



**M** | DOW SUSTAINABILITY FELLOWS  
UNIVERSITY OF MICHIGAN

# Dow Sustainability Distinguished Award Report

**M** TAUBMAN COLLEGE  
architecture + urban planning  
University of Michigan







# 2015 Dow Sustainability Distinguished Award Report | PHASE 3

## *Together We Make Santa Marta*



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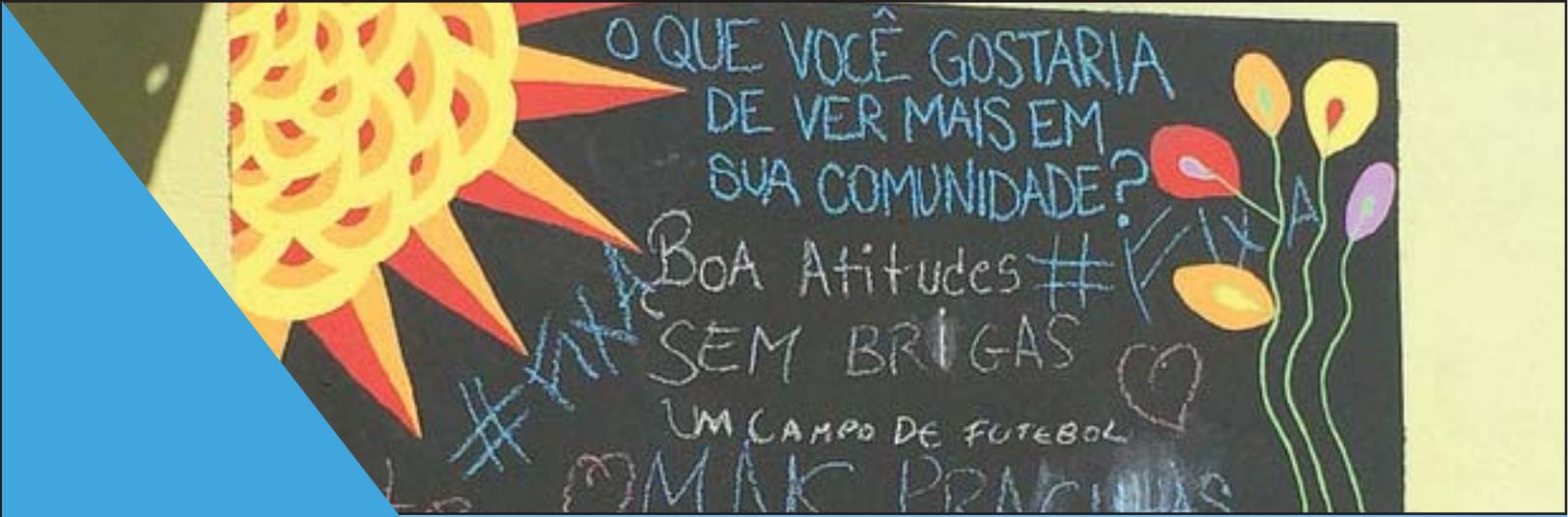
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# Executive Summary

Introduction  
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# Executive Summary

## Introduction

An interdisciplinary team of University of Michigan students from the Taubman College of Architecture and Urban Planning, the School of Natural Resources and the Environment, the School of Social Work, and the School of Kinesiology, Sports Management returned to Vila Santa Marta in May 2016 to:

(1a) implement a series of proposed interventions focused on physical infrastructure upgrading of storm water management structures

(1b) construct new community recreational facilities due to the lack of youth recreation opportunities

(2) pilot a community mapping program designed to improve and teach technical skills as well as establish a stronger relationship between the community and the municipality to provide necessary infrastructure improvements and public services

(3) establish a mesh network that extends the geographical reach of the already available data network in the community thus providing a way for both internet and digital information to be more accessible to a greater portion of Vila Santa Marta

The intent of these interventions is to help improve residents' quality of life and help the Santa Marta community reach their sustainability goals. Our team's travel to Brazil, on-the-ground research, pilot programming, and physical upgrades were made possible through the DOW Distinguished Award and a Ford College Community Challenge grant.

Vila Santa Marta is located in São Leopoldo, a city approximately 30 kilometers north of Porto Alegre, Brazil. São Leopoldo has a conglomeration of informal and formal settlements, which include regularized neighborhoods and public housing projects. Santa Marta faces a host of environmental challenges that result from trash dumping in public spaces, trash burning, animals opening trash bags, and inadequate sewage, water systems, and road infrastructure. These issues stem from systemic inequalities within the governmental structure that provides waste management and infrastructure resources, as well as the lack of public participation in the participatory budget process. In developing our approaches and recommendations for Santa Marta, our team considered the social context of the community, the importance of place based interventions, and the underlying need for sensitivity of the environment, the priorities of residents, and the aspirations of the community. We used rapid appraisal techniques and community participation activities during our intensive field research trip in March 2015, which were crafted after understanding the concerns voiced by our project partners. Our recommendations did not present a single solution for each issue, but instead offered a multi-faceted approach to addressing the concerns of residents and issues in Santa Marta. While not an exhaustive list, we identified six goals that our team used when developing recommendations, which are listed below:

1. **Detering dumping:** The residents voiced concerns about the amount of trash and litter they saw in their neighborhood and the threat illegal dumping posed to their community. The recommendations address their concern about excessive trash by deterring people from dumping and offering new methods of waste management, which can be seen the Smoke Street design solutions in the physical upgrading section of the report.

