

City of Naples

**Basin V Stormwater System Improvement Plan
Phase I: Basin Assessment and Conceptual
Improvement Plan**

November 2005

Final Report

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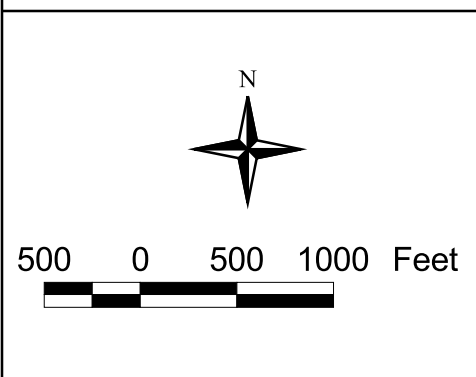
Section 1

Introduction

This design development report documents the analysis of the existing Primary Stormwater Management System (PSMS) of Drainage Basin V (Basin V). This system includes the collection system lakes and channels throughout the residential and commercial developments located in the area approximately bound by Goodlette-Frank Road to the east, U.S. 41 to the west, Ridge Street to the north, and 6th Avenue North to the south. This Basin V analysis builds upon the Gordon River Extension Stormwater Master Plan for Collier County, the City of Naples, and the South Florida Water Management District Big Cypress Basin. The limits for this study area are shown on **Figure 1-1**. The location map in Figure 1-1 indicates the setting of Basin V within the Gordon River Basin.

The modeling and subsequent engineering analysis included the following portions of the PSMS:

- The Goodlette-Frank Road Ditch/trunk line, from Ridge Street to south of 7th Avenue North;
- The U.S. 41 (Tamiami Trail) trunk line, from Golden Gate Parkway to 6th Avenue North;
- The lateral conveyance system from U.S. 41 along 6th Avenue North, which outfalls into the 6th Avenue pond;
- The secondary system from 10th Street North which outfalls into the 6th Avenue pond;
- The lateral conveyance system from 7th Avenue North which outfalls into the 6th Avenue pond;
- The conveyance system along 8th Avenue North, which outfalls into the Goodlette-Frank Road trunk line;
- The outfall piping from the pond between 8th Terrace North and 9th Avenue North, which discharges into the Goodlette-Frank Ditch;
- The two lateral conveyance systems into the 12th Avenue North pond;
- The conveyance system from the 12th Avenue North pond, along 10th Avenue North into the Goodlette-Frank Ditch;
- The lateral conveyance system along 12th Street North;
- The conveyance system to and from the 15th Avenue North pond;



LOCATION MAP



LEGEND




-  Basin V
-  Streets
-  Lakes - Basin V

Figure 1-1
Basin V SWMP
Study Area Map
Naples, Florida



- The Coastland Center Mall primary stormwater management system (conveyance and storage);
- The lateral conveyance system along Golden Gate Parkway, between U.S. 41 and Goodlette-Frank Road;
- The conveyance system within the athletic fields at Naples High School, north of Golden Gate Parkway;
- The conveyance system along 22nd Avenue North, from 10th Street North to Goodlette-Frank Road;
- The lateral conveyance system along 10th Street North;
- The lateral conveyance system along 11th Street North;
- The lateral conveyance system along Royal Palm Drive, from east of 10th Street North to Goodlette-Frank Road;
- The lateral conveyance system along Diana Avenue, from 13th Street North to Goodlette-Frank Road;
- The lateral conveyance system along 26th Avenue North, from 13th Street North to Goodlette-Frank Road;
- The inflow and outfall system for the pond west of 12th Street North;
- The lateral conveyance system along 28th Avenue North, from 10th Street North to Goodlette-Frank Road;
- The lateral conveyance system along 29th Avenue North to the pond located north of 29th Avenue North and west of 14th Street North; and
- The outfall from the 29th Avenue North pond to the Goodlette-Frank Road ditch.

Overall, the Basin V Stormwater System Improvement Plan was originally divided into three phases. The first phase (Phase I) represents the basin assessment as described in this report. The second and third phases (Phase II and Phase III) include preliminary and final design of the recommended alternative(s) and services during construction, respectively. Phases II and III have not been authorized at this time.

The primary tasks of Phase I include the following:

- Task I-1 – Data Compilation and Evaluation. This task included the review and evaluation of data provided by the City of Naples (City) for the limits of the study area. With these data, base maps of the study were prepared and are provided.

Additionally, this task also included the identification of needed additional survey data, for collection by others.

- Task I-2 – Water Quantity Model Evaluations. This task includes the development of model data sets (in SWMM 4.4 format) using the information collected under Task I-1 for the hydrology and hydraulics of the PSMS of Basin V. This included a representation of 80 hydrologic units and 280 conduits within Basin V. Based on these model data sets, the hydraulic performance of the existing PSMS was evaluated for the purpose of identifying deficiencies throughout the system.
- Task I-3 – Alternatives Evaluation. This task includes the evaluation of three alternative improvement scenarios to meet the City’s chosen level of service for road and structural flooding.
- Task I-4 – Basin V Design Development Report. This task includes the documentation of Tasks I-1 thru I-3.
- Task I-5 – Meetings. This task includes participation in up to 8 meetings throughout the duration of project execution for Phase I.

The remaining sections of this report document the items included in Phase I of the Basin V Stormwater System Improvement Plan. Section 2 includes documentation of the data sources for the project. Section 3 contains a description of the methodology used in the development of the water quantity model of the PSMS. Section 4 provides a discussion of the model calibration. Section 5 presents the results of the evaluation of the existing system under the existing land use conditions. Section 6 discusses the results of the alternatives evaluation of proposed system improvements. Finally, Section 7 presents the conclusions of the basin assessment and recommendations for improvements within Basin V to be implemented in follow-up phases.

The results of this study will identify stormwater improvement projects that benefit both primary and secondary stormwater management systems, and will establish the framework for guiding future development and redevelopment within the limits of Basin V.

Section 2

Data Sources

For the evaluation of the Basin V PSMS, data collected as part of Task I-1 was supplemented with additional survey work, plans, and other data collected in coordination with the Gordon River Extension Basin Study. A number of reports, studies, and maps were obtained and reviewed. The sources and types of data used are listed below:

- Collier County Growth Management Plan, Drainage Sub-element Ordinance 97-61, Collier County Board of County Commissioners, October 1997.
- Existing Land Use information issued by the South Florida Water Management District, August 1999.
- FEMA flood zones provided by the Federal Emergency Management Agency, 1996.
- Five-foot contour data provided by the SFWMD based on the USGS 1:24000 data.
- Five-minute interval rainfall data collected by WilsonMiller for the Big Cypress Basin rainfall gage for January 9, 1997 through December 31, 2000.
- Five-minute interval rainfall data for the Collier County Government Center rainfall gage for April 30, 1996 through December 14, 2000.
- Fifteen-minute interval rainfall data for the Naples Conservancy rainfall gage for September 24, 2003 through October 22, 2003.
- Hourly stage, flow and velocity model results for the Golden Gate Canal Outfall prepared by the Big Cypress Basin for the 10-, 25- and 100-year design storm events.
- National Wetlands Inventory data from the U.S. Fish and Wildlife Conservation Service, 1994.
- One-foot contour data for the portion of the basin to the west of Goodlette-Frank Road derived by Kucera International Inc. from the February 10, 1989 aerial photographs.
- Preliminary Engineering Report for the Goodlette-Frank Road prepared by Hole, Montes & Associates, October 1994.
- Primary Stormwater Management System structure identification data for the Gordon River Extension Basin collected in Phase III.
- Rainfall totals for the Naples Conservancy from March 4, 1942 through December 31, 2000.

- Sediment Quality data provided by the Collier County Pollution Control Department and compiled in Phase III.
- Septic Tank data provided by Collier County Health Department.
- Soil Survey of Collier County, Florida, Natural Resources Conservation Service, 1996.
- Stream Flow data obtained from the U.S. Geological Survey.
- Survey data of miscellaneous channels and structures within the primary stormwater management system of the Gordon River Extension Study area collected in Phase III (Book 5).
- Wetland coverage data compiled in Phase III of the Gordon River Extension Basin Study from the SFWMD jurisdictional wetland delineation, U.S. Army Corps of Engineers jurisdictional wetland delineation and the National Wetlands Inventory data, August 1999.
- City of Naples Stormwater Management System Inventory provided by the City of Naples.
- Drainage Structure survey information provided by Agnoli, Barber & Brundage in August 2003.
- Spot Elevations surveyed by Agnoli, Barber & Brundage, provided in August 2003.
- As-Built drawings for the Coastland Mall prepared by Deni Associates, Inc.
- Observed high water mark data provided by the City of Naples for the September 2003 calibration event.
- Rainfall totals from the Naples Conservancy for September 1, 2003 through December 10, 2003.
- Roadway plans for U.S. 41 provided by Faller, Davis & Associates, Inc.
- As-Built drawings for the Naples High School, provided by the City of Naples.
- Documented historical (flooding) problem area map provided by the City of Naples.

Section 3

Data Development and Methodology

This section describes the development of data and methods used to develop the hydrologic and hydraulic models for the Basin V PSMS. The primary goals of this study are to evaluate the extent of flooding and to provide the necessary information to manage the quantity of the stormwater runoff generated within the basin under future build-out land use conditions.

The Basin V PSMS model schematic is shown on **Figure 3-1**. The Gordon River Extension system into which Basin V discharges is also shown for reference.

3.1 Water Quantity Modeling

For this study, Camp Dresser & McKee Inc. (CDM) used the EPA Stormwater Management Model (SWMM) version 4-4 to simulate water quantity. The SWMM computer model was selected based on its ability to simulate the unique hydrologic and hydraulic characteristics of the Basin V study area. In addition, SWMM has been verified for stormwater design and master plan uses throughout Florida and is accepted by the Florida regulatory community.

3.1.1 Stormwater Model Framework

The following paragraphs briefly highlight the water quantity framework used for the Basin V PSMS model.

- Hydrologic Model: SWMM RUNOFF (version 4.4)

RUNOFF provides an analysis of rainfall, runoff, infiltration, and simple hydrologic routing. In this study, RUNOFF was used to develop the hydrographs for the design storm events, from which the output was then entered into EXTRAN at load points in the hydraulic network. These load points are indicated with a unique symbol on Figure 3-1.

- Hydraulic Model: SWMM EXTRAN (version 4.4)

EXTRAN provides dynamic flood routing for the channels, lakes, and structures in the Basin V PSMS. Stages and flows from EXTRAN are the basis for the flood profiles and flood summary tables in the remaining sections of this report. EXTRAN also reports average conduit peak velocities for use in problem area identification. In this study, EXTRAN was used to route design storm events through the developed hydraulic representation of the existing Basin V PSMS.

3.1.2 Hydrologic Model

The hydrologic model used for this study is the EPA SWMM RUNOFF (version 4.4). The program simulates the rates of runoff developed from basins using a non-linear

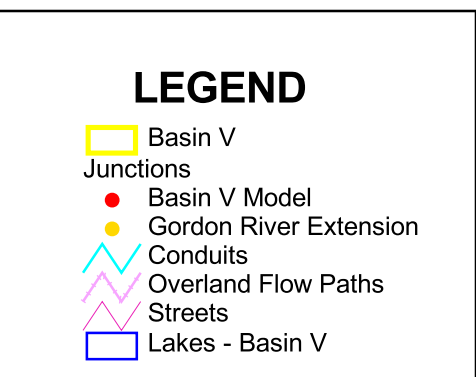
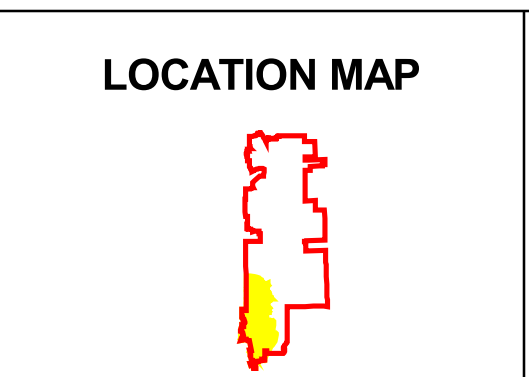
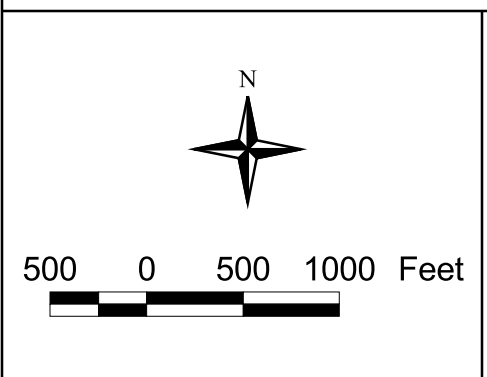
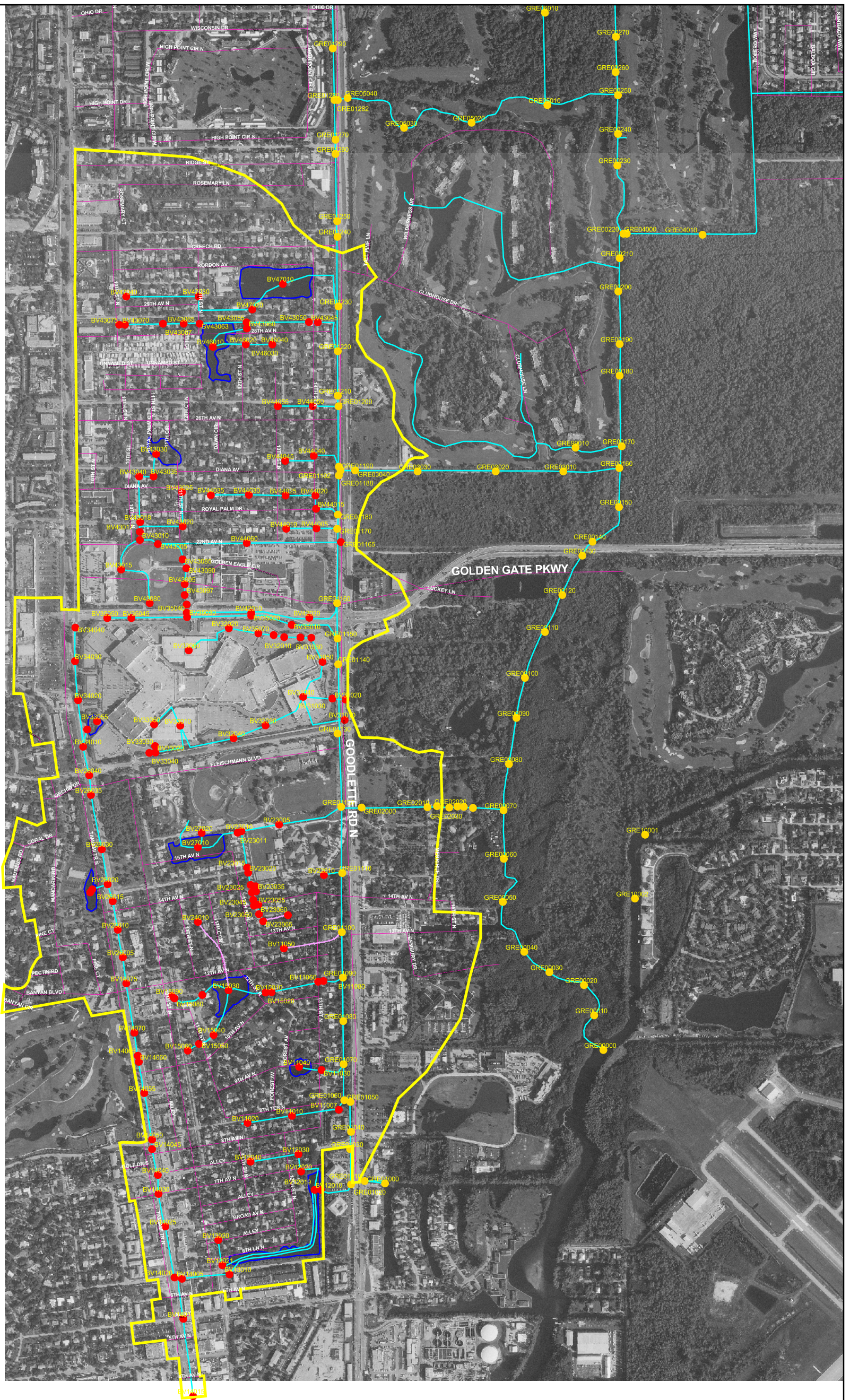


Figure 3-1
 Basin V SWMP
 Model Schematic
 Naples, Florida

CDM

reservoir approximation (Manning's equation). Hydrologic routing techniques are then used to route the overland flows through the pipe, culvert, and channel as required. Program results can then be saved for input in the EXTRAN module of SWMM to perform dynamic hydraulic routing in downstream reaches.

RUNOFF was originally developed in 1970 as part of the original EPA SWMM. The program has been applied many times since its inception and has gained worldwide acceptance. Over the years, the program has undergone many changes and modifications, although the main formulations and calculations remain mostly unchanged from the original codes.

3.1.3 Hydraulic Model

The hydraulic model used for this study was EPA SWMM EXTRAN (version 4.4), which is a hydraulic flow-routing model for open channel and/or closed conduit systems. It uses a link-node (conduit-junction) representation of the stormwater management system in an explicit finite difference solution of the equations of gradually varied, unsteady flow. EXTRAN receives hydrograph input at specific junctions by file transfer from a hydrologic model such as RUNOFF or TR20, and/or by manual input. The model performs dynamic routing of stormwater flows through the PSMS to the points of discharge or outfalls. Since it is dynamic, it simultaneously considers both the storage and conveyance aspects of the stormwater management facilities. The program will simulate branched or looped networks; backwater due to tidal or non-tidal conditions; free surface flow; pressure flow or surcharge; flow reversals; flow transfer by weirs, orifices and pumping facilities; and storage at online or offline facilities. Types of conduits that can be simulated include circular, rectangular, horseshoe arch, elliptical, and basket handle pipes, plus trapezoidal or irregular channel cross-sections. Simulation output takes the form of water surface elevations and inundated areas at each junction and flows and velocities at each conduit.

EXTRAN was originally developed for the City of San Francisco in 1973. At that time, it was called the San Francisco Model, or the WRE Transport Model. In 1974, EPA acquired this model and incorporated it into the SWMM package, calling it the Extended Transport Model-EXTRAN to distinguish it from the TRANSPORT Model developed by the University of Florida as part of the original SWMM package. Since that time, the model has been refined, particularly in the way the flow routing is performed under surcharge conditions and in large open channel networks.

3.2 Hydrologic Parameters

Hydrologic model parameters used for the model simulations are described in detail in this section. **Appendix A (Table A-1 through A-3)** provides the resultant RUNOFF model data organized by hydrologic units including hydrologic unit alphanumeric identification, width, area, percent directly connected impervious area (DCIA), slope, Manning's roughness values, initial abstractions, infiltration rates, and soil storage

values. For the purposes of the Basin V Study, the previously developed hydrologic parameters (i.e., land use imperviousness, soils parameters, etc.) from the Gordon River Extension Basin Study were used for the Basin V Study area. Additionally, the RUNOFF model developed for the Gordon River Extension study was used as a foundation for this project, and modified as documented in the following sections.

3.2.1 Topographic Data

Topographic data were used to define hydrologic unit boundaries, overland flow slopes, channel slopes, critical flood elevations, and stage-area-storage relationships developed for the Gordon River Extension Basin Study. Topographic data for the Gordon River Extension Study Area were available from four major sources:

- 1-foot topographic data were available for the majority of the basin, with the exception of the area west of Goodlette-Frank Road and an area south of Golden Gate Parkway. This information was provided for this study by WilsonMiller, Inc.
- 5-foot topographic data were provided by WilsonMiller, Inc. for the area within the study area located west of Goodlette-Frank Road, in addition to the area south of Golden Gate Parkway
- Survey data provided by WilsonMiller, Inc.
- Collier County Drainage Atlas

For Basin V, the previously delineated four hydrologic units from the Gordon River Extension Basin Study were further delineated as discussed in Section 3.2.2. For the purpose of this additional delineation, the 5-foot topographic data was the only source of information available. As a result, numerous spot elevations were obtained by Agnoli, Barber & Brundage (ABB) to assist with this effort.

3.2.2 Hydrologic Unit Areas

Hydrologic Units (subbasins) are generally defined by natural physical features or constructed stormwater management systems that control and direct stormwater runoff to a common outfall. For the purpose of this study, the following general criteria were used to determine the hydrologic unit boundaries:

- Large-scale physical features such as railroad grades and major roads were used to establish hydrologic divides.
- Hydrologic unit boundaries were delineated where structures of topographic features could appreciably impound water for the 100-year design storm event.
- The present condition hydrologic unit delineations were considered to be approximately the same as the future case since the future development will be

regulated by the City of Naples and by Collier County to maintain the present peak discharges and overall flow schemes.

- Existing reports and studies were used, along with field verification, to define ambiguous boundaries.
- The level of detail used in the hydrologic unit delineation was consistent with the detail required in the model. In areas where there were contributing channels not included in the scope of work for this project, these areas were separated into their own separate subbasin so that the contributing runoff can be quantified for that respective area.

For modeling purposes, the original delineation from the Gordon River Extension Basin Study included four hydrologic units that are included within the limits of Basin V. For this study, these four hydrologic units were delineated into eighty smaller units, ranging in size from 0.8 to 75.5 acres for the purpose of analyzing each documented flooding problem and evaluating development criteria through a sensitivity analysis of each parameter. To remain consistent with the Gordon River Extension Study, the refined hydrologic units in Basin V used the same alphanumeric naming convention, and an additional numeric identifier was added to the end. For example, hydrologic unit GRE-01-1 from the Gordon River Extension Basin Study was further delineated into twenty-seven (27) smaller units identified as GRE-01-1-10 through GRE-01-1-54 for the Basin V Study.

These hydrologic units were then digitized as polygons using the Geographic Information Systems (GIS) software package ArcView version 3.2. The mathematical features of ArcView were then used to calculate the tributary area of each hydrologic unit. These hydrologic units are illustrated on **Figure 3-2**, and the areas are indicated in **Table A-1**.

3.2.3 Rainfall

Rainfall data were used to generate stormwater runoff hydrographs for all sub-basins in the study area. Observed rainfall data are generally characterized by an amount (depth, measured in inches), intensity (measured in inches per hour), frequency of occurrence, return period (measured in years), event duration (measured in hours), spatial distribution (location variance), and temporal distribution (time variance).

Design storms are typically named by the return period of the rainfall depth and by the duration of the storm event. For example, a 25-year/24-hour design storm describes a rainfall depth over a period of 24 hours that has a 4 percent chance of occurring at a particular location in any given year. Design storm depths were obtained from BCB standard isohyet figures. The following rainfall depths were

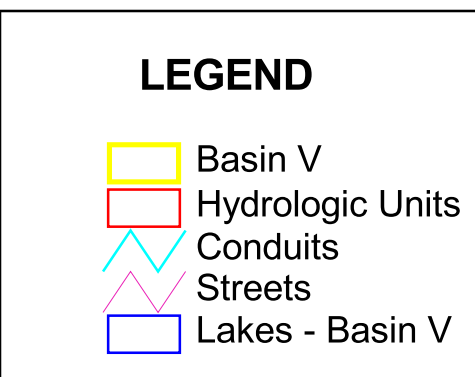
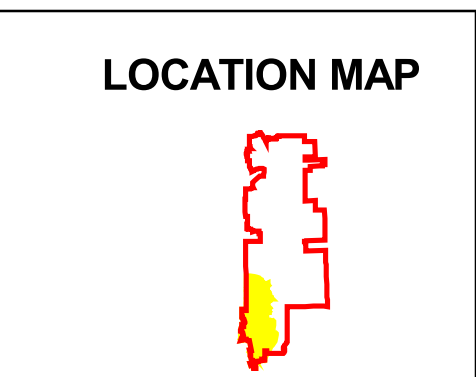
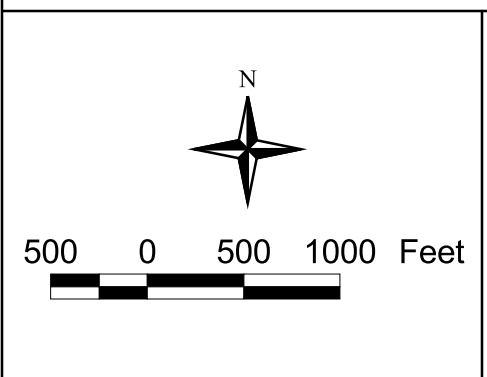
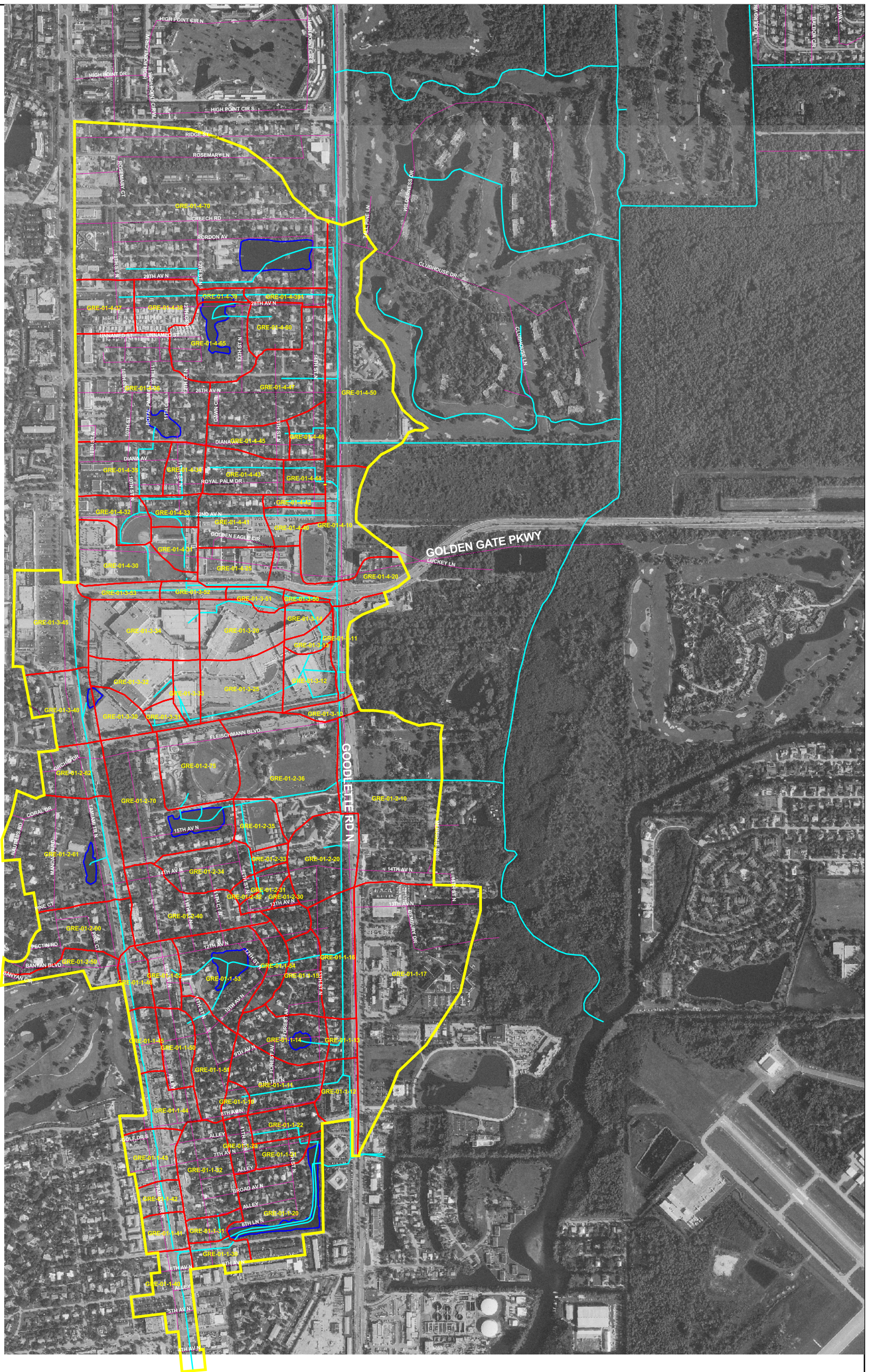


Figure 3-2
 Basin V SWMP
 Hydrologic Unit Map
 Naples, Florida

CDM

estimated from the South Florida Water Management District (SFWMD) figures for the study area:

- 5-year return period/24-hour event duration = 5.5 inches of rainfall
- 10-year return period/72-hour event duration = 9.2 inches of rainfall
- 25-year return period/72-hour event duration = 11.6 inches of rainfall
- 100-year return period/72-hour event duration = 14.2 inches of rainfall

These design storms were chosen per the SFWMD Permit Information Manual, Volume IV, which is consistent with the Environmental Resource Permitting process and standard practice. A description of the rainfall data used for the model calibration is described separately in Section 4.

3.2.4 Overland Flow Parameters

The RUNOFF module of SWMM requires overland flow data in the form of sub-basin widths and average surface slopes to generate stormwater runoff. The overland flow path length of each sub-basin was calculated as the average length of several representative flow paths to the point of interest. Up to three overland flow paths were used to determine the average. Overland flow slope is the average slope over the flow path length and is calculated by dividing the difference in elevation by the hydraulic flow length. Table A-1 in Appendix A lists the overland flow parameters used in this study.

Manning's roughness factors and initial abstractions are also used by RUNOFF for the routing of overland flows. Typical values are listed among the global land use parameters at the top of **Table A-2**. It should be noted that pervious land surfaces were assigned roughness factors (Manning's *n* values) that appear to be much higher than typical published values for open channel flow. The values shown in Table A-2 apply to the hydrologic routing of overland flow (e.g., sheet flow across lawns) rather than the hydraulic routing of channelized stream flow (e.g., flow in ditches, streams, and rivers). The higher roughness value is due to characteristically shallow depths of overland flow (a few inches) that are on the same order of magnitude as the roughness height, which produces hydraulically rough flow behavior.

3.2.5 Land Use Parameters and Impervious Areas

For this study, the existing land use data obtained from the SFWMD and updated by WilsonMiller, Inc. for the Gordon River Extension Basin Study were used. These data were based upon 1998 aerial photography of actual land use. Within the Basin V study area, there were over 41 different land use categories defined in the SFWMD classification system. For the purpose of this study, these 41 land use categories were grouped into eleven land cover categories with similar hydrologic properties as shown in **Table 3-1**.

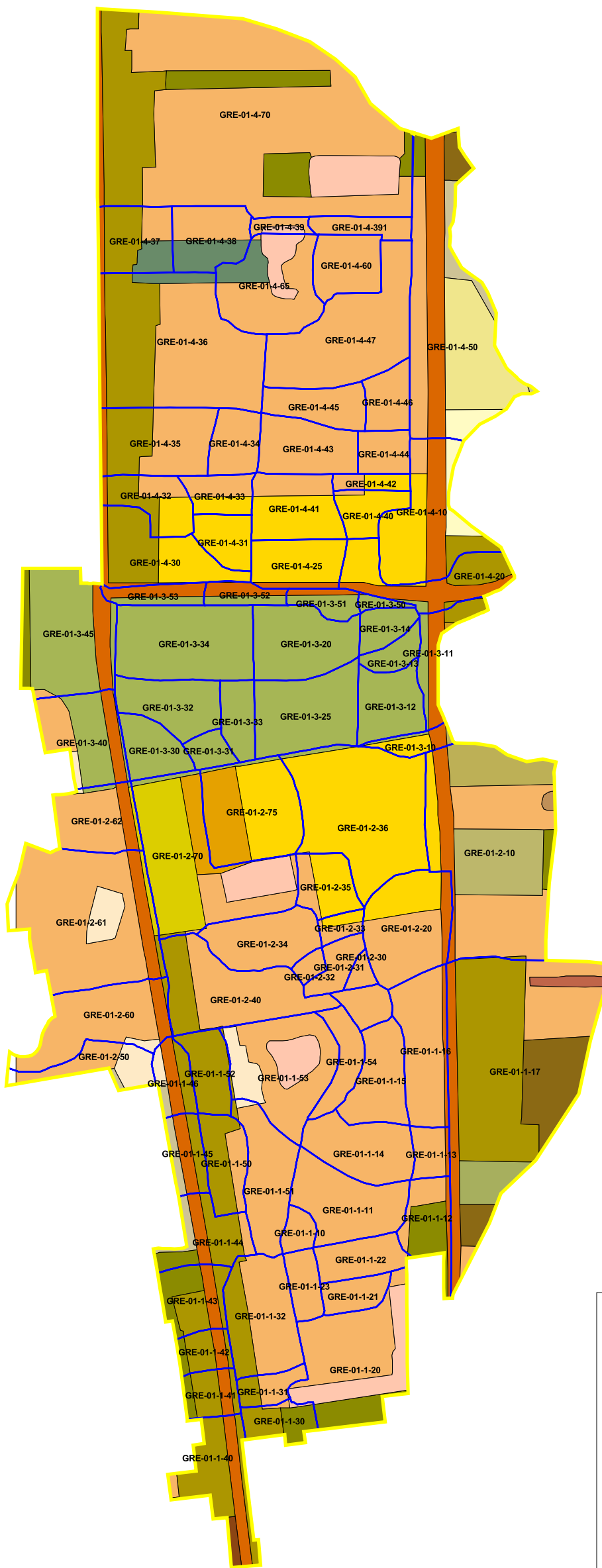
The existing land use categories for Basin V are shown on **Figure 3-3**. The figure indicates the majority of the existing land uses in the basin are medium density residential with approximately 43 percent of the study area, followed by institutional with approximately 25 percent of the project study area.

Table 3-1
Basin V Stormwater System Improvement Plan, Phase I
Land Use Classifications

Code	Description	Land Cover Category
111	Fixed Single Family Units <2 Units/Acre	LDR
121	Fixed Single Family Units 2 - 5 Units/Acre	MDR
133	Multiple Dwelling Units Low Rise <2 Stories	HDR
134	Multiple Dwelling Units High Rise >3 Stories	HDR
147	Mixed Commercial And Services	COM
171	Educational Facilities	INST
172	Religious	INST
174	Medical And Health Care	INST
182	Golf Courses	GOLF
185	Parks And Zoos	OPEN
192	Inactive Land W/Street Pattern No Structures	OPEN
211	Improved Pastures	OPEN
261	Fallow Cropland	OPEN
329	Other Shrubs And Brush	OPEN
411	Pine Flatwoods	OPEN
434	Hardwood Conifer Mixed	OPEN
534	Reservoirs <10 Acres (4 Hectares) w/Dominant Features	WATER
612	Mangrove Swamps	WET
814	Roads And Highways	TRANS
1009	Urban And Built Up	COM
1411	Shopping Centers	COM

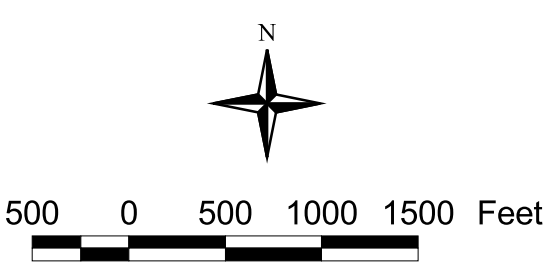
SWMM Land Use Classification Key:

- COM – Commercial
- GOLF - Golf Course
- HDR - High Density Residential
- IND - Office / Light Industrial
- INST – Institutional
- LDR - Low Density Residential
- MDR - Medium Density Residential
- OPEN - Open Space / Forest / Agriculture
- TRANS – Transportation / Roadways
- WATER – Waterbodies
- WET – Wetlands



LEGEND

Basin V	Mixed Commercial and Services
Hydrologic Units	Mobile Home Units Any Density
Existing Land Use	
Canals and Locks	Multiple Dwelling Units High Rise
Educational Facilities	Multiple Dwelling Units Low Rise
Fallow Crop Land	Other Shrubs and Brush
Fixed Single Family Units	Parks and Zoos
Golf Courses	Pine Flatwoods
Hardwood Conifer Mixed	Religious
Improved Pastures	Reservoirs less than 10 acres
Inactive Land with street pattern	Retail Sales and Services - Shopping Cen
Mangrove Swamps	Roads and Highways
Medical and Health Care	Sewage Treatment



LOCATION MAP



Figure 3-3
Basin V SWMP
Existing Land Use Map
Naples, Florida



The resulting 1998 (existing) land use coverage was then intersected with the sub-basin boundaries using ArcView to determine the percentage of each type of land use within each sub-basin. The resulting data were used to create the land use parameters that were used in the existing model.

Directly connected impervious area (DCIA) is the portion of the total impervious area that discharges directly to the hydraulic system, and is a very important parameter when predicting the runoff response of a watershed. The non-DCIA portion represents impervious surfaces that are directed toward pervious areas (e.g., rooftop drains that discharge onto lawns). In the RUNOFF module, infiltration of runoff into the soil is calculated for the pervious and non-DCIA surfaces, but not for the DCIA surfaces.

The top of Table A-2 in Appendix A shows the global hydrologic properties assigned to each land cover category. These global values were used to calculate the land use parameters for each sub-basin represented in the RUNOFF model. Overall, the average area-weighted DCIA value for the entire watershed was 48.7 percent.

3.2.6 Soil Parameters

Information on soil types was obtained from the Department of Agriculture Soil Conservation Service (SCS, now called the Natural Resources Conservation Service) Soil Survey of Collier County. **Table 3-2** shows the soil types represented within Basin V.

Table 3-2
Basin V Stormwater System Improvement Plan, Phase I
Soil Types

SOILNAME ¹	Hydrologic Soil Group
Durbin And Wulfert Mucks, Freq. Flooded (D)	D
Immokalee Fine Sand (B/D)	B/D
Udorthents Shaped	C,B/D ²
Urban Land	C,B/D
Urban Land-Immokalee-Oldsmar, Limestone Sub. Complex (B/D)	B/D
Water	Water

Notes:

¹ Soil names for the Basin V SWMP were taken from the DDCD Soil Survey of Collier County

² The C,B/D Classification was given to the Urban Land soil types. These soil types were evaluated as part of the sensitivity analysis during calibration to determine the most accurate soil grouping.

Each soil type has been assigned a soil map unit and a hydrologic soil group as designated by SCS. Hydrologic soil group A is comprised of soils having very high infiltration potential and low runoff potential. Hydrologic soil group D is

characterized by soils with a very low infiltration potential and a high runoff potential. Hydrologic soil groups B and C are designated in between these two categories. Dual soil groups indicate infiltration properties that depend on local drainage activities. For example, the A/D group indicates poorly drained soils that could be well drained in the vicinity of roadside ditches and swales that tend to draw down groundwater levels. Open water features represent entirely DCIA surfaces and were therefore not assigned to a soil group.

The Horton infiltration equation option in RUNOFF was used to calculate the rate and volume of water that infiltrates into the soil. According to the Horton equation, infiltration is computed as:

$$f_t = f_{\min} + (f_{\max} - f_{\min})e^{-kt};$$

Where:

f_t = the maximum infiltration capacity of the soil at time t (in/hr),

f_{\min} = the minimum (or final) infiltration capacity (in/hr),

f_{\max} = the maximum (or initial) infiltration capacity (in/hr),

k = an exponential decay constant (hr^{-1}), and

t = time (hr).

The decay constant, k , is an empirical parameter that controls the rate of decrease in infiltration capacity during a rainfall event. In the Horton equation, the infiltration rate decreases exponentially from the maximum capacity down to the minimum capacity. The infiltration rates and the decay constants that were used for each hydrologic soil group for this project are indicated in **Table A-3** in Appendix A.

The Horton infiltration equation is based upon conveyance through an unsaturated soil zone, and must be modified in order to represent saturated soil conditions. EPA-SWMM version 4.4 includes a soil storage shut-off option that restricts the infiltration of stormwater once the soil storage capacity is exceeded. Soil storage capacity is a measure of the amount of soil pore space (in inches) available for the storage of infiltrated water. Soil storage capacities were estimated based on the average depth to the wet season high groundwater in each sub-basin. The SFWMD Management and Storage of Surface Waters Permit Information Manual, Volume IV (1994) presents a graphical correlation between the average depth to water table and hydrologic soil group. The graphical correlation was used in this study as an initial estimate of the available soil storage capacity, which was adjusted during the model calibration described in Section 4. The table at the top (right) of Table A-3 in Appendix A shows the average water table depths used in the SFWMD relation for this study. It was determined during calibration of the model for the Gordon River Extension Basin Study that the average depth to the water table within the study area varies from

approximately 3.0 to 0.5 feet. The soil storage capacity for each sub-basin is presented in the final column of Table A-3.

It was determined during calibration of the model that the appropriate soil storage capacities were on the order of 2-3 times greater than the initial estimates shown in Table A-3, with an average value of approximately 0.4 inches compared to 0.14 inches determined using the SFWMD relationship.

A large portion of the soils (approximately 86%) is assigned to the Urban Land category for Basin V. During the calibration process of the model for the Gordon River Extension Basin Study, a sensitivity analysis of the impacts of the assignment of these soils into various hydrologic soil groups (i.e., Group C versus Group D, etc.) was performed to determine the “best-fit” Group for these soils. From the results of this analysis, these Urban Land Soils were placed in Hydrologic Soil Group C.

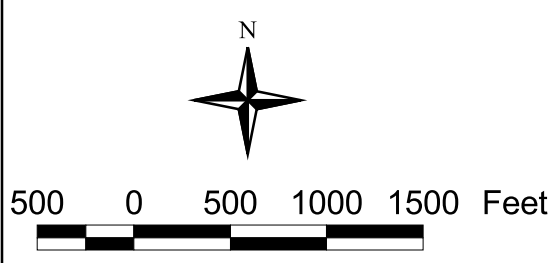
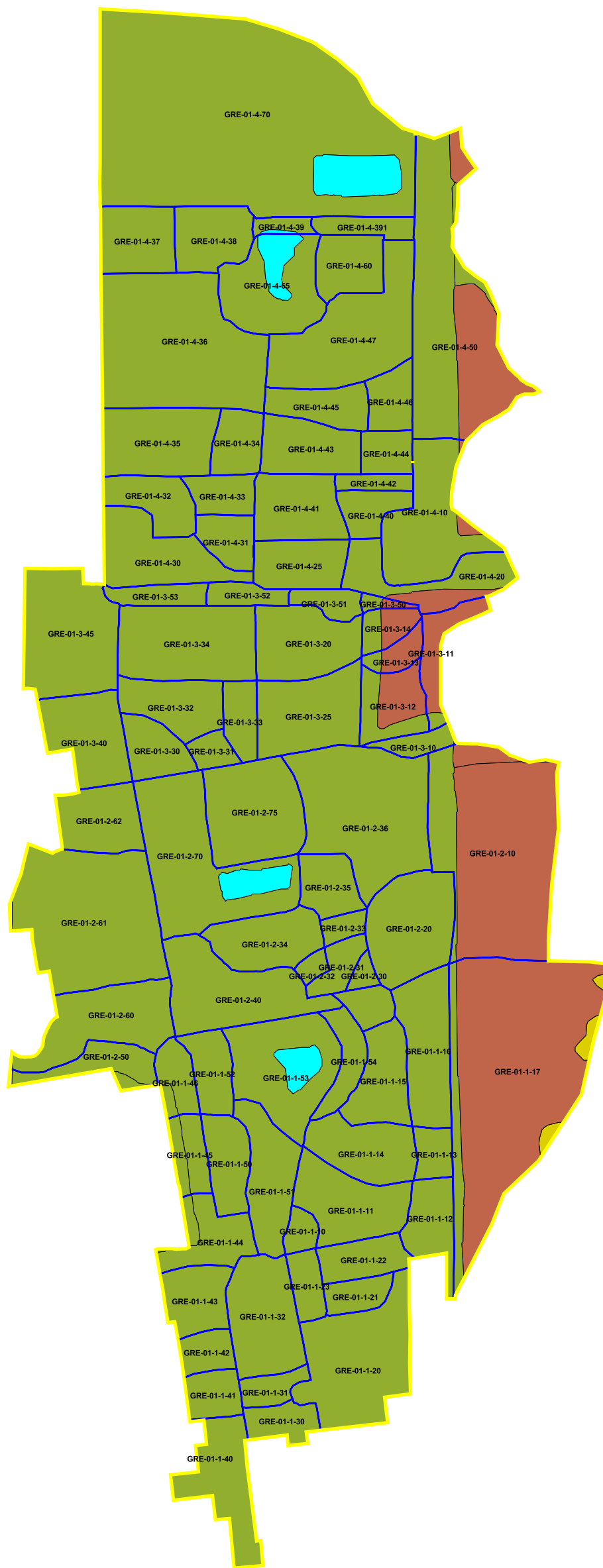
ArcView version 3.2 was then used to generate the percent of each soil group for each hydrologic unit. An illustration of the hydrologic soil groups within the basin is shown on **Figure 3-4**.

3.2.7 Initial Abstraction Parameters

Large depressional areas, such as wetlands or lakes that were not directly connected to the PSMS, were defined as initial abstractions. Initial abstractions attenuate initial runoff by capturing and storing the runoff before it reaches the PSMS. Initial abstractions over DCIA cover do not allow for infiltration whereas abstractions over NDCIA/pervious cover allow for infiltration. CDM estimated initial abstractions using both aerial-topographical maps and the aerial and digital files in ArcView for the Gordon River Extension Basin Study. However, for the purpose of the Basin V analysis, these features located within the study area were incorporated into the hydraulic module of the model.

3.3 Hydraulic Model

The hydraulic module of SWMM is called EXTRAN and was used in this study to simulate flow routing through conveyance structures (such as open channels, culverts, pipes, streets, swales, orifices, and weirs) and in storage facilities (such as lakes, retention ponds, and street/yard surface depressions). It is a dynamic computer model that accounts for the conservation of mass and momentum using the Saint-Venant equations for gradually varied unsteady flow. EXTRAN requires input data that describes the inflow hydrographs (for example, output from RUNOFF), hydraulic properties of conduits and channels, junctions, storage facilities, special control structures (for example, orifices, gates, weirs, and pumps), and model boundary conditions (for example, initial water levels and tidal characteristics). For



LOCATION MAP



LEGEND







-  Basin V
-  Hydrologic Units
- Soils**
-  B/D
-  C,B/D
-  D
-  WATER

Figure 3-4
Basin V SWMP
Soils Map
Naples, Florida



the Basin V Stormwater System Improvement Plan, the EXTRAN data set developed for the Gordon River Extension Basin Study was used as the foundation, and was modified as discussed in the remaining pages of this section.

3.3.1 Conduits and Junctions

The previously developed hydraulic model from the Gordon River Extension study included 172 nodes (also called junctions in this report) and 182 conduits representing the PSMS of the Gordon River Extension Basin. For the Basin V Study, this previously developed model data set was modified with the inclusion of an additional 144 nodes and 280 conduits that represent the Basin V PSMS. Model junctions and pipes in the hydraulic model were added to the EXTRAN file based on data collected previously by the City of Naples and the surveys performed by Agnoli, Barber & Brundage, Inc. (ABB).

The model schematic of the Basin V PSMS is shown on Figure 3-1. Model nodes are typically placed at locations with branching flow (manholes), where conduits change size, at control structures (weirs, orifices, etc.), and other features that could cause a sudden change in hydraulic head. For the purpose of this study, the Basin V system includes two primary reaches (the Goodlette-Frank Ditch/trunk line, and the primary trunk line along U.S. 41) and numerous secondary reaches that are contained within the residential and commercial development of the basin. These systems primarily consist of closed conduits (pipes) and a few irregular-shaped natural channels. These reaches are identified in detail in Section 1.

Channel reaches with approximately the same cross-sectional shape were modeled as a single conduit with junctions at each end. Hydraulic storage elements are areas of depressional storage that are hydraulically connected to the primary conveyance system. Hydraulic storage was calculated using ArcView, version 3.2, with the 1-foot topographic data collected during the Gordon River Extension Study, in conjunction with spot elevations obtained from ABB and field verification of break lines and high points within the basin. Due to the limited topographic information that was available within the study area, these stage/area relationships were used as a calibration parameter, as discussed in Section 4.

For the Basin V analysis, junctions in the model were uniquely named according to their location with respect to the tributary hydrologic unit. The naming convention used for this analysis includes two alphabetic identifiers (“BV” for Basin V), and a five digit numeric identifier. The first two digits of this identifier include the last two digits of the respective hydrologic unit, and the last three digits are the unique identifier for the junction.

The closed conduits included in the EXTRAN model data set include a total length of 37,654 feet (7.13 miles) of circular closed conduit and 5,402 feet (1.02 miles) of elliptical closed conduit. Additionally, there is approximately 5,225 feet of open channel and 4,076 feet of closed conduit included within the limits of Basin V that were included in

the previously developed model from the Gordon River Extension Basin Study. The hydraulic system inventory data are summarized in **Table A-4** in the Appendix.

3.3.2 Lakes and Depressional Areas

Lakes and large depressional areas are represented in the EXTRAN module of the model data sets for the Basin V PSMS. For the purpose of this study, these features are represented by assigning stage versus area relationships at the respective model node. This information was obtained using the previously collected 1-foot topographic data for the study area (where available), in conjunction with the spot elevations obtained by ABB and field verification of visible break lines completed by CDM.

Stage-area relationships were derived from available topographic and survey information and input into the existing conditions model data sets for the eight major lakes identified within the basin. In addition, the smaller depressional areas or stormwater management facilities were represented in the model based on As-Built data provided by the City for both Naples High School and Coastland Mall. The estimated stage-area relationships were modified slightly during the calibration of the model, as explained in Section 4.

3.3.3 Floodplains and Floodways

A floodplain is an area inundated, or flooded, by a particular rain or tidal event. Floodplains are often described by their frequency of occurrence and/or return period (e.g., 25-year or 100-year).

Within Basin V, two classifications of floodplains exist: tidal and stormwater. Tidal floodplains are the result of tide- and wind-generated flood stages, while stormwater (sometimes called riverine or fluvial) floodplains are associated with rainfall.

The Federal Emergency Management Association (FEMA) establishes flood levels and flood insurance standards. It is common practice for FEMA Flood Insurance Studies (FIS) to consider tidal and stormwater flood events to be independent of one another and then superimpose the independent results upon each other to produce comprehensive tidal/stormwater floodplain maps. Based upon these standard practices, the FEMA FIS for Collier County, Florida, and Incorporated Areas (Date) and associated Flood Insurance Rate Maps (FIRMs) identify portions of the county as flood prone and provide an estimate of the 100-year flood stages in order to provide guidance for home building and road elevations. For this study, CDM collected available data in order to estimate the initial tidal and stormwater flood elevations for the boundary conditions throughout the PSMS.

Proper floodplain/floodway data are critical to guiding new development in the establishment of first-floor elevations, road crown elevations, lake control structure and tailwater elevation, allowable fill quantities/encroachment, and facility sizing.

3.3.4 Boundary Conditions

The Basin V boundary conditions are influenced by both tidal and riverine conditions. For this study, the boundary condition of the model previously set at the confluence of the Gordon River Extension with the Golden Gate Canal (in the southern portion of the Gordon River Extension Basin) for the Gordon River Extension Study was used.

As documented in the *Technical Memorandum* for the Gordon River Extension Basin Study (CDM, 2001), a tidal conditions analysis was performed to determine the net impacts of the tidal conditions on the PSMS of the Gordon River Extension Basin. To perform this analysis, tidal and riverine data developed for the City of Naples Draft Stormwater Management Plan (Phase I - Inventory, CDM, October 1990) and for the City of Naples Basin VI Assessment Report (Final Report, August 1998) were reviewed. The City's Basin VI is located immediately downstream of the Gordon River Basin and Basin V study areas.

Additionally, tidal data were obtained from the U.S. Department of Commerce, Coast and Geodetic Survey for the period March 1965 through May 1990 (station number 872 5110, located at the Naples Municipal Pier). Using this data, CDM performed a partial duration time series analysis on monthly high tide values (Wiebull plotting position method) during the Gordon River Extension study. The results indicated a 1-year tidal stillwater elevation of 3.2 ft-NGVD (National Geodetic Vertical Datum of 1929), a 10-year stillwater of 4.1 ft-NGVD, and a 25-year stillwater of 4.9 ft-NGVD. The highest observed tide was 5.0 ft-NGVD, which occurred on December 21, 1972. The only other known tide gauge near the study area was a short-term gauge within Naples Bay. It was operated by the Coast and Geodetic Survey between April and September 1978 and was located just downstream of the U.S. 41 bridge crossing (station number 872 5114, North End, Naples Bay). The highest observed tide at this location was 2.64 ft-NGVD.

During the Gordon River Extension Study, CDM also reviewed the Flood Insurance Study for Collier County (Federal Emergency Management Agency (FEMA), June 1986, Volume 2 - City of Naples). FEMA used a combination of best available tide and hurricane data, as well as computer model simulations to establish a peak elevation-frequency relationship for storm surge inundation from the Gulf of Mexico. Only the 100-year tidal stillwater elevation is determined in the report. With the effects of wave action factored in, the 100-year base flood elevation for transects near the study area range from 10 to 12 ft-NGVD. This would inundate much of the study area. It should be noted that this value represents a coastal surge from the Gulf. No tidal surge data are given for Naples Bay, which has a greater influence on frequent flood events in Basin V than the Gulf. The 100-year tidal surge elevation was not considered appropriate for capital improvement projects in this basin because the tidal surge can not be practicably controlled.

3.3.4.1 Golden Gate Canal

In addition to tidal conditions in Naples Bay, water levels in the Gordon River, and subsequently in Basin V, are also influenced by stormwater runoff generated within the river basin and Golden Gate Canal system. During the Gordon River Extension Study, hourly stage data for the Gordon River (period of record October 1989 to October 1997) were obtained from the BCB and reviewed. The stage recorder is located on the downstream end of the Golden Gate Parkway Bridge, approximately one mile upstream (north) of the confluence with the Golden Gate Canal. For the 8-year record, the maximum hourly stage recorded was 5.6 ft-NGVD. Using the maximum hourly stages from each complete year of record (years 1990 through 1996), the average annual high stage was calculated to be 3.9 ft-NGVD.

3.3.4.2 Sensitivity Analysis

After establishing the model boundary condition based on Golden Gate Canal model results, a sensitivity analysis was performed on the Gordon River Extension PSMS that combined both the Golden Gate Canal discharge and a 1-year tidal stillwater elevation. From this analysis, it was determined that a 1-year stillwater elevation of 3.5 ft-NGVD was the most appropriate boundary condition to be used for the model. As a result, this condition was used for the model calibration and the existing conditions analysis of the Basin V PSMS.

3.3.5 Local Losses

Local losses are associated with abrupt changes in the hydraulic grade line, which, represented explicitly, cause numerical instabilities because of the EXTRAN Saint-Venant solution for “gradually-varied, unsteady flow.” Therefore, local losses must be incorporated into the Manning’s *n* of the conduit to satisfy this gradually varied flow requirement. The guidelines in **Tables 3-3** and **3-4** were used when assigning local loss coefficients.

The exit coefficient (k_{exit}) is computed as:

$$h_L = k_{exit} \frac{v_1^2}{2g} = \frac{(v_1 - v_2)^2}{2g}$$

When the previous equation is rearranged, the following equation is derived:

$$k_{exit} = \frac{(v_1 - v_2)^2}{v_1^2}$$

For lakes, v_2 is approximately 0, and the previous equation yields a value of 1.0 for k_{exit} .

Table 3-3
Basin V Stormwater System Improvement Plan, Phase I
Entrance Loss Coefficients - K_{ent} (From SFWMD, 1989)

<u>Type of Structure and Design of Entrance</u>	
Coefficient K_{ent}	
<u>Pipe, Concrete</u>	
Projecting from fill, socket end (groove-end).....	0.2
Projecting from fill, sq. cut end.....	0.5
Headwall or headwall and wingwalls	
Socket end of pipe (groove-end) 0.2	
Square-edge	0.5
Rounded (radius = 1/12 D)	0.2
Mitered to conform to fill slope	0.7
End-Section conforming to fill slope.....	0.5
Beveled edges, 33.7° or 45° bevels.....	0.2
Side- or slope-tapered inlet	0.2
<u>Pipe, or Pipe-Arch, Corrugated Metal</u>	
Projecting from fill (no headwall)	0.9
Headwall or headwall and wingwalls square-edge	0.5
Mitered to conform to fill slope, paved or unpaved slope	0.7
End-Section conforming to fill slope	0.5
Beveled edges, 33.7° or 45° bevels.....	0.2
Side- or slope-tapered inlet	0.2
<u>Box, Reinforced Concrete</u>	
Headwall parallel to embankment (no wingwalls)	
Square-edged on 3 edges	0.5
Rounded on 3 edges to radius of 1/12 barrel dimension, or beveled edges on 3 sides	0.2
Wingwalls at 30° to 75° to barrel	
Square-edged at crown	0.4
Crown edge rounded to radius of 1/12 barrel dimension, or beveled top edge .0.2	
Wingwall at 10° to 25° to barrel	
Square-edged at crown	0.5
Wingwalls parallel (extension of sides)	
Square-edged at crown	0.7
Side- or slope-tapered inlet.....	0.2

Table 3-4
Basin V Stormwater System Improvement Plan, Phase I
Exit and In-Pipe Loss Coefficients

Description	K
Inlet to manhole	0.25
Manhole in straight section of closed conduit	0.10
Manhole at a 45 degree bend	0.25
Manhole at a 90 degree bend	0.50
Exit closed conduit to lake	1.00*
Exit closed conduit to open channel	0.3-0.7

* Head loss at an abrupt enlargement is characterized by the equation (Vennard and Street, 1982):

$$h_L = k_L \frac{(v_1 - v_2)^2}{2g}$$

where:

- h_L = head loss at an enlargement in feet
- k_L = approximately 1.0 (by experimentation)
- v_1 = velocity in upstream conduit, fps
- v_2 = velocity in downstream conduit, fps
- g = gravitational constant, 32.17 ft/sec²

3.3.6 Stability

EXTRAN model stability criteria are necessary checks to ensure that conditions of continuity are not violated for either conduits or junctions. The equation for conduits is normally used to set the simulation time steps as shown below:

Conduits:

$$\Delta t \leq \frac{L}{\sqrt{gD}} \quad \text{(circular conduits)}$$

where:

- Δt = Time step (seconds)
- L = Conduit length (feet)

$$\Delta t \leq \frac{L}{\sqrt{g \frac{A}{T}}} \quad (\text{in general})$$

where:

Δt = Time step (seconds)
L = Conduit length (feet)
g = acceleration due to gravity (32.174 ft/sec)
D = Conduit depth (feet)
A = Area of flow (square feet)
T = Top width or maximum width of flow surface (feet)

A second stability criterion applies the maximum allowable change in the water surface elevation over a single time step. This junction stability is not directly reported or calculated by EXTRAN; however, the following equation can be conducted after a simulation to test for junction stability:

Junctions:

$$\Delta t \leq \frac{CA_s \Delta H_{\max}}{\sum Q}$$

where:

Δt = Time step (seconds)
C = Dimensionless constant (approximately 0.10)
 A_s = Junction surface area (square feet)
 ΔH_{\max} = Maximum change in head or elevation (feet) for any given time step
Q = simulation of inflows and outflows (ft³/sec)

Worst cases for Instability:

- Pipes: short, deep pipe with high inflow
- Junctions: small storage and/or surface areas with high inflow or outflow

Section 4

Model Calibration

In this section of the report, the selection of calibration events and the comparison of the predicted peak stages to the observed peak stages are discussed. Model calibration refers to the adjustment of model parameters within a reasonable range so that the model results are in agreement with a set of measured data. This task is critical to the reliability and validity of model results. Once calibrated, the model is then used as a tool to size the stormwater management solutions for the problem areas identified within the study area and the stormwater models can be used to support development and redevelopment criteria.

4.1 Rainfall Measurements

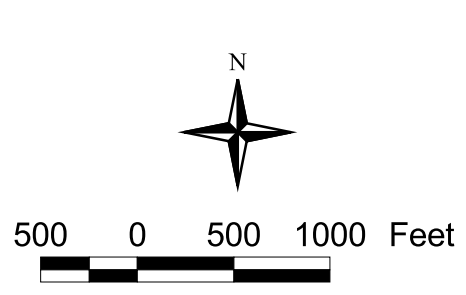
For the Gordon River Extension Study, CDM obtained and reviewed rainfall data from a local rainfall gage operated and maintained by the Big Cypress Basin (BCB). As shown in **Figure 4-1**, the rainfall gage is located at the Naples Nature Center, which is part of the Conservancy of Southwest Florida (referred to in this report as the Conservancy). Stage and rainfall data were reviewed for the period from December 1993 through February 2000. The three candidate calibration events are identified below:

- August 23-26, 1995 (Tropical Storm Jerry, 9.8 inches over 4.5 days)
- October 4-7, 1995
- September 18-22, 1999 (Tropical Storm Floyd, 9.1 inches over 5 days)

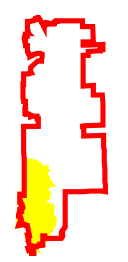
During the development of the model data sets for Basin V, a significant rainfall event occurred in the City of Naples from September 24-29, 2003. At the request of the City, information was obtained for this event from the BCB for the Conservancy gage. The daily rainfall totals from this period are indicated in **Table 4-1**. Over 12 inches of rainfall occurred at this location during this period and there were numerous occurrences of flooding throughout Basin V. High water marks for 21 surface flooding locations were made available by the City at the locations shown in **Figure 4-2**. The 15-minute recorded rainfall depths are plotted in **Figure 4-3**.

Table 4-1
September 24-29, 2003
Daily Rainfall Depths

Date	Daily Rainfall at The Conservancy (inches)
9/24/03	1.5
9/25/03	0.8
9/26/03	2.1
9/27/03	0.4
9/28/03	0.1
9/29/03	7.4
Total	12.3



LOCATION MAP



LEGEND





-  Conservancy Gage
-  Basin V
-  Streets
-  Lakes - Basin V

Figure 4-1
Basin V SWMP
Rain Gage
Location Map
Naples, Florida



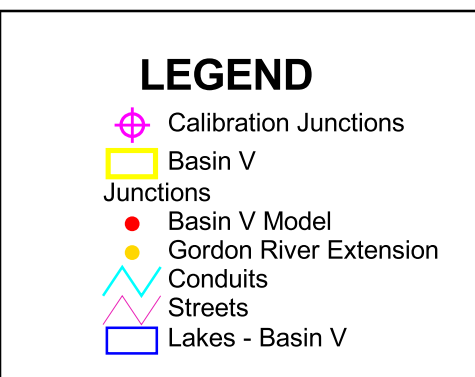
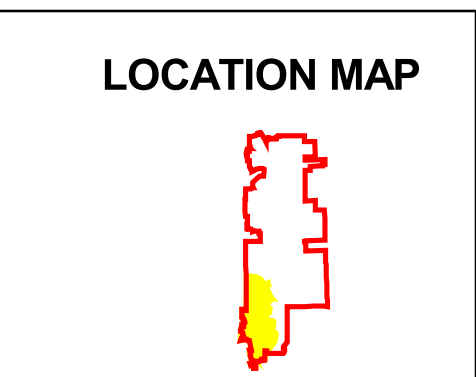
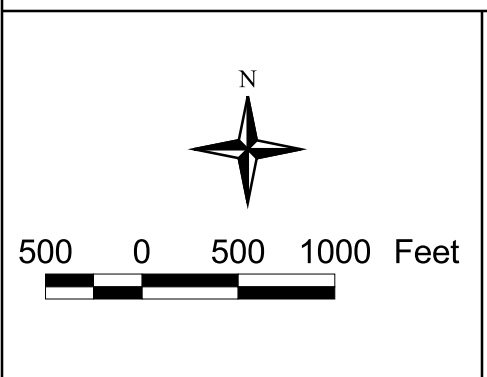
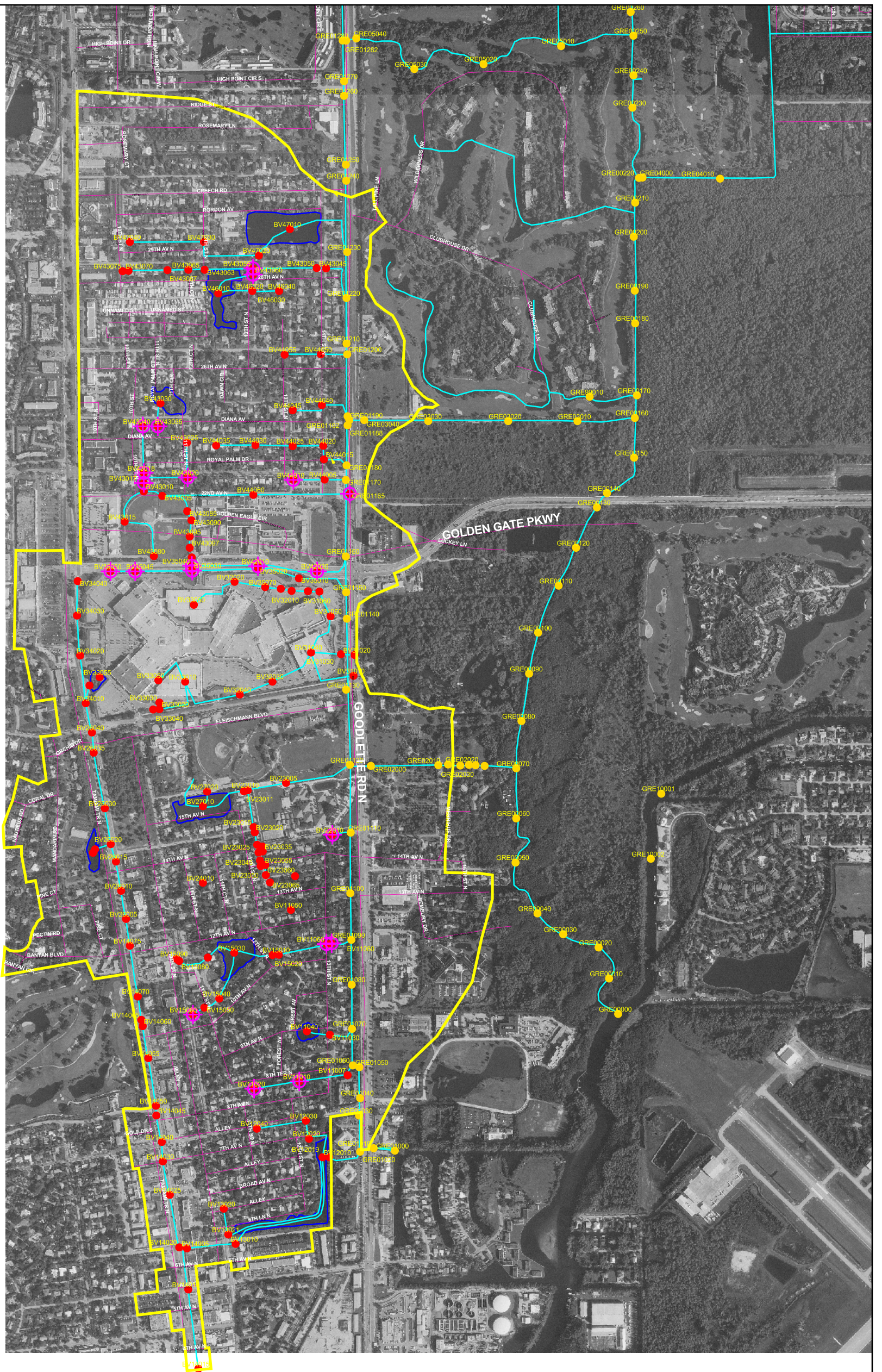
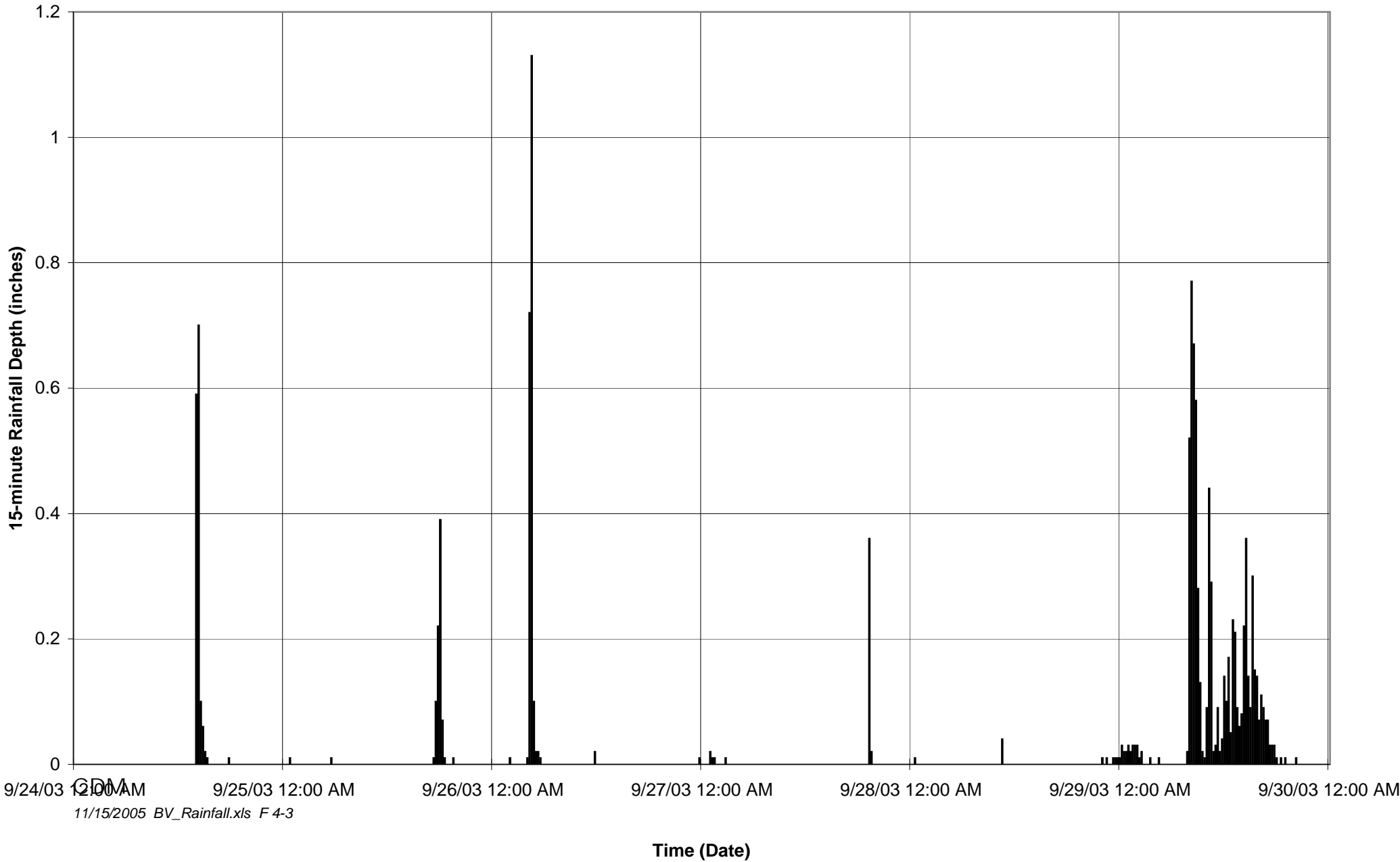


Figure 4-2
 Basin V SWMP
 Calibration Points
 Location Map
 Naples, Florida

CDM

Figure 4-3
City of Naples - Basin V Stormwater System Improvement Plan, Phase I
Calibration Event Rainfall (September 24-29, 2003)



As a result of the timing of this event and the availability of observed high water elevations (i.e., the approximate depth road flooding limits and depths) during this period, this event was selected for the calibration of the model.

