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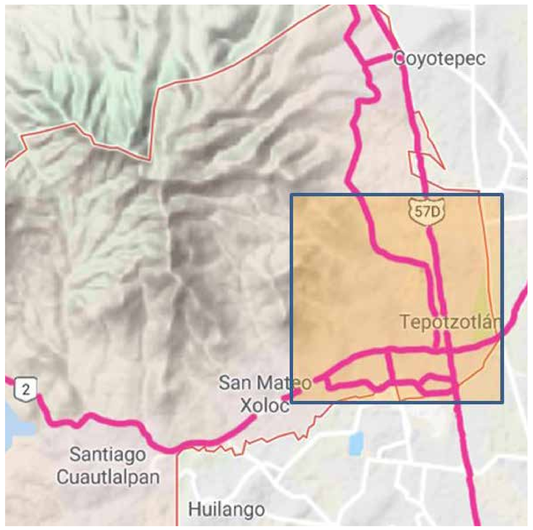


Project Area 5 x 5 km.

Tepotzotlan Urban Center

Alternatives to Climatic Change

Tepotzotlan is a town in the State of Mexico located 42 kilometers north of Mexico City (lat 19.713º, long -99.223º, alt 2290 m).
It has an important historic patrimony formed by the San Francisco Javier College founded in 1584 (World Heritage Site 2010) now transformed into the National Museum of Colonial Period (Museo Nacional del Virreinato), the Chapel of Santiago in Capula (XVI C.), the Xalpa aqueduct (XVIII C) and the haciendas of San Jose La Teja, Xochimanga and La Concepcion (XVII and XVIII C). Additionally, there are two prehispanic sites named La Presita and Momoxtle, and cave paintings.
Its environmental assets include Sierra de Tepotzotlan State Park (13,175 ha) and Xochitla Ecological Reserve (70 ha.)
In 2001, Tepotzotlán was declared "Pueblo Magico" by the Ministry of Tourism as one of the most attractive towns in the country and the closest to the capital, giving Tepotzotlan a great touristic potential.
Tepotzotlán green area constitutes one of only six major state parks around Mexico City´s Valley. This state park system is fundamental for the environmental quality and climatic stability of a population of nearly 20 million people.

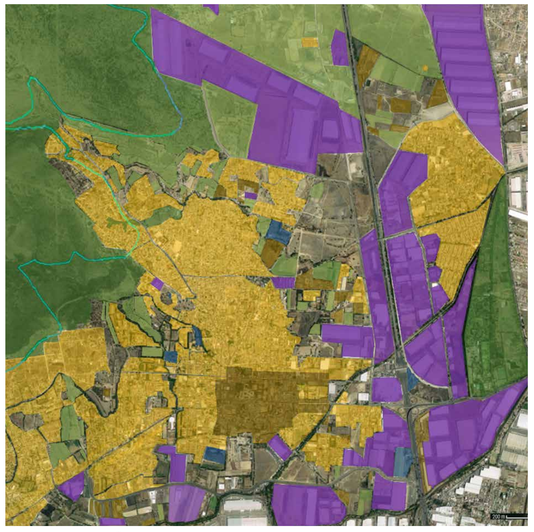
For this studio an area of study of 5 x 5 km (25 km2) was set including the historic core, part of Mexico-Queretaro highway, Xochitla Ecological Park, the south east corner of the Sierra State Park and the Capula Neighborhood. It also includes the south border to the Cuautitlan Municipality divided by the Hondo River. The area is the entrance to the Valley of Mexico of all major land routes from the north and center of the country. Uncontrolled industrial growth has happened next to the Mexico-Queretaro highway, producing a major impact in the area of study. Industry has expanded on farmland, isolating the housing area and historic core from their main communication roads and affecting environmental systems, particularly on hydrology. A newly developed (2015) industrial zone that borders with the State Park is a major concern, as it starts a trend for uncontrolled industrial development in both sides of the highway.
In 2005, the studio Alternative Futures for Tepotzotlan was developed by the University of Harvard and the Universidad Autonoma Metropolitana. Given the fifteen-year interval between scenarios of the present study, the previous work is a very valuable tool that allows us to evaluate past, present and future scenarios (2005, 2020, 2035 and 2050). Some of the original proposals have already been implemented, but others that were fundamental for environmental quality and sustainability of the area were ignored.