2. **Increasing communication and dialogue between the São Leopoldo Municipality and Santa Marta residents:** Information is frequently lost between the residents of Santa Marta and the municipality. Our goal is to encourage a clearer dialogue between the two parties to help public officials recognize the community's needs and help residents better understand what the municipality can offer in return. The aim is to not only build self-agency within the community, but also foster co-management, bringing the municipality and Santa Marta residents together in mutually beneficial ways.

3. **Building community pride and visibility:** Santa Marta's image has suffered under the weight of threats such as illegal dumping, crime, and general disinvestment. The installation of welcome signage at the two entrances of the community will bolster pride in Santa Marta and establish a stronger sense of place. Their aim is to change the community's reputation and shift residents' sense of identity and self-worth.

4. **Improving security:** Unsafe streets, vandalism, and crime threaten Santa Marta's requests for more public spaces to gather and connect. We hope improving security within the neighborhood will offer new welcoming safe spaces and address the threat of crime in implicit, yet powerful ways. Gang activity is linked to the lack of recreational and skills training opportunities for youth. Our recommendations for providing training in community mapping

and the construction of a soccer field will help mitigate these problems.

5. **Controlling flooding:** Equipped with a mix of informal and formal water infrastructure and located in an area prone to heavy rainfall, Santa Marta is especially susceptible to flooding and the risks heavy rain can bring. Our design proposals for Triangle Park and rain gardens for areas prone to heavy flooding are meant to control storm water and proactively reduce flooding in innovative ways.

6. **Developing strategies for requesting service upgrades and creating municipal standards for Santa Marta's streets, sewage, and infrastructure:** Upgrading Santa Marta's streets, sewage, and infrastructure is a gradual process. As the community grows, data collected through the community mapping program can be used to track changes in the community and help streamline any necessary municipal interventions.

Since identifying the root causes to underlying issues and different interventions for these issues, a quasi guidebook was developed and distributed in the summer of 2015 addressing key issues and problems through promoting self-capacity. The complete guidebook, with findings and recommendations, is available on Taubman College's website: <https://taubmancollege.umich.edu/urbanplanning/students/student-work/master-urban-planning>.

This progress report details the progress, efforts, and changes that have taken place in the community since our last site visit in addition to the process and results of the proposed interventions during our most recent trip in May 2016.

### Proposed Interventions

Prior to returning to Vila Santa Marta in May 2016, community members undertook projects related to several of the recommendations and improvements found in the report. Such improvements include increased signage that emphasizes both community ownership and pride, signage that addresses inadequate waste management and deters trash dumping, and other ill-perceived behaviors.

In addition to the increased signage throughout the community, a number of improvements were made in some of the most environmentally sensitive areas such as the addition of a newly constructed bridge at the entrance of the community.

While the community was able to make a few improvements on their own with their limited available resources, there are other landmarks throughout the community that were found in worse condition. For example, due to the poor soil quality and surmounting waste build-up, the creek, and consequently the ravine, have substantially widened, leaving many homes in critical danger of flash floods.

### Field Work

With our anticipated return trip to Vila Santa Marta and our proposed interventions compiled into the distributed guidebook, we worked to strengthen the partnership between the University of Michigan, Com-Vida and the Santa Marta K-9 School, Santa Marta Neighborhood Association, and the São Leopoldo Prefeitura (Municipal Government). With action taken on some of the proposed interventions, residents of Vila Santa Marta developed a firmer connection and communication base with the municipal government. Upon our arrival, our team presented recommendations and feasibility plans to Vila Santa Marta community members, the Neighborhood Association, and



An example of the new signage that has been placed throughout the community in ecological



Newly constructed bridge at the entrance of Vila Santa Marta, a new improvement that has been made since the team's last visit in March 2015



Within a year of our last visit, the creek has widened tremendously creating greater difficulty for residents to commute back and forth

various representatives from the São Leopoldo municipal government. Our project plans were well received by a number of representatives accompanying our team on an initial site visit throughout the community to evaluate changes, improvements, and new or existing problem areas throughout the community. The municipality was supportive of the project plans and proposed outcomes and initiated a number of meetings with the Department of the Environment, the Department of Public Works, and the Department of Education in order to gauge the feasibility of some of the more financially and time intensive plans. Numerous meetings with the Department of the Environment encouraged municipal representatives to visit Vila Santa Marta in order to experience the environmental conditions and direct consequences of trash dumping firsthand. Furthermore, these visits facilitated further discussion in regards to legal issues and permit requirements necessary for the proposed site plans and infrastructure improvements. For example, some of the necessary infrastructure proposals required not only approval from the local municipality, but also were required to be approved by environmental codes approved by the state of Rio Grande do Sul. Such infrastructure improvements are explained more extensively in the physical upgrading section. The Department of Education also demonstrated interest in the applicability of the mapping platform and its potential for integration in future school projects.



