



METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM

Phase II

Ecuador

**Cataloging-in-Publication data provided by the
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Metropolitan Quito Environmental Sanitation Program - Phase II, Ecuador / Catalina Picón, María Ignacia Arrasate, Andreas Georgoulas, Marcello Basani María Cecilia Ramírez, Graham Watkins, Hendrik Meller.

p. cm. — (IDB Monograph ; 449)

Includes bibliographic references.

1. Sanitation-Ecuador. 2. Water-supply-Ecuador. 3. Infrastructure (Economics)-Ecuador. I. Picón, Catalina. II. Arrasate, María Ignacia. III. Georgoulas, Andreas. IV. Ramírez, María Cecilia. V. Watkins, Graham. VI. Meller, Hendrik. VII. Basani, Marcello. VIII. Inter-American Development Bank. Water and Sanitation Division. IX. Series.

IDB-MG-449

JEL code: O22, Q01, Q25, Q53, L95

Keywords: Sustainability, Infrastructure, Water, Sanitation, Ecuador

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This work is part of a series of case studies on sustainable infrastructure practices at the IDB. Cases are not intended to serve as endorsements, sources of primary data, or illustrations of effective or ineffective project design or implementation. The authors would like to thank Oscar Camé, Annika Keil, and Sven Muller (IADB); and Xavier Vidal, José Balarezo, Ingrid Narvaez, and Lucia Burgos (EPMAPS) for their valuable input.

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Cover picture: New public space after the environmental restoration of the Ortega Ravine (Sources: Vidal, Xavier, e-mail message to author, October 7, 2015).

EXECUTIVE SUMMARY

This evaluation applies the Envision™ Rating System on the **Metropolitan Quito Environmental Sanitation Program - Phase II** in Ecuador, focusing in the environmental restoration of Quito's natural drainage system. Envision is a unique system that assesses the sustainability of infrastructure projects, which awards efforts to pursue sustainable values going beyond standards practices. The following assessment demonstrates the achievements of the project and aspects to improve, considering a broad range of criterion. The assessment is organized in 5 categories: Quality of life; Leadership; Resource Allocation; Natural World; and Climate and Risk.

The primary objective the program was to enable the Metropolitan Quito Water and Sewerage Company (EPMAPS) to provide residents of the Metropolitan District of Quito (DMQ) with efficient and sustainable water, sewage, and flood control services. This public program was developed and is operated by EPMAPS. The total cost of the program was US \$112,790,000, with a contribution of US \$67,100,000 from the Inter-American Development Bank (IDB), which was endorsed by Ministry of the Economy and Finance of Ecuador, as well as a national counterpart contribution of US \$42,790,000.¹

When the program was designed, some areas of Quito had inadequate water supplies and no access to proper sewage disposal moreover, years of environmental degradation related to unplanned development and uncontrolled urban expansion on the hillsides and ravines that surround the city have deteriorated natural drainage systems and increased the risk of landslides and flooding, as well as the damages that these types of events have caused. As a response to these problems, the second phase of the program was

composed of five components which were implemented simultaneously throughout the development of the program. These components included potable water system improvements, construction of new sewerage, construction of underground stormwater collectors for flood control, landslide management through environmental restoration, and institutional capacities development.

Among all of the efforts carried out by the program to improve water management in the DMQ, the environmental restoration of 19 ravines stands out the most.² The enhancement of these areas has prevented and minimized the risk of landslides and flooding, making Quito a safer and more resilient city. Furthermore, work with the community characterizes these interventions. One example of this type of work is the restoration of the Ortega Ravine; in this case the program considered the active participation of senior citizens to construct a collective memory of the area and restore the landscape to its initial state. These interventions demonstrate that engineering works alone are not enough to solve problems, and that integration of the environment and the local community can produce better sustainable solutions.

The program not only improved Quito's water and sanitation infrastructure but also promoted interventions to enhance the overall quality of life for the local community, while respecting and enhancing the local landscape. This was achieved by proposing a territorial approach instead of limiting the scope of the work to simply improving the sewage and drinking water systems as a local intervention. This systemic approach that sought to recover natural drainage systems, complemented by engineering works, improved the quality of life for the communities, as it made it possible to reduce the damages caused by landslides and floods from torrential rains. Aside from the work undertaken to improve the potable water and sewage system, new infrastructure for stormwater management and cost-efficient services were also provided. In addition, high-quality recreational

¹ IDB website. Project Information. December 2015. <http://www.iadb.org/en/projects/project-description-title,1303.html?id=EC-L1022>

² EPMAPS. Quebradas Recuperadas. Elaborated by Lucía Burgos (July, 2014), 1

areas developed through environmental restoration also contributed to enhancing overall livability conditions in Quito. Community involvement was essential to achieve a successful result; however, a plan for the incorporation of vulnerable groups should be included into future phases of the program.

The implementation of the environmental conditioning program in degraded areas contributed to improving the low amount of green area per inhabitant in Quito, especially in the southwest zone where no such interventions had been developed so far. In total, 19 ravines comprising a total of 208 acres (84 ha approx.) were intervened.³ In the Ortega Ravine project, new infrastructure was constructed such as lighting, playgrounds, lagoons, and workout equipment, among others. This infrastructure was also incorporated as a way to protect the ravine from misuse and to control urban sprawl.

In addition to the restoration works undertaken in the ravines, the program encouraged their connectivity with surrounding areas and communities. To achieve this, special attention was given to the creation of a new network of trails and pedestrian paths that connected the opposing borders of the ravines. An example of these efforts is the work done in the Ortega Ravine, where the intervention provided visual and social connectivity between the edges of the ravine, as well as exposure to the natural environment with the construction of viewpoints. However, there still is room for improvement in the integration of these interventions with the existing urban system, such as the pedestrian transportation network.

In relation to the preservation of historical and cultural resources, one of the highlights of the city of Quito are the heritage sites located within the city center, which UNESCO declared a Cultural Heritage of Humanity in 1978.⁴ To preserve the buildings that constitute the site, the program used new materials and technologies for the construction of underwater collectors, and special consideration was given to worker safety in order to reduce risks during construction.

The program successfully incorporated ways to engage and enhance its relationship to nature, by mitigating the impacts of urban development on the natural ecosystems and integrating territorial planning measures to avoid future unplanned development. Moreover, the program's interventions promoted the protection of land that is defined as "prime habitat" by the General Secretary of the Metropolitan Council of Quito. It should be noted that it also promoted the occupation of undeveloped land by expanding the sewerage network in the Calderon district in the northern part of Quito, though it did so having developed a planning framework in close coordination with the local municipality to control future development, and guarantee better standards for Quito's growing population and urban expansion.

To recover contaminated water bodies and provide a healthy environment, EPMAPS has been developing various projects to make viable the treatment of wastewater. The comprehensive recovery solution began with a detailed study of the watershed involved. Based on this analysis, the Water and Sewerage Master Plan (1997) was updated in 2008.

The existing hydrological patterns of the natural water systems, including the surface and groundwater systems as well as watersheds, were addressed in a detailed hydrological study developed by a U.S. firm (Hazen and Sawyer). This study provided an integral perspective for water management, with the objective of ensuring the long-term useful life of the program. Additionally, the study was used as guideline for technical planning to elaborate on the Water and Sewerage Master Plan for Quito, as well as in performing a feasibility analysis for river decontamination and gray water treatment in the metropolitan area.

By working on a territorial scale, EPMAPS protected natural drainage systems by applying watercourse protection strategies, and preserved floodplain functions by creating new pervious surfaces for groundwater infiltration. In relation to stormwater management, the program carried out baseline assessments (water quality and characterization studies) to achieve improvements

³ EPMAPS. Quebradas Recuperadas. Elaborated by Lucía Burgos (July, 2014), 2

⁴ José Balarezo, e-mail message to author, September 30, 2015.

in the water quality of Quito's rivers. One of the main objectives of these studies was to maintain the existing natural hydrological network conditions within the program area, through the interception and treatment of more than 95% of the wastewater discharges generated in the metropolitan area of Quito.⁵

The program considered problematic geological formations, and took measures to safeguard aquifers in order to reduce the risks of natural hazards and preserve high-quality groundwater resources. Geological complexity was avoided when siting water-related facilities. Buffers were established around challenging geological areas, and were complemented by runoff controls, spill prevention measures, and cleanup plans. The geological assessment was important to avoiding and minimizing the conditions of risk in the ravines. Green infrastructure was utilized to control erosion and runoff by stormwater, thus reducing the risk of landslides.

The program made appropriate planting efforts in the environmental conditioning of the ravines, so as to improve upon and expand wildlife corridors and link existing habitats and also control invasive species. To achieve this, the work included relocating families living in informal housing, cleaning the debris accumulated over the years, and the restoring the soil to predevelopment conditions.

The program's integral and holistic approach, plus its long-term perspective, demonstrates attentiveness to reducing vulnerabilities in the face of short-term natural hazards, thus promoting a more resilient city. The environmental restoration of the 19 ravines, the interventions for stormwater management, and the increase of infiltration capacity by restoring soils, complemented by the definition of risk-prone areas with regard to the relocation of families living within these areas, directly contributed to reducing short-term risk. Moreover, the actions undertaken by EPMAPS also helped to strengthen the social fabric along the slopes through management training for the local administrative authorities and the maintenance of pleasant natural and urban settings for residents to enjoy the mountainous

landscape, providing a better quality of life for the nearby communities. Furthermore, the program's improvements with regard to planning and landscape interventions contributed to better preparing Quito for long-term adaptability to extreme weather events, such as intense rainfall, and also helped manage the heat island effect by achieving a 10-30% reduction of heat-producing surfaces.⁶

The successful development of the program owes something to the solid leadership demonstrated by the team. To foster collaboration and teamwork, the program team approached the program as a systematic and interconnected set of systems. Along these lines, the collaboration between EPMAPS and the municipality of Quito was fundamental in ensuring the maintenance of the executed works, especially of the restored public spaces within the ravines. In this agreement there was a special commitment to implement an integrated management of Quito's hillsides by generating sustainable institutional and financial tools and promoting community involvement.

Another relevant aspect was the creation of a special Execution Unit with financial autonomy, decision-making independence, and continuity beyond changes in political power. This unit ensured technical control, cost optimization, and optimal execution time for the diverse works within the program. Two important lessons can be extracted from this type of management system: first, that it is extremely important to ensure that the unit in charge of the program's implementation has decision-making authority, and second, that the same team should be maintained through the duration of the program.

Regarding the improvements in infrastructure integration, all of the program investments were planned to create linkages and enhance synergies, and by doing so to improve the overall performance of the program. One key decision was to transform the typical management of water and sanitation into an integrated program that will not only enhance the potable water and sewage system, but also restore important natural

⁵ Resumen Ejecutivo de la Intercepción y Tratamiento de las Aguas Residuales de Quito y Parroquias Anexas. Asociación Hazen and Sawyer-Pi Epsilon.

⁶ Proyecto de Acondicionamiento Ambiental de la Quebrada Ortega Informe Final.

drainage systems such as ravines. The scope of the program increased community benefits and generated better and long-term solutions for existing water and sewage problems, which in turn promoted a better integration within the local community and fostered a long-term sustainable intervention. The completion of these interventions was supported by participatory processes, with the recognition that execution and management would not be possible without the participation of stakeholders in the area.

Over the course of the program's implementation, it was necessary to ensure that policymakers and other public authorities were made aware of the program's important issues and processes. To achieve this, the project team conducted meetings with stakeholders and incorporated their feedback into the process.

In relation with **resources** used, the program advanced the values of sustainability by minimizing transportation costs, utilizing only materials produced, extracted, or processed within the region. Many specific actions demonstrate the program's commitment to achieving sustainable goals. For example, to reduce the use of virgin materials and avoid sending useful materials to landfills, the program developed a waste management plan to reduce waste generation while construction was under way. Specific information is provided on the construction phase of the extension of the El Troje water treatment facility, where 25% of waste production was eliminated.⁷ In order to minimize environmental impacts during the construction of the El Trébol tunnel, the program reduced by 30% the movement off site of soil and other excavated materials.⁸ To do so, the program reutilized the project's excavation materials within nearby projects that needed these types of materials.

With regard to the availability, quantity, and quality of freshwater, the program improved the efficiency of the potable water and sewage systems. Aside from the actions already undertaken by the program, advanced recycling and the reuse of water to meet water needs have been encouraged in order to achieve a greater reduction in potable water consumption. Furthermore,

by monitoring water use and leak detection, the studies conducted for the optimization of the potable water system prevented the needless waste of potable water, and reduced the energy and emissions associated with its treatment and distribution. Additionally, hydraulic studies were conducted in order to optimize drinking water distribution, which allowed the reduction of the Non-Revenue Water index, especially in rural areas.

While the program produced innovations and high levels of achievement in multiple areas, potential for improvement does remain in other areas. Specifically, future phases of the program's development should consider the resources utilized. Opportunities for improvement could include reductions in net embodied energy of materials utilized in construction (as compared to industry norms), and preferential sourcing of materials from suppliers that implement sustainable practices. Special consideration could also be given to recycling and reuse at the end of life of materials used in the multiple components of the program, which could be especially relevant in the case of water treatment plants which incorporate prefabricated components. Additionally, the program could conduct planning or design reviews in order to identify and analyze the options for reducing energy consumption in operations and maintenance, and evaluate the feasibility of utilizing renewable energy to help reduce the need for fossil fuel sources.

⁷ EPMAPS, Libro de Obras Anexo 10F, (July 2013).

⁸ EPMAPS, Anexo 10B, Libro de Obras para la construcción Túnel el Trébol. (March, 2011).



PROJECT DESCRIPTION AND LOCATION

The Metropolitan Quito Environmental Sanitation Program – Phase II is a public project developed and run by the Metropolitan Quito Water and Sewerage Company (EPMAPS). In Quito the provision of water and sanitation services is the responsibility of the Municipality of the Metropolitan District of Quito (DMQ), which delegated the project to EPMAPS.

The total cost of the program was US \$112,790,000, with an estimated contribution of US \$67,100,000 by the Inter-American Development Bank (IDB) – endorsed by Ecuador’s Ministry of the Economy and Finance – and a national counterpart contribution of US \$42,790,000⁹. The IDB’s support has enabled the company to put its efforts into seeking efficiency and providing sustainable quality service to the entire community in a manner consistent with the IDB’s public utility service policy.

The IDB approved the program on the basis of compliance with the 2002 strategy agreed upon with the national government: a strategy aimed at poverty relief and human capital development, efficient management of infrastructure with the participation of private-sector actors, modernization and decentralization of the state, as well as overall promotion of sustainable development.

EPMAPS executed Phase II through the Executing Unit for the Environmental Sanitation Program (PSA), which was supported by the company’s operations departments and is responsible to the Bank for administration of land funds, monitoring Phase II, and coordination with others institutions. This arrangement

provided autonomy in decision making, eliminating duplication of functions, and put a new Executing Unit in charge of hiring highly trained personnel. This program was developed in response to the city’s recent accelerated growth, coupled with a shortage of basic infrastructure services and housing. These conditions have fostered progressive environmental degradation which has increased several risk factors. Risks from natural disasters such as flooding, landslides, mudslides, and land slippage can result in the loss of human life, property damage, and economic disruption.

The Environmental Sanitation Program was developed in two phases. The first began in 2003 with completion in 2007; Phase II was approved in 2006, began in 2007, and was completed in December of 2014 and completed in April of 2015. The initial timeline for Phase II was 6 years, with the intention to benefit 250,000 people in a 16,061-acre area with natural and urban elements¹⁰. The structuring of this program in phases reflected the need to support capacity building of both the municipal government and EPMAPS. Financing was directed toward the expansion of water and sewer services, and for slope management associated with storm sewers. This financing, along with the implementation of various institutional and financial reforms, aimed to gradually improve the company’s prospective sustainability, thus increasing its overall attractiveness for additional funding sources.

The purpose of the second phase of the Environmental Sanitation Program was to enable the Metropolitan Quito Water and Sewerage Company (EPMAPS) to provide residents of the DMQ with efficient and sustainable water, sewer, and flood control services. The objectives were to make water and sewer services in the DMQ financially sustainable in the long term; to make investment in and operation of EPMAPS-operated systems economically efficient; and to ensure universal access to water, sanitation, and flood control services for residents. Many residents relied on poor-quality water supplies and had not had access to proper sewage disposal; therefore this program was aimed to reduce the risk of waterborne illnesses.

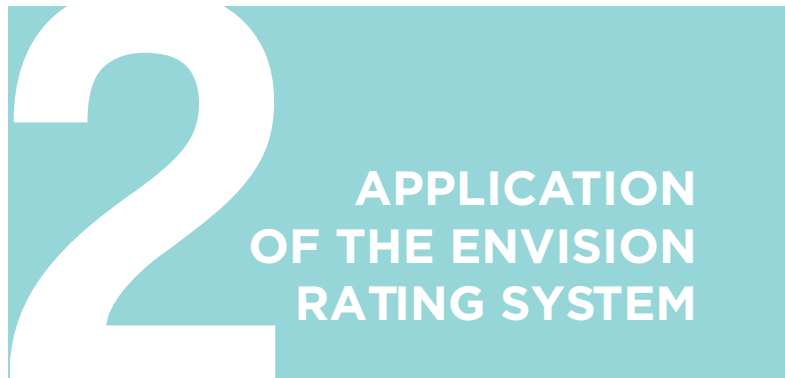
⁹ IDB website. Project Information. December 2015. <http://www.iadb.org/en/projects/project-description-title,1303.html?id=EC-L1022>

¹⁰ IDB. Informe de Terminación de Proyecto PCR. (March, 2015) 22

This second phase of the program was composed of five components: potable waterworks, sewage works, flood control, landslide management, and institutional reinforcement. These five components were undertaken simultaneously throughout the development of the program.

The main goals of the potable waterworks component were to extend and optimize the capacity of the existing system, and to reduce water loss. The sewage projects aimed to enable urban expansion in the north area of Quito by increasing the network's coverage area. Side studies were conducted to understand how to improve water management norms and deal with river decontamination. The flooding control program comprised the largest part of the budget, due to the need to construct technically challenging underground water collectors. The purpose of the landslide management interventions was to manage risk and prevent damages, improve natural drainage, and control flooding. Some community interventions were taken and included the relocation of families living in high-risk areas, community involvement with the program, and the creation of new public spaces. Finally, the institutional strengthening component of the program addresses two needs. The first is to revise the business model, update information systems, and establish differentiated discount rates in order to improve operations and maintenance within EPMAPS. The second is to support the municipalities in the development of zoning studies and territorial planning in the areas where the program is implemented.

After the completion of Phase I, the DMQ and EPMAPS concentrated investments on sewage treatment and solid waste management. In Phase II the mayor of the Metropolitan District of Quito intended to extend the services to the entire DMQ through a citywide services concession, and transfer administration of the concession contracts to EPMAPS. The DMQ as part of this operation asked the IDB for support in preparing the plans and studies for this endeavor, and additional financing¹¹



2 APPLICATION OF THE ENVISION RATING SYSTEM

Metropolitan Quito Environmental Sanitation Program
- Phase II, Ecuador

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 to be assessed is the Metropolitan Quito Environmental Sanitation Program - Phase II in Ecuador.

Envision consists of 60 credits¹² 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.

The criteria for the levels of achievement vary from credit to credit, but generally an “improved” level

¹¹ Inter-American Development Bank - IDB, Ecuador Metropolitan Quito Environmental Sanitation Program (Phase II) (EC-L1022) Loan Proposal. 8

¹² Plus 3 new credits of the Vulnerable Groups subcategory

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 and Zofnass Program websites

as growth, development, job creation, and general improvements related to quality of life. Phase II of the program is considered to have achieved a high performance, yet there are still many things that could be improved upon to reach a higher level, especially with regard to improving local skills with a long-term perspective.

The program proposes a territorial approach, instead of just fixing the sewage and drinking water system. Also, the program team understand that the program will be more successful if the communities are involved by understanding their needs and by allowing them to meaningfully engage with the program. These guidelines would be much stronger if they would be related to a long-term sustainable economic development, as it would help to formalize the new territorial organization.

The sewage and drinking system that the program proposed was very important for improving the quality of life for the population. This is mainly because they were also able to reduce damages in basins and ravines caused by torrential rains that led to landslides and floods. Also, they have provided more and improved connections for drinking water, cost-efficient services, and high-quality environmental areas for mobility, recreation, enjoyment, contemplation, and appropriation of the natural environment.

The scale of the intervention is very important, as it gives a citywide rather than a local impact by trying to integrate the program into the city’s urban structure. A large investment has been made in community development for the management of natural and urban green spaces in the intervention zones and in improving trash and solid waste management of the zones. Community involvement was essential to achieve a successful result and provide a long-term maintenance.

Regarding sustainable growth, while the program was not focused on providing direct types of jobs or educational programs for sustainable and long-term economic growth in areas involved, its various interventions will improve capacity, competitiveness, and attractiveness



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 three four subcategories: Purpose, Well-being, Community, and Vulnerable Groups.

Purpose

The Purpose subcategory addresses the program’s impact on functional aspects of the community, such

¹³ www.sustainableinfrastructure.org

¹⁴ www.zofnass.org

overall for the community. According to available local skills, the program should shift from focusing on hiring local workers for specific jobs to committing to working with the local community in order to assess local employment and educational needs, and to address future community competitiveness.

Well-being

The Well-being subcategory addresses individual comfort, health, and mobility as integral parts of the community. Special attention is given to encouraging alternative modes of transportation and incorporating the components of the program into a larger community mobility network. The program achieved a moderate performance in this regard, contributing to the creation of a network of paths in new public spaces; however, there is still room for improvement, mostly in relation to the integration of the specific interventions with other urban systems, such as the transportation network.

The program achieved a remarkable performance in relation to the use of new materials, technologies, and methodologies, and the special considerations undertaken in health and safety to reduce risk during construction. This was the case for the expansive concrete utilized for the Machángara river channeling, where new construction techniques were applied, and also for the construction challenge posed by the tunnels under the historical center for the 24 de Mayo and the El Tejar stormwater collectors. For cases such as those just mentioned, the program held orientation meetings for workers, to educate and refresh them on industrial safety and occupational health measures to prevent accidents, specifically for the implementation, care, and risks associated with new materials used. The environmental management plan in each project also contained measures to reduce risks affecting the health or safety of the population.

Regarding public nuisances, noise, and vibration, baseline studies were done, and the DMQ managed a noise monitoring network through the Department of the Environment in order to check compliance with environmental regulations. Additionally, during the execution of the program, standard safety preventive signals were located in strategic areas, thus improving user safety. Moreover, lighting was installed in ravines to allow for the safe passage of users from the surrounding communities at all times.

A common practice of the general program was to lessen the work's impact on the communities' mobility through interinstitutional coordination. Thus the program collaborated with the Public Enterprise Mobility and Public Works (EPMMOP) whenever traffic was interrupted by construction work. The program's environmental conditioning projects sought to stop urban expansion in protected, vulnerable, and rural

areas which are not suitable for settlement. Nonetheless, it should be noticed that the sewage projects enabled planned urban expansion by increasing the network's coverage area, hence attracting new families to move in to that area. The program team also sought to solve the inhabitants' mobility issues between the edges of the ravines by building bridges and walking paths. Regarding the Ortega Ravine project, the design was not limited to environmental enhancement, but sought to integrate the ravine with the existing urban structure. Alternative modes of transportation were encouraged, not only by providing new pathways but also by creating a connected circuit that integrates the three sections of the ravine. Ultimately, it is important to highlight the coordination of the program with municipal institutions to solve public transportation issues.

Community

The Community subcategory measures how the program respects and maintains or improves its surroundings through a context-sensitive design. In the case of the Environmental Sanitation Program – Phase II, the level of performance for this subcategory is high. The program not only improved Quito’s water and sanitation infrastructure, but it also promoted interventions to enhance the overall quality of life for the local community, while respecting and enhancing the local character.

The program team has given special consideration to enhancing and restoring the ravines of those areas that are considered to be areas of natural heritage. They worked to restore the flora and fauna of these areas; hence, they sought to incorporate these zones as preservation areas and protect them with the cooperation of nearby inhabitants. In this regard, the program was formulated to incorporate the community in the design so as to rescue and reproduce people’s collective memory of the former condition of these areas. A basic feasibility analysis was performed to detect and avoid impacting cultural resources in the design. An example of this was the work conducted in the historic center of Quito, where special care was taken during excavations for the underground stormwater collectors.

One of the main actions of the plan while restoring the Ortega Ravine area was to visually connect the borders of the ravine. This idea was achieved by designing viewpoints within its border so that users could contemplate nature. These interventions allowed visual and social connectivity between edges of the ravine as well the contemplation of the natural environment. This and all of the environmental conditioning projects were formulated to recover the ravines that were previously used as dump areas. Moreover, participatory design was developed with the Zonal Administration officials, involving the community to implement resting and sight areas along the paths

The actions undertaken by the program not only sought to

enhance the existing public areas but to create new ones. The implementation of the environmental conditioning program in degraded areas helped improve the low level of green area per inhabitant in Quito, especially in the southwest zone, where no such interventions had been developed previously. In the Ortega Ravine project, new infrastructure was incorporated as a way to protect the ravine from misuses and urban sprawl. These new programmatic areas promote the ravine’s accessibility, as people can now flow from one edge to the other, but also its consolidation as a public space. The viewpoints were designed not only as a way to visually connect the two edges of the ravine, but also to provide an area where people could contemplate the natural heritage of their city and hence make them part of the educational process.

Vulnerable Groups

The Vulnerable Groups subcategory evaluates the extent to which the program contributes to the quality of life for women and diverse groups. The program demonstrated a low performance in this area, having addressed limited considerations for these groups. Nonetheless, the team’s comprehensive participatory effort in the ravine projects shows that these groups were integrated into the discussions.

The Plan for Environmental and Social Management took the nearby communities into account before developing its program, holding several meetings and workshops so that individuals could voice their opinions and interests. The project team clearly understands the type of population that lives near the area of intervention, and thus has taken their specific needs into consideration. For example, in the Ortega Ravine project, the team interviewed neighborhood leaders, senior citizens, young people, and children from the zone, and included their opinions and needs in the design phase of the project. Community workshops helped validating the program, as well as communicating the community’s expectations and ensuring the program’s commitments to the neighborhood.

Although several workshops and meetings took place to help the project team become aware of citizens' problems as well as their expected solutions and requirements, none of these gatherings considered women and diverse groups as separate groups, as was done for children and senior citizens. Furthermore, the program didn't include any initiatives to promote women's economic empowerment, either during construction or as part of the program's educational programs for the community.

The program did not consider that the different social groups' patterns and needs for mobility could be altered by the constructed works, although diverse groups were always present in community workshops and meetings and their concerns were addressed by the team. In the future, it is recommended to address the social benefits of projects by identifying safety issues and taking actions to produce a positive impact on mobility patterns for women and diverse groups.

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



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 addresses how the program includes a wide variety of stakeholders to fully capture synergies, savings, and opportunities for collaboration. This requires leadership, commitment, and often new ways of managing the process. The program showed a solid performance in all aspects, and stood out in relation to fostering stakeholder collaboration at all levels, especially with communities and local governments. However, it would have been advisable to have included a planned community involvement program. In addition, the elaboration and publication of an annual report to address and monitor the progress of the sustainable goals of the organization is recommended.