Five Major Requirements by 2050

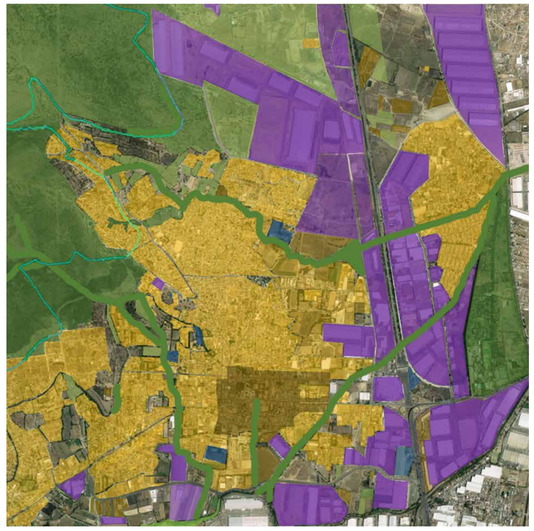
1. Limit Industrial growth.
2. Protect and reforest Sierra Park and Waterways.
3. Maintain the natural hydrological system connecting Sierra and River.
4. Separate truck traffic from buses and cars.
5. Protect and Reuse historic buildings.

Major Assumptions and Innovations

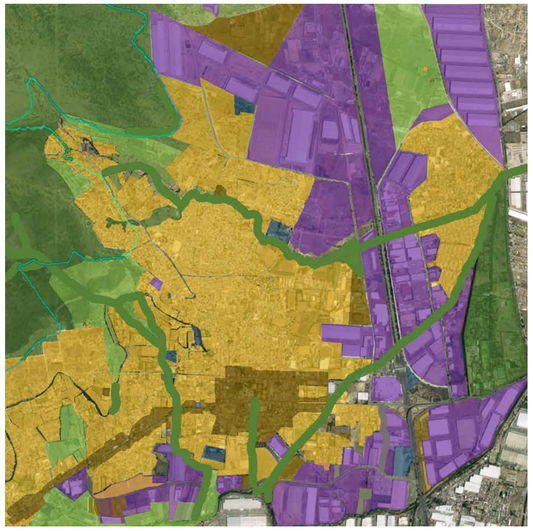
GRE 1.1. Strict Enforcement of State Park Limits (above 2350 m).
WAT 2.1. Identify limits of restricted areas to keep natural drains (green corridors).
GRE 3.2. Implement an integral municipal mobility system that includes public transportation, cycling and pedestrians.
GRE 3.4. Forbid transit of industrial vehicles in urban centers.
IND 6.1. Limit the industrial corridor and promote green industries.
INS 9.1. Historic buildings transformed into hotels, restaurants, museums and commerce with a maximum of two levels.
HOU 7.3. No high density housing developments.
TUR 10.2. Diversify tourist offer in cultural, ecological, adventure, religious and gastronomy, among others, with emphasis in national and international young and elderly people.



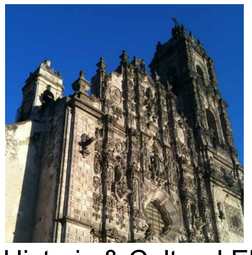
Existing Situation: 2020.

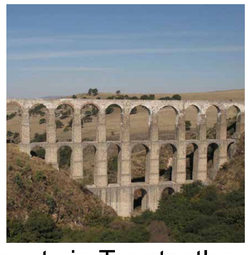


Early Adopter: 2035.

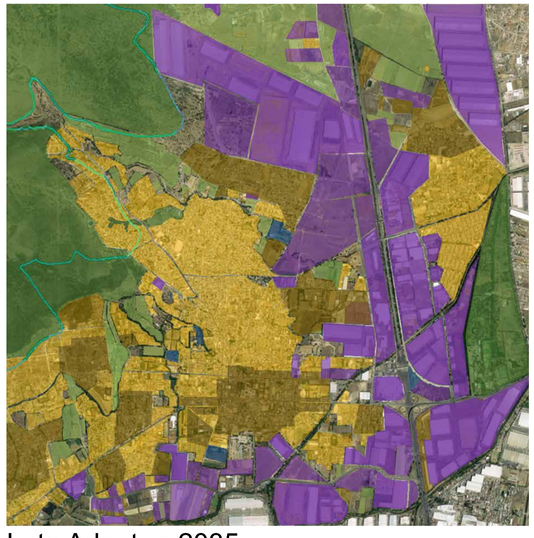


Early Adopter: 2050.

