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Urban Water Conservation in Condado

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Abstract

The Urban water conservation project was sponsored by the Office of Permits in the Municipio de San Juan. The project included inspection of the stormwater sewer system, interviewing local hotel owners, government officials, and teachers, to determine the extent of the stormwater system pollution. We developed recommendations for best management practices and educational campaigns to help keep stormwater sewer runoff as clean as possible, thereby keeping the lagoons and ocean from becoming polluted.

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<u>Abstract</u>	Keenan, edited by Byron
<u>Acknowledgements</u>	Byron, edited by Wesoloski
<u>Authorship</u>	Keenan, edited by Wesoloski
<u>Table of Contents</u>	Keenan, edited by Wesoloski
<u>Table of Figures</u>	Keenan, edited by Wesoloski
<u>Executive Summary</u>	Keenan, Wesoloski, Byron, edited by Keenan
<u>1.0 Introduction</u>	Byron, edited by Keenan
<u>2.0 Background</u>	Keenan, edited by Wesoloski
<u>2.1 Pollution</u>	Keenan, edited by Wesoloski
<u>2.2 Stormwater Runoff and Combined Sewage Overflows</u>	Keenan, edited by Wesoloski
<u>2.3 EPA Regulations</u>	Keenan, edited by Wesoloski
<u>2.4 Public Awareness Campaigns</u>	Byron, edited by Keenan
<u>2.5 Illegal Connections</u>	Byron, edited by Keenan
<u>2.6 Flooding</u>	Byron, edited by Keenan
<u>2.7 Summary</u>	edited by Keenan
<u>3.0 Methodology</u>	Wesoloski
<u>3.1 Identify Reasons for Stormwater Pollution</u>	Wesoloski
<u>3.1.1 Informal Interviews with Local Business Owners</u>	Wesoloski
<u>3.2 Current Status of Stormwater Pollution</u>	Wesoloski
<u>3.2.1 Direct Observations</u>	Wesoloski
<u>3.2.2 Spreadsheet</u>	Wesoloski, 3.1-3.2.2 edited by Byron
<u>3.3 Educational Campaign</u>	Byron
<u>3.3.1 Interviews with School Representatives</u>	Byron
<u>3.3.2 Interviews with Municipio de San Juan Representatives</u>	Byron
<u>3.4 Summary</u>	Byron, 3.3-3.4 edited by Wesoloski
<u>4.0 Results and Analysis</u>	Byron
<u>4.1 Identification of Discharges</u>	Keenan
<u>4.1.1 Informal Interviews</u>	Keenan
<u>4.1.2 Illicit Connections from Businesses</u>	Keenan
<u>4.1.3 Residential Illicit Discharges</u>	Keenan
<u>4.2 Identification of Waste Disposal Practices</u>	Keenan

<u>4.2.1 Trash Cans and Waste Build Up</u>	Keenan
<u>4.2.2 Illicit Waste Discharges</u>	Keenan
<u>4.2.3 Waste Disposal Practices</u>	Keenan, 4.1-4.2.3 edited by Byron
<u>4.3 Identification of Best Management Practices</u>	Byron, edited by Wesoloski
<u>4.4 Identification of Educational Campaigns</u>	Wesoloski
<u>4.4.1 Previous Campaigns</u>	Wesoloski
<u>4.4.2 New Campaigns</u>	Wesoloski, 4.4-4.4.2 edited by Keenan
<u>5.0 Conclusions and Recommendations</u>	Keenan
<u>5.1 Conclusions</u>	Keenan
<u>5.1.1 Residential Areas</u>	Keenan
<u>5.1.2 Commercial Areas</u>	Keenan
<u>5.1.3 Level of Knowledge of Residents</u>	Keenan
<u>5.1.3 Previous Campaigns</u>	Keenan, 5.0-5.1.3 edited by Wesoloski
<u>5.2 Best Management Practices Recommendations</u>	Byron, edited by Keenan
<u>5.3 Educational Campaigns</u>	Wesoloski
<u>5.3.1 Hotel Recommendations</u>	Wesoloski
<u>5.3.2 Commercial Recommendations</u>	Wesoloski
<u>5.3.3 Residential Recommendations</u>	Wesoloski, 5.3-5.3.3 edited by Byron
<u>References</u>	Keenan, edited by Byron
<u>Appendix A: Sponsor Description: Municipio De San Juan.</u>	Keenan, Wesoloski, Byron, edited by Keenan
<u>Appendix B: Brochures</u>	Keenan, Byron, Wesoloski, edited by Wesoloski
<u>Appendix C: Informal Interviews with Residents</u>	Keenan, edited by Byron
<u>Appendix D: List of BMPs</u>	Byron, edited by Keenan
<u>Appendix E: Resident A Interview</u>	Byron, edited by Keenan
<u>Appendix F: Maria Matos and Ileana Orlandi Interview</u>	Byron edited by Keenan
<u>Appendix G: Javier Laureano Interview</u>	Wesoloski, edited by Byron
<u>Appendix H: Professor Meleon Interview</u>	Wesoloski, edited by Byron
<u>Appendix I: Condado maps</u>	Keenan, edited by Byron
<u>Appendix J: Maps of Condado with Inventory</u>	Keenan edited by Byron
<u>Appendix K: Estuario map</u>	Keenan, edited by Wesoloski
<u>Appendix L: Estuario Oil and Grease Chart</u>	Wesoloski, edited by Byron
<u>Appendix M: Estuario Fecal Coliform Chart</u>	Wesoloski, edited by Byron
<u>Appendix N: Survey Protocol</u>	Byron, edited by Wesoloski

<u>Appendix O: Focus Group Protocol</u>	Byron edited by Wesoloski
<u>Appendix P: Community Presentation Protocol</u>	Wesoloski, edited by Keenan

Table of Contents

Abstract	ii
Acknowledgements	iii
Authorship	iv
Table of Contents	vii
Table of Figures	x
Executive Summary	xi
1.0 Introduction	1
2.0 Background	4
2.1 Pollution	4
2.2 Stormwater Runoff and Combined Sewage Overflows	5
2.3 EPA Regulations.....	6
2.4 Public Awareness Campaigns	7
2.5 Illegal Connections	8
2.6 Pet Waste & Flooding	9
2.7 Summary	10
3.0 Methodology	11
3.1 Identify Reasons for Stormwater Pollution	11
3.1.1 Informal Interviews with Local Business Owners	11
3.2 Current Status of Stormwater Pollution	12
3.2.1 Direct Observations.....	12
3.3 Educational Campaign.....	13
3.3.1 Interviews with School Representatives	13
3.3.2 Interviews with Municipio de San Juan Representatives	13
3.4 Summary	14
4.0 Results and Analysis.....	15
4.1 Identification of Discharges.....	15
4.1.1 Informal Interviews.....	16
4.1.2 Illicit Connections from Businesses.....	16
4.1.3 Residential Illicit Discharges	17
4.2 Identification of Waste Disposal Practices	19
4.2.1 Trash Cans and Waste Build Up	20

4.2.2 Illicit Waste Discharges.....	21
4.2.3 Waste Disposal Practices.....	22
4.3 Identification of Best Management Practices	23
4.4 Identification of Educational Campaigns	25
4.4.1 Previous Campaigns	26
4.4.2 New Campaigns	26
5.0 Conclusions and Recommendations.....	29
5.1 Conclusions.....	29
5.1.1 Residential Areas.....	29
5.1.2 Commercial Areas	29
5.1.3 Level of Knowledge of Residents	30
5.2 Best Management Practices Recommendations.....	30
5.3 Educational Campaigns	32
5.3.1 Hotel Recommendations.....	32
5.3.2 Commercial Recommendations.....	33
5.3.3 Residential Recommendations	33
References	34
Appendix A: Sponsor Description: Municipio De San Juan.....	37
Appendix B: Brochures	40
Appendix C: Informal Interviews with Residents	43
Appendix D: List of BMPs	44
Appendix E: Resident A.....	45
Appendix F: Maria Matos and Ileana Orlandi Interview.....	47
Appendix G: Javier Laureano Interview	49
Appendix H: Professor Meleon Interview.....	52
Appendix I: Condado maps	54
Appendix J: Maps of Condado with Inventory	70
Appendix K: Estuario map.....	78
Appendix L: Estuario Oil and Grease Chart	79
Appendix M: Estuario Fecal Coliform Chart.....	80
Appendix N: Feedback Survey Protocol.....	81
Appendix O: Feedback Focus Group Protocol	82

Appendix P: Community Presentation Protocol	83
Appendix Q: Inventory Spreadsheet of Condado.....	85
Appendix R: Informal Pet Owner Survey	95

Table of Figures

oFigure 1: Illicit flow of water across trash.....	17
Figure 2: Soapy discharge into main dumping area.	17
Figure 3: Water to flowing through the side walk instead of over it.	18
Figure 4: Water flowing out from the Condado Lagoon.....	18
Figure 5: Pet waste disposal trash can.....	20
Figure 6: Improper management of waste	20
Figure 7: Trash can with a discharge.	22
Figure 8: Properly maintained trash can	24
Figure 9: Map of Condado, Ocean Park and Isla Verde.	54
Figure 10: Map of Condado	55
Figure 11: Map of Condado	56
Figure 12: Aerial shot of Condado.....	57
Figure 13: Aerial shot of commercial area of Condado.	58
Figure 14: Northern section commercial. Southern section residential	59

Executive Summary

Puerto Rico is a prime tourist destination in the Caribbean. Unfortunately, this island paradise is not perfect. The municipal stormwater sewer system in San Juan cannot handle all the water sent to it each day. Illegal connections to the stormwater sewer system hamper its proper functioning (Riverkeeper, 2012). Businesses, construction sites, and even residents illegally connect to the pipe system (EPA, 2008). During rain storms this problem manifests itself as flooding that allows untreated water to run off into the local bodies of water. This problem is unacceptable in any city and requires immediate action.

The goal of this project was to determine the extent of illegal connections and the types of discharges in Condado district, San Juan, and advise the best course of action to reduce the occurrence of pollution and illegal connections. Condado is home to residential, municipal, industrial, and commercial institutions (EPA, 2009). The diversity in population and types of institutions required our team to inspect multiple institutions like schools, car washes, hotels and restaurants and document their operating procedures to see what caused pollution, where illegal connections were, and what behaviors followed or did not follow the proper regulations (EPA, 2008a). Observations of different populations allowed our team to decide which populations pollute Condado the most and what actions are the most harmful.

During our time working directly with the Office of Permits and Inspector Carlos Ortiz we completed an inventory of the buildings in Condado and recorded any visible discharges. When the infractions were very serious Inspector Ortiz would complete what is known as an intervention. During an intervention Inspector Ortiz would talk to the employees and the managers of the establishment and impress upon them the seriousness of the infraction as well as what needed to be done to correct it and the punishment if it were not corrected. We did not participate in any interventions that took place as our job was to be there as researchers. Discharges ranged from small puddles near the sewers to streams bubbling up from the sewers. After identifying the institutions and populations that caused the most harm, we conducted interviews to gather the specifics about the best ways to educate school children, hotels, restaurants, residents and tourists. Through the interviews we gathered more information about

stormwater sewers and the best ways to educate the public. The subjects interviewed were government officials, residents, a teacher, and pet owners. Government officials provided information about suspected illegal connections, education programs that have already been used, and the main types of sewer pipes in Condado. The teacher informed us about the best ways to educate students and the public through educational campaigns. Residents and pet owners provided information about the level of knowledge the public had about stormwater pollution. This information provided our group with a starting point to initiate programs that could be effective or, on the contrary, ineffective.

The interview we conducted with Maria Matos, the Head of Environmental Affairs at the Office of Permits, and Ileana Orlandi, the Manager of Education, gave us information about the recycling campaign. Both Maria Matos and Ileana Orlandi provided us with a list of ways to conduct productive educational campaigns. We also interviewed the head of the Estuario de la Bahia de San Juan, Javier Laureano. We discussed the problems the Estuario was having with the levels and the types of pollutants in the Condado lagoon. Javier provided us with charts about the levels of pollutants and information about a stormwater sewer newspaper ad campaign. Our final interview was with a school teacher at St. John's School in Condado. She impressed upon us that students respond well to interactive presentations and internet links on a webpage. She also told us that not much has been done in the schools as far as education about stormwater pollution, only recycling.

Using the information gathered from the interviews and surveying process, our group created educational campaigns specific to each of the target audiences identified as problematic during the inspection process. From our research we have determined the following recommended methods for an educational campaign.

- Brochures
- Electronic Brochures/pdfs
- PowerPoint Presentations
- Community Presentations
- School Presentations

We have also developed a set of Best Management Practices that the Municipio de San Juan should implement. With regards to restaurants, the use of grease traps must be enforced as well as the proper procedure for grease disposal. Another Best Management Practice we recommend is the use of a training program that would be carried out by the Municipio de San Juan. Rather than initially fining a business or restaurant if incorrect practices are taking place, we advise the use of a training program to educate them on the correct practices. In addition, biodegradable soaps are recommended when washing sidewalks, walkways, or entrances; the use of anything besides biodegradable soaps would be considered an illicit discharge and has the potential to be carried away in stormwater runoff. We recommend putting garbage in a consolidated, blocked off area where stormwater would not be able to flow into. The majority of the stormwater in the sectioned off garbage area would then be able to be cleaned before it too flows into the stormwater sewers. These BMPs address the bulk of the problems we encountered during our inspection of Condado. At the conclusion of our project we were able to recommend effective solutions to the Office of Permits in San Juan that can mitigate the pollution of the stormwater in Condado.

1.0 Introduction

In cities across the globe, stormwater runoff causes pollution to enter the stormwater sewer system and is often discharged without treatment into local bodies of water. Some major pollutants of water include pet waste, litter, motor oil, cleaning products, paint, construction debris, and outdoor usage of pesticides (EPA, 2008). Flooding increases the magnitude of this problem as it causes a large amount of water runoff that contains waste. Illegal connections to the stormwater sewer system are another problem that complicates the situation. These connections may contain an illicit discharge that is, a discharge other than stormwater, and the extra water in the sewers increases the chances of flooding. The severity of water pollution throughout the world is often overlooked or understated. In a 2005 report, the National Environmental Education and Training Foundation found that 78% of the American public does not understand that runoff from roads, lawns, and agricultural land is currently the most common source of water pollution (EPA, 2005). Also, 47% of Americans believe industry is still the most significant contributor to water pollution. In general, public awareness needs to improve in regard to the contamination of the water supply and as well as of nearby bodies of water.

The Condado region in San Juan, Puerto Rico has been facing several concerns with their waste water management system including flooding and polluted stormwater runoff into local bodies of water (EPA, 2008). San Juan administers an MS4 (Municipal Separate Stormwater Sewer System) permit issued by the Environmental Protection Agency (EPA) to monitor and enforce legal and regulatory issues. The MS4 program deals with illegal connections to the drinking water supply as well as unauthorized discharge connections to the storm sewer system that are polluting receiving bodies of water in Puerto Rico. One of the most prominent problems in San Juan continues to be the lack of public awareness and lack of behavioral change to prevent such pollution from occurring.

Negligent pet owners are perhaps the most difficult members of the public in terms of getting them to coincide with behavioral change. Pet waste runoff is not only a problem in Puerto Rico, but other large cities such as Toronto, Canada, as well. As in San Juan, Toronto has experienced a similar problem with pet waste left on the ground because people refuse to pick up

the waste left behind by their pets (Toronto Star, 2007). Though pet owners might bring their own bag for the waste, once they had collected it the area lacked a receptacle in which to discard the bag. The parks eventually installed trash bins that were specific to pet waste and were equipped with a supply of bags. Now, instead of the waste getting into storm drains it can be collected by garbage trucks and sent to the proper treatment facility.

Another mode of encouraging behavioral change includes informal education. New York City put in place an educational campaign that focused mainly on the impact of polluted stormwater discharges in local bodies of water and the various steps citizens can take to mitigate the amount of pollution (Pataki, 2003). State employees interviewed individuals identified as participating in the permitting process in order to gather information about local businesses and institutions. Soon thereafter they created an educational campaign that included instructional refrigerator magnets, utility bill inserts, and training for businesses on techniques to reduce pollution. However, in Puerto Rico there is currently no plan to implement a change in the stormwater sewer system or even to execute an education system to raise public awareness.

Raising public awareness may be the only feasible solution to the problem because of how everyday actions cause the pollution. Yet there needs to be an effective method to measure the success of how well an educational campaign is reaching out as well as its impact on the ways in which people behave. Those community members who are already aware of the significant problem of polluted water unfortunately are not educated about their own negative contribution (Larson, 2009). Also, individuals are not being given a specific set of management practices to follow. Every city that has created a successful public education program about polluted stormwater runoff has reached out to a range of audiences including businesses, residents, landscapers, and tourists. If public awareness in Condado is only spread to neighborhood residents and does not extend to businesses and tourists, the campaign will not effectively reduce stormwater runoff pollution. Moreover, people need to be informed of how the polluted water can negatively affect them personally in order to realize the urgency of the problem.

Our project goal was to help the government of San Juan garner greater compliance with the stormwater management and permit program and promote public awareness of individuals' personal responsibilities as well as those of others in the community. After canvassing the entire neighborhood of Condado and interviewing several individuals, we have made recommendations to the Municipio de San Juan on how to implement a public education program that involves distributing educational materials such as brochures to the community and conducting outreach activities to convey to the public the consequences of pollution to the environment. By targeting specific types of commercial, industrial, and institutional entities as well, the city will be spreading awareness of the need to reduce pollution in stormwater runoff to those individuals who can effect the most change.

2.0 Background

When the infrastructure of sewer systems becomes compromised, governments take action to correct the problem. Illegal connections to the waste water system together with litter and waste on the streets create a unique pollutant that contaminates bodies of water close to urban areas (EPA, 2011). A stormwater drainage system overburdened with illegal connections will flood local areas and drain into local bodies of water. Detergents, pet waste, litter, oil, and grease on the streets adds more pollution when it gets swept away with the flow of stormwater. The EPA guidelines pertaining to this form of pollution propose using Best Management Practices (BMPs). BMPs can range from educational programs to physical devices put in place to correct the flow of water. This chapter contains information about different EPA guidelines that cities must follow to regulate their sewer systems. Also, we will cite examples of what some urban areas have done to follow these guidelines as well as describe programs that have been effective in dealing with many of the waste management problems present in the Condado district of San Juan, Puerto Rico.