Employees of the Department of the Environment surveying environmental issues throughout Vila Santa Marta



Meeting with Department of Environment to discuss different implementation plans to deter dumping along Smoke Street



Urban and Regional Planning Assistant Professor, Ana Paula Pimentel Walker interviewed by the local newspaper about the University of Michigan's efforts to improve environmental education awareness and provide physical infrastructure upgrading in Vila Santa Marta

Our client, the Santa Marta School, had originally approached the University of Michigan to brainstorm solutions for problems of littering and dumping, lack of youth recreational opportunities, low levels of sense of community and environmental stewardship, and violence. During our May site visit, we were able to begin three projects which include:

1. Based on the needs and requests of the community, our team developed site plans and drawings of storm water drainage structures, recreational facilities, and welcome signage for review by various municipal departments, community leaders, and contractors. Based on the available funds, the physical upgrades our team was able to fund include two large entrance signs on either side of the community that will be illuminated in the dark, improvements to storm water drainage, road quality, and disability access to Triangle Park, a recreational park at the entrance of Vila Santa Marta, and finally a new soccer field in the Neighborhood Association's designated park space. While we hoped to include a stormwater park and provide more feasible solutions to deter the continual overflowing of the creek in the community, the permits, engineering, and construction materials were beyond the budget.

2. For the community mapping program, our team partnered with Detroit-based Loveland Technologies, to collect data on infrastructure and other physical conditions in Vila Santa Marta via Loveland's online platform Site Control. Data collection was conducted using Nexus tablets and personal smartphones, surveying physical conditions that had been observed during the first site visit. The purpose of the community mapping exercises is to provide the community with a tool that puts the power of community data and information in the residents' hands. Survey questions covered a variety of topics related to the issues previously identified by the community. Furthermore,

the community mapping program was also designed to provide an educational outlet for students and community members to learn a new technological skill that can be translated to other community improvement projects and future employment opportunities.

3. To help facilitate the community mapping program a mesh network was set up to increase internet connectivity throughout the community. Our team worked with Rio de Janeiro native, Bruno Vianna, to lead community mapping focus groups and a 1-day mesh network system. Mr. Vianna has previous experience with community driven technology projects and was instrumental in getting the mapping program running.





# Intervention1:

Physical Improvements  
Introduction  
Addressing Recommendations



# Implementation 1:

## Physical Improvements

### Introduction

During the initial physical infrastructure phase, improvements addressed all six of the recommendations listed above in the form of rain gardens and welcome signage for the two main thoroughfares in Santa Marta, as well as a new multi-purpose recreation court or soccer field. The intent of implementing projects such as the rain garden, signage for Smoke Street, signage and infrastructural changes to Triangle Park, and the new soccer field at the community center is to help increase the sense of community ownership and pride by contributing to changing both the environment and neighborhood in desirable ways as requested by the community. Conceptual renderings were produced to show different ways to address the issues of flooding through constructing rain gardens (figure 3) in a specific location within the community and how providing signage for Triangle Park and Smoke Street (figures 1 & 2) can contribute to building community pride and visibility. Initial design efforts were not produced to scale, therefore, the design solutions for the physical infrastructural improvements were purely intended to show a vision for Vila Santa Marta. Since the design solutions were created prior to traveling to Brazil and were largely conceptual, based on the site surveys and conditions, field changes were expected upon arrival.