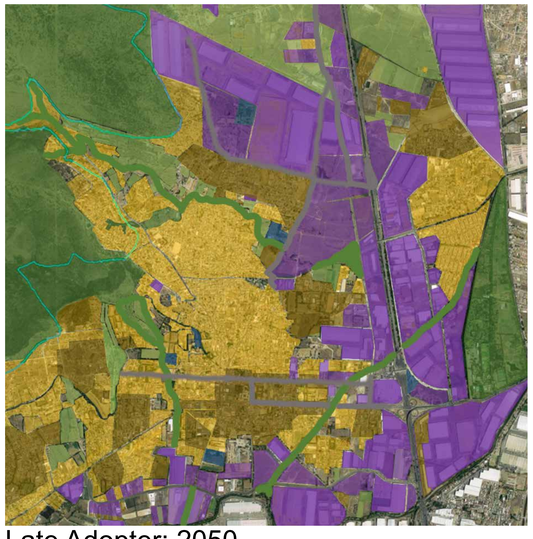




Historic & Cultural Elements in Tepotzotlan.



Late Adopter: 2035.



Late Adopter: 2050.

Early Adapter Scenario, 2050

Based on early analysis, authorities, investors and general population understand risks and opportunities to adapt for climate change and mitigation measures immediately.
Strict measures are enforced to preserve Sierra de Tepotzotlan State Park. Reforestation of all critical causeways is done. Ravines, rivers and waterways are preserved as the natural hydrological system.
Public mobility is re-organized. A second local-foreign bus terminal is developed on the west side of the highway. A new bridge provides direct access to the heavy traffic of the industrial area. Industrial land use is limited to keep Tepotzotlán´s touristic character and avoid isolation of the central core from the rest of municipality.
Use of solar water heaters and photovoltaic systems is promoted. Strong capital groups are invited to invest in Tepotzotlán on green industries.
Tax incentives for reusing ancient buildings for tourism-oriented uses. New services and better communications attract a more diversified tourism. Training people for hospitality services.

Late Adapter Scenario, 2035

State Park suffers plagues and wildfires reducing its borders due to illegal occupation by housing and industry. Late adoption of a reforesting program of the state park borders is started with local species and labels identifying it as a federal area. Green corridors and natural causeways are obstructed by industrial buildings and housing. Flooding increases. Only parts of the natural green-hydraulic system remain due uncontrolled industrial and housing growth. Connection with the river is lost and the hydraulic natural system is broken. Municipal mobility is saturated by trucks, buses and cars. A new bridge in the industrial area is built. The possibility of a public transportation connection node on the west side of the highway is lost. Traffic jams and insecurity, discourage visitors. Many historic buildings are damaged or destroyed. Remaining historic buildings are catalogued, restored and given tourist compatible uses as lodging, restaurants, museums or stores.
Tourism decreases due to the industrial buildings and less attractive context on the entrance and around historic and natural sites. Implementation of a photovoltaic public lighting increases security and emphases historic elements in the access and historic core.

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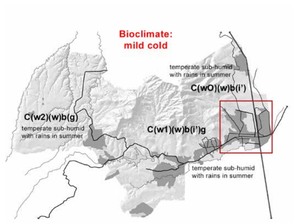
Climate Change

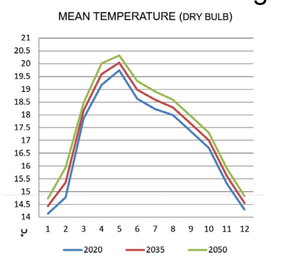
The urban center of Tepotzotlán has a tempered humid climate with rains in summer (Köppen C(w0)(w)b(i ')) and a mild-cold bioclimate. Historical data from 1965 to 2015, shows a 0.6ºC increase in dry bulb temperature, coinciding with the urbanization period of the areas located at the intersection of Hondo and Chiquito rivers. Dry bulb temperature projections were made for the 2020, 2035 and 2050 scenarios showing an estimated temperature increase of 1.1ºC for 2050, possibly caused by the loss of tree mass and agricultural areas; over densification of housing and growth of areas destined for industry, as well as the increase of greenhouse gases by transport. The behavior of rainfall in the same period of time (1965 to 2015) shows a more unstable performance in the last 15 years, with more extreme records in minimum and maximum annual rainfall. The atypical rainfall patterns of the last years and the invasion of the natural areas of water ways have caused floods in the low residential and industrial zones in the raining season.Wildfires in the Sierra Park have happened nearly every year, running uncontrolled due to difficult access to the sierra park and lack of appropriate equipment such as helicopters with large water tanks.



Regional Climate.

Lowlands flooding.

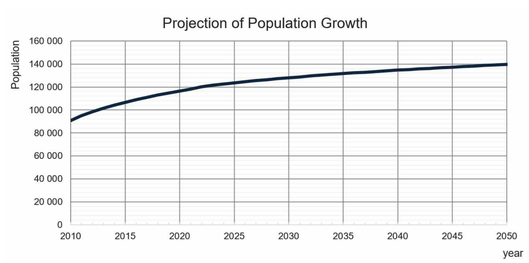
Wildfire at Sierra.



