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ATOTONILCO WASTEWATER TREATMENT PLANT
MEXICO

Figure 01: Planta de Tratamiento de Aguas Residuales Atotonilco
Sources: Atotonilco Wastewater Treatment Plant team

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Cases are not intended to serve as endorsements, sources of primary data, or illustrations of effective or ineffective project design or implementation.

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EXECUTIVE SUMMARY

This evaluation assesses the sustainability of the Atotonilco Wastewater Treatment Plant (PTAR) project, which was developed to treat wastewater generated in the Metropolitan Zone of the Valley of Mexico. This facility is located within the municipality of Atotonilco de Tula in the state of Hidalgo, and occupies 158.5 hectares traversed by the Mexico-Querétaro rail line, a state highway, and the Salto-Tlamaco Canal. At the time of the assessment, the first stage of construction was complete and had been in operation for almost a year. The PTAR is the largest wastewater treatment plant in Latin America and one of the largest in the world, with a capacity of 35,000 liters per second and an estimated lifespan of 50 years.

The consortium Treated Water of the Valley of Mexico (ATVM) was formed to construct and operate the Atotonilco treatment plant for 25 years through an agreement with the Mexican National Water Commission (Conagua). The project has been partially funded by Mexico's National Development Fund, which financed up to 49% of the total cost of the project, estimated at 9.389 million pesos, approximately US $686 million. Of the remaining cost, 20% has been funded by the consortium partners and 31% through commercial bank credit.

The PTAR will have tremendous positive impact on the quality of life of the communities in the region. Not only will they benefit from improved development in the area and job creation, but, by treating the wastewater from the Metropolitan Zone, the project will allow regional farmers to improve their irrigation practices for the benefit of local agriculture in the Mezquital Valley. Cleaner water is expected to significantly improve the health of about 300,000 inhabitants who live and work directly within the irrigation zone and have depended on water from the El Salto River and the Salto-Tlamaco Canal. The project team at the PTAR has considered the needs of the local community and has attempted to address them throughout the development of the project in the form of enhancements and restorations of community spaces.

The project team showed exceptional leadership in demonstrating sustainability as one of its core values and striving to make meaningful commitments to sustainable principles and practices. The project will improve public health and the environmental conditions of the area and will treat more than 60% of the wastewater from the Valley of Mexico. At the same time, the project has been designed to be self-sustaining, generating its own energy using biogas produced from by-products of the water treatment and in some cases natural gas, in order to minimize the amount of energy used from the public energy network.

The project team at the PTAR has developed a detailed manual for the operation and maintenance of the plant's equipment in order to maximize the efficiency and longevity of the

plant and its systems, and to better respond in cases of malfunctions or emergencies. In regard to resource allocation, the PTAR has made efforts to reduce waste and soil relocation during the construction period. The team has clearly identified the amount of waste material generated during construction and has designated spaces for its storage within the site until sorted for donation or recycling. Materials and soil excavated were often reused for other areas of construction within the site, such as fills.

More significantly, the PTAR has succeeded in reducing the plant's energy and water consumption. An outstanding quality of the project is the generation of electrical energy using biogas and natural gas, amounting to an estimated reduction of 81% per year in energy supplied from outside sources. Similarly, efforts to reduce the use of potable water by using recycled or treated water for the operations of the plant will reduce potable water needs by 92.5%. Even though the project site is not considered an area of significant ecological value or prime habitat, the project team has invested significantly in reforestation using native plant species, with the aim of recovering and improving the quality of environmental services in the site.

Water bodies within the boundaries of the project site are the El Salto River and the Salto-Tlamaco irrigation canal; these will most directly benefit from the cleaner water treated by the PTAR. Through the treatment of the water flowing into these water bodies, the project team at the PTAR succeeds in enhancing hydrologic connections, water quality, existing habitats, and the transportation of sediment, as there will be a substantial reduction of raw sewage continuing downstream. The design for the PTAR took into consideration the existing conditions on the site, minimizing land alterations with the intention of avoiding excessive erosion. Cut slopes, fills, and containing walls have been designed to minimize the effects of erosion due to natural causes like wind and surface landslides.

Regarding climate and risk, the project team at the PTAR considered possible emergencies or short-term hazards related to the operations of the plant and incorporated measures to prevent them or respond to them during the design and construction phases. Preventive measures such as training programs are in place involving regular emergency response drills for all staff at the plant. The PTAR has been designed to prioritize the production of electric energy on site; this energy supplied by the cogeneration system will be the preferred source of electrical energy for the operation of the plant and emergency systems. Because of this feature, the plant has been able to increase its resiliency and independence from external energy supply. ATVM estimates that a reduction of an average of 400,000 tons of CO_2e per year will be achieved through the PTAR.

The project's importance transcends its immediate area of influence, generating positive

impacts at a metropolitan scale and contributing to the area's environmental renewal and sustainability. At the same time, the evaluation has highlighted opportunities for improvement in order for the project to have an even bigger impact in the community.

There is significant room for improvement in providing a more inclusive plan that takes into consideration the needs of minorities and disadvantaged groups. The project team could also increase its efforts to understand the needs and opportunities of local communities, and to support the development of more comprehensive policies and regulations regarding the restoration and preservation of local character. Particularly, there is much opportunity for the project team to contribute to creating economic opportunities for women by, for example, offering targeted internships and workshops to support women's well-being and empowerment. Incorporation of energy-efficient equipment and processes beyond the production of energy could be considered to further decrease the project's consumption of energy, as could other alternative ways of producing energy such as solar panels or wind turbines. Similarly, the project team could consider alternatives to potable water use within the plant, such as recycled gray water and stormwater, to achieve a 100% reduction in the use of potable water and attempt to recycle water for the use of the nearby community.

Lastly, it would be beneficial for the project team to more systematically highlight the risks associated with the project and its operation and the measures taken to mediate those risks beyond industry requirements and standards. This analysis should address in detailed the risks associated with the new technology incorporated in the project.

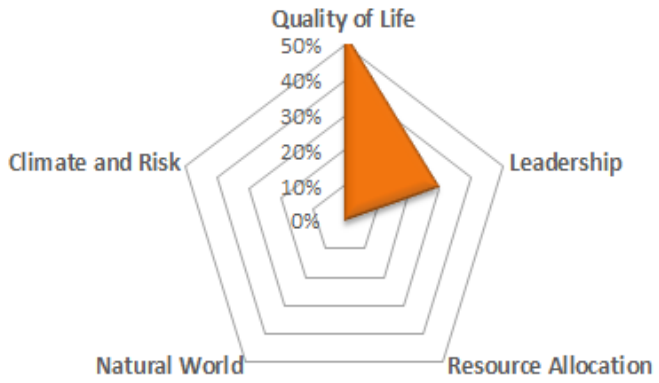

Figure 02: People & Leadership award Summary of results

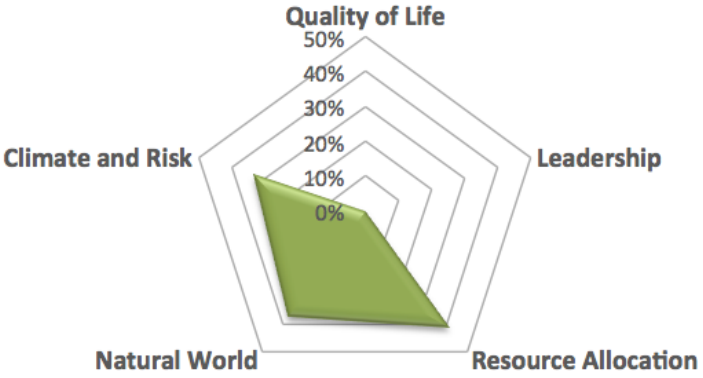

Figure 03: Climate & Environment award Summary of results

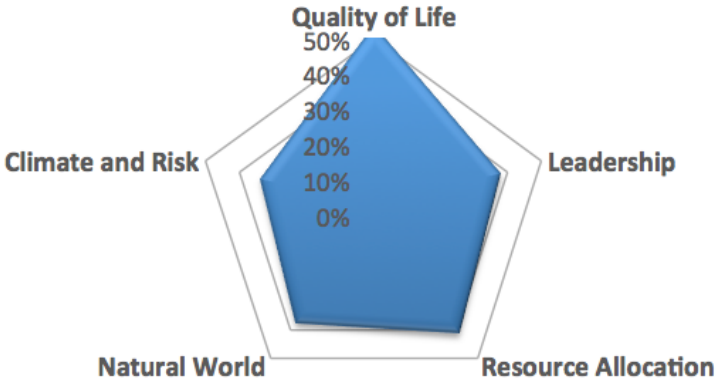

Figure 04: Infrastructure 360 award Summary of results

1. PROJECT DESCRIPTION AND LOCATION

This evaluation assesses the sustainability of the Atotonilco Wastewater Treatment Plant (PTAR)[1] project, which was developed to treat wastewater generated by the Metropolitan Zone of the Valley of Mexico (ZMVM).[2] This facility is located in the locality of Conejos, within the municipality of Atotonilco de Tula in the state of Hidalgo, and it occupies 158.5 hectares traversed by the Mexico-Querétaro rail line, a state highway, and the Salto-Tlamaco Canal. At the time of this assessment, the first stage of construction was complete and had been in operation for almost a year.

Treated Water of the Valley of Mexico (ATVM)[3] is the consortium formed to implement the project. The consortium[4] brings together a group of experienced Mexican and international companies to construct and operate the PTAR for 25 years[5] per an agreement with the Mexican National Water Commission (Conagua).[6] The project has been partially funded by Mexico's National Development Fund,[7] with a contribution of 49%, through commercial bank credit [8] in 31% and by consortium partners with 20% of capital.

The PTAR with a capacity of 35,000 liters per second (35 m^3/s), is the largest wastewater treatment plant in Latin America and one of the largest in the world; it accommodates an average of 23,000 liters per second for most of the year, plus an additional 12,000 liters per second during the rainy season. The plant has an estimated lifespan of 50 years and forms part of a group with five other plants of smaller scale that were completed in Mexico between 2007

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1 Planta de Tratamiento de Aguas Residuales.

2 Zona Metropolitana del Valle de México: made up of the Federal District and 60 other municipalities, one of which is in the state of Hidalgo, with the rest in the state of Mexico.

3 Aguas Tratadas del Valle de México.

4 The consortium is led by Impulsora del Desarrollo y el Empleo en América Latina (IDEAL), which holds a 40.8% stake in ATVM. IDEAL will undertake the PTAR project through its Promotora del Desarrollo de América Latina unit. The financial stakeholders in ATVM include Acciona Agua (24.26%), Atlatec, a subsidiary of Mitsui & Co and Toyo Engineering (24.26%), an ICA subsidiary known as Controladora de Operaciones de Infraestructura (10.2%), as well as DYCUS and other minority investors. Accessed September 28, 2015, http://www.water-technology.net/projects/atotonilcowastewater.

5 Mexican Secretariat of the Environment and Natural Resources (SEMARNAT), National Water Commission (Conagua), "Planta de Tratamiento de Aguas Residuales Atotonilco," n.d, 6, accessed September 28, 2015, http://www.conagua.gob.mx/Conagua07/Publicaciones/Publicaciones/SGAPDS-19-11.pdf.

6 An agency under SEMARNAT with a mission to manage and preserve national waters with the participation of society, in order to achieve sustainable resource management.

7 The Fondo Nacional de Infraestructura will fund up to 49% of the project, including the design, construction, equipment, testing, services, operation, and the maintenance and replacement of equipment. This funding has been committed for a period of 25 years under a contract offering treatment of solid residue from plant activities, its temporary storage, and disposal, as well as the cogeneration of electricity and heat for internal consumption. SEMARNAT, National Water Commission (Conagua), "Manifestación de impacto ambiental modalidad particular, para la Planta de Tratamiento de Aguas Residuales de Atotonilco, Estado de Hidalgo," 2010, 9.

8 SEMARNAT, Conagua, "Planta de Tratamiento de Aguas Residuales Atotonilco," 6.

and 2012. These plants are located in Guadalupe (0.5 m^3/s), Berriozábal (2 m^3/s), El Cristo (4 m^3/s), Zumpango (4 m^3/s) and Nextlalpan (9 m^3/s).[9]

The PTAR is one of the fundamental pieces of the official sanitation project for the Valley of Mexico formalized in 2007 by the Federal Government (through Conagua), which plans to construct a number of projects aimed at securing the supply, distribution, and treatment of water in the region. The program's primary goal is to improve wastewater quality generated in the ZMVM for agricultural use in the Valley of Mexico and surrounding agricultural districts whose population lives and works in the area of influence. The program aims to reduce the overextraction of water from nearby aquifers, develop new sources of potable water (while rehabilitating existing sources), enlarge the capacity of drainage systems to prevent the recurrence of floods in the ZMVM, treat wastewater, and promote water conservation efforts for individuals.

The Atotonilco plant is situated at the end of the Central sewage Discharge Tunnel, a through point for the Eastern sewage Discharge Tunnel where the main regional channels for agricultural irrigation begin.[10] The main criteria for site selection were technical, derived from its strategic location at the exit of the Central Discharge Tunnel and the El Salto River, for which the land was expropriated for public use. The construction of the wastewater treatment plant will improve the quality of sewage coming from the Central Discharge Tunnel from Mexico City that, once treated, will flow through the Salto-Tlamaco Canal and arrive at the Tula River. From the Tula River, farmers in the Mezquital Valley can benefit, as they have in the past used raw sewage to irrigate their land. The project will treat 60%[11] of the wastewater coming from the Federal District, with the remaining untreated 40% continuing downstream. The treated water will have two destinations: the Salto-Tlamaco Canal directly feeding the irrigation areas of the Mezquital Valley, and the El Salto River from which some irrigation channels derive, in particular the Vieja Requeña Canal, discharging its surplus in the Endho dam. Of the treated water, 67% will be used for irrigation and 33% will be sent directly back to the river.

The municipality of Atotonilco de Tula comprises an area of 123.3 km^2, 64% of which is used for agriculture. Prior to the development of the project, the site of the PTAR was used mostly for crops (32.7 ha irrigated and 125.8 ha rain-fed) and cattle. At the same time, the area had been significantly mined for materials such as limestone, sand, and masonry stone. Prior to the construction of the project, the site was divided by a railroad line and a state highway, and two

[9] SEMARNAT, Conagua, "Manifestación de impacto ambiental modalidad particular," 37.

[10] The Eastern Discharge Tunnel has a length of 60 km and a diameter of 7 m. It is part of a larger drainage infrastructure within the sanitation program of the Valley of Mexico. SEMARNAT, Conagua, "Manifestación de impacto ambiental modalidad particular," 71.

[11] Conagua Planeación y Proyectos de Ingeniería, S.C., "Manifestación de impacto ambiental modalidad particular, para la Planta de Tratamiento de Aguas Residuales de Atotonilco, Estado de Hidalgo 'PTAR Atotonilco'," Mexico, 2010, 95.

high voltage lines also ran across the site but have since been relocated.[12] The bodies of water found on the PTAR site are the El Salto River and the Salto-Tlamaco irrigation canal. Both carry untreated wastewater generated by the ZMVM and have been used to irrigate over 80,000 hectares of agricultural land in the state of Hidalgo.[13]

As part of the actions taken by the Government of Mexico to achieve considerable reductions in greenhouse gas emissions in the coming years, Conagua conceptualized the PTAR as a Clean Development Mechanism project. In doing so, it highlighted the areas of opportunity for emissions reductions and provided for the installation of technology to achieve these reductions efficiently.

At the beginning of 2010, Green Gas was awarded the contract for the construction, operation, and maintenance of a combined heat and power (CHP) plant within the wastewater treatment plant. The methane (a potent greenhouse gas) released by the leftover solid waste from the wastewater treatment will be used for generating heat and electricity to feed 12 cogeneration motors, and the energy produced by the process will be utilized within the plant. The plant will help to reduce greenhouse gas emissions by about 400,000 tons of CO_2e per year.

2. APPLICATION OF THE ENVISION RATING SYSTEM

The Envision™ system is a set of guidelines that aid in optimizing the sustainability of an infrastructure project during the planning and preliminary design phases, as well as a means to quantify the relative sustainability of the project. In this case study, the infrastructure evaluates is the Wastewater Treatment Plant Altotonilco in Mexico.

Envision consists of 60 credits grouped into five categories: Quality of Life, Leadership, Resource Allocation, Natural World, and Climate and Risk. Each credit pertains to a specific indicator of sustainability such as reducing energy use, preserving natural habitat, or reducing greenhouse gas emissions. Those credits are rated on a five-point scale referred to as a "level of achievement": "improved," "enhanced," "superior," "conserving," and "restorative." Evaluation criteria are provided to determine whether the qualifications for each level of achievement have been met for a particular credit. In each of the five categories there is a special credit called "Innovate or exceed credit requirements." This is an opportunity to reward exceptional performance that applies innovative methods within the subjects that Envision evaluates.

[12] SEMARNAT, Conagua, "Manifestación de impacto ambiental modalidad particular," 11.
[13] SEMARNAT, Conagua, "Planta de Tratamiento de Aguas Residuales Atotonilco," 1.

The criteria for the levels of achievement vary from credit to credit, but generally an "improved" level of achievement is awarded for performance that slightly exceeds regulatory requirements. "Enhanced" and "superior" levels indicate additional gradual improvement, while "conserving" often indicates performance that achieves a net zero or neutral impact. "Restorative" is the highest level and is typically reserved for projects that produce an overall net positive impact. The Envision system weighs the relative value of each credit and level of achievement by assigning points. Credit criteria are documented in the Envision Guidance Manual, which is available to the public on the ISI[14] and Zofnass Program[15] websites.

3. QUALITY OF LIFE CATEGORY

Envision's first category, Quality of Life, pertains to potential project impacts on surrounding communities and their well-being. More specifically, it distinguishes infrastructure projects that are in line with community goals, clearly established as parts of existing community networks, and consider long-term community benefits and aspirations. Quality of Life incorporates guidance related to community capacity building and promotes infrastructure users and local members as important stakeholders in the decision-making process. The category is divided into four subcategories: Purpose, Well-being, Community, and Vulnerable Groups.

Purpose

The Purpose subcategory assesses the project's impact on adjacent communities and considers the project's goals in relation to the expectations of community stakeholders, focusing on the functional benefits to communities such as growth, development, job creation, and general improvements in quality of life.

One of the principal positive outcomes of the PTAR project is the improvement of irrigation practices enabled by cleaner water, which allows for the diversification of about 80,000 hectares of crops. The improved irrigation creates the possibility to incorporate greenhouse farming into the area and eliminates the previous restriction on crop irrigation. Program efforts also reduced contaminants in the water to allow for drip irrigation. These factors permitted the technification and improved efficiency of water use, offering opportunities for improving local productivity.[16] This enhancement of irrigation should lead to both economic and health improvements in nearby communities.

[14] www.sustainableinfrastructure.org

[15] www.zofnass.org

[16] ATVM, "Capítulo VIII Identificación de los instrumentos metodológicos y elementos técnicos," in "Manifiesto de impacto ambiental modalidad particular 'Construcción y operación del proyecto denominado la Planta de Tratamiento de Aguas Residuales PTAR Atotonilco'," Mexico, 2013, 6.

The team at the PTAR has addressed local community needs by providing enhanced public spaces, protecting areas of historical and archaeological significance, and participating in and supporting local festivals. The project has contributed to the sustainable development of the surrounding community by generating new job opportunities, establishing educational programs focused on improving the competitiveness of the community, and supporting employees in the advancement of skills and education. At the time of the project development, it was expected that over the estimated four-year construction period the PTAR would generate about 10,000 direct jobs and 12,000 indirect jobs,[17] making an economic impact at local and regional levels by attracting new business development and a diversified workforce to the area, as well as making the community more economically competitive and enabling the expansion and improvement of market goods and services to the area's population.[18] There has also been significant investment in the restoration and enhancement of public and community spaces throughout the development and construction of the plant.

There are opportunities for improvement in providing a more rigorous measure of community needs and expectations and a clear strategic plan to address them. There should also be a comprehensive and inclusive plan that takes into consideration the needs of minorities and disadvantaged groups in the company's initiatives for community involvement, in addition to a more rigorous program for educational and training workshops that can provide opportunities for individual professional growth within the community.

Well-being

The Well-being subcategory considers the physical safety and wellness of workers and community members, encouraging the minimization of light pollution, odors, noise, and vibration. Attention is also given to alternative and efficient modes of transportation incorporated into the project.

Throughout the design of the PTAR, efforts were made to address the principal environmental and labor-related risks that would be incurred by the project in order to evaluate design modifications to mitigate them. The use of biogas for energy within the plant poses greater challenges in regard to safety, but its storage and use have been carefully designed to be efficient and safe. Changes in the design of the PTAR project to mitigate risk were approved by

[17] Conagua Planeación y Proyectos de Ingeniería, "Manifestación de impacto ambiental modalidad particular," 201.
[18] ATVM, "Capítulo VIII Identificación de los instrumentos metodológicos y elementos técnicos," 5.

the Ministry of the Environment and Natural Resources,[19] establishing safety and hygiene measures to be implemented based on proposals done by ATVM.

An important part of the project's design focused on the low-pressure storage of the biogas expected from the leftover solid waste from the water treatment process (in a total of 7 gasometers of 8,500 m³ each).[20] The design of the system aims to minimize biogas surplus that would have to be burned under safe conditions to insure the safety of the workers and facilities of the PTAR and to maximize the use of the heat and energy generated. Transportation speeds would be reduced throughout the construction site and unnecessary trips would be limited during construction to further avoid causing dust. To address transportation and traffic, the PTAR offers its employees public transportation alternatives to reach the site. There is further opportunity to consider the impacts on mobility and access in the community at a broader scale and to focus on the project's long-term implications for transportation in the area. Documented studies should show how the proposed alternatives will improve the efficiency, walkability, and livability of the nearby community.

The PTAR is surrounded at its perimeter by a green mound to help mitigate the sound generated within the site. It varies in height according to the proximity of nearby communities. In other instances, vegetation is used as a strategic barrier to dampen the noise from the plant's operations. The vegetation will also contribute to lessening the impact of light spillage and glare within the complex as well as beyond its boundaries. Even though there is evidence of a yearly monitoring program in place, performed by Grupo Ambiental ISA, to measure vibrations, there is opportunity for a more rigorous assessment of noise and vibration levels produced during the construction and operation of the project based on the community's needs and goals for livability.

It would be beneficial for the project team to identify in a more systematic manner the risks associated with the project, and the new technologies beyond industry requirements and standards. The team would also benefit from a comprehensive energy-efficient lighting study to serve in the implementation of an overall lighting zone strategy, which could expose areas of unneeded lighting or where automatic turnoff systems would be appropriate.