Figure 1: Iteration 1 of Smoke Street



Figure 2: Iteration 1 of Triangle Park

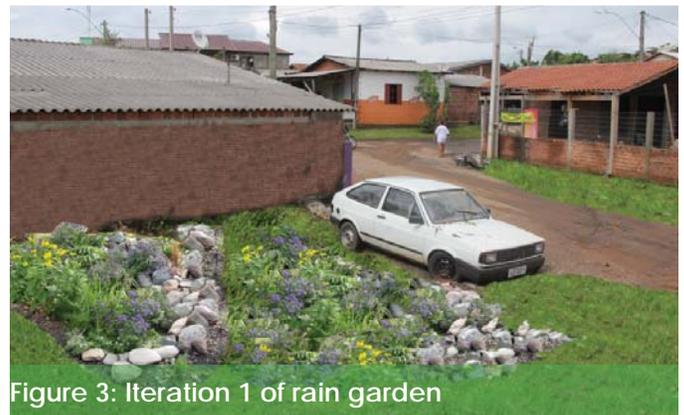


Figure 3: Iteration 1 of rain garden

### Addressing Recommendations

Since trash buildup in areas such as Smoke Street is a consistent problem the community faces, conceptual designs and brainstorming of different solutions to deter trash dumping along the walking paths and into the creek were proposed. Although a few design solution iterations were presented to community members and the various municipal departments including the Department of the Environment, our team faced challenges in the implementation of the proposal. This was primarily due to the municipality's lack of data on whether the land was federally, municipally, or privately owned. This reduced the potential for other physical improvements along Smoke Street, and limited the proposal to a welcome sign designed to promote and build community pride and visibility. The iterations for Smoke Street physical improvements are illustrated in Figures 4, 5, and 6.

Our first meeting with the residents and municipality allowed for both the participants to engage and discuss ideas for addressing their environmental concerns and needed infrastructure improvements. With University of Michigan students facilitating an open discussion between community residents and the municipality, community residents were excited about the possible changes some of the municipal departments were willing to support. These meetings not only provided an opportunity for residents to walk down Smoke Street and Triangle Park with city officials discussing the necessary improvements needed to reduce trash dumping that is contributing to the pollution of the river, but also provided an opportunity for city officials to recognize the extent to which municipal assistance is needed.



Figure 4: Iteration 1 of Smoke Street Trash Prevention

Figure 5: Iteration 2 of Smoke Street Trash Prevention

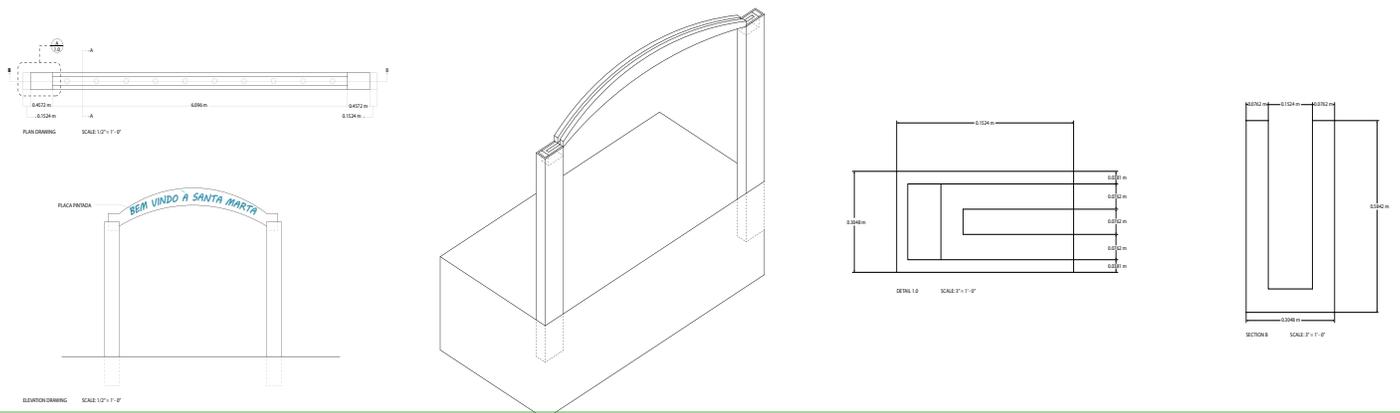


Figure 6: Construction drawing of sign for Smoke Street

The primary purpose of installing arched and heightened welcome signs on Smoke Street and Triangle Park is to create anchor points for the two entrances to the community's neighborhood, and display a sense of community pride and ownership to those visiting the community. These signs are constructed out of aluminum pieces supplied by a local aluminum company, that will also have florescent lighting and materials placed between the two aluminum sheets enabling the words "Welcome to Santa Marta" to be illuminated in the dark.

Triangle Park's physical improvements are designed to control flooding and maintain a higher quality of physical infrastructural improvements. The proposal for Triangle Park includes one of the welcome signs, planters that allow for water to flow from the top of a graded hill to the bottom and then leading into the creek, and re-grading the adjacent street using a permeable surface that helps mitigate flooding during the rainy months. The site plan for Triangle Park is illustrated in [Figure 7](#) with a sectional render visualized in [Figure 8](#). After organizing local engineers and architects to conduct a site visit of Triangle Park and its current condition, before any new infrastructure is installed, underlying sewers need to be cleared for drainage purposes.

Some of the sewers are not even detectable due to the immense waste buildup. If necessary, the municipality must agree to pay for new sewage pipes for proper drainage of pluvial water into the creek, before any of the new proposed installations can occur.