2.1 Pollution

Pollution causes problems for the environment and the government. Every day people take to the streets in cars, motorcycles, trucks, and SUVs. Carbon emissions from burning fossil fuels pollute the air on a regular basis. Fouling the air directly harms people by affecting their lungs; however, it also has consequences that are not as evident to the average person including Ozone damage (Larsen, 2009). Another area of the environment that is impacted by human activities is the water. Governments design systems to send clean water into pipes and pump the water into buildings to be used for multiple purposes. Cities and towns provide treatment for waste water so that it can be recycled. When expected circumstances change, the water treatment system will not work properly. Bacteria, trace metals, and pharmaceuticals are just a few of the pollutants that can pass through the system untreated. Flaws and oversights in the purification process allow these harmful pollutants to stay in the water after it has been treated.

In 2008, New York City conducted an extensive study on levels of pharmaceuticals in its drinking water system because of the failure to properly treat the waste water. The levels of

pharmaceuticals in the water varied seasonally and varied with the sewage treatment facility that was studied (Palmer, 2008). This problem has only recently come to the forefront of pollution research. Modern sewage treatment plants do not screen or treat the water for pharmaceutical drugs. When humans take medicine, birth control pills, or weight training supplements, they increase the body's chemical levels. The body then tries to correct its internal levels and many of the increased hormones or antibiotics are flushed out of the system through urine. The urine makes its way to the water treatment plant where the drug pollutants pass through the system untreated. Finally, hormones and chemicals end up in bays or similar bodies of water where they can cause problems. This "soft" pollution is not pollution in the traditional sense of the word. The water does not look any dirtier, and the water may even taste exactly the same. However, just because the person or animal consuming the water cannot detect anything does not mean pollution is not present. For example, birth control medications are having negative effects on aquatic wildlife. The chemical ethinylestradiol has been causing feminization of fish (Bollman, 2008a). Male fish are developing ovary-like structures in their testes (Thurtell, 2005). The levels of these chemicals in today's waters are not enough to affect humans, but left unchecked that might become a real possibility.

2.2 Stormwater Runoff and Combined Sewage Overflows

Stormwater runoff contributes greatly to the pollution of the water in and around large cities (EPA, 2011). Combined sewage overflows (CSOs) greatly increase pollution when they become overwhelmed because they drain directly into bodies of water. Normally water goes through a water treatment plant first and after proper treatment and purification the water is discharged into a nearby body of water. Unfortunately, during times of extreme rain or melting snow the system can become overwhelmed by the influx of the additional water. During these situations, the system is designed to drain the water directly into the body of water. This means that all the sewage, waste, and pollutants picked up on the streets flow directly into a clean supply of untreated water. In New York City around 460 CSOs drain directly into the Hudson River. What is worse, the sewage system of New York City requires less than one-twentieth of an inch of rain to become overloaded (Riverkeeper, 2012). In one year, CSOs from New York City contribute 27 billion gallons or more of raw sewage and polluted water into the Hudson. Boston has 58 CSO pipes that drain directly into the Boston Harbor, Charles River, Mystic

River, and Neponset River. These are only two examples. Seven hundred seventy-two cities in the United States alone contain CSOs (EPA, 2011). Direct action to correct or shut down CSOs would significantly decrease direct contamination of natural bodies of water close to large urban areas.

2.3 EPA Regulations

Not all regions and sewer pipes in the United States are regulated by the EPA (2011). Urban areas either fit into the EPA's Phase I or Phase II. Phase I, which includes large or medium cities or areas with populations above 100,000, apply for permits for coverage of their stormwater discharge. Phase II requires that small urbanized areas and their immediate surroundings apply for permits to cover their stormwater discharges. Other than those areas the stormwater flow remains pretty much unregulated. The locales listed in Phase I and Phase II are required to create comprehensive stormwater management programs (SWMP s) to reduce contamination and prohibit illicit discharges. Moreover, Phase I and Phase II regulations do not pertain to combined sewers. They only regulate municipal separate storm sewer systems (MS4s), which are defined by four criteria.

1. The pipes are designed to handle stormwater.
2. The pipes are not for combined sewage and stormwater.
3. MS4s are owned by a city or state, not a federally owned sewage treatment facility.
4. MS4s empty their contents into U.S. waters.

Several EPA (2008b) mandates address the management of MS4s. One is the Total Maximum Daily Limit (TMDL). The EPA standardized the units for waste as pounds/day of phosphorous for waste load allocations (WLAs) or point sources. Municipal stormwater sources are regulated as point sources and as such must document their discharges in pounds/day of phosphorous. The load allocations (LAs) are pollutants from nonpoint locations or urban runoff, improper animal handling, forestry practices, or failing septic tanks (EPA, 2011). The amount of pollutants a municipality can discharge into a body of water depends on which body of water they dump water into. The size of the body of water, the previous level of contamination, and the rate that fresh water mixes with the polluted water are all factors that determine the TMDL for a city. The TMDL is calculated by this equation: $TMDL = \sum WLA + \sum LA + MOS$ (EPA, 2008). The

WLAs are the point sources described above; the LAs are the nonpoint sources described above, and MOS is the margin of safety. By adding a margin of safety, any huge influxes of pollutions due to storms or natural disasters such as fires will not cause the level of pollution in the waters to become toxic. As long as cities follow the TMDL, their waters should remain safe, but the samples that cities use to test their water are not always correct or accurate.

Like Boston and New York, Puerto Rico is situated next to natural bodies of water. The EPA's (2011) Clean Water Act and the National Pollutant Discharge Elimination System (NPDES) are two sets of regulations that Puerto Rico currently needs to follow. The Clean Water Act makes it unlawful to discharge pollutants from a point source unless a permit has been obtained. The NPDES permits allow for cities to dump pollutants into bays and other U.S. waters. Private homeowners do not fall under the scope of this legislation. Mainly this bill pertains to companies, governments, and facilities that discharge pollutants directly into bodies of water. The Clean Water Act also established other duties for the EPA. It established standards for regulation of basic pollutants and gave the EPA the right to put into place programs that would control and decrease the amount of pollution. Also the Clean Water Act funds the creation of sewage treatment plants that can handle the new amounts of sewage being sent in from local businesses.

2.4 Public Awareness Campaigns

In addition to limiting the levels of pollutants in the water, the EPA believes in implementing public outreach programs (EPA, 2008a). The programs address behaviors of the population that cause pollution of water. Littering, not properly cleaning up pet waste, and ignoring guidelines for disposal of controlled substances are a few elements that the EPA addresses when trying to change the public's behavior. The EPA focuses mainly on positive reinforcement and increased awareness. The EPA attributes most of the poor behavior of the public to ignorance of the greater consequences of small actions (EPA, 2010). By presenting facts that link small, seemingly harmless actions with larger negative consequences, people are able to see the bigger picture. Also, convenience is an issue for many residents. When listing off solutions that solve a problem, residents must understand that they will not be inconvenienced by potential remedies to pollution problems. Indeed, a solution that is too complex or requires

people to go out of their way will likely be rejected by the public or ignored after only a few attempts. Many times the best solutions are the simplest.

New York City put in place one such straightforward educational campaign (Pataki, 2003). The main parts of the New York City campaign focused on the impact of stormwater discharges on water bodies, the pollutants of concern and their sources, and steps the contributors of stormwater and non-stormwater discharges can take to reduce the pollutants. State employees interviewed persons identified as affecting the stormwater permitting process for information about how they were conforming to the MS4 regulations. This information was used along with information gathered from local businesses and institutions. After all the information had been gathered the teams created campaigns including refrigerator magnets, utility bill inserts, and even trainings for businesses on new techniques for reducing pollution. Their approach was very broad and attacked the issue with several different methods.

2.5 Illegal Connections

Illegal connections and illegal discharges affect the usefulness of the stormwater system. They can also put the system at great risk of filling up and overflowing onto the streets. These illegal connections that hook up to the system without a permit cause major pollution. Construction sites, gas stations, car washes, restaurants and barber shops are examples of potential or actual polluters, according to the EPA (2008). The illegal connections could very well be hiding in plain sight. Connections made to the stormwater system in upstate New York were not known by the residents who used them. The previous owners had not filed the proper paperwork and obtained official permits for the connections that were being used.

Worcester, Massachusetts, has put in place several regulations to identify and correct illegal connections (Environmental News Service, 2008). The Mass Department of Environmental Protection commissioner Laurie Burt identified stormwater as the biggest factor affecting water quality in Worcester. Worcester's programs focus on the Best Management Practices for the sources of the pollutants. The program does not implement any end-of-pipe pollution limitation systems. Currently, Worcester spends 2 million dollars a year maintaining programs such as street sweeping, catch basin maintenance, and identification of illicit

connections to the storm drains. These programs prevent the stormwater contaminants from entering the stormwater system and creating illicit discharges.

2.6 Pet Waste & Flooding

Research into the impact of pet waste as a source of pollution has not been widely conducted. Pet waste is a problem seen in places such as Toronto as well as Puerto Rico. In Puerto Rico the pet waste may stay on the sidewalk until the rains come, and then it is carried by the water into the sewage/drain pipes. Toronto experienced a similar problem with pet waste being left in parks (Toronto Star, 2007). No one would pick up the waste left behind by their pets. They might bag it, but then they would have nowhere to put the waste, and so they left it in the park. The parks eventually installed trash bins that were specific to pet waste. The bins would ensure that the waste did not end up getting mixed in with the regular trash as well as keeping it off the streets and park grounds. Now instead of the waste getting into storm drains, it can be collected by garbage trucks and sent to the proper treatment facility. According to a study done in Toronto, pet waste is the single biggest component of litter by weight. It contributed 1,200 tons each year. The bins for pet waste not only helped keep the park clean, but organized and standardized the pickup and disposal of the waste.

Flooding is a huge issue that leads to the pollution of the streams, bays, and lakes near many cities. It not only increases pollutants, but also affects the lives of citizens living in the city (Knabb, 2008). Traffic can shut down due to a submerged section of road or underpass. Commutes that normally take ten minutes can be extended to hours. Flooding in cities also leads to direct flow of contaminated water into local bodies of water from non-point sources. Instead of flowing into the water through one location, it flows along the streets and into the water from a multitude of locations and across a wide area. Flash floods can claim lives as well. One second a road will be perfectly navigable and the next the influx of stormwater fills the system, and it overflows onto the street. The water system could also overflow because of blocked drains due to poor maintenance of the city's basic infrastructure.

Best Management Practices (BMPs) can help correct the problem of sewers overflowing. BMPs range from physical attempts to correct the stormwater system or prevent failure of the

current system, to public awareness campaigns (EPA, 2008). Physical solutions could be increasing the capacity of the system such that when the storms hit and place huge demands on it, the system can handle the influx of water. Other solutions may include placing devices around storm drains to prevent clogging or blocking. In areas where debris blocks the access of water, these devices would allow the system to continue to function properly and divert the flow of water off the streets and into the sewer or stormwater pipes. Finally, public awareness campaigns help to prevent humans from aggravating the shortcomings of the system. Litter, pet waste, car maintenance, and failing septic systems can lead to pollution of the water and overloading the stormwater pipes. Getting the public to focus on these issues and presenting simple solutions can be a very effective way to eliminate problems in the system.

Quincy, Massachusetts, has put in place numerous flood prevention and flood mitigation techniques. Quincy is located in the greater Boston area and deals with the issue of inner city flooding (FEMA, 2009). The city mapped the municipal flood plain by identifying structures above the flood plain and those in danger below the flood plain. Then, it used government money to elevate structures in the areas with the greatest risk. This preventative measure was the most extensive one taken. The state awarded Quincy almost 1 million dollars to complete these renovations. Homeowners and businesses could apply for federal money if they were in specific risk areas. These measures were mainly preventative and can help to decrease pollution by removing utilities that could spill contaminants into the water.

2.7 Summary

The increased burden on the sewer and stormwater system in San Juan creates a problem that is not unique. Other cities such as Boston have experienced and continue to deal with similar situations (Riverkeeper, 2012). To resolve the problem, governments in those cities have used teams to identify and shut down illegal connections at homes, construction sites, and local businesses (Shulas, 2005). Making it easier to dispose of waste, litter, and other pollutants will be a much better alternative than letting the waste remain on the sidewalk or park. Less pollution and cleaner water are potential positive outcomes of educational campaigns in places like Condado. Cleaning up the environment alone is enough of a reason to develop a reasonable solution to the problems related to water pollution.

3.0 Methodology

The goal of this project was to present a pilot program to the Municipio de San Juan that suggests the best strategy and methods to educate the public on the causes of water pollution and what they can do to prevent such pollution. We helped identify sources of the pollution and the types of pollution that exist, as well as suggest how to potentially remediate these problems. Our objectives were to first determine the types of pollutants and identify illegal connections and illicit discharges in Condado. Next to recommend a public education program and BMPs based off of our inspection and interviews. In this section, we will describe in detail the research methods that we used to achieve our research objectives and thus our goal.

3.1 Identify Reasons for Stormwater Pollution

We needed to determine the reasons for the public behaviors that generate stormwater pollution. In particular, we identified the everyday activities of local businesses and residents of Condado that contribute to the pollution. To collect data regarding disposal practices, we conducted informal interviews with local hotel owners, pet owners, local residents, and Inspector Ortiz and formal interviews with the head of the Estuario program in San Juan, a local school teacher, and our sponsor liaisons, Maria Matos and Ileana Orlandi.

3.1.1 Informal Interviews with Local Business Owners

To determine possible sources of pollutants in the stormwater sewer system, we started conducting informal interviews with local business owners because of their frequent disposal of trash and recyclables. We determined the extent and limits of local business owners' knowledge regarding the causes of water pollution in addition to inspecting their connection to the stormwater pipe systems. This allowed us to locate possible illegal discharges, some of which existed due to a lack of familiarity with the permitting process. To start off each interview, we immediately identified ourselves and our affiliation with the Municipio de San Juan. Next, we explained that the purpose of our inspection and questioning was to help them rather than punish them. We did not confront anyone with the intention of fining them or getting them arrested. Via interviews we sought to determine how a local business disposes of its waste, whether the owner obtained a permit to connect to the water supply and sewage system, and lastly what they knew

in regard to stormwater pollution and EPA regulations. The benefit of interviewing local business owners, who all remain anonymous in our report, is that the information allowed us to determine how best to combat the human actions that are polluting the water system and what exactly we needed to convey in a public awareness program.

3.2 Current Status of Stormwater Pollution

In order to determine which types of pollutants most affect the stormwater sewers in Condado, we took an inventory of all the possible discharge points to the stormwater sewers and the illicit discharges and illegal connections we witnessed. We also took note of improper business procedures to gather data on characteristics of discharges and types of outfalls. We created several spreadsheets to organize the characteristics of the water flow we observed.

3.2.1 Direct Observations

Our primary method of obtaining data for the list of BMPs and the Illicit Discharge Detection and Elimination (IDDE) was through direct observation. The EPA mandated a complete inventory of all the buildings, discharges, and connections to the stormwater sewers in San Juan. Our group completed the inventory for all of Condado. We accomplished the inventory by walking through the region and observing discharges into the stormwater sewers, noting down everyday behaviors of residents, and recording everyday operation of businesses and institutions. Upon detection of a suspicious discharge into the stormwater sewers, we filled in the required information in Excel spreadsheets created by our group (see Appendix Q for an example spreadsheet). Categories on the spreadsheet included discharge, flow, odor, color, debris, etc.

We compiled all data collected during direct observations into an Excel spreadsheet (see Appendix Q for an example of the spreadsheet). The spreadsheets are part of the Illicit Discharge Detection and Elimination mandated by the EPA. The data were compiled and put into a report by our liaison Carlos Ortiz and submitted to the EPA. We looked for discharges into the stormwater sewers. This was accomplished through direct observation of the area. Most of the illegal connections and illicit dischargers were identified by their flow or smell. Illegal connections are simply direct connections into the stormwater sewers that do not have a permit

from the Municipio. Illicit discharges are anything flowing into the stormwater sewers other than stormwater. When the area was dry, there should not be any flow of water in the stormwater sewers because they are separate from the sewage system throughout most of Condado. Any flow and/or smell would indicate connections that could be both illicit and illegal. The characteristics of the water were noted down in different categories of the spreadsheet. We listed the location by identifying the address on the spreadsheet. We did not include any addresses in our final report in order to keep the identity of the businesses, institutions, and residences anonymous.

3.3 Educational Campaign

Our group recommended education campaigns to the Municipio de San Juan to address the problems and infractions we encountered during inspections. We learned different ways to conduct educational campaigns through interviewing a St. John's School teacher, Javier Laureano the head of the Estuario in San Juan, and Ileana Orlandi and Maria Matos from the Office of Permits. These interview results can be seen in Appendix H, G, and F respectively.

3.3.1 Interviews with School Representatives

Since students are the future generation of San Juan, we wanted to cater our educational campaign towards them. San Juan is home to 136 public schools operated by the Puerto Rico Department of Education, as well as several private schools including Robinson and St. John's Schools in Condado district. To learn how to reach out to students, we first interviewed one school teacher at St. John's and determined how best to convey an informational campaign at a school and found out what knowledge students already are getting about water pollution from teachers. Interviewing school representatives was of paramount importance as they are an essential resource and bridge to student outreach. The information gained from that interview can be seen in Appendix H.

3.3.2 Interviews with Municipio de San Juan Representatives

In order to know how to develop a pilot educational campaign, at the recommendation of our sponsor, we first spoke with people in the Municipio de San Juan who have experience with stormwater pollution, public awareness campaigns, and methods for identifying illegal

connections to stormwater sewer pipes (see Appendix F for the interview transcript). We conducted interviews asking each person what he/she thought were the biggest contributors to the stormwater pollution, and what they believed were simple everyday steps that residents and business owners alike can take to start preventing pollution. This can be seen in the survey protocol in Appendix C. We also asked what public campaigns they have seen in the region in the past, what worked, what did not work, and what they believe are the best ways to distribute such information to the public. Those surveys can be seen in Appendix C.

3.4 Summary

In sum, we conducted informal interviews with local business owners, pet owners, local residents and conducted formal interviews with a school teacher, the head of the Estuario program, and the head of the Office of Permits Environmental Affairs. These various people had experience with stormwater pollution, public awareness campaigns, and had knowledge about illegal connections which helped us determine the best methods in regard to making the public awareness campaigns. Along with interviews we also directly observed illegal connections, residents, tourists, and local business owners. Direct observation provided us with data that we compiled into spreadsheets which we then provided to our liaison. Our liaison forwarded them to the EPA to prove that a complete inspection of Condado had been completed. These methods allowed us to create a public education campaign with appropriate local strategies to address the viewpoints and concerns of the variety of populations mentioned above.