The implementation of the fifth component of the program sought institutional reinforcement of EPMAPS and the municipality, which was supported by an interinstitutional agreement for cooperation. This agreement was signed by the Municipality of the DMQ and EPMAPS, and developed for the execution of the

environmental and social program. This collaboration was fundamental to ensuring the maintenance of the executed works, especially that of the restored ravines. In the agreement there was a special commitment to implementing integrated management of Quito's hillsides by generating sustainable institutional and financial tools, and promoting community involvement.

In the Plan for Environmental and Social Management, the functions and responsibilities to address the program's issues of sustainability have been clearly assigned at a department level, and each entity involved had a clear role in achieving a sustainable performance. Moreover, the creation of a special execution unit ensured the technical control, optimization of costs, and the times of execution of the program's multiple projects. The program's interinstitutional coordination was strengthened by the participation and collaboration of area administration and public enterprises, which consolidated a new comprehensive and integral management model for the work on the slopes. In addition, the municipal zoning department technical capacities were strengthened to ensure the implementation of the interventions. Overall, the program's environmental, social, and economic objectives were accomplished and are aligned with the goals and needs of the community.

To foster collaboration and teamwork, the actions undertaken by the program team sought to approach the program as a systematic and interconnected set of systems, considering the context of the entire city's infrastructure. This view contributed to optimizing the overall performance of the program. A common characteristic was the teamwork between the technical and social personnel involved in the program's development. For instance, the completion of the hillside management interventions was characterized and supported by participatory processes; the team recognized that its management was not possible without the participation of all relevant stakeholders of the area, including the community, whose commitment was required.

Management

The Management subcategory evaluates the extent to which the program team identified by-product synergies, and how the design of the completed program integrates with existing and planned community infrastructure. With regard to community infrastructure, the project achieved a high level of performance by transforming a water management and sanitation program into an integrated intervention by mitigating risks and reducing damages, creating new public spaces, and considering territorial planning.

The pursuit of opportunities to use unwanted by-products or discarded materials from nearby operations could improve the program's performance, but the program did not seem to have highly advanced by-product synergy development. Nevertheless, some internal considerations were undertaken; for instance, the debris generated due to minor earth movements was reused in the program to raise up depressed areas, and recycled rubber was used for the trail paths of the ravines. It is recommended that in future the program team shift to more systematic efforts to identify unwanted by-product materials that could be used by the program.

Regarding improvements in infrastructure integration, all of the program investments were planned to create linkages, enhance synergies, and thus improve the overall performance of the program. One of the most successful components was the decision to transform a typical hydrological regulation project into an integrated system that not only included improvements to water and sanitation, but also has worked to restore the natural drainage system of the area's ravines, thus mitigating risks of landslides and flooding. This integrated intervention was accomplished through a complex coordination between key stakeholders and decision makers, which allowed for territorial planning as well as the incorporation of existing infrastructure. The scope of the program increased community benefits and generated better and long-term solutions for the existing water and sewage problems and better

infrastructure integration within the area, which fostered a long-term sustainable intervention.

Planning

The Planning subcategory evaluates considerations related to planning issues (with a long-term view), such as maintenance and monitoring, the regulatory environment, and the extension of the useful life of the program. The project achieved a moderate performance in this category, with room for improvement in developing a systematic assessment of the regulations applicable to the program that might hinder sustainable initiatives. The project could also conduct a feasibility study to identify areas where increasing investment to extend the project's useful life could offer a reasonable payback.

The program developed a long-term monitoring and maintenance plan for the works carried out. The EPMAPS management operations team has plans for annual maintenance of the works developed during the program, and the unit has financial resources allocated for maintenance. Additionally, it is important to highlight that the entire team has been kept together throughout the project's execution and has avoided political interference, allowing for efficiency in the program's implementation.

In relation to the regulatory environment, due to the program's complexity and its large area of intervention, the program team has always sought to reach out to local decision makers to identify problems and conflicts. However, although the program was conformed to local laws, no further efforts were made to identify other regulations that might create barriers to the implementation of the program's sustainability goals. This might be especially relevant in order to implement future initiatives for rainwater harvesting or gray water reuse to maintain the restored public spaces.

One important contribution of the program was to promote a more resilient city by implementing a water management program with a long-term, integrated,

territorial perspective that included the recovery and restoration of natural drainage systems. Through these multiple citywide interventions, the team was able to improve and extend the durability and resilience of the works included within the program's framework, as well as for other urban systems of the Quito metropolitan area. For this purpose, the company developed a water and sanitation master plan, which was used as guideline and was implemented during Phase II of the program. This master plan has been used for technical planning and is valid through 2040.¹⁵



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 is aimed at conserving energy, obtaining materials and equipment from manufacturers and suppliers that implement sustainable practices, reducing the use of virgin materials, avoiding sending useful materials to landfills by recycling and reusing them, minimizing transportation costs and impacts by procuring from local sources, reusing and

¹⁵ This study was developed by the firm Hazen and Sawyer in the United States and was approved in early 2011

diverting wastes, minimizing soil movements off site, and designing so as to encourage future recycling, upcycling, and reuse. The program achieved a low performance in this category, which thus presents a great opportunity for integration into future phases

Efforts to reduce net embodied energy of materials, as compared to industry norms, should be considered in future phases of the program. For this, it is recommended to carry out a life cycle assessment to estimate the required energy for extraction, transportation, and manufacturing of materials for construction, as well as the materials to be used for the program's maintenance and operations. The sources from which materials come are also important; in this regard, it is recommended to review the program's procurement policies with a view to obtaining materials and equipment from manufactures and suppliers that implement sustainable practices. In addition, special consideration should be given to the end of life of materials, components, or equipment used by the program, and the team should integrate actions such as recycling, upcycling, and reuse, as well as design for easy and efficient disassembly.

Recycled materials were used for specific parts of the program. In the environmental restoration projects for Ortega and Shanshayacu ravines, recycled rubber tires were used to build the trails along the ravines; however, no documentation is available to show the percentage of recovered or recycled materials used in the program.

Materials should be locally sourced to minimize transportation costs and environmental impacts, as well as retain regional benefits. The program team assures that all of the materials incorporated were produced, extracted, or processed from within the region, in particular the stone, the iron produced in the ANDEC factory, and concretes with multiple levels of resistance. According to the team, at least 90% of the main materials were locally sourced.¹⁶ In this regard, all materials were sourced within the distances that have been benchmarked by Envision.

In relation to waste management and the reduction of

excavated materials taken off site, two specific projects that are part of the program should be mentioned. In constructing the El Troje water treatment plant, 25% of the waste produced was recycled or reused; to achieve this, the program developed a waste management plan to reduce waste generated during implementation.¹⁷ As a complement, inventories of the waste generated were collected, and potential destinations for recycling and reuse were proposed. Also the removal, transportation, and disposal of contaminated materials generated during the program were managed by a specialized waste management firm. Secondly, in the El Trébol underground stormwater collector project which is located in the center of Quito, the movement of soils and other excavated materials was reduced by 30%.¹⁸ To achieve this, the program tried to reutilize the excavated materials within the project and/or in nearby projects that needed this type of material. Further consideration of waste reduction by recycling or reuse and the on-site reuse of excavated materials should be extended to all of the program's components, and become part of the sustainable policies promoted by the program.

Energy

The Energy subcategory aims to conserve energy by reducing overall energy consumption in operations and maintenance, meeting energy needs through renewable energy sources, and ensuring the functioning and extension of useful life by specifying the commissioning and monitoring of energy systems performance. The program achieved a very low performance in this category, not having any strategies to reduce energy consumption in operations and maintenance throughout the life of the program, not meeting energy needs through the prioritization of renewable energy resources, and not having taken actions to ensure the functioning and performance of energy systems by specifying commissioning and monitoring. To improve these aspects, some recommendations are provided below.

¹⁶ Xavier Vidal, e-mail message to author, October 7, 2015.

¹⁷ EPMAPS, Libro de Obras Anexo 10F, (July 2013).

¹⁸ Empresa Pública Metropolitana de Agua Potable y Saneamiento (EPMAPS), Anexo 10B, Libro de Obras para la construcción Túnel el Trébol. (March, 2011).

The program did not conduct planning or design reviews to identify and analyze options for reducing energy consumption during operations and maintenance. Furthermore, no analysis was conducted to determine the most effective methods for energy reductions so as to incorporate them into the design. In this regard, it is recommended that in future phases the program should provide a holistic design approach when considering the options to reduce overall energy consumption.

There is no documentation available that demonstrates that the program team evaluated the feasibility of renewable energy, including nontraditional energy sources, in order to effectively increase the proportion of operational energy that comes from renewable energy resources. It is recommended that the program include the use of renewable energy resources whenever practical to decrease overall energy needs, providing documentation of the annual percentage of renewable energy used to meet energy needs.

Finally, the program does not intend to commission and monitor the energy systems within the program. It is advised to engage an independent commissioning agent for the energy systems related to the program in order to ensure their efficient functioning and the extension of their useful life. In addition, maintenance activities and the incorporation of advanced monitoring systems, such as energy submeters, will enable more efficient operations and higher levels of energy efficiency.

Water

The Water subcategory aims to reduce the net negative impact on the availability, quantity, and quality of freshwater, reduce overall potable water consumption, and encourage the use of gray water, recycled water, and stormwater to meet water needs; it also evaluates the extent to which projects implement programs to monitor the performance of water systems, and their impact on receiving waters. The program demonstrated a strong and consistent performance in these aspects; however, the program team could increase the extent and comprehensiveness of the commissioning efforts to evaluate the overall impact on natural water systems, going beyond the considerations and improvements undertaken in the monitoring of potable water systems.

Regarding the availability, quantity, and quality of freshwater, the program improved the efficiency of the potable water and sewage systems, and implemented flood management strategies in Quito's Metropolitan District (DMQ). These actions will contribute to achieving a positive net impact on water sources, but no evidence was provided to evaluate how the program is contributing to restoring the natural flows of receiving waterway ecosystems. For example, through the optimization of the El Troje water treatment plant, the program was able to achieve the treatment capacity established in the original design, thus meeting the population's demands, but the impacts of freshwater withdrawals on receiving waters were not quantified. It is recommended that the program conduct a comprehensive water availability assessment to evaluate whether the program will have a long-term negative, neutral, or positive net impact on the quantity and quality of freshwater, surface water, and groundwater sources in the DMQ.

In regard to the goal of reducing overall potable water consumption, the project team conducted a feasibility and cost analysis of the rural parishes and city networks, in order to determine the most effective methods for reduction in use of potable water. The main objective of this plan was to reduce drinking-water consumption as well as to reduce water losses during production and distribution, thus making the use of available water more efficient. This should also help meet the city's increasing demands for potable water in a future affected by climate change. The team affirms that these works diminished water consumption in the DMQ by 28%, from 285 l/h/d in 2005 to 206

l/h/d in 2015, and the percentage of non-revenue water in the DMQ decreased from 37.2% in 2005 to 29.2% in 2015. Beyond the actions already undertaken by the program, advanced recycling and reuse of water is encouraged in order to achieve a further reduction in potable water consumption.

Several studies and models were conducted both to detect potable water system failures and to improve upon monitoring, including the master plan, ANC plan, hydraulic modeling, telemetry, and telecontrol. The integration of impact monitoring and operational monitoring allows for responsive management. This improved the operational efficiency of the system by preventing the needless waste of potable water, and reducing the energy and emissions associated with treatment and distribution. Additionally, hydraulic studies were conducted to optimize the distribution of drinking water, which has allowed for reductions in the non-revenue water index, especially in rural areas.

However, the notable efforts to monitor and control the potable water system could be expanded to include measurements and monitoring that considers the overall impact of the program on the water systems of the DMQ. Connecting all of the works done in the different components of the program will shed light on groundwater recharge rates and water resource replenishment, making clear whether other best practices for water management need to be applied.

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 examines the location of the works undertaken by the program. Interventions should avoid direct and indirect impacts to important ecological areas, such as those considered to have high ecological value or that serve as diverse habitat (e.g., water bodies). Mitigation measures should be taken to minimize disruptions to natural systems, and risk factors

such as adverse geology or steep gradients should also be considered. Moreover, in order to prevent further environmental damage, preserving greenfields and promoting development in previously underutilized or abandoned sites is encouraged. In relation to these aspects, the program demonstrated a high level of achievement, considering that its interventions in the ravines promoted many of the values of this subcategory by mitigating the impacts caused by urban development in natural ecosystems, and the strong territorial planning conducted within the framework of the program.

The program has sought to protect habitat, prime farmland, and greenfields by avoiding development on land that is judged to be “prime habitat” by the General Secretary of the Metropolitan Council of Quito. The metropolitan scale of the program involves multiple interventions; to ensure their coherence, coordination and territorial planning efforts were carried out with local agencies. None of the program’s works consume any soils from prime farmland, and overall the delicate balance between urban expansion and the preservation of valuable land is one of the challenges addressed by the program. Territorial planning has been orchestrated to identify areas for development, such as Parroquia Calderón in the north of Quito, and areas to be conserved for future generations such as the restored ravines. Finally, the construction of new facilities has been minimal compared to the interventions to recover the altered landscapes of the ravines, which had been

occupied by dump sites and illegal housing. In total, 19 ravines, comprising about 208 acres were restored to their natural state.

In relation to water systems, the program developed a complete upstream hydrological study of the Guayllabamba River basin, and a water quality and characterization study of the river basin was performed. As a complement to these studies, EPMAPS utilized the study of Quito's aquifer which permitted the identification of the quality and availability of the city's groundwater. These studies were the basis for all of the actions undertaken by the program, especially regarding the environmental conditioning projects of the ravines. However, there is no documentation available to show that the program protected wetlands and surface water bodies by providing measurable buffer zones.

Regarding the preservation of floodplain functions, the program contributed to minimizing the impacts of urbanization by restoring the ravines and creating pervious surfaces for groundwater infiltration, as well as preventing flooding and landslides caused by extreme rains. One of EPMAPS's main objectives was to protect natural drainage systems through appropriate urban planning, as well as to introduce watercourse conservation and protection strategies. Moreover, the flood control program incorporated projects that could optimize storm drainage capacity. The approach which was taken was both comprehensive and socially inclusive. Unfortunately, there is no documentation available showing the impacts of the program in maintaining or enhancing floodplain functions.

Landslide risks and geological risks were considered and mitigated or avoided. On a metropolitan scale, the program identified adverse or sensitive geology in different locations through the Environmental Impact Assessment and the Environmental Management Plan. The program considered geological complexity (adverse and sensitive) when planning for construction, operations, and maintenance works, in order to reduce costs and risks to life and property. Additionally, the team has established hazard zones, developed buffers

around adverse geological areas, and created runoff controls and spill prevention measures as well as cleanup plans. These notable efforts contributed to effective risk management by utilizing green infrastructure to control erosion and stormwater runoff. Furthermore, families living in risk-prone areas were relocated, and works were carried out to protect others living in moderately risky areas.

The program followed best management practices and included interventions on a metropolitan scale to minimize erosion and prevent landslides. A plan for proper planting and restoration was made within the ravines to convert them into green infrastructure that would contain erosion, and at the same time provide recreational areas for nearby communities.

Land and Water

The Land and Water subcategory rewards projects that seek to minimize impacts on existing bodies of water and avoid the introduction of contaminants, whether through stormwater runoff or pesticides and fertilizers. The program demonstrated a high level of achievement in view of the multiple actions taken to prevent impacts on existing hydrological systems.

In relation to stormwater management, the program carried out a baseline assessment to achieve water quality improvement goals for Quito's rivers. The comprehensive recovery measure began with a detailed study of the watershed. Overall, as a result of actions undertaken by the sanitation program, the program has contributed to improving the water infiltration capacity of the metropolitan area of Quito. For example, the team built several underground collectors to improve stormwater carrying capacity, thus preventing flooding; these collectors include the Anglo-French collector (four groups), Pomasqui collector, and the 24 de Mayo, built with a collective total investment of approximately US \$21 million.²⁰ Moving forward, a study to quantify the program's enhancement of stormwater capacity on a metropolitan scale is recommended. Additionally, the inclusion of low-impact development measures would

²⁰José Balarezo, e-mail message to author, October 29, 2015.

be a robust contribution to enhancing the overall benefits of the program; such measures may include rain gardens and bioretention, rooftop gardens, sidewalk storage, vegetated swales, buffers and strips, tree preservation, rain barrels, and permeable pavements, among others.

In the environmental conditioning projects of the Ortega and Shanshayacu ravines, the team designed landscaping that incorporates plant species that do not require the use of pesticides, herbicides, and fertilizers, or that are conducive to integrated pest management approaches.

However, no documentation addresses whether any operational policies have been put in place to control the application fertilizers and pesticides in the long-term maintenance of the new green areas, or whether any runoff control design measures were installed to minimize groundwater and surface water contamination. It is recommended that the team provide guidelines to the DMQ Public Space Management Department to review operational policies to control the application of fertilizers and pesticides during maintenance.

The construction of the new sewage system and stormwater collectors indirectly prevents surface and groundwater contamination. Additionally, to remediate existing contamination and improve the water quality of the DMQ, the program implemented a river decontamination program, which included a water quality assessment and a monitoring system and the treatment of non-treated sewage water being discharged into Quito's rivers. Additionally, to prevent the future contamination of the restored areas within the framework of the environmental conditioning projects, the program installed land use controls by collaborating with the municipality, and also installed measures to avoid disruptions to surface water runoff by future development.

It is important to emphasize that all of the actions (ravine environmental conditioning projects, sewage, and 12 water treatment plants, among others) were based on a complete hydrological study of the Guayllabamba

river basin by EPMAPS, allowing for a water quality and characterization assessment of the river basin. This was complemented by the study of Quito's aquifer study, permitting a holistic understanding of the city's existing surface and underground waters.

Biodiversity

The Biodiversity subcategory rewards projects that can minimize negative impacts to natural species and their habitats on and near the site. In this the program earned a remarkable level of achievement, but in future phases a comprehensive multiyear management plan to control invasive species should be considered. This type of effort would help in establishing a strategy to control such species in order to restore habitats to preinvasive states.

In relation to the preservation of species biodiversity, the program made appropriate planting efforts in the environmental conditioning works of the ravines to improve upon and expand wildlife corridors and link existing habitats. In Phase II, 4 streams were recovered²². In the Ortega and Shanshayacu ravines the team intended to incorporate the concept of ecological corridors to benefit natural wildlife by connecting existing habitats. The team also planted adequate vegetation while respecting and enhancing the existing vegetation.

Additionally, the environmental conditioning works conducted in the ravines considered the restoration of soils to predevelopment conditions, thus bringing back ecological and hydrological functions. To achieve this, it was necessary to relocate families living in informal housing and clean up the accumulated debris on these sites. Unfortunately, there is no documentation available that supports whether any restoring of disturbed soils was considered during the construction of the other components of the program.

To maintain wetlands and surface water functions, the program considered strategies to enhance hydrological connections. One of the main goals was to protect natural

²¹ Known as PDRQ (Programa Ríos Descontaminación Quito)

²² Xavier Vidal, e-mail message to author, November 30, 2015.

drainage systems through appropriate urban planning and the introduction of watercourse conservation and protection strategies. The comprehensive recovery measure began with a detailed study of the watershed.

To recover contaminated water bodies, EPMAPS developed various projects focused on the treatment of wastewater. One of the program's main objectives regarded the maintenance of the natural conditions of existing hydrological networks within the program area, through the interception of more than 95% of wastewater discharges generated in the DMQ.²³ With the studies and detailed engineering designs for the interception and treatment of residual waters in the DMQ, the program sought to maintain and enhance the quality of water in rivers and ravines. Additionally, through the environmental conditioning program of the ravines and rivers, the program was able to control sediment transport due to the hydrological regulation of creeks and rivers, which was complemented by the construction of water collectors in the San Juan, El Tejar, El Cebollar, and Jerusalem ravines, among others.



CLIMATE AND RISK CATEGORY

Envision aims to promote infrastructure development 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 goal of the Emissions subcategory is to promote the understanding and reduction of dangerous emissions, including greenhouse gas emissions and other dangerous pollutants, during all stages of a program's life cycle. In relation to these goals, the program had a low level of achievement, and there is no documentation available that supports any intention of reducing greenhouse gas emissions and other dangerous pollutants. Although the typology of the program infrastructure does not promote the direct generation of greenhouse gases or other air pollutants during operations, the construction works should have taken into account the consequences of emissions, and how air pollution affects the quality of life for communities.

Greenhouse gas emissions are primarily associated with nonrenewable energy consumption and the embodied energy of materials used during construction and operations. A comprehensive life cycle carbon assessment can estimate the carbon emissions caused by materials extraction, as well as processing, materials transportation, project maintenance, and operations, including vehicle traffic. Therefore, it is recommended for future phases of the program to perform a life cycle carbon assessment that uses recognized and accepted methodologies, data, and softwares. New infrastructure works must be designed to reduce carbon emissions in comparison to the emissions calculated in the life cycle carbon assessment.

Dangerous pollutants damage human health, property, and the environment. Dust and odors also can cause nuisances for nearby residents and reduce property values. In order to minimize these impacts, six dangerous pollutants should be quantified, monitored, and minimized: particulate matter (including dust), ground-level ozone, carbon monoxide, sulfur oxides, nitrogen oxides, and lead; noxious odors should also be considered in a similar manner. No information was provided in relation to these impacts; therefore it is recommended that the program incorporate measurements of air pollutants as compared to global

²³ Resumen Ejecutivo de la Intercepción y Tratamiento de las Aguas Residuales de Quito y Parroquias Anexas. Asociación Hazen and Sawyer-Pi Epsilon.

standards, such as the California Ambient Air Quality Standards, and implement strategies to reduce these pollutants to desired levels.

Resilience

The Resilience subcategory rewards projects that include the ability to withstand short-term risks, such as flooding or fires, and the capability to adapt to changing long-term conditions, such as changes in weather patterns, a rise in sea level, or changes in climate. In relation to these aspects, the program showed a high level of performance by helping to make Quito a more resilient city. However, it is recommended for the development of future phases of the program to incorporate the threat of climate change by commissioning a climate impact assessment, in order to understand and avoid its potential impacts, and elaborating an adaptation plan with possible response measures.

The program has reduced certain vulnerabilities of Quito's community as a whole, by implementing an integrated and holistic program to provide efficient and sustainable water, sewer, and flood control services. The team's approach considered that the construction of engineering works alone was not enough to solve various problems, and therefore a territorial approach was taken which considered an integrated vision of the landscape and urban functions, thus leading to high-impact solutions. However, a more systematic evaluation should be considered of the risks and vulnerabilities of the community, including economic risks, vulnerabilities to extreme weather events, and changes in the environment. The ultimate objective of this assessment is to make a significant contribution to community robustness and resiliency in the face of change.

The improvements to planning, combined with landscape interventions, were capable of reducing overall vulnerabilities and making Quito better prepared for long-term adaptability to extreme weather events. The environmental restoration of the ravines included interventions to enhance stormwater management, increase soil infiltration capacities, define prone-risk

areas, and relocate existing communities, all of which reduced potential damages from short-term hazards. Moreover, the actions undertaken by EPMAPS also helped to strengthen the social fabric on the slopes through the training and management of the local administrative authorities.

Finally, in relation to managing heat island effects by reducing heat accumulation and managing microclimates, the program has shown a reduction of at least 10-30% in heat-producing surfaces within the area of its intervention.²⁴ This has been achieved with the environmental conditioning projects in Ortega and Shanshayacu ravines, where trees were planted along trails, providing shade and comfort. However, it is recommended that future phases of the program include a plan for reducing heat-producing surfaces in its facilities, such as water treatment plants.