Finally, the multi-purpose athletic court provides a gathering place for children and adults to play soccer, basketball, and volleyball near the center of the community. Since gang violence is prevalent throughout the community, there is a lack of recreational opportunities for youth. This is largely due to safety issues and vandalism of existing structures. The installation of a soccer field, offering both recreational opportunity and a symbol of community pride, helps mitigate these problems. Adjacent to the existing playground, it provides public open space for residents to gather and recreate. Our intent for these physical design elements is to encourage a strong sense of place. Conditions of the current recreational area demonstrate an uneven playing surface that is not conducive to inclement weather. Currently as a dirt field, the area floods during heavy rains. The vision for the multi-purpose sport court is illustrated in [Figure 9](#).



Figure 8: Sectional render of Triangle Park

Figure 9: Multi-purpose sport court

Initial iterations of the soccer field include an enclosed court with permeable rubber mats as the primary foundation often found on roller hockey or indoor soccer sport courts. Such materials are able to withstand inclement weather and last up to fifteen years of intense use. Two engineers and architects from the city's Public Works Department gave permission for the construction of the soccer field, meanwhile our team along with the Santa Marta School and the Neighborhood Association consulted four different construction companies to compare budgets and quality of materials. Eventually due to cost overruns and feasibility, a new vision for the multi-purpose court was met in order to fulfill the needs of the community.

The municipality has offered to cover the expenses of providing the equipment and labor to level the field. Initial layers of the multi-purpose sport court will include brick and concrete as a firm foundation that withstands damage and corrosion. With additional support a permeable court layer can be installed in the future with a drainage system lining the sides of the court.

Overall, the physical designs attempted to address the issues raised during the initial field research in March 2015 and provide solutions to new community needs and wishes. Although much of the physical design recommendations have yet to be

