- *Highway and transport*

  - Rural poor very narrow dirt road 1,50 meters and irregular, without rights of way sections Caminos.
  - Lack of new transport routes to this area.

- *Urban image*

  - Within the context constructed, the building of the dam is in an advanced state of deterioration.
  - What forms the natural context, the livestock and agriculture use conducive to erosion in some part. (Figure 25).

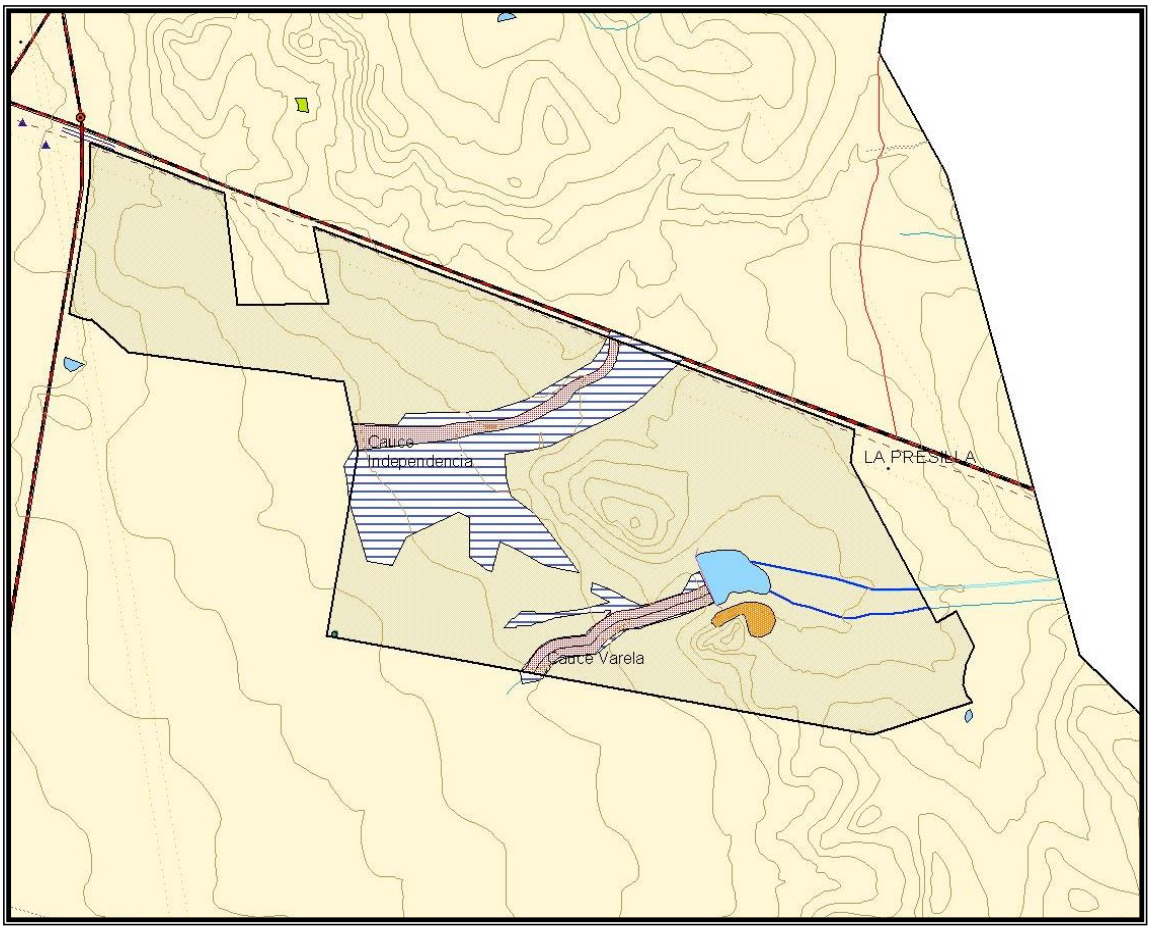

Figure 25 Plano de problemática urbana. Plan Parcial de Desarrollo Urbano de la Sección Sur Oriente de la Intersec-ción Formada por la Carretera Rioverde y el Libramiento de Cuota a Monterrey.

- *Land property*

  According to the "Instituto Estatal de la Vivienda de San Luis Potosí" (INVIES), from 989,71 hectares, 295,42 are for industrial use and 694,29 are private property owned by INVIES. They must be subtracted from the latter area of 4 plots and area within the vessel capturing the Varela prey. This area is made up of 16 plots of which 5 have been purchased by the INVIES. With basis in the current regulations, there is the possibility to expropriate the remaining 11 plots.

  The acquisition of all of the available area ensure low cost of land and no speculation of it.

- *Steps for the consolidation of Ciudad Satelite*

1. Short-term (2007-2009). This period should begin the construction of 15.000 homes in the early stages of 5,000 units annually. The first stage will start in 2007 with site preparation, display and relocation of fauna, the consolidation of risk areas, slope tune in areas of landslides and channeling rainwater and others. Consolidation of the Varela stream.

2. Medium-term (2010-2012) In the medium term the linear park in the Varela stream and the remaining 15.000 houses will be built in stages to 5.000 units per year will be created.

3. Long-term (2015 - The long term will be marked by the consolidation of equipment, sports, education and health providing special infrastructure, lighting missing and the establishment of efficient irrigation systems is also proposed to urban park maintenance, linear park and green areas.

- *Problems*

  Actually, 50% of the buildings are abandoned because the users look for more economic solutions. This has made that some buildings are used by squats creating social problems with the residents.

  Some Japanese companies and one Mexican have been installed there and the women have started to work there.

  There are no politic incentives to promote it.
  Nobody uses the heat water system. It is damaged.
  The water systems distribution is centralized to avoid polluting the urban image, the developer made money but the state lost it; normally the system consists that every house has its elevated tank. This option is better because the water pressure changes, the amount of minerals that contains the water and the untrained people makes the system useless nowadays.
  The buildings are made of concrete and plastic, a solution must be found to decrease the energy dependence and to increase the comfort.

7.3 Social involvement

One important thing in this project is the Impact on public policy.

In Ciudad Satelite on May 2013 took place a workshop between the habitants of Ciudad Satelite, UNESCO Chair on Sustainability and Universidad del Habitat.

In this workshop, the “satelitenses” (people of Ciudad Satelite) talked about their feeling about Ciudad Satelite and how they perceived the help, some of the things they said were:

- They felt like they had no help from the institutions, they were abandoned, the government is not doing what they promised; they do not trust them anymore.
- Foreigners arrive there, take a picture, or do something for a while and then they leave.
- “satelitenses” have asked for many things, to solve different problems, but they receive no solution.
- They feel bad when they interact with outsiders because, most of the times, the foreigner, treat the “satelitense” like and stupid.
- They do not have facilities in Ciudad Satelite and is difficult to move from one part to the other, they want the people to remain in Ciudad Satelite but it is impossible without services.

Historically, it has been a place, where many people have settle but they finally have leaved. In this moment that they have the buildings and they need places to live, is important to work towards the idea of make “Ciudad Satelite” a lovely place to stay and grow there.

We do not have to continue over constructing, we just must improve the conditions of the places we have.

In this line the solutions proposed would be to work with the people from the place, showing them how they can be the installers, creating workshops to explain them how to install the solution proposed, this would reduce the cost of installation and maintenance and would show them a job.

In Ciudad Satelite it is important to work principally with locals and make them love their place. The idea is to work mainly with women because this way they can work in the same place, they can be close to their children in the meanwhile they are working and they save money because they do not have to travel to go to work.

A management group would help new future “satelienses” to feel they are from this place because everyone involved in this community would be taught with the importance of maintaining these green roofs, buildings and future improvement done in this “Ciudad Satelite”

“Satelitenses” do not have to compare themselves to other “new born cities”, because their reality is different and unique among the rest.

To be isolated gives security but also give loneliness, to balance both feelings is difficult, giving self-efficiency and confidence, making them participants of the improvement of their community helps to balance those feelings.

8. SIMULATION WITH NECADA

8.1 Methodology

We are going to work in the lot developed by Invies, this lot is situated in the north-east of the residential area of Ciudad Satelite (Figure 26).

