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SUBWATERSHED-SPECIFIC BMP ASSESSMENT

Prepared For:

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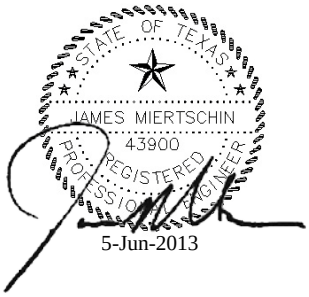

June 2013

TABLE OF CONTENTS

1.0 INTRODUCTION 1

2.0 METHODOLOGY 3
2.1 UNDERSTANDING RUNOFF IN THE SUBWATERSHED 3
2.2 SELECTING A SITE 6
2.3 BMP SELECTION 8
2.4 RUNOFF CALCULATIONS 8
2.5 PUBLIC SITES 10
2.6 BIORETENTION POND 10
2.7 SUMMARY 11

3.0 APPLICATION TO SUBWATERSHED SPC1 12
3.1 SPC1-1 12
3.1.1 OVERVIEW 12
3.1.2 SPC1-1A 15
3.1.3 SPC1-1B 16
3.1.4 SPC1-1C 17
3.1.5 SPC1-1D 19
3.1.6 SPC1-1 SUMMARY 20
3.2 SPC1-2 20
3.2.1 OVERVIEW 20
3.2.2 SPC1-2A 23
3.2.3 SPC1-2B 24
3.2.4 SPC1-2C 25
3.2.5 SPC1-2 SUMMARY 27
3.3 SPC1-3 27
3.3.1 OVERVIEW 27
3.3.2 SPC1-3A 30
3.3.3 SPC1-3B 31
3.3.4 SPC1-3C 32
3.3.5 SPC1-3D 33
3.3.6 SPC1-3 SUMMARY 34
3.4 SPC1-4 34
3.4.1 OVERVIEW 34
3.4.2 SPC1-4A 37
3.4.3 SPC1-4B 38
3.4.4 SPC1-4C 39
3.4.5 SPC1-4D 40
3.4.6 SPC1-4 SUMMARY 41
3.5 SPC1-5 41
3.5.1 OVERVIEW 41
3.5.2 SPC1-5A & B 44

3.5.3 SPC1-5C 45
3.5.4 SPC1-5D 47
3.5.5 SPC1-5E 48
3.5.6 SPC1-5 SUMMARY 49
3.6 SPC1-6 50
3.6.1 OVERVIEW 50
3.6.2 SPC1-6A 53
3.6.3 SPC1-6B 54
3.6.4 SPC1-6C 55
3.6.5 SPC1-6D 56
3.6.6 SPC1-6E 57
3.6.7 SPC1-6 SUMMARY 58
3.7 SPC1-7 58
3.7.1 OVERVIEW 58
3.7.2 SPC1-7A 60
3.7.3 SPC1-7B 61
3.7.4 SPC1-7C 62
3.7.5 SPC1-7 SUMMARY 63
3.8 SPC1-8 64
3.8.1 OVERVIEW 64
3.8.2 SPC1-8A 66
3.8.3 SPC1-8B 67
3.8.4 SPC1-8 SUMMARY 68
3.9 SPC1-9 68
3.10 SPC1-10 69
3.11 SPC1-11 71

4.0 SUMMARY 73

5.0 REFERENCES 76

APPENDIX A

1.0 INTRODUCTION

While there is consensus among water resources professionals that implementation of stormwater best management practices (BMPs) is a viable alternative for mitigation of bacterial loadings, there is often a disconnect with regards to where such measures may be implemented within a specific watershed. This is particularly true in an urban area that has already been developed. In a highly developed area, open space for regional or area wide controls may be lacking. The most feasible approach may be to prescribe retrofit of BMPs to existing developmental areas and sites. In some cases, BMPs could be implemented as retrofits for specific sites, in other cases, future redevelopment of specific sites may provide additional opportunity to implement control measures.

The ongoing Upper San Antonio River Watershed Protection Plan Revision project includes a task to examine watershed-specific BMP location possibilities for management of bacterial loadings. (This project is administered by the San Antonio River Authority, with funding provided by Texas Commission on Environmental Quality.) The objective of the task is to develop options for management measures and implementation strategies on a watershed-specific basis. The overall scope for the task is to identify and select appropriate BMPs, identify tentative potential locations for BMPs, and demonstrate the feasibility of application to a complete subwatershed. For this task, the work will remain at a conceptual-level, which means a preliminary, broad-brush examination of suitable control measures. The task will provide a demonstration of potentially suitable sites within a specific subwatershed, and identification of specific types of controls that could be implemented. This task will not provide any type of detailed design of BMPs. This task builds upon the work completed in a previous task, where publicly-owned parcels were identified throughout the study area. The publicly-owned parcels previously identified are candidates for BMP implementation in the present study, however, additional nonpublic sites will also be considered.

Potential BMP sites are identified based upon their strategic location or perceived availability. These are all example, potential sites. No agreements have been reached with any public or private entity regarding the actual implementation of BMPs or the acquisition of a site. This task then provides a conceptual look at the potential for implementation. Actual implementation of BMPs on any particular site would likely be a long-term project, where first consensus would have to be reached with the public or private site entity regarding the specific design and details of controls, potential costs, and timeline for implementation. In summary, the effort is an attempt to show what *can* be done on specific subwatershed, not mandate what will or will not be implemented.

The Subwatershed investigated in this study is the uppermost portion of the San Pedro Creek watershed. This subwatershed is 840 acres in size, is largely developed, and contains a diverse mix of industrial, residential, park, and commercial land use. The subwatershed will be referred to as San Pedro Creek 1 (SPC1), in this report as shown in Figure 1-1.

Figure 1-1: Boundary of SPC1

2.0 METHODOLOGY

2.1 UNDERSTANDING RUNOFF IN THE SUBWATERSHED

In order to select BMP sites, it is essential to identify the flow paths that runoff will follow during its collection into San Pedro Creek. Information is provided by the City of San Antonio Public Works Department showing the stormwater infrastructure that had been mapped in a GIS layer. In field observations it was noted that much of the infrastructure is missing, or what is mapped is different from what actually exists in ground. To supplement the limited available mapping, 2-ft contours showing the natural topography of the land and field notes were used to determine the assumed stormwater flow paths.

Using 2-ft contours, the direction that runoff flowed from each street was marked with an arrow. This process was carried out over the entire 840 acres of SPC1 in GIS and then field verified. On the next page, Figure 2-1 shows the direction of flow on each street. This new layer, called the Street Flow Direction layer, served as an excellent starting point for the determination of drainage paths for the subwatershed.

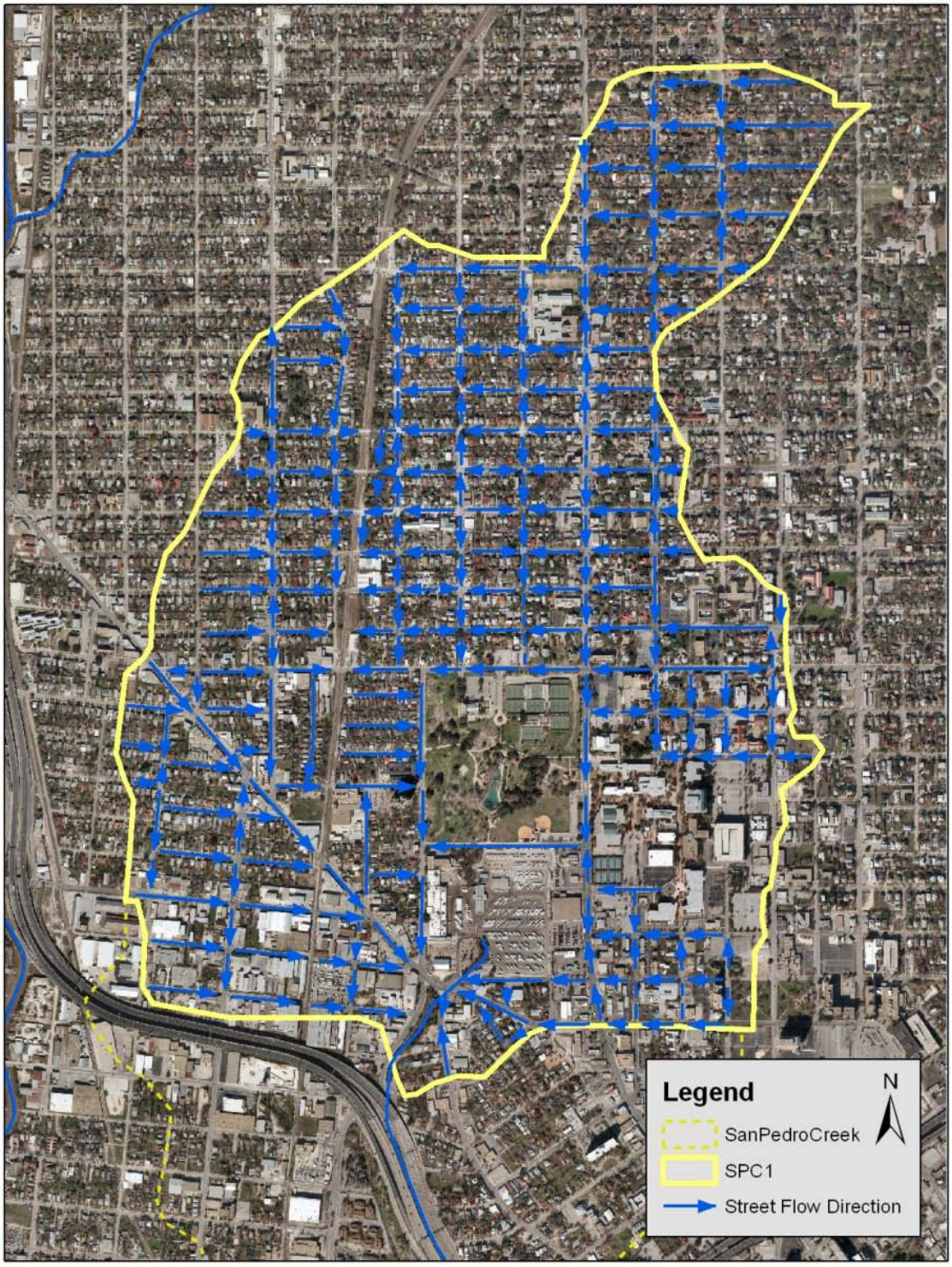

Figure 2-1: Street Flow Direction

A conceptual collection of runoff along drainage paths in the subwatershed was created using the layer with Street Flow Direction, the 2-ft contours layer, and what storm sewer infrastructure was available. Figure 2-2 shows the drainage paths defined by James Miertschin & Associates, Inc.

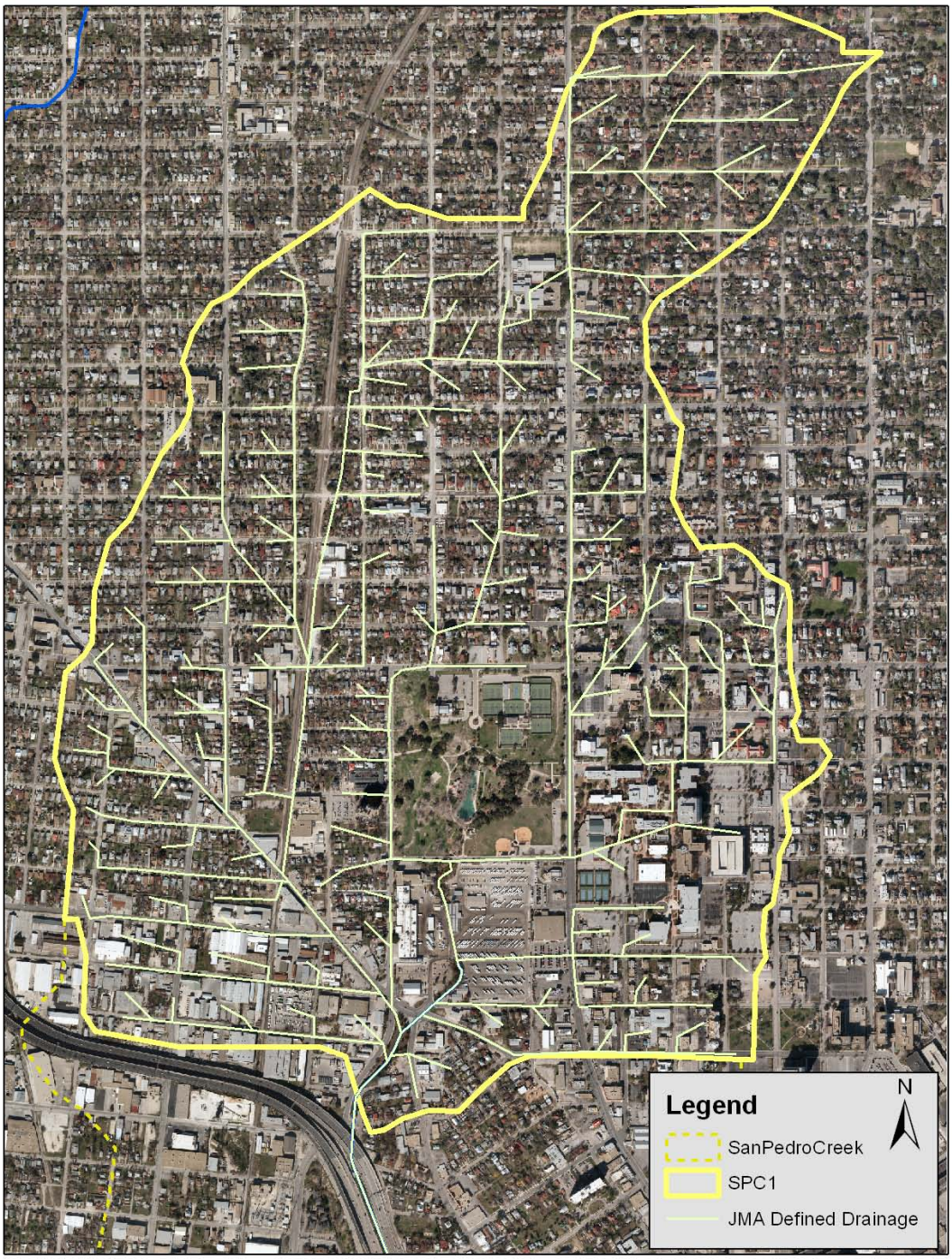

Figure 2-2: SPC1 Drainage Paths

2.2 SELECTING A SITE

The subwatershed SPC1 was divided into 11 more subwatersheds of approximately uniform size and characteristic land use. As a general guideline for size, each subwatershed was broken down to be in the range of 75-120 acres. These subwatersheds were labeled; SPC1-1, SPC1-2, SPC1-3, etc… Figure 2-3 illustrates the 11 subwatersheds of SPC1.

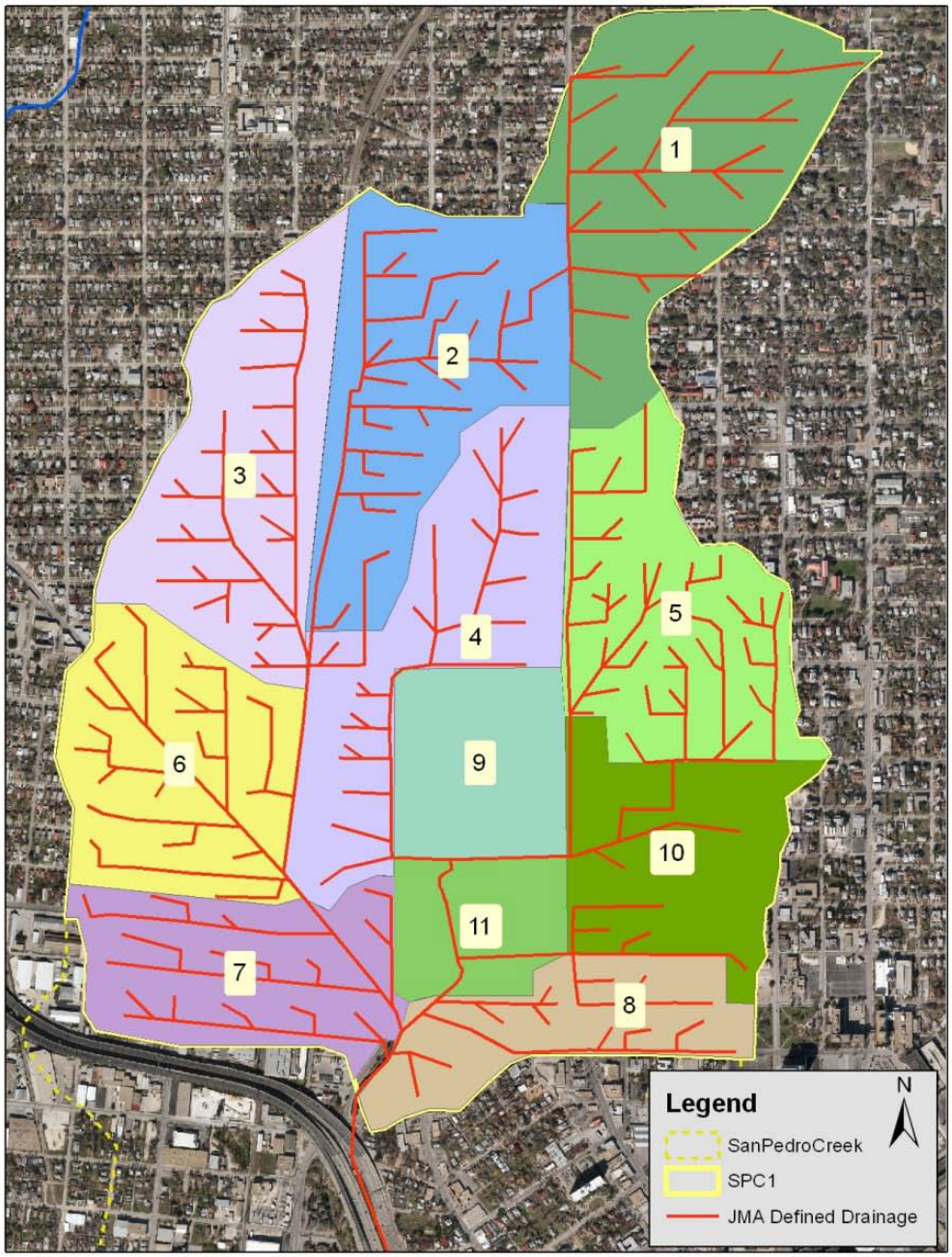

Figure 2-3: Subwatersheds of SPC1

Once a 75-120 acre subwatershed was delineated, individual properties within the subwatershed were assessed as potential BMP locations. Public properties, open space, and minimally developed lots were considered as prime candidates for BMP sites. These lots were singled out visually, or in the case of Public, identified using the Tax Exempt code in the parcel layers provided by Bexar County Appraisal District. The detailed process of identifying public properties was discussed in detail in Task 4 of this ongoing Watershed Protection Plan (JMA, 2013).

Prime receiving locations for large scale BMPs were identified, and the surrounding land that contributed runoff towards them was conceptually outlined and designated as a collection area. The naming convention for the collection areas was based on the subwatershed number followed by a sub classification letter. For example, subwatershed SPC1-7 was divided into three collection areas: SPC1-7A, SPC1-7B, and SPC1-7C. Figure 2-4 shows an example of how SPC1-7 is divided into three collection areas.

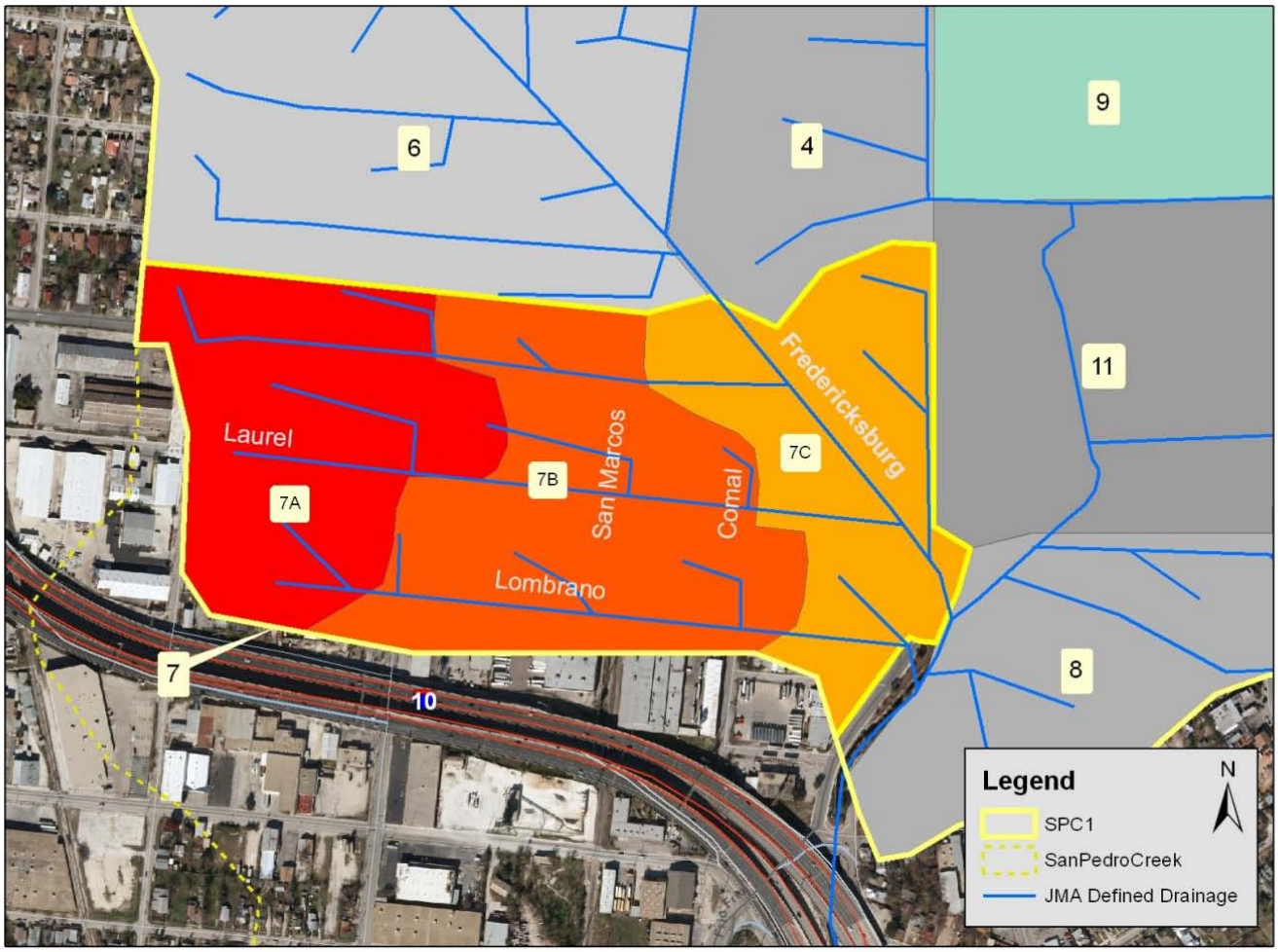

Figure 2-4: Collection Areas in a Subwatershed

These collection areas are of generally similar land use and range in size from 10-30 acres. Illustrating the collection area was immensely useful in identifying what land area is contributing to each potential receiving BMP as well as how the land area conceptually flows into a future BMP. In most cases new infrastructure would need to be built to capture the runoff and convey it to the BMP. These methods of collection and conveyance were considered on a conceptual level and shown in the drainage paths. However, they were not explicitly illustrated or designed as a part of this study.

2.3 BMP SELECTION

Candidate BMPs for bacterial reduction have been reviewed in previous reports (JMA, 2012), and selected BMPS were applied in the previous task (JMA, 2013). For the present analysis, BMP methods were chosen based on the characteristic of the subwatersheds and flow paths. In nearly all cases of this study, bioretention ponds were selected as the best option. Previous reports have demonstrated that bioretention ponds are efficient stand-alone BMPs for bacteria removal, and they are generally applicable where space is very limited for pre-treatment options and BMP suites.

Another BMP that was selected for use in the present analysis was a grassy infiltrating swale. A combination between an infiltration trench and a grassy swale, this BMP combines the aesthetics of a grassy swale with the infiltration and bacteria removal of an infiltration trench. In the present analysis, a grassy infiltrating swale would have ponding/retention capacity and would not directly convey water back into the storm sewer during a runoff event. Grassy infiltrating swales were potentially prescribed along the roadside of certain residential neighborhoods where a grassy right-of-way exists in between the edge of road and the sidewalk.

2.4 RUNOFF CALCULATIONS

Runoff calculations for preliminary BMP sizing were performed according to the impervious cover method used previously in this study (LCRA, 2007). Runoff was calculated for the 1-year design storm, which is equal to 1.93 inches. Typically, the application of this runoff calculation is used to size a BMP in order to capture the entirety of the design storm. However, in a highly urbanized retrofit scenario, as is the case here, it is perhaps overly optimistic that enough land could be purchased in order to achieve 100% capture. Therefore, runoff calculations were made for each collection area and BMPs were designed as large as the available parcel size would permit. It was assumed a BMP would collect runoff until reaching its design volume, at which point a flow splitting device would divert all excess runoff back into the regular storm sewer conveyance system. Design of an actual flow diversion/flow splitting structure would require detailed engineering considerations that are not within the scope of this study. This method was considered advantageous because even if only an initial percentage of flow is captured before bypass, the peak pollutant concentrations are generally found at the beginning of storms and it is most important to at least capture this percentage of the runoff (Hydroscience, Inc., 1979)

In each collection area there were four different types of land uses that were considered: Public, Residential, Open, and Road & Commercial Bldg. It may be valuable to know from which land

use runoff is originating, therefore a different runoff calculation was made for each of the different land use classifications. Figure 2-5 shows drainage calculations from SPC1-2B.

Watershed: **SPC1**
Subwatershed: **SPC1-2**
Collection Area: **SPC1-2B**

1 Year Storm Event 1.93 inches
Drainage Area (DA)
Impervious Cover Area (IC)
Effective Impervious Cover (IC_eff=IC/DA)
RA = Runoff Volume (inches) = [0.05+(0.0085*IC_eff)]*1.93
WQV = Water Quality Volume = DA*RA*(43560/12)

Drainage Area	**1** Public	**2** Residential	**3** Open	**4** Road & Bldgs.
DA (acres)	0.685	9.945	0.384	6.920
IC (acres)	0.014	4.995	0.047	4.760
IC_eff (%)	2.1%	50.2%	12.3%	68.8%
RA (inches)	0.130	0.920	0.298	1.225
WQV (ft^3)	324	33,226	415	30,767

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Figure 2-5: Example Runoff Calculation

No GIS layer of impervious cover was available for this study, so in order to estimate the imperviousness of the land, hand calculations were made for representative areas. Typically the region of interest was visually inspected using area measurement tools in GIS, impervious surfaces were outlined and their areas summed. Where land use was very similar from one collection area to the next, the percent imperviousness was reused instead of hand calculating over a new region. Figure 2-6 shows how the impervious surface area was calculated for the residential drainage area of SPC1-2B.

Figure 2-6: Impervious Surface Area Calculation

2.5 PUBLIC SITES

A common practice in stormwater management is to offer tax breaks and incentives to properties that regulate their own stormwater with low impact development and BMPs. In this study it was hypothesized that public parcels should strive to accomplish on-site retrofit BMPs to return runoff to the level of predevelopment conditions. For this reason, on each contributing Public property, a cursory investigation of an aerial photo was performed to determine whether retrofits appeared feasible. On public lots where it was obviously impractical to require contained on-site runoff, it was either deemed possible to capture no runoff from the site or at least 50%. For public lots that appeared to have enough undeveloped area or free space to construct BMPs that could capture all of the sites runoff, it was considered that the site would capture 100% of onsite runoff. Figure 2-7 demonstrates how the runoff generated by the public drainage area in SPC1-2B is captured on-site.

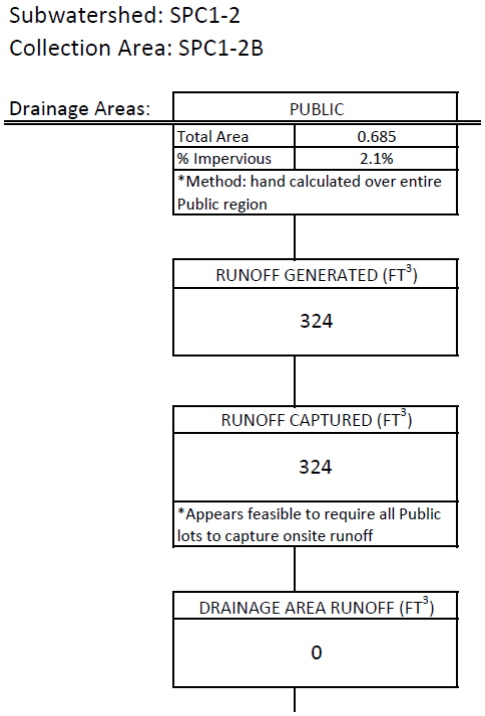

Figure 2-7: Public Onsite Runoff Capture

2.6 BIORETENTION POND

Bioretention pond volumes were calculated based on design methods referenced previously (LCRA, 2007). Pond depths were not to exceed 1 ft and the capture volume was reduced by 5% to accommodate for the reduction in available storage due to deposition of solids in the time between full-scale maintenance activities. Figure 2-8 shows calculations for the capture volume of the bioretention system for SPC1-2B.

The capture volume is the runoff volume that is captured and retained by the BMP. There are two potential pathways for the captured runoff. In some systems, the captured volume is eventually lost via subsurface infiltration into the underlying soil media. In other systems, subsurface drains may be provided so that treated runoff can exit back to the surface drainage conveyance system. This is a detail for final design and layout of BMPs. As a conservative measure, all the capture volumes calculated in this report consider a bioretention system that is limited to its physical volume retention capacity, i.e. no underdrains. If an underdrain were to be included, the total volume captured may increase because the pond would concurrently be draining through the biofilter media as runoff was filling the pond.

Site:	**Pond 1: Public land owned by San Antonio Water System near railroad tracks in a low density residential block.**
Subwatershed:	**SPC1-2**
Collection Area:	**SPC1-2B**

1 Year Storm Event:	1.93	inches
WQV (previously calculated):	64,409	ft^3
Available Land Area:	16,496	ft^2
Conceptual Bioretention Depth:	1	ft max
Pond Volume: (Land Area X Depth)		
Pond Storage Capacity: (Pond Volume/1.05)		

BMP Type	1 Bioretention
WQV (ft^3)	64,409
Available Land Area (ft^2)	16,496
Pond Volume (ft^3)	16,496
Pond Storage Capacity (ft^3)	15,710

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Figure 2-8: Bioretention Pond Capacity Calculation

2.7 SUMMARY

For each collection area analysis, a flow chart was made demonstrating the runoff generated and volumes captured by assigned BMPs. A final analysis of the proposed improvements to the collection area SPC1-2B is summarized in Figure2-9.