4.2 Calibration Results

As shown in Table 4-1, the majority of the rainfall for this event occurred on September 29, 2003, with approximately 7.4 inches of rainfall occurring at the Conservancy over less than a twenty-four hour period, which represents a return period between 5 and 10 years. A review of the preceding days indicated that a significant amount of rainfall (approximately 4.9 inches) occurred in the five days leading up to this event. As a result, this entire 6-day period (September 24, 2003 through September 29, 2003) was used for the calibration event to account for the hydrologic conditions within the basin on September 29, 2003.

As mentioned earlier, observed high water marks were collected by City personnel on September 29, 2003, and a map was provided showing the approximate limits and depths of flooding that were experienced within the basin during this event. As indicated in Figure 4-2, there are twenty-one locations that will be used for the purpose of the calibrating the Basin V PSMS model.

The majority of the observed flooding problems involved road flooding, with observed flooding depths of approximately 2 inches (or 0.17 ft) to over 12 inches (or greater than 1 foot). The depths provided by the City were then added to the top-of-road elevations surveyed by ABB at each of the respective junctions. The resulting values were then used as the observed high water elevations for the model calibration.

Photographs of the flooding experienced at Golden Gate Parkway and at 26th Avenue for this event are shown in **Figures 4-4** and **4-5**.

The initial run of the calibration event indicated differences between the predicted and observed peak stages of up to 2.7 feet. Overall, the basin-wide average for the difference for the initial calibration run was an over-prediction of approximately 0.4 feet (or approximately 5 inches). As a result, several modifications were made in an iterative process to the hydrologic and hydraulic input parameters of the model. These modifications included the following:

- Modifications were made to the depth and width of the overflow channels that were used to represent the overland flow (hydraulic) conveyance throughout the basin;
- Variable stage/storage data were modified at numerous locations of lakes and large depressional areas. Modification of this data was needed to adjust for uncertainties resulting from the limited topographical information that was available for the study area;

Figure 4-4: Golden Gate Parkway, looking west from Goodlette-Frank Road



Figure 4-5: Goodlette-Frank Ditch, Looking South from 26th Avenue North



- Minimal variable stage/storage data was added at several junctions to represent small depressional areas (roadside swales and “yard” storage) throughout the basin;
- Modifications were made to the load points of several of the hydrologic units;
- Additional local head losses were added to several of the conduits along Golden Gate Parkway; and
- Modifications were made to the hydraulic representation of the overflow conduits from model nodes BV43018 to BV43010.

During this calibration process, several other factors were considered. These additional factors include the following:

- Consideration was given to different boundary conditions for the model. For example, consideration was given to varying fixed boundary condition elevations (2.0 and 3.5 ft-NGVD) and to using a time versus stage boundary condition. However, using the results from the calibration and sensitivity analysis performed for the Gordon River Extension Study, these varying boundary conditions did not have an effect on the stages within Basin V. As a result, a fixed boundary condition of 3.5 ft-NGVD was used for the Basin V analysis. This condition reflects an above-normal tidal tailwater representing a 1-year tidal stillwater elevation, which is the standard of practice for riverine flooding studies that are subject to tidal effects.
- Consideration was given to potential blockages of several of the small closed conduits within the Basin V PSMS. In early 2003, the City completed a television (TV) analysis of several of the conduits within the system, and some blockages and failures were observed. However, conversations with City staff have indicated that these observed deficiencies were eliminated (i.e., blockages removed or pipes replaced) prior to the September calibration event. As a result, no blockages were included in the final calibration simulation.
- Consideration was given to modifications of several of the hydrologic parameters, however, the parameters (and methodologies) were not changed for the Basin V analysis, as they were determined to be acceptable for the Gordon River Study. Regarding soil storage capacity, a typical design storm condition of 0.5-ft depth to wet season high groundwater table was used as an initial starting point for calibration using the SFWMD relationship described in Section 3.2.6. This condition was based on the recommendations of Collier County, Naples, and SFWMD in the Gordon River Extension Study. The base model was calibrated based on a historic storm in the area, and the soil storage values were adjusted to match high water marks. There are portions of the watershed where the water table is deeper than 0.5-ft below the surface in many areas, such as Goodlette-Frank Road, Coastland Mall, and other higher areas that do not have poorly-drained soils.

Accordingly, the calibrated soil storage capacities are higher than the initial estimate shown in the final column of Table A-3.

Overall, the model provides a reasonable match of the observed peak stages throughout the basin. As indicated in **Table 4-2**, the average of the observed peak stages at the 21 model nodes used for the anecdotal calibrations indicates that the predicted peak stages are within one tenth of a foot across the entire basin. Analysis of the differences between the observed and predicted peak stages indicates that the peak stages are over-predicted at seven locations and under-predicted at thirteen locations (with the predicting peak stage matching the observed peak stage at the remaining node). Of these differences, they are all within 0.2-feet (or approximately 2 inches) at all but six of the model nodes, and the predicted peak stage is within 0.5-feet (6 inches) at each of the locations. As a result, the City has agreed that the model is considered calibrated for the purpose of this project.

Table 4-2
City of Naples - Basin V Stormwater System Improvement Plan, Phase I
Comparison of Observed and Predicted Peak Stages - September 24-29, 2003

Model Junction	Location	Road Crown Elevation (ft-NGVD)	Peak Flood Stage/Depth of Road Flooding			
			Observed High Water Mark (ft-NGVD) ⁽¹⁾	Observed Depth of Flooding (ft)	Model Predicted (ft-NGVD)	Difference (ft) ⁽²⁾
BV11010	Intersection of 8th Avenue North and 12th Street North	6.2	6.5	0.3	6.8	0.2
BV11020	8th Avenue North	7.2	8.1	0.9	7.8	-0.3
BV11060	u/s end of crossing at 10th Ave N and 13th St N	7.9	8.5	0.6	8.6	0.1
BV11070	d/s end of crossing at 10th Ave N and 13th St N	7.7	8.5	0.8	8.2	-0.4
BV15060	Intersection of 10th Avenue North and 10th Street North	9.5	9.7	0.2	10.2	0.5
BV22010	14th Avenue North	7.2	7.5	0.3	7.6	0.1
BV35030	Golden Gate Parkway (West of Goodlette-Frank Road)	8.6	9.4	0.9	9.3	-0.1
BV35040	Golden Gate Parkway (West of Goodlette-Frank Road)	9.1	9.4	0.3	9.3	-0.1
BV35045	Golden Gate Parkway (West of Goodlette-Frank Road)	8.3	9.4	1.1	9.3	-0.1
BV35050	Golden Gate Parkway (West of Goodlette-Frank Road)	8.5	9.4	0.9	9.3	-0.1
BV42010	Golden Gate Parkway (West of Goodlette-Frank Road)	9.2	9.4	0.2	9.4	0.0
BV42020	Golden Gate Parkway (West of Goodlette-Frank Road)	9.0	9.4	0.5	9.2	-0.3
BV43017	Intersection of 22nd Avenue North and 10th Street North	10.0	10.3	0.3	10.1	-0.2
BV43018	10th Avenue North, d/s of 22nd Avenue	10.8	11.1	0.3	11.0	-0.2
BV43020	Intersection of 22nd Avenue North and 11th Street North	9.7	10.0	0.4	10.1	0.1
BV43035	Diana Avenue, d/s of 10th Street North	10.7	11.2	0.4	11.5	0.4
BV43040	Intersection of Diana Avenue and 10th Street North	10.7	11.0	0.4	11.5	0.5
BV43055	Intersection of 28th Avenue North and 12th Street North	11.0	11.4	0.4	10.9	-0.6
BV43060	d/s end of 28th Avenue North crossing	10.8	11.0	0.2	10.9	-0.1
BV44010	22nd Avenue North	9.5	9.8	0.3	9.6	-0.2
GRE01165	Along Goodlette-Frank Road	9.0	9.2	0.2	9.0	-0.2

Avg. Difference -0.1

Notes:

- (1) - Observed peak stages in this table indicate approximate approximate high water marks (HWM) from observations by City of Naples staff. These elevations represent the observed depths of flooding, added to the critical elevation adjacent to the respective model junction. No surveyed high water marks were available for this event.
- (2) - Values indicated in this column indicate the difference between the observed and predicted peak stages. Observed differences between the two columns (observed and predicted) may differ from values in this column due to rounding.
- (3) - It should be noted that high water marks can be influenced by waves from wind and vehicular traffic.

Section 5

Existing System Evaluation

After calibrating and validating the model based on available high water marks and anecdotal data, problem areas were identified in which peak flood stages exceeded the defined level of service (LOS). Peak flood stages throughout the Basin V PSMS were tabulated and compared to road centerline, yard, and building finished floor elevations. The relative severity of existing system flooding was determined and flooding problem areas to be addressed by proposed improvement alternatives were identified.

5.1 Level of Service Criteria

The LOS provided by the Basin V PSMS is a measure of its performance to meet hydrologic and hydraulic criteria. LOS standards are intended to protect public safety by:

- Providing emergency access and evacuation route ingress and egress.
- Limiting damage to public and private property.
- Minimizing other hazards due to stormwater flooding.

For this study, LOS criteria were compared to hydraulic model results throughout the basin in order to identify existing system deficiencies at locations where the LOS criteria are not achieved. The LOS evaluation served two main purposes, including:

- Model validation. Corroborating model results with observed system behavior (i.e., matching the known flooding problem areas) improved the model credibility.
- Problem area identification. Problem areas were identified and prioritized by ranking the deficiencies in terms of the frequency and severity of LOS criteria exceedances.

Generally LOS criteria for retrofit improvements are commensurate with engineering design standards for new development. However, if the cost-benefit ratio is often prohibitive in retrofit situations, LOS criteria may be relaxed in built-out locations in order to balance public safety with available funding. Many homes within Basin V were built at or near the road crown elevation and therefore LOS criteria are different from those in the City's engineering design standards. The following service classes for property and structure flooding protection were used for this study:

- Class A is the highest level of flood protection and was assigned where flow is contained within the conveyance system and no flooding of yards, roads or structures is indicated.

- Class B is the next level of protection and was assigned where there is no overtopping of the road crown, but where minimal yard flooding may be indicated.
- Class C was assigned where there is no structural flooding, but where yard and minimal roadway flooding (depth less than 6 inches) is indicated. Although the road crown is flooded, it is still deemed passable and does not prevent emergency ingress or egress (e.g., hurricane evacuation).
- Class D is the lowest level of flooding protection and was assigned where extensive road flooding (depths greater than 6 inches) or structure flooding is predicted.

A figure depicting the four LOS classes described above is included in **Appendix B** of this report.

It should be noted that Class C LOS (i.e., up to 6 inches of road flooding) was chosen for the 25-year and 100-year/72-hour storms as the retrofit target for the Gordon River Extension project for Collier County, Naples, and the BCB. Also, a Class B LOS (i.e., no overtopping of the road crown) was the desired target in Alternative 2 for this project. Based upon recommendations by CDM, the City has chosen to refine the above LOS criteria for Alternative 3 as follows:

- LOS 1 - No overtopping of the road crown elevation for the 5-year/24-hour storm,
- LOS 2 - 3 inches of road crown overtopping for the 10-year/72-hour storm,
- LOS 3 - 6 inches of road crown overtopping for the 25-year/72-hour storm,
- LOS 4 - 9 inches of road crown overtopping for the 100-year/72-hour storm, and
- LOS 5 - No building flooding for the 100-year/72 hour storm

The specific LOS criteria used in the Alternatives Evaluation are described in detail in Section 6.

5.2 Model Basis

In order to apply the calibrated model to the design storm events for the existing system evaluation, the following model considerations were determined:

- Maintenance – For the purposes of this study, it was expected that the PSMS would be fully maintained and operable. The City’s CCTV inspection program did not reveal any significant maintenance issues and obstructions were limited to pipes less than 12 inches in diameter. Noted occurrences of blockage or debris that

were represented in the calibration were not included in the existing system model.

- System Improvements – There were no new PSMS improvements within Basin V since the September 2003 calibration event to warrant an update of the hydraulic model. However, there were modifications to the Gordon River Extension system and these were updated in the model as described in Section 5.3.
- Hydrologic Conditions – Land use parameters were not modified since the existing Basin V land use conditions currently reflect complete build-out of the tributary area to the Basin V PSMS. Soil parameters were estimated based on AMC II (average wet season) conditions.
- Hydraulic Boundary Conditions – A constant water surface elevation of 3.5 ft-NGVD was used to represent high tide conditions as described in Sections 3.3.4 and 4.2. The same boundary condition used for model calibration was used in the existing system evaluation.

5.3 Gordon River Extension System Modifications

Several significant modifications were made to either the hydrology or hydraulics within the Gordon River Extension study area. To account for these modifications, several changes were made to the existing conditions model. These modifications include the following:

- The Wilderness Golf Course (adjacent to Reach 00 and Reach 05) has undergone major modifications to the site topography. To eliminate historic flooding experienced during the wet season, a significant amount of fill was placed on the site, thus eliminating a portion of the floodplain (storage) currently included in the model. To represent these site modifications, the natural channel cross sections adjacent to this property were modified using the proposed topography of the site.
- Modifications for the realignment of Burning Tree Drive are currently under design. These modifications include the replacement of the existing natural channel (Reach 07) that is adjacent to this roadway with a single 3-ft by 7-ft concrete box culvert. These modifications, which include this culvert, at revised invert elevations, and revised roadway elevations, have been incorporated into the model.
- Modifications to the Pine Ridge Commons Outfall. This modification has been reflected in the model by moving 44.3 acres from hydrologic unit GRE-00-13 to hydrologic unit GRE-00-11. No additional modifications were made to the hydrologic parameters used for these areas.

- A portion of Reach 01 (Goodlette-Frank ditch) has been enclosed since the development of the original existing conditions model. This section of the ditch is between junction GRE01170 and GRE01160, which is between 22nd Avenue and Golden Gate Parkway. At this location, twin 36-inch PVC pipes have been installed. The model has been modified to reflect these hydraulic changes.
- Modifications to the representation of the natural channel cross-sections along the primary reach of the Gordon River (Reach 00), from the Golden Gate Parkway to the Conservancy. These represent the Gordon River Cleanout Project completed in 2002 by Collier County. The channel roughness coefficients used for this portion of the system (from model node GRE00130 to GRE00060) were lowered to reflect the permitted removal of the native and exotic vegetation lying in, on and over the surface of the existing channel.

5.4 Level of Service Elevations

There are three critical threshold elevations that are needed to apply the LOS criteria for this evaluation, including:

- Road Centerline – For each junction in the PSMS, the road centerline or crown elevation was used to determine the depth of road flooding. The critical threshold elevation was generally taken as the low point along the road centerline in the vicinity of the corresponding model junction. The surveyed elevations were obtained from a variety of sources and are tabulated in **Table A-5** of the Appendix. Where available, the edge of pavement elevation is also shown for reference. In cases where more than one elevation was identified, the lowest surveyed or estimated elevation was generally used. Furthermore, in some cases the surveyed or estimated elevation did not appear to be reasonable when compared to adjacent junctions and was adjusted as appropriate. There were twelve such occurrences and these are highlighted in the right side of Table A-5.
- Yard – Where appropriate, the low point on public property was estimated and assigned to the corresponding model junction as shown in Table A-5. These elevations were estimated from available topography, ground elevations obtained by survey, or estimated as the adjacent inlet throat elevation.
- Building/Structure – The critical structure elevation is shown in Table A-5 and represents the lowest finished floor elevation in the vicinity of the respective model junction. In cases where more than one structure is adjacent to the respective junction, the lowest structure was used in the evaluation.

5.5 Level of Service Evaluation

The calibrated model was applied to the design storm events described in section 3.2.3. The LOS provided by the existing Basin V PSMS was determined by comparing predicted peak flood stages to the threshold elevations described above. The evaluation results are shown in **Table 5-1** using the LOS Class A-D categories. For

TABLE 5-1
 City of Naples - Basin V Stormwater System Improvement Plan, Phase I
 Existing System LOS Evaluation

Junction Name	Location	Road Crown Elevation (ft-NGVD)	Yard Elevation (ft-NGVD)	Structure Elevation (ft-NGVD)	5-yr/24-hr Event			10-yr/72-hr Event			25-yr/72-hr Event			100-yr/72-hr Event		
					Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾
GRE01020	Outfall to Golden Gate Canal Confluence	6.5	6.3	7.0	4.7		A	5.1		A	5.8		A	6.4		B
BV12010		n/a	n/a	n/a	6.2		A	6.7		A	7.0		A	7.2		A
BV12019	control structure from 6th Avenue Pond	n/a	n/a	n/a	6.3		A	6.7		A	7.1		A	7.3		A
BV13020	Alley	7.1	7.9	9.5	7.4	0.3	C	7.6	0.5	C	7.7	0.6	D	7.9	0.8	D
BV13021	10th Street North	6.4	6.6	8.8	6.8	0.3	C	6.9	0.5	C	7.1	0.7	D	7.4	0.9	D
BV13010	6th Avenue North	5.9	5.5	n/a	6.4	0.5	C	6.8	0.9	D	7.1	1.2	D	7.3	1.5	D
BV14005	intersection of 6th Avenue North and Tamiami Tr N	9.0	n/a	n/a	8.0		A	8.3		A	8.6		A	8.9		A
BV14010	intersection of US 41 and 5th Avenue North	8.1	n/a	n/a	7.6		A	7.9		A	8.2	0.1	C	8.5	0.5	C
BV14015	intersection of US 41 and 3rd Avenue North	7.9	n/a	n/a	6.7		A	7.3		A	7.9		A	8.4	0.6	D
BV14020	intersection of US 41 and 6th Avenue North	9.8	n/a	n/a	8.5		A	8.8		A	9.2		A	9.7		A
BV14025	US 41, u/s of 6th Avenue North	10.9	n/a	n/a	9.0		A	9.4		A	9.9		A	10.6		A
BV14030	US 41, d/s of 7th Avenue North	9.6	n/a	n/a	9.4		A	9.8	0.2	C	10.2	0.6	D	10.7	1.1	D
BV14040	intersection of US 41 and 7th Avenue North	n/a	n/a	n/a	9.8		A	10.2		A	10.5		A	10.8		A
BV14045	US 41, d/s of 8th Avenue North	10.4	n/a	n/a	9.9		A	10.3		A	10.6	0.2	C	10.9	0.5	C
BV14050	intersection of US 41 and 8th Avenue North	10.2	n/a	n/a	10.0		A	10.4	0.2	C	10.7	0.4	C	10.9	0.7	D
BV14055	US 41, u/s of 8th Avenue North	10.4	n/a	n/a	10.1		A	10.5	0.1	C	10.7	0.3	C	11.0	0.6	D
BV14060	d/s end of crossing at intersection of US 41 and 10th Avenue	10.0	n/a	n/a	10.2	0.1	C	10.5	0.5	C	10.8	0.7	D	11.0	1.0	D
BV14065	u/s end of crossing at intersection of US 41 and 10th Avenue	10.8	n/a	n/a	10.2		A	10.5		A	10.8		A	11.2	0.4	C
BV14070	US 41, u/s of 10th Avenue	10.4	n/a	n/a	10.2		A	10.5	0.1	C	10.8	0.4	C	11.2	0.8	D
BV14075	US 41, d/s of 12th Avenue North	10.5	n/a	n/a	10.2		A	10.6	0.0	C	10.8	0.3	C	11.4	0.8	D
BV26005	US 41, u/s of 12th Avenue North	10.4	n/a	n/a	10.2		A	10.6	0.2	C	10.9	0.5	C	11.4	1.0	D
BV26010	US 41, d/s of 14th Avenue North	10.2	n/a	n/a	10.1		A	10.5	0.3	C	10.9	0.7	D	11.4	1.2	D
BV26015	US 41, d/s of 14th Avenue North	10.5	n/a	n/a	10.0		A	10.4		A	11.0	0.5	C	11.4	0.9	D
BV26020	US 41, u/s of 14th Avenue North	11.2	n/a	n/a	9.9		A	10.5		A	11.0		A	11.4	0.2	C
BV26025	pond west of US 41	n/a	n/a	n/a	9.8		A	10.5		A	11.0		A	11.4		A
BV26026	pond west of US 41	n/a	n/a	n/a	9.8		A	10.5		A	11.0		A	11.4		A
BV26030	US 41, u/s of 14th Avenue North	n/a	n/a	n/a	9.9		A	10.5		A	11.0		A	11.4		A
BV26035	US 41, d/s of Fleischmann Boulevard	11.7	n/a	n/a	9.9		A	10.5		A	11.0		A	11.4		A
BV26040	intersection of US 41 and Fleischmann Boulevard	11.9	n/a	n/a	9.9		A	10.5		A	11.0		A	11.4		A
BV34010	US 41, u/s of Fleischmann Boulevard	11.5	n/a	n/a	9.9		A	10.5		A	11.0		A	11.4		A
BV33056	retention area at west side of mall	n/a	n/a	n/a	9.1		A	10.0		A	10.5		A	10.9		A
BV33055	retention area at west side of mall	n/a	n/a	n/a	9.1		A	10.0		A	10.5		A	10.9		A
BV34020	US 41, west of Coastland Mall	11.3	n/a	n/a	10.0		A	10.7		A	11.2		A	11.6	0.3	C
BV34030	US 41, west of Coastland Mall	11.4	n/a	n/a	10.0		A	10.7		A	11.2		A	11.6	0.2	C
BV34040	south of US 41 and Golden Gate Parkway intersection	11.5	n/a	n/a	10.7		A	11.2		A	11.5		A	11.8	0.3	C
BV12020	12th Street North	5.3	5.3	7.5	6.3	1.0	D	6.7	1.5	D	7.1	1.8	D	7.3	2.0	D
BV12030	intersection of 7th Avenue North and 12th Street North	5.5	5.9	7.6	6.3	0.8	D	6.7	1.2	D	7.1	1.6	D	7.3	1.8	D
BV12040	7th Avenue North	7.0	6.3	8.4	5.9		A	6.3		B	6.7		B	7.1	0.0	C
BV24010	east of 11th Street North	9.5	9.0	11.4	9.9	0.4	C	10.0	0.5	C	10.1	0.6	D	10.5	1.0	D
GRE01030	Goodlette-Frank Road	6.7	6.5	7.0	5.2		A	5.6		A	6.0		A	6.5		A
GRE01040	Goodlette-Frank Road	6.9	6.7	7.5	5.5		A	5.8		A	6.2		A	6.5		A
GRE01050	Goodlette-Frank Road	7.1	6.9	7.5	5.9		A	6.2		A	6.5		A	6.7		A
GRE01060	Goodlette-Frank Road	7.3	7.1	7.5	6.2		A	6.4		A	6.6		A	6.8		A
BV11007	u/s of intersection of 8th Ave N and Goodlette-Frank Road	5.8	4.5	n/a	6.2	0.4	C	6.4	0.6	D	6.6	0.8	D	6.8	1.0	D
BV11010	intersection of 8th Avenue North and 12th Street North	6.2	5.7	n/a	6.8	0.5	D	6.9	0.6	D	7.0	0.8	D	7.1	0.9	D
BV11020	8th Avenue North	7.2	6.9	8.8	7.7	0.5	C	8.1	0.9	D	8.4	1.2	D	8.6	1.4	D
GRE01070	Goodlette-Frank Road	7.5	7.3	8.8	6.3		A	6.5		A	6.7		A	7.0		A
BV11030	13th Street North	7.4	5.9	n/a	7.0		B	7.2		B	7.4	0.1	C	7.6	0.2	C
BV11040	Pond west of 13th Street North	n/a	n/a	n/a	7.0		A	7.2		A	7.4		A	7.6		A

TABLE 5-1
 City of Naples - Basin V Stormwater System Improvement Plan, Phase I
 Existing System LOS Evaluation

Junction Name	Location	Road Crown Elevation (ft-NGVD)	Yard Elevation (ft-NGVD)	Structure Elevation (ft-NGVD)	5-yr/24-hr Event			10-yr/72-hr Event			25-yr/72-hr Event			100-yr/72-hr Event		
					Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾
GRE01080	Goodlette-Frank Road	7.6	7.4	7.8	6.3		A	6.6		A	6.8		A	7.0		A
GRE01090	Goodlette-Frank Road	7.7	7.5	8.0	6.4		A	6.8		A	7.2		A	7.7		B
BV11070	d/s end of crossing at 10th Ave N and 13th St N	7.7	6.9	n/a	8.1	0.5	C	8.3	0.6	D	8.4	0.7	D	8.5	0.8	D
BV11060	u/s end of crossing at 10th Ave N and 13th St N	7.9	8.2	9.5	8.5	0.7	D	8.6	0.7	D	8.7	0.8	D	8.7	0.8	D
BV15010	d/s end of 12th Street North crossing	9.5	9.5	11.4	8.6		A	9.3		A	9.5	0.1	C	9.8	0.3	C
BV15020	u/s end of 12th Street North crossing ⁽¹⁾	10.2	9.3	n/a	8.7		A	9.6		B	9.9		B	10.4	0.2	C
BV15030	pond at 12th Street North	n/a	n/a	n/a	8.9		A	9.7		A	10.1		A	10.5		A
BV15070	11th Street North(8)	9.0	9.7	11.5	8.9		A	9.7	0.7	D	10.1	1.1	D	10.5	1.4	D
BV15080	intersection of 11th Street North and 10th Street North	8.6	n/a	n/a	9.0	0.4	C	9.7	1.1	D	10.1	1.5	D	10.5	1.8	D
BV15090	intersection of 11th Street North and 10th Street North	9.2	n/a	12.9	8.9		A	9.7	0.5	D	10.1	0.9	D	10.5	1.3	D
BV15040	intersection of 11th Street North and 10th Avenue North	9.1	n/a	n/a	8.9		A	9.7	0.6	D	10.1	1.0	D	10.5	1.4	D
BV15050	10th Avenue North	10.1	10.3	12.6	9.0		A	9.8		A	10.2	0.1	C	10.5	0.4	C
BV15060	intersection of 10th Avenue North and 10th Street North	9.5	9.4	11.1	8.9		A	9.8	0.3	C	10.2	0.7	D	10.5	1.0	D
GRE01100	Goodlette-Frank Road	7.8	7.6	8.0	6.4		A	6.6		A	6.9		A	7.1		A
BV11050	north of 12th Avenue North	9.1	8.2	10.0	8.0		A	8.0		A	8.0		A	8.0		A
GRE01110	Goodlette-Frank Road	7.9	7.7	8.5	6.3		A	6.6		A	6.8		A	7.2		A
BV22010	14th Avenue North	7.2	6.9	9.9	7.6	0.4	C	7.7	0.5	D	7.8	0.6	D	7.9	0.7	D
GRE01120	Goodlette-Frank Road	8.0	7.8	8.5	5.7		A	6.1		A	6.4		A	6.8		A
BV23005	north of Lake Park Elementary School	8.7	7.4	n/a	8.4		B	8.6		B	8.9	0.1	C	9.1	0.3	C
BV23010	corner of 15th Avenue North and 12th Street North	7.4	n/a	n/a	8.4	0.9	D	8.6	1.2	D	8.8	1.4	D	9.0	1.6	D
BV23011	15th Avenue North	7.2	n/a	n/a	8.4	1.1	D	8.6	1.3	D	8.8	1.5	D	9.0	1.7	D
BV27010	Pond north of 14th Avenue North	n/a	n/a	n/a	7.0		A	8.0		A	8.4		A	8.9		A
BV27020	15th Avenue North	6.6	n/a	n/a	7.0	0.4	C	8.0	1.3	D	8.4	1.8	D	8.9	2.3	D
BV23015	d/s end of 14th Avenue North crossing	7.4	7.6	9.6	8.3	1.0	D	8.6	1.2	D	8.8	1.4	D	9.0	1.6	D
BV23020	u/s end of 14th Avenue North crossing	7.9	7.2	n/a	8.3	0.4	C	8.6	0.7	D	8.8	0.9	D	9.0	1.1	D
BV23025	intersection of 12th Street North and 14th Avenue North	7.9	7.4	n/a	8.3	0.4	C	8.6	0.7	D	8.8	0.9	D	9.0	1.1	D
BV23030	intersection of 12th Street North and 14th Avenue North	7.7	7.5	10.0	8.3	0.6	D	8.6	0.9	D	8.8	1.1	D	9.0	1.3	D
BV23035	intersection of 12th Street North and 14th Avenue North	7.9	n/a	n/a	8.2	0.4	C	8.5	0.7	D	8.7	0.9	D	8.9	1.1	D
BV23040	intersection of 12th Street North and 14th Avenue North	8.1	7.4	n/a	8.2	0.1	C	8.5	0.4	C	8.7	0.6	D	8.9	0.8	D
BV23045	12th Street North, south of 14th Avenue North	8.4	7.9	n/a	8.1		B	8.4		B	8.6	0.2	C	8.9	0.5	D
BV23050	12th Street North, south of 14th Avenue North	8.2	7.9	10.6	8.0		B	8.3	0.2	C	8.5	0.4	C	8.9	0.8	D
BV23055	12th Street North, north of 13th Avenue North	8.2	n/a	n/a	8.0		A	8.3	0.2	C	8.5	0.4	C	8.9	0.7	D
BV23060	d/s end of 13th Avenue North crossing	7.7	n/a	n/a	8.0	0.3	C	8.3	0.7	D	8.5	0.9	D	8.9	1.3	D
BV23065	u/s end of 13th Avenue North crossing	7.7	n/a	n/a	8.0	0.3	C	8.3	0.6	D	8.5	0.8	D	8.9	1.2	D
BV23070	south of 13th Avenue North	8.2	7.9	10.0	6.5		A	7.2		A	8.4	0.2	C	8.9	0.7	D
GRE01130	intersection of Fleischmann Ave and Goodlette-Frank Road	8.2	7.6	n/a	6.3		A	6.5		A	6.5		A	6.8		A
GRE01140	along Goodlette-Frank Road	8.0	7.8	9.5	8.2	0.2	C	8.7	0.7	D	8.9	0.9	D	9.1	1.1	D
GRE01150	along Goodlette-Frank Road	9.9	8.3	10.0	8.2		A	8.7		B	8.9		B	9.1		B
BV35010	Golden Gate Parkway	11.1	n/a	n/a	8.3		A	8.8		A	9.0		A	9.3		A
BV35020	Golden Gate Parkway	n/a	n/a	n/a	9.0		A	9.7		A	10.1		A	10.4		A
BV35030	Golden Gate Parkway	8.6	n/a	n/a	9.2	0.7	D	9.7	1.2	D	10.1	1.6	D	10.4	1.8	D
BV35040	Golden Gate Parkway	9.1	n/a	n/a	9.3	0.2	C	9.8	0.7	D	10.2	1.1	D	10.4	1.3	D
BV43098	baseball fields at Naples High School (outfall to south)	n/a	n/a	n/a	9.3		A	9.8		A	10.2		A	10.6		A
BV35045	Golden Gate Parkway	8.3	n/a	n/a	9.2	0.9	D	9.7	1.4	D	10.1	1.8	D	10.4	2.1	D
BV35050	Golden Gate Parkway	8.5	n/a	n/a	9.2	0.7	D	9.7	1.2	D	10.1	1.6	D	10.4	1.9	D
GRE01155	along Goodlette-Frank Road	10.0	9.8	10.5	8.3		A	8.8		A	9.0		A	9.3		A
GRE01160	along Goodlette-Frank Road	10.0	9.8	10.5	8.8		A	9.5		A	9.8		A	10.0	0.0	C
BV42020	Golden Gate Parkway	9.0	n/a	n/a	9.1	0.2	C	9.6	0.7	D	9.9	0.9	D	10.1	1.1	D
BV42010	Golden Gate Parkway	9.2	n/a	n/a	9.4	0.2	C	10.0	0.8	D	10.2	1.0	D	10.4	1.2	D

TABLE 5-1
 City of Naples - Basin V Stormwater System Improvement Plan, Phase I
 Existing System LOS Evaluation

Junction Name	Location	Road Crown Elevation (ft-NGVD)	Yard Elevation (ft-NGVD)	Structure Elevation (ft-NGVD)	5-yr/24-hr Event			10-yr/72-hr Event			25-yr/72-hr Event			100-yr/72-hr Event		
					Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾
GRE01170	along Goodlette-Frank Road	9.0	9.5	10.5	8.8		A	9.4	0.4	C	9.8	0.8	D	10.0	1.0	D
BV44005	intersection of 22nd Avenue North and 14th Street North	9.2	n/a	n/a	9.3	0.1	C	9.4	0.3	C	9.8	0.6	D	10.0	0.8	D
BV44010	22nd Avenue North	9.5	9.4	11.4	9.6	0.1	C	9.7	0.2	C	9.8	0.3	C	10.0	0.5	D
GRE01180	along Goodlette-Frank Road	9.7	9.5	10.5	8.4		A	9.1		A	9.4		A	9.7		B
BV44015	14th Street North, north of 22nd Avenue North	8.3	7.8	n/a	8.8	0.5	C	9.1	0.8	D	9.4	1.1	D	9.7	1.4	D
BV44020	intersection of 14th Street North and Royal Palm Drive	9.1	8.5	12.3	9.5	0.4	C	9.6	0.5	D	9.7	0.6	D	9.8	0.7	D
BV44025	intersection of Royal Palm Drive and 13th Street North	9.5	8.9	n/a	9.9	0.4	C	10.0	0.5	D	10.1	0.6	D	10.2	0.7	D
BV44030	Royal Palm Drive, u/s of 13th Street North	9.8	9.6	11.7	10.3	0.5	C	10.3	0.5	D	10.4	0.6	D	10.5	0.7	D
BV44035	Royal Palm Drive, u/s of 13th Street North	10.1	9.5	n/a	10.0		B	10.1	0.0	C	10.3	0.2	C	10.5	0.4	C
GRE01188	along Goodlette-Frank Road	11.0	10.8	11.5	8.4		A	9.1		A	9.4		A	9.7		A
GRE01190	along Goodlette-Frank Road	11.0	10.8	11.5	8.2		A	8.9		A	9.2		A	9.5		A
GRE01192	along Goodlette-Frank Road	11.0	10.8	11.5	8.4		A	9.1		A	9.4		A	9.7		A
BV44040	intersection of 14th Street North and Diana Avenue	n/a	9.5	n/a	10.5		A	10.8		A	10.9		A	11.1		A
BV44045	intersection of Diana Avenue and 13th Street North	9.8	9.5	12.7	10.5	0.6	D	10.8	1.0	D	10.9	1.1	D	11.1	1.3	D
GRE01200	along Goodlette-Frank Road	11.0	10.8	11.5	8.5		A	9.1		A	9.4		A	9.7		A
BV44050	intersection of 14th Street North and 26th Avenue North	10.5	n/a	n/a	11.2	0.7	D	11.3	0.8	D	11.5	1.0	D	11.6	1.2	D
BV44055	intersection of 13th Street North and 26th Avenue North	11.5	11.6	13.8	11.7	0.2	C	11.9	0.4	C	12.0	0.6	D	12.2	0.7	D
GRE01210	along Goodlette-Frank Road	11.0	10.8	11.5	8.9		A	9.8		A	10.2		A	10.6		A
GRE01220	along Goodlette-Frank Road	11.0	10.8	11.5	9.0		A	9.8		A	10.2		A	10.6		A
BV43045	d/s end of 14th Street North & 28th Ave N crossing	10.8	n/a	n/a	9.1		A	9.9		A	10.3		A	10.8		A
BV43050	u/s end of 14th Street North & 28th Ave N crossing	11.0	10.3	n/a	9.2		A	10.0		A	10.4		B	10.9		B
BV43055	intersection of 28th Avenue North and 12th Street North	11.0	10.7	n/a	10.9		B	11.1	0.1	C	11.3	0.3	C	11.6	0.6	D
BV43060	d/s end of 28th Avenue North & 12th St N crossing	10.8	10.2	n/a	10.6		B	10.8		B	10.9	0.1	C	11.6	0.8	D
BV46010	Pond south of 28th Avenue North	n/a	n/a	n/a	9.1		A	10.2		A	10.9		A	11.6		A
BV46020	12th Street North, east of Pond	9.8	10.1	12.6	9.1		A	10.2	0.5	C	10.9	1.1	D	11.6	1.9	D
BV46040	east of 12th Street north	n/a	n/a	n/a	9.1		A	10.2		A	10.9		A	11.6		A
BV43063	intersection of 28th Avenue North and 12th Street North	11.9	11.3	n/a	12.1	0.2	C	12.3	0.4	C	12.5	0.6	D	12.6	0.7	D
BV43065	28th Avenue north, west of 12th Street North	12.0	10.8	13.5	12.2	0.2	C	12.4	0.4	C	12.5	0.5	D	12.7	0.7	D
BV43067	28th Avenue north, d/s of 10th Street North	12.3	11.9	n/a	12.7	0.4	C	12.8	0.5	C	12.9	0.6	D	13.0	0.6	D
BV43070	d/s end of 10th Street North & 28th Ave N crossing	12.5	12.1	13.0	11.7		A	12.5	0.0	C	12.7	0.2	C	12.8	0.3	C
BV43075	u/s end of 10th Street North & 28th Ave N crossing	12.6	11.8	n/a	11.6		A	12.1		B	12.6	0.1	C	12.8	0.3	C
GRE01230	along Goodlette-Frank Road	11.0	10.8	11.5	9.0		A	9.8		A	10.2		A	10.6		A
BV47010	pond north of 28th Avenue North	n/a	n/a	n/a	10.3		A	10.8		A	11.1		A	11.2		A
BV47020	east of 12th Street North	10.2	11.0	12.7	10.3	0.1	C	10.8	0.6	D	11.1	0.9	D	11.2	1.0	D
BV47030	south of 12th St North and 29th Ave North intersection	10.4	n/a	n/a	10.3		A	10.7	0.3	C	10.9	0.5	D	11.1	0.7	D
BV47040	south of 29th Ave North and 10th St North intersection	10.6	11.4	13.0	10.0		A	10.2		A	10.4		A	10.8	0.2	C
BV43030	pond north of Diana Avenue	n/a	n/a	n/a	11.6		A	12.0		A	12.2		A	12.4		A
BV43035	Diana Avenue, d/s of 10th Street North	10.7	9.7	12.6	11.6	0.8	D	12.0	1.2	D	12.2	1.4	D	12.3	1.6	D
BV43040	intersection of Diana Avenue and 10th Street North	10.7	10.2	n/a	11.5	0.9	D	11.9	1.3	D	12.1	1.4	D	12.3	1.6	D
BV43010	10th Street North, Naples High School baseball fields	n/a	n/a	n/a	9.8		A	10.2		A	10.5		A	10.7		A
BV43017	22nd Avenue North, south of 10th Street North	12.0	n/a	n/a	10.2	0.1	C	10.8	0.8	D	11.0	1.0	D	11.2	1.2	D
BV43018	intersection of 10th Avenue North and 22nd Avenue	10.8	n/a	n/a	11.0	0.2	C	11.3	0.6	D	11.5	0.7	D	11.7	0.9	D
BV43015	baseball fields at Naples High School	n/a	n/a	n/a	9.8		A	10.2		A	10.5		A	10.7		A
BV43005	baseball fields at Naples High School	n/a	n/a	n/a	9.7		A	10.1		A	10.4		A	10.6		A
BV43020	intersection of 22nd Avenue North and 11th Street North	9.7	n/a	n/a	10.2	0.5	C	10.8	1.2	D	11.0	1.4	D	11.2	1.6	D
BV43025	intersection of 11th Street North and Royal Palm Drive	10.7	10.5	12.1	9.8		A	10.2		A	10.6		B	11.0	0.3	C
BV43080	baseball fields at Naples High School	n/a	n/a	n/a	10.1		A	10.3		A	10.5		A	10.8		A
BV43085	baseball fields at Naples High School	n/a	n/a	n/a	9.7		A	10.1		A	10.4		A	10.6		A
BV43090	baseball fields at Naples High School	n/a	n/a	n/a	9.7		A	10.1		A	10.4		A	10.6		A

TABLE 5-1
 City of Naples - Basin V Stormwater System Improvement Plan, Phase I
 Existing System LOS Evaluation

Junction Name	Location	Road Crown Elevation (ft-NGVD)	Yard Elevation (ft-NGVD)	Structure Elevation (ft-NGVD)	5-yr/24-hr Event			10-yr/72-hr Event			25-yr/72-hr Event			100-yr/72-hr Event		
					Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾
BV43095	baseball fields at Naples High School	n/a	n/a	n/a	9.6		A	10.1		A	10.4		A	10.6		A
BV43097	baseball fields at Naples High School	n/a	n/a	n/a	9.7		A	9.9		A	10.3		A	10.6		A
GRE01163	along Goodlette-Frank Road	9.0	n/a	n/a	8.8		A	9.5	0.5	C	9.8	0.8	D	10.0	1.0	D
BV44060	Naples High School	n/a	n/a	n/a	9.4		A	9.9		A	10.2		A	10.4		A
GRE01164	along Goodlette-Frank Road	9.0	n/a	n/a	8.8		A	9.5	0.5	C	9.8	0.8	D	10.0	1.0	D
GRE01167	along Goodlette-Frank Road	9.0	n/a	n/a	8.8		A	9.4	0.4	C	9.8	0.8	D	10.0	1.0	D
BV31010	Goodlette-Frank Road, east of Coastland Mall	n/a	n/a	n/a	7.3		A	7.8		A	8.0		A	8.2		A
BV31040	Coastland Mall	10.6	n/a	n/a	8.1		A	9.2		A	9.4		A	10.0		A
BV31020	Goodlette-Frank Road, east of Coastland Mall	n/a	n/a	n/a	7.9		A	8.7		A	8.9		A	9.1		A
BV31030	Coastland Mall	10.6	n/a	n/a	8.0		A	8.9		A	9.1		A	9.5		A
BV31050	Coastland Mall	12.6	n/a	n/a	8.2		A	9.3		A	9.6		A	10.3		A
BV31060	Coastland Mall	12.7	n/a	n/a	8.2		A	9.3		A	9.7		A	10.7		A
BV31070	Coastland Mall	12.4	n/a	n/a	8.3		A	9.4		A	9.8		A	10.8		A
BV32010	Coastland Mall	11.5	n/a	n/a	8.4		A	9.4		A	10.0		A	10.9		A
BV35060	Coastland Mall	11.4	n/a	n/a	8.5		A	9.5		A	10.1		A	11.1		A
BV35070	Coastland Mall	11.2	n/a	n/a	8.6		A	9.6		A	10.3		A	11.3	0.1	C
BV32020	Coastland Mall	12.4	n/a	n/a	8.8		A	9.7		A	10.6		A	11.6		A
BV33060	Coastland Mall	12.0	n/a	n/a	8.9		A	9.8		A	10.7		A	11.8		A
BV32030	Coastland Mall	12.2	n/a	n/a	8.5		A	9.6		A	9.7		A	10.2		A
BV32040	Coastland Mall	11.7	n/a	n/a	8.4		A	9.6		A	10.4		A	11.1		A
BV33010	Coastland Mall	n/a	n/a	n/a	8.1		A	8.8		A	9.4		A	10.0		A
BV33050	Coastland Mall	12.9	n/a	n/a	8.2		A	8.8		A	9.5		A	10.1		A
BV33020	Coastland Mall	10.9	n/a	n/a	8.4		A	8.8		A	9.4		A	9.9		A
BV33040	Coastland Mall	11.5	n/a	n/a	8.3		A	8.8		A	9.4		A	9.8		A
BV33030	Coastland Mall	11.5	n/a	n/a	8.3		A	8.8		A	9.4		A	9.9		A

Total Number of LOS Class "B" Exceedances 50 72 83 95

Notes:

- (1) - Elevations, peak flood stages, and road flooding depths have all been rounded to the nearest tenth of a foot.
- (2) - Model results are computed to the nearest hundredth of a foot, but are shown in this table rounded to the nearest tenth of a foot. Therefore, even if the predicted stages from the model are shown to be equal to the respective critical elevation, the table may show an exceedance due to rounding (e.g. if the critical building elevation is 5.0, and the predicted peak stage from the model is 5.01, an exceedance is shown in the table).
- (3) - Level of Service (LOS) classes were assigned as follows:
 Class "A" LOS was assigned where flow is contained within the conveyance system; no flooding of major roadways, minor roadways, yards or structures is predicted;
 Class "B" LOS was assigned where there is no flooding of major roadways, minor roadways, or structures, but where yard flooding is predicted;

 Class "C" LOS was assigned where yard flooding and flooding of major roadways which precludes the use of the outside lane and travel in inside lanes is possible but difficult (depth less than 6-inches) is predicted, but where no structural flooding is predicted; and
 Class "D" LOS was assigned where extensive road flooding (depths greater than 6-inches) or structural flooding is predicted.
- (4) - Class "B" LOS exceedances for the 25-yr/24-hr design storm event are highlighted.

each model junction, the name, location and threshold LOS elevations are given on the left side of Table 5-1. Peak flood stage results, road flooding depths, and LOS class for the various design storm events are given on the right side of the table.

Table 5-2 shows a summary of the LOS evaluation. The number and overall percentage of locations that achieve a given LOS class are tabulated for each design storm event. There are a total of 172 junctions that have a defined LOS class within the Basin V PSMS. **Figure 5-1** shows the LOS classes for the 25-year/72-hour design storm event for all junctions in the basin. Note there were a number of junctions where LOS criteria could not be defined, generally within lakes, and are denoted as “n/a” in Figure 5-1.

Table 5-3 shows a comparison of predicted flooding problems to reported and observed flooding problems. Results are listed in descending order where predicted

road flooding depths exceeds 0.5 ft for the 100-year/72-hour event. Observed or reported flooding problem areas were based on two sources:

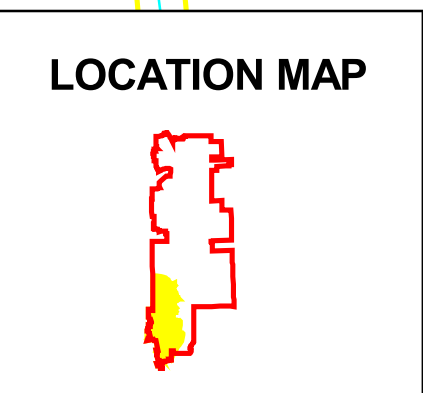
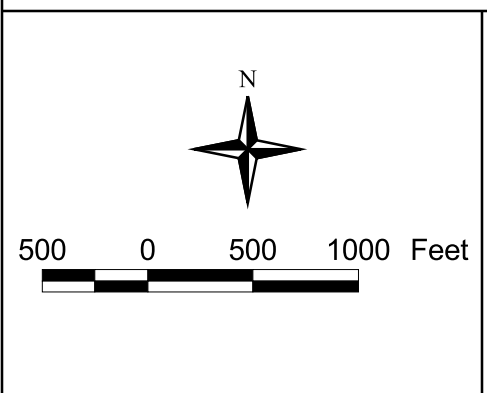
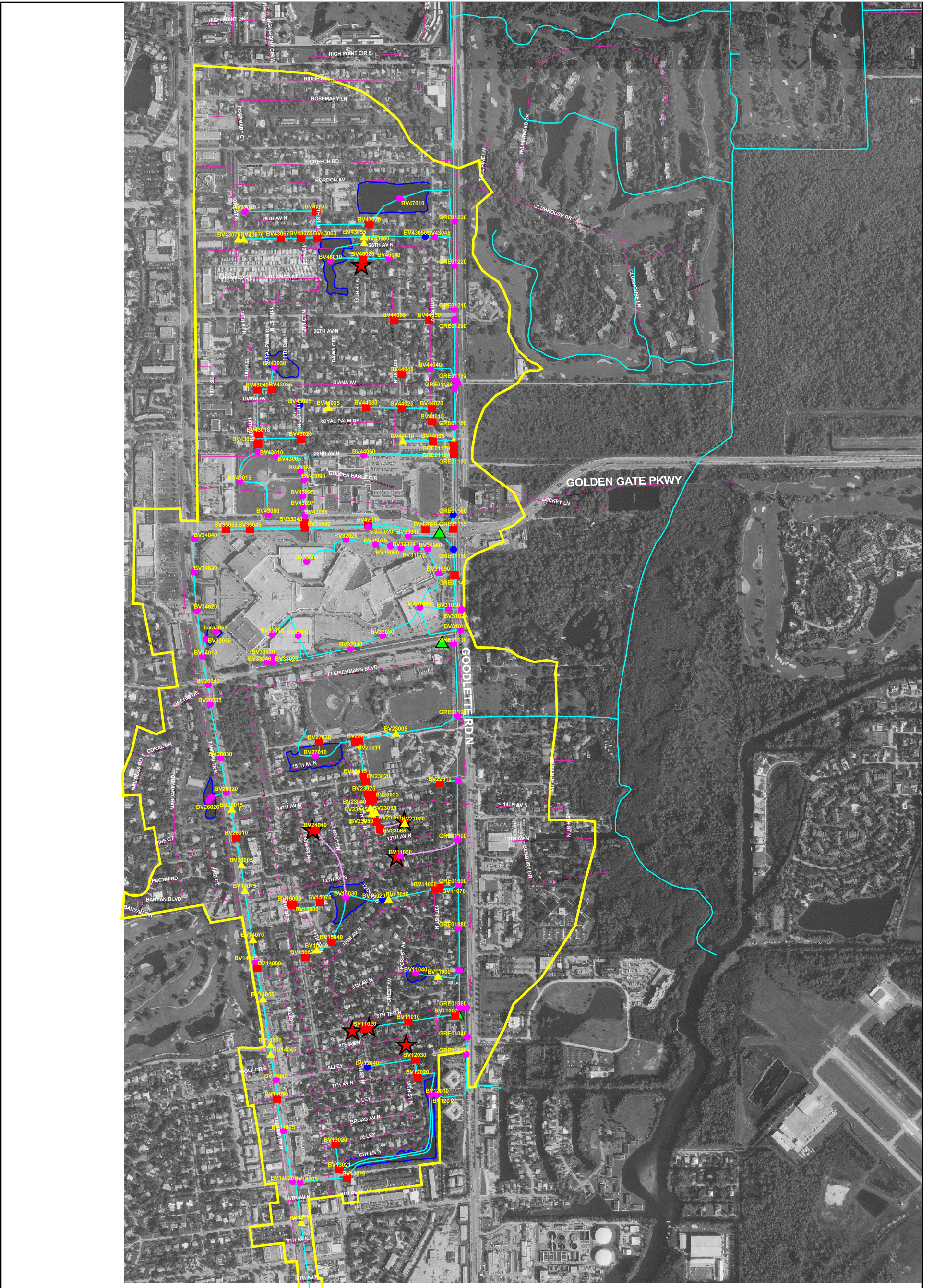
- Locations indicated by the City on their updated reported flooding problem map. Note that the flooding type (e.g., road, yard, building/structure, etc.) or nature of the problem (e.g., primary versus secondary system problem, debris/maintenance issue) was not indicated.
- Observed depths of flooding reported by City staff for the September 24-29, 2003 calibration event.

5.6 Problem Area Locations

Table 5-4 shows the grouping of the LOS exceedances into distinct problem areas. Problem areas were assigned an identification code based on geographic location within the watershed. As described in Section 6, improvement alternative projects were developed to address each problem area. There are a total of 25 problem areas in the Basin V PSMS. Problem areas 1A and 1B are interrelated since they are affected by tailwater conditions in the 6th Ave. N./12th St. N. pond. Also, problem areas 7A, 7B, and 7C are interrelated and upstream of the 10th Ave. N. pond. For the purposes of this evaluation, these were considered to be distinct problem areas despite being interrelated.

TABLE 5-2City of Naples - Basin V Stormwater System Improvement Plan, Phase I
Existing System LOS Evaluation Summary

Level of Service	Number of Locations (Model Junctions) by Design Storm Event							
	5-yr/24-hr		10-yr/72-hr		25-yr/72-hr		100-yr/72-hr	
Class A	115	67%	92	53%	84	49%	72	42%
Class B	7	4%	8	5%	5	3%	5	3%
Class C	35	20%	30	17%	22	13%	20	12%
Class D	15	9%	42	24%	61	35%	75	44%
Total		100%		100%		100%		100%



LEGEND

- Basin V - 25-Year LOS
- No Road, Yard or Structure Flooding
- Yard Flooding
- ▲ No structural flooding, with yard flooding or <6" Road Flooding
- Road Flooding > 6" or Structure Flooding
- ★ Reported Flooding Problems
- ▲ Observed Flooding Problems
- Basin V
- Conduits
- Overland Flow Paths
- Streets
- Lakes - Basin V

Figure 5-1
 Basin V SWMP
 25-Year/72-Hour
 LOS Map
 Naples, Florida

TABLE 5-3

City of Naples - Basin V Stormwater System Improvement Plan, Phase I
Existing System LOS Evaluation - Comparison To Reported Flooding Problems

Junction Name	Location	Observed or Reported Problem ⁽²⁾	5-yr/24-hr Event		10-yr/72-hr Event		25-yr/72-hr Event		100-yr/72-hr Event	
			Road Flood Depth (ft)	LOS Class	Road Flood Depth (ft)	LOS Class	Road Flood Depth (ft)	LOS Class	Road Flood Depth (ft)	LOS Class
BV27020	15th Avenue North		0.4	C	1.3	D	1.8	D	2.3	D
BV35045	Golden Gate Parkway	Y	0.9	D	1.4	D	1.8	D	2.1	D
BV12020	12th Street North		1.0	D	1.5	D	1.8	D	2.0	D
BV35050	Golden Gate Parkway	Y	0.7	D	1.2	D	1.6	D	1.9	D
BV46020	12th Street North, east of Pond	Y		A	0.5	C	1.1	D	1.9	D
BV15080	intersection of 11th Street North and 10th Street North		0.4	C	1.1	D	1.5	D	1.8	D
BV35030	Golden Gate Parkway	Y	0.7	D	1.2	D	1.6	D	1.8	D
BV12030	intersection of 7th Avenue North and 12th Street North	Y	0.8	D	1.2	D	1.6	D	1.8	D
BV23011	15th Avenue North		1.1	D	1.3	D	1.5	D	1.7	D
BV43040	intersection of Diana Avenue and 10th Street North	Y	0.9	D	1.3	D	1.4	D	1.6	D
BV23015	d/s end of 14th Avenue North crossing		1.0	D	1.2	D	1.4	D	1.6	D
BV43035	Diana Avenue, d/s of 10th Street North	Y	0.8	D	1.2	D	1.4	D	1.6	D
BV43020	intersection of 22nd Avenue North and 11th Street North	Y	0.5	C	1.2	D	1.4	D	1.6	D
BV23010	corner of 15th Avenue North and 12th Street North		0.9	D	1.2	D	1.4	D	1.6	D
BV13010	6th Avenue North		0.5	C	0.9	D	1.2	D	1.5	D
BV15070	11th Street North(8)			A	0.7	D	1.1	D	1.4	D
BV44015	14th Street North, north of 22nd Avenue North		0.5	C	0.8	D	1.1	D	1.4	D
BV11020	8th Avenue North	Y	0.5	C	0.9	D	1.2	D	1.4	D
BV15040	intersection of 11th Street North and 10th Avenue North			A	0.6	D	1.0	D	1.4	D
BV23030	intersection of 12th Street North and 14th Avenue North	Y	0.6	D	0.9	D	1.1	D	1.3	D
BV35040	Golden Gate Parkway	Y	0.2	C	0.7	D	1.1	D	1.3	D
BV44045	intersection of Diana Avenue and 13th Street North		0.6	D	1.0	D	1.1	D	1.3	D
BV15090	intersection of 11th Street North and 10th Street North			A	0.5	D	0.9	D	1.3	D
BV23060	d/s end of 13th Avenue North crossing		0.3	C	0.7	D	0.9	D	1.3	D
BV23065	u/s end of 13th Avenue North crossing		0.3	C	0.6	D	0.8	D	1.2	D
BV43017	22nd Avenue North, south of 10th Street North	Y	0.1	C	0.8	D	1.0	D	1.2	D
BV26010	US 41, d/s of 14th Avenue North			A	0.3	C	0.7	D	1.2	D
BV42010	Golden Gate Parkway	Y	0.2	C	0.8	D	1.0	D	1.2	D
BV44050	intersection of 14th Street North and 26th Avenue North		0.7	D	0.8	D	1.0	D	1.2	D
GRE01140	along Goodlette-Frank Road		0.2	C	0.7	D	0.9	D	1.1	D
BV42020	Golden Gate Parkway	Y	0.2	C	0.7	D	0.9	D	1.1	D
BV23035	intersection of 12th Street North and 14th Avenue North		0.4	C	0.7	D	0.9	D	1.1	D
BV23020	u/s end of 14th Avenue North crossing		0.4	C	0.7	D	0.9	D	1.1	D
BV14030	US 41, d/s of 7th Avenue North			A	0.2	C	0.6	D	1.1	D
BV23025	intersection of 12th Street North and 14th Avenue North		0.4	C	0.7	D	0.9	D	1.1	D
BV11007	u/s of intersection of 8th Ave N and Goodlette-Frank Road	Y	0.4	C	0.6	D	0.8	D	1.0	D
GRE01163	along Goodlette-Frank Road	Y		A	0.5	C	0.8	D	1.0	D
GRE01164	along Goodlette-Frank Road	Y		A	0.5	C	0.8	D	1.0	D
BV14060	d/s end of crossing at intersection of US 41 and 10th Avenue		0.1	C	0.5	C	0.7	D	1.0	D
BV47020	east of 12th Street North		0.1	C	0.6	D	0.9	D	1.0	D
GRE01170	along Goodlette-Frank Road			A	0.4	C	0.8	D	1.0	D
GRE01167	along Goodlette-Frank Road	Y		A	0.4	C	0.8	D	1.0	D
BV26005	US 41, u/s of 12th Avenue North			A	0.2	C	0.5	C	1.0	D
BV24010	east of 11th Street North	Y	0.4	C	0.5	C	0.6	D	1.0	D

TABLE 5-3

City of Naples - Basin V Stormwater System Improvement Plan, Phase I
Existing System LOS Evaluation - Comparison To Reported Flooding Problems

Junction Name	Location	Observed or Reported Problem ⁽²⁾	5-yr/24-hr Event		10-yr/72-hr Event		25-yr/72-hr Event		100-yr/72-hr Event	
			Road Flood	LOS	Road Flood	LOS	Road Flood	LOS	Road Flood	LOS
			Depth (ft)	Class	Depth (ft)	Class	Depth (ft)	Class	Depth (ft)	Class
BV15060	intersection of 10th Avenue North and 10th Street North	Y		A	0.3	C	0.7	D	1.0	D
BV13021	10th Street North		0.3	C	0.5	C	0.7	D	0.9	D
BV26015	US 41, d/s of 14th Avenue North			A		A	0.5	C	0.9	D
BV11010	intersection of 8th Avenue North and 12th Street North	Y	0.5	D	0.6	D	0.8	D	0.9	D
BV43018	intersection of 10th Avenue North and 22nd Avenue	Y	0.2	C	0.6	D	0.7	D	0.9	D
BV44005	intersection of 22nd Avenue North and 14th Street North		0.1	C	0.3	C	0.6	D	0.8	D
BV23040	intersection of 12th Street North and 14th Avenue North		0.1	C	0.4	C	0.6	D	0.8	D
BV14070	US 41, u/s of 10th Avenue			A	0.1	C	0.4	C	0.8	D
BV14075	US 41, d/s of 12th Avenue North			A	0.0	C	0.3	C	0.8	D
BV11070	d/s end of crossing at 10th Ave N and 13th St N	Y	0.5	C	0.6	D	0.7	D	0.8	D
BV43060	d/s end of 28th Avenue North & 12th St N crossing	Y		B		B	0.1	C	0.8	D
BV11060	u/s end of crossing at 10th Ave N and 13th St N	Y	0.7	D	0.7	D	0.8	D	0.8	D
BV13020	Alley		0.3	C	0.5	C	0.6	D	0.8	D
BV23050	12th Street North, south of 14th Avenue North			B	0.2	C	0.4	C	0.8	D
BV22010	14th Avenue North	Y	0.4	C	0.5	D	0.6	D	0.7	D
BV23055	12th Street North, north of 13th Avenue North			A	0.2	C	0.4	C	0.7	D
BV44020	intersection of 14th Street North and Royal Palm Drive		0.4	C	0.5	D	0.6	D	0.7	D
BV44030	Royal Palm Drive, u/s of 13th Street North		0.5	C	0.5	D	0.6	D	0.7	D
BV43063	intersection of 28th Avenue North and 12th Street North		0.2	C	0.4	C	0.6	D	0.7	D
BV14050	intersection of US 41 and 8th Avenue North			A	0.2	C	0.4	C	0.7	D
BV23070	south of 13th Avenue North	Y		A		A	0.2	C	0.7	D
BV44055	intersection of 13th Street North and 26th Avenue North		0.2	C	0.4	C	0.6	D	0.7	D
BV43065	28th Avenue north, west of 12th Street North		0.2	C	0.4	C	0.5	D	0.7	D
BV44025	intersection of Royal Palm Drive and 13th Street North		0.4	C	0.5	D	0.6	D	0.7	D
BV47030	south of 12th St North and 29th Ave North intersection			A	0.3	C	0.5	D	0.7	D
BV43067	28th Avenue north, d/s of 10th Street North		0.4	C	0.5	C	0.6	D	0.6	D
BV43055	intersection of 28th Avenue North and 12th Street North	Y		B	0.1	C	0.3	C	0.6	D
BV14055	US 41, u/s of 8th Avenue North			A	0.1	C	0.3	C	0.6	D
BV14015	intersection of US 41 and 3rd Avenue North			A		A		A	0.6	D
BV23045	12th Street North, south of 14th Avenue North			B		B	0.2	C	0.5	D
BV44010	22nd Avenue North	Y	0.1	C	0.2	C	0.3	C	0.5	D

Notes:

- (1) - All reported or observed locations and predicted 100-yr LOS Class D locations are shown.
- (2) - Observed or reported flooding problem areas identified on City flooding problem area map or where flooding was observed for the Sept 24-29, 2003 calibration event.
- (3) - Results are ranked by predicted flooding depth for 100-yr/72-hr event.