4.0 Results and Analysis

Our results and analysis will cover the data we have collected and how they helped us to create a list of Best Management Practices and educational campaigns. We identified illegal connections and illicit discharges by inspecting private residences, hotels, restaurants, car washes, and construction sites. We also analyzed the waste disposal practices of residents, tourists, business owners, and government officials. Using the results of our research we were able to create a list of recommended Best Management Practices to help the Municipio de San Juan raise public awareness along with suggestions on the best ways to educate the public about proper waste management and disposal.

4.1 Identification of Discharges

During our time working directly with the Office of Permits and Inspector Carlos Ortiz we completed an inventory of the buildings in Condado and any discharges they may have had. The inspection process allowed us to observe buildings from the street level and sometimes go inside and talk to the business owners. The maps of the areas we inspected can be seen in Appendix I and Appendix J. When the infractions were very serious Inspector Ortiz would complete what is known as an intervention. During an intervention Inspector Ortiz talked to the employees and the managers of the establishment and impressed upon them the seriousness of the infraction as well as what needed to be done to correct it and the punishment if it was not corrected. We did not participate in any interventions that took place as our job was to be there as researchers. If any action needed to be taken, Inspector Ortiz addressed it on a later date or dismissed us from working with him while he was involved in a direct intervention. Discharges ranged from small puddles near the sewers to streams bubbling up from the sewers. In this section we present the most relevant examples from the inspection portion of the IDDE that are representative of the different types of infractions that exist in Condado. For the complete inventory spreadsheet, please see Appendix Q.

4.1.1 Informal Interviews

Most of the time the interviews focused on what problem the business or residence was causing. Inspector Ortiz would tell the owner or manager of the establishment that the current situation was unacceptable. The infractions included several different problems. If the problem was a flow that went over the sidewalk, Inspector Ortiz would then inform the manager that the correct procedure for directing the discharge was a pipe that went through the sidewalk. Restaurants also had problems with grease traps and detergents discharging into the stormwater sewers. Another problem that needed to be addressed with informal interviews was pet waste. Interviews about pet waste were short and gave us information about disposal techniques and the extent of the problem. Pet owners seemed to know that the proper procedure required using a bag to pick up their pet's waste; however, many of them did not actively practice this. The informal interviews were used in conjunction with direct observations in order to obtain most of this information.

4.1.2 Illicit Connections from Businesses

Outside of one business in Condado our group observed a direct connection into the stormwater sewer. The flow was moving very fast, and the contents of the discharge did not appear to be entirely water. Inside the stream there were visible bubbles indicating a detergent of some kind. We took down the location of the discharge and its description. Our group used the Excel spreadsheet we created to completely and accurately record these discharges. Because we were not sure which building this discharge was coming from, we marked it down for several suspected locations. Later on Inspector Ortiz could use this information to conduct a formal investigation. This type of discharge was of great concern because it signaled that a point source connected directly inside the sewers. More importantly, it also flowed inconsistently; in fact, when we walked by later in the day it was no longer discharging into the sewer. Discharges like these are hard to detect but can cause significant pollution.



Figure 1: Illicit flow of water across trash



Figure 2: Soapy discharge into main dumping area.

Next to one of the larger hotels in Condado our group suspected improper behavior by the establishment. Inspector Ortiz met some resistance when he tried to inspect the side of the building, which was the delivery alley. He went inside and obtained permission from the owner of the property. He signaled us to follow him down to the loading dock on the side of the hotel. Multiple pipes coming out of the side of the building directed streams of water carrying detergent and flowing through trash towards a main dumping well seen in Figure 1. The final dumping point is shown in figure 2. The discharges from these pipes were classified as illicit. We took several pictures of the discharges and the surroundings as well as marked down the location on our spreadsheet. Our liaison was not certain if the well carried the polluted water to the correct sewer pipe system. This site was a perfect example of the problem this project was trying to address. The hotel had multiple point sources all carrying potentially illicit discharges. The contents of those pipes needed to go into the septic sewers, but if they went into the stormwater sewers, they would be illegal. If the discharges were going into the stormwater sewers, they would cause a large amount of pollution. The discharges were all fast moving flows that were continuous. Problems such as these needed to be addressed and remedied as quickly as possible.

4.1.3 Residential Illicit Discharges

In residential areas, discharges were less dramatic. While inspecting residential areas during the mornings, we saw numerous of water marks flowing out from the residential yards.

These discharges are legal because they occur when residents water their gardens in the morning and they only consist of water. We were concerned about chemicals from fertilizers or pesticides getting into the stormwater sewers; however, Inspector Ortiz assured us that these types of discharges were not a problem. The number of gardens in Condado was very small and it was not as significant a pollutant as oil, grease, trash, or detergents. Also the laws for MS4s do not



Figure 3: Water to flowing through the side walk instead of over it.

include sections about fertilizers or pesticides (EPA, 2012). This is due to the assumption that urban areas do not have land for farming or gardening. Several areas of Condado have more land for gardens as it becomes more residential. If the recommendations for this project were to be applied to a more rural area fertilizers and pesticides would have to be taken into account. Problems we did see in residential neighborhoods included water discharging near trash cans, soapy water from washing cars in driveways or on the side of the street, and discharges flowing over the top of the sidewalk. These flows

can be significant, but we did not see them frequently. Most of the residents' stormwater sewers were free of discharge, and several houses had pipes that went through the sidewalk as seen in Figure 3. Even if nothing was flowing out, we recorded all these points of discharge. Nevertheless, the problem with our sampling was that we could not check the same locations every day and over an extended period of time. Rather, we could only go through each area once. This limitation of our methods could mean that there are more illegal discharges than we were able to document. If we discovered a flow, we marked it down, and if there were no flow, we would note the location in case a discharge occurred at a later date.

One of the more severe discharges we detected occurred near the Condado Lagoon. The land around the lagoon is a flood plain, yet it was still developed for housing. On one of the streets close to the lagoon we saw that water was bubbling up from the manholes on either side of the street as seen in Figure 4. More than an inch



Figure 4: Water flowing out from the Condado Lagoon

of water had accumulated on the asphalt. To make matters worse, the drain in the middle of the street that was supposed to allow water to flow back into the lagoon was instead discharging water onto the street. This location clearly needs correction; however, it will be difficult since this land is in a natural flood plain. One possible solution to this problem would be for the Municipio de San Juan to increase the elevation of the road. In a study done on flooding discussed in section 2.6 of this report, buildings built in flood plains were redesigned and raised. After the reconstruction had been completed, the buildings were safer and no longer in the flood plain. The same could be proposed for the roads in this area of Condado. Only a few streets were affected by the lagoon flood plain in Condado. Redesigning those streets along with that portion of the sewer system at a higher elevation may be the only plausible solution to correct the flooding problem there. Whenever the level of the lagoon rises due to increased rain, that location will flood.

On the other side of the lagoon the stormwater sewers on one of the streets were full of water from the lagoon. The area was low lying enough that water was being pushed into the sewer pipes from the lagoon. It was not as bad as the first street we discussed above, but if it were to rain a lot, there might be a similar backed up sewer pipe situation from which water would stream out of the manhole coverings. This problem definitely showcased the extreme problems Condado is experiencing with the stormwater sewers.

4.2 Identification of Waste Disposal Practices

Direct and indirect flows of water into the stormwater sewers causes a significant problem, but the mismanagement of waste adds to the problem. Water that was clean can easily become contaminated by garbage placed haphazardly at the edge of the street or in alley ways. When the water flows over these collections of trash, the water picks up pollution that is not good for plant and animal life living in the bays and lagoons. The importance of our inspections was to identify those actions carried out by businesses, hotels, and residents that pollute the stormwater sewer system and figure out ways to correct the problems.



Figure 5: Pet waste disposal trash can

4.2.1 Trash Cans and Waste Build Up

In addition to discharges, our group observed disposal practices of several kinds of waste. Local residents had basic trash cans with some bags lying on the ground, while businesses and construction sites had dumpsters and debris in several locations; trash cans on the sidewalks accommodated disposable goods including some designated specifically for pet waste. Condado has plenty of trash cans on the sidewalks and even a good number of pet waste bins seen in Figure 5, which suggests that litter and waste should not be on the ground. Condado even has some trash compactors on the sidewalks. The identification of these receptacles helped us identify some of the best

management practices mentioned later in the report.

We identified several places that illustrated improper waste disposal. The hotel mentioned in section 4.1.2 had water flowing directly across its trash. Numerous bags and heaps of garbage lay strewn all over the side alley of the hotel as seen in Figure 6. As explained above, there was no question that water was flowing over the garbage and getting into the sewer system. If this were the normal practice, the lagoon would be filled with debris and be an ugly sight to look at, not to mention the health hazards for those who choose to swim in it. This hotel had perhaps the most egregious faulty waste disposal practices. Indeed, all our previous inspections showed us citizens and



Figure 6: Improper management of waste

business owners maintaining their trash properly with little error. And we saw no such extreme examples during the presentations at the Office of Permits before we went into the field. We proposed several procedures for situations such as these. Businesses with significant amounts of waste such as this establishment should schedule regular trash pickups for pallets and other waste with a licensed contractor.

4.2.2 Illicit Waste Discharges

Outside one of the restaurants in Condado employees were illegally discharging bleach into the stormwater sewers while cleaning off the sidewalk in front of the establishment. Inspector Ortiz used this opportunity to go inside and complete an inspection of the entire premises. We met the owner, and he took us to an outdoor area behind the kitchen. There we saw several trash cans with discharges flowing past them. The discharges originated higher up on the walls outside and were a dirty brown color as well as odorous. Inspector Ortiz informed us that these discharges continued to flow past the building and were definitely contaminating the stormwater sewer system. It was unclear what the discharges consisted of, but they were much more contaminated than most of the discharges we had seen during other inspections.

We interviewed one restaurant owner about his disposal of grease. He took us out behind the building and was more than willing to show us the grease trap that his business owned. All restaurants need to have grease traps to dispose of their grease properly along with a licensed disposal company. While working with the Municipio de San Juan we saw that many people were willing to cooperate with the government. Yet several of the restaurants we inspected were not equipped with grease traps and were in close proximity to bodies of water. They could have been dumping the grease so that it ended up in those bodies of water or they might have a licensed company dispose of their used grease. This particular type of infraction has proven to be a major problem for the Condado lagoon. In 2009, the Condado lagoon had unsatisfactory levels of oil and grease in it (Estuario, 2009). The increased levels of grease proved that restaurants and cars were polluting the water in the lagoon. Increased regulation for grease and grease traps as well as regulations for car washes are the best way to combat and correct this problem. Along with regulations, educational presentations to members from the management bodies of those businesses were the best way to get businesses to take action about the problem.

Inspector Ortiz told us that the businesses are much more receptive when they have an option instead of getting fined. Businesses that have infractions would much rather take time to go to a meeting than accept a fine until the infraction is fixed.

In residential neighborhoods we noticed several houses that had trashcans with a discharge coming out from the bottom as seen in Figure 7. Such seepage seemed to be the most prominent problem in residential areas. Trash would be left on the side of the street, and rain would flow underneath the trash and into the stormwater sewers. A similar problem existed on the sidewalks in the tourist areas. We saw several trashcans along Ashford Avenue that had



Figure 7: Trash can with a discharge.

some sort of discharge flowing into the stormwater sewers. This problem may look small, but it can occur multiple times every week and add up to become a much bigger problem.

4.2.3 Waste Disposal Practices

Sr. Laureano, the head of the Estuario de la Bahia de San Juan, provided us with useful information about waste disposal practices (the interview transcript can be seen in Appendix G). The Estuario program tries to protect and preserve the estuaries in San Juan. There are several lagoons and bays in San Juan, and one of them is in Condado near the region we inspected. Sr. Laureano mentioned several problems about trash in San Juan and indicated that it was definitely polluting the lagoon in Condado and probably the ocean as well. Sr. Laureano's main concern was that the restaurants were dumping directly into the lagoon. This problem can be addressed with the community meeting detailed in Appendix P.

Currently, the Estuario program is trying to replant the mangroves that were cut down sometime during the middle of the last century. The fecal e-coli forms in the lagoon have

subsided to normal levels as of 2009, but the rest of the trash is still affecting the mangroves and the general quality of the water (Estuario, 2012). Both during the interview with Javier Laureano and the boat trip to test the water quality in San Jose bay, we were told the species of fish, birds, and turtles that live in the bays today are very resilient and are not significantly impacted by the current levels of pollution. From what we learned from Estuario de la Bahia de San Juan, we realized that there were other parts of the environment, such as plant life and sea life that are being affected by the water pollution. The goal of cleaning up the water pollution is not simply to clean up the water for people. Waste in the water was affecting the wild plant life in the lagoon and slowing its growth.

From the interview we also learned that the problem extends beyond Condado. The other sections of San Juan contain even larger bodies of water than the lagoon in Condado. Results from the Estuario's data collection show that the pollution levels in the different bays and lagoons in San Juan vary. Some bodies of water contain more pollution than Condado, while some are cleaner. The tables they provided us can be seen in Appendix L and Appendix M. A successful program to significantly reduce pollution in Condado has the potential to be replicated and applied to other regions that need help.

4.3 Identification of Best Management Practices

The recommended Best Management Practices that we have put together were created from the information we obtained during several interviews, our inspection of Condado, as well as our research on how other cities have dealt with the problems that we discussed in Chapter two. We directly observed several instances of illegal discharges as well as examples of proper management practices. From these observations we were able to construct a list of BMPs that would mitigate the amount of stormwater pollution in Condado area.

Through direct observation of multiple restaurants in Condado during our inspections, we learned that it is extremely important for restaurants to have grease traps as well as to use them properly. After identifying an illegal discharge at one restaurant, we toured the back of the facility and observed the improper usage of a grease trap. If grease is not disposed of properly it can clog up drains, sewers, and cause hazardous waste to build up in nearby bodies of water. As

simple as it seems, the proper usage of a grease trap involves the restaurant employees disposing of the grease directly into the grease trap which was not being done at all restaurants we observed.

Through direct observation we noticed that many people wash their driveways, cars, sidewalks, etc., using soap or detergent and allow the soapy water to runoff into stormwater drains. However, through an informal interview with our inspection partner, we learned that grass filters would be an effective way to minimize any discharges that could potentially enter the stormwater system. The grass filters are carpets of grass that allow water to flow through while picking up any solid objects or discharge from the same water runoff. For example, when washing a car or driveway, water runoff would flow downhill and through the grass filter, which would pick up any debris or residue that could potentially enter the stormwater drains. The unpolluted water, however, would still be able to flow through the grass and to its proper destination.

During our inspection period, we came across several cases in which pipes emptied out over sidewalks, picked up debris and carried it directly toward the drain. We asked our sponsor whether that was allowed and learned that there is currently no law against it. We believe that the government should enforce or encourage residents to have their pipes go underneath the sidewalk to ensure that cleaner water does not pick up substances that are harmful to the environment in stormwater runoff.



Figure 8: Properly maintained trash can

During our inspections and in informal interviews with our sponsor, we understood that poorly kept garbage and dumpster areas are a major concern relating to stormwater pollution. We strongly believe that all garbage areas should be kept in a secluded area blocked off by walls, fences, or some type of construction that would not allow stormwater to runoff underneath and pick up any debris or residue as shown in Figure 8.

While talking to one resident after a suspected discharge, we were informed that he was using biodegradable soaps to make sure he was not creating any illicit discharge. Our concern was that when residents or businesses do cleaning outdoors, they are not always following this procedure to prevent soapy discharge from entering the stormwater drains. This one resident should serve as a model for others in Condado.

Through several interviews we learned that many people are not actually aware of the illicit discharge and illegal connection problem. This led us to the conclusion that rather than implementing an initial fine for an illegal discharge, the Municipio de San Juan should have a training program or system set up to educate any offenders before targeting them with a fine.

While inspecting in Condado we came across a specific business that had poorly kept dumpsters and illegal discharges in a low lying area. Bad odors, dirty water, and large puddle areas were building up beneath the dumpsters and were not being pumped out properly. We noted that in low lying areas, especially where dumpsters and garbage are present, a pump should be used to properly dispose of any runoff to deliver it to the proper sewage drain. After running this idea by our sponsor, he informed us that it would be a good idea to make sure every business obtains a certificate of proof that they are correctly pumping out the dirty water into the correct sewer drain.

4.4 Identification of Educational Campaigns

From our research we were able to determine BMPs for the residents, businesses, and hotels in Condado. Interviews with our sponsors Maria Matos, head of the Environmental Affairs Program in San Juan, and Ileana Orlandi, Manager of Education for the Office of Permits, as well as an interview with Javier Laureano, Executive Director of the Estuary Program, provided us with valuable recommendations for potential educational campaigns as they all have expertise in running similar and successful public awareness programs, most recently for recycling.

4.4.1 Previous Campaigns

Formal interviews provided us with information about what educational campaigns the Municipio de San Juan already provided to the public. The interview we conducted with Maria Matos, the Head of Environmental Affairs at the Office of Permits, and Ileana Orlandi, the Manager of Education, focused on educational campaigns held in the past such as the recycling campaign. We asked them what their experience with that campaign was in order to identify strategies that worked well and those that did not work at all. Both Maria Matos and Ileana Orlandi were very helpful and provided us with a list of ways to conduct effective educational campaigns. We also interviewed the head of the Estuario de la Bahia de San Juan, Javier Laureano. Javier provided us with charts displaying the levels of pollutants in the bays and lagoons of San Juan and information about a stormwater sewer campaign that the Estuario had run previously. The transcripts for these interviews can be found in Appendix F and Appendix G.

4.4.2 New Campaigns

At the recommendation of our sponsor we identified brochures as one of the most effective methods for reaching the largest number of Condado residents, businesses, hotels, and tourists. In 2006, the Office of Permits ran a very successful educational campaign to improve recycling. In running their program, the office found brochures as the most proficient and efficient way to convey the educational material to the targeted public. We have modeled our recommended campaign on this one. We created a series of brochures designed specifically for each specific targeted audience (See Appendix B). Each brochure contains an educational overview of the MS4 system as well as a summary of the pollution issues that the Municipio de San Juan is facing, together with the detrimental effects pollution has on the environment. The brochure describes the necessary prevention methods and actions (BMPs) specific to each target population that should be taken to prevent illegal connections and illicit discharges into the stormwater sewers. We propose that these brochures be distributed to residents through the mail, and to businesses at a mandatory meeting convened by the Municipio de San Juan. At the recommendation of our sponsor, we propose that the brochures be distributed to hotels around Condado, and at the request of the Office of Permits, distributed by the hotels to tourists and hotel guests upon arrival.