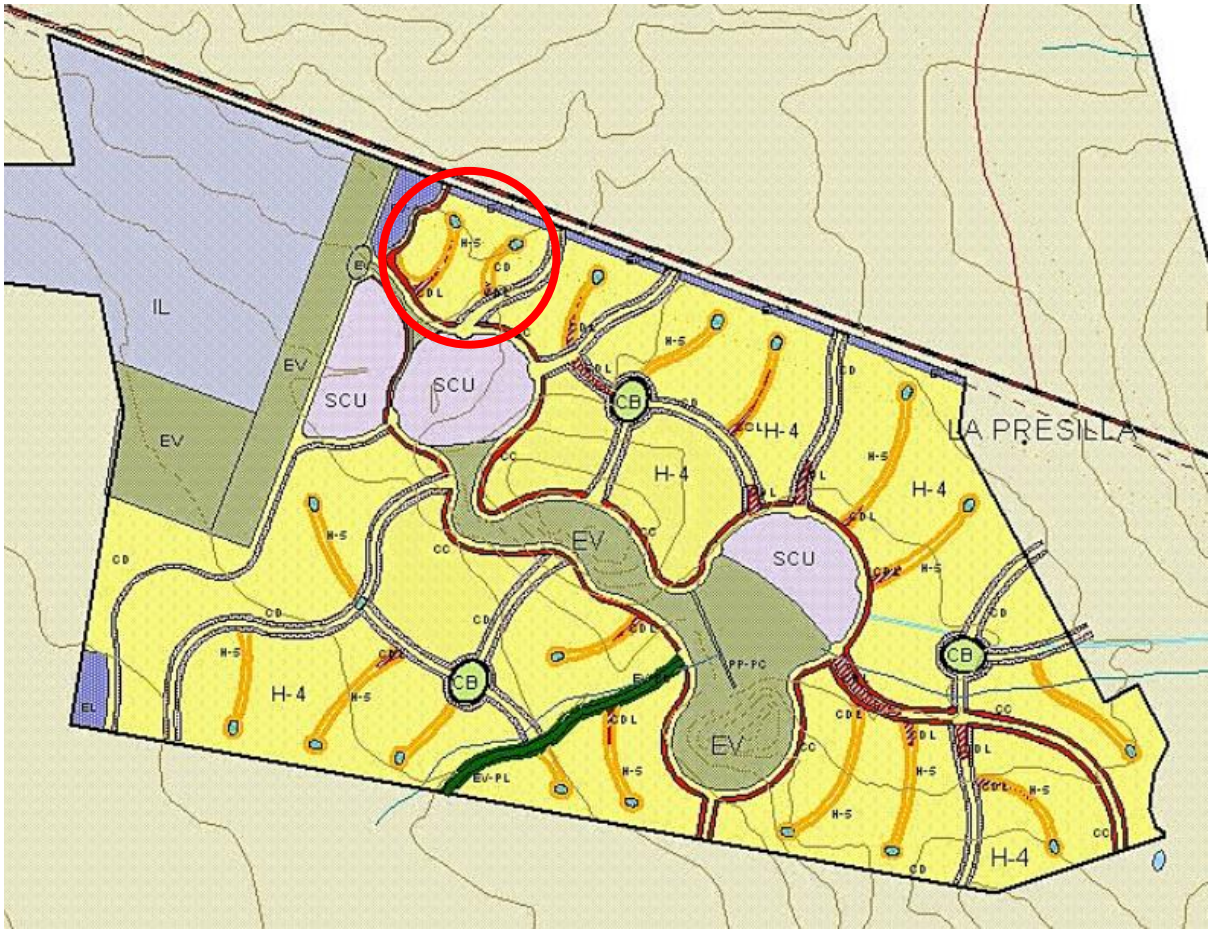

Figure 26 Zoning plan. Plan parcial de desarrollo urbano San Luis Potosí

The orientation of the building changes in different situations as they have used the same building for all the Invies lot. (Figure 27). I have worked with the building North-South.

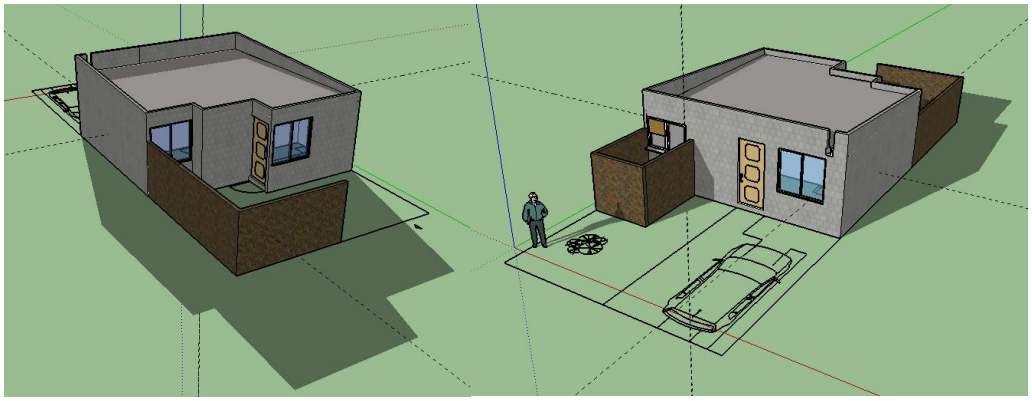

Figure 27 Invies house model. South Facade. January. 14:00 h. Own work

The buildings are units of one floor with flat roof and four windows and garden in two of the four sides. The buildings are 50m2 and with the garden, it can be from 120 to 189 m2 in total. (Figure 28).

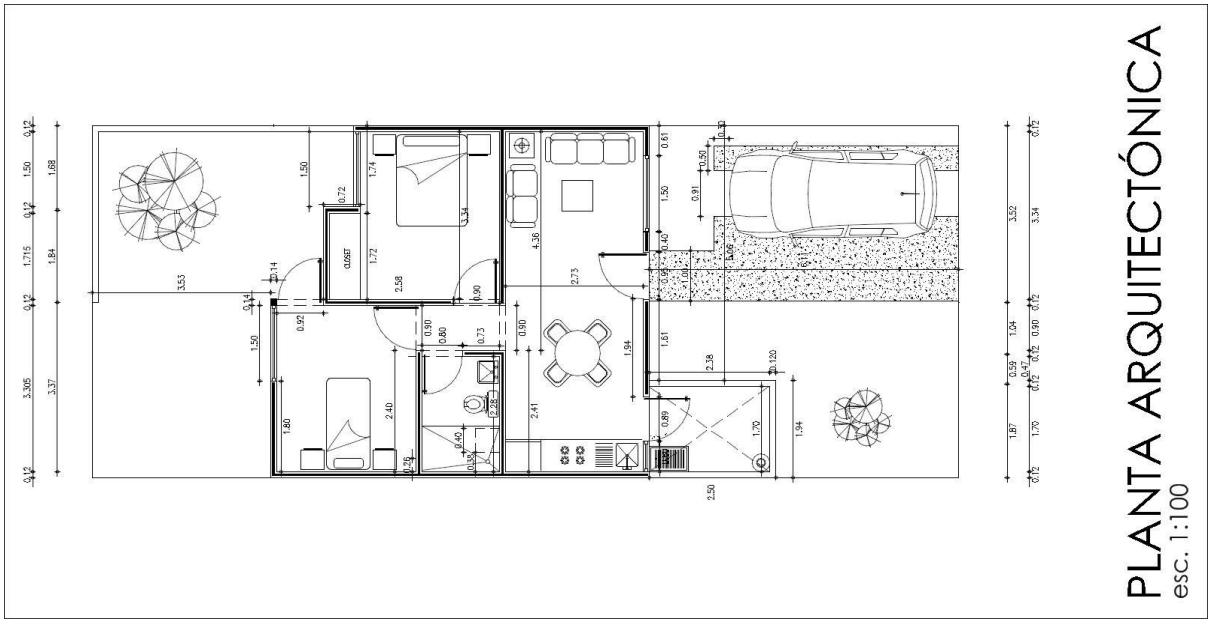

Figure 28 Architectural plan. INVIES

The materials used in these buildings are concrete for the walls, floor and ceiling, plastic for some doors, metal and glass for some doors and windows; they do not have Air Conditioning or heating system, just a waterproofing layer between the earth and the concrete of the floor.

8.2 Information used.

In the case of CS, they have most of the year low temperatures, it is a neighborhood for people with low income of money, there want to go towards self-efficiency

Area of the model: 50 m2.

Situation: San Luis Potosí, México. 21º09'30 "S, 24º33'09 "N, 98º19'52 "E 102º17'51 “W.

Orientation: North – South.

Date of construction: 2007.

a. Green roof.

A green roof helps to reduce pollution and retain water that can be used for gardening, toilets, cleaning.

The type of green roof used would be extensive because:

2) It has low maintenance.
3) Lighter than the other systems.
4) Low need of water.
5) Just 10 cm of substrate needed.

The average cost of construction of this green roof is 696 pesos/ m2 and has no maintenance. (Source: Membramas y soluciones).

As we can see in Figure 29 the system consist of different layers, waterproof layer, anti- root barrier, drainage storage and ventilation layer, geotextile and substrate.

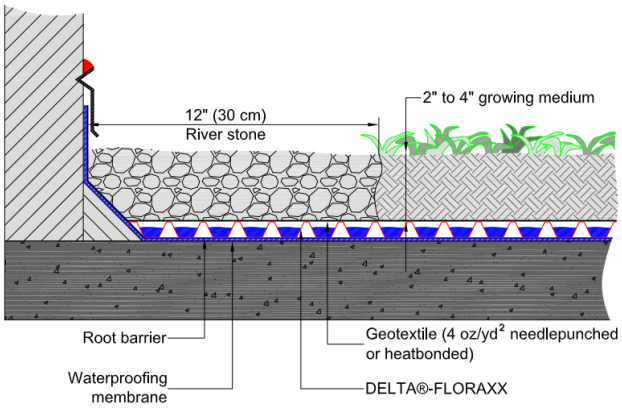

Figure 29 Green roof system. Delta garden roof system with floorax. Membranas y soluciones. Mexico.

b. Cantilever.

The cantilever of 2 m long for 0,2 m wide, above the windows (Figure 30).

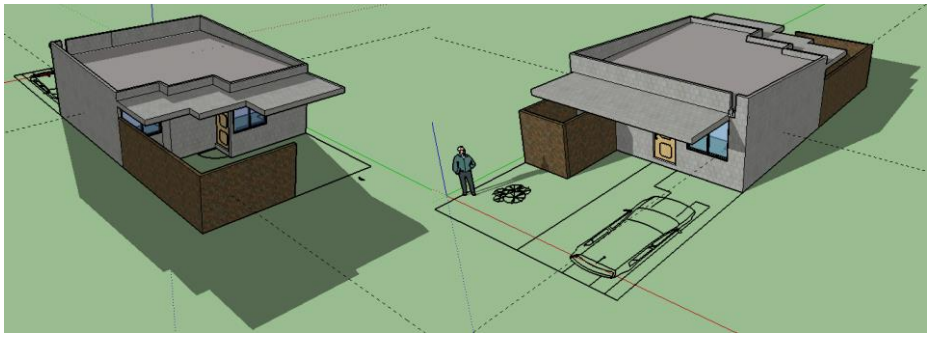

Figure 30 Invies house model with cantilever. South Facade. January. 14:00 h. Own work

The cost of the cantilever is 648,90 $ pesos / m2 and the maintenance 32,45 $ pesos the first 10 years. (Source: Cype Ingenieros, EHL).

c. External insulation.