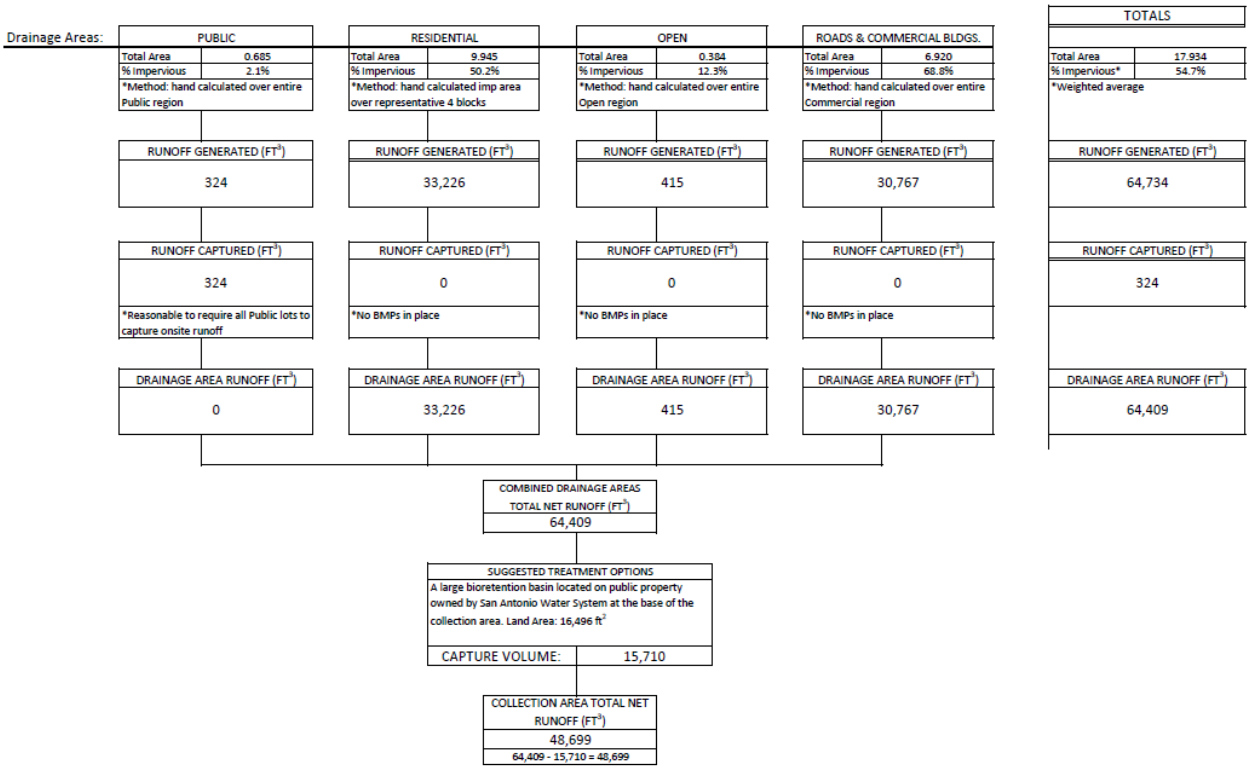

Figure 2-9: Collection Area Calculations Summary

3.0 APPLICATION TO SUBWATERSHED SPC1

In this section, the application of the methodology for BMP implementation will be described for the various subwatershed areas that comprise the SPC1 subwatershed of San Pedro Creek. A total of 11 subwatersheds were delineated for uppermost San Pedro Creek. Each of these subwatersheds was further defined in terms of identifiable runoff collection areas. For each collection area, a BMP implementation scheme was developed.

3.1 SPC1-1

3.1.1 OVERVIEW

SPC1-1 is the largest subwatershed of SPC1. Its land use is primarily residential and there are few public or open land opportunities to be acquired for BMP sites. Table 3-1 summarizes the land use of each collection area in SPC1-1.

Table 3-1: Collection Area Land Use

SPC1-1	Area (acres)	% Imp. Cover	Primary Land Use
1A	87.203	44.6%	Residential
1B	10.541	61.1%	Residential
1C	4.494	67.3%	Residential
1D	5.47	70.7%	Rd. & Comm.
TOTAL	**107.708**	**48.5%**	

Figure 3-1 illustrates how the subwatershed was divided into four collection areas. Many of the properties labeled as Open Space are not actually vacant or open lots. It is presumed that they might have been open during the development of the GIS layer in 2006, but have more recently come to be developed.

The two public properties in SPC1-1 are not ideal locations for off-site runoff to be diverted into large scale BMPs. This is because Monte Vista Montessori is located at the top of the areas subwatershed, and the Oblate Title Holding Corporation's land is fully developed. Both public properties were however considered as good locations for on-site runoff management. For this reason, it is shown in the runoff calculations that the public property runoff volume is subtracted from the overall collection area runoff.

Figure 3-1: SPC1-1 Distribution of Land Use

All of the runoff for SPC1-1 collects to a central point located on the property of Mark Twain Middle School, on San Pedro Ave. where Agarita Street intersects. Figure 3-2 illustrates the conceptual collection of runoff and where BMPs are strategically located.

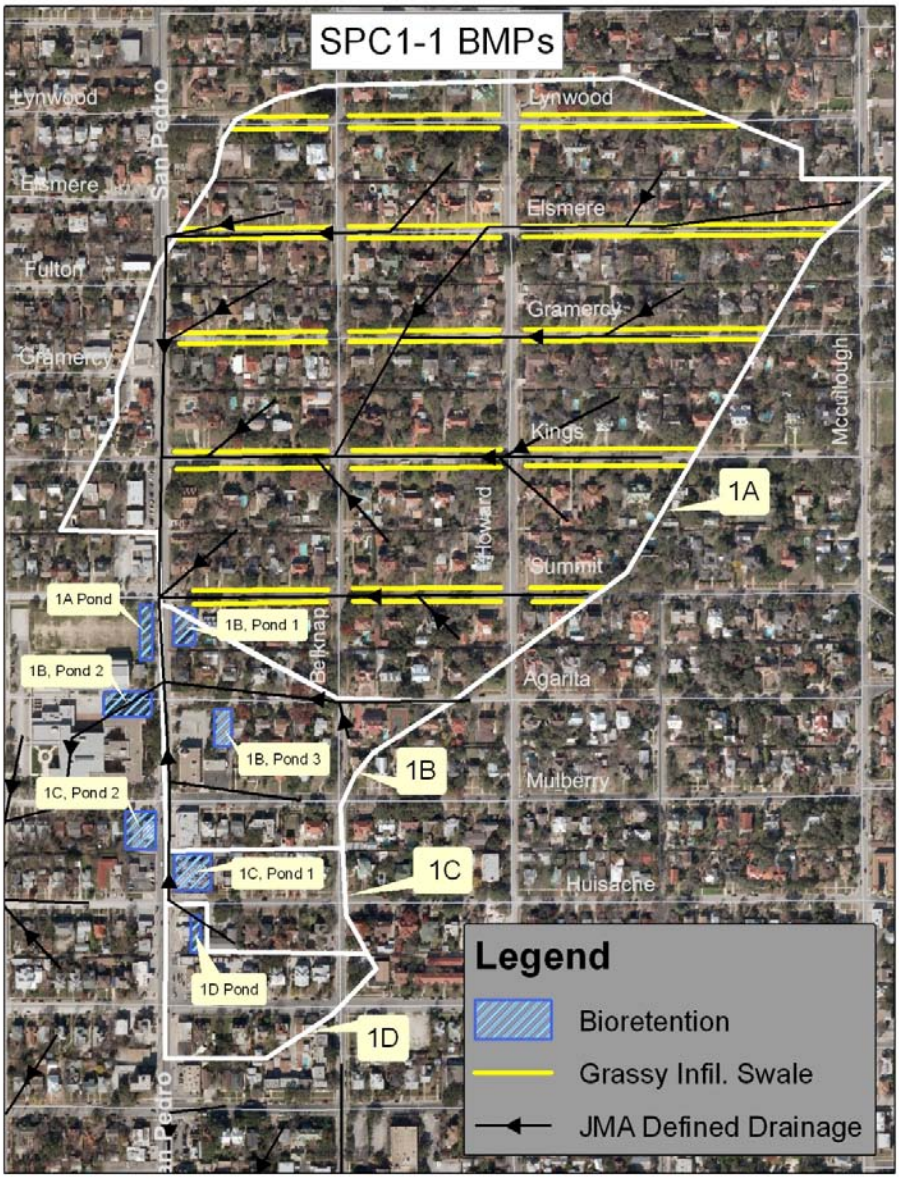

Figure 3-2: SPC1-1 Collection of Runoff and BMP Site Selection

Each of the collection areas in SPC1-1 are described in the following pages. Calculations of runoff quantities and BMP capture volumes are presented for each collection area in Appendix A.

3.1.2 SPC1-1A

1A is the largest collection area of the subwatershed and is primarily residential land use. Undeveloped open space is limited. One option would be to assume that various residential properties would be acquired and converted to BMP sites. Instead, for this study, grassy infiltrating swales were considered along the edge of the streets where a grass lined right of way exists between the sidewalk and the street. This BMP was estimated by JMA to capture 60% of the runoff generated from the residential lots. The 60% capture efficiency is a variable that takes into account the fact that some homes connect their roof and driveway runoff directly into the street, effectively bypassing the swale.

Another BMP site selected for 1A was at the East end of the soccer field owned by the public property of Mark Twain Middle School. This site was selected because it is located in a position where runoff from the entire collection area could be diverted to.

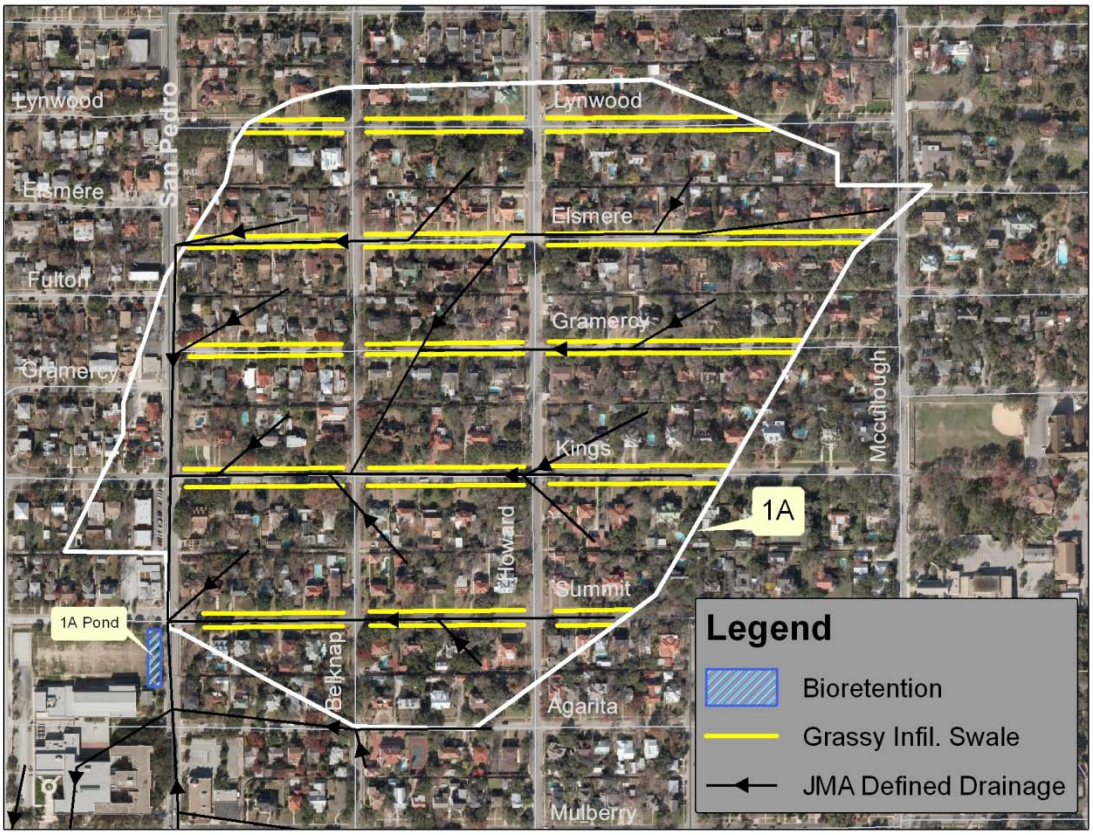

Figure 3-3: SPC1-1A BMP Sites

A summary of the runoff generated from 1A and the volume captured by BMPs is shown below.

Runoff Generated (ft^3)	Public Land On-Site Capture (ft^3)	Grassy Infiltrating Swales Capture (ft^3)	Bioretention Pond Capture (ft^3)	Total Capture (ft^3)	% Capture
262,401	2,069	102,626	7,563	112,258	42.8%

3.1.3 SPC1-1B

1B consists of a mix of residential and commercial land use. Three locations were identified as potential bioretention pond sites. The first site, shown in Figure 3-4, is a privately owned vacant lot.

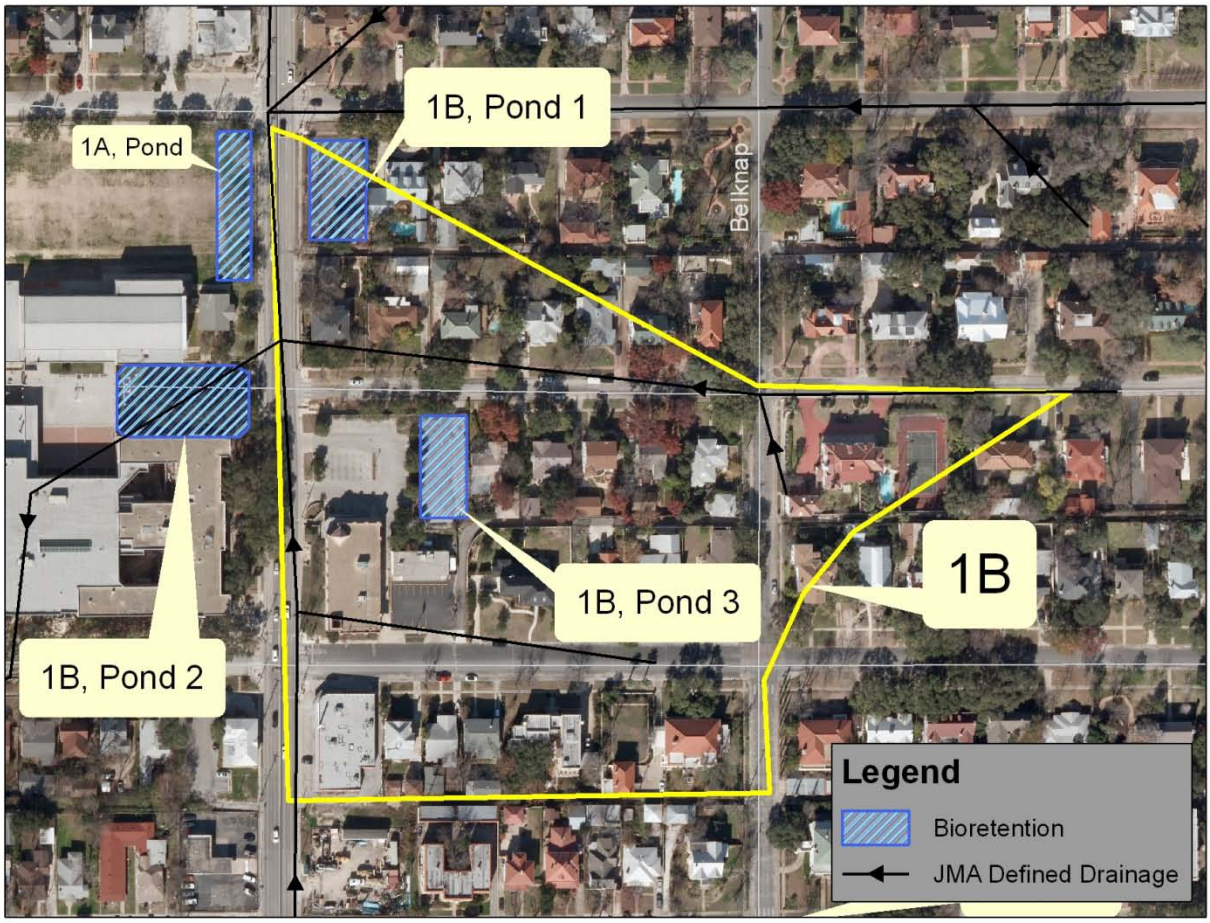

Figure 3-4: SPC1-1B BMP Sites

The second site is on public land owned by Mark Twain Middle School where it's apparent in Figure 3-5 that there appears to be a pond and some stormwater infrastructure for the school. This plan proposes to expand the pond and convert it to bioretention that will capture runoff from both the school and a portion of 1B. This pond may be a required detention facility, in which case replacing it with a bioretention might not be possible.

Figure 3-5: Stormwater Management Behind Mark Twain Middle School

The third bioretention pond site is located behind the parking lot of a privately owned commercial building. The lot appears to be vacant.

A summary of the combined capture volume of the three bioretention ponds is shown below.

Runoff Generated (ft^3)	Public Land On-Site Capture (ft^3)	Bioretention Ponds Capture (ft^3)	Total Capture (ft^3)	% Capture
42,189	N/A	29,076	29,076	68.9%

3.1.4 SPC1-1C

1C is primarily residential land use with some Commercial activity. Two sites were selected for bioretention ponds. The first site is a privately owned equipment yard on San Pedro Ave. that was selected because of its location and low level of development. The second site is across San Pedro Ave., and proposes to convert much of the publicly owned parking lot owned by San Antonio ISD into a bioretention pond. These two options are shown in Figure 3-6.

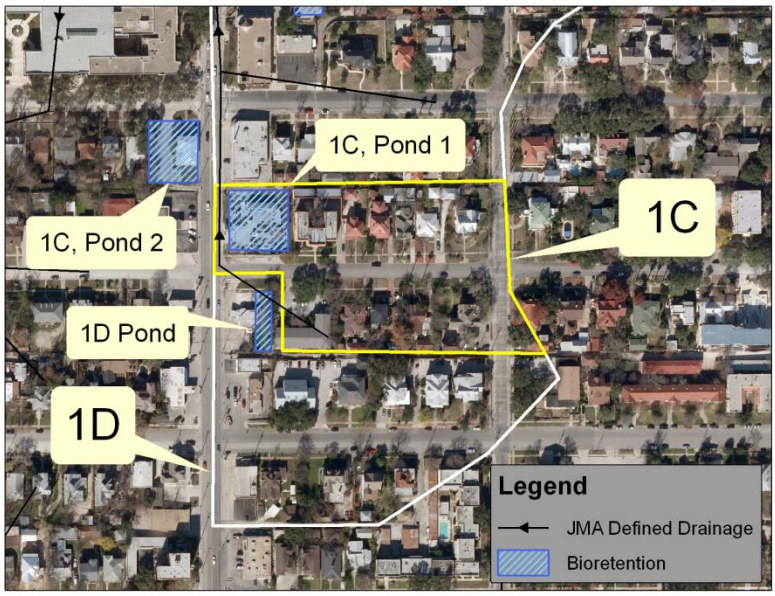

Figure 3-6: SPC1-1C BMP Sites

A summary of the combined capture volume of the two bioretention ponds proposed to treat the collection area runoff of 1C is shown below.

Runoff Generated (ft^3)	Public Land On-Site Capture (ft^3)	Bioretention Ponds Capture (ft^3)	Total Capture (ft^3)	% Capture
19,579	N/A	16,400	16,400	83.8%

3.1.5 SPC1-1D

1D is primarily Commercial land use and has the highest % Imperviousness of SPC1-1. One potential BMP site was identified on a privately owned open space behind a Commercial building on San Pedro Ave. This site was selected because it is located at the base of the collection area where runoff could be diverted to and the land was undeveloped. Figure 3-7 illustrates the location of the proposed bioretention pond.

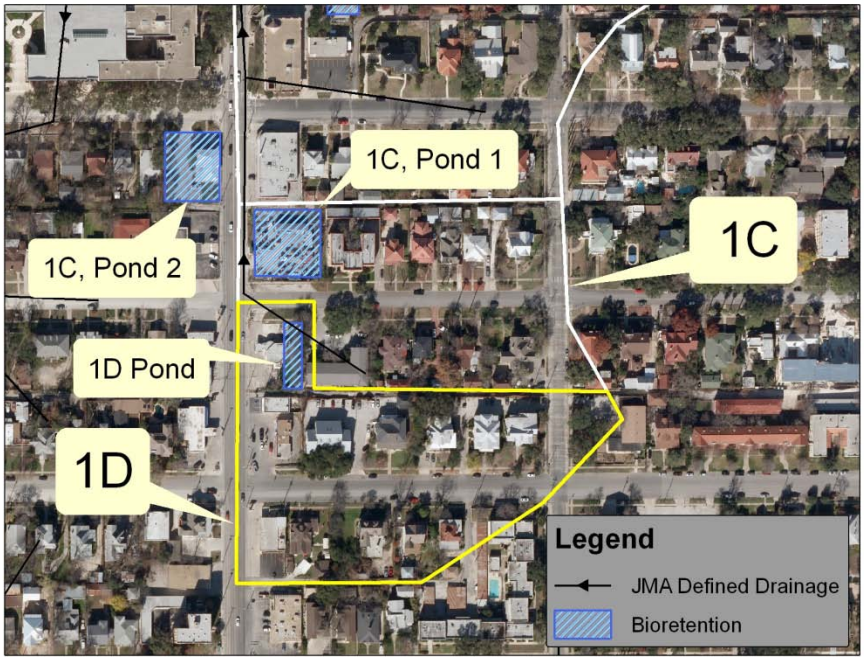

Figure 3-7: SPC1-1D BMP Sites

A summary of the capture volume of the proposed bioretention pond for 1D is shown below.

Runoff Generated (ft^3)	Public Land On-Site Capture (ft^3)	Bioretention Ponds Capture (ft^3)	Total Capture (ft^3)	% Capture
24,930	738	14,495	15,233	61.1%

3.1.6 SPC1-1 SUMMARY

The combined efforts of the BMPs selected over the four collection areas would represent a substantial 49.5% capture and treatment of runoff from the design storm. Table 3-2 summarizes BMP capture information for SPC1-1.

Table 3-2: Subwatershed SPC1-1 Treatment Summary

Collection Area	Runoff Generated (ft^3)	Total Capture (ft^3)	% Capture
1A	262,401	112,258	42.8%
1B	42,189	29,076	68.9%
1C	19,579	16,400	83.8%
1D	24,930	15,233	61.1%
SPC1-1 Total	**349,099**	**172,967**	**49.5%**

3.2 SPC1-2

3.2.1 OVERVIEW

SPC1-2 consists of a moderately dense residential neighborhood that lies on the east side of the rail road tracks running through SPC1. Table 3-3 summarizes the imperviousness of the land use throughout each of the three collection areas. A complete calculation of the impervious cover is shown in the runoff calculations of Appendix A.

Table 3-3: SPC1-2 Collection Area Land Use

SPC1-2	Area (acres)	% Imp. Cover	Primary Land Use
2A	65.925	53.9%	Residential
2B	17.934	54.7%	Residential
2C	19.321	61.4%	Residential/Comm.
TOTAL	**103.18**	**55.4%**	

On the following page Figure 3-8 illustrates the division of the subwatershed into collection areas 2A, 2B, and 2C. There were many public and open spaces dispersed throughout the subwatershed.

Figure 3-8: SPC1-2 Distribution of Land Use

All of the subwatershed flows west towards the rail road tracks and then collects in stormwater infrastructure to flow south. Figure 3-9 illustrates the conceptual collection of runoff and where BMPs are located to capture drainage.

Figure 3-9: SPC1-2 Collection of Runoff and BMP Site Selection

3.2.2 SPC1-2A

2A is the largest collection area of the subwatershed and is mostly residential with Mark Twain Middle School located at the top. The runoff of 2A flows west and is captured on Ripley St. Figure 3-10 shows the collection As in 1A, Grassy Infiltrating swales were considered along the edge street to capture 60% of residential runoff.

Along the edge of the rail road tracks there is a long, grassy, open area that was considered for linked bioretention ponds. There is currently stormwater infrastructure in place at this location.

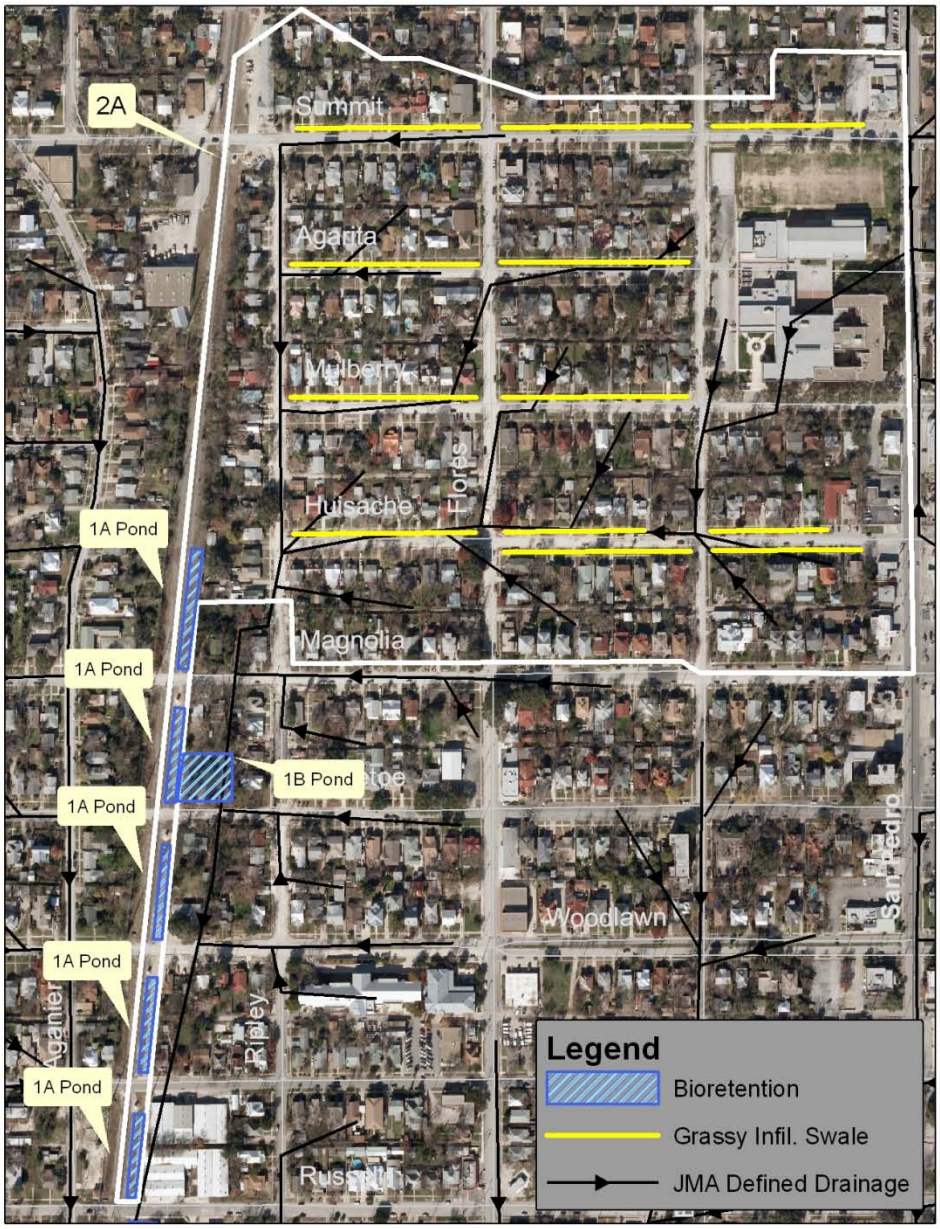

Figure 3-10: SPC1-2A BMP Sites

A summary of runoff generated by 2A and the volume captured by BMPs is presented below.

Runoff Generated (ft^3)	Public Land On-Site Capture (ft^3)	Grassy Infil. Swales Capture (ft^3)	Bioretention Ponds Capture (ft^3)	Total Capture (ft^3)	% Capture
234,501	30,187	118,104	29,947	178,238	76.0%

3.2.3 SPC1-2B

2B consists of residential neighborhoods, however, unlike 2A there was not a large enough right-of-way between the street and the sidewalk to consider grassy infiltrating swales. At the base of the collection area, an undeveloped public property owned by San Antonio Water System was identified as potential BMP site for bioretention. Figure 3-11 illustrates the location.

Figure 3-11: SPC1-2B BMP Sites

A Summary of the impact this bioretention pond would have is shown below.

Runoff Generated (ft^3)	Public Land On-Site Capture (ft^3)	Bioretention Ponds Capture (ft^3)	Total Capture (ft^3)	% Capture
64,734	324	15,710	16,034	24.8%

3.2.4 SPC1-2C

2C contains an even mix of residential and commercial land use and has one large contributing public property owned by Seraphic Sisters, Inc. It was considered that the site of Seraphic Sisters could implement on-site BMPs to capture 100% of its runoff.

At the base of the collection area a bioretention pond was proposed over an undeveloped section of land adjacent to the railroad tracks. This location is illustrated in Figure 3-12 and a photo viewing the location from French St. is shown in Figure 3-13.

Figure 3-12: SPC1-2C BMP Site

Figure 3-13: Proposed Bioretention Site

A summary of the runoff generated by 2C and the volume captured by bioretention is presented below.

Runoff Generated (ft^3)	Public Land On-Site Capture (ft^3)	Bioretention Ponds Capture (ft^3)	Total Capture (ft^3)	% Capture
77,386	15,845	23,919	39,764	51.4%

3.2.5 SPC1-2 SUMMARY

The combined efforts of the BMPs selected over the three collection areas would represent a substantial 62.1% capture and treatment of runoff from a design storm. Table 3-4 summarizes BMP capture information for SPC1-2.

Table 3-4: Subwatershed SPC1-2 Treatment Summary

Collection Area	Runoff Generated (ft^3)	Total Capture (ft^3)	% Capture
2A	234,501	178,238	76.0%
2B	64,734	16,034	24.8%
2C	77,386	39,764	51.4%
SPC1-2 Total	**376,621**	**234,036**	**62.1%**

3.3 SPC1-3

3.3.1 OVERVIEW

SPC1-3 is primarily residential with a mix of commercial businesses and public properties dispersed throughout. Figure 3-14 shows the subwatershed and its four collection areas along and names all the public property owners. SPC1-3 is bounded by the railroad tracks along its eastern edge.

For this subwatershed it was considered that all the public properties could capture 100% of on-site runoff. This fact is represented in the runoff calculations summarized later in this section as well as shown in further detail in the calculation pages of Appendix A.

Table 3-5 summarizes the land use and % imperviousness of the subwatershed.

Table 3-5: SPC1-3 Collection Area Land Use

SPC1-3	Area (acres)	% Imp. Cover	Primary Land Use
3A	13.409	53.9%	Commercial
3B	22.046	54.7%	Residential
3C	37.349	61.4%	Residential
3D	26.773	65.8%	Residential
TOTAL	**103.18**	**55.4%**	

Figure 3-14: SPC1-3 Distribution of Land Use

The runoff from SPC1-3 flows west to east towards the railroad tracks, converges and then flows south to Ashby St. Figure 3-15 illustrates the conceptual drainage collection of the runoff and where large-scale BMPs are strategically located to capture regional stormwater.

Figure 3-15: SPC1-3 Collection of Runoff and BMP Site Selection

3.3.2 SPC1-3A

3A is the smallest of the collection areas and the most impervious. An area in the middle of a residential block was selected as a potential BMP site. This location has development on it and is advantageously located to direct off-site runoff for treatment. Figure 3-16 illustrates the location selected for the bioretention pond.

Figure 3-16: SPC1-3A BMP Sites

A summary of the runoff generated from the collection area and the volume captured by the bioretention system proposed is shown below.

Runoff Generated (ft^3)	Public Land On-Site Capture (ft^3)	Bioretention Ponds Capture (ft^3)	Total Capture (ft^3)	% Capture
60,574	8,504	11,747	20,251	33.4%

3.3.3 SPC1-3B

3B collects residential runoff and runs it down Aganier St to a proposed bioretention pond located in the back lot of a public property owned by The Spiritual Assembly of Baha"is of Sa Etal. This site was selected because it is public and area is undeveloped .Figure 3-17 illustrates the proposed BMP site.