Community

The Community subcategory addresses the importance of context-sensitive design and efforts

[19] SEMARNAT (Secretaría de Medio Ambiente y Recursos Naturales) is the federal agency responsible for promoting the protection, restoration and conservation of ecosystems and natural resources and environmental goods and services to Mexico, in order to facilitate their use and sustainable development.

[20] ATVM, "Capítulo I datos generales del proyecto, del promovente y del responsable del estudio de impacto ambiental," in "Manifiesto de impacto ambiental modalidad particular," 54.

to respect, maintain, and improve the project's surroundings, taking into consideration the visual and functional impacts of the design. Such efforts can include preserving views and natural features or incorporating the local character of the built environment into the design.

The PTAR team has made a great effort to analyze, conserve, and restore existing archaeological remains on the site. Likewise, landscape conservation concepts were introduced during the design of the project such as the study of the environment to preserve and highlight the main natural attractions. Areas designated for the conservation of local vegetation were designed to be protected from invasive species. The preservation of the landscape seems to have been carefully considered throughout the development of the project. In order to guarantee the best possible outcome, regular environmental monitoring was performed throughout. The ecological and bioclimatic characteristics of specific areas around the site were considered to enhance their future adaptation.

Due to its creation of public space in the area, the PTAR has gained recognition through other award processes for its outstanding contribution to the improvement of the environment. To enhance the quality of life in the community, the project team participated in the creation of various multipurpose spaces, the improvement and construction of garden and outdoor communal spaces, the renovation of the community's soccer field, the leveling of roads, the improvement of drainage for the municipality of Atotonilco, the rehabilitation of local streets, and the donation of materials and trees for the improvement of various schools in the area.

There is further opportunity to analyze options to restore the historic and cultural resources of the area, as well as to develop long-term monitoring and maintenance plans for archaeological protection and enhancement. The project team could also increase its efforts to understand the needs and opportunities of local communities, and to support the development of more comprehensive policies and regulations regarding the restoration and preservation of local character.

Vulnerable Groups

The Vulnerable Groups subcategory refers to the project's engagement with indigenous, minority, and female communities. Infrastructure projects might impact vulnerable populations and can create benefits in mobility and education or stimulate and promote empowerment.

Diverse community needs and gender equality concerns have not been addressed to a significant extent by the PTAR project team. Documentation could be provided showing assessments made to identify, for example, the risks to women's health and safety within the treatment plant. The PTAR team would benefit from incorporating the input of women and

minority groups into the project design and implementation, addressing social and gender-based disparities and ensuring that benefits are equitably distributed throughout the community.

There is much options for the project team to contribute to the creation of economic opportunities for women by, for example, offering targeted internships and workshops to support women's well-being and empowerment. Efforts could also be made to identify the needs of women and diverse communities in terms of mobility and access, and to address these in design changes and adaptations from the original project design.

4. LEADERSHIP CATEGORY

The Leadership category evaluates project team initiatives that establish communication and collaboration strategies early on, with the ultimate objective of achieving sustainable performance. Envision rewards stakeholder engagement as well as encompassing a holistic, long-term view of the project's life cycle. Leadership is distributed into three subcategories: Collaboration, Management, and Planning.

Collaboration

The Collaboration subcategory aims to provide effective leadership and commitment to achieve project sustainability goals, establish a management system that seeks to improve sustainability performance, and foster collaboration and innovative methodologies for teamwork. The subcategory rewards projects that include input from the various stakeholders involved in order to fully capture opportunities for innovation and synergies. Teams are encouraged to meet and communicate, allowing stakeholders to contribute ideas and perspectives to the design and development of the project.

In this regard, the PTAR team has demonstrated that sustainability is a core value of the project through goals that show a meaningful commitment to the principles of sustainability and sustainable performance improvement. The primary goals include achieving comprehensive and sustainable management of water basins and aquifers and promoting the technical, administrative, and financial development of the water sector, seeking 100% clean wastewater from the metropolitan area, in order to improve the development and health of the inhabitants of the Mezquital Valley (who will have cleaner tributaries and can diversify agricultural production).[21]

[21] Conagua Comunicado de Prensa No. 016-09 (2009).

The project will improve public health and environmental conditions and will treat more than 60% of the wastewater from the Valley of Mexico. Notably, the project will be self-sustaining, generating its own electricity through biogas produced from water treatment by-products. This will also contribute to improving air quality, minimizing the emissions produced by other means of energy production, and increasing the efficiency of energy generation by reducing losses in transmission (since this energy is generated on site). The sustainable organizational performance of the project is regularly monitored by means of an annual report.

The project team would benefit from a clear identification of roles and responsibilities within the company in addressing the issues of sustainability and creating a sustainability management policy in line with the scale and complexity of the project. This would also support the project's ability to handle unexpected change. The team should further consider exceeding the mandatory health and safety standards and improving social and ethical performance.

Even though there is evidence supporting the involvement of the community and social stakeholders in decisions made during the time of design development and execution, there are still opportunities for the project team to foster broader involvement and relationship-building with the stakeholders involved – for example, by creating an ongoing community relations program for a more transparent participation process and more meaningful input as well as the establishment of stronger ties with stakeholders.

Management

The Management subcategory considers new ways of managing and understanding the project as a whole in order to reduce costs, enhance efficiency, increase sustainability, extend the life of the project, and make it more resilient to future unexpected problems.

To increase efficiency and build strong relationships with nearby facilities, there should have been a more systematic and conscious effort to identify unwanted by-product materials from other nearby companies that could have been used during the construction phase of the project PTAR. This type of collaboration can reach the objective of reducing the amount of raw materials required for the project while also decreasing the cost. To accomplish this, the project team should identify such by-product synergy opportunities. Even though, for the PTAR, there is proof of the internal recycling and reuse of waste material from construction such as plastics, woods, and metals, the project team has provided no evidence of the reuse of materials coming from alternative sources or nearby facilities. These materials could be used for short-term project construction or the longer-term operation of the completed project.

This subcategory also aims to identify the efforts made by the project team to integrate the

new and existing infrastructure in order to increase efficiency and effectiveness. The different initiatives delivered by the PTAR team include improving the potable water systems, constructing a vehicular and pedestrian bridge connecting to the existing community cemetery, sidewalks, and roads in adjacent communities (San Antonio, El Portal, and San José Acoculco), creating an auditorium, and rehabilitating a health center and other community improvements – all as the result of an assessment of the expressed needs of these communities.

Even though these contribute to the enhancement of community infrastructure systems, the project still has room for improvement by addressing sustainability at a larger scale and taking into consideration a systems-based approach. There is opportunity to consider the restoration of community knowledge and social capital as well as the improvement not only of infrastructural elements but also of natural systems.

Planning

The Planning subcategory encourages taking a long-term view of the project in order to increase its sustainability and avoid pitfalls in planning for the future. It aims to reduce costs and make processes more efficient. In order to extend the durability and resilience of the PTAR project, the team has developed a detailed manual for the operation and maintenance of the plant equipment and systems, clearly identifying the personnel needed to implement monitoring and maintenance. The PTAR also counts on a system of energy production shared between biogas and natural gas, enhancing the project's sustainability and extending its lifespan.

The PTAR project's supervisory control and data acquisition system will provide control functions, monitoring, alarm, alarm registration, reporting, and data logging. The system will generate a daily database of alarms, maneuvers, measurements, and average results of water quality parameters for point-measuring dosages and levels, reflecting results in daily reports and storing files on a daily basis. The system will include a separate network control process to be fully capable and configurable, allowing for the operation of PTAR facilities in automatic, semiautomatic, and manual modes. This system configuration is expected to maximize the efficiency of PTAR operations. The plant will have a central control room in the key areas of operation and control in the main building.[22]

The project team would benefit from shifting its focus from identifying conflicts and resolutions on individual projects to larger-scale infrastructural changes, and from studying possible ways in which the infrastructure and constructed works could be repurposed or adjusted for future

[22] SEMARNAT, Conagua, "Manifestación de impacto ambiental modalidad particular," 30.

programs or expansions. No regulations or policies have been identified that go against the implementation of sustainable practices within the project.

5. RESOURCE ALLOCATION CATEGORY

The Resource Allocation category deals with material, energy, and water requirements during the construction and operation phases of infrastructure projects. The quantity and source of these elements as well as their impact on overall sustainability are investigated throughout this section of the Envision rating system. Envision guides teams to choose less toxic materials and promotes renewable energy resources. Resource Allocation is divided into three subcategories: Materials, Energy, and Water.

Materials

The Materials subcategory serves to encourage the minimization of the amount of materials used for the construction and operation of the project. It promotes the conservation of energy by reducing the net embodied energy of project materials and the reduction of virgin materials by using reclaimed or recycled ones; it also rewards projects that establish relationships with suppliers and manufacturers who implement sustainable practices.

Prior to construction of the project, the PTAR team developed a plan to monitor the handling of residue and waste, establishing procedures guaranteeing the execution of the objectives defined by the plan. Once the areas generating waste are identified, the necessary measures are taken regarding prevention, minimization, source separation, storage, transportation, use, recovery, and disposal of waste products. The project team has made significant efforts to identify the amount of waste materials produced during construction in order to separate and donate them to individuals, companies, or recycling facilities. At the same time, materials excavated from the construction site were reused for construction within the site, such as for embankments and fills.

There is further opportunity for the project team to elaborate on measures taken during the design phase to identify ways to reuse suitable excavated materials or soils within the project site, and eliminate the need to transport additional soils to the site. This is a quantitative assessment, and percentages of excavated material reused should be specified. Overall, the PTAR project team should find more quantitative means to measure efforts to minimize the total amount of materials used in the project.

The team should also provide more information about the life cycle assessment of the materials

used as well as the amount of reclaimed, recycled, or prefabricated materials that will allow for future reuse. The long-term capacity of the project to be efficiently disassembled at the end of its useful life, with parts reused or recycled, should be thought about during the initial design. The project team should provide more detailed documentation specifying the quantities of waste materials produced during construction and the percentage that were recycled. Not only should the quantity of waste generated be considered, but also its recyclability and its toxicity.

Acceptable means to divert waste from landfills include reduction, reuse, or recycling of materials for projects on site, and the use of appropriate material for infill. The project team should provide documentation of calculations measuring the total waste reduction and percentage of materials diverted to be reused or recycled.

Energy

The Energy subcategory encourages the use of renewable energy in order to minimize fossil fuel consumption. It requires projects to have a monitoring system in place to ensure that they function as planned and maintain the intended level of efficiency throughout their life. Total energy consumption by equipment and processes per year have been estimated by the PTAR project team. The total estimated energy consumption is 245.8 GWh of electrical energy per year.[23] The energy produced at the plant from biogas is estimated to be 197.491[24] GWh per year (supplying 81% of the plant's total need), and 45.214 GWh per year coming from other sources.

One outstanding quality of this project is the generation of electrical energy using biogas from the leftover solid waste from the wastewater treatment. That energy is generated at a central station that integrates 12 motor-generators fueled by the biogas, with a capacity of 2.717 MW each. The central station will have a total capacity of 32.604 MW, with an estimated annual production of 200.586 GWh of electric energy and the consumption of 90,211,000 m^3 of biogas.[25]

The PTAR team has established a monitoring system that will be utilized during start-up tests and throughout the operating lifespan of the plant, for inspections, all measurements, and collecting samples in order to assess the compliance of the plant's functions. There is also a track program in place in charge of mitigation measures and establishing mechanisms for correction in case of deviations from the expected results. A record of all results will be followed, with quarterly, semiannual, and, in some cases, annual tests performed.

[23] Promotora del Desarrollo de América Latina, "Resumen de consumos eléctricos," Mexico, 2015, 1.
[24] ATVM, "Proyecto de mejora para la sustentabilidad energética," Mexico, 2015, 7.
[25] Comisión Reguladora de Energía, "Titulo de permiso de cogeneración de energía eléctrica," Mexico, 2013, 3.

There are opportunities for the project team to consider using energy-efficient equipment and processes to further decrease the project's consumption of energy. At the same time, the team should establish a long-term monitoring system, such as energy submetering, to enable more efficient operations. Other alternative ways of producing energy such as solar panels or wind turbines can be considered in order to further reduce fossil fuel consumption

Water

The Water subcategory emphasizes the efficient use of water, particularly potable water, encouraging the use of alternative water sources such as water captured from stormwater runoff. Monitoring water availability and consumption is an important aspect of this subcategory.

Within the PTAR, the water used for the wastewater treatment is taken from the disinfection process (the last stage of treatment), which means the water is reused and no potable water is needed for these services. Potable water is only used for network fire testing (150 m^3/day) and for general services (518.4 m^3/day). Thus, of the plant's total estimated water consumption (8,899.92 m^3/day), only 668.4 m^3/day will be potable water; for other services within the plant, treated water will be used.[26] The use of treated and filtered water amounts to a 92.5% reduction in the use of potable water.

There is further opportunity for the project team to increase the scope of water availability assessment and improve water management to achieve net impact on surface and groundwater. Net positive impact can be achieved by replenishing the water volume at the source. Replenishing surface and groundwater to historic levels would go above and beyond the credit requirements.

The project team could consider alternatives to potable water use such as recycled gray water and stormwater to achieve a 100% reduction in the use of potable water and attempt to recycle water for the use of the nearby community. In order to improve the operational efficiency of the plant, the project team should consider long-term monitoring systems that assess water consumption for the internal operations of the plant, as opposed to the ones related to the treatment of wastewater.

[26] ATVM, "Manual de operación y mantenimiento de la PTAR Atotonilco," Mexico, 2015, 33, 48, 71, 82.

6. NATURAL WORLD CATEGORY

The Natural World category focuses on how infrastructure projects may impact natural systems and promotes opportunities for positive synergistic effects. Envision encourages strategies for conservation and distinguishes projects with a focus on enhancing surrounding natural systems. Natural World is subdivided into three subcategories: Siting, Land and Water, and Biodiversity.

Siting

The Siting subcategory highlights the importance of infrastructure projects avoiding negative impacts on ecological areas of high value, such as water bodies and wetlands, and establishing buffer zones to protect them. Even though the PTAR's site is not considered an area of significant ecological value or prime habitat, the project team has invested significantly in the reforestation of native plant species with the aim of recovering and improving the quality of environmental services on the site. However, no sign of buffer zones or other mitigation measures have been observed, and there is no clear indication of whether or not any on-site soils have been identified as prime farmland deemed important for conserving for future generations. It would have been important for the project team to determine the type of soil on the site and provide evidence of efforts made to avoid development on the identified farmland areas.

Water bodies within the boundaries of the project site are the El Salto River and the Salto-Tlamaco irrigation canal; both will most directly benefit from the cleaner water treated by the PTAR. The project team should aim to achieve levels of restoration that go beyond protection and provide plans outlining their goals and efforts in restoring these habitats. The design for the PTAR took into consideration the existing conditions of the site, minimizing its alteration with the intention of avoiding excessive erosion. Cut slopes, fills, and containing walls boards have been designed to minimize the effects of erosion due to natural causes like wind and landslides. The project team should consider the effect heavy rains might have on the constructed slopes and embankments. Due to the very low likelihood of flooding in the area, the project team has not devised an emergency plan to protect the infrastructure in the case of a flood.

The PTAR established a detailed plan with specific procedures and safety measures to prevent, control, and respond to emergencies caused by human or natural agents. The site is located in a safe area with no negative effects on aquifers.

The project site for the PTAR does not qualify as a greenfield or brownfield according to the documentation provided; therefore, no preservation of a greenfield has been achieved.

Land and Water

The Land and Water category encourages the minimization of contaminants through stormwater runoff or pesticides and fertilizers on existing hydrologic cycles. In order to minimize the volume of rainwater and direct contact with the sludge, the project team at the PTAR has designed a peripheral canal around the cells for sludge disposal, which will capture external runoff, avoiding pollution of the water. For the precipitation that falls directly on the layout cells of sludge infill, an interior drainage system has been designed that ensures the rapid evacuation of rainwater in a superficial way, avoiding stagnation and infiltration into the lower layers of sludge arranged in the cells.

The reforestation scheme at the PTAR emphasizes the use of native plants to be replanted so as to achieve the original quantity of plants before the project was constructed. The use of the native mesquite dominates the scheme. The mesquite plant provides shade and food for the native wildlife and livestock, along with shade and shelter for small plants (such as cacti). This plant avoids the desertification of the Mezquital Valley, protecting it from erosion and acting as a soil improver. The project team plans to use fumigation to prevent pests, fungi and bacteria. When necessary, herbicide will also be used at an amount of one liter per hectare per year.

The nature of the operations at the PTAR is to treat wastewater from the Valley of Mexico discharging into the El Salto river and the irrigation canal Salto-Tlamaco. The sanitation of the water will prevent the formation of septic material banks in irrigation channels and reduce the contamination of the rivers and springs that currently receive the wastewater. There is a rigorous control of process, testing, and analysis in place for both the incoming water as well as the outgoing treated water in order to guarantee quality.

The project team has identified the equipment and facilities containing potentially polluting substances and locating them away from sensitive areas in zones designated for their storage and maintenance. At the PTAR, measures such as personnel training and constant monitoring and maintenance have been put in place to prepare for emergency spillage and leaks of polluting substances to prevent groundwater and surface water contamination.

The project team could create an erosion, sedimentation, and pollutant control plan for construction and operation activities associated with the project. There is opportunity to improve the project's water storage and infiltration capacity in order to minimize impacts on

the water's base flow, nutrient cycling, sediment transport, and groundwater recharge. There is also an opportunity for the project team to eliminate all pesticides, herbicides and fertilizers used, increase composting, and create a pest management program. The project team is encouraged to find alternative uses to pesticides for the protection of the plants.

Biodiversity

The Biodiversity subcategory encourages infrastructure projects to minimize negative impacts on existing species and their habitats by promoting connectivity and the enhancement of animal movements. The PTAR project team planned reforestation (particularly of cacti) at the site. The reforestation will be carried out intensively by planting just over a tenth of the affected area (16 of 158.5 ha). This will be done in areas devoid of vegetation within the property as well as in neighboring communities that qualify as having similar environmental conditions, as specified in the General Directory of Environmental Impact and Risk of Environmental Impact of the Project.

As part of the mitigation process, the project team at the PTAR established a nursery to encourage the propagation of native species (mostly trees and cacti) to be used for mixed reforestation processes. The project team planned to reforest with a mixture of native mesquite species and pine species. This mixed reforestation is intended to promote higher environmental quality and avoid monoculture. Both species specified for reforestation are appropriate for the site and its environmental characteristics.

In order to control invasive species, herbicide will be used when necessary at a rate of one liter per hectare per year. At the same time, personnel will manually perform an annual cut-down of invasive plants over a period of two weeks after the onset of the rainy season. This will promote the development of other plants that are naturally associated with the mesquite in the region, such as pastures or various native herbs, and will avoid the propagation of those that interfere with the establishment of the mesquite.

To prevent soil erosion, the project team at the PTAR planned to regenerate the topsoil toward the end of the construction phase by placing grass in areas designated for that purpose. The topsoil layer that was disturbed during the construction phase was separated and stored for use in subsequent steps in the installation of green areas on the premises. While these efforts are commendable, the project team could expand its efforts from the protection and enhancement of existing wildlife and vegetation to the restoration and creation of new wildlife corridors and habitats.

Through the treatment of the water flowing into the El Salto River and the Salto-Tlamaco Canal, the project team at the PTAR succeeds in enhancing hydrologic connections, water quality, existing habitats, and the transportation of sediment, as there will be a substantial reduction of raw sewage continuing downstream. There is further opportunity for the project team to establish a management and maintenance plan that addresses prediction and prevention measures to minimize the propagation of invasive species, sets detection and management strategies to identify and catalog invasive species, and offers strategies for the monitoring and removal of these species.

7. CLIMATE AND RISK CATEGORY

Envision aims to promote infrastructure developments that are sensitive to long-term climate disturbances. Climate and Risk focuses on avoiding direct and indirect contributions to greenhouse gas emissions, as well as promotes mitigation and adaptation actions to ensure short- and long-term resilience to hazards. Climate and Risk is further divided into two subcategories: Emissions and Resilience.

Emissions

The Emissions subcategory promotes the reduction of dangerous emissions during all stages of a project's life. From the early stages of the design of the PTAR, it was intended to use biogas for the production of electrical energy through motor-generators. These motor-generators have been adapted to be able to function with biogas or with natural gas for shared cogeneration of electricity, increasing the sustainability of the project and guaranteeing the availability of energy at all times. ATVM is aware of the positive significant environmental benefit from the treatment of wastewater from the Valley of Mexico, which will achieve an estimated reduction of 400,000 tons of CO_2 equivalent per year.

It is necessary for the project team to provide a life cycle assessment conducted in accordance with the International Organization for Standardization standards 14040 and 14044. There is an opportunity for improvements in the reduction of emissions beyond regulatory requirements and the achievement of carbon-neutral status. There is also an opportunity for the project team to include active controls and monitoring systems based on specific standards (California Ambient Air Quality Standards or South Coast Air Quality Management) as well as to establish measures for mitigation. The project should aim not only to create zero net production of pollutants, but also to implement measures to improve air quality beyond predevelopment levels.

The PTAR will comply with federal, state, and municipal laws and regulations as well as Mexican official standards related to preventing and controlling air pollution. Activities in four stages of development of the project will be carried out in such a way that air pollution is kept to a minimum. Necessary measures are taken to prevent unnecessary generation of dust. Land surfaces prone to releasing dust will be kept moist via irrigation or by reducing applications of chemical dust. When feasible, the dusty materials collected in piles or subject to vehicular traffic will be covered to prevent dust. Buildings for operating facilities that may be affected by dust will be protected.

Resilience

The Resilience subcategory focuses on a project's ability to adapt in order to decrease its vulnerability and ensure that it will be able to withstand climate risk. For the design of the civil works and facilities of the PTAR, a balance between cuts and embankments has been considered to optimize overall earthmoving while achieving the elevations necessary to position the facilities above flood risk. At the same time, the design took into consideration surface drainage works to prevent flooding inside the facility. In the area between the El Salto River and the railway, a perimeter wall of block concrete has been designed to help control flooding and water infiltration in the buildings, roads, and other components of the PTAR.