The external insulation used (Figure 31) has the “mortero base” that is an insulating mortar between the support and the monolayer mortar.

The cost of the external insulation is 331,26 $ pesos / m2 and the maintenance 16,56 $ pesos the first 10 years. (Source: Cype Ingenieros, NAR).

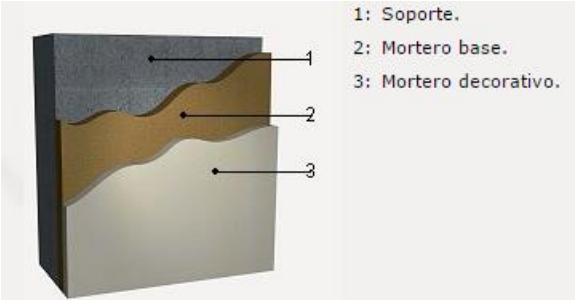

Figure 31 External insulation system. Weber system. Cype Ingenieros

I have worked with Necada in the desktop mode (Figure 32).

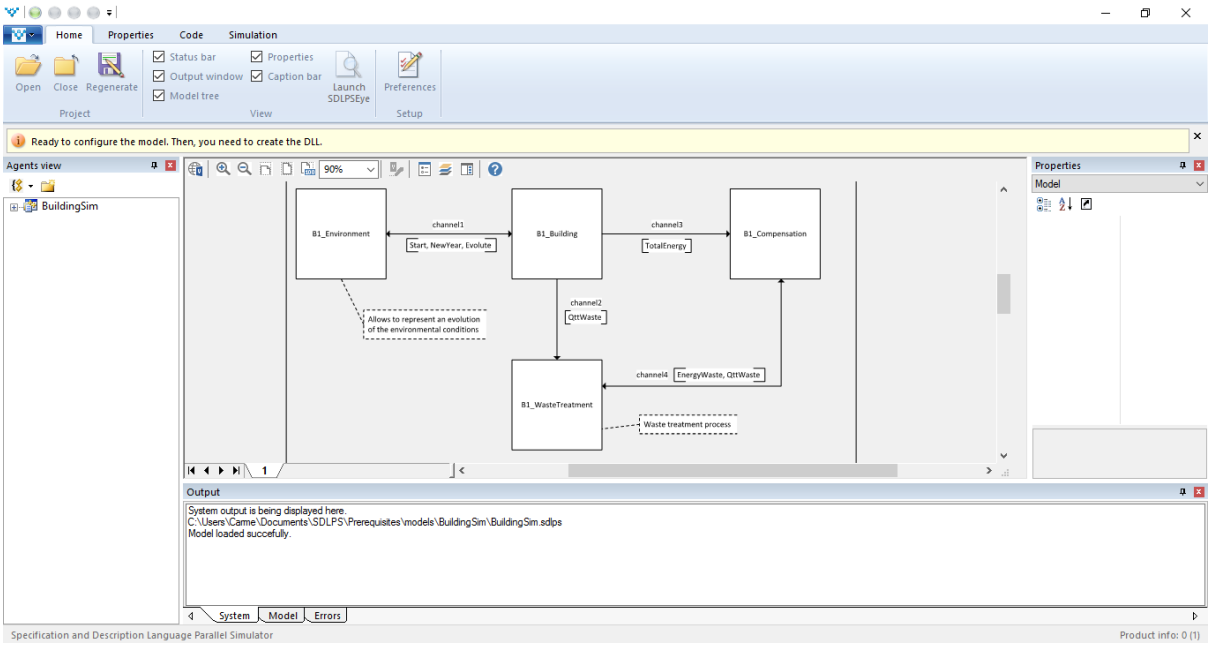

Figure 32 Desktop mode. Necada

And the cloud mode (Figure 33)

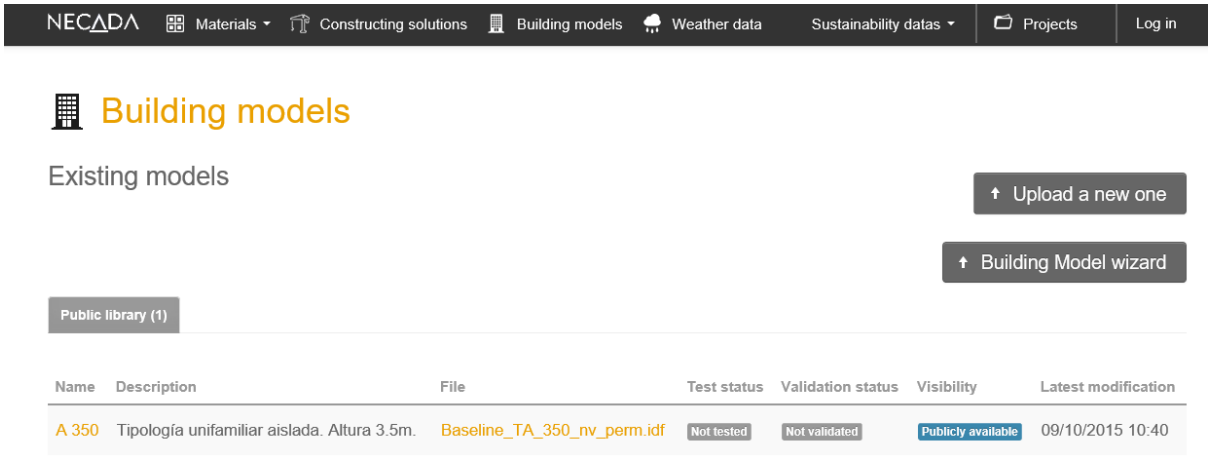

Figure 33 Necada cloud mode. Necada

In both, using an idf file, you choose between the different options and the program returns you the results in a notepad file, this way you can choose the best solution.

8.3 Results

I have done 7 different simulations (Table 5) with Necada.

Code	Name	Description
0	IM	Initial model
1	IM+GR	Initial model + green roof
2	IM + CL	Initial model + cantilever
3	IM + GR + CL	Initial model + green roof + cantilever
4	IM + GR + EI	Initial model + green roof + external isolation
5	IM + EI + CL	Initial model + external isolation + cantilever
6	IM + GR+ EI + CL	Initial model + green roof + external isolation + cantilever

Table 5 Model names. Own work

These are the results of the simulations (Table 6). For one year of conditioning the building.

Simulation	District Heating [kWh]	District Cooling [kWh]	Total [kWh]	Cost (pesos)	Cost (euros)
0	275,00	163,89	438,89	428,36	23,80
1	213,89	33,33	247,22	241,29	13,40
2	450,00	102,78	552,78	539,51	29,97
3	397,22	13,89	411,11	401,24	22,29
4	194,44	19,44	213,89	208,76	11,60
5	311,11	111,11	422,22	412,09	22,89
6	297,22	2,78	300,00	292,80	16,27

Table 6 Energy needed of the models and cost. Own work.

District Heating is the amount of energy needed to heat this building when needed.

Disctrict Cooling is the amount of energy needed to cool this building when needed.

The average price of 1 kWh in Mexico is 0,976 pesos (Source: Comisión federal de electricidad de Mexico, October 2015).

1 € = 18 pesos.

In this table we can see the solution 4 (IM+ GR + EI) has the lowest need of heating.

Solution 2 (IM + CL) needs a lot of heating, this is because San Luis Potosi has low temperatures most part of the year, I have simulated using orientation Nort-South and, even if during the summer it can work really well, during the winter there is a high need of extra energy for heating this building to be between 21º-25º.

The average price of 1 kWh in Mexico is 0,976 pesos (Source: Comisión federal de electricidad de Mexico, October 2015).

On table 7 is shown the cost of constructing the different solutions, the cost of the existents buildings is not consider.

Simulation	Construction (pesos)	Maintainance (pesos)	Construction (euros)	Maintainance (euros)
0	0,00	0,00	0,00	0,00
1	31320,00	0,00	1740,00	0,00
2	14905,23	745,38	828,07	41,41
3	46225,23	745,38	2568,07	41,41
4	60119,74	1439,73	3339,99	79,98
5	43704,98	2185,10	2428,05	121,39
6	75024,98	2185,10	4168,05	121,39

Table 7 Cost of construction and maintainance. Own work.

- *Simulation 1 analysis:*

The solution number 1 (IM + GR) is the only one with no maintenance and the first year the average savings the first year would be 43, 67% = ((241,29 * 100) / 428, 36).

To get the value of how much money would be saved each year, considering the increase of the energy price 2% every year (Source: Comisión Federal de electricidad de Mexico) I have calculated:

Initial investment: 31320 pesos = 1740 euros
1º year value = (kWh IM * energy price) – (kWh GR * energy price)
2 – 50 ºyear value = (kWh IM * (energy price+ (energy price 1ºyear *2%))) – (kWh GR * (energy price+ (energy price 1ºyear *2%)))

Calculating the TIR (Tasa Interna de Retorno), IRR (Internal Rate of Return), it would take more than 50 year to recover the investment.

It is important to consider the reduction of CO2 emissions because of the implementation of CO2. (Table 8)

Average emission of CO2 from electricity, 2013 = 0, 4999 TCO2e/MWh (Source: Programa GEI, Gases Efecto Invernadero, Mexico).