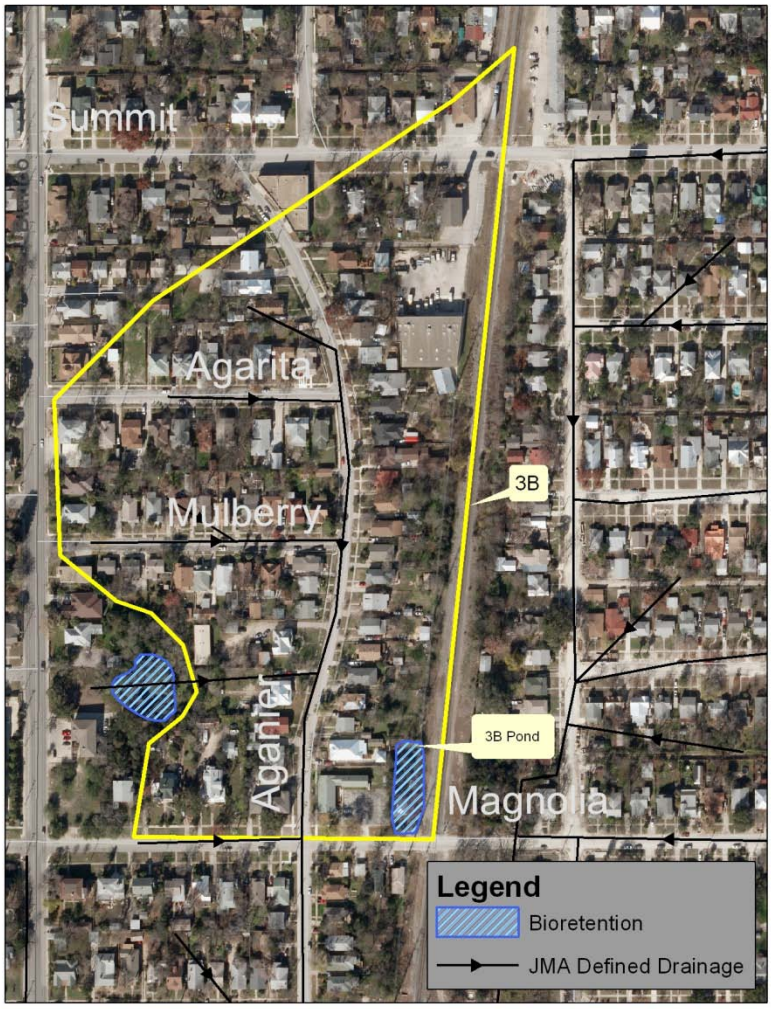

Figure 3-17: SPC1-3B BMP Site

A summary of the runoff generate by 3B and the volume captured by BMPs is shown below.

Runoff Generated (ft^3)	Public Land On-Site Capture (ft^3)	Bioretention Ponds Capture (ft^3)	Total Capture (ft^3)	% Capture
71,046	2,154	10,091	12,245	17.2%

3.3.4 SPC1-3C

3C consists of mainly residential land use. Two adjacent locations were identified as potential bioretention pond sites right next to the railroad tracks. Both locations are publicly owned by the City Public Service Board. Figure 3-18 shows the location of the two bioretention ponds.

Figure 3-18: SPC1-3C BMP Sites

The photo in Figure 3-19 is facing south towards the site from the intersection of Aganier and Craig.

Figure 3-19: SPC1-3C BMP Site

The impact of the two bioretention ponds on the overall collection area runoff is summarized below.

Runoff Generated (ft^3)	Public Land On-Site Capture (ft^3)	Bioretention Ponds Capture (ft^3)	Total Capture (ft^3)	% Capture
153,101	4,963	14,543	19,506	12.7%

3.3.5 SPC1-3D

3D is primarily residential land, but also contains a significant portion of highly impervious Rd. & Comm. Bldg. land use. Runoff from the area flows along the conceptual drainage shown in Figure 3-20 and it was considered that the runoff could be collected into the bioretention pond shown. The site selected for the bioretention pond is largely undeveloped and privately owned.

Figure 3-20: SPC1-3D BMP Site

A summary of the runoff generated from SPC1-3D and the capture volume of the BMP proposed is shown below.

Runoff Generated (ft^3)	Public Land On-Site Capture (ft^3)	Bioretention Ponds Capture (ft^3)	Total Capture (ft^3)	% Capture
114,205	51	17,554	17,605	15.4%

3.3.6 SPC1-3 SUMMARY

The combined efforts of the BMPs selected over the four collection areas would represent a 17.4% capture and treatment of runoff from a design storm. Table 3-4 summarizes BMP capture information for SPC1-3.

Table 3-6: Subwatershed SPC1-3 Treatment Summary

Collection Area	Runoff Generated (ft^3)	Total Capture (ft^3)	% Capture
3A	60,574	20,251	33.4%
3B	71,046	12,245	17.2%
3C	153,101	19,506	12.7%
3D	114,205	17,605	15.4%
SPC1-3 Total	**398,926**	**69,607**	**17.4%**

3.4 SPC1-4

3.4.1 OVERVIEW

SPC1-4 is mostly a higher density residential subwatershed. At its most southern collection area, 4D, the land use becomes primarily commercial. Table 3-7 summarizes the land use statistics of the subwatershed.

Table 3-7: SPC1-4 Collection Area Land Use

SPC1-4	Area (acres)	% Imp. Cover	Primary Land Use
4A	54.938	66.0%	Residential
4B	6.119	57.3%	Residential
4C	15.095	68.0%	Residential
4D	15.218	67.1%	Commercial
TOTAL	**91.37**	**65.9%**	

On the next page, Figure 3-12 illustrates the land use over the subwatershed. There are many public properties and the subwatershed is adjacent to San Pedro Park which offers an expansive land area for large scale BMPs. In a cursory inspection it was considered unreasonable to enact zero runoff from each public property. This was because many of the public properties were so highly impervious and space for on-site BMPs was severely limited.

Figure 3-21: SPC1-4 Distribution of Land Use

The runoff for SPC1-4 collects to two different areas; either into San Pedro Park, or along the railroad tracks on the western edge of the subwatershed down to Fredericksburg Street. Figure 3-22 illustrates the conceptual drainage paths for the subwatershed along with the BMP sites selected to capture runoff.

Figure 3-22: SPC1-4 Collection of Runoff and BMP Site Selection

3.4.2 SPC1-4A

4A is the largest collection area of the subwatershed and is primarily a higher density residential land use. The public properties in 4A are characterized by a large building with a parking lot structure. The level of imperviousness for these properties was measured to be 82.2%. It was considered that, with some considerable effort, all public lots could strive to accomplish a 50% capture of on-site runoff. At the northwest corner of San Pedro Park a large BMP site was selected for a bioretention facility, this site is illustrated in Figure 3-23.

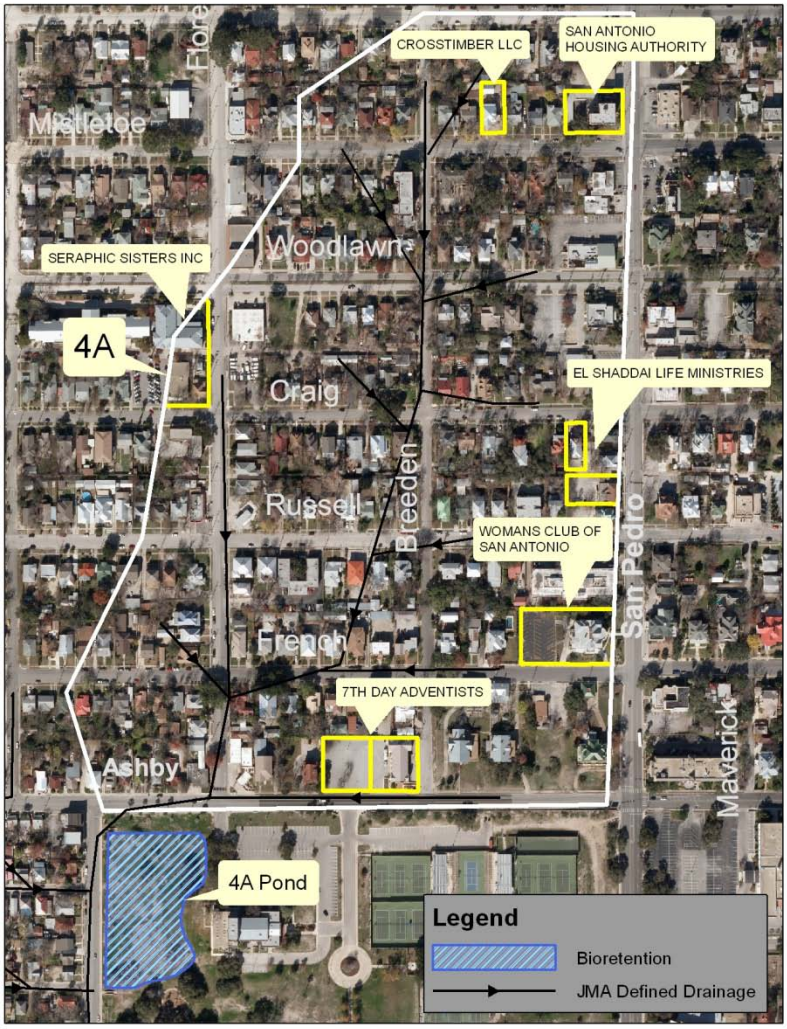

Figure 3-23: SPC 1-4A BMP Sites

Below is a summary of the runoff generated by 4A and the impact of the proposed BMPs.

Runoff Generated (ft^3)	Public Land On-Site Capture (ft^3)	Bioretention Ponds Capture (ft^3)	Total Capture (ft^3)	% Capture
235,058	8,169	85,265	93,434	39.7%

3.4.3 SPC1-4B

4B is a smaller collection area that is mostly residential in land use. The BMP site was selected to be on a vacant lot of land in between two private residences. Figure 3-24 illustrates the site selected.

Figure 3-24: SPC 1-4B BMP Sites

A summary of the runoff generated by 4B and the volume captured by BMPs is presented below.

Runoff Generated (ft^3)	Public Land On-Site Capture (ft^3)	Bioretention Ponds Capture (ft^3)	Total Capture (ft^3)	% Capture
23,037	N/A	6,390	6,390	27.7%

3.4.4 SPC1-4C

4C is residential and contains some public properties that are very developed. It was considered in this study that 50% of the public runoff could be captured by on-site BMPs. The runoff from the rest of the collection area flowed east onto Flores Street and into a bioretention pond located in San Pedro Park. Figure 3-25 illustrates the public properties and the bioretention facility of 4C.

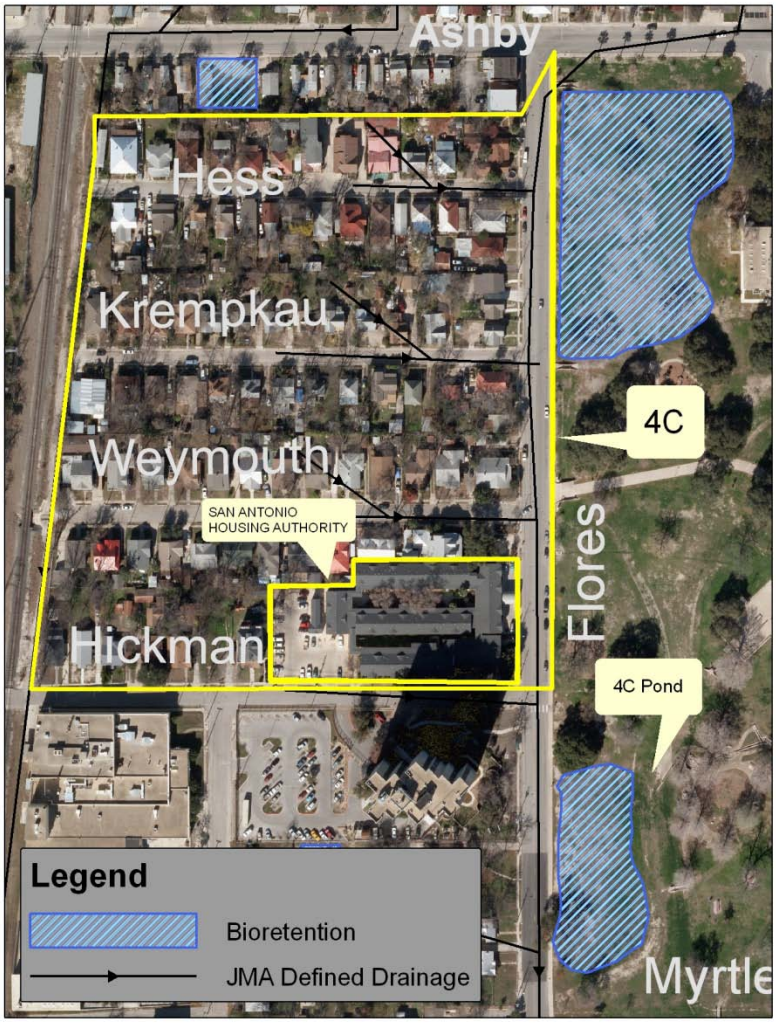

Figure 3-25: SPC1-4C

A summary of the runoff generated by 4C and the volume captured by BMPs is presented below.

Runoff Generated (ft^3)	Public Land On-Site Capture (ft^3)	Bioretention Ponds Capture (ft^3)	Total Capture (ft^3)	% Capture
66,458	4,409	34,122	38,531	58.0%

3.4.5 SPC1-4D

4D contains a significant portion of low density residential properties and commercial land use. There is one large public property owned by the San Antonio Housing Authority and it was considered possible for 100% on-site runoff capture. The site selected for a BMP was located on a vacant privately owned open area. Figure 3-26 illustrates the public land and the bioretention pond placement.

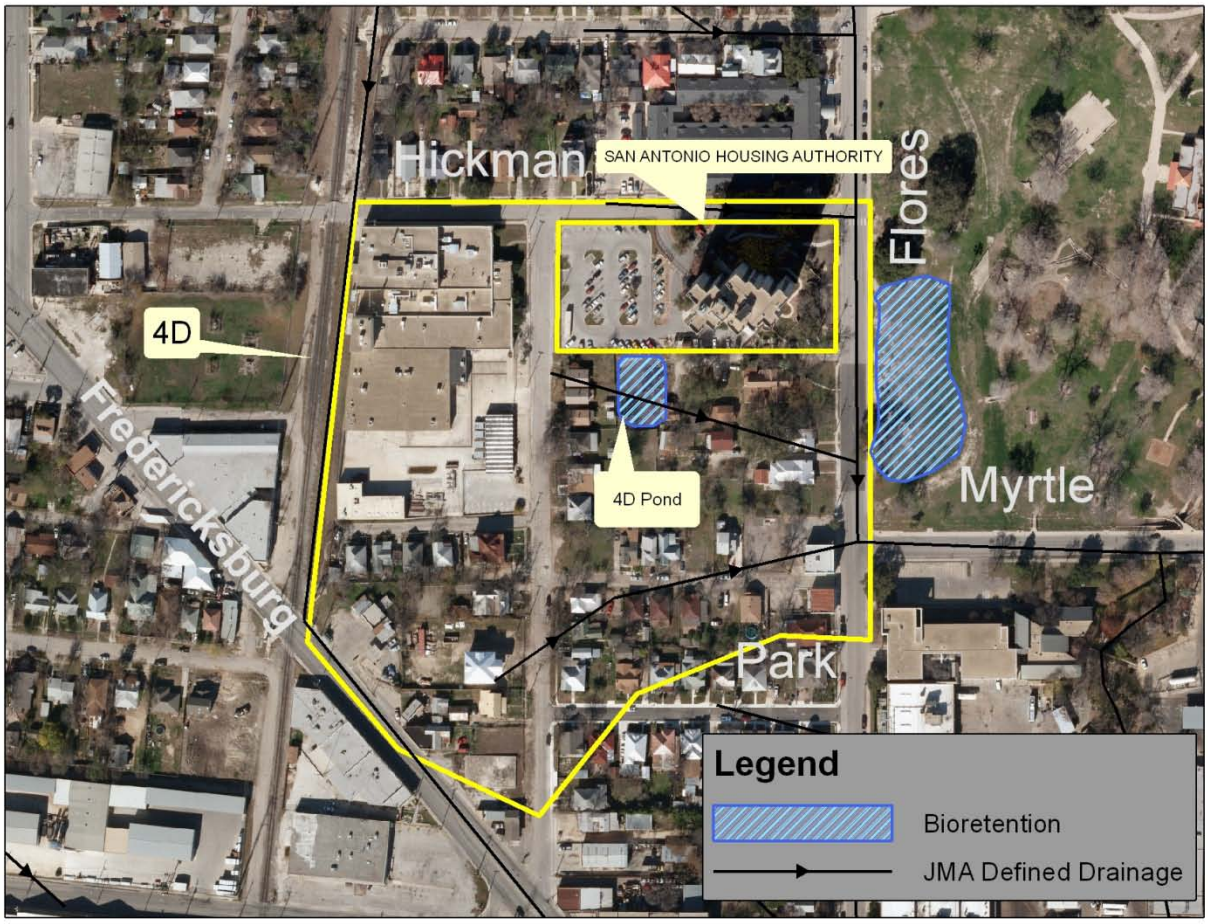

Figure 3-26: SPC1-4D BMP Site

A summary of the runoff generated and the volume captured by BMPs is presented below.

Runoff Generated (ft^3)	Public Land On-Site Capture (ft^3)	Bioretention Ponds Capture (ft^3)	Total Capture (ft^3)	% Capture
66,141	9,178	7,269	16,447	24.9%

3.4.6 SPC1-4 SUMMARY

The combined efforts of the large scale BMPs and the public on-site capture represented 39.6% of capture and runoff treatment from the design storm. Table 3-8 summarizes this information.

Table 3-8: Subwatershed SPC1-4 Treatment Summary

Collection Area	Runoff Generated (ft^3)	Total Capture (ft^3)	% Capture
4A	235,058	93,434	39.7%
4B	23,037	6,390	27.7%
4C	66,458	38,531	58.0%
4D	66,141	16,447	24.9%
SPC1-4 Total	**390,694**	**154,802**	**39.6%**

3.5 SPC1-5

3.5.1 OVERVIEW

SPC1-5 is a mostly commercial region with a high percent of imperviousness. The public land in this region is primarily associated with the Alamo Community College. On the next page, Figure 3-27 illustrates the land use of the region.

Table 3-9: SPC1-5 Collection Area Land Use

SPC1-5	Area (acres)	% Imp. Cover	Primary Land Use
5A	20.631	72.9%	Residential
5B	1.360	58.2%	Commercial
5C	8.294	69.4%	Residential/Comm.
5D	16.364	76.9%	Public
5E	42.874	68.4%	Commercial
TOTAL	**89.523**	**70.9%**	

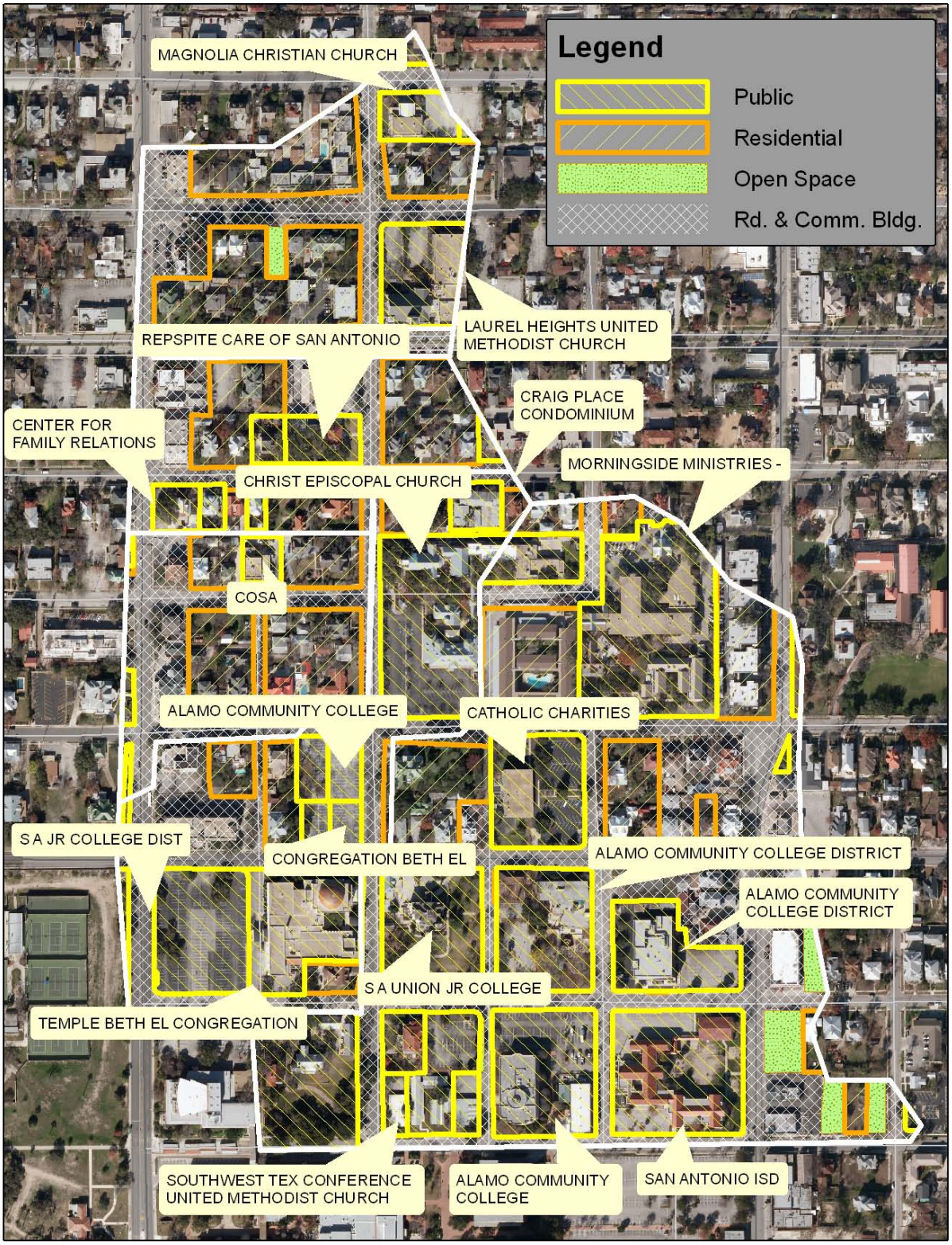

Figure 3-27: SPC1-5 Distribution of Land Use

The drainage for SPC1-5 flows west in the northern portion of the subwatershed and collects along San Pedro Ave to flow south. In the southern portion of the subwatershed the drainage flows south and collects at point where 5E Pond 4 is marked in Figure 3-28.

Figure 3-28: SPC1-5 Collection of Runoff and BMP Site Selection

3.5.2 SPC1-5A & B

5A and 5B were considered to be one collection area, but for the purposes of runoff calculations were shown as two. 5A collects runoff from land use that 8.9 acres residential and 7.6 acres commercial. The runoff flows west to a bioretention facility that is located in the back lot of a public property owned by El Shaddai Life Ministries. This location was chosen based on the public properties location at the base of the collection area and due to the fact that the land area was undeveloped. The collection area of 5B represents the region of runoff that could be captured by a grassy infiltrating swale in the median of Woodlawn. Figure 3-29 illustrates the two BMP sites for 5A and 5B.

Figure 3-29: SPC1-5A & B BMP Sites

A summary of the runoff generated by 5A and the volume captured by BMPs is presented below.

Collection Area	Runoff Generated (ft^3)	Public Land On-Site Capture (ft^3)	Bioretention Pond Capture (ft^3)	Total Capture (ft^3)	% Capture
5A	96,816	17,817	3,608	21,425	22.1%

A summary of the runoff generated by 5B and the volume captured by the grassy infiltrating swales is presented below. A 6,000 ft^3 capture volume was estimated for the swale based on land area available.

Collection Area	Runoff Generated (ft^3)	Grassy Infiltrating Swales Capture (ft^3)	Total Capture (ft^3)	% Capture
5B	5,185	6,000	6,000	100%

3.5.3 SPC1-5C

5C is largely residential and flows in the direction of two public areas at the base of the collection area. These two areas are shown in the locations marked by 5C Pond 1 and 2 in Figure 3-30.

The area occupied by Pond 1 is owned by the Women's Club of San Antonio and is currently used as lawn space.

Pond 2 is on lawn space that is partially owned by the City of San Antonio and partially privately owned.

Figure 3-30: SPC1-5C BMP Sites

A summary of the runoff generated by 5C and the volume captured is presented below.

Runoff Generated (ft^3)	Public Land On-Site Capture (ft^3)	Bioretention Pond Capture (ft^3)	Total Capture (ft^3)	% Capture
37,161	1,709	7,791	9,500	25.6%

3.5.4 SPC1-5D

5D is highly commercial land use and most of the commercial properties are public. It was considered after a cursory investigation that while 100% of public runoff seems unattainable, public properties should strive to capture 50% of on-site runoff. The locations of the BMP sites and an illustration of the public properties is shown in Figure 3-31.

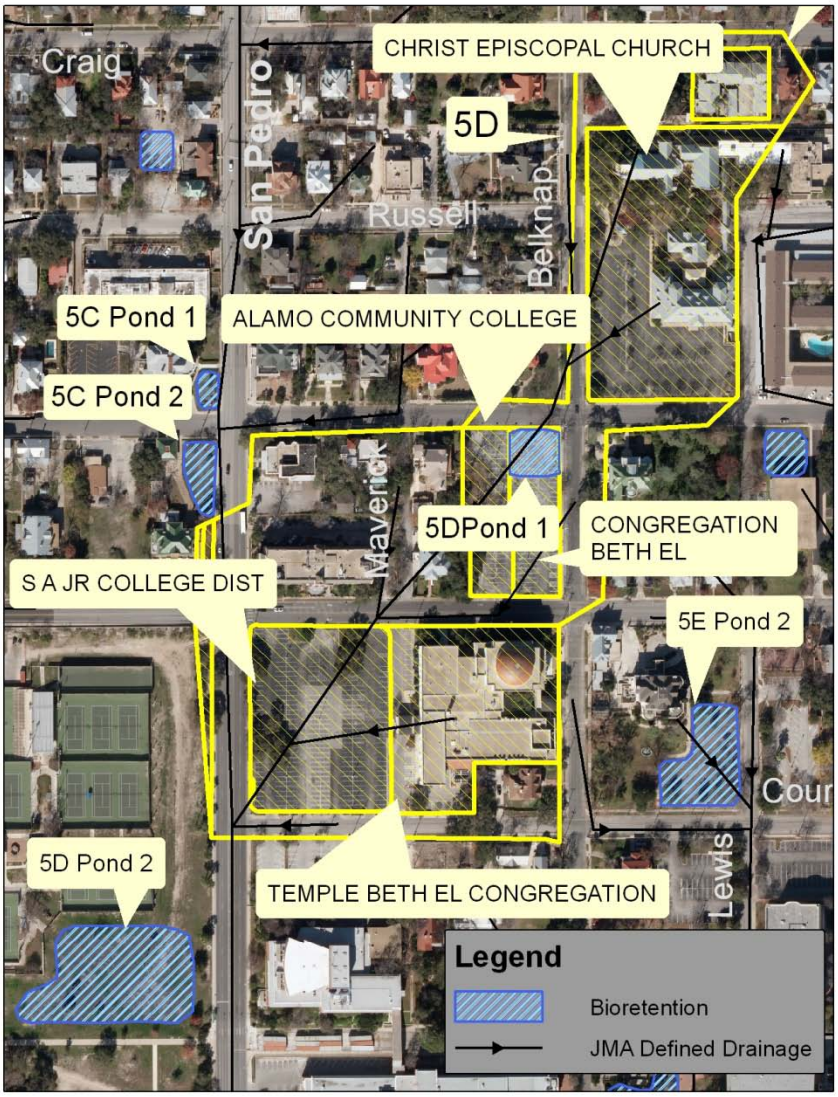

Figure 3-31: SPC1-5D BMP Sites

A summary of the runoff generated by 5D and the volume captured by BMPs is shown below.

Runoff Generated (ft^3)	Public Land On-Site Capture (ft^3)	Bioretention Pond Capture (ft^3)	Total Capture (ft^3)	% Capture
80,714	21,824	49,257	71,081	88.1%

3.5.5 SPC1-5E

5E is heavily commercial land use, and the majority of the collection area consists of public properties. Because of the high volume of public properties available, four sites were selected for large scale BMPs. The four locations are shown in Figure 3-32.

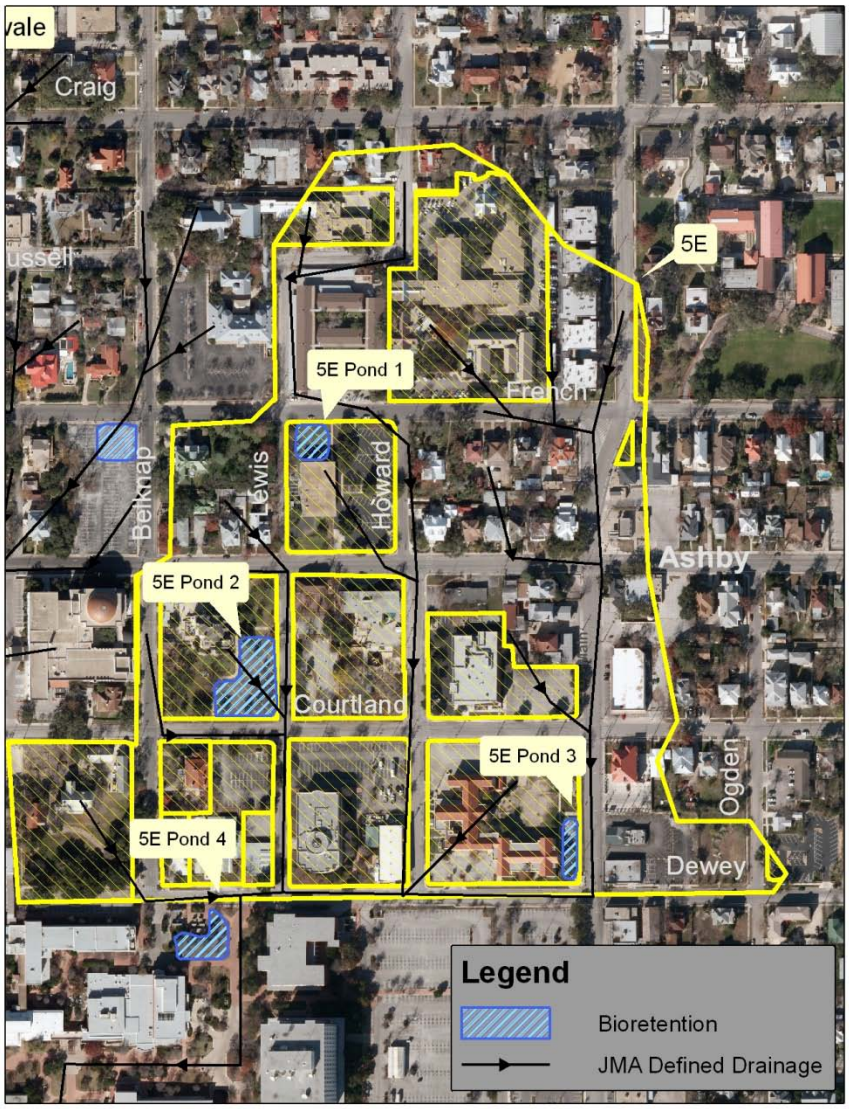

Figure 3-32: SPC1-5E BMP Sites

Pond 1 is on the property of a public lot owned by Catholic Charities.

Pond 2 is on the property of a public lot owned by S.A. Union Jr. College

Pond 3 is on the property of a public lot owned by San Antonio ISD

Pond 4 is on the property of a public lot owned by Alamo Community College.

All the ponds utilize either a green space or an undeveloped portion their respective property. It was also considered that 50% of all the public properties runoff in 5D could be captured by on-site BMPs.

A summary of the runoff generated by the collection area as well as the volume captured by BMPs is presented below.

Runoff Generated (ft^3)	Public Land On-Site Capture (ft^3)	Bioretention Pond Capture (ft^3)	Total Capture (ft^3)	% Capture
188,806	39,887	35,570	75,457	40%

3.5.6 SPC1-5 SUMMARY

The combined efforts of the BMPs selected over the SPC1-5 subwatershed represent a substantial 45% rate of capture and treatment from the design storm. Table 3-10 summarizes this information

Table 3-10: Subwatershed SPC1-5 Treatment Summary

Collection Area	Runoff Generated (ft^3)	Total Capture (ft^3)	% Capture
5A	96,816	21,425	22.1%
5B	5,185	6,000	100%
5C	37,161	9,500	25.6%
5D	80,714	71,081	88.1%
5E	188,806	75,457	40%
SPC1-4 Total	**408,682**	**183,463**	**44.9%**

3.6 SPC1-6

3.6.1 OVERVIEW

SPC1-6 is a mix of residential and commercial land use with the imperviousness values summarized below in Table 3-11.