From Sra. Matos and Sra. Orlandi we also determined that creating a PowerPoint presentation for a community-wide lecture, and also for school presentations, would be a strong and effective way to reach out to the people and businesses of Condado. Our sponsors discussed the success of this method in their previous recycling campaign. Also, in interviewing Professor Malone from Saint John's School in Condado (see Appendix H for interview transcript), we determined that PowerPoint presentations, as well as electronic brochures in pdf files, are a productive method to distribute these material to students. After being translated into Spanish as well, the PowerPoint presentation presents all of the information from the four brochures and combines it and the BMPs into one complete presentation. This presentation can be used by an Office of Permits employee at a community gathering sponsored by the Municipio de San Juan Office of Permits, and it would be open to all residents, businesses, and community leaders who wish to attend. Also, at the recommendation of Professor Malone, guest speakers from the Municipio de San Juan can also present the PowerPoint slides at a school assembly to children in grades 7-12. Professor Meleon believes this would be the best and most effective method to reach school children.

Javier Laureano, Executive Director of the Estuary Program (see Appendix G), provided us with additional information on other methods to reach out to the public. One of his main points of concern in discussing stormwater pollution was that the "NO DUMPING" markers placed next to stormwater drains that directly flow into bodies of water do not last, and many people are removing them. This is the result of vandalism and theft. This is a major problem, especially for residents near the lagoon. According to Javier Laureano, the stickers have been useful and successful in preventing dumping of illegal substances that discharge directly into local bodies of water and cause pollution. We recommend a stronger adhesive for the stickers to assure that they are not tampered with or stolen.

Señor Laureano also described in detail a state level newspaper advertisement campaign regarding stormwater that was undertaken in the early 2000s. He stated that while it was free to create and distribute, the success of the advertisement campaign was never evaluated. He explained that while the advertisements are typically effective, it is also just as important to measure their success by determining if businesses, residents, and hotels adopt new practices

based on the presented information. To do so the state created a survey, polling 8,000 persons followed up by multiple five-person focus groups to assess the effectiveness of the ad campaign (Estuario 2011). By 2004 there was a 14% increase in awareness. We recommend that the Municipio plan to have a survey questionnaire sent via mail to all residents of Condado (see Appendix N), and that they conduct regular inspections and follow-up visits by Inspector Ortiz to neighborhood businesses and hotels to ensure that they are following regulations. We also advise the Municipio de San Juan to run a number of five to ten-person focus groups to further assess the effectiveness of the educational campaign and to determine how the program could be improved.

5.0 Conclusions and Recommendations

Together with the Municipio de San Juan our group inspected the entire area of Condado to create a list of BMPs and develop educational campaigns that the Office of Permits can use to inform the public about stormwater pollution and its impacts. With this information the Office of Permits can decide on how best to address the problems of water pollution in the stormwater sewers of Condado. After applying these proposed solutions to Condado, the Municipio may decide to use them in other parts of San Juan experiencing similar problems.

5.1 Conclusions

Our group observed numerous problems in Condado during the weeks we inspected the region and we gathered substantial research through informal as well as formally structured interviews. The information presented below sums up the different elements of the project and sets up our final recommendations for the Office of Permits.

5.1.1 Residential Areas

The first areas we inspected in Condado were the residential areas. These sections in Condado made up the eastern and southern portion of the maps (see Appendix M). Major issues in the residential areas included overflows over the sidewalk and improper management of trash can waste. According to the residents the main problem was people lacking a proactive stance on the pollution problem.

5.1.2 Commercial Areas

The commercial sections of Condado made up the northern and western sections of the maps (see Appendix M). Commercial areas included hotels, hospitals, schools, restaurants, car washes, and stores. Hotels and restaurants represented the biggest problems in these areas. Nearly every morning both hotels and restaurants used detergents to clean out the front of their establishments. Furthermore, both stand-alone and hotel restaurants posed the problem of grease traps that require proper maintenance. Hotels also showed problems with illegal connections to the sewer and unkempt trash heaps.

5.1.3 Level of Knowledge of Residents

We conducted some informal interviews during our stay in San Juan to determine the level of knowledge of the residents. The residents supplied us with information about their experiences with water pollution. From these interviews we concluded that residents did not know a great deal about the water pollution problem in San Juan nor did they know what to do to correct the problem. Although they knew about recycling from a previous campaign conducted by the Municipio, most were ignorant about stormwater sewers.

5.2 Best Management Practices Recommendations

Through our inspection of Condado and a series of interviews we developed a set of recommended Best Management Practices. We believe if these management practices are followed, it will help mitigate stormwater pollution in the Condado region. Some of our recommendations target best management practices for residents and people in the community, while others are focused on possible actions the Municipio de San Juan can take.

With regard to restaurants, the use of grease traps must be enforced as well as the proper procedure for how the disposal of grease. The person who picks up the grease from the grease trap must have the appropriate certification to ensure the grease is being disposed of properly. Also, restaurants should receive a receipt that states the date and time of the disposal in case an inspection should occur.

Another Best Management Practice we recommend is the use of a training program that would be carried out by the Municipio de San Juan. Rather than initially fining businesses or restaurants if incorrect practices were taking place, we recommend that the violators be required to attend a training program to educate them on the correct practices. This can be done through an educational campaign presentation. If, after completing the training program the business or restaurant still does not cooperate or change its habits, then a fine may be imposed.

An important Best Management Practice that can be used in residential, hotel, and commercial areas is the use of biodegradable soaps. When washing sidewalks, walkways, or entrances, the use of anything besides biodegradable soaps should be considered an illicit discharge. The use of biodegradable soaps would prevent any illicit discharges from entering the stormwater drains.

Poorly kept garbage areas also contribute to stormwater pollution. A Best Management Practice that we recommend would be to require that all buildings put their garbage in a consolidated, blocked off area where stormwater could not invade. We recommend constructing a lift or elevation in the ground that surrounds the entire garbage area so that runoff cannot sweep under garbage areas or dumpsters and pick up potential debris. Another recommendation would be to construct a drain that would be connected to the regular sewer system, which could be especially beneficial to restaurants and hotels.

In order to prevent debris from being carried away in runoff we recommend the use of grass filters. This would be very beneficial for when individuals or businesses wash their driveways, sidewalks, or building entrances.

In particular, a pump should be used to properly dispose of any runoff and deliver it to the proper sewage drain in low-lying areas where dumpsters and garbage are present. A Best Management Practice we recommend for the Municipio is to require certification of the use of this pump and its connection to the standard sewer system—as opposed to the stormwater sewer system—to ensure that these garbage areas are being well kept and that runoff does not enter the stormwater system.

A Best Management Practice we recommend is to have all pipes travel underneath sidewalks rather than have them empty out over the sidewalk. If a pipe empties out clean water over the sidewalk, it has the potential to pick up debris and residue from the sidewalk that then ends up in the stormwater drain. By having pipes go underneath the sidewalk and directly into the street, it decreases the chance of picking up trash or anything that could contaminate the water in general.

To mitigate stormwater pollution on a broader scale, another Best Management Practice we recommend to the Municipio de San Juan would be to install grates in the stormwater system that would not allow any debris to filter through into the pipes. This would be a multi-level sewer in which the stormwater would filter through the grate while any debris or trash picked up along the way would not enter the system.

5.3 Educational Campaigns

From our research we have determined the following as our recommended methods to distribute and enact educational campaigns.

- Brochures
- Electronic Brochures/pdfs
- PowerPoint Presentations
- Community Presentations
- School Presentations

5.3.1 Hotel Recommendations

From our interview with our sponsors (See Appendix F) we have determined that the best method to reach hotels and their guests are brochures and government mandated community presentations.

The brochures (See Appendix B) are specific to hotels and discuss Best Management Practices (BMPs) specific to everyday hotel activities. At the recommendation of our sponsor, we propose that these brochures be distributed to all hotels in Condado. We also recommend that representatives from all hotels in Condado be mandated to attend a community presentation sponsored by the Municipio de San Juan which would be open to all residents and community leaders who also wish to attend. This PowerPoint presentation would be given by a Municipio de San Juan trained employee and will cover in detail all of the information provided in the brochures as well as give the hotels the opportunity to provide feedback and to ask questions about any BMP or regulation that they are required to follow.

5.3.2 Commercial Recommendations

Our recommendations for the commercial sector are the same as for hotels. We have determined that brochures and mandatory attendance at a community PowerPoint presentation are the best methods of education for the commercial sector. The brochures (See Appendix B) will also first cover an overview of the MS4 system as well as a brief summary of the environmental issues in Condado. However, the brochure then describes the necessary prevention methods and BMPs specific to restaurants and other commercial businesses. These brochures will be distributed to the businesses upon arrival at the presentation.

5.3.3 Residential Recommendations

We have determined that brochures and the community presentation open to the public are the best way to target the residents of Condado. The third variation of brochure that we have created focuses on BMPs for residents and residential buildings. The brochure focuses on the BMPs relevant and specific to residents. At the recommendation of our sponsor, we propose that these brochures be mailed out to each resident. Residents are also welcome to attend the community presentations where they will have the opportunity to ask questions and provide feedback.

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Appendix A: Sponsor Description: Municipio De San Juan

The Municipio de San Juan includes the entire governing body and the government sponsored jobs of the San Juan district in Puerto Rico (Saniti-Padilla, 2010). The Government of the Municipio de San Juan strives to protect and serve all the people within the municipality and to ensure fair and equal opportunities to residents, citizens, and legal immigrants. Citizens of San Juan elect the members of this governing body. Since this is a government, it does not make a profit. Instead, the Municipality of San Juan collects tax revenue from its citizens. Tourists also provide revenue by going on vacation and spending money on taxed items.

The Municipio de San Juan employs over 139,000 citizens including the Mayor of San Juan and the Municipal Legislature (Saniti-Padilla, 2010). The government is divided into the executive and legislative branches and each contains smaller departments. The executive branch is divided and sub-divided several times. These departments include The Office of Finance, The Office of Technology, The Department of Arts, Culture, and Tourism, etc. Each branch has its own level of autonomy and can decide some of its own policies. Each department hires workers who are government funded. These employees carry out the small tasks that keep the city running smoothly. All departments must abide by a budget set forth by the executive branch and approved by the legislative branch. The total annual budget of the Municipio is around \$999,000,000.

The Municipio controls most of the government spending in San Juan and can fund programs as it sees fit. The Municipio has the power to enforce any program focused on the proper regulation of standard business practices harmful to the environment. Any bill passed by the legislature of the municipality must be fully funded and properly supervised (San Juan, 2010). The Department of Urban Development, Office of Permits, the Office of Works Engineering and Construction, and the Department of Planning and Land are the most relevant agencies for this project. These departments have information on the problems of water conservation and information about existing connections to the sewer system in San Juan, and they also have set precedents for the current regulation of the municipal sewer pipe system.

The Office of Permits directly regulates the correction of illegal connections to the water system. They operate with an overall budget close to \$50,000,000 (San Juan, 2010). The office regulates the payments made to the Municipio for specifically regulated services such as waste removal and water supply and sewer system. They have all the records of companies that have legally connected to the water supply as well as the money collected from these organizations. Other duties of the Office of Permits include inspecting sidewalks and roads in construction sites that will be transferred to the municipality, overseeing disposal of solid waste at construction sites, and holding public hearings on permission for grants and licenses. The Office of Permits needs to ensure that citizens, companies, and construction sites keep waste controlled according to official guidelines set forth by the Municipio and the EPA. Several government standards guide their efforts to regulate the environmental conditions of San Juan. Regulation of MS4s in particular requires them to uphold the standards of the sewer system.

Like the Municipio as a whole, the Office of Permits is divided into multiple sections (San Juan, 2010). At the top is the General Manager, charged with overseeing the entire Permit Office and dictating its courses of action. The Complaints and Investigation Office follows up on formal complaints filed by the citizens of San Juan. Complaints range from serious environmental issues to minor neighbor squabbles. The Environment Affairs Program insures that all operations within the Municipio de San Juan adhere to government, national, and international standards. They also document all regulatory and legal action the office takes in response to violations. The Permissions Office is in charge of granting or denying requests by companies and citizens for licenses and permits. The Inspection section of the Office of Permits looks into the details of all cases the Office is currently involved in for violations. They are the detectives of the force. Finally, the Secretary's Office handles all formal paperwork processing and must keep records of all transactions the Office of Permits makes.

One organization that works on similar problems in Puerto Rico is the San Juan Citizens Alliance (San Juan Citizens Alliance, 2012). The San Juan Citizens Alliance is a "grass roots" organization dedicated to social, economic and environmental justice in the San Juan Basin. They strive to organize San Juan Basin residents to protect San Juan's water, air, and public lands. They do not collaborate directly with the Municipio, however, they work to build

awareness, and one of the bills they are currently monitoring is the Clean Water Cooperative Federalism Act of 2011 (H.R. 2018). This bill would strip away long standing protections provided by the Clean Water Act. H.R. 2018 attacks the heart of the Clean Water Act and would shred this federal safety net by preventing the Environmental Protection Agency (EPA) from ensuring adequate water quality standards to protect public health and the environment.

The EPA (2005) is also an important player that is very concerned with environmental conditions and works with the Municipio to combat the inefficiencies in the water pipe system. Their mission is to ensure that all Americans are protected from significant risks to human health and the environment where they live. They focus on national efforts to reduce environmental risks based on the best available scientific information. They work closely with The Puerto Rico Water Resources and Environmental Research Institute, which is a research facility dedicated to the investigation and development of water resources in Puerto Rico. The Water Resources Research Institute retains partnerships among state universities, federal, state, and local governments, businesses and industries, and non-governmental organizations aimed at solving problems of water supply and water quality at local, state, regional, and national levels.

The Municipio de San Juan also handles the removal of solid waste along with programs and services for the management of stormwater. This program manages contracts with private firms for the management and disposal of household and commercial solid waste, including the collection of residential recyclables, as well as the privatized service handling bulky waste and debris. With a history of funding projects that protect the environment the Municipio should also look favorably upon plans to clean up the state of the city's water.

Appendix B: Brochures



Overview of MS4

MS4- Municipal Separate Storm Water Sewer System

MS4s drain directly into the ocean, lagoons, and bays without treatment by sewage plants.

Any pollution that gets into the water will still be in the water when it leaves the sewer pipes.

The main cause of pollution into these sewer drains comes from citizens and small businesses not large corporations and factories.



Connections to the System

Illegal Connections

All connections to the MS4s are regulated

by the Municipio de San Juan.
The Office

of Permits handles the
permitting process

and certifies a connection
after

going through each
application.

When a connection is made
without

a permit, this is considered
an illegal

connection.



Illicit Discharge

The contents of any
discharge or

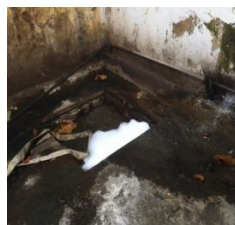
flow into the MS4s should
be

entirely storm water. Any

discharges containing
substances

other than storm water are
deemed

illicit discharges.



What can be done

It is possible to help prevent pollution
from entering the storm water sewers.

Citizens can:

Place grass filters at the bottom of their
driveways when washing their cars



Ensure they have pipes that go through
the sidewalk when trying to remove
storm water build up from their
property



Keep their trash cans in a consolidated
area where the water can be easily
cleaned before depositing the water
into the MS4s





Overview of MS4

MS4- Municipal Separate Storm Water Sewer System

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application.

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an illegal

connection.



Illicit Discharge

The contents of any
discharge or

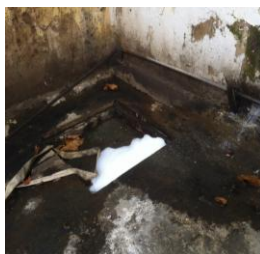
flow into the MS4s should
be

entirely storm water. Any

discharges containing
substances

other than storm water are
deemed

illicit discharges.



What can be done

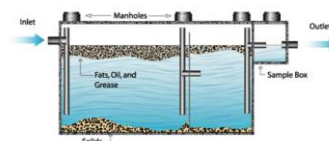
It is possible to help prevent pollution
from entering the storm water sewers.

Hotels can:

Train their employees the correct
procedures so they do not dump
detergents into the storm water sewers

Use biodegradable soaps when cleaning
anything near a stormwater drain.

Any hotels that also contain restaurants
ensure that the restaurant uses a grease
trap and that a licensed agency removes
the grease at regular intervals



Keep their trash cans and dumpsters in a
consolidated area where the water can
be easily cleaned before depositing the
water into the MS4s. Also schedule
regular pick ups for waste so it does not
build up and look like this:





Overview of MS4

MS4- Municipal Separate Storm Water Sewer System

MS4s drain directly into the ocean, lagoons, and bays without treatment by sewage plants.

Any pollution that gets into the water will still be in the water when it leaves the sewer pipes.

The main cause of pollution into these sewer drains comes from citizens and small businesses not large corporations and factories.



and certifies a connection after

going through each application.

When a connection is made without

a permit, this is considered an illegal

connection.



Illicit Discharge

The contents of any discharge or

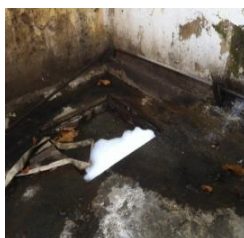
flow into the MS4s should be

entirely storm water. Any

discharges containing substances

other than storm water are deemed

illicit discharges.



What can be done

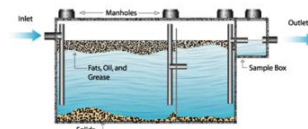
It is possible to help prevent pollution from entering the storm water sewers.

Businesses can:

Train their employees the correct procedures so they do not dump detergents into the storm water sewers

Use biodegradable soaps when cleaning anything near a stormwater drain.

Restaurants should use grease traps in their kitchens with regular dates set for removal of grease



Keep their trash cans and dumpsters in a consolidated area where the water can be easily cleaned before depositing the water into the MS4s. Also schedule regular pick ups for waste so it does not build up and look like this:



Connections to the System

Illegal Connections

All connections to the MS4s are regulated

by the Municipio de San Juan. The Office

of Permits handles the permitting process

Appendix C: Informal Interviews with Residents

We introduced ourselves as the Municipio de San Juan. We explained we were carrying out an inspection of the area to look for illegal connections and stormwater pollution.

Questions included:

Where are from?

How long have you lived here?

Do you know anything about stormwater pollution in Condado?

Do you know what MS4s are?

Do you know where MS4s drain to?

General Feedback from these informal interviews showed a lack of knowledge of the subject.