Simulation	District Heating [kWh]	District Cooling [kWh]	Total [kWh]	Emisions CO2/year
0	275,00	163,89	438,89	219,40
1	213,89	33,33	247,22	123,59
2	450,00	102,78	552,78	276,33
3	397,22	13,89	411,11	205,51
4	194,44	19,44	213,89	106,92
5	311,11	111,11	422,22	211,07
6	297,22	2,78	300,00	149,97

Table 8 Emision kCO2/year. Own work

95,81 kgCO2 (219,40 kgCO2- 123,59 kgCO2) of emissions would be reduced each year applying the green roof.

8.4 Conclusion.

Comparing the results, we can observe that local government investment is needed to fund these initiatives, because the locals would not be able to afford this investment.

Choosing the solution of implementing the green roof would help to:

- Reduce the emissions of CO2.
- Fix particles suspended in the air.
- Return 50-60% rainwater to the atmosphere via evapotranspiration and not to the drain.
- Increase the comfort of the users retaining heat in the winter and reducing the temperature between 2-4 º in the summer
- Increase the relative humidity.
- Reduce the heat island effect.
- Indirectly: reduction in health care cost because it increases the quality of life

9. FUTURE LINES OF RESEARCH

The possible lines to be developed would be in the idea of continuing to work together between these departments.

These means to continue using this Case Study for testing the different improvement of the existing model and to develop a language able to be understood for the interested people involved in Ciudad Satelite, UNHABITAT, Catedra Unesco de Sostenibilitat, INNLAB, and the final users who are the most important of the final result, local government and “satelitenses”.

10. CONCLUSIONS OF THE PROJECT

Working together with three different departments, I have learnt how difficult is to find common languages to interact and how useful is to be patient and able to find the right moment to share the potentials of each one to go towards a common desirable result. Sometimes is very difficult to know what people from the same university is developing and how useful can be for the other departments.

What I have tried in this project is, thanks to the opportunity given from UNHABITAT, is to show the opportunities of working in a transdisciplinary way to solve, a little bit, a problem of that affects the habitants of this isolated core.

In this master of sustainability I have learnt how important was to work with professionals from other backgrounds using the right language, the aim of this project is not to have an architectural result, the aim is to get closer to solve the problem about the self-efficiency of isolated cores using local software and knowledge from the same university.

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IV. Anexes

IV.I Future sustainable cities projects

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IV. II Materials used in the simulation details.

a. External Insulation, Generador de precios Mexico. Cype Ingenieros.

NAR010 **m²** **Sistema weber.therm Mineral "WEBER CEMARKSA" de aislamiento térmico y revestimiento mineral de fachadas.**

Aislamiento térmico y revestimiento mineral de fachadas, por su cara exterior, **con el sistema weber.therm Mineral "WEBER CEMARKSA", formado por una capa de mortero termoaislante weber.therm Aislone "WEBER CEMARKSA", de 20 mm de espesor, y una capa de mortero monocapa Weber.pral Terra "WEBER CEMARKSA", acabado rústico planchado, color Polar, de 10 mm de espesor**.

Descompuesto	Ud	Descomposición	Rend.	Precio unitario	Precio concepto
mt28maw 010	kg	Mortero termoaislante w eber.therm Aislone "WEBER CEMARKSA", compuesto de conglomerantes hidráulicos, cargas minerales, aligerantes, fibras de vidrio de alta dispersión y aditivos especiales.	5,000	27,20	136,00
mt28mon030	m	Junquillo de PVC.	0,750	6,35	4,76
mt28mon050	m	Perfil de PVC rígido para formación de aristas en revestimientos de mortero monocapa.	1,250	6,71	8,39
mt28moc010lk1a	kg	Mortero monocapa Weber.pral Terra "WEBER CEMARKSA", acabado rústico planchado, color Polar, compuesto de cemento blanco, cal, hidrófugos a base de siloxano, agregados de granulometría compensada, aditivos orgánicos y pigmentos minerales, resistencia a compresión de 3 a 7,5 N/mm², absorción de agua por capilaridad menor de 0,2 kg/m² min½.	14,500	9,33	135,29
mo038	h	Oficial revocador.	0,353	43,00	15,18
mo077	h	Ayudante revocador.	0,353	26,63	9,40
mo109	h	Peón revocador.	0,236	26,63	6,28
	%	Medios auxiliares	2,000	315,30	6,31
	%	Costes indirectos	3,000	321,61	9,65
Coste de mantenimiento decenal: $ 16,56 en los primeros 10 años.				Total:	331,26

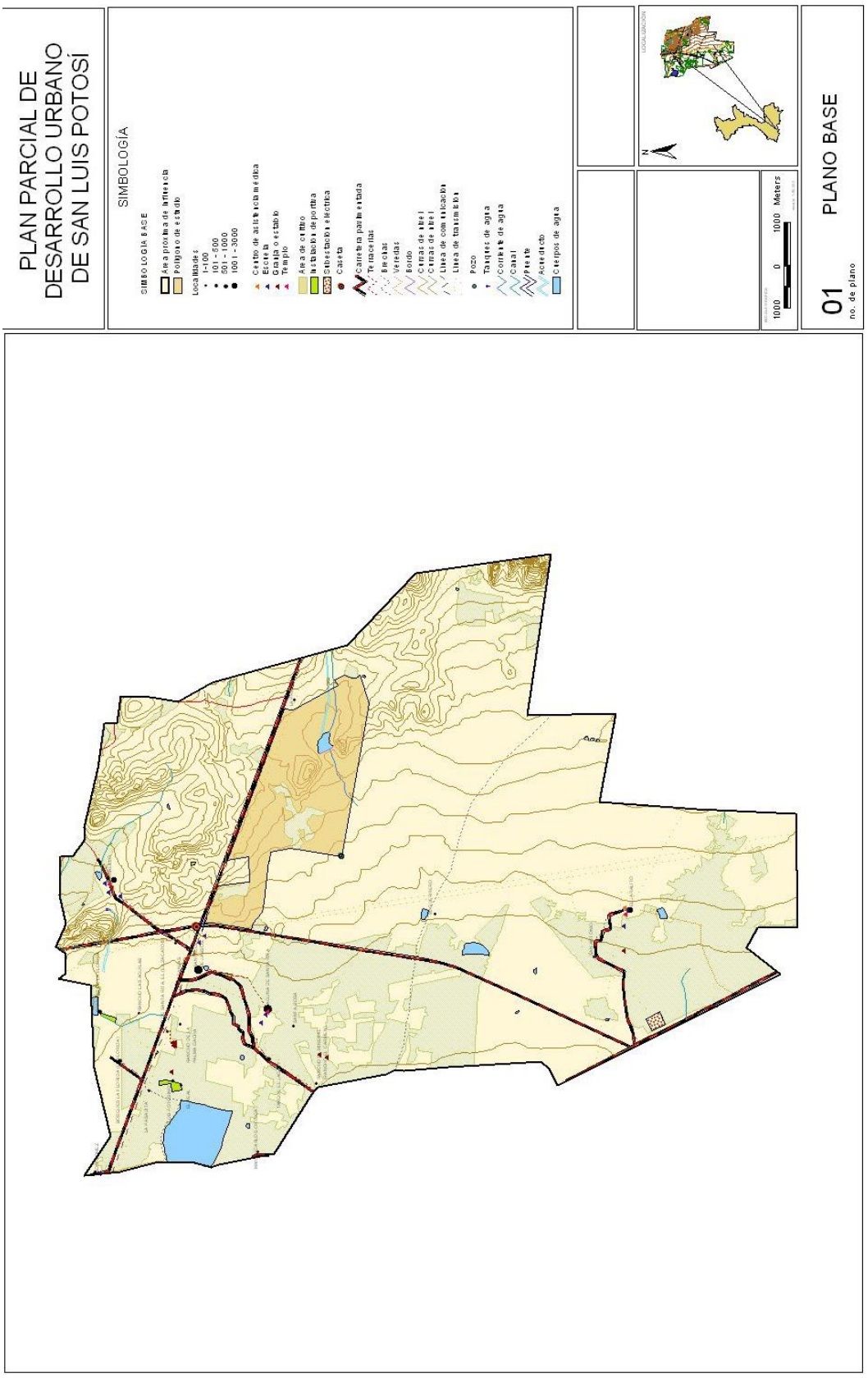
b. Cantilever, Generador de precios Mexico. Cype Ingenieros.