TABLE 5-4
 City of Naples - Basin V Stormwater System Improvement Plan, Phase I
 Problem Area Summary

Junction Name	Location	Road Crown Elevation (ft-NGVD)	Yard Elevation (ft-NGVD)	Structure Elevation (ft-NGVD)	Problem Area	25-yr/72-hr Event		
						Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾
BV13010	6th Avenue North	5.9	5.5	n/a	1A	7.1	1.2	D
BV14010	intersection of US 41 and 5th Avenue North	8.1	n/a	n/a	1A	8.2	0.1	C
BV14030	US 41, d/s of 7th Avenue North	9.6	n/a	n/a	1B	10.2	0.6	D
BV14045	US 41, d/s of 8th Avenue North	10.4	n/a	n/a	1B	10.6	0.2	C
BV14050	intersection of US 41 and 8th Avenue North	10.2	n/a	n/a	1B	10.7	0.4	C
BV14055	US 41, u/s of 8th Avenue North	10.4	n/a	n/a	1B	10.7	0.3	C
BV14060	d/s end of crossing at intersection of US 41 and 10th Avenue	10.0	n/a	n/a	1B	10.8	0.7	D
BV14070	US 41, u/s of 10th Avenue	10.4	n/a	n/a	1B	10.8	0.4	C
BV14075	US 41, d/s of 12th Avenue North	10.5	n/a	n/a	1B	10.8	0.3	C
BV26005	US 41, u/s of 12th Avenue North	10.4	n/a	n/a	1B	10.9	0.5	C
BV26010	US 41, d/s of 14th Avenue North	10.2	n/a	n/a	1B	10.9	0.7	D
BV26015	US 41, d/s of 14th Avenue North	10.5	n/a	n/a	1B	11.0	0.5	C
BV13020	Alley	7.1	7.9	9.5	2	7.7	0.6	D
BV13021	10th Street North	6.4	6.6	8.8	2	7.1	0.7	D
BV12020	12th Street North	5.3	5.3	7.5	3	7.1	1.8	D
BV12030	intersection of 7th Avenue North and 12th Street North	5.5	5.9	7.6	3	7.1	1.6	D
BV11007	u/s of intersection of 8th Ave N and Goodlette-Frank Road	5.8	4.5	n/a	4	6.6	0.8	D
BV11010	intersection of 8th Avenue North and 12th Street North	6.2	5.7	n/a	4	7.0	0.8	D
BV11020	8th Avenue North	7.2	6.9	8.8	4	8.4	1.2	D
BV11030	13th Street North	7.4	5.9	n/a	5	7.4	0.1	C
BV11070	d/s end of crossing at 10th Ave N and 13th St N	7.7	6.9	n/a	6	8.4	0.7	D
BV11060	u/s end of crossing at 10th Ave N and 13th St N	7.9	8.2	9.5	6	8.7	0.8	D
BV15010	d/s end of 12th Street North crossing	9.5	9.5	11.4	6	9.5	0.1	C
BV15040	intersection of 11th Street North and 10th Avenue North	9.1	n/a	n/a	7A	10.1	1.0	D
BV15050	10th Avenue North	10.1	10.3	12.6	7A	10.2	0.1	C
BV15060	intersection of 10th Avenue North and 10th Street North	9.5	9.4	11.1	7A	10.2	0.7	D
BV15070	11th Street North(8)	9.0	9.7	11.5	7B	10.1	1.1	D
BV15080	intersection of 11th Street North and 10th Street North	8.6	n/a	n/a	7B	10.1	1.5	D
BV15090	intersection of 11th Street North and 10th Street North	9.2	n/a	12.9	7B	10.1	0.9	D
BV24010	east of 11th Street North	9.5	9.0	11.4	7C	10.1	0.6	D
BV22010	14th Avenue North	7.2	6.9	9.9	8	7.8	0.6	D
BV23005	north of Lake Park Elementary School	8.7	7.4	n/a	9	8.9	0.1	C
BV23010	corner of 15th Avenue North and 12th Street North	7.4	n/a	n/a	9	8.8	1.4	D
BV23011	15th Avenue North	7.2	n/a	n/a	9	8.8	1.5	D
BV23015	d/s end of 14th Avenue North crossing	7.4	7.6	9.6	9	8.8	1.4	D

TABLE 5-4

City of Naples - Basin V Stormwater System Improvement Plan, Phase I
Problem Area Summary

Junction Name	Location	Road Crown Elevation (ft-NGVD)	Yard Elevation (ft-NGVD)	Structure Elevation (ft-NGVD)	Problem Area	25-yr/72-hr Event		
						Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾
BV23020	u/s end of 14th Avenue North crossing	7.9	7.2	n/a	9	8.8	0.9	D
BV23025	intersection of 12th Street North and 14th Avenue North	7.9	7.4	n/a	9	8.8	0.9	D
BV23030	intersection of 12th Street North and 14th Avenue North	7.7	7.5	10.0	9	8.8	1.1	D
BV23035	intersection of 12th Street North and 14th Avenue North	7.9	n/a	n/a	9	8.7	0.9	D
BV23040	intersection of 12th Street North and 14th Avenue North	8.1	7.4	n/a	9	8.7	0.6	D
BV23045	12th Street North, south of 14th Avenue North	8.4	7.9	n/a	9	8.6	0.2	C
BV23050	12th Street North, south of 14th Avenue North	8.2	7.9	10.6	9	8.5	0.4	C
BV23055	12th Street North, north of 13th Avenue North	8.2	n/a	n/a	9	8.5	0.4	C
BV23060	d/s end of 13th Avenue North crossing	7.7	n/a	n/a	9	8.5	0.9	D
BV23065	u/s end of 13th Avenue North crossing	7.7	n/a	n/a	9	8.5	0.8	D
BV23070	south of 13th Avenue North	8.2	7.9	10.0	9	8.4	0.2	C
BV27020	15th Avenue North	6.6	n/a	n/a	10	8.4	1.8	D
GRE01140	along Goodlette-Frank Road	8.0	7.8	9.5	11	8.9	0.9	D
BV35030	Golden Gate Parkway	8.6	n/a	n/a	12	10.1	1.6	D
BV35045	Golden Gate Parkway	8.3	n/a	n/a	12	10.1	1.8	D
BV35050	Golden Gate Parkway	8.5	n/a	n/a	12	10.1	1.6	D
BV35040	Golden Gate Parkway	9.1	n/a	n/a	12,13	10.2	1.1	D
BV42020	Golden Gate Parkway	9.0	n/a	n/a	13	9.9	0.9	D
BV42010	Golden Gate Parkway	9.2	n/a	n/a	13	10.2	1.0	D
BV43035	Diana Avenue, d/s of 10th Street North	10.7	9.7	12.6	14	12.2	1.4	D
BV43040	intersection of Diana Avenue and 10th Street North	10.7	10.2	n/a	14	12.1	1.4	D
BV43017	22nd Avenue North, south of 10th Street North	10.0	n/a	n/a	14	11.0	1.0	D
BV43018	intersection of 10th Avenue North and 22nd Avenue	10.8	n/a	n/a	14	11.5	0.7	D
BV43020	intersection of 22nd Avenue North and 11th Street North	9.7	n/a	n/a	14	11.0	1.4	D
GRE01170	along Goodlette-Frank Road	9.0	9.5	10.5	15	9.8	0.8	D
GRE01163	along Goodlette-Frank Road	9.0	n/a	n/a	15	9.8	0.8	D
GRE01164	along Goodlette-Frank Road	9.0	n/a	n/a	15	9.8	0.8	D
GRE01167	along Goodlette-Frank Road	9.0	n/a	n/a	15	9.8	0.8	D
BV44005	intersection of 22nd Avenue North and 14th Street North	9.2	n/a	n/a	16	9.8	0.6	D
BV44010	22nd Avenue North	9.5	9.4	11.4	16	9.8	0.3	C
BV44015	14th Street North, north of 22nd Avenue North	8.3	7.8	n/a	17	9.4	1.1	D
BV44020	intersection of 14th Street North and Royal Palm Drive	9.1	8.5	12.3	17	9.7	0.6	D
BV44025	intersection of Royal Palm Drive and 13th Street North	9.5	8.9	n/a	17	10.1	0.6	D
BV44030	Royal Palm Drive, u/s of 13th Street North	9.8	9.6	11.7	17	10.4	0.6	D
BV44035	Royal Palm Drive, u/s of 13th Street North	10.1	9.5	n/a	17	10.3	0.2	C

TABLE 5-4

City of Naples - Basin V Stormwater System Improvement Plan, Phase I
Problem Area Summary

Junction Name	Location	Road Crown Elevation (ft-NGVD)	Yard Elevation (ft-NGVD)	Structure Elevation (ft-NGVD)	Problem Area	25-yr/72-hr Event		
						Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾
BV44045	intersection of Diana Avenue and 13th Street North	9.8	9.5	12.7	18	10.9	1.1	D
BV44050	intersection of 14th Street North and 26th Avenue North	10.5	n/a	n/a	19	11.5	1.0	D
BV44055	intersection of 13th Street North and 26th Avenue North	11.5	11.6	13.8	19	12.0	0.6	D
BV43055	intersection of 28th Avenue North and 12th Street North	11.0	10.7	n/a	20	11.3	0.3	C
BV43060	d/s end of 28th Avenue North & 12th St N crossing	10.8	10.2	n/a	20	10.9	0.1	C
BV43063	intersection of 28th Avenue North and 12th Street North	11.9	11.3	n/a	20	12.5	0.6	D
BV43065	28th Avenue north, west of 12th Street North	12.0	10.8	13.5	20	12.5	0.5	D
BV43067	28th Avenue north, d/s of 10th Street North	12.3	11.9	n/a	20	12.9	0.6	D
BV43070	d/s end of 10th Street North & 28th Ave N crossing	12.5	12.1	13.0	20	12.7	0.2	C
BV43075	u/s end of 10th Street North & 28th Ave N crossing	12.6	11.8	n/a	20	12.6	0.1	C
BV46020	12th Street North, east of Pond	9.8	10.1	12.6	21	10.9	1.1	D
BV47020	east of 12th Street North	10.2	11.0	12.7	22	11.1	0.9	D
BV47030	south of 12th St North and 29th Ave North intersection	10.4	n/a	n/a	22	10.9	0.5	D

Total Number of LOS Class "B" Exceedances

83

Notes:

- (1) - Elevations, peak flood stages, and road flooding depths have all been rounded to the nearest tenth of a foot.
- (2) - Model results are computed to the nearest hundredth of a foot, but are shown in this table rounded to the nearest tenth of a foot. Therefore, even if the predicted stages from the model are shown to be equal to the respective critical elevation, the table may show an exceedance due to rounding (e.g. if the critical building elevation is 5.0, and the predicted peak stage from the model is 5.01, an exceedance is shown in the table).
- (3) - Level of Service (LOS) classes were assigned as follows:
 Class "A" LOS was assigned where flow is contained within the conveyance system; no flooding of major roadways, minor roadways, yards or structures is predicted;
 Class "B" LOS was assigned where there is no flooding of major roadways, minor roadways, or structures, but where yard flooding is predicted;
 Class "C" LOS was assigned where yard flooding and flooding of major roadways which precludes the use of the outside lane and travel in inside lanes is possible but difficult (depth less than 6-inches) is predicted, but where no structural flooding is predicted; and
 Class "D" LOS was assigned where extensive road flooding (depths greater than 6-inches) or structural flooding is predicted.

Section 6

Alternatives Evaluation

This section summarizes the development and evaluation of proposed improvement alternatives for the Basin V PSMS. Three alternatives were evaluated and are described below:

- Alternative 1 – Improvements recommended in the Gordon River Extension (GRE) study, which represent the combination of County and City improvements developed to address flooding problems in the GRE system. Problem areas in the Basin V PSMS located west of Goodlette-Frank Road were not addressed by the GRE study. The target LOS was to provide Class C LOS (i.e., maximum 6-in overtopping of the road crown) for the 25-year/72-hour design storm event. Alternative 1 improvements are described in detail in Section 6.1.
- Alternative 2 – City improvements developed specifically to address the problem areas in the Basin V PSMS only. The target LOS was to provide Class B LOS (i.e., no overtopping of the road crown) for the 25-year/72-hour design storm event. Alternative 2 improvements are described in detail in Section 6.2.
- Alternative 3 – This set of improvements represents a refinement of Alternative 2. Improvements were developed to achieve the various LOS criteria for several design storm events, including Class C LOS (i.e., maximum 6-in overtopping of the road crown) for the 25-year/72-hour design storm event. These criteria are consistent with similar coastal Florida communities. Alternative 3 improvements are described in detail in Section 6.3.

Section 6.4 presents a summary and comparison of alternatives.

6.1 Alternative 1

Alternative 1 comprises the currently recommended alternative for Phase IV of the Gordon River Extension Basin Study (i.e., GRE Alternative 2). Alternatives in the GRE study were developed to meet LOS criteria throughout the County system, which were based on a joint decision made by Collier County, the City, and SFWMD. As a result, proposed improvements under Alternative 1 are intended to provide Class C LOS (i.e., maximum 6-in overtopping of the road crown) for the 25-year/72-hour design storm event.

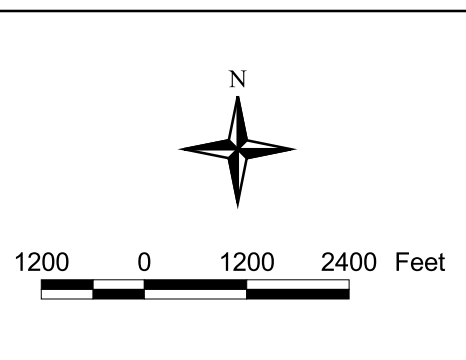
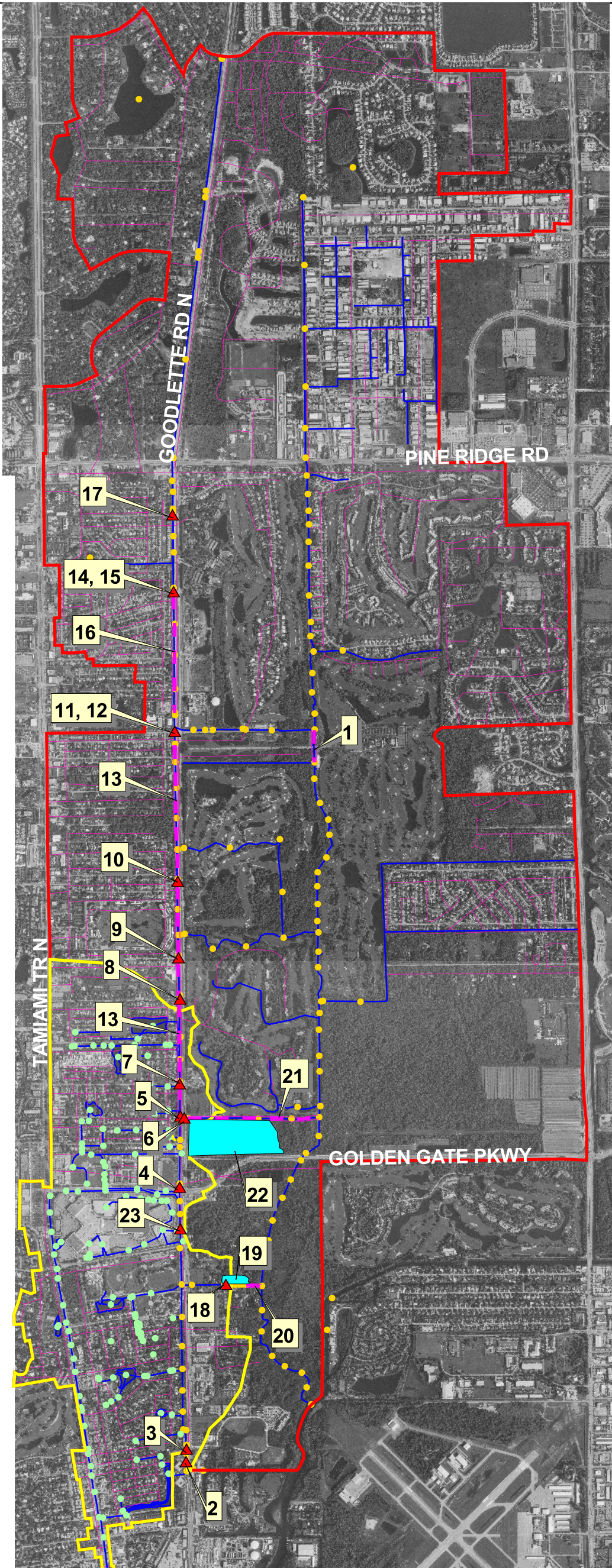
Alternative 1 improvements were developed to address stormwater problems within the County system and along Goodlette-Frank Road. While GRE improvements were not developed to specifically address the Basin V problem areas west of Goodlette-Frank Road, they do have a significant impact on the hydraulic performance of the Basin V system since this is the primary outfall of Basin V.

6.1.1 Project Description

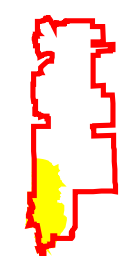
The components of Alternative 1 were developed with consideration of the most effective basin-wide solutions to achieving the desired hydraulic performance along the GRE PSMS. At the same time, consideration was also given to the permissibility of the ultimate improvement scenario and the inclusion of water quality best management practices to assist with the requirements of the pending total maximum daily load (TMDL) regulations for the Gordon River.

The location of Alternative 1 improvements are shown on **Figure 6-1** and summarized in **Table 6-1**. The components that directly impact the Basin V PSMS include:

- Map ID 2 (model node GRE01030 to GRE01020): Replace the existing 342-ft section of 48-inch RCP at the downstream end of Reach 01 with a single 4-ft by 7-ft reinforced concrete box culvert (RCBC). Upon implementation of these improvements, an equivalent conduit (or series of parallel conduits) may be used to provide the required conveyance capacity. A single box culvert section was selected for this alternative improvement scenario to represent the smallest footprint of the proposed improvements. This equivalent capacity concept can be used at any of the remaining conveyance improvements described in the remainder of this section;
- Map ID 3 (model node GRE01040 to GRE01030): Replace the existing 136-ft section of 48-inch RCP with a single 4-ft by 6-ft RCBC;
- Map ID 4 (model node GRE01160 to GRE01155): Replace the existing 200-ft section of 34-inch by 53-inch elliptical reinforced concrete pipe (ERCP) with a single 48-inch by 76-inch ERCP to match the adjacent downstream culvert (GRE01155 to GRE01150);
- Map ID 5 (model node GRE01192 to GRE01190): Modify the configuration of the existing weir. This modification includes lowering the crest elevation of the weir and notch to 5.0 and 4.4 ft-NGVD, respectively. This modification results in a weir crest (and notch) that is 1.0-ft lower than under the existing conditions. However, the same treatment volume is provided at this location with the increased channel depth that is included in this alternative improvement scenario;
- Map ID 6 (model node GRE01190 to GRE03040): Replace the existing 150-ft section of 48-inch by 76-inch ERCP under Goodlette-Frank Road with a single 6-ft by 12-ft RCBC at modified invert elevations;
- Map ID 7 (model node GRE01210 to GRE01200): Replace the existing 110-ft section of triple 36-inch RCP under 26th Avenue with a single 6-ft by 12-ft RCBC at modified invert elevations;



LOCATION MAP



LEGEND

- Structure Improvements
- Pond Locations
- Channel Improvements
- Basin V
- Gordon River Extension Basin
- Junctions**
- Basin V Model
- Gordon River Extension
- Conduits
- Streets
- Lakes - Basin V

Figure 6-1
Basin V Stormwater System
Improvement Plan - Phase I
Alternative 1 Improvement Map
Naples, Florida



TABLE 6-1

City of Naples - Basin V Stormwater System Improvement Plan, Phase I
Alternative 1 Improvement Summary

Map ID	Upstream Junction	Downstream Junction	Location	Improvement Type
1	GRE00360	GRE00350	Primary Reach (00) - Royal Poincianna bridge	Widen channel section under bridge by excavating, and lower inverts slightly.
2	GRE01030	GRE01020	Closed conduit at southern end of Reach 01	Replace existing pipe with 4'x7' RCBC
3	GRE01040	GRE01030	Closed conduit at southern end of Reach 01	Replace existing pipe with 4'x6' RCBC
4	GRE01160	GRE01155	Goodlette Frank Road Ditch - Upstream end of Golden Gate Parkway crossing	Replace existing 34"x53" ERCP with 48"x76" ERCP to match existing pipe at downstream end of Golden Gate Parkway crossing.
5	GRE01192	GRE01190	Goodlette Frank Road - Weir modification	Lower weir crest (and notch) to elevation 5.0 ft-NGVD (drops crest elevation by 1.0 ft)
6	GRE01190	GRE03040	Goodlette Frank Road - Outfall from GF Ditch to Reach 03	Replace existing 48"x76" ERCP with 6'x12' RCBC
7	GRE01210	GRE01200	Goodlette Frank Ditch - 26th Avenue Crossing	Replace 3-36" RCPs with 1-6'x12' RCBC
8	GRE01250	GRE01240	Goodlette Frank Ditch -Creech Road Crossing	Replace 54" RCP with 6'x12' RCBC
9	GRE01270	GRE01260	Goodlette Frank Ditch - Ridge Street Crossing	Replace existing 48" RCP with 6'x12' RCBC
10	GRE01310	GRE01300	Goodlette Frank Ditch - Ohio Drive Crossing	Replace existing 48" RCP with 6'x12' RCBC
11	GRE01380	GRE01360	Goodlette Frank Ditch - Solana Road Crossing	Replace existing 24" RCP with 6'x12' RCBC, with lower invert elevations to allow adequate cover.
12	GRE01380	GRE01360	Goodlette Frank Ditch - Solana Road Crossing	Raise road centerline of Solana Boulevard to 11.5 ft-NGVD
13	GRE01360	GRE01190	Along Reach 01	Channel excavation and grading to allow for installation of 6'x12' RCBC at each of the road crossings along this system.
14	GRE01430	GRE01420	Goodlette Frank Ditch - Granada Boulevard Crossing	Replace existing 48" x76" ERCP with 5'x10' RCBC
15	GRE01430	GRE01420	Goodlette Frank Ditch - Granada Boulevard Crossing	Raise road centerline of Granada Boulevard to 12.0 ft-NGVD
16	GRE01420	GRE01382	Goodlette Frank Ditch	Excavate 1-ft from Goodlette-Frank Road ditch to provide lower invert elevations from Granada to Solana Boulevard
17	GRE01470	GRE01460	Goodlette Frank Ditch - Pompei Lane Crossing	Replace existing 48" x76" ERCP with 4'x9' RCBC
18	GRE02010	GRE02020	Conservancy Parking Lot driveway	Replace existing pipes with 3-29"x45" ERCP
19	GRE02010		Along Reach 02	Provide 2-acre pond along north bank of Reach 02 (in the Conservancy overflow parking area). Facility provided to receive peak flows, which means minimal water quality treatment provided.
20	GRE02060	GRE00070	Downstream end of Reach 02	Remove mangroves from channel banks (lower manning's N of channels)
21	GRE03040	GRE00160	Reach 03	Widen existing channel, 4-5 ft deep with bank-to-bank distance of 45-feet.
22	GRE03040		Along Reach 03	Provide 27-acre pond along the south bank of Reach 03 (on the vacant parcel); connectivity includes routing of initial flows to pond through a trapezoidal channel, allowing for a high flow pop-off where peak flows can continue down the existing channel; and a weir outfall that will allow sheet flow through existing downstream wetlands to junction GRE03010.
23	GRE01140	GRE01130	Goodlette Frank Road Adjacent to the mall	Replace existing 570-ft section of 2 - 29"x45" ERCP with two sections of 3 - 3'x5' RCBC, and 200-ft open channel in between road crossings.

Notes:

1.) 'Map ID' corresponds to the labels on the Alternative 1 Improvement Map (Figure 6-1).

- Map ID 13 (model node GRE01360 to GRE01190): Excavate 1.0-ft from the existing natural channel sections along Goodlette Frank Road (between these junctions). These channel modifications are necessary to accommodate the revised invert elevations at each of the 6-ft by 12-ft RCBC roadway crossings along this portion of the system;
- Map ID 18 (model node GRE02010 to GRE02020): Replace the existing 40-ft section of triple 19-inch by 30-inch ERCP under the driveway to the Conservancy parking lot with triple 29-inch by 45-inch ERCP;
- Map ID 19 (adjacent to model node GRE02010): Construct a 2-acre stormwater management facility along the north bank of Reach 02 (in the Conservancy overflow parking area) to receive peak flows from the system for attenuation;
- Map ID 22 (adjacent to model node GRE03040): Construct a 27-acre stormwater management facility on the vacant parcel along the south bank of Reach 03. The hydraulics of this facility include the construction of a trapezoidal channel for the inlet, construction of a high flow diversion weir adjacent to the inlet which allows peak flow to overflow into the existing natural channel, and the construction of a broad crested weir along the eastern bank of the facility to allow outflow to sheet flow through the existing wetlands, back into the existing system;
- Map ID 23 (model node GRE01140 to GRE01130): Replace the existing 570-ft section of double 29-inch x 45-inch ERCP with two sections of triple 3-ft x 5-ft RCBC, and 200-ft open channel in between road crossings.

Map IDs 1, 20 and 21 are located on the main branch of the GRE PSMS. Map IDs 8-12 and 14-17 are located upstream of Basin V along the Goodlette-Frank Road system.

It should be noted that a few of the aforementioned improvements are in areas where flooding is not predicted for the existing system. However, it is necessary to increase the conveyance capacity at these locations in order to reduce the peak stages at nearby upstream junctions. For example, at the overflow parking driveway at the Conservancy, model nodes GRE02010 to GRE02020, the existing culverts provide at least a Class “C” LOS for the 25-year design storm event, which is acceptable for the purpose of the development of this alternative. However, by increasing the conveyance capacity of these culverts, the stages at the upstream portion of Reach 02 are lowered, providing an increased LOS in upstream portions of the system.

The primary concept behind this alternative improvement scenario is to increase the conveyance capacity along Reach 03 in order to provide the increased LOS at the majority of the problem areas along the primary stormwater management system of the Gordon River Extension Basin. In addition, the two stormwater management facilities included in this scenario help to provide attenuation within the system, thus helping to meet the requirements of the regulatory agencies (e.g., SFWMD and

USACE), and provide a water quality aspect to the retrofit improvement scenario to assist with meeting the pending TMDL regulations for the Gordon River.

6.1.2 Level of Service Evaluation – Alternative 1

The resulting peak flood stages for Alternative 1 within the Basin V PSMS are presented in **Table 6-2**. Model results for each of the four design storm events are presented and the difference between existing system peak stages as presented in Table 5-1 are given.

As stated previously, there were no improvements developed for the GRE Study west of Goodlette-Frank Road. As a result, the benefit of reduced flood stages within the Basin V PSMS is limited to junctions along and immediately adjacent to Goodlette-Frank Road. Peak flood stages are reduced by up to 1.3 ft for the 5-yr/24-hr event and up to 1.8 ft for the 100-yr/72-hr event.

Furthermore, the reduction in peak flood stages south of Fleischmann Boulevard (model node GRE01130) are somewhat diminished by the increase in flows along Goodlette-Frank Road due to the cumulative conveyance improvements upstream.

The LOS provided by the proposed Alternative 1 improvements was determined by comparing predicted peak flood stages to the threshold elevations as shown in **Table 6-3**. For each model junction, the name, location and threshold LOS elevations are given on the left side of Table 6-3. Peak flood stage results, road flooding depths, and LOS class for the various design storm events are given on the right side of the table.

Table 6-4 shows a summary of the LOS evaluation for Alternative 1. The number and overall percentage of locations that achieve a given LOS Class are tabulated for each design storm event. There are a total of 172 junctions that have a defined LOS class within the Basin V PSMS. The table indicates minimal benefits to the Basin V PSMS in terms of LOS Class improvements. Compared to the existing system, there is a net improvement of 1 LOS Class B exceedance and 2 LOS Class C exceedances.

Since GRE alternatives were developed only for the Goodlette-Frank Road problems, it is expected that the LOS Class improvements are limited to the two problem areas along the Goodlette-Frank Road system. These were identified in Table 5-4 as problem area 11 and 15. Problem area 11 (model node GRE01140) was improved from an existing LOS Class D to LOS Class A. Problem area (model nodes GRE01170 to GRE01164) were improved from an existing LOS Class D to LOS Class C (i.e., from 0.8 feet to 0.2 feet of road flooding).

As noted earlier, the GRE target criteria for hydraulic performance was LOS Class C (i.e., maximum 6-in overtopping of the road crown for the 25-year/72-hour design storm event). This was achieved by Alternative 1 for the two problem areas along Goodlette-Frank Road. Problem areas within the Basin V PSMS west of Goodlette-Frank Road were not improved by Alternative 1.

TABLE 6-2
City of Naples - Basin V Stormwater System Improvement Plan, Phase I
Peak Flood Stage Comparison - Alternative 1

Junction Name	Location	5-yr/24-hr Event		10-yr/72-hr Event		25-yr/72-hr Event		100-yr/72-hr Event	
		Peak Stage (ft-NGVD)	Difference (ft)	Peak Stage (ft-NGVD)	Difference (ft)	Peak Stage (ft-NGVD)	Difference (ft)	Peak Stage (ft-NGVD)	Difference (ft)
GRE01020	Outfall to Golden Gate Canal Confluence	4.8	0.1	5.2	0.2	5.9	0.2	6.5	0.0
BV12010		6.3	0.0	6.7	0.0	7.0	0.0	7.3	0.0
BV12019	control structure from 6th Avenue Pond	6.3	0.0	6.8	0.0	7.1	0.0	7.3	0.0
BV13020	Alley	7.4	0.0	7.6	0.0	7.7	0.0	7.9	0.0
BV13021	10th Street North	6.8	0.0	6.9	0.0	7.1	0.0	7.4	0.0
BV13010	6th Avenue North	6.4	0.0	6.8	0.0	7.1	0.0	7.3	0.0
BV14005	intersection of 6th Avenue North and Tamiami Tr N	8.0	0.0	8.3	0.0	8.6	0.0	8.9	0.0
BV14010	intersection of US 41 and 5th Avenue North	7.6	0.0	7.9	0.0	8.2	0.0	8.6	0.0
BV14015	intersection of US 41 and 3rd Avenue North	6.8	0.0	7.3	0.0	7.9	0.0	8.4	0.0
BV14020	intersection of US 41 and 6th Avenue North	8.5	0.0	8.8	0.0	9.2	0.0	9.7	0.0
BV14025	US 41, u/s of 6th Avenue North	9.0	0.0	9.4	0.0	9.9	0.0	10.5	0.0
BV14030	US 41, d/s of 7th Avenue North	9.4	0.0	9.8	0.0	10.2	0.0	10.7	0.0
BV14040	intersection of US 41 and 7th Avenue North	9.8	0.0	10.2	0.0	10.5	0.0	10.8	0.0
BV14045	US 41, d/s of 8th Avenue North	9.9	0.0	10.3	0.0	10.6	0.0	10.9	0.0
BV14050	intersection of US 41 and 8th Avenue North	10.0	0.0	10.4	0.0	10.7	0.0	10.9	0.0
BV14055	US 41, u/s of 8th Avenue North	10.1	0.0	10.5	0.0	10.7	0.0	11.0	0.0
BV14060	d/s end of crossing at intersection of US 41 and 10th Avenue	10.2	0.0	10.5	0.0	10.8	0.0	11.1	0.0
BV14065	u/s end of crossing at intersection of US 41 and 10th Avenue	10.2	0.0	10.5	0.0	10.8	0.0	11.2	0.0
BV14070	US 41, u/s of 10th Avenue	10.2	0.0	10.5	0.0	10.8	0.0	11.2	0.0
BV14075	US 41, d/s of 12th Avenue North	10.2	0.0	10.6	0.0	10.8	0.0	11.4	0.0
BV26005	US 41, u/s of 12th Avenue North	10.2	0.0	10.6	0.0	10.9	0.0	11.4	0.0
BV26010	US 41, d/s of 14th Avenue North	10.1	0.0	10.5	0.0	10.9	0.0	11.4	0.0
BV26015	US 41, d/s of 14th Avenue North	10.0	0.0	10.4	0.0	11.0	0.0	11.4	0.0
BV26020	US 41, u/s of 14th Avenue North	9.9	0.0	10.5	0.0	11.0	0.0	11.4	0.0
BV26025	pond west of US 41	9.8	0.0	10.5	0.0	11.0	0.0	11.4	0.0
BV26026	pond west of US 41	9.8	0.0	10.5	0.0	11.0	0.0	11.4	0.0
BV26030	US 41, u/s of 14th Avenue North	9.9	0.0	10.5	0.0	11.0	0.0	11.4	0.0
BV26035	US 41, d/s of Fleischmann Boulevard	9.9	0.0	10.5	0.0	11.0	0.0	11.4	0.0
BV26040	intersection of US 41 and Fleischmann Boulevard	9.9	0.0	10.5	0.0	11.0	0.0	11.4	0.0
BV34010	US 41, u/s of Fleischmann Boulevard	9.9	0.0	10.5	0.0	11.0	0.0	11.4	0.0
BV33056	retention area at west side of mall	9.1	0.0	10.0	0.0	10.5	0.0	10.9	0.0
BV33055	retention area at west side of mall	9.1	0.0	10.0	0.0	10.5	0.0	10.9	0.0
BV34020	US 41, west of Coastland Mall	10.0	0.0	10.7	0.0	11.2	0.0	11.6	0.0
BV34030	US 41, west of Coastland Mall	10.0	0.0	10.7	0.0	11.2	0.0	11.6	0.0
BV34040	south of US 41 and Golden Gate Parkway intersection	10.7	0.0	11.2	0.0	11.5	0.0	11.8	0.0
BV12020	12th Street North	6.3	0.0	6.8	0.0	7.1	0.0	7.3	0.0
BV12030	intersection of 7th Avenue North and 12th Street North	6.3	0.0	6.8	0.0	7.1	0.0	7.3	0.0
BV12040	7th Avenue North	5.9	0.0	6.3	0.0	6.7	0.0	7.1	0.0
BV24010	east of 11th Street North	9.9	0.0	10.0	0.0	10.1	0.0	10.5	0.0
GRE01030	Goodlette-Frank Road	4.9	-0.3	5.4	-0.2	6.0	0.0	6.5	0.0
GRE01040	Goodlette-Frank Road	5.0	-0.5	5.4	-0.4	6.0	-0.1	6.5	0.0
GRE01050	Goodlette-Frank Road	5.7	-0.2	6.0	-0.2	6.4	-0.1	6.7	0.0
GRE01060	Goodlette-Frank Road	6.0	-0.2	6.3	-0.1	6.5	-0.1	6.8	0.0
BV11007	u/s of intersection of 8th Ave N and Goodlette-Frank Road	6.1	-0.1	6.3	-0.1	6.5	-0.1	6.8	0.0
BV11010	intersection of 8th Avenue North and 12th Street North	6.8	0.0	6.9	0.0	7.0	0.0	7.1	0.0
BV11020	8th Avenue North	7.7	0.0	8.1	0.0	8.4	0.0	8.6	0.0

TABLE 6-2
 City of Naples - Basin V Stormwater System Improvement Plan, Phase I
 Peak Flood Stage Comparison - Alternative 1

Junction Name	Location	5-yr/24-hr Event		10-yr/72-hr Event		25-yr/72-hr Event		100-yr/72-hr Event	
		Peak Stage (ft-NGVD)	Difference (ft)	Peak Stage (ft-NGVD)	Difference (ft)	Peak Stage (ft-NGVD)	Difference (ft)	Peak Stage (ft-NGVD)	Difference (ft)
GRE01070	Goodlette-Frank Road	6.1	-0.1	6.4	-0.1	6.7	0.0	7.0	0.0
BV11030	13th Street North	6.9	0.0	7.2	0.0	7.4	0.0	7.6	0.0
BV11040	Pond west of 13th Street North	6.9	0.0	7.2	0.0	7.4	0.0	7.6	0.0
GRE01080	Goodlette-Frank Road	6.2	-0.1	6.5	0.0	6.8	0.0	7.0	0.0
GRE01090	Goodlette-Frank Road	6.4	0.0	6.8	0.0	7.2	0.0	7.7	0.0
BV11070	d/s end of crossing at 10th Ave N and 13th St N	8.1	0.0	8.3	0.0	8.4	0.0	8.5	0.0
BV11060	u/s end of crossing at 10th Ave N and 13th St N	8.5	0.0	8.6	0.0	8.7	0.0	8.7	0.0
BV15010	d/s end of 12th Street North crossing	8.6	0.0	9.3	0.0	9.5	0.0	9.8	0.0
BV15020	u/s end of 12th Street North crossing(1)	8.7	0.0	9.6	0.0	9.9	0.0	10.4	0.0
BV15030	pond at 12th Street North	8.9	0.0	9.7	0.0	10.1	0.0	10.5	0.0
BV15070	11th Street North(8)	8.9	0.0	9.7	0.0	10.1	0.0	10.5	0.0
BV15080	intersection of 11th Street North and 10th Street North	9.0	0.0	9.7	0.0	10.1	0.0	10.5	0.0
BV15090	intersection of 11th Street North and 10th Street North	8.9	0.0	9.7	0.0	10.1	0.0	10.5	0.0
BV15040	intersection of 11th Street North and 10th Avenue North	8.9	0.0	9.7	0.0	10.1	0.0	10.5	0.0
BV15050	10th Avenue North	9.0	0.0	9.8	0.0	10.2	0.0	10.5	0.0
BV15060	intersection of 10th Avenue North and 10th Street North	8.9	0.0	9.8	0.0	10.2	0.0	10.5	0.0
GRE01100	Goodlette-Frank Road	6.3	0.0	6.6	0.0	6.9	0.0	7.1	0.0
BV11050	north of 12th Avenue North	8.0	0.0	8.0	0.0	8.0	0.0	8.0	0.0
GRE01110	Goodlette-Frank Road	6.3	0.0	6.6	0.0	6.8	0.0	7.2	0.0
BV22010	14th Avenue North	7.6	0.0	7.7	0.0	7.8	0.0	7.9	0.0
GRE01120	Goodlette-Frank Road	5.8	0.1	6.4	0.3	6.8	0.4	7.2	0.4
BV23005	north of Lake Park Elementary School	8.4	0.0	8.6	0.0	8.9	0.0	9.1	0.0
BV23010	corner of 15th Avenue North and 12th Street North	8.4	0.0	8.6	0.0	8.8	0.0	9.0	0.0
BV23011	15th Avenue North	8.4	0.0	8.6	0.0	8.8	0.0	9.0	0.0
BV27010	Pond north of 14th Avenue North	7.1	0.0	8.0	0.0	8.5	0.0	9.0	0.0
BV27020	15th Avenue North	7.1	0.0	8.0	0.0	8.5	0.0	9.0	0.0
BV23015	d/s end of 14th Avenue North crossing	8.3	0.0	8.6	0.0	8.8	0.0	9.0	0.0
BV23020	u/s end of 14th Avenue North crossing	8.3	0.0	8.6	0.0	8.8	0.0	9.0	0.0
BV23025	intersection of 12th Street North and 14th Avenue North	8.3	0.0	8.6	0.0	8.8	0.0	9.0	0.0
BV23030	intersection of 12th Street North and 14th Avenue North	8.3	0.0	8.6	0.0	8.8	0.0	9.0	0.0
BV23035	intersection of 12th Street North and 14th Avenue North	8.2	0.0	8.5	0.0	8.7	0.0	9.0	0.0
BV23040	intersection of 12th Street North and 14th Avenue North	8.2	0.0	8.5	0.0	8.7	0.0	9.0	0.0
BV23045	12th Street North, south of 14th Avenue North	8.1	0.0	8.4	0.0	8.6	0.0	9.0	0.0
BV23050	12th Street North, south of 14th Avenue North	8.0	0.0	8.4	0.0	8.6	0.0	9.0	0.0
BV23055	12th Street North, north of 13th Avenue North	8.0	0.0	8.4	0.0	8.6	0.0	9.0	0.0
BV23060	d/s end of 13th Avenue North crossing	8.0	0.0	8.4	0.0	8.5	0.0	9.0	0.0
BV23065	u/s end of 13th Avenue North crossing	8.0	0.0	8.4	0.0	8.5	0.0	9.0	0.0
BV23070	south of 13th Avenue North	6.5	0.0	7.2	0.0	8.4	0.0	9.0	0.0
GRE01130	intersection of Fleschmann Ave and Goodlette-Frank Road	6.9	0.5	6.8	0.3	6.8	0.3	7.2	0.4
GRE01140	along Goodlette-Frank Road	7.3	-0.9	7.4	-1.3	7.6	-1.3	7.7	-1.4
GRE01150	along Goodlette-Frank Road	7.3	-0.9	7.5	-1.2	7.7	-1.2	7.8	-1.3
BV35010	Golden Gate Parkway	7.4	-0.8	7.7	-1.1	7.9	-1.1	8.1	-1.2
BV35020	Golden Gate Parkway	8.6	-0.4	9.4	-0.3	9.9	-0.2	10.3	-0.1
BV35030	Golden Gate Parkway	9.0	-0.2	9.5	-0.2	9.9	-0.2	10.3	-0.1
BV35040	Golden Gate Parkway	9.1	-0.2	9.6	-0.2	10.0	-0.1	10.3	-0.1
BV43098	baseball fields at Naples High School (outfall to south)	9.1	-0.2	9.7	-0.1	10.1	-0.1	10.5	0.0

TABLE 6-2
 City of Naples - Basin V Stormwater System Improvement Plan, Phase I
 Peak Flood Stage Comparison - Alternative 1

Junction Name	Location	5-yr/24-hr Event		10-yr/72-hr Event		25-yr/72-hr Event		100-yr/72-hr Event	
		Peak Stage (ft-NGVD)	Difference (ft)	Peak Stage (ft-NGVD)	Difference (ft)	Peak Stage (ft-NGVD)	Difference (ft)	Peak Stage (ft-NGVD)	Difference (ft)
BV35045	Golden Gate Parkway	9.1	-0.2	9.5	-0.2	9.9	-0.2	10.3	-0.1
BV35050	Golden Gate Parkway	9.1	-0.2	9.5	-0.2	9.9	-0.2	10.3	-0.1
GRE01155	along Goodlette-Frank Road	7.8	-0.5	8.0	-0.8	8.3	-0.7	8.6	-0.7
GRE01160	along Goodlette-Frank Road	8.3	-0.6	8.7	-0.8	9.2	-0.6	9.5	-0.5
BV42020	Golden Gate Parkway	8.8	-0.4	9.4	-0.3	9.7	-0.2	10.0	-0.1
BV42010	Golden Gate Parkway	9.2	-0.3	9.9	-0.1	10.1	-0.1	10.3	-0.1
GRE01170	along Goodlette-Frank Road	8.3	-0.5	8.7	-0.7	9.2	-0.6	9.5	-0.5
BV44005	intersection of 22nd Avenue North and 14th Street North	9.2	-0.1	9.4	0.0	9.5	-0.3	9.6	-0.5
BV44010	22nd Avenue North	9.5	0.0	9.7	0.0	9.8	0.0	9.9	-0.2
GRE01180	along Goodlette-Frank Road	8.3	-0.2	8.8	-0.3	9.2	-0.2	9.5	-0.2
BV44015	14th Street North, north of 22nd Avenue North	8.8	0.0	8.9	-0.2	9.2	-0.2	9.5	-0.2
BV44020	intersection of 14th Street North and Royal Palm Drive	9.5	0.0	9.6	0.0	9.7	0.0	9.8	0.0
BV44025	intersection of Royal Palm Drive and 13th Street North	9.9	0.0	10.0	0.0	10.1	0.0	10.2	0.0
BV44030	Royal Palm Drive, u/s of 13th Street North	10.3	0.0	10.3	0.0	10.4	0.0	10.5	0.0
BV44035	Royal Palm Drive, u/s of 13th Street North	10.0	0.0	10.1	0.0	10.3	0.0	10.4	0.0
GRE01188	along Goodlette-Frank Road	8.2	-0.2	8.8	-0.3	9.2	-0.1	9.5	-0.2
GRE01190	along Goodlette-Frank Road	6.9	-1.3	7.7	-1.1	8.2	-1.0	8.6	-0.9
GRE01192	along Goodlette-Frank Road	8.2	-0.2	8.9	-0.2	9.2	-0.1	9.5	-0.2
BV44040	intersection of 14th Street North and Diana Avenue	10.4	-0.1	10.7	0.0	10.9	0.0	11.1	0.0
BV44045	intersection of Diana Avenue and 13th Street North	10.4	-0.1	10.7	0.0	10.9	0.0	11.1	0.0
GRE01200	along Goodlette-Frank Road	8.4	-0.1	8.9	-0.2	9.3	-0.1	9.6	-0.1
BV44050	intersection of 14th Street North and 26th Avenue North	11.2	0.0	11.3	0.0	11.5	0.0	11.6	0.0
BV44055	intersection of 13th Street North and 26th Avenue North	11.7	0.0	11.9	0.0	12.0	0.0	12.2	0.0
GRE01210	along Goodlette-Frank Road	8.6	-0.3	9.3	-0.4	9.8	-0.4	10.2	-0.4
GRE01220	along Goodlette-Frank Road	8.9	-0.1	9.6	-0.2	10.0	-0.3	10.3	-0.3
BV43045	d/s end of 14th Street North & 28th Ave N crossing	9.0	-0.1	9.7	-0.2	10.1	-0.2	10.5	-0.3
BV43050	u/s end of 14th Street North & 28th Ave N crossing	9.2	0.0	9.9	-0.1	10.2	-0.2	10.7	-0.3
BV43055	intersection of 28th Avenue North and 12th Street North	10.8	-0.1	11.1	0.0	11.3	0.0	11.6	-0.1
BV43060	d/s end of 28th Avenue North & 12th St N crossing	10.6	0.0	10.8	0.0	10.9	0.0	11.6	-0.1
BV46010	Pond south of 28th Avenue North	9.1	0.0	10.1	-0.1	10.8	-0.1	11.6	-0.1
BV46020	12th Street North, east of Pond	9.1	0.0	10.1	-0.1	10.8	-0.1	11.6	-0.1
BV46040	east of 12th Street north	9.1	0.0	10.1	-0.1	10.8	-0.1	11.6	-0.1
BV43063	intersection of 28th Avenue North and 12th Street North	12.1	0.0	12.3	0.0	12.5	0.0	12.6	0.0
BV43065	28th Avenue north, west of 12th Street North	12.2	0.0	12.4	0.0	12.5	0.0	12.7	0.0
BV43067	28th Avenue north, d/s of 10th Street North	12.7	0.0	12.8	0.0	12.9	0.0	13.0	0.0
BV43070	d/s end of 10th Street North & 28th Ave N crossing	11.7	0.0	12.5	0.0	12.7	0.0	12.8	0.0
BV43075	u/s end of 10th Street North & 28th Ave N crossing	11.5	0.0	12.1	0.0	12.6	0.0	12.8	0.0
GRE01230	along Goodlette-Frank Road	8.9	-0.1	9.6	-0.2	10.0	-0.2	10.3	-0.3
BV47010	pond north of 28th Avenue North	10.3	0.0	10.8	0.0	11.1	0.0	11.2	0.0
BV47020	east of 12th Street North	10.3	0.0	10.8	0.0	11.1	0.0	11.2	0.0
BV47030	south of 12th St North and 29th Ave North intersection	10.3	0.0	10.7	0.0	10.9	0.0	11.1	0.0
BV47040	south of 29th Ave North and 10th St North intersection	10.0	0.0	10.2	0.0	10.4	0.0	10.8	0.0
BV43030	pond north of Diana Avenue	11.6	0.0	12.0	0.0	12.2	0.0	12.4	0.0
BV43035	Diana Avenue, d/s of 10th Street North	11.6	0.0	12.0	0.0	12.2	0.0	12.3	0.0
BV43040	intersection of Diana Avenue and 10th Street North	11.5	0.0	11.9	0.0	12.1	0.0	12.3	0.0
BV43010	10th Street North, Naples High School baseball fields	9.7	-0.1	10.2	-0.1	10.4	-0.1	10.7	-0.1

TABLE 6-2
 City of Naples - Basin V Stormwater System Improvement Plan, Phase I
 Peak Flood Stage Comparison - Alternative 1

Junction Name	Location	5-yr/24-hr Event		10-yr/72-hr Event		25-yr/72-hr Event		100-yr/72-hr Event	
		Peak Stage (ft-NGVD)	Difference (ft)	Peak Stage (ft-NGVD)	Difference (ft)	Peak Stage (ft-NGVD)	Difference (ft)	Peak Stage (ft-NGVD)	Difference (ft)
BV43017	22nd Avenue North, south of 10th Street North	10.1	-0.1	10.8	0.0	11.0	0.0	11.2	0.0
BV43018	intersection of 10th Avenue North and 22nd Avenue	11.0	0.0	11.3	0.0	11.5	0.0	11.7	0.0
BV43015	baseball fields at Naples High School	9.8	0.0	10.2	-0.1	10.4	-0.1	10.7	-0.1
BV43005	baseball fields at Naples High School	9.5	-0.2	10.1	-0.1	10.4	0.0	10.6	0.0
BV43020	intersection of 22nd Avenue North and 11th Street North	10.1	-0.1	10.8	0.0	11.0	0.0	11.2	0.0
BV43025	intersection of 11th Street North and Royal Palm Drive	9.7	-0.1	10.1	0.0	10.6	0.0	10.9	0.0
BV43080	baseball fields at Naples High School	10.0	0.0	10.2	0.0	10.5	-0.1	10.7	-0.1
BV43085	baseball fields at Naples High School	9.5	-0.2	10.1	-0.1	10.4	0.0	10.6	0.0
BV43090	baseball fields at Naples High School	9.5	-0.2	10.1	-0.1	10.4	0.0	10.6	0.0
BV43095	baseball fields at Naples High School	9.5	-0.1	10.0	-0.1	10.4	0.0	10.6	0.0
BV43097	baseball fields at Naples High School	9.7	0.0	9.8	-0.1	10.2	-0.1	10.6	0.0
GRE01163	along Goodlette-Frank Road	8.3	-0.6	8.7	-0.8	9.2	-0.6	9.5	-0.5
BV44060	Naples High School	9.0	-0.3	9.7	-0.2	10.1	-0.1	10.4	0.0
GRE01164	along Goodlette-Frank Road	8.3	-0.6	8.7	-0.8	9.2	-0.6	9.5	-0.5
GRE01167	along Goodlette-Frank Road	8.3	-0.5	8.7	-0.7	9.2	-0.6	9.5	-0.5
BV31010	Goodlette-Frank Road, east of Coastland Mall	7.1	-0.2	7.2	-0.6	7.3	-0.6	7.4	-0.8
BV31040	Coastland Mall	7.7	-0.4	8.6	-0.6	9.0	-0.4	9.6	-0.4
BV31020	Goodlette-Frank Road, east of Coastland Mall	7.1	-0.8	7.2	-1.5	7.3	-1.6	7.4	-1.8
BV31030	Coastland Mall	7.3	-0.7	7.8	-1.1	8.0	-1.1	8.3	-1.2
BV31050	Coastland Mall	7.8	-0.4	8.8	-0.5	9.2	-0.3	10.0	-0.3
BV31060	Coastland Mall	7.9	-0.3	8.9	-0.4	9.5	-0.2	10.4	-0.2
BV31070	Coastland Mall	8.0	-0.3	8.9	-0.4	9.6	-0.2	10.6	-0.2
BV32010	Coastland Mall	8.1	-0.2	9.1	-0.3	9.8	-0.2	10.8	-0.2
BV35060	Coastland Mall	8.4	-0.1	9.2	-0.3	9.9	-0.2	11.0	-0.1
BV35070	Coastland Mall	8.5	-0.1	9.4	-0.2	10.1	-0.2	11.2	-0.1
BV32020	Coastland Mall	8.8	0.0	9.6	-0.1	10.4	-0.1	11.5	-0.1
BV33060	Coastland Mall	8.9	0.0	9.7	-0.1	10.6	-0.1	11.7	-0.1
BV32030	Coastland Mall	7.8	-0.7	9.0	-0.6	9.5	-0.2	9.9	-0.3
BV32040	Coastland Mall	8.4	0.0	8.9	-0.7	10.4	0.0	10.9	-0.2
BV33010	Coastland Mall	8.0	-0.1	8.7	-0.1	9.3	-0.2	9.9	-0.2
BV33050	Coastland Mall	8.1	0.0	8.8	0.0	9.4	-0.2	9.9	-0.2
BV33020	Coastland Mall	8.4	0.0	8.7	-0.1	9.1	-0.2	9.6	-0.2
BV33040	Coastland Mall	8.3	0.0	8.7	-0.1	9.1	-0.2	9.6	-0.3
BV33030	Coastland Mall	8.3	0.0	8.5	-0.3	9.1	-0.2	9.6	-0.3

- Notes:
- | | | | | | |
|--|------|------|------|------|------|
| | max: | 0.5 | 0.3 | 0.4 | 0.4 |
| | min: | -1.3 | -1.5 | -1.6 | -1.8 |
- (1) - Peak flood stages have been rounded to the nearest tenth of a foot.
 (2) - Difference compares peak flood stage to existing conditions (Table 5-1).

TABLE 6-3

City of Naples - Basin V Stormwater System Improvement Plan, Phase I
Proposed System LOS Evaluation - Alternative 1

Junction Name	Location	Road Crown Elevation (ft-NGVD)	Yard Elevation (ft-NGVD)	Structure Elevation (ft-NGVD)	5-yr/24-hr Event			10-yr/72-hr Event			25-yr/72-hr Event			100-yr/72-hr Event		
					Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾
GRE01020	Outfall to Golden Gate Canal Confluence	6.5	6.3	7.0	4.8		A	5.2		A	5.9		A	6.5		B
BV12010		n/a	n/a	n/a	6.3		A	6.7		A	7.0		A	7.3		A
BV12019	control structure from 6th Avenue Pond	n/a	n/a	n/a	6.3		A	6.8		A	7.1		A	7.3		A
BV13020	Alley	7.1	7.9	9.5	7.4	0.3	C	7.6	0.5	C	7.7	0.6	D	7.9	0.8	D
BV13021	10th Street North	6.4	6.6	8.8	6.8	0.3	C	6.9	0.5	C	7.1	0.7	D	7.4	0.9	D
BV13010	6th Avenue North	5.9	5.5	n/a	6.4	0.5	C	6.8	0.9	D	7.1	1.2	D	7.3	1.5	D
BV14005	intersection of 6th Avenue North and Tamiami Tr N	9.0	n/a	n/a	8.0		A	8.3		A	8.6		A	8.9		A
BV14010	intersection of US 41 and 5th Avenue North	8.1	n/a	n/a	7.6		A	7.9		A	8.2	0.1	C	8.6	0.5	C
BV14015	intersection of US 41 and 3rd Avenue North	7.9	n/a	n/a	6.8		A	7.3		A	7.9		A	8.4	0.6	D
BV14020	intersection of US 41 and 6th Avenue North	9.8	n/a	n/a	8.5		A	8.8		A	9.2		A	9.7		A
BV14025	US 41, u/s of 6th Avenue North	10.9	n/a	n/a	9.0		A	9.4		A	9.9		A	10.5		A
BV14030	US 41, d/s of 7th Avenue North	9.6	n/a	n/a	9.4		A	9.8	0.2	C	10.2	0.6	D	10.7	1.1	D
BV14040	intersection of US 41 and 7th Avenue North	n/a	n/a	n/a	9.8		A	10.2		A	10.5		A	10.8		A
BV14045	US 41, d/s of 8th Avenue North	10.4	n/a	n/a	9.9		A	10.3		A	10.6	0.2	C	10.9	0.5	C
BV14050	intersection of US 41 and 8th Avenue North	10.2	n/a	n/a	10.0		A	10.4	0.2	C	10.7	0.4	C	10.9	0.7	D
BV14055	US 41, u/s of 8th Avenue North	10.4	n/a	n/a	10.1		A	10.5	0.1	C	10.7	0.3	C	11.0	0.6	D
BV14060	d/s end of crossing at intersection of US 41 and 10th Avenue	10.0	n/a	n/a	10.2	0.1	C	10.5	0.5	C	10.8	0.7	D	11.1	1.0	D
BV14065	u/s end of crossing at intersection of US 41 and 10th Avenue	10.8	n/a	n/a	10.2		A	10.5		A	10.8		A	11.2	0.4	C
BV14070	US 41, u/s of 10th Avenue	10.4	n/a	n/a	10.2		A	10.5	0.1	C	10.8	0.4	C	11.2	0.8	D
BV14075	US 41, d/s of 12th Avenue North	10.5	n/a	n/a	10.2		A	10.6	0.0	C	10.8	0.3	C	11.4	0.8	D
BV26005	US 41, u/s of 12th Avenue North	10.4	n/a	n/a	10.2		A	10.6	0.2	C	10.9	0.5	C	11.4	1.0	D
BV26010	US 41, d/s of 14th Avenue North	10.2	n/a	n/a	10.1		A	10.5	0.3	C	10.9	0.7	D	11.4	1.2	D
BV26015	US 41, d/s of 14th Avenue North	10.5	n/a	n/a	10.0		A	10.4		A	11.0	0.5	C	11.4	0.9	D
BV26020	US 41, u/s of 14th Avenue North	11.2	n/a	n/a	9.9		A	10.5		A	11.0		A	11.4	0.2	C
BV26025	pond west of US 41	n/a	n/a	n/a	9.8		A	10.5		A	11.0		A	11.4		A
BV26026	pond west of US 41	n/a	n/a	n/a	9.8		A	10.5		A	11.0		A	11.4		A
BV26030	US 41, u/s of 14th Avenue North	n/a	n/a	n/a	9.9		A	10.5		A	11.0		A	11.4		A
BV26035	US 41, d/s of Fleischmann Boulevard	11.7	n/a	n/a	9.9		A	10.5		A	11.0		A	11.4		A
BV26040	intersection of US 41 and Fleischmann Boulevard	11.9	n/a	n/a	9.9		A	10.5		A	11.0		A	11.4		A
BV34010	US 41, u/s of Fleischmann Boulevard	11.5	n/a	n/a	9.9		A	10.5		A	11.0		A	11.4		A
BV33056	retention area at west side of mall	n/a	n/a	n/a	9.1		A	10.0		A	10.5		A	10.9		A
BV33055	retention area at west side of mall	n/a	n/a	n/a	9.1		A	10.0		A	10.5		A	10.9		A
BV34020	US 41, west of Coastland Mall	11.3	n/a	n/a	10.0		A	10.7		A	11.2		A	11.6	0.3	C
BV34030	US 41, west of Coastland Mall	11.4	n/a	n/a	10.0		A	10.7		A	11.2		A	11.6	0.2	C
BV34040	south of US 41 and Golden Gate Parkway intersection	11.5	n/a	n/a	10.7		A	11.2		A	11.5		A	11.8	0.3	C
BV12020	12th Street North	5.3	5.3	7.5	6.3	1.0	D	6.8	1.5	D	7.1	1.8	D	7.3	2.0	D
BV12030	intersection of 7th Avenue North and 12th Street North	5.5	5.9	7.6	6.3	0.8	D	6.8	1.3	D	7.1	1.6	D	7.3	1.8	D
BV12040	7th Avenue North	7.0	6.3	8.4	5.9		A	6.3		B	6.7		B	7.1	0.1	C
BV24010	east of 11th Street North	9.5	9.0	11.4	9.9	0.4	C	10.0	0.5	C	10.1	0.6	D	10.5	1.0	D
GRE01030	Goodlette-Frank Road	6.7	6.5	7.0	4.9		A	5.4		A	6.0		A	6.5		A
GRE01040	Goodlette-Frank Road	6.9	6.7	7.5	5.0		A	5.4		A	6.0		A	6.5		A
GRE01050	Goodlette-Frank Road	7.1	6.9	7.5	5.7		A	6.0		A	6.4		A	6.7		A
GRE01060	Goodlette-Frank Road	7.3	7.1	7.5	6.0		A	6.3		A	6.5		A	6.8		A
BV11007	u/s of intersection of 8th Ave N and Goodlette-Frank Road	5.8	4.5	n/a	6.1	0.3	C	6.3	0.5	C	6.5	0.8	D	6.8	1.0	D
BV11010	intersection of 8th Avenue North and 12th Street North	6.2	5.7	n/a	6.8	0.5	D	6.9	0.6	D	7.0	0.8	D	7.1	0.9	D
BV11020	8th Avenue North	7.2	6.9	8.8	7.7	0.5	C	8.1	0.9	D	8.4	1.2	D	8.6	1.4	D
GRE01070	Goodlette-Frank Road	7.5	7.3	8.8	6.1		A	6.4		A	6.7		A	7.0		A
BV11030	13th Street North	7.4	5.9	n/a	6.9		B	7.2		B	7.4	0.1	C	7.6	0.2	C
BV11040	Pond west of 13th Street North	n/a	n/a	n/a	6.9		A	7.2		A	7.4		A	7.6		A

TABLE 6-3

City of Naples - Basin V Stormwater System Improvement Plan, Phase I
Proposed System LOS Evaluation - Alternative 1

Junction Name	Location	Road Crown Elevation (ft-NGVD)	Yard Elevation (ft-NGVD)	Structure Elevation (ft-NGVD)	5-yr/24-hr Event			10-yr/72-hr Event			25-yr/72-hr Event			100-yr/72-hr Event		
					Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾
GRE01080	Goodlette-Frank Road	7.6	7.4	7.8	6.2		A	6.5		A	6.8		A	7.0		A
GRE01090	Goodlette-Frank Road	7.7	7.5	8.0	6.4		A	6.8		A	7.2		A	7.7		B
BV11070	d/s end of crossing at 10th Ave N and 13th St N	7.7	6.9	n/a	8.1	0.5	C	8.3	0.6	D	8.4	0.7	D	8.5	0.8	D
BV11060	u/s end of crossing at 10th Ave N and 13th St N	7.9	8.2	9.5	8.5	0.7	D	8.6	0.7	D	8.7	0.8	D	8.7	0.8	D
BV15010	d/s end of 12th Street North crossing	9.5	9.5	11.4	8.6		A	9.3		A	9.5	0.1	C	9.8	0.3	C
BV15020	u/s end of 12th Street North crossing ⁽¹⁾	10.2	9.3	n/a	8.7		A	9.6		B	9.9		B	10.4	0.2	C
BV15030	pond at 12th Street North	n/a	n/a	n/a	8.9		A	9.7		A	10.1		A	10.5		A
BV15070	11th Street North(8)	9.0	9.7	11.5	8.9		A	9.7	0.7	D	10.1	1.1	D	10.5	1.4	D
BV15080	intersection of 11th Street North and 10th Street North	8.6	n/a	n/a	9.0	0.3	C	9.7	1.1	D	10.1	1.5	D	10.5	1.8	D
BV15090	intersection of 11th Street North and 10th Street North	9.2	n/a	12.9	8.9		A	9.7	0.5	D	10.1	0.9	D	10.5	1.3	D
BV15040	intersection of 11th Street North and 10th Avenue North	9.1	n/a	n/a	8.9		A	9.7	0.6	D	10.1	1.0	D	10.5	1.4	D
BV15050	10th Avenue North	10.1	10.3	12.6	9.0		A	9.8		A	10.2	0.1	C	10.5	0.4	C
BV15060	intersection of 10th Avenue North and 10th Street North	9.5	9.4	11.1	8.9		A	9.8	0.3	C	10.2	0.7	D	10.5	0.9	D
GRE01100	Goodlette-Frank Road	7.8	7.6	8.0	6.3		A	6.6		A	6.9		A	7.1		A
BV11050	north of 12th Avenue North	9.1	8.2	10.0	8.0		A	8.0		A	8.0		A	8.0		A
GRE01110	Goodlette-Frank Road	7.9	7.7	8.5	6.3		A	6.6		A	6.8		A	7.2		A
BV22010	14th Avenue North	7.2	6.9	9.9	7.6	0.4	C	7.7	0.5	D	7.8	0.6	D	7.9	0.7	D
GRE01120	Goodlette-Frank Road	8.0	7.8	8.5	5.8		A	6.4		A	6.8		A	7.2		A
BV23005	north of Lake Park Elementary School	8.7	7.4	n/a	8.4		B	8.6		B	8.9	0.1	C	9.1	0.3	C
BV23010	corner of 15th Avenue North and 12th Street North	7.4	n/a	n/a	8.4	0.9	D	8.6	1.2	D	8.8	1.4	D	9.0	1.6	D
BV23011	15th Avenue North	7.2	n/a	n/a	8.4	1.1	D	8.6	1.3	D	8.8	1.5	D	9.0	1.7	D
BV27010	Pond north of 14th Avenue North	n/a	n/a	n/a	7.1		A	8.0		A	8.5		A	9.0		A
BV27020	15th Avenue North	6.6	n/a	n/a	7.1	0.4	C	8.0	1.4	D	8.5	1.8	D	9.0	2.3	D
BV23015	d/s end of 14th Avenue North crossing	7.4	7.6	9.6	8.3	1.0	D	8.6	1.2	D	8.8	1.4	D	9.0	1.6	D
BV23020	u/s end of 14th Avenue North crossing	7.9	7.2	n/a	8.3	0.4	C	8.6	0.7	D	8.8	0.9	D	9.0	1.1	D
BV23025	intersection of 12th Street North and 14th Avenue North	7.9	7.4	n/a	8.3	0.4	C	8.6	0.7	D	8.8	0.9	D	9.0	1.1	D
BV23030	intersection of 12th Street North and 14th Avenue North	7.7	7.5	10.0	8.3	0.6	D	8.6	0.9	D	8.8	1.1	D	9.0	1.3	D
BV23035	intersection of 12th Street North and 14th Avenue North	7.9	n/a	n/a	8.2	0.4	C	8.5	0.7	D	8.7	0.9	D	9.0	1.1	D
BV23040	intersection of 12th Street North and 14th Avenue North	8.1	7.4	n/a	8.2	0.1	C	8.5	0.4	C	8.7	0.6	D	9.0	0.9	D
BV23045	12th Street North, south of 14th Avenue North	8.4	7.9	n/a	8.1		B	8.4		B	8.6	0.2	C	9.0	0.6	D
BV23050	12th Street North, south of 14th Avenue North	8.2	7.9	10.6	8.0		B	8.4	0.2	C	8.6	0.4	C	9.0	0.8	D
BV23055	12th Street North, north of 13th Avenue North	8.2	n/a	n/a	8.0		A	8.4	0.2	C	8.6	0.4	C	9.0	0.8	D
BV23060	d/s end of 13th Avenue North crossing	7.7	n/a	n/a	8.0	0.3	C	8.4	0.7	D	8.5	0.9	D	9.0	1.3	D
BV23065	u/s end of 13th Avenue North crossing	7.7	n/a	n/a	8.0	0.3	C	8.4	0.6	D	8.5	0.8	D	9.0	1.2	D
BV23070	south of 13th Avenue North	8.2	7.9	10.0	6.5		A	7.2		A	8.4	0.2	C	9.0	0.7	D
GRE01130	intersection of Fleischmann Ave and Goodlette-Frank Road	8.2	7.6	n/a	6.9		A	6.8		A	6.8		A	7.2		A
GRE01140	along Goodlette-Frank Road	8.0	7.8	9.5	7.3		A	7.4		A	7.6		A	7.7		A
GRE01150	along Goodlette-Frank Road	9.9	8.3	10.0	7.3		A	7.5		A	7.7		A	7.8		A
BV35010	Golden Gate Parkway	11.1	n/a	n/a	7.4		A	7.7		A	7.9		A	8.1		A
BV35020	Golden Gate Parkway	n/a	n/a	n/a	8.6		A	9.4		A	9.9		A	10.3		A
BV35030	Golden Gate Parkway	8.6	n/a	n/a	9.0	0.5	C	9.5	1.0	D	9.9	1.4	D	10.3	1.7	D
BV35040	Golden Gate Parkway	9.1	n/a	n/a	9.1		A	9.6	0.5	D	10.0	0.9	D	10.3	1.2	D
BV43098	baseball fields at Naples High School (outfall to south)	n/a	n/a	n/a	9.1		A	9.7		A	10.1		A	10.5		A
BV35045	Golden Gate Parkway	8.3	n/a	n/a	9.1	0.8	D	9.5	1.2	D	9.9	1.6	D	10.3	2.0	D
BV35050	Golden Gate Parkway	8.5	n/a	n/a	9.1	0.6	D	9.5	1.0	D	9.9	1.4	D	10.3	1.8	D
GRE01155	along Goodlette-Frank Road	10.0	9.8	10.5	7.8		A	8.0		A	8.3		A	8.6		A
GRE01160	along Goodlette-Frank Road	10.0	9.8	10.5	8.3		A	8.7		A	9.2		A	9.5		A
BV42020	Golden Gate Parkway	9.0	n/a	n/a	8.8		A	9.4	0.4	C	9.7	0.8	D	10.0	1.0	D

TABLE 6-3

City of Naples - Basin V Stormwater System Improvement Plan, Phase I
Proposed System LOS Evaluation - Alternative 1