Table 3-11: SPC1-6 Collection Area Land Use

SPC1-6	Area (acres)	% Imp. Cover	Primary Land Use
6A	15.841	58.1%	Residential
6B	17.155	62.0%	Residential
6C	12.539	51.3%	Residential/Comm.
6D	20.651	67.1%	Residential/Comm.
6E	18.256	52.8%	Residential
TOTAL	84.442	58.9%	

Land use is commercial along Fredericksburg and low to medium density housing in the residential regions. There was a cluster of public properties near the top portion of the subwatershed and a good distribution of open land areas in lower receiving areas. Figure 3-33 illustrates the land use distribution over SPC1-6.

Figure 3-33: SPC1-6 Distribution of Land Use

The runoff from SPC1-6 collects along Fredericksburg and is transported via storm sewer gravity mains directly to an outfall into San Pedro Creek. Figure 3-34 illustrates the collection of runoff in the subwatershed and where BMPs could be placed throughout to capture and treat runoff.

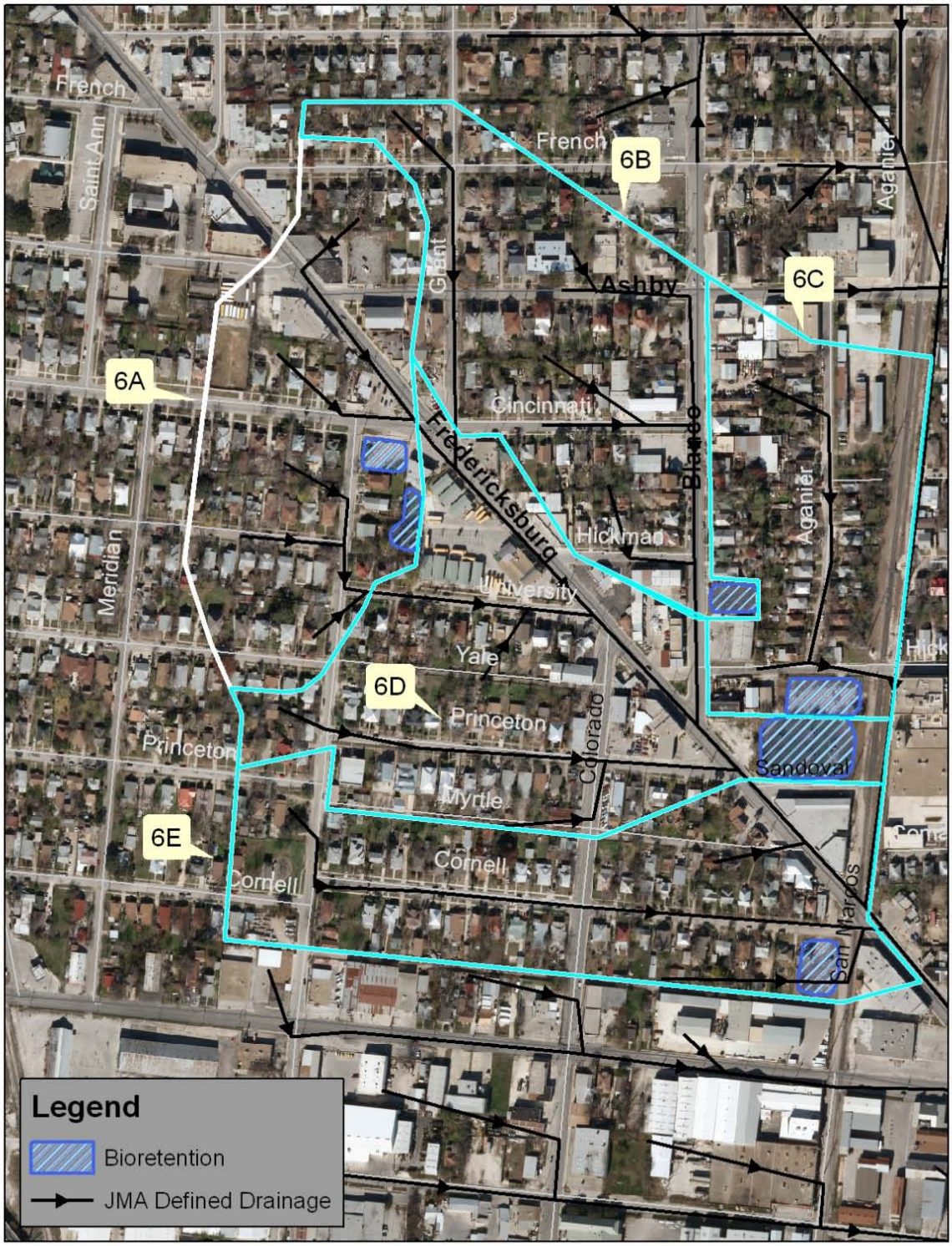

Figure 3-34: SPC1-6 Collection of Runoff and BMP Site Selection

3.6.2 SPC1-6A

6A is residential with nine public property lots distributed in the receiving portion of the collection area. Figure 3-35 illustrates the collection of runoff and capture into two bioretention ponds located in the vacant areas of public properties owned by Bexar County and Youth Empowerment Services, Inc.

Figure 3-35: SPC1-6A BMP Sites

A summary of the runoff generated and volume captured by the BMPs prescribed is shown below.

Runoff Generated (ft^3)	Public Land On-Site Capture (ft^3)	Bioretention Pond Capture (ft^3)	Total Capture (ft^3)	% Capture
60,381	8,377	16,358	24,735	41%

3.6.3 SPC1-6B

6B is primarily residential land use. The runoff from 6B flows east on residential streets and collects on Blanco. Near the intersection of Blanco and Hickman a privately owned vacant lot was selected as a BMP site for bioretention. Figure 3-36 illustrates the collection of runoff towards the bioretention pond at Hickman and Blanco.

Figure 3-36: SPC1-6B BMP Sites

A summary of the runoff generated by 6B and the volume captured and treated by BMPs is shown below.

Runoff Generated (ft^3)	Public Land On-Site Capture (ft^3)	Bioretention Pond Capture (ft^3)	Total Capture (ft^3)	% Capture
69,347	515	8,486	9,001	13.0%

3.6.4 SPC1-6C

6C contains land use that is primarily commercial and residential. The commercial land use is mostly industrial with a high degree of imperviousness, but also includes the rail road tracks which were considered to have no impervious area. The flow drains from the residential and industrial land use into Aganier and flows into a bioretention pond site at the intersection of Hickman. This site was selected because the land, although privately owned, is vacant and completely undeveloped. Figure 3-37 illustrates the collection of runoff and the BMP site selected.

Figure 3-37: SPC1-6C

A summary of the runoff generated and the volume captured by bioretention is presented below.

Runoff Generated (ft^3)	Public Land On-Site Capture (ft^3)	Bioretention Pond Capture (ft^3)	Total Capture (ft^3)	% Capture
42,682	N/A	17,713	17,713	41.5%

3.6.5 SPC1-6D

6D contains a considerable portion of both residential and commercial land use. At the top of the collection area is a large runoff contributing public property owned by Youth Empowerment Services, Inc. This property was considered for its own on-site runoff treatment. At the base of the collection area a large privately owned vacant lot was selected for the site of a bioretention basin. This pond location is illustrated in Figure 3-38.

Figure 3-38: SPC1-6D BMP Site

A summary of the runoff generated by 6D and the volume captured by BMPs is presented below.

Runoff Generated (ft^3)	Public Land On-Site Capture (ft^3)	Bioretention Pond Capture (ft^3)	Total Capture (ft^3)	% Capture
89,747	10,485	36,986	47,471	52.9%

3.6.6 SPC1-6E

Collection area 6E is a low impervious surface area residential region. Runoff was considered to flow from the residential lots onto Cornell and east towards the bioretention pond specified in Figure 3-39 shown below. There were no public properties to be considered for this region and so a privately owned vacant lot was selected.

Figure 3-39: SPC1-6E BMP Sites

A summary of the runoff generated by 6D and the volume captured by BMPs is presented below.

Runoff Generated (ft^3)	Public Land On-Site Capture (ft^3)	Bioretention Pond Capture (ft^3)	Total Capture (ft^3)	% Capture
63,748	0	13,143	13,143	20.6%

3.6.7 SPC1-6 SUMMARY

The combined efforts of the BMPs selected over the five collection area of the subwatershed represent a 34.4% capture and treatment of runoff from the design storm over SPC1-6. Table 3-12 summarizes this information.

Table 3-12: Subwatershed SPC1-6 Treatment Summary

Collection Area	Runoff Generated (ft^3)	Total Capture (ft^3)	% Capture
6A	60,381	24,735	41.0%
6B	69,347	9,001	13.0%
6C	42,682	17,713	41.5%
6D	89,747	47,471	52.9%
6E	63,748	13,143	20.6%
SPC1-6 Total	**325,905**	**112,063**	**34.4%**

3.7 SPC1-7

3.7.1 OVERVIEW

Subwatershed SPC1-7 is almost entirely commercial land use. This makes the region very impervious and highly developed with few convenient areas for large scale BMPs. Table 3-13 summarizes the imperviousness of the subwatershed and each collection area.

Table 3-13

SPC1-7	Area (acres)	% Imp. Cover	Primary Land Use
7A	22.054	80.7%	Commercial
7B	26.761	90.1%	Commercial
7C	19.992	82.0%	Commercial
TOTAL	**68.807**	**84.7%**	

Figure 3-40 illustrates the land use distributed over the subwatershed. There are public properties spread along the outer edges of the collection area, very few of which would make a suitable large scale BMP site location.

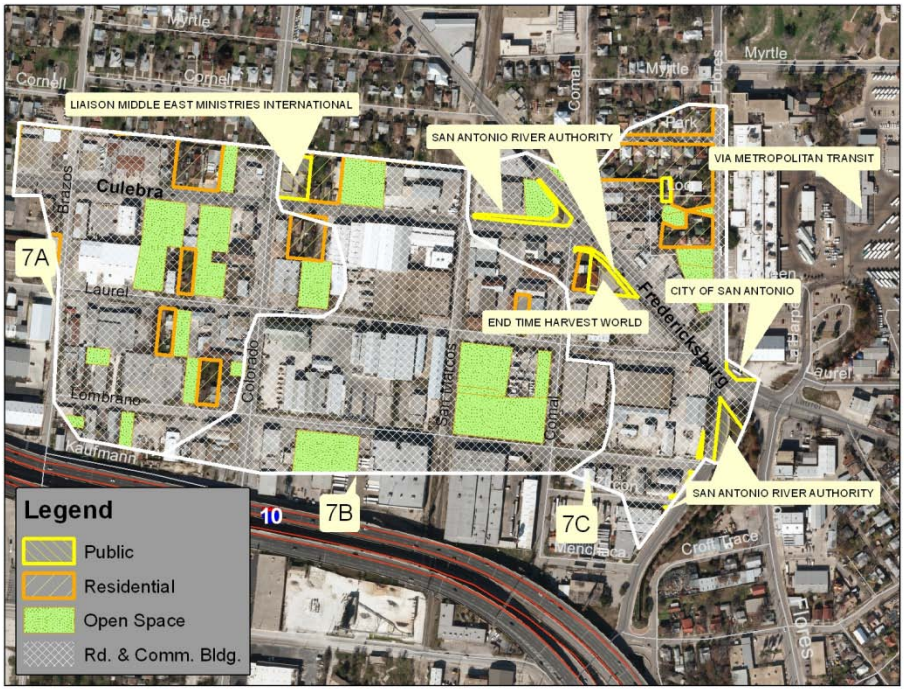

Figure 3-40: SPC1-7 Distribution of Land Use

Sites that were selected according to land use and drainage are illustrated in figure 3-41 below.

Figure 3-41: SPC1-7 Collection of Runoff and BMP Site Selection

3.7.2 SPC1-7A

7A is located at the top of the subwatershed. Its land use is commercial and there were no public properties in the collection area boundaries, however many suitable locations were considered for large scale BMPs. These BMP sites are illustrated below in Figure 3-42.

Figure 3-42: SPC1-7A BMP Sites

A summary of the runoff generated by 7A and the volume captured by BMPs is presented below.

Runoff Generated (ft^3)	Public Land On-Site Capture (ft^3)	Bioretention Pond Capture (ft^3)	Total Capture (ft^3)	% Capture
113,756	0	26,026	26,026	22.9%

3.7.3 SPC1-7B

Collection area 7B is heavily commercial in land use. The buildings are nearly all associated with industrial activity and the region is 90.1% impervious. The runoff generated by the collection area flows east to collect on Fredericksburg. For this collection area, the topography suggests that it could be possible construct a storm sewer gravity main system to collect the flow along San Marco and run it south. Upon intersecting with Lombrano the storm sewer could flow east and discharge into the pond illustrated in Figure 3-43. This system would also prevent large flows and potential washouts across the railroad tracks running down San Marcos.

Figure 3-43: SPC1-7B BMP Site

A summary of the runoff generated by 7B and the volume captured by BMPs is shown below.

Runoff Generated (ft^3)	Public Land On-Site Capture (ft^3)	Bioretention Pond Capture (ft^3)	Total Capture (ft^3)	% Capture
153,023	2,213	12,944	15,157	9.9%

3.7.4 SPC1-7C

7C contains a residential neighborhood as well as a significant land area of commercial. At the base of the collection area is the San Pedro Creek. The only suitable area that was considered for a BMP site was on public land owned by the San Antonio River Authority. This site, directly next to the creek, is illustrated in Figure 3-44.

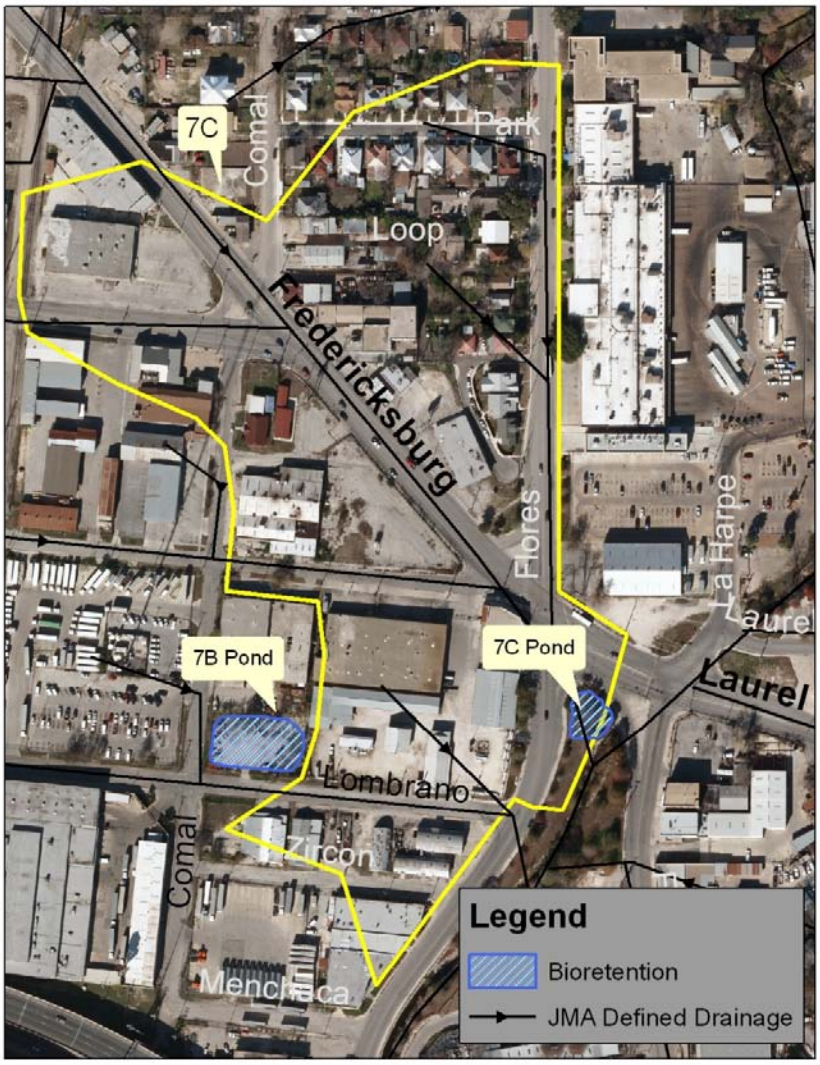

Figure 3-44: SPC1-7C BMP Site

A summary of the runoff generated by 7C and the volume captured by BMPs is presented below.

Runoff Generated (ft^3)	Public Land On-Site Capture (ft^3)	Bioretention Pond Capture (ft^3)	Total Capture (ft^3)	% Capture
104,596	3,092	4,466	7,558	7.2%

3.7.5 SPC1-7 SUMMARY

The combined efforts of the BMPs selected over the three collection areas would represent a 13.1% capture and treatment of the resultant flow from the design storm. Table 3-18 summarizes the results of the proposed measures.

Table 3-18: Subwatershed SPC1-7 Treatment Summary

Collection Area	Runoff Generated (ft^3)	Total Capture (ft^3)	% Capture
7A	113,756	26,026	22.9%
7B	153,023	15,157	9.9%
7C	104,596	7,558	7.2%
SPC1-1 Total	**371,375**	**48,741**	**13.1%**

3.8 SPC1-8

3.8.1 OVERVIEW

SPC1-8 is largely commercial land use and, in the lower portion contains some residential blocks. Figure 3-45 illustrates how the land use is distributed over the two collection areas.

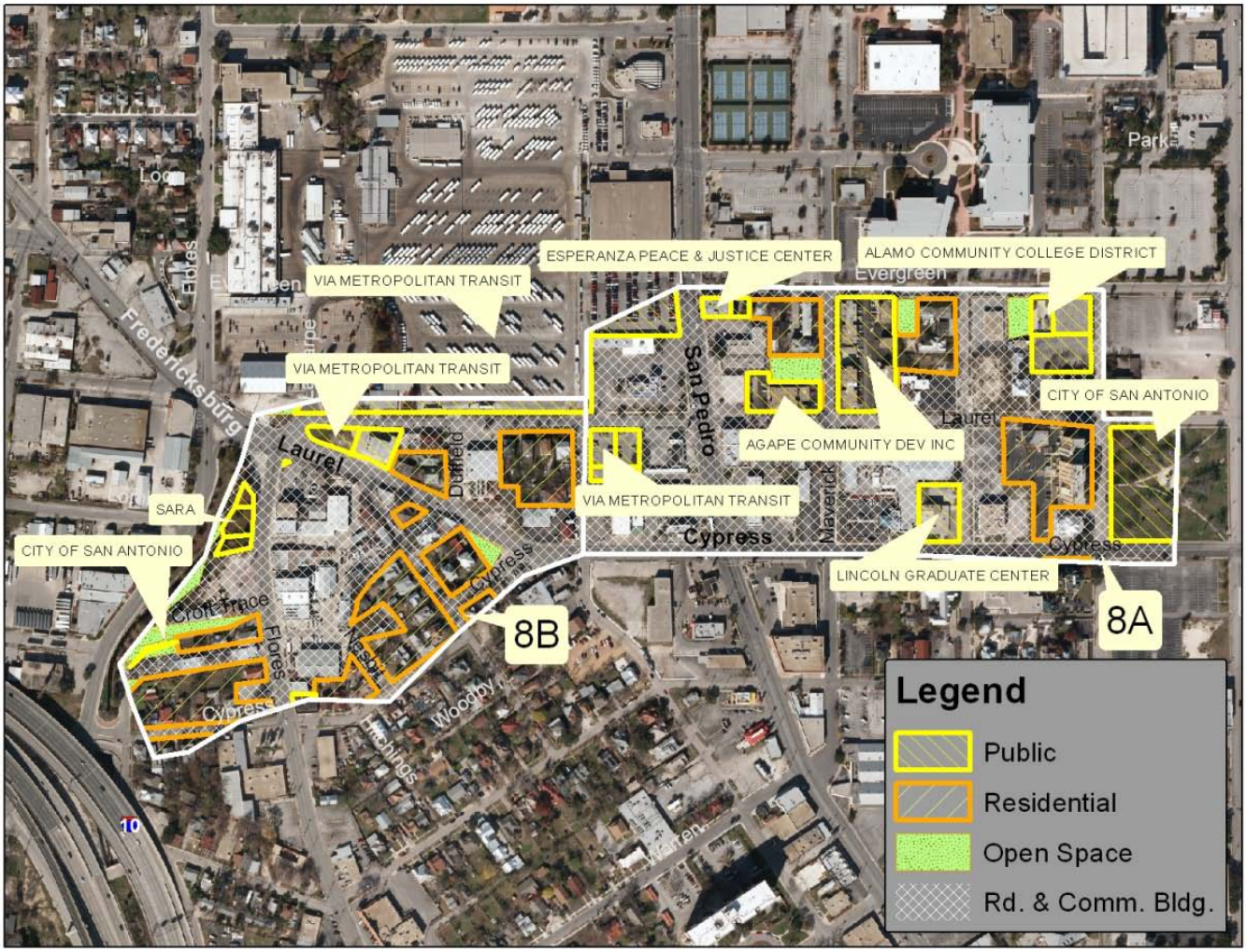

Figure 3-45: SPC1-8 Distribution of Land Use

Table 3-19 summarizes the land use and imperviousness for the collection areas of SPC1-8.

Table 3-19:SPC1-8 Collection Area Land Use

SPC1-8	Area (acres)	% Imp. Cover	Primary Land Use
8A	30.079	80.3%	Commercial
8B	21.546	73.1%	Commercial
TOTAL	51.625	77.3%	

The runoff from the 8A collection area flows onto Laurel and Flores then collects into stormwater infrastructure and outfalls into San Pedro Creek at the intersection of Fredericksburg and Laurel. The runoff from 8B flows west on either Laurel or Cypress and collects in storm sewer infrastructure along San Pedro, where it is directed to an outfall into San Pedro Creek within the Via Metropolitan Transit grounds. Figure 3-46 illustrates the collection of runoff drainage and shows the locations of several BMP sites suggested for runoff treatment.

Figure 3-46: SPC1-8 Collection of Runoff and BMP Site Selection

3.8.2 SPC1-8A

8A is Located at the top of the subwatershed and is mostly commercial and high density residential land use. Four sites were selected for large scale BMPs, these sites are illustrated in Figure 3-47 and a detailed description of the pond site and size is attached in Appendix A.

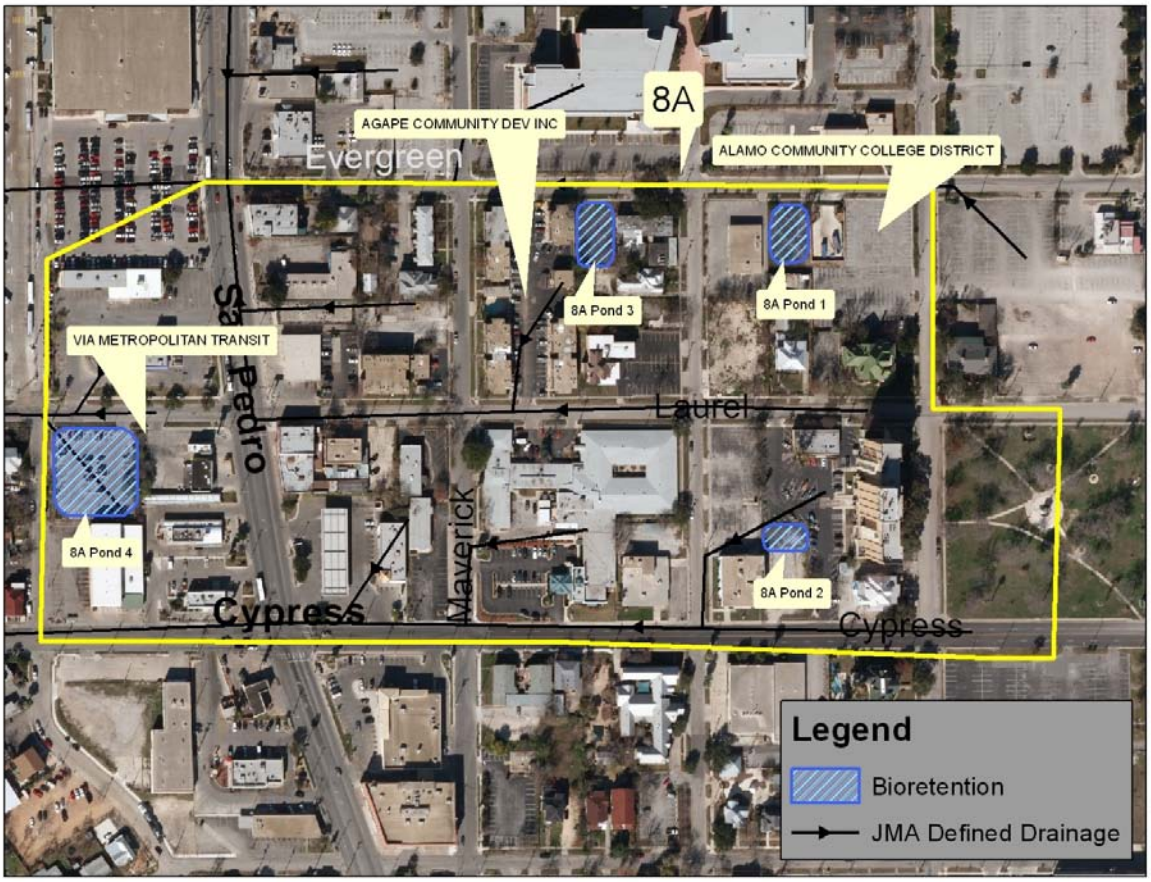

Figure 3-47: SPC1-8A BMP Sites

Because nearly all of the public land was used for off-site, large scale BMPs it was considered that there would be no room left for the public properties to handle their own stormwater runoff separately. For this reason, 0% of the public runoff was considered to be treated by on-site BMPs.

A summary of the runoff generated by 8A and the volume captured by BMPs is shown below.

Runoff Generated (ft^3)	Public Land On-Site Capture (ft^3)	Bioretention Pond Capture (ft^3)	Total Capture (ft^3)	% Capture
154,453	0	35,551	35,551	23.0%

3.8.3 SPC1-8B

8B is largely commercial land use and has a few block of residential land use intermixed. Runoff flows onto Laurel and Flores then converges to stormwater infrastructure at the intersection of the two streets and outfalls into San Pedro Creek. Shown in Figure 3-48 are two bioretention pond locations that would capture and treat runoff before its direct outfall into the creek. Both ponds are located on vacant land that is publicly owned. Pond 1's location is owned by Via Metropolitan Transit and Pond 2 is on land owned by San Antonio River Authority.

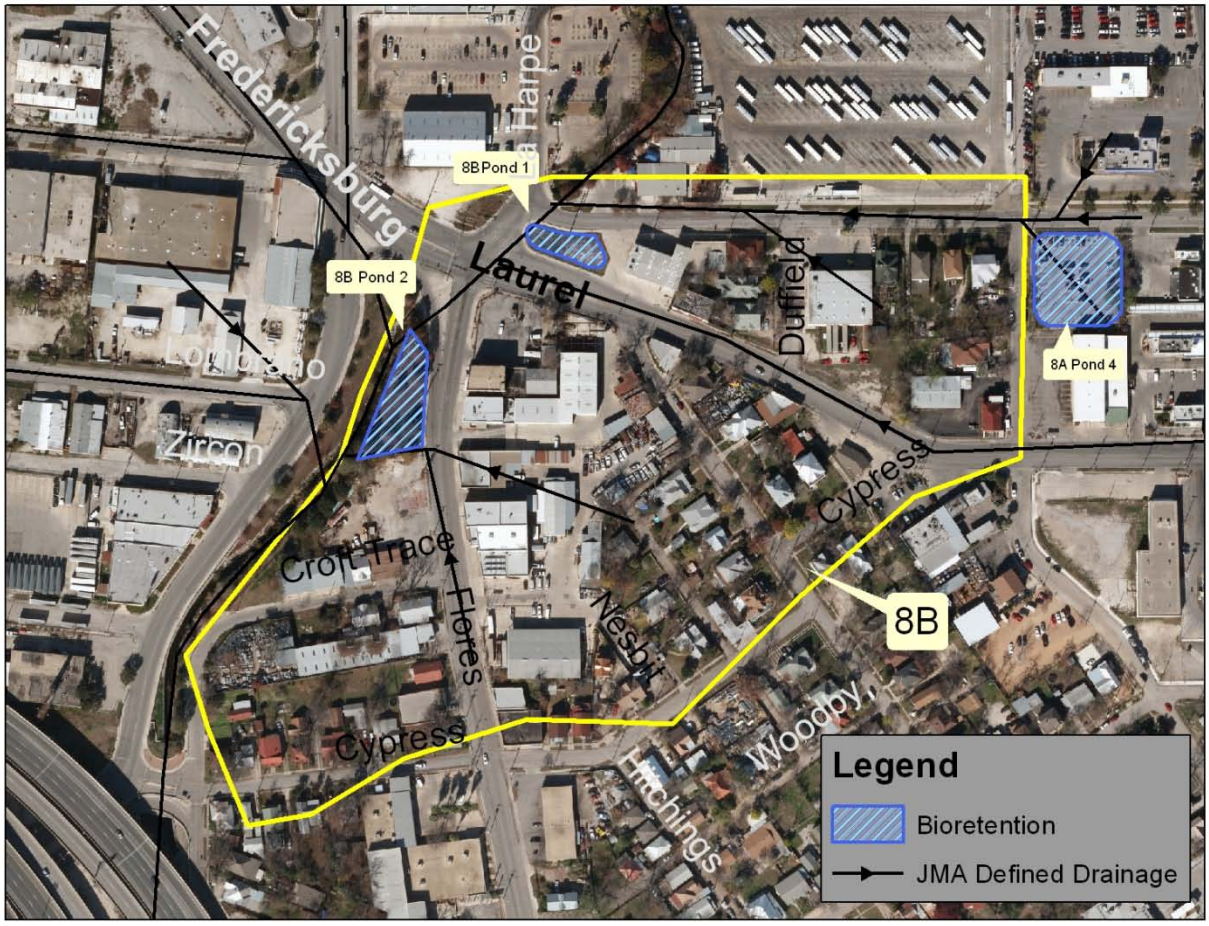

Figure 3-48: SPC1-8B BMP Sites

A summary of the runoff generated by 8B and the volume captured by BMPs is shown below.

Runoff Generated (ft^3)	Public Land On-Site Capture (ft^3)	Bioretention Pond Capture (ft^3)	Total Capture (ft^3)	% Capture
101,383	0	17,303	17,303	17.1%

3.8.4 SPC1-8 SUMMARY

Table 3-20 summarizes the efforts to capture and treat runoff from SPC1-8 subwatershed.

Table 3-20: Subwatershed SPC1-8 Treatment Summary

SPC1-8	Area (acres)	% Imp. Cover	Primary Land Use
8A	154,453	23.0%	Commercial
8B	101,383	17.1%	Commercial
TOTAL	**255,836**	**20.7%**	

3.9 SPC1-9

SPC1-9 is the area of San Pedro Park. The entire park area is public land and as such, the methodology of dividing the subwatershed into separate land uses is not applicable. For this region it was considered that a BMP was necessary to capture the runoff generated by the impervious area of the tennis courts shown in Figure 3-49.

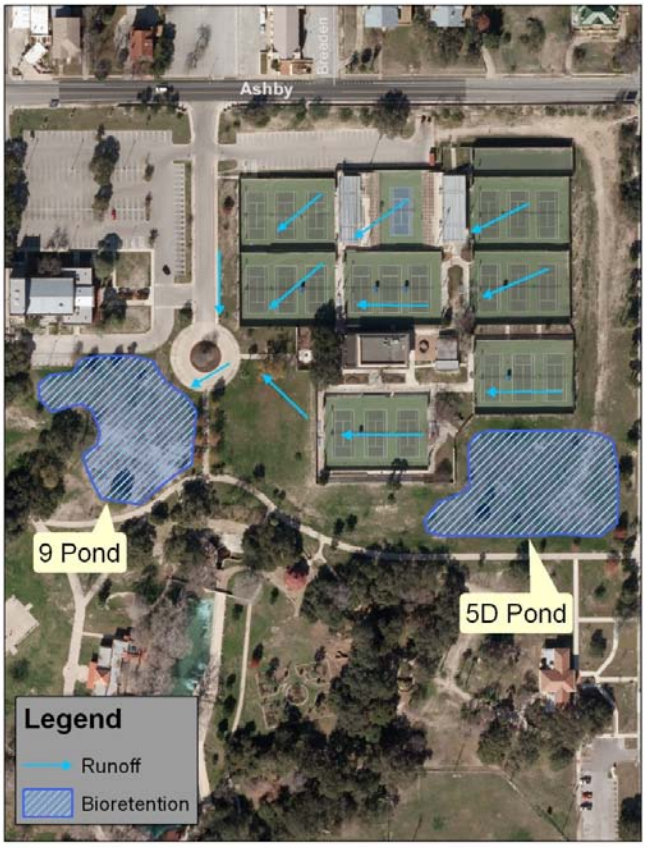

Figure 3-49: SPC1-9 BMP Site

All of San Pedro Park was calculated to have 27% imperviousness and a runoff calculation was performed for the entire area this is shown in Table 3-21. A summary of the runoff generated and the volume captured by BMPs is shown in Table 3-22.