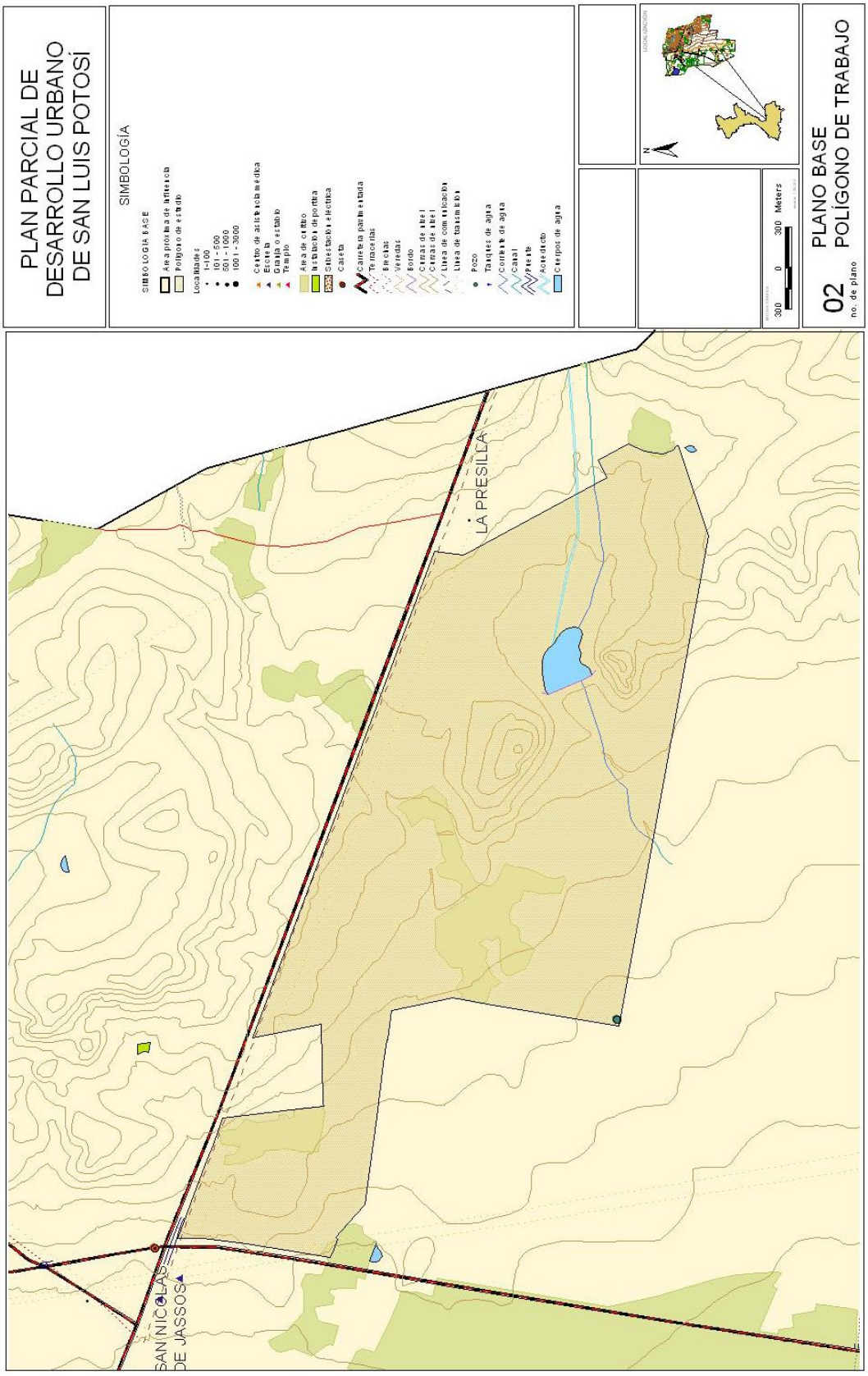
EHL010 **m²** **Losa plana.**

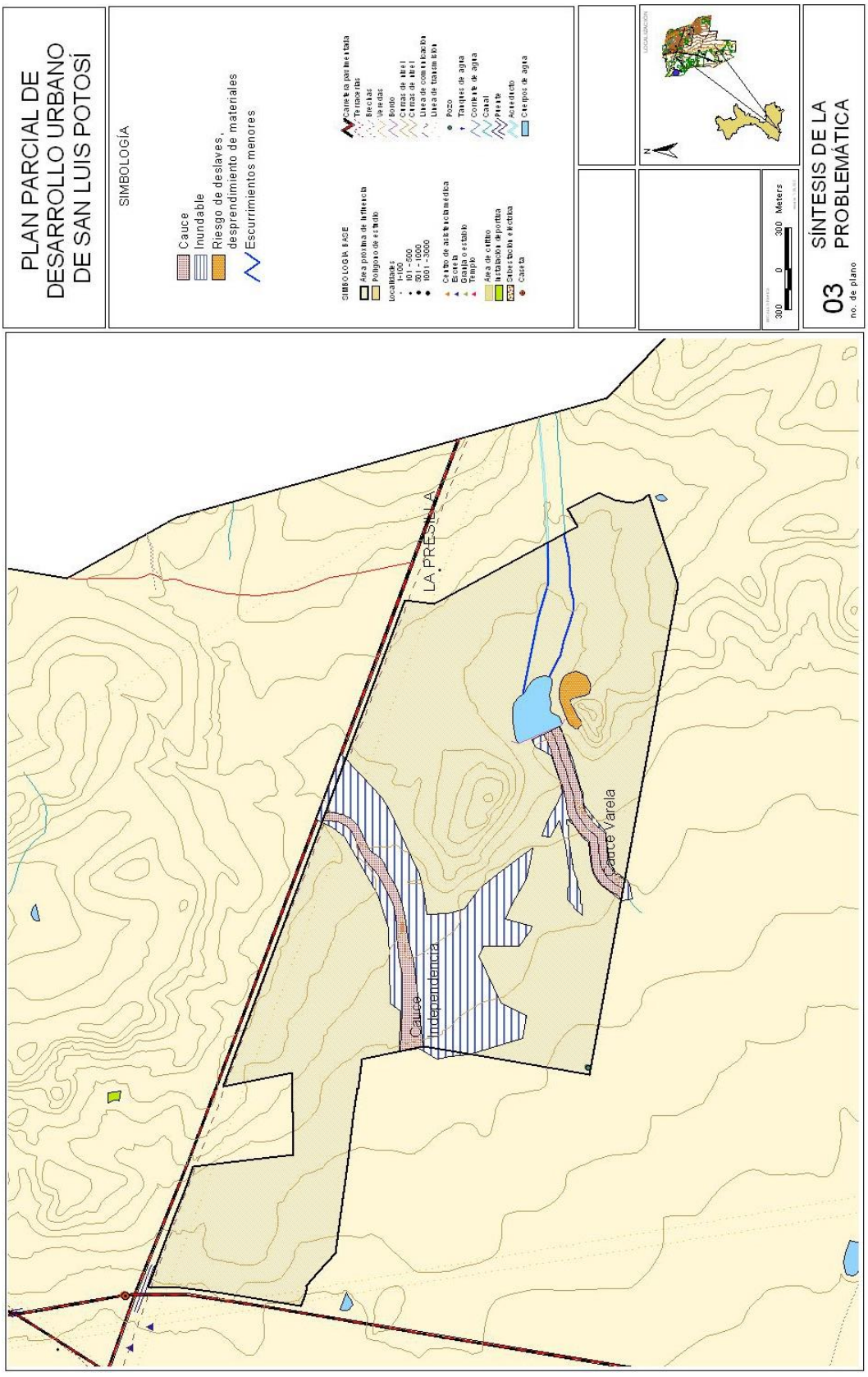
Losa plana de concreto armado, **horizontal**, peralte **10** cm, realizada con **concreto f'c=20 MPa (200 kg/cm²), clasificación de exposición A1, tamaño máximo del agregado 12 mm, revenimiento de 5 a 10 cm, hecho en obra, y colado con medios manuales**, y acero **fy=4200 kg/cm²**, cuantía **22** kg/m²; montaje y desmontaje del **sistema de cimbra continuo** ; altura libre de piso a techo de **hasta 3 m**. Sin incluir repercusión de columnas.