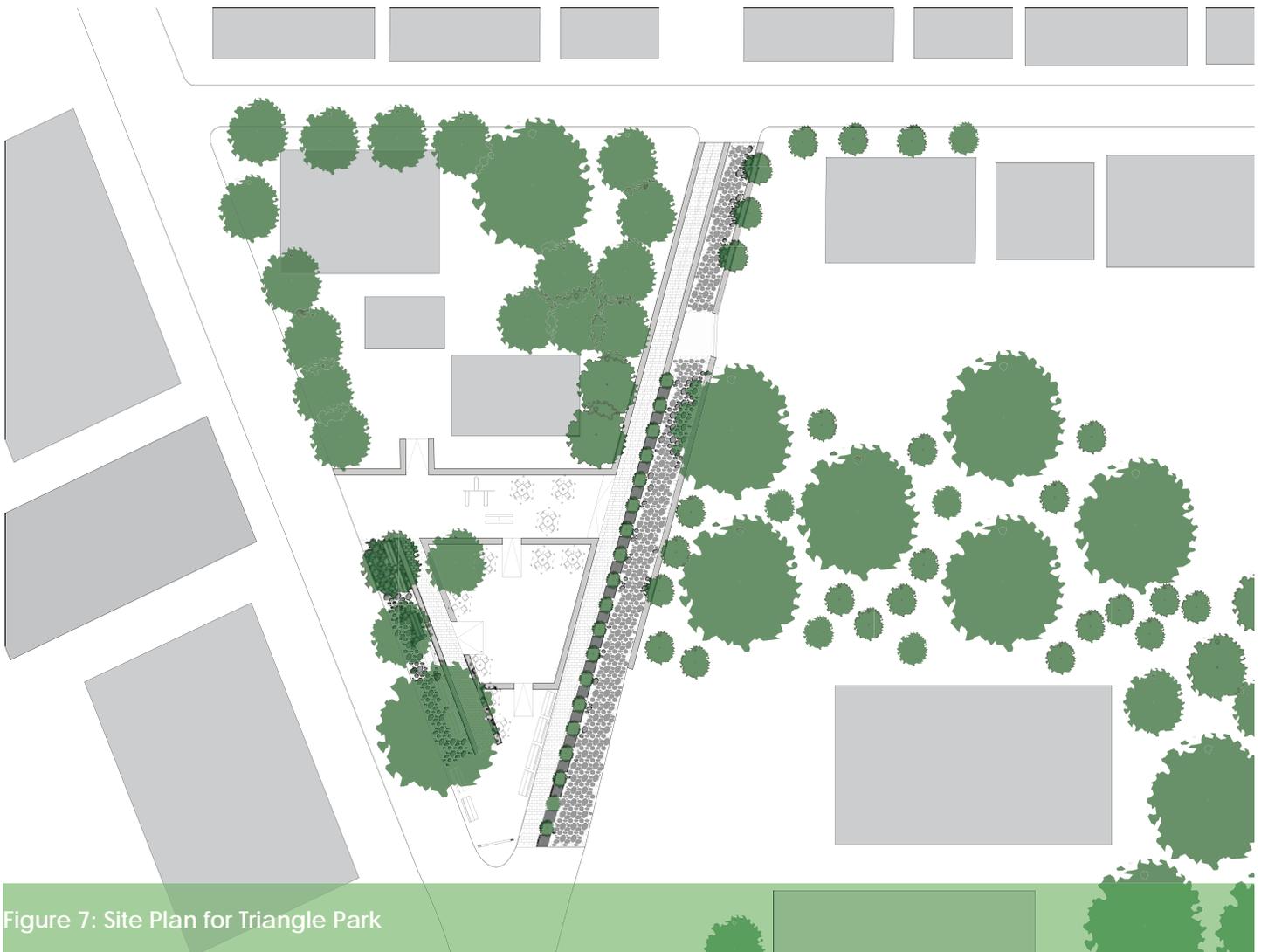


Figure 7: Site Plan for Triangle Park

completed, these proposals help provide a vision that the residents can build on for future improvements and developments as their community continues to grow. The Dow Sustainability Distinguished Award made this process possible through funding some of these physical infrastructure upgrades and supporting sustainable practices for the community of Santa Marta. Furthermore, the Dow Distinguished Award initial seed money facilitated open communication between the municipality and Santa Marta residents and brought the necessary attention and investment in the community on behalf of the municipality. Our hope is that strengthening this partnership will be sustained in the years to come and the community and municipality will be able to work together to administer projects in the future.



Trash in creek that runs along Smoke Street



Discussing Triangle Park design with Engineer



Trash along Smoke Street



Trash burning along Smoke Street



Trash at entryway on Smoke Street





## Intervention2:

Community Mapping

What is community mapping?

Community mapping workshop

Community mapping

Going forward



## Implementation 2:

### Community Mapping

*What is community mapping? Why is it needed for Santa Marta?*

Our team piloted a community mapping program which enabled the students and residents of Santa Marta to learn mapping and other technical skills. Community mapping is a process through which residents map characteristics of their community. The mapping can be digital or hand drawn, depending on the desired outcomes for the activity. For example, a community might want to create hand drawn maps to identify how residents perceive the community space. Alternatively, creating digital maps can benefit a community by developing new data that can easily be analyzed alongside other municipal data.

Many of the issues Santa Marta faces, such as illegal dumping, lack of street paving and formal infrastructure can be addressed through community mapping. Data collected on these topics and others will be presented to the São Leopoldo municipal government as justification for improvements and can help prioritize needs in the participatory budgeting process.

The community mapping pilot program provided local residents with the opportunity to produce important information about community needs, such as identifying dumping areas



and which roads needs infrastructural improvements. For example, residents identified the locations of storm drains and street lighting across the neighborhood. They can use this information to identify gaps in these types of infrastructure. Providing the educational opportunity for a range of Santa Marta residents to work with new technology empowered them to participate in building a stronger and a more resilient community, while addressing waste management issues. Our team allocated a portion of the Dow Distinguished Award to purchase software and equipment for the mapping program and hire a mapping expert to help design the program's process. The community mapping activities were

designed to provide residents with opportunities to develop employable skills such as community organizing, leading meetings, collecting quality data, and interpreting the data.

### *Community mapping workshop in Santa Marta*

To introduce community members to the community mapping program we facilitated a discussion workshop designed to help residents understand the mapping process and identify their wants and needs. The workshop was modeled after mapping activities in the Community Technology Fieldguide, (Re) Building Technology developed by the Detroit Community Technology Project and the Open Technology Institute. The workshop was open to the public and held at the Santa Marta School prior to engaging in field mapping activities.

The workshop was facilitated by University of Michigan students along with the assistance of Bruno Vianna, a consultant based out of Rio de Janeiro. Mr. Vianna was hired to assist with the community mapping program and establish a mesh network. Workshop participants included residents, Santa Marta School students and teachers, representatives from various municipal departments, and professors from a local university, Universidade do Vale do Rio dos Sinos (UNISINOS).

We began the workshop by facilitating a discussion on the importance of community mapping. We asked each participant to answer the following question, “What does it mean to you to map your community, and how would you do it?” This question proved to be very informative as participants began sharing their hopes for the mapping program. They spoke about the possible benefits to the community, how mapping can help address issues faced by the community, and even identified the data they were interested in collecting and mapping.

The second activity was designed to help us further identify issues in the community. Participants were asked to identify three issues in the community and write each one down on a post-it note. The participants then displayed their post-it notes on a wall and grouped them according to subject matter. Finally, each person was given three sticky dots to vote for the issues they felt were most important and were encouraged to discuss their preferences with the group. The resulting visual representation of their priorities and the conversation that followed allowed everyone to better understand how mapping can be used to adequately address the wants and needs of the community.



Group discussion with Santa Marta residents



A Santa Marta resident talks about issues in her community

## Community mapping in Santa Marta

Our team contracted Loveland Technologies, a Detroit-based startup that is dedicated to making parcel data accessible online for communities and the public. Loveland Technologies created an application, called Site Control that enables surveyors to select and answer survey questions by individual parcel. The intuitive nature of the application allowed residents to interact with the survey with minimal training. The application allows residents to view and analyze collected survey data online querying by survey response. This powerful tool allows for rapid identification of trends and real-time tracking of progress. Data can also be exported for more detailed analyses with other mapping programs or statistical

software.