The project team at the PTAR considered possible emergencies or short-term hazards related to the operations of the plant and incorporated measures to prevent them or respond to them during the design and construction phases. Equipment that monitors chlorine gas leaks is included among the project's security systems. These also included absorption, alarm, ventilation, and backup safety control systems. At the same time, preventive measures such as training programs are in place to regularly perform emergency response drills for all staff at the plant. An impact assessment and adaptation plan should be provided including calculations of expected changes in flood elevations or sea rise. An inventory should also be made of structures important to the operation of the project that are located in areas of possible inundation. There is opportunity for the project team to identify the community outreach efforts taken during this process as well as to get input from local emergency management departments. The project team should also identify and assess the traps and vulnerabilities that could create high long-term costs and risks for nearby communities.

There is further opportunity for the project team to form strategies to prepare for or mitigate the negative consequences of climate change or other significant alterations in environmental and operating conditions, which can include structural changes increasing the adaptability of the infrastructure. The team could also incorporate decentralized systems for operation that distribute networks and help spread risk in case of failures or emergencies. Building surfaces at

the PTAR have been specified to be painted white in order to reduce localized heat accumulation, allowing for an estimated 30% of hardscape surfaces to meet solar reflectance index requirements; nevertheless, the heat island effect could be further reduced by considering more surfaces with solar reflectance and increasing vegetation and materials that can positively alter microclimates around them. Drawings or diagrams showing areas that meet the requirements of solar reflectance index should be provided in order to estimate the percentage of the project's surfaces that could be improved.

APPENDIX:
APPENDIX A: PROJECT PICTURES AND DRAWINGS

Figure 05. Location of the project
Sources: Zofnass Program for Sustainable Infrastructure, Harvard Graduate School of Design, 2015.

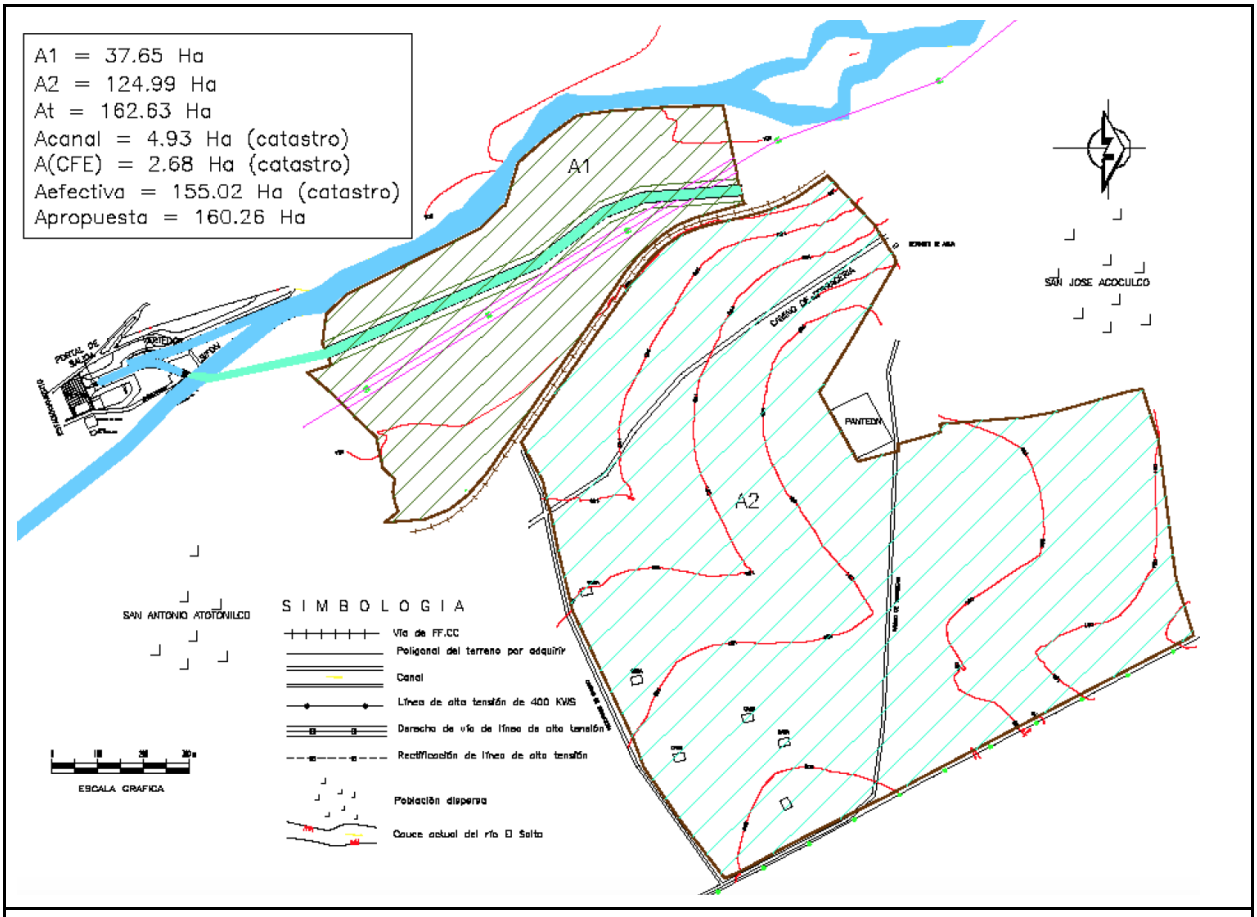

Figure 06: Main areas that constitute PTAR Atotonilco site.
Sources: Conagua, *Manifestación de Impacto Ambiental Modalidad Particular, para la Planta de Tratamiento de Aguas Residuales de Atotonilco, Estado de Hidalgo.* Mexico: 2010.

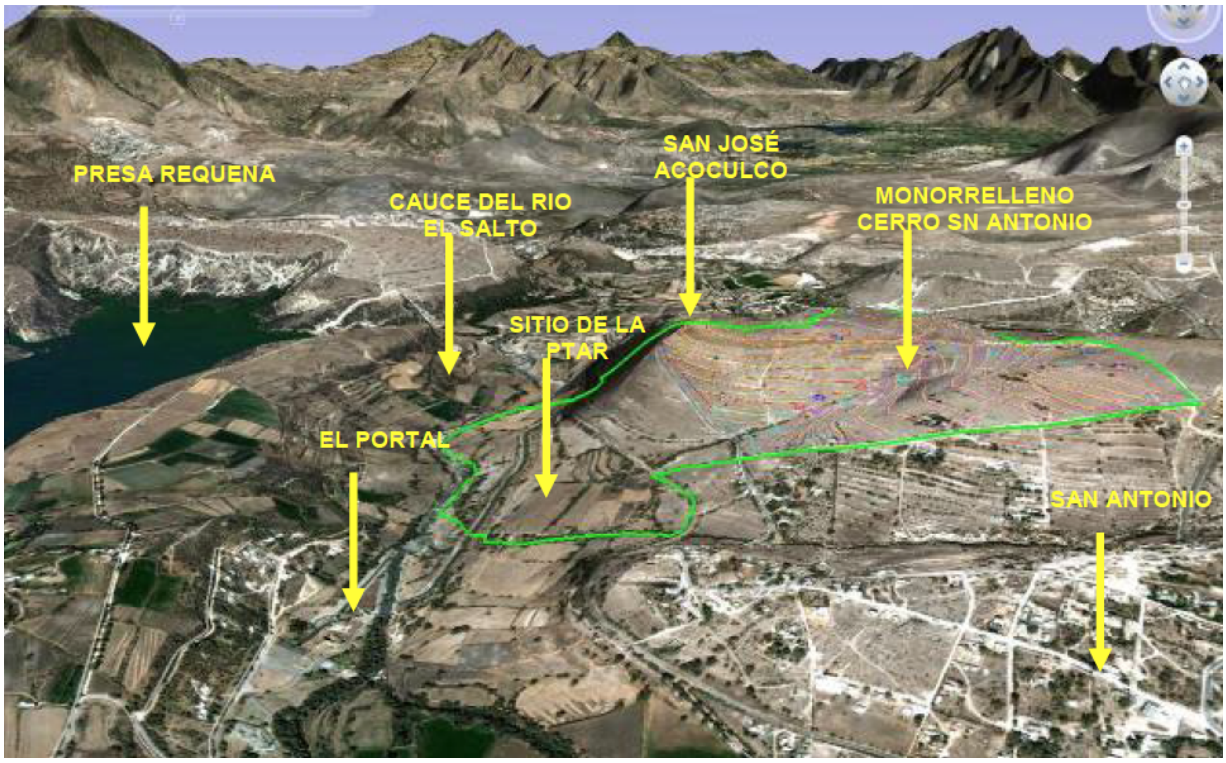

Figure 07: Aerial view of the PTAR site, NW view.
Source: Conagua, *Manifestación de Impacto Ambiental Modalidad Particular, para la Planta de Tratamiento de Aguas Residuales de Atotonilco, Estado de Hidalgo.* Mexico: 2010.

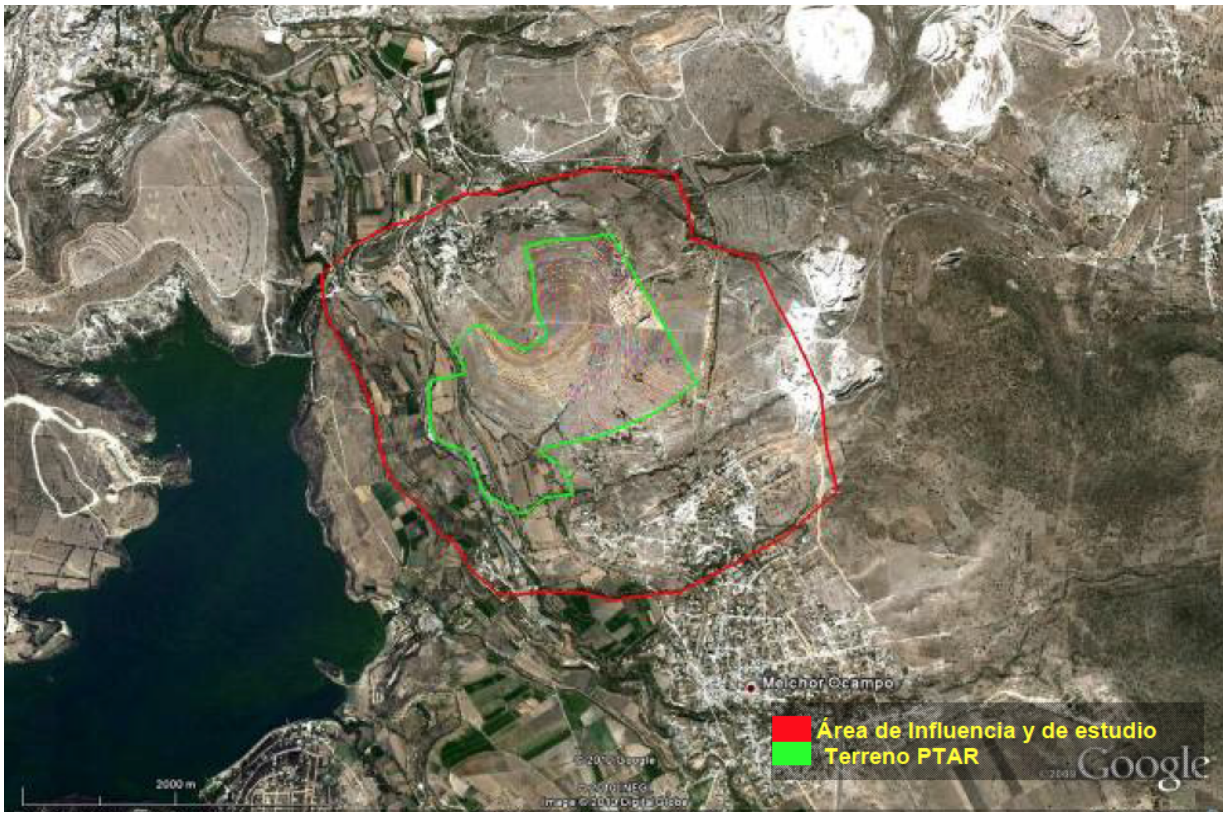

Figure 08: Red: Area of influence and study. Green: PTAR site.
Source: Conagua, *Manifestación de Impacto Ambiental Modalidad Particular, para la Planta de Tratamiento de Aguas Residuales de Atotonilco, Estado de Hidalgo.* Mexico: 2010.

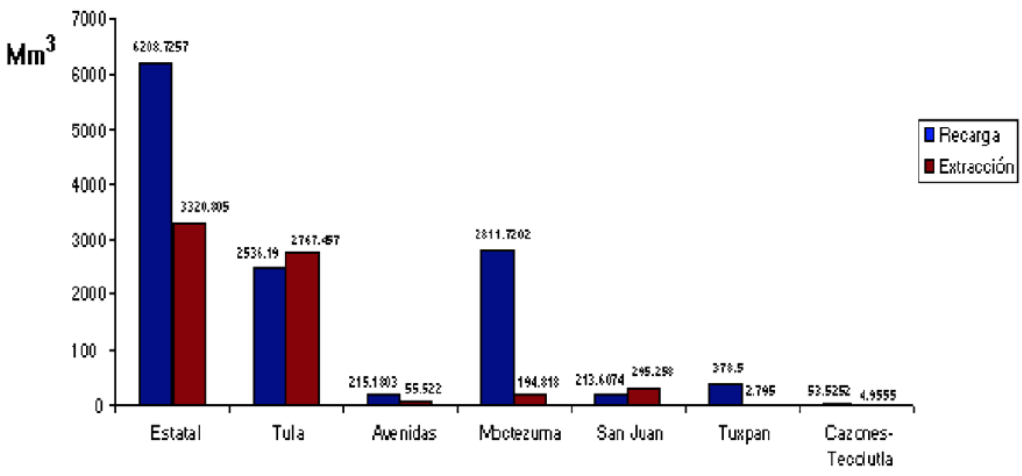

Figure 09: Water balance of surface waters.
Sources: Conagua, *Manifestación de Impacto Ambiental Modalidad Particular, para la Planta de Tratamiento de Aguas Residuales de Atotonilco, Estado de Hidalgo.* Mexico: 2010.

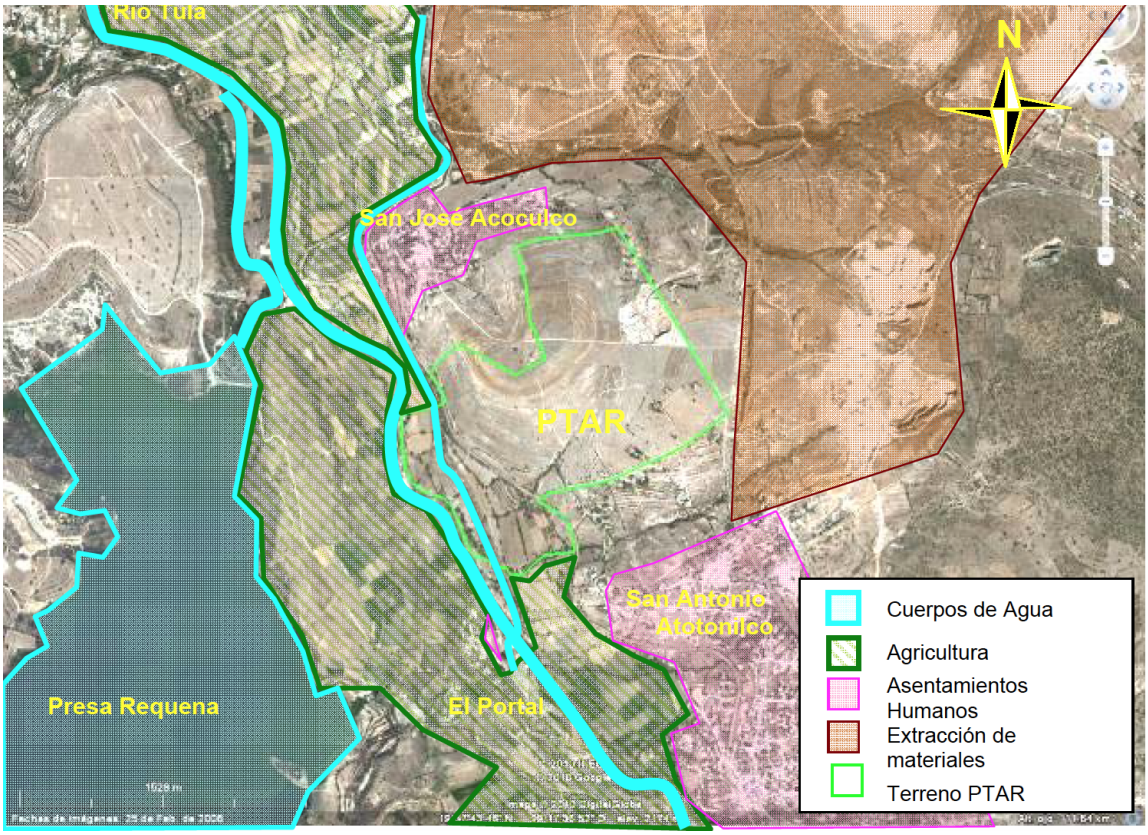

Figure 10: Land use in the adjacencies of the PTAR.
Sources: Conagua, *Manifestación de Impacto Ambiental Modalidad Particular, para la Planta de Tratamiento de Aguas Residuales de Atotonilco, Estado de Hidalgo.* Mexico: 2010.

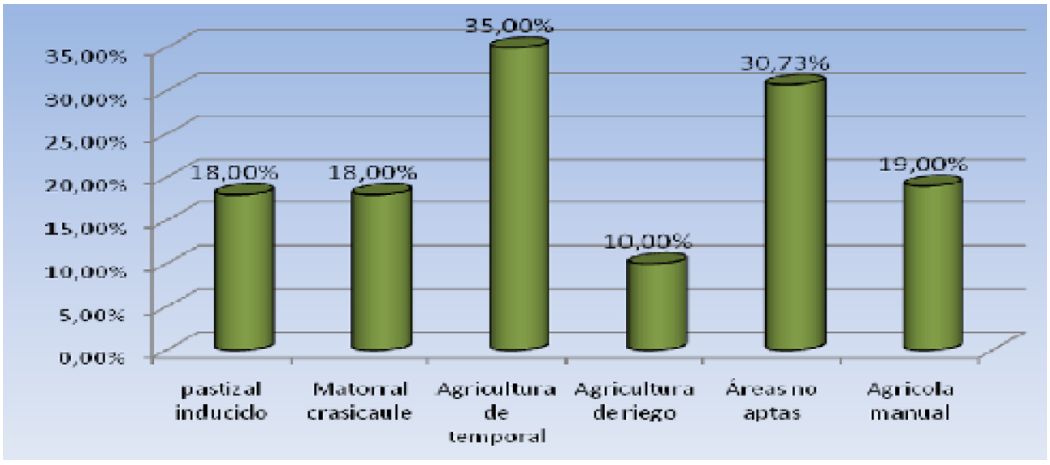

Figure 11: Current land use in Atotonilco de Tula.
Sources: Conagua, *Manifestación de Impacto Ambiental Modalidad Particular, para la Planta de Tratamiento de Aguas Residuales de Atotonilco, Estado de Hidalgo.* Mexico: 2010.

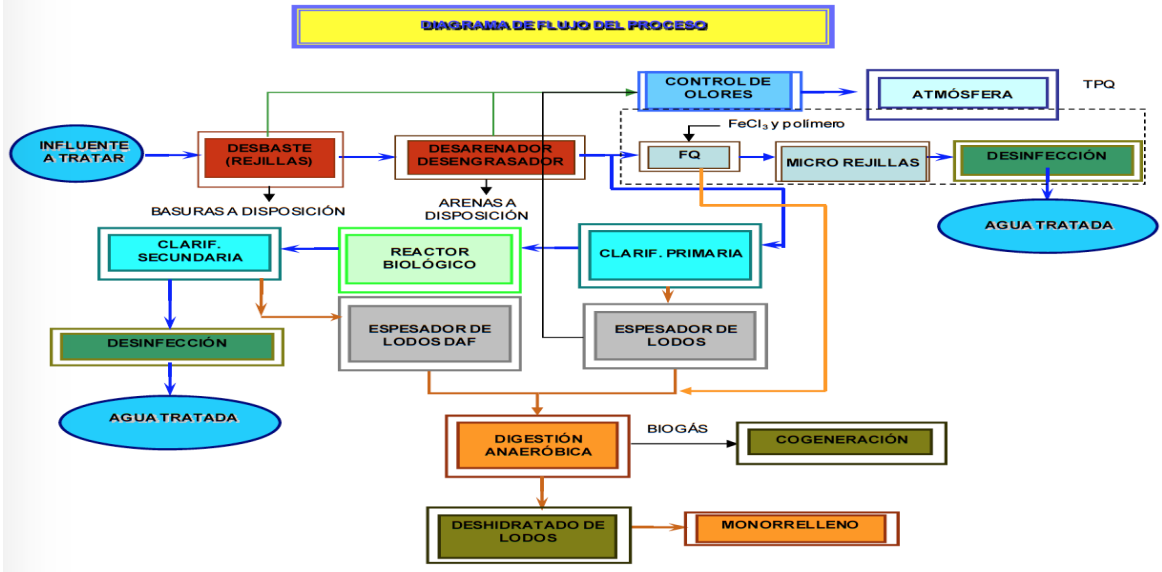

Figure 12: Water treatment process description.
Sources: Conagua, *Manifestación de Impacto Ambiental Modalidad Particular, para la Planta de Tratamiento de Aguas Residuales de Atotonilco, Estado de Hidalgo.* Mexico: 2010.

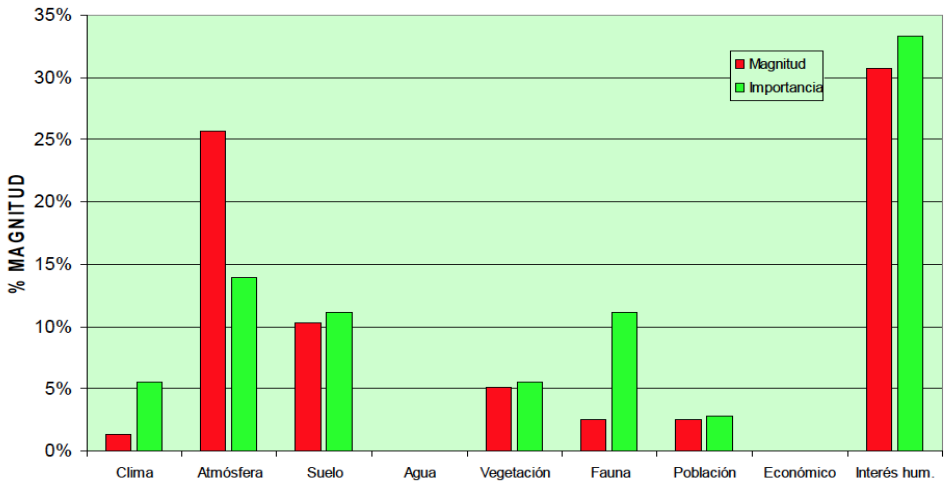

Figure 13: Incidence of adverse impacts on environmental factors.
Sources: Conagua, *Manifestación de Impacto Ambiental Modalidad Particular, para la Planta de Tratamiento de Aguas Residuales de Atotonilco, Estado de Hidalgo.* Mexico: 2010.