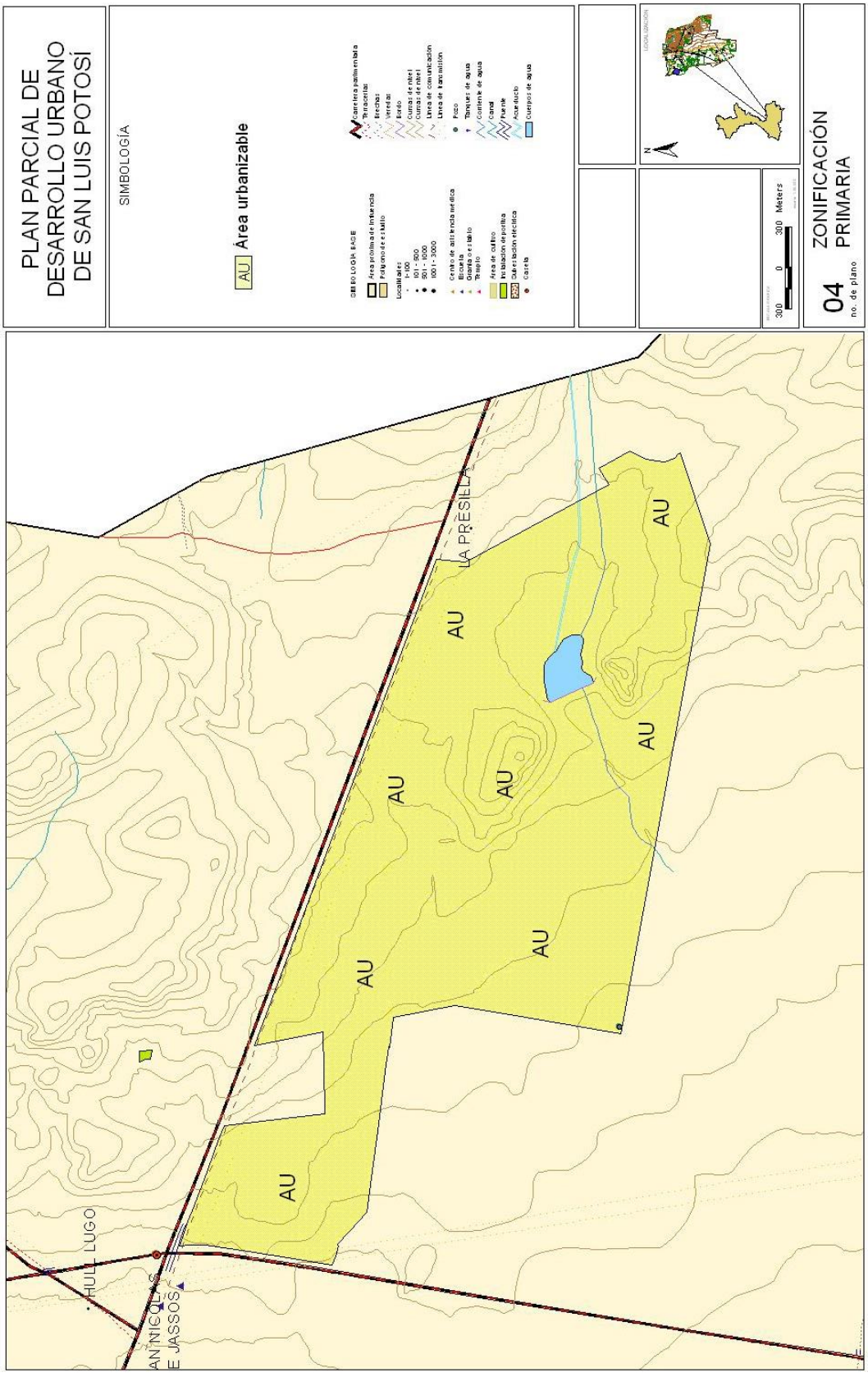
Descompuesto	Ud	Descomposición	Rend.	Precio unitario	Precio concepto
mt08efl010a	m²	Sistema de cimbra continuo para losa de concreto reforzado, hasta 3 m de altura libre de piso a techo, compuesto de: puntales, sopandas metálicas y superficie de la cimbra de madera tratada reforzada con varillas y perfiles.	1,100	195,39	214,93
mt08cor010a	m	Molde de poliestireno expandido para cornisa.	0,100	116,46	11,65
mt07aco020i	Ud	Separador homologado para losas planas.	3,000	1,04	3,12
mt07aco080a	kg	Acero fy=4200 kg/cm², diámetros varios, según NMX-C-407-ONNCCE.	22,000	11,14	245,08
mt08aaa010a	m³	Agua.	0,026	19,83	0,52
mt01arg000f	m³	Arena cribada.	0,056	128,51	7,20
mt01arg001fc	m³	Agregado grueso homogeneizado, de tamaño máximo 12 mm.	0,068	225,61	15,34
mt08cem000f	kg	Cemento gris en sacos.	39,514	1,95	77,05
mq06hor010	h	Revolvedora de concreto.	0,063	20,09	1,27
mo042	h	Oficial estructurista.	0,596	39,87	23,76
mo089	h	Ayudante estructurista.	0,596	20,97	12,50
mo113	h	Cabo albañil.	0,131	19,22	2,52
mo112	h	Peón albañil.	0,138	19,61	2,71
	%	Medios auxiliares	2,000	617,65	12,35
	%	Costes indirectos	3,000	630,00	18,90
Coste de mantenimiento decenal: $ 32,45 en los primeros 10 años.				Total:	648,90

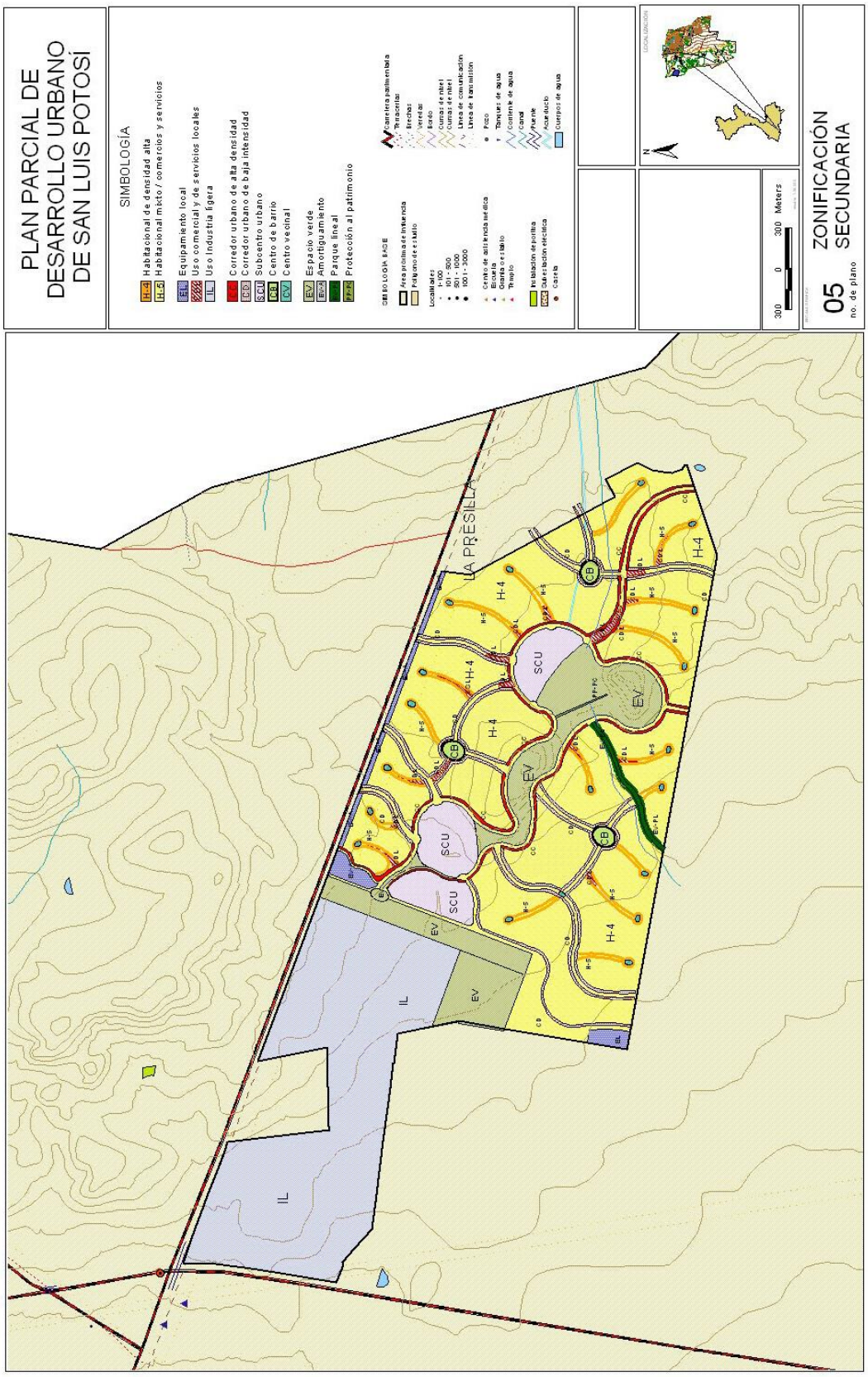
IV. III Plan parcial desarrollo urbano de San Luis Potosí.