Table 3-21: SPC1-9 Collection Area Land Use

SPC1-9	Area (acres)	% Imp. Cover	Primary Land Use
9	47.350	27%	Open
TOTAL	**47.350**	**20.7%**	

Table 3-22: Subwatershed SPC1-9 Treatment Summary

Collection Area	Runoff Generated (ft^3)	Total Capture (ft^3)	% Capture
9	92,680	36,418	39.3%
SPC1-9 Total	**92,680**	**36,418**	**39.3%**

3.10 SPC1-10

SPC1-10, like SPC1-9, is entirely a public area and so the methodology of this study changed. For this region, which consists primarily of the Alamo Community College Campus, a goal was set to return the subwatershed to zero impervious surface conditions. The Impervious surface area was measured over the entire region and an 81.6% degree of imperviousness was calculated. The specific methods to return the areas runoff to pre-development conditions were not addressed in the scope of this study, but a summary of the hydrologic effects is summarized in Table 3-23.

Table 3-23: Subwatershed SPC1-10 Treatment Summary

Collection Area	Runoff Generated (ft^3)	Total Capture (ft^3)	% Capture
10	340,724	317,814	93.3%
SPC1-10 Total	**340,724**	**317,814**	**93.3%**

Figure 3-50 illustrates the boundaries of SPC1-10 and Figure 3-51 illustrates the impervious surface area of the subwatershed.

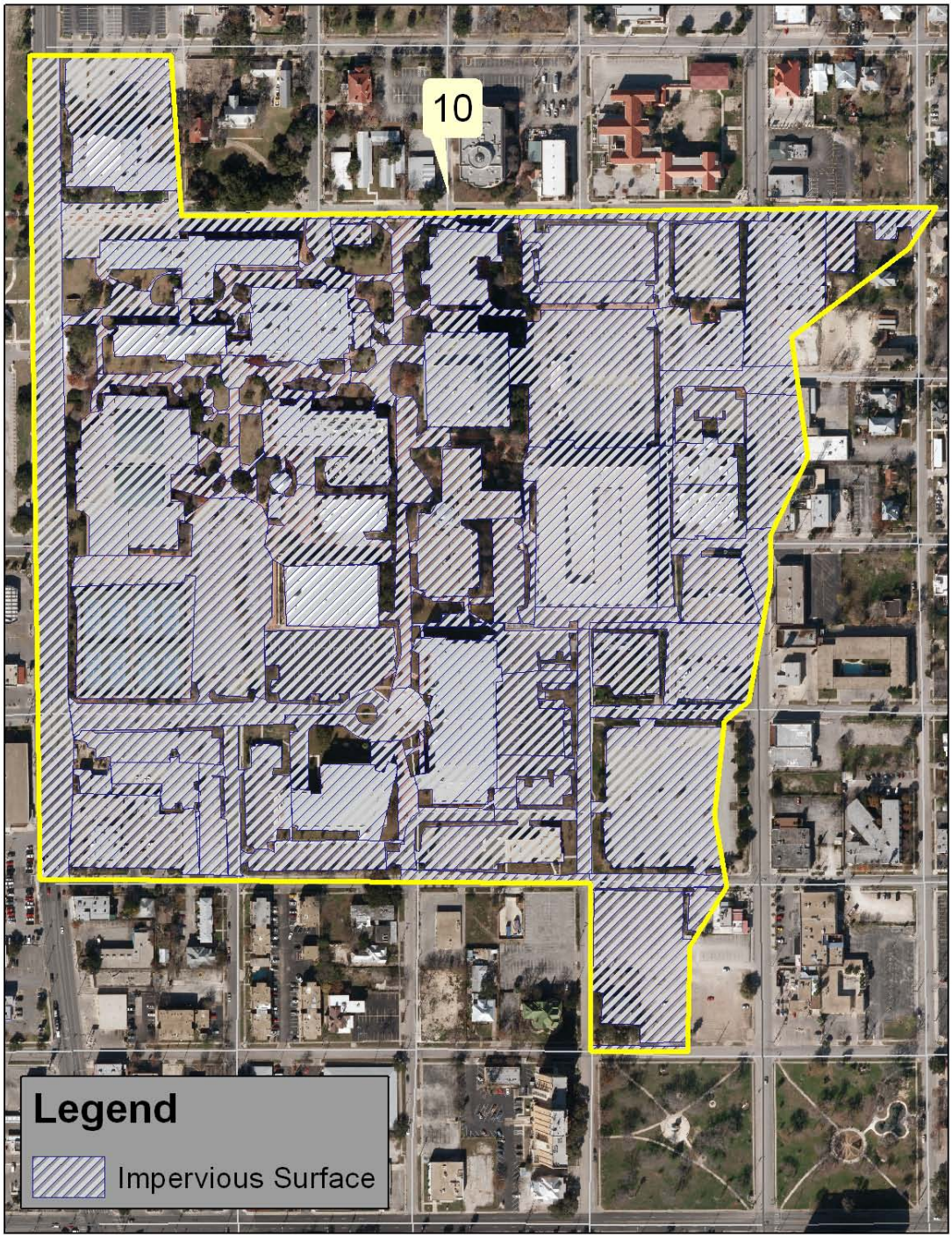

Figure 3-50: SPC1-10 Impervious Surface Area

3.11 SPC1-11

SPC1-11 is the Via Metropolitan Transit property. This property was studied earlier in Task Four of this ongoing project. In that study two sand filtration basins were selected as the method of treatment, and they were able to capture and treat a total of 64,000 ft^3 of runoff from the area. Figure 3-51 shows the area over which the runoff calculations were performed and Figure 3-52 demonstrates the calculations.

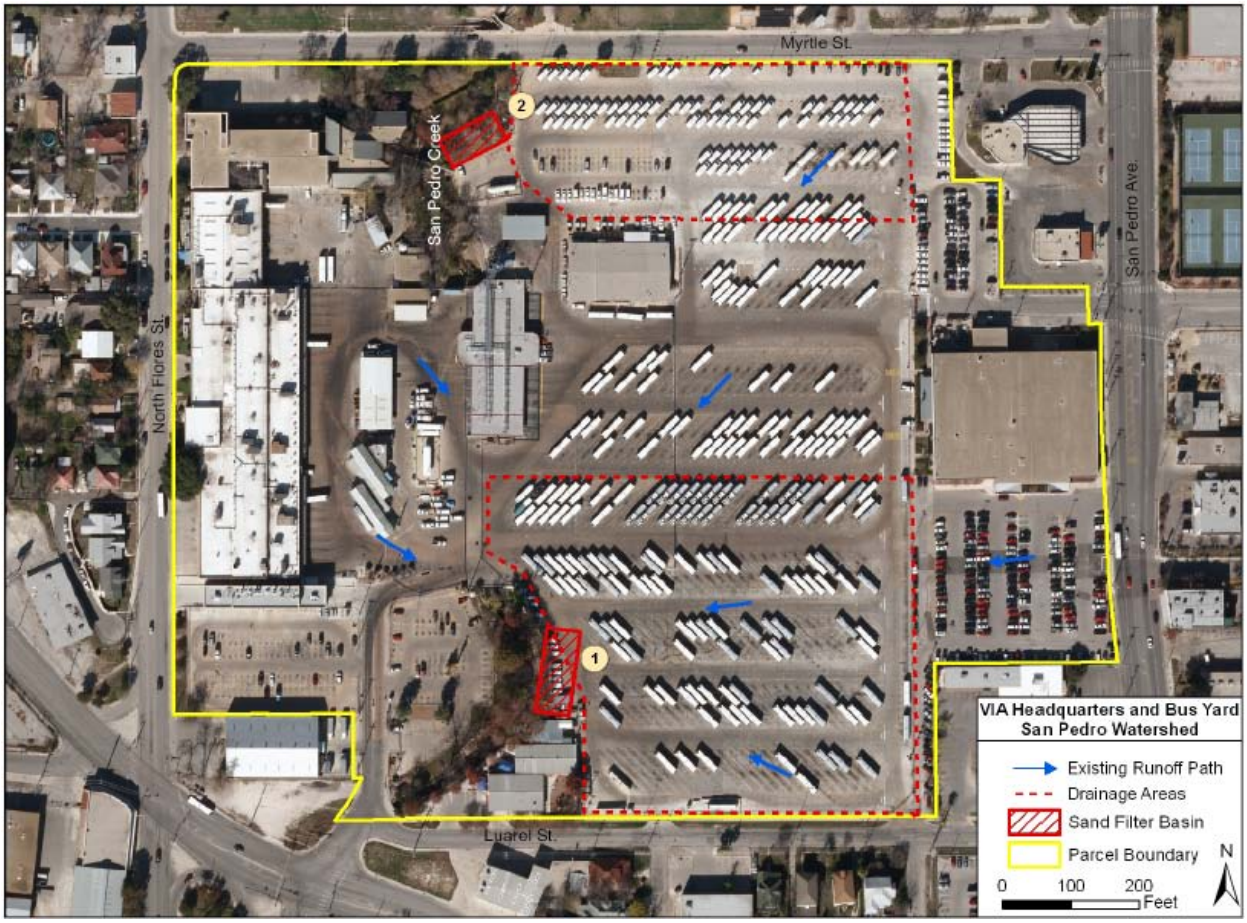

Figure 3-51: VIA Metropolitan Transit Runoff Study Area

Site:	**VIA Metropolitan Transit, Headquarters and Bus Yard**	
Address:	**1020 San Pedro, San Antonio, TX**	
Watershed:	**San Pedro Creek**	
Lot Size	30.55	acres
1 Year Storm Event	1.93	inches
Drainage Area (DA)		
Impervious Cover Area (IC)		
Effective Impervious Cover (IC_eff=IC/DA)		
RA = Runoff Volume (inches) = [0.05+(0.0085*IC_eff)]*1.93		
WQV = Water Quality Volume = DA*RA*(43560/12)		
RV = Required Volume = WQV*1.05		
Conceptual Sand Filter Sizing: 2:1 (L:W) ratio, 8' Max Depth		

BMP Type	**1** Sand Filter	**2** Sand Filter
DA (acres)	6.17	3.00
IC (acres)	6.17	3.00
IC_eff (%)	100%	100%
RA (inches)	1.74	1.74
WQV (ft^3)	38,904	18,916
RV (ft^3)	40,849	19,862
Length (ft)	125	90
Width (ft)	50	45
Depth (ft)	7	5
Volume (ft^3)	43,750	20,250

Figure 3-52: Calculations of BMP Capture Volume

A summary of the runoff generated by the entire area of the Via Metropolitan Transit yard and the runoff that could be captured using the methods presented previously in Task Four is shown below in Table 3-24.

Table 3-24: Subwatershed SPC1-11 Treatment Summary

Collection Area	Runoff Generated (ft^3)	Total Capture (ft^3)	% Capture
11	194,705	64,000	32.9%
SPC1-11 Total	**194,705**	**64,000**	**32.9%**

4.0 SUMMARY

All of the BMPs proposed over the 11 collection areas of SPC1 would represent a significant effort to improve the runoff water quality. In total 50 bioretention ponds and 22,000 ft of grassy infiltrating swale have been proposed. These systems would require the land acquisition of roughly 620,000 ft^2. On the next page, Table 4-1 summarizes the effects of the proposed BMPs over the SPC1 subwatershed.

The conceptual application of BMPs to SPC1 demonstrates the potential opportunities for successful deployment of control measures. It will also be illustrative to consider the potential bacteria loadings that might be removed in conjunction with the proposed applications.

To project the loadings that might be removed, estimated fecal coliform loadings originating from land surface washoff were extracted from the earlier TMDL modeling activities (JMA, 2006). Annual fecal coliform loads were estimated in the TMDL for the central sub-watersheds of the Upper San Antonio River, which comprises most of the developed urban area. Loads for residential, commercial/industrial, and rangeland (open) land use area were summed for the central region to obtain an estimated annual fecal coliform load of 9.0288×10^{15} org/yr. Then, this load was converted to unitized area load by dividing by the central region watershed area of 86,978 ac. The unitized fecal coliform annual loading was therefore estimated to be 1.038×10^{11} org/yr-ac.

The unitized annual loading could then be applied to each of the drainage areas of the example BMPs. Bacteria removed could be projected from the nominal removal expectations for individual BMPs, for example, 70% removal for bioretention and 70% for sand filters (JMA, 2012). With the assumption that roadside grassy infiltrating swales would primarily infiltrate rather than convey stormwater, it was estimated that they would remove bacteria at the same efficiency as a bioretention pond. This assumption appears to be reasonable, since the mechanisms for removal are similar. With this methodology, projected bacteria removals are displayed in Table 4-2 for each of the nine conceptual BMP application sites.

Table 4-1: SPC1 Total BMP Summary

	Total Area (acres)	Total Runoff (ft^3)	Public Capture (ft^3)	Residential Capture (ft^3)	Bioretention Capture (ft^3)	Total Capture (ft^3)	% Capture
SPC1-1A	87.203	262,401	2,069	102,626	7,563	112,258	42.8%
SPC1-1B	10.573	42,189	0	0	29,076	29,076	68.9%
SPC1-1C	4.494	19,579	0	0	16,400	16,400	83.8%
SPC1-1D	5.470	24,930	738	0	14,495	15,233	61.1%
SPC1-2A	65.925	234,501	30,187	70,863	29,974	131,024	55.9%
SPC1-2B	17.934	64,734	324	0	15,710	16,035	24.8%
SPC1-2C	19.321	77,386	15,845	0	23,919	39,764	51.4%
SPC1-3A	13.409	60,574	8,504	0	11,747	20,251	33.4%
SPC1-3B	22.046	71,046	2,154	0	10,091	12,245	17.2%
SPC1-3C	37.349	153,101	4,963	0	14,543	19,506	12.7%
SPC1-3D	26.773	114,205	51	0	17,554	17,605	15.4%
SPC1-4A	54.938	148,190	15,814	0	23,919	39,733	26.8%
SPC1-4B	6.119	23,037	0	0	6,390	6,390	27.7%
SPC1-4C	15.095	66,458	4,409	0	34,122	38,531	58.0%
SPC1-4D	15.218	66,141	9,178	0	7,269	16,447	24.9%
SPC1-5A	20.631	96,816	17,817	0	3,608	21,425	22.1%
SPC1-5B	1.360	5,185	0	0	5,185	5,185	100.0%
SPC1-5C	8.294	37,161	1,709	0	7,791	9,501	25.6%
SPC1-5D	16.364	80,714	21,824	0	49,257	71,082	88.1%
SPC1-5E	42.874	188,806	39,887	0	35,570	75,457	40.0%
SPC1-6A	15.841	60,381	8,377	0	16,358	24,735	41.0%
SPC1-6B	17.155	69,347	515	0	8,486	9,000	13.0%
SPC1-6C	12.539	42,682	0	0	17,713	17,713	41.5%
SPC1-6D	20.651	89,747	10,485	0	36,986	47,470	52.9%
SPC1-6E	18.256	63,748	0	0	13,143	13,143	20.6%
SPC1-7A	22.054	113,756	0	0	26,026	26,026	22.9%
SPC1-7B	26.761	153,023	2,213	0	12,944	15,157	9.9%
SPC1-7C	19.992	104,596	3,092	0	4,466	7,558	7.2%
SPC1-8A	30.079	154,453	0	0	35,551	35,551	23.0%
SPC1-8B	21.546	101,383	0	0	17,303	17,303	17.1%
SPC1-9	47.350	92,680	0	0	36,418	36,418	39.3%
SPC1-10	65.402	340,724	317,814	0	0	317,814	93.3%
SPC1-11	33.366	194,705	64,000	0	0	64,000	32.9%
TOTAL	842.382	3,418,380	581,971	173,489	589,578	1,345,037	39.3%

Table 4-2: Projected Bacteria Removals

	Drainage Area (acres)	% Drainage Area Captured	Effectual Drainage Area Treated (acres)	Overall Bacteria Removal	Fecal Coliform Load Removal (org/yr)
SPC1-1A	87.203	42.8%	37.323	63%	2.44E+12
SPC1-1B	10.573	68.9%	7.285	63%	4.76E+11
SPC1-1C	4.494	83.8%	3.766	63%	2.46E+11
SPC1-1D	5.470	61.1%	3.342	63%	2.19E+11
SPC1-2A	65.925	55.9%	36.852	63%	2.41E+12
SPC1-2B	17.934	24.8%	4.448	63%	2.91E+11
SPC1-2C	19.321	51.4%	9.931	63%	6.49E+11
SPC1-3A	13.409	33.4%	4.479	63%	2.93E+11
SPC1-3B	22.046	17.2%	3.792	63%	2.48E+11
SPC1-3C	37.349	12.7%	4.743	63%	3.10E+11
SPC1-3D	26.773	15.4%	4.123	63%	2.70E+11
SPC1-4A	54.938	26.8%	14.723	63%	9.63E+11
SPC1-4B	6.119	27.7%	1.695	63%	1.11E+11
SPC1-4C	15.095	58.0%	8.755	63%	5.73E+11
SPC1-4D	15.218	24.9%	3.789	63%	2.48E+11
SPC1-5A	20.631	22.1%	4.559	63%	2.98E+11
SPC1-5B	1.360	100.0%	1.360	63%	8.89E+10
SPC1-5C	8.294	25.6%	2.123	63%	1.39E+11
SPC1-5D	16.364	88.1%	14.417	63%	9.43E+11
SPC1-5E	42.874	40.0%	17.150	63%	1.12E+12
SPC1-6A	15.841	41.0%	6.495	63%	4.25E+11
SPC1-6B	17.155	13.0%	2.230	63%	1.46E+11
SPC1-6C	12.539	41.5%	5.204	63%	3.40E+11
SPC1-6D	20.651	52.9%	10.924	63%	7.14E+11
SPC1-6E	18.256	20.6%	3.761	63%	2.46E+11
SPC1-7A	22.054	22.9%	5.050	63%	3.30E+11
SPC1-7B	26.761	9.9%	2.649	63%	1.73E+11
SPC1-7C	19.992	7.2%	1.439	63%	9.41E+10
SPC1-8A	30.079	23.0%	6.918	63%	4.52E+11
SPC1-8B	21.546	17.1%	3.684	63%	2.41E+11
SPC1-9	47.350	39.3%	18.609	63%	1.22E+12
SPC1-10	65.402	93.3%	61.020	63%	3.99E+12
SPC1-11	33.366	32.9%	10.977	63%	7.18E+11
TOTAL	842.382	39.3%	328.617	20.790	2.14E+13

*90% of storm events are treated at 70% removal, therefore, overall annual removal is 63%

5.0 REFERENCES

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APPENDIX A

Subwatershed: SPC1-1

Collection Area: SPC1-1A

Drainage Areas:

	PUBLIC	RESIDENTIAL	OPEN	ROADS & COMMERCIAL BLDGS.	TOTALS
Total Area	0.664	65.032	0.378	21.128	87.203
% Impervious	46.4%	38.3%	26.7%	64.5%	44.6%
	*Method: hand calculated imp area over entire region	*Method: hand calculated imp area over representative 4 blocks	*Method hand calculated imp area over entire region	*Method hand calculated imp area over representative 4 blocks	*Weighted average
RUNOFF GENERATED (FT^3)	2,069	171,043	735	88,554	262,401
RUNOFF CAPTURED (FT^3)	2,069	102,626	0	0	104,695
	*Appeared Feasible to require this public lot to capture 100% of on-site runoff	*Grassy infiltrating swales on side streets capture aprox 60% runoff	*No BMPs in place	*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	0	68,417	735	88,554	157,706
	2,069 - 2,069= 0	171,043 - 102,626 = 68,417	735 - 0 = 735	88,554 - 0 = 88,554	

COMBINED DRAINAGE AREAS TOTAL NET RUNOFF (FT^3)

157,706

SUGGESTED TREATMENT OPTIONS

Place a bioretention pond at the East end of Mark Twain Middle School soccer field. Available Land Area: 7,941 ft^2

CAPTURE VOLUME:	7,563

COLLECTION AREA TOTAL NET RUNOFF (FT^3)

150,143

157,706 - 7,563 = 150,143

Watershed: **SPC1**
Subwatershed: **SPC1-1**
Collection Area: **SPC1-1A**

1 Year Storm Event 1.93 inches
Drainage Area (DA)
Impervious Cover Area (IC)
Effective Impervious Cover (IC_eff=IC/DA)
RA = Runoff Volume (inches) = [0.05+(0.0085*IC_eff)]*1.93
WQV = Water Quality Volume = DA*RA*(43560/12)

Drainage Area	**1** Public	**2** Residential	**3** Open	**4** Road & Bldgs.
DA (acres)	0.664	65.032	0.378	21.128
IC (acres)	0.308	24.897	0.101	13.628
IC_eff (%)	46.4%	38.3%	26.7%	64.5%
RA (inches)	0.858	0.725	0.535	1.155
WQV (ft^3)	2,069	171,043	735	88,554

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Site: **1 pond located at the East end of Mark Twain Middle School soccer field**

Subwatershed: **SPC1-1**

Collection Area: **SPC1-1A**

1 Year Storm Event:	1.93	inches
WQV (previously calculated):	157,706	ft^3
Available Land Area:	7,941	ft^2
Conceptual Bioretention Depth:	1	ft max
Pond Volume: (Land Area X Depth)		
Pond Storage Capacity: (Pond Volume/1.05)		

BMP Type	**1** Bioretention
WQV (ft^3)	157,706
Available Land Area (ft^2)	7,941
Pond Volume (ft^3)	7,941
Pond Storage Capacity (ft^3)	7,563

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Subwatershed: SPC1-1

Collection Area: SPC1-1B

Drainage Areas:

	PUBLIC	RESIDENTIAL	OPEN	ROADS & COMMERCIAL BLDGS.	TOTALS
Total Area	0.000	4.867	1.253	4.453	10.573
% Impervious	0.0%	44.3%	25.3%	89.6%	61.1%
	*Method: Hand calculated over entire Public region	*Method: Hand calculated over entire Residential region	*Method: Hand calculated over entire Open region	*Method: Hand calculated over entire Rd. & Comm. region	
RUNOFF GENERATED (FT^3)	0	14,544	2,327	25,318	42,189
RUNOFF CAPTURED (FT^3)	0	0	0	0	0
	*No BMPs in place	*No BMPs in place	*No BMPs in place	*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	0	14,544	2,327	25,318	42,189

COMBINED DRAINAGE AREAS TOTAL NET RUNOFF (FT^3)

42,189

SUGGESTED TREATMENT OPTIONS

Three bioretention ponds located throughout the collection area mostly on private land. See Bioretention Pond Sizing Calculations page for more details. Total Land Area 30,530 ft^2

CAPTURE VOLUME:	29,076

COLLECTION AREA TOTAL NET RUNOFF (FT^3)

13,113

42,189 - 29,076 = 13,113

Watershed: **SPC1**
Subwatershed: **SPC1-1**
Collection Area: **SPC1-1B**

1 Year Storm Event 1.93 inches
Drainage Area (DA)
Impervious Cover Area (IC)
Effective Impervious Cover (IC_eff=IC/DA)
RA = Runoff Volume (inches) = [0.05+(0.0085*IC_eff)]*1.93
WQV = Water Quality Volume = DA*RA*(43560/12)

Drainage Area	**1** Public	**2** Residential	**3** Open	**4** Road & Bldgs.
DA (acres)	0.000	4.867	1.253	4.453
IC (acres)	0.000	2.156	0.317	3.990
IC_eff (%)	0.0%	44.3%	25.3%	89.6%
RA (inches)	0.000	0.823	0.512	1.566
WQV (ft^3)	0	14,544	2,327	25,318

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Site: **Pond 1: Privately owned vacant lot with a land use classification as Open. (Available Land: 7,317 ft^2)**
Pond 2: Public land Behind Mark Twain Middle School where regional stormwater currently collects. (Available Land: 14,451 ft^2)
Pond 3: Privately owned vacant lot along San Pedro Blvd. with a land use classification as Open. (Available Land: 8,762 ft^2)

1 Year Storm Event:	1.93	inches
WQV (previously calculated):	42,189	ft^3
Available Land Area:	30,530	ft^2
Conceptual Bioretention Depth:	1	ft max
Pond Volume: (Land Area X Depth)		
Pond Storage Capacity: (Pond Volume/1.05)		

BMP Type	**1** Bioretention
WQV (ft^3)	42,189
Available Land Area (ft^2)	30,530
Pond Volume (ft^3)	30,530
Pond Storage Capacity (ft^3)	29,076

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Subwatershed: SPC1-1

Collection Area: SPC1-1C

Drainage Areas:

	PUBLIC	RESIDENTIAL	OPEN	ROADS & COMMERCIAL BLDGS.	TOTALS
Total Area	0.000	3.083	0.000	1.411	4.494
% Impervious	0.0%	61.3%	0.0%	80.5%	67.3%
		*Method: hand calculated imp area over representative 4 blocks		*Method hand calculated imp area over representative 4 blocks	*Weighted average
RUNOFF GENERATED (FT^3)	0	12,327	0	7,252	19,579
RUNOFF CAPTURED (FT^3)	0	0	0	0	0
	*No BMPs in place	*No BMPs in place	*No BMPs in place	*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	0	12,327	0	7,252	19,579

COMBINED DRAINAGE AREAS TOTAL NET RUNOFF (FT^3)

19,579

SUGGESTED TREATMENT OPTIONS

Two linked bioretention ponds. First pond located at a privately owned equipment yard on San Pedro Blvd. Second pond public parcel 70 ft west across San Pedro Blvd. Total Land Area: 17,220 ft^2

CAPTURE VOLUME:	16,400

COLLECTION AREA TOTAL NET RUNOFF (FT^3)

3,179

19,579 - 16,400 = 3,179

Watershed: **SPC1**
Subwatershed: **SPC1-1**
Collection Area: **SPC1-1C**

1 Year Storm Event 1.93 inches
Drainage Area (DA)
Impervious Cover Area (IC)
Effective Impervious Cover (IC_eff=IC/DA)
RA = Runoff Volume (inches) = [0.05+(0.0085*IC_eff)]*1.93
WQV = Water Quality Volume = DA*RA*(43560/12)

Drainage Area	**1** Public	**2** Residential	**3** Open	**4** Road & Bldgs.
DA (acres)	0.000	3.083	0.000	1.411
IC (acres)	0.000	1.889	0.000	1.135
IC_eff (%)	0.0%	61.3%	0.0%	80.5%
RA (inches)	0.000	1.101	0.000	1.416
WQV (ft^3)	0	12,327	0	7,252

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Site:	**Pond 1: Privately owned equipment yard at base of Collection Area designated with land use; Open**
	Pond 2: Publicly owned parcel 70ft from Pond 1 across San Pedro Blvd. owned by San Antonio ISD
Subwatershed:	**SPC1-1**
Collection Area:	**SPC1-1C**

1 Year Storm Event:	1.93	inches
WQV (previously calculated):	19,579	ft^3
Available Land Area:	17,220	ft^2
Conceptual Bioretention Depth:	1	ft max
Pond Volume: (Land Area X Depth)		
Pond Storage Capacity: (Pond Volume/1.05)		

BMP Type	**1** Bioretention
WQV (ft^3)	19,579
Available Land Area (ft^2)	17,220
Pond Volume (ft^3)	17,220
Pond Storage Capacity (ft^3)	16,400

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Subwatershed: SPC1-1

Collection Area: SPC1-1D

Drainage Areas:

	PUBLIC	RESIDENTIAL	OPEN	ROADS & COMMERCIAL BLDGS.	TOTALS
Total Area	0.185	2.606	0.000	2.679	5.470
% Impervious	61.1%	61.3%	0.0%	80.5%	70.7%
	*Method: hand calculated imp area over entire region	*Method: hand calculated imp area over representative 4 blocks		*Method hand calculated imp area over representative 4 blocks	
RUNOFF GENERATED (FT^3)	738	10,419	0	13,773	24,930
RUNOFF CAPTURED (FT^3)	738	0	0	0	738
	*Appears feasible to require this public lot to capture 100% of on-site runoff	*No BMPs in place	*No BMPs in place	*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	0	10,419	0	13,773	24,193

COMBINED DRAINAGE AREAS TOTAL NET RUNOFF (FT^3)

24,193

SUGGESTED TREATMENT OPTIONS

Bioretention located in privately owned greenspace behind building on San Pedro Blvd. Total Land Area: 15,220 ft^2

CAPTURE VOLUME: 14,495

COLLECTION AREA TOTAL NET RUNOFF (FT^3)

9,697

24,193 - 14,495 = 9,697

Watershed: **SPC1**
Subwatershed: **SPC1-1**
Collection Area: **SPC1-1D**

1 Year Storm Event 1.93 inches
Drainage Area (DA)
Impervious Cover Area (IC)
Effective Impervious Cover (IC_eff=IC/DA)
RA = Runoff Volume (inches) = [0.05+(0.0085*IC_eff)]*1.93
WQV = Water Quality Volume = DA*RA*(43560/12)

Drainage Area	**1** Public	**2** Residential	**3** Open	**4** Road & Bldgs.
DA (acres)	0.185	2.606	0.000	2.679
IC (acres)	0.113	1.596	0.000	2.155
IC_eff (%)	61.1%	61.3%	0.0%	80.5%
RA (inches)	1.099	1.101	0.000	1.416
WQV (ft^3)	738	10,419	0	13,773

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Site: **Privately owned greenspace behind building on San Pedro Blvd.**
Subwatershed: **SPC1-1**
Collection Area: **SPC1-1D**

1 Year Storm Event:	1.93	inches
WQV (previously calculated):	24,193	ft^3
Available Land Area:	15,220	ft^2
Conceptual Bioretention Depth:	1	ft max
Pond Volume: (Land Area X Depth)		
Pond Storage Capacity: (Pond Volume/1.05)		

BMP Type	**1** Bioretention
WQV (ft^3)	24,193
Available Land Area (ft^2)	15,220
Pond Volume (ft^3)	15,220
Pond Storage Capacity (ft^3)	14,495

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Subwatershed: SPC1-2

Collection Area: SPC1-2A

Drainage Areas:

PUBLIC	
Total Area	7.622
% Impervious	60.6%
*Method: hand calculated imp area over entire region	
RUNOFF GENERATED (FT^3)	30,187
RUNOFF CAPTURED (FT^3)	30,187
*Appears feasible to capture 100% of on-site runoff	
REMAINING RUNOFF (FT^3)	0
30,187 - 30,187= 0	

RESIDENTIAL	
Total Area	35.532
% Impervious	49.9%
*Method: hand calculated imp area over representative 4 blocks	
RUNOFF GENERATED (FT^3)	118,104
RUNOFF CAPTURED (FT^3)	70,863
*Grassy infiltrating swales on side streets capture aprox 60% runoff	
REMAINING RUNOFF (FT^3)	47,242
118,104 - 70,863 = 47,242	

OPEN	
Total Area	0.584
% Impervious	36.2%
*Method hand calculated imp area over entire region	
RUNOFF GENERATED (FT^3)	1,463
RUNOFF CAPTURED (FT^3)	0
*No BMPs in place	
REMAINING RUNOFF (FT^3)	1,463
1,463 - 0 = 1,463	

ROADS & COMMERCIAL BLDGS.	
Total Area	22.188
% Impervious	58.3%
*Method hand calculated imp area over entire region	
RUNOFF GENERATED (FT^3)	84,746
RUNOFF CAPTURED (FT^3)	0
*No BMPs in place	
REMAINING RUNOFF (FT^3)	84,746
84,746 - 0 = 84,746	