²⁴ Proyecto de Acondicionamiento Ambiental de la Quebrada Ortega Informe Final

APPENDIX A: PROJECT PICTURES AND DRAWINGS

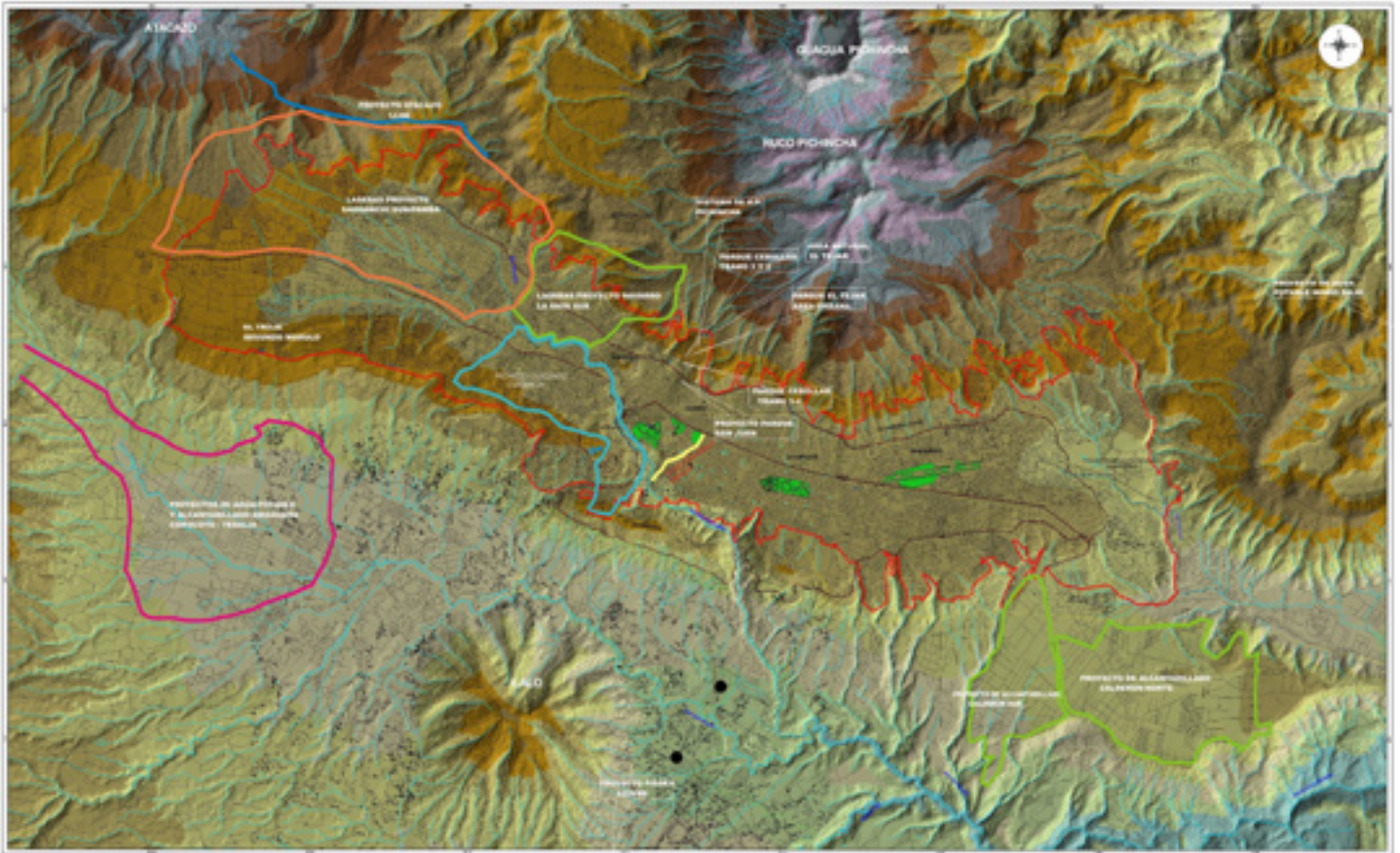


Figure 2: General picture of the program / Location of the projects (PSA -FASE II)

Sources: Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito, Programa de Saneamiento Ambiental, Programa de Saneamiento Ambiental Fase II PSA Préstamo BID 1802/OC-EC. Quito Metropolitan District. 2012, Page 4

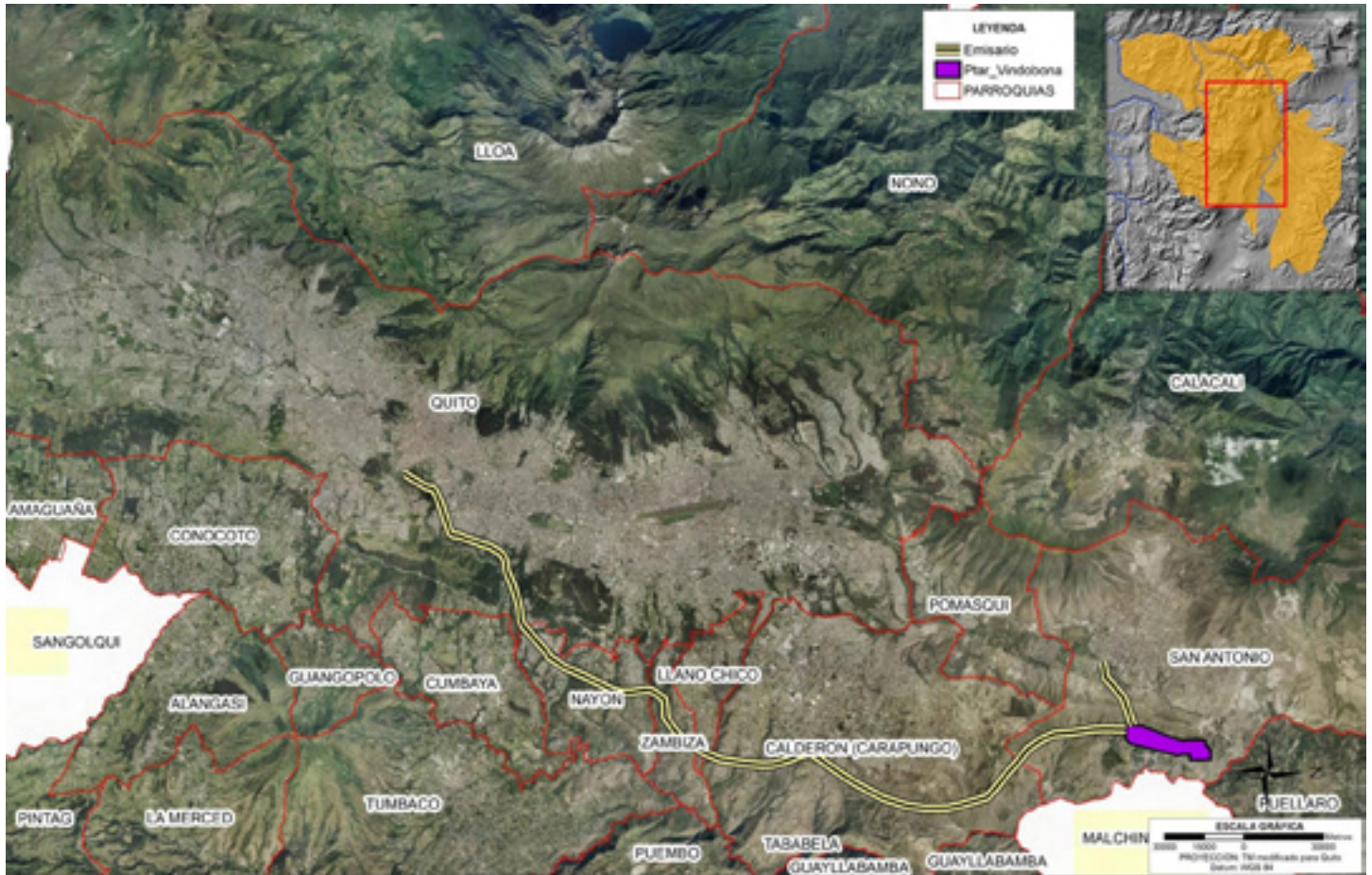


Figure 3: Hydrology Map 1 / Location of the projects (PSA -FASE II)

Sources: Hazen and Sawyer, MT04 - Gen Climatología, Hidrología y Modelación de Caudales Máximos de las Cuencas Urbanas de Quito, Agosto 2015

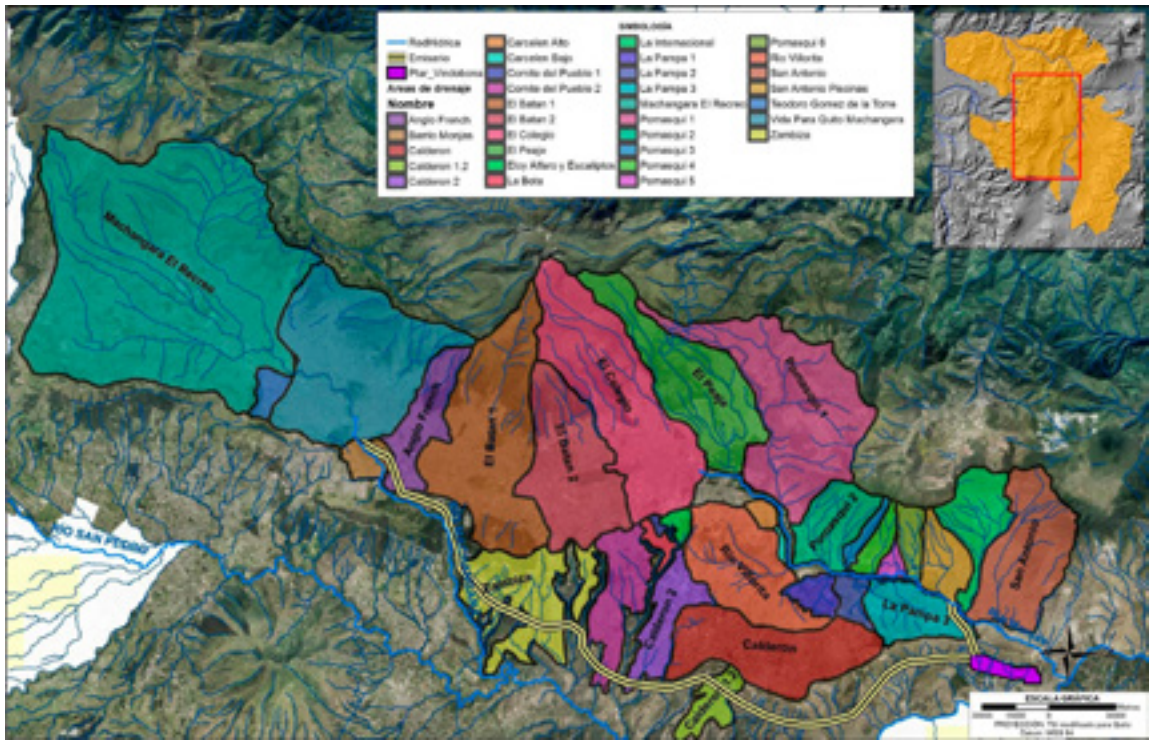


Figure 4: Hydrology Map 2 / Drainage areas

Sources: Hazen and Sawyer, MT04 - Gen Climatología, Hidrología y Modelación de Caudales Máximos de las Cuencas Urbanas de Quito, Agosto 2015

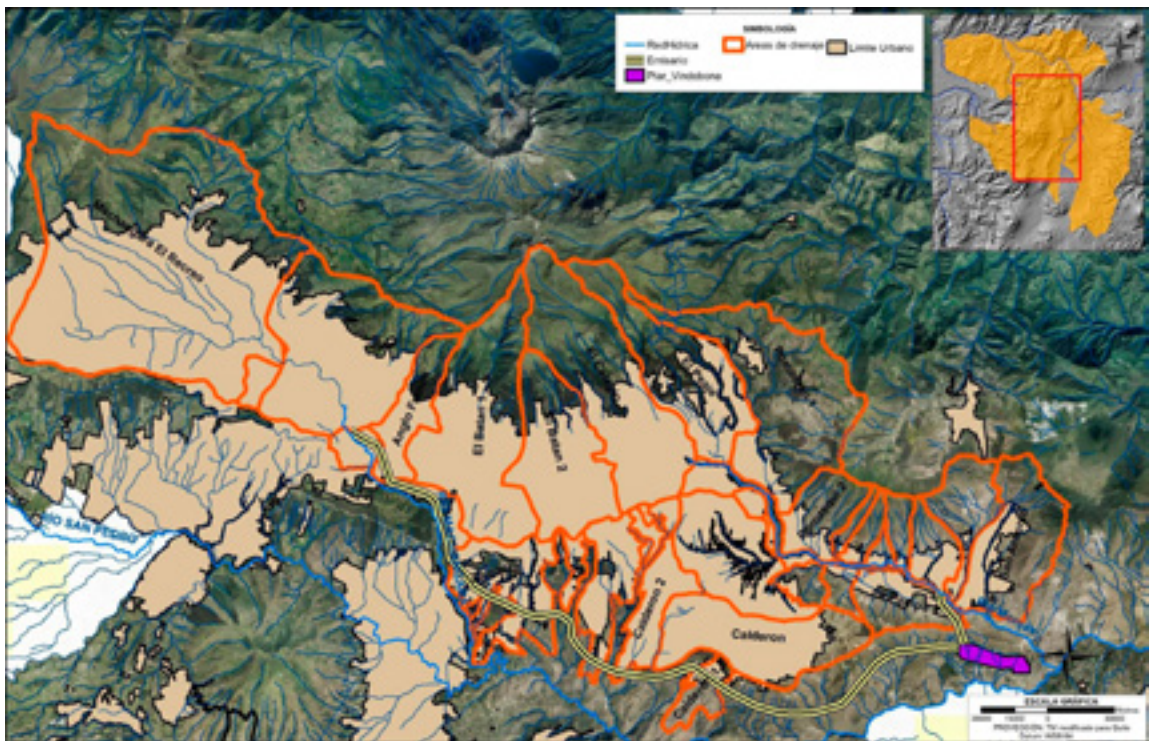


Figure 5: Hydrology Map 2 / Drainage areas - Urban Areas

Sources: Hazen and Sawyer, MT04 - Gen Climatología, Hidrología y Modelación de Caudales Máximos de las Cuencas Urbanas de Quito, Agosto 2015

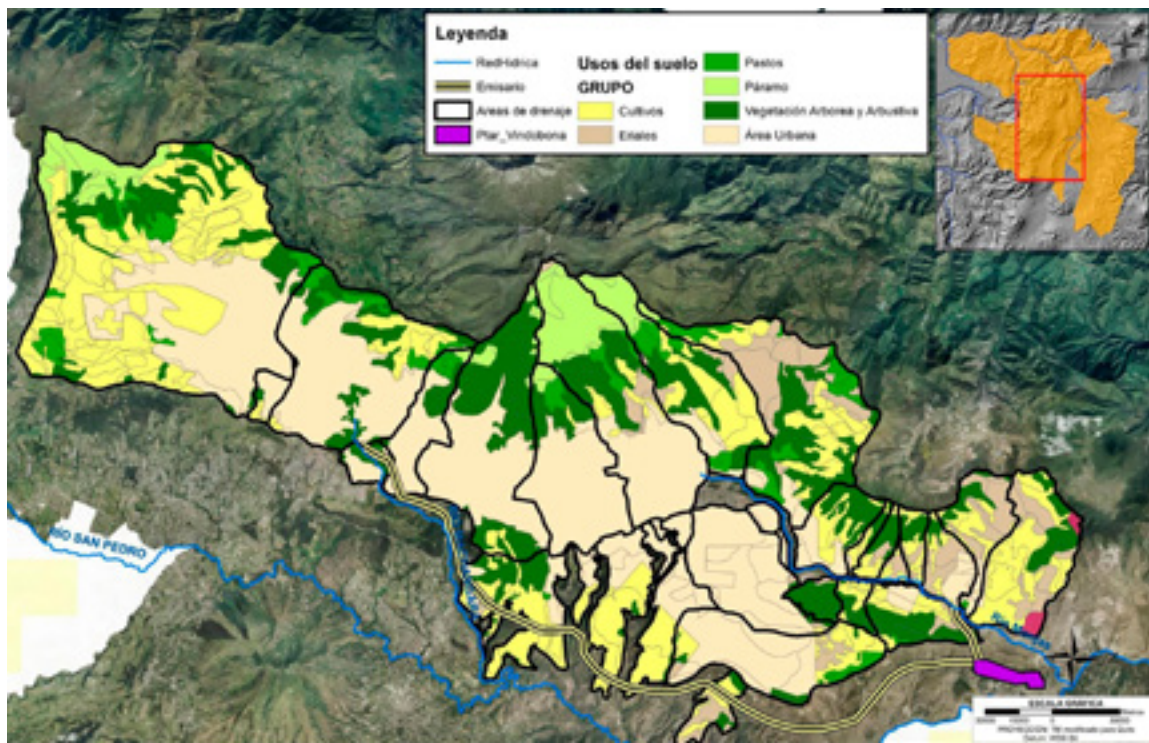


Figure 6: Hydrology Map 2 / Land use and Vegetation cover

Sources: Hazen and Sawyer, MT04 - Gen Climatología, Hidrología y Modelación de Caudales Máximos de las Cuencas Urbanas de Quito, Agosto 2015



Figure 7: Training talk

Sources: Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS), Manual de Seguridad y Salud Ocupacional del programa de Saneamiento Ambiental de la Empresa Pública, July 2012



Figure 8: First aid training

Sources: Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS), Manual de Seguridad y Salud Ocupacional del programa de Saneamiento Ambiental de la Empresa Pública, July 2012



Figure 9: Technical teams' meeting presentation / Execution and implementation of water regulation works in the Ortega Ravine

Sources: Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS), Manual de Seguridad y Salud Ocupacional del programa de Saneamiento Ambiental de la Empresa Pública, July 2012



Figure 10: Construcción del Proyecto de Alcantarillado Calderón Sur

Sources: Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS), Programa de Saneamiento Ambiental (PSA) Préstamo BID 1802/OC-EC, Sistematización reunión cierre vía calle Clemente Pulupa, June 2013



Figure 11: Jerusalén Ravine project / Left before works - Right after works

Sources: Empresa Metropolitana Alcantarillado y Agua Potable de Quito EPMAPS, Programa de Saneamiento ambiental para el Distrito Metropolitano de Quito (PSA) Enlace 3: Reporte fotográfico antes y después de las intervenciones Quebrada Jerusalén, February 2015



Figure 12 : Ortega Ravine project / Section 2 - Noboa Street / Left Image - Before works / Right Image - After works

Sources: Empresa Metropolitana Alcantarillado y Agua Potable de Quito EPMAPS, Programa de Saneamiento ambiental para el Distrito Metropolitano de Quito (PSA) Enlace 3: Reporte fotográfico antes y después de las intervenciones Quebrada Jerusalén, February 2015



Figure 13: Citizen participation

Sources: Empresa Metropolitana Alcantarillado y Agua Potable de Quito EPMAPS, Programa de Saneamiento ambiental para el Distrito Metropolitano de Quito (PSA) Fotos Capítulo 8



Figure 13: Tramos de intervención de la Quebrada Ortega

Sources: Proyecto de Acondicionamiento Ambiental de la Quebrada Ortega Informe Final

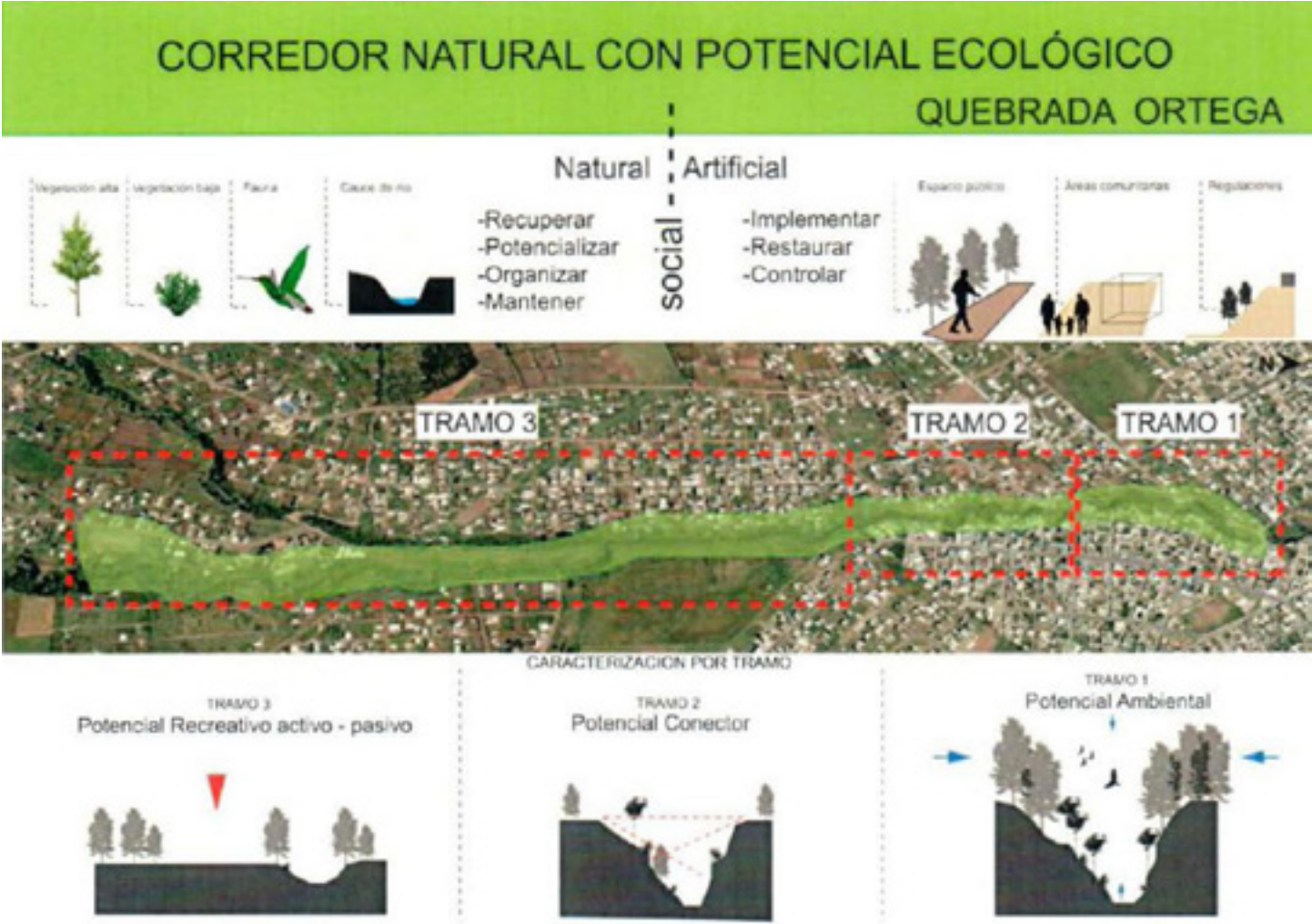


Figure 15 : Ortega Ravine Project / 3

Sections: Proyecto de Acondicionamiento Ambiental de la Quebrada Ortega Informe Final

ACONDICIONAMIENTO AMBIENTAL DE LA QUEBRADA ORTEGA



PROPUESTA DE INTERVENCIÓN TRAMO 1

Propuesta Calle Monroy



ESTADO ACTUAL



PROPUESTA

Figure 16 : Ortega Ravine Project / Section 1

Sections: Proyecto de Acondicionamiento Ambiental de la Quebrada Ortega Informe Final

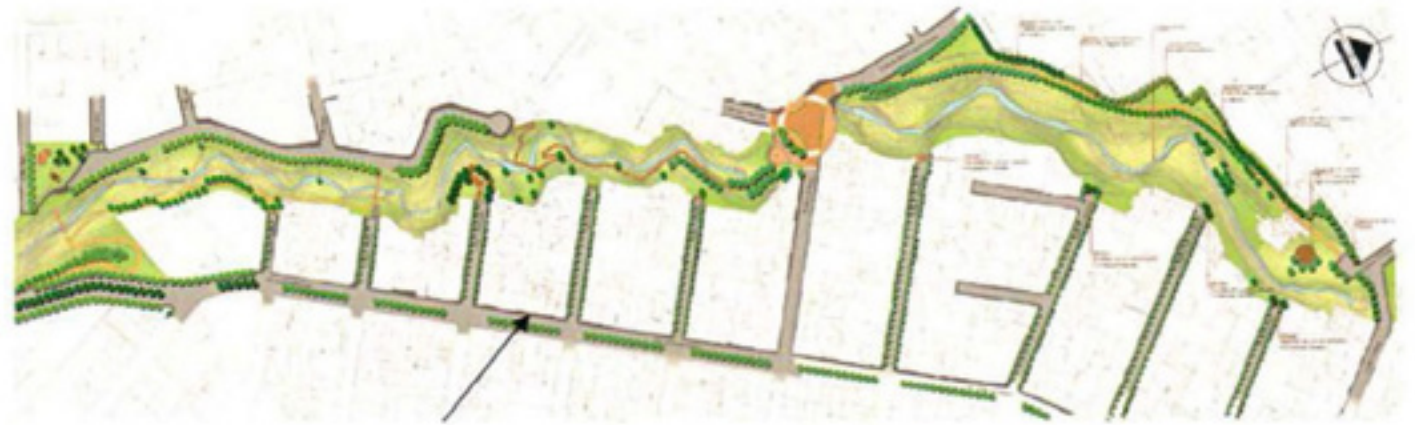


Figure 17 : Ortega Ravine Project / Section 1

Sections: Proyecto de Acondicionamiento Ambiental de la Quebrada Ortega Informe Final



Figure 18 : Ortega Ravine Project / Children

Sections: Proyecto de Acondicionamiento Ambiental de la Quebrada Ortega Informe Final

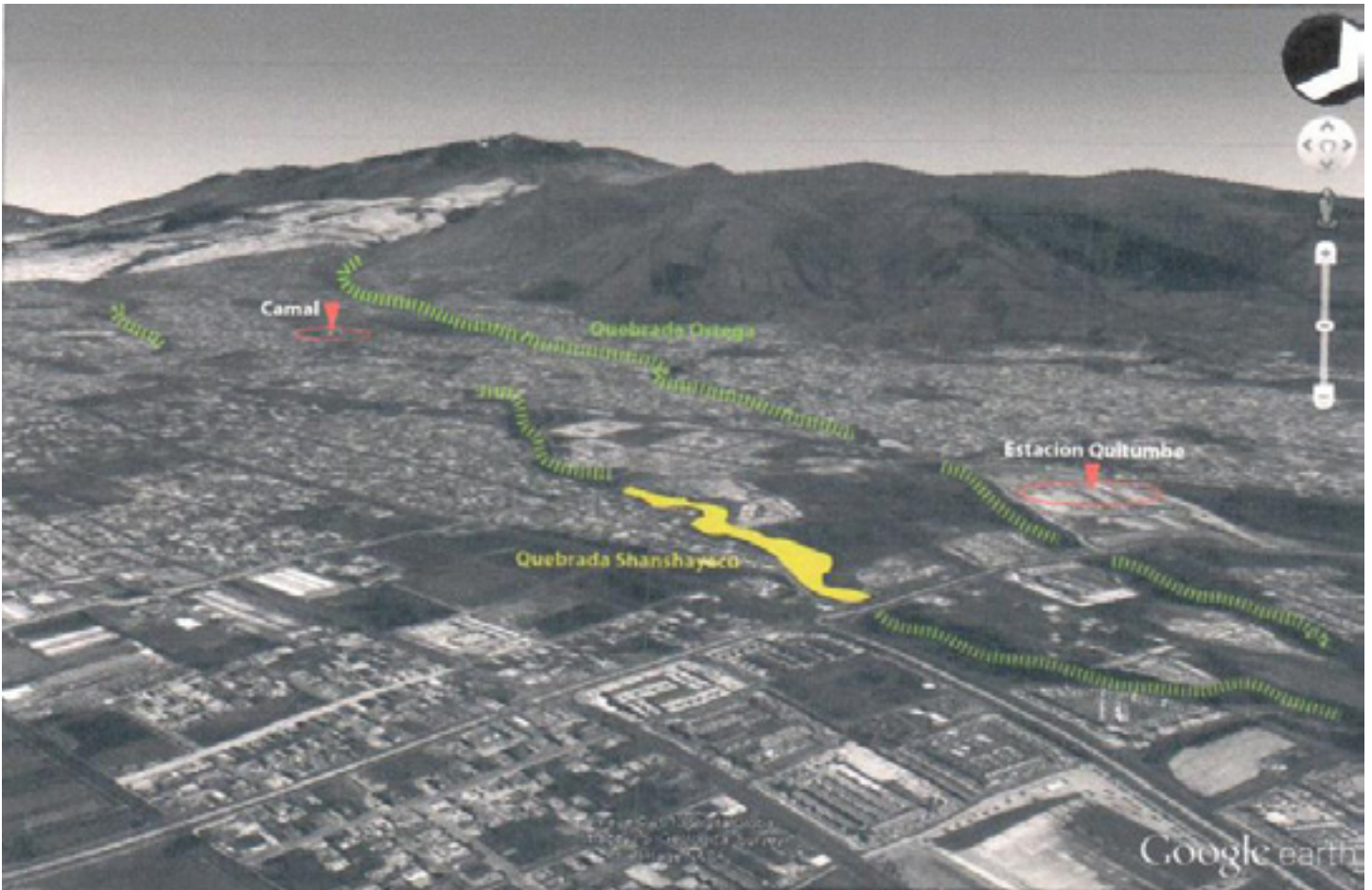


Figure 19 : Location of Shanshayacu Ravine

Sections: Proyecto de Acondicionamiento Ambiental de la Quebrada Ortega Informe Final