Figure 14: Photo of the construction works.
Sources: SEMARNAT. *Planta de Tratamiento de Aguas Residuales Atotonilco.* Mexico: 2014.

Figure 15: Photo of the construction works.
Sources: SEMARNAT. *Planta de Tratamiento de Aguas Residuales Atotonilco.* Mexico: 2014.

Figure 16: Photo of work at agricultural fields.
Sources: SEMARNAT. *Planta de Tratamiento de Aguas Residuales Atotonilco.* Mexico: 2014.

Figure 17: Presentation to communities, Atotonilco de Tula.
Sources: Aguas Tratadas del Valle de Mexico (ATVM), *Biosphere 2035* (2012), 17.

Figure 18: Presentation to communities, Atotonilco de Tula.
Sources: Aguas Tratadas del Valle de Mexico (ATVM), *Biosphere 2035* (2012), 23.

Figure 19: Support to the festival of mother's day.
Sources: Aguas Tratadas del Valle de Mexico (ATVM), *Apoyo para el festival del día de las madres - Apoyo con uniformes a la liga de fútbol* (2011), 1.

Figure 20: Support with uniforms to the Conejos Community's Femenil league.
Sources: Aguas Tratadas del Valle de Mexico (ATVM), *Apoyo para el festival del día de las madres - Apoyo con uniformes a la liga de fútbol* (2011), 2.

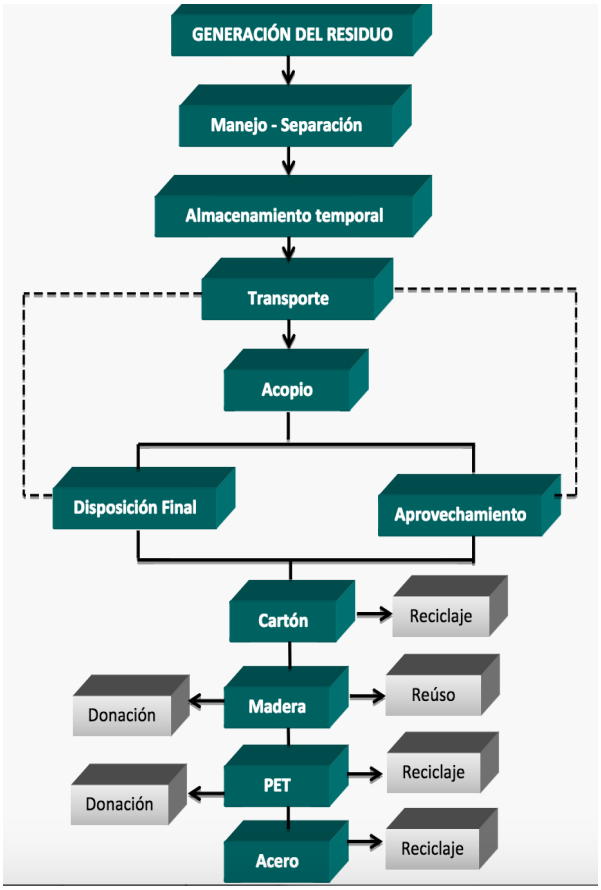

Figure 21: Flowchart of integrated management of solidwaste. Table 1: Flowchart of RME management at PTAR.
Sources: Aguas Tratadas del Valle de Mexico (ATVM), *Plan de manejo de residuos de manejo especial - proyecto de construcción, planta de tratamiento de aguas residuales Atotonilco, 26.*

Figure 22: PET generation at area 300.
Sources: Aguas Tratadas del Valle de Mexico (ATVM), *Plan de manejo de residuos de manejo especial - proyecto de construcción, planta de tratamiento de aguas residuales Atotonilco,* 13, 11.

Figure 23: Sound buffer
Sources: ATVM, *Estudio de Tipología de Pantallas Acústicas.* Mexico: 2009

APPENDIX B: ENVISION POINTS TABLE

ENVISION POINTS TABLE

			IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
QUALITY OF LIFE	PURPOSE	QL1.1 Improve community quality of life	2	5	10	20	25
		QL1.2 Stimulate sustainable growth and development	1	2	5	13	16
		QL1.3 Develop local skills and capabilities	1	2	5	12	15
	WELLBEING	QL2.1 Enhance public health and safety	2	—	—	16	
		QL2.2 Minimize noise and vibration	1	—	—	8	11
		QL2.3 Minimize light pollution	1	2	4	8	11
		QL2.4 Improve community mobility and access	1	4	7	14	
		QL2.5 Encourage alternative modes of transportation	1	3	6	12	15
		QL2.6 Improve site accessibility, safety and wayfinding	—	3	6	12	15
	COMMUNITY	QL3.1 Preserve historic and cultural resources	1	—	7	13	16
		QL3.2 Preserve views and local character	1	3	6	11	14
		QL3.3 Enhance public space	1	3	6	11	13
	VULNERABLE GROUPS	QL4.1 Identify and address the needs of women and diverse communities *	1	2	3	4	
		QL4.2 Stimulate and promote women's economic empowerment	1	2	3	4	
		QL4.3 Improve access and mobility of women and diverse communities *	1	2	3	4	5
					Maximum QL Points:	194**	
LEADERSHIP	COLLABORATION	LD1.1 Provide effective leadership and commitment	2	4	9	17	
		LD1.2 Establish a sustainability management system	1	4	7	14	
		LD1.3 Foster collaboration and teamwork	1	4	8	15	
		LD1.4 Provide for stakeholder involvement	1	5	9	14	
	MANAGEMENT	LD2.1 Pursue by-product synergy opportunities	1	3	6	12	15
		LD2.2 Improve infrastructure integration	1	3	7	13	16
	PLANNING	LD3.1 Plan for long-term monitoring and maintenance	1	3	—	10	
		LD3.2 Address conflicting regulations and policies	1	2	4	8	
		LD3.3 Extend useful life	1	3	6	12	
					Maximum LD Points:	121*	
RESOURCE ALLOCATION	MATERIALS	RA1.1 Reduce net embodied energy	2	6	12	18	
		RA1.2 Support sustainable procurement practices	2	3	6	9	
		RA1.3 Use recycled materials	2	5	11	14	
		RA1.4 Use regional materials	3	6	9	10	
		RA1.5 Divert waste from landfills	3	6	8	11	
		RA1.6 Reduce excavated materials taken off site	2	4	5	6	
		RA1.7 Provide for deconstruction and recycling	1	4	8	12	
	ENERGY	RA2.1 Reduce energy consumption	3	7	12	18	
		RA2.2 Use renewable energy	4	6	13	16	20
		RA2.3 Commission and monitor energy systems	—	3	—	11	
	WATER	RA3.1 Protect fresh water availability	2	4	9	17	21
		RA3.2 Reduce potable water consumption	4	9	13	17	21
		RA3.3 Monitor water systems	1	3	6	11	
					Maximum RA Points:	182*	

ENVISION POINTS TABLE

			IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
NATURAL WORLD	SITING	NW1.1 Preserve prime habitat	—	—	9	14	18
		NW1.2 Protect wetlands and surface water	1	4	9	14	18
		NW1.3 Preserve prime farmland	—	—	6	12	15
		NW1.4 Avoid adverse geology	1	2	3	5	
		NW1.5 Preserve floodplain functions	2	5	8	14	
		NW1.6 Avoid unsuitable development on steep slopes	1	—	4	6	
		NW1.7 Preserve greenfields	3	6	10	15	23
	LAND & WATER	NW2.1 Manage stormwater	—	4	9	17	21
		NW2.2 Reduce pesticide and fertilizer impacts	1	2	5	9	
		NW2.3 Prevent surface and groundwater contamination	1	4	9	14	18
	BIODIVERSITY	NW3.1 Preserve species biodiversity	2	—	—	13	16
		NW3.2 Control invasive species	—	—	5	9	11
		NW3.3 Restore disturbed soils	—	—	—	8	10
		NW3.4 Maintain wetland and surface water functions	3	6	9	15	19
					Maximum NW Points:	203*	
CLIMATE & RISK	EMISSIONS	CR1.1 Reduce greenhouse gas emissions	4	7	13	18	25
		CR1.2 Reduce air pollutant emissions	2	6	—	12	15
	RESILIENCE	CR2.1 Assess climate threat	—	—	—	15	
		CR2.2 Avoid traps and vulnerabilities	2	6	12	16	20
		CR2.3 Prepare for long-term adaptability	—	—	—	16	20
		CR2.4 Prepare for short-term hazards	3	—	10	17	21
		CR2.5 Manage heat islands effects	1	2	4	6	
					Maximum CR Points:	122*	
					Maximum TOTAL Points:	822*	

* Indigenous or afro-descendant peoples
** Not every credit has a restorative level. Therefore totals include the maximum possible points for each credit whether conserving or restorative.

Figure 24: Envision credits with scores by achievement level. This table includes experimental "Vulnerable Groups" credits developed in collaboration with the Inter-American Development Bank.
Sources: Envision™ and the Zofnass Program for Sustainable Infrastructure.