Temperature 2020-2050

Population Trend

Actual population of Tepotzotlán is 116,599 inhabitants. Based on the 2010 Census and the 2020 projection by Mexico´s National Commission of Population (CONAPO), the demographic growth of Tepotzotlan was estimated at a yearly rate of approximately 2.1%, while the actual national demographic rate is 1.3%. The data shows that immigration is a determining factor in the increase of the population due to Tepotzotlan´s location in the out ring of Mexico City´s Metropolitan Area. Tepotzotlan's population increased 28% in the last 15 years and it can reach the 140,000 inhabitants by 2050. From 2005 to 2020 the industrial area increased 140%.



Projection of Population Growth 2010-2050

Methodology

Following geodesign methodology, as structured by Dr. Stenitz (2010), throughout 2018 a series of workshops were developed to identify groups of interest from the local government, ONG´s, investors and academia. A diagnostic of the most relevant threads and opportunities was georeferenced. The location of proposals and possible key projects was set; then working groups of students were organized to develop initial design concepts.

Geodesign Workshop.

Key Projects

The following key projects were identified and developed:

1, 2 and 3. Capula Neighborhood Downtown. An ancient town within walking distance to the historic core and entrance to Sierra Park, includes the old chapel of Nuestra Señora del Refugio, a Seminar House and the Civic Center.

4. The Water Trail. A linear park following a 400 years old irrigation channel next to the border of Sierra Park

5. Capula Water Trail Museum. A support and educational facility that is a view point for the Old Town, Valley and Sierra.

6. La Presita Archeological Museum and Arroyo Seco Linear Park. An undeveloped green corridor between Sierra and Hondo River.

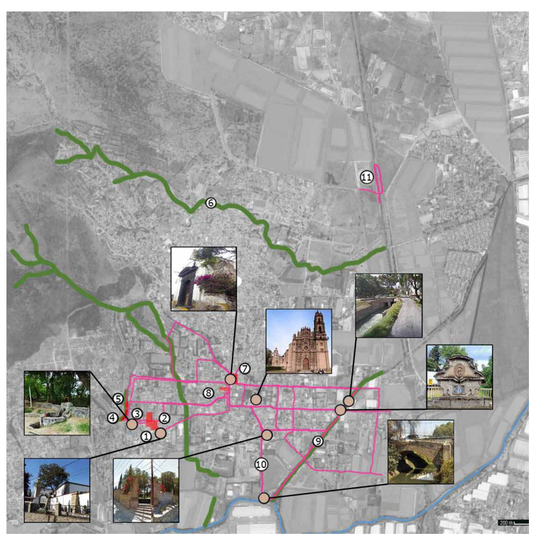
7. Downtown Youth Hostel. A series of new facilities for young national and international tourism

8. Municipal Market. Improvement of a major culinary attraction selling local farming products.

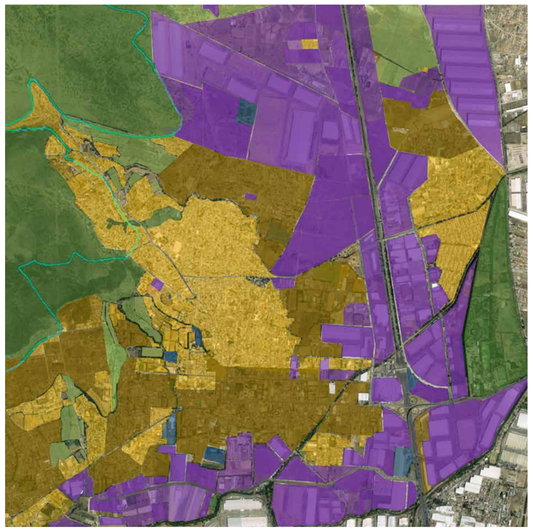
9. Rio Chiquito Linear Park. A shaded promenade linking the ancient Puente de los Jesuitas with the main access.

10. Puente de los Jesuitas and Camino Real. Conservation and improvement project of these important historical elements that are endangered by heavy traffic and alterations.

11. New bridge over the highway. For access to heavy traffic to the industrial area.



Key Projects' Location.



Non-Adapter Scenario: 2050.

Previous Scenario, 2005

In 2005, a diagnostic of the main problems and opportunities was matched with proposed actions for growth in an orderly and sustainable municipal development. Actions include: the creation of a system of green corridors on runoff areas and natural causes; the development of a linear park in the Rio Hondo; the construction of dams and levees to control possible flooding and to create water reservoirs; detonate the tourist vocation of the municipality with other emblematic points like State Park and Xalpa Aqueduct; creation of hotels and tourist services of quality in the historic center.