SPC1-2A TOTALS	
Total Area	65.925
% Impervious*	53.9%
*Weighted average	
RUNOFF GENERATED (FT^3)	234,501
RUNOFF CAPTURED (FT^3)	101,050
REMAINING RUNOFF (FT^3)	133,451

COMBINED DRAINAGE AREAS TOTAL NET RUNOFF (FT^3)
133,451

SUGGESTED TREATMENT OPTIONS	
Place 5 linked bioretention ponds 16ft from centerline of railroad tracks. This is in optimal position at the base of the collection area and some storm infrastruture already exists here. Total Land Area: 31,473 ft^2 .	
CAPTURE VOLUME:	29,974

COLLECTION AREA TOTAL NET RUNOFF (FT^3)
103,476
133,451 - 29,974 = 103,476

Watershed: **SPC1**
Subwatershed: **SPC1-2**
Collection Area: **SPC1-2A**

1 Year Storm Event 1.93 inches
Drainage Area (DA)
Impervious Cover Area (IC)
Effective Impervious Cover (IC_eff=IC/DA)
RA = Runoff Volume (inches) = [0.05+(0.0085*IC_eff)]*1.93
WQV = Water Quality Volume = DA*RA*(43560/12)

Drainage Area	**1** Public	**2** Residential	**3** Open	**4** Road & Bldgs.
DA (acres)	7.622	35.532	0.584	22.188
IC (acres)	4.621	17.743	0.211	12.926
IC_eff (%)	60.6%	49.9%	36.2%	58.3%
RA (inches)	1.091	0.916	0.690	1.052
WQV (ft^3)	30,187	118,104	1,463	84,746

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Site: **5 ponds linked together 16ft east of railroad tracks**
Subwatershed: **SPC1-2**
Collection Area: **SPC1-2A**

1 Year Storm Event:	1.93	inches
WQV (previously calculated):	102,982	ft^3
Available Land Area:	31,473	ft^2
Conceptual Bioretention Depth:	1	ft max
Pond Volume: (Land Area X Depth)		
Pond Storage Capacity: (Pond Volume/1.05)		

BMP Type	**1** Bioretention
WQV (ft^3)	102,982
Available Land Area (ft^2)	31,473
Pond Volume (ft^3)	31,473
Pond Storage Capacity (ft^3)	29,974

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Subwatershed: SPC1-2

Collection Area: SPC1-2B

Drainage Areas:

	PUBLIC	RESIDENTIAL	OPEN	ROADS & COMMERCIAL BLDGS.	TOTALS
Total Area	0.685	9.945	0.384	6.920	17.934
% Impervious	2.1%	50.2%	12.3%	68.8%	54.7%
	*Method: hand calculated over entire Public region	*Method: hand calculated imp area over representative 4 blocks	*Method: hand calculated over entire Open region	*Method: hand calculated over entire Commercial region	*Weighted average
RUNOFF GENERATED (FT^3)	324	33,226	415	30,767	64,734
RUNOFF CAPTURED (FT^3)	324	0	0	0	324
	*Appears feasible to require all Public lots to capture onsite runoff	*No BMPs in place	*No BMPs in place	*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	0	33,226	415	30,767	64,409

COMBINED DRAINAGE AREAS TOTAL NET RUNOFF (FT^3)

64,409

SUGGESTED TREATMENT OPTIONS

A large bioretention basin located on public property owned by San Antonio Water System at the base of the collection area. Land Area: 16,496 ft^2

CAPTURE VOLUME: 15,710

COLLECTION AREA TOTAL NET RUNOFF (FT^3)

48,699

64,409 - 15,710 = 48,699

Watershed: **SPC1**
Subwatershed: **SPC1-2**
Collection Area: **SPC1-2B**

1 Year Storm Event 1.93 inches
Drainage Area (DA)
Impervious Cover Area (IC)
Effective Impervious Cover (IC_eff=IC/DA)
RA = Runoff Volume (inches) = [0.05+(0.0085*IC_eff)]*1.93
WQV = Water Quality Volume = DA*RA*(43560/12)

Drainage Area	**1** Public	**2** Residential	**3** Open	**4** Road & Bldgs.
DA (acres)	0.685	9.945	0.384	6.920
IC (acres)	0.014	4.995	0.047	4.760
IC_eff (%)	2.1%	50.2%	12.3%	68.8%
RA (inches)	0.130	0.920	0.298	1.225
WQV (ft^3)	324	33,226	415	30,767

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Site: **Pond 1: Public land owned by San Antonio Water System near railroad tracks in a low density residential block.**

Subwatershed: **SPC1-2**

Collection Area: **SPC1-2B**

1 Year Storm Event:	1.93	inches
WQV (previously calculated):	64,409	ft^3
Available Land Area:	16,496	ft^2
Conceptual Bioretention Depth:	1	ft max
Pond Volume: (Land Area X Depth)		
Pond Storage Capacity: (Pond Volume/1.05)		

BMP Type	**1** Bioretention
WQV (ft^3)	64,409
Available Land Area (ft^2)	16,496
Pond Volume (ft^3)	16,496
Pond Storage Capacity (ft^3)	15,710

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Subwatershed: SPC1-2

Collection Area: SPC1-2C

Drainage Areas:

	PUBLIC	RESIDENTIAL	OPEN	ROADS & COMMERCIAL BLDGS.	TOTALS
Total Area	3.205	7.840	0.596	7.680	19.321
% Impervious	77.2%	50.2%	35.5%	68.2%	61.4%
	*Method: hand calculated over entire Public region	*Method: Used 1-2B because had similar residential density	*Method: hand calculated over entire Open region	*Method: hand calculated over entire Commercial region	*Weighted average
RUNOFF GENERATED (FT^3)	15,845	26,194	1,468	33,879	77,386
RUNOFF CAPTURED (FT^3)	15,845	0	0	0	15,845
	*Appears feasible to capture all onsite runoff	*No BMPs in place	*No BMPs in place	*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	0	26,194	1,468	33,879	61,541

COMBINED DRAINAGE AREAS TOTAL NET RUNOFF (FT^3)

61,541

SUGGESTED TREATMENT OPTIONS

A large bioretention basin located at base of collection area on Commercial and Open land. Some stormwater infrastructure already exists. Total Land Area: 25,115 ft^2

CAPTURE VOLUME:	23,919

COLLECTION AREA TOTAL NET RUNOFF (FT^3)

37,622

61,541 - 23,919 = 37,622

Watershed: **SPC1**
Subwatershed: **SPC1-2**
Collection Area: **SPC1-2C**

1 Year Storm Event 1.93 inches
Drainage Area (DA)
Impervious Cover Area (IC)
Effective Impervious Cover (IC_eff=IC/DA)
RA = Runoff Volume (inches) = [0.05+(0.0085*IC_eff)]*1.93
WQV = Water Quality Volume = DA*RA*(43560/12)

Drainage Area	**1** Public	**2** Residential	**3** Open	**4** Road & Bldgs.
DA (acres)	3.205	7.840	0.596	7.680
IC (acres)	2.472	3.938	0.211	5.237
IC_eff (%)	77.2%	50.2%	35.5%	68.2%
RA (inches)	1.362	0.920	0.678	1.215
WQV (ft^3)	15,845	26,194	1,468	33,879

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Site: **Pond 1: Mix of Open and Commercial land located just East of the railroad tracks. Some stormwater infrastructure already exists.**

Subwatershed: **SPC1-2**

Collection Area: **SPC1-2C**

1 Year Storm Event:	1.93	inches
WQV (previously calculated):	61,541	ft^3
Available Land Area:	25,115	ft^2
Conceptual Bioretention Depth:	1	ft max
Pond Volume: (Land Area X Depth)		
Pond Storage Capacity: (Pond Volume/1.05)		

BMP Type	**1** Bioretention
WQV (ft^3)	61,541
Available Land Area (ft^2)	25,115
Pond Volume (ft^3)	25,115
Pond Storage Capacity (ft^3)	23,919

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Subwatershed: SPC1-3

Collection Area: SPC1-3A

Drainage Areas:

PUBLIC	
Total Area	1.655
% Impervious	80.4%
*Method: Hand calculated over entire Public region	
RUNOFF GENERATED (FT^3)	8,504
RUNOFF CAPTURED (FT^3)	8,504
*Appears feasible to capture 100% of onsite runoff	
DRAINAGE AREA RUNOFF (FT^3)	0

RESIDENTIAL	
Total Area	3.220
% Impervious	42.3%
*Method: Hand calculated over entire Residential region	
RUNOFF GENERATED (FT^3)	9,230
RUNOFF CAPTURED (FT^3)	0
*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	9,230

OPEN	
Total Area	1.351
% Impervious	29.8%
*Method: hand calculated over entire Open region	
RUNOFF GENERATED (FT^3)	2,868
RUNOFF CAPTURED (FT^3)	0
*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	2,868

ROADS & COMMERCIAL BLDGS.	
Total Area	7.184
% Impervious	87.6%
*Method: Hand calculated over entire Road and Commercial region	
RUNOFF GENERATED (FT^3)	39,971
RUNOFF CAPTURED (FT^3)	0
*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	39,971

TOTALS	
Total Area	13.409
% Impervious*	70.0%
*Weighted average	
RUNOFF GENERATED (FT^3)	60,574
RUNOFF CAPTURED (FT^3)	8,504
DRAINAGE AREA RUNOFF (FT^3)	52,069

COMBINED DRAINAGE AREAS TOTAL NET RUNOFF (FT^3)
52,069

SUGGESTED TREATMENT OPTIONS	
A bioretention pond located in the middle of a Residential block where there appears to be a natural drainage path and woods. Total Land Area: 12,334 ft^2	
CAPTURE VOLUME:	11,747

COLLECTION AREA TOTAL NET RUNOFF (FT^3)
40,323
52,069 - 11,747 = 40,323

Watershed: **SPC1**
Subwatershed: **SPC1-3**
Collection Area: **SPC1-3A**

1 Year Storm Event 1.93 inches
Drainage Area (DA)
Impervious Cover Area (IC)
Effective Impervious Cover (IC_eff=IC/DA)
RA = Runoff Volume (inches) = [0.05+(0.0085*IC_eff)]*1.93
WQV = Water Quality Volume = DA*RA*(43560/12)

Drainage Area	**1** Public	**2** Residential	**3** Open	**4** Road & Bldgs.
DA (acres)	1.655	3.220	1.351	7.184
IC (acres)	1.331	1.361	0.402	6.290
IC_eff (%)	80.4%	42.3%	29.8%	87.6%
RA (inches)	1.416	0.790	0.585	1.533
WQV (ft^3)	8,504	9,230	2,868	39,971

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Site: **Pond 1: A bioretention pond located in the middle of a Residential block where there appears to be a natural drainage path and woods**

Subwatershed: **SPC1-3**

Collection Area: **SPC1-3A**

1 Year Storm Event:	1.93	inches
WQV (previously calculated):	52,069	ft^3
Available Land Area:	12,334	ft^2
Conceptual Bioretention Depth:	1	ft max
Pond Volume: (Land Area X Depth)		
Pond Storage Capacity: (Pond Volume/1.05)		

BMP Type	**1** Bioretention
WQV (ft^3)	52,069
Available Land Area (ft^2)	12,334
Pond Volume (ft^3)	12,334
Pond Storage Capacity (ft^3)	11,747

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Subwatershed: SPC1-3

Collection Area: SPC1-3B

Drainage Areas:

PUBLIC	
Total Area	0.468
% Impervious	71.5%
*Method: Hand calculated over entire Public region	
RUNOFF GENERATED (FT^3)	2,154
RUNOFF CAPTURED (FT^3)	2,154
*Appears feasible to capture 100% of onsite runoff	
DRAINAGE AREA RUNOFF (FT^3)	0

RESIDENTIAL	
Total Area	14.394
% Impervious	42.3%
*Method: Used 42.3% value from similar Residential region; 1-3A	
RUNOFF GENERATED (FT^3)	41,301
RUNOFF CAPTURED (FT^3)	0
*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	41,301

OPEN	
Total Area	1.351
% Impervious	59.9%
*Method: hand calculated over entire Open region	
RUNOFF GENERATED (FT^3)	5,294
RUNOFF CAPTURED (FT^3)	0
*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	5,294

ROADS & COMMERCIAL BLDGS.	
Total Area	5.834
% Impervious	58.3%
*Method: Used 58.3% value from similar Rd. & Comm. Region; 1-2A	
RUNOFF GENERATED (FT^3)	22,297
RUNOFF CAPTURED (FT^3)	0
*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	22,297

TOTALS	
Total Area	22.046
% Impervious*	48.2%
*Weighted average	
RUNOFF GENERATED (FT^3)	71,046
RUNOFF CAPTURED (FT^3)	2,154
DRAINAGE AREA RUNOFF (FT^3)	68,892

COMBINED DRAINAGE AREAS TOTAL NET RUNOFF (FT^3)

68,892

SUGGESTED TREATMENT OPTIONS

A bioretention pond located at the base of the Collection Area near the railroad tracs in the back of a Public lot owned by "Spiritual Assembly of Baha"is of Sa Etal". Total Land Area: 10,595 ft^2

CAPTURE VOLUME:	10,091

COLLECTION AREA TOTAL NET RUNOFF (FT^3)

58,802

68,892 - 10,091 = 58,802

Watershed: **SPC1**
Subwatershed: **SPC1-3**
Collection Area: **SPC1-3B**

1 Year Storm Event 1.93 inches
Drainage Area (DA)
Impervious Cover Area (IC)
Effective Impervious Cover (IC_eff=IC/DA)
RA = Runoff Volume (inches) = [0.05+(0.0085*IC_eff)]*1.93
WQV = Water Quality Volume = DA*RA*(43560/12)

Drainage Area	**1** Public	**2** Residential	**3** Open	**4** Road & Bldgs.
DA (acres)	0.468	14.394	1.351	5.834
IC (acres)	0.334	6.089	0.810	3.401
IC_eff (%)	71.5%	42.3%	59.9%	58.3%
RA (inches)	1.269	0.790	1.080	1.053
WQV (ft^3)	2,154	41,301	5,294	22,297

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Site: **Pond 1: A bioretention pond located at the base of the Collection Area near the railroad tracs in the back of a Public lot owned by "Spiritual Assembly of Baha"is of Sa Etal".**

Subwatershed: **SPC1-3**

Collection Area: **SPC1-3B**

1 Year Storm Event:	1.93	inches
WQV (previously calculated):	68,892	ft^3
Available Land Area:	10,595	ft^2
Conceptual Bioretention Depth:	1	ft max
Pond Volume: (Land Area X Depth)		
Pond Storage Capacity: (Pond Volume/1.05)		

BMP	**1**
Type	Bioretention
WQV (ft^3)	68,892
Available Land Area (ft^2)	10,595
Pond Volume (ft^3)	10,595
Pond Storage Capacity (ft^3)	10,091

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Subwatershed: SPC1-3

Collection Area: SPC1-3C

Drainage Areas:

	PUBLIC	RESIDENTIAL	OPEN	ROADS & COMMERCIAL BLDGS.	TOTALS
Total Area	1.062	23.766	0.383	12.138	37.349
% Impervious	72.6%	50.2%	46.6%	87.6%	63.0%
	*Method: Hand calculated over entire Public region	*Method: Used calculations from similar region 1-2B	*Method: hand calculated over entire Open region	*Method: Used calculations from similar region 1-3A	*Weighted average
RUNOFF GENERATED (FT^3)	4,963	79,372	1,196	67,570	153,101
RUNOFF CAPTURED (FT^3)	4,963	0	0	0	4,963
	*Appears feasible to capture 100% of onsite runoff	*No BMPs in place	*No BMPs in place	*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	0	79,372	1,196	67,570	148,138

COMBINED DRAINAGE AREAS TOTAL NET RUNOFF (FT^3)

148,138

SUGGESTED TREATMENT OPTIONS

Two ponds located at the base of the Collection Area on vacant Public land owned by "City Public Service Board" next to railroad tracks. Total Land Area: 15,270 ft^2

CAPTURE VOLUME:	14,543

COLLECTION AREA TOTAL NET RUNOFF (FT^3)

133,595

148,138 - 14,543 = 133,595

Watershed: **SPC1**
Subwatershed: **SPC1-3**
Collection Area: **SPC1-3C**

1 Year Storm Event 1.93 inches
Drainage Area (DA)
Impervious Cover Area (IC)
Effective Impervious Cover (IC_eff=IC/DA)
RA = Runoff Volume (inches) = [0.05+(0.0085*IC_eff)]*1.93
WQV = Water Quality Volume = DA*RA*(43560/12)

Drainage Area	**1** Public	**2** Residential	**3** Open	**4** Road & Bldgs.
DA (acres)	1.062	23.766	0.383	12.138
IC (acres)	0.771	11.931	0.178	10.633
IC_eff (%)	72.6%	50.2%	46.6%	87.6%
RA (inches)	1.287	0.920	0.861	1.534
WQV (ft^3)	4,963	79,372	1,196	67,570

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Site: **Pond 1: Two ponds located at the base of the Collection Area on vacant Public land owned by "City Public Service Board" next to railroad tracks.**

Subwatershed: **SPC1-3**

Collection Area: **SPC1-3C**

1 Year Storm Event:	1.93	inches
WQV (previously calculated):	148,138	ft^3
Available Land Area:	15,270	ft^2
Conceptual Bioretention Depth:	1	ft max
Pond Volume: (Land Area X Depth)		
Pond Storage Capacity: (Pond Volume/1.05)		

BMP	**1**
Type	Bioretention
WQV (ft^3)	148,138
Available Land Area (ft^2)	15,270
Pond Volume (ft^3)	15,270
Pond Storage Capacity (ft^3)	14,543

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Subwatershed: SPC1-3

Collection Area: SPC1-3D

Drainage Areas:

	PUBLIC	RESIDENTIAL	OPEN	ROADS & COMMERCIAL BLDGS.	TOTALS
Total Area	0.145	14.714	0.484	11.429	26.773
% Impervious	0.0%	50.2%	42.3%	87.6%	65.8%
	*Method: Hand calculated over entire Public region	*Method: Used 50.2% from similar Residential region; 1-2B	*Method: hand calculated over entire Open region	*Method: Used 87.6% from similar Rd. & Comm. Bldg. region; 1-3A	*Weighted average
RUNOFF GENERATED (FT^3)	51	49,142	1,390	63,622	114,205
RUNOFF CAPTURED (FT^3)	51	0	0	0	51
	*Appears feasible to capture 100% of onsite runoff	*No BMPs in place	*No BMPs in place	*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	0	49,142	1,390	63,622	114,154

COMBINED DRAINAGE AREAS TOTAL NET RUNOFF (FT^3)

114,154

SUGGESTED TREATMENT OPTIONS

One pond located at the base of the Collection Area on vacant private land. Total Available Land Area: 18,432 ft^2

CAPTURE VOLUME:	17,554

COLLECTION AREA TOTAL NET RUNOFF (FT^3)

96,600

114,154 - 17,554 = 96,600

Watershed: **SPC1**
Subwatershed: **SPC1-3**
Collection Area: **SPC1-3D**

1 Year Storm Event 1.93 inches
Drainage Area (DA)
Impervious Cover Area (IC)
Effective Impervious Cover (IC_eff=IC/DA)
RA = Runoff Volume (inches) = [0.05+(0.0085*IC_eff)]*1.93
WQV = Water Quality Volume = DA*RA*(43560/12)

Drainage Area	**1** Public	**2** Residential	**3** Open	**4** Road & Bldgs.
DA (acres)	0.145	14.714	0.484	11.429
IC (acres)	0.000	7.387	0.205	10.012
IC_eff (%)	0.0%	50.2%	42.3%	87.6%
RA (inches)	0.097	0.920	0.790	1.534
WQV (ft^3)	51	49,142	1,390	63,622

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Site: **Pond 1: Located on a mostly vacant private lot west of the railroad tracks. Total Land Area: 18,432 ft^2**

Subwatershed: **SPC1-3**
Collection Area: **SPC1-3D**

1 Year Storm Event:	1.93	inches
WQV (previously calculated):	114,154	ft^3
Available Land Area:	18,432	ft^2
Conceptual Bioretention Depth:	1	ft max
Pond Volume: (Land Area X Depth)		
Pond Storage Capacity: (Pond Volume/1.05)		

BMP Type	**1** Bioretention
WQV (ft^3)	114,154
Available Land Area (ft^2)	18,432
Pond Volume (ft^3)	18,432
Pond Storage Capacity (ft^3)	17,554

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Subwatershed: SPC1-4

Collection Area: SPC1-4A

Drainage Areas:

	PUBLIC	RESIDENTIAL	OPEN	ROADS & COMMERCIAL BLDGS.	TOTALS
Total Area	3.115	27.343	0.926	23.555	54.938
% Impervious	79.4%	50.2%	22.8%	22.2%	39.4%
	*Method: hand calculated over entire Public region	*Method: Used 1-2B because had similar residential density	*Method: hand calculated over entire Open region	*Method: hand calculated over entire Commercial region	*Weighted average
RUNOFF GENERATED (FT^3)	15,814	91,354	1,583	39,440	148,190
RUNOFF CAPTURED (FT^3)	15,814	0	0	0	15,814
	*Appears feasible to capture 100% of onsite runoff	*No BMPs in place	*No BMPs in place	*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	0	91,354	1,583	39,440	132,377

COMBINED DRAINAGE AREAS TOTAL NET RUNOFF (FT^3)

132,377

SUGGESTED TREATMENT OPTIONS

A large bioretention basin located at base of collection area on Commercial and Open land. Some stormwater infrastructure already exists. Total Land Area: 25,115 ft^2

CAPTURE VOLUME:	23,919

COLLECTION AREA TOTAL NET RUNOFF (FT^3)

108,458

61,541 - 23,919 = 37,622

Watershed: **SPC1**
Subwatershed: **SPC1-4**
Collection Area: **SPC1-4A**

1 Year Storm Event 1.93 inches
Drainage Area (DA)
Impervious Cover Area (IC)
Effective Impervious Cover (IC_eff=IC/DA)
RA = Runoff Volume (inches) = [0.05+(0.0085*IC_eff)]*1.93
WQV = Water Quality Volume = DA*RA*(43560/12)

Drainage Area	**1** Public	**2** Residential	**3** Open	**4** Road & Bldgs.
DA (acres)	3.115	27.343	0.926	23.555
IC (acres)	2.472	13.732	0.211	5.237
IC_eff (%)	79.4%	50.2%	22.8%	22.2%
RA (inches)	1.399	0.920	0.471	0.461
WQV (ft^3)	15,814	91,354	1,583	39,440

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Site: **Pond 1: Mix of Open and Commercial land located just East of the railroad tracks. Some stormwater infrastructure already exists.**

Subwatershed: **SPC1-4**

Collection Area: **SPC1-4A**

1 Year Storm Event:	1.93	inches
WQV (previously calculated):	61,541	ft^3
Available Land Area:	25,115	ft^2
Conceptual Bioretention Depth:	1	ft max
Pond Volume: (Land Area X Depth)		
Pond Storage Capacity: (Pond Volume/1.05)		

BMP Type	**1** Bioretention
WQV (ft^3)	61,541
Available Land Area (ft^2)	25,115
Pond Volume (ft^3)	25,115
Pond Storage Capacity (ft^3)	23,919

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Subwatershed: SPC1-4

Collection Area: SPC1-4B

Drainage Areas:

PUBLIC	
Total Area	0.000
% Impervious	0.0%
*Method: hand calculated over entire Public region	
RUNOFF GENERATED (FT^3)	0
RUNOFF CAPTURED (FT^3)	0
DRAINAGE AREA RUNOFF (FT^3)	0

RESIDENTIAL	
Total Area	3.176
% Impervious	47.0%
*Method: Hand calculated over representative 4-block region	
RUNOFF GENERATED (FT^3)	10,000
RUNOFF CAPTURED (FT^3)	0
*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	10,000

OPEN	
Total Area	0.492
% Impervious	7.7%
*Method: hand calculated over entire Open region	
RUNOFF GENERATED (FT^3)	399
RUNOFF CAPTURED (FT^3)	0
*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	399

ROADS & COMMERCIAL BLDGS.	
Total Area	2.452
% Impervious	80.7%
*Method: Used %Imp. of 1-2C, similar Commercial land use.	
RUNOFF GENERATED (FT^3)	12,639
RUNOFF CAPTURED (FT^3)	0
*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	12,639

TOTALS	
Total Area	6.120
% Impervious*	57.3%
*Weighted average	
RUNOFF GENERATED (FT^3)	23,038
RUNOFF CAPTURED (FT^3)	0
DRAINAGE AREA RUNOFF (FT^3)	23,038

COMBINED DRAINAGE AREAS TOTAL NET RUNOFF (FT^3)
23,037

SUGGESTED TREATMENT OPTIONS	
A very large area bioretention pond located in the Northwest corner of San Pedro Park. Total Land Area: 89,528 ft^2	
CAPTURE VOLUME:	6,390

COLLECTION AREA TOTAL NET RUNOFF (FT^3)
16,647
23037 - 6,390 = 16,647

Watershed: **SPC1**
Subwatershed: **SPC1-4**
Collection Area: **SPC1-4B**

1 Year Storm Event 1.93 inches
Drainage Area (DA)
Impervious Cover Area (IC)
Effective Impervious Cover (IC_eff=IC/DA)
RA = Runoff Volume (inches) = [0.05+(0.0085*IC_eff)]*1.93
WQV = Water Quality Volume = DA*RA*(43560/12)

Drainage Area	**1** Public	**2** Residential	**3** Open	**4** Road & Bldgs.
DA (acres)	0.000	3.176	0.492	2.452
IC (acres)	0.000	1.493	0.038	1.979
IC_eff (%)	0.0%	47.0%	7.7%	80.7%
RA (inches)	0.000	0.868	0.223	1.420
WQV (ft^3)	0	10,002	399	12,639

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Site: **Pond 1: a bioretention pond located at the base of the collection area that has a land use classified as Open and is surrounded by residential lots. Total Land Area: 6710 ft2**

Subwatershed: **SPC1-4**
Collection Area: **SPC1-4A**

1 Year Storm Event:	1.93	inches
WQV (previously calculated):	23,037	ft^3
Available Land Area:	6,710	ft^2
Conceptual Bioretention Depth:	1	ft max
Pond Volume: (Land Area X Depth)		
Pond Storage Capacity: (Pond Volume/1.05)		

BMP Type	**1** Bioretention
WQV (ft^3)	23,037
Available Land Area (ft^2)	6,710
Pond Volume (ft^3)	6,710
Pond Storage Capacity (ft^3)	6,390

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Subwatershed: SPC1-4

Collection Area: SPC1-4C

Drainage Areas:

PUBLIC	
Total Area	1.552
% Impervious	89.6%
*Method: Hand calculated over entire Public region	
RUNOFF GENERATED (FT^3)	8,818
RUNOFF CAPTURED (FT^3)	4,409
*Appears feasible to capture 50% of onsite runoff	
DRAINAGE AREA RUNOFF (FT^3)	4,409

RESIDENTIAL	
Total Area	10.195
% Impervious	59.6%
*Method: Hand calculated over half of Residential region	
RUNOFF GENERATED (FT^3)	39,781
RUNOFF CAPTURED (FT^3)	0
*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	39,781

OPEN	
Total Area	0.090
% Impervious	42.3%
*Method: hand calculated over entire Open region	
RUNOFF GENERATED (FT^3)	258
RUNOFF CAPTURED (FT^3)	0
*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	258

ROADS & COMMERCIAL BLDGS.	
Total Area	3.259
% Impervious	84.8%
*Method: Hand calculated over entire Road and Commercial region	
RUNOFF GENERATED (FT^3)	17,601
RUNOFF CAPTURED (FT^3)	0
*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	17,601

TOTALS	
Total Area	15.095
% Impervious*	68.0%
*Weighted average	
RUNOFF GENERATED (FT^3)	66,458
RUNOFF CAPTURED (FT^3)	4,409
DRAINAGE AREA RUNOFF (FT^3)	62,048

COMBINED DRAINAGE AREAS TOTAL NET RUNOFF (FT^3)
62,048

SUGGESTED TREATMENT OPTIONS	
A bioretention pond located in the Southwest corner of San Pedro Park. Total Land Area: 35,828 ft^2	
CAPTURE VOLUME:	34,122

COLLECTION AREA TOTAL NET RUNOFF (FT^3)
27,926
62,048 - 34,122 = 27,926

Watershed: **SPC1**
Subwatershed: **SPC1-4**
Collection Area: **SPC1-4C**

1 Year Storm Event 1.93 inches
Drainage Area (DA)
Impervious Cover Area (IC)
Effective Impervious Cover (IC_eff=IC/DA)
RA = Runoff Volume (inches) = [0.05+(0.0085*IC_eff)]*1.93
WQV = Water Quality Volume = DA*RA*(43560/12)

Drainage Area	**1** Public	**2** Residential	**3** Open	**4** Road & Bldgs.
DA (acres)	1.552	10.195	0.090	3.259
IC (acres)	1.390	6.081	0.038	2.764
IC_eff (%)	89.6%	59.6%	42.3%	84.8%
RA (inches)	1.566	1.075	0.791	1.488
WQV (ft^3)	8,818	39,781	258	17,601

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Site: **Pond 1: A bioretention pond located in the Southwest corner of San Pedro Park.**

Subwatershed: **SPC1-4**
Collection Area: **SPC1-4C**

1 Year Storm Event:	1.93	inches
WQV (previously calculated):	62,048	ft^3
Available Land Area:	35,828	ft^2
Conceptual Bioretention Depth:	1	ft max
Pond Volume: (Land Area X Depth)		
Pond Storage Capacity: (Pond Volume/1.05)		

BMP Type	**1** Bioretention
WQV (ft^3)	62,048
Available Land Area (ft^2)	35,828
Pond Volume (ft^3)	35,828
Pond Storage Capacity (ft^3)	34,122

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Subwatershed: SPC1-4

Collection Area: SPC1-4D

Drainage Areas:

PUBLIC	
Total Area	1.981
% Impervious	71.9%
*Method: Hand calculated over entire Public region	
RUNOFF GENERATED (FT^3)	9,178
RUNOFF CAPTURED (FT^3)	9,178
*Appears feasible to capture 100% of onsite runoff	
DRAINAGE AREA RUNOFF (FT^3)	0

RESIDENTIAL	
Total Area	4.702
% Impervious	44.6%
*Method: Hand calculated over half of Residential region	
RUNOFF GENERATED (FT^3)	14,133
RUNOFF CAPTURED (FT^3)	0
*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	14,133

OPEN	
Total Area	1.351
% Impervious	25.7%
*Method: hand calculated over entire Open region	
RUNOFF GENERATED (FT^3)	2,544
RUNOFF CAPTURED (FT^3)	0
*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	2,544

ROADS & COMMERCIAL BLDGS.	
Total Area	7.184
% Impervious	88.3%
*Method: Hand calculated over entire Road and Commercial region	
RUNOFF GENERATED (FT^3)	40,286
RUNOFF CAPTURED (FT^3)	0
*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	40,286

TOTALS	
Total Area	15.218
% Impervious*	67.1%
*Weighted average	
RUNOFF GENERATED (FT^3)	66,141
RUNOFF CAPTURED (FT^3)	9,178
DRAINAGE AREA RUNOFF (FT^3)	56,963

COMBINED DRAINAGE AREAS TOTAL NET RUNOFF (FT^3)

56,963

SUGGESTED TREATMENT OPTIONS

A bioretention pond located in the Southwest corner of San Pedro Park. Total Land Area: 35,828 ft^2

CAPTURE VOLUME:	7,269

COLLECTION AREA TOTAL NET RUNOFF (FT^3)

49,694

56,963 - 7,269 = 49,694

Watershed: **SPC1**
Subwatershed: **SPC1-4**
Collection Area: **SPC1-4D**

1 Year Storm Event 1.93 inches
Drainage Area (DA)
Impervious Cover Area (IC)
Effective Impervious Cover (IC_eff=IC/DA)
RA = Runoff Volume (inches) = [0.05+(0.0085*IC_eff)]*1.93
WQV = Water Quality Volume = DA*RA*(43560/12)