Junction Name	Location	Road Crown Elevation (ft-NGVD)	Yard Elevation (ft-NGVD)	Structure Elevation (ft-NGVD)	5-yr/24-hr Event			10-yr/72-hr Event			25-yr/72-hr Event			100-yr/72-hr Event		
					Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾
BV42010	Golden Gate Parkway	9.2	n/a	n/a	9.2		A	9.9	0.7	D	10.1	0.9	D	10.3	1.1	D
GRE01170	along Goodlette-Frank Road	9.0	9.5	10.5	8.3		A	8.7		A	9.2	0.2	C	9.5	0.5	D
BV44005	intersection of 22nd Avenue North and 14th Street North	9.2	n/a	n/a	9.2	0.0	C	9.4	0.2	C	9.5	0.3	C	9.6	0.4	C
BV44010	22nd Avenue North	9.5	9.4	11.4	9.5	0.0	C	9.7	0.2	C	9.8	0.3	C	9.9	0.4	C
GRE01180	along Goodlette-Frank Road	9.7	9.5	10.5	8.3		A	8.8		A	9.2		A	9.5		B
BV44015	14th Street North, north of 22nd Avenue North	8.3	7.8	n/a	8.8	0.5	C	8.9	0.6	D	9.2	0.9	D	9.5	1.3	D
BV44020	intersection of 14th Street North and Royal Palm Drive	9.1	8.5	12.3	9.5	0.4	C	9.6	0.5	D	9.7	0.6	D	9.8	0.7	D
BV44025	intersection of Royal Palm Drive and 13th Street North	9.5	8.9	n/a	9.9	0.4	C	10.0	0.5	D	10.1	0.6	D	10.2	0.7	D
BV44030	Royal Palm Drive, u/s of 13th Street North	9.8	9.6	11.7	10.3	0.5	C	10.3	0.5	D	10.4	0.6	D	10.5	0.7	D
BV44035	Royal Palm Drive, u/s of 13th Street North	10.1	9.5	n/a	10.0		B	10.1	0.0	C	10.3	0.2	C	10.4	0.4	C
GRE01188	along Goodlette-Frank Road	11.0	10.8	11.5	8.2		A	8.8		A	9.2		A	9.5		A
GRE01190	along Goodlette-Frank Road	11.0	10.8	11.5	6.9		A	7.7		A	8.2		A	8.6		A
GRE01192	along Goodlette-Frank Road	11.0	10.8	11.5	8.2		A	8.9		A	9.2		A	9.5		A
BV44040	intersection of 14th Street North and Diana Avenue	n/a	9.5	n/a	10.4		A	10.7		A	10.9		A	11.1		A
BV44045	intersection of Diana Avenue and 13th Street North	9.8	9.5	12.7	10.4	0.6	D	10.7	0.9	D	10.9	1.1	D	11.1	1.3	D
GRE01200	along Goodlette-Frank Road	11.0	10.8	11.5	8.4		A	8.9		A	9.3		A	9.6		A
BV44050	intersection of 14th Street North and 26th Avenue North	10.5	n/a	n/a	11.2	0.7	D	11.3	0.8	D	11.5	1.0	D	11.6	1.2	D
BV44055	intersection of 13th Street North and 26th Avenue North	11.5	11.6	13.8	11.7	0.2	C	11.9	0.4	C	12.0	0.6	D	12.2	0.7	D
GRE01210	along Goodlette-Frank Road	11.0	10.8	11.5	8.6		A	9.3		A	9.8		A	10.2		A
GRE01220	along Goodlette-Frank Road	11.0	10.8	11.5	8.9		A	9.6		A	10.0		A	10.3		A
BV43045	d/s end of 14th Street North & 28th Ave N crossing	10.8	n/a	n/a	9.0		A	9.7		A	10.1		A	10.5		A
BV43050	u/s end of 14th Street North & 28th Ave N crossing	11.0	10.3	n/a	9.2		A	9.9		A	10.2		A	10.7		B
BV43055	intersection of 28th Avenue North and 12th Street North	11.0	10.7	n/a	10.8		B	11.1	0.1	C	11.3	0.3	C	11.6	0.6	D
BV43060	d/s end of 28th Avenue North & 12th St N crossing	10.8	10.2	n/a	10.6		B	10.8		B	10.9	0.1	C	11.6	0.8	D
BV46010	Pond south of 28th Avenue North	n/a	n/a	n/a	9.1		A	10.1		A	10.8		A	11.6		A
BV46020	12th Street North, east of Pond	9.8	10.1	12.6	9.1		A	10.1	0.4	C	10.8	1.1	D	11.6	1.8	D
BV46040	east of 12th Street north	n/a	n/a	n/a	9.1		A	10.1		A	10.8		A	11.6		A
BV43063	intersection of 28th Avenue North and 12th Street North	11.9	11.3	n/a	12.1	0.1	C	12.3	0.4	C	12.5	0.6	D	12.6	0.7	D
BV43065	28th Avenue north, west of 12th Street North	12.0	10.8	13.5	12.2	0.2	C	12.4	0.4	C	12.5	0.5	D	12.7	0.7	D
BV43067	28th Avenue north, d/s of 10th Street North	12.3	11.9	n/a	12.7	0.4	C	12.8	0.5	C	12.9	0.6	D	13.0	0.6	D
BV43070	d/s end of 10th Street North & 28th Ave N crossing	12.5	12.1	13.0	11.7		A	12.5		B	12.7	0.2	C	12.8	0.3	C
BV43075	u/s end of 10th Street North & 28th Ave N crossing	12.6	11.8	n/a	11.5		A	12.1		B	12.6	0.1	C	12.8	0.3	C
GRE01230	along Goodlette-Frank Road	11.0	10.8	11.5	8.9		A	9.6		A	10.0		A	10.3		A
BV47010	pond north of 28th Avenue North	n/a	n/a	n/a	10.3		A	10.8		A	11.1		A	11.2		A
BV47020	east of 12th Street North	10.2	11.0	12.7	10.3	0.1	C	10.8	0.6	D	11.1	0.9	D	11.2	1.0	D
BV47030	south of 12th St North and 29th Ave North intersection	10.4	n/a	n/a	10.3		A	10.7	0.3	C	10.9	0.5	D	11.1	0.7	D
BV47040	south of 29th Ave North and 10th St North intersection	10.6	11.4	13.0	10.0		A	10.2		A	10.4		A	10.8	0.2	C
BV43030	pond north of Diana Avenue	n/a	n/a	n/a	11.6		A	12.0		A	12.2		A	12.4		A
BV43035	Diana Avenue, d/s of 10th Street North	10.7	9.7	12.6	11.6	0.8	D	12.0	1.2	D	12.2	1.4	D	12.3	1.6	D
BV43040	intersection of Diana Avenue and 10th Street North	10.7	10.2	n/a	11.5	0.9	D	11.9	1.3	D	12.1	1.4	D	12.3	1.6	D
BV43010	10th Street North, Naples High School baseball fields	n/a	n/a	n/a	9.7		A	10.2		A	10.4		A	10.7		A
BV43017	22nd Avenue North, south of 10th Street North	10.0	n/a	n/a	10.1	0.1	C	10.8	0.8	D	11.0	1.0	D	11.2	1.2	D
BV43018	intersection of 10th Avenue North and 22nd Avenue	10.8	n/a	n/a	11.0	0.2	C	11.3	0.6	D	11.5	0.7	D	11.7	0.9	D
BV43015	baseball fields at Naples High School	n/a	n/a	n/a	9.8		A	10.2		A	10.4		A	10.7		A
BV43005	baseball fields at Naples High School	n/a	n/a	n/a	9.5		A	10.1		A	10.4		A	10.6		A
BV43020	intersection of 22nd Avenue North and 11th Street North	9.7	n/a	n/a	10.1	0.4	C	10.8	1.1	D	11.0	1.4	D	11.2	1.6	D
BV43025	intersection of 11th Street North and Royal Palm Drive	10.7	10.5	12.1	9.7		A	10.1		A	10.6		B	10.9	0.2	C
BV43080	baseball fields at Naples High School	n/a	n/a	n/a	10.0		A	10.2		A	10.5		A	10.7		A
BV43085	baseball fields at Naples High School	n/a	n/a	n/a	9.5		A	10.1		A	10.4		A	10.6		A

TABLE 6-3

City of Naples - Basin V Stormwater System Improvement Plan, Phase I
Proposed System LOS Evaluation - Alternative 1

Junction Name	Location	Road Crown Elevation (ft-NGVD)	Yard Elevation (ft-NGVD)	Structure Elevation (ft-NGVD)	5-yr/24-hr Event			10-yr/72-hr Event			25-yr/72-hr Event			100-yr/72-hr Event		
					Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾
BV43090	baseball fields at Naples High School	n/a	n/a	n/a	9.5		A	10.1		A	10.4		A	10.6		A
BV43095	baseball fields at Naples High School	n/a	n/a	n/a	9.5		A	10.0		A	10.4		A	10.6		A
BV43097	baseball fields at Naples High School	n/a	n/a	n/a	9.7		A	9.8		A	10.2		A	10.6		A
GRE01163	along Goodlette-Frank Road	9.0	n/a	n/a	8.3		A	8.7		A	9.2	0.2	C	9.5	0.5	D
BV44060	Naples High School	n/a	n/a	n/a	9.0		A	9.7		A	10.1		A	10.4		A
GRE01164	along Goodlette-Frank Road	9.0	n/a	n/a	8.3		A	8.7		A	9.2	0.2	C	9.5	0.5	D
GRE01167	along Goodlette-Frank Road	9.0	n/a	n/a	8.3		A	8.7		A	9.2	0.2	C	9.5	0.5	D
BV31010	Goodlette-Frank Road, east of Coastland Mall	n/a	n/a	n/a	7.1		A	7.2		A	7.3		A	7.4		A
BV31040	Coastland Mall	10.6	n/a	n/a	7.7		A	8.6		A	9.0		A	9.6		A
BV31020	Goodlette-Frank Road, east of Coastland Mall	n/a	n/a	n/a	7.1		A	7.2		A	7.3		A	7.4		A
BV31030	Coastland Mall	10.6	n/a	n/a	7.3		A	7.8		A	8.0		A	8.3		A
BV31050	Coastland Mall	12.6	n/a	n/a	7.8		A	8.8		A	9.2		A	10.0		A
BV31060	Coastland Mall	12.7	n/a	n/a	7.9		A	8.9		A	9.5		A	10.4		A
BV31070	Coastland Mall	12.4	n/a	n/a	8.0		A	8.9		A	9.6		A	10.6		A
BV32010	Coastland Mall	11.5	n/a	n/a	8.1		A	9.1		A	9.8		A	10.8		A
BV35060	Coastland Mall	11.4	n/a	n/a	8.4		A	9.2		A	9.9		A	11.0		A
BV35070	Coastland Mall	11.2	n/a	n/a	8.5		A	9.4		A	10.1		A	11.2	0.0	C
BV32020	Coastland Mall	12.4	n/a	n/a	8.8		A	9.6		A	10.4		A	11.5		A
BV33060	Coastland Mall	12.0	n/a	n/a	8.9		A	9.7		A	10.6		A	11.7		A
BV32030	Coastland Mall	12.2	n/a	n/a	7.8		A	9.0		A	9.5		A	9.9		A
BV32040	Coastland Mall	11.7	n/a	n/a	8.4		A	8.9		A	10.4		A	10.9		A
BV33010	Coastland Mall	n/a	n/a	n/a	8.0		A	8.7		A	9.3		A	9.9		A
BV33050	Coastland Mall	12.9	n/a	n/a	8.1		A	8.8		A	9.4		A	9.9		A
BV33020	Coastland Mall	10.9	n/a	n/a	8.4		A	8.7		A	9.1		A	9.6		A
BV33040	Coastland Mall	11.5	n/a	n/a	8.3		A	8.7		A	9.1		A	9.6		A
BV33030	Coastland Mall	11.5	n/a	n/a	8.3		A	8.5		A	9.1		A	9.6		A

Total Number of LOS Class "B" Exceedances

46

66

82

93

Notes:

- (1) - Elevations, peak flood stages, and road flooding depths have all been rounded to the nearest tenth of a foot.
- (2) - Model results are computed to the nearest hundredth of a foot, but are shown in this table rounded to the nearest tenth of a foot. Therefore, even if the predicted stages from the model are shown to be equal to the respective critical elevation, the table may show an exceedance due to rounding (e.g. if the critical building elevation is 5.0, and the predicted peak stage from the model is 5.01, an exceedance is shown in the table).
- (3) - Level of Service (LOS) classes were assigned as follows:
Class "A" LOS was assigned where flow is contained within the conveyance system; no flooding of major roadways, minor roadways, yards or structures is predicted;
Class "B" LOS was assigned where there is no flooding of major roadways, minor roadways, or structures, but where yard flooding is predicted;

Class "C" LOS was assigned where yard flooding and flooding of major roadways which precludes the use of the outside lane and travel in inside lanes is possible but difficult (depth less than 6-inches) is predicted, but where no structural flooding is predicted; and
Class "D" LOS was assigned where extensive road flooding (depths greater than 6-inches) or structural flooding is predicted.

TABLE 6-4

City of Naples - Basin V Stormwater System Improvement Plan, Phase I
Proposed System LOS Evaluation Summary - Alternative 1

Level of Service	Number of Locations (Model Junctions) by Design Storm Event							
	5-yr/24-hr		10-yr/72-hr		25-yr/72-hr		100-yr/72-hr	
Class A	119	69%	98	57%	87	51%	75	44%
Class B	7	4%	8	5%	3	2%	4	2%
Class C	32	19%	27	16%	27	16%	21	12%
Class D	14	8%	39	23%	55	32%	72	42%
Total		100%		100%		100%		100%

6.1.3 Water Quality Considerations

While Alternative 1 provided minimal LOS improvements within the Basin V PSMS, the proposed detention facilities offer significant water quality treatment benefits.

Alternative 1 includes water quality best management practices to provide treatment for a portion of the untreated areas along Goodlette-Frank Road. Under the proposed conditions of Alternative 1, modifications are proposed at one of the weirs along the Goodlette-Frank ditch (adjacent to Reach 03 at model node GRE01192). However, Alternative 1 includes an increased channel cross section, approximately 1-foot added depth for almost two miles along the ditch (from model node GRE01420 to GRE01382 and from GRE01360 to GRE01192). As a result, water quality treatment volume is provided by these weirs within the Goodlette-Frank ditch under the proposed Alternative 1 scenario.

Treatment and flow attenuation benefits are provided by two wet detention facilities in Alternative 1. The first is a 2-acre facility located at the Conservancy outfall adjacent to Reach 02 (Map ID 19, model node GRE02010). The small footprint of this facility, along with the hydraulic conditions (predicted peak stages and peak flows) under the proposed conditions, has caused this facility to be designed with a focus primarily on water quantity. With this in mind, this facility provides approximately 9 acre-ft of attenuation volume for the peak flows from the adjacent channel (Reach 02), which are routed through this system through a natural channel section.

The second facility covers 27 acres and is located at the Fleischmann parcel 18 adjacent to the south bank of Reach 03 (Map ID 22, model node GRE03040). This facility provides approximately 40 acre-ft of treatment (and attenuation) volume, designed to receive flows from the increased conveyance capacity of the Goodlette-Frank ditch. This facility would provide treatment for approximately 0.7 equivalent inches of the runoff from a tributary area of approximately 760 acres.

6.1.4 Conceptual Capital Cost Estimate

Implementation costs of the proposed Alternative 1 improvements have been estimated in the GRE study at approximately \$10,039,000 (plus any incidental costs such as property acquisition, legal fees, utility relocation, etc.).

6.1.5 Implementation Issues

Limits on the post-development discharge volume and peak flow rates are the critical permitting issues for proposed improvements. The discharge volume limitation was raised by the USACE as part of the Section 404 Dredge and fill permit. The SFWMD has stated for the Environmental Resource Permit (ERP) that the project needed to maintain the total volume and demonstrate no increase in peak stages at the discharge point, since peak flows are needed to increase slightly in order to assist in achieving the LOS. Treatment would be provided by the projects to also demonstrate a reduction in existing non-point source pollutant loads to the Gordon River. Since retention is not a practicable basin-wide option to potentially reduce volume of

discharge, recharge wells have been discussed as a possible alternative to address potential USACE volume reduction requirements.

The overall runoff volume leaving the system (under the proposed Alternative 1 conditions, including the 2- and 27-acre facilities) remains the same, and predicted peak stages (and subsequent LOS provided) remain at (or below) the predicted peak stages under the existing conditions. During a pre-application meeting with SFWMD, we learned that this will be critical during permitting of these proposed improvements.

6.1.6 Project Update

Collier County is moving forward on the design, permitting, and construction of a 6-lane road widening project along Goodlette-Frank Road. There is a concern that this County project will use available water quality treatment volume in the Fleischmann parcel 18 detention facility. The entire parcel is needed to achieve the desired LOS for the GRE improvements, and any road improvements would need to be treated separately.

6.2 Alternative 2

Alternative 2 was developed to achieve LOS Class B criteria throughout the Basin V PSMS, with particular emphasis in addressing all 25 existing system problem areas that were identified in Section 5.4.

Proposed improvements under Alternative 2 are intended to provide Class B LOS (i.e., no overtopping of the road crown) for the 25-year/72-hour design storm event. This is more stringent than the County's desired Class C LOS (i.e., maximum 6-in overtopping of the road crown) that was used in the development of Alternative 1.

6.2.1 Project Description

The location of Alternative 2 improvements are shown on **Figures 6-2a and 6-2b** and summarized in **Table 6-5**. Note: Map IDs 11-22 are shown in Figure 6-2a and Map IDs 1A-10 are shown on Figure 6-2b. The components include:

- Map ID 1A (model node BV14005 to BV12019): Replace the existing 519-ft section of 54-inch RCP with 4-ft x 10-ft RCBC.
- Map ID 1B (model node BV26015 to BV14005): Add parallel 1,580-ft section of 36-inch RCP. Replace the existing 2,171-ft section of 54-inch RCP with 4-ft x 8-ft RCBC.
- Map ID 2 (model node BV13020 to BV12019): Add parallel 390-ft section of 3-ft x 5-ft RCBC.
- Map ID 3 (model node BV12010 to GRE01020): Add parallel 286-ft section of 48-inch RCP. This improvement increases the lake outfall capacity, improving the

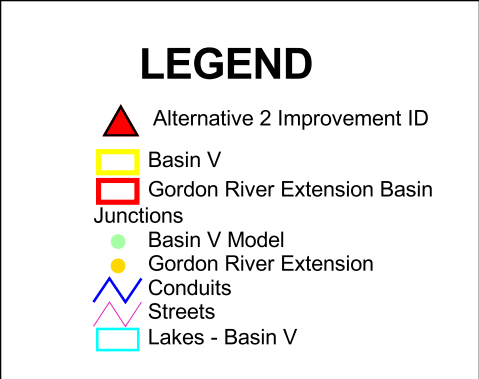
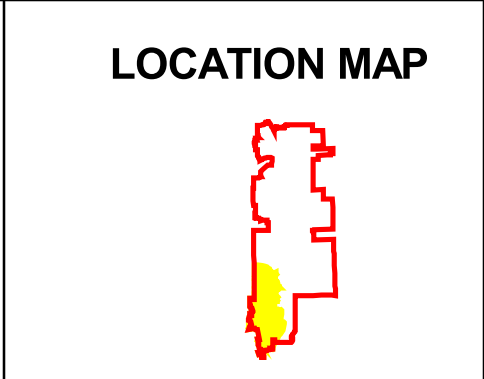
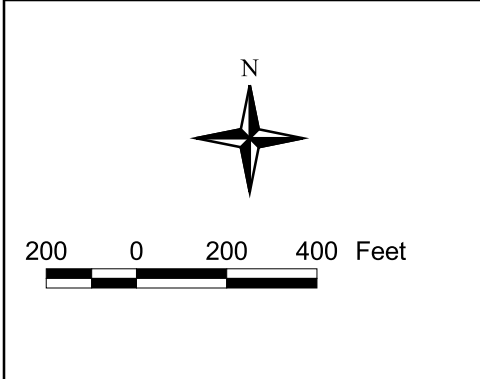
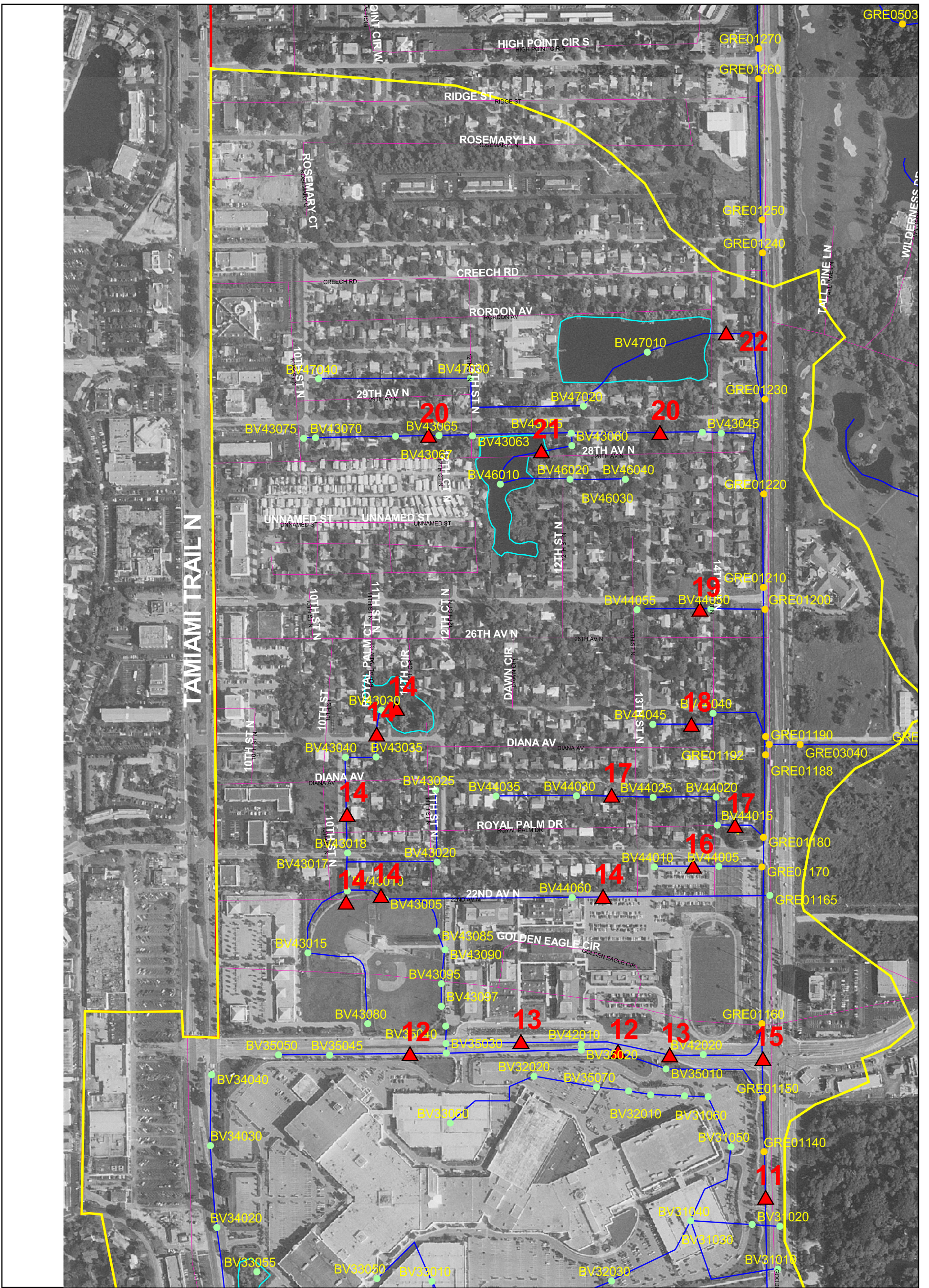


Figure 6-2a
 Basin V Stormwater System
 Improvement Plan - Phase I
 Alternative 2 Improvement Map - North
 Naples, Florida

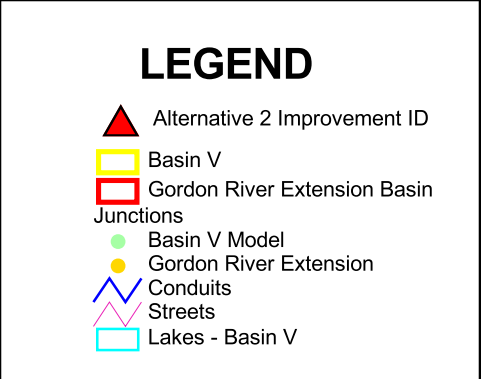
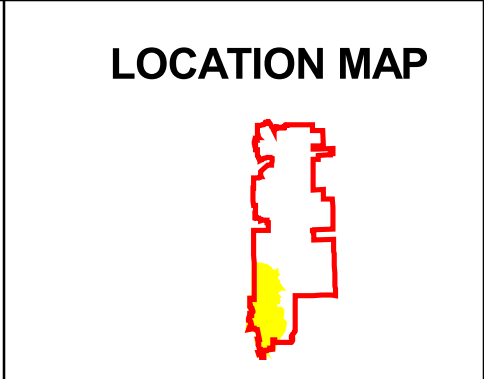
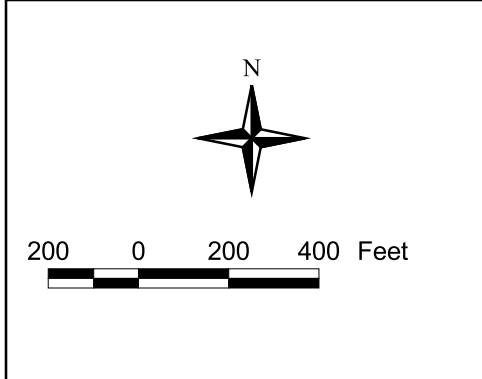


Figure 6-2b
Basin V Stormwater System
Improvement Plan - Phase I
Alternative 2 Improvement Map - South
Naples, Florida

CDM

TABLE 6-5
 City of Naples - Basin V Stormwater System Improvement Plan, Phase I
 Alternative 2 Improvement Summary

Map ID	Upstream Junction	Downstream Junction	Location	Improvement Type
1A	BV14005	BV12019	6th Ave. N., east of US 41	Replace existing 519-ft section of 54" RCP with 4'x10' RCBC.
1B	BV26015	BV14005	US 41, between 14th Ave. N. and 7th Ave. N.	Add parallel 1580-ft section of 36" RCP. Replace existing 2171-ft section of 54" RCP with 4'x8' RCBC.
2	BV13020	BV12019	10th St. N., north of 6th Ave. N.	Add parallel 390-ft section of 3'x5' RCBC.
3	BV12010	GRE01020	easement south of 7th Ave. N., west of Goodlette-Frank Road	Add parallel 286-ft section of 48" RCP.
4	BV11020	GRE01060	8th Ave. N., west of Goodlette-Frank Road	Add parallel 389-ft section of 24" RCP. Add parallel 572-ft section of 48" RCP.
5	BV11040	GRE01070	13th St. N. pond, west of Goodlette-Frank Road	Replace existing 134-ft section of 12" RCP with 24" RCP. Add parallel 308-ft section of 18" RCP. Lower pond NWL by 0.5 ft.
6	BV15030	GRE01090	10th Ave. N., west of Goodlette-Frank Road	Replace existing 660-ft section of 24" RCP with 4'x5' RCBC. Replace existing 198-ft section of 18" RCP with 4'x9' RCBC. Lower pond NWL by 1 ft.
7A	BV15050	BV15030	11th St. N./10th Ave. N., south of 10th Ave. N. pond	Add parallel 277-ft section of 36" RCP.
7B	BV15080	BV15030	11th St. N., west of 10th Ave. N. pond	Add parallel 370-ft section of 36" RCP.
7C	BV24010	BV15030	11th St. N., north of 10th Ave. N. pond	Add new 600-ft section of 42" RCP.
8	BV22010	GRE01110	14th Ave. N., west of Goodlette-Frank Road	Add parallel 170-ft section of 42" RCP.
9	BV23065	GRE01120	12th St. N./easement west of Goodlette-Frank Road	Add parallel 619-ft section of 30" RCP. Add new 750-ft section of 42" RCP. Replace existing 106-ft section of 2-12" RCP with 42" RCP. Replace existing 1010-ft section of 24"x38" ERCP with 4'x6' RCBC.
10	BV27010		15th Ave. N. pond	Lower pond NWL by 1.25 ft.
11	GRE01140	GRE01130	Goodlette Frank Road, adjacent to the mall	Replace existing 570-ft section of 2 - 29"x45" ERCP with two sections of 2 - 3'x8' and 1 - 3'x7' RCBC, and 200-ft open channel in between road crossings.
12	BV35045	GRE01150	Golden Gate Parkway (south side), west of Goodlette-Frank Road	Add parallel 560-ft section of 36" RCP. Replace existing 549-ft section of 24"x38" ERCP with 4'x8' RCBC. Replace existing 891-ft section of 24"x38" ERCP with 4'x9' RCBC.
13	BV35040	GRE01160	Golden Gate Parkway (north side), west of Goodlette-Frank Road	Add parallel 549-ft section of 36" RCP. Replace existing 656-ft section of 24"x38" ERCP with 4'x7' RCBC. Replace existing 231-ft section of 42" RCP with 4'x9' RCBC.
14	BV43030	GRE01163	Diana Ave./10th St. N./easement west of Goodlette-Frank Road (Naples High School)	Replace existing 817-ft section of 12" RCP with 4'x8' RCBC. Replace existing 53-ft section of 42" RCP with 4'x9' RCBC. Replace existing 154-ft section of 3 - 29"x45" ERCP with 4'x10' RCBC. Replace existing 1392-ft section of 54" RCP with 5'x9' RCBC. Lower Diana Ave. pond NWL by 4 ft.
15	GRE01160	GRE01150	Goodlette-Frank Road ditch, Golden Gate Parkway crossing	Replace existing 200-ft section of 34"x53" ERCP with 4'x10' RCBC. Replace existing 128-ft section of 48"x76" ERCP with 4'x10' RCBC.
16	BV44010	GRE01170	22nd Ave. N., west of Goodlette-Frank Road	Add parallel 300-ft section of 18" RCP. Add parallel 170-ft section of 30" RCP.
17	BV44030	GRE01180	Royal Palm Drive, west of Goodlette-Frank Road	Add parallel 602-ft section of 48" RCP. Replace existing 342-ft section of 18" RCP with 4'x5' RCBC.
18	BV44045	GRE01192	Diana Ave., west of Goodlette-Frank Road	Add parallel 331-ft section of 30" RCP. Add parallel 210-ft section of 42" RCP.
19	BV44055	GRE01200	26th Ave. N., west of Goodlette-Frank Road	Add parallel 335-ft section of 30" RCP. Replace existing 240-ft section of 24" RCP with 4'x7' RCBC.
20	BV43067	GRE01220	28th Ave. N., west of Goodlette-Frank Road	Add parallel 363-ft section of 30" RCP. Add parallel 479-ft section of 42" RCP. Replace existing 857-ft section of 24" RCP with 4'x9' RCBC.
21	BV46010	BV43060	28th Ave. N. pond/12th St. N.	Add parallel 97-ft section of 24" RCP.
22	BV47010	GRE01230	14th St. N. pond, west of Goodlette-Frank Road	Replace existing 228-ft section of 24" RCP with 5'x9' RCBC.

Note:

- 1.) 'Map ID' corresponds to the labels on the Alternative 2 Improvement Maps (Figure 6-2).

LOS at locations upstream of the lake (i.e., at 12th St. N., 10th St. N., and 6th Ave. N.). Modifying the outlet control structures to lower the pond normal water level (NWL) would reduce peak flood stages upstream. However, the current NWL is at elevation 2.6 ft-NGVD and the impact on groundwater would have to be evaluated. No control structure modifications are included in Alternative 2.

- Map ID 4 (model node BV11020 to GRE01060): Add parallel 389-ft section of 24-inch RCP. Add parallel 572-ft section of 48-inch RCP.
- Map ID 5 (model node BV11040 to GRE01070): Replace the existing 134-ft section of 12-inch RCP with 24-inch RCP. Add parallel 308-ft section of 18-inch RCP. Lower the 13th St. N. pond NWL by 0.5 ft (from 4.78 ft-NGVD to 4.28 ft-NGVD). The invert of the pond outfall (i.e., the replacement 24-inch RCP) would be raised 1.5 ft above the NWL to provide additional water quality treatment volume in this 0.6-acre pond.
- Map ID 6 (model node BV15030 to GRE01090): Replace the existing 660-ft section of 24-inch RCP with 4-ft x 5-ft RCBC. Replace the existing 198-ft section of 18-inch RCP with 4-ft x 9-ft RCBC. Lower the 10th Ave. N. pond NWL by 1.0 ft (from 5 ft-NGVD to 4 ft-NGVD). The invert of the pond outfall (i.e., the replacement 4-ft x 5-ft RCBC) would be raised 1.5 ft above the NWL to provide additional water quality treatment volume in this 1.7-acre pond. To accommodate this new outfall, the reach along 10th Ave. N. would require inverts 2-ft below their current elevation.
- Map ID 7A (model node BV15050 to BV15030): Add parallel 277-ft section of 36-inch RCP.
- Map ID 7B (model node BV15080 to BV15030): Add parallel 370-ft section of 36-inch RCP.
- Map ID 7C (model node BV24010 to BV15030): Add new 600-ft section of 42-inch RCP. The road flooding in problem area 7C resulted from the lack of a storm drain. The alignment of this new conveyance system would pick up drainage from mid-block on 11th St. N. south to 12th Ave. N. and into the 10th Ave. N. pond through a new easement.
- Map ID 8 (model node BV22010 to GRE01110): Add parallel 170-ft section of 42-inch RCP.
- Map ID 9 (model node BV23065 to GRE01120): Add parallel 619-ft section of 30-inch RCP. Add new 750-ft section of 42-inch RCP. The alignment of this new conveyance system would connect to the existing system at 14th Ave. N./12th St. N, convey west on 14th Ave. N. to approximately 11th St. N. and then north into the 15th Ave. N. pond through a new easement. Replace the existing 106-ft section

of double 12-inch RCP with 42-inch RCP. Replace the existing 1,010-ft section of 24-inch x 38-inch ERCP with 4-ft x 6-ft RCBC.

- Map ID 10 (model node BV27010): Lower the 15th Ave. N. pond NWL by 1.25 ft (from 4.75 ft-NGVD to 3.5 ft-NGVD). The invert of the pond outfall (i.e., the replacement 42-in RCP at Map ID 9) would be raised 1.5 ft above the NWL to provide additional water quality treatment volume in this 2.5-acre pond.
- Map ID 11 (model node GRE01140 to GRE01130): Replace the existing 570-ft section of double 29-inch x 45-inch ERCP with two sections of double 3-ft x 8-ft and single 3-ft x 7-ft RCBC, and 200-ft open channel in between road crossings. This is similar to Map ID 23 in Alternative 1, though with larger culverts and without lowering of the ditch bottom in this reach.
- Map ID 12 (model node BV35045 to GRE01150): Add parallel 560-ft section of 36-inch RCP. Replace the existing 549-ft section of 24-inch x 38-inch ERCP with 4-ft x 8-ft RCBC. Replace the existing 891-ft section of 24-inch x 38-inch ERCP with 4-ft x 9-ft RCBC.
- Map ID 13 (model node BV35040 to GRE01160): Add parallel 549-ft section of 36-inch RCP. Replace the existing 656-ft section of 24-inch x 38-inch ERCP with 4-ft x 7-ft RCBC. Replace the existing 231-ft section of 42-inch RCP with 4-ft x 9-ft RCBC.
- Map ID 14 (model node BV43030 to GRE01163): Replace the existing 817-ft section of 12-inch RCP with 4-ft x 8-ft RCBC. Replace the existing 53-ft section of 42-inch RCP with 4-ft x 9-ft RCBC. Replace the existing 154-ft section of triple 29-inch x 45-inch ERCP with 4-ft x 10-ft RCBC. Replace the existing 1,392-ft section of 54-inch RCP with 5-ft x 9-ft RCBC. Lower the Diana Ave. pond NWL by 4.0 ft (from 8.26 ft-NGVD to 4.26 ft-NGVD). The invert of the pond outfall (i.e., the replacement 4-ft x 8-ft RCBC) would be raised 1.5 ft above the NWL to provide additional water quality treatment volume in this 1.1-acre pond. Although there is no proposed change to the existing NWL in the Naples High School pond (3.5 ft-NGVD, located at model node BV43010), Alternative 2 proposes to raise the invert of the pond outfall (i.e., the replacement 4-ft x 10-ft RCBC) 1.5 ft above the NWL to provide additional water quality treatment volume in this 0.2-acre pond.
- Map ID 15 (model node GRE01160 to GRE01150): Replace the existing 200-ft section of 34-inch x 53-inch ERCP with 4-ft x 10-ft RCBC. Replace the existing 128-ft section of 48-inch x 76-inch ERCP with 4-ft x 10-ft RCBC. This is similar to Map ID 4 in Alternative 1.
- Map ID 16 (model node BV44010 to GRE01170): Add parallel 300-ft section of 18-inch RCP. Add parallel 170-ft section of 30-inch RCP.
- Map ID 17 (model node BV44030 to GRE01180): Add parallel 602-ft section of 48-inch RCP. Replace the existing 342-ft section of 18-inch RCP with 4-ft x 5-ft RCBC.

- Map ID 18 (model node BV44045 to GRE01192): Add parallel 331-ft section of 30-inch RCP. Add parallel 210-ft section of 42-inch RCP.
- Map ID 19 (model node BV44055 to GRE01200): Add parallel 335-ft section of 30-inch RCP. Replace the existing 240-ft section of 24-inch RCP with 4-ft x 7-ft RCBC.
- Map ID 20 (model node BV43067 to GRE01220): Add parallel 363-ft section of 30-inch RCP. Add parallel 479-ft section of 42-inch RCP. Replace the existing 857-ft section of 24-inch RCP with 4-ft x 9-ft RCBC.
- Map ID 21 (model node BV46010 to BV43060): Add parallel 97-ft section of 24-inch RCP. There is no proposed modification to the existing NWL in the 28th Ave. N. pond.
- Map ID 22 (model node BV47010 to GRE01230): Replace the existing 228-ft section of 24-inch RCP with 5-ft x 9-ft RCBC. There is no proposed modification to the existing NWL in the 14th St. N. pond.

Alternative 2 includes a combination of conveyance and detention improvements depending on the unique hydraulic response in each problem area. Improvement projects were developed through many simulation iterations, including optimization runs to arrive at the final set of improvements as listed above. Pipe sizes were optimized such that the minimum pipe size that achieved the LOS criteria (within practical limits) for the Basin V problem areas as well as not creating new problem areas downstream due to increased conveyance upstream.

The methodology for developing conveyance improvements generally used the same alignment and invert elevations as the existing system, with exceptions as noted in the individual map ID descriptions above. Proposed RCP improvements ranged from commercially-available sizes between 18-inch and 48-inch in diameter. Proposed RCBC improvements ranged from commercially-available sizes with either a 4-ft or 5-ft rise, with the exception of Map ID 2 and 11 where 3-ft rise culverts were chosen due to cover limitations. The structural adequacy of existing pipes was not generally known, so the decision to use parallel or replacement pipes was solely based on size. If a 48-inch diameter pipe did not achieve the desired LOS, then 4-ft rise culverts were evaluated. The exception was for pond outfalls smaller than 48-inch diameter that were replaced if they needed to provide additional water quality treatment volume.

The methodology for developing detention improvements was to modify the existing control structures either by lowering the NWL or by adjusting the size of the outlet to achieve the desired LOS. Lowering the NWL was achieved by installing a 6-inch drawdown orifice at the proposed NWL elevation. Water quality treatment volume was provided by installing a flood control weir in the outfall structure at an elevation of 1.5 ft above the proposed NWL elevation. Proposed NWL elevations were set no lower than 3.5 ft-NGVD due to potential groundwater interactions, nor was the

existing NWL lowered by more than 1.25 ft (with the exception of the Diana Ave. N. pond) in anticipation of public acceptance.

Existing detention facilities within Basin V have generally not been used for stormwater management to their full extent, with the exception of the 6th Ave. N./12th St. N. pond which includes manually-operated gate valves. Currently, existing ponds generally have no outlet control structure and the existing NWL is controlled by the invert of the outfall pipe. Expanding or dredging the existing ponds was not investigated in Alternative 2. Due to limited access and/or easements, this does not appear to be feasible for many of the Basin V ponds, particularly the 13th St. N., 10th Ave. N., and Diana Ave. ponds.

Proposed modifications to existing detention facilities in Basin V were noted in the map ID descriptions above and include:

- 13th St. N. wet pond (model node BV11040);
- 10th Ave. N. wet pond (model node BV15030);
- 15th Ave. N. wet pond (model node BV27010);
- Diana Ave. wet pond (model node BV43030).

Existing detention facilities that were not modified due to limited benefit in improving LOS at existing problem areas include:

- 6th Ave. N./12th St. N. wet pond (model node BV12019);
- 14th Ave. N./US 41 wet pond (model node BV26025);
- Coastland Center mall dry pond (model node BV33055);
- Naples High School dry pond (model node BV43080);
- 28th Ave. N. wet pond (model node BV46010);
- 14th St. N wet pond (model node BV47010).

No new detention facilities are proposed in Alternative 2 beyond those in Alternative 1 due to practical limits on available land. Land that is potentially available for detention facilities (e.g., Fleischmann parcel 18, the Conservancy outfall, Jungle Larry's, and near the post office) are all downstream of Basin V problem areas and would not significantly improve the LOS upstream. Facilities at these locations would be essential for meeting the peak flow, peak stage, and water quality treatment requirements as discussed in Section 6.2.3

6.2.2 Level of Service Evaluation – Alternative 2

The resulting peak flood stages for Alternative 2 within the Basin V PSMS are presented in **Table 6-6**. Model results for each of the four design storm events are presented and the difference between existing system peak stages as presented in Table 5-1 are given.

The benefit of reduced flood stages is indicated throughout Basin V PSMS. Peak flood stages are reduced by up to 2.7 ft for the 5-yr/24-hr event and up to 2.1 ft for the 100-yr/72-hr event. Similar to Alternative 1, the reduction in peak flood stages south of Fleischmann Boulevard (model node GRE01130) are somewhat diminished by the increase in flows along Goodlette-Frank Road due to the cumulative conveyance improvements upstream. Peak flood stages south of Fleischmann Boulevard increase by up to 0.8 ft for the 25-yr/24-hr event.

The LOS provided by the proposed Alternative 2 improvements was determined by comparing predicted peak flood stages to the threshold elevations as shown in **Table 6-7**. For each model junction, the name, location and threshold LOS elevations are given on the left side of Table 6-7. Peak flood stage results, road flooding depths, and LOS class for the various design storm events are given on the right side of the table.

Table 6-8 shows a summary of the LOS evaluation for Alternative 2. The number and overall percentage of locations that achieve a given LOS Class are tabulated for each design storm event. There are a total of 172 junctions that have a defined LOS class within the Basin V PSMS. The table indicates significant benefits to the Basin V PSMS in terms of LOS Class improvements. Compared to the existing system, there is a net improvement of 65 LOS Class B exceedances and 33 LOS Class C exceedances.

There are 18 locations where the desired LOS Class B was not achieved by Alternative 2 improvements (i.e., no overtopping of the road crown for the 25-year/72-hour design storm event). These are grouped by map ID/problem area in the following list:

- Map ID 1A (model node BV13010): Peak flood stages increase by 0.2 ft compared to existing conditions for the 25-yr/24-hr design storm event. The yard and road crown elevations are much lower than adjacent model nodes and this location remains LOS Class D. It may be possible to achieve LOS Class B by adding a berm around the 6th Ave. N./12th St. N. pond and installing a flap gate on the inflow pipe. This option was not evaluated in Alternative 2.
- Map ID 2 (model node BV13021): Although peak flood stages decrease by 0.1 ft compared to existing conditions for the 25-yr/24-hr design storm event, the low road crown elevation results in this location remaining LOS Class D. It may be possible to achieve LOS Class B by adding a berm around the 6th Ave. N./12th St. N. pond and installing a flap gate on the inflow pipe. This option was not evaluated in Alternative 2.

TABLE 6-6
 City of Naples - Basin V Stormwater System Improvement Plan, Phase I
 Peak Flood Stage Comparison - Alternative 2

Junction Name	Location	5-yr/24-hr Event		10-yr/72-hr Event		25-yr/72-hr Event		100-yr/72-hr Event	
		Peak Stage (ft-NGVD)	Difference (ft)	Peak Stage (ft-NGVD)	Difference (ft)	Peak Stage (ft-NGVD)	Difference (ft)	Peak Stage (ft-NGVD)	Difference (ft)
GRE01020	Outfall to Golden Gate Canal Confluence	5.2	0.5	5.6	0.6	6.2	0.5	6.8	0.3
BV12010		6.0	-0.2	6.6	-0.1	7.0	-0.1	7.2	0.0
BV12019	control structure from 6th Avenue Pond	6.1	-0.2	6.6	-0.1	7.0	0.0	7.3	0.0
BV13020	Alley	6.2	-1.3	6.7	-0.9	7.1	-0.7	7.4	-0.5
BV13021	10th Street North	6.1	-0.6	6.6	-0.3	7.0	-0.1	7.3	0.0
BV13010	6th Avenue North	6.2	-0.2	6.6	-0.1	7.2	0.2	7.6	0.3
BV14005	intersection of 6th Avenue North and Tamiami Tr N	6.4	-1.6	7.1	-1.2	7.6	-1.0	8.1	-0.9
BV14010	intersection of US 41 and 5th Avenue North	6.2	-1.4	6.8	-1.1	7.3	-0.8	7.8	-0.7
BV14015	intersection of US 41 and 3rd Avenue North	6.1	-0.7	6.6	-0.6	7.0	-0.8	7.4	-1.0
BV14020	intersection of US 41 and 6th Avenue North	6.6	-1.9	7.4	-1.4	8.0	-1.2	8.5	-1.2
BV14025	US 41, u/s of 6th Avenue North	6.9	-2.1	7.9	-1.6	8.6	-1.3	9.2	-1.4
BV14030	US 41, d/s of 7th Avenue North	7.2	-2.2	8.2	-1.6	9.0	-1.2	9.6	-1.1
BV14040	intersection of US 41 and 7th Avenue North	7.5	-2.3	8.6	-1.6	9.4	-1.1	10.0	-0.8
BV14045	US 41, d/s of 8th Avenue North	7.7	-2.3	8.8	-1.6	9.6	-1.0	10.2	-0.7
BV14050	intersection of US 41 and 8th Avenue North	7.8	-2.3	8.9	-1.5	9.7	-0.9	10.3	-0.6
BV14055	US 41, u/s of 8th Avenue North	8.0	-2.2	9.1	-1.4	9.9	-0.9	10.4	-0.6
BV14060	d/s end of crossing at intersection of US 41 and 10th Avenue	8.1	-2.1	9.2	-1.3	9.9	-0.8	10.4	-0.6
BV14065	u/s end of crossing at intersection of US 41 and 10th Avenue	8.2	-2.0	9.3	-1.3	10.0	-0.8	10.5	-0.7
BV14070	US 41, u/s of 10th Avenue	8.4	-1.8	9.4	-1.1	10.1	-0.7	10.5	-0.7
BV14075	US 41, d/s of 12th Avenue North	8.7	-1.6	9.7	-0.9	10.2	-0.6	10.7	-0.7
BV26005	US 41, u/s of 12th Avenue North	8.8	-1.4	9.7	-0.9	10.2	-0.6	10.8	-0.6
BV26010	US 41, d/s of 14th Avenue North	8.8	-1.3	9.7	-0.8	10.2	-0.7	10.8	-0.5
BV26015	US 41, d/s of 14th Avenue North	8.9	-1.1	9.7	-0.7	10.3	-0.7	11.0	-0.4
BV26020	US 41, u/s of 14th Avenue North	8.9	-0.9	9.7	-0.7	10.5	-0.5	11.0	-0.4
BV26025	pond west of US 41	9.3	-0.6	9.9	-0.6	10.5	-0.5	11.0	-0.4
BV26026	pond west of US 41	9.3	-0.6	9.9	-0.6	10.5	-0.5	11.1	-0.4
BV26030	US 41, u/s of 14th Avenue North	9.0	-0.9	9.7	-0.7	10.5	-0.5	11.0	-0.4
BV26035	US 41, d/s of Fleischmann Boulevard	9.3	-0.6	10.0	-0.5	10.6	-0.4	11.1	-0.4
BV26040	intersection of US 41 and Fleischmann Boulevard	9.3	-0.6	10.0	-0.5	10.6	-0.4	11.1	-0.4
BV34010	US 41, u/s of Fleischmann Boulevard	9.3	-0.6	10.0	-0.5	10.6	-0.4	11.1	-0.3
BV33056	retention area at west side of mall	8.4	-0.8	9.2	-0.8	9.9	-0.6	10.4	-0.5
BV33055	retention area at west side of mall	8.4	-0.7	9.2	-0.8	9.9	-0.6	10.4	-0.5
BV34020	US 41, west of Coastland Mall	9.4	-0.6	10.2	-0.4	11.1	-0.2	11.5	-0.1
BV34030	US 41, west of Coastland Mall	9.5	-0.6	10.3	-0.4	11.1	-0.2	11.5	-0.1
BV34040	south of US 41 and Golden Gate Parkway intersection	10.2	-0.5	11.1	-0.1	11.4	-0.1	11.7	-0.1
BV12020	12th Street North	6.1	-0.2	6.6	-0.1	7.0	0.0	7.3	0.0
BV12030	intersection of 7th Avenue North and 12th Street North	6.1	-0.2	6.6	-0.1	7.0	-0.1	7.3	0.0
BV12040	7th Avenue North	5.7	-0.3	6.1	-0.2	6.5	-0.2	7.0	-0.1
BV24010	east of 11th Street North	7.9	-2.0	8.6	-1.4	9.4	-0.7	9.7	-0.8
GRE01030	Goodlette-Frank Road	5.6	0.4	5.9	0.4	6.3	0.3	6.7	0.2
GRE01040	Goodlette-Frank Road	5.8	0.3	6.1	0.3	6.4	0.2	6.7	0.2
GRE01050	Goodlette-Frank Road	6.2	0.2	6.4	0.2	6.6	0.2	6.9	0.2
GRE01060	Goodlette-Frank Road	6.3	0.2	6.5	0.2	6.8	0.2	7.0	0.2
BV11007	u/s of intersection of 8th Ave N and Goodlette-Frank Road	6.3	0.2	6.5	0.2	6.8	0.2	7.0	0.2
BV11010	intersection of 8th Avenue North and 12th Street North	6.4	-0.4	6.5	-0.3	6.8	-0.3	7.0	-0.1
BV11020	8th Avenue North	6.5	-1.2	6.7	-1.4	7.0	-1.3	7.4	-1.2

TABLE 6-6
 City of Naples - Basin V Stormwater System Improvement Plan, Phase I
 Peak Flood Stage Comparison - Alternative 2

Junction Name	Location	5-yr/24-hr Event		10-yr/72-hr Event		25-yr/72-hr Event		100-yr/72-hr Event	
		Peak Stage (ft-NGVD)	Difference (ft)	Peak Stage (ft-NGVD)	Difference (ft)	Peak Stage (ft-NGVD)	Difference (ft)	Peak Stage (ft-NGVD)	Difference (ft)
GRE01070	Goodlette-Frank Road	6.6	0.3	6.8	0.3	7.0	0.3	7.3	0.4
BV11030	13th Street North	6.8	-0.1	7.1	-0.1	7.3	-0.1	7.5	-0.1
BV11040	Pond west of 13th Street North	6.8	-0.1	7.1	-0.1	7.3	-0.1	7.5	-0.1
GRE01080	Goodlette-Frank Road	6.7	0.4	7.0	0.4	7.2	0.5	7.5	0.5
GRE01090	Goodlette-Frank Road	6.9	0.5	7.3	0.5	7.7	0.5	8.1	0.5
BV11070	d/s end of crossing at 10th Ave N and 13th St N	7.0	-1.1	7.4	-0.9	7.8	-0.6	8.2	-0.3
BV11060	u/s end of crossing at 10th Ave N and 13th St N	7.0	-1.5	7.4	-1.2	7.9	-0.8	8.3	-0.4
BV15010	d/s end of 12th Street North crossing	7.3	-1.3	7.8	-1.5	8.3	-1.3	8.6	-1.2
BV15020	u/s end of 12th Street North crossing(1)	7.5	-1.3	7.9	-1.7	8.4	-1.5	8.8	-1.7
BV15030	pond at 12th Street North	7.6	-1.3	8.1	-1.7	8.5	-1.6	8.9	-1.5
BV15070	11th Street North(8)	7.6	-1.3	8.1	-1.7	8.5	-1.6	8.9	-1.5
BV15080	intersection of 11th Street North and 10th Street North	7.6	-1.4	8.1	-1.7	8.6	-1.5	8.9	-1.5
BV15090	intersection of 11th Street North and 10th Street North	7.4	-1.5	7.8	-1.9	8.3	-1.8	8.8	-1.7
BV15040	intersection of 11th Street North and 10th Avenue North	7.7	-1.2	8.1	-1.6	8.6	-1.5	9.0	-1.5
BV15050	10th Avenue North	7.7	-1.2	8.2	-1.6	8.8	-1.5	9.1	-1.4
BV15060	intersection of 10th Avenue North and 10th Street North	7.8	-1.1	8.1	-1.7	8.5	-1.8	8.9	-1.5
GRE01100	Goodlette-Frank Road	6.7	0.4	7.1	0.4	7.4	0.5	7.7	0.6
BV11050	north of 12th Avenue North	8.0	0.0	8.0	0.0	8.0	0.0	8.0	0.0
GRE01110	Goodlette-Frank Road	6.6	0.3	7.0	0.4	7.3	0.5	7.7	0.5
BV22010	14th Avenue North	6.8	-0.8	7.1	-0.6	7.4	-0.5	7.7	-0.3
GRE01120	Goodlette-Frank Road	6.1	0.4	6.8	0.6	7.2	0.8	7.6	0.8
BV23005	north of Lake Park Elementary School	6.3	-2.1	6.8	-1.9	7.2	-1.7	7.6	-1.4
BV23010	corner of 15th Avenue North and 12th Street North	6.3	-2.0	6.8	-1.8	7.2	-1.6	7.6	-1.3
BV23011	15th Avenue North	6.3	-2.1	6.8	-1.8	7.2	-1.6	7.6	-1.3
BV27010	Pond north of 14th Avenue North	6.2	-0.9	6.8	-1.1	7.2	-1.2	7.7	-1.3
BV27020	15th Avenue North	6.3	-0.8	6.9	-1.1	7.2	-1.2	7.7	-1.3
BV23015	d/s end of 14th Avenue North crossing	6.3	-2.1	7.0	-1.6	7.3	-1.5	7.7	-1.3
BV23020	u/s end of 14th Avenue North crossing	6.4	-1.8	7.1	-1.5	7.4	-1.3	7.8	-1.2
BV23025	intersection of 12th Street North and 14th Avenue North	6.7	-1.6	7.2	-1.4	7.7	-1.1	7.9	-1.0
BV23030	intersection of 12th Street North and 14th Avenue North	6.5	-1.8	7.1	-1.4	7.5	-1.3	7.9	-1.0
BV23035	intersection of 12th Street North and 14th Avenue North	6.7	-1.6	7.2	-1.3	7.7	-1.1	7.9	-1.0
BV23040	intersection of 12th Street North and 14th Avenue North	6.7	-1.6	7.2	-1.4	7.7	-1.1	7.9	-1.0
BV23045	12th Street North, south of 14th Avenue North	6.7	-1.4	7.2	-1.2	7.6	-1.0	7.9	-1.0
BV23050	12th Street North, south of 14th Avenue North	6.7	-1.3	7.2	-1.2	7.6	-0.9	7.9	-1.0
BV23055	12th Street North, north of 13th Avenue North	6.7	-1.3	7.2	-1.2	7.6	-0.9	7.9	-1.0
BV23060	d/s end of 13th Avenue North crossing	6.7	-1.3	7.2	-1.2	7.6	-0.9	7.9	-1.0
BV23065	u/s end of 13th Avenue North crossing	6.8	-1.2	7.2	-1.1	7.6	-0.9	7.9	-1.0
BV23070	south of 13th Avenue North	6.5	0.0	6.8	-0.4	7.0	-1.4	7.3	-1.7
GRE01130	intersection of Fleschmann Ave and Goodlette-Frank Road	7.2	0.8	7.2	0.7	7.2	0.6	7.6	0.8
GRE01140	along Goodlette-Frank Road	7.4	-0.8	7.7	-1.0	7.9	-1.0	8.0	-1.1
GRE01150	along Goodlette-Frank Road	7.5	-0.7	7.9	-0.8	8.1	-0.9	8.2	-0.9
BV35010	Golden Gate Parkway	7.5	-0.8	8.0	-0.8	8.2	-0.8	8.3	-0.9
BV35020	Golden Gate Parkway	7.4	-1.6	8.1	-1.7	8.4	-1.8	8.6	-1.8
BV35030	Golden Gate Parkway	7.4	-1.8	8.2	-1.6	8.5	-1.6	8.7	-1.6
BV35040	Golden Gate Parkway	7.2	-2.1	8.5	-1.3	8.9	-1.2	9.3	-1.1
BV43098	baseball fields at Naples High School (outfall to south)	7.2	-2.1	8.6	-1.2	9.1	-1.2	9.5	-1.0

TABLE 6-6
 City of Naples - Basin V Stormwater System Improvement Plan, Phase I
 Peak Flood Stage Comparison - Alternative 2

Junction Name	Location	5-yr/24-hr Event		10-yr/72-hr Event		25-yr/72-hr Event		100-yr/72-hr Event	
		Peak Stage (ft-NGVD)	Difference (ft)	Peak Stage (ft-NGVD)	Difference (ft)	Peak Stage (ft-NGVD)	Difference (ft)	Peak Stage (ft-NGVD)	Difference (ft)
BV35045	Golden Gate Parkway	7.4	-1.8	8.3	-1.5	8.6	-1.5	8.9	-1.5
BV35050	Golden Gate Parkway	7.8	-1.4	8.7	-1.1	8.9	-1.3	9.0	-1.4
GRE01155	along Goodlette-Frank Road	7.8	-0.5	8.2	-0.6	8.4	-0.6	8.7	-0.6
GRE01160	along Goodlette-Frank Road	8.1	-0.7	8.6	-0.9	8.9	-0.9	9.2	-0.8
BV42020	Golden Gate Parkway	6.4	-2.7	8.7	-0.9	9.0	-0.8	9.3	-0.8
BV42010	Golden Gate Parkway	6.8	-2.7	8.7	-1.2	9.0	-1.1	9.3	-1.0
GRE01170	along Goodlette-Frank Road	8.1	-0.6	8.6	-0.8	8.9	-0.8	9.3	-0.8
BV44005	intersection of 22nd Avenue North and 14th Street North	8.2	-1.2	8.6	-0.8	9.0	-0.8	9.3	-0.8
BV44010	22nd Avenue North	8.4	-1.2	9.1	-0.6	9.4	-0.4	9.7	-0.4
GRE01180	along Goodlette-Frank Road	8.2	-0.3	8.7	-0.4	9.1	-0.3	9.4	-0.3
BV44015	14th Street North, north of 22nd Avenue North	8.2	-0.5	8.7	-0.4	9.1	-0.3	9.4	-0.3
BV44020	intersection of 14th Street North and Royal Palm Drive	8.3	-1.2	8.8	-0.9	9.1	-0.6	9.4	-0.4
BV44025	intersection of Royal Palm Drive and 13th Street North	8.5	-1.4	8.9	-1.1	9.3	-0.8	9.6	-0.6
BV44030	Royal Palm Drive, u/s of 13th Street North	8.8	-1.4	9.3	-1.1	9.7	-0.8	10.0	-0.5
BV44035	Royal Palm Drive, u/s of 13th Street North	8.3	-1.7	8.5	-1.6	8.8	-1.5	9.1	-1.4
GRE01188	along Goodlette-Frank Road	8.2	-0.2	8.7	-0.4	9.1	-0.3	9.4	-0.3
GRE01190	along Goodlette-Frank Road	8.0	-0.2	8.6	-0.3	8.9	-0.3	9.2	-0.3
GRE01192	along Goodlette-Frank Road	8.2	-0.2	8.7	-0.4	9.1	-0.3	9.4	-0.3
BV44040	intersection of 14th Street North and Diana Avenue	8.3	-2.2	8.8	-2.0	9.1	-1.8	9.5	-1.6
BV44045	intersection of Diana Avenue and 13th Street North	9.1	-1.4	9.4	-1.4	9.8	-1.2	10.0	-1.1
GRE01200	along Goodlette-Frank Road	8.4	-0.1	8.8	-0.3	9.1	-0.3	9.4	-0.3
BV44050	intersection of 14th Street North and 26th Avenue North	9.3	-1.9	9.6	-1.7	9.9	-1.5	10.3	-1.3
BV44055	intersection of 13th Street North and 26th Avenue North	10.1	-1.6	10.3	-1.6	10.6	-1.5	11.0	-1.2
GRE01210	along Goodlette-Frank Road	8.9	0.1	9.5	-0.3	9.9	-0.2	10.3	-0.2
GRE01220	along Goodlette-Frank Road	9.1	0.1	9.6	-0.2	10.0	-0.2	10.4	-0.2
BV43045	d/s end of 14th Street North & 28th Ave N crossing	9.1	0.0	9.6	-0.3	10.0	-0.3	10.4	-0.4
BV43050	u/s end of 14th Street North & 28th Ave N crossing	9.1	-0.1	9.6	-0.4	10.0	-0.4	10.4	-0.5
BV43055	intersection of 28th Avenue North and 12th Street North	9.1	-1.9	9.6	-1.5	10.0	-1.3	10.4	-1.2
BV43060	d/s end of 28th Avenue North & 12th St N crossing	9.0	-1.6	9.7	-1.1	10.2	-0.8	10.7	-0.9
BV46010	Pond south of 28th Avenue North	9.0	-0.2	9.7	-0.5	10.2	-0.7	10.7	-0.9
BV46020	12th Street North, east of Pond	9.0	-0.2	9.7	-0.5	10.2	-0.7	10.7	-0.9
BV46040	east of 12th Street north	9.0	-0.2	9.7	-0.5	10.2	-0.7	10.7	-0.9
BV43063	intersection of 28th Avenue North and 12th Street North	9.5	-2.6	9.8	-2.5	10.2	-2.3	10.5	-2.1
BV43065	28th Avenue north, west of 12th Street North	9.8	-2.4	10.2	-2.2	10.9	-1.7	11.2	-1.5
BV43067	28th Avenue north, d/s of 10th Street North	10.4	-2.3	11.1	-1.7	12.2	-0.7	12.5	-0.4
BV43070	d/s end of 10th Street North & 28th Ave N crossing	10.5	-1.3	11.0	-1.5	11.4	-1.2	12.0	-0.8
BV43075	u/s end of 10th Street North & 28th Ave N crossing	10.8	-0.7	11.3	-0.9	11.8	-0.9	12.3	-0.5
GRE01230	along Goodlette-Frank Road	9.1	0.1	9.6	-0.2	10.0	-0.2	10.4	-0.2
BV47010	pond north of 28th Avenue North	9.1	-1.2	9.7	-1.1	10.1	-0.9	10.5	-0.8
BV47020	east of 12th Street North	9.1	-1.2	9.7	-1.1	10.1	-0.9	10.5	-0.8
BV47030	south of 12th St North and 29th Ave North intersection	9.1	-1.2	9.7	-1.0	10.1	-0.8	10.5	-0.6
BV47040	south of 29th Ave North and 10th St North intersection	9.2	-0.8	9.5	-0.8	9.7	-0.8	9.9	-0.8
BV43030	pond north of Diana Avenue	9.8	-1.8	10.9	-1.1	11.3	-0.9	11.6	-0.8
BV43035	Diana Avenue, d/s of 10th Street North	9.7	-1.9	10.7	-1.3	11.1	-1.1	11.5	-0.9
BV43040	intersection of Diana Avenue and 10th Street North	9.5	-2.0	10.5	-1.5	10.9	-1.2	11.3	-1.0
BV43010	10th Street North, Naples High School baseball fields	8.4	-1.3	9.5	-0.8	9.9	-0.6	10.3	-0.5

TABLE 6-6
City of Naples - Basin V Stormwater System Improvement Plan, Phase I
Peak Flood Stage Comparison - Alternative 2

Junction Name	Location	5-yr/24-hr Event		10-yr/72-hr Event		25-yr/72-hr Event		100-yr/72-hr Event	
		Peak Stage (ft-NGVD)	Difference (ft)	Peak Stage (ft-NGVD)	Difference (ft)	Peak Stage (ft-NGVD)	Difference (ft)	Peak Stage (ft-NGVD)	Difference (ft)
BV43017	22nd Avenue North, south of 10th Street North	8.5	-1.7	9.6	-1.2	10.1	-0.9	10.6	-0.7
BV43018	intersection of 10th Avenue North and 22nd Avenue	8.8	-2.3	9.9	-1.4	10.3	-1.2	10.7	-0.9
BV43015	baseball fields at Naples High School	9.4	-0.4	9.9	-0.4	10.1	-0.4	10.3	-0.5
BV43005	baseball fields at Naples High School	8.4	-1.3	9.3	-0.8	9.8	-0.6	10.1	-0.5
BV43020	intersection of 22nd Avenue North and 11th Street North	8.6	-1.5	9.5	-1.3	10.1	-0.9	10.6	-0.7
BV43025	intersection of 11th Street North and Royal Palm Drive	9.3	-0.4	9.7	-0.5	10.1	-0.5	10.5	-0.5
BV43080	baseball fields at Naples High School	10.0	-0.1	10.2	-0.1	10.3	-0.2	10.5	-0.3
BV43085	baseball fields at Naples High School	8.4	-1.2	9.3	-0.8	9.8	-0.6	10.1	-0.5
BV43090	baseball fields at Naples High School	8.5	-1.2	9.3	-0.8	9.8	-0.6	10.1	-0.5
BV43095	baseball fields at Naples High School	8.9	-0.7	9.5	-0.6	9.7	-0.6	10.1	-0.5
BV43097	baseball fields at Naples High School	9.7	-0.1	9.8	-0.1	9.9	-0.4	10.0	-0.6
GRE01163	along Goodlette-Frank Road	8.1	-0.7	8.6	-0.9	8.9	-0.9	9.3	-0.8
BV44060	Naples High School	8.3	-1.1	9.0	-0.9	9.4	-0.7	9.8	-0.6
GRE01164	along Goodlette-Frank Road	8.1	-0.7	8.6	-0.8	8.9	-0.8	9.3	-0.8
GRE01167	along Goodlette-Frank Road	8.1	-0.6	8.6	-0.8	8.9	-0.8	9.3	-0.8
BV31010	Goodlette-Frank Road, east of Coastland Mall	7.3	0.0	7.5	-0.3	7.6	-0.4	7.7	-0.6
BV31040	Coastland Mall	7.8	-0.3	8.8	-0.4	9.1	-0.3	9.7	-0.4
BV31020	Goodlette-Frank Road, east of Coastland Mall	7.3	-0.6	7.5	-1.2	7.6	-1.3	7.7	-1.5
BV31030	Coastland Mall	7.5	-0.5	8.0	-0.9	8.2	-0.9	8.5	-1.0
BV31050	Coastland Mall	7.9	-0.2	8.9	-0.4	9.3	-0.3	10.0	-0.3
BV31060	Coastland Mall	8.0	-0.2	9.0	-0.4	9.5	-0.2	10.5	-0.2
BV31070	Coastland Mall	8.1	-0.2	9.0	-0.3	9.6	-0.2	10.6	-0.2
BV32010	Coastland Mall	8.2	-0.1	9.2	-0.3	9.8	-0.2	10.8	-0.2
BV35060	Coastland Mall	8.4	-0.1	9.3	-0.2	10.0	-0.2	11.0	-0.1
BV35070	Coastland Mall	8.6	0.0	9.4	-0.2	10.2	-0.1	11.2	-0.1
BV32020	Coastland Mall	8.8	0.0	9.6	-0.1	10.5	-0.1	11.5	-0.1
BV33060	Coastland Mall	8.9	0.0	9.7	-0.1	10.6	-0.1	11.7	-0.1
BV32030	Coastland Mall	7.9	-0.6	9.1	-0.5	9.5	-0.2	10.0	-0.3
BV32040	Coastland Mall	8.4	0.0	8.9	-0.7	10.4	0.0	10.9	-0.2
BV33010	Coastland Mall	8.0	-0.1	8.7	-0.1	9.3	-0.2	9.9	-0.2
BV33050	Coastland Mall	8.1	0.0	8.8	0.0	9.4	-0.1	10.0	-0.2
BV33020	Coastland Mall	8.4	0.0	8.7	-0.1	9.2	-0.2	9.6	-0.2
BV33040	Coastland Mall	8.3	0.0	8.7	-0.1	9.2	-0.2	9.6	-0.2
BV33030	Coastland Mall	8.3	0.0	8.5	-0.3	9.2	-0.2	9.6	-0.2