For the northern area, it was proposed the construction of a new bridge over the motorway, a regional hotel and a central bus station, among others. In order to promote investment and employment, it was planned the creation of an industrial corridor paralleling the Highway. Its entrance depended on the relocation of the highway tollbooth and the construction of a second bridge that would give access to the heavy traffic and free the car and bus access to the village.

Unfortunately, some important parts of the proposal have not been carried out such as: the green corridors on water causes, a linear Park Rio Hondo, ecotourism in the State Park, relocation of the tollbooth and the second bridge to access industrial corridor.

2005 Plan Now

Fifteen years later some of the proposals have been carried out such as: the central bus station, the regional hotel, a new access bridge at the highway, some hotels and inns in the historic center, a new crafts market, enlargement of the municipal market, the development of an industrial corridor parallel to the motorway with the construction of a wide avenue.

However, industry was not contained in the proposed corridor area invading agricultural land to the borders of the State Park, the urban area and even the historical center.

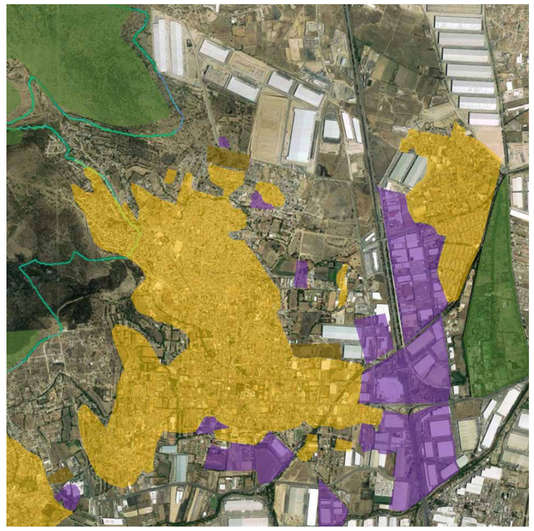
Instead the Rio Hondo Park, local and state government built a "a Southern Beltway" trying to give access to the towns located towards the west without passing through the historic center. None the less, due to land speculation and the lack of regulation, industry has taken over the land on the southern beltway and the Rio Hondo, blocking access to the river from the historic core.

In 2004 population was 90,200, for 2018 it has increased to 113,010. However, in the same period the land occupied by industry doubled. For these reasons, this zone of study was chosen again to find alternatives that solve current problems and take into account the effects of climate change and urban growth in the short and medium term.

Non-Adapter Scenario, 2050

No attention has been given to climate change. A general one to two degrees temperature increase alters weather behavior. Heat island phenomenon further increases local temperature due to extensive industrial and housing buildings, heavy traffic, deforestation of Sierra Park and loss of farmland. Industrial developments constrain urban area and restrict historical center access. Severe traffic of trucks and public transportation affects the entrance bridge node to the municipality, difficulting evacuation and emergency equipment access in case of natural disasters. Industry has been extended over the inner and high lands, west of the municipality, consequently heavy trucks drive along the inner roads.

Tourism is almost lost due to the difficult access and deterioration of historical buildings. River and watercourses are heavily polluted and blocked by housing and industrial debris. The natural hydrological system is broken. Trees and vegetation next to the river are dying. Industry has blocked watercourses; constant flooding affects several urban areas. Many mix areas are used as an industry support workshop. Local production tends to disappear.



Previous Scenario: 2005.

Participants and Collaborators

Participants
Universidad Autónoma Metropolitana
UAM, CyAD, Medio Ambiente.
Professors of the Área Arquitectura Bioclimática and Laboratorio de Diseño Bioclimático:
Aníbal Figueroa C
Víctor Armando Fuentes F.
Gloria María Castorena E.
Héctor Valerdi M.
Edwin Israel Tovar J.
Program in Architecture:
Oscar Uriel González M.
José Yair Sánchez B.
Alberto Sánchez F.
María del Pilar Pescador G.
Armando Ambrosio R.
Ana L. Ávalos T.
Luz Adriana Méndez S.
Ordóñez Galván Jesús S.
Jaime Abraham Jiménez S.
Brandon Giovani Victoriano A.

Collaborators
UAM, Program in Diseño Planificación y Conservación de Paisajes y Jardines:
Saúl Alcántara O.

H. Ayuntamiento de Tepotzotlán:
Ángel Zuppa N. (Major)
Roberto Solís T.
Daniel González J.

Universidad Autónoma Metropolitana
Casa abierta al tiempo Azcapotzalco

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The Water Trail

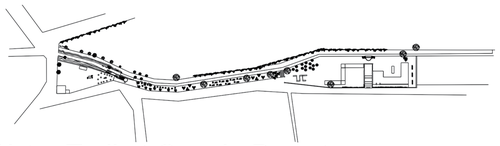
It is proposed to recover and restore through a linear park the old water channels from the farmer district of the Capula Neighborhood to the former San Francisco Javier College in the historic center.