APPENDIX C: GRAPHS

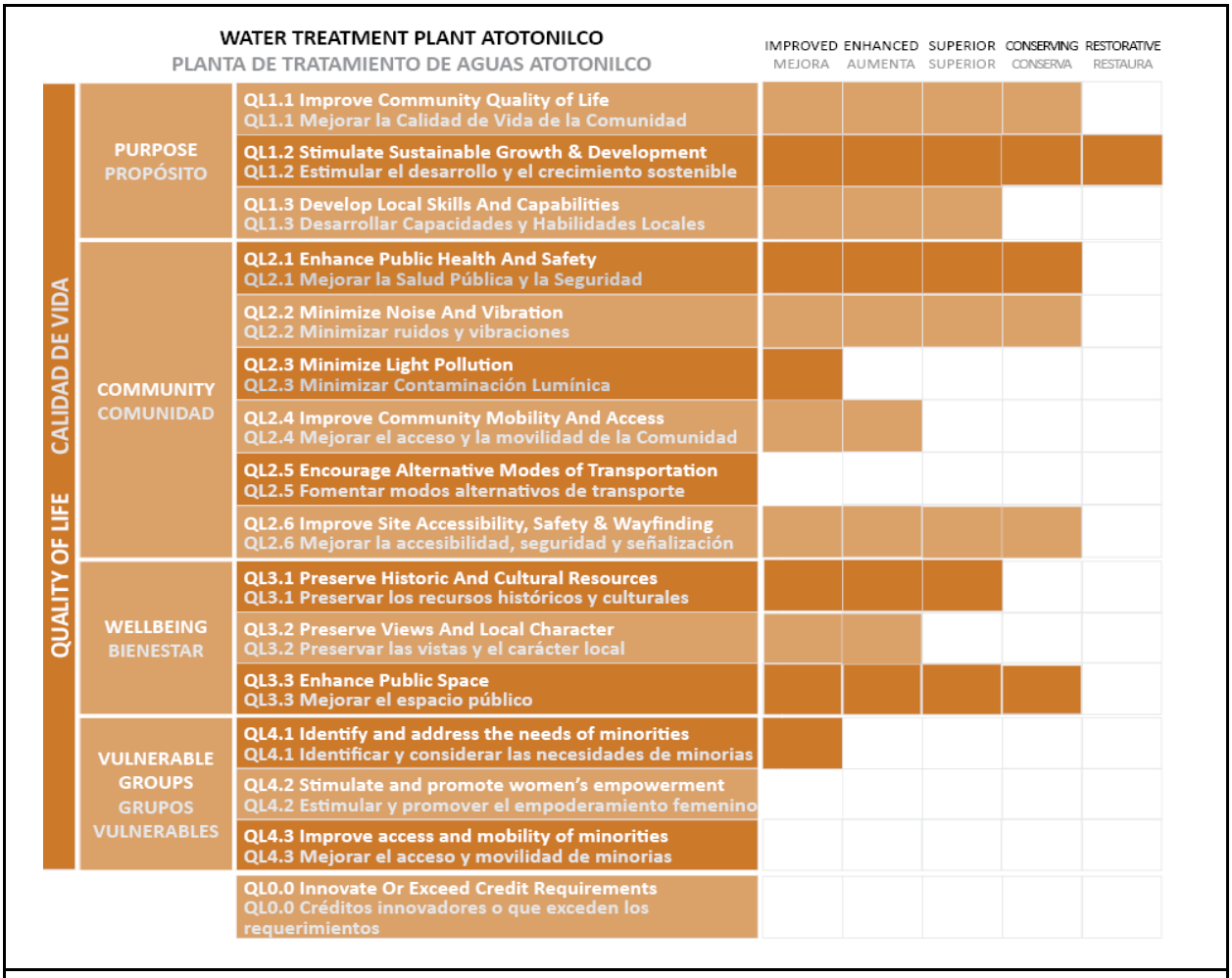

Figure 25: Quality of Life category_ Summary of results

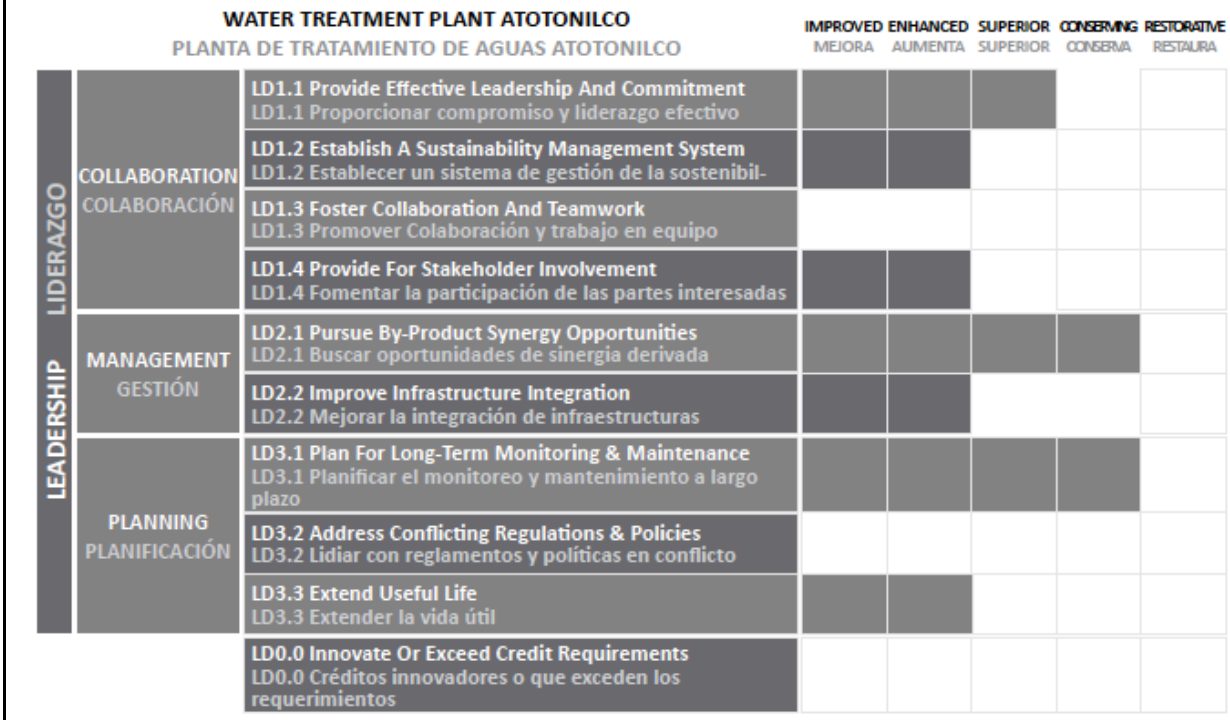

Figure 26: Leadership category_ Summary of results

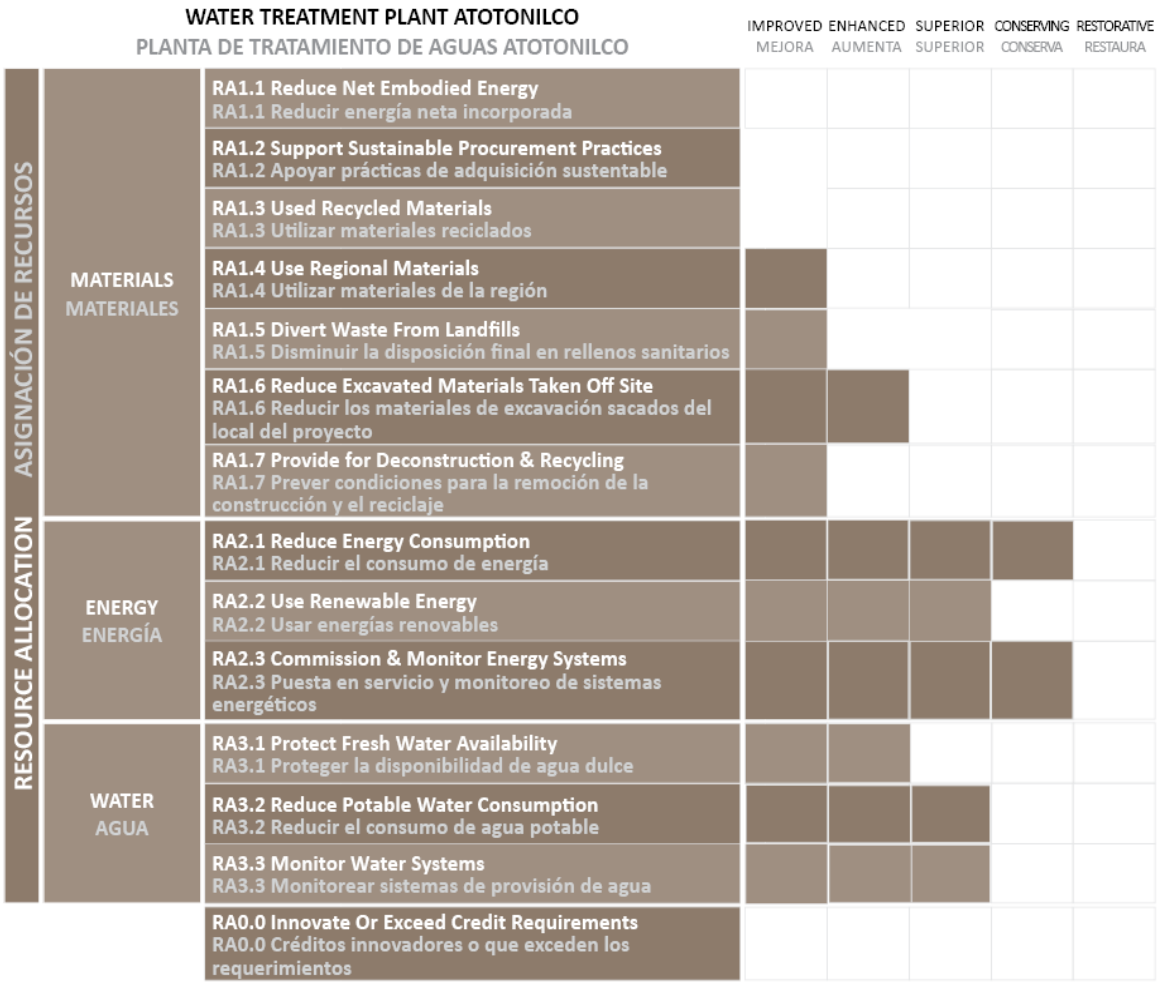

Figure 27:Resource Allocation category_ Summary of results

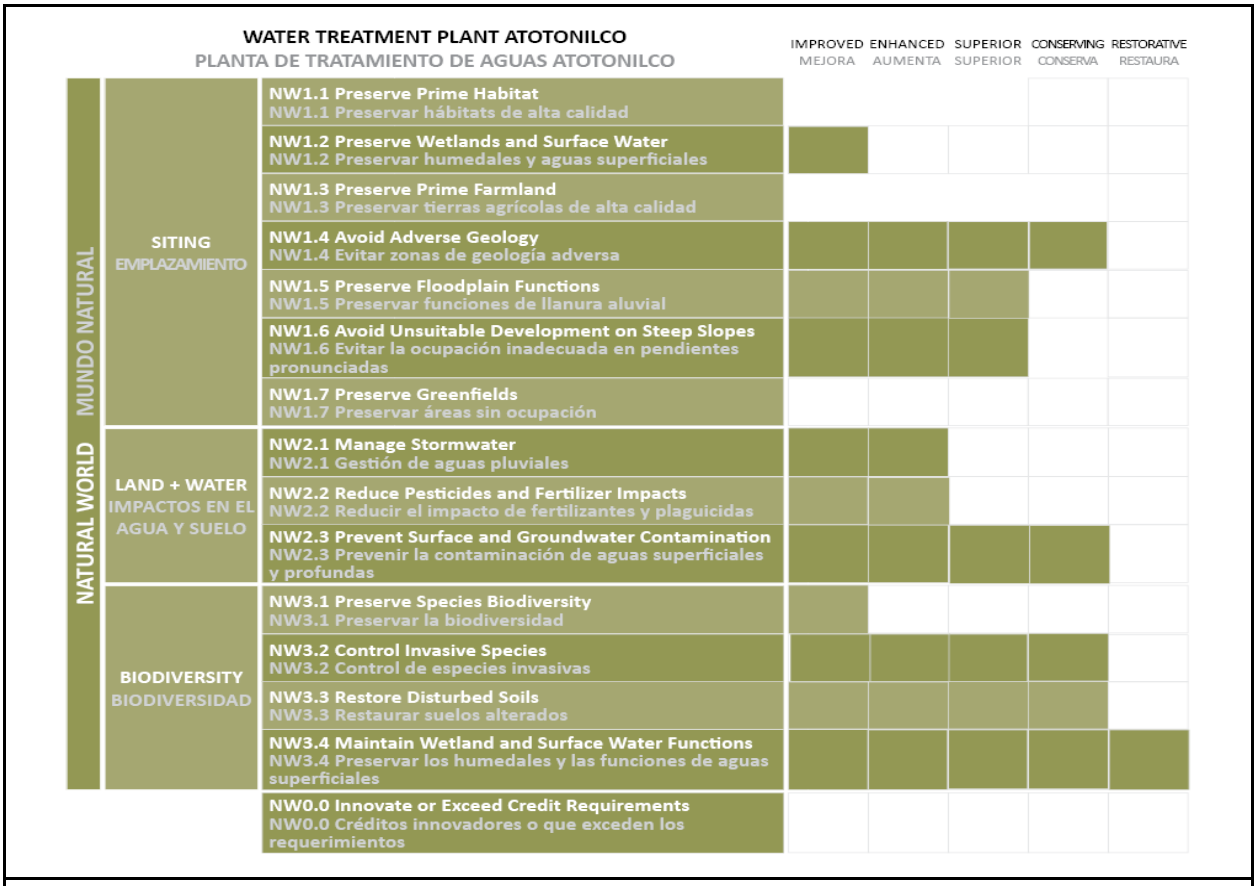

Figure 28: Natural World category_ Summary of results

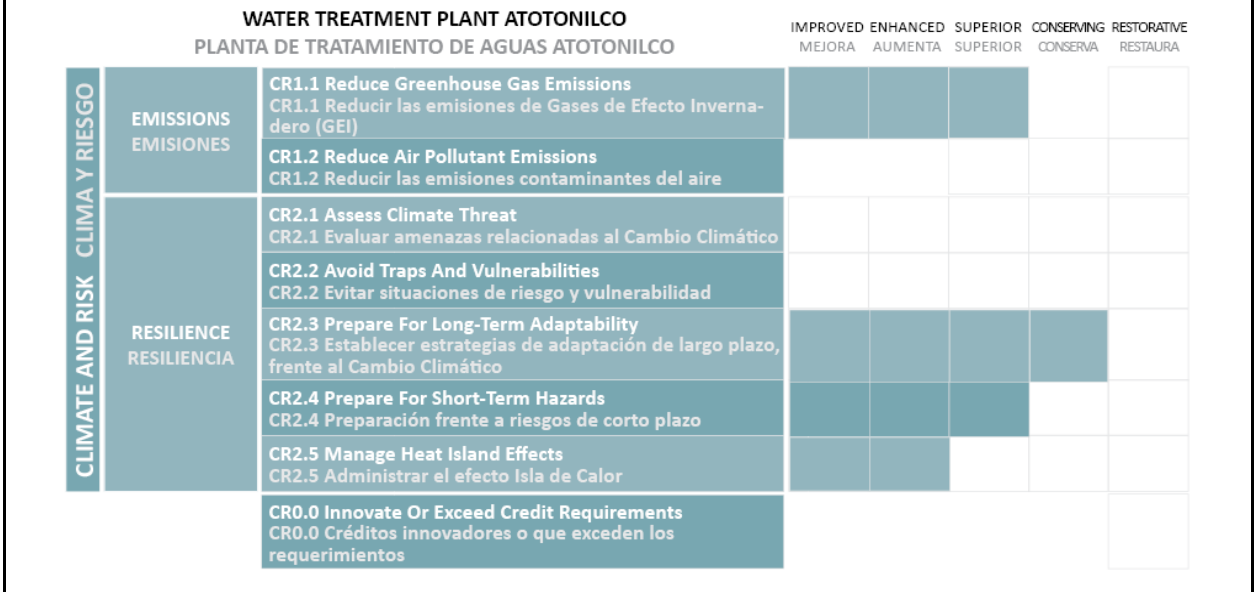

Figure 29: Climate & Risk category_ Summary of results

			WATER TREATMENT PLANT ANTOTONILCO, MEXICO	PT.	Performance
1	QUALITY OF LIFE	PURPOSE	QL1.1 Improve Community Quality of Life	20	Conserving
2			QL1.2 Stimulate Sustainable Growth & Development	16	Restorative
3			QL1.3 Develop Local Skills And Capabilities	5	Superior
4		COMMUNITY	QL2.1 Enhance Public Health And Safety	16	Conserving
5			QL2.2 Minimize Noise And Vibration	8	Conserving
6			QL2.3 Minimize Light Pollution	1	Improved
7			QL2.4 Improve Community Mobility And Access	4	Enhanced
8			QL2.5 Encourage Alternative Modes of Transportation	0	No score
9			QL2.6 Improve Site Accessibility, Safety & Wayfinding	12	Conserving
10		WELLBEING	QL3.1 Preserve Historic And Cultural Resources	7	Superior
11			QL3.2 Preserve Views And Local Character	3	Enhanced
12			QL3.3 Enhance Public Space	11	Conserving
		VULNERABLE GROUPS	QL 4.1 Identify and address the needs of women and diverse communities (indigenous or afro-descendant peoples)	1	Improved
			QL4.2 Stimulate and promote women's economic empowerme	0	No score
			QL4.3 Improve access and mobility of women and diverse communities (indigenous or afro-descendant peoples)	0	No score
			QL0.0 Innovate Or Exceed Credit Requirements	0	N/A
			QL	104	

			WATER TREATMENT PLANT ANTOTONILCO, MEXICO	PT.	Performance
13	LEADERSHIP	COLLABORATION	LD1.1 Provide Effective Leadership And Commitment	9	Superior
14			LD1.2 Establish A Sustainability Management System	4	Enhanced
15			LD1.3 Foster Collaboration And Teamwork	0	No score
16			LD1.4 Provide For Stakeholder Involvement	5	Enhanced
17		MNGMT.	LD2.1 Pursue By-Product Synergy Opportunities	12	Conserving
18			LD2.2 Improve Infrastructure Integration	3	Enhanced
19		PLANNING	LD3.1 Plan For Long-Term Monitoring & Maintenance	10	Conserving
20			LD3.2 Address Conflicting Regulations & Policies	0	No score
21			LD3.3 Extend Useful Life	3	Enhanced
			LD0.0 Innovate Or Exceed Credit Requirements	0	N/A
			LD	46	

			WATER TREATMENT PLANT ANTOTONILCO, MEXICO	PT.	Performance
22	RESOURCE ALLOCATION	MATERIALS	RA1.1 Reduce Net Embodied Energy	0	No score
23			RA1.2 Support Sustainable Procurement Practices	0	No score
24			RA1.3 Used Recycled Materials	0	No score
25			RA1.4 Use Regional Materials	3	Improved
26			RA1.5 Divert Waste From Landfills	3	Improved
27			RA1.6 Reduce Excavated Materials Taken Off Site	4	Enhanced
28			RA1.7 Provide for Deconstruction & Recycling	1	Improved
29		ENERGY	RA2.1 Reduce Energy Consumption	17	Conserving
30			RA2.2 Reduce Pesticide and Fertilizer Impacts	13	Superior
31			RA2.3 Commission & Monitor Energy Systems	11	Conserving
32		WATER	RA3.1 Protect Fresh Water Availability	4	Enhanced
33			RA3.2 Reduce Potable Water Consumption	13	Superior
34			RA3.3 Monitor Water Systems	6	Superior
			RA0.0 Innovate Or Exceed Credit Requirements	0	N/A
			RA	75	

			WATER TREATMENT PLANT ANTOTONILCO, MEXICO	PT.	Performance
35	NATURAL WORLD	SITING	NW1.1 Preserve Prime Habitat	0	No score
36			NW1.2 Preserve Wetlands and Surface Water	1	Improved
37			NW1.3 Preserve Prime Farmland	0	No score
38			NW1.4 Avoid Adverse Geology	5	Conserving
39			NW1.5 Preserve Floodplain Functions	8	Superior
40			NW1.6 Avoid Unsuitable Development on Steep Slopes	4	Superior
41			NW1.7 Preserve Greenfields	0	No score
42		L & W	NW2.1 Manage Stormwater	4	Enhanced
43			NW2.2 Reduce Pesticides and Fertilizer Impacts	2	Enhanced
44			NW2.3 Prevent Surface and Groundwater Contamination	14	Conserving
45		BIODIVERSITY	NW3.1 Preserve Species Biodiversity	2	Improved
46			NW3.2 Control Invasive Species	9	Conserving
47			NW3.3 Restore Disturbed Soils	8	Conserving
48			NW3.4 Maintain Wetland and Surface Water Functions	19	Restorative
			NW0.0 Innovate or Exceed Credit Requirements	0	N/A
			NW	76	

			WATER TREATMENT PLANT ANTOTONILCO, MEXICO	PT.	Performance
49	CLIMATE	EMISSION	CR1.1 Reduce Greenhouse Gas Emissions	13	Superior
50			CR1.2 Reduce Air Pollutant Emissions	0	No score
51		RESILENCE	CR2.1 Assess Climate Threat	0	No score
52			CR2.2 Avoid Traps And Vulnerabilities	0	No score
53			CR2.3 Prepare For Long-Term Adaptability	16	Conserving
54			CR2.4 Prepare For Short-Term Hazards	10	Superior
55			CR2.5 Manage Heat Island Effects	2	Enhanced
			CR0.0 Innovate Or Exceed Credit Requirements	0	N/A
			CR	41	
			Total points	**342**	**0**

Figure 30: Envision credits with scores by achievement level. This table includes experimental "Vulnerable Groups" credits developed in collaboration with the Inter-American Development Bank.
Sources: Envision™ and the Zofnass Program for Sustainable Infrastructure.

APPENDIX D: CREDIT DETAIL

WATER TREATMENT PLANT ANTOTONILCO, MEXICO: CREDIT SPREADSHEET WITH DETAILS		
CATEGORY I, PEOPLE AND LEADERSHIP		
SUB CATEGORY: QUALITY OF LIFE		
	Score	**WATER TREATMENT PLANT ANTOTONILCO, MEXICO**
QL1.1 Improve Community Quality of Life	**20**	**Conserving** Located in the municipality of Atotonilco de Tula in the state of Hidalgo, the "Planta de Tratamiento de Aguas Residuales Atotonilco" (PTAR) has established four areas of influence defined as zones A, B, C and D. Perimeter A includes four localities with 1,213 inhabitants in immediate proximity to the project, located between 250 and 1,000 m away: San Jose Aculco, San Antonio, El Portal, and Caleras de Dorantes. This area of influence has played an important role in establishing significant interactions of a social and economic nature throughout the development of the project. Perimeter B consists of an area of 1 to 3 km away from the PTAR site, and includes Melchor Ocampo, Acoculco, and Presa Escondida, with a total of 4,298 inhabitants. Perimeter C consists of an area of influence between 3 and 7 km away from the site, with a population of 20,578 inhabitants. Lastly, Perimeter D consists of an area between 7 and 8 km away, which includes 67,755 inhabitants. These localities have been identified as the ones with the most direct socioeconomic impacts felt by the project. At the same time, besides the municipality of Atotonilco de Tula (where the project is located), it is important to mention the nearby municipalities of Tepeji del Rio and Tula de Allende, which are also considered areas of influence due to their proximity to the project and the size of their populations. There is evidence supporting the project's involvement of the community and social stakeholders in the form of interviews, where an assessment was made with regards to community acceptance of the project, its construction, and its operation. The project is expected to have a positive impact on the nearby community, the environment, and the local economy. The construction and operation of the PTAR will present an opportunity for farmers, who for years have had no choice but to use raw sewage water, to access cleaner treated water for the benefit of local agriculture. This will benefit the area with significant sanitation improvements and an overall improvement in the health of about 300,000 inhabitants who live and work directly within the irrigation zone of the Mezquital Valley. The benefit to another 400,000 inhabitants in the zone of influence is expected due to the water quality improvement. The sanitation of the water will prevent the formation of septic material banks in irrigation channels and reduce the contamination of rivers and springs that currently receive the wastewater. One example of how the needs and goals of the nearby community were taken into consideration is in the project's valorization of cultural resources through the rehabilitation of public spaces. The project's efforts to involve the community is also shown by its support of local celebrations of civil and religious festivities, and in its participation in assemblies and meetings addressing the interests of the community. It is through this process of communication that the needs and goals of the community have been assessed and addressed throughout the development and construction of the PTAR.

		Source: Conagua Planeación y Proyectos de Ingeniería, S.C. Manifestación de Impacto Ambiental Modalidad Particular, para la Planta de Tratamiento de Aguas Residuales de Atotonilco, Estado de Hidalgo "PTAR Atotonilco." Mexico: 2010. SEMARNAT. Planta de Tratamiento de Aguas Residuales Atotonilco. Mexico: 2014. ATVM. Biogeosphere 2035. Mexico: 2014.
		RECOMMENDATIONS The project could demonstrate a more holistic assessment of community needs and long-term goals were done and taken into consideration. There should also be more proof presented, showing that the project has improved community pride and that high levels of satisfaction and acceptance from community participants can be reported in a measurable way with stronger evidence of community acceptance and appreciation.
QL1.2 Stimulate Sustainable Growth & Development	**16**	**Restorative**
		The construction and operation of the PTAR significantly improved employment levels and the economic and social conditions of the municipality of Atotonilco. At the time of development, it was expected that over the estimated four years of construction, the PTAR would generate about 10,000 direct jobs and 12,000 indirect jobs, making an economic impact at the local and regional level by: attracting new business development and a diversified workforce to the area, making the community more economically competitive, and enabling the expansion and improvement of market goods and services to the area's population. The project team was committed to providing works of social benefit such as improving infrastructure and services for the towns in the area, rehabilitating wells that supply water to bridges and roads, and creating training centers - in particular, the Institute for Training Industry (ICATI) to provide human resources for various stages of the PTAR and the local and regional industry. The documentation provided notes the attitude of collaboration manifested in response to the development of the project, showing the support for the expected economic benefits and, simultaneously, raising social requirements for the entire population. Irrigation will be improved through the implementation of this project, allowing for the diversification of crops on about 80,000 hectares of agricultural land, creating the possibility to include greenhouse crops, eliminating the restriction that exists for crop irrigation in the area, and reducing contaminants in the water. This will allow for drip irrigation and the technification and more efficient use of water, creating opportunities to improve local productivity. There is photographic evidence showing that the project promoted the growth and sustainable economic development of nearby communities through small-scale interventions to restore and create areas of common use for the community, such as multipurpose spaces and gardens.
		Source: ATVM. Datos de Empleos Directos Generados por la PTAR Atotonilco. Mexico: 2015. ATVM. ATVM-2010. Mexico: 2015. Conagua Planeación y Proyectos de Ingeniería, S.C. Manifestación de Impacto Ambiental Modalidad Particular, para la Planta de Tratamiento de Aguas Residuales de Atotonilco, Estado de Hidalgo "PTAR Atotonilco." Mexico: 2010. ATVM. 2011 (Mexico: 2015).

		RECOMMENDATIONS The project would benefit from being more specific in its strategies to promote business attractiveness and economic development-centered job and opportunity creation. Specific proof should also be provided highlighting the gains obtained from the rehabilitation and restoration of existing natural, built, and cultural resources if efforts were made to achieve those upgrades separate from those to treat wastewater.
QL1.3 Develop Local Skills and Capabilities	**5**	**Superior**
		Data backed by the Hispanic Mexican Water Company (SAHM) shows that trainees have been hired for internships where they have been coached in the relevant subject and, at the end of their stay, the company has hired them as direct full-time employees in each of the areas according to their professional profile. Evidence was provided supporting the company's commitment to the education of its workers, establishing educational programs focused on improving the competitiveness of the community, and supporting employees to continue pursuing education and obtaining certifications.
		Source: ATVM. Lista de personal que realizó prácticas profesionales en la PTAR Atotonilco y obtuvo un puesto de trabajo. Mexico: 2015. ATVM. 2011 (Mexico: 2014).
		RECOMMENDATIONS The project would benefit from taking a closer look at the needs of specific groups, such as minority or disadvantaged groups, to determine how they can be integrated into the company's plans for growth, outreach, and inclusion in order to provide them with opportunities for individual professional growth in the future. More specifically, it is recommended to show how the project can further advance local knowledge, skills, and capabilities.
QL2.1 Enhance Public Health And Safety	**16**	**Conserving**
		Changes in the design of the PTAR to mitigate risks incurred by the project were approved by the Ministry of the Environment and Natural Resources (SEMARNAT). These changes established safety and hygiene measures to be implemented in the PTAR based on proposals done by ATVM and identified new technologies that can also represent a risk for employees and in general to the public. Studies were done to identify the principal environmental and laboral risks that will be incurred by the project in order to evaluate design modifications to mitigate them. A matrix was established for the assessment of risks based on their levels of severity and frequency. An analysis performed to identify the risks associated with the use of chlorine gas in the disinfection process validated the two scenarios of greatest impact and risk to be: (i) a leak by a rupture in the discharge hose from the tank car within the encapsulated buildings for a time of 20 minutes and (ii) a rupture of the tubed infrastructure that distributes the chlorine gas in areas closest to the human settlements. The biogas obtained from the leftover solid waste from the wastewater treatment will be stored on site for the production of heat and energy to be used within the plant. Part of the project design focused on the storage under low pressure of the expected biogas (a total of 7 gasometers of 8,500 m^3 each). The gasometers have been designed taking into consideration the possible risks associated with their use and meeting all the necessary requirements. The design of the system aims to minimize biogas surplus that would have to be burned under safe conditions to insure the

		safety of the workers and the facilities of the PTAR, and to maximize the use of the heat and energy generated. In each temporary biogas storage system, there will be self-closing valves in case of an earthquake. The cogeneration motors will have their own emergency refrigeration system, as will the buildings where the heating of leftover waste will be done. Changes in the design included the relocation of the biogas storage area to take it further away from the area designated for the storage of chlorine gas. To minimize risks associated with the handling of biogas on site, low-pressure storage was proposed. The SO_2 system was also modified and completely removed from the process of operation in the plant. Buildings are designed such that in the event of a chlorine leak, the gas remains within the shell of the building. Measures taken to mitigate the production of dust included the application of daily irrigation through water pipes in the access routes to the PTAR, parking and other areas. Water would be used when necessary and before expected winds. There would be curtains installed for protection against the wind and dust. Trees would also be used to block against the wind and dust. When winds are too intense, work would be temporarily suspended. Transportation speeds would be reduced throughout the construction site and unnecessary trips would be limited during construction to further avoid producing dust.
		Source: ATVM. Resolutivo de Modificación. 2015. SEMARNAT. Referente al Oficio BOO.03.04.-0299. Mexico: 2010. Secretaria de Gobierno Hidalgo. Oficio No. SSPCyGR/1226/12. Mexico: 2012. ATVM. "Capítulo I Datos Generales del Proyecto, del Promovente y del Responsable del Estudio de Impacto Ambiental," Manifiesto de Impacto Ambiental Modalidad Particular "Construcción y Operación del Proyecto Denominado la Planta de Tratamiento de Aguas Residuales PTAR Atotonilco." Mexico: 2013.
		RECOMMENDATIONS It would be beneficial for the project team to highlight more systematically the risks associated with the project and the measures taken to mediate those risks that go beyond industry requirements and that address the new technology implemented in the project.
QL2.2 Minimize Noise And Vibration	**8**	**Conserving**
		The intent of this subcategory is to qualify the measures taken to minimize noise and vibration from the project's construction and operations in order to improve community livability. In the case of PTAR, annual studies are performed to mitigate the project's impacts. The project requires vehicles used for transportation within the site to meet requirements defined by SEMARNAT, which mention the maximum permissible levels of noise caused by automobile exhaust pipes as well as the noise level allowed during business hours. There is evidence of a yearly monitoring program in place, performed by GAISA (Grupo Ambiental ISA), that measures vibrations derived from fixed sources and determines the level of sound exposure of the project. Within the plant, silencers will be installed in the areas where the motors fed by the biogas are located, which will significantly reduce the noise generated. Renovation of the air within each motor will be done through helical fans. The PTAR is surrounded along its perimeter by a green mound to help mitigate the sound generated within the site. It varies in height according to the proximity of nearby communities. In other instances, vegetation is used to dampen the noise from

		the plant's operations.
		Source: Diario Oficial, Secretaria del Trabajo y Previsión Social NORMA Oficial Mexicana NOM-024-STPS-2001 Vibraciones-Condiciones de Seguridad e Higiene en los Centros de Trabajo. Mexico: 2002. ATVM. Estudio para Determinar el Nivel de Emisión de Ruido Proveniente de Fuentes Fijas. Mexico: 2015. ATVM. "Capítulo VI Medidas Preventivas y de Mitigación de los Impactos Ambientales," Manifiesto de Impacto Ambiental Modalidad Particular "Construcción y Operación del Proyecto Denominado la Planta de Tratamiento de Aguas Residuales PTAR Atotonilco." Mexico: 2013. ATVM. Estudio de Tipología de Pantallas Acústicas. Mexico: 2009.
		RECOMMENDATIONS In order to have obtained a higher achievement level, the project could have shown evidence of analyses done to estimate noise and vibration levels incurred by the construction and operation of the project and compared it to the community's needs and goals for livability.
QL2.3 Minimize Light Pollution	**1**	**Improved**
		The lighting systems were designed according to the necessities of the project's operations. During the design process, the project team conducted an evaluation of the illumination in various zones, focusing on enhancing energy efficiency. The team also took into consideration the necessary components of illumination to reduce the dispersion of light. The strategic placement of vegetation and high barriers to mitigate noise also contribute to lessen the impact of light-spillage and glare within the complex as well as beyond its boundaries. There is not enough evidence provided showing the project's commitment to energy-efficient lighting systems. There is no evidence of a plan that established lighting zones balancing the sensitivity of certain environments or receptors, nor of measures taken to address the preservation of the night sky.
		Source: *Diario Oficial, Secretaria del Trabajo y Previsión Social NORMA Oficial Mexicana NOM-025-STPS-2008, Condiciones de Iluminación en los Centros de Trabajo. Mexico: 2008.* *ATVM. Memoria de Cálculo Alumbrado Exterior. Mexico: 2012.*
		RECOMMENDATIONS The project team would benefit from a rigorous energy-efficient lighting study that could expose areas of unneeded lighting or where automatic turnoff systems would be appropriate. The implementation of an overall lighting zone strategy would also be beneficial for the project as well as the design of lighting components that reduce or eliminate light spillage into sensitive environments, preserving the night sky.
QL2.4 Improve Community Mobility And Access	**4**	**Enhanced**
		The intent of this credit is to measure the extent to which the project eases traffic congestion and enhances mobility and access in the area, improving livability. The credit specifically focuses on walkability, reduction in commute time, traverse times to existing facilities and transportation as well as improved user safety - considering personal vehicles, transit, bicycles and pedestrians. The PTAR planned to reduce traffic congestion and improve pedestrian traffic as part of its