We interviewed people from Condado, Ocean Park, and Isla Verde. Residents did not know what MS4s were or where they drained to. However, residents were concerned about the overlying problem. Residents did not want the water around their city polluted, but they did not know how to help.

Appendix D: List of BMPs

Best Management Practices

- Grease traps
- Municipio training program
- Contain Garbage in a closed off area to prevent stormwater runoff pollution
- Grass filters
- Biodegradable soaps
- Pump into sewer system for low lying areas especially near dumpsters

Appendix E: Resident A

Interview Protocol for Resident A

We introduce ourselves and our affiliation with the Municipio de San Juan. We give a brief overview of our project. We explain our project involves stormwater sewers, specifically pollution and illegal connections. Then we explain that the purpose of this interview is to gather information on the best ways to educate people about pollution into MS4s.

1. What is your job description?
2. Where are you from?
3. How do you feel about the water pollution levels in Condado?
4. What do you think the biggest cause of pollution is in Condado?
5. Do you think pet waste is a problem in Condado?
6. Have you seen any educational campaigns that try to prevent pollution?
7. Do you know of any effective strategies to inform the public?
8. What does work and what does not?
9. Are there any perceptions in the community in regard to pollution and stormwater runoff?

Municipio de San Juan Team

Resident A Interview transcript

Thursday 12 April. 2012

12:00pm-12:30pm

Ashford Imperial, 2nd floor

Participants: Resident A, Michael Byron (secretary), Daniel Keenan (chair), Joseph Wesoloski

1. The group asks what Resident A's job is and resident A informs the group of her job description.
2. When asked where she was from, she replied as being from Cuba but spending most of her time growing up in Puerto Rico. She knows the area quite well because of living here for such a long period of time.
3. When asked about her knowledge on the topic of water pollution, she claimed she knew very little. She believed the biggest problem dealing with pollution was caused by manufacturing companies and was unaware of stormwater pollution being a big issue.
4. She did not believe pet waste was a significant issue and was unaware of any educational campaigns present or past that dealt with stormwater pollution.
5. When asked about the best ways to inform the public, she discussed how many residents are not concerned with a lot that goes on down here. She explained that many people felt as if the states would always be there to help them in terms of money or any other issues. She specifically states that Puerto Rico is like a teenager who looks up to their parents (the United States) for any funding and has minimal concern about environmental issues.

Appendix F: Maria Matos and Ileana Orlandi Interview

Interview Protocol for Ileana

We introduce ourselves and our affiliation with the Municipio de San Juan. We give a brief overview of our project. We explain our project involves stormwater sewers, specifically pollution and illegal connections. Then we explain that the purpose of this interview is to gather information on the best ways to educate people about pollution into MS4s.

1. What is your job in the Permit Office?
2. Have you worked on educational campaigns before? If so, describe them?
3. What worked/what did not work?
4. Where did these campaigns take place?
5. Who were these campaigns geared towards?
6. Do you have any suggestions for us?
7. Would a PowerPoint be effective and to whom would it be effective?
8. Would posters be effective and to whom would they be effective?
9. Would brochures be effective and to whom would they be effective?
10. What is the best way to sound helpful and not forceful?
11. Are there any images that could make our campaign more successful?
12. What would you do to make an educational campaign the most effective?

Municipio de San Juan Team

Advisor-Liaison Interview Transcript

Friday 30 March. 2012

1:00pm-2:00pm

Municipio de San Juan Office of Permits

Participants: Maria Matos, Ileana Orlandi, Michael Byron, Daniel Keenan (chair), Joseph Wesoloski (secretary)

Ileana translates that Maria is the Head of Environmental Affairs at the office of permits

Ileana says that she is the manager in charge of education at the Office of permits

Ileana translated the description Maria gave of the educational campaigns she had run previously. She talked about the educational campaign about recycling that took place earlier in the previous decade.

Maria said that community presentations were the best way to get the message across. Ileana explained that they had arranged to have competitions between different communities to see who could have the cleaner neighborhood. The public was very receptive and really like cleaning up where they lived.

Ileana showed us examples of brochures and ads that the Municipio ran to raise awareness of the recycling campaign.

Maria Matos gave us a CD recording of one of the community presentations that was done during the recycling educational campaign.

Ileana talked about the different sections of Condado and how it has changed over the years. It was always the rich neighborhood in San Juan and now it has begun to change a little. Condado is more run down than it used to be. Ileana and Maria used people wanting to return Condado to a prestigious place to get them to recycle more.

Maria Matos said that brochures are very good mediums to reach the public.

Ileana Orlandi said that the best way to get the message out is with multiple fronts. If the brochures go out at the same time as the community meetings then people will hear about it more and it is more likely to get the message across.

Appendix G: Javier Laureano Interview

Interview Protocol for Javier Laureano

We introduce ourselves and our affiliation with the Municipio de San Juan. We give a brief overview of our project. We explain our project involves stormwater sewers, specifically pollution and illegal connections. Then we explain that the purpose of this interview is to gather information on the best ways to educate people about pollution into MS4s.

- 1).What is your job description?
- 2).What are some things you have accomplished in your position?
- 3).Could you give us a general overview of the conservation program?
- 4). Have you run any educational campaigns in the past related to the Estuary Conservation?
- 5).What is effective?
- 6).What is not effective?
- 7).What are the major problems you have seen on the conservation front?
- 8).What is being done to correct the problems?
- 9). What programs restore the lagoons?
- 10).What restaurants are polluting the lagoon?
- 11).What is being done to prevent or correct that problem?

Municipio de San Juan Team

Javier Laureano Interview transcript

Tuesday 3 April. 2012

10:00am-10:30am

Office of the Estuary, Vig Towers

Participants: Javier Laureano, Michael Byron (secretary), Daniel Keenan, Joseph Wesoloski (chair)

- 1). We introduce ourselves and identify ourselves and our affiliation with the Municipio de San Juan. Joe gives a brief overview of the project.
- 2). Dan goes into further detail, explaining our project involves stormwater sewers, specifically pollution and illegal connections. Joe then explains that the purpose of this interview is to gather information on the best ways to educate people about pollution into MS4s.
- 3). Joe asks Javier what is his job description. Javier states that he is the Executive Director of the Estuary Program which is funded by EPA through the Clean Water Act. He explains that there are 28 programs that follow the CCMP (comprehensive conservations).
- 4). Dan asks Javier what are some things that he has accomplished in his position. Javier explains that the estuary is a community based center. They have been very successful in planting red mangroves and have made great strides in coral reef restoration. He states that there are 45 new coral structures in front of La Concha hotel.
- 5). Javier also explains to us that they run Water Quality Monitoring Programs. He suggests that we join for a day on a boat trip and follow the procedures to help us gauge a better idea of what they do. Javier says that he will set up the trip.
- 6). Joe asks if in the past they have run any educational programs related to the estuary conservation. Javier mentions the estuary's stormwater campaign. He states that the "NO DUMPING" markers next to stormwater drains that run directly into bodies of water do not last and are often stolen or tampered with. He states that people are very interested in preserving the lagoon and that Condado lagoon residents are a different community to target.
- 7). Javier also explains that they ran newspaper ad campaigns at the state level in the early 2000s. However, he stated that they could not measure the successfulness of the campaign because they had no way to measure the public awareness.

8). Javier then stated that it is very important to not only implement a campaign, but also to measure the success of that campaign. To do so they polled 8,000 people and also ran 5 person focus groups. He then stated by 2004 there was a 14% increase in awareness.

9). Dan asks in the educational campaign what was successful and what was not. Javier states that law violations against not having grease traps are important. The businesses can receive fines. He also states that residents are dumping grease in the stormwater sewers as well; however, there is no law.

10). Javier then shows us an informational packet complete with the water quality data analysis of the local bodies of water. He notes on page 17 the high oil and grease levels in the local lagoons. Javier states that people are contributing to that problem highly.

11). We thank Javier for his time and he states that he will call us and set up the boat trip with the Water Quality Monitoring Program.

Appendix H: Professor Meleon Interview

Interview Protocol

We introduce ourselves and our affiliation with the Municipio de San Juan. We give a brief overview of our project. We explain our project involves stormwater sewers, specifically pollution and illegal connections. Then we explain that the purpose of this interview is to gather information on the best ways to educate people about pollution into MS4s.

Questions

Where are you from?

What is your job description?

What do you teach at St. John's School?

What age group do you teach at St. John's School?

What do you think is the biggest problem that pollutes stormwater?

What would you recommend for educational campaigns?

How is it different to educate children vs. adults?

What do you think would not work for educational campaigns?

Have you had any experience with educational campaigns?

Municipio de San Juan Team

Wilma Meleon Interview Transcript

Tuesday 17 April. 2012

2:00pm-2:30am

St. John's School

Participants: Professor Meleon, Michael Byron (chair), Daniel Keenan, Joseph Wesoloski (secretary)

1. Group informs Person A of the background of our project and inquires what knowledge the student body might have or not have in regards to stormwater pollution. Person A states that the biggest emphasis within the school currently is recycling.
2. We questioned what the best way to get across to the students would be. Person A said we should mainly focus on grades 7 – 12 because any grades before that may not understand or retain much of the information.
3. Person A stated some possible options to be PowerPoint presentations to show in assemblies, a field trip to see the process of waste removal, and brochures that were in pdf format and were accessible online. Once again, these three suggestions were based on the idea of a paperless approach as to continue with their recycling campaign.
4. Person A explains that by having a brochure in pdf format the parents can also have access to print them out at home. This would help raise awareness further than to just the school community.

Appendix I: Condado maps



Figure 9: Map of Condado, Ocean Park and Isla Verde.



Figure 10: Map of Condado



Figure 11: Map of Condado



Figure 12: Aerial shot of Condado

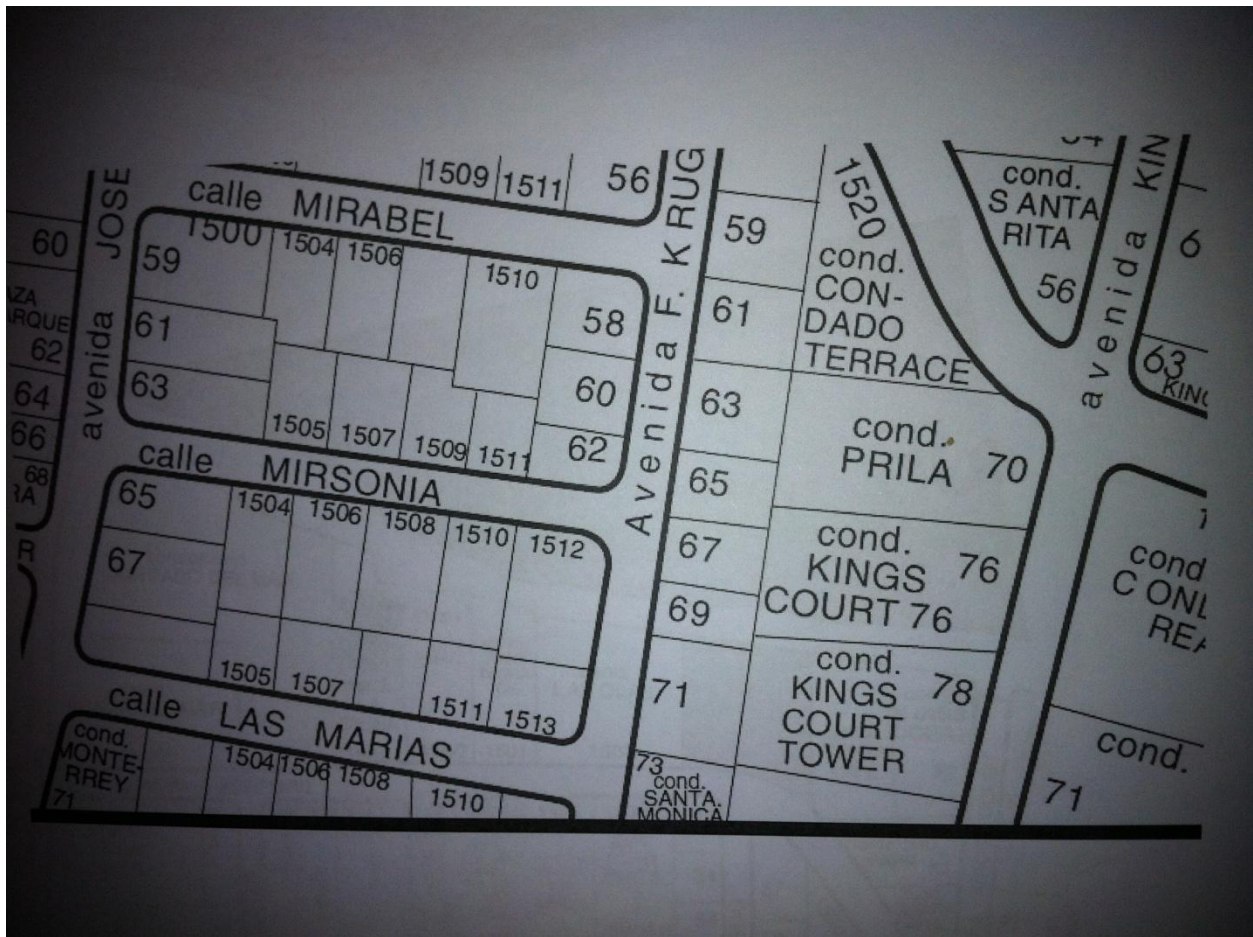


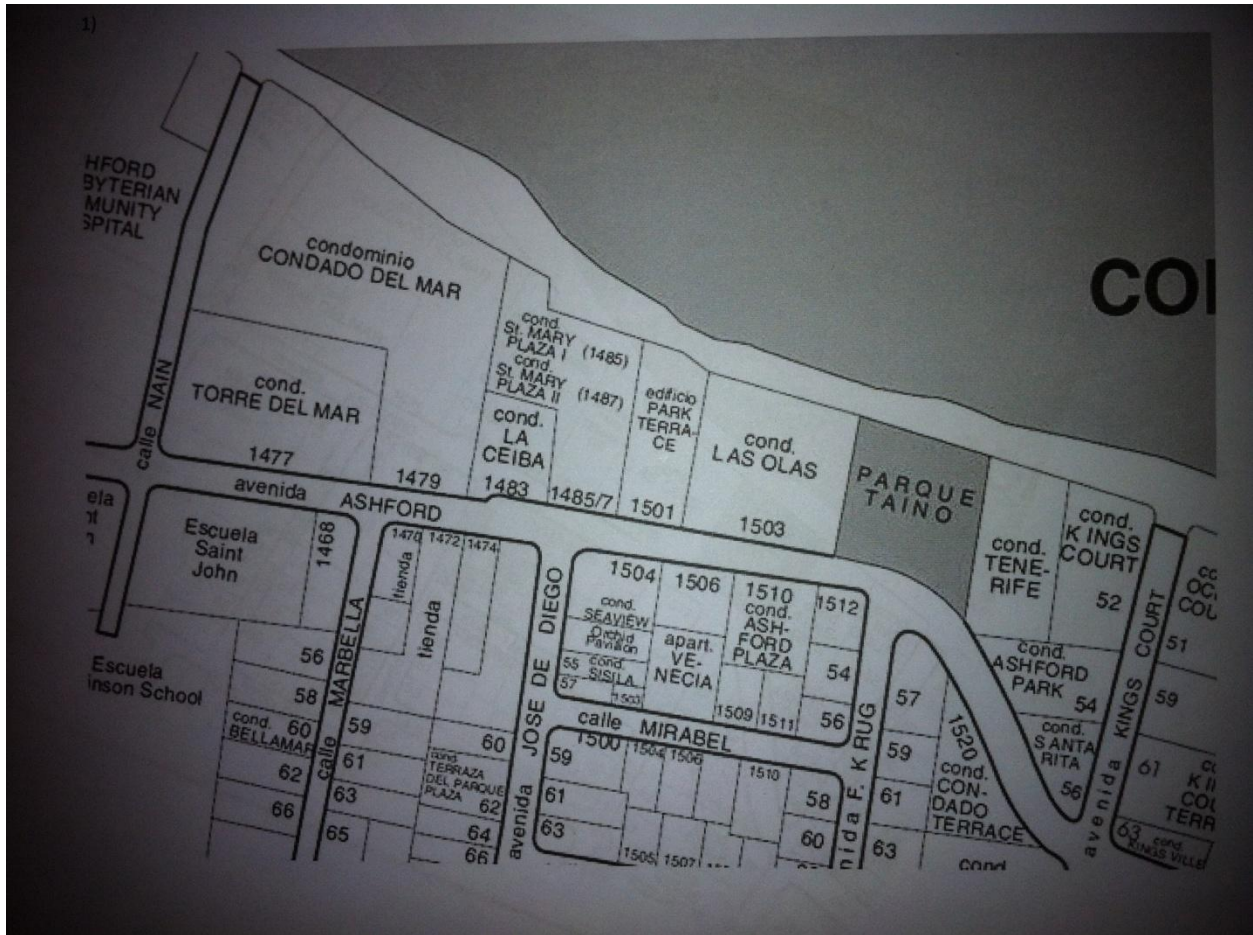
Figure 13: Aerial shot of commercial area of Condado.