APPENDIX B: ENVISION POINTS TABLE

| | | | MEJORA | AUMENTA | SUPERIOR | CONSERVA | RESTAURAR |
|--|-------------------|---|--------|---------|----------|----------|-----------|
| QUALITY OF LIFE | PURPOSE | QL 1.1 Improve community quality of life | 2 | 5 | 10 | 20 | 25 |
| | | QL 1.2 Stimulate sustainable growth and development | 1 | 2 | 5 | 13 | 16 |
| | | QL 1.3 Develop local skills and capabilities | 1 | 2 | 5 | 12 | 15 |
| | WELLBEING | QL 2.1 Enhance public health and safety | 2 | -- | -- | 16 | |
| | | QL 2.2 Minimize noise and vibration | 1 | -- | -- | 8 | 11 |
| | | QL 2.3 Minimize light pollution | 1 | 2 | 4 | 8 | 11 |
| | | QL 2.4 Improve community mobility and access | 1 | 4 | 7 | 14 | |
| | | QL 2.5 Encourage alternative modes of transportation | 1 | 3 | 6 | 12 | 15 |
| | | QL 2.6 Improve site accessibility, safety and wayfinding | -- | 3 | 6 | 12 | 15 |
| | COMMUNITY | QL 3.1 Preserve historic and cultural resources | 1 | -- | 7 | 13 | 16 |
| | | QL 3.2 Preserve views and local character | 1 | 3 | 6 | 11 | 14 |
| | | QL 3.3 Enhance public space | 1 | 3 | 6 | 11 | 13 |
| | VULNERABLE GROUPS | QL 4.1 Identify and address the needs of women and diverse communities* | 1 | 2 | 3 | 4 | |
| QL 4.2 Stimulate and promote women's economic empowerment | | 1 | 2 | 3 | 4 | | |
| QL 4.3 Improve access and mobility of women and diverse communities* | | 1 | 2 | 3 | 4 | 5 | |
| | | Maximum QL Points: | | | | | 194" |
| LEADERSHIP | COLLABORATION | LD 1.1 Provide effective leadership and commitment | 2 | 4 | 9 | 17 | |
| | | LD 1.2 Establish a sustainability management system | 1 | 4 | 7 | 14 | |
| | | LD 1.3 Foster collaboration and teamwork | 1 | 4 | 8 | 15 | |
| | | LD 1.4 Provide for stakeholder involvement | 1 | 5 | 9 | 14 | |
| | MANAGEMENT | LD 2.1 Pursue by-product synergy opportunities | 1 | 3 | 6 | 12 | 15 |
| | | LD 2.2 Improve infrastructure integration | 1 | 3 | 7 | 13 | 16 |
| | | LD 3.1 Plan for long-term monitoring and maintenance | 1 | 3 | -- | 10 | |
| | PLANNING | LD 3.2 Address conflicting regulations and policies | 1 | 2 | 4 | 8 | |
| | | LD 3.3 Extend useful life | 1 | 3 | 6 | 12 | |
| | | Maximum LD Points: | | | | | 121" |
| RESOURCE ALLOCATION | MATERIALS | RA 1.1 Reduce net embodied energy | 2 | 6 | 12 | 18 | |
| | | RA 1.2 Support sustainable procurement practices | 2 | 3 | 6 | 9 | |
| | | RA 1.3 Use recycled materials | 2 | 5 | 11 | 14 | |
| | | RA 1.4 Use regional materials | 3 | 6 | 9 | 10 | |
| | | RA 1.5 Divert waste from landfills | 3 | 6 | 8 | 11 | |
| | | RA 1.6 Reduce excavated materials taken off site | 2 | 4 | 5 | 6 | |
| | | RA 1.7 Provide for deconstruction recycling | 1 | 4 | 8 | 12 | |
| | ENERGY | RA 2.1 Reduce energy consumption | 3 | 7 | 12 | 18 | |
| | | RA 2.2 Use renewable energy | 4 | 6 | 13 | 16 | 20 |
| | | RA 2.3 Commission and monitor energy systems | -- | 3 | -- | 11 | |
| | WATER | RA 3.1 Protect fresh water availability | 2 | 4 | 9 | 17 | 21 |
| | | RA 3.2 Reduce potable water consumption | 4 | 9 | 13 | 17 | 21 |
| | | RA 3.3 Monitor water systems | 1 | 3 | 6 | 11 | |
| | | Maximum RA Points: | | | | | 182" |
| NATURAL WORLD | SITING | NW 1.1 Preserve prime habitat | -- | -- | 9 | 14 | 18 |
| | | NW 1.2 Protect wetlands and surface water | 1 | 4 | 9 | 14 | 18 |
| | | NW 1.3 Preserve prime farmland | -- | -- | 6 | 12 | 15 |
| | | NW 1.4 Avoid adverse geology | 1 | 2 | 3 | 5 | |
| | | NW 1.5 Preserve floodplain functions | 2 | 5 | 8 | 14 | |
| | | NW 1.6 Avoid unsuitable development on steep slopes | 1 | -- | 4 | 6 | |
| | | NW 1.7 Preserve greenfields | 3 | 6 | 10 | 15 | 23 |
| | LAND & WATER | NW 2.1 Manage stormwater | -- | 4 | 9 | 17 | 21 |
| | | NW 2.2 Reduce pesticide and fertilizer impacts | 1 | 2 | 5 | 9 | |
| | | NW 2.3 Prevent surface and groundwater contamination | 1 | 4 | 9 | 14 | 18 |
| | BIODIVERSITY | NW 3.1 Preserve species biodiversity | 2 | -- | -- | 13 | 16 |
| | | NW 3.2 Control invasive species | -- | -- | 5 | 9 | 11 |
| | | NW 3.3 Restore disturbed soils | -- | -- | -- | 8 | 10 |
| | | NW 3.4 Maintain wetland and surface water functions | 3 | 6 | 9 | 15 | 19 |
| | | Maximum NW Points: | | | | | 203" |
| CLIMATE & RISK | EMISSIONS | CR 1.1 Reduce greenhouse gas emissions | 4 | 7 | 13 | 18 | 25 |
| | | CR 1.2 Reduce air pollutant emissions | 2 | 6 | -- | 12 | 15 |
| | | CR 2.1 Assess climate threat | -- | -- | -- | 15 | |
| | RESILIENCE | CR 2.2 Avoid traps and vulnerabilities | 2 | 6 | 12 | 16 | 20 |
| | | CR 2.3 Prepare for long-term adaptability | -- | -- | -- | 16 | 20 |
| | | CR 2.4 Prepare for short-term hazards | 3 | -- | 10 | 17 | 21 |
| | | CR 2.5 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.

APPENDIX C: GRAPHS

METROPOLITAN QUITO ENVIRONMENTAL SANATORIO PROGRAM-PHASE II

PROGRAMA DE SANEAMIENTO AMBIENTAL DE QUITO. FASE II

| | | | I | E | S | C | R* |
|-----------------------------------|---|---|---|---|---|---|----|
| QUALITY OF LIFE - CALIDAD DE VIDA | PURPOSE PROPÓSITO | QL 1.1 Improve community quality of life QL 1.1 Mejorar la calidad de vida de la comunidad | | | | | |
| | | QL 1.2 Stimulate sustainable growth and development QL 1.2 Estimular el desarrollo y el crecimiento sostenible | | | | | |
| | | QL 1.3 Develop local skills and capabilities QL 1.3 Desarrollar capacidades y habilidades locales | | | | | |
| | COMMUNITY COMUNIDAD | QL 2.1 Enhance public health and safety QL 2.1 Mejorar la salud pública y la seguridad | | | | | |
| | | QL 2.2 Minimize noise and vibration QL 2.2 Minimizar ruidos y vibraciones | | | | | |
| | | QL 2.3 Minimize light pollution QL 2.3 Minimizar contaminación Lumínica | | | | | |
| | | QL 2.4 Improve community mobility and access QL 2.4 Mejorar el acceso y la movilidad de la comunidad | | | | | |
| | | QL 2.5 Encourage alternatives modes of transportation QL 2.5 Fomentar modos alternativos de transporte | | | | | |
| | | QL 2.6 Improve site accessibility, safety and wayfinding QL 2.6 Mejorar la accesibilidad, seguridad y señalización | | | | | |
| | WELLBEING BIENESTAR | QL 3.1 Preserve historic and cultural resources QL 3.1 Preservar los recursos históricos y culturales | | | | | |
| | | QL 3.2 Preserve views and local character QL 3.2 Preservar las vistas y el carácter local | | | | | |
| | | QL 3.3 Enhance public space QL 3.3 Mejorar el espacio público | | | | | |
| | VULNERABLE GROUPS GRUPOS VULNERABLES | QL 4.1 Identify and address the needs of minorities QL 4.1. Identificar y considerar las necesidades de minorías | | | | | |
| | | QL 4.2 Stimulate and promote women's empowerment QL 4.2 Estimular y promover el empoderamiento femenino | | | | | |
| | | QL 4.3 Improve access and mobility of minorities QL 4.3 Mejorar el acceso y movilidad de minorías | | | | | |
| | | QL 0.0 Innovate or exceed credit requirements QL 0.0 Créditos innovadores o que exceden los requerimientos | | | | | |

* **I**MPROVE **E**NHANCED **S**UPERIOR **C**ONSERVING **R**ESTORATIVE
 MEJORA AUMENTA SUPERIOR CONSERVA RESTAURA

Figure 23: Quality of Life category_ Summary of results

METROPOLITAN QUITO ENVIRONMENTAL SANATORIO PROGRAM-PHASEII

PROGRAMA DE SANEAMIENTO AMBIENTAL DE QUITO. FASE II

| | | | I | E | S | C | R* |
|------------------------|-------------------------------|---|---|---|---|---|----|
| LEADERSHIP - LIDERAZGO | COLLABORATION COLABORACIÓN | LD 1.1 Provide effective leadership and commitment LD1.1 Proporcionar compromiso y liderazgo efectivo | | | | | |
| | | LD 1.2 Establish a sustainability management system LD 1.2 Establecer un sistema de gestión de la sostenibilidad | | | | | |
| | | LD 1.3 Foster collaboration and teamwork LD 1.3 Promover colaboración y trabajo en equipo | | | | | |
| | | LD 1.4 Provide for stakeholder involvement LD 1.4 Fomentar la participación de las partes interesadas | | | | | |
| | MANAGEMENT GESTIÓN | LD 2.1 Pursue by-product synergy opportunities LD 2.1 Mejorar la integración de infraestructuras | | | | | |
| | | LD 2.2 Improve infrastructure integration LD 2.2 Mejorar la integración de infraestructuras | | | | | |
| | PLANNING PLANIFICACIÓN | LD 3.1 Plan for long-term monitoring & maintenance LD 3.1 Planificar el monitoreo y mantenimiento | | | | | |
| | | LD 3.2 Address conflicting regulations & policies LD 3.2 Lidar con reglamentos y políticas en conflicto | | | | | |
| | | LD 3.3 Extend useful life LD 3.3 Extender la vida útil | | | | | |
| | | LD 0.0 Innivate or exceed credit requirements LD 0.0 Créditos innovadores o que exceden los requerimientos | | | | | |

* **I**MPROVE **E**NHANCED **S**UPERIOR **C**ONSERVING **R**ESTORATIVE
 MEJORA AUMENTA SUPERIOR CONSERVA RESTAURA

Figure 24: Leadership category_ Summary of results

METROPOLITAN QUITO ENVIRONMENTAL SANATORIO PROGRAM-PHASE II

PROGRAMA DE SANEAMIENTO AMBIENTAL DE QUITO. FASE II

| | | | I | E | S | C | R* |
|--|-------------------------|--|---|---|---|---|----|
| RESOURCE ALLOCATION - ASIGNACIÓN DE RECURSOS | MATERIALS MATERIALES | RA 1.1 Reduce Net Embodied energy RA 1.1 Reducir energía neta incorporada | | | | | |
| | | RA 1.2 Support sustainable procurement practices RA 1.2 Apoyar prácticas de adquisición sustentable | | | | | |
| | | RA 1.3 Used recycled materials RA 1.3 Used recycled materials | | | | | |
| | | RA 1.4 Use regional materials RA 1.4 Utilizar materiales de la region | | | | | |
| | | RA 1.5 Divert waste from landfills RA 1.5 Disminuir la disposición final en rellenos sanitarios | | | | | |
| | | RA 1.6 Reduce excavated materials taken off site RA 1.6 Reducir los materiales de excavación sacados del local del proyecto | | | | | |
| | | RA 1.7 Provide for deconstruction & recycling RA 1.7 Prever condiciones para la remoción de la construcción y el reciclaje | | | | | |
| | ENERGY ENERGÍA | RA 2.1 Reduce energy consumption RA 2.1 Reducir el consumo de energía | | | | | |
| | | RA 2.2 Use renewable energy RA 2.2 Usar energías renovables | | | | | |
| | | RA 2.3 Commission & monitor energy systems RA 2.3 Puestas en servicio y monitoreo de sistemas energetícos | | | | | |
| | WATER AGUA | RA 3.1 Protect fresh water availability RA 3.1 Proteger la disponibilidad de agua dulce | | | | | |
| | | RA 3.2 Reduce potable water consumption RA 3.2 Reducir el consumo de agua potable | | | | | |
| | | RA 3.3 Monitor water systems RA 3.3 Monitorear sistemas de provisión de agua | | | | | |
| | | RA 0.0 Innovate or exceed credit requirements RA 0.0 Créditos innovadores o que exceden los requerimientos | | | | | |

* IMPROVE MEJORA ENHANCED AUMENTA SUPERIOR SUPERIOR CONSERVING CONSERVA RESTORATIVE RESTAURA

Figure 25: Resource Allocation category_ Summary of results

METROPOLITAN QUITO ENVIRONMENTAL SANATORIO PROGRAM-PHASEII
PROGRAMA DE SANEAMIENTO AMBIENTAL DE QUITO, FASE II

| | | | I | E | S | C | R* |
|-------------------------------|---|--|---|---|---|---|----|
| NATURAL WORLD - MUNDO NATURAL | SITING EMPLAZAMIENTO | NW 1.1 Preserve prime habitat NW 1.1 Preservar hábitats de alta calidad | | | | | |
| | | NW 1.2 Preserve wetlands and surface water NW 1.2 Preservar humedales y aguas superficiales | | | | | |
| | | NW 1.3 Preserve prime farmland NW 1.3 Preservar tierras agrícolas de alta calidad | | | | | |
| | | NW 1.4 Avoid adverse geology NW 1.4 Evitar zonas de geología adversa | | | | | |
| | | NW 1.5 Preserve floodplain functions NW 1.5 Preservar funciones de llanura aluvial | | | | | |
| | | NW 1.6 Avoid unsuitable development on steep slopes NW 1.6 Evitar la ocupación inadecuada en pendientes pronunciadas | | | | | |
| | | NW 1.7 Preserve greenfields NW 1.7 Preservar áreas sin ocupación | | | | | |
| | LAND + WATER IMPACTOS EN EL AGUA Y SUELO | NW 2.1 Manage stormwater NW 2.1 Gestión de aguas pluviales | | | | | |
| | | NW 2.2 Reduce pesticides and fertilizer impacts NW 2.2 Reducir el impacto de fertilizantes y plaguicidas | | | | | |
| | | NW 2.3 Prevent surface and groundwater contamination NW 2.3 Prevenir la contaminación de aguas superficiales y profundas | | | | | |
| | BIODIVERSITY BIODIVERSIDAD | NW 3.1 Preserve species biodiversity NW 3.1 Preservar la biodiversidad | | | | | |
| | | NW 3.2 Control Invasive species NW 3.2 Control de especies invasivas | | | | | |
| | | NW 3.3 Maintain wetland and surface water functions NW 3.3 Preservar los humedales y las funciones de aguas superficiales | | | | | |
| | | NW 3.2 Control Invasive species NW 3.2 Control de especies invasivas | | | | | |
| | | NW 0.0 Innovate or exceed credit requirements RA 0.0 Créditos innovadores o que exceden los requerimientos | | | | | |

* **I**MPROVE **E**NHANCED **S**UPERIOR **C**ONSERVING **R**ESTORATIVE
MEJORA AUMENTA SUPERIOR CONSERVA RESTAURA

Figure 26: Natural World category_ Summary of results

METROPOLITAN QUITO ENVIRONMENTAL SANATORIO PROGRAM-PHASEII
PROGRAMA DE SANEAMIENTO AMBIENTAL DE QUITO. FASE II

| | | | I | E | S | C | R* |
|-----------------------------------|---------------------------|---|---|---|---|---|----|
| CLIMATE AND RISK - CLIMA Y RIESGO | EMISSIONS EMISIONES | CR 1.1 Reduce greenhouse gas emissions CR 1.1 Reducir las emisiones de gases de efecto invernadero (GEI) | | | | | |
| | | CR 1.2 Reduce air pollutant emissions CR 1.2 Reducir las emisiones contaminantes del aire | | | | | |
| | RESILIENCE RESILIENCIA | CR 2.1 Assess climate threat CR 2.1 Evaluar amenazas relacionadas al cambio climático | | | | | |
| | | CR 2.2 Avoid traps and vulnerabilities CR 2.2 Evitar situaciones de riesgo y vulnerabilidad | | | | | |
| | | CR 2.3 Prepare for long-term adaptability CR 2.3 Establecer estrategias de adaptación de largo plazo, frente al cambio climático | | | | | |
| | | CR 2.4 Prepare for short-term hazards CR 2.4 Preparación frente al riesgo de corto plazo | | | | | |
| | | CR 2.5 Manage heat island effects CR 2.5 Administrar el efecto de isla de calor | | | | | |
| | | CR 0.0 Innivate or exceed credit requirements CR 0.0 Créditos innovadores o que exceden los requerimientos | | | | | |

* **I**MPROVE **E**NHANCED **S**UPERIOR **C**ONSERVING **R**ESTORATIVE
MEJORA AUMENTA SUPERIOR CONSERVA RESTAURA

Figure 27: Climate & Risk category_ Summary of results

| METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM - PHASE II, ECUADOR | | | | PT. | PERFORMANCE |
|---|-----------------|-------------------|---|------------|-------------|
| 1 | QUALITY OF LIFE | PURPOSE | QL1.1 Improve community quality of life | 20 | Conserving |
| 2 | | | QL1.2 Stimulate sustainable growth and development | 13 | Conserving |
| 3 | | | QL1.3 Develop local skills and capabilities | 5 | Superior |
| 4 | | COMMUNITY | QL2.1 Enhance public health and safety | 2 | Improved |
| 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 | 14 | Conserving |
| 8 | | | QL2.5 Encourage alternative modes of transportation | 3 | Enhanced |
| 9 | | | QL2.6 Improve site accessibility, safety and wayfinding | 6 | Superior |
| 10 | | WELLBEING | QL3.1 Preserve historic and cultural resources | 7 | Superior |
| 11 | | | QL3.2 Preserve views and local character | 6 | Superior |
| 12 | | | QL3.3 Enhance public space | 13 | Restorative |
| 13 | | VULNERABLE GROUPS | QL4.1 Identify and address the needs of women and diverse communities (indigenous or afro-descendant peoples) | 2 | Enhanced |
| 14 | | | QL4.2 Stimulate and promote women's economic empowerment | 0 | No score |
| 15 | | | QL 4.3 Improve access and mobility of women and diverse communities (indigenous or afro-descendant peoples) | 2 | Enhanced |
| QL0.0 Innovate or Exceed Credit Requirements | | | | 8 | |
| QL | | | | 110 | |

| METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM - PHASE II, ECUADOR | | | | PT. | PERFORMANCE | |
|---|------------|---------------|--|-----------|-------------|--|
| 16 | LEADERSHIP | COLLABORATION | LD 1.1 Provide effective leadership and commitment | 4 | Enhanced | |
| 17 | | | LD 1.2 Establish a sustainability management system | 7 | Superior | |
| 18 | | | LD 1.3 Foster collaboration and teamwork | 4 | Enhanced | |
| 19 | | | LD 1.4 Provide for stakeholder involvement | 14 | Conserving | |
| 20 | | MANAGEMENT | LD 2.1 Pursue by-product synergy opportunities | 0 | No score | |
| 21 | | | LD 2.2 Improve infrastructure integration | 16 | Restorative | |
| 22 | | PLANNING | LD 3.1 Plan for long-term monitoring and maintenance | 10 | Conserving | |
| 23 | | | LD 3.2 Address conflicting regulations and policies | 1 | Improved | |
| 24 | | | LD 3.3 Extend useful life | 3 | Enhanced | |
| LDO.0 Innovate Or Exceed Credit Requirements | | | | 6 | | |
| LD | | | | 65 | | |

| METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM - PHASE II, ECUADOR | | | PT. | PERFORMANCE | |
|---|---------------------|--|--|-------------|----------|
| 25 | RESOURCE ALLOCATION | MATERIALS | RA 1.1 Reduce net embodied energy | 0 | No score |
| 26 | | | RA 1.2 Support sustainable procurement practices | 0 | No score |
| 27 | | | RA 1.3 Use recycled materials | 2 | Improved |
| 28 | | | RA 1.4 Use regional materials | 9 | Superior |
| 29 | | | RA 1.5 Divert waste from landfills | 3 | Improved |
| 30 | | | RA 1.6 Reduce excavated materials taken off site | 2 | Improved |
| 31 | | | RA 1.7 Provide for deconstruction recycling | 0 | No score |
| 32 | | ENERGY | RA 2.1 Reduce energy consumption | 0 | No score |
| 33 | | | RA 2.2 Use renewable energy | 0 | No score |
| 34 | | | RA 2.3 Commission and monitor energy systems | 0 | No score |
| 35 | WATER | RA 3.1 Protect fresh water availability | 4 | Enhanced | |
| 36 | | RA 3.2 Reduce potable water consumption | 4 | Improved | |
| 37 | | RA 3.3 Monitor water systems | 11 | Conserving | |
| | | RA0.0 Innovate Or Exceed Credit Requirements | 0 | N/A | |
| RA | | | 35 | | |

| METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM - PHASE II, ECUADOR | | | PT. | PERFORMANCE | |
|---|---------------|--------------|--|-------------|-------------|
| 38 | NATURAL WORLD | SITING | NW 1.1 Preserve prime habitat | 18 | Restorative |
| 39 | | | NW 1.2 Preserve wetlands and surface water | 1 | Improved |
| 40 | | | NW 1.3 Preserve prime farmland | 12 | Conserving |
| 41 | | | NW 1.4 Avoid adverse geology | 5 | Conserving |
| 42 | | | NW 1.5 Preserve floodplain functions | 5 | Enhanced |
| 43 | | | NW 1.6 Avoid unsuitable development on steep slopes | 6 | Conserving |
| 44 | | | NW 1.7 Preserve greenfields | 10 | Superior |
| 45 | | LAND & WATER | NW 2.1 Manage stormwater | 21 | Restorative |
| 46 | | | NW 2.2 Reduce pesticide and fertilizer impacts | 9 | Conserving |
| 47 | | | NW 2.3 Prevent surface and groundwater contamination | 18 | Restorative |
| 48 | | BIODIVERSITY | NW 3.1 Preserve species biodiversity | 16 | Restorative |
| 49 | | | NW 3.2 Control invasive species | 5 | Superior |
| 50 | | | NW 3.3 Restore disturbed soils | 10 | Restorative |
| 51 | | | NW 3.4 Maintain wetland and surface water functions | 19 | Restorative |
| | | | NW0.0 Innovate Or Exceed Credit Requirements | 9 | N/A |
| NW | | | 164 | | |

| NORTE GRANDE TRANSMISSION LINE, ARGENTINA | | | PT. | PERFORMANCE | |
|---|---------|------------|--|-------------|-------------|
| 52 | CLIMATE | EMISSIONS | CR 1.1 Reduce greenhouse gas emissions | 0 | No Score |
| 53 | | | CR 1.2 Reduce air pollutant emissions | 0 | No Score |
| 54 | | RESILIENCE | CR 2.1 Assess climate threat | 0 | No Score |
| 55 | | | CR 2.2 Avoid traps and vulnerabilities | 6 | Enhanced |
| 56 | | | CR 2.3 Prepare for long-term adaptability | 0 | Superior |
| 57 | | | CR 2.4 Prepare for short-term hazards | 21 | Restorative |
| 58 | | | CR 2.5 Manage heat islands effects | 2 | Enhanced |
| | | | CR0.0 Innovate Or Exceed Credit Requirements | 0 | N/A |
| CR | | | 29 | | |
| Total Points | | | 403 | | |

APPENDIX A: PROJECT PICTURES AND DRAWINGS

SUB CATEGORY: QUALITY OF LIFE

| Score | | METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM - PHASE II |
|---|---------------|---|
| GL1.1 IMPROVE COMMUNITY QUALITY OF LIFE | 20 | Conserving |
| | | <p>This section particularly focuses on assessing whether infrastructure projects were in line with community needs, and sought to improve quality of life while minimizing negative impacts. One of the program's main goals was to provide the local population with drinking water, sewage access, and flood control in efficient and sustainable ways over the long-term. In this regard, they were able to reduce damages to basins and ravines caused by landslides and floods resulting from torrential rains. Also, they have expanded and improved connections for drinking water, cost-efficient services, and high-quality environmental areas for recreation and the enjoyment of nature in areas that had previously been avoided due to issues such as extensive litter. Additionally, the program was not limited to local interventions, but to a comprehensive integration with the city's urban structure. Moreover, an additional USD \$494,592 on top of the full program amount has been invested in community development for the management of natural and urban green spaces in intervention zones, as well as improving trash and solid waste management. In relation to the landslide management component, mitigation measures were taken and the risk was reduced to 547 families, and in the cases where resettlement was necessary the cost per house was US\$25,000. These actions reduced risk and allowed the recovery of these spaces for the public use by surrounding communities. The documentation provided demonstrated the community's engagement during the process through the conduction of design workshops and meetings to explain the interventions and to solicit feedback from affected parties. Moreover, nearby communities were informed through meetings when constructions works were delayed. During those encounters people were also able to voice their approval or disapproval of the program's development.</p> |
| | Source | <ol style="list-style-type: none"> 1. Banco Interamericano de Desarrollo, Informe de Terminación de Proyecto PCR. (March, 2015) 2. Inter-American Development Bank - IDB, Ecuador Metropolitan Quito Environmental Sanitation Program (Phase II) (EC-L1022) Loan Proposal 3. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS), Programa de Saneamiento Ambiental (PSA) Préstamo BID 1802/OC-EC, Reunión Presentación AZQ Feb 2013. (March, 2013) 4. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS), Programa de Saneamiento Ambiental (PSA) Préstamo BID 1802/OC-EC, Sistematización reunión cierre vía calle Clemente Pulupa. (June, 2013) 5. Proyecto de Acondicionamiento Ambiental de la Quebrada Ortega Informe Final. 16-18 6. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS), Programa de Saneamiento Ambiental (PSA), Préstamo 1802. (June, 2009) 7. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS), Programa de Saneamiento Ambiental (PSA), Préstamo 1802, Nueva York Bombona. (September, 2009) 8. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS), Programa de Saneamiento Ambiental (PSA), Préstamo 1802, El Rosal. (September, 2009) 9. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS), Programa de Saneamiento Ambiental (PSA), Préstamo 1802, G3-AF. (September, 2009) 10. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS), Programa de Saneamiento Ambiental (PSA), Préstamo BID 1802/OC-EC, Capacitación + Operativo. (September, 2009). 11. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS), Programa de Saneamiento Ambiental (PSA), Préstamo BID 1802/OC-EC, Capacitación + Operativo (July, 2009) |