The visitor can choose to journey in a pedestrian way, by bicycle or on horse ride.

The path shows the water irrigation system, the endemic vegetation of Tepotzotlán, the old colonial hydraulic engineering devises for the control and distribution of the water of the Zanja Real (Royal Ditch) and views to the State Park.

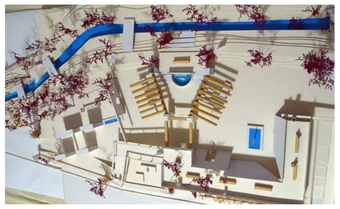
The living history of water allows us to understand the importance of preserving the water and the biotic elements that constitute the environmental system; conserve permeable areas; provide green common areas for the inhabitants and visitors of Tepotzotlán and regulate the local climate with the management of vegetation and bodies of water.

This is an irrigation system that has been operating for more than 400 years and is still in use today.



Water Trail at Capula Downtown.

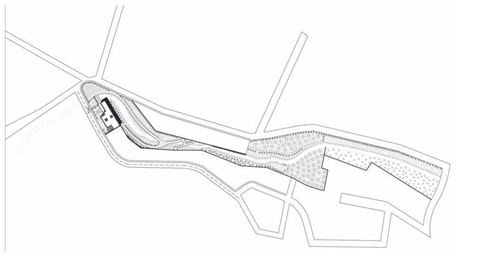
Views from Water Trail Site.



Water Trail Museum Model

Capula Water Trail Museum

In the middle of the Water Trail route, a small informative facility is located to offer the visitor a space to rest and relax in a bioclimatic area integrated with the natural landscape. The architectural grouping includes a closed exhibition area and another one destined to outdoor events. It also provides an area of contemplation to observe the historical center to the east, the Sierra de Tepotzotlán to the west and the nearby Zanja Real (Royal Ditch). The space next to the museum allows the passage through bridges over the Zanja Real. Also, the visitor will find the necessary services to make the Water Trail a safe and interesting environmental, cultural and local experience.



La Presita Archeological Museum

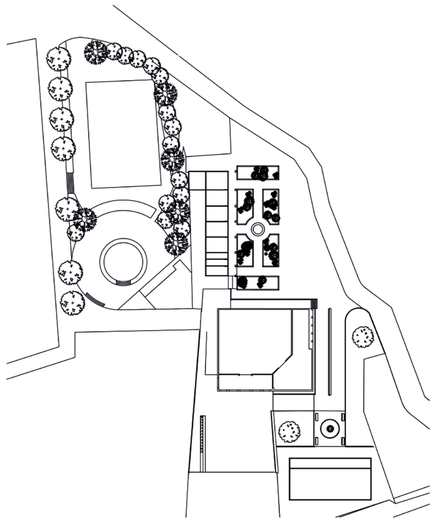
Capula Neighborhood Downtown

As a destination within the water trail and framed by the Sierra de Tepotzotlán, the recently remodeled old Chapel of Capula is a tourist attraction, to which new complementary buildings have been added: The Church of Our Lady of Refuge, the Seminary Building and a new secondary access the Civic Center.

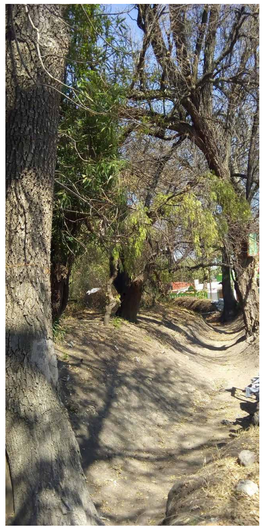
Visitors can see the architecture of the place through the historic buildings located in the downtown neighborhood.

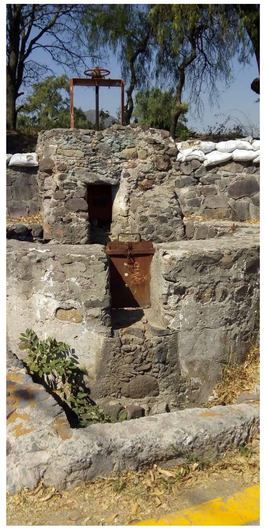
It is proposed a harmonic incorporation of different buildings by porticos linking cloisters and patios for the development of social and cultural activities. Reforestation with trees will provide shade and shelter. Revaluing the old buildings with an urban image project, will allow the town of Capula to strengthen the local economy and preserve its historical heritage.