- Notes:
- | | | | | | |
|--|------|------|------|------|------|
| | max: | 0.8 | 0.7 | 0.8 | 0.8 |
| (1) - Peak flood stages have been rounded to the nearest tenth of a foot. | min: | -2.7 | -2.5 | -2.3 | -2.1 |
| (2) - Difference compares peak flood stage to existing conditions (Table 5-1). | | | | | |

TABLE 6-7

City of Naples - Basin V Stormwater System Improvement Plan, Phase I
Proposed System LOS Evaluation - Alternative 2

Junction Name	Location	Road Crown Elevation (ft-NGVD)	Yard Elevation (ft-NGVD)	Structure Elevation (ft-NGVD)	5-yr/24-hr Event			10-yr/72-hr Event			25-yr/72-hr Event			100-yr/72-hr Event		
					Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾
GRE01020	Outfall to Golden Gate Canal Confluence	6.5	6.3	7.0	5.2		A	5.6		A	6.2		A	6.8	0.3	C
BV12010		n/a	n/a	n/a	6.0		A	6.6		A	7.0		A	7.2		A
BV12019	control structure from 6th Avenue Pond	n/a	n/a	n/a	6.1		A	6.6		A	7.0		A	7.3		A
BV13020	Alley	7.1	7.9	9.5	6.2		A	6.7		A	7.1		A	7.4	0.3	C
BV13021	10th Street North	6.4	6.6	8.8	6.1		A	6.6	0.2	C	7.0	0.6	D	7.3	0.9	D
BV13010	6th Avenue North	5.9	5.5	n/a	6.2	0.3	C	6.6	0.8	D	7.2	1.4	D	7.6	1.7	D
BV14005	intersection of 6th Avenue North and Tamiami Tr N	9.0	n/a	n/a	6.4		A	7.1		A	7.6		A	8.1		A
BV14010	intersection of US 41 and 5th Avenue North	8.1	n/a	n/a	6.2		A	6.8		A	7.3		A	7.8		A
BV14015	intersection of US 41 and 3rd Avenue North	7.9	n/a	n/a	6.1		A	6.6		A	7.0		A	7.4		A
BV14020	intersection of US 41 and 6th Avenue North	9.8	n/a	n/a	6.6		A	7.4		A	8.0		A	8.5		A
BV14025	US 41, u/s of 6th Avenue North	10.9	n/a	n/a	6.9		A	7.9		A	8.6		A	9.2		A
BV14030	US 41, d/s of 7th Avenue North	9.6	n/a	n/a	7.2		A	8.2		A	9.0		A	9.6		A
BV14040	intersection of US 41 and 7th Avenue North	n/a	n/a	n/a	7.5		A	8.6		A	9.4		A	10.0		A
BV14045	US 41, d/s of 8th Avenue North	10.4	n/a	n/a	7.7		A	8.8		A	9.6		A	10.2		A
BV14050	intersection of US 41 and 8th Avenue North	10.2	n/a	n/a	7.8		A	8.9		A	9.7		A	10.3	0.1	C
BV14055	US 41, u/s of 8th Avenue North	10.4	n/a	n/a	8.0		A	9.1		A	9.9		A	10.4		A
BV14060	d/s end of crossing at intersection of US 41 and 10th Avenue	10.0	n/a	n/a	8.1		A	9.2		A	9.9		A	10.4	0.4	C
BV14065	u/s end of crossing at intersection of US 41 and 10th Avenue	10.8	n/a	n/a	8.2		A	9.3		A	10.0		A	10.5		A
BV14070	US 41, u/s of 10th Avenue	10.4	n/a	n/a	8.4		A	9.4		A	10.1		A	10.5	0.1	C
BV14075	US 41, d/s of 12th Avenue North	10.5	n/a	n/a	8.7		A	9.7		A	10.2		A	10.7	0.2	C
BV26005	US 41, u/s of 12th Avenue North	10.4	n/a	n/a	8.8		A	9.7		A	10.2		A	10.8	0.4	C
BV26010	US 41, d/s of 14th Avenue North	10.2	n/a	n/a	8.8		A	9.7		A	10.2		A	10.8	0.6	D
BV26015	US 41, d/s of 14th Avenue North	10.5	n/a	n/a	8.9		A	9.7		A	10.3		A	11.0	0.5	C
BV26020	US 41, u/s of 14th Avenue North	11.2	n/a	n/a	8.9		A	9.7		A	10.5		A	11.0		A
BV26025	pond west of US 41	n/a	n/a	n/a	9.3		A	9.9		A	10.5		A	11.0		A
BV26026	pond west of US 41	n/a	n/a	n/a	9.3		A	9.9		A	10.5		A	11.1		A
BV26030	US 41, u/s of 14th Avenue North	n/a	n/a	n/a	9.0		A	9.7		A	10.5		A	11.0		A
BV26035	US 41, d/s of Fleischmann Boulevard	11.7	n/a	n/a	9.3		A	10.0		A	10.6		A	11.1		A
BV26040	intersection of US 41 and Fleischmann Boulevard	11.9	n/a	n/a	9.3		A	10.0		A	10.6		A	11.1		A
BV34010	US 41, u/s of Fleischmann Boulevard	11.5	n/a	n/a	9.3		A	10.0		A	10.6		A	11.1		A
BV33056	retention area at west side of mall	n/a	n/a	n/a	8.4		A	9.2		A	9.9		A	10.4		A
BV33055	retention area at west side of mall	n/a	n/a	n/a	8.4		A	9.2		A	9.9		A	10.4		A
BV34020	US 41, west of Coastland Mall	11.3	n/a	n/a	9.4		A	10.2		A	11.1		A	11.5	0.2	C
BV34030	US 41, west of Coastland Mall	11.4	n/a	n/a	9.5		A	10.3		A	11.1		A	11.5	0.1	C
BV34040	south of US 41 and Golden Gate Parkway intersection	11.5	n/a	n/a	10.2		A	11.1		A	11.4		A	11.7	0.2	C
BV12020	12th Street North	5.3	5.3	7.5	6.1	0.8	D	6.6	1.3	D	7.0	1.7	D	7.3	2.1	D
BV12030	intersection of 7th Avenue North and 12th Street North	5.5	5.9	7.6	6.1	0.6	D	6.6	1.1	D	7.0	1.5	D	7.3	1.8	D
BV12040	7th Avenue North	7.0	6.3	8.4	5.7		A	6.1		A	6.5		B	7.0		B
BV24010	east of 11th Street North	9.5	9.0	11.4	7.9		A	8.6		A	9.4		B	9.7	0.2	C
GRE01030	Goodlette-Frank Road	6.7	6.5	7.0	5.6		A	5.9		A	6.3		A	6.7		B
GRE01040	Goodlette-Frank Road	6.9	6.7	7.5	5.8		A	6.1		A	6.4		A	6.7		B
GRE01050	Goodlette-Frank Road	7.1	6.9	7.5	6.2		A	6.4		A	6.6		A	6.9		A
GRE01060	Goodlette-Frank Road	7.3	7.1	7.5	6.3		A	6.5		A	6.8		A	7.0		A
BV11007	u/s of intersection of 8th Ave N and Goodlette-Frank Road	5.8	4.5	n/a	6.3	0.5	D	6.5	0.7	D	6.8	1.0	D	7.0	1.2	D
BV11010	intersection of 8th Avenue North and 12th Street North	6.2	5.7	n/a	6.4	0.1	C	6.5	0.3	C	6.8	0.5	D	7.0	0.8	D
BV11020	8th Avenue North	7.2	6.9	8.8	6.5		A	6.7		A	7.0		B	7.4	0.2	C
GRE01070	Goodlette-Frank Road	7.5	7.3	8.8	6.6		A	6.8		A	7.0		A	7.3		B
BV11030	13th Street North	7.4	5.9	n/a	6.8		B	7.1		B	7.3		B	7.5	0.1	C

TABLE 6-7

City of Naples - Basin V Stormwater System Improvement Plan, Phase I
Proposed System LOS Evaluation - Alternative 2

Junction Name	Location	Road Crown Elevation (ft-NGVD)	Yard Elevation (ft-NGVD)	Structure Elevation (ft-NGVD)	5-yr/24-hr Event			10-yr/72-hr Event			25-yr/72-hr Event			100-yr/72-hr Event		
					Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾
BV11040	Pond west of 13th Street North	n/a	n/a	n/a	6.8		A	7.1		A	7.3		A	7.5		A
GRE01080	Goodlette-Frank Road	7.6	7.4	7.8	6.7		A	7.0		A	7.2		A	7.5		B
GRE01090	Goodlette-Frank Road	7.7	7.5	8.0	6.9		A	7.3		A	7.7		B	8.1	0.4	D
BV11070	d/s end of crossing at 10th Ave N and 13th St N	7.7	6.9	n/a	7.0		B	7.4		B	7.8	0.1	C	8.2	0.5	D
BV11060	u/s end of crossing at 10th Ave N and 13th St N	7.9	8.2	9.5	7.0		A	7.4		A	7.9		A	8.3	0.4	C
BV15010	d/s end of 12th Street North crossing	9.5	9.5	11.4	7.3		A	7.8		A	8.3		A	8.6		A
BV15020	u/s end of 12th Street North crossing ⁽¹⁾	10.2	9.3	n/a	7.5		A	7.9		A	8.4		A	8.8		A
BV15030	pond at 12th Street North	n/a	n/a	n/a	7.6		A	8.1		A	8.5		A	8.9		A
BV15070	11th Street North(8)	9.0	9.7	11.5	7.6		A	8.1		A	8.5		A	8.9		A
BV15080	intersection of 11th Street North and 10th Street North	8.6	n/a	n/a	7.6		A	8.1		A	8.6		A	8.9	0.3	C
BV15090	intersection of 11th Street North and 10th Street North	9.2	n/a	12.9	7.4		A	7.8		A	8.3		A	8.8		A
BV15040	intersection of 11th Street North and 10th Avenue North	9.1	n/a	n/a	7.7		A	8.1		A	8.6		A	9.0		A
BV15050	10th Avenue North	10.1	10.3	12.6	7.7		A	8.2		A	8.8		A	9.1		A
BV15060	intersection of 10th Avenue North and 10th Street North	9.5	9.4	11.1	7.8		A	8.1		A	8.5		A	8.9		A
GRE01100	Goodlette-Frank Road	7.8	7.6	8.0	6.7		A	7.1		A	7.4		A	7.7		B
BV11050	north of 12th Avenue North	9.1	8.2	10.0	8.0		A	8.0		A	8.0		A	8.0		A
GRE01110	Goodlette-Frank Road	7.9	7.7	8.5	6.6		A	7.0		A	7.3		A	7.7		A
BV22010	14th Avenue North	7.2	6.9	9.9	6.8		A	7.1		B	7.4	0.2	C	7.7	0.5	C
GRE01120	Goodlette-Frank Road	8.0	7.8	8.5	6.1		A	6.8		A	7.2		A	7.6		A
BV23005	north of Lake Park Elementary School	8.7	7.4	n/a	6.3		A	6.8		A	7.2		A	7.6		B
BV23010	corner of 15th Avenue North and 12th Street North	7.4	n/a	n/a	6.3		A	6.8		A	7.2		A	7.6	0.2	C
BV23011	15th Avenue North	7.2	n/a	n/a	6.3		A	6.8		A	7.2		A	7.6	0.4	C
BV27010	Pond north of 14th Avenue North	n/a	n/a	n/a	6.2		A	6.8		A	7.2		A	7.7		A
BV27020	15th Avenue North	6.6	n/a	n/a	6.3		A	6.9	0.2	C	7.2	0.6	D	7.7	1.0	D
BV23015	d/s end of 14th Avenue North crossing	7.4	7.6	9.6	6.3		A	7.0		A	7.3		A	7.7	0.3	C
BV23020	u/s end of 14th Avenue North crossing	7.9	7.2	n/a	6.4		A	7.1		A	7.4		B	7.8		B
BV23025	intersection of 12th Street North and 14th Avenue North	7.9	7.4	n/a	6.7		A	7.2		A	7.7		B	7.9	0.0	C
BV23030	intersection of 12th Street North and 14th Avenue North	7.7	7.5	10.0	6.5		A	7.1		A	7.5		B	7.9	0.3	C
BV23035	intersection of 12th Street North and 14th Avenue North	7.9	n/a	n/a	6.7		A	7.2		A	7.7		A	7.9	0.1	C
BV23040	intersection of 12th Street North and 14th Avenue North	8.1	7.4	n/a	6.7		A	7.2		A	7.7		B	7.9		B
BV23045	12th Street North, south of 14th Avenue North	8.4	7.9	n/a	6.7		A	7.2		A	7.6		A	7.9		B
BV23050	12th Street North, south of 14th Avenue North	8.2	7.9	10.6	6.7		A	7.2		A	7.6		A	7.9		B
BV23055	12th Street North, north of 13th Avenue North	8.2	n/a	n/a	6.7		A	7.2		A	7.6		A	7.9		A
BV23060	d/s end of 13th Avenue North crossing	7.7	n/a	n/a	6.7		A	7.2		A	7.6		A	7.9	0.3	C
BV23065	u/s end of 13th Avenue North crossing	7.7	n/a	n/a	6.8		A	7.2		A	7.6		A	7.9	0.2	C
BV23070	south of 13th Avenue North	8.2	7.9	10.0	6.5		A	6.8		A	7.0		A	7.3		A
GRE01130	intersection of Fleschmann Ave and Goodlette-Frank Road	8.2	7.6	n/a	7.2		A	7.2		A	7.2		A	7.6		B
GRE01140	along Goodlette-Frank Road	8.0	7.8	9.5	7.4		A	7.7		A	7.9		B	8.0	0.0	C
GRE01150	along Goodlette-Frank Road	9.9	8.3	10.0	7.5		A	7.9		A	8.1		A	8.2		A
BV35010	Golden Gate Parkway	11.1	n/a	n/a	7.5		A	8.0		A	8.2		A	8.3		A
BV35020	Golden Gate Parkway	n/a	n/a	n/a	7.4		A	8.1		A	8.4		A	8.6		A
BV35030	Golden Gate Parkway	8.6	n/a	n/a	7.4		A	8.2		A	8.5		A	8.7	0.2	C
BV35040	Golden Gate Parkway	9.1	n/a	n/a	7.2		A	8.5		A	8.9		A	9.3	0.2	C
BV43098	baseball fields at Naples High School (outfall to south)	n/a	n/a	n/a	7.2		A	8.6		A	9.1		A	9.5		A
BV35045	Golden Gate Parkway	8.3	n/a	n/a	7.4		A	8.3		A	8.6	0.3	C	8.9	0.6	D
BV35050	Golden Gate Parkway	8.5	n/a	n/a	7.8		A	8.7	0.2	C	8.9	0.4	C	9.0	0.5	C
GRE01155	along Goodlette-Frank Road	10.0	9.8	10.5	7.8		A	8.2		A	8.4		A	8.7		A
GRE01160	along Goodlette-Frank Road	10.0	9.8	10.5	8.1		A	8.6		A	8.9		A	9.2		A

TABLE 6-7

City of Naples - Basin V Stormwater System Improvement Plan, Phase I
Proposed System LOS Evaluation - Alternative 2

Junction Name	Location	Road Crown Elevation (ft-NGVD)	Yard Elevation (ft-NGVD)	Structure Elevation (ft-NGVD)	5-yr/24-hr Event			10-yr/72-hr Event			25-yr/72-hr Event			100-yr/72-hr Event		
					Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾
BV42020	Golden Gate Parkway	9.0	n/a	n/a	6.4		A	8.7		A	9.0	0.1	C	9.3	0.4	C
BV42010	Golden Gate Parkway	9.2	n/a	n/a	6.8		A	8.7		A	9.0		A	9.3	0.1	C
GRE01170	along Goodlette-Frank Road	9.0	9.5	10.5	8.1		A	8.6		A	8.9		A	9.3	0.3	C
BV44005	intersection of 22nd Avenue North and 14th Street North	9.2	n/a	n/a	8.2		A	8.6		A	9.0		A	9.3	0.1	C
BV44010	22nd Avenue North	9.5	9.4	11.4	8.4		A	9.1		A	9.4		A	9.7	0.2	C
GRE01180	along Goodlette-Frank Road	9.7	9.5	10.5	8.2		A	8.7		A	9.1		A	9.4		A
BV44015	14th Street North, north of 22nd Avenue North	8.3	7.8	n/a	8.2		B	8.7	0.5	C	9.1	0.8	D	9.4	1.1	D
BV44020	intersection of 14th Street North and Royal Palm Drive	9.1	8.5	12.3	8.3		A	8.8		B	9.1		B	9.4	0.3	C
BV44025	intersection of Royal Palm Drive and 13th Street North	9.5	8.9	n/a	8.5		A	8.9		B	9.3		B	9.6	0.1	C
BV44030	Royal Palm Drive, u/s of 13th Street North	9.8	9.6	11.7	8.8		A	9.3		A	9.7		B	10.0	0.2	C
BV44035	Royal Palm Drive, u/s of 13th Street North	10.1	9.5	n/a	8.3		A	8.5		A	8.8		A	9.1		A
GRE01188	along Goodlette-Frank Road	11.0	10.8	11.5	8.2		A	8.7		A	9.1		A	9.4		A
GRE01190	along Goodlette-Frank Road	11.0	10.8	11.5	8.0		A	8.6		A	8.9		A	9.2		A
GRE01192	along Goodlette-Frank Road	11.0	10.8	11.5	8.2		A	8.7		A	9.1		A	9.4		A
BV44040	intersection of 14th Street North and Diana Avenue	n/a	9.5	n/a	8.3		A	8.8		A	9.1		A	9.5		A
BV44045	intersection of Diana Avenue and 13th Street North	9.8	9.5	12.7	9.1		A	9.4		A	9.8		B	10.0	0.2	C
GRE01200	along Goodlette-Frank Road	11.0	10.8	11.5	8.4		A	8.8		A	9.1		A	9.4		A
BV44050	intersection of 14th Street North and 26th Avenue North	10.5	n/a	n/a	9.3		A	9.6		A	9.9		A	10.3		A
BV44055	intersection of 13th Street North and 26th Avenue North	11.5	11.6	13.8	10.1		A	10.3		A	10.6		A	11.0		A
GRE01210	along Goodlette-Frank Road	11.0	10.8	11.5	8.9		A	9.5		A	9.9		A	10.3		A
GRE01220	along Goodlette-Frank Road	11.0	10.8	11.5	9.1		A	9.6		A	10.0		A	10.4		A
BV43045	d/s end of 14th Street North & 28th Ave N crossing	10.8	n/a	n/a	9.1		A	9.6		A	10.0		A	10.4		A
BV43050	u/s end of 14th Street North & 28th Ave N crossing	11.0	10.3	n/a	9.1		A	9.6		A	10.0		A	10.4		B
BV43055	intersection of 28th Avenue North and 12th Street North	11.0	10.7	n/a	9.1		A	9.6		A	10.0		A	10.4		A
BV43060	d/s end of 28th Avenue North & 12th St N crossing	10.8	10.2	n/a	9.0		A	9.7		A	10.2		A	10.7		B
BV46010	Pond south of 28th Avenue North	n/a	n/a	n/a	9.0		A	9.7		A	10.2		A	10.7		A
BV46020	12th Street North, east of Pond	9.8	10.1	12.6	9.0		A	9.7		A	10.2	0.4	C	10.7	0.9	D
BV46040	east of 12th Street north	n/a	n/a	n/a	9.0		A	9.7		A	10.2		A	10.7		A
BV43063	intersection of 28th Avenue North and 12th Street North	11.9	11.3	n/a	9.5		A	9.8		A	10.2		A	10.5		A
BV43065	28th Avenue north, west of 12th Street North	12.0	10.8	13.5	9.8		A	10.2		A	10.9		B	11.2		B
BV43067	28th Avenue north, d/s of 10th Street North	12.3	11.9	n/a	10.4		A	11.1		A	12.2		B	12.5	0.2	C
BV43070	d/s end of 10th Street North & 28th Ave N crossing	12.5	12.1	13.0	10.5		A	11.0		A	11.4		A	12.0		A
BV43075	u/s end of 10th Street North & 28th Ave N crossing	12.6	11.8	n/a	10.8		A	11.3		A	11.8		A	12.3		B
GRE01230	along Goodlette-Frank Road	11.0	10.8	11.5	9.1		A	9.6		A	10.0		A	10.4		A
BV47010	pond north of 28th Avenue North	n/a	n/a	n/a	9.1		A	9.7		A	10.1		A	10.5		A
BV47020	east of 12th Street North	10.2	11.0	12.7	9.1		A	9.7		A	10.1		A	10.5	0.3	C
BV47030	south of 12th St North and 29th Ave North intersection	10.4	n/a	n/a	9.1		A	9.7		A	10.1		A	10.5	0.1	C
BV47040	south of 29th Ave North and 10th St North intersection	10.6	11.4	13.0	9.2		A	9.5		A	9.7		A	9.9		A
BV43030	pond north of Diana Avenue	n/a	n/a	n/a	9.8		A	10.9		A	11.3		A	11.6		A
BV43035	Diana Avenue, d/s of 10th Street North	10.7	9.7	12.6	9.7		A	10.7		B	11.1	0.4	C	11.5	0.7	D
BV43040	intersection of Diana Avenue and 10th Street North	10.7	10.2	n/a	9.5		A	10.5		B	10.9	0.2	C	11.3	0.7	D
BV43010	10th Street North, Naples High School baseball fields	n/a	n/a	n/a	8.4		A	9.5		A	9.9		A	10.3		A
BV43017	22nd Avenue North, south of 10th Street North	10.0	n/a	n/a	8.5		A	9.6		A	10.1	0.1	C	10.6	0.5	D
BV43018	intersection of 10th Avenue North and 22nd Avenue	10.8	n/a	n/a	8.8		A	9.9		A	10.3		A	10.7		A
BV43015	baseball fields at Naples High School	n/a	n/a	n/a	9.4		A	9.9		A	10.1		A	10.3		A
BV43005	baseball fields at Naples High School	n/a	n/a	n/a	8.4		A	9.3		A	9.8		A	10.1		A
BV43020	intersection of 22nd Avenue North and 11th Street North	9.7	n/a	n/a	8.6		A	9.5		A	10.1	0.4	C	10.6	0.9	D
BV43025	intersection of 11th Street North and Royal Palm Drive	10.7	10.5	12.1	9.3		A	9.7		A	10.1		A	10.5		B

TABLE 6-7

City of Naples - Basin V Stormwater System Improvement Plan, Phase I
Proposed System LOS Evaluation - Alternative 2

Junction Name	Location	Road Crown Elevation (ft-NGVD)	Yard Elevation (ft-NGVD)	Structure Elevation (ft-NGVD)	5-yr/24-hr Event			10-yr/72-hr Event			25-yr/72-hr Event			100-yr/72-hr Event		
					Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾
BV43080	baseball fields at Naples High School	n/a	n/a	n/a	10.0		A	10.2		A	10.3		A	10.5		A
BV43085	baseball fields at Naples High School	n/a	n/a	n/a	8.4		A	9.3		A	9.8		A	10.1		A
BV43090	baseball fields at Naples High School	n/a	n/a	n/a	8.5		A	9.3		A	9.8		A	10.1		A
BV43095	baseball fields at Naples High School	n/a	n/a	n/a	8.9		A	9.5		A	9.7		A	10.1		A
BV43097	baseball fields at Naples High School	n/a	n/a	n/a	9.7		A	9.8		A	9.9		A	10.0		A
GRE01163	along Goodlette-Frank Road	9.0	n/a	n/a	8.1		A	8.6		A	8.9		A	9.3	0.3	C
BV44060	Naples High School	n/a	n/a	n/a	8.3		A	9.0		A	9.4		A	9.8		A
GRE01164	along Goodlette-Frank Road	9.0	n/a	n/a	8.1		A	8.6		A	8.9		A	9.3	0.3	C
GRE01167	along Goodlette-Frank Road	9.0	n/a	n/a	8.1		A	8.6		A	8.9		A	9.3	0.3	C
BV31010	Goodlette-Frank Road, east of Coastland Mall	n/a	n/a	n/a	7.3		A	7.5		A	7.6		A	7.7		A
BV31040	Coastland Mall	10.6	n/a	n/a	7.8		A	8.8		A	9.1		A	9.7		A
BV31020	Goodlette-Frank Road, east of Coastland Mall	n/a	n/a	n/a	7.3		A	7.5		A	7.6		A	7.7		A
BV31030	Coastland Mall	10.6	n/a	n/a	7.5		A	8.0		A	8.2		A	8.5		A
BV31050	Coastland Mall	12.6	n/a	n/a	7.9		A	8.9		A	9.3		A	10.0		A
BV31060	Coastland Mall	12.7	n/a	n/a	8.0		A	9.0		A	9.5		A	10.5		A
BV31070	Coastland Mall	12.4	n/a	n/a	8.1		A	9.0		A	9.6		A	10.6		A
BV32010	Coastland Mall	11.5	n/a	n/a	8.2		A	9.2		A	9.8		A	10.8		A
BV35060	Coastland Mall	11.4	n/a	n/a	8.4		A	9.3		A	10.0		A	11.0		A
BV35070	Coastland Mall	11.2	n/a	n/a	8.6		A	9.4		A	10.2		A	11.2	0.0	C
BV32020	Coastland Mall	12.4	n/a	n/a	8.8		A	9.6		A	10.5		A	11.5		A
BV33060	Coastland Mall	12.0	n/a	n/a	8.9		A	9.7		A	10.6		A	11.7		A
BV32030	Coastland Mall	12.2	n/a	n/a	7.9		A	9.1		A	9.5		A	10.0		A
BV32040	Coastland Mall	11.7	n/a	n/a	8.4		A	8.9		A	10.4		A	10.9		A
BV33010	Coastland Mall	n/a	n/a	n/a	8.0		A	8.7		A	9.3		A	9.9		A
BV33050	Coastland Mall	12.9	n/a	n/a	8.1		A	8.8		A	9.4		A	10.0		A
BV33020	Coastland Mall	10.9	n/a	n/a	8.4		A	8.7		A	9.2		A	9.6		A
BV33040	Coastland Mall	11.5	n/a	n/a	8.3		A	8.7		A	9.2		A	9.6		A
BV33030	Coastland Mall	11.5	n/a	n/a	8.3		A	8.5		A	9.2		A	9.6		A

Total Number of LOS Class "B" Exceedances

5

9

18

62

Notes:

- (1) - Elevations, peak flood stages, and road flooding depths have all been rounded to the nearest tenth of a foot.
- (2) - Model results are computed to the nearest hundredth of a foot, but are shown in this table rounded to the nearest tenth of a foot. Therefore, even if the predicted stages from the model are shown to be equal to the respective critical elevation, the table may show an exceedance due to rounding (e.g. if the critical building elevation is 5.0, and the predicted peak stage from the model is 5.01, an exceedance is shown in the table).
- (3) - Level of Service (LOS) classes were assigned as follows:
 Class "A" LOS was assigned where flow is contained within the conveyance system; no flooding of major roadways, minor roadways, yards or structures is predicted;
 Class "B" LOS was assigned where there is no flooding of major roadways, minor roadways, or structures, but where yard flooding is predicted;
 Class "C" LOS was assigned where yard flooding and flooding of major roadways which precludes the use of the outside lane and travel in inside lanes is possible but difficult (depth less than 6-inches) is predicted, but where no structural flooding is predicted; and
 Class "D" LOS was assigned where extensive road flooding (depths greater than 6-inches) or structural flooding is predicted.

TABLE 6-8City of Naples - Basin V Stormwater System Improvement Plan, Phase I
Proposed System LOS Evaluation Summary - Alternative 2

Level of Service	Number of Locations (Model Junctions) by Design Storm Event							
	5-yr/24-hr		10-yr/72-hr		25-yr/72-hr		100-yr/72-hr	
Class A	164	95%	156	91%	138	80%	93	54%
Class B	3	2%	7	4%	16	9%	17	10%
Class C	2	1%	5	3%	10	6%	45	26%
Class D	3	2%	4	2%	8	5%	17	10%
Total		100%		100%		100%		100%

- Map ID 3 (model nodes BV12020 and BV12030): Although peak flood stages decrease by 0.1 ft at both locations compared to existing conditions for the 25-yr/24-hr design storm event, the low road crown elevations result in these two locations remaining LOS Class D. It may be possible to achieve LOS Class B by adding a berm around the 6th Ave. N./12th St. N. pond and installing a flap gate on the inflow pipe. This option was not evaluated in Alternative 2.
- Map ID 4 (model nodes BV11007 and BV11010): Peak flood stages increase by up to 0.3 ft at these locations compared to existing conditions for the 25-yr/24-hr design storm event. The low road crown and yard elevations result in these two locations remaining LOS Class D.
- Map ID 6 (model node BV11070): Although peak flood stages decrease by 0.6 ft compared to existing conditions for the 25-yr/24-hr design storm event, the low road crown and yard elevations result in this location achieving only LOS Class C.
- Map ID 8 (model node BV22010): Although peak flood stages decrease by 0.4 ft compared to existing conditions for the 25-yr/24-hr design storm event, the low road crown and yard elevations result in this location achieving only LOS Class C.
- Map ID 10 (model node BV27020): Although peak flood stages decrease by 1.2 ft compared to existing conditions for the 25-yr/24-hr design storm event, the low road crown elevation results in this location remaining LOS Class C.
- Map ID 12 (model nodes BV35045 and BV35050): Although peak flood stages decrease by up to 1.5 ft compared to existing conditions for the 25-yr/24-hr design storm event, the low road crown elevations result in these two locations achieving only LOS Class C. It may be possible to achieve LOS Class B by increasing conveyance within the Goodlette-Frank Road system. However, it was felt that the proposed improvements are within their practical limit and the marginal benefits to problem area 12 do not warrant the cost of additional improvements.
- Map ID 13 (model node BV42020): Although peak flood stages decrease by 0.8 ft compared to existing conditions for the 25-yr/24-hr design storm event, the low road crown elevation results in this location achieving only LOS Class C. It may be possible to achieve LOS Class B by increasing conveyance within the Goodlette-Frank Road system. However, it was felt that the proposed improvements are within their practical limit and the marginal benefits to problem area 13 do not warrant the cost of additional improvements.
- Map ID 14 (model nodes BV43017, BV43020, BV43035 and BV43040): Although peak flood stages decrease by up to 1.2 ft compared to existing conditions for the 25-yr/24-hr design storm event, the low road crown and yard elevations result in these locations achieving only LOS Class C.

- Map ID 17 (model node BV44015): Although peak flood stages decrease by 0.3 ft compared to existing conditions for the 25-yr/24-hr design storm event, the low road crown and yard elevations result in this location remaining LOS Class D.
- Map ID 21 (model node BV46020): Although peak flood stages decrease by 0.7 ft compared to existing conditions for the 25-yr/24-hr design storm event, the low road crown and yard elevations result in this location achieving only LOS Class C.

Due to physical constraints, low-lying structures, and/or marginal flood control benefits for the additional cost of further improvements, it may be more practicable to consider limited overtopping of roads for a shorter duration (allowing emergency traffic) and to move or raise the lower structures. Before investigating such duration benefits or considering reduced LOS in these areas, additional survey of the LOS threshold elevations is recommended.

6.2.3 Water Quality Considerations

Treatment and flow attenuation benefits are provided by the proposed modification of five existing detention facilities in Alternative 2. A total of 8.5 acre-ft of water quality treatment volume is provided in the proposed detention improvements, including:

- 13th St. N. wet pond (map ID 5, model node BV11040): 0.6 acres with 1.5-ft treatment = 0.9 acre-ft;
- 10th Ave. N. wet pond (map ID 6, model node BV15030): 1.7 acres with 1.5-ft treatment = 2.3 acre-ft;
- 15th Ave. N. wet pond (map ID 10, model node BV27010): 2.5 acres with 1.5-ft treatment = 3.7 acre-ft;
- Naples High School dry pond (map ID 14, model node BV43010): 0.1 acres with 1.5-ft treatment = 0.2 acre-ft;
- Diana Ave. N. wet pond (map ID 14, model node BV43030): 1.1 acres with 1.5-ft treatment = 1.5 acre-ft.

6.2.4 Conceptual Capital Cost Estimate

During discussions with the City, it was determined that the improvements representing Alternative 2 may not be pursued; therefore, capital cost estimates were not prepared since the scope of services identified two alternative cost estimates.

6.3 Alternative 3

Alternative 3 represents a refinement of Alternative 2 and was developed to achieve the City's revised set of retrofit LOS criteria throughout the Basin V PSMS, with

particular emphasis in addressing existing system problem areas that were identified in Section 5.6.

The LOS criteria used to develop Alternative 3 improvements are consistent with similar coastal Florida communities, and include the following:

- LOS 1 - No overtopping of the road crown elevation for the 5-year/24-hour design storm event,
- LOS 2 - Maximum overtopping of 3 inches (0.25 ft) above the road crown elevation for the 10-year/72-hour design storm event,
- LOS 3 - Maximum overtopping of 6 inches (0.5 ft) above the road crown elevation for the 25-year/72-hour design storm event (Note: this is equivalent to the LOS Class C designation that was used in the evaluation of the existing system and Alternatives 1 and 2),
- LOS 4 - Maximum overtopping of 9 inches (0.75 ft) above the road crown elevation for the 100-year/72-hour design storm event, and
- LOS 5 - No building flooding for the 100-year/72-hour design storm event.

The LOS criteria used for Alternative 3 do not follow the class designations that were used to evaluate the existing system and Alternatives 1 and 2. Although not used to develop Alternative 3 improvements, the former LOS class designations have been retained in Tables 6-11, 6-12, and 6-17 in order to compare results between alternatives. For each design storm event, the corresponding LOS class is given as follows:

- Class B when there is no overtopping of the road crown,
- Class C when there is a maximum 6-in overtopping of the road crown, and
- Class D when the road overtopping depth exceeds 6 inches.

6.3.1 Project Description

The location of the problem areas addressed by Alternative 3 improvements are the same as were shown on Figures 6-1 and 6-2 and are summarized in **Table 6-9**. Note: Map IDs 1A-10 are shown on Figure 6-2b and Map IDs 11-22 are shown in Figure 6-2a. The components include:

- Map ID 1B (model node BV26015 to BV14005): Add new 1,100-ft section of 42-in RCP into pond at 10th Ave N. (BV14075 to BV15030). Add new 1,000-ft section of 24-in RCP into pond at 15th Ave N. (BV26020 to BV27010).

TABLE 6-9

City of Naples - Basin V Stormwater System Improvement Plan, Phase I
Alternative 3 Improvement Summary

Map ID	Upstream Junction	Downstream Junction	Location	Improvement Type
1A	BV14005	BV12019	6th Ave. N., east of US 41	No improvements necessary, problems addressed by Map ID 1B improvements.
1B	BV26015	BV14005	US 41, between 14th Ave. N. and 7th Ave. N.	Add new 1100-ft section of 42" RCP into pond at 10th Ave (BV14075 to BV15030). Add new 1000-ft section of 24" RCP into pond at 15th Ave (BV26020 to BV27010).
2	BV13020	BV12019	10th St. N., north of 6th Ave. N.	Add parallel 390-ft section of 3'x5' RCBC.
3	BV12010	GRE01020	easement south of 7th Ave. N., west of Goodlette-Frank Road	Add parallel 286-ft section of 48" RCP.
4	BV11020	GRE01060	8th Ave. N., west of Goodlette-Frank Road	Add parallel 389-ft section of 24" RCP. Add parallel 572-ft section of 48" RCP.
5	BV11040	GRE01070	13th St. N. pond, west of Goodlette-Frank Road	Revise pond control structure. Lower pond NWL by 0.5 ft.
6	BV15030	GRE01090	10th Ave. N., west of Goodlette-Frank Road	Replace existing 660-ft section of 24" RCP with 48" RCP. Replace existing 198-ft section of 18" RCP with 48" RCP. Lower pond NWL by 1.5 ft.
7A	BV15050	BV15030	11th St. N./10th Ave. N., south of 10th Ave. N. pond	No improvements necessary, problems addressed by Map ID 6 improvements.
7B	BV15080	BV15030	11th St. N., west of 10th Ave. N. pond	Add parallel 370-ft section of 24" RCP.
7C	BV24010	BV15030	11th St. N., north of 10th Ave. N. pond	Add new 600-ft section of 18" RCP.
8	BV22010	GRE01110	14th Ave. N., west of Goodlette-Frank Road	Add parallel 170-ft section of 24" RCP.
9	BV23065	GRE01120	12th St. N./easement west of Goodlette-Frank Road	Add parallel 619-ft section of 18" RCP. Add new 750-ft section of 24" RCP. Replace existing 106-ft section of 2-12" RCP with 48" RCP. Replace existing 1010-ft section of 24"x38" ERCP with 4'x5' RCBC.
10	BV27010		15th Ave. N. pond	Lower pond NWL by 1.25 ft.
11	GRE01140	GRE01130	Goodlette Frank Road, adjacent to the mall	Replace existing 570-ft section of 2 - 29"x45" ERCP with two sections of 3 - 3'x6' RCBC and 200-ft open channel in between road crossings.
12	BV35045	GRE01150	Golden Gate Parkway (south side), west of Goodlette-Frank Road	Add parallel 560-ft section of 36" RCP. Replace existing 549-ft section of 24"x38" ERCP with 4'x7' RCBC. Replace existing 891-ft section of 24"x38" ERCP with 4'x8' RCBC.
13	BV42010	GRE01160	Golden Gate Pkwy (north side), west of Goodlette-Frank	Add parallel 887-ft section of 36" RCP.
14	BV43030	GRE01163	Diana Ave./10th St. N./easement west of Goodlette-Frank Road (Naples High School)	Replace existing 817-ft section of 12" RCP with 4'x8' RCBC. Replace existing 53-ft section of 42" RCP with 4'x9' RCBC. Replace existing 154-ft section of 3 - 29"x45" ERCP with 4'x10' RCBC. Replace existing 1392-ft section of 54" RCP with 5'x9' RCBC. Lower Diana Ave. pond NWL by 4 ft. Add parallel 414-ft section of 18" RCP.
15	GRE01160	GRE01150	Goodlette-Frank Road ditch, Golden Gate Parkway crossing	Replace existing 200-ft section of 34"x53" ERCP with 4'x9' RCBC. Replace existing 128-ft section of 48"x76" ERCP with 4'x9' RCBC.
16	BV44010	GRE01170	22nd Ave. N., west of Goodlette-Frank Road	No improvements necessary, problems addressed by Map ID 15 improvements.
17	BV44030	GRE01180	Royal Palm Drive, west of Goodlette-Frank Road	Add parallel 602-ft section of 48" RCP. Replace existing 342-ft section of 18" RCP with 4'x5' RCBC.
18	BV44045	GRE01192	Diana Ave., west of Goodlette-Frank Road	Add parallel 331-ft section of 18" RCP. Add parallel 210-ft section of 24" RCP.
19	BV44050	GRE01200	26th Ave. N., west of Goodlette-Frank Road	Replace existing 240-ft section of 24" RCP with 48" RCP.
20	BV43067	GRE01220	28th Ave. N., west of Goodlette-Frank Road	Add parallel 842-ft section of 18" RCP. Replace existing 857-ft section of 24" RCP with 4'x6' RCBC.



TABLE 6-9

City of Naples - Basin V Stormwater System Improvement Plan, Phase I
Alternative 3 Improvement Summary

Map ID	Upstream Junction	Downstream Junction	Location	Improvement Type
21	BV46010	BV43060	28th Ave. N. pond/12th St. N.	Add parallel 97-ft section of 24" RCP.
22	BV47010	GRE01230	14th St. N. pond, west of Goodlette-Frank Road	Add parallel 228-ft section of 48" RCP.
23	GRE01192	GRE01190	Goodlette Frank Road - Weir modification	Lower weir crest and notch elevation by approximately 1.0 ft (to 5.0 and 4.4 ft-NGVD, respectively). This is similar to Map ID 5 in Alternative 1.
24	GRE01190	GRE03040	Goodlette Frank Road - Outfall from GF Ditch to Reach 03	Replace existing 48"x76" ERCP with 4'x10' RCBC. This is similar to Map ID 6 in Alternative 1.
25	GRE03040	GRE00160	Reach 03	Widen existing 2,593 ft channel (4-5 ft deep, bank-to-bank distance of 45-feet). This is similar to Map ID 21 in Alternative 1.
26	GRE03040	GRE03010	Along Reach 03	Provide 27-acre SMWF along the south bank of Reach 03 (on the vacant parcel); route initial flows to pond through a trapezoidal channel, allowing for a high flow pop-off where peak flows can continue down the existing channel; and a weir outfall that will allow sheet flow through existing downstream wetlands to junction GRE03010. This is similar to Map ID 22 in Alternative 1.

Note:

1.) 'Map ID' corresponds to the labels on the Alternative 2 Improvement Maps (Figure 6-2).

- Map ID 2 (model node BV13020 to BV12019): Add parallel 390-ft section of 3-ft x 5-ft RCBC.
- Map ID 3 (model node BV12010 to GRE01020): Add parallel 286-ft section of 48-inch RCP. This improvement increases the lake outfall capacity, improving the LOS at locations upstream of the lake (i.e., at 12th St. N., 10th St. N., and 6th Ave. N.). Modifying the outlet control structures to lower the pond normal water level (NWL) would reduce peak flood stages upstream. However, the current NWL is at elevation 2.6 ft-NGVD and the impact on groundwater would have to be evaluated. No control structure modifications are included in Alternative 3.
- Map ID 4 (model node BV11020 to GRE01060): Add parallel 389-ft section of 24-inch RCP. Add parallel 572-ft section of 48-inch RCP.
- Map ID 5 (model node BV11040 to GRE01070): Lower the 13th St. N. pond NWL by 0.5 ft (from 4.78 ft-NGVD to 4.28 ft-NGVD). Add control structures to this 0.6-acre pond, including a 6-inch drawdown orifice that controls the NWL and a weir for flood control (crest set 1.5 ft above the NWL for water quality treatment). The control structure would be tied into the existing outfall (134-ft section of 12-inch RCP).
- Map ID 6 (model node BV15030 to GRE01090): Replace the existing 660-ft section of 24-inch RCP with 48-inch RCP. Replace the existing 198-ft section of 18-inch RCP with 48-inch RCP. Lower the 10th Ave. N. pond NWL by 1.5 ft (from 5 ft-NGVD to 3.5 ft-NGVD). Add control structures to this 1.7-acre pond, including a 6-inch drawdown orifice that controls the NWL and a weir for flood control (crest set 1.5 ft above the NWL for water quality treatment). To accommodate this new outfall, the reach along 10th Ave. N. would require inverts 2 ft below their current elevation.
- Map ID 7B (model node BV15080 to BV15030): Add parallel 370-ft section of 24-inch RCP.
- Map ID 7C (model node BV24010 to BV15030): Add new 600-ft section of 18-inch RCP. The road flooding in problem area 7C resulted from the lack of a storm drain. The alignment of this new conveyance system would pick up drainage from mid-block on 11th St. N. south to 12th Ave. N. and into the 10th Ave. N. pond through a new easement.
- Map ID 8 (model node BV22010 to GRE01110): Add parallel 170-ft section of 24-inch RCP.
- Map ID 9 (model node BV23065 to GRE01120): Add parallel 619-ft section of 18-inch RCP. Add new 750-ft section of 24-inch RCP. The alignment of this new conveyance system would connect to the existing system at 14th Ave. N./12th St. N, convey west on 14th Ave. N. to approximately 11th St. N. and then north into the 15th Ave. N. pond through a new easement. Replace the existing 106-ft section

of double 12-inch RCP with 48-inch RCP. Replace the existing 1,010-ft section of 24-inch x 38-inch ERCP with 4-ft x 5-ft RCBC (or add an equivalent parallel pipe).

- Map ID 10 (model node BV27010): Lower the 15th Ave. N. pond NWL by 1.25 ft (from 4.75 ft-NGVD to 3.5 ft-NGVD). Add control structures to this 2.5-acre pond, including a 6-inch drawdown orifice that controls the NWL and a weir for flood control (crest set 1.5 ft above the NWL for water quality treatment).
- Map ID 11 (model node GRE01140 to GRE01130): Replace the existing 570-ft section of double 29-inch x 45-inch ERCP with two sections of triple 3-ft x 6-ft RCBC and a 200-ft open channel section in between road crossings.
- Map ID 12 (model node BV35045 to GRE01150): Add parallel 560-ft section of 36-inch RCP. Replace the existing 549-ft section of 24-inch x 38-inch ERCP with 4-ft x 7-ft RCBC. Replace the existing 891-ft section of 24-inch x 38-inch ERCP with 4-ft x 8-ft RCBC.
- Map ID 13 (model node BV42010 to GRE01160): Add parallel 887-ft section of 36-inch RCP.
- Map ID 14 (model node BV43030 to GRE01163): Replace the existing 817-ft section of 12-inch RCP with 4-ft x 8-ft RCBC. Replace the existing 53-ft section of 42-inch RCP with 4-ft x 9-ft RCBC. Replace the existing 154-ft section of triple 29-inch x 45-inch ERCP with 4-ft x 10-ft RCBC. Replace the existing 1,392-ft section of 54-inch RCP with 5-ft x 9-ft RCBC. Add parallel 414-ft section of 18-in RCP. Lower the Diana Ave. pond NWL by 4.0 ft (from 8.26 ft-NGVD to 4.26 ft-NGVD). Add control structures to this 1.1-acre pond, including a 6-inch drawdown orifice that controls the NWL and a weir for flood control (crest set 1.5 ft above the NWL for water quality treatment). Although there is no proposed change to the existing NWL in the Naples High School pond (3.5 ft-NGVD, located at model node BV43010), Alternative 3 proposes to add control structures to this 0.2-acre pond, including a 6-inch drawdown orifice that controls the NWL and a weir for flood control (crest set 1.5 ft above the NWL for water quality treatment).
- Map ID 15 (model node GRE01160 to GRE01150): Replace the existing 200-ft section of 34-inch x 53-inch ERCP with 4-ft x 9-ft RCBC. Replace the existing 128-ft section of 48-inch x 76-inch ERCP with 4-ft x 9-ft RCBC.
- Map ID 17 (model node BV44030 to GRE01180): Add parallel 602-ft section of 48-inch RCP. Replace the existing 342-ft section of 18-inch RCP with 4-ft x 5-ft RCBC.
- Map ID 18 (model node BV44045 to GRE01192): Add parallel 331-ft section of 18-inch RCP. Add parallel 210-ft section of 24-inch RCP.
- Map ID 19 (model node BV44050 to GRE01200): Replace the existing 240-ft section of 24-inch RCP with 48-inch RCP.

- Map ID 20 (model node BV43067 to GRE01220): Add parallel 842-ft section of 18-inch RCP. Replace the existing 857-ft section of 24-inch RCP with 4-ft x 6-ft RCBC.
- Map ID 21 (model node BV46010 to BV43060): Add parallel 97-ft section of 24-inch RCP. There is no proposed modification to the existing NWL in the 28th Ave. N. pond.
- Map ID 22 (model node BV47010 to GRE01230): Add parallel 228-ft section of 48-inch RCP. There is no proposed modification to the existing NWL in the 14th St. N. pond.
- Map ID 23 (model node GRE01192 to GRE01190): Modify the configuration of the existing control structure in the Goodlette-Frank Road ditch. This modification includes lowering the crest elevation of the weir and notch to 5.0 and 4.4 ft-NGVD, respectively. This modification lowers the existing weir crest and notch by approximately 1.0 ft. This is similar to Map ID 5 in Alternative 1 as shown on Figure 6-1.
- Map ID 24 (model node GRE01190 to GRE03040): Replace the existing 150-ft section of 48-inch by 76-inch ERCP under Goodlette-Frank Road with 4-ft by 10-ft RCBC. This is similar to Map ID 6 in Alternative 1 as shown on Figure 6-1.
- Map ID 25 (model node GRE03040 to GRE00160): Widen the existing 2,593-ft section of open channel along Reach 03 (adjacent to the proposed stormwater management facility at Map ID 26). The proposed channel cross section is to have a depth of approximately 5 ft, a bottom width of 10 ft, and a top width of 45 ft. This is similar to Map ID 21 in Alternative 1 as shown on Figure 6-1.
- Map ID 26 (adjacent to model node GRE03040): Construct a 27-acre stormwater management facility on the vacant parcel along the south bank of Reach 03. The hydraulics of this facility include the construction of a trapezoidal channel for the inlet, construction of a high flow diversion weir adjacent to the inlet which allows peak flow to overflow into the existing natural channel, and the construction of a broad crested weir along the eastern bank of the facility to allow outflow to sheet flow through the existing wetlands, back into the existing system. The surface area of the pond is approximately 24 acres at the initial water level of 3.5 ft-NGVD, which is consistent with the seasonal high groundwater table assumption used throughout Basin V. The weir crest of the outlet control structure (and the diversion weir to Reach 03) was set at an elevation of 4.5 ft-NGVD. This is similar to Map ID 22 in Alternative 1 as shown on Figure 6-1.

Alternative 3 includes a combination of conveyance and detention improvements depending on the unique hydraulic response in each problem area. Improvement projects were developed using the same methodology as Alternative 2 improvements as described in Section 6.2.1.

Proposed modifications to existing detention facilities in Basin V were noted in the map ID descriptions above and include:

- 13th St. N. wet pond (model node BV11040);
- 10th Ave. N. wet pond (model node BV15030);
- 15th Ave. N. wet pond (model node BV27010);
- Diana Ave. wet pond (model node BV43030).

Existing detention facilities that were not modified due to limited benefit in improving LOS at existing problem areas include:

- 6th Ave. N./12th St. N. wet pond (model node BV12019);
- 14th Ave. N./US 41 wet pond (model node BV26025);
- Coastland Center mall dry pond (model node BV33055);
- Naples High School dry pond (model node BV43080);
- 28th Ave. N. wet pond (model node BV46010);
- 14th St. N wet pond (model node BV47010).

Map ID 26 represents a new detention facility proposed in the Fleischmann parcel in order to meet the peak flow and runoff volume requirements as described below in Section 6.3.2.

6.3.2 Level of Service Evaluation – Alternative 3

The resulting peak flood stages for Alternative 3 within the Basin V PSMS are presented in **Table 6-10**. Model results for each of the four design storm events are presented and the difference between existing system peak stages as presented in Table 5-1 are given.

The benefit of reduced flood stages is indicated throughout Basin V PSMS. Peak flood stages are reduced by up to 2.6 ft for the 5-yr/24-hr event and up to 1.9 ft for the 100-yr/72-hr event. Similar to Alternatives 1 and 2, the reduction in peak flood stages south of Fleischmann Boulevard (model node GRE01130) are somewhat diminished by the increase in flows along Goodlette-Frank Road due to the cumulative conveyance improvements upstream. Peak flood stages south of Fleischmann Boulevard increase by up to 0.6 ft for the 25-yr/72-hr event.

The LOS provided by the proposed Alternative 3 improvements was determined by comparing predicted peak flood stages to the threshold elevations as shown in

TABLE 6-10
City of Naples - Basin V Stormwater System Improvement Plan, Phase I
Peak Flood Stage Comparison - Alternative 3

Junction Name	Location	5-yr/24-hr Event		10-yr/72-hr Event		25-yr/72-hr Event		100-yr/72-hr Event	
		Peak Stage (ft-NGVD)	Difference (ft)	Peak Stage (ft-NGVD)	Difference (ft)	Peak Stage (ft-NGVD)	Difference (ft)	Peak Stage (ft-NGVD)	Difference (ft)
GRE01020	Outfall to Golden Gate Canal Confluence	5.1	0.4	5.5	0.4	5.9	0.1	6.4	0.0
BV12010		5.7	-0.5	6.3	-0.4	6.7	-0.3	7.0	-0.3
BV12019	control structure from 6th Avenue Pond	5.8	-0.5	6.3	-0.4	6.8	-0.3	7.1	-0.3
BV13020	Alley	5.9	-1.6	6.4	-1.2	6.8	-0.9	7.2	-0.7
BV13021	10th Street North	5.8	-1.0	6.4	-0.6	6.8	-0.3	7.1	-0.3
BV13010	6th Avenue North	6.2	-0.1	6.5	-0.3	6.8	-0.3	7.1	-0.2
BV14005	intersection of 6th Avenue North and Tamiami Tr N	7.7	-0.4	8.2	-0.1	8.6	-0.1	8.8	-0.1
BV14010	intersection of US 41 and 5th Avenue North	7.3	-0.3	7.8	-0.1	8.0	-0.1	8.4	-0.2
BV14015	intersection of US 41 and 3rd Avenue North	6.2	-0.5	6.8	-0.5	7.3	-0.6	8.0	-0.4
BV14020	intersection of US 41 and 6th Avenue North	8.0	-0.4	8.7	-0.1	9.1	-0.1	9.5	-0.2
BV14025	US 41, u/s of 6th Avenue North	8.5	-0.5	9.3	-0.2	9.7	-0.2	10.3	-0.3
BV14030	US 41, d/s of 7th Avenue North	8.8	-0.6	9.6	-0.2	10.0	-0.2	10.4	-0.3
BV14040	intersection of US 41 and 7th Avenue North	9.1	-0.7	9.9	-0.2	10.3	-0.2	10.6	-0.2
BV14045	US 41, d/s of 8th Avenue North	9.2	-0.8	10.0	-0.3	10.4	-0.2	10.7	-0.2
BV14050	intersection of US 41 and 8th Avenue North	9.2	-0.8	10.1	-0.3	10.5	-0.2	10.7	-0.2
BV14055	US 41, u/s of 8th Avenue North	9.3	-0.8	10.1	-0.4	10.5	-0.2	10.8	-0.2
BV14060	d/s end of crossing at intersection of US 41 and 10th Avenue	9.3	-0.8	10.1	-0.4	10.5	-0.2	10.8	-0.3
BV14065	u/s end of crossing at intersection of US 41 and 10th Avenue	9.3	-0.8	10.1	-0.4	10.5	-0.2	10.8	-0.4
BV14070	US 41, u/s of 10th Avenue	9.3	-0.9	10.1	-0.4	10.5	-0.3	10.8	-0.5
BV14075	US 41, d/s of 12th Avenue North	9.3	-0.9	10.1	-0.5	10.5	-0.3	10.9	-0.5
BV26005	US 41, u/s of 12th Avenue North	9.4	-0.8	10.1	-0.5	10.5	-0.4	10.9	-0.4
BV26010	US 41, d/s of 14th Avenue North	9.3	-0.8	10.0	-0.4	10.4	-0.5	11.0	-0.4
BV26015	US 41, d/s of 14th Avenue North	9.3	-0.7	9.9	-0.5	10.5	-0.4	11.1	-0.3
BV26020	US 41, u/s of 14th Avenue North	9.3	-0.5	9.9	-0.6	10.6	-0.4	11.1	-0.3
BV26025	pond west of US 41	9.4	-0.4	10.0	-0.5	10.6	-0.4	11.1	-0.3
BV26026	pond west of US 41	9.4	-0.4	10.0	-0.5	10.6	-0.4	11.1	-0.3
BV26030	US 41, u/s of 14th Avenue North	9.4	-0.5	9.9	-0.6	10.6	-0.4	11.1	-0.3
BV26035	US 41, d/s of Fleischmann Boulevard	9.6	-0.3	10.1	-0.4	10.7	-0.3	11.1	-0.3
BV26040	intersection of US 41 and Fleischmann Boulevard	9.7	-0.2	10.1	-0.4	10.7	-0.3	11.1	-0.3
BV34010	US 41, u/s of Fleischmann Boulevard	9.6	-0.3	10.1	-0.4	10.7	-0.3	11.1	-0.3
BV33056	retention area at west side of mall	8.5	-0.6	9.4	-0.6	10.1	-0.4	10.5	-0.4
BV33055	retention area at west side of mall	8.5	-0.6	9.4	-0.6	10.1	-0.4	10.5	-0.4
BV34020	US 41, west of Coastland Mall	9.7	-0.3	10.4	-0.3	11.1	-0.1	11.5	-0.1
BV34030	US 41, west of Coastland Mall	9.7	-0.3	10.4	-0.3	11.1	-0.1	11.5	-0.1
BV34040	south of US 41 and Golden Gate Parkway intersection	10.4	-0.3	11.1	0.0	11.5	-0.1	11.8	0.0
BV12020	12th Street North	5.8	-0.5	6.3	-0.4	6.8	-0.3	7.1	-0.3
BV12030	intersection of 7th Avenue North and 12th Street North	5.9	-0.4	6.3	-0.4	6.8	-0.3	7.1	-0.3
BV12040	7th Avenue North	5.5	-0.4	5.9	-0.4	6.3	-0.3	6.7	-0.3
BV24010	east of 11th Street North	9.6	-0.2	9.8	-0.2	9.9	-0.2	10.0	-0.5
GRE01030	Goodlette-Frank Road	5.5	0.3	5.8	0.2	6.1	0.1	6.5	0.0
GRE01040	Goodlette-Frank Road	5.7	0.2	6.0	0.2	6.2	0.1	6.5	0.0
GRE01050	Goodlette-Frank Road	6.1	0.1	6.3	0.1	6.5	0.0	6.7	0.0
GRE01060	Goodlette-Frank Road	6.2	0.1	6.4	0.1	6.6	0.0	6.9	0.0
BV11007	u/s of intersection of 8th Ave N and Goodlette-Frank Road	6.2	0.1	6.4	0.1	6.6	0.0	6.9	0.0
BV11010	intersection of 8th Avenue North and 12th Street North	6.3	-0.4	6.5	-0.4	6.7	-0.4	6.9	-0.3
BV11020	8th Avenue North	6.4	-1.2	6.7	-1.4	7.0	-1.4	7.3	-1.2

TABLE 6-10
City of Naples - Basin V Stormwater System Improvement Plan, Phase I
Peak Flood Stage Comparison - Alternative 3

Junction Name	Location	5-yr/24-hr Event		10-yr/72-hr Event		25-yr/72-hr Event		100-yr/72-hr Event	
		Peak Stage (ft-NGVD)	Difference (ft)	Peak Stage (ft-NGVD)	Difference (ft)	Peak Stage (ft-NGVD)	Difference (ft)	Peak Stage (ft-NGVD)	Difference (ft)
GRE01070	Goodlette-Frank Road	6.4	0.1	6.6	0.1	6.9	0.2	7.2	0.2
BV11030	13th Street North	7.0	0.0	7.3	0.1	7.4	0.0	7.6	0.0
BV11040	Pond west of 13th Street North	7.0	0.0	7.3	0.1	7.4	0.0	7.6	0.0
GRE01080	Goodlette-Frank Road	6.5	0.2	6.8	0.3	7.1	0.3	7.4	0.4
GRE01090	Goodlette-Frank Road	6.7	0.3	7.0	0.2	7.4	0.2	7.9	0.2
BV11070	d/s end of crossing at 10th Ave N and 13th St N	6.9	-1.2	7.4	-0.9	7.9	-0.5	8.2	-0.3
BV11060	u/s end of crossing at 10th Ave N and 13th St N	7.1	-1.5	7.6	-1.0	8.2	-0.5	8.5	-0.2
BV15010	d/s end of 12th Street North crossing	7.4	-1.2	8.1	-1.1	8.7	-0.9	9.1	-0.7
BV15020	u/s end of 12th Street North crossing(1)	7.5	-1.2	8.3	-1.3	8.8	-1.1	9.4	-1.1
BV15030	pond at 12th Street North	7.8	-1.1	8.5	-1.2	9.1	-1.0	9.7	-0.8
BV15070	11th Street North(8)	7.7	-1.1	8.5	-1.2	9.1	-1.0	9.7	-0.8
BV15080	intersection of 11th Street North and 10th Street North	7.7	-1.2	8.7	-1.0	9.1	-1.0	9.7	-0.8
BV15090	intersection of 11th Street North and 10th Street North	7.6	-1.2	8.5	-1.3	9.1	-1.0	9.7	-0.8
BV15040	intersection of 11th Street North and 10th Avenue North	8.1	-0.8	8.7	-1.0	9.2	-0.9	9.7	-0.8
BV15050	10th Avenue North	8.9	-0.1	9.1	-0.7	9.4	-0.8	10.0	-0.5
BV15060	intersection of 10th Avenue North and 10th Street North	8.3	-0.6	8.8	-1.0	9.4	-0.8	10.0	-0.5
GRE01100	Goodlette-Frank Road	6.6	0.2	6.9	0.3	7.3	0.4	7.6	0.5
BV11050	north of 12th Avenue North	8.0	0.0	8.0	0.0	8.0	0.0	8.0	0.0
GRE01110	Goodlette-Frank Road	6.5	0.1	6.9	0.3	7.2	0.4	7.6	0.3
BV22010	14th Avenue North	7.3	-0.3	7.5	-0.2	7.7	-0.1	7.8	-0.1
GRE01120	Goodlette-Frank Road	6.0	0.3	6.6	0.5	7.0	0.6	7.4	0.6
BV23005	north of Lake Park Elementary School	6.3	-2.1	6.8	-1.8	7.3	-1.5	7.7	-1.3
BV23010	corner of 15th Avenue North and 12th Street North	6.3	-2.1	6.8	-1.8	7.3	-1.5	7.7	-1.3
BV23011	15th Avenue North	6.3	-2.1	6.8	-1.8	7.2	-1.5	7.7	-1.3
BV27010	Pond north of 14th Avenue North	6.4	-0.6	6.9	-1.0	7.4	-1.1	7.8	-1.1
BV27020	15th Avenue North	6.5	-0.6	6.9	-1.0	7.4	-1.1	7.8	-1.1
BV23015	d/s end of 14th Avenue North crossing	6.9	-1.4	7.5	-1.1	7.7	-1.1	7.9	-1.1
BV23020	u/s end of 14th Avenue North crossing	7.1	-1.2	7.6	-0.9	7.8	-0.9	8.0	-0.9
BV23025	intersection of 12th Street North and 14th Avenue North	7.3	-1.0	7.9	-0.7	8.0	-0.8	8.2	-0.7
BV23030	intersection of 12th Street North and 14th Avenue North	7.1	-1.2	7.6	-0.9	8.0	-0.8	8.2	-0.7
BV23035	intersection of 12th Street North and 14th Avenue North	7.3	-0.9	7.8	-0.7	8.0	-0.7	8.2	-0.7
BV23040	intersection of 12th Street North and 14th Avenue North	7.3	-0.9	7.8	-0.7	8.0	-0.7	8.2	-0.7
BV23045	12th Street North, south of 14th Avenue North	7.3	-0.8	7.8	-0.6	8.0	-0.6	8.2	-0.7
BV23050	12th Street North, south of 14th Avenue North	7.3	-0.7	7.8	-0.6	8.0	-0.5	8.2	-0.7
BV23055	12th Street North, north of 13th Avenue North	7.2	-0.8	7.7	-0.7	8.0	-0.5	8.2	-0.7
BV23060	d/s end of 13th Avenue North crossing	7.1	-0.8	7.7	-0.7	8.0	-0.5	8.2	-0.7
BV23065	u/s end of 13th Avenue North crossing	7.2	-0.8	7.7	-0.7	8.0	-0.5	8.2	-0.7
BV23070	south of 13th Avenue North	6.5	0.0	6.8	-0.4	7.0	-1.4	7.3	-1.7
GRE01130	intersection of Fleschmann Ave and Goodlette-Frank Road	7.2	0.8	7.2	0.7	7.2	0.6	7.4	0.6
GRE01140	along Goodlette-Frank Road	7.5	-0.7	7.8	-0.9	8.1	-0.9	8.2	-0.9
GRE01150	along Goodlette-Frank Road	7.6	-0.6	8.0	-0.7	8.2	-0.8	8.3	-0.8
BV35010	Golden Gate Parkway	7.6	-0.7	8.0	-0.7	8.3	-0.7	8.5	-0.8
BV35020	Golden Gate Parkway	7.6	-1.4	8.1	-1.6	8.5	-1.7	8.7	-1.6
BV35030	Golden Gate Parkway	7.8	-1.4	8.3	-1.5	8.6	-1.5	8.9	-1.4
BV35040	Golden Gate Parkway	7.9	-1.4	8.5	-1.3	9.0	-1.1	9.5	-0.9
BV43098	baseball fields at Naples High School (outfall to south)	7.9	-1.4	8.6	-1.2	9.2	-1.1	9.7	-0.8

TABLE 6-10
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Peak Flood Stage Comparison - Alternative 3

Junction Name	Location	5-yr/24-hr Event		10-yr/72-hr Event		25-yr/72-hr Event		100-yr/72-hr Event	
		Peak Stage (ft-NGVD)	Difference (ft)	Peak Stage (ft-NGVD)	Difference (ft)	Peak Stage (ft-NGVD)	Difference (ft)	Peak Stage (ft-NGVD)	Difference (ft)
BV35045	Golden Gate Parkway	7.8	-1.4	8.4	-1.4	8.7	-1.4	9.0	-1.4
BV35050	Golden Gate Parkway	8.2	-1.1	8.7	-1.1	8.9	-1.2	9.1	-1.3
GRE01155	along Goodlette-Frank Road	7.8	-0.5	8.3	-0.5	8.5	-0.5	8.8	-0.5
GRE01160	along Goodlette-Frank Road	8.1	-0.8	8.7	-0.8	9.0	-0.8	9.3	-0.8
BV42020	Golden Gate Parkway	8.4	-0.7	8.9	-0.7	9.4	-0.5	9.7	-0.3
BV42010	Golden Gate Parkway	8.4	-1.0	9.0	-1.0	9.6	-0.6	10.0	-0.4
GRE01170	along Goodlette-Frank Road	8.1	-0.7	8.6	-0.8	8.9	-0.8	9.2	-0.8
BV44005	intersection of 22nd Avenue North and 14th Street North	9.2	-0.1	9.4	0.0	9.5	-0.3	9.6	-0.5
BV44010	22nd Avenue North	9.5	-0.1	9.7	0.0	9.8	0.0	9.9	-0.2
GRE01180	along Goodlette-Frank Road	8.1	-0.3	8.4	-0.7	8.5	-0.9	8.6	-1.1
BV44015	14th Street North, north of 22nd Avenue North	8.2	-0.6	8.5	-0.6	8.7	-0.7	8.8	-0.9
BV44020	intersection of 14th Street North and Royal Palm Drive	8.2	-1.3	8.6	-1.0	8.9	-0.8	9.1	-0.8
BV44025	intersection of Royal Palm Drive and 13th Street North	8.5	-1.5	8.9	-1.1	9.2	-0.9	9.5	-0.7
BV44030	Royal Palm Drive, u/s of 13th Street North	8.8	-1.5	9.2	-1.1	9.6	-0.8	9.9	-0.6
BV44035	Royal Palm Drive, u/s of 13th Street North	8.2	-1.7	8.4	-1.8	8.4	-1.9	8.5	-1.9
GRE01188	along Goodlette-Frank Road	8.1	-0.3	8.4	-0.7	8.5	-0.9	8.5	-1.2
GRE01190	along Goodlette-Frank Road	5.6	-2.6	6.6	-2.3	7.3	-1.9	7.9	-1.6
GRE01192	along Goodlette-Frank Road	6.6	-1.8	7.2	-1.9	7.6	-1.8	8.1	-1.6
BV44040	intersection of 14th Street North and Diana Avenue	8.5	-2.0	8.6	-2.1	9.5	-1.4	10.4	-0.7
BV44045	intersection of Diana Avenue and 13th Street North	9.4	-1.1	9.8	-0.9	10.2	-0.8	10.4	-0.7
GRE01200	along Goodlette-Frank Road	8.3	-0.2	8.7	-0.4	8.8	-0.6	8.8	-0.9
BV44050	intersection of 14th Street North and 26th Avenue North	10.3	-0.9	10.7	-0.6	10.9	-0.5	11.2	-0.4
BV44055	intersection of 13th Street North and 26th Avenue North	11.2	-0.5	11.7	-0.1	11.9	-0.1	12.1	-0.1
GRE01210	along Goodlette-Frank Road	8.8	0.0	9.5	-0.3	10.0	-0.2	10.1	-0.4
GRE01220	along Goodlette-Frank Road	9.0	0.0	9.6	-0.2	10.1	-0.2	10.3	-0.4
BV43045	d/s end of 14th Street North & 28th Ave N crossing	9.0	-0.1	9.6	-0.3	10.1	-0.3	10.3	-0.5
BV43050	u/s end of 14th Street North & 28th Ave N crossing	9.0	-0.2	9.6	-0.4	10.1	-0.3	10.3	-0.7
BV43055	intersection of 28th Avenue North and 12th Street North	9.0	-1.9	9.6	-1.5	10.1	-1.2	10.3	-1.3
BV43060	d/s end of 28th Avenue North & 12th St N crossing	9.0	-1.7	9.7	-1.1	10.2	-0.8	10.6	-1.0
BV46010	Pond south of 28th Avenue North	8.9	-0.2	9.7	-0.5	10.2	-0.7	10.6	-1.0
BV46020	12th Street North, east of Pond	8.9	-0.2	9.7	-0.5	10.2	-0.7	10.6	-1.0
BV46040	east of 12th Street north	8.9	-0.2	9.7	-0.5	10.2	-0.7	10.6	-1.0
BV43063	intersection of 28th Avenue North and 12th Street North	10.4	-1.7	11.2	-1.1	12.0	-0.5	12.4	-0.2
BV43065	28th Avenue north, west of 12th Street North	10.8	-1.4	11.7	-0.7	12.4	-0.2	12.5	-0.1
BV43067	28th Avenue north, d/s of 10th Street North	12.4	-0.3	12.6	-0.2	12.8	-0.1	12.9	0.0
BV43070	d/s end of 10th Street North & 28th Ave N crossing	11.1	-0.6	11.6	-0.8	12.5	-0.1	12.7	-0.1
BV43075	u/s end of 10th Street North & 28th Ave N crossing	11.1	-0.5	11.6	-0.5	12.2	-0.5	12.7	-0.1
GRE01230	along Goodlette-Frank Road	9.0	0.0	9.6	-0.2	10.1	-0.2	10.3	-0.4
BV47010	pond north of 28th Avenue North	9.5	-0.8	10.4	-0.4	10.7	-0.4	10.9	-0.3
BV47020	east of 12th Street North	9.5	-0.8	10.4	-0.4	10.7	-0.4	10.9	-0.3
BV47030	south of 12th St North and 29th Ave North intersection	9.5	-0.8	10.4	-0.4	10.6	-0.3	10.8	-0.3
BV47040	south of 29th Ave North and 10th St North intersection	9.4	-0.7	9.7	-0.6	9.9	-0.5	10.1	-0.7
BV43030	pond north of Diana Avenue	10.0	-1.6	11.1	-0.9	11.4	-0.8	11.7	-0.7
BV43035	Diana Avenue, d/s of 10th Street North	9.6	-2.0	10.7	-1.3	11.1	-1.0	11.5	-0.9
BV43040	intersection of Diana Avenue and 10th Street North	9.4	-2.1	10.5	-1.5	10.9	-1.2	11.4	-0.9
BV43010	10th Street North, Naples High School baseball fields	8.5	-1.3	9.6	-0.6	10.1	-0.4	10.4	-0.4

TABLE 6-10
 City of Naples - Basin V Stormwater System Improvement Plan, Phase I
 Peak Flood Stage Comparison - Alternative 3

Junction Name	Location	5-yr/24-hr Event		10-yr/72-hr Event		25-yr/72-hr Event		100-yr/72-hr Event	
		Peak Stage (ft-NGVD)	Difference (ft)	Peak Stage (ft-NGVD)	Difference (ft)	Peak Stage (ft-NGVD)	Difference (ft)	Peak Stage (ft-NGVD)	Difference (ft)
BV43017	22nd Avenue North, south of 10th Street North	8.5	-1.7	9.7	-1.1	10.2	-0.8	10.6	-0.6
BV43018	intersection of 10th Avenue North and 22nd Avenue	8.8	-2.2	9.9	-1.4	10.3	-1.2	10.8	-0.9
BV43015	baseball fields at Naples High School	9.4	-0.4	9.9	-0.3	10.1	-0.4	10.4	-0.4
BV43005	baseball fields at Naples High School	8.3	-1.4	9.3	-0.8	9.8	-0.6	10.2	-0.5
BV43020	intersection of 22nd Avenue North and 11th Street North	8.5	-1.6	9.7	-1.1	10.2	-0.8	10.6	-0.6
BV43025	intersection of 11th Street North and Royal Palm Drive	9.3	-0.5	9.8	-0.4	10.1	-0.5	10.5	-0.4
BV43080	baseball fields at Naples High School	10.0	-0.1	10.2	-0.1	10.3	-0.2	10.5	-0.3
BV43085	baseball fields at Naples High School	8.4	-1.3	9.3	-0.8	9.8	-0.6	10.2	-0.5
BV43090	baseball fields at Naples High School	8.5	-1.2	9.3	-0.8	9.8	-0.6	10.2	-0.5
BV43095	baseball fields at Naples High School	8.9	-0.7	9.5	-0.6	9.7	-0.6	10.1	-0.5
BV43097	baseball fields at Naples High School	9.7	-0.1	9.8	-0.1	9.9	-0.4	10.0	-0.6
GRE01163	along Goodlette-Frank Road	8.1	-0.8	8.7	-0.8	9.0	-0.8	9.3	-0.7
BV44060	Naples High School	8.2	-1.1	9.0	-0.9	9.4	-0.7	9.8	-0.6
GRE01164	along Goodlette-Frank Road	8.1	-0.8	8.7	-0.8	9.0	-0.8	9.3	-0.7
GRE01167	along Goodlette-Frank Road	8.1	-0.7	8.6	-0.8	8.9	-0.8	9.2	-0.8
BV31010	Goodlette-Frank Road, east of Coastland Mall	7.3	0.1	7.6	-0.2	7.7	-0.3	7.8	-0.5
BV31040	Coastland Mall	7.9	-0.2	8.8	-0.4	9.1	-0.3	9.7	-0.3
BV31020	Goodlette-Frank Road, east of Coastland Mall	7.3	-0.6	7.6	-1.1	7.7	-1.2	7.8	-1.4
BV31030	Coastland Mall	7.5	-0.5	8.1	-0.8	8.3	-0.8	8.6	-0.9
BV31050	Coastland Mall	8.0	-0.2	8.9	-0.4	9.3	-0.2	10.1	-0.2
BV31060	Coastland Mall	8.1	-0.2	9.0	-0.3	9.5	-0.2	10.5	-0.2
BV31070	Coastland Mall	8.1	-0.1	9.1	-0.3	9.6	-0.2	10.6	-0.2
BV32010	Coastland Mall	8.3	-0.1	9.2	-0.2	9.8	-0.2	10.8	-0.2
BV35060	Coastland Mall	8.4	-0.1	9.3	-0.2	10.0	-0.1	11.0	-0.1
BV35070	Coastland Mall	8.6	0.0	9.4	-0.2	10.2	-0.1	11.2	-0.1
BV32020	Coastland Mall	8.8	0.0	9.6	-0.1	10.5	-0.1	11.5	-0.1
BV33060	Coastland Mall	8.9	0.0	9.7	-0.1	10.6	-0.1	11.7	-0.1
BV32030	Coastland Mall	8.0	-0.6	9.3	-0.3	9.5	-0.2	10.0	-0.3
BV32040	Coastland Mall	8.4	0.0	8.9	-0.5	10.4	0.0	11.0	-0.2
BV33010	Coastland Mall	8.1	-0.1	8.7	-0.1	9.3	-0.2	9.9	-0.2
BV33050	Coastland Mall	8.1	0.0	8.8	0.0	9.4	-0.1	10.0	-0.1
BV33020	Coastland Mall	8.4	0.0	8.7	-0.1	9.2	-0.2	9.6	-0.2
BV33040	Coastland Mall	8.3	0.0	8.7	-0.1	9.2	-0.2	9.6	-0.2
BV33030	Coastland Mall	8.3	0.0	8.6	-0.2	9.2	-0.2	9.6	-0.2

- Notes:
- | | | | | | |
|---|------|------|------|------|------|
| | max: | 0.8 | 0.7 | 0.6 | 0.6 |
| (1) - Peak flood stages have been rounded to the nearest tenth of a foot. | min: | -2.6 | -2.3 | -1.9 | -1.9 |
- (2) - Difference compares peak flood stage to existing conditions (Table 5-1).