		improvements of the existing infrastructure with new paths, roads and parking lots (including main access to the PTAR) designed for safe travel at all times of the year. The project team coordinated with communities, specifying measures to reduce negative impacts and traffic congestion during construction. Within the PTAR site, to prevent crossing at the level of the railroad tracks, a new vehicular access road was designed which also includes sidewalks for pedestrian crossing. Further, a bridge was designed for crossing the El Salto Channel with two lanes. With the recommendation of specialists who focus on ensuring the operation of the PTAR's central road, earth structures originally proposed were replaced with a viaduct designed to contain two lanes and a sidewalk for pedestrian traffic.
		Source: Conagua Planeación y Proyectos de Ingeniería, S.C. Manifiesto de Impacto Ambiental Modalidad Particular, para la Planta de Tratamiento de Aguas Residuales de Atotonilco, Estado de Hidalgo "PTAR Atotonilco." Mexico: 2010. ATVM. Contrato de Transporte de Personas. Mexico: 2011.
		RECOMMENDATIONS The project team would benefit from looking at the impacts on mobility and access in the community at a broader scale and focusing on the long-term implications the constructed work will have on transportation in the area. Documented studies should show how the proposed alternatives will improve the efficiency, walkability and livability of the nearby community.
QL2.5 Encourage Alternative Modes of Transportation	**0**	**No score**
		This credit measures the extent to which the project improves accessibility to non-motorized and public transportation and promotes alternative modes of transportation to reduce congestion. The project documentation indicates the PTAR is located at an appropriate distance accessible to the pedestrian. The plant promotes the use of public transportation to arrive at the site and also offers public transportation to its personnel, reducing the need and use of individual transportation. However, there is no evidence for alternate means of transportation proposed (e.g. rail, water).
		Source: ATVM. Estación para Ascenso y Descenso Peatón. Mexico: 2015. (Images) ATVM. Alternativas de Transporte. Mexico: 2015. (Images) ATVM. Transporte Público Brindando para el Personal de la Planta de Tratamiento de Aguas Residuales Atotonilco de Tula. Mexico: 2015. SEMARNAT. Referente al Oficio ATVM/SEMARNAT/203-2012. Mexico: 2012.
		RECOMMENDATIONS Stronger measures could be taken to promote the use of public transportation, such as the restriction of parking for motorized vehicles and incentives for the use of carsharing and bicycles. Drawings would be useful in helping to identify the nodes of access to the site from the rest of the region.
QL2.6 Improve Site Accessibility, Safety & Wayfinding	**12**	**Conserving**
		This credit measures the improvements in user accessibility, safety, and wayfinding of the site and surrounding areas. These are measured based on their clarity, readability, and user benefits. All barriers and obstructions at the PTAR have been designed to be illuminated with warning lights,

		from dusk until dawn, to enhance the security and orientation throughout the construction site for users and emergency personnel. Project signage was designed to enhance accessibility and wayfinding in order to protect environmentally and culturally sensitive sites nearby and to integrate the local community, adding elements that help establish safety in the surrounding areas. In the communities of San Antonio and Melchor Ocampo, these include the rehabilitation of the streets adjacent to a local school, the placement of signage for pedestrian and vehicular traffic, and the painting of crosswalks. Signage has been located strategically to announce the entry and exit of vehicles, trucks, and machinery approaching the project area. There is signage for loading or unloading vehicles with excavation or construction materials, and signage indicating that vehicles are not allowed to park on primary roads. Signs have also been set up indicating where heavy trucks are to be received and unloaded to avoid the disruption of traffic and potential accidents due to vehicle movements.
		Source: Diario Oficial, Secretaria del Trabajo y Previsión Social NORMA Oficial Mexicana NOM-026-STPS-2008, Colores y Señales de Seguridad e Higiene, e Identificación de Riesgos por Fluidos Conducidos en Tuberías. Mexico: 2008. ATVM. Segundo Reporte Anual de Cumplimento del Programa de Vigilancia Ambiental de los Resolutivos de Impacto Ambiental No. S.G.P.A.DGIRA.-DG.6159.10, S.G.P.A.DGIRA.-DG.7400.10. Mexico: 2012. ATVM. SH_0000_DGO_PN_0001_0_A Atencion y respuesta a Emergencias. Mexico: 2015. ATVM. Apoyo a Seguridad Pública Municipio de Atotonilco de Tula. Mexico: 2012.
		RECOMMENDATIONS It is recommended to provide stronger documentation showing how the signage is clear and intuitive throughout the site and effective in case of emergency. More specifically, the project team could address the measures taken to calm traffic in areas identified for heavy pedestrian use in and around the PTAR site.
QL3.1 Preserve Historic and Cultural Resources	**7**	**Superior**
		This credit rewards projects that address the need to preserve and enhance historic and cultural sites to enhance a community's overall cultural resources. In the case of the PTAR project, a historic preservation study was carried out by INAH (Instituto Nacional de Antropología e Historia) before construction began. There was a detailed analysis of viability, with a focus on conservation and restoration. Efforts were carried out to identify and analyze the extent of conservation and restoration of archaeological remains found on the site. The INAH detected ceramic art from the natives of Teotihuacan as well as materials from the Toltecs and the Aztecs on the project site. A colonial aqueduct that had been damaged by previous work was also discovered in the area. Prior to beginning construction, an agreement was reached between INAH and ATVM to both protect and restore the aqueduct, and for INAH to perform archeological research and carry out extensive excavation on the site. Additionally, periodic inspections for monitoring impacts on cultural and historic resources were scheduled during each phase of the project's construction.
		Source: INAH. Oficio No. 401-43/650. Mexico: 2001. ATVM. Convenio de Colaboración para Llevar a Cabo Labores de Salvamento Arqueológico. Mexico: 2015.

		ATVM. Salvamento Arqueológico en el Predio de la PLanta de Tratamiento de Aguas Residuales (PTAR) Atotonilco. Mexico: 2015.
		RECOMMENDATIONS A sensitive design approach should be considered in order to avoid impacts on historic and cultural resources in the area and preserve historical remains. Options to restore historic and cultural resources should also be considered. There may be additional opportunity to develop long-term monitoring and maintenance plans for archeological protection, preservation, and enhancement.
QL3.2 Preserve Views and Local Character	**3**	**Enhanced**
		The preservation of the landscape seems to have been carefully considered throughout the development of the project. In the design of the PTAR, there was a focus on functionality and reducing the scale of large structures to promote gentle slopes of green areas and landscape views in appropriate places. The landscape design of the project also responds to soil improvement, the environment, local conditions to reflect the sensitivity to water conservation, and the integration of water treatment plants with the surrounding communities. The purpose of landscape design was both aesthetic and ecological, with low construction costs and maintenance. Landscape concepts were introduced during the design of the project, such as a study of the environment to preserve and highlight the main natural attractions. Examples of this include access formed by walkways and corridors framed by waterways, squares and open courtyards that integrate architecture with nature, the use of slopes to highlight or hide items, plants that enrich and preserve the microclimate, and sprinkler systems with treated water. Furthermore, areas designated for the conservation of local vegetation were designed to be protected from invasive species, particularly from ornamental vegetation outside of the regional ecosystem. There is evidence of regular environmental monitoring having been performed throughout the development of the project. The ecological and bioclimatic characteristics of specific areas around the site where considered in order to enhance their future adaptation. Staff monitoring the environmental conditions conducted tours throughout the project in order to detect species that could be at risk. Workers on site are also educated through talks - for example, one theme was "Rescue Program and Relocation of Fauna."
		Source: ATVM. Manifiesto de Impacto Ambiental Modalidad Particular “Construcción y Operación del Proyecto Denominado la Planta de Tratamiento de Aguas Residuales PTAR Atotonilco.” Mexico: 2013. ATVM. Colaboración de las Comunidades con la PTAR Atotonilco. Mexico: 2012. Conagua. “Subdirección General de Agua Potable Drenaje y Saneamiento,” In Contrato de Prestación de Servicios. Mexico: 2010.
		RECOMMENDATIONS To achieve higher performance levels for this credit, the project team could increase its efforts to understand community needs and identify opportunities for the preservation, protection, and enhancement of the local historical, cultural, and natural environment. Efforts could be made to aid local communities in developing more comprehensive policies and regulations regarding the restoration and preservation of local character.
QL3.3 Enhance Public Space	**11**	**Conserving**
		In 2012, the PTAR received the Biogeosphere 2035 award for outstanding contributions to the

		improvement of the environment. To enhance the life of the community, the project team participated in the creation of various multipurpose spaces, the improvement and construction of garden and outdoor communal spaces, the renovation of the community's soccer field, the leveling of roads, drainage work for the municipality of Atotonilco, the rehabilitation of local streets, and the donation of materials and trees for the improvement of various schools in the area. Overall, the project team is creating new spaces in the area that will enhance community liability by adding more recreational facilities and create a benefit for current and future users as well.
		Source: ATVM. Mejoras al Espacio Público. Mexico: 2015. ATVM. Biogeosphere 2035. Mexico: 2014.
		RECOMMENDATIONS The project team would benefit from a more systematic assessment of the condition of existing public spaces, identifying stakeholder involvement in decisions on which spaces to improve and where to invest in new common spaces.
QL 4.1- Identify and address the needs of women and diverse communities (indigenous or afro-descendant peoples)		**Improved**
	1	This credit evaluates the degree to which the project has taken into account the needs of women and diverse communities. The only proof provided in the case of the PTAR showing efforts to address women's concerns or needs in the community are the supply of new uniforms for the girl's soccer league and support for the Mother's Day Festival. The PTAR provides job opportunities equally for both men and women, even though the SAHM indicates that women represent only 28% of total employees. Data regarding risk prevention for the project is not specific to women but for workers in general. According to the information provided, it is believed that the identification of women and diverse community needs and gender equality concerns have not been addressed to a significant extent.
		Source: SAHM. Fuerza de Trabajo. Mexico: 2015. ATVM. "Capítulo VI Medidas Preventivas y de Mitigación de los Impactos Ambientales," Manifiesto de Impacto Ambiental Modalidad Particular "Construcción y Operación del Proyecto Denominado la Planta de Tratamiento de Aguas Residuales PTAR Atotonilco." Mexico: 2013.
		RECOMMENDATIONS It is recommended to provide documentation of assessments made to identify the hazards and risks to women's health and safety within the treatment plant. In addition, provide proof that the input of women and diverse groups has been incorporated into the project design and implementation in order to address social and gender-based disparities and ensure benefits are equitably distributed throughout the community.
QL4.2 - Stimulate and promote women's economic empowerment	**0**	**No score**
		There is no significant evidence that the project contributes to an increase in economic opportunities for women. No specific targets or strategies to improve women's opportunities have been identified.
		Source: SAHM. Fuerza de Trabajo. Mexico: 2015.

		Conagua. Contrato de Prestación de Servicios No. SGAPDS-GFOO-DFMEXHGO-10-001-LPI. Mexico: 2009.
		RECOMMENDATIONS To meet the demands of this credit, the project team could strive to make women the target of educational and income-generating opportunities in order to improve women's wellbeing and empowerment. The project team could make public commitments to hire women for the project, and there are opportunities to promote internships for women as well.
QL4.3 - Improve access and mobility of women and diverse communities (indigenous or afro-descendant peoples)	**0**	**No score**
		The design of the project considered areas, services, and nodes of transportation for the general public. There is no evidence that the project adopted strategies to directly improve the safety of transportation for women and diverse groups in the community.
		Source: Conagua. Contrato de Prestación de Servicios No. SGAPDS-GFOO-DFMEXHGO-10-001-LPI. Mexico: 2009. ATVM. "Capítulo VI Medidas Preventivas y de Mitigación de los Impactos Ambientales," Manifiesto de Impacto Ambiental Modalidad Particular "Construcción y Operación del Proyecto Denominado la Planta de Tratamiento de Aguas Residuales PTAR Atotonilco." Mexico: 2013. ATVM. Estudio para la Determinación del Nivel de Exposición a Ruido (NER) y Análisis del Espectro Acústico. Mexico: 2015
		RECOMMENDATIONS Documentation could be provided showing efforts taken to identify the project's effects on the access and mobility of women and diverse communities as well as the decisions made and actions taken to address them, such as design changes and adaptations to the original project design.
QL0.0 Innovate Or Exceed Credit Requirements		N/A
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SUB CATEGORY:LEADERSHIP		
	Score	**WATER TREATMENT PLANT ANTOTONILCO, MEXICO**
LD1.1 Provide Effective Leadership And Commitment	**9**	**Superior**
		The project team demonstrates meaningful commitment to the principles of sustainability and sustainable performance improvement. Sustainability is a core value of the project as demonstrated by its goals and ambitions. In November 2007, the National Water Commission presented the Water Sustainability Program of the Valley of the Mexico Basin, addressing challenges related to the protection of aquifers, development of new drinking water sources, the use water exchange agricultural, drainage, wastewater treatment and ecological restoration of

		water bodies in the Valley of Mexico. The two representative works included in the program are the Eastern Discharge Tunnel (TEO) and the PTAR. The primary goals include achieving comprehensive and sustainable management of water basins and aquifers, promoting the technical, administrative and financial development of the water sector, and seeking 100% clean wastewater from the metropolitan area in order to improve the development and health of the inhabitants of Valle del Mezquital who will have cleaner tributaries and can diversify agricultural production. The project will improve public health and environmental conditions and will treat more than 60% of wastewater from the Valley of Mexico. It will also be self-sustaining, generating its own electricity and contributing to improving air quality by not emitting greenhouse gases. The sustainable organizational performance of the project is regularly monitored by means of an annual report.
		Source: Conagua Planeación y Proyectos de Ingeniería, S.C. Manifestación de Impacto Ambiental Modalidad Particular, para la Planta de Tratamiento de Aguas Residuales de Atotonilco, Estado de Hidalgo "PTAR Atotonilco." Mexico: 2010. Conagua. Comunicado de Prensa No. 016-09. Mexico: 2009.
		RECOMMENDATIONS The project team could show more evidence of integrated sustainability initiatives and efforts within the company.
LD1.2 Establish A Sustainability Management System	**4**	**Enhanced**
		This credit assesses whether the management system in place seeks to improve the environmental, economic, and social performance of the project. The project team management has created a Health and Safety Program that establishes measures of environment and sustainability within the project. It also has appointed a position in charge of achieving environmental objectives and economic changes from the beginning of the project. The social targets are aligned with the goals and needs of communities as identified in the Environmental Impact Assessment for the project.
		Source: ATVM. Estructura Organizacional PTAR Atotonilco. Mexico: 2013. ATVM. Programa de Seguridad e Higiene del Trabajo del Contratista No. P-DG-SHT-001, Rev 1. Mexico: 2010. Conagua. Contrato de Prestación de Servicios No. SGAPDS-GFOO-DFMEXHGO-10-001-LPI. Mexico: 2009. Conagua Planeación y Proyectos de Ingeniería, S.C. Manifestación de Impacto Ambiental Modalidad Particular, para la Planta de Tratamiento de Aguas Residuales de Atotonilco, Estado de Hidalgo "PTAR Atotonilco." Mexico: 2010. ATVM. "Capítulo VIII Identificación de los Instrumentos Metodológicos y Elementos Técnicos," Manifiesto de Impacto Ambiental Modalidad Particular "Construcción y Operación del Proyecto Denominado la Planta de Tratamiento de Aguas Residuales PTAR Atotonilco." Mexico: 2013. Conagua Planeación y Proyectos de Ingeniería, S.C. Manifestación de Impacto Ambiental

		Modalidad Particular, para la Planta de Tratamiento de Aguas Residuales de Atotonilco, Estado de Hidalgo "PTAR Atotonilco." Mexico: 2010.
		RECOMMENDATIONS The project team would benefit from a clearer identification of roles and responsibilities within the company in charge of addressing issues of sustainability and creating a sustainability management policy in line with the scale and complexity of the project. The team should also consider exceeding health and safety standards and improving social and ethical performance.
LD1.3 Foster Collaboration And Teamwork	**0**	**No score**
		This credit provides incentives for collaboration between owner and project team in the delivery of the completed project, bringing the owner and project team members together at an early stage of the planning and design phases to explore ways to improve performance and reduce costs by using whole system design methodologies. There is no substantial proof that collaboration and teamwork principles were taken into consideration and incorporated into the design, execution, and delivery of the project.
		Source: MESLEK Recursos Humanos. Plan de Capacitación Corporativo MEK de México S.C. Mexico: 2014. Conagua. "Apéndice 2, Volumen II," Contrato de Prestación de Servicios. Mexico: 2009.
		RECOMMENDATIONS The project team would benefit from incorporating effective and innovative methodologies for risk and reward sharing between the project owner and project team. An agreement could be made between the owner and members of the team committing to share knowledge and work together at various stages of design with a common goal of efficiency and sustainable practices to achieve a better quality of construction. Early collaboration and integration would create opportunities for mutual feedback.
LD1.4 Provide For Stakeholder Involvement	**5**	**Enhanced**
		There is evidence supporting the project's involvement of the community and social stakeholders in the form of interviews, where an assessment was made with regards to community acceptance of the project, its construction, and its operation. Community input was taken into consideration in determining the scope of the project and the infrastructural improvements and services needed in the area. Some of these included rehabilitating wells that supply water to bridges and roads, and creating training centers, in particular the Institute for Training Industry (ICATI), that could provide human resources for various stages of the PTAR and for the local and regional industry.
		Source: Conagua. "Apéndice 2, Volumen II," Contrato de Prestación de Servicios. Mexico: 2009.
		RECOMMENDATIONS To improve performance in this credit, the project team could foster broader involvement and relationship building with the various stakeholders - for example, by creating an ongoing community relations program for a more transparent participation process, allowing for more meaningful input and the establishment of stronger ties with stakeholders.

LD2.1 Pursue By-Product Synergy Opportunities	**12**	**Conserving**
		This credit measures the extent to which the project team has identified specific material needs for the project and has looked for nearby sources or facilities with unwanted resources that can meet those needs, allowing for the capture of synergies and mutual benefits. Even though the snergisty approach has happened within the facility, on of themain highlight of the project it is to produce 70% of the energy required for the operation of the facility with by-products coming from the water cleaning operations of the facility
		Source: ATVM. Subproductos en el Diseño y Fase de Construccion en Operación. Mexico: 2015.
		RECOMMENDATIONS The project team would have benefited from a more systematic and aggressive effort to identify unwanted by-product materials from other nearby companies that could have been used during the construction phase of the project, leading to relationship building with these nearby facilities and at the same time reducing the amount of raw materials required for construction. Such materials could have been used for short-term construction as well as for long-term operations of the completed project.
LD2.2 Improve Infrastructure Integration	**3**	**Enhanced**
		This credit measures the extent to which the project integrates with existing or planned infrastructure, increasing overall efficiency and effectiveness. The projects delivered by the PTAR team include improving the system of potable water, the construction of a vehicular and pedestrian bridge connecting to the existing community cemetery, sidewalks and pavement of various roads (in the adjacent communities of San Antonio, El Portal and San Jose Acoculco), the creation of an auditorium, the rehabilitation of a health center, and other community improvements that were the result of an assessment of the expressed needs of these communities. Even though these projects contribute to the enhancement of community infrastructure systems, they are weak in addressing the sustainability of larger scale infrastructure systems and existing community assets.
		Source: ATVM. Proyectos de Mejora para la Sustentabilidad Energetica. Mexico: 2015. Conagua Planeación y Proyectos de Ingeniería, S.C. Manifestación de Impacto Ambiental Modalidad Particular, para la Planta de Tratamiento de Aguas Residuales de Atotonilco, Estado de Hidalgo “PTAR Atotonilco.” Mexico: 2010.
		RECOMMENDATIONS The project team would benefit from shifting the optimization of individual components to system optimization, integrating related systems, and increasing its focus on restoring existing facilities and infrastructure. There is also opportunity for considering the restoration of community knowledge and social capital assets and the improvement of not only infrastructural elements but also of natural systems.