Along the water trail that connects historic buildings and natural parks, there are support facilities for sitting, food and drink located at 300-meter intervals. These facilities will be operated by the local population.



Capula Downtown Plan.

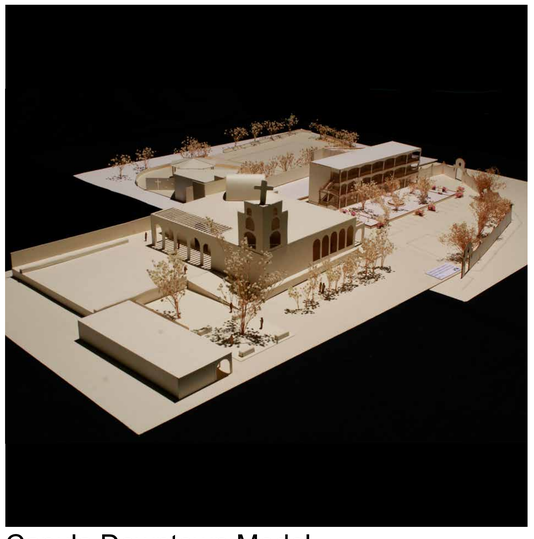




Capula Water Trail Museum Site.

La Presita Archeological Museum

In the Ricardo Flores Magón Neighborhood, the Arroyo Seco from the Sierra de Tepotzotlán is contained by a small dam dated in the XVII century called La Presita. Next to it are located two large prehispanic monolithic sculptures. One of them represents a skull that has the trace of the solar trajectory and the other is the torso of a deity. Due to the historical and environmental importance of this site, the water basin and the old dam will be restored to its original condition and the monolith's surroundings cleared and landscaped. This restoration will be complemented by a small Museum that informs visitors. The site includes another old bridge from the XVII century that was part of the Camino Real. The museum is designed with bioclimatic principles and a local flora educational landscaping. The museum is the anchor of Arroyo Seco Linear Park, that is one of the few remaining green corridors linking Sierra Park to Rio Hondo and one of the most important parts of the hydrological system. The linear park is intended to work as barrier between industrial and mixed used areas and the habitational and historic core.

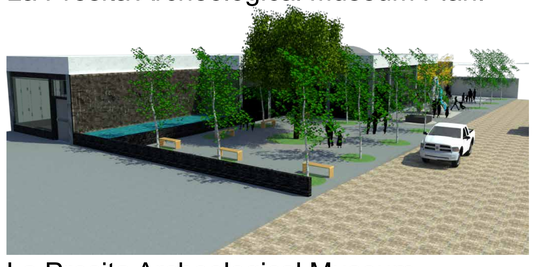


Capula Downtown Model.

Capula Downtown Historic Monuments.

La Presita Archeological Museum Site.

La Presita Archeological Museum Plan.



La Presita Archeological Museum.

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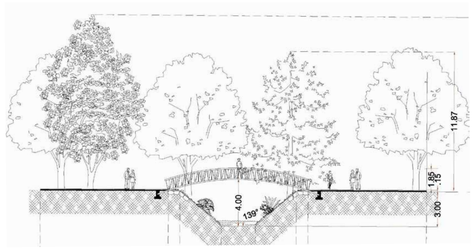
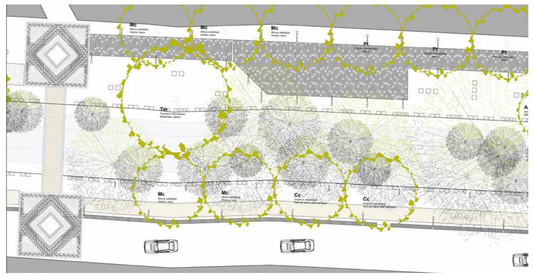
Rio Chiquito Linear Park Site.





Rio Chiquito Linear Park Project Details.

Quesadilla Stands at Municipal Market.

Youth Hostel

Several alternatives destined for youth tourism were generated, focusing in the unattended group of visitors from 18 to 30 years of age.This group seeks adventure, alternative buildings, contact with nature, gastronomic and artisanal experiences as a form of incorporation with the local community. The hostel has a capacity of 98 beds for young people. The projected facility has an efficient design that reduces operating costs to its maximum to offer an economic lodging alternative for one night or short stays. Emphasis is given to common areas and activities. No car parking is provided, to promote public transportation. Bicycles will be available for guests.

Youth Hostel Concept.

Río Chiquito Linear Park

From the Historical Center towards the east, at about 1000 meters, is located the Chiquito River.

This Channel was built in pre-Hispanic times for the irrigation of agricultural lands and the control of flooding in low areas. The changes in agricultural to urban use have changed the usefulness of the irrigation channel, and made its flooding purpose less evident.