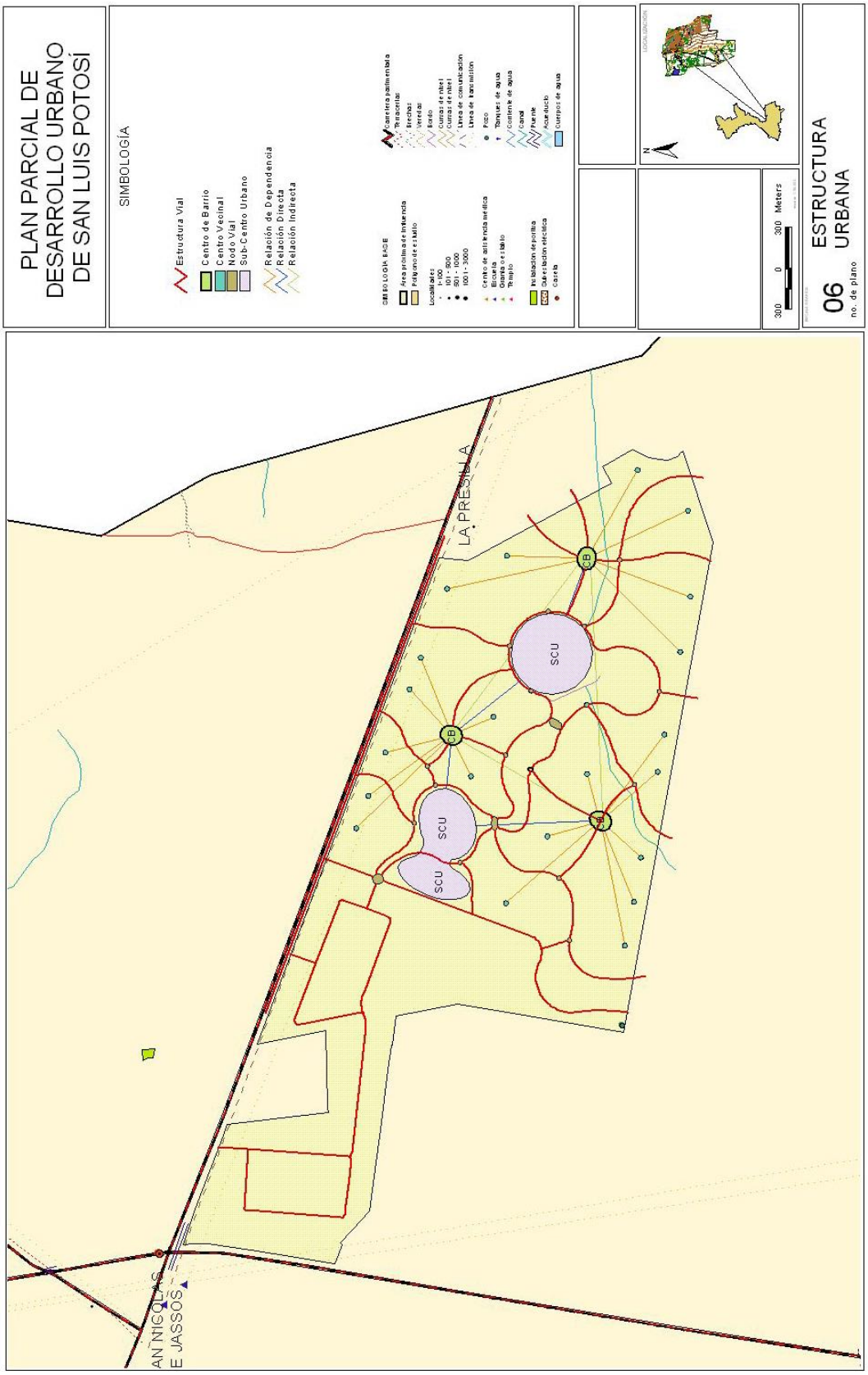


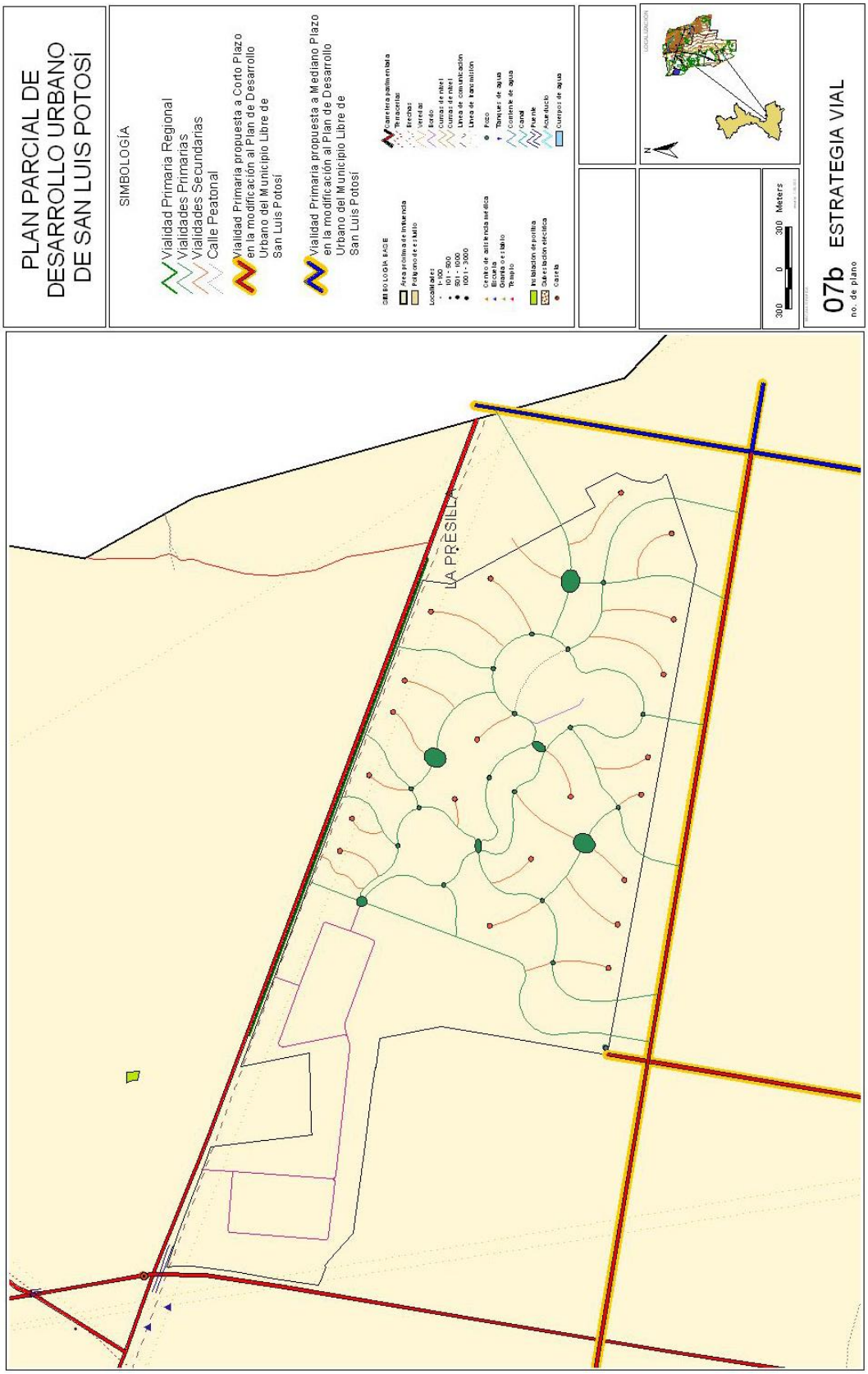

PLAN PARCIAL DE DESARROLLO URBANO DE SAN LUIS POTOSÍ
SIMBOLOGÍA
SIMBOLOGÍA BASE
Area próxima de intervención
Polígono de estudio
Localidades
1 - 100
101 - 500
501 - 1000
1001 - 3000
Centro de asistencia médica
Escuela
Granja o establo
Templo
Area de cultivo
Instalación deportiva
Subestación eléctrica
Caseta
Carretera pavimentada
Terracerías
Brechas
Veredas
Bordo
Cimas de nivel
Cimas de nivel
Línea de comunicación
Línea de transmisión
Pozo
Tanques de agua
Cortina de agua
Canal
Presa
Acueducto
Cuerpos de agua
LOCALIZACIÓN
N
300 0 300 Meters
02
no. de plano
PLANO BASE
POLÍGONO DE TRABAJO
LA PRESILLA
SAN NICOLÁS
DE JASSOS

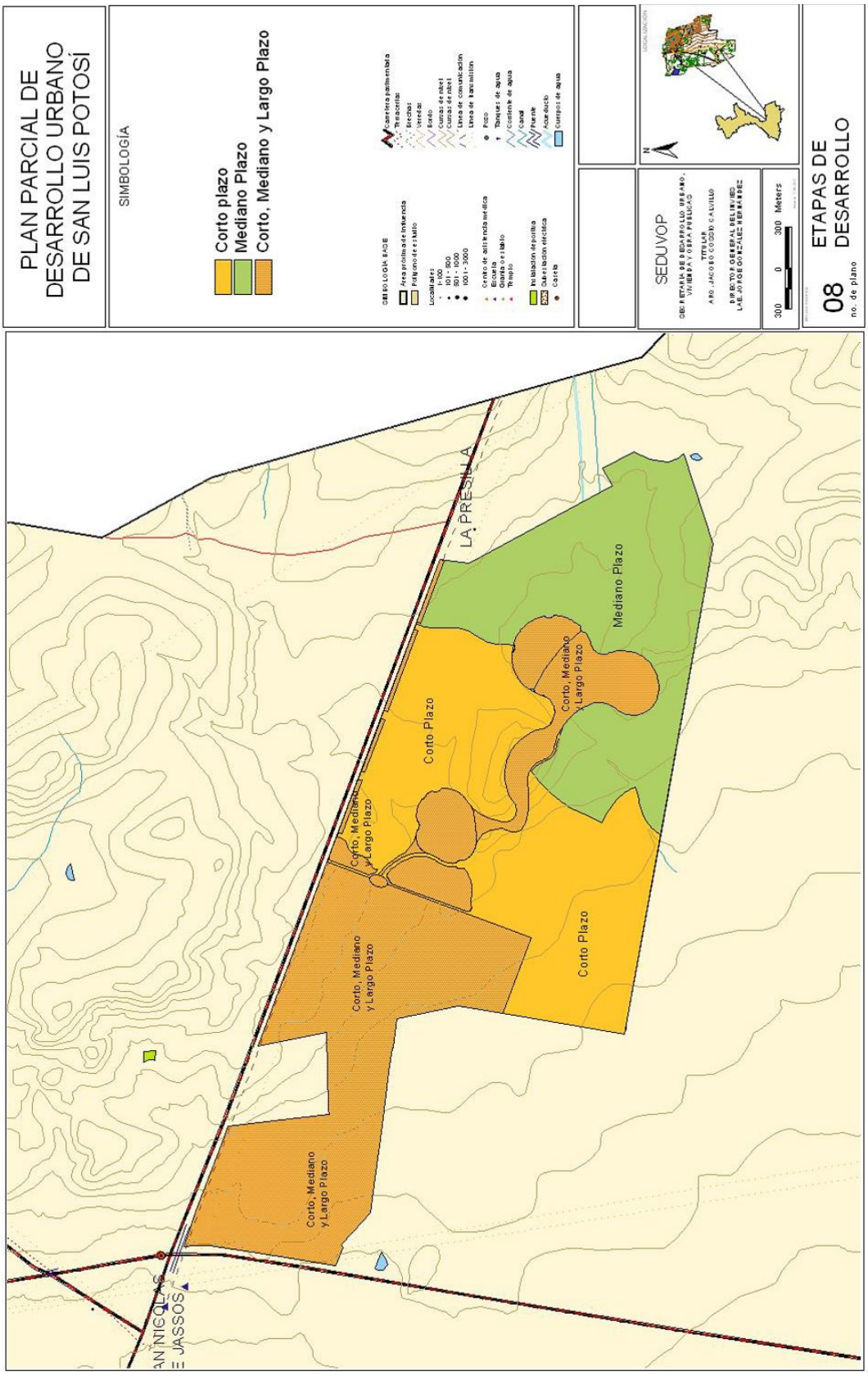

PLAN PARCIAL DE DESARROLLO URBANO DE SAN LUIS POTOSÍ
SIMBOLOGÍA
Cauce
Inundable
Riesgo de deslaves, desprendimiento de materiales
Escurrimientos menores
SIMBOLOGIA BASE
Area propuesta de intervención
Polígono de estudio
Localidades
1-100
101 - 500
501 - 1000
1001 - 3000
Centro de asistencia médica
Escuela
Grupo de estudio
Templo
Area de cultivo
Instalación deportiva
Estacionamiento público
Caseta
Carretera pavimentada
Terracerías
Brechas
Vialidad
Bordo
Curvas de nivel
Curvas de nivel
Línea de conducción
Línea de transmisión
Pozo
Tanques de agua
Cuerpo de agua
Canal
Presa
Acueducto
Cenotes de agua
LOCALIZACIÓN
N
300 0 300 Meters
03
no. de plano
SÍNTESIS DE LA PROBLEMÁTICA
LA PRESILLA
Cauce Independencia
Calle Varela