Drainage Area	**1** Public	**2** Residential	**3** Open	**4** Road & Bldgs.
DA (acres)	1.981	4.702	1.351	7.184
IC (acres)	1.425	2.907	0.348	6.342
IC_eff (%)	71.9%	44.6%	25.7%	88.3%
RA (inches)	1.276	0.828	0.518	1.545
WQV (ft^3)	9,176	14,135	2,541	40,292

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Site: **Pond 1: A bioretention pond located on vacant lot in a Residential neighborhood.**

Subwatershed: **SPC1-4**
Collection Area: **SPC1-4D**

1 Year Storm Event:	1.93	inches
WQV (previously calculated):	56,963	ft^3
Available Land Area:	7,632	ft^2
Conceptual Bioretention Depth:	1	ft max
Pond Volume: (Land Area X Depth)		
Pond Storage Capacity: (Pond Volume/1.05)		

BMP Type	**1** Bioretention
WQV (ft^3)	56,963
Available Land Area (ft^2)	7,632
Pond Volume (ft^3)	7,632
Pond Storage Capacity (ft^3)	7,269

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Subwatershed: SPC1-5

Collection Area: SPC1-5A

Drainage Areas:

PUBLIC	
Total Area	3.687
% Impervious	75.3%
*Method: Hand calculated over entire Public region	
RUNOFF GENERATED (FT^3)	17,817
RUNOFF CAPTURED (FT^3)	17,817
*Appears feasible to capture 100% of onsite runoff	
DRAINAGE AREA RUNOFF (FT^3)	0

RESIDENTIAL	
Total Area	8.892
% Impervious	62.6%
*Method: Hand calculated over entire Residential region	
RUNOFF GENERATED (FT^3)	36,261
RUNOFF CAPTURED (FT^3)	0
*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	36,261

OPEN	
Total Area	0.484
% Impervious	15.2%
*Method: hand calculated over entire Open region	
RUNOFF GENERATED (FT^3)	608
RUNOFF CAPTURED (FT^3)	0
*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	608

ROADS & COMMERCIAL BLDGS.	
Total Area	7.568
% Impervious	87.6%
*Method: Hand calculated over entire Road & Commercial region	
RUNOFF GENERATED (FT^3)	42,129
RUNOFF CAPTURED (FT^3)	0
*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	42,129

TOTALS	
Total Area	20.631
% Impervious*	72.9%
*Weighted average	
RUNOFF GENERATED (FT^3)	96,816
RUNOFF CAPTURED (FT^3)	17,817
DRAINAGE AREA RUNOFF (FT^3)	78,999

COMBINED DRAINAGE AREAS TOTAL NET RUNOFF (FT^3)
78,999

SUGGESTED TREATMENT OPTIONS	
A pond outside, and downline of the Collection Area's boundary. The pond is located in the back parking lot of the Publicily owned "El Shaddai Life Ministries" property. Total Land Area: 3,788 ft^2	
CAPTURE VOLUME:	3,608

COLLECTION AREA TOTAL NET RUNOFF (FT^3)
75,391
78,999 - 3,608 = 75,391

Watershed: **SPC1**
Subwatershed: **SPC1-5**
Collection Area: **SPC1-5A**

1 Year Storm Event 1.93 inches
Drainage Area (DA)
Impervious Cover Area (IC)
Effective Impervious Cover (IC_eff=IC/DA)
RA = Runoff Volume (inches) = [0.05+(0.0085*IC_eff)]*1.93
WQV = Water Quality Volume = DA*RA*(43560/12)

Drainage Area	**1** Public	**2** Residential	**3** Open	**4** Road & Bldgs.
DA (acres)	3.687	8.892	0.484	7.568
IC (acres)	2.775	5.566	0.074	6.475
IC_eff (%)	75.3%	62.6%	15.2%	87.6%
RA (inches)	1.331	1.123	0.346	1.534
WQV (ft^3)	17,817	36,261	608	42,129

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Site: **Pond 1: A pond outside, and downline of the Collection Area's boundary. The pond is located in the back parking lot of the Publicily owned "El Shaddai Life Ministries" property.**

Subwatershed: **SPC1-5**

Collection Area: **SPC1-5A**

1 Year Storm Event:	1.93	inches
WQV (previously calculated):	78,999	ft^3
Available Land Area:	3,788	ft^2
Conceptual Bioretention Depth:	1	ft max
Pond Volume: (Land Area X Depth)		
Pond Storage Capacity: (Pond Volume/1.05)		

BMP	**1**
Type	Bioretention
WQV (ft^3)	78,999
Available Land Area (ft^2)	3,788
Pond Volume (ft^3)	3,788
Pond Storage Capacity (ft^3)	3,608

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Subwatershed: SPC1-5

Collection Area: SPC1-5B

Drainage Areas:

	PUBLIC	RESIDENTIAL	OPEN	ROADS & COMMERCIAL BLDGS.	TOTALS
Total Area	0.000	0.003	0.000	1.356	1.360
% Impervious	0.0%	0.0%	0.0%	58.3%	58.2%
	*Method: Hand calculated over entire Public region	*Method: Hand calculated over entire Residential region	*Method: hand calculated over entire Open region	*Method: Hand calculated over entire Rd. & Comm. region	*Weighted average
RUNOFF GENERATED (FT^3)	0	1	0	5,184	5,185
RUNOFF CAPTURED (FT^3)	0	0	0	0	0
	*No BMPs in place	*No BMPs in place	*No BMPs in place	*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	0	1	0	5,184	5,185

COMBINED DRAINAGE AREAS TOTAL NET RUNOFF (FT^3)

5,185

SUGGESTED TREATMENT OPTIONS

Run a grassy infiltrating swale along the ceter median of Woodlawn. Total Land Area: 6,391 ft^2

CAPTURE VOLUME:	UNKNOWN

COLLECTION AREA TOTAL NET RUNOFF (FT^3)

UNKNOWN

Watershed: **SPC1**
Subwatershed: **SPC1-5**
Collection Area: **SPC1-5B**

1 Year Storm Event 1.93 inches
Drainage Area (DA)
Impervious Cover Area (IC)
Effective Impervious Cover (IC_eff=IC/DA)
RA = Runoff Volume (inches) = [0.05+(0.0085*IC_eff)]*1.93
WQV = Water Quality Volume = DA*RA*(43560/12)

Drainage Area	**1** Public	**2** Residential	**3** Open	**4** Road & Bldgs.
DA (acres)	0.000	0.003	0.000	1.356
IC (acres)	0.000	0.000	0.000	1.004
IC_eff (%)	0.0%	0.0%	0.0%	58.3%
RA (inches)	0.000	0.097	0.000	1.053
WQV (ft^3)	0	1	0	5,184

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Site: **Pond 1: A bioretention pond located at the base of the Collection Area near the railroad tracs in the back of a Public lot owned by "Spiritual Assembly of Baha"is of Sa Etal".**

Subwatershed: **SPC1-5**

Collection Area: **SPC1-5B**

1 Year Storm Event:	1.93	inches
WQV (previously calculated):	68,892	ft^3
Available Land Area:	10,595	ft^2
Conceptual Bioretention Depth:	1	ft max
Pond Volume: (Land Area X Depth)		
Pond Storage Capacity: (Pond Volume/1.05)		

BMP	**1**
Type	Bioretention
WQV (ft^3)	68,892
Available Land Area (ft^2)	10,595
Pond Volume (ft^3)	10,595
Pond Storage Capacity (ft^3)	10,091

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Subwatershed: SPC1-5

Collection Area: SPC1-5C

Drainage Areas:

	PUBLIC	RESIDENTIAL	OPEN	ROADS & COMMERCIAL BLDGS.	TOTALS
Total Area	0.467	4.097	0.016	3.715	8.294
% Impervious	55.6%	56.1%	88.0%	85.6%	69.4%
	*Method: Hand calculated over entire Public region	*Method: Hand calculated over entire Residential region	*Method: hand calculated over entire Open region	*Method: Hand calculated over entire Road & Commercial region	*Weighted average
RUNOFF GENERATED (FT^3)	1,709	15,114	87	20,250	37,161
RUNOFF CAPTURED (FT^3)	1,709	0	0	0	1,709
	*Appears feasible to capture 100% of onsite runoff	*No BMPs in place	*No BMPs in place	*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	0	15,114	87	20,250	35,451

COMBINED DRAINAGE AREAS TOTAL NET RUNOFF (FT^3)

35,451

SUGGESTED TREATMENT OPTIONS

Two ponds both on the West side of San Pedro Blvd. One is located on Public property owned by the"Womans Club of San Antonio". The second, located mostly on Public property owned by the City of San Antonio. Total Land Area: 8,181 ft^2

CAPTURE VOLUME:	7,791

COLLECTION AREA TOTAL NET RUNOFF (FT^3)

27,660

35,451 - 7,791 = 27,660

Watershed: **SPC1**
Subwatershed: **SPC1-5**
Collection Area: **SPC1-5C**

1 Year Storm Event 1.93 inches
Drainage Area (DA)
Impervious Cover Area (IC)
Effective Impervious Cover (IC_eff=IC/DA)
RA = Runoff Volume (inches) = [0.05+(0.0085*IC_eff)]*1.93
WQV = Water Quality Volume = DA*RA*(43560/12)

Drainage Area	**1** Public	**2** Residential	**3** Open	**4** Road & Bldgs.
DA (acres)	0.467	4.097	0.016	3.715
IC (acres)	0.260	2.297	0.014	3.182
IC_eff (%)	55.6%	56.1%	88.0%	85.6%
RA (inches)	1.009	1.016	1.540	1.502
WQV (ft^3)	1,709	15,114	87	20,250

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Site: **Pond 1: Public property owned by the"Womans Club of San Antonio" at the address 1717 SAN PEDRO AVE. Land Area: 2,311 ft^2**

Pond 2: Mostly Public property owned by the City of San Antonio just South of Pond 1. Land appears to be associated with a bus route. Land Area: 5,869 ft^2

Subwatershed: **SPC1-5**

Collection Area: **SPC1-5C**

1 Year Storm Event:	1.93	inches
WQV (previously calculated):	35,451	ft^3
Available Land Area:	8,181	ft^2
Conceptual Bioretention Depth:	1	ft max
Pond Volume: (Land Area X Depth)		
Pond Storage Capacity: (Pond Volume/1.05)		

BMP Type	**1** Bioretention
WQV (ft^3)	35,451
Available Land Area (ft^2)	8,181
Pond Volume (ft^3)	8,181
Pond Storage Capacity (ft^3)	7,791

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Subwatershed: SPC1-5

Collection Area: SPC1-5D

Drainage Areas:

	PUBLIC	RESIDENTIAL	OPEN	ROADS & COMMERCIAL BLDGS.	TOTALS
Total Area	8.682	2.085	0.000	5.596	16.364
% Impervious	78.5%	49.7%	0.0%	84.6%	76.9%
	*Method: Hand calculated over entire Public region	*Method: Hand calculated over entire Residential region	*Method: hand calculated over entire Open region	*Method: Hand calculated over entire Road & Commercial region	*Weighted average
RUNOFF GENERATED (FT^3)	43,649	6,900	0	30,166	80,714
RUNOFF CAPTURED (FT^3)	21,824	0	0	0	21,824
	*Appears feasible to capture 50% of onsite runoff.	*No BMPs in place	*No BMPs in place	*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	21,824	6,900	0	30,166	58,890

COMBINED DRAINAGE AREAS TOTAL NET RUNOFF (FT^3)

58,890

SUGGESTED TREATMENT OPTIONS

Two ponds. The first would require 15% of the Alamo Community College parking lot and is located in the middle of the Collection area. The second is located in San Pedro Park just south of the tennis courts. Both are on Public land. Total Land Area: 51,720 ft^2

CAPTURE VOLUME:	49,257

COLLECTION AREA TOTAL NET RUNOFF (FT^3)

9,632

58,890, - 49,257 = 9,632

Watershed: **SPC1**
Subwatershed: **SPC1-5**
Collection Area: **SPC1-5D**

1 Year Storm Event 1.93 inches
Drainage Area (DA)
Impervious Cover Area (IC)
Effective Impervious Cover (IC_eff=IC/DA)
RA = Runoff Volume (inches) = [0.05+(0.0085*IC_eff)]*1.93
WQV = Water Quality Volume = DA*RA*(43560/12)

Drainage Area	**1** Public	**2** Residential	**3** Open	**4** Road & Bldgs.
DA (acres)	8.682	2.085	0.000	5.596
IC (acres)	6.819	1.036	0.000	4.736
IC_eff (%)	78.5%	49.7%	0.0%	84.6%
RA (inches)	1.385	0.912	0.000	1.485
WQV (ft^3)	43,649	6,900	0	30,166

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Site: **Pond 1: Public property owned by Alamo Community College currently used as a parking lot. Pond would require 15% of parking lot space. Total Land Area: 7,177 ft^2**

Pond 2: At the base of the Collection Area is the San Pedro Park. This pond is located in the park just South of the tennis courts. Total Land Area: 44,543 ft^2

Subwatershed: **SPC1-5**

Collection Area: **SPC1-5D**

1 Year Storm Event:	1.93	inches
WQV (previously calculated):	58,890	ft^3
Available Land Area:	51,720	ft^2
Conceptual Bioretention Depth:	1	ft max
Pond Volume: (Land Area X Depth)		
Pond Storage Capacity: (Pond Volume/1.05)		

BMP Type	**1** Bioretention
WQV (ft^3)	58,890
Available Land Area (ft^2)	51,720
Pond Volume (ft^3)	51,720
Pond Storage Capacity (ft^3)	49,257

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Subwatershed: SPC1-5

Collection Area: SPC1-5E

Drainage Areas:

PUBLIC	
Total Area	20.712
% Impervious	58.8%
*Method: Hand calculated over entire Public region	

RESIDENTIAL	
Total Area	6.491
% Impervious	62.9%
*Method: Hand calculated over entire Residential region	

OPEN	
Total Area	1.041
% Impervious	52.5%
*Method: hand calculated over entire Open region	

ROADS & COMMERCIAL BLDGS.	
Total Area	14.629
% Impervious	84.6%
*Method: Used 84.6% from similar Rd & Comm. region; 1-5D	

TOTALS	
Total Area	42.874
% Impervious*	68.1%
*Weighted average	

	PUBLIC	RESIDENTIAL	OPEN	ROADS & COMMERCIAL BLDGS.	TOTALS
RUNOFF GENERATED (FT^3)	79,774	26,583	3,623	78,826	188,806
RUNOFF CAPTURED (FT^3)	39,887	0	0	0	39,887
	*Appears feasible to capture 50% of onsite runoff.	*No BMPs in place	*No BMPs in place	*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	39,887	26,583	3,623	78,826	148,919

COMBINED DRAINAGE AREAS TOTAL NET RUNOFF (FT^3)

148,919

SUGGESTED TREATMENT OPTIONS

Four ponds throughout the Collection Area all located on public properties. For detailed information on each pond see Pond Sizing Calculations page. Total Land Area: 37,349 ft^2

CAPTURE VOLUME:	35,570

COLLECTION AREA TOTAL NET RUNOFF (FT^3)

113,348

148,919 - 35,570 = 113,348

Watershed: **SPC1**
Subwatershed: **SPC1-5**
Collection Area: **SPC1-5E**

1 Year Storm Event 1.93 inches
Drainage Area (DA)
Impervious Cover Area (IC)
Effective Impervious Cover (IC_eff=IC/DA)
RA = Runoff Volume (inches) = [0.05+(0.0085*IC_eff)]*1.93
WQV = Water Quality Volume = DA*RA*(43560/12)

Drainage Area	**1** Public	**2** Residential	**3** Open	**4** Road & Bldgs.
DA (acres)	20.712	6.491	1.041	14.629
IC (acres)	12.178	4.082	0.547	12.376
IC_eff (%)	58.8%	62.9%	52.5%	84.6%
RA (inches)	1.061	1.128	0.958	1.484
WQV (ft^3)	79,774	26,583	3,623	78,826

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Site: **Pond 1: Located in the upper portion of the Collection Area, this pond is in the side yard of a Public lot owned by "Catholic Charities". Address is 202 @. French Pl. Total Land Area: 5,622 ft^2**

Pond 2: Located in the mid-portion of the Collection Area, this pond is uses the yar of a Public lot owned by "SA Union Jr. College". Address: 310 W. Ashby Pl. Total Land Area: 19,084 ft^2

Pond 3: Located in the lower most Eastern portion of the Collection Area, this pond uses the yard of a Public lot owned by "San Antonio ISD". Address: 1915 N. Main Ave. Total Land Area: 4,237 ft^2

Pond 4: Located just below the Collection Area, this pond uses the yard of a Public lot owned by "Alamo Community College". It is on the north edge of campus boundary. Total Land Area: 8,407 ft^2

Subwatershed: **SPC1-5**

Collection Area: **SPC1-5E**

1 Year Storm Event:	1.93	inches
WQV (previously calculated):	148,919	ft^3
Available Land Area:	37,349	ft^2
Conceptual Bioretention Depth:	1	ft max
Pond Volume: (Land Area X Depth)		
Pond Storage Capacity: (Pond Volume/1.05)		

BMP	**1**
Type	Bioretention
WQV (ft^3)	148,919
Available Land Area (ft^2)	37,349
Pond Volume (ft^3)	37,349
Pond Storage Capacity (ft^3)	35,570

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Subwatershed: SPC1-6

Collection Area: SPC1-6A

Drainage Areas:

PUBLIC	
Total Area	2.557
% Impervious	49.1%
*Method: Hand calculated over entire Public region	

RESIDENTIAL	
Total Area	7.605
% Impervious	45.8%
*Method: Hand calculated over entire Residential region	

OPEN	
Total Area	0.380
% Impervious	55.9%
*Method: hand calculated over entire Open region	

ROADS & COMMERCIAL BLDGS.	
Total Area	5.299
% Impervious	80.3%
*Method: Hand calculated over entire Rd. & Comm. region	

TOTALS	
Total Area	15.841
% Impervious*	58.1%
*Weighted average	

	PUBLIC	RESIDENTIAL	OPEN	ROADS & COMMERCIAL BLDGS.	TOTALS
RUNOFF GENERATED (FT^3)	8,377	23,401	1,397	27,206	60,381
RUNOFF CAPTURED (FT^3)	8,377	0	0	0	8,377
	* Appears feasible to capture 100% of on-site runoff.	*No BMPs in place	*No BMPs in place	*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	0	23,401	1,397	27,206	52,004

COMBINED DRAINAGE AREAS TOTAL NET RUNOFF (FT^3)

52,004

SUGGESTED TREATMENT OPTIONS

Two ponds located at the base of the Collection Area. Pond 1 would be located on public property owned by "Bexar County" that is currently vacant. Pond 2 is in the back yard of multiple Public lots owned by "Youth Empowerment Services". Total Land Area: 17,176 ft^2

CAPTURE VOLUME:	16,358

COLLECTION AREA TOTAL NET RUNOFF (FT^3)

35,646

52,004 - 16,358 = 35,646

Watershed: **SPC1**
Subwatershed: **SPC1-6**
Collection Area: **SPC1-6A**

1 Year Storm Event 1.93 inches
Drainage Area (DA)
Impervious Cover Area (IC)
Effective Impervious Cover (IC_eff=IC/DA)
RA = Runoff Volume (inches) = [0.05+(0.0085*IC_eff)]*1.93
WQV = Water Quality Volume = DA*RA*(43560/12)

Drainage Area	**1** Public	**2** Residential	**3** Open	**4** Road & Bldgs.
DA (acres)	2.557	7.605	0.380	5.299
IC (acres)	1.256	3.482	0.212	4.257
IC_eff (%)	49.1%	45.8%	55.9%	80.3%
RA (inches)	0.903	0.848	1.013	1.414
WQV (ft^3)	8,377	23,401	1,397	27,206

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Site: **Pond 1: Located on public property owned by "Bexar County" that is currently vacant. Total Land Area: 8,837 ft^2**

Pond 2: In the back yard of multiple Public lots owned by "Youth Empowerment Services". Total Land Area: 8,339 ft^2

Subwatershed: **SPC1-6**
Collection Area: **SPC1-6A**

1 Year Storm Event:	1.93	inches
WQV (previously calculated):	52,004	ft^3
Available Land Area:	17,176	ft^2
Conceptual Bioretention Depth:	1	ft max
Pond Volume: (Land Area X Depth)		
Pond Storage Capacity: (Pond Volume/1.05)		

BMP Type	**1** Bioretention
WQV (ft^3)	52,004
Available Land Area (ft^2)	17,176
Pond Volume (ft^3)	17,176
Pond Storage Capacity (ft^3)	16,358

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Subwatershed: SPC1-6

Collection Area: SPC1-6B

Drainage Areas:

	PUBLIC	RESIDENTIAL	OPEN	ROADS & COMMERCIAL BLDGS.	TOTALS
Total Area	0.082	9.384	0.602	7.087	17.155
% Impervious	100.0%	56.6%	10.3%	73.1%	62.0%
	*Method: Hand calculated over entire Public region	*Method: Hand calculated over representative 4-block region	*Method: Hand calculated over entire Open region	*Method: Hand calculated over entire Rd. & Comm. region	*Weighted average
RUNOFF GENERATED (FT^3)	515	34,909	580	33,344	69,347
RUNOFF CAPTURED (FT^3)	515	0	0	0	515
	* Appears feasible to capture 100% of on-site runoff.	*No BMPs in place	*No BMPs in place	*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	0	34,909	580	33,344	68,832

COMBINED DRAINAGE AREAS TOTAL NET RUNOFF (FT^3)

68,832

SUGGESTED TREATMENT OPTIONS

One pond located at the base of the Collection Area on a privately owned vacant lot. Total Land Area: 8,910 ft^2

CAPTURE VOLUME:	8,486

COLLECTION AREA TOTAL NET RUNOFF (FT^3)

60,346

68,832 - 8,486 = 60,346

s

Watershed: **SPC1**
Subwatershed: **SPC1-6**
Collection Area: **SPC1-6B**

1 Year Storm Event 1.93 inches
Drainage Area (DA)
Impervious Cover Area (IC)
Effective Impervious Cover (IC_eff=IC/DA)
RA = Runoff Volume (inches) = [0.05+(0.0085*IC_eff)]*1.93
WQV = Water Quality Volume = DA*RA*(43560/12)

Drainage Area	**1** Public	**2** Residential	**3** Open	**4** Road & Bldgs.
DA (acres)	0.082	9.384	0.602	7.087
IC (acres)	0.082	5.310	0.062	5.182
IC_eff (%)	100.0%	56.6%	10.3%	73.1%
RA (inches)	1.737	1.025	0.265	1.296
WQV (ft^3)	515	34,909	580	33,344

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Site: **Pond 1: Pond located at the base of the Collection Area on a privately owned vacant lot.**

Subwatershed: **SPC1-6**
Collection Area: **SPC1-6B**

1 Year Storm Event:	1.93	inches
WQV (previously calculated):	68,832	ft^3
Available Land Area:	8,910	ft^2
Conceptual Bioretention Depth:	1	ft max
Pond Volume: (Land Area X Depth)		
Pond Storage Capacity: (Pond Volume/1.05)		

BMP Type	**1** Bioretention
WQV (ft^3)	68,832
Available Land Area (ft^2)	8,910
Pond Volume (ft^3)	8,910
Pond Storage Capacity (ft^3)	8,486

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Subwatershed: SPC1-6

Collection Area: SPC1-6C

Drainage Areas:

PUBLIC	
Total Area	0.000
% Impervious	0.0%
*Method: Hand calculated over entire Public region	
RUNOFF GENERATED (FT^3)	0
RUNOFF CAPTURED (FT^3)	0
*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	0

RESIDENTIAL	
Total Area	5.116
% Impervious	56.6%
*Method: Used 56.6% value from similar Residential region; 1-6B	
RUNOFF GENERATED (FT^3)	19,030
RUNOFF CAPTURED (FT^3)	0
*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	19,030

OPEN	
Total Area	0.794
% Impervious	22.0%
*Method: Hand calculated over entire Open region	
RUNOFF GENERATED (FT^3)	1,317
RUNOFF CAPTURED (FT^3)	0
*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	1,317

ROADS & COMMERCIAL BLDGS.	
Total Area	6.629
% Impervious	50.7%
*Method: Hand calculated over entire Rd. & Comm. region	
RUNOFF GENERATED (FT^3)	22,336
RUNOFF CAPTURED (FT^3)	0
*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	22,336

TOTALS	
Total Area	12.539
% Impervious*	51.3%
*Weighted average	
RUNOFF GENERATED (FT^3)	42,682
RUNOFF CAPTURED (FT^3)	0
DRAINAGE AREA RUNOFF (FT^3)	42,682

COMBINED DRAINAGE AREAS TOTAL NET RUNOFF (FT^3)
42,682

SUGGESTED TREATMENT OPTIONS	
One pond located at the base of the Collection Area on a privately owned vacant lot. Total Land Area: 18,598 ft^2	
CAPTURE VOLUME:	17,713

COLLECTION AREA TOTAL NET RUNOFF (FT^3)
24,970
42,682 - 17,713 = 24,970

Watershed: **SPC1**
Subwatershed: **SPC1-6**
Collection Area: **SPC1-6C**

1 Year Storm Event 1.93 inches
Drainage Area (DA)
Impervious Cover Area (IC)
Effective Impervious Cover (IC_eff=IC/DA)
RA = Runoff Volume (inches) = [0.05+(0.0085*IC_eff)]*1.93
WQV = Water Quality Volume = DA*RA*(43560/12)

Drainage Area	**1** Public	**2** Residential	**3** Open	**4** Road & Bldgs.
DA (acres)	0.000	5.116	0.794	6.629
IC (acres)	0.000	2.895	0.174	3.361
IC_eff (%)	0.0%	56.6%	22.0%	50.7%
RA (inches)	0.000	1.025	0.457	0.928
WQV (ft^3)	0	19,030	1,317	22,336

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Site: **Pond 1: Pond located at the base of the Collection Area on a privately owned vacant lot.**

Subwatershed: **SPC1-6**
Collection Area: **SPC1-6C**

1 Year Storm Event:	1.93	inches
WQV (previously calculated):	42,682	ft^3
Available Land Area:	18,598	ft^2
Conceptual Bioretention Depth:	1	ft max

Pond Volume: (Land Area X Depth)
Pond Storage Capacity: (Pond Volume/1.05)

BMP Type	**1** Bioretention
WQV (ft^3)	42,682
Available Land Area (ft^2)	18,598
Pond Volume (ft^3)	18,598
Pond Storage Capacity (ft^3)	17,713

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Subwatershed: SPC1-6

Collection Area: SPC1-6D

Drainage Areas:

	PUBLIC	RESIDENTIAL	OPEN	ROADS & COMMERCIAL BLDGS.	TOTALS
Total Area	1.971	8.398	2.263	8.018	20.651
% Impervious	83.5%	56.6%	45.1%	80.3%	67.1%
	*Method: Hand calculated over entire Public region	*Method: Used 56.6% value from similar Residential region; 1-6B	*Method: Hand calculated over entire Open region	*Method: Used 80.3% value from similar Rd. & Comm. Region; 1-6A	*Weighted average
RUNOFF GENERATED (FT^3)	10,485	31,242	6,869	41,152	89,747
RUNOFF CAPTURED (FT^3)	10,485	0	0	0	10,485
	* Appears feasible to capture 100% of on-site runoff.	*No BMPs in place	*No BMPs in place	*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	0	31,242	6,869	41,152	79,262

COMBINED DRAINAGE AREAS TOTAL NET RUNOFF (FT^3)

79,262

SUGGESTED TREATMENT OPTIONS

One large pond located at the base of the Collection Area on a privately owned vacant lot. Total Land Area: 38,835 ft^2

CAPTURE VOLUME:	36,986

COLLECTION AREA TOTAL NET RUNOFF (FT^3)

42,277

79,262 - 36,986 = 42,277

Watershed: **SPC1**
Subwatershed: **SPC1-6**
Collection Area: **SPC1-6D**

1 Year Storm Event 1.93 inches
Drainage Area (DA)
Impervious Cover Area (IC)
Effective Impervious Cover (IC_eff=IC/DA)
RA = Runoff Volume (inches) = [0.05+(0.0085*IC_eff)]*1.93
WQV = Water Quality Volume = DA*RA*(43560/12)

Drainage Area	**1** Public	**2** Residential	**3** Open	**4** Road & Bldgs.
DA (acres)	1.971	8.398	2.263	8.018
IC (acres)	1.645	4.752	1.020	6.439
IC_eff (%)	83.5%	56.6%	45.1%	80.3%
RA (inches)	1.466	1.025	0.836	1.414
WQV (ft^3)	10,485	31,242	6,869	41,152

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Site: **Pond 1: Pond located at the base of the Collection Area on a privately owned vacant lot.**

Subwatershed: **SPC1-6**
Collection Area: **SPC1-6D**

1 Year Storm Event:	1.93	inches
WQV (previously calculated):	79,262	ft^3
Available Land Area:	38,835	ft^2
Conceptual Bioretention Depth:	1	ft max
Pond Volume: (Land Area X Depth)		
Pond Storage Capacity: (Pond Volume/1.05)		

BMP Type	**1** Bioretention
WQV (ft^3)	79,262
Available Land Area (ft^2)	38,835
Pond Volume (ft^3)	38,835
Pond Storage Capacity (ft^3)	36,986

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Subwatershed: SPC1-6

Collection Area: SPC1-6E

Drainage Areas:

PUBLIC	
Total Area	0.000
% Impervious	0.0%
*Method: Hand calculated over entire Public region	
RUNOFF GENERATED (FT^3)	0
RUNOFF CAPTURED (FT^3)	0
* Appears feasible to capture 100% of on-site runoff.	
DRAINAGE AREA RUNOFF (FT^3)	0

RESIDENTIAL	
Total Area	10.829
% Impervious	38.3%
*Method: Hand calculated over entire Residential region	
RUNOFF GENERATED (FT^3)	28,505
RUNOFF CAPTURED (FT^3)	0
*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	28,505

OPEN	
Total Area	1.098
% Impervious	36.3%
*Method: Hand calculated over entire Open region	
RUNOFF GENERATED (FT^3)	2,757
RUNOFF CAPTURED (FT^3)	0
*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	2,757

ROADS & COMMERCIAL BLDGS.	
Total Area	6.330
% Impervious	80.3%
*Method: Used 80.3% value from similar Rd. & Comm. region; 1-6A	
RUNOFF GENERATED (FT^3)	32,486
RUNOFF CAPTURED (FT^3)	0
*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	32,486

TOTALS	
Total Area	18.256
% Impervious*	52.8%
*Weighted average	
RUNOFF GENERATED (FT^3)	63,748
RUNOFF CAPTURED (FT^3)	0
DRAINAGE AREA RUNOFF (FT^3)	63,748

COMBINED DRAINAGE AREAS TOTAL NET RUNOFF (FT^3)
63,748

SUGGESTED TREATMENT OPTIONS	
One large pond located at the base of the Collection Area on a privately owned vacant lot. Total Land Area: 13,800 ft^2	
CAPTURE VOLUME:	13,143

COLLECTION AREA TOTAL NET RUNOFF (FT^3)
50,605
63,748 - 13,143 = 50,605

Watershed: **SPC1**
Subwatershed: **SPC1-6**
Collection Area: **SPC1-6E**

1 Year Storm Event 1.93 inches
Drainage Area (DA)
Impervious Cover Area (IC)
Effective Impervious Cover (IC_eff=IC/DA)
RA = Runoff Volume (inches) = [0.05+(0.0085*IC_eff)]*1.93
WQV = Water Quality Volume = DA*RA*(43560/12)

Drainage Area	**1** Public	**2** Residential	**3** Open	**4** Road & Bldgs.
DA (acres)	0.000	10.829	1.098	6.330
IC (acres)	0.000	4.150	0.398	5.083
IC_eff (%)	0.0%	38.3%	36.3%	80.3%
RA (inches)	0.000	0.725	0.692	1.414
WQV (ft^3)	0	28,505	2,757	32,486

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Site: **Pond 1: Pond located at the base of the Collection Area on a privately owned vacant lot.**

Subwatershed: **SPC1-6**
Collection Area: **SPC1-6E**

1 Year Storm Event:	1.93	inches
WQV (previously calculated):	63,748	ft^3
Available Land Area:	13,800	ft^2
Conceptual Bioretention Depth:	1	ft max

Pond Volume: (Land Area X Depth)
Pond Storage Capacity: (Pond Volume/1.05)

BMP Type	**1** Bioretention
WQV (ft^3)	63,748
Available Land Area (ft^2)	13,800
Pond Volume (ft^3)	13,800
Pond Storage Capacity (ft^3)	13,143

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Subwatershed: SPC1-7

Collection Area: SPC1-7A

Drainage Areas:

PUBLIC	
Total Area	0.000
% Impervious	0.0%
*Method: Hand calculated over entire Public region	

RESIDENTIAL	
Total Area	1.900
% Impervious	44.2%
*Method: Hand calculated over entire Residential region	

OPEN	
Total Area	3.243
% Impervious	50.0%
*Method: Hand calculated over entire Open region	

ROADS & COMMERCIAL BLDGS.	
Total Area	16.911
% Impervious	90.7%
*Method: Hand calculated over entire Rd. & Comm. Region.	