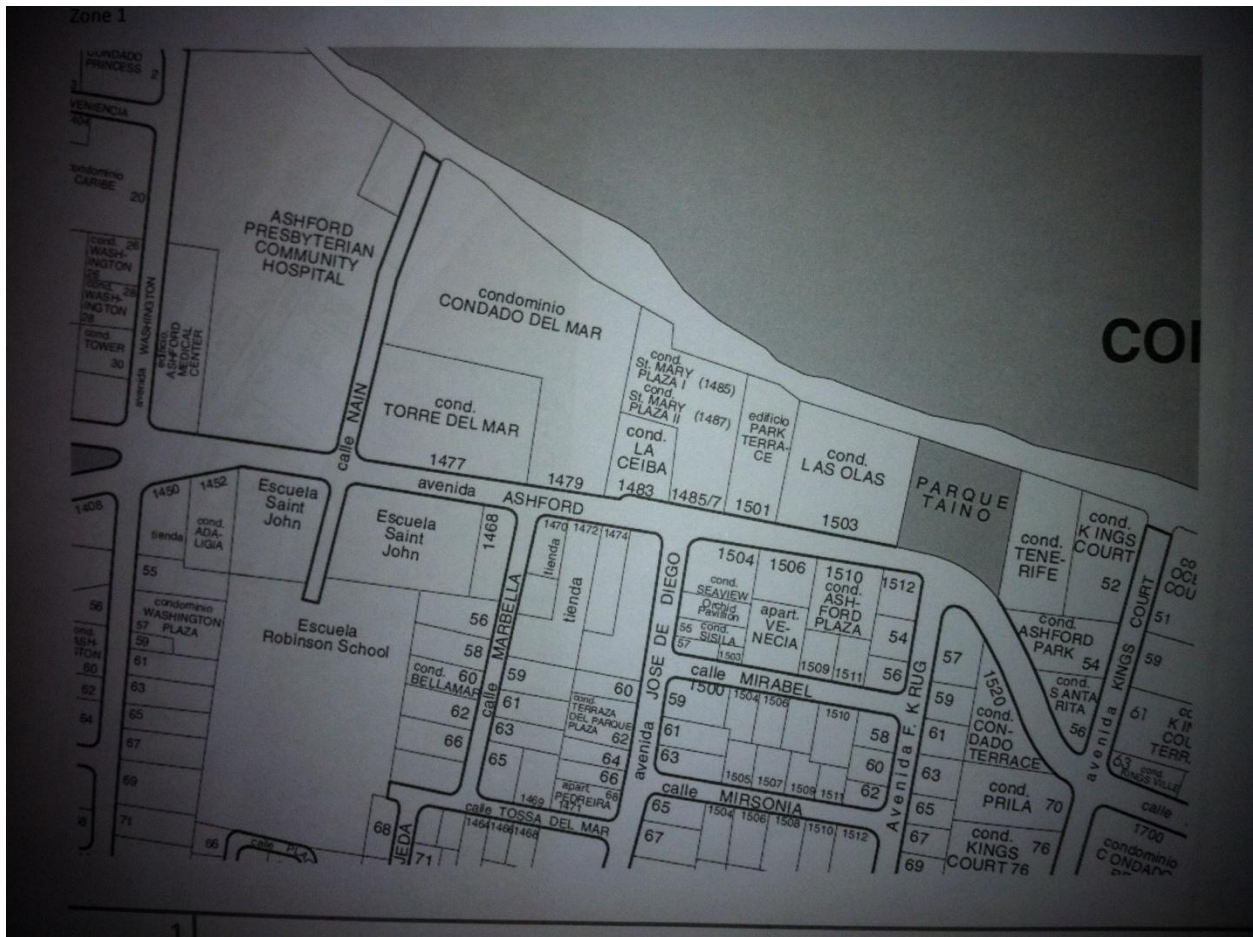


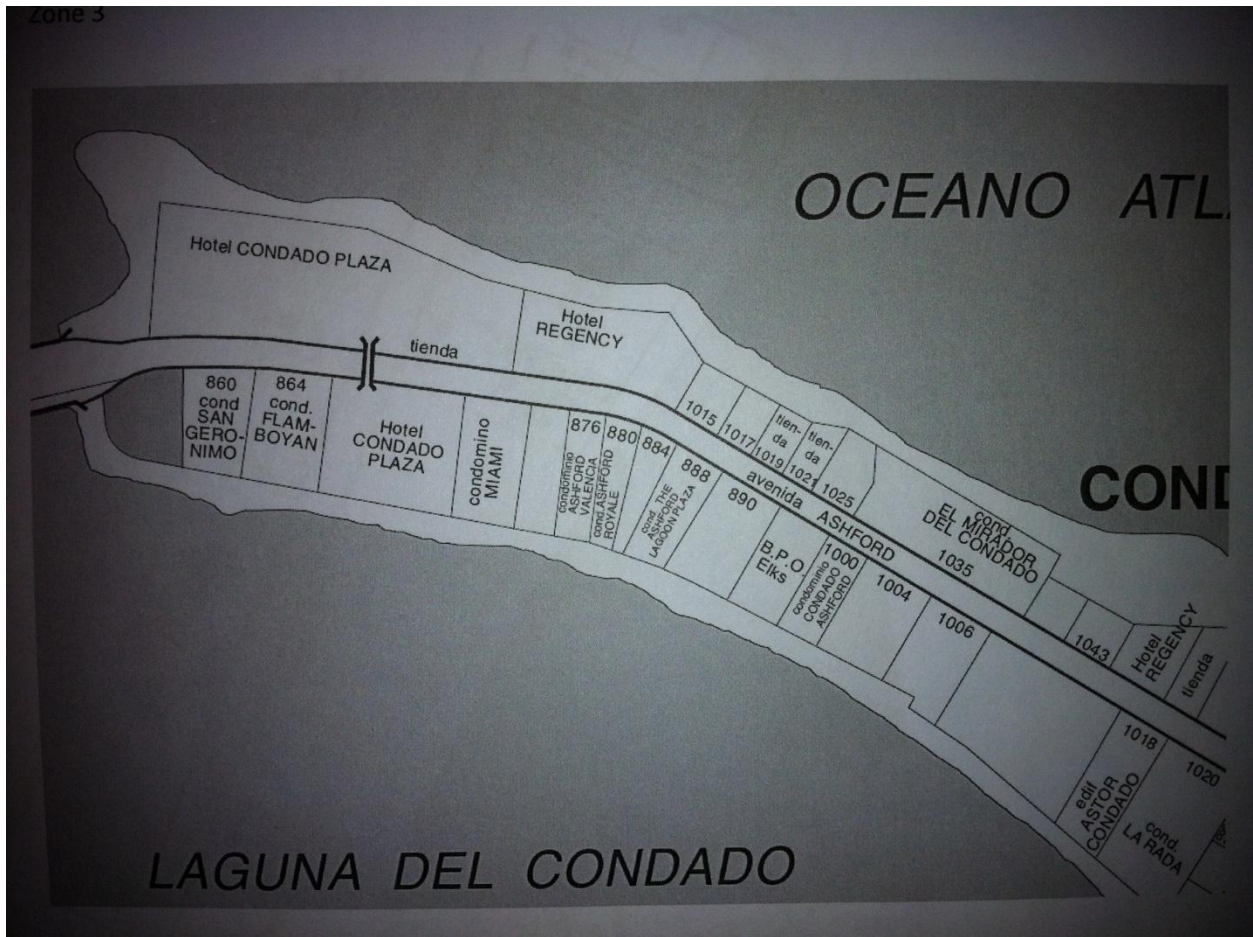
Figure 14: Northern section commercial. Southern section residential

All following maps were used in the inventory process and are maps of different sections of Condado.