| Score | | METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM - PHASE II |
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| GL1.2 STIMULATE SUSTAINABLE GROWTH & DEVELOPMENT | Source | <p>12. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS), Programa de Saneamiento Ambiental (PSA), Préstamo 1802, Diciembre 09. (December, 2009)</p> <p>13. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS), Programa de Saneamiento Ambiental (PSA), Préstamo BID 1802/OC-EC, Reunión Asunción América. (May, 2009)</p> <p>14. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS), Programa de Saneamiento Ambiental (PSA), Préstamo BID 1802/OC-EC, Reunión Asunción Nueva York. (June, 2009)</p> <p>15. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS), Programa de Saneamiento Ambiental (PSA), Préstamo 1802, Reunión y Recorrido. (April, 2009)</p> <p>16. Director Ejecutivo del PSA to Lcdo. Marco Goyes, 9 de Septiembre 2009, MEMORANDO No. 1681 PSA-2009, Asunto Aula de Capacitación - Distrito Centro de la EPMAPS</p> <p>17. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS) Programa de Saneamiento Ambiental (PSA) Préstamo 1802, Anexo 14F, Explicar las razones de la dilatación del tiempo de terminación del colector a “zanja abierta” del tramo de la calle Céstaris. (January, 2011)</p> |
| | Recommendations | <p>The program should have a long-term proposal regarding community involvement and maintenance of the new open spaces, shifting the focus from a haphazard community engagement approach to a meaningful and systematic process. Furthermore, although the final report states that local communities were satisfied with the work done in ravines, there is no evidence demonstrating the level of satisfaction of the resettled families.</p> |
| | 13 | Conserving |
| | | <p>This credit is designed to foster sustainable long-term economic growth and development for the community. In this regard the program created some new jobs during the execution of construction. Nonetheless, the different components of the program indirectly contributed to improve the overall sustainable growth and development of the Quito metropolitan area by providing a resilient infrastructure for urban water management, allowing business continuity during extreme weather events, and thus minimizing losses. Furthermore, one of the greatest contributions of the program was the design and construction of new public spaces of high-environmental quality, which provided risk-free areas for recreation and leisure. These works contributed to the restoration of natural and cultural resources that improved the livability of the affected communities. The landslide management component of Phase II aimed to implement an integral management of Quito’s foothills and ravines to avoid informal occupation of these natural areas, which constitute part of the city’s natural heritage. Moreover, every environmental conditioning project sought to increase recreational areas, and hence improve the community’s integration. The enhancement of the existing, and the creation of new sewage infrastructure allowed for the development of the northern area of Quito, known as Calderon Parish. This program was developed in response to the city’s recent accelerated growth, coupled with a shortage of basic infrastructure services</p> |

| | | Score | METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM - PHASE II |
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| QL1.2 STIMULATE SUSTAINABLE GROWTH & DEVELOPMENT | | | and housing. In this regard, the program was of great contribution to the city's development and planning as it developed a holistic zonification plan for a better assimilation of the program into the existing urban area. |
| | Source | | <ol style="list-style-type: none"> 1. Empresa Pública Metropolitana de Agua Potable y Saneamiento, Libro de Obras Anexo 1F. (November, 2014) 2. Memoria Descriptiva, Proyecto de Alumbrado Público acondicionamiento ambiental de la Quebrada Ortega. 3. Municipio del Distrito Metropolitano de Quito Alcaldía, Convenio de Cooperación Interinstitucional entre el Municipio del Distrito Metropolitano de Quito y la Empresa Metropolitana de Alcantarillado y agua Potable de Quito” EPMAPS, para la ejecución del plan ambiental y social (PMAyS). (April, 2007) 4. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS) Programa de Saneamiento Ambiental del Distrito Metroplitano de Quito (PSA) FASE II, Plan Definitivo de Mitigación y Reasentamiento de Familias en Riesgo, Primera Etapa, de la fase II, Quebradas del Eje Navarro-La Raya Sur y Cuenca de la Quebrada de Jerusalén. (July, 2008) |
| | Recommendations | | The program was not focused on providing direct jobs or educational programs for sustainable and long-term economic growth in the involved areas, but the interventions included in the different components of the program still improved capacity, competitiveness, and attractiveness of the overall community. For a higher level of achievement, it is recommended to consider programs that can improve capacity and competitiveness from a social perspective in order to foster further development. |
| QL1.3 DEVELOP LOCAL SKILLS AND CAPABILITIES | 5 | Superior | |
| | | | This credit addresses the degree to which the program improves both local employment and skills mix during its design, construction, and operations phases. In this sense, many of the works executed during Phases I and II of the PSA were performed by contractors that hired people from the area, thus making the most of their skills and knowledge. Many of these workers obtained specialized training for local jobs. For instance, many were trained in industrial safety and special construction practices. In the case of the El Trébol tunnel, an underground stormwater collector project located in the center of Quito, expansive concrete was used which was a new type of material. This new technique was implemented to support the dome of an underground stormwater collector located in the historical area of Quito. In relation to the community, according to the information provided, the training for the solid waste management initiative sought to educate the population on how to recycle and use the new public devices for recycling. As 60% of Quito's domestic waste is organic (more in the historical area) this program trained the population on how to recycle and use organic waste. |

| | | Score | METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM - PHASE II |
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| GL1.3 DEVELOP LOCAL SKILLS AND CAPABILITIES | Source | | <p>1. Empresa Pública Metropolitana de Agua Potable y Saneamiento, Libro de Obras Anexo 1F. (November, 2014)</p> <p>2. Empresa Pública Metropolitana de Agua Potable y Saneamiento, “Separemos los Residuos para Reciclar” (poster to promote recycling)</p> <p>3. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS) Programa de Saneamiento Ambiental (PSA) - Fase II Componente Manejo de Laderas, Campaña de Educación Ambiental en apoyo a la gestión de los residuos sólidos en el área de intervención del PSA Fase II, Manual sobre Micro Emprendimientos para el reciclaje de residuos sólidos. (August, 2012)</p> <p>4. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS) Programa de Saneamiento Ambiental (PSA), Acta de Entrega - Recepción Única, “Contrato de Servicios de Consultoría en capacitación y Asesoría para la implementación de la Gestión Ambiental local en la Comunidad Ubicada en el Tramo Alto de la Quebrada Ortega-Sector Ecuatoriana”. (January, 2014)</p> |
| | Recommendations | | <p>To increase levels of achievement, the program should shift from hiring local workers for specific jobs, to a team that commits to working with the local community to assess local employment and educational needs, and to address future community competitiveness. Also, plans and commitments related to the program should consider disadvantaged groups and/or disabled people. Educational programs should foster local capacity development by improving local skills based on making meaningful contributions to long-term competitiveness.</p> |
| GL2.1 ENHANCE PUBLIC HEALTH AND SAFETY | | 2 | Improved |
| | | | <p>In relation to the use of new materials, technologies, or methodologies, special considerations for health and safety were taken into account for the program. As a common practice, every Monday the program team performed introductory meetings for workers to learn and be reminded of industrial safety and occupational health measures to prevent accidents. Also, during these meetings safety measures for the implementation, care, and risks of new materials used were discussed; such as for the expansive concrete used for the Machángara river channeling in the El Trébol area. To achieve this, staff and supervisors were trained in the manufacturing process and casting technique. Unfortunately there is no record of these meetings. Moreover, the program team faced a significant construction challenge with the tunnels built within the historical center, corresponding to the 24 de Mayo and El Tejar collectors. This was a very delicate site as it was declared a World Heritage Site by UNESCO on September 8, 1978, hence no construction or other modifications should have significantly disturbed the zone. To achieve this purpose, especial explosives were utilized and safety measures were implemented for construction workers. Furthermore, the environmental management plan for each project contemplated measures to reduce risks affecting the health or safety of the population and workers. The different projects related to the program improvements in the potable water system, sewage, landslide risk management, and flooding mitigation works were accepted by local authorities and governed by the “Manual de Seguridad y Salud ocupacional del programa de saneamiento ambiental” which sought to ensure customer satisfaction and at the same time respect the environment, and workers’ health.</p> |

| | | Score | METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM - PHASE II |
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| QL1.3 DEVELOP LOCAL SKILLS AND CAPABILITIES | Source | | <p>1. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito, Programa de Saneamiento Ambiental (PSA), Obras que cuentan con el Manual de Seguridad Industrial y Manual de Gestión Ambiental, Cuadro de Obras con PMA</p> <p>2. Marco Maldonado Carbo to Ing. Juan A. Neira Carrasco, 20 November 2007, Memorando Manual de Control Ambiental de Obras de la EPMAPS entre Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito y Alcaldía Metropolitana</p> <p>3. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito, Manual de Seguridad y Salud Ocupacional del Programa de Saneamiento Ambiental de la Empresa Pública. (July, 2012)</p> <p>4. Empresa Pública Metropolitana de Agua Potable y Saneamiento, Libro de Obras Anexo 8F. (July, 2010)</p> <p>5. José Balarezo, e-mail message to author, September 30, 2015.</p> |
| | Recommendations | | <p>In the case of the application of new technologies, materials, and methodologies, it is recommended that a comprehensive risk assessment is incorporated into the program in order to facilitate health and safety plans. Besides, systematic documentation of the significant risks identified related to the use of any new or non-standard technologies and the changes instituted in methodologies and protocols should complement this assessment.</p> |
| QL2.2 MINIMIZE NOISE AND VIBRATION | | 8 | Conserving |
| | | | <p>Baseline studies of existing levels of noise have been conducted. Also, the DMQ managed a noise monitoring network through the Department of the Environment. Noise measurements are recorded in order to see if the levels comply the environmental regulations. The network covers annually approximately 413 companies, and report on their legal compliance or noncompliance of noise limitations. Moreover, sound level meters were used daily during the construction works, in order to control the level of noise produced by machinery, and hence, ensure industrial safety and compliance with environmental regulations of the area.</p> <p>In the case of the Anglo French Project, an underground storm-water collector, noise pollution issues were discussed and solved. For example, there were problems with noise while a well was being built. Noise measurements were made together with the community, with the construction company, the Administración Zonal Centro y PSA. To reduce noise problems, nighttime working hours were diminished, and work began to start one hour later in the morning. Also, while tunneling the Anglo French, it was necessary to replace the air turbine with one of a lower speed, and also to build insulation booths or sound damping for the engine in order to ensure that environmental regulations for noise were adhered to environmental regulations.</p> |
| | Source | | <p>1. Municipio del Distrito Metropolitano de Quito, Proceso de actualización de los planes metropolitanos de desarrollo y ordenamiento territorial del distrito metropolitano de quito situación ambiental en el DMQ, Diagnóstico Estratégico-Eje Ambiental</p> <p>2. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS), Manual de Seguridad y Salud Ocupacional del programa de Saneamiento</p> |

| | | Score | METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM - PHASE II |
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| | Source | | <p>METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM - PHASE II Ambiental de la Empresa Pública. (July, 2012) 3. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS) Programa de Saneamiento Ambiental (PSA) Préstamo 1802, Anexo Ruido. (Abril, 2009)</p> |
| | Recommendations | | <p>The program should aim to create quieter communities, shifting from just meeting the regulatory standards to further actions to reduce ambient noise and vibration. Specifications set for noise and vibration during construction and operations should take into account community needs.</p> |
| | | 1 | Improved |
| QL2.3 MINIMIZE LIGHT POLLUTION | | | <p>Minimizing light pollution was not an objective of the program, nonetheless, lighting was considered in the ravine restoration component. The program wanted to assure the population's safety and allow for ravine use at night by adding lighting into the ravines. In the case of the Quebrada Ortega project, the intervention spanned a total distance of about 2.7 km, and covered an area of 38 acres. This intervention sought to improve and increase street lighting in the most vulnerable areas. Intervened areas were selected according to respective lighting needs, which were evaluated on-site by the team, as well as by utilizing the feedback gathered in previous community workshops (mainly related with security concerns). Aside from the basic lightning assessment performed in the recovery of the ravines to provide these public spaces with adequate levels of lighting, further alternatives to minimize energy consumption and light spillage should be evaluated.</p> |
| | Source | | <p>1. Memoria Descriptiva, Proyecto de Alumbrado Público acondicionamiento ambiental de la Quebrada Ortega. 2. Municipio del Distrito Metropolitano de Quito, Proyecto de Acondicionamiento Ambiental de la Quebrada Ortega Informe Final.</p> |
| | Recommendations | | <p>The program should consider incorporating alternative lighting to reduce glare and light spillage, and to increase the use of dark-sky friendly lighting. An overall lightning needs assessment is recommended in public spaces and facilities related to the program, in order to redefine the levels of light needed, and to identify where to eliminate unnecessary lighting. This can also contribute to reduced energy costs.</p> |

| Score | | METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM - PHASE II |
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| QL2.4 IMPROVE COMMUNITY MOBILITY AND ACCESS | 14 | Conserving |
| | | <p>A common practice of the general program was to use inter-institutional coordination to lessen the impact communities' mobility due to disruptions created by its activities. To do so, when traffic was disrupted special coordination with the Public Enterprise Mobility and Public Works (EPMMOP) was required. These cutoffs were published in the media to inform inhabitants of alternative routes. Moreover, meetings were held with the community and were useful in communicating interruptions and reducing negative impacts.</p> <p>The environmental restoration projects were not only limited to environmental enhancement, but also sought to integrate these areas into the existing urban fabric. In the case of the Ortega ravine intervention, they proposed to extend the ravine towards the city by planting trees on nearby roads, and thus creating green corridors. In this case, community mobility was improved by creating a connected circuit that integrates all sections of the ravine, allowing for the population walk continuously. Also, it is important to highlight the coordination of the program with municipal institutions in solving public transportation issues. In projects such as the Quebrada Ortega and Río Grande, residents requested the incorporation of bus stations to facilitate public transportation in crowded areas.</p> <p>In relation to urban sprawl, the program's environmental conditioning projects sought to stop urban expansion into protected, vulnerable, or rural areas. Nonetheless, the expansion of the sewage system, such as the Calderon project, enabled urban expansion by increasing the network's coverage area, attracting new families to live there. However, in all cases the program safeguarded the integration of the works with territorial planning instruments, which provided a comprehensive framework for development by working in coordination with the municipalities involved, such the Calderón Municipality.</p> |
| | Source | <ol style="list-style-type: none"> 1. Proyecto de Acondicionamiento Ambiental de la Quebrada Ortega Informe Final. 18-22. 2. María Hernández, Administradora Municipal de la Zona Quitumbe to Xavier Vidal Pacurucu, Director Ejecutivo del PSA, Coordinación Actores involucrados.(Quito: April, 2013), 1. 3. Lucía Burgos, EMAAPQ, to José Balarezo, José Burbano, Juan Espinos, EPMAPS, Sistematización Acuerdo Transportistas, Calle Cestarís (ANEXO MOVILIDAD). (June, 2010), 1-22. 4. EPMAPS, Sistematización reunión cierre vía calle Clemente Pulupa . (June, 2013), 1-5. 5. Xavier Vidal, e-mail message to author, October 7, 2015. |
| Recommendations | <p>The program team could expand the range of discussions to connect environmental restoration interventions to further pedestrian-related mobility considerations. This integral vision of the city as a whole could contribute to shifting from a motorized transportation network to a non-motorized one. Therefore, further documentation evaluating possibilities for the integration of different urban systems to improve overall livability of communities is recommended.</p> | |

| Score | | METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM - PHASE II |
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| QL2.5 ENCOURAGE ALTERNATIVE MODES OF TRANSPORTATION | 3 | Enhanced |
| | | <p>The works conducted to improve the ravines as part of the landslide management component of the program promotes the inclusion of public, walkable paths. For example, the Ortega’s environmental plan was formulated to recover the ravine’s natural and social environment by maintaining and planting adequate vegetation in accordance with its natural conditions, as well as proposing public spaces that help to integrate inhabitants of direct and indirect influence with proposals such as trails, viewpoints, and recreational areas. The actions undertaken also sought to solve the inhabitants’ mobility issues between the edges of the ravine by implementing bridges and trails.</p> <p>Alternative modes of transportation were encouraged, not only by providing new pathways, but also by creating a connected circuit that integrates the three sections of the ravine, thus allowing the population to walk continuously from Saenz street to the newly created recreational area. This walk includes: walking trails; bridges that allow for physical and social integration of the population located on the edges of the ravine; a public plaza on Noboa street built to consider the roadworks and water projects implemented within the area; and finally a large recreational area designed on top of a sanitized landfill.</p> |
| | Source | 1. Proyecto de Acondicionamiento Ambiental de la Quebrada Ortega Informe Final. 3-4, 14, 19-21 |
| | Recommendations | The interventions should promote the integration of the pedestrian network with other modes of transportation. Moreover, although new pathways are designed within the framework of the program, it is unclear how they connect with a larger network of existing trails and bicycle paths. Also, the new pathways should consider the connection with the existent public transportation network and encourage transit access points to the new public spaces. |
| | 6 | Superior |
| | | <p>As a safety standard, during the construction of the works preventative signals were located within strategic areas, thus improving user safety. In order to prevent accidents and improve accessibility on public roads during construction, the program developed standardized signage, providing security to pedestrians, drivers, and workers. This safety standards can be found in the document developed by the EPMAPS, Manual de Seguridad y Salud Ocupacional del programa de Saneamiento Ambiental de la Empresa Pública. According to the team, in addition to the security measures in the areas of intervention the program realized a detailed analysis to determinate the security needs and accessibility of the surrounding population. Also, documentation was found that outlines how the team informed the nearby population of the works and innovations being done in the area. To improve accessibility, lighting in ravines has been implemented, thus allowing the safe use of these public spaces, and allowing for the mobility of users at all times.</p> |

| | | Score | METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM - PHASE II |
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| QL2.6 IMPROVE SITE ACCESSIBILITY, SAFETY & WAYFINDING | Source | | <p>1. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS), Manual de Seguridad y Salud Ocupacional del programa de Saneamiento Ambiental de la Empresa Pública. (July, 2012) 198-211, 236-214, 250.</p> <p>2. Proyecto de Acondicionamiento Ambiental de la Quebrada Ortega Informe Final . 19-20</p> <p>3. Memoria Descriptiva, Proyecto de Alumbrado Público acondicionamiento ambiental de la Quebrada Ortega. 2-4</p> <p>4. Acondicionamiento Señalética Río Grande Ortega, Acondicionamiento Ambiental Quebrada Ortega.</p> <p>5. Empresa Metropolitana Alcantarillado y Agua Potable de Quito EPMPs, Programa de Saneamiento ambiental para el Distrito Metropolitano de Quito (PSA) Observaciones al caso de estudio - Envision PSA File. (January 2016) 2</p> |
| | Recommendations | | <p>It is recommended that the program should provide an increasingly clear, identifiable, and intuitive design and examples of signage for safe access and egress. Also, beyond providing the accessibility, safety, and wayfinding aspects, the changes made to the site and general vicinity of the completed program should improve overall access and safety for the adjacent neighborhoods, beyond that of previous levels.</p> |
| QL3.1 PRESERVE HISTORIC AND CULTURAL RESOURCES | 8 | Conserving | |
| | | | <p>The program team has given special consideration to enhancing and restoring the ravines of the areas which are considered to be those of natural heritage. As they worked to restore the fauna and flora of these areas, the program also sought to turn them into protected areas that should be taken care of by nearby inhabitants.</p> <p>In this regard, the program was formulated to incorporate the community into the design, so as to incorporate and preserve the community’s collective memory within these areas. In the Quebrada Ortega project, the opinions of senior citizens that live in the Setenta y Piquito area were included in the design; therefore, collaboration with this group allowed for the restoration of the historical memory of this location. By understanding the expectations and aspirations of community members, the team was able to articulate their ambitions and understandings for defining a good quality of life.</p> <p>Moreover, a feasibility analysis was performed to identify and avoid impacts to cultural resources in the design. An example of this were the works conducted during the excavation and construction of the stormwater collectors in the historical center of Quito, where special care was taken to not affect houses designated as “cultural heritage” by the city. For these works, they avoided the use of destructive excavation methods such as dynamite, and instead utilized a system of stone breakup progressive known as “crack”, which minimize negative impacts.</p> |

| Score | | METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM - PHASE II |
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| GL3.1 PRESERVE HISTORIC AND CULTURAL RESOURCES | Source | <ol style="list-style-type: none"> 1. Proyecto de Acondicionamiento Ambiental de la Quebrada Ortega Informe Final 2. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS), Programa de Saneamiento Ambiental (PSA), Préstamo 1802. (June, 2009) 3. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS), Programa de Saneamiento Ambiental (PSA), Préstamo 1802, Nueva York Bombona. (September, 2009) 4. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS), Programa de Saneamiento Ambiental (PSA), Préstamo 1802, El Rosal. (September, 2009) 5. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS), Programa de Saneamiento Ambiental (PSA), Préstamo 1802, G3-AF. (September, 2009) 6. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS), Programa de Saneamiento Ambiental (PSA), Préstamo BID 1802/OC-EC, Capacitación + Operativo. (September, 2009) 7. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS), Programa de Saneamiento Ambiental (PSA), Préstamo BID 1802/OC-EC, Capacitación + Operativo. (July, 2009) 8. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS), Programa de Saneamiento Ambiental (PSA), Préstamo BID 1802/OC-EC, Capacitación + Operativo. (July, 2009) 9. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS), Programa de Saneamiento Ambiental (PSA), Préstamo 1802, Diciembre 09. (December, 2009) 10. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS), Programa de Saneamiento Ambiental (PSA), Préstamo BID 1802/OC-EC, Reunión Asunción América. (May, 2009) 11. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS), Programa de Saneamiento Ambiental (PSA), Préstamo BID 1802/OC-EC, Reunión Asunción Nueva York. (June, 2009) 12. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS), Programa de Saneamiento Ambiental (PSA), Préstamo 1802, Reunión y Recorrido. (April, 2009) |
| | Recommendations | <p>Efforts for preservation and conservation should shift towards restoration and enhancement of cultural and heritage sites. More discussions and coordination are recommended in order to identify significant historical and cultural resources for the community, beyond those already designated by the city, therefore increasing the scope of analysis and incorporating a larger extent of interests.</p> |

| Score | | METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM - PHASE II |
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| QL3.2 PRESERVE VIEWS AND LOCAL CHARACTER | 6 | Superior |
| | | <p>In relation to maintaining the local character of the community, one of the main functions of the program while restoring the “Quebrada Ortega” area was to visually connect the borders of the ravine. This idea was achieved by designing viewpoints within the ravine in order to enable users opportunity to appreciate nature. These interventions allowed for visual and social connectivity between the edges of the ravine, as well as contemplation of the natural environment. This aspect (and all of the environmental conditioning projects) was formulated to recover the ravines that were previously used as garbage dumps. The projects preserved the local character of the area by restoring these spaces to their previous state, and in some cases new features were integrated into the landscape; one example is the artificial lagoon in Quebrada Ortega created with the purpose of enhancing the area as a public space. The program showed alignment with community values by working with local officials, community members, and decision makers to solicit opinions about the local character. Also, participatory designs were developed with the zonal administration officials involved in the community to implement leisure and viewing areas. Looking forward, in order to protect the ravines from future real estate development, the program team recommends analyzing the possibility of implementing municipal regulations within the urban area located along the borders of the ravines.</p> |
| | Source | <ol style="list-style-type: none"> 1. Proyecto de Acondicionamiento Ambiental de la Quebrada Ortega Informe Final 2. Empresa Pública Metropolitana de Agua Potable y Saneamiento, Libro de Obras Anexo 11F. (October, 2014) 1. 3. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS), Programa de Saneamiento Ambiental (PSA) Préstamo BID 1802/OC-EC, Reunión Presentación AZQ. (March, 2013) 4. María Hernández, Administradora Municipal de la Zona Quitumbe to Xavier Vidal Pacurucu, Director Ejecutivo del PSA, Coordinación Actores involucrados 5. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS) Programa de Saneamiento Ambiental (PSA), Lista Shanshayacu. (August, 2013) 6. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS) Programa de Saneamiento Ambiental (PSA), Acompañamiento Social en la Fase De Construcción De Obras Ejecutadas por la Empresa Pública Metropolitana de Agua Potable Y Saneamiento, a través del Programa de Saneamiento Ambiental (PSA) Contribuciones Prácticas. Una Guía A Partir De La Experiencia. (December, 2009) |
| Recommendations | <p>The program should include clauses on the preservation of high-value landscapes and landscape features, as well as programs for monitoring and enforcement of the protected areas. Also, the program should restore lost and damaged natural landscape features, and lost character features within the community by removing physical barriers, structures, or vegetation.</p> | |

| Score | | METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM - PHASE II |
|----------------------------|---|--|
| QL3.3 ENHANCE PUBLIC SPACE | 13 | Restorative |
| | | <p>The actions undertaken by the program not only sought to enhance the existing public areas, but also to create new ones. The implementation of the environmental conditioning program in degraded areas contributed to improving the low-level of green area per capita in Quito, especially in the southwest zone where no such interventions had yet been developed. In total, 19 ravines were intervened in comprising a total of 208 acres. In the Ortega ravine project, new infrastructure such as illumination, playgrounds, lagoons, and workout equipment, among others, were constructed. This infrastructure was also incorporated as a way to protect the ravine from misuse and urban sprawl. Moreover, the program’s new programmatic areas promoted the population’s accessibility by allowing for pedestrian flow from one edge of the ravine to the other; the programs also consolidate these areas as public spaces. The viewpoints were not only designed as a way to visually connect both edges of the ravine, but also as a way to provide for an area where people could take in and appreciate the natural heritage of their city. This ravine was divided into three sections. The first section is focused on the environmental potential of the ravine; the second enhances the visual and social potential to connect the nearby communities; the third, which is the longest section, is comprised of a filled in area where the project is traversed by two important roads.</p> |
| | Source | <ol style="list-style-type: none"> 1. Empresa Pública Metropolitana de Agua Potable y Saneamiento, Libro de Obras Anexo 11F. (October, 2014) 1. 2. Empresa Pública Metropolitana de Agua Potable y Saneamiento, Libro de Obras Anexo 12F. (September, 2014) 1-3. 3. Proyecto de Acondicionamiento Ambiental de la Quebrada Ortega Informe Final. 20-38. |
| Recommendations | <p>It is recommended to expand upon the scope and extent of the restoration efforts which were already made, with regards to the landslide management component of the program. The restoration works which was done in the ravines could be replicated in other similar areas, thus fostering the creation of new public spaces, and enhancing overall community livability. The creation of wildlife refuges could be consider as part of such efforts.</p> | |

| | | Score | METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM - PHASE II |
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| QL 4.1- IDENTIFY AND ADDRESS THE NEEDS OF WOMEN AND DIVERSE COMMUNITIES (INDIGENOUS OR AFRO-DESCENDANT PEOPLES) | | 2 | Enhanced |
| | | | <p>The program developed several meetings with nearby communities. The program team clearly understands the type of population that lives near the intervention area, and hence, takes into consideration their specific needs. For example in the Quebrada Ortega project, the team interviewed neighborhood leaders, senior citizens, young people, and children from the zone. These interviews ensured the inclusion of diverse groups amongst the community members, and the needs that they identified were included into the design of the project. According to the information provided, the program team made significant efforts to review, evaluate, and incorporate these perspectives.</p> <p>Several workshops with communities were performed which helped the program team in realizing the diverse interests. The team conducted different types of workshops, summarized the relevant problems for citizens, their respective expected solutions, and the requirements to implement these solutions. Final workshops with communities allowed for the validation of the proposal, as well the community expectations and commitments with regards to the program.</p> |
| | Source | | 1. Proyecto de Acondicionamiento Ambiental de la Quebrada Ortega Informe Final 2. Proyecto de Acondicionamiento Ambiental de la Quebrada Shanshayacu Informe Final |
| | Recommendations | | <p>Ideas, concerns, and interests of women specifically were not included, and they were not mentioned as being a separate group that could provide specific feedback for improving the program. Evidence presented in the interventions of the Ortega, Rio Grande and Shanshayacu ravines demonstrates that the overall community's interests were incorporated into the design, however, a stronger focus in identifying and addressing the needs of specific groups is recommended.</p> |

| | | Score | METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM - PHASE II |
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| QL4.2 - STIMULATE AND PROMOTE WOMEN'S ECONOMIC EMPOWERMENT | 0 | No score | |
| | | | No documentation which was presented showed that the program stimulated and promoted women's economic empowerment. Although women were included in the different workshops which were developed within the program as a way to promote community involvement, there was no specific action that encouraged economic empowerment, specifically with regards to the group. |
| | Source | | n/a |
| | Recommendations | | The program team could develop plans to increase women's empowerment and involvement in the program; to do so, the program should register the number, occupations, and genders of all of the individuals employed by the program, and promote the inclusion of women by implementing educational and training programs that support female employees. |
| QL4.3 - IMPROVE ACCESS AND MOBILITY OF WOMEN AND DIVERSE COMMUNITIES (INDIGENOUS OR AFRO-DESCENDANT PEOPLES) | 2 | Enhanced | |
| | | | This credit evaluates the efforts made to understand the various patterns and needs of mobility of different social groups. The program developed several meetings with nearby communities, therefore the team addressed the different groups of the population that live near the area of intervention, and hence, took their specific needs into consideration. Special efforts to involve vulnerable groups such as women, children and the elderly in workshops were made. According to the team, workshops encouraged the participation of these groups and their specific patterns of mobility were considered in the program's design. Hence, throughout the meetings and workshops, both women and different ethnic groups were present, and were able to raise their voice and express opinions and interests. |
| | Source | | 1. Proyecto de Acondicionamiento Ambiental de la Quebrada Ortega Informe Final 2. Proyecto de Acondicionamiento Ambiental de la Quebrada Shanshayacu Informe Final 3. Empresa Metropolitana Alcantarillado y Agua Potable de Quito EPMPS, Programa de Saneamiento ambiental para el Distrito Metropolitano de Quito (PSA) Observaciones al caso de estudio - Envision PSA File. (January 2016) 2 |
| | Recommendations | | For a higher level of achievement, potential negative impacts for these groups should be reduced or eliminated. Besides, needs and interests of women and ethnic groups should have a higher priority in the workshops and meetings. More efforts can be made to identify different patterns of mobility and respective barriers; in order to take these elements into consideration and address safety related issues. |

| | | Score | METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM - PHASE II |
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| QLO.0 INNOVATE OR EXCEED CREDIT REQUIREMENTS | | 8 | <p>The remarkable work done by the team in relation to the environmental restoration of the ravines, and the integration of citizens during the process, by utilizing different methodologies and ensuring the participation of all age groups, should be highlighted. The works which were implemented include the recovery of multiple degraded areas, which were previously used as dumps and destroyed by informal housing settlements. Due to the illegal activities that took place in these areas, they became dangerous places that citizens avoided. In order to reverse this situation, the program considered the active participation of senior citizens to rebuild the ravines from collective memory, and through this input implement efforts to restore the landscape to its initial state.</p> <p>Moreover, the purpose of several meetings held with the community was to gather the perspectives of the local inhabitants to refine interventions by understanding the conditions of these spaces before the environmental degradation had begun. As recognized by the team, the commitment and approval of the community was fundamental in minimizing social conflicts, and thus facilitated the construction of the works. Furthermore, the landslide management component was developed as an integral component that supported a higher level of sustainability by integrating environmental and social perspectives. By restoring these valuable natural assets, landslide risks were minimized, and the areas were returned to the community as public spaces, thus improving upon the overall livability of the area.</p> |
| | | | |
| | | Source | Proyecto de Acondicionamiento Ambiental de la Quebrada Ortega Informe Final. 1-4 |
| | | Recommendations | It is recommended to develop a methodology for the reconstruction of the "collective memory," in order to allow for the replication of the work which was done with senior citizens in the recovery of important spaces for the community. Additionally, the program should consider ways to integrate the restored and recovered spaces into a broader urban-scale; for example by consolidating a system of connected parks and green corridors. Moreover, the restoration of the ravines could also contribute to creating wildlife refuges to preserve and enhance the endemic ecosystem. |
| | | 110 | |