LD3.1 Plan For Long-Term Monitoring & Maintenance	**10**	**Conserving**
		This credit measures the comprehensiveness and detail of the project's long-term monitoring and maintenance plans to ensure that design performance will be maintained. The PTAR team has developed a detailed manual for the operation and maintenance of the plant's equipment and systems. The personnel needed to implement the monitoring and maintenance have been clearly identified. This supervisory control and data acquisition (SCADA) system will provide control functions, monitoring, alarm, alarm registration, reporting, and data logging. The SCADA system will generate a daily database of alarms, maneuvers, measurements, and average results of water quality parameters, reflecting results in daily reports and storing files. The system will include a separate network control process to be fully capable and configurable to operate the PTAR facilities in automatic, semi-automatic and manual modes. This system configuration is expected to maximize the efficiency of the PTAR's operations. The plant will have a central control room in the key areas of operation and control in the main building. At the same time, the maintenance of systems and machinery has been taken into consideration from the beginning of the PTAR's design development to ensure a prolonged life span for the plant. Special areas have been designated throughout the project for inspection and maintenance of machinery to prevent the spillage of lubricants and solvents. The project team defines maintenance as the business function that is entrusted with constant control of the facilities with personnel guaranteeing the regular functions and good condition of the machinery. Because of the large scale of the project, the team anticipates various amounts of residue will derive from the maintenance of the equipment and structures, which include recyclable materials, organic compostable waste, and hazardous residue. Special areas have been designated for their temporary storage and sorting that are separated from areas of production, services, offices and storage areas for raw materials and finished products. These temporary storage facilities were designed to be strategically located in areas that minimize the risk of possible emissions, explosions, or flooding. They will also count on devices to contain possible spillage of the hazardous waste, such as thick concrete walls, containment parapets, and retention tanks for collecting waste liquid or leachate.
		Source: ATVM. Plan de Trabajo para el Mantenimiento en el Largo Plazo. Mexico: 2015. SAHM. Organigrama General de Ejecución PTAR Atotonilco Vehículo de Obra Electromecanica. Mexico: 2015. ATVM. Manual de Operación y Mantenimiento. Mexico. n.d.
		RECOMMENDATIONS There is further opportunity for the project team to develop a detailed schedule of the maintenance and monitoring of their machinery and systems and to develop a tracking system recording these operations.
LD3.2 Address Conflicting	**0**	**No score**
		This credit measures the efforts made by the project team to identify and change laws, standards, regulations or policies that may unintentionally create obstacles for the implementation of

Regulations & Policies		sustainability goals, objectives, and practices. No specific information has been provided relating to the identification of conflicting regulations in order to implement sustainable practices.
		Source: ATVM. Regulaciones, Política y Estándares. Mexico: 2010.
		RECOMMENDATIONS The project team would benefit from shifting from identifying conflict and resolutions on individual projects to a larger scale of infrastructural change.
LD3.3 Extend Useful Life	**3**	**Enhanced**
		In order to extend the durability and resilience of the project, the project team has devised a manual for the operation and maintenance of in-place systems at the plant. At the same time, the PTAR counts on a system of energy production shared between biogas and natural gas, enhancing the project's resilience and ability to extend its lifespan. However, no proof is shown regarding the possible reconfiguration and flexibility of the constructed works to allow for expansion or change of uses.
		Source: ATVM. Manual de Operación y Mantenimiento de la PTAR Atotonilco. Mexico: 2015. ATVM. Propuesta Energética. Mexico: 2015.
		RECOMMENDATIONS The project team would benefit from studying possible ways in which the infrastructure and constructed works could be repurposed or adjusted to future programs or expansions.
LD0.0 Innovate Or Exceed Credit Requirements		*N/A*
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CATEGORY II: CLIMATE AND ENVIRONMENT		
RESOURCE ALLOCATION		
	Score	**WATER TREATMENT PLANT ANTOTONILCO, MEXICO**
RA1.1 Reduce Net Embodied Energy	**0**	**No score**
		Embodied energy is defined as the sum of energy that was used in the production of a material or product, including raw material extraction, transport, manufacture, and all undertaken processes until the material or product is complete. This credit measures the percentage reduction in the net embodied energy of the project from a life cycle energy assessment perspective to reduce overall

		energy use. It considers the long-term lifespan of the project, including future disassembly. Even though there is documentation showing its monthly energy consumption, no proof is provided by the project team regarding life cycle energy assessments performed or regarding considerations taken to reduce the net embodied energy of materials used.
		Source: *N/A*
		RECOMMENDATIONS In order to satisfy the requirements for this credit, an estimate of the net embodied energy of the project's materials would be required. This estimate should be carried out by means of a life cycle assessment (LCA) and should measure the energy embodied in the extraction, transportation, refinement, and manufacturing of materials used for both construction and maintenance over the lifespan of the building.
RA1.2 Support Sustainable Procurement Practices	**0**	**No score**
		This credit measures the percentage of materials sourced from manufacturers who meet sustainable practice requirements, encouraging the consideration of materials that serve to protect human health and the environment, that contain recycled content, and that do not contain hazardous materials in their composition. Even though there is information showing a format for evaluating materials and service providers that considers their capacity to meet technical requirements, availability to provide tests, and the quality of their equipment, it does not specify their use of sustainable practices.
		Source: N/A
		RECOMMENDATIONS The goal of this credit is for the project to utilize materials and equipment from manufacturers and suppliers that implement sustainable practices. In order to meet the requirements for this credit, the project team should provide evidence that a program was put in place to review the policies and criteria for supplier selection. Information should be provided specifying the percentages of materials purchased from suppliers that implement sustainable practices and policies in their companies or through the use of legitimate third party certified materials. The project team should provide proof of efforts made to increase the amount of low-impact materials specified and the use of suppliers and subcontractors who adhere to sustainable practices. There is also an opportunity to demonstrate efforts made to identify worker health and safety or environmental violations during the construction and operation of the project.
RA1.3 Used Recycled Materials	**0**	**No score**
		This credit encourages the use of recycled materials and avoidance of virgin materials to minimize the amount of waste sent to landfills. It evaluates the volume and/or total amount of recycled materials used for the construction of the project. There is no evidence to identify the amount of recycled materials incorporated into the construction of the PTAR project.
		Source: ATVM. Plan de Manejo de Residuos de Manejo Especial. Mexico. n.d.

		RECOMMENDATIONS The project team should provide proof of efforts made to specify a significant amount of reclaimed or recycled materials and structures for the project. Reports of any inventory or assessment identifying usable materials should be provided as well as documentation specifying the location and weight or volume of reused structures and materials used. Inventory of materials should provide the name of the product, the manufacturer, the weight or volume, and the percentage of recycled content included. Any recycled or reclaimed material should meet all state and local requirements for the use of recycled materials in construction. Examples of materials can include reclaimed bricks, recycled plastics, or reprocessed timber.
RA1.4 Use Regional Materials	**3**	**Improved**
		This credit measures the percentage of materials used that were sourced within specific distances from the project, encouraging the minimization of transportation costs and impacts while also retaining and enhancing regional benefits. The specification of local materials should not compromise the quality, durability, or safety of the materials. Regarding the use of plants for landscaping and reforestation, the PTAR project team made significant efforts to use local plants to replace any that were damaged during construction and, when insufficient, they planted specimens of the same species or another (approved by the appropriate authority) in a nursery nearby the project site. Even though documentation is provided specifying the providers of construction materials located in close proximity to the project, the amount and specification of materials obtained from them is not provided.
		Source: ATVM. Proveedores Cercanos al Proyecto. Mexico. n.d.
		RECOMMENDATIONS The project team should increase the percentage of locally sourced materials, plants, and soils without compromising quality. Soils, mulches, and aggregates should be sourced within 80 kilometers from the site, concrete should be sourced within 160 kilometers, plants should be sourced within 400 kilometers, and other materials within 800 kilometers. Reports identifying the amount of materials sourced and their origin should be provided.
RA1.5 Divert Waste From Landfills	**3**	**Improved**
		This credit measures the total amount of waste diverted from disposal in landfills. The intention is to encourage the maximization of waste that can be reused or recycled. There is a requirement for the development of a management plan and the identification of sources and destinations for the recycling of materials. Prior to construction, the project team developed a plan to monitor the handling of residue and waste, establishing procedures that guarantee the execution of objectives defined by the plan. Once the areas generating waste are identified, necessary measures are taken regarding prevention, minimization, source separation, storage, transportation, use, recovery and final disposal of the waste generated. The materials identified for reuse and recycling include wood, polyethylene terephthalate or PET,

		cardboard, and ferrous materials. Documentation describes the amount of material produced during the period of construction between December 2011 and 2012 which amounted to 638.4 tons for recycling. These materials were donated to individuals or companies or taken to recycling facilities. There is no specific number that represents the total amount of waste material produced during construction in order to calculate a percentage.
		Source: ATVM. Plan de Manejo de Residuos de Manejo Especial. Mexico: 2013.
		RECOMMENDATIONS The project team should provide more detailed documentation specifying the quantities of the waste material produced during construction and the percentage of that waste material that was recycled. Not only should the quantity of waste generated be considered, but also its recyclability and its toxicity. Acceptable means of the diversion of waste include its reduction, the reuse or recycling of materials for projects on site, materials sent to recycling plants, and the use of appropriate materials for infill. It is necessary for the project team to provide documentation of calculations measuring the total waste reduction and percentage of materials diverted to reuse or recycle; these can include hazardous materials.
RA1.6 Reduce Excavated Materials Taken Off Site	**4**	**Enhanced**
		This credit measures the extent to which the project team has considered limiting the movement off site of soil and excavated materials during construction, reducing the need for transportation and in turn minimizing environmental impacts. To the maximum extent possible, the project team at the PTAR aimed for materials obtained from excavations of structures and ditches to be used for building fillings and embankments. Additional materials would be obtained from adjacent or nearby land. The project team expected not to use expansive soils for earthworks excavation or filling in structures. The embankments and fillings were built according to the levels and gradients indicated in the conceptual design. The slopes of the landfill are designed to be stable at all conditions of load. The stability analysis included protective layers of fill and slope. The minimum safety factor of slope failure will be 1.5 for static conditions and at least 1.1 for seismic loading conditions. All excavations for demolition work and all excavations below the level of permanent ground, caused by the withdrawal of structures, were to be filled with suitable material and level to match the proposed grading plan. Parts of these landfills that form the base of a road, driveway, or support structure will be filled and compacted in accordance with project specifications.
		Source: Conagua Planeación y Proyectos de Ingeniería, S.C. Manifestación de Impacto Ambiental Modalidad Particular, para la Planta de Tratamiento de Aguas Residuales de Atotonilco, Estado de Hidalgo “PTAR Atotonilco.” Mexico: 2010.
		RECOMMENDATIONS There is more opportunity for the project team to elaborate on measures taken during the design phase to identify ways to minimize grading, reuse suitable excavated materials or soils within the project site, and eliminate the need for transporting additional soils to the site. This is a

		quantitative assessment and percentages of excavated material reused should be specified in order to achieve a higher score.
RA1.7 Provide for Deconstruction & Recycling	**1**	**Improved**
		This credit encourages the project team to think about the long-term capacity of the project to be efficiently disassembled or taken apart at the end of its useful life for the reuse or recycle of its parts. Credit is given to teams that designed the project considering that at the end of its useful life, the completed project can be easily disassembled and the construction components reused. Limited information is provided by the project team mentioning the possibility for the disassembly of prefabricated concrete elements found in the structure of the PTAR, particularly the elements used for filtering the wastewater.
		Source: Conagua Planeación y Proyectos de Ingeniería, S.C. Manifestación de Impacto Ambiental Modalidad Particular, para la Planta de Tratamiento de Aguas Residuales de Atotonilco, Estado de Hidalgo "PTAR Atotonilco." Mexico: 2010.
		RECOMMENDATIONS To meet the criteria for this credit, the project team should provide information specifying the materials used that include more life-cycle elements that transcend the construction and period of operation. There is also the opportunity to consider flexible or alternate use of the components - for example, the use of prefabricated units that can be easily disassembled or separated for later reuse.
RA2.1 Reduce Energy Consumption	**17**	**Conserving**
		This credit measures the project team's efforts to reduce the overall energy consumed in the project. It requires the team to calculate the anticipated operation and maintenance energy consumption on an annual basis for the life of the project in order to achieve a reduction in operational energy. Total energy consumption by equipment and processes per year were identified and estimated. The amount of energy to be generated by the biogas plant extracted from the sludge was also estimated. The total estimated energy consumption for the PTAR is 245.8 GWh of electric energy per year while the biogas is estimated to produce 200.586 GWh of electric energy per year, arriving at a net energy consumption of 45.214 GWh by the plant per year - accounting to an over 81% energy reduction.
		Source: Promotora del Desarrollo de América Latina. Resumen de Consumos Eléctricos. Mexico: 2015. Comisión Reguladora de Energía. Titulo de Permiso de Cogeneración de Energía Eléctrica. Mexico: 2013.
		RECOMMENDATIONS There is further opportunity for the project team to consider using energy-efficient equipment and processes beyond the production of energy to further decrease energy consumption.
RA2.2 Use Renewable Energy	**13**	**Superior**
		This credit rewards projects that invest significantly in renewable energy. This can be on-site or via

		off-site facilities linked to the project. In the case of the PTAR, one of the outstanding qualities of the project is the generation of electric energy using biogas generated from the sludge extracted from cleaning the water. The biogas obtained from the leftover solid waste from the wastewater treatment will be stored on-site for the production of heat and energy. The process of generating the energy will happen through the use of a central station integrating 12 motor-generators fueled by the biogas with a capacity of 2.717 MW each. The central station will have a total capacity of 32.604 MW, with an estimated annual production of 200.586 GWh of electric energy and the consumption of 90,211,000 m³ of biogas.
		Source: Comisión Reguladora de Energía. Titulo de Permiso de Cogeneración de Energía Eléctrica. Mexico: 2013.
		RECOMMENDATIONS There are additional ways for the project team to consider producing energy in order to reduce fossil fuel consumption, such as the use of solar panels or wind turbines, among others.
RA 2.3 Commission & Monitor Energy Systems	**11**	**Conserving**
		This credit rewards projects that are conscious of the fact that energy efficient systems can fail, and that in order to ensure systems in place are operating correctly there is a need for regular monitoring. The team at the PTAR has established a monitoring system that will be performed during start-up tests and throughout the lifespan of the plant's operations for all measurements, inspections, and sample collecting in order to assess the compliance of the plant's functions. There is a track program in place in charge of mitigation measures and establishing mechanisms for correction in case of deviations from the expected results. A record of all results from the quarterly, semiannual, and (in some cases) annual tests will be kept. All sampling to be carried out as part of the monitoring program will be done by a third party company that is licensed and certified for all laboratory testing and environmental monitoring. All monitoring must be carried out by accredited laboratories and approved by the Federal Law Methodology and Standardization. The results and/or test reports must be available for review by the environmental authority. Conagua is to actively participate in the monitoring procedures of the PTAR as well.
		Source: ATVM. Supervisión de Permiso de Cogeneración. Mexico: 2015. ATVM. Manual de Operación y Mantenimiento. Mexico. n.d.
		RECOMMENDATIONS The project team should ensure a long-term monitoring system is in place, such as energy sub-metering, to enable more efficient operations.
RA3.1 Protect Fresh Water Availability	**4**	**Enhanced**
		This credit awards projects that reduce the negative net impact on the availability, quantity and quality of fresh water on the site. Project teams should determine if the project's water consumption will have a long-term net negative, net neutral, or positive impact on the water sources on the site. It is important to consider the overall performance of the PTAR when assessing this credit, as the main objective of the project is to treat wastewater coming from Mexico City to be used for the irrigation of about 90,000 hectares nearby the project site. The objectives of the PTAR include the

		protection of the rivers in the area and the prevention of waste accumulation in the banks of the rivers, protecting the health of the farmers and their families that depend on the river water for irrigation. The PTAR also aims to reduce septic waste traveling in irrigation canals, enabling irrigation technology to be used in the area which allows for diversification of crops. These efforts will also contribute to the ecological restoration of the Endhó dam.
		Source: Conagua, Manifestación de Impacto Ambiental Modalidad Particular, para la Planta de Tratamiento de Aguas Residuales de Atotonilco, Estado de Hidalgo (Mexico: 2010), 105, 109, 151-152, 164-173. ATVM, Manual de Operación y Mantenimiento de la PTAR Atotonilco (Mexico), 33.
		RECOMMENDATIONS There is further opportunity for the project team to increase the scope of water availability assessment and improve water management to achieve conditions with no net impact on surface and groundwater. Net positive impact and restoration can be achieved by replenishing the water volume at the source. Replenishing surface and groundwater to historic levels would go above and beyond the credit requirements.
RA3.2 Reduce Potable Water Consumption	**13**	**Superior**
		This credit encourages the reduction of overall potable water consumption in the project and the use of greywater, recycled water, and stormwater to meet water needs as measured by the estimated percentage of water reduced. Within the PTAR, the water used for the process of wastewater treatment is taken from the disinfection process (the last stage of treatment), which means the water is reused and, therefore, no potable water is needed for these services. Potable water is only used for network fire testing (150 m^3/day) and for general services (518.4 m^3/day). For other services within the plant, treated water will be used (7,931.52 m^3/day). Of the total estimated water consumption of the plant totalling 8,899.92 m^3/day, only 668.4 m^3/day will be potable water, extracted from a well on site that has been conditioned by filtration and chlorination. The use of treated and filtered water amounts to a 92.5% reduction in the use of potable water.
		Source: ATVM, MEAI DP 08 Memoria Descriptiva (Mexico). ATVM, Manual de Operación y Mantenimiento de la PTAR Atotonilco (Mexico: 2015), 33, 48, 71, 82.
		RECOMMENDATIONS The project team could consider alternatives to potable water use such as recycled greywater and stormwater to use within the plant to achieve a 100% reduction in the use of potable water and attempt to recycle water for the use of the nearby community.
RA3.3 Monitor Water Systems	**6**	**Superior**
		This credit assesses the procedures incorporated into the design of project systems capable of monitoring water usage in order to study flows, detect leaks to prevent the waste of water, and minimize the embodied energy and emissions associated with its treatment and distribution. Each of the hydropneumatic systems in place at the PTAR are pre-programmed. When any deviation from the original design parameters occurs, an alarm signal will be received in the control room of the plant, providing an efficient way to track any problems or emergencies in the system.

		There are also measures in place that monitor and analyze both the wastewater coming into the plant to be treated and the treated water that goes back to the water bodies, enabling the long-term monitoring of surface and groundwater quality.
		Source: Conagua, Anexo 9 (Mexico). ATVM, Manual de Operación y Mantenimiento de la PTAR Atotonilco (Mexico).
		RECOMMENDATIONS In order to improve the operational efficiency of the plant, the project team should consider increasing the extent and expanding the scope of water monitoring activities to achieve responsive monitoring.
RA 0.0 Innovate Or Exceed Credit Requirements		*N/A*
	75	

NATURAL WORLD		
	Score	**WATER TREATMENT PLANT ANTOTONILCO, MEXICO**
NW1.1 Preserve Prime Habitat	**0**	**No score**
		This credit rewards projects that make efforts to avoid impacts on sites of high ecological value, defined as "prime habitat", and those that invest in establishing protective buffer zones. Prime habitats are defined as the most ideal habitats for protecting wildlife biodiversity due to their size, location, diversity of habitat types, or presence of a particular type of habitat for plant or animal species. It emphasizes the importance of siting projects strategically to minimize impacts on these habitats to the greatest extent. The highest achievement level is given to those that not only avoid adversely impacting sites of ecological value but also strive to maintain and restore such sites through the project lifespan. Even though the site for the construction of the PTAR is not considered by any third party to be an area of significant ecological value or prime habitat, the project team has invested significantly in the reforestation of native species found on site with the agenda of recovering and improving the quality of environmental services; however, no sign of buffer zones or other mitigation measures have been observed.
		Source: Conagua, Programa de Reforestación (Mexico: 2010), 12,13, 27.
		RECOMMENDATIONS A specific identification on what type of land the project is located on is recommended in order to guarantee the impact that this development is causing.
NW1.2	**1**	**Improved**

Preserve Wetlands and Surface Water		This credit measures the project team's efforts in maintaining the integrity of, and protecting, areas designated as wetlands, shorelines, and water bodies by establishing buffer zones around them. These are intended to safeguard the wildlife habitats found in these zones, providing habitat corridors, maintaining biodiversity, regulating water temperature, maintaining water quality, and protecting against human disturbance. Efforts are measured by the size of the natural buffer zones established by the project team. Water bodies in the boundaries of the project site are El Salto river and the irrigation canal El Salto-Tlamaco. These water bodies carry sewage waste generated in Mexico City and are where the water used for irrigation in the Mezquital Valley is sourced. These bodies of water will benefit from the cleaner water treated by the PTAR, protecting them and their habitats. The Tula River Basin consists of the Alfajayucan, Tula, El Salto and the Salado rivers, and is ranked the second largest entity in terms of surface hydrology covering 23% of the area; its main collector is the Tula River. This basin is of great importance, both for its large area and the amount of tributaries that feed it and irrigation districts associated with it.
		Source: Conagua, Manifestación de Impacto Ambiental Modalidad Particular, para la Planta de Tratamiento de Aguas Residuales de Atotonilco, Estado de Hidalgo (Mexico: 2010).
		RECOMMENDATIONS In order to achieve higher performance levels for this credit, the project team should aim for levels of restoration that go beyond protection and provide plans outlining goals and efforts to restore these habitats.
NW1.3 Preserve Prime Farmland	**0**	**No score**
		This credit emphasizes the importance of preserving prime farmland found on the site of infrastructure projects. These zones have characteristics such as an adequate and dependable water supply, a favorable temperature and growing season, an acceptable level of acidity, soils with permeable properties, and they are not excessively eroded or saturated with water. The site for the construction of the PTAR is considered agricultural land and some of the site has been used for agricultural purposes in the past. At the time of construction, the areas of significant agricultural activity were located adjacent to the site to the southwest. Even though the site had been identified as agricultural in the past, there is no proof shared by the project team to indicate that studies were done to determine whether or not on-site soils have been identified as prime farmland deemed important for conserving for future generations. No evidence has been provided indicating intentions of protecting a significant percentage of prime farmland.
		Source: Conagua, Manifestación de Impacto Ambiental Modalidad Particular, para la Planta de Tratamiento de Aguas Residuales de Atotonilco, Estado de Hidalgo (Mexico: 2010), 10, 11.
		RECOMMENDATIONS In order for the project team to score higher in this credit, it is necessary for the team to demonstrate that efforts were made to avoid development on identified farmland areas.
NW1.4 Avoid	**5**	**Conserving**

Adverse Geology		This credit rewards projects that consider and avoid development in adverse geologic zones and projects that protect aquifers, aiming to reduce natural hazard risks and preserve high quality groundwater resources. The land where the PTAR has been constructed was characterized by two distinct areas: one relatively flat, between El Salto river and the railroad with a surface area of 38 ha, and an area of low hills between the railway and the northeastern boundary of the property, with an area of 135 ha. In the highest part of the property, three runoffs are derived. Together with these runoffs, agriculture and the disappearance of natural vegetation have led to water erosion of the soil. The topography of the site will be affected mainly in the upper parts (east and northeast of the property) where soil movement was performed for the accumulation of the residual sludge from the wastewater treatment. Regarding the plans and strategies developed to reduce risk of damage and the establishment of operating procedures and a monitoring program for adverse geologic settings, the project team has developed an Internal Program for Civil Protection (Programa Interno de Protección Civil) with the purpose of safeguarding the physical integrity of the administrative personnel and clients of the ATVM, and preserving the property and buildings of the treatment plant. There is documentation showing the PTAR plan establishing procedures and safety measures to prevent, control, and respond to emergencies caused by human or natural agents. Significant documentation is provided in regards to natural risk assessments done at the scale of the whole municipality of Atotonilco de Tula, suggesting there are no adverse geological features on the site such as earthquake faults, low lying coastal areas, or karst formations (defined as geologic formations such as limestone or dolomite that is shaped by the dissolution of layers of bedrock) and thus the site is located in a safe area with no negative effects on aquifers.
		Source: Conagua, Programa Interno de Proteccion Civil (Mexico), 74-77. SEDATU, Atlas de Riesgos Naturales Municipio Atotonilco de Tula (Texcoco, Mexico: 2014), 87, 89, 98.
		RECOMMENDATIONS -
NW1.5 Preserve Floodplain Functions	**8**	**Superior**
		This credit encourages the preservation of floodplain functions by limiting development and its impacts in order to maintain water management capacities. The impact from the overall development of the PTAR will not decrease the capacity for floodplain riparian vegetation or the protection of soil, instead it aims to maintain existing vegetation and protect the water bodies in the area. Because of the very low likelihood of flooding in the area, the project team has not devised an emergency plan to protect the infrastructure in case of a flood.
		Source: SEDATU, Atlas de Riesgos Naturales Municipio Atotonilco de Tula (Texcoco, Mexico: 2014).
		RECOMMENDATIONS The benchmark of achievement for this credit is obtained when floodplain functions are not considered beyond local laws and requirements. In order to achieve higher levels, the project team should strive to go beyond avoiding floodplain development to maintaining its functions, or even further to enhancing riparian and aquatic habitat.