Our team worked with the Santa Marta School to develop a survey that posed questions about infrastructure and other physical conditions by individual parcel throughout the community. The questions, for instance, asked whether the parcel had a storm drain or lighting fixture in front of it, whether it had a garbage basket, and the condition of the street it was on. Such questions will help the community identify the locations of needed upgrades and gaps in infrastructure and help present this information to the municipal government. As Santa Marta is an informal settlement, the boundaries of the parcels in certain areas change frequently as residents move in and out and informally construct their homes. As a result, the São Leopoldo government does not have an accurate dataset of parcels for the community. In an effort to provide the municipality with the most accurate information available, the team included questions about the boundaries on the parcel map on the survey application, anticipating that the parcels on the ground might not match exactly the parcels in the map. The survey questions did not require surveyors to interact with residents; all the questions could be answered by observing a parcel.



Participants place their post-it notes on the poster



Post-it notes with issues found in the participants community

The team contacted the City of São Leopoldo to obtain a GIS Shapefile of the parcels in Santa Marta, which Loveland Technologies was able to upload to their application and use for creating the survey interface. Due to the informal nature and sometimes rapidly changing community shape, the municipal government does not have complete or accurate data on parcel boundaries. In order to use the Site

Control application the community had to be mapped in parcel format, University of Michigan team members roughly approximated parcel boundaries based on aerial imagery. To complete the surveys, the team and the Santa Marta School partners divided the map of Santa Marta into five sections and split into three groups to conduct the surveys. Each group consisted of at least one University of Michigan team member, Com-Vida student, and Santa Marta teacher or resident. Each group had one device (Nexus tablet or person cellphone) for conducting surveys and one or two tablets for tracking other observations using photos and notes that were geotagged with geographic coordinates for mapping at a later date. As expected, our team faced some challenges with the technological platform as it is still being refined and modified. Only three of the devices available to the teams were actually compatible with the Site Control application.

The group conducted surveys of the Santa Marta parcels over the course of five days. Not all of the parcels in the community were surveyed due to the technological difficulties encountered and the size of the area being surveyed. Our team with assistance of Com-Vida and community members completed surveys for 678 of approximately 1,216 parcels. However, to reiterate, an important aspect of this mapping exercise was for residents and students to thoroughly familiarize themselves with the application, conduct surveys, analyze the data, and conduct future, new surveys. As such, the residents are now experienced and comfortable in completing the remainder of the surveys on their own later this summer. As technological problems arose, it became clear our team needed to make a significant effort to provide the community with the correct data collection devices. Loveland Technologies donated five Nexus tablets that are compatible with the Site Control application so that the Santa Marta community can



Com-Vida leaders using the Loveland app to survey a parcel



UM student, Alexis, assisting Com-Vida student, Arno, on parcel surveying



Bruno, leading a group of surveyors



A Com-Vida student surveys a parcel

continue their mapping.

Despite these difficulties, the process was largely successful, as the Santa Marta residents and students were able to analyze the parcel data as the survey results came in each day. However, the process also revealed a number of important lessons learned that the group can incorporate in future endeavors. First, the device compatibility issue and need for cellular data were important factors that prevented the group from completing additional surveys during the allotted site visit. Furthermore, the application was not compatible with all versions of Android and presented difficulties with iOS (iPhones). If the application were compatible with more versions of Android, more residents and students could have conducted

simultaneous surveys. Moreover, the application was not functional offline and therefore used data when it was running. Our team provided SIM cards to the residents and students with compatible devices so they did not have to use their own data plans. In the future, testing the devices on the ground can help alleviate these problems before surveying begins. Furthermore, the groups identified potential improvements to the survey questions during first few days of survey collection, but did not want to make changes to the survey at that point in order to avoid inconsistencies. In the future, conducting a pilot survey before beginning the full survey process could help the community avoid these issues. Some of the problems could have been addressed before our arrival in Santa Marta, others are likely to have only been discovered during the survey process.

### Going Forward

There are approximately 1,216 parcels in Santa Marta. Over the course of five days, our team surveyed 678 parcels. The remaining 538 parcels will be surveyed in July and August 2016. Once surveying is complete, both the community and the municipality will have a better, more accurate dataset of the Santa Marta community. While the parcels used for surveying are approximations, these parcels could serve as a starting point for the municipality should they decide to undertake a formal land survey of the community. The Santa Marta residents are also willing to teach nearby communities how to survey their communities and share this information with the São Leopoldo municipal government. Santa Marta residents will be able to use their experience with this process to assist new communities; refining and taking ownership of the process proceeding forward. The Loveland Technologies Site



Control application will be live, allowing the community access to continuing collect data for two years. At that time another local organization or, perhaps, the São Leopoldo government can decide to continue the account for a fee. Regardless, the data collected will remain on the Loveland Technologies server and available for download.