CATEGORY I, PEOPLE AND LEADERSHIP

SUB CATEGORY: LEADERSHIP

| Score | METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM - PHASE II |
|------------------------|---|
| 4 | <p>Enhanced</p> <p>The fifth component of the Environmental Sanitation Program for the Metropolitan District of Quito refers to institutional reinforcement, which includes the institutional strengthening of EPMAPS, and as well of the municipality. The implementation of these plans was supported by inter-institutional cooperation between the Municipio del Distrito Metropolitano de Quito, la Empresa Metropolitana de Alcantarillado and Agua Potable de Quito (EPMAPS) for the execution of the environmental and social program.</p> <p>For the long-term, the inter-institutional collaboration which was established has been fundamental to ensuring the maintenance of the executed works, specifically in the restored ravines. The agreement included a special commitment to implement an integrated management of Quito's hillsides, by generating sustainable institutional and financial tools to promote community involvement. In the agreement, funds were also allocated for the ecological restoration and risk management projects of the ravines; these interventions are meant to complement the water regulation and flood control programs. Furthermore, public commitment to the values of sustainability is demonstrated through the main objectives of Quito's hillside management program, which are to mitigate flooding and landslide risks by improving the collectors; to restore ravines by creating new public spaces; and to work with the community to ensure that they are appropriately involved, thus ensuring the sustainability of the investments.</p> |
| Source | <ol style="list-style-type: none"> 1. Oscar Luis Camé Saldivar, e-mail message to author, September 30, 2015. 2. Empresa Metropolitana de Alcantarillado y agua Potable de Quito (EMAPS). Subconvenio de Cooperación Interinstitucional celebrado entre la Empresa Metropolitana de Alcantarillado y Agua Potable "EPMAPS" y la Empresa Metropolitana de Aseo "EMASEO" para el manejo de las Laderas y Quebradas de Quito. (Quito: April, 2007) 3. Municipio del Distrito Metropolitano de Quito Alcaldía, Convenio de Cooperación Interinstitucional entre el Municipio del Distrito Metropolitano de Quito y la Empresa Metropolitana de Alcantarillado y agua Potable de Quito" EPMAPS, para la ejecución del plan ambiental y social (PMAYS). (Quito: April, 2007) |
| Recommendations | <p>The program's policies, activities, and performance should reflect that sustainability has been made a core value of the organization and the project team. This commitment should be supported by various examples of activities undertaken in addition to the publication of an annual report that highlights the sustainable performance of the organization in addressing and monitoring the progress of sustainable goals.</p> |

LD1.1 PROVIDE EFFECTIVE LEADERSHIP AND COMMITMENT

| | Score | METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM - PHASE II |
|--|----------------------|--|
| LD1.2 ESTABLISH A SUSTAINABILITY MANAGEMENT SYSTEM | 7 | <p>Superior</p> |
| | | <p>The corresponding functions and responsibilities to address the program’s issues of sustainability have been clearly assigned at a departmental level. Moreover, the creation of a special execution unit guaranteed technical control, optimization of costs, and minimized execution times for the multiple projects which conform the program.</p> <p>Each entity involved had a clear role for achieving a sustainable performance. Obligations and responsibilities of each of the entities involved in Phase II of the environmental and social management plan (PMAyS) of the “Saneamiento Ambiental” program of Quito are detailed in the PMAyS agreement. For example, in the projects developed during Phase II of the Environmental Sanitation Program (PSA), the PMAyS agreement explains that they will need the support of various organizations such as the municipality, operating units, and zonal administrations, among others, which are all part of the municipality’s organizational structure, and have jurisdiction throughout the territory and on the adopted solutions.</p> <p>Through the institutional strengthening which was needed to contribute to the sustainability of the program’s investment, the team has foreseen the need to incorporate new capacities from the zonal administrations during program implementation. Efforts were aimed to strengthen their technical capacity through training and the practical application of management tools that will support program interventions, and subsequently allow for the municipality to continue managing the risk-prone hillside areas.</p> <p>The comprehensive studies and works done on slopes, ravines, and natural areas were the product of inter-institutional coordination. These efforts were consolidated through the participation and collaboration of zonal administrations and public companies, and yielded a new comprehensive and integrated management model for the works undertaken on the slopes (e.g. integrated management plan for the Pichincha-Atacazo slopes; PMILEPA).</p> <p>Moreover, documents demonstrated that the involved authorities took part in the workshops developed through some of the ravine restoration projects, such as those of the Quebrada Río Grande and Ortega. Overall, the program’s environmental, social, and economic objectives and goals were accomplished and are aligned with the goals and needs of the community.</p> |
| | <p>Source</p> | <ol style="list-style-type: none"> 1. Municipio del Distrito Metropolitano de Quito Alcaldía. Convenio de Cooperación Interinstitucional entre el Municipio del Distrito Metropolitano de Quito y la Empresa Metropolitana de Alcantarillado y agua Potable de Quito “EPMAPS” para la ejecución del plan ambiental y social (PMAyS). (Quito: April, 2007) 2. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS). Programa de Saneamiento Ambiental (PSA) Préstamo BID 1802/OC-EC, Reunión Presentación AZQ. 1-5. March, 2013 3. Proyecto de Acondicionamiento Ambiental de la Quebrada Ortega Informe Final. 20-38. 4. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS), Programa de Saneamiento Ambiental del Distrito Metropolitano de Quito Fase II. Reglamento Operativo del Programa. (December, 2006) 60-75. |

| Score | | METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM - PHASE II |
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| LD1.3 FOSTER COLLABORATION AND TEAMWORK | Recommendations | The program should include clauses on the preservation of high-value landscapes and landscape features, as well as programs for monitoring and enforcement of the protected areas. Also, the program should restore lost and damaged natural landscape features, and lost character features within the community by removing physical barriers, structures, or vegetation. |
| | 4 | Enhanced |
| | | <p>This credit examines the extent of collaboration within the program team, and the integration of whole-systems design and delivery approaches.</p> <p>The actions undertaken by the team sought to approach the program as a systematic and interconnected set of systems, considering the context of the entire city infrastructure. For instance, the main objective of the hillside management program was to implement integrated management of the slopes of Quito. The completion of these interventions was characterized and supported by participatory processes, recognizing that execution and management was not possible without the participation of stakeholders interacting in the area, and whose commitment was required.</p> <p>A common characteristic in the program was the teamwork between the technical and social personnel involved in the program’s development. Permanent coordination meetings were made by the team to maintain an holistic approach in the design and execution of the program. For instance, urban solid waste management involved educational activities for the population, educating them on the composition of the waste generated by the communities living on the hillside area, as well as encouraging changes of inappropriate behavior.</p> <p>These examples illustrate the systemic and collaborative approach undertaken by the team, however, no evidence was provided in relation to explicit risk and reward sharing as part of the contractual agreement between the program’s owner and the executors of the works.</p> |
| | Source | <ol style="list-style-type: none"> 1. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS) Programa de Saneamiento Ambiental de la ciudad de Quito, Juan A. Neira Carrasco, Gerente General EPMAPS, IV. Subprograma manejo de laderas de Quito, Reglamento Operativo para el manejo participativo de laderas,. 4-18. March, 2007. 2. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS). Manual de Seguridad y Salud Ocupacional del programa de Saneamiento Ambiental de la Empresa Pública (July 2012). 3. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS). Acta de Entrega - Recepción Única “Contrato de Servicios de Consultoría en Capacitación y Asesoría para la implementación de la Gestión Ambiental local en la Comunidad Ubicada en el Tramo Alto de la Quebrada Ortega-Sector-Ecuatoriana”. January, 2014. 4. Notaría Quinta Del Distrito Metropolitano de Quito. Expropiación Total y Compensación Social por Reasentamiento (March 2015). |

| Score | | METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM - PHASE II |
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| LD1.4 PROVIDE FOR STAKEHOLDER INVOLVEMENT | Recommendations | To achieve higher levels of performance, the importance of risk and/or reward sharing should be recognized and explicitly incorporated in the owner’s contract with the implementing team, thus complementing the existing collaborative processes of management; this is an important step in advancing sustainable performance. For a whole-systems design approach, it is recommended that the design considerations include sources of demand, using renewable energy sources, eliminating design conflicts, and eliminating duplicated functions or unnecessary redundancies. |
| | 14 | Conserving |
| | | <p>The intent of this credit is to evaluate the extent to which program stakeholders are identified and engaged with in program decision-making. In this case, the complexity of the program, and the scale of the interventions highlighted the great necessity for the identification and meaningful incorporation of stakeholders during all phases.</p> <p>Over the course of the program’s implementation, it was necessary to inform and incorporate decision-makers to ensure that policy-makers and other public authorities were made aware of the program’s important issues and processes. To achieve this they conducted meetings with stakeholders in order to be able to incorporate their feedback into the process.</p> <p>It is important to highlight the strong relation with municipalities for implementing a program that promoted the enhancement of an area from a territorial and environmental planning perspective. It is also crucial to mention the strong relationship that the team developed with communities for conducting the program, considering that many of the works involved significant changes to the population’s way of life, especially with regards to the resettlement of families. Additionally, other works had high levels of impact on the lives of the surrounding communities while they were being undertaken. For example, due to the many public interruptions caused by the construction of the new sewage system, it was necessary that the team maintained constant communications with municipalities, communities, and other authorities to ensure implementation and minimize nuisances.</p> |
| | Source | <p>1. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS). Desarrollo Programa Sólido, Ayuda Memoria. January, 2014.</p> <p>2. Inter-American Development Bank. Informe de Terminación de Proyecto PCR (March 2015).</p> |
| | Recommendations | Although key stakeholders and key concerns have been identified and incorporated into the program, the public participation process could be improved upon by being conscious of the participation of all members of the community, including women. It is recommended to have included a planned community involvement program since the beginning of the program. Moreover, there should be evidence of specific and significant cases where changes were made to designs based on feedback, for which there was none. |

| | | Score | METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM - PHASE II |
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| LD2.1 PURSUE BY-PRODUCT SYNERGY OPPORTUNITIES | 0 | No Score | |
| | | | The identification and pursuing of opportunities to use unwanted byproducts or discarded materials from nearby operations will improve the projects's performance. In this regard, the documentation which was provided did not reflect byproduct synergy efforts in order to identify the materials needed, and resources available from nearby facilities. Nevertheless, some internal considerations were undertaken, for instance, the debris generated from minor earth movements was reused in the program to compensate in depressed areas, and recycled rubber was used for the trail paths of the ravines. However, to fulfill this credit a general assessment with the identification and characterization on a limited set of nearby facilities and waste streams is necessary. |
| | Source | | 1. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS). Libro de Obras Anexo 10F.1-3 July, 2013 2. Proyecto de Acondicionamiento Ambiental de la Quebrada Ortega Informe Final . 31 |
| | Recommendations | | It is recommended that in future the program teams shifts to more systematic efforts to identify unwanted byproduct materials that could be used in the program, by more aggressively searching and screening for opportunities. Considering that the project sought to promote territorial planning for the area of intervention, it may incorporate a search for regional byproduct synergy resources to meet materials needs, and capture synergy opportunities. Additionally, the team may become involved in forming relationships with nearby facility managers to implement industrial- ecology practices. |
| LD2.2 IMPROVE INFRASTRUCTURE INTEGRATION | 16 | Restorative | |
| | | | All of the program investments were planned to create linkages, enhance synergies, and by doing so, improve the overall performance of the program. One of the most successful points of the program was the decision to transform a typical hydrological regulation project into an integral one that included improvements to the water and sanitation systems, but also has worked to restore the natural drainage system of the intervention area— comprised of ravines—, thus reducing and mitigating risk conditions such as those of landslides and flooding. This important decision generated community benefits, as well as better and long-term solutions for existing water-related problems. It is important to highlight the scope of the intervention, which supports the implementation of multi-sectoral metropolitan territorial planning. In this regard, the project is not limited to a local-scale, but rather one that is city-wide, thus trying to integrate the project with other urban systems; this means that the program was designed to consider the existing community's infrastructure, so as to promote a better integration in the area and to achieve a long-term sustainable intervention. In addition, the program considered and incorporated valuable community assets, such as knowledge and social capital, by promoting the active engagement of citizens throughout all of the process and across multiple types of interventions. |
| | Source | | 1. Proyecto de Acondicionamiento Ambiental de la Quebrada Ortega Informe Final . 2-4, 20-38. 2. Municipio del Distrito Metropolitano de Quito Alcaldía. Convenio de Cooperación Interinstitucional entre el Municipio del Distrito Metropolitano de Quito y la Empresa Metropolitana de Alcantarillado y agua Potable de Quito (EPMAPS). para la ejecución del plan ambiental y social (PMAyS). April, 2007 |

| Score | | METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM - PHASE II |
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| LD3.1 PLAN FOR LONG-TERM MONITORING & MAINTENANCE | Recommendations | Aside from the restoration of natural assets and the consideration of valuable community assets, the restorative efforts could consider a broader scope of community infrastructure elements, and thus sustaining and/or restoring community assets in a way that enhances overall community efficiencies and effectiveness. |
| | 10 | Conserving |
| | | The program developed a plan for long-term monitoring and maintenance of the works done, and has identified personnel and resources to make it happen. The management operations team of the Empresa Pública Metropolitana de Agua Potable y Alcantarillado y Saneamiento Ambiental (EPMAPS) has plans for annual maintenance of the works developed during the PSA Environmental Sanitation Program. Part of this plan can be found on the calendar of maintenance for the executed works, in the “Anexo 2F” document. Also, the management operations team has allocated financial resources for the maintenance of the works managed by EPMAPS, including those for an annual maintenance plan. In this regard, the program has staff and resources for the maintenance of the program, and understands its corresponding responsibilities. Additionally, the whole team has been maintained throughout the program’s duration, avoided political interference, and has allowed for efficiency throughout the program’s implementation. In the case of the new green spaces developed by the program, long-term maintenance is ensured by an agreement between the program and the municipality. In this regard, the new areas are being transferred to the Public Space Management Unit, which is part of the municipality and is in charge of this task. |
| | Source | <ol style="list-style-type: none"> 1. Director Ejecutivo del PSA. Memorando N° 290 -PSA-2013 Asunto: Elaboración Calendario Mantenimiento obras ejecutadas PSA Préstamos BID 1424/ OC-EC. Anexo 2F (May 16, 2013). 2. Marcello Basani. E-mail message to the author, September 28, 2015. 3. José Baralezo. e-mail message to author, October 29, 2015. 4. Xavier Vidal Pacurucu, EMAAPQ. Actas de Entrega Recepción Definitiva, Espacio Público (PSA-2015-357) (2015). 5. Luis Zurita, EMAAPQ. Actas de Entrega Recepción Definitiva, Espacio Público (PSA-2015-222) (2015). 6. Xavier Vidal Pacurucu, EMAAPQ. Actas de Entrega Recepción Definitiva, Espacio Público (PSA-2015-115) (2015) |
| | Recommendations | The program considered a comprehensive long term plan for monitoring and maintenance, therefore no recommendation are provided. |

| | | Score | METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM - PHASE II |
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| LD3.2 ADDRESS CONFLICTING REGULATIONS & POLICIES | 1 | | Improved |
| | | | This credit assesses the efforts made to identify regulations or policies that may run counter to sustainable practices. On a local scale, the program meets regulations addressing conflicting regulations and policies to implement the program. In this regard, due to its complexity and its large area of intervention, which ultimately affects all of metropolitan Quito (DMQ), the program team always sought to incorporate and reach decision makers during development, especially for identifying and solving the program’s problems and conflicts. The collaborative work conducted for the resettlement of the families inhabiting the areas prone to landslides is an example of such efforts. Although the program tries to develop a holistic and integrated project, it has not focused on identifying laws or policies that inadvertently may be an obstacle to the implementation of sustainable infrastructure. Furthermore, there was no documentation available that evidences any systematic research to identify laws that could be in conflict with the program’s sustainable goals. |
| | | Source | 1. Empresa Pública Metropolitana de Agua Potable y Saneamiento, Permuta entre el Municipio del Distrito Metropolitano de Quito María Lucía Viracocha Centeno y Otros La Empresa Pública Metropolitana de Agua Potable y Saneamiento Cuantía: USD \$ 45.689.30 J.E.L Di 4 copias, Acercamiento Tomadores Decisiones (May, 2014). |
| | | Recommendations | It is recommended to avoid any conflicts with existing regulations, laws, and standards that may unintentionally run counter to sustainability goals, objectives, and/or practices. To achieve this, it is recommended to conduct a systematic assessment of such items which are applicable to the program, especially considering that this program incorporates a territorial planning approach. Moreover, actions such as rainwater harvesting or greywater reuse for irrigation might be considered for the maintenance of the restored public spaces, therefore policies and norms that could hinder these initiatives should be addressed. |
| LD3.3 EXTEND USEFUL LIFE | 3 | | Enhanced |
| | | | The intent of this credit is to evaluate considerations to promote a more durable, flexible, and resilient project design. This program was made holistic through the decision to convert a typical hydrological regulation project into an integrated program with a long-term perspective (beyond conventional improvements to water-management infrastructure). This included the recovery and restoration of vulnerable zones in order to reduce and mitigate risks and allow for the interception of water. Through these multiple city-wide interventions, the team was able to improve upon and extend the durability and resilience of the works included in the project framework. In addition, these interventions extended to other urban systems of the Quito metropolitan area that were vulnerable to flooding, thus guaranteeing business continuity and minimizing potential damages caused by extreme weather and rainfall. Furthermore, the future maintenance of the newly restored areas was considered in the management of the program, thus ensuring their durability over time. The company developed a water and sanitation master plan which was used as guideline for all of the interventions, and was implemented during the Phase II of the program. This study was developed by the U.S firm, Hazen and Sawyer, and was approved in early 2011. This master plan has been used for technical planning and is valid through 2040. |

| Score | | METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM - PHASE II |
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| LD3.3 EXTEND USEFUL LIFE | Source | <p>1. Proyecto de Acondicionamiento Ambiental de la Quebrada Ortega Informe Final . 1-20</p> <p>2. Municipio del Distrito Metropolitano de Quito Alcaldía. Convenio de Cooperación Interinstitucional entre el Municipio del Distrito Metropolitano de Quito y la Empresa Metropolitana de Alcantarillado y agua Potable de Quito "EPMAPS", para la ejecución del plan ambiental y social (PMAyS). (April, 2007) 1-7.</p> <p>3. Xavier Vidal, e-mail message to author, October 7, 2015.</p> <p>4. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito., Programa de Saneamiento Ambiental para el Distrito Metropolitano de Quito (PSA) Préstamo BID No. 1802/OC-EC, Estudios de Actualización del Plan Integrado de Agua Potable y Alcantarillado para el DMQ, Resumen Ejecutivo Plan Maestro de Agua Potable. (March, 2011).</p> |
| | Recommendations | <p>Although the program pushed the boundaries to improve overall performance over the useful life of ravine restoration projects, further considerations regarding the durability of the materials utilized, and the flexibility in design in other projects that belong to program are recommended. For example, in the case of the wastewater facilities, the utilized materials should be easily adaptable for changes to configurations, retrofitting, or repairs. In addition, feasibility studies to identify areas to increase investments for extending useful, which will offer a reasonable payback should be conducted; these should consider all of the interventions that comprise the program.</p> |
| LDO.0 INNOVATE OR EXCEED CREDIT REQUIREMENTS | 6 | |
| | | <p>The successful implementation of the program was carried out by a special execution unit. This unit was specially developed for this project, and fell under the jurisdiction of the general manager. This unit had autonomy for decision-making, highly-trained personnel, and a management department dedicated to controlling and supervise the works. This unit ensured technical controls, cost optimization, and the optimal timelines for the diverse works which are embedded in the framework of the program. Additionally, the project team was maintained throughout the entire duration of the program, avoiding political interference in the continuity of its operations, and allowed for efficiency in implementing the program. Two important lessons can be taken from this type of management system. The first is that it is extremely important to ensure that the execution unit in charge of the program's implementation has decision-making power. The second is that incentives should be incorporated in order to ensure the maintenance of the the same team throughout the duration of the program.</p> |
| | Source | <p>1. Marcello Basani, IDB, e-mail message to author, September 28, 2015.</p> <p>2. Inter-American Development Bank. Informe de Terminación de Proyecto PCR (March 31, 2015).</p> |
| | Recommendations | <p>Looking forward, it is recommended that the successful management model implemented for this program be replicated on a wide-scale basis, or be made applicable and transferable to multiple types of public sector sponsored infrastructure projects.</p> |