Table 6-11. For each model junction, the name, location and threshold LOS elevations are given on the left side of Table 6-11. Peak flood stage results, road flooding depths, and LOS class (using the former class designations for the evaluation of the existing system and Alternatives 1 and 2) for the various design storm events are given on the right side of the table. The desired LOS criteria could not be achieved with a practical/feasible set of improvements at a number of locations. Locations where the Alternative 3 LOS criteria are not met are termed “LOS exceedances” and tabulated at the bottom of Table 6-11 and summarized as follows:

- 8 locations that overtop the road crown elevation for the 5-year/24-hour design storm event,
- 9 locations where overtopping exceeds 3 inches (0.25 ft) above the road crown elevation for the 10-year/72-hour design storm event,
- 6 locations where overtopping exceeds 6 inches (0.5 ft) above the road crown elevation for the 25-year/72-hour design storm event,
- 13 locations where overtopping exceeds 9 inches (0.75 ft) above the road crown elevation for the 100-year/72-hour design storm event,
- No building flooding for the 100-year/72-hour design storm event.

Table 6-12 shows a summary of the LOS evaluation for Alternative 3. For comparison purposes, the LOS class types used to evaluate Alternatives 1 and 2 are given. The number and overall percentage of locations that achieve a given LOS Class are tabulated for each design storm event. There are a total of 172 junctions that have a defined LOS class within the Basin V PSMS. The table indicates significant benefits to the Basin V PSMS in terms of LOS Class improvements. Compared to the existing system, there is a net improvement of 55 LOS Class C exceedances for the 25-yr/72-hr event.

As shown in Tables 6-11 and 6-12, there are 6 locations where the desired LOS was not achieved by Alternative 3 improvements for the 25-yr/72-hr event. These are grouped by map ID/problem area in the following list:

- Map ID 1A (model node BV13010): Although peak flood stages decrease by 0.3 ft compared to existing conditions for the 25-yr/72-hr design storm event, the low road crown elevation results in this location exceeding the desired LOS criteria. The yard and road crown elevations are much lower than adjacent model nodes. It may be possible to achieve the desired LOS by adding a berm around the 6th Ave. N./12th St. N. pond and installing a flap gate on the inflow pipe. This option was not evaluated in Alternative 3.
- Map ID 3 (model nodes BV12020 and BV12030): Although peak flood stages decrease by 0.3 ft at both locations compared to existing conditions for the 25-yr/72-hr design storm event, the low road crown elevations result in these two

TABLE 6-11
 City of Naples - Basin V Stormwater System Improvement Plan, Phase I
 Proposed System LOS Evaluation - Alternative 3

Junction Name	Location	Road Crown Elevation (ft-NGVD)	Yard Elevation (ft-NGVD)	Structure Elevation (ft-NGVD)	5-yr/24-hr Event			10-yr/72-hr Event			25-yr/72-hr Event			100-yr/72-hr Event				
					Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	Bldg Flood Depth (ft)	LOS ⁽³⁾	
GRE01020	Outfall to Golden Gate Canal Confluence	6.5	6.3	7.0	5.1		A	5.5		A	5.9		A	6.4				B
BV12010		n/a	n/a	n/a	5.7		A	6.3		A	6.7		A	7.0				A
BV12019	control structure from 6th Avenue Pond	n/a	n/a	n/a	5.8		A	6.3		A	6.8		A	7.1				A
BV13020	Alley	7.1	7.9	9.5	5.9		A	6.4		A	6.8		A	7.2	0.1			C
BV13021	10th Street North	6.4	6.6	8.8	5.8		A	6.4		A	6.8	0.4	C	7.1	0.7			D
BV13010	6th Avenue North	5.9	5.5	n/a	6.2	0.4	C	6.5	0.6	D	6.8	0.9	D	7.1	1.2			D
BV14005	intersection of 6th Avenue North and Tamiami Tr N	9.0	n/a	n/a	7.7		A	8.2		A	8.6		A	8.8				A
BV14010	intersection of US 41 and 5th Avenue North	8.1	n/a	n/a	7.3		A	7.8		A	8.0		A	8.4	0.3			C
BV14015	intersection of US 41 and 3rd Avenue North	7.9	n/a	n/a	6.2		A	6.8		A	7.3		A	8.0	0.2			C
BV14020	intersection of US 41 and 6th Avenue North	9.8	n/a	n/a	8.0		A	8.7		A	9.1		A	9.5				A
BV14025	US 41, u/s of 6th Avenue North	10.9	n/a	n/a	8.5		A	9.3		A	9.7		A	10.3				A
BV14030	US 41, d/s of 7th Avenue North	9.6	n/a	n/a	8.8		A	9.6		A	10.0	0.4	C	10.4	0.8			D
BV14040	intersection of US 41 and 7th Avenue North	n/a	n/a	n/a	9.1		A	9.9		A	10.3		A	10.6				A
BV14045	US 41, d/s of 8th Avenue North	10.4	n/a	n/a	9.2		A	10.0		A	10.4		A	10.7	0.3			C
BV14050	intersection of US 41 and 8th Avenue North	10.2	n/a	n/a	9.2		A	10.1		A	10.5	0.2	C	10.7	0.5			D
BV14055	US 41, u/s of 8th Avenue North	10.4	n/a	n/a	9.3		A	10.1		A	10.5	0.1	C	10.8	0.4			C
BV14060	d/s end of crossing at intersection of US 41 and 10th Avenue	10.0	n/a	n/a	9.3		A	10.1	0.1	C	10.5	0.5	C	10.8	0.8			D
BV14065	u/s end of crossing at intersection of US 41 and 10th Avenue	10.8	n/a	n/a	9.3		A	10.1		A	10.5		A	10.8	0.0			C
BV14070	US 41, u/s of 10th Avenue	10.4	n/a	n/a	9.3		A	10.1		A	10.5	0.1	C	10.8	0.4			C
BV14075	US 41, d/s of 12th Avenue North	10.5	n/a	n/a	9.3		A	10.1		A	10.5		A	10.9	0.4			C
BV26005	US 41, u/s of 12th Avenue North	10.4	n/a	n/a	9.4		A	10.1		A	10.5	0.2	C	10.9	0.6			D
BV26010	US 41, d/s of 14th Avenue North	10.2	n/a	n/a	9.3		A	10.0		A	10.4	0.2	C	11.0	0.8			D
BV26015	US 41, d/s of 14th Avenue North	10.5	n/a	n/a	9.3		A	9.9		A	10.5	0.0	C	11.1	0.6			D
BV26020	US 41, u/s of 14th Avenue North	11.2	n/a	n/a	9.3		A	9.9		A	10.6		A	11.1				A
BV26025	pond west of US 41	n/a	n/a	n/a	9.4		A	10.0		A	10.6		A	11.1				A
BV26026	pond west of US 41	n/a	n/a	n/a	9.4		A	10.0		A	10.6		A	11.1				A
BV26030	US 41, u/s of 14th Avenue North	n/a	n/a	n/a	9.4		A	9.9		A	10.6		A	11.1				A
BV26035	US 41, d/s of Fleischmann Boulevard	11.7	n/a	n/a	9.6		A	10.1		A	10.7		A	11.1				A
BV26040	intersection of US 41 and Fleischmann Boulevard	11.9	n/a	n/a	9.7		A	10.1		A	10.7		A	11.1				A
BV34010	US 41, u/s of Fleischmann Boulevard	11.5	n/a	n/a	9.6		A	10.1		A	10.7		A	11.1				A
BV33056	retention area at west side of mall	n/a	n/a	n/a	8.5		A	9.4		A	10.1		A	10.5				A
BV33055	retention area at west side of mall	n/a	n/a	n/a	8.5		A	9.4		A	10.1		A	10.5				A
BV34020	US 41, west of Coastland Mall	11.3	n/a	n/a	9.7		A	10.4		A	11.1		A	11.5	0.2			C
BV34030	US 41, west of Coastland Mall	11.4	n/a	n/a	9.7		A	10.4		A	11.1		A	11.5	0.1			C
BV34040	south of US 41 and Golden Gate Parkway intersection	11.5	n/a	n/a	10.4		A	11.1		A	11.5		A	11.8	0.3			C
BV12020	12th Street North	5.3	5.3	7.5	5.8	0.5	C	6.3	1.0	D	6.8	1.5	D	7.1	1.8			D
BV12030	intersection of 7th Avenue North and 12th Street North	5.5	5.9	7.6	5.9	0.4	C	6.3	0.8	D	6.8	1.3	D	7.1	1.6			D
BV12040	7th Avenue North	7.0	6.3	8.4	5.5		A	5.9		A	6.3		B	6.7				B
BV24010	east of 11th Street North	9.5	9.0	11.4	9.6	0.2	C	9.8	0.3	C	9.9	0.4	C	10.0	0.5			C
GRE01030	Goodlette-Frank Road	6.7	6.5	7.0	5.5		A	5.8		A	6.1		A	6.5				A
GRE01040	Goodlette-Frank Road	6.9	6.7	7.5	5.7		A	6.0		A	6.2		A	6.5				A
GRE01050	Goodlette-Frank Road	7.1	6.9	7.5	6.1		A	6.3		A	6.5		A	6.7				A
GRE01060	Goodlette-Frank Road	7.3	7.1	7.5	6.2		A	6.4		A	6.6		A	6.9				A
BV11007	u/s of intersection of 8th Ave N and Goodlette-Frank Road	5.8	4.5	n/a	6.2	0.4	C	6.4	0.7	D	6.6	0.8	D	6.9	1.1			D
BV11010	intersection of 8th Avenue North and 12th Street North	6.2	5.7	n/a	6.3	0.1	C	6.5	0.3	C	6.7	0.4	C	6.9	0.6			D
BV11020	8th Avenue North	7.2	6.9	8.8	6.4		A	6.7		A	7.0		B	7.3	0.2			C
GRE01070	Goodlette-Frank Road	7.5	7.3	8.8	6.4		A	6.6		A	6.9		A	7.2				A
BV11030	13th Street North	7.4	5.9	n/a	7.0		B	7.3		B	7.4	0.1	C	7.6	0.2			C
BV11040	Pond west of 13th Street North	n/a	n/a	n/a	7.0		A	7.3		A	7.4		A	7.6				A
GRE01080	Goodlette-Frank Road	7.6	7.4	7.8	6.5		A	6.8		A	7.1		A	7.4				A
GRE01090	Goodlette-Frank Road	7.7	7.5	8.0	6.7		A	7.0		A	7.4		A	7.9	0.2			C
BV11070	d/s end of crossing at 10th Ave N and 13th St N	7.7	6.9	n/a	6.9		A	7.4		B	7.9	0.2	C	8.2	0.6			D

TABLE 6-11
 City of Naples - Basin V Stormwater System Improvement Plan, Phase I
 Proposed System LOS Evaluation - Alternative 3

Junction Name	Location	Road Crown Elevation (ft-NGVD)	Yard Elevation (ft-NGVD)	Structure Elevation (ft-NGVD)	5-yr/24-hr Event			10-yr/72-hr Event			25-yr/72-hr Event			100-yr/72-hr Event			
					Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	Bldg Flood Depth (ft)	LOS ⁽³⁾
BV11060	u/s end of crossing at 10th Ave N and 13th St N	7.9	8.2	9.5	7.1		A	7.6		A	8.2	0.3	C	8.5	0.6		D
BV15010	d/s end of 12th Street North crossing	9.5	9.5	11.4	7.4		A	8.1		A	8.7		A	9.1			A
BV15020	u/s end of 12th Street North crossing ⁽¹⁾	10.2	9.3	n/a	7.5		A	8.3		A	8.8		A	9.4			B
BV15030	pond at 12th Street North	n/a	n/a	n/a	7.8		A	8.5		A	9.1		A	9.7			A
BV15070	11th Street North(8)	9.0	9.7	11.5	7.7		A	8.5		A	9.1	0.1	C	9.7	0.6		D
BV15080	intersection of 11th Street North and 10th Street North	8.6	n/a	n/a	7.7		A	8.7	0.1	C	9.1	0.5	C	9.7	1.0		D
BV15090	intersection of 11th Street North and 10th Street North	9.2	n/a	12.9	7.6		A	8.5		A	9.1		A	9.7	0.5		C
BV15040	intersection of 11th Street North and 10th Avenue North	9.1	n/a	n/a	8.1		A	8.7		A	9.2	0.1	C	9.7	0.6		D
BV15050	10th Avenue North	10.1	10.3	12.6	8.9		A	9.1		A	9.4		A	10.0			A
BV15060	intersection of 10th Avenue North and 10th Street North	9.5	9.4	11.1	8.3		A	8.8		A	9.4		B	10.0	0.5		C
GRE01100	Goodlette-Frank Road	7.8	7.6	8.0	6.6		A	6.9		A	7.3		A	7.6			A
BV11050	north of 12th Avenue North	9.1	8.2	10.0	8.0		A	8.0		A	8.0		A	8.0			A
GRE01110	Goodlette-Frank Road	7.9	7.7	8.5	6.5		A	6.9		A	7.2		A	7.6			A
BV22010	14th Avenue North	7.2	6.9	9.9	7.3	0.1	C	7.5	0.3	C	7.7	0.5	C	7.8	0.6		D
GRE01120	Goodlette-Frank Road	8.0	7.8	8.5	6.0		A	6.6		A	7.0		A	7.4			A
BV23005	north of Lake Park Elementary School	8.7	7.4	n/a	6.3		A	6.8		A	7.3		A	7.7			B
BV23010	corner of 15th Avenue North and 12th Street North	7.4	n/a	n/a	6.3		A	6.8		A	7.3		A	7.7	0.3		C
BV23011	15th Avenue North	7.2	n/a	n/a	6.3		A	6.8		A	7.2		A	7.7	0.4		C
BV27010	Pond north of 14th Avenue North	n/a	n/a	n/a	6.4		A	6.9		A	7.4		A	7.8			A
BV27020	15th Avenue North	6.6	n/a	n/a	6.5		A	6.9	0.3	C	7.4	0.7	D	7.8	1.2		D
BV23015	d/s end of 14th Avenue North crossing	7.4	7.6	9.6	6.9		A	7.5	0.1	C	7.7	0.3	C	7.9	0.5		D
BV23020	u/s end of 14th Avenue North crossing	7.9	7.2	n/a	7.1		A	7.6		B	7.8		B	8.0	0.1		C
BV23025	intersection of 12th Street North and 14th Avenue North	7.9	7.4	n/a	7.3		A	7.9		B	8.0	0.1	C	8.2	0.3		C
BV23030	intersection of 12th Street North and 14th Avenue North	7.7	7.5	10.0	7.1		A	7.6		B	8.0	0.3	C	8.2	0.6		D
BV23035	intersection of 12th Street North and 14th Avenue North	7.9	n/a	n/a	7.3		A	7.8		A	8.0	0.2	C	8.2	0.4		C
BV23040	intersection of 12th Street North and 14th Avenue North	8.1	7.4	n/a	7.3		A	7.8		B	8.0		B	8.2	0.1		C
BV23045	12th Street North, south of 14th Avenue North	8.4	7.9	n/a	7.3		A	7.8		A	8.0		B	8.2			B
BV23050	12th Street North, south of 14th Avenue North	8.2	7.9	10.6	7.3		A	7.8		A	8.0		B	8.2	0.1		C
BV23055	12th Street North, north of 13th Avenue North	8.2	n/a	n/a	7.2		A	7.7		A	8.0		A	8.2	0.0		C
BV23060	d/s end of 13th Avenue North crossing	7.7	n/a	n/a	7.1		A	7.7		A	8.0	0.4	C	8.2	0.6		D
BV23065	u/s end of 13th Avenue North crossing	7.7	n/a	n/a	7.2		A	7.7		A	8.0	0.3	C	8.2	0.5		D
BV23070	south of 13th Avenue North	8.2	7.9	10.0	6.5		A	6.8		A	7.0		A	7.3			A
GRE01130	intersection of Fleschmann Ave and Goodlette-Frank Road	8.2	7.6	n/a	7.2		A	7.2		A	7.2		A	7.4			A
GRE01140	along Goodlette-Frank Road	8.0	7.8	9.5	7.5		A	7.8		B	8.1	0.1	C	8.2	0.2		C
GRE01150	along Goodlette-Frank Road	9.9	8.3	10.0	7.6		A	8.0		A	8.2		A	8.3			B
BV35010	Golden Gate Parkway	11.1	n/a	n/a	7.6		A	8.0		A	8.3		A	8.5			A
BV35020	Golden Gate Parkway	n/a	n/a	n/a	7.6		A	8.1		A	8.5		A	8.7			A
BV35030	Golden Gate Parkway	8.6	n/a	n/a	7.8		A	8.3		A	8.6	0.1	C	8.9	0.4		C
BV35040	Golden Gate Parkway	9.1	n/a	n/a	7.9		A	8.5		A	9.0		A	9.5	0.4		C
BV43098	baseball fields at Naples High School (outfall to south)	n/a	n/a	n/a	7.9		A	8.6		A	9.2		A	9.7			A
BV35045	Golden Gate Parkway	8.3	n/a	n/a	7.8		A	8.4	0.0	C	8.7	0.4	C	9.0	0.7		D
BV35050	Golden Gate Parkway	8.5	n/a	n/a	8.2		A	8.7	0.2	C	8.9	0.4	C	9.1	0.6		D
GRE01155	along Goodlette-Frank Road	10.0	9.8	10.5	7.8		A	8.3		A	8.5		A	8.8			A
GRE01160	along Goodlette-Frank Road	10.0	9.8	10.5	8.1		A	8.7		A	9.0		A	9.3			A
BV42020	Golden Gate Parkway	9.0	n/a	n/a	8.4		A	8.9		A	9.4	0.4	C	9.7	0.8		D
BV42010	Golden Gate Parkway	9.2	n/a	n/a	8.4		A	9.0		A	9.6	0.4	C	10.0	0.8		D
GRE01170	along Goodlette-Frank Road	9.0	9.5	10.5	8.1		A	8.6		A	8.9		A	9.2	0.2		C
BV44005	intersection of 22nd Avenue North and 14th Street North	9.2	n/a	n/a	9.2		A	9.4	0.2	C	9.5	0.3	C	9.6	0.4		C
BV44010	22nd Avenue North	9.5	9.4	11.4	9.5		B	9.7	0.2	C	9.8	0.3	C	9.9	0.4		C
GRE01180	along Goodlette-Frank Road	9.7	9.5	10.5	8.1		A	8.4		A	8.5		A	8.6			A
BV44015	14th Street North, north of 22nd Avenue North	8.3	7.8	n/a	8.2		B	8.5	0.2	C	8.7	0.4	C	8.8	0.5		C
BV44020	intersection of 14th Street North and Royal Palm Drive	9.1	8.5	12.3	8.2		A	8.6		B	8.9		B	9.1			B

TABLE 6-11
 City of Naples - Basin V Stormwater System Improvement Plan, Phase I
 Proposed System LOS Evaluation - Alternative 3

Junction Name	Location	Road Crown Elevation (ft-NGVD)	Yard Elevation (ft-NGVD)	Structure Elevation (ft-NGVD)	5-yr/24-hr Event			10-yr/72-hr Event			25-yr/72-hr Event			100-yr/72-hr Event			
					Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	Bldg Flood Depth (ft)	LOS ⁽³⁾
BV44025	intersection of Royal Palm Drive and 13th Street North	9.5	8.9	n/a	8.5		A	8.9		A	9.2		B	9.5			B
BV44030	Royal Palm Drive, u/s of 13th Street North	9.8	9.6	11.7	8.8		A	9.2		A	9.6		B	9.9	0.1		C
BV44035	Royal Palm Drive, u/s of 13th Street North	10.1	9.5	n/a	8.2		A	8.4		A	8.4		A	8.5			A
GRE01188	along Goodlette-Frank Road	11.0	10.8	11.5	8.1		A	8.4		A	8.5		A	8.5			A
GRE01190	along Goodlette-Frank Road	11.0	10.8	11.5	5.6		A	6.6		A	7.3		A	7.9			A
GRE01192	along Goodlette-Frank Road	11.0	10.8	11.5	6.6		A	7.2		A	7.6		A	8.1			A
BV44040	intersection of 14th Street North and Diana Avenue	n/a	9.5	n/a	8.5		A	8.6		A	9.5		A	10.4			A
BV44045	intersection of Diana Avenue and 13th Street North	9.8	9.5	12.7	9.4		A	9.8	0.0	C	10.2	0.4	C	10.4	0.6		D
GRE01200	along Goodlette-Frank Road	11.0	10.8	11.5	8.3		A	8.7		A	8.8		A	8.8			A
BV44050	intersection of 14th Street North and 26th Avenue North	10.5	n/a	n/a	10.3		A	10.7	0.2	C	10.9	0.4	C	11.2	0.7		D
BV44055	intersection of 13th Street North and 26th Avenue North	11.5	11.6	13.8	11.2		A	11.7	0.2	C	11.9	0.4	C	12.1	0.6		D
GRE01210	along Goodlette-Frank Road	11.0	10.8	11.5	8.8		A	9.5		A	10.0		A	10.1			A
GRE01220	along Goodlette-Frank Road	11.0	10.8	11.5	9.0		A	9.6		A	10.1		A	10.3			A
BV43045	d/s end of 14th Street North & 28th Ave N crossing	10.8	n/a	n/a	9.0		A	9.6		A	10.1		A	10.3			A
BV43050	u/s end of 14th Street North & 28th Ave N crossing	11.0	10.3	n/a	9.0		A	9.6		A	10.1		A	10.3			A
BV43055	intersection of 28th Avenue North and 12th Street North	11.0	10.7	n/a	9.0		A	9.6		A	10.1		A	10.3			A
BV43060	d/s end of 28th Avenue North & 12th St N crossing	10.8	10.2	n/a	9.0		A	9.7		A	10.2		B	10.6			B
BV46010	Pond south of 28th Avenue North	n/a	n/a	n/a	8.9		A	9.7		A	10.2		A	10.6			A
BV46020	12th Street North, east of Pond	9.8	10.1	12.6	8.9		A	9.7		A	10.2	0.4	C	10.6	0.9		D
BV46040	east of 12th Street north	n/a	n/a	n/a	8.9		A	9.7		A	10.2		A	10.6			A
BV43063	intersection of 28th Avenue North and 12th Street North	11.9	11.3	n/a	10.4		A	11.2		A	12.0	0.1	C	12.4	0.5		C
BV43065	28th Avenue north, west of 12th Street North	12.0	10.8	13.5	10.8		A	11.7		B	12.4	0.4	C	12.5	0.5		D
BV43067	28th Avenue north, d/s of 10th Street North	12.3	11.9	n/a	12.4	0.1	C	12.6	0.3	C	12.8	0.5	C	12.9	0.6		D
BV43070	d/s end of 10th Street North & 28th Ave N crossing	12.5	12.1	13.0	11.1		A	11.6		A	12.5	0.1	C	12.7	0.3		C
BV43075	u/s end of 10th Street North & 28th Ave N crossing	12.6	11.8	n/a	11.1		A	11.6		A	12.2		B	12.7	0.1		C
GRE01230	along Goodlette-Frank Road	11.0	10.8	11.5	9.0		A	9.6		A	10.1		A	10.3			A
BV47010	pond north of 28th Avenue North	n/a	n/a	n/a	9.5		A	10.4		A	10.7		A	10.9			A
BV47020	east of 12th Street North	10.2	11.0	12.7	9.5		A	10.4	0.2	C	10.7	0.5	C	10.9	0.7		D
BV47030	south of 12th St North and 29th Ave North intersection	10.4	n/a	n/a	9.5		A	10.4		A	10.6	0.2	C	10.8	0.4		C
BV47040	south of 29th Ave North and 10th St North intersection	10.6	11.4	13.0	9.4		A	9.7		A	9.9		A	10.1			A
BV43030	pond north of Diana Avenue	n/a	n/a	n/a	10.0		A	11.1		A	11.4		A	11.7			A
BV43035	Diana Avenue, d/s of 10th Street North	10.7	9.7	12.6	9.6		A	10.7		B	11.1	0.4	C	11.5	0.7		D
BV43040	intersection of Diana Avenue and 10th Street North	10.7	10.2	n/a	9.4		A	10.5		B	10.9	0.3	C	11.4	0.7		D
BV43010	10th Street North, Naples High School baseball fields	n/a	n/a	n/a	8.5		A	9.6		A	10.1		A	10.4			A
BV43017	22nd Avenue North, south of 10th Street North	10.0	n/a	n/a	8.5		A	9.7		A	10.2	0.2	C	10.6	0.6		D
BV43018	intersection of 10th Avenue North and 22nd Avenue	10.8	n/a	n/a	8.8		A	9.9		A	10.3		A	10.8			A
BV43015	baseball fields at Naples High School	n/a	n/a	n/a	9.4		A	9.9		A	10.1		A	10.4			A
BV43005	baseball fields at Naples High School	n/a	n/a	n/a	8.3		A	9.3		A	9.8		A	10.2			A
BV43020	intersection of 22nd Avenue North and 11th Street North	9.7	n/a	n/a	8.5		A	9.7	0.1	C	10.2	0.6	D	10.6	1.0		D
BV43025	intersection of 11th Street North and Royal Palm Drive	10.7	10.5	12.1	9.3		A	9.8		A	10.1		A	10.5			B
BV43080	baseball fields at Naples High School	n/a	n/a	n/a	10.0		A	10.2		A	10.3		A	10.5			A
BV43085	baseball fields at Naples High School	n/a	n/a	n/a	8.4		A	9.3		A	9.8		A	10.2			A
BV43090	baseball fields at Naples High School	n/a	n/a	n/a	8.5		A	9.3		A	9.8		A	10.2			A
BV43095	baseball fields at Naples High School	n/a	n/a	n/a	8.9		A	9.5		A	9.7		A	10.1			A
BV43097	baseball fields at Naples High School	n/a	n/a	n/a	9.7		A	9.8		A	9.9		A	10.0			A
GRE01163	along Goodlette-Frank Road	9.0	n/a	n/a	8.1		A	8.7		A	9.0		A	9.3	0.3		C
BV44060	Naples High School	n/a	n/a	n/a	8.2		A	9.0		A	9.4		A	9.8			A
GRE01164	along Goodlette-Frank Road	9.0	n/a	n/a	8.1		A	8.7		A	9.0		A	9.3	0.3		C
GRE01167	along Goodlette-Frank Road	9.0	n/a	n/a	8.1		A	8.6		A	8.9		A	9.2	0.2		C
BV31010	Goodlette-Frank Road, east of Coastland Mall	n/a	n/a	n/a	7.3		A	7.6		A	7.7		A	7.8			A
BV31040	Coastland Mall	10.6	n/a	n/a	7.9		A	8.8		A	9.1		A	9.7			A
BV31020	Goodlette-Frank Road, east of Coastland Mall	n/a	n/a	n/a	7.3		A	7.6		A	7.7		A	7.8			A

TABLE 6-11
 City of Naples - Basin V Stormwater System Improvement Plan, Phase I
 Proposed System LOS Evaluation - Alternative 3

Junction Name	Location	Road Crown Elevation (ft-NGVD)	Yard Elevation (ft-NGVD)	Structure Elevation (ft-NGVD)	5-yr/24-hr Event			10-yr/72-hr Event			25-yr/72-hr Event			100-yr/72-hr Event				
					Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	Bldg Flood Depth (ft)	LOS ⁽³⁾	
BV31030	Coastland Mall	10.6	n/a	n/a	7.5		A	8.1		A	8.3		A	8.6				A
BV31050	Coastland Mall	12.6	n/a	n/a	8.0		A	8.9		A	9.3		A	10.1				A
BV31060	Coastland Mall	12.7	n/a	n/a	8.1		A	9.0		A	9.5		A	10.5				A
BV31070	Coastland Mall	12.4	n/a	n/a	8.1		A	9.1		A	9.6		A	10.6				A
BV32010	Coastland Mall	11.5	n/a	n/a	8.3		A	9.2		A	9.8		A	10.8				A
BV35060	Coastland Mall	11.4	n/a	n/a	8.4		A	9.3		A	10.0		A	11.0				A
BV35070	Coastland Mall	11.2	n/a	n/a	8.6		A	9.4		A	10.2		A	11.2	0.0			C
BV32020	Coastland Mall	12.4	n/a	n/a	8.8		A	9.6		A	10.5		A	11.5				A
BV33060	Coastland Mall	12.0	n/a	n/a	8.9		A	9.7		A	10.6		A	11.7				A
BV32030	Coastland Mall	12.2	n/a	n/a	8.0		A	9.3		A	9.5		A	10.0				A
BV32040	Coastland Mall	11.7	n/a	n/a	8.4		A	8.9		A	10.4		A	11.0				A
BV33010	Coastland Mall	n/a	n/a	n/a	8.1		A	8.7		A	9.3		A	9.9				A
BV33050	Coastland Mall	12.9	n/a	n/a	8.1		A	8.8		A	9.4		A	10.0				A
BV33020	Coastland Mall	10.9	n/a	n/a	8.4		A	8.7		A	9.2		A	9.6				A
BV33040	Coastland Mall	11.5	n/a	n/a	8.3		A	8.7		A	9.2		A	9.6				A
BV33030	Coastland Mall	11.5	n/a	n/a	8.3		A	8.6		A	9.2		A	9.6				A

Total Number of LOS Exceedances	8	9	6	13	0
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Notes:

- (1) - Elevations, peak flood stages, and road flooding depths have all been rounded to the nearest tenth of a foot.
- (2) - Model results are computed to the nearest hundredth of a foot, but are shown in this table rounded to the nearest tenth of a foot. Therefore, even if the predicted stages from the model are shown to be equal to the respective critical elevation, the table may show an exceedance due to rounding (e.g. if the critical building elevation is 5.0, and the predicted peak stage from the model is 5.01, an exceedance is shown in the table).
- (3) - Level of Service (LOS) classes were assigned as follows:
 - Class "A" LOS was assigned where flow is contained within the conveyance system; no flooding of major roadways, minor roadways, yards or structures is predicted;
 - Class "B" LOS was assigned where there is no flooding of major roadways, minor roadways, or structures, but where yard flooding is predicted;
 - Class "C" LOS was assigned where yard flooding and flooding of major roadways which precludes the use of the outside lane and travel in inside lanes is possible but difficult (depth less than 6-inches) is predicted, but where no structural flooding is predicted; and
 - Class "D" LOS was assigned where extensive road flooding (depths greater than 6-inches) or structural flooding is predicted.
- (4) - Locations have been highlighted that do not meet the following road flooding criteria:
 - No road flooding for the 5-year/24-hour design storm event
 - Road flooding not to exceed 3 inches (0.25 ft) for the 10-year/72-hour design storm event
 - Road flooding not to exceed 6 inches (0.5 ft) for the 25-year/72-hour design storm event
 - Road flooding not to exceed 9 inches (0.75 ft) for the 100-year/72-hour design storm event
 - No building flooding for the 100-year/72-hour design storm event

TABLE 6-12

City of Naples - Basin V Stormwater System Improvement Plan, Phase I
Proposed System LOS Evaluation Summary - Alternative 3

Level of Service	Number of Locations (Model Junctions) by Design Storm Event							
	5-yr/24-hr		10-yr/72-hr		25-yr/72-hr		100-yr/72-hr	
Class A	161	94%	139	81%	108	63%	83	48%
Class B	3	2%	11	6%	12	7%	10	6%
Class C	8	5%	18	10%	46	27%	41	24%
Class D	0	0%	4	2%	6	3%	38	22%
Total		100%		100%		100%		100%

locations exceeding the desired LOS criteria. It may be possible to achieve the desired LOS by adding a berm around the 6th Ave. N./12th St. N. pond and installing a flap gate on the inflow pipe. This option was not evaluated in Alternative 3.

- Map ID 4 (model node BV11007): Peak flood stages are unchanged compared to existing conditions for the 25-yr/72-hr design storm event. The low road crown and yard elevations results in this location exceeding the desired LOS criteria.
- Map ID 10 (model node BV27020): Although peak flood stages decrease by 1.1 ft compared to existing conditions for the 25-yr/72-hr design storm event, the low road crown elevation results in this location exceeding the desired LOS criteria.
- Map ID 14 (model node BV43020): Although peak flood stages decrease by 0.8 ft compared to existing conditions for the 25-yr/72-hr design storm event, the low road crown elevation results in this location exceeding the desired LOS criteria.

Due to physical constraints, low-lying structures, and/or marginal flood control benefits for the additional cost of further improvements, it may be more practicable to consider limited overtopping of roads for a shorter duration (allowing emergency traffic) and to move or raise the lower structures. Before investigating such duration benefits or considering reduced LOS in these areas, additional survey of the LOS threshold elevations is recommended.

Table 6-13 summarizes the road flooding depth and duration of flooding for the LOS exceedances that were identified earlier in Table 6-11. Road flooding duration was determined by visually inspecting the computed stage hydrographs at each location, noting the cumulative length of time that the stage exceeds the road crown elevation.

There are four sections of the table, corresponding to the four design storm events: 5-year/24-hour, 10-year/72-hour, 25-year/72-hour, and 100-year/72-hour. In each section, the junction name and location are given, along with the peak computed flood stage, road flooding depth and duration of flooding for both existing and Alternative 3 conditions. The difference in flooding depth and duration are shown in the right side of the table.

For example, junction BV24010 is located on 11th Street North, mid-block between 13th Avenue and 14th Avenue North and is not currently served by a storm sewer pipe. For the 5-year/24-hour storm, the flood stage exceeded the road crown by up to 0.4 feet over a duration of 68.1 hours. With Alternative 3 improvements, the flood stage exceeds the road crown by up to 0.2 feet, while still exceeds the desired LOS criteria however the duration of flooding is greatly reduced to 3.6 hours.

6.3.3 Water Quality Considerations

Table 6-14 summarizes the water quality treatment volume calculations for Alternative 3 improvements. Treatment and flow attenuation benefits are provided by

TABLE 6-13

City of Naples - Basin V Stormwater System Improvement Plan, Phase I
Proposed System LOS Evaluation - Road Flooding Depth and Duration Summary, Alternative 3

Junction Name	Location	5-yr/24-hr Event - Existing			5-yr/24-hr Event - Alternative 3				
		Peak Stage (ft-NGVD)	Road Flood Depth (ft)	Duration (hr)	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	Δ	Duration (hr)	Δ
BV13010	6th Avenue North	6.4	0.5	4.0	6.2	0.4	-0.1	1.0	-3.0
BV12020	12th Street North	6.3	1.0	5.2	5.8	0.5	-0.5	1.6	-3.6
BV12030	intersection of 7th Avenue North and 12th Street North	6.3	0.8	5.6	5.9	0.4	-0.4	1.8	-3.8
BV24010	east of 11th Street North	9.9	0.4	68.1	9.6	0.2	-0.2	3.6	-64.5
BV11007	u/s of intersection of 8th Ave N and Goodlette-Frank Road	6.2	0.4	2.1	6.2	0.4	0.1	2.3	0.2
BV11010	intersection of 8th Avenue North and 12th Street North	6.8	0.5	3.4	6.3	0.1	-0.4	0.9	-2.5
BV22010	14th Avenue North	7.6	0.4	2.0	7.3	0.1	-0.3	0.3	-1.7
BV43067	28th Avenue north, d/s of 10th Street North	12.7	0.4	1.2	12.4	0.1	-0.3	0.3	-0.9

Junction Name	Location	10-yr/72-hr Event - Existing			10-yr/72-hr Event - Alternative 3				
		Peak Stage (ft-NGVD)	Road Flood Depth (ft)	Duration (hr)	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	Δ	Duration (hr)	Δ
BV13010	6th Avenue North	6.8	0.9	5.9	6.5	0.6	-0.3	2.4	-3.5
BV12020	12th Street North	6.7	1.5	7.3	6.3	1.0	-0.4	2.8	-4.4
BV12030	intersection of 7th Avenue North and 12th Street North	6.7	1.2	8.2	6.3	0.8	-0.4	4.3	-3.9
BV24010	east of 11th Street North	10.0	0.5	105.5	9.8	0.3	-0.2	4.8	-100.7
BV11007	u/s of intersection of 8th Ave N and Goodlette-Frank Road	6.4	0.6	3.1	6.4	0.7	0.1	4.6	1.5
BV11010	intersection of 8th Avenue North and 12th Street North	6.9	0.6	4.3	6.5	0.3	-0.4	3.2	-1.0
BV22010	14th Avenue North	7.7	0.5	2.7	7.5	0.3	-0.2	0.8	-1.9
BV27020	15th Avenue North	8.0	1.3	41.4	6.9	0.3	-1.0	11.0	-30.3
BV43067	28th Avenue north, d/s of 10th Street North	12.8	0.5	1.7	12.6	0.3	-0.2	0.7	-1.0

TABLE 6-13

City of Naples - Basin V Stormwater System Improvement Plan, Phase I
Proposed System LOS Evaluation - Road Flooding Depth and Duration Summary, Alternative 3

Junction Name	Location	25-yr/72-hr Event - Existing			25-yr/72-hr Event - Alternative 3				
		Peak Stage (ft-NGVD)	Road Flood Depth (ft)	Duration (hr)	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	Δ	Duration (hr)	Δ
BV13010	6th Avenue North	7.1	1.2	8.0	6.8	0.9	-0.3	3.4	-4.5
BV12020	12th Street North	7.1	1.8	9.5	6.8	1.5	-0.3	3.9	-5.6
BV12030	intersection of 7th Avenue North and 12th Street North	7.1	1.6	10.5	6.8	1.3	-0.3	6.0	-4.5
BV11007	u/s of intersection of 8th Ave N and Goodlette-Frank Road	6.6	0.8	4.8	6.6	0.8	0.0	7.5	2.7
BV27020	15th Avenue North	8.4	1.8	51.7	7.4	0.7	-1.1	16.2	-35.5
BV43020	intersection of 22nd Avenue North and 11th Street North	11.0	1.4	6.2	10.2	0.6	-0.8	1.2	-5.0

Junction Name	Location	100-yr/72-hr Event - Existing			100-yr/72-hr Event - Alternative 3				
		Peak Stage (ft-NGVD)	Road Flood Depth (ft)	Duration (hr)	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	Δ	Duration (hr)	Δ
BV13010	6th Avenue North	7.3	1.5	10.3	7.1	1.2	-0.2	4.6	-5.7
BV14030	US 41, d/s of 7th Avenue North	10.7	1.1	2.3	10.4	0.8	-0.3	0.8	-1.4
BV14060	d/s end of crossing at intersection of US 41 and 10th Avenue	11.0	1.0	4.3	10.8	0.8	-0.3	1.8	-2.5
BV26010	US 41, d/s of 14th Avenue North	11.4	1.2	6.0	11.0	0.8	-0.4	3.1	-2.9
BV12020	12th Street North	7.3	2.0	12.0	7.1	1.8	-0.3	5.0	-7.0
BV12030	intersection of 7th Avenue North and 12th Street North	7.3	1.8	13.2	7.1	1.6	-0.3	8.7	-4.4
BV11007	u/s of intersection of 8th Ave N and Goodlette-Frank Road	6.8	1.0	7.9	6.9	1.1	0.0	11.7	3.8
BV15080	intersection of 11th Street North and 10th Street North	10.5	1.8	47.5	9.7	1.0	-0.8	5.8	-41.7
BV27020	15th Avenue North	8.9	2.3	61.6	7.8	1.2	-1.1	21.6	-40.0
BV42020	Golden Gate Parkway	10.1	1.1	9.2	9.7	0.8	-0.3	1.4	-7.8
BV42010	Golden Gate Parkway	10.4	1.2	7.8	10.0	0.8	-0.4	1.0	-6.8
BV46020	12th Street North, east of Pond	11.6	1.9	36.2	10.6	0.9	-1.0	13.5	-22.7
BV43020	intersection of 22nd Avenue North and 11th Street North	11.2	1.6	8.8	10.6	1.0	-0.6	1.8	-7.0

Table 6-14

City of Naples - Basin V Stormwater System Improvement Plan, Phase I
 Water Quality Treatment Volume Calculations - Alternative 3

Map ID	Detention Facility Name	Model Junction Pond	Outlet	Water Level (ft-NGVD)		Water Qty. Treatment	Surface Area (acre)		Water Qty. Treatment Volume (acre-ft)
				Existing	Proposed		NWL Proposed	Water Qty. Treatment	
Proposed Modification to Existing Detention Facilities									
5	13th Street N.	BV11040	BV11030	4.8	4.3	5.8	0.6	0.6	0.9
6	10th Avenue N.	BV15030	BV15020	5.0	3.5	5.0	1.4	1.6	2.3
10	15th Avenue N.	BV27010	BV23011	4.8	3.5	5.0	2.4	2.5	3.7
14	Diana Avenue	BV43030	BV43035	8.3	4.3	5.8	1.0	1.1	1.5
Total									8.3

the proposed modification of four existing detention facilities in Alternative 3 as shown in the top of Table 6-14. For each detention facility, the corresponding Map ID, facility name, and model junctions are given along with the existing and proposed water levels. The normal water level (NWL) represents the initial starting level in each facility at the start of the simulations (controlled by 6-inch drawdown orifice), and the water quality treatment level represents the proposed weir crest elevation. The volume between these two levels is available for water quality treatment. The corresponding surface area at each of these water levels is given on the right side of the table, with the resulting water quality treatment volume computed in the final column.

A total of 8.3 acre-ft of water quality treatment volume is provided in the proposed improvements to existing detention facilities, including:

- 13th St. N. pond (map ID 5, model node BV11040) = 0.9 acre-ft;
- 10th Ave. N. pond (map ID 6, model node BV15030) = 2.3 acre-ft;
- 15th Ave. N. pond (map ID 10, model node BV27010) = 3.7 acre-ft;
- Diana Ave. N. pond (map ID 14, model node BV43030) = 1.5 acre-ft.

The proposed detention facility in Fleischmann parcel 18 (adjacent to the south bank of Reach 03, Map ID 26) is included among the improvements in Alternative 3 and provides approximately 24.5 acre-ft of water quality treatment volume. However, the water quality treatment volume is being claimed as part of the GRE project and cannot be double-counted for the purposes of this study.

Conversely, there are a number of existing detention facilities that have been designed for water quality treatment within the Basin V PSMS, including:

- The underground storage tanks at Coastland Mall, which serve a tributary area of 67 acres,
- The detention facility located east of Mandarin Drive and west of US 41 at the intersection of 14th Avenue North, which serves a tributary area of 25 acres, and
- The Naples High School dry detention facility, which serves a tributary area of 22 acres.

Subtracting the above areas (114 acres) from the total Basin V watershed (637 acres) leaves an area of 523 acres requiring treatment of the first inch of runoff, per the SFWMD ERP requirements. The resulting water quality treatment volume requirement for the watershed is therefore 43.6 acre-ft. As noted above, the total water quality treatment volume provided by detention improvements in Alternative 3 is 8.3 acre-ft. As a result, an additional 35.3 acre-ft of water quality treatment volume must be provided within the Basin V watershed.

The required volume could be accommodated by a facility (or combination of facilities) with a surface area of 23.5 acres assuming a water quality treatment depth (height above normal pool elevation) of 1.5 feet. Opportunities for such detention facilities may be available at the Conservancy and Jungle Larry's property.

6.3.4 Conceptual Capital Cost Estimate

The construction cost estimate for Alternative 3 improvements is presented in **Table 6-15**. The same general cost basis that was used to estimate construction costs for alternatives in the Gordon River Extension study were used in this study and updated to 2005 dollars. Cost items are grouped by the Map ID number and the total cost of all capital improvement projects in Alternative 3 is shown on the final page. In addition, a 30-percent contingency has been factored into the project total cost, as well as 15-percent for engineering design and permitting, survey, and geotechnical analysis. The costs for property/easement acquisition and legal fees have not been included in the total since they are highly variable.

Work sharing and coordination with Collier County may be pursued for several projects. Two of the Alternative 3 improvements are located within the Goodlette-Frank Road right-of-way, including Map ID numbers 11 and 15. In addition, Map ID numbers 23, 24, 25 and 26 are located along Reach 03 within the County's jurisdiction.

Table 6-16 presents a construction option intended to reduce cost and disruption to roads, utilities, and stormwater service. This option uses parallel pipes where feasible for locations where pipe replacements are specified in Section 6.3.1 for Map ID 6, 9, 12, 14, 15, 17, 19, 20, and 24.

6.4 Comparison of Alternatives

Table 6-17 shows the comparison of model results between the existing system and the three alternatives for the 25-yr/72-hr design storm event. Of the 61 LOS Class C exceedances in the existing Basin V PSMS, 6 are eliminated by Alternative 1, 53 are eliminated by Alternative 2, and 55 are eliminated by Alternative 3.

There were significant differences between the two alternatives in terms of the LOS criteria used to develop alternatives, the extent of problem areas to be addressed by proposed improvement projects, and the volume of water quality treatment volume provided by detention improvements.

Alternative 1 improvements were developed according to County standards of achieving LOS Class C for two problem areas within the Basin V PSMS (along Goodlette-Frank Road). Alternative 2 improvements were developed in this study with the intent of achieving LOS Class B for all problem areas within the Basin V PSMS. Alternative 3 improvements were developed with the intent of achieving retrofit LOS criteria, including a LOS Class C for the 25-yr/72-hr event for all problem areas within the Basin V PSMS.

Table 6-15
City of Naples - Basin V Stormwater System Improvement Plan, Phase I
Engineer's Conceptual Opinion of Probable Construction Cost - Alternative 3

Map ID #	Brief Description of Items	Unit	Estimated Quantity	Unit Price	Cost ⁽¹⁾
1B	Add new pipe along 10th Ave. N. and 15th Ave. N. (BV26015 to BV14005)				
	Erosion Control	EA	1	\$ 10,000.00	\$ 10,000
	Maintenance of Traffic - Detour Traffic (Lane Closure)	EA	1	\$ 15,000.00	\$ 15,000
	Dewatering	LS	1	\$ 10,000.00	\$ 10,000
	24-Inch Reinforced Concrete Pipe (1000' Length)	FT	1000	\$ 60.00	\$ 60,000
	42-Inch Reinforced Concrete Pipe (1100' Length)	FT	1100	\$ 105.00	\$ 115,500
	Curb Inlets	EA	16	\$ 5,000.00	\$ 80,000
	Manholes	EA	8	\$ 5,000.00	\$ 40,000
	Bedding Stone	TN	2000	\$ 20.00	\$ 40,000
	Endwalls	EA	2	\$ 10,000.00	\$ 20,000
	Mill Existing Asphalt	SY	4670	\$ 4.50	\$ 21,015
	Milled Asphalt Disposal	CY	390	\$ 20.00	\$ 7,800
	12" Type "B" Stabilization Subbase	SY	4670	\$ 12.00	\$ 56,040
	8" Limerock Base	SY	4670	\$ 13.50	\$ 63,045
	2" Type S-1 Asphalt	SY	4500	\$ 12.00	\$ 54,000
	Replace Existing Sidewalk	LS	1	\$ 10,000.00	\$ 10,000
	Sodding	SY	2330	\$ 7.50	\$ 17,475
				Subtotal=	\$ 620,000
2	Add parallel pipe along 10th St. N. (BV13020 to BV12019)				
	Erosion Control	EA	1	\$ 5,000.00	\$ 5,000
	Maintenance of Traffic - Detour Traffic (Lane Closure)	EA	1	\$ 5,000.00	\$ 5,000
	Dewatering	LS	1	\$ 7,000.00	\$ 7,000
	3-Foot x 5-Foot Concrete Box Culvert (390' Length)	FT	390	\$ 580.00	\$ 226,200
	Bedding Stone	TN	350	\$ 20.00	\$ 7,000
	Endwalls	EA	1	\$ 10,000.00	\$ 10,000
	Mill Existing Asphalt	SY	870	\$ 4.50	\$ 3,915
	Milled Asphalt Disposal	CY	70	\$ 20.00	\$ 1,400
	12" Type "B" Stabilization Subbase	SY	870	\$ 12.00	\$ 10,440
	8" Limerock Base	SY	870	\$ 13.50	\$ 11,745
	2" Type S-1 Asphalt	SY	800	\$ 12.00	\$ 9,600
	Replace Existing Sidewalk	LS	1	\$ 3,000.00	\$ 3,000
	Sodding	SY	430	\$ 7.50	\$ 3,225
				Subtotal=	\$ 304,000
3	Add parallel pipe, outfall from 6th Ave. N. pond (BV12010 to GRE01020)				
	Erosion Control	EA	1	\$ 5,000.00	\$ 5,000
	Maintenance of Traffic - Detour Traffic (Lane Closure)	EA	1	\$ 15,000.00	\$ 15,000
	Dewatering	LS	1	\$ 7,000.00	\$ 7,000
	48-Inch Reinforced Concrete Pipe (286' Length)	FT	286	\$ 120.00	\$ 34,320
	Bedding Stone	TN	250	\$ 20.00	\$ 5,000
	Sodding	SY	1000	\$ 7.50	\$ 7,500
				Subtotal=	\$ 74,000
4	Add parallel pipe along 8th Ave. N. (BV11020 to GRE01060)				
	Erosion Control	EA	1	\$ 5,000.00	\$ 5,000
	Maintenance of Traffic - Detour Traffic (Lane Closure)	EA	1	\$ 15,000.00	\$ 15,000
	Removal and Disposal of Existing Pipes	LS	1	\$ 10,000.00	\$ 10,000
	Dewatering	LS	1	\$ 7,000.00	\$ 7,000
	24-Inch Reinforced Concrete Pipe (389' Length)	FT	389	\$ 60.00	\$ 23,340
	48-Inch Reinforced Concrete Pipe (572' Length)	FT	572	\$ 120.00	\$ 68,640
	Bedding Stone	TN	900	\$ 20.00	\$ 18,000
	Mill Existing Asphalt	SY	2140	\$ 4.50	\$ 9,630
	Milled Asphalt Disposal	CY	180	\$ 20.00	\$ 3,600
	12" Type "B" Stabilization Subbase	SY	2140	\$ 12.00	\$ 25,680
	8" Limerock Base	SY	2140	\$ 13.50	\$ 28,890
	2" Type S-1 Asphalt	SY	2000	\$ 12.00	\$ 24,000
	Replace Existing Sidewalk	LS	1	\$ 5,000.00	\$ 5,000
	Sodding	SY	1070	\$ 7.50	\$ 8,025
				Subtotal=	\$ 252,000

Map ID #	Brief Description of Items	Unit	Estimated Quantity	Unit Price	Cost ⁽¹⁾
5	Detention improvements at 13th St. N. pond (BV11040)				
	Detention facility control structure	LS	1	\$ 30,000.00	\$ 30,000
				Subtotal=	\$ 30,000
6	Pipe and detention improvements along 10th Ave. N. (BV15030 to GRE01090)				
	Erosion Control	EA	1	\$ 5,000.00	\$ 5,000
	Maintenance of Traffic - Detour Traffic (Lane Closure)	EA	1	\$ 15,000.00	\$ 15,000
	Removal and Disposal of Existing Pipes	LS	1	\$ 10,000.00	\$ 10,000
	Dewatering	LS	1	\$ 7,000.00	\$ 7,000
	48-Inch Reinforced Concrete Pipe (858' Length)	FT	858	\$ 120.00	\$ 102,960
	Bedding Stone	TN	800	\$ 20.00	\$ 16,000
	Mill Existing Asphalt	SY	1910	\$ 4.50	\$ 8,595
	Milled Asphalt Disposal	CY	160	\$ 20.00	\$ 3,200
	12" Type "B" Stabilization Subbase	SY	1910	\$ 12.00	\$ 22,920
	8" Limerock Base	SY	1910	\$ 13.50	\$ 25,785
	2" Type S-1 Asphalt	SY	1850	\$ 12.00	\$ 22,200
	Replace Existing Sidewalk	LS	1	\$ 5,000.00	\$ 5,000
	Sodding	SY	950	\$ 7.50	\$ 7,125
	Detention facility control structure	LS	1	\$ 25,000.00	\$ 25,000
					Subtotal=
7B	Add parallel pipe along 11th St. N. (BV15080 to BV15030)				
	Erosion Control	EA	1	\$ 5,000.00	\$ 5,000
	Maintenance of Traffic - Detour Traffic (Lane Closure)	EA	1	\$ 5,000.00	\$ 5,000
	Dewatering	LS	1	\$ 7,000.00	\$ 7,000
	24-Inch Reinforced Concrete Pipe (370' Length)	FT	370	\$ 60.00	\$ 22,200
	Bedding Stone	TN	300	\$ 20.00	\$ 6,000
	Mill Existing Asphalt	SY	820	\$ 4.50	\$ 3,690
	Milled Asphalt Disposal	CY	70	\$ 20.00	\$ 1,400
	12" Type "B" Stabilization Subbase	SY	820	\$ 12.00	\$ 9,840
	8" Limerock Base	SY	820	\$ 13.50	\$ 11,070
	2" Type S-1 Asphalt	SY	750	\$ 12.00	\$ 9,000
	Replace Existing Sidewalk	LS	1	\$ 3,000.00	\$ 3,000
Sodding	SY	410	\$ 7.50	\$ 3,075	
				Subtotal=	\$ 86,000
7C	Add new pipe along 11th St. N. (BV24010 to BV15030)				
	Erosion Control	EA	1	\$ 5,000.00	\$ 5,000
	Maintenance of Traffic - Detour Traffic (Lane Closure)	EA	1	\$ 10,000.00	\$ 10,000
	Dewatering	LS	1	\$ 7,000.00	\$ 7,000
	18-Inch Reinforced Concrete Pipe (600' Length)	FT	600	\$ 45.00	\$ 27,000
	Curb Inlets	EA	4	\$ 5,000.00	\$ 20,000
	Manholes	EA	4	\$ 5,000.00	\$ 20,000
	Bedding Stone	TN	500	\$ 20.00	\$ 10,000
	Endwalls	EA	1	\$ 10,000.00	\$ 10,000
	Mill Existing Asphalt	SY	1330	\$ 4.50	\$ 5,985
	Milled Asphalt Disposal	CY	110	\$ 20.00	\$ 2,200
	12" Type "B" Stabilization Subbase	SY	1330	\$ 12.00	\$ 15,960
	8" Limerock Base	SY	1330	\$ 13.50	\$ 17,955
	2" Type S-1 Asphalt	SY	1250	\$ 12.00	\$ 15,000
Replace Existing Sidewalk	LS	1	\$ 5,000.00	\$ 5,000	
Sodding	SY	670	\$ 7.50	\$ 5,025	
				Subtotal=	\$ 176,000
8	Add parallel pipe along 14th Ave. N. (BV22010 to GRE01110)				
	Erosion Control	EA	1	\$ 5,000.00	\$ 5,000
	Maintenance of Traffic - Detour Traffic (Lane Closure)	EA	1	\$ 15,000.00	\$ 15,000
	Dewatering	LS	1	\$ 7,000.00	\$ 7,000
	24-Inch Reinforced Concrete Pipe (170' Length)	FT	170	\$ 60.00	\$ 10,200
	Bedding Stone	TN	150	\$ 20.00	\$ 3,000
	Mill Existing Asphalt	SY	380	\$ 4.50	\$ 1,710
	Milled Asphalt Disposal	CY	30	\$ 20.00	\$ 600
	12" Type "B" Stabilization Subbase	SY	380	\$ 12.00	\$ 4,560
	8" Limerock Base	SY	380	\$ 13.50	\$ 5,130
	2" Type S-1 Asphalt	SY	350	\$ 12.00	\$ 4,200
	Replace Existing Sidewalk	LS	1	\$ 3,000.00	\$ 3,000
Sodding	SY	190	\$ 7.50	\$ 1,425	
				Subtotal=	\$ 61,000
9	Pipe improvements along 12th St. N. (BV23065 to GRE01120)				

Map ID #	Brief Description of Items	Unit	Estimated Quantity	Unit Price	Cost ⁽¹⁾
	Erosion Control	EA	1	\$ 10,000.00	\$ 10,000
	Maintenance of Traffic - Detour Traffic (Lane Closure)	EA	1	\$ 15,000.00	\$ 15,000
	Removal and Disposal of Existing Pipes	LS	1	\$ 15,000.00	\$ 15,000
	Dewatering	LS	1	\$ 10,000.00	\$ 10,000
	18-Inch Reinforced Concrete Pipe (619' Length)	FT	619	\$ 45.00	\$ 27,855
	24-Inch Reinforced Concrete Pipe (750' Length)	FT	750	\$ 60.00	\$ 45,000
	48-Inch Reinforced Concrete Pipe (106' Length)	FT	106	\$ 120.00	\$ 12,720
	4-Foot x 5-Foot Concrete Box Culvert (1010' Length)	FT	1010	\$ 670.00	\$ 676,700
	Curb Inlets	EA	18	\$ 5,000.00	\$ 90,000
	Manholes	EA	9	\$ 5,000.00	\$ 45,000
	Bedding Stone	TN	2200	\$ 20.00	\$ 44,000
	Endwalls	EA	1	\$ 10,000.00	\$ 10,000
	Mill Existing Asphalt	SY	4900	\$ 4.50	\$ 22,050
	Milled Asphalt Disposal	CY	410	\$ 20.00	\$ 8,200
	12" Type "B" Stabilization Subbase	SY	4900	\$ 12.00	\$ 58,800
	8" Limerock Base	SY	4900	\$ 13.50	\$ 66,150
	2" Type S-1 Asphalt	SY	4700	\$ 12.00	\$ 56,400
	Replace Existing Sidewalk	LS	1	\$ 10,000.00	\$ 10,000
	Sodding	SY	2500	\$ 7.50	\$ 18,750
				Subtotal=	\$ 1,242,000
10	Detention improvements at 15th Ave. N. pond (BV27010)				
	Detention facility control structure	LS	1	\$ 20,000.00	\$ 20,000
				Subtotal=	\$ 20,000
11	Conveyance improvements adjacent to the Mall (GRE01140 to GRE01130)				
	Erosion Control	EA	1	\$ 5,500.00	\$ 5,500
	Maintenance of Traffic - Periodic Lane Closure	EA	1	\$ 10,000.00	\$ 10,000
	Removal and Disposal of Existing Elliptical Pipe	LS	1	\$ 20,000.00	\$ 20,000
	Dewatering	LS	1	\$ 11,500.00	\$ 11,500
	3-Foot x 6-Foot Concrete Box Culverts - 3 sets (200' Length) at Mall Entrance	FT	600	\$ 630.00	\$ 378,000
	3-Foot x 6-Foot Concrete Box Culverts - 3 sets (170' Length) at Fleishman Boulevard	FT	510	\$ 630.00	\$ 321,300
	Backfill Material/Compaction	CY	2100	\$ 9.00	\$ 18,900
	Endwalls	EA	4	\$ 5,500.00	\$ 22,000
	Mill Existing Asphalt	SY	2500	\$ 4.50	\$ 11,250
	Milled Asphalt Disposal	CY	250	\$ 20.00	\$ 5,000
	12" Type "B" Stabilization Subbase	SY	1430	\$ 12.00	\$ 17,160
	8" Limerock Base	SY	1400	\$ 13.50	\$ 18,900
	2" Type S-1 Asphalt	SY	1350	\$ 12.00	\$ 16,200
	Excavation of Material in Channel (Upstream & Downstream of Culverts)	LF	50	\$ 10.00	\$ 500
	New Open Channel Excavation (200-feet)	CY	1100	\$ 4.00	\$ 4,400
	Disposal of Channel Excavation Material	CY	1200	\$ 10.00	\$ 12,000
	Sodding	SY	700	\$ 7.50	\$ 5,250
	Property Acquisition	AC	0	see note (2)	-
				Subtotal=	\$ 878,000
12	Pipe improvements along Golden Gate Parkway (BV35045 to GRE01150)				
	Erosion Control	EA	1	\$ 10,000.00	\$ 10,000
	Maintenance of Traffic - Detour Traffic (Lane Closure)	EA	1	\$ 25,000.00	\$ 25,000
	Removal and Disposal of Existing Pipes	LS	1	\$ 20,000.00	\$ 20,000
	Dewatering	LS	1	\$ 10,000.00	\$ 10,000
	36-Inch Reinforced Concrete Pipe (560' Length)	FT	560	\$ 90.00	\$ 50,400
	4-Foot x 7-Foot Concrete Box Culvert (549' Length)	FT	549	\$ 790.00	\$ 433,710
	4-Foot x 8-Foot Concrete Box Culvert (891' Length)	FT	891	\$ 840.00	\$ 748,440
	Curb Inlets	EA	10	\$ 5,000.00	\$ 50,000
	Manholes	EA	7	\$ 5,000.00	\$ 35,000
	Bedding Stone	TN	2000	\$ 20.00	\$ 40,000
	Mill Existing Asphalt	SY	5560	\$ 4.50	\$ 25,020
	Milled Asphalt Disposal	CY	460	\$ 20.00	\$ 9,200
	12" Type "B" Stabilization Subbase	SY	5560	\$ 12.00	\$ 66,720
	8" Limerock Base	SY	5560	\$ 13.50	\$ 75,060
	2" Type S-1 Asphalt	SY	5400	\$ 12.00	\$ 64,800
	Replace Existing Sidewalk	LS	1	\$ 10,000.00	\$ 10,000
	Sodding	SY	2220	\$ 7.50	\$ 16,650
				Subtotal=	\$ 1,690,000