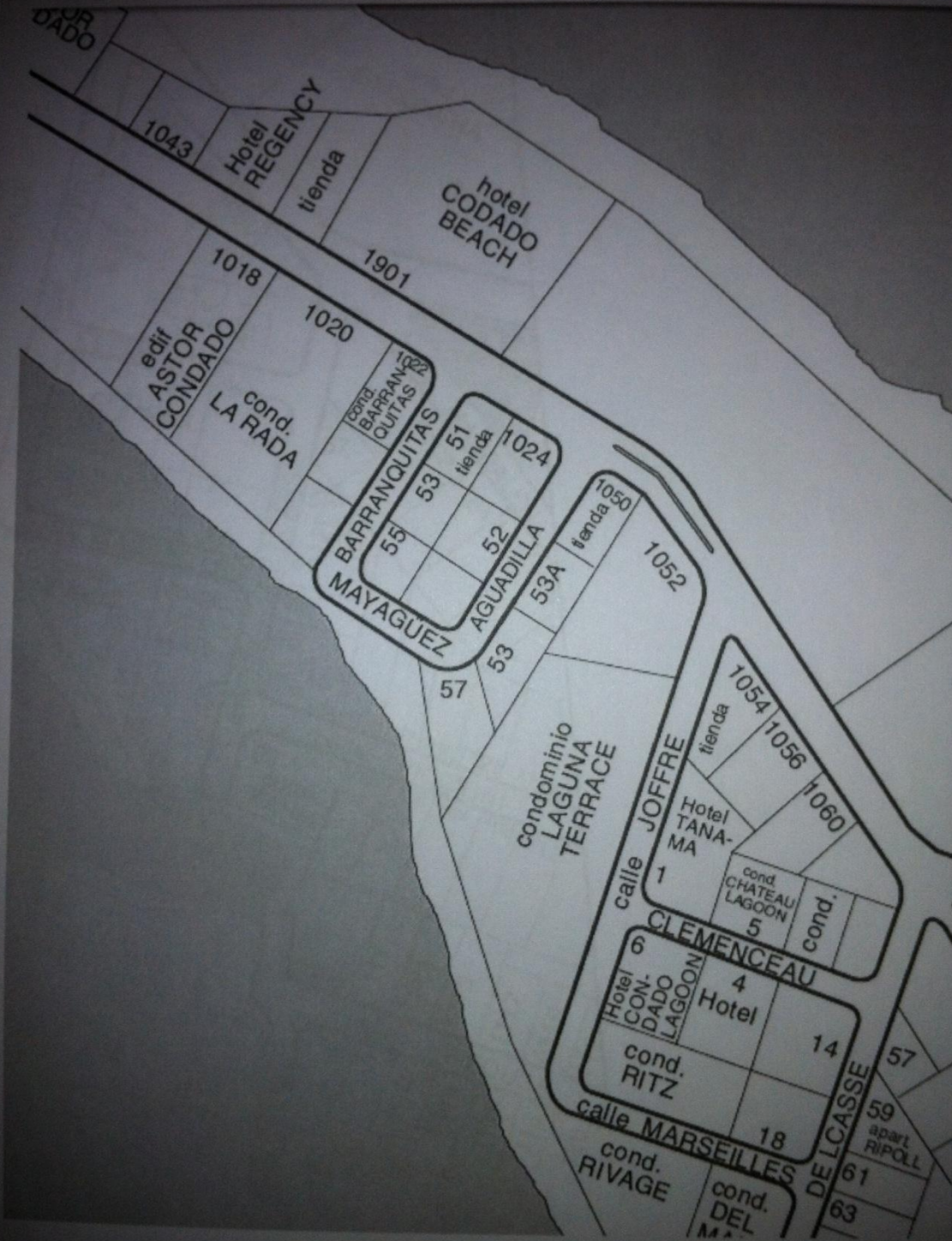






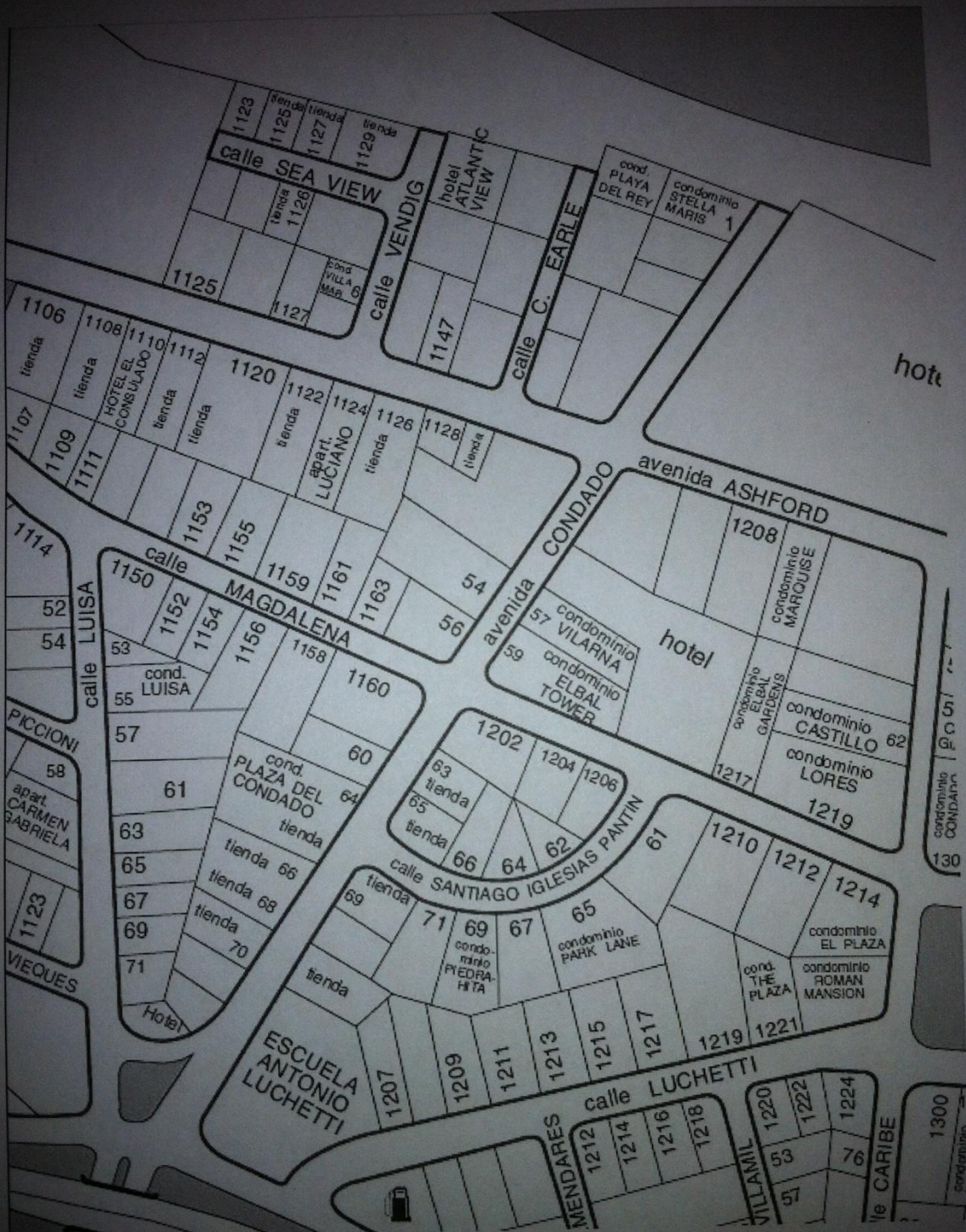


Zone 3

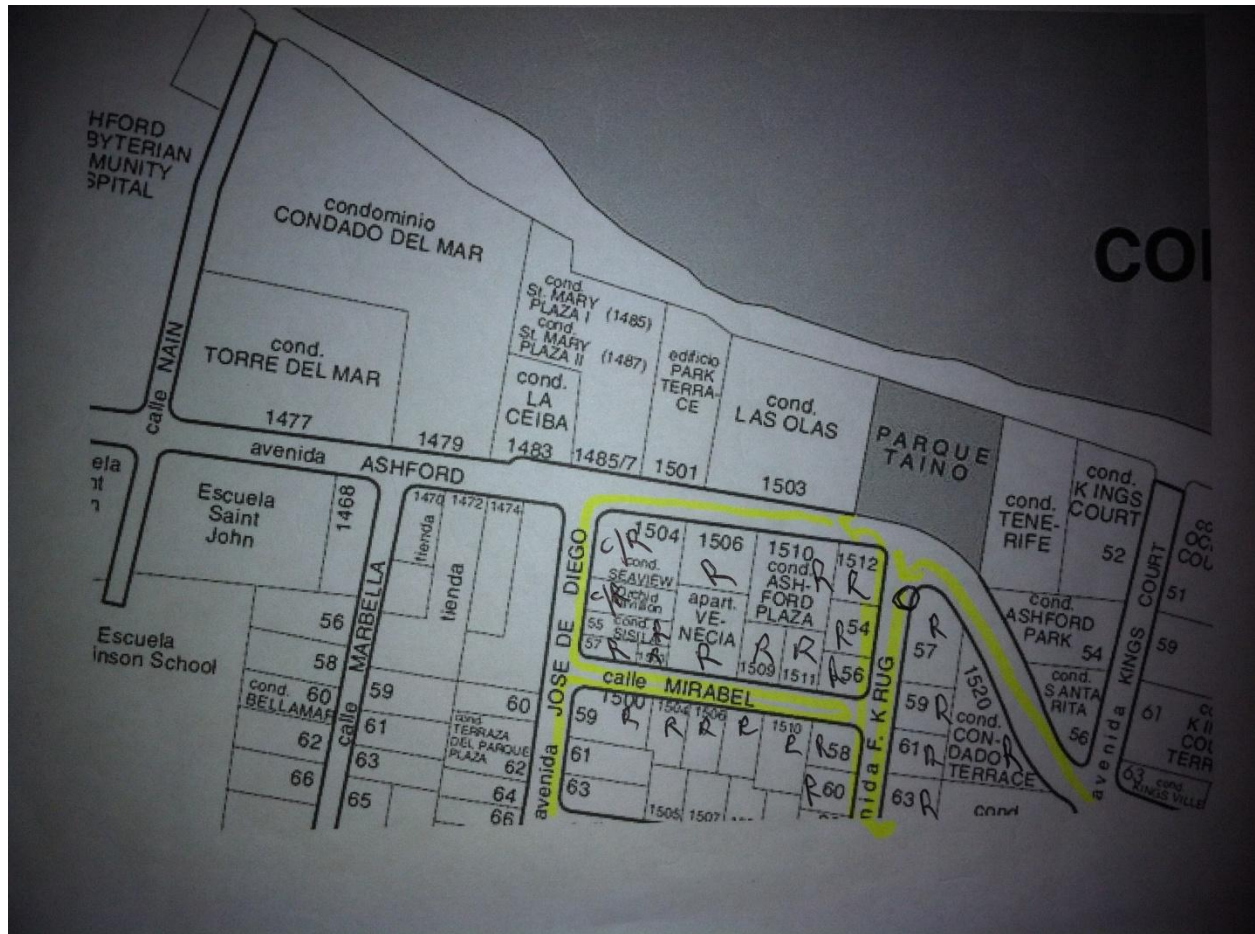


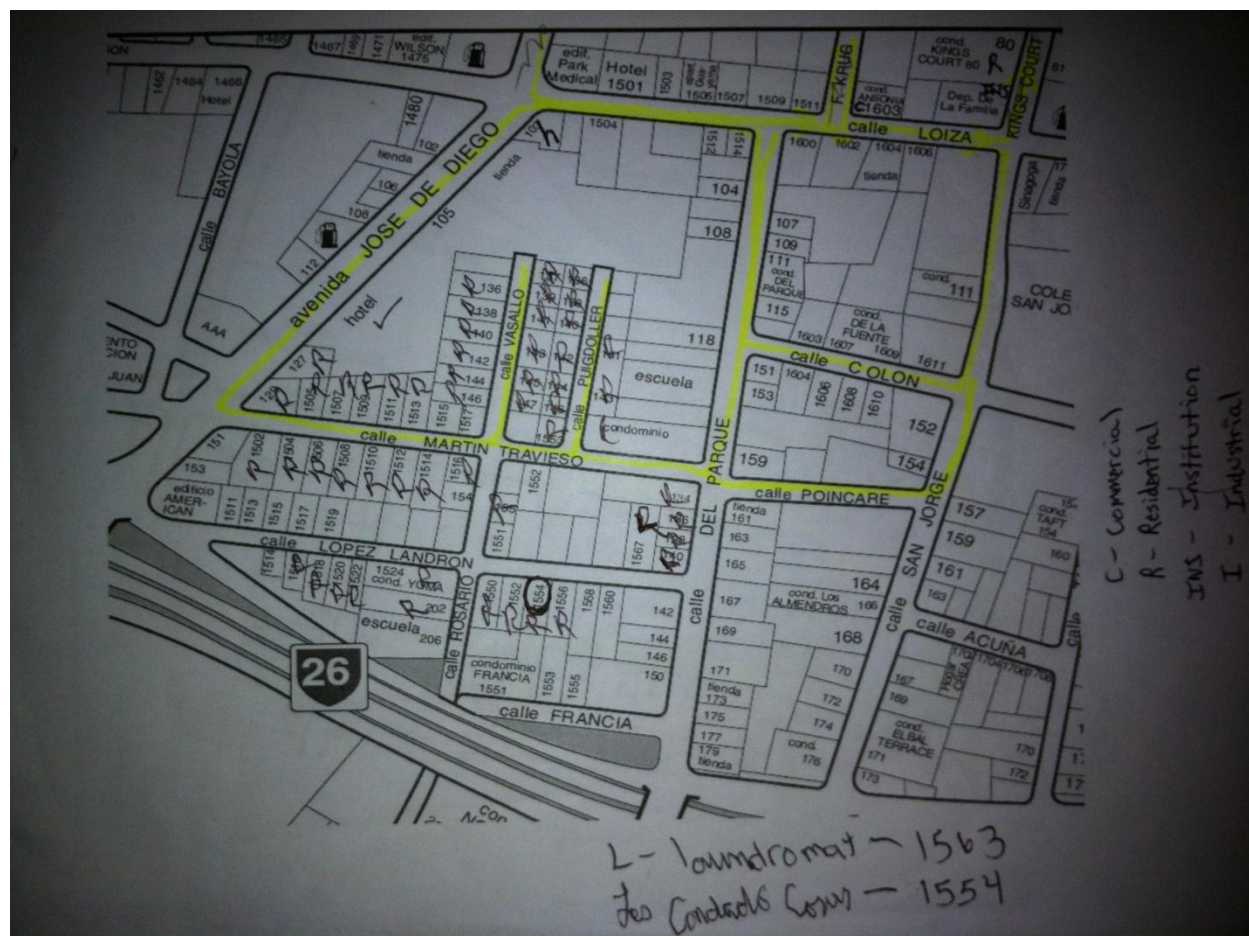


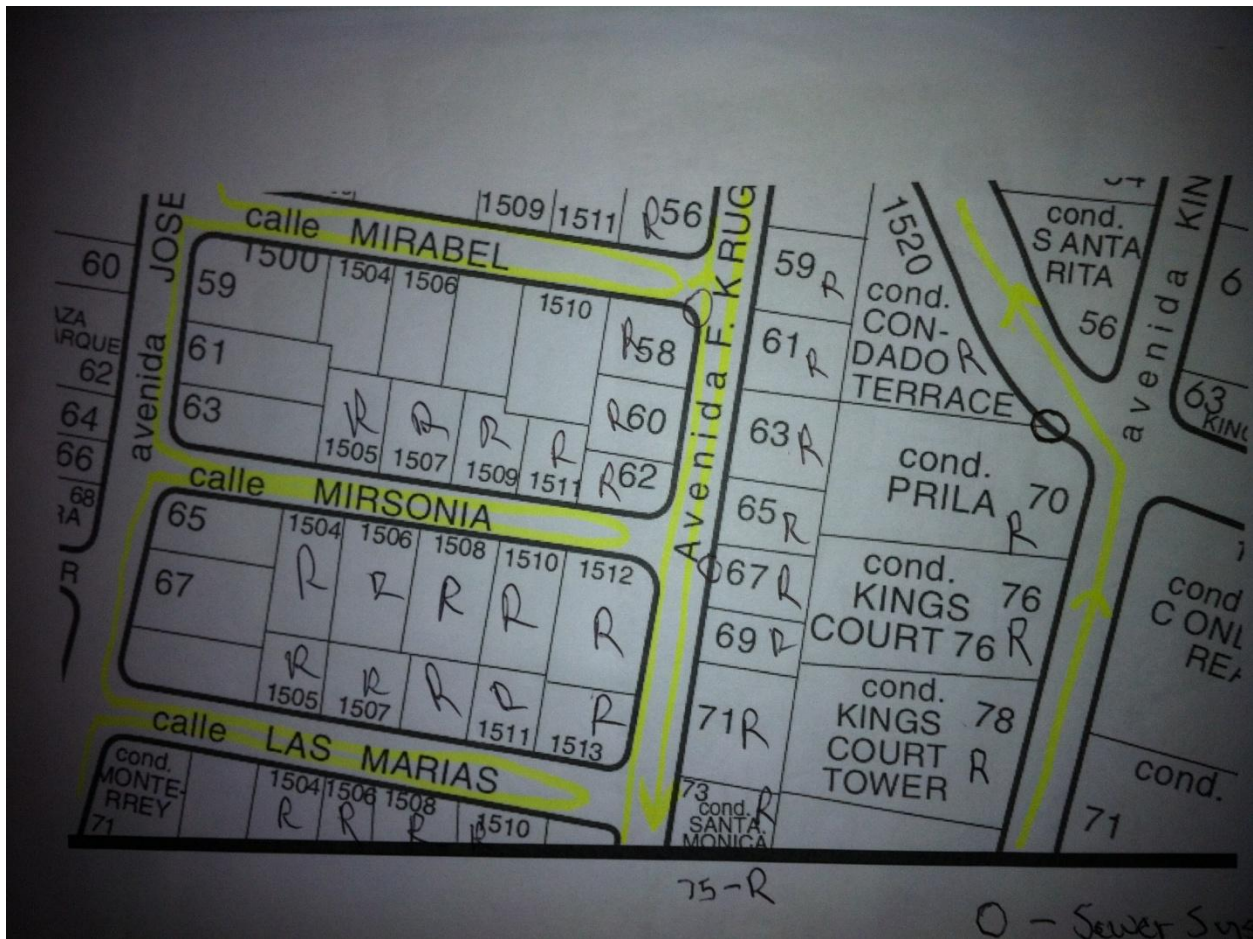
Zone 3



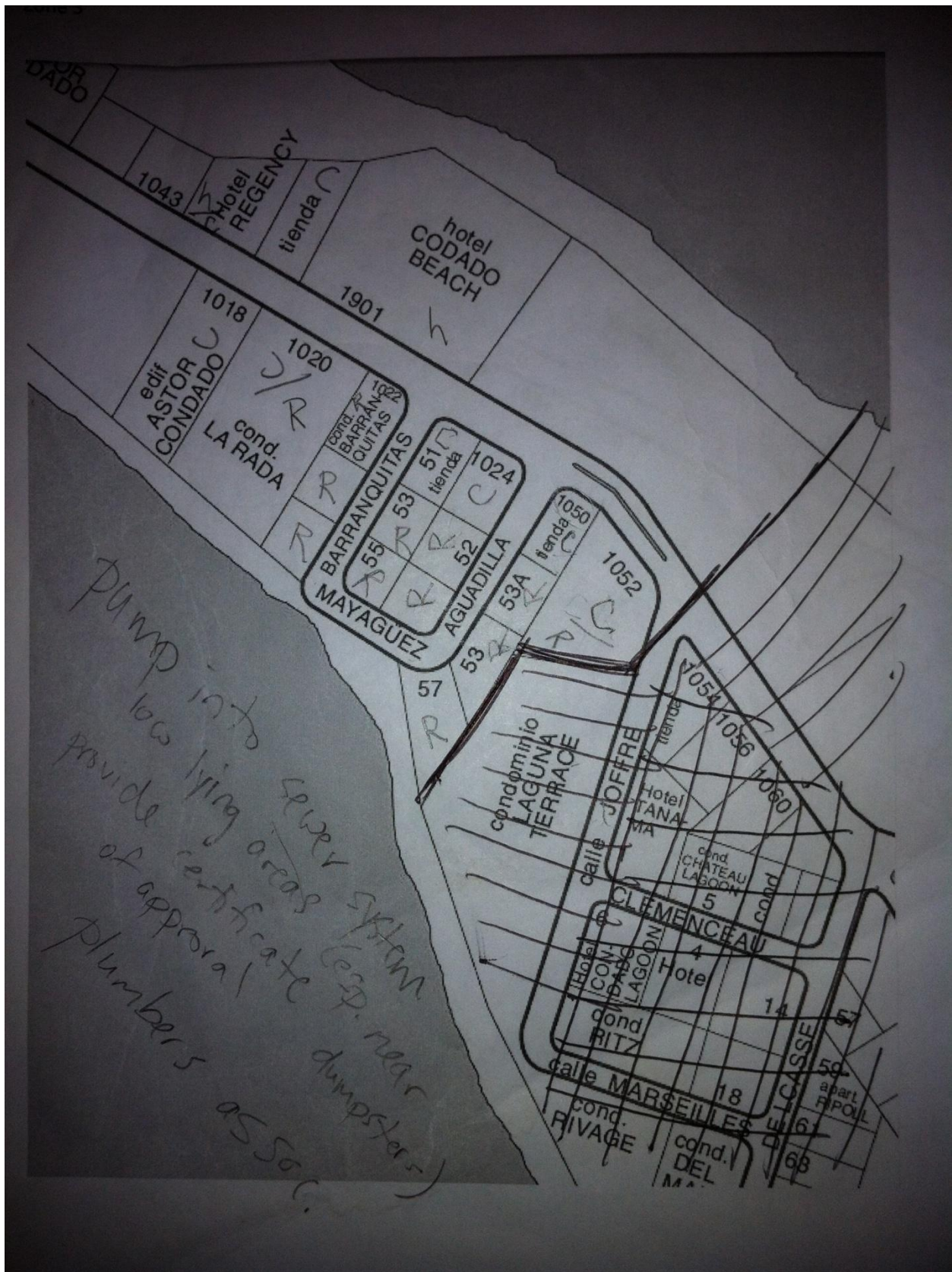
Appendix J: Maps of Condado with Inventory