NW1.6 Avoid Unsuitable Development on Steep Slopes	**4**	**Superior**
		This credit encourages the protection of steep slopes and hillsides from unsuitable development in order to avoid risks from erosion, landslides, or other natural hazards. This credit measures the degree to which development on such sites is avoided by the project team. The PTAR has been designed taking into consideration the existing conditions on the site, minimizing its alteration with the intention of avoiding excessive erosion. The final filling and slopes will be stable under all possible load conditions that may occur during or after construction. Cut slopes, fillers and boards have been designed to minimize the effects of erosion due to natural causes like wind and surface landslides.
		Source: Conagua Planeación y Proyectos de Ingeniería, S.C., Manifestación de Impacto Ambiental Modalidad Particular, para la Planta de Tratamiento de Aguas Residuales de Atotonilco, Estado de Hidalgo "PTAR Atotonilco" (Mexico: 2010), 149-150. Conagua Planeación y Proyectos de Ingeniería, S.C., Manifestación de Impacto Ambiental Modalidad Particular, para la Planta de Tratamiento de Aguas Residuales de Atotonilco, Estado de Hidalgo "PTAR Atotonilco" (Mexico: 2010), 17-21.
		RECOMMENDATIONS The project team should consider the effect heavy rains might have on the constructed slopes and embankments such as erosion and landslides.
NW1.7 Preserve Greenfields	**0**	**No score**
		Aiming to lessen the adverse impact a project can have on wildlife, this credit rewards projects that select greyfields (considered here as previously developed sites) and/or sites classified as brownfields rather than undeveloped greenfields for their site. Brownfields are properties that present contamination caused by previous uses; choosing to locate the project on such a site would give the opportunity to remediate it, adding environmental benefits such as cleaning up contamination. This credit is measured by the percentage of area selected that is considered a greyfield and the percentage of use and cleanup of a site classified as brownfield. The project site for the PTAR does not qualify as a greyfield or brownfield according to the documentation provided, therefore no preservation of a greenfield has been achieved.
		Source: -
		RECOMMENDATION
NW2.1 Manage Stormwater	**4**	**Enhanced**
		This credit measures the infiltration and evaporation capacity of the project site with the intention of minimizing the impact of infrastructure on stormwater runoff. In order to minimize the volume of rainwater and direct contact with sludge, the project team at the PTAR has designed a peripheral canal around the cells for sludge disposal, which will capture runoff from abroad and infill. Runoff will be captured so it does not reach the cell sludge disposal, avoiding the pollution of the water.

		For the precipitation that falls directly on the layout cells of sludge infill, an interior drainage system has been designed that ensures the rapid evacuation of rainwater in a superficial way, avoiding stagnation and infiltration into the lower layers of sludge arranged in the cells. The bottom of the sludge disposal cells is formed by a layer of waterproof polyethylene liner, ensuring that any leachate infiltration does not go beyond the bottom of the cells - avoiding the pollution of subsoil and groundwater. In addition, the waterproof layer is designed with a slope ensuring that the flow that does infiltrate discharges to a drain of gravel located at the base of the boards of the containment cells for biosolids. These gravel drains at the base of sludge containment dikes will channel the leachate collected to a network of pipes, leading to two lagoons.
		Source: Conagua Planeación y Proyectos de Ingeniería, S.C., Manifestación de Impacto Ambiental Modalidad Particular, para la Planta de Tratamiento de Aguas Residuales de Atotonilco, Estado de Hidalgo "PTAR Atotonilco" (Mexico: 2010), 56-58.
		RECOMMENDATIONS In order to reach higher levels of achievement, the project team could create an erosion, sedimentation and pollutant control plan for construction and operation activities associated with the project. There is also opportunity to improve the project's water storage and infiltration capacity in order to minimize impacts on the water's base flow, nutrient cycling, sediment transport, and groundwater recharge.
NW2.2 Reduce Pesticides and Fertilizer Impacts	**2**	**Enhanced**
		This credit measures the project's efforts to reduce the use of pesticides and fertilizers on site with the intention to reduce nonpoint-source pollution. The reforestation scheme at the PTAR emphasizes the use of native plants to be replanted so as to achieve the original quantity of plants before the project was constructed. The use of the native mesquite dominates the scheme. The mesquite plant (Prosopis laevigata), planted at a density of 133 individuals per hectare offset from each other at nine meters, will provide shade and food for the native wildlife and livestock, along with shade and shelter for small plants (such as cacti). This plant avoids the desertification of the Mezquital Valley, protecting it from erosion and acting as a soil improver. There are two modes of fertilization, one from manure and compost and one from modules. If they can successfully propagate the mesquite, these plants act as natural fertilizer favoring their use. In the case of mesquite, there are instructions to incorporate well rotted 0.5 kg of dry manure by seed strains. There is no need for fertilization with nitrogen, as mesquite has a natural nitrogen fixation, but the organic fertilizer (manure) will facilitate faster development. There is documentation provided by the project team showing that fumigation with methyl bromide will be used to prevent pests, fungi and bacteria. The safety standards outlined by the manufacturer will be followed during application. When necessary, herbicide will also be used at an amount of one liter per hectare per year.
		Source: Conagua, Programa de Reforestación (Mexico: 2010), 10, 13, 17, *20-21.*
		RECOMMENDATIONS There is an opportunity for the project team to eliminate all pesticides, herbicides and fertilizers used, increasing composting and creating a pest management program. The project team is

		encouraged to find alternative uses to pesticides for the protection of the plants.
NW2.3 Prevent Surface and Groundwater Contamination	**14**	**Conserving**
		This credit rewards projects that have developed plans to prevent and monitor surface and groundwater contamination. The nature of the operations at the PTAR is to treat wastewater from the Valley of Mexico, discharging into the El Salto river and the irrigation canal Salto-Tlamaco. The plant is expected to treat 60% of the wastewater coming from the Federal District. Of the treated water, 67% will be used for irrigation and 33% will be sent directly back to the river. The sanitation of the water will prevent the formation of septic material banks in irrigation channels and reduce the contamination of the rivers and springs that currently receive the wastewater. There is documentation provided by the project team showing reports of the control of process, testing and analysis of both the incoming water as well as the treated water in order to guarantee quality. They have identified equipment and facilities containing potentially polluting substances and locating them away from sensitive areas in zones designated for their storage and maintenance. The project considers the process for the control of all operations by taking samples, analyzing them and determining the actions required for a complete characterization of the processes throughout the various phases of the treatment. This is done to achieve optimum adjustment of the operating parameters and coupling the various steps in order to get the most out of the system. The analytical process looks at two types of determinations: analytical and physical. The analytical one obtains the necessary information on chemical and biological characteristics of water and mud, and the testing is performed in the laboratory of the plant. The physical settleability studies are mainly conducted in situ. Complementing these two analytical determinations to calculate the parameters that govern the operation of each process and therefore adapt its dynamics are optimized so that the system performance. At the PTAR, multiple measures of prevention regarding hazardous materials and equipment have been put in place in order to prepare for and prevent emergencies of spillage or leaks of polluting substances leading to groundwater and surface water contamination. These measures include personnel training, constant maintenance and monitoring of machinery and equipment, and a plan in case of emergency.
		Source: ATVM, Manual de Operación y Mantenimiento (Mexico), 6.
		RECOMMENDATIONS There is additional opportunity for the project team to shift from responsive measures to prevention, source reduction and elimination of all future contamination inflicted in ground and surface water due to the operation of the plant.
NW3.1 Preserve Species Biodiversity	**2**	**Improved**
		The project team planned for reforestation (particularly of cacti) to take place at the site of the PTAR. The reforestation will be carried out intensively by planting just over a tenth of the affected area (16 of 158.5 ha). This will be done in areas devoid of vegetation within the property as well as

		neighboring communities (ones that qualify as having similar environmental conditions), as specified in the General Director of Environmental Impact and Risk of Environmental Impact of the Project. As part of the mitigation process, the project team at the PTAR has established the creation of a nursery, that can encourage the propagation of native species (mostly trees and cacti) to be used for mixed reforestation processes. The purpose of the nursery is to improve the survival of plants for reforestation, creating more favorable growth conditions for the new plants to develop and gain the strength necessary to be transplanted to a permanent place.
		Source: Conagua. Programa de Reforestación. Mexico: 2010.
		RECOMMENDATIONS There is further opportunity for the project team to expand its efforts from protection and enhancement of existing wildlife and vegetation to the restoration and creation of new wildlife corridors and habitats.
NW 3.2 Control Invasive Species	**9**	**Conserving**
		This credit measures the degree to which projects have taken into consideration the use of appropriate noninvasive species and have made efforts to eliminate existing invasive species. The project team at the PTAR planned to reforest with a mixture of 75% ative mesquite species and 25% pine species. This mixed reforestation is intended to promote higher environmental quality and avoid monoculture. Both of the species specified for reforestation are appropriate for the site and its environmental characteristics. In order to control invasive species, herbicide will be used when necessary at a rate of one liter per hectare per year. At the same time, personnel will manually perform a once per year cutdown of invasive plants for a period of two weeks after the onset of the rainy season. This will promote the development of other plants that are naturally associated with the mesquite in the region, such as pastures or various native herbs, and avoid the propagation of those that interfere with the establishment of mesquite.
		Source: Conagua. Programa de Reforestación. Mexico: 2010.
		RECOMMENDATIONS There is additional opportunity for the project team to establish a management and maintenance plan that addresses prediction and prevention measures to minimize the propagation of invasive species, sets detection and management strategies to identify and catalog the invasive species, and offers strategies for the monitoring and removal of these species.
NW3.3 Restore Disturbed Soils	**8**	**Conserving**
		This credit rewards projects that have made significant efforts to restore soils and areas that have been disturbed during the construction phase of the project, bringing back original ecological and hydrological functions. To prevent soil erosion, the project team at the PTAR planned to regenerate the topsoil towards the end of the construction phase by placing grass in areas

		designated for that purpose, and laying vegetable residual land preserved for that purpose. Later works of reforestation of native species were planned. The topsoil layer that was disturbed during the construction phase was separated and stored for use in subsequent steps in the installation of green areas on the premises. Any plant residue was expected to be shredded or chopped, mixed and scattered in the green areas as a soil. There is photographic evidence of the temporary relocation of topsoils for their later reuse and restoration after the end of construction.
		Source: ATVM. "Capítulo VI Medidas Preventivas y de Mitigación de los Impactos Ambientales," Manifiesto de Impacto Ambiental Modalidad Particular "Construcción y Operación del Proyecto Denominado la Planta de Tratamiento de Aguas Residuales PTAR Atotonilco." Mexico: 2013.
		RECOMMENDATIONS It is recommended to show the percentage of disturbed soil that has been restored
NW3.4 Maintain wetland and surface water functions.	**19**	**Restorative**
		This credit measures the project's efforts to maintain and restore the ecosystem functions of streams, wetlands, waterbodies, and their riparian areas. The construction of the PTAR is planned to improve the quality of sewage coming from Mexico City. The treated water will have two destinations: the Salto-Tlamaco Canal directly feeding the irrigation areas of the Mezquital Valley, and the El Salto River from which some irrigation channels derive - in particular, the Vieja Requeña Canal, discharging its surplus in the Endho Dam. Through the treatment of the water flowing into the El Salto River and the Salto-Tlamaco Canal, the project team at the PTAR succeeds in enhancing hydrologic connections for existing habitats and improving the transportation of sediment and the water quality, enhancing previously disturbed functions.
		Source: ATVM. Memoria Descriptiva. Mexico. n.d.
		RECOMMENDATIONS The project team could work towards initiatives that aim to restore ecosystem functions to achieve fully functioning ecosystems.
NW 0.0 Innovate Or Exceed Credit Requirements		*N/A*
	76	

CLIMATE AND RISK		
	Score	**WATER TREATMENT PLANT ANTOTONILCO, MEXICO**
CR1.1 Reduce	**13**	**Superior**

Greenhouse Gas Emissions		The intent of this credit is to ensure the project team has conducted a comprehensive life-cycle carbon analysis in order to reduce the amount of net greenhouse gas emissions created during the life of the project. From the early stages of design, the PTAR intended to use biogas for the production of electric energy through motor-generators. These motor-generators have been adapted to be able to function with biogas or with natural gas for shared cogeneration of electricity, increasing the sustainability of the project and guaranteeing the availability of energy at all times. Aware of the significant environmental impact that will be generated from the treatment of wastewater from the Valley of Mexico, the ATVM estimates that through the PTAR a reduction of 400,000 tons CO_2 equivalent per year (tCO_2e/year) will be achieved. CO_2 Solutions, in conjunction with ATVM, aims to initiate the process of registration under the Clean Development Mechanism (CDM) to the Executive Board of the UNFCCC (UN Framework Convention for Climate Change).
		Source: ATVM, Procedimiento de Actuación Desarrollo de Proyectos MDL (Mexico: 2015), 4.
		RECOMMENDATIONS In order to fulfill this credit, a streamlined life-cycle assessment should be conducted in accordance with the International Organization for Standardization 14040 and ISO 14044 standards. There is opportunity for improvements in the reduction of emissions as compared to regulatory requirements to achieve carbon-neutral status.
CR1.2 Reduce Air Pollutant Emissions	**0**	**No score**
		The intention of this credit is to reduce the emission of pollutants such as particulate matter (including dust), ground-level ozone carbon monoxide, sulfur oxides, and lead, as well as noxious odors. In regards to air pollution, the PTAR will comply with federal laws and regulations and Mexican Official Standards that are applicable to prevent and control air pollution. Activities in four stages of development of the project will be carried out in such a way that air pollution is kept to a minimum. Regarding the control of dust, necessary measures are taken to prevent unnecessary dusting. Land surfaces prone to release dust will be kept moist with irrigation or by reducing applications of chemical dust. The dusty materials collected in piles or subject to vehicular traffic, when feasible, will be covered to prevent dust. Buildings for operating facilities that may be affected by dust will be protected conveniently. In terms of emissions, it is known that gases will be generated during the treatment of wastewater and sludge; however, control and treatment equipment have been incorporated during the design process to prevent the discharge of the gases generated into the atmosphere - this includes the removal of odor from the wastewater treatment system, the sludge water torches biogas and the absorption of chlorine.
		Source: ATVM, MEAI DP 08 Memoria Descriptiva (Mexico), 73.

		RECOMMENDATIONS There is further opportunity for the project team to include active controls and monitoring systems as well as establish measures for mitigation. The project should follow the California Ambient Air Quality Standards and should follow Sections XI and XIV of the South Coast Air Quality Management (SCAQM) rules. The project should aim not only to create zero net production of pollutants but also to implement measures to improve air quality beyond pre-development levels.
CR2.1 Assess Climate Threat	**0**	**No score**
		This credit measures the steps taken by the project team to prepare for climate variation and natural hazards. The project team should provide a comprehensive Climate Impact Assessment and Adaptation Plan. There is no evidence provided by the project team for this category.
		Source: -
		RECOMMENDATIONS An impact assessment and adaptation plan should be provided, including calculations of expected changes in flood elevations or sea rise. An inventory should be made of structures important to the operation of the project that are located in areas of possible inundation and a plan developed to address these changes. There is opportunity for the project team to identify the community outreach efforts taken during this process as well as to get input from local emergency management departments.
CR2.2 Avoid Traps And Vulnerabilities	**0**	**No score**
		This credit measures the extent to which the project team has assessed potential long-term traps, vulnerabilities and risks due to long-term changes (such as climate change) and measured the degree to which these affect the community. There is no evidence provided by the project team for this category.
		Source: -
		RECOMMENDATIONS The project team should identify and assess possible traps and vulnerabilities that could create high, long-term costs and risks for the nearby communities. A detailed plan outlining the potential traps and vulnerabilities as well as their associated costs and risks should be provided.
CR2.3 Prepare For Long-Term Adaptability	**16**	**Conserving**
		The intent of this credit is to ensure that infrastructure systems are designed to be resilient and adaptable to the consequences of long-term climate change. For the design of the civil works and facilities of the PTAR, a balance between cuts and embankments has been considered to optimize full earthmoving while achieving the elevations necessary to position the facilities outside the risk of floods. The PTAR has been designed taking into consideration surface drainage works to prevent flooding in case of torrential rains. The pavement of roads found within the PTAR has been designed based on the properties of the subgrade soil as well as loads and expected traffic frequencies. In sloping

		zones, channels beside the road have been included with sufficient depth to prevent the flow of rainwater to infiltrate and saturate the subgrade. In the area between the El Salto river and the railway, a perimeter wall of block concrete has been designed to help in controlling flooding and water infiltration into the buildings, roads and other components of the PTAR. Considerations were also taken to build storm drains to prevent the pooling of rainwater. Drainage facilities will be adequate to prevent damage to the works, the land and adjacent properties. The existing channels and drainage pipes are conditioned to transport all flows attributable to activities of the work. Dams will be built if necessary to divert spills and prevent entry to adjacent properties to protect the premises of the work and to drive water channels and drainage pipes. Ponds will be permitted as necessary to prevent flooding. The PTAR has been designed to prioritize the production of electric energy on-site as one of its primary functions. This generated energy will be the preferred use of electric energy for the operation of the plant and emergency systems, supplied by the cogeneration system. Each substation will feature automatic transfer boards to be fed by emergency power plants located in the substations. Because of this feature, the plant has been able to increase its resiliency and independence from external energy suppliers, which can be viewed as adaptation to long-term conditions.
		Source: Conagua Planeación y Proyectos de Ingeniería, S.C., Manifestación de Impacto Ambiental Modalidad Particular, para la Planta de Tratamiento de Aguas Residuales de Atotonilco, Estado de Hidalgo "PTAR Atotonilco" (Mexico: 2010), 5-7, 13, 18, 20, 68-69.
		RECOMMENDATIONS There is more opportunity for the project team to form strategies to prepare for, or mitigate the negative consequences of, climate change or other significant alterations in environmental and operating conditions, which can include structural changes. There is also opportunity for incorporating decentralized systems for operation that distribute networks and help spread risk in case of failures or emergencies.
CR2.4 Prepare For Short-Term Hazards	**10**	**Superior**
		This credit rewards projects that have taken steps to protect against natural and manmade short-term hazards. The project team at the PTAR naturally considered possible emergencies related to the operations of the plant and incorporated measures to respond during the design and construction phases. After the identification and prioritization of risks, the PTAR team made several changes in order to ensure that there is no risk to surrounding populations. Of the security systems incorporated, one includes equipment that attends to chlorine gas leaks. Others incorporate safety control systems of absorption, alarm, ventilation, and backup. There is no specific identification of the probability that risks happen in a 25- or 50-year timeframe. At the same time, preventive measures such as training programs are in place to regularly perform emergency response drills for all staff at the plant. In addition, the specialized staff that runs the chlorine equipment is to be trained and certified in manual operation, safety, and hygiene according to the criteria established by the American Institute of Chlorine. There are also scheduled annual audits and inspections of the machinery by qualified third party companies to verify the compliance of norms and recommendations that will guarantee security measures are in place.
		Source: SEMARNAT, Oficio Número BOO.03.03.-0299 (Mexico: 2010), 10-12, 25-325.

		RECOMMENDATIONS There is additional opportunity for the project team to identify and research possible natural hazards that can have an impact on the operations of the plant and the safety of its workers (and how these disasters may change over the life of the project). After this analysis, measures should be included in the design and operation of the plant to safeguard against them. It is recommended to identify the probability of these types of events happening in order to prepare for them.
CR2.5 Manage Heat Island Effects	**2**	**Enhanced**
		The intention of this credit is to encourage the minimization of surfaces with low solar reflectance in order to reduce heat accumulation and manage microclimates. The building surfaces at the PTAR have been specified to be painted white in order to reduce localized heat accumulation, allowing for an estimated 30% of hardscape surfaces to meet solar reflectance index requirements.
		Source: Comex, Informe de Resultados de Análisis (Mexico: 2012)
		RECOMMENDATIONS There is further opportunity to reduce heat island effects to a greater extent by considering more surfaces with solar reflectance and increasing vegetation and materials that can positively alter microclimates around them. Drawings or diagrams showing areas that meet the requirements of solar reflectance index should be provided in order to estimate the percentage of the project's surfaces that could be improved.
CR0.0 Innovate Or Exceed Credit Requirements		*N/A*
	41	

OVERALL:	**342**	**WATER TREATMENT PLANT ANTOTONILCO, MEXICO**

APPENDIX E: SOURCES

DOCUMENTATION PROVIDED
General Information.

ATVM. *Biogeosphere 2035.* Mexico: 2014.
ATVM. *Datos de Empleos Directos Generados por la PTAR Atotonilco*. Mexico: 2015.
ATVM. *Mejora de Espacios Culturales*. Mexico: 2011.
ATVM. *Lista de personal que realizó prácticas profesionales en la PTAR Atotonilco y obtuvo un puesto de trabajo.* Mexico: 2015.
ATVM. *Rehabilitación, Recuperación, Creación y Reutilización de Infraestructura Existente.* Mexico: 2015.
ATVM. *Resolutivo de Modificación.* 2015.
ATVM. *Estudio para Determinar el Nivel de Emisión de Ruido Proveniente de Fuentes Fijas.* Mexico: 2015.
ATVM. *Estudio de Tipología de Pantallas Acústicas.* Mexico: 2009.
ATVM. *Memoria de Cálculo Alumbrado Exterior.* Mexico: 2012.
ATVM. *Contrato de Transporte de Personas*. Mexico: 2011.
ATVM. *Estación para Ascenso y Descenso Peatón.* Mexico: 2015. (*Images)*
ATVM. *Alternativas de Transporte.* Mexico: 2015. (*Images)*
ATVM. *Transporte Público Brindado para el Personal de la Planta de Tratamiento de Aguas Residuales Atotonilco de Tula.* Mexico: 2015.
ATVM. *Segundo Reporte Anual de Cumplimento del Programa de Vigilancia Ambiental de los Resolutivos de Impacto Ambiental No. S.G.P.A.DGIRA.-DG.6159.10, S.G.P.A.DGIRA.-DG.7400.10*. Mexico: 2012.
ATVM. *SH_0000_DGO_PN_0001_0_A Atencion y respuesta a Emergencias*. Mexico: 2015.
ATVM. *Apoyo a Seguridad Pública Municipio de Atotonilco de Tula*. Mexico: 2012.
ATVM. *Convenio de Colaboración para Llevar a Cabo Labores de Salvamento Arqueológico*. Mexico:

2015.
ATVM. *Salvamento Arqueológico en el Predio de la Planta de Tratamiento de Aguas Residuales (PTAR) Atotonilco.* Mexico: 2015.
ATVM. *Colaboración de las Comunidades con la PTAR Atotonilco.* Mexico: 2012.
ATVM. *Mejoras al Espacio Público.* Mexico: 2015.
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