Map ID #	Brief Description of Items	Unit	Estimated Quantity	Unit Price	Cost ⁽¹⁾
13	Add parallel pipe along Golden Gate Parkway (BV42010 to GRE01160)				
	Erosion Control	EA	1	\$ 5,000.00	\$ 5,000
	Maintenance of Traffic - Detour Traffic (Lane Closure)	EA	1	\$ 25,000.00	\$ 25,000
	Dewatering	LS	1	\$ 7,000.00	\$ 7,000
	36-Inch Reinforced Concrete Pipe (887' Length)	FT	887	\$ 90.00	\$ 79,830
	Curb Inlets	EA	3	\$ 5,000.00	\$ 15,000
	Manholes	EA	3	\$ 5,000.00	\$ 15,000
	Bedding Stone	TN	800	\$ 20.00	\$ 16,000
	Mill Existing Asphalt	SY	2460	\$ 4.50	\$ 11,070
	Milled Asphalt Disposal	CY	210	\$ 20.00	\$ 4,200
	12" Type "B" Stabilization Subbase	SY	2460	\$ 12.00	\$ 29,520
	8" Limerock Base	SY	2460	\$ 13.50	\$ 33,210
	2" Type S-1 Asphalt	SY	2400	\$ 12.00	\$ 28,800
	Replace Existing Sidewalk	LS	1	\$ 5,000.00	\$ 5,000
	Sodding	SY	990	\$ 7.50	\$ 7,425
				Subtotal=	\$ 282,000
14	Pipe and detention improvements along Diana Ave./10th St. N. (BV43030 to GRE01163)				
	Erosion Control	EA	1	\$ 10,000.00	\$ 10,000
	Maintenance of Traffic - Detour Traffic (Lane Closure)	EA	1	\$ 15,000.00	\$ 15,000
	Removal and Disposal of Existing Pipes	LS	1	\$ 30,000.00	\$ 30,000
	Dewatering	LS	1	\$ 10,000.00	\$ 10,000
	18-Inch Reinforced Concrete Pipe (414' Length)	FT	414	\$ 45.00	\$ 18,630
	4-Foot x 8-Foot Concrete Box Culvert (817' Length)	FT	817	\$ 840.00	\$ 686,280
	4-Foot x 9-Foot Concrete Box Culvert (53' Length)	FT	53	\$ 890.00	\$ 47,170
	4-Foot x 10-Foot Concrete Box Culvert (154' Length)	FT	154	\$ 940.00	\$ 144,760
	5-Foot x 9-Foot Concrete Box Culvert (1392' Length)	FT	1392	\$ 1,000.00	\$ 1,392,000
	Curb Inlets	EA	20	\$ 5,000.00	\$ 100,000
	Manholes	EA	10	\$ 5,000.00	\$ 50,000
	Bedding Stone	TN	2600	\$ 20.00	\$ 52,000
	Mill Existing Asphalt	SY	6290	\$ 4.50	\$ 28,305
	Milled Asphalt Disposal	CY	520	\$ 20.00	\$ 10,400
	12" Type "B" Stabilization Subbase	SY	6290	\$ 12.00	\$ 75,480
	8" Limerock Base	SY	6290	\$ 13.50	\$ 84,915
	2" Type S-1 Asphalt	SY	6100	\$ 12.00	\$ 73,200
	Replace Existing Sidewalk	LS	1	\$ 10,000.00	\$ 10,000
	Sodding	SY	3140	\$ 7.50	\$ 23,550
	Detention facility control structures (Diana Ave and dry pond at High School)	EA	2	\$ 15,000.00	\$ 30,000
				Subtotal=	\$ 2,892,000
15	Replace existing pipe under Golden Gate Parkway (GRE01160 to GRE01150)				
	Erosion Control	EA	1	\$ 5,000.00	\$ 5,000
	Maintenance of Traffic - Detour Traffic (Lane Closure)	EA	1	\$ 25,000.00	\$ 25,000
	Removal and Disposal of Existing Elliptical Pipe	LS	1	\$ 15,000.00	\$ 15,000
	Dewatering	LS	1	\$ 7,000.00	\$ 7,000
	4-Foot x 9-Foot Concrete Box Culvert (328' Length)	FT	328	\$ 890.00	\$ 291,920
	Bedding Stone	TN	230	\$ 20.00	\$ 4,600
	Endwall	EA	1	\$ 10,000.00	\$ 10,000
	Cast-In-Place Concrete Structures	EA	1	\$ 30,000.00	\$ 30,000
	Mill Existing Asphalt	SY	910	\$ 4.50	\$ 4,095
	Milled Asphalt Disposal	CY	80	\$ 20.00	\$ 1,600
	12" Type "B" Stabilization Subbase	SY	910	\$ 12.00	\$ 10,920
	8" Limerock Base	SY	910	\$ 13.50	\$ 12,285
	3" Type S-1 Asphalt	SY	850	\$ 18.00	\$ 15,300
	Excavation of Material in Channel (Upstream of Culverts)	LF	50	\$ 10.00	\$ 500
	Disposal of Channel Excavation Material	CY	60	\$ 10.00	\$ 600
	Sodding	SY	250	\$ 7.50	\$ 1,875
				Subtotal=	\$ 436,000

Map ID #	Brief Description of Items	Unit	Estimated Quantity	Unit Price	Cost ⁽¹⁾
17	Pipe improvements along Royal Palm Dr. (BV44030 to GRE01180)				
	Erosion Control	EA	1	\$ 5,000.00	\$ 5,000
	Maintenance of Traffic - Detour Traffic (Lane Closure)	EA	1	\$ 10,000.00	\$ 10,000
	Removal and Disposal of Existing Pipes	LS	1	\$ 5,000.00	\$ 5,000
	Dewatering	LS	1	\$ 7,000.00	\$ 7,000
	48-Inch Reinforced Concrete Pipe (602' Length)	FT	602	\$ 120.00	\$ 72,240
	4-Foot x 5-Foot Concrete Box Culvert (342' Length)	FT	342	\$ 670.00	\$ 229,140
	Curb Inlets	EA	8	\$ 5,000.00	\$ 40,000
	Manholes	EA	3	\$ 5,000.00	\$ 15,000
	Bedding Stone	TN	900	\$ 20.00	\$ 18,000
	Mill Existing Asphalt	SY	2100	\$ 4.50	\$ 9,450
	Milled Asphalt Disposal	CY	170	\$ 20.00	\$ 3,400
	12" Type "B" Stabilization Subbase	SY	2100	\$ 12.00	\$ 25,200
	8" Limerock Base	SY	2100	\$ 13.50	\$ 28,350
	2" Type S-1 Asphalt	SY	2000	\$ 12.00	\$ 24,000
	Replace Existing Sidewalk	LS	1	\$ 5,000.00	\$ 5,000
	Sodding	SY	1050	\$ 7.50	\$ 7,875
				Subtotal=	\$ 505,000
18	Add parallel pipe along Diana Ave. (BV44045 to GRE01192)				
	Erosion Control	EA	1	\$ 5,000.00	\$ 5,000
	Maintenance of Traffic - Detour Traffic (Lane Closure)	EA	1	\$ 10,000.00	\$ 10,000
	Dewatering	LS	1	\$ 7,000.00	\$ 7,000
	18-Inch Reinforced Concrete Pipe (331' Length)	FT	331	\$ 45.00	\$ 14,895
	24-Inch Reinforced Concrete Pipe (210' Length)	FT	210	\$ 60.00	\$ 12,600
	Curb Inlets	EA	6	\$ 5,000.00	\$ 30,000
	Manholes	EA	2	\$ 5,000.00	\$ 10,000
	Bedding Stone	TN	500	\$ 20.00	\$ 10,000
	Endwalls	EA	1	\$ 10,000.00	\$ 10,000
	Mill Existing Asphalt	SY	1200	\$ 4.50	\$ 5,400
	Milled Asphalt Disposal	CY	100	\$ 20.00	\$ 2,000
	12" Type "B" Stabilization Subbase	SY	1200	\$ 12.00	\$ 14,400
	8" Limerock Base	SY	1200	\$ 13.50	\$ 16,200
	2" Type S-1 Asphalt	SY	1100	\$ 12.00	\$ 13,200
	Replace Existing Sidewalk	LS	1	\$ 5,000.00	\$ 5,000
	Sodding	SY	600	\$ 7.50	\$ 4,500
				Subtotal=	\$ 170,000
19	Replace existing pipe along 26th Ave. N. (BV44050 to GRE01200)				
	Erosion Control	EA	1	\$ 5,000.00	\$ 5,000
	Maintenance of Traffic - Detour Traffic (Lane Closure)	EA	1	\$ 10,000.00	\$ 10,000
	Removal and Disposal of Existing Pipes	LS	1	\$ 5,000.00	\$ 5,000
	Dewatering	LS	1	\$ 7,000.00	\$ 7,000
	48-Inch Reinforced Concrete Pipe (240' Length)	FT	240	\$ 120.00	\$ 28,800
	Curb Inlets	EA	4	\$ 5,000.00	\$ 20,000
	Manholes	EA	1	\$ 5,000.00	\$ 5,000
	Bedding Stone	TN	200	\$ 20.00	\$ 4,000
	Mill Existing Asphalt	SY	530	\$ 4.50	\$ 2,385
	Milled Asphalt Disposal	CY	40	\$ 20.00	\$ 800
	12" Type "B" Stabilization Subbase	SY	530	\$ 12.00	\$ 6,360
	8" Limerock Base	SY	530	\$ 13.50	\$ 7,155
	2" Type S-1 Asphalt	SY	500	\$ 12.00	\$ 6,000
	Replace Existing Sidewalk	LS	1	\$ 3,000.00	\$ 3,000
	Sodding	SY	270	\$ 7.50	\$ 2,025
				Subtotal=	\$ 113,000

Map ID #	Brief Description of Items	Unit	Estimated Quantity	Unit Price	Cost ⁽¹⁾
20	Pipe improvements along 28th Ave. N. (BV43067 to GRE01220)				
	Erosion Control	EA	1	\$ 10,000.00	\$ 10,000
	Maintenance of Traffic - Detour Traffic (Lane Closure)	EA	1	\$ 15,000.00	\$ 15,000
	Removal and Disposal of Existing Pipes	LS	1	\$ 20,000.00	\$ 20,000
	Dewatering	LS	1	\$ 10,000.00	\$ 10,000
	18-Inch Reinforced Concrete Pipe (842' Length)	FT	842	\$ 45.00	\$ 37,890
	4-Foot by 6-Foot Concrete Box Culvert (857' Length)	FT	857	\$ 730.00	\$ 625,610
	Curb Inlets	EA	12	\$ 5,000.00	\$ 60,000
	Manholes	EA	6	\$ 5,000.00	\$ 30,000
	Bedding Stone	TN	1600	\$ 20.00	\$ 32,000
	Mill Existing Asphalt	SY	3800	\$ 4.50	\$ 17,100
	Milled Asphalt Disposal	CY	310	\$ 20.00	\$ 6,200
	12" Type "B" Stabilization Subbase	SY	3800	\$ 12.00	\$ 45,600
	8" Limerock Base	SY	3800	\$ 13.50	\$ 51,300
	2" Type S-1 Asphalt	SY	3600	\$ 12.00	\$ 43,200
	Replace Existing Sidewalk	LS	1	\$ 7,000.00	\$ 7,000
	Sodding	SY	1900	\$ 7.50	\$ 14,250
				Subtotal=	\$ 1,025,000
21	Add parallel pipe, outfall from 28th Ave. N. pond (BV46010 to BV43060)				
	Erosion Control	EA	1	\$ 3,000.00	\$ 3,000
	Maintenance of Traffic - Detour Traffic (Lane Closure)	EA	1	\$ 5,000.00	\$ 5,000
	Dewatering	LS	1	\$ 5,000.00	\$ 5,000
	24-Inch Reinforced Concrete Pipe (97' Length)	FT	97	\$ 60.00	\$ 5,820
	Bedding Stone	TN	80	\$ 20.00	\$ 1,600
	Endwalls	EA	1	\$ 10,000.00	\$ 10,000
	Mill Existing Asphalt	SY	110	\$ 4.50	\$ 495
	Milled Asphalt Disposal	CY	10	\$ 20.00	\$ 200
	12" Type "B" Stabilization Subbase	SY	110	\$ 12.00	\$ 1,320
	8" Limerock Base	SY	110	\$ 13.50	\$ 1,485
	2" Type S-1 Asphalt	SY	100	\$ 12.00	\$ 1,200
	Replace Existing Sidewalk	LS	1	\$ 3,000.00	\$ 3,000
	Sodding	SY	400	\$ 7.50	\$ 3,000
				Subtotal=	\$ 41,000
22	Add parallel pipe, outfall from 14th St. N. pond (BV47010 to GRE01230)				
	Erosion Control	EA	1	\$ 5,000.00	\$ 5,000
	Maintenance of Traffic - Detour Traffic (Lane Closure)	EA	1	\$ 15,000.00	\$ 15,000
	Dewatering	LS	1	\$ 7,000.00	\$ 7,000
	48-Inch Reinforced Concrete Pipe (228' Length)	FT	228	\$ 120.00	\$ 27,360
	Bedding Stone	TN	200	\$ 20.00	\$ 4,000
	Endwalls	EA	2	\$ 10,000.00	\$ 20,000
	Mill Existing Asphalt	SY	170	\$ 4.50	\$ 765
	Milled Asphalt Disposal	CY	10	\$ 20.00	\$ 200
	12" Type "B" Stabilization Subbase	SY	170	\$ 12.00	\$ 2,040
	8" Limerock Base	SY	170	\$ 13.50	\$ 2,295
	2" Type S-1 Asphalt	SY	150	\$ 12.00	\$ 1,800
	Replace Existing Sidewalk	LS	1	\$ 3,000.00	\$ 3,000
	Sodding	SY	250	\$ 7.50	\$ 1,875
				Subtotal=	\$ 90,000
23	Weir modifications adjacent to Reach 03 (GRE01192 to GRE01190)				
	Removal and Disposal of Existing Weir	EA	1	\$ 5,000.00	\$ 5,000
	Construction of new weir	LS	1	\$ 10,000.00	\$ 10,000
				Subtotal=	\$ 15,000

Map ID #	Brief Description of Items	Unit	Estimated Quantity	Unit Price	Cost ⁽¹⁾
24	Replace existing pipe under Goodlette Frank Road (GRE01190 to GRE03040)				
	Erosion Control	EA	1	\$ 5,000.00	\$ 5,000
	Maintenance of Traffic - Detour Traffic (Lane Closure)	EA	1	\$ 25,000.00	\$ 25,000
	Removal and Disposal of Existing Elliptical Pipe	LS	1	\$ 20,000.00	\$ 20,000
	Dewatering	LS	1	\$ 7,000.00	\$ 7,000
	4-Foot by 10-Foot Concrete Box Culvert (150' Length)	FT	150	\$ 940.00	\$ 141,000
	Bedding Stone	TN	155	\$ 20.00	\$ 3,100
	Endwalls	EA	2	\$ 10,000.00	\$ 20,000
	Mill Existing Asphalt	SY	670	\$ 4.50	\$ 3,015
	Milled Asphalt Disposal	CY	60	\$ 20.00	\$ 1,200
	12" Type "B" Stabilization Subbase	SY	670	\$ 12.00	\$ 8,040
	8" Limerock Base	SY	670	\$ 13.50	\$ 9,045
	3" Type S-1 Asphalt	SY	625	\$ 18.00	\$ 11,250
	Median and Landscape Replacement	LS	1	\$ 25,000.00	\$ 25,000
	Sodding	SY	350	\$ 7.50	\$ 2,625
				Subtotal=	\$ 281,000
25	Widen existing channel sections along Reach 03 (GRE03040 to GRE00160)				
	Erosion Control	EA	1	\$ 10,000.00	\$ 10,000
	Clear & Grub	AC	6	\$ 2,000.00	\$ 12,000
	Dewatering	LS	1	\$ 30,000.00	\$ 30,000
	Excavation and Grading of Channel Material	LF	2600	\$ 16.00	\$ 41,600
	Disposal of Channel Excavation Material	CY	10800	\$ 10.00	\$ 108,000
	Replacement of Native Vegetation	AC	3	\$ 15,000.00	\$ 45,000
	Sodding	SY	5800	\$ 7.50	\$ 43,500
	Seed & Mulch	AC	3	\$ 2,450.00	\$ 7,350
	Property Acquisition	AC		see note (2)	-
				Subtotal=	\$ 297,000
26	Construct 27-acre SWMF along Reach 03 (GRE03040)				
	Erosion Control	EA	1	\$ 1,500.00	\$ 1,500
	Clear & Grub	AC	30	\$ 2,000.00	\$ 60,000
	Dewatering	LS	1	\$ 100,000.00	\$ 100,000
	Excavation Regular	CY	222400	\$ 4.00	\$ 889,600
	Excavation Subsoil	CY	176200	\$ 6.00	\$ 1,057,200
	Excavation Channel	CY	725	\$ 3.50	\$ 2,538
	Flow Diversion Structure	LS	1	\$ 15,000.00	\$ 15,000
	Pond Outfall Structure	LS	1	\$ 25,000.00	\$ 25,000
	Seed & Mulch	AC	8	\$ 2,450.00	\$ 19,600
	Sodding	SY	11200	\$ 7.50	\$ 84,000
	Property Acquisition	AC		see note (2)	-
				Subtotal=	\$ 2,254,000
				Construction Total =	\$ 14,110,000
	Contingencies @ 30%	LS			\$ 4,233,000
	Engineering Design; Survey; Geotechnical and Permitting Fees @ 15%	LS			\$ 2,751,000
				PROJECT TOTAL ^{(3), (4), (5), (6)} =	\$ 21,094,000
Note:					
(1)	All costs are in 2005 dollars, and have been rounded up to the nearest thousand dollars.				
(2)	Cost for Property Acquisition and Legal Fees are not Included				
(3)	Costs included are for stormwater related infrastructure only. Therefore, no costs are included for water, wastewater and other utility improvements.				
(4)	Potential costs for hazardous material containment or removal have not been included in this opinion of probable construction costs.				
(5)	Line Items for property acquisition have only been included for Improvement IDs 11, 25 and 26. For the purpose of this opinion of probable construction cost, it is assumed that the construction associated with the remaining improvements will be performed in existing easements or right-of-ways.				
(6)	Costs do not include potential wetland mitigation or survival maintenance which may be required.				

**Table 6-16
City of Naples - Basin V Stormwater System Improvement Plan, Phase I
Engineer's Conceptual Opinion of Probable Construction Cost - Alternative 3**

Map ID #	Brief Description of Items	Unit	Estimated Quantity	Unit Price	Cost ⁽¹⁾
1B	Add new pipe along 10th Ave. N. and 15th Ave. N. (BV26015 to BV14005)				
	Erosion Control	EA	1	\$ 10,000.00	\$ 10,000
	Maintenance of Traffic - Detour Traffic (Lane Closure)	EA	1	\$ 15,000.00	\$ 15,000
	Dewatering	LS	1	\$ 10,000.00	\$ 10,000
	24-Inch Reinforced Concrete Pipe (1000' Length)	FT	1000	\$ 60.00	\$ 60,000
	42-Inch Reinforced Concrete Pipe (1100' Length)	FT	1100	\$ 105.00	\$ 115,500
	Curb Inlets	EA	16	\$ 5,000.00	\$ 80,000
	Manholes	EA	8	\$ 5,000.00	\$ 40,000
	Bedding Stone	TN	2000	\$ 20.00	\$ 40,000
	Endwalls	EA	2	\$ 10,000.00	\$ 20,000
	Mill Existing Asphalt	SY	4670	\$ 4.50	\$ 21,015
	Milled Asphalt Disposal	CY	390	\$ 20.00	\$ 7,800
	12" Type "B" Stabilization Subbase	SY	4670	\$ 12.00	\$ 56,040
	8" Limerock Base	SY	4670	\$ 13.50	\$ 63,045
	2" Type S-1 Asphalt	SY	4500	\$ 12.00	\$ 54,000
	Replace Existing Sidewalk	LS	1	\$ 10,000.00	\$ 10,000
	Sodding	SY	2330	\$ 7.50	\$ 17,475
				Subtotal=	\$ 620,000
2	Add parallel pipe along 10th St. N. (BV13020 to BV12019)				
	Erosion Control	EA	1	\$ 5,000.00	\$ 5,000
	Maintenance of Traffic - Detour Traffic (Lane Closure)	EA	1	\$ 5,000.00	\$ 5,000
	Dewatering	LS	1	\$ 7,000.00	\$ 7,000
	3-Foot x 5-Foot Concrete Box Culvert (390' Length)	FT	390	\$ 580.00	\$ 226,200
	Bedding Stone	TN	350	\$ 20.00	\$ 7,000
	Endwalls	EA	1	\$ 10,000.00	\$ 10,000
	Mill Existing Asphalt	SY	870	\$ 4.50	\$ 3,915
	Milled Asphalt Disposal	CY	70	\$ 20.00	\$ 1,400
	12" Type "B" Stabilization Subbase	SY	870	\$ 12.00	\$ 10,440
	8" Limerock Base	SY	870	\$ 13.50	\$ 11,745
	2" Type S-1 Asphalt	SY	800	\$ 12.00	\$ 9,600
	Replace Existing Sidewalk	LS	1	\$ 3,000.00	\$ 3,000
	Sodding	SY	430	\$ 7.50	\$ 3,225
				Subtotal=	\$ 304,000
3	Add parallel pipe, outfall from 6th Ave. N. pond (BV12010 to GRE01020)				
	Erosion Control	EA	1	\$ 5,000.00	\$ 5,000
	Maintenance of Traffic - Detour Traffic (Lane Closure)	EA	1	\$ 15,000.00	\$ 15,000
	Dewatering	LS	1	\$ 7,000.00	\$ 7,000
	48-Inch Reinforced Concrete Pipe (286' Length)	FT	286	\$ 120.00	\$ 34,320
	Bedding Stone	TN	250	\$ 20.00	\$ 5,000
	Sodding	SY	1000	\$ 7.50	\$ 7,500
				Subtotal=	\$ 74,000
4	Add parallel pipe along 8th Ave. N. (BV11020 to GRE01060)				
	Erosion Control	EA	1	\$ 5,000.00	\$ 5,000
	Maintenance of Traffic - Detour Traffic (Lane Closure)	EA	1	\$ 15,000.00	\$ 15,000
	Removal and Disposal of Existing Pipes	LS	1	\$ 10,000.00	\$ 10,000
	Dewatering	LS	1	\$ 7,000.00	\$ 7,000
	24-Inch Reinforced Concrete Pipe (389' Length)	FT	389	\$ 60.00	\$ 23,340
	48-Inch Reinforced Concrete Pipe (572' Length)	FT	572	\$ 120.00	\$ 68,640
	Bedding Stone	TN	900	\$ 20.00	\$ 18,000
	Mill Existing Asphalt	SY	2140	\$ 4.50	\$ 9,630
	Milled Asphalt Disposal	CY	180	\$ 20.00	\$ 3,600
	12" Type "B" Stabilization Subbase	SY	2140	\$ 12.00	\$ 25,680
	8" Limerock Base	SY	2140	\$ 13.50	\$ 28,890
	2" Type S-1 Asphalt	SY	2000	\$ 12.00	\$ 24,000
	Replace Existing Sidewalk	LS	1	\$ 5,000.00	\$ 5,000
	Sodding	SY	1070	\$ 7.50	\$ 8,025
				Subtotal=	\$ 252,000

Map ID #	Brief Description of Items	Unit	Estimated Quantity	Unit Price	Cost ⁽¹⁾
5	Detention improvements at 13th St. N. pond (BV11040)				
	Detention facility control structure	LS	1	\$ 30,000.00	\$ 30,000
				Subtotal=	\$ 30,000
6	Pipe and detention improvements along 10th Ave. N. (BV15030 to GRE01090)				
	Erosion Control	EA	1	\$ 5,000.00	\$ 5,000
	Maintenance of Traffic - Detour Traffic (Lane Closure)	EA	1	\$ 15,000.00	\$ 15,000
	Removal and Disposal of Existing Pipes	LS	1	\$ 10,000.00	\$ 10,000
	Dewatering	LS	1	\$ 7,000.00	\$ 7,000
	48-Inch Reinforced Concrete Pipe (858' Length)	FT	858	\$ 120.00	\$ 102,960
	Bedding Stone	TN	800	\$ 20.00	\$ 16,000
	Mill Existing Asphalt	SY	1910	\$ 4.50	\$ 8,595
	Milled Asphalt Disposal	CY	160	\$ 20.00	\$ 3,200
	12" Type "B" Stabilization Subbase	SY	1910	\$ 12.00	\$ 22,920
	8" Limerock Base	SY	1910	\$ 13.50	\$ 25,785
	2" Type S-1 Asphalt	SY	1850	\$ 12.00	\$ 22,200
	Replace Existing Sidewalk	LS	1	\$ 5,000.00	\$ 5,000
	Sodding	SY	950	\$ 7.50	\$ 7,125
	Detention facility control structure	LS	1	\$ 25,000.00	\$ 25,000
			Subtotal=	\$ 276,000	
7B	Add parallel pipe along 11th St. N. (BV15080 to BV15030)				
	Erosion Control	EA	1	\$ 5,000.00	\$ 5,000
	Maintenance of Traffic - Detour Traffic (Lane Closure)	EA	1	\$ 5,000.00	\$ 5,000
	Dewatering	LS	1	\$ 7,000.00	\$ 7,000
	24-Inch Reinforced Concrete Pipe (370' Length)	FT	370	\$ 60.00	\$ 22,200
	Bedding Stone	TN	300	\$ 20.00	\$ 6,000
	Mill Existing Asphalt	SY	820	\$ 4.50	\$ 3,690
	Milled Asphalt Disposal	CY	70	\$ 20.00	\$ 1,400
	12" Type "B" Stabilization Subbase	SY	820	\$ 12.00	\$ 9,840
	8" Limerock Base	SY	820	\$ 13.50	\$ 11,070
	2" Type S-1 Asphalt	SY	750	\$ 12.00	\$ 9,000
	Replace Existing Sidewalk	LS	1	\$ 3,000.00	\$ 3,000
Sodding	SY	410	\$ 7.50	\$ 3,075	
			Subtotal=	\$ 86,000	
7C	Add new pipe along 11th St. N. (BV24010 to BV15030)				
	Erosion Control	EA	1	\$ 5,000.00	\$ 5,000
	Maintenance of Traffic - Detour Traffic (Lane Closure)	EA	1	\$ 10,000.00	\$ 10,000
	Dewatering	LS	1	\$ 7,000.00	\$ 7,000
	18-Inch Reinforced Concrete Pipe (600' Length)	FT	600	\$ 45.00	\$ 27,000
	Curb Inlets	EA	4	\$ 5,000.00	\$ 20,000
	Manholes	EA	4	\$ 5,000.00	\$ 20,000
	Bedding Stone	TN	500	\$ 20.00	\$ 10,000
	Endwalls	EA	1	\$ 10,000.00	\$ 10,000
	Mill Existing Asphalt	SY	1330	\$ 4.50	\$ 5,985
	Milled Asphalt Disposal	CY	110	\$ 20.00	\$ 2,200
	12" Type "B" Stabilization Subbase	SY	1330	\$ 12.00	\$ 15,960
	8" Limerock Base	SY	1330	\$ 13.50	\$ 17,955
	2" Type S-1 Asphalt	SY	1250	\$ 12.00	\$ 15,000
Replace Existing Sidewalk	LS	1	\$ 5,000.00	\$ 5,000	
Sodding	SY	670	\$ 7.50	\$ 5,025	
			Subtotal=	\$ 176,000	
8	Add parallel pipe along 14th Ave. N. (BV22010 to GRE01110)				
	Erosion Control	EA	1	\$ 5,000.00	\$ 5,000
	Maintenance of Traffic - Detour Traffic (Lane Closure)	EA	1	\$ 15,000.00	\$ 15,000
	Dewatering	LS	1	\$ 7,000.00	\$ 7,000
	24-Inch Reinforced Concrete Pipe (170' Length)	FT	170	\$ 60.00	\$ 10,200
	Bedding Stone	TN	150	\$ 20.00	\$ 3,000
	Mill Existing Asphalt	SY	380	\$ 4.50	\$ 1,710
	Milled Asphalt Disposal	CY	30	\$ 20.00	\$ 600
	12" Type "B" Stabilization Subbase	SY	380	\$ 12.00	\$ 4,560
	8" Limerock Base	SY	380	\$ 13.50	\$ 5,130
	2" Type S-1 Asphalt	SY	350	\$ 12.00	\$ 4,200
Replace Existing Sidewalk	LS	1	\$ 3,000.00	\$ 3,000	
Sodding	SY	190	\$ 7.50	\$ 1,425	
			Subtotal=	\$ 61,000	

Map ID #	Brief Description of Items	Unit	Estimated Quantity	Unit Price	Cost ⁽¹⁾
9	Pipe improvements along 12th St. N. (BV23065 to GRE01120)				
	Erosion Control	EA	1	\$ 10,000.00	\$ 10,000
	Maintenance of Traffic - Detour Traffic (Lane Closure)	EA	1	\$ 15,000.00	\$ 15,000
	Removal and Disposal of Existing Pipes	LS	1	\$ 15,000.00	\$ 15,000
	Dewatering	LS	1	\$ 10,000.00	\$ 10,000
	18-Inch Reinforced Concrete Pipe (619' Length)	FT	619	\$ 45.00	\$ 27,855
	24-Inch Reinforced Concrete Pipe (750' Length)	FT	750	\$ 60.00	\$ 45,000
	48-Inch Reinforced Concrete Pipe (106' Length)	FT	106	\$ 120.00	\$ 12,720
	43-Inch by 68-Inch Elliptical Reinforced Concrete Pipe (1010' Length)	FT	1010	\$ 215.00	\$ 217,150
	Curb Inlets	EA	18	\$ 5,000.00	\$ 90,000
	Manholes	EA	9	\$ 5,000.00	\$ 45,000
	Bedding Stone	TN	2200	\$ 20.00	\$ 44,000
	Endwalls	EA	1	\$ 10,000.00	\$ 10,000
	Mill Existing Asphalt	SY	4900	\$ 4.50	\$ 22,050
	Milled Asphalt Disposal	CY	410	\$ 20.00	\$ 8,200
	12" Type "B" Stabilization Subbase	SY	4900	\$ 12.00	\$ 58,800
	8" Limerock Base	SY	4900	\$ 13.50	\$ 66,150
	2" Type S-1 Asphalt	SY	4700	\$ 12.00	\$ 56,400
	Replace Existing Sidewalk	LS	1	\$ 10,000.00	\$ 10,000
	Sodding	SY	2500	\$ 7.50	\$ 18,750
				Subtotal=	\$ 782,000
10	Detention improvements at 15th Ave. N. pond (BV27010)				
	Detention facility control structure	LS	1	\$ 20,000.00	\$ 20,000
				Subtotal=	\$ 20,000
11	Conveyance improvements adjacent to the Mall (GRE01140 to GRE01130)				
	Erosion Control	EA	1	\$ 5,500.00	\$ 5,500
	Maintenance of Traffic - Periodic Lane Closure	EA	1	\$ 10,000.00	\$ 10,000
	Dewatering	LS	1	\$ 11,500.00	\$ 11,500
	48-In. by 76-In. Elliptical Reinforced Concrete Pipe -2 sets (200' Length) at Mall Entrance	FT	600	\$ 225.00	\$ 135,000
	48-In. by 76-In. Elliptical Reinforced Concrete Pipe -2 sets (170' Length) at Fleishman Blvd.	FT	510	\$ 225.00	\$ 114,750
	Backfill Material/Compaction	CY	2100	\$ 9.00	\$ 18,900
	Endwalls	EA	4	\$ 5,500.00	\$ 22,000
	Mill Existing Asphalt	SY	2500	\$ 4.50	\$ 11,250
	Milled Asphalt Disposal	CY	250	\$ 20.00	\$ 5,000
	12" Type "B" Stabilization Subbase	SY	1430	\$ 12.00	\$ 17,160
	8" Limerock Base	SY	1400	\$ 13.50	\$ 18,900
	2" Type S-1 Asphalt	SY	1350	\$ 12.00	\$ 16,200
	Excavation of Material in Channel (Upstream & Downstream of Culverts)	LF	50	\$ 10.00	\$ 500
	New Open Channel Excavation (200-feet)	CY	1100	\$ 4.00	\$ 4,400
	Disposal of Channel Excavation Material	CY	1200	\$ 10.00	\$ 12,000
	Sodding	SY	700	\$ 7.50	\$ 5,250
	Property Acquisition	AC	0	see note (2)	-
				Subtotal=	\$ 408,000
12	Pipe improvements along Golden Gate Parkway (BV35045 to GRE01150)				
	Erosion Control	EA	1	\$ 10,000.00	\$ 10,000
	Maintenance of Traffic - Detour Traffic (Lane Closure)	EA	1	\$ 25,000.00	\$ 25,000
	Dewatering	LS	1	\$ 10,000.00	\$ 10,000
	36-Inch Reinforced Concrete Pipe (560' Length)	FT	560	\$ 90.00	\$ 50,400
	53-Inch by 83-Inch Elliptical Reinforced Concrete Pipe (549' Length)	FT	549	\$ 300.00	\$ 164,700
	4-Foot x 7-Foot Concrete Box Culvert (891' Length)	FT	891	\$ 790.00	\$ 703,890
	Curb Inlets	EA	10	\$ 5,000.00	\$ 50,000
	Manholes	EA	7	\$ 5,000.00	\$ 35,000
	Bedding Stone	TN	2000	\$ 20.00	\$ 40,000
	Mill Existing Asphalt	SY	5560	\$ 4.50	\$ 25,020
	Milled Asphalt Disposal	CY	460	\$ 20.00	\$ 9,200
	12" Type "B" Stabilization Subbase	SY	5560	\$ 12.00	\$ 66,720
	8" Limerock Base	SY	5560	\$ 13.50	\$ 75,060
	2" Type S-1 Asphalt	SY	5400	\$ 12.00	\$ 64,800
	Replace Existing Sidewalk	LS	1	\$ 10,000.00	\$ 10,000
	Sodding	SY	2220	\$ 7.50	\$ 16,650
				Subtotal=	\$ 1,356,000

Map ID #	Brief Description of Items	Unit	Estimated Quantity	Unit Price	Cost ⁽¹⁾	
13	Add parallel pipe along Golden Gate Parkway (BV42010 to GRE01160)					
	Erosion Control	EA	1	\$ 5,000.00	\$ 5,000	
	Maintenance of Traffic - Detour Traffic (Lane Closure)	EA	1	\$ 25,000.00	\$ 25,000	
	Dewatering	LS	1	\$ 7,000.00	\$ 7,000	
	36-Inch Reinforced Concrete Pipe (887' Length)	FT	887	\$ 90.00	\$ 79,830	
	Curb Inlets	EA	3	\$ 5,000.00	\$ 15,000	
	Manholes	EA	3	\$ 5,000.00	\$ 15,000	
	Bedding Stone	TN	800	\$ 20.00	\$ 16,000	
	Mill Existing Asphalt	SY	2460	\$ 4.50	\$ 11,070	
	Milled Asphalt Disposal	CY	210	\$ 20.00	\$ 4,200	
	12" Type "B" Stabilization Subbase	SY	2460	\$ 12.00	\$ 29,520	
	8" Limerock Base	SY	2460	\$ 13.50	\$ 33,210	
	2" Type S-1 Asphalt	SY	2400	\$ 12.00	\$ 28,800	
	Replace Existing Sidewalk	LS	1	\$ 5,000.00	\$ 5,000	
	Sodding	SY	990	\$ 7.50	\$ 7,425	
					Subtotal=	\$ 282,000
	14	Pipe and detention improvements along Diana Ave./10th St. N. (BV43030 to GRE01163)				
Erosion Control		EA	1	\$ 10,000.00	\$ 10,000	
Maintenance of Traffic - Detour Traffic (Lane Closure)		EA	1	\$ 15,000.00	\$ 15,000	
Removal and Disposal of Existing Pipes		LS	1	\$ 5,000.00	\$ 5,000	
Dewatering		LS	1	\$ 10,000.00	\$ 10,000	
18-Inch Reinforced Concrete Pipe (414' Length)		FT	414	\$ 45.00	\$ 18,630	
4-Foot x 8-Foot Concrete Box Culvert (817' Length)		FT	817	\$ 84.00	\$ 686,280	
4-Foot x 7-Foot Concrete Box Culvert (53' Length)		FT	53	\$ 790.00	\$ 41,870	
4-Foot x 6-Foot Concrete Box Culvert (154' Length)		FT	154	\$ 730.00	\$ 112,420	
4-Foot x 9-Foot Concrete Box Culvert (1392' Length)		FT	1392	\$ 890.00	\$ 1,238,880	
Curb Inlets		EA	20	\$ 5,000.00	\$ 100,000	
Manholes		EA	10	\$ 5,000.00	\$ 50,000	
Bedding Stone		TN	2600	\$ 20.00	\$ 52,000	
Mill Existing Asphalt		SY	6290	\$ 4.50	\$ 28,305	
Milled Asphalt Disposal		CY	520	\$ 20.00	\$ 10,400	
12" Type "B" Stabilization Subbase		SY	6290	\$ 12.00	\$ 75,480	
8" Limerock Base		SY	6290	\$ 13.50	\$ 84,915	
2" Type S-1 Asphalt	SY	6100	\$ 12.00	\$ 73,200		
Replace Existing Sidewalk	LS	1	\$ 10,000.00	\$ 10,000		
Sodding	SY	3140	\$ 7.50	\$ 23,550		
Detention facility control structures (Diana Ave and dry pond at High School)	EA	2	\$ 15,000.00	\$ 30,000		
				Subtotal=	\$ 2,676,000	
15	Replace existing pipe under Golden Gate Parkway (GRE01160 to GRE01150)					
	Erosion Control	EA	1	\$ 5,000.00	\$ 5,000	
	Maintenance of Traffic - Detour Traffic (Lane Closure)	EA	1	\$ 25,000.00	\$ 25,000	
	Dewatering	LS	1	\$ 7,000.00	\$ 7,000	
	4-Foot x 7-Foot Concrete Box Culvert (200' Length)	FT	200	\$ 790.00	\$ 158,000	
	3-Foot x 6-Foot Concrete Box Culvert (128' Length)	FT	128	\$ 630.00	\$ 80,640	
	Bedding Stone	TN	230	\$ 20.00	\$ 4,600	
	Endwall	EA	1	\$ 10,000.00	\$ 10,000	
	Cast-In-Place Concrete Structures	EA	1	\$ 30,000.00	\$ 30,000	
	Mill Existing Asphalt	SY	910	\$ 4.50	\$ 4,095	
	Milled Asphalt Disposal	CY	80	\$ 20.00	\$ 1,600	
	12" Type "B" Stabilization Subbase	SY	910	\$ 12.00	\$ 10,920	
	8" Limerock Base	SY	910	\$ 13.50	\$ 12,285	
	3" Type S-1 Asphalt	SY	850	\$ 18.00	\$ 15,300	
	Excavation of Material in Channel (Upstream of Culverts)	LF	50	\$ 10.00	\$ 500	
	Disposal of Channel Excavation Material	CY	60	\$ 10.00	\$ 600	
	Sodding	SY	250	\$ 7.50	\$ 1,875	
				Subtotal=	\$ 367,000	

Map ID #	Brief Description of Items	Unit	Estimated Quantity	Unit Price	Cost ⁽¹⁾
17	Pipe improvements along Royal Palm Dr. (BV44030 to GRE01180)				
	Erosion Control	EA	1	\$ 5,000.00	\$ 5,000
	Maintenance of Traffic - Detour Traffic (Lane Closure)	EA	1	\$ 10,000.00	\$ 10,000
	Dewatering	LS	1	\$ 7,000.00	\$ 7,000
	48-Inch Reinforced Concrete Pipe (602' Length)	FT	602	\$ 120.00	\$ 72,240
	48-Inch by 76-Inch Elliptical Reinforced Concrete Pipe (342' Length)	FT	342	\$ 225.00	\$ 76,950
	Curb Inlets	EA	8	\$ 5,000.00	\$ 40,000
	Manholes	EA	3	\$ 5,000.00	\$ 15,000
	Bedding Stone	TN	900	\$ 20.00	\$ 18,000
	Mill Existing Asphalt	SY	2100	\$ 4.50	\$ 9,450
	Milled Asphalt Disposal	CY	170	\$ 20.00	\$ 3,400
	12" Type "B" Stabilization Subbase	SY	2100	\$ 12.00	\$ 25,200
	8" Limerock Base	SY	2100	\$ 13.50	\$ 28,350
	2" Type S-1 Asphalt	SY	2000	\$ 12.00	\$ 24,000
	Replace Existing Sidewalk	LS	1	\$ 5,000.00	\$ 5,000
	Sodding	SY	1050	\$ 7.50	\$ 7,875
				Subtotal=	\$ 347,000
18	Add parallel pipe along Diana Ave. (BV44045 to GRE01192)				
	Erosion Control	EA	1	\$ 5,000.00	\$ 5,000
	Maintenance of Traffic - Detour Traffic (Lane Closure)	EA	1	\$ 10,000.00	\$ 10,000
	Dewatering	LS	1	\$ 7,000.00	\$ 7,000
	18-Inch Reinforced Concrete Pipe (331' Length)	FT	331	\$ 45.00	\$ 14,895
	24-Inch Reinforced Concrete Pipe (210' Length)	FT	210	\$ 60.00	\$ 12,600
	Curb Inlets	EA	6	\$ 5,000.00	\$ 30,000
	Manholes	EA	2	\$ 5,000.00	\$ 10,000
	Bedding Stone	TN	500	\$ 20.00	\$ 10,000
	Endwalls	EA	1	\$ 10,000.00	\$ 10,000
	Mill Existing Asphalt	SY	1200	\$ 4.50	\$ 5,400
	Milled Asphalt Disposal	CY	100	\$ 20.00	\$ 2,000
	12" Type "B" Stabilization Subbase	SY	1200	\$ 12.00	\$ 14,400
	8" Limerock Base	SY	1200	\$ 13.50	\$ 16,200
	2" Type S-1 Asphalt	SY	1100	\$ 12.00	\$ 13,200
	Replace Existing Sidewalk	LS	1	\$ 5,000.00	\$ 5,000
	Sodding	SY	600	\$ 7.50	\$ 4,500
				Subtotal=	\$ 170,000
19	Replace existing pipe along 26th Ave. N. (BV44050 to GRE01200)				
	Erosion Control	EA	1	\$ 5,000.00	\$ 5,000
	Maintenance of Traffic - Detour Traffic (Lane Closure)	EA	1	\$ 10,000.00	\$ 10,000
	Removal and Disposal of Existing Pipes	LS	1	\$ 5,000.00	\$ 5,000
	Dewatering	LS	1	\$ 7,000.00	\$ 7,000
	48-Inch Reinforced Concrete Pipe (240' Length)	FT	240	\$ 120.00	\$ 28,800
	Curb Inlets	EA	4	\$ 5,000.00	\$ 20,000
	Manholes	EA	1	\$ 5,000.00	\$ 5,000
	Bedding Stone	TN	200	\$ 20.00	\$ 4,000
	Mill Existing Asphalt	SY	530	\$ 4.50	\$ 2,385
	Milled Asphalt Disposal	CY	40	\$ 20.00	\$ 800
	12" Type "B" Stabilization Subbase	SY	530	\$ 12.00	\$ 6,360
	8" Limerock Base	SY	530	\$ 13.50	\$ 7,155
	2" Type S-1 Asphalt	SY	500	\$ 12.00	\$ 6,000
	Replace Existing Sidewalk	LS	1	\$ 3,000.00	\$ 3,000
	Sodding	SY	270	\$ 7.50	\$ 2,025
				Subtotal=	\$ 113,000

Map ID #	Brief Description of Items	Unit	Estimated Quantity	Unit Price	Cost ⁽¹⁾
20	Pipe improvements along 28th Ave. N. (BV43067 to GRE01220)				
	Erosion Control	EA	1	\$ 10,000.00	\$ 10,000
	Maintenance of Traffic - Detour Traffic (Lane Closure)	EA	1	\$ 15,000.00	\$ 15,000
	Dewatering	LS	1	\$ 10,000.00	\$ 10,000
	18-Inch Reinforced Concrete Pipe (842' Length)	FT	842	\$ 45.00	\$ 37,890
	48-Inch by 76-Inch Elliptical Reinforced Concrete Pipe (857' Length)	FT	857	\$ 225.00	\$ 192,825
	Curb Inlets	EA	12	\$ 5,000.00	\$ 60,000
	Manholes	EA	6	\$ 5,000.00	\$ 30,000
	Bedding Stone	TN	1600	\$ 20.00	\$ 32,000
	Mill Existing Asphalt	SY	3800	\$ 4.50	\$ 17,100
	Milled Asphalt Disposal	CY	310	\$ 20.00	\$ 6,200
	12" Type "B" Stabilization Subbase	SY	3800	\$ 12.00	\$ 45,600
	8" Limerock Base	SY	3800	\$ 13.50	\$ 51,300
	2" Type S-1 Asphalt	SY	3600	\$ 12.00	\$ 43,200
	Replace Existing Sidewalk	LS	1	\$ 7,000.00	\$ 7,000
	Sodding	SY	1900	\$ 7.50	\$ 14,250
					Subtotal=
21	Add parallel pipe, outfall from 28th Ave. N. pond (BV46010 to BV43060)				
	Erosion Control	EA	1	\$ 3,000.00	\$ 3,000
	Maintenance of Traffic - Detour Traffic (Lane Closure)	EA	1	\$ 5,000.00	\$ 5,000
	Dewatering	LS	1	\$ 5,000.00	\$ 5,000
	24-Inch Reinforced Concrete Pipe (97' Length)	FT	97	\$ 60.00	\$ 5,820
	Bedding Stone	TN	80	\$ 20.00	\$ 1,600
	Endwalls	EA	1	\$ 10,000.00	\$ 10,000
	Mill Existing Asphalt	SY	110	\$ 4.50	\$ 495
	Milled Asphalt Disposal	CY	10	\$ 20.00	\$ 200
	12" Type "B" Stabilization Subbase	SY	110	\$ 12.00	\$ 1,320
	8" Limerock Base	SY	110	\$ 13.50	\$ 1,485
	2" Type S-1 Asphalt	SY	100	\$ 12.00	\$ 1,200
	Replace Existing Sidewalk	LS	1	\$ 3,000.00	\$ 3,000
Sodding	SY	400	\$ 7.50	\$ 3,000	
				Subtotal=	\$ 41,000
22	Add parallel pipe, outfall from 14th St. N. pond (BV47010 to GRE01230)				
	Erosion Control	EA	1	\$ 5,000.00	\$ 5,000
	Maintenance of Traffic - Detour Traffic (Lane Closure)	EA	1	\$ 15,000.00	\$ 15,000
	Dewatering	LS	1	\$ 7,000.00	\$ 7,000
	48-Inch Reinforced Concrete Pipe (228' Length)	FT	228	\$ 120.00	\$ 27,360
	Bedding Stone	TN	200	\$ 20.00	\$ 4,000
	Endwalls	EA	2	\$ 10,000.00	\$ 20,000
	Mill Existing Asphalt	SY	170	\$ 4.50	\$ 765
	Milled Asphalt Disposal	CY	10	\$ 20.00	\$ 200
	12" Type "B" Stabilization Subbase	SY	170	\$ 12.00	\$ 2,040
	8" Limerock Base	SY	170	\$ 13.50	\$ 2,295
	2" Type S-1 Asphalt	SY	150	\$ 12.00	\$ 1,800
	Replace Existing Sidewalk	LS	1	\$ 3,000.00	\$ 3,000
Sodding	SY	250	\$ 7.50	\$ 1,875	
				Subtotal=	\$ 90,000
23	Weir modifications adjacent to Reach 03 (GRE01192 to GRE01190)				
	Removal and Disposal of Existing Weir	EA	1	\$ 5,000.00	\$ 5,000
	Construction of new weir	LS	1	\$ 10,000.00	\$ 10,000
				Subtotal=	\$ 15,000

Map ID #	Brief Description of Items	Unit	Estimated Quantity	Unit Price	Cost ⁽¹⁾
24	Add parallel pipe under Goodlette Frank Road (GRE01190 to GRE03040)				
	Erosion Control	EA	1	\$ 5,000.00	\$ 5,000
	Maintenance of Traffic - Detour Traffic (Lane Closure)	EA	1	\$ 25,000.00	\$ 25,000
	Dewatering	LS	1	\$ 7,000.00	\$ 7,000
	4-Foot by 6-Foot Concrete Box Culvert (150' Length)	FT	150	\$ 730.00	\$ 109,500
	Bedding Stone	TN	155	\$ 20.00	\$ 3,100
	Endwalls	EA	2	\$ 10,000.00	\$ 20,000
	Mill Existing Asphalt	SY	670	\$ 4.50	\$ 3,015
	Milled Asphalt Disposal	CY	60	\$ 20.00	\$ 1,200
	12" Type "B" Stabilization Subbase	SY	670	\$ 12.00	\$ 8,040
	8" Limerock Base	SY	670	\$ 13.50	\$ 9,045
	3" Type S-1 Asphalt	SY	625	\$ 18.00	\$ 11,250
	Median and Landscape Replacement	LS	1	\$ 25,000.00	\$ 25,000
	Sodding	SY	350	\$ 7.50	\$ 2,625
				Subtotal=	\$ 230,000
25	Widen existing channel sections along Reach 03 (GRE03040 to GRE00160)				
	Erosion Control	EA	1	\$ 10,000.00	\$ 10,000
	Clear & Grub	AC	6	\$ 2,000.00	\$ 12,000
	Dewatering	LS	1	\$ 30,000.00	\$ 30,000
	Excavation and Grading of Channel Material	LF	2600	\$ 16.00	\$ 41,600
	Disposal of Channel Excavation Material	CY	10800	\$ 10.00	\$ 108,000
	Replacement of Native Vegetation	AC	3	\$ 15,000.00	\$ 45,000
	Sodding	SY	5800	\$ 7.50	\$ 43,500
	Seed & Mulch	AC	3	\$ 2,450.00	\$ 7,350
	Property Acquisition	AC		see note (2)	-
				Subtotal=	\$ 297,000
26	Construct 27-acre SWMF along Reach 03 (GRE03040)				
	Erosion Control	EA	1	\$ 1,500.00	\$ 1,500
	Clear & Grub	AC	30	\$ 2,000.00	\$ 60,000
	Dewatering	LS	1	\$ 100,000.00	\$ 100,000
	Excavation Regular	CY	222400	\$ 4.00	\$ 889,600
	Excavation Subsoil	CY	176200	\$ 6.00	\$ 1,057,200
	Excavation Channel	CY	725	\$ 3.50	\$ 2,538
	Flow Diversion Structure	LS	1	\$ 15,000.00	\$ 15,000
	Pond Outfall Structure	LS	1	\$ 25,000.00	\$ 25,000
	Seed & Mulch	AC	8	\$ 2,450.00	\$ 19,600
	Sodding	SY	11200	\$ 7.50	\$ 84,000
	Property Acquisition	AC		see note (2)	-
				Subtotal=	\$ 2,254,000
				Construction Total =	\$ 11,899,000
	Contingencies @ 30%	LS			\$ 3,570,000
	Engineering Design; Survey; Geotechnical and Permitting Fees @ 15%	LS			\$ 2,320,000
				PROJECT TOTAL ^{(3), (4), (5), (6)} =	\$ 17,789,000
Note:					
(1)	All costs are in 2005 dollars, and have been rounded up to the nearest thousand dollars.				
(2)	Cost for Property Acquisition and Legal Fees are not Included				
(3)	Costs included are for stormwater related infrastructure only. Therefore, no costs are included for water, wastewater and other utility improvements.				
(4)	Potential costs for hazardous material containment or removal have not been included in this opinion of probable construction costs.				
(5)	Line Items for property acquisition have only been included for Improvement IDs 11, 25 and 26. For the purpose of this opinion of probable construction cost, it is assumed that the construction associated with the remaining improvements will be performed in existing easements or right-of-ways.				
(6)	Costs do not include potential wetland mitigation or survival maintenance which may be required.				

TABLE 6-17

City of Naples - Basin V Stormwater System Improvement Plan, Phase I
Proposed System LOS Evaluation - Comparison of Alternatives (25-yr/72-hr Event)

Junction Name	Location	Road Crown Elevation (ft-NGVD)	Yard Elevation (ft-NGVD)	Structure Elevation (ft-NGVD)	Problem Area ID	Existing System			Alternative 1			Alternative 2			Alternative 3		
						Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾
BV13010	6th Avenue North	5.9	5.5	n/a	1A	7.1	1.2	D	7.1	1.2	D	7.2	1.4	D	6.8	0.9	D
BV14010	intersection of US 41 and 5th Avenue North	8.1	n/a	n/a	1A	8.2	0.1	C	8.2	0.1	C	7.3		A	8.0		A
BV14030	US 41, d/s of 7th Avenue North	9.6	n/a	n/a	1B	10.2	0.6	D	10.2	0.6	D	9.0		A	10.0	0.4	C
BV14045	US 41, d/s of 8th Avenue North	10.4	n/a	n/a	1B	10.6	0.2	C	10.6	0.2	C	9.6		A	10.4		A
BV14050	intersection of US 41 and 8th Avenue North	10.2	n/a	n/a	1B	10.7	0.4	C	10.7	0.4	C	9.7		A	10.5	0.2	C
BV14055	US 41, u/s of 8th Avenue North	10.4	n/a	n/a	1B	10.7	0.3	C	10.7	0.3	C	9.9		A	10.5	0.1	C
BV14060	d/s end of crossing at intersection of US 41 and 10th Avenue	10.0	n/a	n/a	1B	10.8	0.7	D	10.8	0.7	D	9.9		A	10.5	0.5	C
BV14070	US 41, u/s of 10th Avenue	10.4	n/a	n/a	1B	10.8	0.4	C	10.8	0.4	C	10.1		A	10.5	0.1	C
BV14075	US 41, d/s of 12th Avenue North	10.5	n/a	n/a	1B	10.8	0.3	C	10.8	0.3	C	10.2		A	10.5		A
BV26005	US 41, u/s of 12th Avenue North	10.4	n/a	n/a	1B	10.9	0.5	C	10.9	0.5	C	10.2		A	10.5	0.2	C
BV26010	US 41, d/s of 14th Avenue North	10.2	n/a	n/a	1B	10.9	0.7	D	10.9	0.7	D	10.2		A	10.4	0.2	C
BV26015	US 41, d/s of 14th Avenue North	10.5	n/a	n/a	1B	11.0	0.5	C	11.0	0.5	C	10.3		A	10.5	0.0	C
BV13020	Alley	7.1	7.9	9.5	2	7.7	0.6	D	7.7	0.6	D	7.1		A	6.8		A
BV13021	10th Street North	6.4	6.6	8.8	2	7.1	0.7	D	7.1	0.7	D	7.0	0.6	D	6.8	0.4	C
BV12020	12th Street North	5.3	5.3	7.5	3	7.1	1.8	D	7.1	1.8	D	7.0	1.7	D	6.8	1.5	D
BV12030	intersection of 7th Avenue North and 12th Street North	5.5	5.9	7.6	3	7.1	1.6	D	7.1	1.6	D	7.0	1.5	D	6.8	1.3	D
BV11007	u/s of intersection of 8th Ave N and Goodlette-Frank Road	5.8	4.5	n/a	4	6.6	0.8	D	6.5	0.8	D	6.8	1.0	D	6.6	0.8	D
BV11010	intersection of 8th Avenue North and 12th Street North	6.2	5.7	n/a	4	7.0	0.8	D	7.0	0.8	D	6.8	0.5	D	6.7	0.4	C
BV11020	8th Avenue North	7.2	6.9	8.8	4	8.4	1.2	D	8.4	1.2	D	7.0		B	7.0		B
BV11030	13th Street North	7.4	5.9	n/a	5	7.4	0.1	C	7.4	0.1	C	7.3		B	7.4	0.1	C
BV11070	d/s end of crossing at 10th Ave N and 13th St N	7.7	6.9	n/a	6	8.4	0.7	D	8.4	0.7	D	7.8	0.1	C	7.9	0.2	C
BV11060	u/s end of crossing at 10th Ave N and 13th St N	7.9	8.2	9.5	6	8.7	0.8	D	8.7	0.8	D	7.9		A	8.2	0.3	C
BV15010	d/s end of 12th Street North crossing	9.5	9.5	11.4	6	9.5	0.1	C	9.5	0.1	C	8.3		A	8.7		A
BV15040	intersection of 11th Street North and 10th Avenue North	9.1	n/a	n/a	7A	10.1	1.0	D	10.1	1.0	D	8.6		A	9.2	0.1	C
BV15050	10th Avenue North	10.1	10.3	12.6	7A	10.2	0.1	C	10.2	0.1	C	8.8		A	9.4		A
BV15060	intersection of 10th Avenue North and 10th Street North	9.5	9.4	11.1	7A	10.2	0.7	D	10.2	0.7	D	8.5		A	9.4		B
BV15070	11th Street North(8)	9.0	9.7	11.5	7B	10.1	1.1	D	10.1	1.1	D	8.5		A	9.1	0.1	C
BV15080	intersection of 11th Street North and 10th Street North	8.6	n/a	n/a	7B	10.1	1.5	D	10.1	1.5	D	8.6		A	9.1	0.5	C
BV15090	intersection of 11th Street North and 10th Street North	9.2	n/a	12.9	7B	10.1	0.9	D	10.1	0.9	D	8.3		A	9.1		A
BV24010	east of 11th Street North	9.5	9.0	11.4	7C	10.1	0.6	D	10.1	0.6	D	9.4		B	9.9	0.4	C
BV22010	14th Avenue North	7.2	6.9	9.9	8	7.8	0.6	D	7.8	0.6	D	7.4	0.2	C	7.7	0.5	C
BV23005	north of Lake Park Elementary School	8.7	7.4	n/a	9	8.9	0.1	C	8.9	0.1	C	7.2		A	7.3		A
BV23010	corner of 15th Avenue North and 12th Street North	7.4	n/a	n/a	9	8.8	1.4	D	8.8	1.4	D	7.2		A	7.3		A
BV23011	15th Avenue North	7.2	n/a	n/a	9	8.8	1.5	D	8.8	1.5	D	7.2		A	7.2		A
BV23015	d/s end of 14th Avenue North crossing	7.4	7.6	9.6	9	8.8	1.4	D	8.8	1.4	D	7.3		A	7.7	0.3	C
BV23020	u/s end of 14th Avenue North crossing	7.9	7.2	n/a	9	8.8	0.9	D	8.8	0.9	D	7.4		B	7.8		B
BV23025	intersection of 12th Street North and 14th Avenue North	7.9	7.4	n/a	9	8.8	0.9	D	8.8	0.9	D	7.7		B	8.0	0.1	C
BV23030	intersection of 12th Street North and 14th Avenue North	7.7	7.5	10.0	9	8.8	1.1	D	8.8	1.1	D	7.5		B	8.0	0.3	C
BV23035	intersection of 12th Street North and 14th Avenue North	7.9	n/a	n/a	9	8.7	0.9	D	8.7	0.9	D	7.7		A	8.0	0.2	C
BV23040	intersection of 12th Street North and 14th Avenue North	8.1	7.4	n/a	9	8.7	0.6	D	8.7	0.6	D	7.7		B	8.0		B
BV23045	12th Street North, south of 14th Avenue North	8.4	7.9	n/a	9	8.6	0.2	C	8.6	0.2	C	7.6		A	8.0		B
BV23050	12th Street North, south of 14th Avenue North	8.2	7.9	10.6	9	8.5	0.4	C	8.6	0.4	C	7.6		A	8.0		B
BV23055	12th Street North, north of 13th Avenue North	8.2	n/a	n/a	9	8.5	0.4	C	8.6	0.4	C	7.6		A	8.0		A
BV23060	d/s end of 13th Avenue North crossing	7.7	n/a	n/a	9	8.5	0.9	D	8.5	0.9	D	7.6		A	8.0	0.4	C
BV23065	u/s end of 13th Avenue North crossing	7.7	n/a	n/a	9	8.5	0.8	D	8.5	0.8	D	7.6		A	8.0	0.3	C
BV23070	south of 13th Avenue North	8.2	7.9	10.0	9	8.4	0.2	C	8.4	0.2	C	7.0		A	7.0		A
BV27020	15th Avenue North	6.6	n/a	n/a	10	8.4	1.8	D	8.5	1.8	D	7.2	0.6	D	7.4	0.7	D
GRE01140	along Goodlette-Frank Road	8.0	7.8	9.5	11	8.9	0.9	D	7.6		A	7.9		B	8.1	0.1	C
BV35030	Golden Gate Parkway	8.6	n/a	n/a	12	10.1	1.6	D	9.9	1.4	D	8.5		A	8.6	0.1	C
BV35045	Golden Gate Parkway	8.3	n/a	n/a	12	10.1	1.8	D	9.9	1.6	D	8.6	0.3	C	8.7	0.4	C
BV35050	Golden Gate Parkway	8.5	n/a	n/a	12	10.1	1.6	D	9.9	1.4	D	8.9	0.4	C	8.9	0.4	C
BV35040	Golden Gate Parkway	9.1	n/a	n/a	12,13	10.2	1.1	D	10.0	0.9	D	8.9		A	9.0		A

TABLE 6-17

City of Naples - Basin V Stormwater System Improvement Plan, Phase I
Proposed System LOS Evaluation - Comparison of Alternatives (25-yr/72-hr Event)

Junction Name	Location	Road Crown Elevation (ft-NGVD)	Yard Elevation (ft-NGVD)	Structure Elevation (ft-NGVD)	Problem Area ID	Existing System			Alternative 1			Alternative 2			Alternative 3		
						Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾	Peak Stage (ft-NGVD)	Road Flood Depth (ft)	LOS ⁽³⁾
BV42020	Golden Gate Parkway	9.0	n/a	n/a	13	9.9	0.9	D	9.7	0.8	D	9.0	0.1	C	9.4	0.4	C
BV42010	Golden Gate Parkway	9.2	n/a	n/a	13	10.2	1.0	D	10.1	0.9	D	9.0		A	9.6	0.4	C
BV43035	Diana Avenue, d/s of 10th Street North	10.7	9.7	12.6	14	12.2	1.4	D	12.2	1.4	D	11.1	0.4	C	11.1	0.4	C
BV43040	intersection of Diana Avenue and 10th Street North	10.7	10.2	n/a	14	12.1	1.4	D	12.1	1.4	D	10.9	0.2	C	10.9	0.3	C
BV43017	22nd Avenue North, south of 10th Street North	10.0	n/a	n/a	14	11.0	1.0	D	11.0	1.0	D	10.1	0.1	C	10.2	0.2	C
BV43018	intersection of 10th Avenue North and 22nd Avenue	10.8	n/a	n/a	14	11.5	0.7	D	11.5	0.7	D	10.3		A	10.3		A
BV43020	intersection of 22nd Avenue North and 11th Street North	9.7	n/a	n/a	14	11.0	1.4	D	11.0	1.4	D	10.1	0.4	C	10.2	0.6	D
GRE01170	along Goodlette-Frank Road	9.0	9.5	10.5	15	9.8	0.8	D	9.2	0.2	C	8.9		A	8.9		A
GRE01163	along Goodlette-Frank Road	9.0	n/a	n/a	15	9.8	0.8	D	9.2	0.2	C	8.9		A	9.0		A
GRE01164	along Goodlette-Frank Road	9.0	n/a	n/a	15	9.8	0.8	D	9.2	0.2	C	8.9		A	9.0		A
GRE01167	along Goodlette-Frank Road	9.0	n/a	n/a	15	9.8	0.8	D	9.2	0.2	C	8.9		A	8.9		A
BV44005	intersection of 22nd Avenue North and 14th Street North	9.2	n/a	n/a	16	9.8	0.6	D	9.5	0.3	C	9.0		A	9.5	0.3	C
BV44010	22nd Avenue North	9.5	9.4	11.4	16	9.8	0.3	C	9.8	0.3	C	9.4		A	9.8	0.3	C
BV44015	14th Street North, north of 22nd Avenue North	8.3	7.8	n/a	17	9.4	1.1	D	9.2	0.9	D	9.1	0.8	D	8.7	0.4	C
BV44020	intersection of 14th Street North and Royal Palm Drive	9.1	8.5	12.3	17	9.7	0.6	D	9.7	0.6	D	9.1		B	8.9		B
BV44025	intersection of Royal Palm Drive and 13th Street North	9.5	8.9	n/a	17	10.1	0.6	D	10.1	0.6	D	9.3		B	9.2		B
BV44030	Royal Palm Drive, u/s of 13th Street North	9.8	9.6	11.7	17	10.4	0.6	D	10.4	0.6	D	9.7		B	9.6		B
BV44035	Royal Palm Drive, u/s of 13th Street North	10.1	9.5	n/a	17	10.3	0.2	C	10.3	0.2	C	8.8		A	8.4		A
BV44045	intersection of Diana Avenue and 13th Street North	9.8	9.5	12.7	18	10.9	1.1	D	10.9	1.1	D	9.8		B	10.2	0.4	C
BV44050	intersection of 14th Street North and 26th Avenue North	10.5	n/a	n/a	19	11.5	1.0	D	11.5	1.0	D	9.9		A	10.9	0.4	C
BV44055	intersection of 13th Street North and 26th Avenue North	11.5	11.6	13.8	19	12.0	0.6	D	12.0	0.6	D	10.6		A	11.9	0.4	C
BV43055	intersection of 28th Avenue North and 12th Street North	11.0	10.7	n/a	20	11.3	0.3	C	11.3	0.3	C	10.0		A	10.1		A
BV43060	d/s end of 28th Avenue North & 12th St N crossing	10.8	10.2	n/a	20	10.9	0.1	C	10.9	0.1	C	10.2		A	10.2		B
BV43063	intersection of 28th Avenue North and 12th Street North	11.9	11.3	n/a	20	12.5	0.6	D	12.5	0.6	D	10.2		A	12.0	0.1	C
BV43065	28th Avenue north, west of 12th Street North	12.0	10.8	13.5	20	12.5	0.5	D	12.5	0.5	D	10.9		B	12.4	0.4	C
BV43067	28th Avenue north, d/s of 10th Street North	12.3	11.9	n/a	20	12.9	0.6	D	12.9	0.6	D	12.2		B	12.8	0.5	C
BV43070	d/s end of 10th Street North & 28th Ave N crossing	12.5	12.1	13.0	20	12.7	0.2	C	12.7	0.2	C	11.4		A	12.5	0.1	C
BV43075	u/s end of 10th Street North & 28th Ave N crossing	12.6	11.8	n/a	20	12.6	0.1	C	12.6	0.1	C	11.8		A	12.2		B
BV46020	12th Street North, east of Pond	9.8	10.1	12.6	21	10.9	1.1	D	10.8	1.1	D	10.2	0.4	C	10.2	0.4	C
BV47020	east of 12th Street North	10.2	11.0	12.7	22	11.1	0.9	D	11.1	0.9	D	10.1		A	10.7	0.5	C
BV47030	south of 12th St North and 29th Ave North intersection	10.4	n/a	n/a	22	10.9	0.5	D	10.9	0.5	D	10.1		A	10.6	0.2	C
Total Number of LOS "C" Exceedances						61			55			8			6		

Notes:

- (1) - Elevations, peak flood stages, and road flooding depths have all been rounded to the nearest tenth of a foot.
- (2) - Model results are computed to the nearest hundredth of a foot, but are shown in this table rounded to the nearest tenth of a foot. Therefore, even if the predicted stages from the model are shown to be equal to the respective critical elevation, the table may show an exceedance due to rounding (e.g. if the critical building elevation is 5.0, and the predicted peak stage from the model is 5.01, an exceedance is shown in the table).
- (3) - Level of Service (LOS) classes were assigned as follows:
Class "A" LOS was assigned where flow is contained within the conveyance system; no flooding of major roadways, minor roadways, yards or structures is predicted;
Class "B" LOS was assigned where there is no flooding of major roadways, minor roadways, or structures, but where yard flooding is predicted;

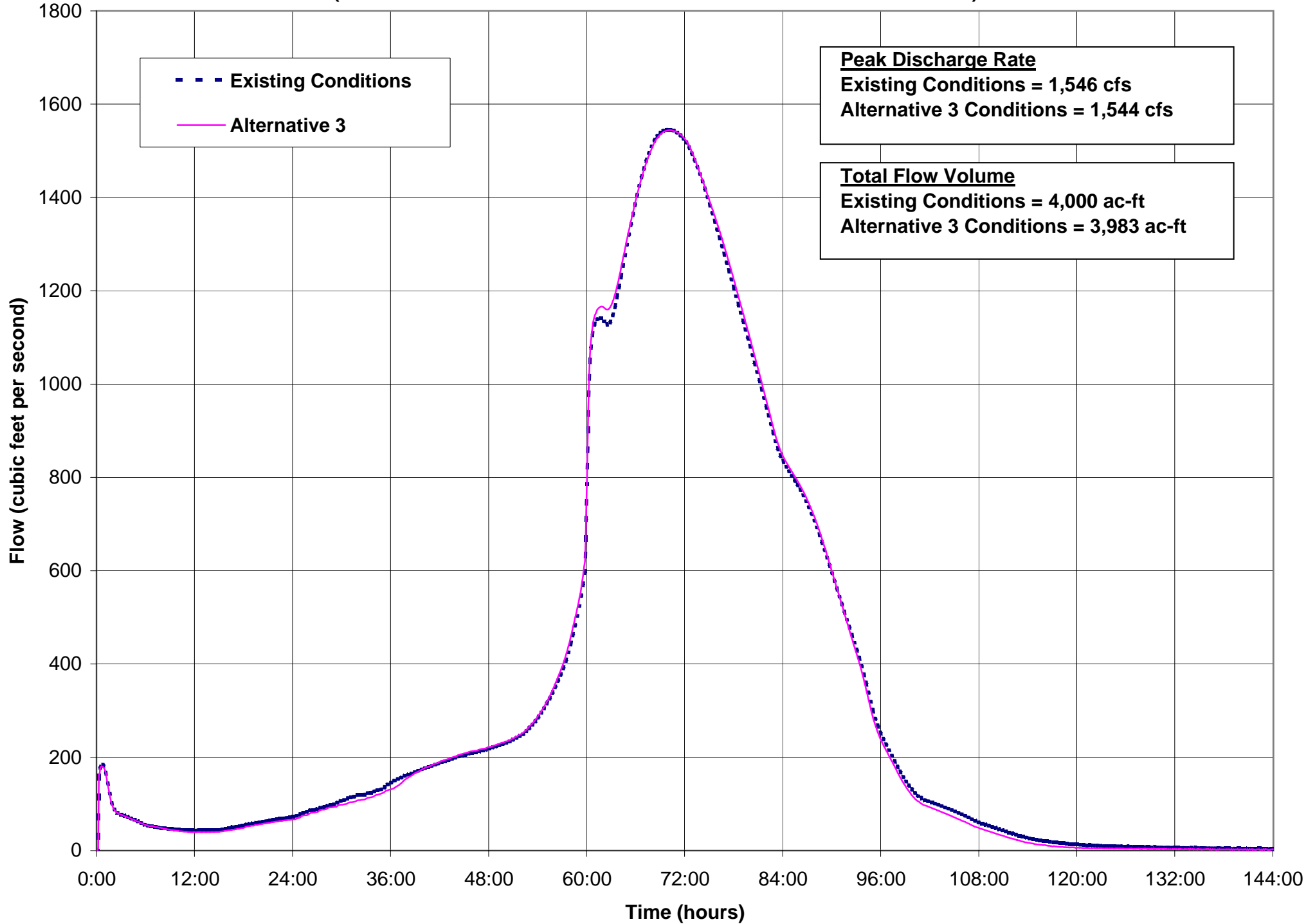
Class "C" LOS was assigned where yard flooding and flooding of major roadways which precludes the use of the outside lane and travel in inside lanes is possible but difficult (depth less than 6-inches) is predicted, but where no structural flooding is predicted; and
Class "D" LOS was assigned where extensive road flooding (depths greater than 6-inches) or structural flooding is predicted.