It is proposed to recover the channel, regenerate it and give it a collective and tourist use as a linear park that allows the development of recreational, sports and cultural activities.

The project incorporates pedestrian and bicycle mobility for tourist and everyday use.

The Chiquito River is an environmental connector between the two industrial zones of the town.

The path is designed as a space that offers a comfortable, shaded and secure circulation for pedestrians and cyclist, a security camera system, an efficient lighting with photo voltaic lamps and WiFi connectivity.

Historical Elements

There are three important cultural elements on the route: The Old Bridge of the Jesuits, the Guardacantones of the Colorado Bridge Fernando VI and the Old Pantheon of the Barrio de Texcacoa.

For the preservation of the historical bridge of the Jesuits, we plan the relocation toward the west of the vehicular bridge that connects the industrial zone of Cuautitlán Izcalli with the town of Tepotzotlán.

This allows the old bridge to have its own space.

This element becomes an icon for access to the place, and aknoledges that it is part of the colonial road “Camino Real de Tierra Adentro” that runs from Mexico to California.

The old bridge offers a safe area for pedestrians and cyclists to pass over the river appreciating the landscape of the Rio Hondo.

Avenida del Trabajo (Work’s Avenue) is the old Camino Real historical entrance to Tepotzotlán.

It is proposed to reduce the vehicle section to two lanes generating a bike and a pedestrian´s path that diversifies mobility and expand pedestrian safe access to other parts of the historic core.

The lateral ditches will be recovered for the passage of rainwater and the edges will be reforested to green the road.

Municipal market

The Municipal Market is a major culinary attraction with is famous “quesadillas”. It is located in the historic center opposite to the entrance of the National Museum and next the House of Culture.

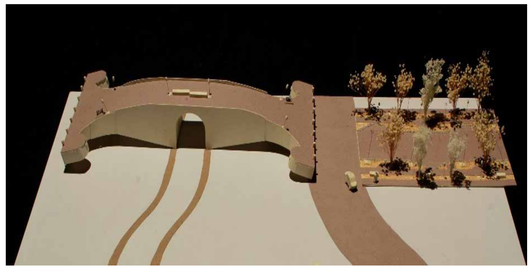
An addition to this space was proposed with the creation of a central patio that allows to control the climatic conditions in the same way that of the old buildings of the locality did. In the patio, a common food area was created in an open space with local trees and flowers.

Design concepts consist of natural cooling, heating and ventilation. Other strategies include daylighting and the use of efficient lighting systems in evening and night time.

On the upper floor, a wide semi-covered terrace was created to appreciate the sunset over the Sierra de Tepotzotlán State Park as the closing remark of everyday’s activities.

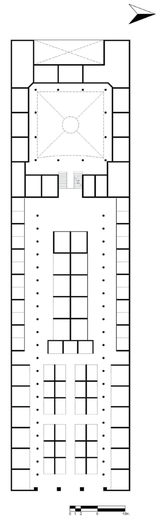
Most food ingredients will be marketed and labeled by “Fair Trade”, “Made in Tepotzotlán” and –when possible- “Organic food, Pesticide free”.

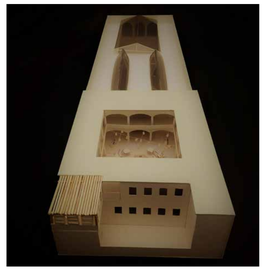
Youth Hostel Concept.



Rio Chiquito Site and Project.

Jesuits’ Bridde and Guardacantones.





Municipal Market Plan and Model.

Conclusions

In recent years Tepotzotlán’s growth has been disorderly, mainly because of land speculation problems due to pressure of the expanding industrial and commercial activity of Mexico City. Unfortunately, the type of industry that is settling in the municipality is not the productive one that requires labor and offers good wages to the inhabitants, but mainly they are warehouses for the transfer of goods that occupy a lot of land, bring heavy traffic and create a few low paid jobs. From an ecological point of view, urban and industrial growth is severely affecting the hydrological system and the State Park. On one hand, climate change is causing strong and punctual atypical precipitations that do not have a rapid and natural free flow, as a result floods are more common. On the other hand, high temperatures in the dry season are causing fires in the Sierra de Tepotzotlán.Therefore, logical planning proposals are focused to restore and maintain the hydrologic balance and limit industrial growth.The aim of specific projects is to preserve historic areas and buildings, promoting Tepotzotlán´s tourist vocation, creating linear parks on green corridors for locals and tourist, separate the access of industrial heavy transport, restructure a more efficient and sustainable system of public transportation that includes cyclist´s and pedestrian´s paths, among others.