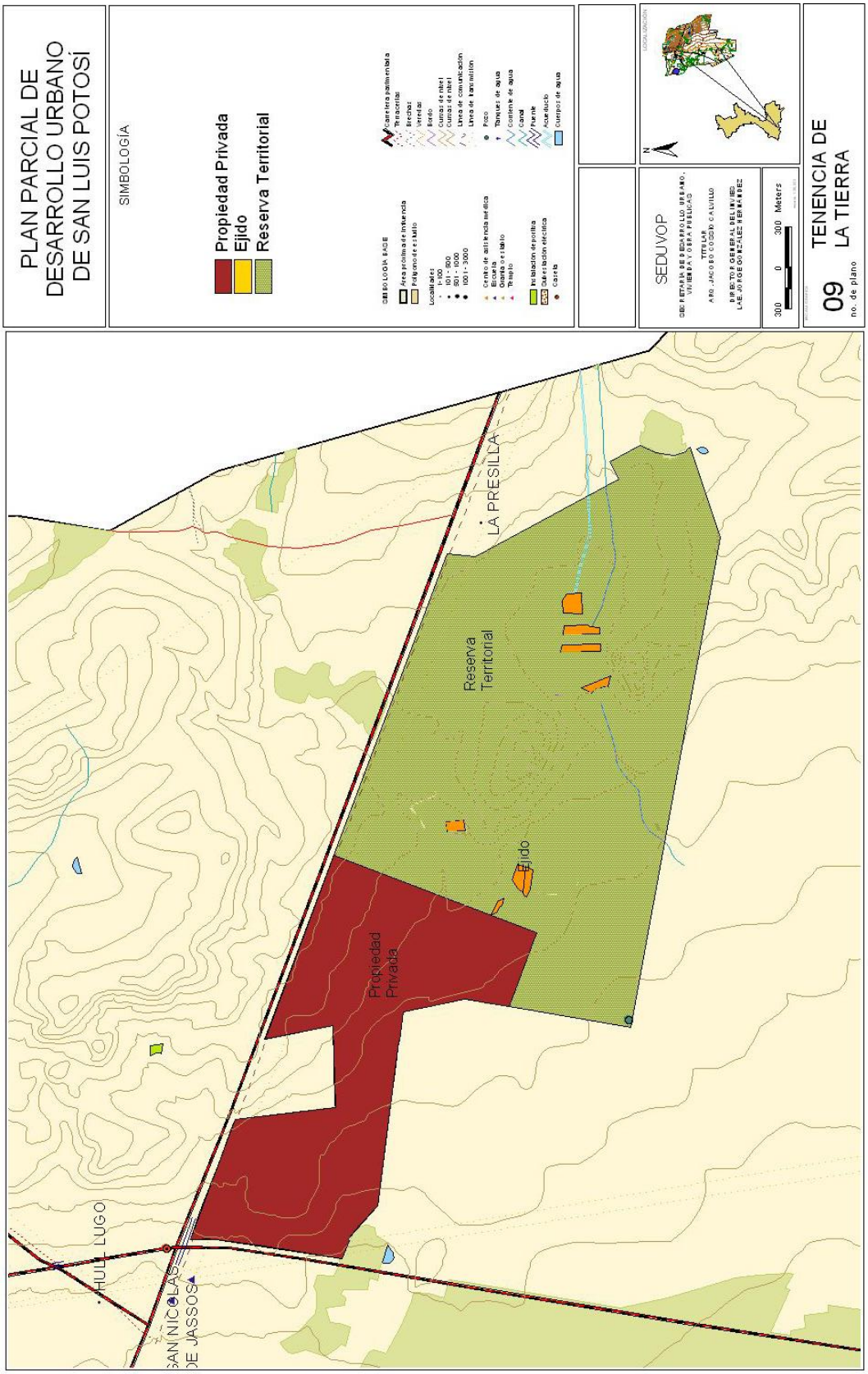

PLAN PARCIAL DE DESARROLLO URBANO DE SAN LUIS POTOSÍ
SIMBOLOGÍA
AU Área urbanizable
SIMBOLOGÍA BASE
Área próxima de intervención
Polígono de estudio
Localidades
1-100
101 - 800
801 - 1000
1001 - 3000
Centro de salud
Escuela
Centro de abasto
Templo
Área de cultivo
Instalación deportiva
Subestación eléctrica
Cárcel
Carretera panamericana
Terracerías
Brechas
Veredas
Estado
Curvas de nivel
Curvas de nivel
Curvas de nivel
Línea de comunicación
Línea de transmisión
Pozo
Tanque de agua
Contenk de agua
Canal
Puente
Acueducto
Cuerpos de agua
LOCALIZACIÓN
N
300 0 300 Meters
04 no. de plano
ZONIFICACIÓN PRIMARIA
AU
LA PRESILLA
HUEHUETLAN
SAN NICOLÁS DE JASSOS


PLAN PARCIAL DE DESARROLLO URBANO DE SAN LUIS POTOSÍ
SIMBOLOGÍA
Habitacional de densidad alta
Habitacional mixto / comercios y servicios
Equipamiento local
Uso comercial y de servicios locales
Uso Industria ligera
Corredor urbano de alta densidad
Corredor urbano de baja intensidad
Subcentro urbano
Centro de barrio
Centro vecinal
Espacio verde
Amortiguamiento
Parque lineal
Protección al patrimonio
SIMBOLOGÍA BASE
Area próxima de intervención
Polígono de estudio
Localidades
Centro de salud
Escuela
Granja o establo
Templo
Instalación de policía
Subestación eléctrica
Caseta
Carretera pavimentada
Terracerías
Brechas
Vereda
Bordo
Curvas de nivel
Curvas de nivel
Línea de comunicación
Línea de transmisión
Pozo
Tanque de agua
Contenedor de agua
Canal
Puente
Acueducto
Cuerpos de agua
LOCALIZACIÓN
300 0 300 Meters
ZONIFICACIÓN SECUNDARIA
05
no. de plano
LA PRESILLA
H-4
CB
SCU
EV
IL


PLAN PARCIAL DE DESARROLLO URBANO DE SAN LUIS POTOSÍ
SIMBOLOGÍA
Estructura Vial
Centro de Barrio
Centro Vecinal
Nodo Vial
Sub-Centro Urbano
Relación de Dependencia
Relación Directa
Relación Indirecta
SIMBOLOGÍA BASE
Localidades
1-100
101 - 500
501 - 1000
1001 - 3000
Pozo
Tanques de agua
Cisterna
Canal
Planta
Acueducto
Cuerpos de agua
Caseta
Meters
300
0
300
ESTRUCTURA URBANA
06
no. de plano
LA PRESILLA
SAN NICOLÁS DE JASSOS
SCU
SCU
SCU
CB
CB
CB


PLAN PARCIAL DE DESARROLLO URBANO DE SAN LUIS POTOSÍ
SIMBOLOGÍA
Vialidad Primaria Regional
Vialidades Primarias
Vialidades Secundarias
Calle Peatonal
Vialidad Primaria propuesta a Corto Plazo en la modificación al Plan de Desarrollo Urbano del Municipio Libre de San Luis Potosí
Vialidad Primaria propuesta a Mediano Plazo en la modificación al Plan de Desarrollo Urbano del Municipio Libre de San Luis Potosí
SIMBOLOGÍA BASE
Carretera panamericana
Terracerías
Brechas
Veredas
Barda
Curvas de nivel
Curvas de nivel
Línea de comunicación
Línea de transmisión
Pozo
Tanques de agua
Contenes de agua
Canal
Puente
Acueducto
Cuerpos de agua
Área próxima de influencia
Polígono de estudio
Localidades
1-100
101 - 500
501 - 1000
1001 - 3000
Centro de asistencia medica
Escuela
Centro de culto
Templo
Instalación deportiva
Subestación eléctrica
Cárcel
LOCALIZACIÓN
N
300
0
300
Meters
07b
no. de plano
ESTRATEGIA VIAL
LA PRESILLA


PLAN PARCIAL DE DESARROLLO URBANO DE SAN LUIS POTOSÍ
SIMBOLOGÍA
Corto plazo
Mediano Plazo
Corto, Mediano y Largo Plazo
SEDUVOP
ETAPAS DE DESARROLLO
08
LA PRESA
Corto Plazo
Mediano Plazo
Corto, Mediano y Largo Plazo
Meters


PLAN PARCIAL DE DESARROLLO URBANO DE SAN LUIS POTOSÍ
SIMBOLOGÍA
Propiedad Privada
Ejido
Reserva Territorial
SEDUVOP
09
TENENCIA DE LA TIERRA
no. de plano
LA PRESILLA
Reserva Territorial
Ejido
Propiedad Privada
HUIZ LUGO
SAN NICOLAS DE JASSOS