TOTALS	
Total Area	22.054
% Impervious*	80.7%
*Weighted average	

	PUBLIC	RESIDENTIAL	OPEN	ROADS & COMMERCIAL BLDGS.	TOTALS
RUNOFF GENERATED (FT^3)	0	5,672	10,786	97,298	113,756
RUNOFF CAPTURED (FT^3)	0	0	0	0	0
	* Appears feasible to capture 100% of on-site runoff.	*No BMPs in place	*No BMPs in place	*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	0	5,672	10,786	97,298	113,756

COMBINED DRAINAGE AREAS TOTAL NET RUNOFF (FT^3)

113,756

SUGGESTED TREATMENT OPTIONS

Three ponds located throughout the Collection Area. All the ponds are situated on vacant lots. Total Land Area: 27,327 ft^2

CAPTURE VOLUME:	26,026

COLLECTION AREA TOTAL NET RUNOFF (FT^3)

87,731

113,756 - 26,026 = 87,731

Watershed: **SPC1**
Subwatershed: **SPC1-7**
Collection Area: **SPC1-7A**

1 Year Storm Event 1.93 inches
Drainage Area (DA)
Impervious Cover Area (IC)
Effective Impervious Cover (IC_eff=IC/DA)
RA = Runoff Volume (inches) = [0.05+(0.0085*IC_eff)]*1.93
WQV = Water Quality Volume = DA*RA*(43560/12)

Drainage Area	**1** Public	**2** Residential	**3** Open	**4** Road & Bldgs.
DA (acres)	0.000	1.900	3.243	16.911
IC (acres)	0.000	0.841	1.621	15.344
IC_eff (%)	0.0%	44.2%	50.0%	90.7%
RA (inches)	0.000	0.822	0.916	1.585
WQV (ft^3)	0	5,672	10,786	97,298

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Site: **Pond 1: Pond located mid Collection Area on Culebra Rd. The land is currently just a vacant lot. Total Land Area: 6,146 ft^2**

Pond 2: Pond located mid Collection Area off of N. Colorado St. The land is mostly a vacant lot with small businesses near it. Total Land Area: 9,794 ft^2

Poond 3: Located at the base of the Collection Area on a vacant lot off of W. Laurel St. Total Land Area: 11,387 ft^2

Subwatershed: **SPC1-7**
Collection Area: **SPC1-7A**

1 Year Storm Event:	1.93	inches
WQV (previously calculated):	113,756	ft^3
Available Land Area:	27,327	ft^2
Conceptual Bioretention Depth:	1	ft max
Pond Volume: (Land Area X Depth)		
Pond Storage Capacity: (Pond Volume/1.05)		

BMP Type	**1** Bioretention
WQV (ft^3)	113,756
Available Land Area (ft^2)	27,327
Pond Volume (ft^3)	27,327
Pond Storage Capacity (ft^3)	26,026

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Subwatershed: SPC1-7

Collection Area: SPC1-7B

Drainage Areas:

PUBLIC	
Total Area	0.399
% Impervious	87.3%
*Method: Hand calculated over entire Public region	
RUNOFF GENERATED (FT^3)	2,213
RUNOFF CAPTURED (FT^3)	2,213
* Appears feasible to capture 100% of on-site runoff.	
DRAINAGE AREA RUNOFF (FT^3)	0

RESIDENTIAL	
Total Area	0.674
% Impervious	52.9%
*Method: Hand calculated over entire Residential region	
RUNOFF GENERATED (FT^3)	2,357
RUNOFF CAPTURED (FT^3)	0
*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	2,357

OPEN	
Total Area	3.594
% Impervious	96.4%
*Method: Hand calculated over entire Open region	
RUNOFF GENERATED (FT^3)	21,900
RUNOFF CAPTURED (FT^3)	0
*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	21,900

ROADS & COMMERCIAL BLDGS.	
Total Area	22.095
% Impervious	90.3%
*Method: Used 90.3% value from similar Rd. & Comm. region; 1-7A	
RUNOFF GENERATED (FT^3)	126,553
RUNOFF CAPTURED (FT^3)	0
*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	126,553

TOTALS	
Total Area	26.761
% Impervious*	90.1%
*Weighted average	
RUNOFF GENERATED (FT^3)	153,023
RUNOFF CAPTURED (FT^3)	2,213
DRAINAGE AREA RUNOFF (FT^3)	150,809

COMBINED DRAINAGE AREAS TOTAL NET RUNOFF (FT^3)
150,809

SUGGESTED TREATMENT OPTIONS	
One pond located at the base of the collection area in a largely vacant construction equipment storage lot on Lombrano St. Total Land Area: 13,591 ft^2	
CAPTURE VOLUME:	12,944

COLLECTION AREA TOTAL NET RUNOFF (FT^3)
137,866
150,809 - 12,944 = 137,866

Watershed: **SPC1**
Subwatershed: **SPC1-7**
Collection Area: **SPC1-7B**

1 Year Storm Event 1.93 inches
Drainage Area (DA)
Impervious Cover Area (IC)
Effective Impervious Cover (IC_eff=IC/DA)
RA = Runoff Volume (inches) = [0.05+(0.0085*IC_eff)]*1.93
WQV = Water Quality Volume = DA*RA*(43560/12)

Drainage Area	**1** Public	**2** Residential	**3** Open	**4** Road & Bldgs.
DA (acres)	0.399	0.674	3.594	22.095
IC (acres)	0.348	0.356	3.466	19.952
IC_eff (%)	87.3%	52.9%	96.4%	90.3%
RA (inches)	1.529	0.964	1.679	1.578
WQV (ft^3)	2,213	2,357	21,900	126,553

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Site: **Pond 1: located at the base of the collection area in a largely vacant construction equipment storage lot on Lombrano St.Total Land Area: 13,591 ft^2**

Subwatershed: **SPC1-7**
Collection Area: **SPC1-7B**

1 Year Storm Event:	1.93	inches
WQV (previously calculated):	150,809	ft^3
Available Land Area:	13,591	ft^2
Conceptual Bioretention Depth:	1	ft max
Pond Volume: (Land Area X Depth)		
Pond Storage Capacity: (Pond Volume/1.05)		

BMP Type	**1** Bioretention
WQV (ft^3)	150,809
Available Land Area (ft^2)	13,591
Pond Volume (ft^3)	13,591
Pond Storage Capacity (ft^3)	12,944

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Subwatershed: SPC1-7

Collection Area: SPC1-7C

Drainage Areas:

	PUBLIC	RESIDENTIAL	OPEN	ROADS & COMMERCIAL BLDGS.	TOTALS
Total Area	1.120	2.734	1.103	15.036	19.992
% Impervious	40.5%	58.7%	68.3%	90.3%	82.0%
	*Method: Hand calculated over entire Public region	*Method: Hand calculated over entire Residential region	*Method: Hand calculated over entire Open region	*Method: Used 90.3% value from similar Rd. & Comm. region; 1-7A	*Weighted average
RUNOFF GENERATED (FT^3)	3,092	10,509	4,871	86,124	104,596
RUNOFF CAPTURED (FT^3)	3,092	0	0	0	3,092
	*Appears feasible to capture 100% of on-site runoff.	*No BMPs in place	*No BMPs in place	*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	0	10,509	4,871	86,124	101,503

COMBINED DRAINAGE AREAS TOTAL NET RUNOFF (FT^3)

101,503

SUGGESTED TREATMENT OPTIONS

One bio retention pond located at the base of the Collection Area next to San Pedro Creek. Total Area: 4689 ft^2

CAPTURE VOLUME:	4,466

COLLECTION AREA TOTAL NET RUNOFF (FT^3)

97,038

101,503 - 4,466 = 97,038

Watershed: **SPC1**
Subwatershed: **SPC1-7**
Collection Area: **SPC1-7C**

1 Year Storm Event 1.93 inches
Drainage Area (DA)
Impervious Cover Area (IC)
Effective Impervious Cover (IC_eff=IC/DA)
RA = Runoff Volume (inches) = [0.05+(0.0085*IC_eff)]*1.93
WQV = Water Quality Volume = DA*RA*(43560/12)

Drainage Area	**1** Public	**2** Residential	**3** Open	**4** Road & Bldgs.
DA (acres)	1.120	2.734	1.103	15.036
IC (acres)	0.453	1.604	0.753	13.578
IC_eff (%)	40.5%	58.7%	68.3%	90.3%
RA (inches)	0.761	1.059	1.217	1.578
WQV (ft^3)	3,092	10,509	4,871	86,124

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Site: **Pond 1: Bioretention pond located at the base of the Collection Area next to San Pedro Creek. Total Area: 4689 ft^2**

Subwatershed: **SPC1-7**
Collection Area: **SPC1-7C**

1 Year Storm Event:	1.93	inches
WQV (previously calculated):	101,503	ft^3
Available Land Area:	4,689	ft^2
Conceptual Bioretention Depth:	1	ft max
Pond Volume: (Land Area X Depth)		
Pond Storage Capacity: (Pond Volume/1.05)		

BMP Type	**1** Bioretention
WQV (ft^3)	101,503
Available Land Area (ft^2)	4,689
Pond Volume (ft^3)	4,689
Pond Storage Capacity (ft^3)	4,466

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Subwatershed: SPC1-8

Collection Area: SPC1-8A

Drainage Areas:

PUBLIC	
Total Area	5.971
% Impervious	69.1%
*Method: Hand calculated over entire Public region	
RUNOFF GENERATED (FT^3)	26,674
RUNOFF CAPTURED (FT^3)	0
* No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	26,674

RESIDENTIAL	
Total Area	2.977
% Impervious	63.2%
*Method: Hand calculated over entire Residential region	
RUNOFF GENERATED (FT^3)	12,255
RUNOFF CAPTURED (FT^3)	0
*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	12,255

OPEN	
Total Area	0.631
% Impervious	42.3%
*Method: Hand calculated over entire Open region	
RUNOFF GENERATED (FT^3)	1,809
RUNOFF CAPTURED (FT^3)	0
*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	1,809

ROADS & COMMERCIAL BLDGS.	
Total Area	20.500
% Impervious	87.3%
*Method: Hand calculated over entire Rd. & Comm. region	
RUNOFF GENERATED (FT^3)	113,715
RUNOFF CAPTURED (FT^3)	0
*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	113,715

TOTALS	
Total Area	30.079
% Impervious*	80.3%
*Weighted average	
RUNOFF GENERATED (FT^3)	154,453
RUNOFF CAPTURED (FT^3)	0
DRAINAGE AREA RUNOFF (FT^3)	154,453

COMBINED DRAINAGE AREAS TOTAL NET RUNOFF (FT^3)
154,453

SUGGESTED TREATMENT OPTIONS	
Four bioretention ponds located all throughout the Collection Area. Total Land Area: 37,329 ft^2	
CAPTURE VOLUME:	35,551

COLLECTION AREA TOTAL NET RUNOFF (FT^3)
118,901
154,453 - 35,551 = 118,901

Watershed: **SPC1**
Subwatershed: **SPC1-8**
Collection Area: **SPC1-8A**

1 Year Storm Event 1.93 inches
Drainage Area (DA)
Impervious Cover Area (IC)
Effective Impervious Cover (IC_eff=IC/DA)
RA = Runoff Volume (inches) = [0.05+(0.0085*IC_eff)]*1.93
WQV = Water Quality Volume = DA*RA*(43560/12)

Drainage Area	**1** Public	**2** Residential	**3** Open	**4** Road & Bldgs.
DA (acres)	5.971	2.977	0.631	20.500
IC (acres)	4.128	1.883	0.267	17.890
IC_eff (%)	69.1%	63.2%	42.3%	87.3%
RA (inches)	1.231	1.134	0.790	1.528
WQV (ft^3)	26,674	12,255	1,809	113,715

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Site:

Pond 1: Located at the top of the Collection Area off of Evergreen St. this pond is in an advantagous location to serve parking lot/building drainage from Public property owned by "Alamo Community College" Total Land Area: 6117 ft^2

Pond 2: Located at the top of the Collection Area off of Cyprus and Lewis St. this pond is in an advantagous location to serve a large impervious Commercial area. Total Land Area: 3258 ft^2

Pond 3: Located mid-Collection Area off of Evergreen St. this pond is in an advantagous location to serve parking lot/building drainage from Public property owned by "Agape Community Dev. Inc." at 321 W. Laurel. Total Land Area: 6688 ft^2

Pond 4: Located at the bottom of the Collection Area at 516 W. Laurel, this pond is in an advantagous location to serve remaining drainage from entire South portion of Collection Area. Total Land Area: 21,265 ft^2

Subwatershed: **SPC1-8**
Collection Area: **SPC1-8A**

1 Year Storm Event:	1.93	inches
WQV (previously calculated):	154,453	ft^3
Available Land Area:	37,329	ft^2
Conceptual Bioretention Depth:	1	ft max
Pond Volume: (Land Area X Depth)		
Pond Storage Capacity: (Pond Volume/1.05)		

BMP	**1**
Type	Bioretention
WQV (ft^3)	154,453
Available Land Area (ft^2)	37,329
Pond Volume (ft^3)	37,329
Pond Storage Capacity (ft^3)	35,551

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Subwatershed: SPC1-8

Collection Area: SPC1-8B

Drainage Areas:

PUBLIC	
Total Area	1.619
% Impervious	66.9%
*Method: Hand calculated over entire Public region	
RUNOFF GENERATED (FT^3)	7,018
RUNOFF CAPTURED (FT^3)	0
* Nearly all public land is propoosed as being used for offsite BMPs	
DRAINAGE AREA RUNOFF (FT^3)	7,018

RESIDENTIAL	
Total Area	5.537
% Impervious	43.4%
*Method: Hand calculated over entire Residential region	
RUNOFF GENERATED (FT^3)	16,253
RUNOFF CAPTURED (FT^3)	0
*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	16,253

OPEN	
Total Area	0.754
% Impervious	48.7%
*Method: Hand calculated over entire Open region	
RUNOFF GENERATED (FT^3)	2,449
RUNOFF CAPTURED (FT^3)	0
*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	2,449

ROADS & COMMERCIAL BLDGS.	
Total Area	13.636
% Impervious	87.3%
*Method: Used 87.3% value from similar Rd & Comm. region; 1-8A	
RUNOFF GENERATED (FT^3)	75,664
RUNOFF CAPTURED (FT^3)	0
*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	75,664

TOTALS	
Total Area	21.546
% Impervious*	73.1%
*Weighted average	
RUNOFF GENERATED (FT^3)	101,383
RUNOFF CAPTURED (FT^3)	0
DRAINAGE AREA RUNOFF (FT^3)	101,383

COMBINED DRAINAGE AREAS TOTAL NET RUNOFF (FT^3)
101,383

SUGGESTED TREATMENT OPTIONS	
Two bioretention ponds located at the base of the Collection Area. Both ponds are on public property that is currently vacant. Total Land Area: 18,168 ft^2	
CAPTURE VOLUME:	17,303

COLLECTION AREA TOTAL NET RUNOFF (FT^3)
84,080
94,365 - 17,303 = 77,062

Watershed: **SPC1**
Subwatershed: **SPC1-8**
Collection Area: **SPC1-8B**

1 Year Storm Event 1.93 inches
Drainage Area (DA)
Impervious Cover Area (IC)
Effective Impervious Cover (IC_eff=IC/DA)
RA = Runoff Volume (inches) = [0.05+(0.0085*IC_eff)]*1.93
WQV = Water Quality Volume = DA*RA*(43560/12)

Drainage Area	**1** Public	**2** Residential	**3** Open	**4** Road & Bldgs.
DA (acres)	1.619	5.537	0.754	13.636
IC (acres)	1.083	2.404	0.367	11.904
IC_eff (%)	66.9%	43.4%	48.7%	87.3%
RA (inches)	1.194	0.809	0.895	1.529
WQV (ft^3)	7,018	16,253	2,449	75,664

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Site: **Pond 1: Bioretention located at the base of the Collection Area on Public land owned by "Via Metropolitan Transit" that is currently greenspace. Address: 103 Fredericksburg Rd. Total Land Area: 5,168 ft^2**

Pond 2: Large bioretention pond located next to San Pedro Creek on Public land Owned by " San Antonio River Authority". Address: 1453 N. Flores St. Total Land Area: 13,000 ft^2

Subwatershed: **SPC1-8**
Collection Area: **SPC1-8B**

1 Year Storm Event:	1.93	inches
WQV (previously calculated):	94,365	ft^3
Available Land Area:	18,168	ft^2
Conceptual Bioretention Depth:	1	ft max
Pond Volume: (Land Area X Depth)		
Pond Storage Capacity: (Pond Volume/1.05)		

BMP Type	**1** Bioretention
WQV (ft^3)	94,365
Available Land Area (ft^2)	18,168
Pond Volume (ft^3)	18,168
Pond Storage Capacity (ft^3)	17,303

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Subwatershed: SPC1-9

Collection Area: SPC1-9

Drainage Areas:

PUBLIC	
Total Area	47.350
% Impervious	27.0%
*Method: Hand calculated over entire Public region	

RESIDENTIAL	
Total Area	0.000
% Impervious	0.0%

OPEN	
Total Area	0.000
% Impervious	0.0%

ROADS & COMMERCIAL BLDGS.	
Total Area	0.000
% Impervious	0.0%

TOTALS	
Total Area	47.350
% Impervious*	27.0%
*Weighted average	

	PUBLIC	RESIDENTIAL	OPEN	ROADS & COMMERCIAL BLDGS.	TOTALS
RUNOFF GENERATED (FT^3)	92,680	0	0	0	92,680
RUNOFF CAPTURED (FT^3)	0	0	0	0	0
	* Appears that park space is used to its fullest extent and there is no remaining room for large scale BMPs	*No BMPs in place	*No BMPs in place	*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	92,680	0	0	0	92,680

COMBINED DRAINAGE AREAS TOTAL NET RUNOFF (FT^3)

92,680

SUGGESTED TREATMENT OPTIONS

One bio retention pond located below the tennis courts

Total Land Area 38,239ft^2

CAPTURE VOLUME:	36,418

COLLECTION AREA TOTAL NET RUNOFF (FT^3)

56,262

92,680 - 36,418 = 56,262

Watershed: **SPC1**
Subwatershed: **SPC1-9**
Collection Area: **SPC1-9**

1 Year Storm Event 1.93 inches
Drainage Area (DA)
Impervious Cover Area (IC)
Effective Impervious Cover (IC_eff=IC/DA)
RA = Runoff Volume (inches) = [0.05+(0.0085*IC_eff)]*1.93
WQV = Water Quality Volume = DA*RA*(43560/12)

Drainage Area	**1** Public	**2** Residential	**3** Open	**4** Road & Bldgs.
DA (acres)	47.350	0.000	0.000	0.000
IC (acres)	12.778	0.000	0.000	0.000
IC_eff (%)	27.0%	0.0%	0.0%	0.0%
RA (inches)	0.539	0.000	0.000	0.000
WQV (ft^3)	92,680	0	0	0

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Site: **Pond 1: Park tennis courts are proposed to drain to the bioretention pond located below the park offices.**

Subwatershed: **SPC1-9**
Collection Area: **SPC1-9**

1 Year Storm Event:	1.93	inches
WQV (previously calculated):	92,680	ft^3
Available Land Area:	38,239	ft^2
Conceptual Bioretention Depth:	1	ft max
Pond Volume: (Land Area X Depth)		
Pond Storage Capacity: (Pond Volume/1.05)		

BMP Type	**1** Bioretention
WQV (ft^3)	92,680
Available Land Area (ft^2)	38,239
Pond Volume (ft^3)	38,239
Pond Storage Capacity (ft^3)	36,418

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Subwatershed: SPC1-10

Collection Area: SPC1-10

Drainage Areas:

	PUBLIC	RESIDENTIAL	OPEN	ROADS & COMMERCIAL BLDGS.	TOTALS
Total Area	65.402	0.000	0.000	0.000	65.402
% Impervious	81.6%	0.0%	0.0%	0.0%	81.6%
	*Method: Hand calculated over entire Public region	*Method: Hand calculated over entire Residential region	*Method: Hand calculated over entire Open region	*Method: Hand calculated over entire Rd. & Comm region	*Weighted average
RUNOFF GENERATED (FT^3)	340,724	0	0	0	340,724
RUNOFF CAPTURED (FT^3)	317,814	0	0	0	317,814
	350,724 - 22,910 = 317,814 *Return to predevelopment conditions	*No BMPs in place	*No BMPs in place	*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	22,910	0	0	0	22,910

COMBINED DRAINAGE AREAS TOTAL NET RUNOFF (FT^3)

22,910

SUGGESTED TREATMENT OPTIONS

Unspecified BMPs to return area to predevelopment conditions.

COLLECTION AREA TOTAL NET

22,910

Watershed: **SPC1**
Subwatershed: **SPC1-10**
Collection Area: **SPC1-10**

1 Year Storm Event 1.93 inches
Drainage Area (DA)
Impervious Cover Area (IC)
Effective Impervious Cover (IC_eff=IC/DA)
RA = Runoff Volume (inches) = [0.05+(0.0085*IC_eff)]*1.93
WQV = Water Quality Volume = DA*RA*(43560/12)

Drainage Area	**1** Current Conditions	**2** Predevelopment IC = 0
DA (acres)	65.402	65.402
IC (acres)	53.369	0.000
IC_eff (%)	81.6%	0.0%
RA (inches)	1.435	0.097
WQV (ft^3)	340,724	22,910

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Site:

Subwatershed: **SPC1-10**
Collection Area: **SPC1-10**

1 Year Storm Event:	1.93	inches
WQV (previously calculated):		ft^3
Available Land Area:		ft^2
Conceptual Bioretention Depth:	1	ft max
Pond Volume: (Land Area X Depth)		
Pond Storage Capacity: (Pond Volume/1.05)		

BMP Type	**1** Bioretention
WQV (ft^3)	0
Available Land Area (ft^2)	0
Pond Volume (ft^3)	0
Pond Storage Capacity (ft^3)	0

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Subwatershed: SPC1-11

Collection Area: SPC1-11

Drainage Areas:

	PUBLIC	RESIDENTIAL	OPEN	ROADS & COMMERCIAL BLDGS.	TOTALS
Total Area	33.366	0.000	0.000	0.000	33.366
% Impervious	92.1%	0.0%	0.0%	0.0%	92.1%
	*Method: Hand calculated over entire Public region	*Method: Hand calculated over entire Residential region	*Method: Hand calculated over entire Open region	*Method: Hand calculated over entire Rd. & Comm region	*Weighted average
RUNOFF GENERATED (FT^3)	194,705	0	0	0	194,705
RUNOFF CAPTURED (FT^3)	0	0	0	0	0
		*No BMPs in place	*No BMPs in place	*No BMPs in place	
DRAINAGE AREA RUNOFF (FT^3)	194,705	0	0	0	194,705

COMBINED DRAINAGE AREAS TOTAL NET RUNOFF (FT^3)

194,705

SUGGESTED TREATMENT OPTIONS

Sand filtrationg basins as designed in Task 4.

CAPTURE VOLUME:	64,000

COLLECTION AREA TOTAL NET RUNOFF (FT^3)

130,705

194,705 - 64,000 = 130,705

Watershed: **SPC1**
Subwatershed: **SPC1-11**
Collection Area: **SPC1-11**

1 Year Storm Event 1.93 inches
Drainage Area (DA)
Impervious Cover Area (IC)
Effective Impervious Cover (IC_eff=IC/DA)
RA = Runoff Volume (inches) = [0.05+(0.0085*IC_eff)]*1.93
WQV = Water Quality Volume = DA*RA*(43560/12)

Drainage Area	**1** Public	**2** Residential	**3** Open	**4** Road & Bldgs.
DA (acres)	33.366	0.000	0.000	0.000
IC (acres)	30.733	0.000	0.000	0.000
IC_eff (%)	92.1%	0.0%	0.0%	0.0%
RA (inches)	1.608	0.000	0.000	0.000
WQV (ft^3)	194,705	0	0	0

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Site:

Subwatershed: **SPC1-**
Collection Area: **SPC1-**

1 Year Storm Event:	1.93	inches
WQV (previously calculated):		ft^3
Available Land Area:		ft^2
Conceptual Bioretention Depth:	1	ft max
Pond Volume: (Land Area X Depth)		
Pond Storage Capacity: (Pond Volume/1.05)		

BMP Type	**1** Bioretention
WQV (ft^3)	0
Available Land Area (ft^2)	0
Pond Volume (ft^3)	0
Pond Storage Capacity (ft^3)	0

*Methodology: LCRA WQ Mgmt. Technical Manual, 2007

Review of Deliverable 5.1 & 5.2, Submitted April 10, 2013
Contract 582-12-10083, Update of the Upper San Antonio River WPP
San Antonio River Authority

Comments From: Bill Carter – TCEQ, Nonpoint Source Team

Section	Page	Comment	Response to Comment
General		Can't find list of references (e.g., for "(JMA, 2013)", "(LCRA, 2007)", etc. noted on p. 7)	Added section 5.0 REFERENCES
General		This document is a remarkable analysis of BMP opportunities and potential runoff flow management. Given the context of the WPP for bacteria, is there any way to provide estimates of bacteria reduction potentially achieved by the suggested BMPs?	Thank you for the compliment. Yes, information on bacteria reduction has been added to section 4.0 SPC1 SUMMARY
2.1	2	Line 5, first word: "available" should be "mapped"?	Revision noted
2.4	8	And similar entries for subwatershed calculations: Suggest changing RA = Runoff Volume to Runoff Depth since it is in inches	It is clearly labeled as Volume (inches) and this is directly taken from the referenced source material.
2.5	9	Please clarify last line, "…is considered to be captured on-site." Do you mean actually or potentially captured?	Actually captured. Note revision.
2.5	9	Table, 3rd box: Does the asterisked note "Reasonable to require all Public lots to capture onsite runoff" mean that the 100% capture amount is based on a general principle of assigned responsibility without specific evaluation of BMP space requirements or technical feasibility for this site? If feasibility was verified, please say so. Please clarify meaning.	It was a general principle; however to avoid confusion the note will be changed to clarify that it only "appeared feasible" and that feasibility was not verified.
3.1.2 ff	14 ff	5th line: "…capture 60% of the runoff…" and similar discussions of "capture" in subsequent sections and tables. Please clarify whether capture means retention until infiltrated, or until filtered and released, or if it means the volumetric capacity of the BMPs in some other sense. The fate of the "captured" runoff needs to be clear throughout the document. My best guess would be that the BMPs will have an average stated depth over a stated area, and runoff of that total volume will be retained in the BMP until infiltrated in the 1 year storm event.	Capture means retention and in this case until infiltration occurs. In the case of bioretention BMPs, the fate of the captured runoff could be either infiltration or release via an under-drain collection system if provided. So depending upon the construction details, runoff treated by the BMP may subsequently be released, but

			the bacteria load would be effectively reduced. A note was added to section 2.6 for additional explanation.
3.11.1	70	First line: Sentence should end after the first "property." Next sentence begins "This property…" Delete the first "in" on this line.	Corrected
3.11.1	71	Short paragraph: "resented" should be "presented"	Corrected
Appendix A	After 73	Appendix A needs page numbering	Appendix A was created from multiple individual excel files. It was believed that more benefit would be derived by placing the subwatershed identifier at the bottom of each page. The reader can simply page through the appendix based upon the subwatershed labels. Page numbers in this appendix would not facilitate location of material since there is no table of contents.
Appendix A SPC1-1C	First page of section	Table: Drainage area is zero, but Impervious cover area is 0.308 acres? Please resolve discrepancy. Please QC a random selection of tables for such discrepancies.	Corrected. A QC was performed for other such discrepancies.

Comments From: Michael Bloom – Geosyntec Consultants, Inc.

Section	Page	Comment	Response to Comment
1.0	1	Statistically significant removal of bacteria (e. coli) by stormwater BMPs is rarely demonstrated. See http://www.bmpdatabase.org/Docs/2012%20Water%20Quality%20Analysis%20Addendum/BMP%20Database%20Categorical_SummaryAddendumReport_Final.pdf Media filters and retention ponds are demonstrated to work. Biofiltration systems are expected to work, however, limited data exists to explicitly show this. Volume reduction BMPs (using infiltration and ET) certainly can reduce total annual loads. Some literature suggests that E. coli exist in stream sediments and are resuspended during rain events. See http://www.h-	BMPS and their anticipated bacteria removal rates were extensively reviewed in previous reports. The expectation for 70% removal of bacteria by bioretention BMPs appears reasonable.

		gac.com/community/water/tmdl/BIG/workgroups/research_further.pdf	
2.0	2	Complete storm sewer system mapping (conveyance routes, etc.) is not required under MS4 permits, only outfall location and receiving water names.	Removed
2.4	7	Does this method determine and consider the volume of runoff that will infiltrate and evaporate and corresponding load of bacteria eliminated?	BMP bacteria removal efficiencies were used from a previous study.
4.0	72	In order to evaluate the potential benefits of the proposed retrofits the report should estimate the bacteria load reduction that would result from the implementation of these projects. This could be accomplished via the application of a pretty simple spreadsheet model that would evaluate loading reductions expected due to volume losses (infiltration and ET) as well as concentration reduction (using effluent data from the International Stormwater BMP Database) and an estimate of the amount of runoff treated (vs. bypassed). Some folks employ some continuous simulation modeling to develop "generic" representations of BMP performance and then apply these in a spreadsheet. It is important to be able to evaluate the costs vs. benefits of proposed projects. If possible, the report should estimate what portions of impaired water would potentially be delisted as a result of these retrofits or the reduction the amount or extent of exceedances of water quality standards. Also, if within the scope of work, the cost of these retrofits should be shown using perhaps, unit costs for the BMPs and some appraisal district values for land accuisition. The WERF Whole Life Cost model could rapidly used to order of magnitude of costs, see http://www.werf.org/c/KnowledgeAreas/Stormwater/ProductsToolsnonWERF/BMP_and_LID_Whole_Li.aspx	Information regarding bacteria loads potentially removed by BMPs has been added.

Comments From: Thuane Nyguen – City of San Antonio, Public Works

Section	Page	Comment	Response to Comment
General		The report needs to go through a thorough QAQC process as I found numerous typos and grammar errors.	Provided
2.2	6	Churches are tax exempt but they're not public properties, at least not in the traditional sense such as SAWS and COSA.	The preceding Task 4 provided an explanation of the inclusion of churches and other tax-exempt entities.
2.3	7	What about individual rain gardens on individual residential lots?	To the extent that individual rain gardens area similar to bioretention facilities, they would accomplish the same objectives. Typically, the size of individual rain gardens is relatively small however.
2.5	9	What about adding requirements to the code requiring new and redevelopments to implement BMPs? The City of Austin has been doing this for a while.	This report did not intend to suggest any new coding requirements
3.1.3	15	this pond could be a mandatory on site detention pond so converting it to bioretention may not be allowed.	Added this caution into report
3.1.4	16	Is the parking lot currently underutilized?	No comprehensive research was performed to determine if the parking lot is underutilized.
3.7.4	61	Is site in floodplain?	Floodplains were not researched for this conceptual study. It appears that some bioretention BMPs may be located in small floodplains.
3.8.3	66	Are they in floodplain?	Floodplains were not researched for this conceptual study. It appears that some bioretention BMPs may be located in small floodplains.

END OF DOCUMENT