CATEGORY II: CLIMATE AND ENVIRONMENT

RESOURCE ALLOCATION

| | Score | METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM - PHASE II |
|--|------------------------|--|
| RA1.1 REDUCE NET EMBODIED ENERGY | 0 | No Score |
| | Source | n/a |
| | Recommendations | To advance to higher levels of achievement, it is recommended that the project team make efforts to increase reductions in net embodied energy, as compared to industry norms. An estimate of the net embodied energy of program materials is required, demonstrated by means of a life cycle assessment (LCA). The estimation must consider the materials which have been used in the program's construction, as well as those to be used for maintenance and operations. |
| RA1.2 SUPPORT SUSTAINABLE PROCUREMENT PRACTICES | 0 | No Score |
| | Source | n/a |
| | Recommendations | To advance to higher levels of achievement, it is recommended that the project team make efforts to increase reductions in net embodied energy, as compared to industry norms. An estimate of the net embodied energy of program materials is required, demonstrated by means of a life cycle assessment (LCA). The estimation must consider the materials which have been used in the program's construction, as well as those to be used for maintenance and operations. |

| | | Score | METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM - PHASE II |
|-------------------------------|-----------------|-------|--|
| RA1.3 USED RECYCLED MATERIALS | | 2 | Improved |
| | | | The program used recycled materials on specific parts of the program, pushing forward its sustainable values. This contributes to reducing the use of virgin materials, and avoid sending useful materials to landfills. In the Quebrada Ortega and Quebrada Shanshayacu projects, recycled rubber (from tires) was used for the synthetic pavement trail paths in the ravines. These tires were subject to a grinding process, with a binder added on-site was used to construct the recycled rubber walkways. It should be noted that this was the first instance of this type of endeavor in Ecuador. However, there is no documentation that shows the percentage of recovered or recycled materials used in the broad range of projects that comprise the overall program. |
| | Source | | 1. Proyecto de Acondicionamiento Ambiental de la Quebrada Ortega Informe Final . 30. 2. Empresa Pública Metropolitana de Agua Potable y Saneamiento (EPMAPS). Libro de Obras Anexo 12F (September, 2014). |
| | Recommendations | | It is recommended to improve upon and expand efforts to specify reclaimed and recycled materials, and structures in order to increase their total percentage within the project scope. A report of the inventory should be conducted, as well as a reasonable assessment of what is usable, which would both help to better organize the process. The inventory should be very detailed to be more efficient. The program should aim to achieve at least 80% (by weight or volume) materials use from reclaimed or recycled materials to achieve the top score. |
| RA1.4 USE REGIONAL MATERIALS | | 9 | Superior |
| | | | In relation to the intention of minimizing transportation costs and impacts, as well as retaining regional benefits by procuring from local sources, the program team has assured that all materials incorporated into the program were either produced, extracted, or processed within the region. Such is the case for the materials used for the construction of the tunnels, such as the concrete, aggregates, sands, and wood and iron casting frames; all of these materials were produced by ANDEC, a company located in Quito. According to the team, all of the materials which were utilized were sourced from within the following distances: soils, mulches, and aggregates (80 km); concrete (160 km); plants (400 km); and all other materials (800 km). However, no documentation is available to prove that all of the materials were locally sourced. |
| | Source | | 1. Vidal, X., e-mail message to author, October 7, 2015. 2. Empresa Pública Metropolitana de Agua Potable y Saneamiento, Libro de Obras Anexo 12F (September, 2014) |
| | Recommendations | | It is recommended that the team always specify the use of locally sourced materials; this contributes to minimizing the transportation costs and impacts, as well as retaining regional economic benefits. It is recommend to keep an elaborative inventory of all materials used by type and weight, or volume, and identify their sources and distances from the respective project site. |

| | | Score | METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM - PHASE II |
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| RA1.5 DIVERT WASTE FROM LANDFILLS | | 3 | Improved |
| | | | Regarding the intention to divert waste from landfills, the program developed a waste management plan to reduce waste generation during the program’s implementation. Specific information has been provided in relation to the construction phase of the El Troje water treatment facility extension. Measures were implemented to prevent plastic elements changed in the flocculators to be incinerated. A local company, specialized on incineration of toxic waste, was contracted to eliminate them. Moreover, inventories of the waste generated were collected, and potential destinations for recycling and reuse were proposed. Also, the removal, transportation and disposal of contaminated materials generated during the construction of the project were managed by a specialized waste management firm. It is estimated that about 25% of the waste produced was recycled or reused. |
| | Source | | 1. Empresa Pública Metropolitana de Agua Potable y Saneamiento (EPMAPS), Libro de Obras Anexo 10F, (July 2013). 2. Xavier Vidal, e-mail message to author, December 02, 2015 |
| | Recommendations | | The program team has developed a waste management plan to decrease and divert waste from landfills, yet it has only achieved the minimum requirement of 25%. Moving forward, it is recommended that the team considers the recyclability of the waste-stream, as well as its toxicity, rather than just the quantity of waste being generated. |
| RA1.6 REDUCE EXCAVATED MATERIALS TAKEN OFF SITE | | 2 | Improved |
| | | | During construction, the program should consider minimizing the movement of soils and other excavated materials off-site, in order to reduce the amount of transportation required, and thus the associated environmental impacts. During the construction of the El Trébol water collection tunnel, the team minimized 30% of the movement of soils and other excavated materials; to achieve this, they re-utilized excavation materials in other nearby projects that needed these types of materials. In this regard, part of the materials from the El Trébol excavation works were sent to the Anglo-French digging wells. This process positively impacted the program’s economic efficiency by saving on transportation costs (from the excavation area to dumps) and reducing the environmental impacts of excavated materials transported. |
| | Source | | 1. Empresa Pública Metropolitana de Agua Potable y Saneamiento (EPMAPS), Anexo 10B, Libro de Obras para la construcción Túnel el Trébol. (March, 2011). 2. Vidal, X., e-mail message to author, October 7, 2015. |
| | Recommendations | | Although the program recycled and reused 30% of the excavated materials generated by the El Trébol water collection tunnel, it is recommend that a higher goal be targeted. Furthermore, it is recommended that the overall program includes reports that demonstrate how the diverse projects were designed by considering the balancing of cut and fill interventions. |

| Score | | METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM - PHASE II |
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| RA1.7 PROVIDE FOR DECONSTRUCTION & RECYCLING | 0 | No Score |
| | | Within the water and sanitation program, multiple types of projects have been considered, however, there is no documentation to support any designs that consider the future recycling, upcycling, and/or reuse facilitated by ease and efficiency in disassembly or deconstruction of constructed components at the end of their useful life. Further efforts should be made to minimize the use of non-recyclable materials, or materials that will contaminate the waste stream and limit recyclability at the end of the useful life of the project. |
| | Source | n/a |
| Recommendations | The project team should consider the likely effects of time and facilities operations on utilized materials before determining if they will retain value for recyclability and/or reuse at the end of useful life; keeping in mind that the ability to recycle a material does not always mean it is likely to be recycled. It is recommended that in future plans, at appropriate times, the program identifies, tracks, and communicates the components and prefabricated units that have been designed for disassembly and/or deconstruction. | |
| RA2.1 REDUCE ENERGY CONSUMPTION | 0 | No Score |
| | | This credit rewards the intention to conserve energy by reducing overall operations and maintenance energy consumption throughout the life of the program. Unfortunately, there is no available documentation showing planning or design reviews that have been conducted in order to identify and analyze options for reducing energy consumption during operations and maintenance, throughout the life-cycles of the multiple components that comprise the program. Furthermore, there is no evidence of any analysis conducted to determine the most effective methods for energy reductions incorporated into the design. |
| | Source | n/a |
| Recommendations | Considering that energy generation is the primary source of greenhouse gas emissions (as well as other pollutants that are harmful to the environment and human health), the project team should have taken a holistic design approach when considering options to reduce overall energy consumption by as much as possible. To achieve this, the project team should try to reduce energy consumption above industry norms by integrating energy-efficient equipment and processes into the project. | |

| Score | | METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM - PHASE II |
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| RA2.2 USE RENEWABLE ENERGY | 0 | No Score |
| | | This credit intends to push forward the idea of meeting energy needs through renewable energy sources. Unfortunately, the program team did not consider the use of renewable energy within the program. Also, there is no available documentation that demonstrates if the team evaluated the feasibility of renewable energy, including nontraditional energy sources, to effectively increase the proportion of operational energy that comes from renewable energy resources. |
| | Source | n/a |
| | Recommendations | It is recommended that in the future the project incorporates the use of renewable energy sources whenever practical, so as to decrease overall energy needs; if included, the project team should provide documentation of the annual percentage of renewable energy used to meet the project's energy needs. |
| RA 2.3 COMMISSION & MONITOR ENERGY SYSTEMS | 0 | No Score |
| | | This credit awards considerations to ensure the efficient functioning and extension of useful life by specifying the commissioning and monitoring of the performance of energy systems. Installing advanced monitoring equipment allows for operators to better identify efficiency losses, in order to enable enhanced performance over time. In this regard, there is no documentation that supports any intention to commission and monitor energy systems within the program. |
| | Source | n/a |
| | Recommendations | To ensure that the program functions in an energy efficient manner, it is recommended that an independent commissioning be conducted to ensure that systems are functioning since the beginning of operations. In addition, maintenance activities and the incorporation of advanced monitoring systems, such as energy sub-meters, will enable more efficient operations and higher levels of energy efficiency. |

| | | Score | METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM - PHASE II |
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| RA3.2 REDUCE POTABLE WATER CONSUMPTION | 4 | Enhanced | |
| | | | <p>This credit awards the intention of reducing negative impacts on the availability, quantity, and quality of freshwater. The project has sought to improve the efficiency of potable water and sewage systems, as well as implement flood management strategies within Quito’s Metropolitan District (DMQ). As part of the water and sewerage master plan (2009-2011), a complete upstream hydrological study of the Guayllabamba river basin was performed by EPMAPS, which allowed for the program to be aware of the watershed’s condition; these actions will contribute to better understanding the available water resources. With the efficient use of available water, by reducing potable water losses in the production and distribution process, a positive impact to freshwater availability could be inferred, however, there is no documentation showing such an. In the case of the optimization of the El Troje wastewater treatment plant, the program was able to process more water in order to meet demand for the growing population. Additionally, the environmental conditioning interventions restored the natural drainage conditions of Quito’s ravine system. These works also contribute to replenishing the quantity and quality of fresh surface water and groundwater supplies. However, the impacts of the program on protecting freshwater availability were not quantified in the documentation provided.</p> |
| | Source | | <ol style="list-style-type: none"> 1. Empresa Pública Metropolitana de Agua Potable y Saneamiento (EPMAPS), Sistema de Plantas Control Caudales a nivel de Planta 3, Anexo 15 (January, 2014). 2. Hazen and Sawyer, MT04 - Gen Climatología, Hidrología y Modelación de Caudales Máximos de las Cuencas Urbanas de Quito (August, 2015). |
| Recommendations | | <p>A higher level of achievement will be met by reaching at least a 50% of reduction. In future phases of the program, it is recommended to create a report that identifies if potable water use reduction strategies will meet respective sound, planning, and design criteria. In addition to the actions already undertaken by the program, it is encouraged to incorporate advanced recycling and reuse of water to achieve a larger percent of reduction in potable water consumption, meet water needs.</p> | |
| RA3.3 MONITOR WATER SYSTEMS | 11 | Conserving | |
| | | | <p>This credit evaluates the implementation of programs to monitor the performance of water systems and their impact on receiving waters, in order to help both business and the environment. Systems capable of monitoring flows and usage, and detecting leaks can save money in operations, and prevent the needless waste of potable water, as well as the energy and emissions associated with treatment and distribution. In its first component, the program includes the optimization of the potable water system by monitoring water usage and detecting leaks in order to improve the operational efficiency of the system. The integration of the impact and operational monitoring allows for responsive management.</p> <p>Related to the aforementioned component, several studies and models were conducted to both detect system failures and to improve monitoring, including the master plan, ANC plan, hydrologic modelling, telemetry, and telecontrol. Some hydrologic studies were conducted for optimizing the distribution of drinking water. These studies began in rural parishes and then were done in urban areas; they comprise an operational situation assessment, have complemented network and customer cadastres, and assist with the calibration, planning, and works design through hydrologic modeling. This enables the efficient management of networks by improving connections; this will allowed for a reduction in the non-revenue water index, especially in rural areas.</p> |

| Score | | METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM - PHASE II |
|--|-----------------|--|
| | Source | 1. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS), Programa de Saneamiento Ambiental Fase II PSA Préstamo BID 1802/OC-EC (Quito Metropolitan District: 2012), 4. 2. Xavier Vidal, e-mail message to author, October 22, 2015. |
| | Recommendations | To measure the program’s impact on water systems, a general study that measures water performance and connects all of the works done in the physical components of the program is necessary to expand from exclusively monitoring potable water to integrating groundwater recharge rates, and/or other best management practices with regards to surface water connections. |
| RAO.0 INNOVATE OR EXCEED CREDIT REQUIREMENTS | 0 | n/a |
| | | 35 |

CATEGORY II: CLIMATE AND ENVIRONMENT

NATURAL WORLD

Score METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM - PHASE II

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|------------------------------|------------------------|---|
| NW1.1 PRESERVE PRIME HABITAT | 18 | Restorative |
| | | <p>This credit intends to assess efforts to avoid placing projects and related works on land that has been identified as being of high ecological value, or as having species of high value. In this regard, the program tries to avoid development on land that is judged to be “prime habitat” by the General Secretary of the Metropolitan Council of Quito. The metropolitan scale of the program involves multiple interventions, and to ensure coherence, a coordination project and territorial planning efforts with local agencies were done. Actions to preserve prime habitat and restore the ecosystem were considered. For example, the “Integral Management of the Eje Pichincha Atacazo Hillside” (PMILEPA) was the key tool in identifying, regulating, and scheduling the use, occupancy, protection, and utilization of the Eje Pichincha Atacazo Hillside (30,191 acres). This document considered the area’s potential and natural abilities to ensure environmental preservation for the benefit of both the city and the DMQ as a whole. The plan defined the territory by the following biogeographic zonings: Zona Núcleo, the zone in which to preserve and protect natural resources; Zona Agroecológica, the zone suitable for sustainable management, the use of renewable natural resources, and low impact activities; Zona Transición, which was delineated to consolidate urban areas. However, it must comply with special rules for land use and occupancy to facilitate integration with the natural area and control urban growth; Zona Urbana, where the consolidation of the western neighborhoods of Quito was set to take place with actions intended to improve and promote the environmental and landscape conditions of the zone. Additionally, the program has preserved natural buffer zones of at least 300 feet around all areas deemed to be “prime habitat,” to increase prime habitat areas and connectivity.</p> |
| | Source | <ol style="list-style-type: none"> 1. Empresa Metropolitana Alcantarillado y Agua Potable de Quito (EPMAPS), Plan de Manejo Integral de las laderas del Eje Pichincha Atacazo - PMILEPA (January, 2009). 2. José Balarezo, e-mail message to author, October 29, 2015. |
| | Recommendations | <p>It is recommended to expand actions to preserve the prime habitat of areas within the overall DMQ to increase the awareness of preserving lands of high ecological value. Also, the program should include active efforts for maintenance and restoration of these lands.</p> |

| | | Score | METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM - PHASE II |
|---|--------|--|---|
| NW1.2 PRESERVE WETLANDS AND SURFACE WATER | | 1 | Improved |
| | | | <p>This credit awards projects that seek to protect, buffer, enhance, and restore areas which have been designated as wetlands, shorelines, and bodies of water by providing natural buffer zones, vegetation, and soil protection zones. As part of the water and sewerage master plan (2009-2011), a complete upstream hydrological study of the Guayllabamba River basin was performed by EPMAPS, which allowed for the program team to be aware of the watershed's condition. In addition to this assessment, a water quality and characterization study of the river basin was performed; as a complement to these studies, EPMAPS utilized the Quito's aquifer study, which allowed for identifying the quality and availability of the city's groundwater.</p> <p>Regarding the Quebrada Río Grande environmental conditioning project, walls and bridges were constructed within the area to protect the existing aquifer by removing and preventing intensive urban occupations in the ravines that have been declared as national heritage. These areas are maintained with appropriate vegetation that helps to control water and wind erosion. Nevertheless, there is no documentation available regarding the consideration of buffer zones to avoid development within at least 50 foot of wetlands, shorelines, or water bodies. Furthermore, no documents are provided in order to evaluate if the program has integrated vegetation and soil protection zones (VSPZ) as part of its policies to provide a natural zone, unaffected by development, to protect wetlands or waterbodies.</p> |
| | Source | | <ol style="list-style-type: none"> 1. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS), Acondicionamiento Ambiental de la Quebrada Río Grande, preservación de acuífero, 2-5. 2. José Balarezo, e-mail message to author, October 29, 2015. 3. José Balarezo, e-mail message to author, November 5, 2015. 4. Hazen and Sawyer, MTO4 - Gen Climatología, Hidrología y Modelación de Caudales Máximos de las Cuencas Urbanas de Quito (August, 2015). 5. Empresa Metropolitana Alcantarillado y Agua Potable de Quito (EPMAPS), Plan de Descontaminación de los ríos de Quito, Banco de Datos de Calidad de los Ríos de Quito, Años 2002-2007 (March, 2008). 6. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS), Caracterización de las Descargas de Aguas Residuales de Quito, Anexo 4F. |
| Recommendations | | <p>As part of the water management program, it is recommended to avoid development on wetlands, shorelines, and water bodies, as well as to develop buffer zones around these areas in order to protect them. The identification of water bodies, establishment of vegetation and soil protection zones, and outlining of efforts to restore wetlands or water bodies could be part of a plan for maintaining the integrity of these important elements.</p> | |

| | | Score | METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM - PHASE II |
|-------------------------------|--------|--|---|
| NW1.3 PRESERVE PRIME FARMLAND | | 12 | Conserving |
| | | | <p>This credit seeks to identify and protect soils designated as prime farmland, unique farmland, or farmland, which is important to support the economic base of many rural and sub-rural communities. None of the works of the program have consumed any prime farmland soils, and moreover, the delicate balance between urban expansion and the preservation of valuable land is part of the challenges which have been addressed by the program. Territorial planning has been done to identify areas for future development and urban expansion, such as Parroquia Calderon in the north of Quito, and areas to be conserved for future generations. For example, in the integrated management of the Eje Pichincha Atacazo Hillside (PMILEPA), the team has designated the area as Zona Agroecológica. This approximately 3,000 acres area will be primarily used as a natural zone for renewable resources, including agriculture, and will have the key role of establishing protective barriers around, and for controlling natural hazards in the city. In relation to this effort, agriculture and low-impact grazing on sustainably managed soils with gradients of less than 20%, and non-timber product on hillsides with a gradient of 20% to 50% are allowed. Moreover, no more than the 10% of the total protected area will contain development.</p> |
| | Source | | <ol style="list-style-type: none"> 1. Empresa Metropolitana Alcantarillado y Agua Potable de Quito (EPMAPS), Plan de Manejo Integral de las laderas del Eje Pichincha Atacazo - PMILEPA (January, 2009). 2. José Balarezo, e-mail message to author, October 29, 2015. |
| Recommendations | | <p>Aside from the planning actions undertaken to avoid development and preserve prime farmland in certain areas of the DMQ, for a higher level of achievement, the program could integrate meaningful efforts to restore prime farmland that was previously developed. This will contribute to preserving this valuable resource for future generations.</p> | |
| NW1.4 AVOID ADVERSE GEOLOGY | | 12 | Conserving |
| | | | <p>This credit tries to avoid development on adverse geologic formations and safeguard aquifers to reduce risks of natural hazards and preserve high-quality groundwater resources. In relation to the siting of facilities that are part of the program, such as the El Troje water treatment plant, geological risks were considered and avoided. Furthermore, on a metropolitan scale, the program has identified and delineated adverse or sensitive geology through the environmental impact assessment (EIA) and the environmental management plan (PMA) in different locations, such as Quebradas San Juan, el Tejar, El Cebollar, Jerusalém, Navarro-Raya Sur, Sunipamba-Saguanchi, Cuscungo-Clemencia, as well as in the local rivers. The program considered the geological complexity (adverse and sensitive) for construction, operations, and maintenance works, in order to reduce costs and risks when implementing structures to safeguard against mortality and prevent damages. Additionally, the team has established hazard zones, developed buffers around adverse geological areas, and created runoff controls, as well as spill prevention and cleanup plans in the aforementioned projects. The best example is the integrated management plan of the Pichincha - Atacazo hillside axis. This study was comprised of the analysis of 30,191 acres, of which 2,453 acres were in urban areas, and 5,937 acres were in the natural area. These notable efforts contributed to effective risk management by utilizing green infrastructure to</p> |

| | | Score | METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM - PHASE II |
|-------------------------------------|-----------------|-----------------|--|
| NW1.4 AVOID ADVERSE GEOLOGY | | | control erosion and runoff by stormwater. Furthermore, families living in risk prone areas were relocated, and works to protect others living in moderately risky areas were conducted. These actions contributed to enhancing the overall resilience of communities, who were positively affected by the program. The geological assessment was important to avoiding and helping in reducing risk. These criteria were used in all of the indicated studies, and executed under the environmental sanitation program. |
| | Source | | <ol style="list-style-type: none"> 1. Xavier Vidal, e-mail message to author, October 22, 2015. 2. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS), Plan de Manejo Integral de las Laderas Eje Pichincha-Atacazo. 3. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS), Plan Definitivo de Mitigación y Reasentamiento de Familias en Riesgo, Primera Etapa, de la fase II, Quebradas del Eje Navarro-La Raya Sur y Cuenca de la Quebrada de Jerusalén. (July, 2008). 4. José Balarezo, e-mail message to author, October 29, 2015. |
| | Recommendations | | Monitoring plans are recommended to ensure the effectiveness of the conducted work, and to allow for responsive management in necessary cases. Also, safety plans should be developed to complement the effectiveness of the physical interventions. |
| NW1.5 PRESERVE FLOODPLAIN FUNCTIONS | 5 | Enhanced | |
| | | | This credit rewards the preservation of floodplain functions by limiting development and the impacts of development to maintain water management capacities and capabilities. It is important to mention that a detailed hydrological study was performed to identify the condition of the watershed which was intervened upon. This study allowed for a water quality and characterization assessment of the river basin, and therefore provided guidelines for the ravine’s environmental conditioning projects. In this regard, the program contributed to minimizing the impacts of urbanization (by restoring the ravines and creating pervious surfaces for groundwater infiltration), preventing flooding and landslides caused by extreme rain. These actions contributed to enhancing infiltration capacities and preserving floodplain functions. One of the main objectives of EPMAPS was to protect natural drainage systems through appropriate urban planning, and the introduction of watercourse conservation and protection strategies. Moreover, the flood control program incorporated the projects that could optimize storm drainage capacity. The approach which was taken was both comprehensive, and socially inclusive, however, there is no documentation available to quantify the impacts of the program to maintain and enhance floodplain functions. |
| | Source | | <ol style="list-style-type: none"> 1. Proyecto de Acondicionamiento Ambiental de la Quebrada Ortega Informe Final. 20-38 2. Proyecto de Acondicionamiento Ambiental de la Quebrada Shanshayacu Informe Final . 2-10 3. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS) Plan de Manejo Integral de las Laderas Eje Pichincha-Atacazo 4. Vidal X., Burgos L., Zevallos, O., “Protection and environmental restoration of the slopes of Pichincha in Quito, Ecuador,” in Water and Cities in Latin America: Challenges for Sustainable Development, Earthscan Studies in Water Resource Management. 2-16 |

| Score | | METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM - PHASE II |
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| | Source | 5. José Balarezo, e-mail message to author, November 5, 2015. 6. Hazen and Sawyer, MTO4 - Gen Climatología, Hidrología y Modelación de Caudales Máximos de las Cuencas Urbanas de Quito (August, 2015). 7. Empresa Metropolitana Alcantarillado y Agua Potable de Quito (EPMAPS), Plan de Descontaminación de los ríos de Quito, Banco de Datos de Calidad de los Ríos de Quito, Años 2002-2007 (March, 2008). 8. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS), Plan de Descontaminación de los Ríos de Quito. Caracterización de las Descargas de Aguas Residuales de Quito, Anexo 4F. 1-3 |
| | Recommendations | Documentation estimating floodplain infiltration capacity and post-program floodplain infiltration capacity must be made available; this will encourage the further use of green infrastructure and environmental restoration in order to preserve or enhance floodplain functions on an urban scale. Additionally, the program could consider possible beneficial uses for stormwater runoff, and strategies to maintain or enhance habitat within and along the waterway floodplain, as well as to enhance aquatic habitat connectivity. |
| NW1.5 PRESERVE FLOODPLAIN FUNCTIONS | 6 | Conserving |
| | | This credit intends to protect slopes and hillsides from inappropriate and unsuitable development to avoid exposure to and risks from erosion, landslides, and other natural hazards. Hillsides and steep slopes are part of the natural beauty of the landscape of the city of Quito, but these areas are also a source of risk when occupied illegally. In this sense, the program follows best management practices, and includes interventions on a metropolitan scale to minimize erosion, and prevent landslides. These interventions included the establishment of protected zones, measures to avoid future development on steep slopes and landslide risk prone areas, and the relocation of families living in risk prone areas, complemented with mitigation works to protect others living in moderately risky areas. Moreover, all of the studies which were conducted considered the adverse topographical and geological variables for the locations of the different infrastructures. The topography of the intervened sites was taken into account for the selection and study of 12 wastewater treatment plants, and for placing interceptors that collect sewage and lead to the treatment plant. Furthermore, a proper planting and restoration plan was made within the ravines to convert them into green spaces and recreation areas, thus improving the overall livability for nearby communities. |
| | Source | 1. Proyecto de Acondicionamiento Ambiental de la Quebrada Ortega Informe Final. 20-38 2. Proyecto de Acondicionamiento Ambiental de la Quebrada Shanshayacu Informe Final . 2-10 3. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS) Plan de Manejo Integral de las Laderas Eje Pichincha-Atacazo 4. Vidal X., Burgos L., Zevallos, O., "Protection and environmental restoration of the slopes of Pichincha in Quito, Ecuador," in Water and Cities in Latin America: Challenges for Sustainable Development, Earthscan Studies in Water Resource Management. 2-16 5. José Balarezo, e-mail message to author, November 5, 2015. 6. Hazen and Sawyer, MTO4 - Gen Climatología, Hidrología y Modelación de Caudales Máximos de las Cuencas Urbanas de Quito (August, 2015). 7. Empresa Metropolitana Alcantarillado y Agua Potable de Quito (EPMAPS), Plan de Descontaminación de los ríos de Quito, Banco de Datos de Calidad de los Ríos de Quito, Años 2002-2007 (March, 2008). 8. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS), Plan de Descontaminación de los Ríos de Quito. Caracterización de las Descargas de Aguas Residuales de Quito, Anexo 4F. 1-3 |

| | | Score | METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM - PHASE II |
|--|-----------------|-------------------|--|
| NW1.6 AVOID UNSUITABLE DEVELOPMENT ON STEEP SLOPES | Recommendations | | Documentation estimating floodplain infiltration capacity and post-program floodplain infiltration capacity must be made available; this will encourage the further use of green infrastructure and environmental restoration in order to preserve or enhance floodplain functions on an urban scale. Additionally, the program could consider possible beneficial uses for stormwater runoff, and strategies to maintain or enhance habitat within and along the waterway floodplain, as well as to enhance aquatic habitat connectivity. |
| | 6 | Conserving | |
| | | | This credit intends to protect slopes and hillsides from inappropriate and unsuitable development to avoid exposure to and risks from erosion, landslides, and other natural hazards. Hillsides and steep slopes are part of the natural beauty of the landscape of the city of Quito, but these areas are also a source of risk when occupied illegally. In this sense, the program follows best management practices, and includes interventions on a metropolitan scale to minimize erosion, and prevent landslides. These interventions included the establishment of protected zones, measures to avoid future development on steep slopes and landslide risk prone areas, and the relocation of families living in risk prone areas, complemented with mitigation works to protect others living in moderately risky areas. Moreover, all of the studies which were conducted considered the adverse topographical and geological variables for the locations of the different infrastructures. The topography of the intervened sites was taken into account for the selection and study of 12 wastewater treatment plants, and for placing interceptors that collect sewage and lead to the treatment plant. Furthermore, a proper planting and restoration plan was made within the ravines to convert them into green spaces and recreation areas, thus improving the overall livability for nearby communities. |
| | Source | | 1. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS), Plan Definitivo de Mitigación y Reasentamiento de Familias en Riesgo, Primera Etapa, de la fase II, Quebradas del Eje Navarro-La Raya Sur y Cuenca de la Quebrada de Jerusalén, (July, 2008). 2. José Balarezo, e-mail message to author, October 29, 2015. 3. Xavier Vidal, e-mail message to author, December 02, 2015. |
| | Recommendations | | The program follows best management practices to minimize erosion and prevent landslides, as well as minimizing siting on steep slopes or hillsides by integrating a master plan with restrictions to guide development. Therefore, no further recommendations are provided. |

| Score | | METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM - PHASE II |
|----------------------------|--|---|
| NW1.7 PRESERVE GREENFIELDS | 10 | Superior |
| | | <p>This credit awards projects that seek to protect, buffer, enhance, and restore areas which have been designated as wetlands, shorelines, and bodies of water by providing natural buffer zones, vegetation, and soil protection zones. As part of the water and sewerage master plan (2009-2011), a complete upstream hydrological study of the Guayllabamba River basin was performed by EPMAPS, which allowed for the program team to be aware of the watershed's condition. In addition to this assessment, a water quality and characterization study of the river basin was performed; as a complement to these studies, EPMAPS utilized the Quito's aquifer study, which allowed for identifying the quality and availability of the city's groundwater.</p> <p>Regarding the Quebrada Río Grande environmental conditioning project, walls and bridges were constructed within the area to protect the existing aquifer by removing and preventing intensive urban occupations in the ravines that have been declared as national heritage. These areas are maintained with appropriate vegetation that helps to control water and wind erosion. Nevertheless, there is no documentation available regarding the consideration of buffer zones to avoid development within at least 50 foot of wetlands, shorelines, or water bodies. Furthermore, no documents are provided in order to evaluate if the program has integrated vegetation and soil protection zones (VSPZ) as part of its policies to provide a natural zone, unaffected by development, to protect wetlands or waterbodies.</p> |
| | Source | <ol style="list-style-type: none"> 1. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS), Quebradas Recuperadas. 1-2 2. Proyecto de Acondicionamiento Ambiental de la Quebrada Ortega Informe Final 3. Proyecto de Acondicionamiento Ambiental de la Quebrada Shanshayacu Informe Final 4. Empresa Metropolitana Alcantarillado y Agua Potable de Quito (EPMAPS), Plan de Manejo Integral de las laderas del Eje Pichicha Atacazo - PMILEPA (January, 2009). |
| Recommendations | <p>It is recommended that in the future the program should study the effect and impacts of the urban expansion which has been promoted by the program in relation to the development of greenfield areas. Additionally, it is important to have elaborate documentation that estimates the percentage of previously developed area that was restored by the program's interventions.</p> | |