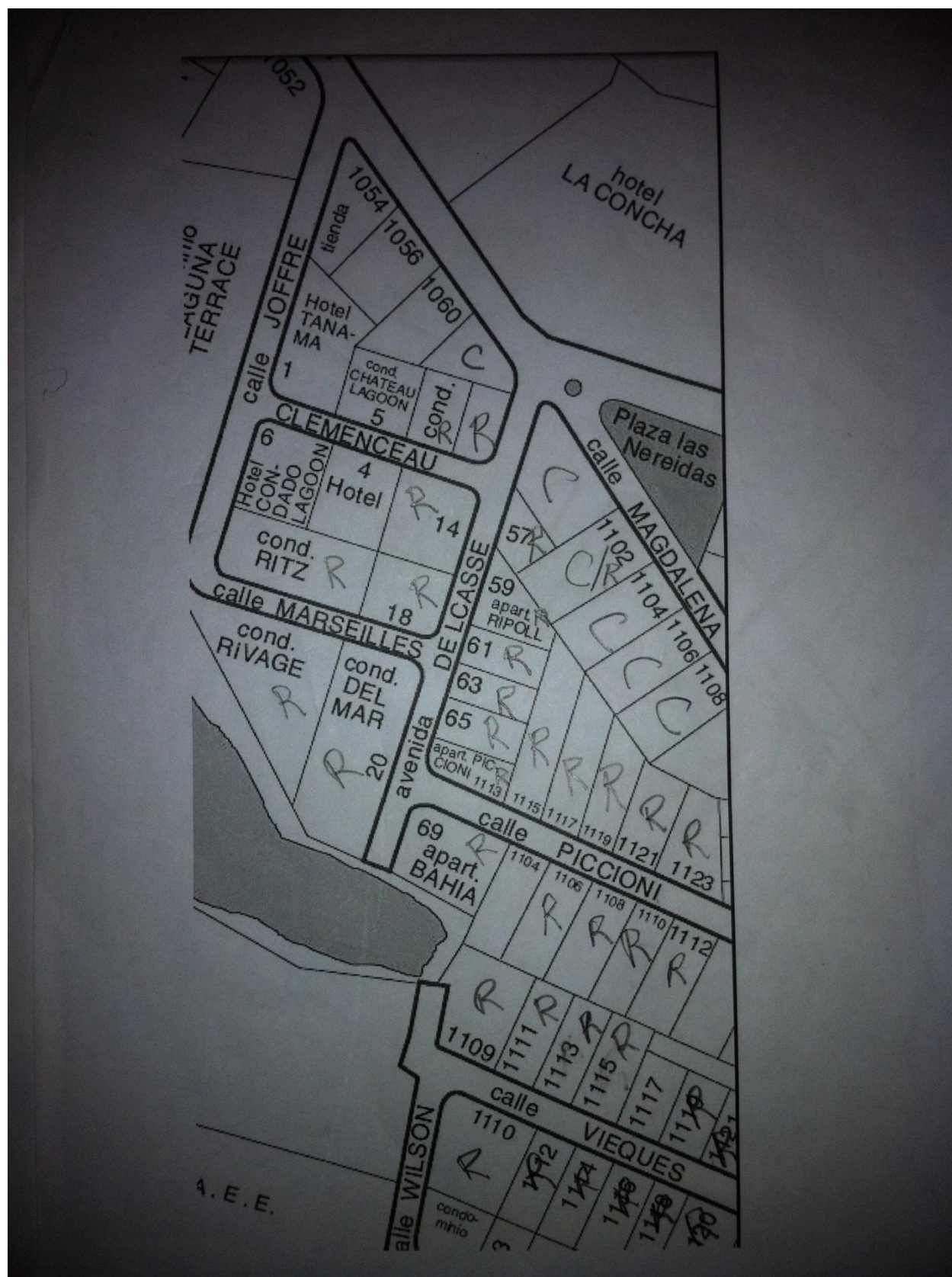


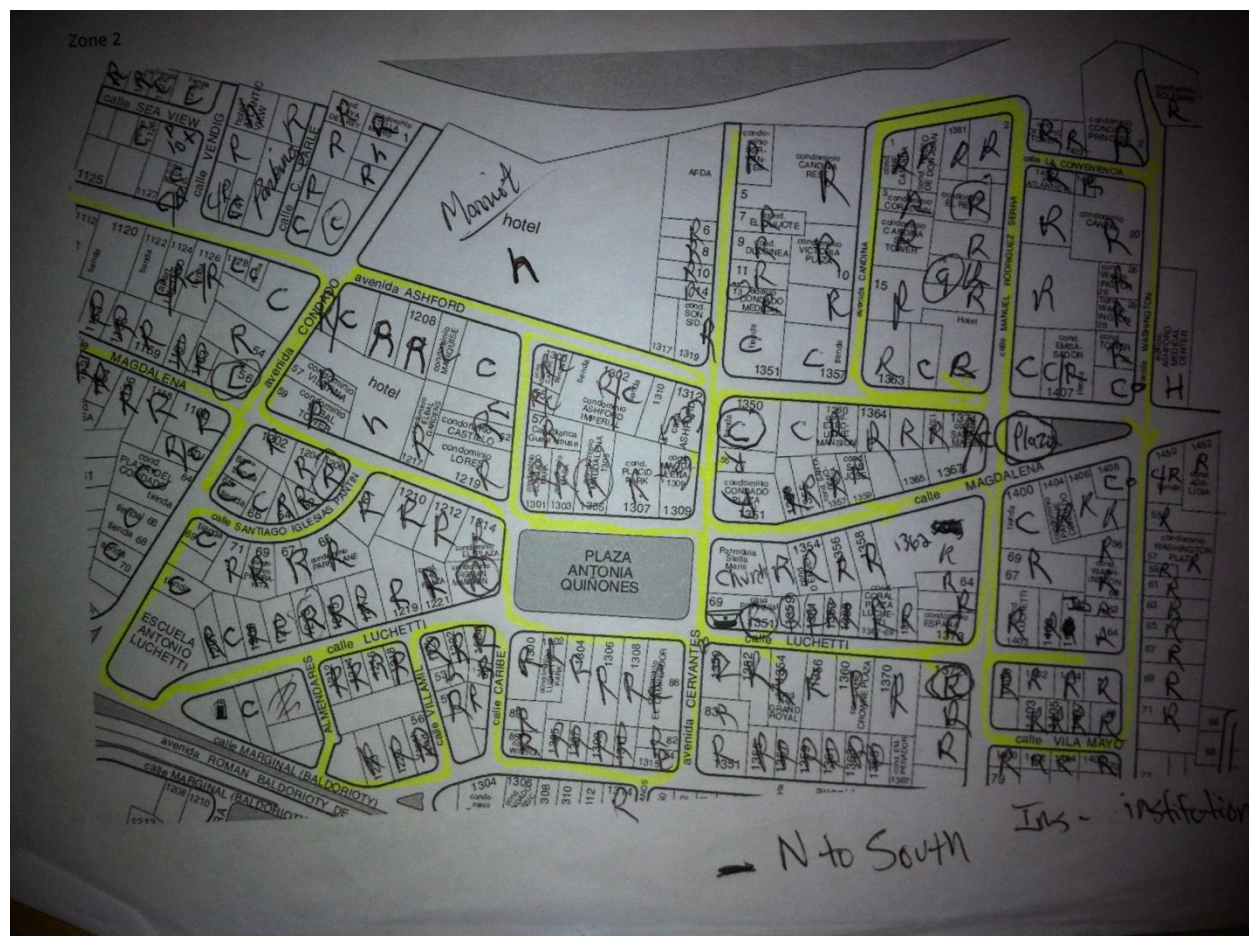








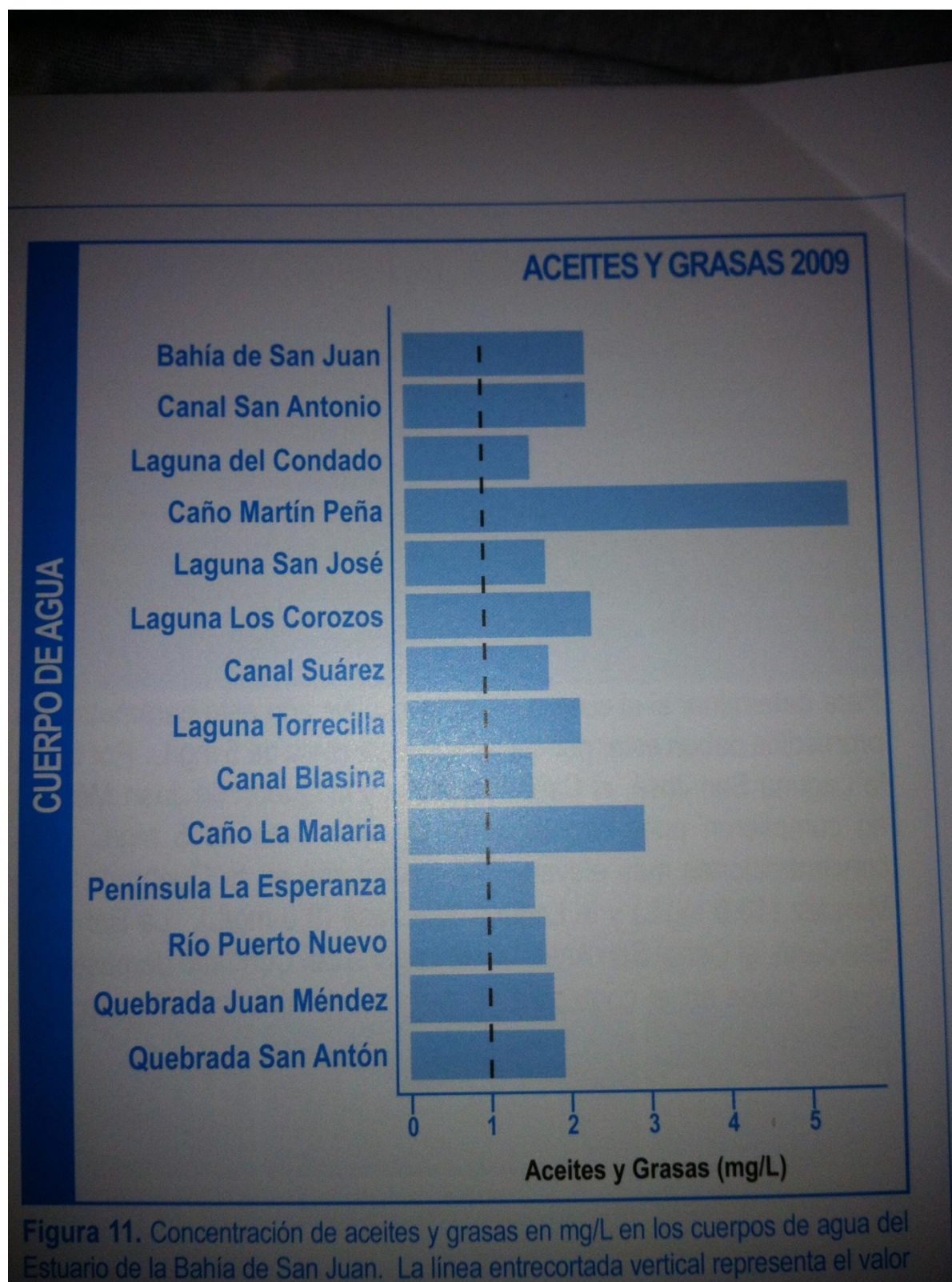




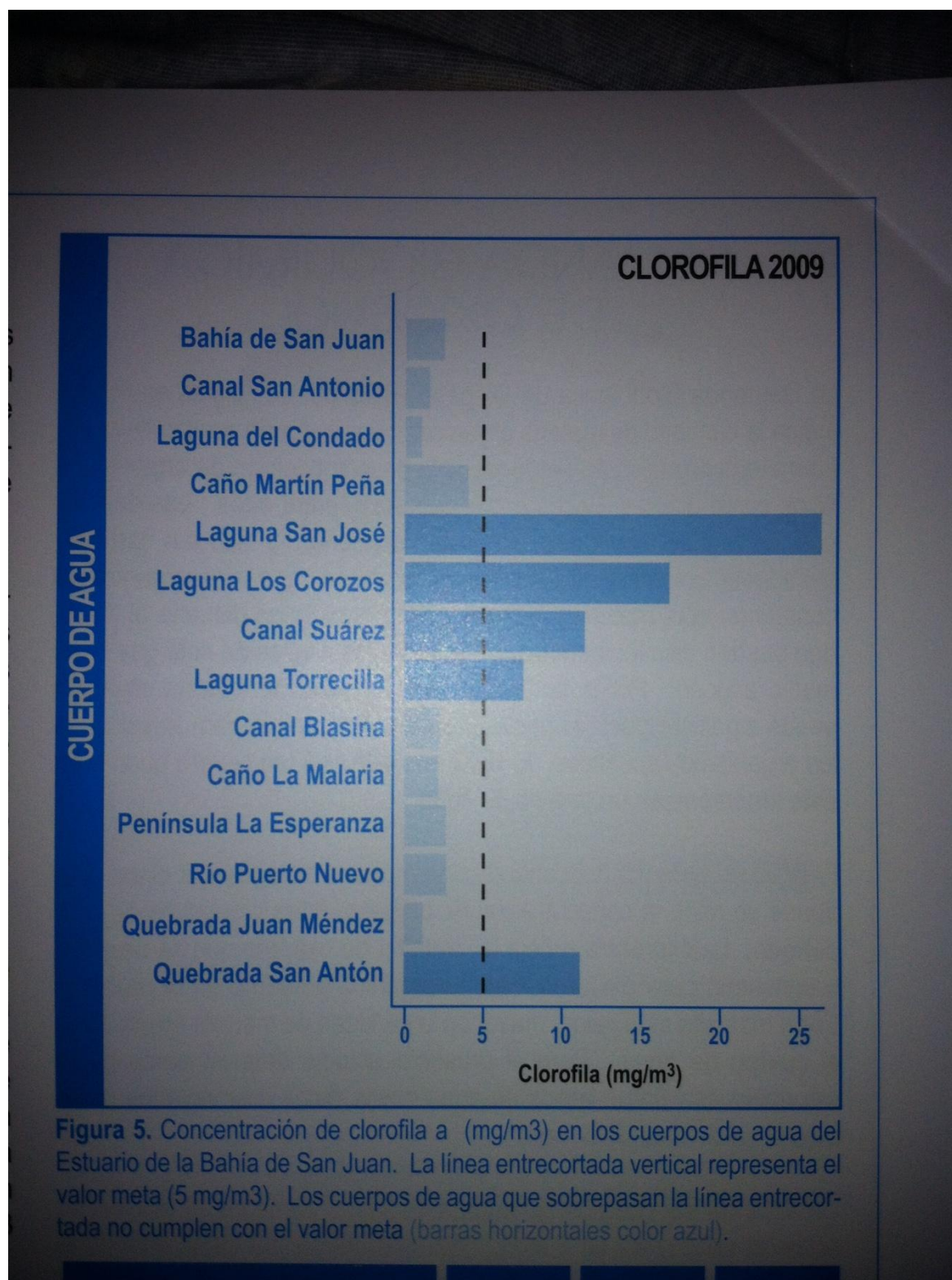
Appendix K: Estuario map



Appendix L: Estuario Oil and Grease Chart



Appendix M: Estuario Fecal Coliform Chart



Appendix N: Feedback Survey Protocol

Survey Feedback Protocol

1. Mail out survey to the entire Condado district residents
2. Enclose with a letter describing the campaigns and programs that have been taking place
3. Ask politely for their cooperation in completing the survey

Questions

- Did you hear about the campaign?
- Have you noticed a cleaner environment since the campaign was done?
- Did it change the behaviors of people in your community?

Appendix O: Feedback Focus Group Protocol

Focus Group Protocol

1. Mailing list of Condado
2. Choose people at random
3. Make focus group
4. Contact them by phone and mail to ensure that they participate
5. Provide some incentive

When the focus group meets together, begin with discussing a brief overview of the campaign done in Condado about stormwater pollution.

- Did you hear about the campaign?
- Did it raise awareness about the severity of stormwater pollution?
- Did it change the behaviors of people in the community?
- Have you noticed a cleaner environment since the campaign was done?
- Do you believe it was an effective campaign?
- What best management practices have you noticed or not noticed people utilizing since the campaign was done?

Appendix P: Community Presentation Protocol

Community Presentation Protocol

Presentation will be Municipio de San Juan sponsored and run. It will be in PowerPoint presentation format. The presentation will be presented by a trained Municipio de San Juan Office of Permits official.

Mandated to attend by the Municipio will be all restaurant and business owners in Condado, as well as an official from each hotel in Condado. Also, not mandatory, a letter of invitation will be mailed to all Condado residents and community leaders that wish to attend.

Contents of the presentation will be modeled after the final presentation delivered by the Municipio de San Juan WPI project team to the Office of Permits officials and will be translated into Spanish.

Content of presentation includes:

- Overview of MS4 system
 - The EPA mandates more control of the Municipal Stormwater Sewer System
 - Restaurants and commercial businesses, residents, and hotels contribute to the problem
 - Business practices are economically but not environmentally friendly
- Informative review of terminology (illegal connections vs. illicit discharges)
 - Illegal connections are unlawful connections with no permit
 - Illicit discharges are discharges not entirely composed of stormwater
- Overview of water pollution in Condado
 - Improper business practices
 - Illegal connections to sewer system
 - Improper disposal of waste
 - Lack of awareness
- Inadequate management of pollutants
 - Oil and grease residues
 - Sediments
 - Detergents
 - Motor Oil
 - Metals from construction sites
- Discharges
 - Discharges over sidewalks include bleach, cleaning detergents, oil and grease from cars
 - Direct connection to the sewer
 - Waste and detergents
- Improper disposal of waste
 - Residential trash cans are leaking and not enclosed

- Commercial dumpsters are not maintained
- Review of laws and regulations currently in place
- List of penalties and fines if proper practices are not followed
- Best Management Practices (BMPs) for residents
 - Grass filters
 - Grates in sewers
 - Biodegradable soaps
 - Enclosed trashcans
 - Drainage pipes through sidewalks
- BMPs for commercial businesses and hotels
 - Enclosed trashcans
 - Grease traps for restaurants
 - Training programs

Following the presentation there will be time for questions and feedback.

Appendix Q: Inventory Spreadsheet of Condado

Classification	Discharge	Description	Point Source	Point of	
				Discharge	Additional Information
R	yes	washing parking lot	----	yes (6)	over sidewalk, water meter
R	----	n/a	----	----	
R	----	n/a	----	----	
R	----	n/a	----	----	flooding out of septic sewer
	yes	lagoon discharge	----	----	water meter
C	----	n/a	----	----	
R	----	n/a	----	----	
R	----	n/a	----	yes	
R	----	n/a	----	yes	
R	----	n/a	----	----	
R	----	n/a	----	----	water meter
R	----	n/a	----	----	
R	----	n/a	----	----	
R	----	n/a	----	----	
C	yes	copper color, thick	----	----	
R	----	n/a	----	----	
R	----	n/a	----	----	
R	----	n/a	----	----	
C	----	n/a	----	----	
R	----	n/a	----	yes	water meter
R	----	n/a	----	----	
R	----	n/a	----	----	
R	----	n/a	----	----	
R	----	n/a	----	----	
R	yes	flooded sewer	----	----	
R	----	n/a	----	----	
R	----	n/a	----	----	
R	----	n/a	----	----	
R	----	n/a	----	----	water meter
R	----	n/a	----	----	
R	----	n/a	----	----	no cover on water meter
R	----	n/a	----	----	
R	----	n/a	----	----	water meter
R	----	n/a	----	----	
R	yes	flow	----	yes	
R	----	n/a	----	----	
R	----	n/a	----	----	
R	----	n/a	----	----	

	----	n/a	----	----	
	----	n/a	----	----	
C	yes	dumping bleach	----	----	dripping discharge in back
	----	n/a	----	----	
	----	n/a	----	----	water meter
	----	n/a	----	----	
	----	n/a	----	----	water meter
C / R	yes	septic	----	----	
C	yes	green	----	yes	water meter, construction
C	yes	trash, septic	----	yes (6)	water meter
R	----	n/a	----	----	
C / R	----	n/a	----	----	
C	----	n/a	----	----	
C	----	n/a	----	----	
C	----	n/a	----	----	
R	yes	steady flow	yes	----	into stormwater sewer
R	----	n/a	----	----	
R	----	n/a	----	----	
R	----	n/a	----	----	
R	----	n/a	----	----	
R	----	n/a	----	----	
R	----	n/a	----	----	
R	----	n/a	----	----	
h / C	----	n/a	----	----	
R	----	n/a	----	----	
R	----	n/a	----	----	
h	----	n/a	----	----	construction site
C	----	n/a	----	----	
h / C	yes	trash can discharge	----	yes	poor dumpster area
C	----	n/a	----	----	
R	yes	n/a	yes	----	into stormwater sewer
C	----	n/a	----	----	
C	----	n/a	----	----	
C	----	n/a	----	----	
C	----	n/a	----	----	
C	----	n/a	----	----	

Classification	Discharge	Description	Point Source	Point of	
				Discharge	Additional Information
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	

R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	stagnant puddle
R	---	n/a	---	yes	stagnant puddle
R	yes	n/a	---	---	from water meter
R	---	n/a	---	---	
					paint chips from construction
R	yes	blue, solid paint	---	---	
R	yes	clear, heavy flow	---	---	
R	---	n/a	---	---	
R	yes	odor	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
H	yes	murky color, debris, flow	yes	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	yes	
R	---	n/a	---	yes	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	yes	
R	---	n/a	---	yes	
R	---	n/a	---	---	
R	---	n/a	---	yes	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	yes	white	---	---	water meter
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
		milky with debris and flow			
R	yes		---	---	washing out paint buckets

R	---	n/a	---	---	
R	---	n/a	---	---	
h	---	n/a	---	yes	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	septic
R	---	n/a	---	---	
R	---	n/a	---	yes (2)	
R	---	n/a	---	yes (2)	
R	---	n/a	---	---	
R	---	n/a	---	yes	
R	---	n/a	---	yes	
R	yes	n/a	---	yes	water meter
R	---	n/a	---	---	
C	---	n/a	---	---	
C	---	n/a	---	---	
C	---	n/a	---	---	
C / R	---	n/a	---	---	
C / R	---	n/a	---	---	
C	---	n/a	---	---	
C	---	n/a	---	---	
C	---	n/a	---	---	
C / R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
C	---	n/a	---	---	
C	yes	n/a	---	yes	over sidewalk
C / R	---	n/a	---	yes	water meter
C / R	---	n/a	yes	yes	flow in sewer
C	---	n/a	---	---	
C	---	n/a	---	---	
C	yes	n/a	---	---	
C	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	yes	clear	---	---	
R	---	n/a	---	---	
C / R	---	n/a	---	---	
C / R	---	n/a	---	---	
C / R	---	n/a	---	---	
C / R	---	n/a	---	---	
C / R	---	n/a	---	---	
C	---	n/a	---	---	

C	---	n/a	---	---	
C	---	n/a	---	---	
h	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
C	---	n/a	---	---	
C	---	n/a	---	---	
R	---	n/a	---	---	
C	---	n/a	---	---	water meter
C / R	---	n/a	---	yes	
R	---	n/a	---	---	
R	---	n/a	---	---	water meter
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	yes	clear	---	yes	water meter
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	yes	bubbles, odor, flow	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	water meter
R	---	n/a	---	---	
R	yes	clear	---	yes (3)	central air discharge
C	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
C	---	n/a	---	---	
C / R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	construction site
R	---	n/a	---	---	
R	---	n/a	---	---	
h	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	yes	black, septic residue	yes	---	into sewer
R	yes	odor, flow, debris, black	---	yes	into sewer, greasy

R	---	n/a	---	---	
R	yes	clear	---	yes	broken grate
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	yes	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
C	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	yes	clear	---	yes	over sidewalk
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	water meter
R	---	n/a	---	---	
R	---	n/a	---	yes (2)	
R	---	n/a	---	yes	water meter
R	---	n/a	---	---	water meter
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	yes	
R	yes	green, stagnant puddle	---	yes	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	sharkmouth
R	---	n/a	---	---	
C	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	yes	n/a	yes	---	flooding
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	

R	yes	odor	yes	yes	
R	yes	soapy	---	yes	
R	yes	construction debris	---	---	construction site
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	yes	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	yes	
I	yes	bad odor, heavy flow	---	---	sewer and septic combined
R	---	n/a	---	---	
h	---	n/a	---	---	
R	---	n/a	---	---	
C	---	n/a	---	---	
C	---	n/a	---	---	
R	---	n/a	---	yes	
C	yes	n/a	yes	---	
C / R	yes	clear	---	yes	over sidewalk
C	---	n/a	---	yes	water meter
C	---	n/a	---	---	full drain
C	---	n/a	---	---	
C	---	n/a	---	---	
h	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
C	---	n/a	---	---	
C	yes	clear, debris, heavy flow	---	yes	
C	---	n/a	---	---	
C	---	n/a	---	---	
I	---	n/a	---	---	
	---	n/a	---	yes (2)	

Classification	Discharge	Description	Point Source	Point of	
				Discharge	Additional Information
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	yes	clear, no odor	---	---	

R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	yes	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	yes	green, no odor, debris	---	yes	over sidewalk , vegetables
R	---	n/a	---	---	
R	---	n/a	---	---	
R	yes	clear, no odor, flow	---	yes	over sidewalk
R	---	n/a	---	---	
R	yes	clear, no odor, flow	---	---	
C / R	yes	grey, odor	---	---	
C / R	yes	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	yes	n/a	---	yes	over sidewalk
R	---	n/a	---	---	
		shiny, no odor, debris,			
R	yes	flow	---	---	oil? , water meter
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	yes	n/a	---	yes	over sidewalk

R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	yes	brown	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	yes	n/a	---	---	dumping on sidewalk , boxes
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
R	---	n/a	---	---	
C / R	yes	brown	---	---	

Appendix R: Informal Pet Owner Survey

Ask the owner of the pet if they have time for us to talk to them. Then we tell them we are doing a project about storm water pollution.

Some questions asked were:

Where are you from?

Do you pick up after your pet's waste?

Do you see others not picking up pet waste?

Do you think pet waste is a problem in Condado?

Do you think that Condado has enough pet waste trash cans?

Answers we received from these informal surveys varied. A few of the owners said they picked up after their pet and a few said they did not, but they probably should. The majority of the pet owners surveyed were from Condado. One was from Ocean Park. The general consensus was that Condado did have pet waste trash cans, but they were never used because there were not enough pet waste bags. The city does not fill up the waste bags enough for people to use them. Also there are many people who do not pick up after their pet.