Parcels currently mapped are marked in blue





# Intervention 3:

## Mesh Network

What is a Mesh Network?

Mesh Network Workshops

Current Status

## Implementation 3:

### Mesh networks

#### *What is a mesh network? Why is it needed?*

The Santa Marta community is challenged by internet connection issues and a lack of digital infrastructure. While these challenges have been primarily problematic for school programming, the initiation of the digital community mapping portion of this project has introduced new opportunities and ways the Santa Marta community may utilize technological resources. As a result, a mesh network was installed at the Santa Marta K-9 School that will serve a variety of community needs.

A mesh network is made up of a series of routers and antennas that, once installed, wirelessly distribute digital information that can be accessed by any internet-capable digital device, such as computers, laptops, tablets, and smartphones. A mesh network essentially extends the geographical extent of a data network, providing a way for both internet and digital information to be readily accessible to a physically larger portion of the community. It also allows for digital communication between residents via personal devices. Furthermore, essential to the sustainability of a mesh network is the community's role in maintaining the infrastructure of routers and the server connection. This calls for the technical engagement and coordination of residents to serve as stewards of the network and maintain its viability in the future. Overall, the mesh network is a community solution to the technological challenges posed by a lack of internet access. The alternative is for individual residents to purchase internet connection which is not financially feasible for many in the community.

#### *Workshops in Santa Marta*

A one day workshop was led by Bruno Vianna at the Santa Marta K-9 School to teach residents about mesh networks and how to set one up in their community. The workshop was modeled after mapping activities in the

Community Technology Fieldguide, (Re) Building Technology developed by the Detroit Community Technology Project and the Open Technology Institute. This workshop commenced with a general discussion about how an internet network functions. Originating from questions about how cell phones send and receive text messages, the discussion progressed to understanding how a mesh network uses routers to communicate digital information. Using the prior knowledge of a few students, Mr. Vianna proceeded to have students and other residents build a small mesh network within the classroom. This required them to explain to the rest of the group the basic functions of a router, how a router receives an internet connection, and how it sends digital information to other devices. Several consensus-building activities were then used to have the group collaboratively design a mesh network for Santa Marta.

A simple community mapping activity was used to engage the group to think about different locations for routers within Santa Marta. On a large sheet of paper, students and staff were asked to draw their community, including roads, buildings, and other infrastructure. From this, they went on to identify roofs of homes, stores, hillsides, and other high elevation locations that could serve as potential locations for the routers. This exercise not only served the purpose of having the group decide locations for the equipment, but it also allowed them to develop a group vision of their community. The final portion of the workshop involved installing the routers throughout the school. In collaboration with students and staff, Mr. Vianna installed several router devices around the school. Five routers were installed throughout the school grounds

in order to build a strong signal within the school, from where the network can continue to grow if more routers are installed in the future.

### Current Status

Aptly named Comunet (Community + Internet) by a student, the network is housed at the Santa Marta School. The network is currently in use by students and it will be providing access to the Neighborhood Association as soon as internet issues are troubleshooted and smoothed out. They are working on increasing the internet connection to 20 megabytes in order to better meet the technological needs of the community.



Bruno showing the students how to set up a network



Alexis and Santa Marta School teachers assembling the router



Bruno, showing Com-Vida student, Adrian, how to connect the router



Bruno installing the router at Santa Marta School while Com-Vida students and UM Student, Alexis, assist



Students drawing a map of Santa Marta



Teachers and students discussing where routers should be placed

### *Future project plans*

Working closely with the municipal departments and Santa Marta community leaders, mobilizing initiatives for infrastructure and public service improvements is crucial to improve the environmental sustainability of these projects. Further collaboration between these two entities involves rethinking and proposing modifications to current urban policies so that housing and environmental concerns are better integrated and better data documentation of existing communities is built into the process. This, in turn, will help with the prioritization of infrastructure projects and promote efficient delivery of public services. Our project's focus is on environmental planning that directly affects low-income and informal housing that intends to implement more sustainable practices in housing development as well as work against environmental degradation. We believe that by initiating a few physical upgrades, promoting welcome signage, and constructing a multi-purpose sport court that benefits the whole Santa Marta community, there will be a shift in community responsibility and a community-wide desire to maintain these improvements. Furthermore, the community mapping exercises will help facilitate a more direct conversation with the municipality with visual evidence of areas that need upgrading or require various other improvements. The extent of media coverage our efforts have received throughout São Leopoldo and the Rio Grande do Sul region, could indicate there is a greater incentive on the municipality to continue to provide a greater number of services and conduct more outreach in the community.

We are excited about the growth and promise of this project and are looking forward to seeing other area communities work with and learn from Santa Marta's experiences to map their own communities and effectively communicate and express their needs with their municipalities.