| Score | | METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM - PHASE II |
|-------------------------|--|---|
| NW2.1 MANAGE STORMWATER | 21 | Restorative |
| | | <p>This credit rewards projects that minimize the impacts of infrastructure on the quantity and quality of stormwater runoff, thereby increasing water storage capacity. Impervious surfaces reduce the amount of stormwater that infiltrates into the ground, thus increasing the amount of runoff. The interventions undertaken by EPMAPS had the objective of implementing stormwater runoff control systems that will be sustainable over the long term. In relation to this objective, the program carried out a baseline assessment to achieve the water quality improvement goals for Quito’s rivers.</p> <p>The comprehensive recovery measure began with a detailed study of the DMQ watershed. This study permitted a holistic comprehension, which yielded a water quality and characterization assessment of the city’s existing surface and underground waters. Additionally, the team has designed and implemented water-quality monitoring programs on the rivers, as well as on 30 locations of sewage water discharge into water bodies. Moreover, the restoration of approximately 280 acre of ravines, which was included in the environmental restoration conducted by the program, contributed to increasing the amount of green areas, and thus increasing water infiltration.</p> <p>Overall, as a result of the actions undertaken by the program, program measures have contributed to improving the water infiltration capacity of the DMQ. Moreover, other handling structures have contributed to supporting stormwater management, such as the several underground collectors which were built to improve capacity for stormwater management, and prevent flooding in the center of Quito; these measures include the Anglo French collector (four groups), Pomasqui collector, and 24 de Mayo, with a total investment of approximately USD \$21 million.</p> |
| | Source | <ol style="list-style-type: none"> 1. José Balarezo, e-mail message to author, October 29, 2015. 2. Vidal X., Burgos L., Zevallos, O., “Protection and environmental restoration of the slopes of Pichincha in Quito, Ecuador,” in Water and Cities in Latin America: Challenges for Sustainable Development, Earthscan Studies in Water Resource Management. 1-17. 3. José Balarezo, e-mail message to author, November 5, 2015. 4. Hazen and Sawyer, MT04 - Gen Climatología, Hidrología y Modelación de Caudales Máximos de las Cuencas Urbanas de Quito, (August, 2015) 5. Empresa Metropolitana Alcantarillado y Agua Potable de Quito (EPMAPS), Plan de Descontaminación de los ríos de Quito, Banco de Datos de Calidad de los Ríos de Quito, Años 2002-2007, (March, 2008). |
| Recommendations | <p>Although the program has considered the restoration of a broad natural area which contributes to water infiltration, it is recommended that the team should provide a plan which quantifies the effects of the program in relation to stormwater capacity. Additionally, the inclusion of low-impact development measures on a metropolitan scale would be a valuable contribution to enhancing the overall impact of the program; such measures may include: rain gardens, bioretention, rooftop gardens, sidewalk storage, vegetated swales, buffers and strips, tree preservation, rain barrels and cisterns, permeable pavers, and impervious surface reductions, among others.</p> | |

| Score | | METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM - PHASE II |
|---|-----------------|--|
| NW2.2 REDUCE PESTICIDES AND FERTILIZER IMPACTS | 9 | Conserving |
| | | <p>This credit intends to reduce nonpoint source pollution by reducing the quantity, toxicity, bioavailability, and persistence of pesticides and fertilizers. In this regard, the environmental conditioning projects of Quebrada Ortega and Shanshayacu consider the incorporation of plant species which require no use of pesticides, herbicides and fertilizers, or which use integrated pest management approaches, within the landscaping designs. In the case of the Quebrada Ortega Project the team planted both native and introduced species (adapted to the climate), and used improved soils with organic fertilizers; as a result of these actions, the trees do not require herbicides or pesticides. However, there is no documentation about the operational policies to control the application of fertilizers and pesticides, or any runoff control measures which were included to minimize groundwater and surface water contamination. In general, all of the new green areas developed by the environmental sanitation program have been transferred to the Public Space Management department (part of the Metropolitan District of Quito), which will take over the maintenance of these green areas over the long-term.</p> |
| | Source | <p>1. Proyecto de Acondicionamiento Ambiental de la Quebrada Ortega Informe Final . 8-13 2. José Balarezo, e-mail message to author, October 29, 2015.</p> |
| | Recommendations | <p>For the long term maintenance of public spaces to be performed by the DMQ Public Space Management department, it is recommended to apply and review operational policies and programs for controlling the application of fertilizers and pesticides. Additionally, it is important to incorporate runoff controls into the design, to minimize any possible contamination of ground and surface waters.</p> |
| | 18 | Restorative |
| NW2.3 PREVENT SURFACE AND GROUNDWATER CONTAMINATION | | <p>This credit rewards projects that preserve freshwater resources by incorporating measures to prevent pollutants from contaminating surface water and groundwater, and monitor the impacts throughout operations.</p> <p>All the actions undertaken by EPMAPS were based on a detailed hydrological study that included a complete water quality and characterization assessment of the intervened river basins, which allowed for expanding the focus to monitoring surface and groundwater in the DMQ area overall. Additionally, the program is developing the “Decontamination of Quito’s Rivers Program” (PRDQ) with the purpose of treating non-treated sewage that is discharged into Quito’s rivers. Currently, EPMAPS has designed for the treatment of 2,500 l/s in 2040 of wastewater, and is developing final designs for wastewater treatment in Quito and its adjoining parishes (Nayón, Zámiza, Llano Chico Calderon, Pomasqui, San Antonio de Pichincha), which will have a flow of 7,550 l/s by 2045. Additionally, the team has designed and implemented water-quality monitoring programs for the rivers, as well as for 30 locations where sewage is discharged into water bodies. In addition, to prevent the future contamination of the areas which were restored within the framework of the environmental conditioning projects, the program installed land-use controls by collaborating with the municipality, and installed measures to avoid disruptions to surface water runoff from future development.</p> |

| Score | | METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM - PHASE II |
|-------------------------------------|-----------------|--|
| NW3.1 PRESERVE SPECIES BIODIVERSITY | | <p>Moreover, with the expansion of the sewage system and the construction of underground stormwater collectors, the program was able to improve service for much of Quito’s population, and indirectly protect and prevent surface and groundwater contamination caused by septic systems and uncontrolled runoff. However, no documentation was provided regarding protection plans to avoid groundwater pollution by considering spill and leak prevention during the construction of the works.</p> |
| | Source | <ol style="list-style-type: none"> 1. Municipio del Distrito Metropolitano de Quito Alcaldía, Convenio de Cooperación Interinstitucional entre el Municipio del Distrito Metropolitano de Quito y la Empresa Metropolitana de Alcantarillado y agua Potable de Quito” EPMAPS”, para la ejecución del plan ambiental y social (PMAyS). (April, 2007) 2. José Balarezo, e-mail message to author, November 5, 2015. 3. Hazen and Sawyer, MT04 - Gen Climatología, Hidrología y Modelación de Caudales Máximos de las Cuencas Urbanas de Quito, (August, 2015). 4. Empresa Metropolitana Alcantarillado y Agua Potable de Quito (EPMAPS), Plan de Descontaminación de los ríos de Quito, Banco de Datos de Calidad de los Ríos de Quito, Años 2002-2007, (March, 2008). 5. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS), Caracterización de las Descargas de Aguas Residuales de Quito, Anexo 4F. |
| | Recommendations | <p>The clear hydrogeologic delineation studies contributed to the prevention of surface and groundwater contamination, by taking into consideration the complexity of the aquifers, in combination with environmental conditioning projects, to enhance natural drainage systems, stormwater collectors, sewage improvements, and the river decontamination and monitoring program. Additionally, the program made substantial efforts remediate existing contamination in the overall DMQ area, therefore, no further recommendations are provided.</p> |
| | 16 | Restorative |
| | | <p>This credit intends to protect biodiversity by preserving and restoring species and habitats, and is measured by the degree of habitat protection. The program made appropriate planting efforts in the environmental conditioning works of the ravines to improve upon and expand wildlife corridors, and link existing habitats. Moreover, the works done on the Ortega and Shanshayacu ravines was intended to incorporate the concept of ecological corridors to create and expand natural wildlife. In the intervention of the Ortega ravine, efforts sought to recover existing vegetation on the first section, and for the second, the team planted adequate vegetation, respecting and enhancing the existing wildlife. For this, the program used a local species called the “Suro,” and whenever possible, the team tried to protect the vegetation located close to the trails, thus improving upon and expanding wildlife corridors. For the third section of the Quebrada Ortega ravine (where no vegetation existed due to filling works), new species were planted in order to create new wildlife habitat. This intervention is also linked to the works done on the hillsides of the Pichincha-Atacazo axis by creating new connections between areas of important habitat.</p> |

| | | Score | METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM - PHASE II |
|---------------------------------|-----------------|-------|---|
| | Source | | 1. Proyecto de Acondicionamiento Ambiental de la Quebrada Ortega Informe Final, 34. 2. Proyecto de Acondicionamiento Ambiental de la Quebrada Shanshayacu Informe Final . 2-3 |
| | Recommendations | | Although there have been efforts create corridors throughout the DMQ, for future phases it is recommended that a strategic plan for ecological corridors be developed to assure the incorporation, restoration, and protection of new habitats, and the improvement and preservation of species biodiversity. |
| NW 3.2 CONTROL INVASIVE SPECIES | | 5 | Superior |
| | | | For controlling invasive species, the program should intend to use appropriate non-invasive species and identify, control, or eliminate existing invasive species. Invasive species include non-indigenous or non-native flora and fauna that adversely affect the habitats in which they reside. For the reforestation efforts, species selection was carried out according to the requirements of the area. The program has considered species that can best adapt to and tolerate the cold and altitude. The shape, foliage, and the role in the environment of the species was also very important in the design. Moreover, the selection was based on the analysis of existing species, according to a biotic diagnosis, and according to the climate of the intervened zone. The introduced species included cholán, yalomán, quisuar, arrayán, aliso, sauce piramidal, tilo, flor de mayo, farol chino, fucxia, sauce llorón, nogal, arupo, surero, and congo negro. Most of the existing species which were found on the sites were native, but the invasive species (15.09%) will eventually be replaced with native species once they complete their natural cycle. Moreover, workshops were also held to educate the community in recognizing native and invasive species, and in removing non-indigenous species. |
| | Source | | 1. Proyecto de Acondicionamiento Ambiental de la Quebrada Ortega Informe Final, 8-13. 2. Xavier Vidal, e-mail message to author, December 2, 2015. |
| | Recommendations | | Although the program recognizes native and invasive species, with the latter to be eliminated as they complete their cycles, the program should also include a management/maintenance plan to address certain issues, such as strategies for minimizing invasive species, as well as for the monitoring and removal of invasive species. Additionally, this plan should include a strategy for eliminating invasive species on-site, and methods for restoring habitats to pre-invasive states |

| | | Score | METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM - PHASE II |
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| NW3.3 RESTORE DISTURBED SOILS | 10 | Restorative | |
| | | | <p>This credit intends to restore soils that were disturbed during construction and previous development in order to bring back ecological and hydrological functions. In relation to this, for 19 ravines (208 acres) that were occupied with informal housing and used as garbage dumps, 100% of the soils that were disturbed as a result of previous development were restored. First, families were relocated and accumulated debris were cleaned up, then the topsoil was restored and adequate vegetation was planted to enhance ecological and hydrological functions.</p> <p>In relation to other works done within the framework of the program, such as the wastewater treatment facilities, the sewage network extension, and the installation of water collectors, it is assumed that soil restoration was also performed in intervened areas after construction works were finalized. Unfortunately, there is no documentation available to address if any attempts to restore disturbed soils were considered in the other components of the program.</p> |
| | Source | | <p>1. Proyecto de Acondicionamiento Ambiental de la Quebrada Ortega Informe Final. 20-38. 2. Inter-American Development Bank, Informe de Terminación de Proyecto PCR, (March 31, 2015) 3. José Balarezo, e-mail message to author, November 10, 2015.</p> |
| Recommendations | | | <p>In the case of including new construction as part of the future phases of the program, it is recommended to include efforts to restore soils and repurpose them to function in a manner comparable to their original state, as well as to expand the program scope to the restoration of soils disturbed during previous development.</p> |
| MAINTAIN WETLAND AND SURFACE WATER FUNCTIONS. | 19 | Restorative | |
| | | | <p>This credit rewards projects that intend to maintain and restore the ecosystem functions of streams, wetlands, and waterbodies, as well as their riparian areas. One of the main goals of EPMAPS was to protect natural drainage systems through appropriate urban planning, and to introduce waterway conservation and protection strategies. Having the desire to recover contaminated water bodies to provide a healthy environment, EPMAPS (within Quito's river decontamination studies; PDRQ) has been developing various projects to make the treatment of wastewaters viable. The comprehensive recovery solution began with a detailed study of the involved watershed, which allowed for a water quality and characterization assessment of four rivers in the Guayallabamba River basin. In this regard, the program has maintained and enhanced hydrological connections, with the maintenance of the natural conditions of existing hydrological networks within the program area being one of the main objectives of PDRQ; this has improved water quality and quantity through the interception of more than 95% of wastewater discharges generated in the DMQ. Additionally, with the elaboration of studies, and detailed engineering designs for the interception and treatment systems, the program sought to maintain and enhance the quality of water in rivers and ravines within the DMQ. Furthermore, with the environmental conditioning program of the 19 ravines and four rivers, the program was able to maintain and enhance natural habitats. Additionally, this program has helped to control sediment transport due to hydrological regulation of creeks and rivers. These efforts were complemented with the construction of the water collectors of the San Juan, el Tejar, El Cebollar, and Jerusalem ravines, among others.</p> |

| Score | | NGETP - NORTHEAST SECTION (NEA) |
|-----------------|--|---------------------------------|
| Source | 1. Proyecto de Acondicionamiento Ambiental de la Quebrada Ortega Informe Final 2. Vidal X., Burgos L., Zevallos, O., "Protection and environmental restoration of the slopes of Pichincha in Quito, Ecuador," in Water and Cities in Latin America: Challenges for Sustainable Development, Earthscan Studies in Water Resource Management. 1-17 3. José Balarezo, e-mail message to author, November 5, 2015. 4. Hazen and Sawyer, MT04 - Gen Climatología, Hidrología y Modelación de Caudales Máximos de las Cuencas Urbanas de Quito. (August, 2015). 5. Empresa Metropolitana Alcantarillado y Agua Potable de Quito (EPMAPS), Plan de Descontaminación de los ríos de Quito, Banco de Datos de Calidad de los Ríos de Quito, Años 2002-2007, (March, 2008). 6. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS), Plan de Descontaminación de los Ríos de Quito. Caracterización de las Descargas de Aguas Residuales de Quito, Anexo 4F. | |
| Recommendations | The program has maintained and restored the ecosystem functions of streams, wetlands, water bodies and their riparian areas, therefore no recommendations are provided. | |

| Score | | NGETP - NORTHEAST SECTION (NEA) | |
|--|------------------------|---|--|
| NW 0.0 INNOVATE OR EXCEED CREDIT REQUIREMENTS | | <p>The program was pioneer in the Hillside/Landslide management component, especially on the recovery of ravines as new green public spaces and recreational areas. In the case of the Integral Management Plan of the Pichincha-Atacazo Hillside project, for example, they sought to protect, preserve, restore, and ensure a suitable and sustainable management of these deteriorated areas. To achieve this idea they focused in 3 innovative components that allowed them to declare the areas as Protected Natural Areas, these were: environmental planning, land management and community involvement. Together with the environmental and water sanitation perspective, flood control and relocation of families from risk zones was also very important in this project, so as to protect vulnerable families. The applied recovery process by the program to restore and protect these areas and the urban drainage systems, exceeds the existing standards that regulate companies which provide water and sanitation amenities to the city. In fact, in Ecuador and in the region, there are no other cases in which a water and sanitation company take cares of these issues. Because of this innovation the IDB has granted the program a special mention in the Water and Sanitation Prize in 2009. Moreover, the products and knowledge generated during the execution of this component have been appropriate transferred to the Municipality in charge of this area.</p> | |
| | Source | <p>1. Proyecto de Acondicionamiento Ambiental de la Quebrada Ortega Informe Final. 20-38 1. EPMAPS. (January 2016). 2 2. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS) Plan de Manejo Integral de las Laderas Eje Pichincha-Atacazo. 1 3. Vidal X., Burgos L., Zevallos, O., "Protection and environmental restoration of the slopes of Pichincha in Quito, Ecuador" in Water and Cities in Latin America: Challenges for Sustainable Development, Earthscan Studies in Water Resource Management. 1-17</p> | |
| | Recommendations | <p>The program makes a significant effort to preserve important resources in perpetuity, to control invasive species, and avoid the intervention of sensitive areas. It is recommend for future phases that the project clearly monitor the environmental performance of these interventions that far exceed both industry norms and the existing requirements within the system.</p> | |
| | | 35 | |

CATEGORY II: CLIMATE AND ENVIRONMENT

CLIMATE AND RISK

| Score | METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM - PHASE II | |
|---------------------------------------|--|---|
| CR1.1 REDUCE GREENHOUSE GAS EMISSIONS | 0 | No Score |
| | Source | n/a |
| | Recommendations | It is recommended that the program team performs a life-cycle carbon assessment of the project by using recognized and accepted methodologies, data, and softwares. Moreover, the program must be designed to reduce carbon emissions, compared to the emissions calculated in the life-cycle carbon assessment. |
| CR1.2 REDUCE AIR POLLUTANT EMISSIONS | 0 | No Score |
| | Source | This credits seeks to reduce the emissions of six criteria pollutants, as well as noxious odors: the six pollutants are particulate matter (including dust), ground-level ozone, carbon monoxide, sulfur oxides, nitrogen oxides, and lead. These pollutants cause damage to human health, property, and the environment. Dust and odors also can cause nuisances for nearby residents and reduce property values. To fulfill the needs of this credit, measures should be taken to minimize adverse impacts on air quality by following the California Ambient Air Quality Standards (CAAQS). However, there is no documentation showing that the program identified, monitored, and mitigated these type of air pollutants. |
| | Recommendations | The program should calculate expected emissions according to CAAQS, and implement strategies to reduce air pollution to required levels. |

| Score | | METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM - PHASE II |
|---------------------------------------|-----------------|--|
| CR2.1 ASSESS CLIMATE THREAT | 0 | No Score |
| | | <p>The exact effects of climate change are still uncertain, but a rise in temperatures is an impact which can, not only increase water evaporation rates, but also can likely change the quantity, intensity, and timing of precipitation. Gradual increases in temperatures, or decreases in precipitation may increase pressures on energy and water systems. Communities rely on infrastructure projects, therefore such failures can cause devastating consequences. This credit seeks for projects to develop a comprehensive climate impact assessment and adaptation plan, which should include a vulnerability assessment, risk assessment, and adaptation assessment. This process should include collaboration with the local emergency management departments, and meetings with the local community. Although the program considered the reduction of vulnerabilities as one of its components, by addressing flooding and landslide issues on risk-prone areas, and hence improving urban resilience, a comprehensive climate threat assessment, accompanied by the development of an adaptation plan, was not considered amongst steps towards becoming prepared for climate variation and natural hazards.</p> |
| | Source | n/a |
| | Recommendations | It is recommended to create a climate impact assessment and adaptation plan that identifies climate change-related risks, and possible adaptation measures. |
| CR2.2 AVOID TRAPS AND VULNERABILITIES | 0 | No Score |
| | | <p>This credit awards projects that intend to avoid or not create high long-term costs, or add additional risks and vulnerabilities to communities. In this regard, the program reduces certain vulnerabilities of Quito’s community as a whole, by having implemented an integrated and holistic program that sought to provide residents of the Metropolitan District of Quito (DMQ) with efficient and sustainable water, sewer, and flood control services. The second phase of the program was composed of five components, including potable water works, sewage works, flood control, landslide management, and institutional reinforcement, which collectively sought to tackle Quito’s water issues in the most comprehensive way possible. The team’s approach considered that the construction of engineering works alone was not enough to solve problems, therefore a territorial approach was applied, considering an integrated vision for landscape and urban functions which would lead to high-impact solutions. Specific examples to reduce vulnerabilities include the implementation of water collectors in Quito’s center to reduce flooding vulnerability, and the environmental sanitation works done in the 19 ravines, where the team restored natural habitats, recovered the natural drainage system, and relocated communities living in the ravines to reduce risks from landslides and floods. The works undertaken by the program were able to reduce the high level of vulnerability for Quito overall by implementing interventions that were done through appropriate urban planning and conservation of important waterways. Unfortunately, there is no documentation to support a clear long-term plan for reducing costs and risks for affected communities.</p> |

| Score | | METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM - PHASE II |
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| | Source | <p>1. Inter-American Development Bank, Informe de Terminación de Proyecto PCR, (May, 2015).</p> <p>2. Vidal X., Burgos L., Zevallos, O., “Protection and environmental restoration of the slopes of Pichincha in Quito, Ecuador” in Water and Cities in Latin America: Challenges for Sustainable Development, Earthscan Studies in Water Resource Management. 1-17</p> <p>3. Proyecto de Acondicionamiento Ambiental de la Quebrada Ortega Informe Final</p> <p>4. Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito (EPMAPS), Plan de Descontaminación de los Ríos de Quito. Caracterización de las Descargas de Aguas Residuales de Quito, Anexo 4F.</p> |
| | Recommendations | <p>A more systematic evaluation of community risks and vulnerabilities, including economic risks, vulnerability to extreme weather events, and changes in the environment, should all be considered. A detailed plan to ensure long-term resilience must assess the program within all community infrastructure as a whole. The ultimate objective of this assessment is to make a significant contribution to the robustness and resiliency of the community in the face of change.</p> |
| CR2.3 PREPARE FOR LONG-TERM ADAPTABILITY | 0 | No Score |
| | | <p>This credit seeks to prepare infrastructure to be resilient to the consequences of long-term climate change in order to perform under altered conditions, or to be able to adapt to long-term consequences such as a rise in sea levels, extreme weather events, humidity, precipitation, and seasonal hydrology, among others. The program’s improvements on planning and landscape interventions were capable of reducing overall vulnerabilities, and helping to better prepare Quito for extreme weather events, such as intense rainfall. For example, the enhancement of natural systems, such as ravines, prevents landslides and flooding within these areas, and prepares the city for natural disasters. The actions which were implemented by the program improve resiliency and adaptive capacities on an urban scale, however, a comprehensive assessment of climate change consequences is missing, which would be able to provide the identification of specific measures to address other potential long-term threats.</p> |
| | Source | <p>1. Inter-American Development Bank, Informe de Terminación de Proyecto PCR, (March, 2015).</p> <p>2. Vidal X., Burgos L., Zevallos, O., “Protection and environmental restoration of the slopes of Pichincha in Quito, Ecuador” in Water and Cities in Latin America: Challenges for Sustainable Development, Earthscan Studies in Water Resource Management.</p> <p>3. Proyecto de Acondicionamiento Ambiental de la Quebrada Ortega Informe Final</p> |
| | Recommendations | <p>In addition to addressing flooding and landslide risks, further strategies may be considered to manage long-term changes such as the ability of desertification or a changing water table, which can also produce long-term alterations to infrastructure systems and their sites. Strategies for managing long-term changes may include structural changes, decentralized systems, natural systems, alternative supply options, adaptive capacities, and appropriate site selection.</p> |

| Score | | METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM - PHASE II |
|-----------------------------|--|---|
| CR2.1 ASSESS CLIMATE THREAT | 21 | Restorative |
| | | <p>This credit intends to increase the prospects for resilience and long-term recovery of the project and site from natural and human-induced short-term hazards, such as flooding and fires, which may not be related to climate change or may pose other risk factors. The slopes and ravines of Quito had experienced a disorderly pattern of urban development and changes in land-use. The illegal occupation of these areas led to the deterioration of water quality and a destabilization of the slopes through changes in soil humidity and the destruction of green areas. Additionally, extensive areas of ecological importance were converted for farming and livestock activities. In this context, EPMAPS has had to deal with landslides on the slopes that have damaged and obstructed local water intake, as well as structures, thereby reducing the city’s capacity to capture and transport water. The program’s environmental interventions to protect natural drainage systems were key to preparing the communities for short-term hazards. In the case of the environmental restoration of the 19 ravines, interventions such as stormwater management, expanded infiltration capacities, the defining of risk-prone areas, and the relocation of existing at-risk communities directly contributed to minimizing risks and damages to public and private property caused by short term hazards such as flooding, landslides, and discharges of mud and rubble. Moreover, the actions undertaken by EPMAPS also helped to strengthen the social fabric on the slopes through the training and management of local administrative authorities, and in maintaining pleasant natural and urban settings for individuals to enjoy the mountainous landscape, thus providing a better quality of life for the nearby communities.</p> |
| | Source | <ol style="list-style-type: none"> 1. Inter-American Development Bank, Informe de Terminación de Proyecto PCR, (May, 2015). 2. Vidal X., Burgos L., Zevallos, O., “Protection and environmental restoration of the slopes of Pichincha in Quito, Ecuador,” in Water and Cities in Latin America: Challenges for Sustainable Development, Earthscan Studies in Water Resource Management. 3. Proyecto de Acondicionamiento Ambiental de la Quebrada Ortega Informe Final |
| Recommendations | <p>Urban areas are increasingly vulnerable to human-induced hazards, therefore it is recommended to expand the scope of the short-term potential hazards which are addressed. Such efforts will contribute to including further protection measures for risk-prone areas, beyond the boundaries of the areas of intervention of the program.</p> | |

| | | Score | METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM - PHASE II |
|--|---|-----------------|---|
| CR2.1 ASSESS CLIMATE THREAT | 2 | | Enhanced |
| | | | This credit rewards projects that seek to minimize surfaces with a low solar reflectance in order to reduce localized heat accumulation, and manage microclimates. The urban heat island effect can be minimized and managed through the use of materials with a high solar reflectance index (SRI), or through increased vegetation, which provides cooling via evapotranspiration. In this regard, a minimal amount of hardscape surfaces, such as rooftops and pavement, were created by the program, while new green areas were created to achieve a reduction of at least 10-30% of heat-producing surfaces of the intervened area. These efforts were achieved in the Quebrada Ortega and Shanshayacu environmental conditioning projects, where trees were planted along trails, and also provided shade and comfort. Additionally, the vegetation introduction provides other functions, such as in attracting birds, providing security, and protecting existing habitats. |
| | | Source | 1. Proyecto de Acondicionamiento Ambiental de la Quebrada Ortega Informe Final |
| | | Recommendations | For facilities related to the program, such as water treatment plants, it is recommended to use materials with a high solar reflectance index (SRI); this could be complemented by a plan for reducing heat-producing surfaces by increasing vegetation on rooftops, on an urban scale. |
| CR0.0 INNOVATE OR EXCEED CREDIT REQUIREMENTS | 0 | | |
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| | | 29 | |

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| Overall | 403 | METROPOLITAN QUITO ENVIRONMENTAL SANITATION PROGRAM - PHASE II |
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