Alternative 1 detention improvements provide over 49 acre-ft of water quality treatment volume to the GRE study area, which includes a large portion of the Basin V watershed. Alternative 2 detention improvements provide 8.5 acre-ft of water quality treatment volume to the Basin V watershed. Proposed modifications to existing detention facilities in Alternative 3 provides 8.3 acre-ft of water quality treatment volume to the Basin V watershed.

As noted in Section 6.3.3, to meet the water quality treatment volume requirements within the Basin V watershed, an additional 35.3 acre-ft of storage must be provided in additional detention facilities beyond those represented by the Alternative 3 improvements. There appears to be an opportunity for such facilities at the Conservancy and Jungle Larry's property. These costs are not included in Tables 6-15 or 6-16.

As noted earlier, the Basin V PSMS is interconnected with the Gordon River system and culminates in two outfalls, the main Gordon River outfall (model conduit GRE00010) and the Goodlette-Frank Road outfall (model conduit GRE01010). **Figure 6-3** shows the cumulative flow hydrograph at these outfalls for the 25-year/72-hour design storm event under existing and proposed conditions with Alternative 3 improvements. The peak discharge rate is reduced by 2 cfs under Alternative 3 compared to existing conditions. In addition, Alternative 3 reduces the total runoff volume by 17 acre-ft compared to existing conditions.

Figure 6-3
Gordon River Outfall Hydrograph
(Cumulative Flows from Model Conduit GRE00010 and GRE01010)



Section 7

Summary and Recommendations

This section summarizes the findings of Phase I of the Basin V Stormwater System Improvement Plan and presents recommendations for the Basin V Stormwater Management Program.

7.1 Summary

The purpose of this study was to develop a stormwater system improvement plan. To accomplish this objective, the stormwater model developed for the Collier County Gordon River Extension Study was extended to include a more detailed hydrologic and hydraulic representation of the Basin V PSMS. The model was calibrated to match known flooding problem areas throughout Basin V for the storm events of September 24-29, 2003. Based on these models, the existing system stormwater level of service (LOS) throughout the basin was evaluated, and locations that did not achieve the desired LOS were grouped into problem areas.

Three conceptual improvement alternatives were developed to address the defined problem areas and meet a range of property and structure flooding LOS goals, including:

- Alternative 1 represents a combination of County and City improvements developed to address flooding problems in the Gordon River Extension system. Improvement projects were developed to provide a Class C LOS (i.e., maximum 6-inch overtopping of the road crown) for the 25-year/72-hour design storm event. Flooding benefits from these improvements are only indicated in the Basin V PSMS in the vicinity of Goodlette-Frank Road, since detailed Basin V problem areas were not fully addressed by the GRE study.
- Alternative 2 represents City improvements developed to address the problem areas in the Basin V PSMS. The target LOS was to provide Class B LOS (i.e., no overtopping of the road crown) for the 25-year/72-hour design storm event. This is the current LOS for new development in the City. The desired LOS was achieved in most locations; however, there was a concern that such a relatively high level of service would be cost-prohibitive considering City funding sources. As a result, a third more cost-effective alternative was sought.
- Alternative 3 represents a refined set of retrofit LOS criteria that are consistent with similar coastal Florida communities such as Jacksonville, Miami, Daytona Beach, Ormond Beach, Atlantic Beach, and Rockledge. Alternative 3 improvements were developed to achieve the various LOS criteria for several design storm events, including Class C LOS (i.e., maximum 6-in overtopping of the road crown) for the 25-year/72-hour design storm event as well as up to 3 inches for the 10-year 72-hour storm, up to 9 inches for the 100-year 72-hour storm, and all storm event flood stages below known building elevations. In the locations where LOS are not

achieved, the flood protection benefit (in terms of reduced flooding duration) is also quantified (Table 6-13). This alternative provides 8.3 acre-ft of water quality treatment volume, meets the pre-development peak discharge rate, and meets the pre-development runoff volume requirement. The major difference to the Alternative 2 recommendations is the incorporation of Reach 3 improvements that were initially developed in Alternative 1 (i.e., weir modifications to divert more flow to Reach 3, improvements to Reach 3 ditch, and the new 27-acre detention facility in Fleischmann parcel 18).

7.2 Recommendations

This study recommends a comprehensive stormwater management program for the Basin V watershed, including:

- A set of capital improvement projects to address flooding problem areas where there is an immediate threat to property, buildings, and roads; and
- Programmatic recommendations for preserving the capacity and integrity of the existing PSMS.

7.2.1 Capital Improvement Program and Phasing

Based on the findings of this study, CDM recommends that the City pursue the set of capital improvement projects comprising Alternative 3, which:

- Best achieves the desired level of service goals throughout the Basin V watershed;
- Provides 8.3 acre-ft of water quality treatment volume to support the Environmental Resource Permit (ERP) process;
- Minimizes and avoids wetland impacts to the maximum extent practicable, since flood control objectives are achieved without the need to impact mangrove areas, possible mitigation, or Section 404 USACE permit; and
- Allows a phased implementation independently, or in concert with Collier County and with other private land owners.

The total conceptual capital construction cost for all improvement projects in Alternative 3 is shown in Table 6-15. An optional construction cost using parallel pipes rather than replacements pipes where feasible is shown in Table 6-16.

CDM recommends that the City proceed with a conceptual ERP for the Alternative 3 improvement projects. A phased approach to implementation can then be undertaken and it is further recommended that the City consider the following decisions regarding project phasing:

- Consider State Revolving Fund (SRF) loans and other State grants to support the City funds for implementation.

- Acquisition of lands and easements necessary to construct and maintain the conveyance improvements and detention facilities;
- Modification of the existing detention facilities (lakes) per the improvements described for Map ID 5, 6, 10, and 14;
- Investigate the feasibility of the additional 35.3 acres of storage recommended to meet the water quality treatment volume requirements, located at the Conservancy and Jungle Larry's properties; and
- Implement the remaining conveyance improvements in Alternative 3 as appropriate and as permitted.

7.2.2 Stormwater Management Program

The recommended stormwater improvements described in the previous section will require maintenance in order to achieve the levels of service for flood control in the existing and proposed Basin V PSMS. Specific actions for maintaining this capacity are recommended and described below.

Maintenance

Maintenance of existing conveyance and detention facilities and lakes is important to provide the desired LOS for stormwater management. The performance of proposed improvements also requires that the system is fully maintained and operable. Recommended maintenance programs remove some of the vegetation, debris, and silt to achieve original design functions and potentially lower repair costs in the future. Such maintenance items include:

- Catch basin/inlet cleaning,
- Debris/vegetation removal at culverts,
- Debris/vegetation removal along open channels,
- Inspection, mowing and debris removal at detention facility outlets; inspect after every major storm event or at least 4 times per year,
- Closed-circuit television (CCTV) inspection and cleaning of storm sewers and culverts every 20 years, and
- Swale restoration.

Preserve Existing Surface and Floodplain Storage

Floodplain and other surface storage preservation maintains (i.e., does not worsen) existing flood stages along the Basin V PSMS. CDM recommends no net loss of 100-year floodplain storage for development or redevelopment in the basin. The results from the Basin V SWMM should be used to identify the closest applicable 100 year stage. Development and redevelopment should then provide onsite grading and

associated calculations to demonstrate no net loss of storage, and more storage may be required for increased runoff due to new pavement as noted in the next recommendation.

Future Development and Redevelopment Controls

There are persistent development and growth pressures in Naples. As areas within the watershed are further developed or redeveloped, the new conditions will affect system management practices and planning for associated improvement projects.

CDM recommends ordinance modifications that require individual property owners to control future increases in flooding, erosion, and pollutant discharges associated with new development. This often requires the site to be graded such that the difference in runoff from new pavement is retained, unless there is downstream conveyance storage and treatment capacity.

The City may also wish to consider imposing impervious limits on a parcel basis (e.g., 50 percent maximum imperviousness in high density residential zoning). This has been implemented in some other coastal cities experiencing redevelopment and large increase in impervious area which will overburden the stormwater system (e.g., Atlantic Beach).

Finally, the City should either encourage or require retention of runoff for the first 1 to 2 inches of rainfall for areas with suitable soils (NRCS hydrologic soil groups A and B) in order to reduce runoff volume and pollutant load to the receiving waters. As has been documented for permit discussions, the agencies are considering volumetric reductions as part of the permit process, especially when a USACE Section 404 Dredge and Fill permit is required.

Retrofit LOS Criteria

CDM recommends the retrofit LOS criteria for City stormwater management improvements projects (e.g., up to 3 inches of road crown overtopping for the 10-year storm, 6 inches for the 25-year storm, and 9 inches for the 100-year storm). This allows a practicable approach to stormwater management. New development should continue to meet the requirements of no road overtopping for the 25-year storm.

Inverted Street Crowns

For retrofits and new development, it may be appropriate to allow inverted street crowns in some applications as it may save money in pipe costs and “cut-through” intermediate high spots to provide cost-effective stormwater conveyance. This can also reduce curb and gutter costs and reduce tree loss.

Topographic Survey

Detailed aerial photogrammetry is recommended for the stormwater system improvements design in order to refine the representation of surface overflow and better quantify the extent of inundation under design storm events.

Floodproofing Measures

For structures (homes and buildings) that regularly flood (i.e., repetitive loss structures), an alternative to stormwater system retrofits would be a program that allows the City, in cooperation with FEMA, to assist willing property owners with flood proofing, elevating, or purchasing (and removing) flood prone structures.

APPENDIX A

RUNOFF Model Data

TABLE A-1 - Overland Flow Parameter Calculations

Project: City of Naples - Basin V Stormwater System Improvement Plan, Phase I
Scenario: Existing System

Hydrologic Unit		Overland Flow Path 1				Overland Flow Path 2				Overland Flow Path 3				Area-Weighted Flow Parameters			
		Max Elev (ft)	Min Elev (ft)	Path Length (ft)	Area-Weight	Max Elev (ft)	Min Elev (ft)	Path Length (ft)	Area-Weight	Max Elev (ft)	Min Elev (ft)	Path Length (ft)	Area-Weight	Total Weight	Slope (ft/ft)	Length (ft)	Width (ft)
ID	Area (ac)																
GRE-01-1-10	1.76	8.2	7.2	125	1.00	1.0	0.0	1	0.00	1.0	0.0	1.0	0.00	1.00	0.0080	125	614
GRE-01-1-11	9.84	8.0	6.5	420	0.70	7.5	6.5	275	0.30	1.0	0.0	1.0	0.00	1.00	0.0036	377	1,138
GRE-01-1-12	5.46	6.5	5.8	295	0.60	6.5	5.8	180	0.40	1.0	0.0	1.0	0.00	1.00	0.0030	249	955
GRE-01-1-13	2.63	8.5	7.0	220	1.00	1.0	0.0	1	0.00	1.0	0.0	1.0	0.00	1.00	0.0068	220	522
GRE-01-1-14	8.22	8.0	5.0	410	0.50	6.3	5.0	180	0.50	1.0	0.0	1.0	0.00	1.00	0.0073	295	1,213
GRE-01-1-15	7.02	9.0	7.5	590	0.70	9.5	7.5	220	0.30	1.0	0.0	1.0	0.00	1.00	0.0045	479	639
GRE-01-1-16	12.49	8.2	7.5	420	0.60	8.4	7.5	310	0.40	1.0	0.0	1.0	0.00	1.00	0.0022	376	1,447
GRE-01-1-17	44.90	8.0	6.5	1625	0.50	7.3	6.5	1250	0.50	1.0	0.0	1.0	0.00	1.00	0.0008	1,438	1,361
GRE-01-1-20	16.86	7.5	5.7	650	0.60	7.0	5.7	250	0.40	1.0	0.0	1.0	0.00	1.00	0.0037	490	1,499
GRE-01-1-21	2.94	7.5	5.1	400	0.60	6.0	5.1	175	0.40	1.0	0.0	1.0	0.00	1.00	0.0057	310	413
GRE-01-1-22	4.64	7.5	5.5	350	0.60	6.0	5.5	220	0.40	1.0	0.0	1.0	0.00	1.00	0.0043	298	678
GRE-01-1-23	2.99	9.0	7.5	350	0.60	8.7	7.5	210	0.40	1.0	0.0	1.0	0.00	1.00	0.0049	294	443
GRE-01-1-30	3.45	6.5	5.9	200	0.60	6.4	5.9	170	0.40	1.0	0.0	1.0	0.00	1.00	0.0030	188	799
GRE-01-1-31	2.56	7.2	6.4	200	0.60	7.0	6.4	200	0.40	1.0	0.0	1.0	0.00	1.00	0.0036	200	557
GRE-01-1-32	10.92	9.0	7.1	740	0.60	7.5	7.1	400	0.40	1.0	0.0	1.0	0.00	1.00	0.0019	604	788
GRE-01-1-40	9.30	9.0	8.1	390	0.60	8.4	7.9	150	0.40	1.0	0.0	1.0	0.00	1.00	0.0027	294	1,379
GRE-01-1-41	3.51	10.2	9.2	180	1.00	1.0	0.0	1	0.00	1.0	0.0	1.0	0.00	1.00	0.0056	180	848
GRE-01-1-42	2.95	10.9	10.3	175	1.00	1.0	0.0	1	0.00	1.0	0.0	1.0	0.00	1.00	0.0034	175	735
GRE-01-1-43	5.80	10.3	9.6	210	1.00	1.0	0.0	1	0.00	1.0	0.0	1.0	0.00	1.00	0.0033	210	1,203
GRE-01-1-44	6.41	10.9	10.3	320	0.60	11.0	10.3	180	0.40	1.0	0.0	1.0	0.00	1.00	0.0027	264	1,058
GRE-01-1-45	3.71	10.5	10.0	225	0.50	10.7	10.2	225	0.50	1.0	0.0	1.0	0.00	1.00	0.0022	225	719
GRE-01-1-46	3.60	11.0	10.5	200	1.00	1.0	0.0	1	0.00	1.0	0.0	1.0	0.00	1.00	0.0027	200	784
GRE-01-1-50	5.47	9.5	8.7	625	0.70	9.2	8.7	240	0.30	1.0	0.0	1.0	0.00	1.00	0.0015	510	467
GRE-01-1-51	8.65	12.0	10.1	750	0.80	10.5	10.1	200	0.20	1.0	0.0	1.0	0.00	1.00	0.0024	640	589
GRE-01-1-52	4.60	11.0	8.6	310	0.50	10.5	8.6	350	0.50	1.0	0.0	1.0	0.00	1.00	0.0066	330	607
GRE-01-1-53	14.10	9.0	8.6	320	0.70	9.5	8.6	150	0.30	1.0	0.0	1.0	0.00	1.00	0.0027	269	2,284
GRE-01-1-54	3.95	9.8	9.5	475	0.50	9.7	9.5	350	0.50	1.0	0.0	1.0	0.00	1.00	0.0006	413	417
GRE-01-2-10	33.56	9.5	7.0	380	0.60	9.8	7.0	650	0.40	1.0	0.0	1.0	0.00	1.00	0.0057	488	2,996
GRE-01-2-20	11.86	9.0	7.2	570	0.60	8.5	7.2	330	0.40	1.0	0.0	1.0	0.00	1.00	0.0035	474	1,089
GRE-01-2-30	1.03	6.5	6.0	95	1.00	1.0	0.0	1	0.00	1.0	0.0	1.0	0.00	1.00	0.0053	95	472
GRE-01-2-31	2.81	8.5	7.7	260	0.50	9.0	7.7	175	0.50	1.0	0.0	1.0	0.00	1.00	0.0053	218	562

TABLE A-1 - Overland Flow Parameter Calculations

Project: City of Naples - Basin V Stormwater System Improvement Plan, Phase I
Scenario: Existing System

Hydrologic Unit		Overland Flow Path 1				Overland Flow Path 2				Overland Flow Path 3				Area-Weighted Flow Parameters			
		Max Elev (ft)	Min Elev (ft)	Path Length (ft)	Area-Weight	Max Elev (ft)	Min Elev (ft)	Path Length (ft)	Area-Weight	Max Elev (ft)	Min Elev (ft)	Path Length (ft)	Area-Weight	Total Weight	Slope (ft/ft)	Length (ft)	Width (ft)
ID	Area (ac)																
GRE-01-2-32	1.03	9.0	8.1	230	1.00	1.0	0.0	1	0.00	1.0	0.0	1.0	0.00	1.00	0.0039	230	195
GRE-01-2-33	1.56	8.5	7.6	300	0.70	8.2	7.6	115	0.30	1.0	0.0	1.0	0.00	1.00	0.0037	245	278
GRE-01-2-34	7.85	11.0	8.0	680	1.00	1.0	0.0	1	0.00	1.0	0.0	1.0	0.00	1.00	0.0044	680	503
GRE-01-2-35	4.72	8.5	7.4	310	1.00	1.0	0.0	1	0.00	1.0	0.0	1.0	0.00	1.00	0.0035	310	663
GRE-01-2-36	22.11	10.5	8.5	820	0.80	9.0	8.5	260	0.20	1.0	0.0	1.0	0.00	1.00	0.0023	708	1,360
GRE-01-2-40	13.67	10.0	7.0	575	0.60	8.5	7.0	350	0.40	1.0	0.0	1.0	0.00	1.00	0.0048	485	1,228
GRE-01-2-50	4.94	13.0	10.5	675	1.00	1.0	0.0	1	0.00	1.0	0.0	1.0	0.00	1.00	0.0037	675	319
GRE-01-2-60	11.77	12.0	9.9	635	1.00	1.0	0.0	1	0.00	1.0	0.0	1.0	0.00	1.00	0.0033	635	807
GRE-01-2-61	25.36	11.5	9.0	575	0.50	12.0	9.0	415	0.50	1.0	0.0	1.0	0.00	1.00	0.0058	495	2,232
GRE-01-2-62	7.27	3.5	2.8	275	1.00	1.0	0.0	1	0.00	1.0	0.0	1.0	0.00	1.00	0.0025	275	1,152
GRE-01-2-70	20.84	10.0	6.7	840	0.60	8.0	6.7	425	0.40	1.0	0.0	1.0	0.00	1.00	0.0036	674	1,347
GRE-01-2-75	12.99	8.5	6.6	650	1.00	1.0	0.0	1	0.00	1.0	0.0	1.0	0.00	1.00	0.0029	650	870
GRE-01-3-10	2.14	9.0	7.0	325	0.70	8.0	7.0	140	0.30	1.0	0.0	1.0	0.00	1.00	0.0065	270	346
GRE-01-3-11	4.27	10.0	8.0	460	1.00	1.0	0.0	1	0.00	1.0	0.0	1.0	0.00	1.00	0.0043	460	405
GRE-01-3-12	6.28	11.0	8.0	300	0.70	10.5	8.0	225	0.30	1.0	0.0	1.0	0.00	1.00	0.0103	278	986
GRE-01-3-13	2.27	11.9	9.0	230	0.60	11.7	9.0	230	0.40	1.0	0.0	1.0	0.00	1.00	0.0123	230	430
GRE-01-3-14	2.78	13.0	12.7	200	1.00	13.0	12.4	175	0.00	1.0	0.0	1.0	0.00	1.00	0.0015	200	604
GRE-01-3-20	9.69	13.2	12.0	570	0.50	13.6	11.5	420	0.50	1.0	0.0	1.0	0.00	1.00	0.0036	495	852
GRE-01-3-25	11.00	14.2	11.9	480	0.60	14.6	12.1	350	0.40	1.0	0.0	1.0	0.00	1.00	0.0057	428	1,119
GRE-01-3-30	3.33	12.5	11.5	390	0.50	12.1	11.5	290	0.50	1.0	0.0	1.0	0.00	1.00	0.0023	340	427
GRE-01-3-31	1.99	12.0	10.9	230	1.00	1.0	0.0	1	0.00	1.0	0.0	1.0	0.00	1.00	0.0048	230	377
GRE-01-3-32	3.21	13.9	12.9	350	1.00	1.0	0.0	1	0.00	1.0	0.0	1.0	0.00	1.00	0.0029	350	400
GRE-01-3-33	3.51	12.1	11.1	370	1.00	1.0	0.0	1	0.00	1.0	0.0	1.0	0.00	1.00	0.0027	370	413
GRE-01-3-34	14.44	13.0	12.0	600	1.00	1.0	0.0	1	0.00	1.0	0.0	1.0	0.00	1.00	0.0017	600	1,048
GRE-01-3-35	5.16	13.9	12.9	350	1.00	1.0	0.0	1	0.00	1.0	0.0	1.0	0.00	1.00	0.0029	350	642
GRE-01-3-40	9.06	11.5	10.7	300	0.60	11.8	11.3	260	0.40	1.0	0.0	1.0	0.00	1.00	0.0024	284	1,390
GRE-01-3-45	15.48	11.0	9.8	500	1.00	1.0	0.0	1	0.00	1.0	0.0	1.0	0.00	1.00	0.0024	500	1,349
GRE-01-3-50	0.79	8.5	8.0	75	1.00	1.0	0.0	1	0.00	1.0	0.0	1.0	0.00	1.00	0.0067	75	458
GRE-01-3-51	2.39	11.0	8.1	200	1.00	1.0	0.0	1	0.00	1.0	0.0	1.0	0.00	1.00	0.0145	200	521
GRE-01-3-52	2.39	9.1	8.6	200	0.70	10.5	8.6	200	0.30	1.0	0.0	1.0	0.00	1.00	0.0046	200	521
GRE-01-3-53	2.83	8.7	8.2	200	1.00	1.0	0.0	1	0.00	1.0	0.0	1.0	0.00	1.00	0.0025	200	617

TABLE A-1 - Overland Flow Parameter Calculations

Project: City of Naples - Basin V Stormwater System Improvement Plan, Phase I
Scenario: Existing System

Hydrologic Unit		Overland Flow Path 1				Overland Flow Path 2				Overland Flow Path 3				Area-Weighted Flow Parameters			
		Max Elev (ft)	Min Elev (ft)	Path Length (ft)	Area-Weight	Max Elev (ft)	Min Elev (ft)	Path Length (ft)	Area-Weight	Max Elev (ft)	Min Elev (ft)	Path Length (ft)	Area-Weight	Total Weight	Slope (ft/ft)	Length (ft)	Width (ft)
ID	Area (ac)																
GRE-01-4-10	13.38	9.0	7.0	370	0.60	10.0	7.0	300	0.40	1.0	0.0	1.0	0.00	1.00	0.0072	342	1,704
GRE-01-4-20	8.73	9.5	0.5	550	0.60	10.5	8.0	330	0.40	1.0	0.0	1.0	0.00	1.00	0.0128	462	823
GRE-01-4-25	6.27	12.2	11.7	365	1.00	1.0	0.0	1	0.00	1.0	0.0	1.0	0.00	1.00	0.0014	365	748
GRE-01-4-30	10.02	10.0	8.0	500	0.70	10.0	8.0	200	0.30	1.0	0.0	1.0	0.00	1.00	0.006	410	1,065
GRE-01-4-31	3.80	12.0	10.0	240	0.70	11.0	10.0	150	0.30	1.0	0.0	1.0	0.00	1.00	0.008	213	776
GRE-01-4-32	5.57	11.0	8.0	340	0.60	11.5	8.0	230	0.40	1.0	0.0	1.0	0.00	1.00	0.011	296	819
GRE-01-4-33	3.62	10.0	1.0	150	0.50	10.0	9.5	200	0.50	1.0	0.0	1.0	0.00	1.00	0.031	175	901
GRE-01-4-34	4.35	10.4	9.4	280	1.00	1.0	0.0	1	0.00	1.0	0.0	1.0	0.00	1.00	0.004	280	676
GRE-01-4-35	10.63	13.0	10.7	550	0.60	12.0	10.7	245	0.40	1.0	0.0	1.0	0.00	1.00	0.005	428	1,082
GRE-01-4-36	27.82	13.5	10.2	890	0.70	13.0	10.2	510	0.30	1.0	0.0	1.0	0.00	1.00	0.004	776	1,561
GRE-01-4-37	6.98	13.5	12.4	405	0.70	13.0	12.4	275	0.30	1.0	0.0	1.0	0.00	1.00	0.003	366	831
GRE-01-4-38	6.68	13.0	12.1	325	0.70	12.7	12.1	220	0.30	1.0	0.0	1.0	0.00	1.00	0.003	294	992
GRE-01-4-39	1.44	12.0	11.5	100	1.00	1.0	0.0	1	0.00	1.0	0.0	1.0	0.00	1.00	0.005	100	626
GRE-01-4-391	2.80	11.7	11.1	190	1.00	1.0	0.0	1	0.00	1.0	0.0	1.0	0.00	1.00	0.003	190	641
GRE-01-4-40	3.56	10.5	9.2	300	1.00	1.0	0.0	1	0.00	1.0	0.0	1.0	0.00	1.00	0.004	300	517
GRE-01-4-41	8.00	11.0	8.5	250	1.00	1.0	0.0	1	0.00	1.0	0.0	1.0	0.00	1.00	0.010	250	1,394
GRE-01-4-42	1.79	9.0	8.6	100	1.00	1.0	0.0	1	0.00	1.0	0.0	1.0	0.00	1.00	0.004	100	780
GRE-01-4-43	7.26	11.0	9.7	460	0.70	11.0	9.9	275	0.30	1.0	0.0	1.0	0.00	1.00	0.003	405	782
GRE-01-4-44	3.15	9.7	8.5	250	1.00	1.0	0.0	1	0.00	1.0	0.0	1.0	0.00	1.00	0.005	250	549
GRE-01-4-45	5.14	11.0	9.8	470	1.00	1.0	0.0	1	0.00	1.0	0.0	1.0	0.00	1.00	0.003	470	477
GRE-01-4-46	3.85	10.0	9.5	300	0.60	10.0	9.5	260	0.40	1.0	0.0	1.0	0.00	1.00	0.002	284	591
GRE-01-4-47	17.21	12.5	11.0	670	0.60	12.0	10.7	500	0.40	1.0	0.0	1.0	0.00	1.00	0.002	602	1,245
GRE-01-4-50	29.31	10.5	5.0	700	0.60	11.0	6.0	650	0.40	1.0	0.0	1.0	0.00	1.00	0.008	680	1,877
GRE-01-4-60	5.67	10.8	9.8	370	0.60	10.7	9.8	300	0.40	1.0	0.0	1.0	0.00	1.00	0.003	342	722
GRE-01-4-65	12.10	10.0	8.8	325	0.60	10.0	8.8	220	0.40	1.0	0.0	1.0	0.00	1.00	0.004	283	1,863
GRE-01-4-70	75.54	12.5	10.0	1300	1.00	1.0	0.0	1	0.00	1.0	0.0	1	0.00	1.00	0.002	1,300	2,531

Total 779.77 acres, 1.22 mi² **Area-wtd Average:** 0.004 590 1,368

TABLE A-2 - Land Use Parameter Calculations

Project: City of Naples - Basin V Stormwater System Improvement Plan, Phase I
Scenario: Existing System

Hydrology Parameter	Land Use Category										
	OPEN	LDR	MDR	HDR	COM	WET	WAT	IND	INST	GOLF	TRANS
Imperv. n	0.015	0.015	0.015	0.015	0.015	0.060	0.060	0.015	0.015	0.015	0.015
Pervious n	0.400	0.250	0.250	0.250	0.250	0.400	0.250	0.250	0.250	0.250	0.250
Imperv. I _a	0.10	0.10	0.10	0.10	0.10	0.50	0.50	0.10	0.10	0.10	0.10
Pervious I _a	0.35	0.25	0.25	0.25	0.25	0.50	0.50	0.25	0.25	0.25	0.20
% Imperv.	1	25	40	55	80	100	100	70	60	100	80.0
% DCIA	0	15	32	45	75	100	100	60	50	100	75.0
% NDCIA	1	10	8	10	5	0	0	10	10	0	5
% Pervious	99	75	60	45	20	0	0	30	40	0	20.0
Total	100	100	100	100	100	100	100	100	100	100	100.0

Code	Land Cover Category
OPEN	Open space / Forest / Agriculture
LDR	Low density residential (< 2 dwelling units per acre)
MDR	Medium density residential (2-5 dwelling units per acre)
HDR	High density residential (> 5 dwelling units per acre)
COM	Commercial
WET	Wetlands
WAT	Waterbodies
IND	Office / LightIndustrial
INST	Institutional
GOLF	Golf Course
TRANS	Transportation / Roadways

Hydrologic Unit ID	Percent By Land Use Category												Total	% Pervious	% NDCIA	% DCIA	Manning's "n"		Dep. Storage (in)	
	OPEN	LDR	MDR	HDR	COM	WET	WAT	IND	INST	GOLF	TRANS	DCIA					/NDCIA	DCIA	/NDCIA	
GRE-01-1-10	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.00	60.0	8.0	32.0	0.015	0.222	0.10	0.23
GRE-01-1-11	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.00	60.0	8.0	32.0	0.015	0.222	0.10	0.23
GRE-01-1-12	0.0	0.0	33.7	53.4	0.0	0.0	0.0	0.0	0.0	0.0	12.9	0.0	100.00	46.8	8.7	44.5	0.015	0.213	0.10	0.22
GRE-01-1-13	0.0	0.0	88.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.5	0.0	100.00	55.4	7.7	36.9	0.015	0.221	0.10	0.23
GRE-01-1-14	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.00	60.0	8.0	32.0	0.015	0.222	0.10	0.23
GRE-01-1-15	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.00	60.0	8.0	32.0	0.015	0.222	0.10	0.23
GRE-01-1-16	0.0	0.0	92.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.6	0.0	100.00	57.0	7.8	35.3	0.015	0.222	0.10	0.23
GRE-01-1-17	7.1	0.9	16.1	19.9	43.9	0.0	2.3	0.0	0.0	0.0	9.8	0.0	100.00	37.1	6.1	56.8	0.016	0.226	0.11	0.24
GRE-01-1-20	0.0	0.0	55.4	16.0	0.0	0.0	28.6	0.0	0.0	0.0	0.0	0.0	100.00	40.5	6.0	53.5	0.028	0.221	0.21	0.31
GRE-01-1-21	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.00	60.0	8.0	32.0	0.015	0.222	0.10	0.23
GRE-01-1-22	0.0	0.0	99.7	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.00	59.9	8.0	32.0	0.015	0.222	0.10	0.23
GRE-01-1-23	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.00	60.0	8.0	32.0	0.015	0.222	0.10	0.23
GRE-01-1-30	0.0	0.0	5.0	44.2	47.5	0.0	3.2	0.0	0.0	0.0	0.0	0.0	100.00	32.4	7.2	60.4	0.016	0.208	0.11	0.23
GRE-01-1-31	0.0	0.0	64.0	0.0	35.7	0.0	0.4	0.0	0.0	0.0	0.0	0.0	100.00	45.5	6.9	47.6	0.015	0.219	0.10	0.23
GRE-01-1-32	0.0	0.0	69.4	0.0	30.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.00	47.8	7.1	45.2	0.015	0.220	0.10	0.23
GRE-01-1-40	0.0	0.0	3.1	0.0	63.7	0.0	0.0	0.0	7.2	0.0	26.0	0.0	100.00	22.7	5.5	71.9	0.015	0.204	0.10	0.21
GRE-01-1-41	0.0	0.0	0.0	17.0	60.7	0.0	0.0	0.0	0.0	0.0	22.3	0.0	100.00	24.2	5.8	69.9	0.015	0.204	0.10	0.21
GRE-01-1-42	0.0	0.0	0.0	15.5	60.9	0.0	0.0	0.0	0.0	0.0	23.6	0.0	100.00	23.9	5.8	70.3	0.015	0.204	0.10	0.21
GRE-01-1-43	0.0	0.0	0.0	37.8	43.2	0.0	0.0	0.0	0.0	0.0	19.0	0.0	100.00	29.5	6.9	63.7	0.015	0.205	0.10	0.21
GRE-01-1-44	0.0	0.0	9.4	15.4	41.6	0.0	0.0	0.0	0.0	13.9	19.7	0.0	100.00	24.8	5.4	69.8	0.015	0.208	0.10	0.22
GRE-01-1-45	0.0	0.0	0.0	0.0	35.1	0.0	0.0	0.0	0.0	25.4	39.5	0.0	100.00	14.9	3.7	81.4	0.015	0.203	0.10	0.20
GRE-01-1-46	0.0	0.0	0.0	0.0	34.7	0.0	0.0	0.0	15.5	11.0	38.8	0.0	100.00	20.9	5.2	73.9	0.015	0.203	0.10	0.20
GRE-01-1-50	0.0	0.0	32.3	0.0	67.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.00	32.9	6.0	61.1	0.015	0.214	0.10	0.23
GRE-01-1-51	0.0	0.0	96.0	0.0	1.8	0.0	0.0	0.0	2.2	0.0	0.0	0.0	100.00	58.8	8.0	33.2	0.015	0.222	0.10	0.23
GRE-01-1-52	0.0	0.0	0.0	0.0	99.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	100.00	20.2	5.0	74.8	0.015	0.203	0.10	0.22
GRE-01-1-53	0.0	0.0	63.2	0.0	1.0	0.0	19.0	0.0	16.8	0.0	0.0	0.0	100.00	44.9	6.8	48.4	0.024	0.220	0.18	0.28
GRE-01-1-54	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.00	60.0	8.0	32.0	0.015	0.222	0.10	0.23
GRE-01-2-10	39.4	17.9	24.3	2.3	0.3	0.9	0.0	0.0	5.8	0.0	9.1	0.0	100.00	72.2	5.4	22.4	0.015	0.290	0.10	0.27
GRE-01-2-20	0.0	0.0	56.8	0.0	0.0	0.0	0.0	0.0	33.0	0.0	10.2	0.0	100.00	49.3	8.4	42.3	0.015	0.216	0.10	0.22

TABLE A-2 - Land Use Parameter Calculations

Project: City of Naples - Basin V Stormwater System Improvement Plan, Phase I
Scenario: Existing System

Hydrology Parameter	Land Use Category										
	OPEN	LDR	MDR	HDR	COM	WET	WAT	IND	INST	GOLF	TRANS
Imperv. n	0.015	0.015	0.015	0.015	0.015	0.060	0.060	0.015	0.015	0.015	0.015
Pervious n	0.400	0.250	0.250	0.250	0.250	0.400	0.250	0.250	0.250	0.250	0.250
Imperv. I _a	0.10	0.10	0.10	0.10	0.10	0.50	0.50	0.10	0.10	0.10	0.10
Pervious I _a	0.35	0.25	0.25	0.25	0.25	0.50	0.50	0.25	0.25	0.25	0.20
% Imperv.	1	25	40	55	80	100	100	70	60	100	80.0
% DCIA	0	15	32	45	75	100	100	60	50	100	75.0
% NDCIA	1	10	8	10	5	0	0	10	10	0	5
% Pervious	99	75	60	45	20	0	0	30	40	0	20.0
Total	100	100	100	100	100	100	100	100	100	100	100.0

Code	Land Cover Category
OPEN	Open space / Forest / Agriculture
LDR	Low density residential (< 2 dwelling units per acre)
MDR	Medium density residential (2-5 dwelling units per acre)
HDR	High density residential (> 5 dwelling units per acre)
COM	Commercial
WET	Wetlands
WAT	Waterbodies
IND	Office / LightIndustrial
INST	Institutional
GOLF	Golf Course
TRANS	Transportation / Roadways

Hydrologic Unit ID	Percent By Land Use Category												Total	% Pervious	% NDCIA	% DCIA	Manning's "n"		Dep. Storage (in)	
	OPEN	LDR	MDR	HDR	COM	WET	WAT	IND	INST	GOLF	TRANS	DCIA					/NDCIA	DCIA	/NDCIA	
GRE-01-2-30	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.00	60.0	8.0	32.0	0.015	0.222	0.10	0.23	
GRE-01-2-31	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.00	60.0	8.0	32.0	0.015	0.222	0.10	0.23	
GRE-01-2-32	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.00	60.0	8.0	32.0	0.015	0.222	0.10	0.23	
GRE-01-2-33	0.0	0.0	57.3	0.0	0.0	0.0	0.0	0.0	42.7	0.0	0.0	100.00	51.5	8.9	39.7	0.015	0.215	0.10	0.23	
GRE-01-2-34	0.1	0.0	99.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.00	60.0	8.0	32.0	0.015	0.222	0.10	0.23	
GRE-01-2-35	0.0	0.0	29.4	0.0	0.0	0.0	0.0	0.0	70.6	0.0	0.0	100.00	45.9	9.4	44.7	0.015	0.210	0.10	0.22	
GRE-01-2-36	0.0	0.0	0.1	0.0	2.2	0.0	0.0	0.0	97.8	0.0	0.0	100.00	39.6	9.9	50.5	0.015	0.203	0.10	0.22	
GRE-01-2-40	0.0	0.0	73.0	0.0	27.0	0.0	0.0	0.0	0.0	0.0	0.0	100.00	49.2	7.2	43.6	0.015	0.220	0.10	0.23	
GRE-01-2-50	0.0	0.0	54.8	0.0	0.0	0.0	0.0	0.0	41.1	4.1	0.0	100.00	49.3	8.5	42.2	0.015	0.215	0.10	0.23	
GRE-01-2-60	0.0	0.0	85.1	0.0	1.9	0.0	0.0	0.0	3.4	0.0	9.6	100.00	54.7	7.7	37.5	0.015	0.221	0.10	0.23	
GRE-01-2-61	2.4	0.0	78.3	0.0	1.2	0.0	0.0	0.0	8.8	0.0	9.4	100.00	54.9	7.7	37.4	0.015	0.224	0.10	0.23	
GRE-01-2-62	4.6	0.0	74.8	0.0	3.4	0.0	0.0	0.0	1.0	0.0	16.2	100.00	53.7	7.1	39.1	0.015	0.229	0.10	0.23	
GRE-01-2-70	49.6	0.0	18.0	0.0	2.9	0.0	16.4	0.0	13.1	0.0	0.0	100.00	65.7	3.4	30.9	0.022	0.310	0.17	0.33	
GRE-01-2-75	0.0	0.0	0.0	0.0	3.2	0.0	0.0	0.0	96.8	0.0	0.0	100.00	39.4	9.8	50.8	0.015	0.203	0.10	0.22	
GRE-01-3-10	5.4	0.0	0.0	0.0	13.1	0.0	0.0	0.0	57.6	0.0	23.8	100.00	35.8	7.7	56.6	0.015	0.215	0.10	0.22	
GRE-01-3-11	1.8	0.0	0.0	0.0	52.7	0.0	0.0	0.0	0.0	0.0	45.5	100.00	21.4	4.9	73.6	0.015	0.208	0.10	0.20	
GRE-01-3-12	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.00	20.0	5.0	75.0	0.015	0.203	0.10	0.22	
GRE-01-3-13	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.00	20.0	5.0	75.0	0.015	0.203	0.10	0.22	
GRE-01-3-14	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.00	20.0	5.0	75.0	0.015	0.203	0.10	0.22	
GRE-01-3-20	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.00	20.0	5.0	75.0	0.015	0.203	0.10	0.22	
GRE-01-3-25	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.00	20.0	5.0	75.0	0.015	0.203	0.10	0.22	
GRE-01-3-30	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.00	20.0	5.0	75.0	0.015	0.203	0.10	0.22	
GRE-01-3-31	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.00	20.0	5.0	75.0	0.015	0.203	0.10	0.22	
GRE-01-3-32	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.00	20.0	5.0	75.0	0.015	0.203	0.10	0.22	
GRE-01-3-33	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.00	20.0	5.0	75.0	0.015	0.203	0.10	0.22	
GRE-01-3-34	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.00	20.0	5.0	75.0	0.015	0.203	0.10	0.22	
GRE-01-3-35	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.00	20.0	5.0	75.0	0.015	0.203	0.10	0.22	
GRE-01-3-40	0.0	0.0	25.7	0.0	52.4	0.0	0.0	0.0	4.1	0.0	17.8	100.00	31.1	6.0	62.9	0.015	0.212	0.10	0.22	
GRE-01-3-45	0.0	0.0	1.4	8.9	75.7	0.0	0.0	0.0	0.0	0.0	14.0	100.00	22.8	5.5	71.7	0.015	0.204	0.10	0.22	

TABLE A-2 - Land Use Parameter Calculations

Project: City of Naples - Basin V Stormwater System Improvement Plan, Phase I
Scenario: Existing System

Hydrology Parameter	Land Use Category										
	OPEN	LDR	MDR	HDR	COM	WET	WAT	IND	INST	GOLF	TRANS
Imperv. n	0.015	0.015	0.015	0.015	0.015	0.060	0.060	0.015	0.015	0.015	0.015
Pervious n	0.400	0.250	0.250	0.250	0.250	0.400	0.250	0.250	0.250	0.250	0.250
Imperv. I _a	0.10	0.10	0.10	0.10	0.10	0.50	0.50	0.10	0.10	0.10	0.10
Pervious I _a	0.35	0.25	0.25	0.25	0.25	0.50	0.50	0.25	0.25	0.25	0.20
% Imperv.	1	25	40	55	80	100	100	70	60	100	80.0
% DCIA	0	15	32	45	75	100	100	60	50	100	75.0
% NDCIA	1	10	8	10	5	0	0	10	10	0	5
% Pervious	99	75	60	45	20	0	0	30	40	0	20.0
Total	100	100	100	100	100	100	100	100	100	100	100.0

Code	Land Cover Category
OPEN	Open space / Forest / Agriculture
LDR	Low density residential (< 2 dwelling units per acre)
MDR	Medium density residential (2-5 dwelling units per acre)
HDR	High density residential (> 5 dwelling units per acre)
COM	Commercial
WET	Wetlands
WAT	Waterbodies
IND	Office / LightIndustrial
INST	Institutional
GOLF	Golf Course
TRANS	Transportation / Roadways

Hydrologic Unit ID	Percent By Land Use Category												Total	% Pervious	% NDCIA	% DCIA	Manning's "n"		Dep. Storage (in)	
	OPEN	LDR	MDR	HDR	COM	WET	WAT	IND	INST	GOLF	TRANS	DCIA					/NDCIA	DCIA	/NDCIA	
GRE-01-3-50	0.0	0.0	0.0	0.0	96.2	0.0	0.0	0.0	0.0	0.0	3.8	100.00	20.0	5.0	75.0	0.015	0.203	0.10	0.22	
GRE-01-3-51	0.0	0.0	0.0	0.0	74.0	0.0	0.0	0.0	0.0	0.0	26.0	100.00	20.0	5.0	75.0	0.015	0.203	0.10	0.21	
GRE-01-3-52	0.0	0.0	0.0	0.0	44.1	0.0	0.0	0.0	1.9	0.0	53.9	100.00	20.4	5.1	74.5	0.015	0.203	0.10	0.20	
GRE-01-3-53	0.0	0.0	0.0	0.0	36.6	0.0	0.0	0.0	0.0	0.0	63.3	100.00	20.0	5.0	75.0	0.015	0.203	0.10	0.19	
GRE-01-4-10	11.9	0.0	6.4	0.0	10.6	0.0	0.0	0.0	42.3	0.0	28.8	100.00	40.4	6.8	52.8	0.015	0.231	0.10	0.23	
GRE-01-4-20	0.0	0.0	0.0	0.0	32.5	0.0	0.0	0.0	27.6	0.0	39.8	100.00	25.5	6.4	68.1	0.015	0.203	0.10	0.20	
GRE-01-4-25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	88.2	0.0	11.8	100.00	37.6	9.4	52.9	0.015	0.203	0.10	0.22	
GRE-01-4-30	0	0	0	0	50.13	0	0	0	39.51	0	10.4	100.00	27.9	7.0	65.1	0.015	0.203	0.10	0.22	
GRE-01-4-31	0	0	0	0	0	0	0	0	100	0	0.0	100.00	40.0	10.0	50.0	0.015	0.203	0.10	0.22	
GRE-01-4-32	0	0	24.6	0	37.52	0	0	0	33.05	0	4.8	100.00	36.4	7.4	56.2	0.015	0.210	0.10	0.22	
GRE-01-4-33	0	0	58.51	0	0	0	0	0	41.49	0	0.0	100.00	51.7	8.8	39.5	0.015	0.216	0.10	0.23	
GRE-01-4-34	0	0	100	0	0	0	0	0	0	0	0.0	100.00	60.0	8.0	32.0	0.015	0.222	0.10	0.23	
GRE-01-4-35	0	0	56.65	0	37.43	0	0	0	0	0	5.9	100.00	42.7	6.7	50.6	0.015	0.218	0.10	0.23	
GRE-01-4-36	0	0	57.72	0	37.99	0	0	0	0	0	4.3	100.00	43.1	6.7	50.2	0.015	0.218	0.10	0.23	
GRE-01-4-37	0	0	20.75	0	70.86	0	0	0	0	0	8.4	100.00	28.3	5.6	66.1	0.015	0.211	0.10	0.22	
GRE-01-4-38	0	0	56.13	0	43.87	0	0	0	0	0	0.0	100.00	42.5	6.7	50.9	0.015	0.218	0.10	0.23	
GRE-01-4-39	0	0	68.78	0	0	0	31.22	0	0	0	0.0	100.00	41.3	5.5	53.2	0.029	0.224	0.22	0.32	
GRE-01-4-391	0	0	100	0	0	0	0	0	0	0	0.0	100.00	60.0	8.0	32.0	0.015	0.222	0.10	0.23	
GRE-01-4-40	0	0	6.324	0	0	0	0	0	93.68	0	0.0	100.00	41.3	9.9	48.9	0.015	0.205	0.10	0.22	
GRE-01-4-41	0	0	31.19	0	0	0	0	0	68.81	0	0.0	100.00	46.2	9.4	44.4	0.015	0.210	0.10	0.22	
GRE-01-4-42	0	0	40.5	0	0	0	0	0	59.5	0	0.0	100.00	48.1	9.2	42.7	0.015	0.212	0.10	0.23	
GRE-01-4-43	0	0	100	0	0	0	0	0	0	0	0.0	100.00	60.0	8.0	32.0	0.015	0.222	0.10	0.23	
GRE-01-4-44	0	0	99.97	0	0	0	0	0	0.032	0	0.0	100.00	60.0	8.0	32.0	0.015	0.222	0.10	0.23	
GRE-01-4-45	0	0	100	0	0	0	0	0	0	0	0.0	100.00	60.0	8.0	32.0	0.015	0.222	0.10	0.23	
GRE-01-4-46	0	0	100	0	0	0	0	0	0	0	0.0	100.00	60.0	8.0	32.0	0.015	0.222	0.10	0.23	
GRE-01-4-47	0	0	100	0	0	0	0	0	0	0	0.0	100.00	60.0	8.0	32.0	0.015	0.222	0.10	0.23	
GRE-01-4-50	39.03	0	20.6	7.098	0	0	0	0	0	7.064	26.2	100.00	59.4	4.1	36.5	0.015	0.290	0.10	0.26	
GRE-01-4-60	0	0	100	0	0	0	0	0	0	0	0.0	100.00	60.0	8.0	32.0	0.015	0.222	0.10	0.23	
GRE-01-4-65	0	0	65.22	0	16.18	0	18.6	0	0	0	0.0	100.00	42.4	6.0	51.6	0.023	0.222	0.17	0.28	

TABLE A-2 - Land Use Parameter Calculations

Project: City of Naples - Basin V Stormwater System Improvement Plan, Phase I
Scenario: Existing System

Hydrology Parameter	Land Use Category										
	OPEN	LDR	MDR	HDR	COM	WET	WAT	IND	INST	GOLF	TRANS
Imperv. n	0.015	0.015	0.015	0.015	0.015	0.060	0.060	0.015	0.015	0.015	0.015
Pervious n	0.400	0.250	0.250	0.250	0.250	0.400	0.250	0.250	0.250	0.250	0.250
Imperv. I _a	0.10	0.10	0.10	0.10	0.10	0.50	0.50	0.10	0.10	0.10	0.10
Pervious I _a	0.35	0.25	0.25	0.25	0.25	0.50	0.50	0.25	0.25	0.25	0.20
% Imperv.	1	25	40	55	80	100	100	70	60	100	80.0
% DCIA	0	15	32	45	75	100	100	60	50	100	75.0
% NDCIA	1	10	8	10	5	0	0	10	10	0	5
% Pervious	99	75	60	45	20	0	0	30	40	0	20.0
Total	100	100	100	100	100	100	100	100	100	100	100.0

Code	Land Cover Category
OPEN	Open space / Forest / Agriculture
LDR	Low density residential (< 2 dwelling units per acre)
MDR	Medium density residential (2-5 dwelling units per acre)
HDR	High density residential (> 5 dwelling units per acre)
COM	Commercial
WET	Wetlands
WAT	Waterbodies
IND	Office / LightIndustrial
INST	Institutional
GOLF	Golf Course
TRANS	Transportation / Roadways

Hydrologic Unit ID	Percent By Land Use Category												% Pervious	% NDCIA	% DCIA	Manning's "n"		Dep. Storage (in)	
	OPEN	LDR	MDR	HDR	COM	WET	WAT	IND	INST	GOLF	TRANS	Total				DCIA	/NDCIA	DCIA	/NDCIA
GRE-01-4-70	0	0	65.8	9.836	15.83	0	6.623	0.0	0	0	1.9	100.00	47.5	7.1	45.4	0.018	0.220	0.13	0.25
Area-wtd Avg:	5%	1%	43%	4%	3%	0%	12%	0%	25%	1%	7%	100%	44.6	6.8	48.7				

Note: The Manning's "n" values on this table indicate the roughness factors used for overland flow calculations. Under these conditions, pervious land surfaces were assigned high roughness factors due to characteristically shallow depths of overland flow (a few inches) that are on the same order of magnitude as the roughness height, which produces hydraulically rough flow behavior.

TABLE A-3 - Soil Parameter Calculations

Project: City of Naples - Basin V Stormwater System Improvement Plan, Phase I
Scenario: Existing System

Hydrologic Soil Group	Max. Infiltration Rate (in/hr)	Min. Infiltration Rate (in/hr)	Infiltration Decay Rate (hr ⁻¹)
A	10.00	2.00	2.00
B	7.50	1.00	2.00
C	5.00	0.50	2.00
D	3.00	0.25	2.00

Hydrologic Soil Group	Average Depth to Water Table (ft)
A	5.0
B	4.0
C	2.5
D	0.0
A/D	0.5
B/D	0.5
C/D	0.5
C,B/D	0.5

Hydrologic Unit ID	Percent By Hydrologic Unit											Percent Pervious	Percent NDCIA	Max. Infiltration Rate (in/hr)	Min. Infiltration Rate (in/hr)	Infiltration Decay Rate (s ⁻¹)	Average Depth To Water Table (ft)	Soil Storage Capacity (in)
	Group A	Group B	Group C	Group D	Group A/D	Group B/D	Group C/D	Group C,B/D	All Groups	Water	Total							
GRE-01-1-10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	100.0	60.0	8.0	4.41	0.44	0.00056	0.5	0.15
GRE-01-1-11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	100.0	60.0	8.0	4.41	0.44	0.00056	0.5	0.15
GRE-01-1-12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	100.0	46.8	8.7	4.22	0.42	0.00056	0.5	0.14
GRE-01-1-13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	100.0	55.4	7.7	4.39	0.44	0.00056	0.5	0.14
GRE-01-1-14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	100.0	60.0	8.0	4.41	0.44	0.00056	0.5	0.15
GRE-01-1-15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	100.0	60.0	8.0	4.41	0.44	0.00056	0.5	0.15
GRE-01-1-16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	100.0	57.0	7.8	4.40	0.44	0.00056	0.5	0.14
GRE-01-1-17	0.0	0.0	0.0	3.2	0.0	87.7	0.0	9.1	100.0	0.0	100.0	37.1	6.1	2.73	0.23	0.00056	0.5	0.14
GRE-01-1-20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	100.0	40.5	6.0	4.35	0.44	0.00056	0.5	0.14
GRE-01-1-21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	100.0	60.0	8.0	4.41	0.44	0.00056	0.5	0.15
GRE-01-1-22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	100.0	59.9	8.0	4.41	0.44	0.00056	0.5	0.15
GRE-01-1-23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	100.0	60.0	8.0	4.41	0.44	0.00056	0.5	0.15
GRE-01-1-30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	100.0	32.4	7.2	4.09	0.41	0.00056	0.5	0.13
GRE-01-1-31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	100.0	45.5	6.9	4.34	0.43	0.00056	0.5	0.14
GRE-01-1-32	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	100.0	47.8	7.1	4.35	0.44	0.00056	0.5	0.14
GRE-01-1-40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	100.0	22.7	5.5	4.03	0.40	0.00056	0.5	0.13
GRE-01-1-41	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	100.0	24.2	5.8	4.03	0.40	0.00056	0.5	0.13
GRE-01-1-42	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	100.0	23.9	5.8	4.03	0.40	0.00056	0.5	0.13
GRE-01-1-43	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	100.0	29.5	6.9	4.05	0.41	0.00056	0.5	0.13
GRE-01-1-44	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	100.0	24.8	5.4	4.11	0.41	0.00056	0.5	0.14
GRE-01-1-45	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	100.0	14.9	3.7	4.00	0.40	0.00056	0.5	0.13
GRE-01-1-46	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	100.0	20.9	5.2	4.00	0.40	0.00056	0.5	0.13
GRE-01-1-50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	100.0	32.9	6.0	4.23	0.42	0.00056	0.5	0.14
GRE-01-1-51	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	100.0	58.8	8.0	4.40	0.44	0.00056	0.5	0.14
GRE-01-1-52	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	100.0	20.2	5.0	4.00	0.40	0.00056	0.5	0.13
GRE-01-1-53	0.0	0.0	0.0	0.0	0.0	0.0	0.0	86.0	86.0	14.0	100.0	44.9	6.8	4.34	0.43	0.00056	0.5	0.14
GRE-01-1-54	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	100.0	60.0	8.0	4.41	0.44	0.00056	0.5	0.15
GRE-01-2-10	0.0	0.0	0.0	0.0	0.0	84.8	0.0	15.2	100.0	0.0	100.0	72.2	5.4	3.07	0.27	0.00056	0.5	0.15

TABLE A-3 - Soil Parameter Calculations

Project: City of Naples - Basin V Stormwater System Improvement Plan, Phase I
 Scenario: Existing System

Hydrologic Soil Group	Max. Infiltration Rate (in/hr)	Min. Infiltration Rate (in/hr)	Infiltration Decay Rate (hr ⁻¹)
A	10.00	2.00	2.00
B	7.50	1.00	2.00
C	5.00	0.50	2.00
D	3.00	0.25	2.00

Hydrologic Soil Group	Average Depth to Water Table (ft)
A	5.0
B	4.0
C	2.5
D	0.0
A/D	0.5
B/D	0.5
C/D	0.5
C,B/D	0.5

Hydrologic Unit ID	Percent By Hydrologic Unit											Percent Pervious	Percent NDCIA	Max. Infiltration Rate (in/hr)	Min. Infiltration Rate (in/hr)	Infiltration Decay Rate (s ⁻¹)	Average Depth To Water Table (ft)	Soil Storage Capacity (in)
	Group A	Group B	Group C	Group D	Group A/D	Group B/D	Group C/D	Group C,B/D	All Groups	Water	Total							
GRE-01-2-20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	100.0	49.3	8.4	4.28	0.43	0.00056	0.5	0.14
GRE-01-2-30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	100.0	60.0	8.0	4.41	0.44	0.00056	0.5	0.15
GRE-01-2-31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	100.0	60.0	8.0	4.41	0.44	0.00056	0.5	0.15
GRE-01-2-32	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	100.0	60.0	8.0	4.41	0.44	0.00056	0.5	0.15
GRE-01-2-33	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	100.0	51.5	8.9	4.27	0.43	0.00056	0.5	0.14
GRE-01-2-34	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	100.0	60.0	8.0	4.41	0.44	0.00056	0.5	0.15
GRE-01-2-35	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	100.0	45.9	9.4	4.15	0.41	0.00056	0.5	0.14
GRE-01-2-36	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	100.0	39.6	9.9	4.00	0.40	0.00056	0.5	0.13
GRE-01-2-40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	100.0	49.2	7.2	4.36	0.44	0.00056	0.5	0.14
GRE-01-2-50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	100.0	49.3	8.5	4.27	0.43	0.00056	0.5	0.14
GRE-01-2-60	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	100.0	54.7	7.7	4.38	0.44	0.00056	0.5	0.14
GRE-01-2-61	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	100.0	54.9	7.7	4.39	0.44	0.00056	0.5	0.14
GRE-01-2-62	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	100.0	53.7	7.1	4.42	0.44	0.00056	0.5	0.15
GRE-01-2-70	0.0	0.0	0.0	0.0	0.0	0.0	0.0	88.0	88.0	12.0	100.0	65.7	3.4	4.75	0.48	0.00056	0.5	0.16
GRE-01-2-75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	100.0	39.4	9.8	4.00	0.40	0.00056	0.5	0.13
GRE-01-3-10	0.0	0.0	0.0	0.0	0.0	0.7	0.0	99.3	100.0	0.0	100.0	35.8	7.7	4.11	0.41	0.00056	0.5	0.14
GRE-01-3-11	0.0	0.0	0.0	0.0	0.0	91.2	0.0	8.8	100.0	0.0	100.0	21.4	4.9	2.58	0.22	0.00056	0.5	0.13
GRE-01-3-12	0.0	0.0	0.0	0.0	0.0	52.5	0.0	47.5	100.0	0.0	100.0	20.0	5.0	3.16	0.30	0.00056	0.5	0.13
GRE-01-3-13	0.0	0.0	0.0	0.0	0.0	79.5	0.0	20.5	100.0	0.0	100.0	20.0	5.0	2.73	0.24	0.00056	0.5	0.13
GRE-01-3-14	0.0	0.0	0.0	0.0	0.0	58.3	0.0	41.7	100.0	0.0	100.0	20.0	5.0	3.07	0.28	0.00056	0.5	0.13
GRE-01-3-20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	100.0	20.0	5.0	4.00	0.40	0.00056	0.5	0.13
GRE-01-3-25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	100.0	20.0	5.0	4.00	0.40	0.00056	0.5	0.13
GRE-01-3-30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	100.0	20.0	5.0	4.00	0.40	0.00056	0.5	0.13
GRE-01-3-31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	100.0	20.0	5.0	4.00	0.40	0.00056	0.5	0.13
GRE-01-3-32	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	100.0	20.0	5.0	4.00	0.40	0.00056	0.5	0.13
GRE-01-3-33	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	100.0	20.0	5.0	4.00	0.40	0.00056	0.5	0.13
GRE-01-3-34	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	100.0	20.0	5.0	4.00	0.40	0.00056	0.5	0.13
GRE-01-3-35	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	100.0	20.0	5.0	4.00	0.40	0.00056	0.5	0.13

TABLE A-3 - Soil Parameter Calculations

Project: City of Naples - Basin V Stormwater System Improvement Plan, Phase I
Scenario: Existing System

Hydrologic Soil Group	Max. Infiltration Rate (in/hr)	Min. Infiltration Rate (in/hr)	Infiltration Decay Rate (hr ⁻¹)
A	10.00	2.00	2.00
B	7.50	1.00	2.00
C	5.00	0.50	2.00
D	3.00	0.25	2.00

Hydrologic Soil Group	Average Depth to Water Table (ft)
A	5.0
B	4.0
C	2.5
D	0.0
A/D	0.5
B/D	0.5
C/D	0.5
C,B/D	0.5

Hydrologic Unit ID	Percent By Hydrologic Unit											Percent Pervious	Percent NDCIA	Max. Infiltration Rate (in/hr)	Min. Infiltration Rate (in/hr)	Infiltration Decay Rate (s ⁻¹)	Average Depth To Water Table (ft)	Soil Storage Capacity (in)
	Group A	Group B	Group C	Group D	Group A/D	Group B/D	Group C/D	Group C,B/D	All Groups	Water	Total							
GRE-01-3-40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	100.0	31.1	6.0	4.19	0.42	0.00056	0.5	0.14
GRE-01-3-45	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	100.0	22.8	5.5	4.03	0.40	0.00056	0.5	0.13
GRE-01-3-50	0.0	0.0	0.0	0.0	0.0	42.6	0.0	57.4	100.0	0.0	100.0	20.0	5.0	3.32	0.31	0.00056	0.5	0.13
GRE-01-3-51	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	100.0	20.0	5.0	4.00	0.40	0.00056	0.5	0.13
GRE-01-3-52	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	100.0	20.4	5.1	4.00	0.40	0.00056	0.5	0.13
GRE-01-3-53	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	100.0	20.0	5.0	4.00	0.40	0.00056	0.5	0.13
GRE-01-4-10	0.0	0.0	0.0	0.0	0.0	4.0	0.0	96.0	100.0	0.0	100.0	40.4	6.8	4.21	0.42	0.00056	0.5	0.14
GRE-01-4-20	0.0	0.0	0.0	0.0	0.0	24.3	0.0	75.7	100.0	0.0	100.0	25.5	6.4	3.61	0.35	0.00056	0.5	0.13
GRE-01-4-25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	100.0	37.6	9.4	4.00	0.40	0.00056	0.5	0.13
GRE-01-4-30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0	100.0	27.9	7.0	4.00	0.40	0.00056	0.5	0.13
GRE-01-4-31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0	100.0	40.0	10.0	4.00	0.40	0.00056	0.5	0.13
GRE-01-4-32	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0	100.0	36.4	7.4	4.16	0.42	0.00056	0.5	0.14
GRE-01-4-33	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0	100.0	51.7	8.8	4.27	0.43	0.00056	0.5	0.14
GRE-01-4-34	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0	100.0	60.0	8.0	4.41	0.44	0.00056	0.5	0.15
GRE-01-4-35	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0	100.0	42.7	6.7	4.32	0.43	0.00056	0.5	0.14
GRE-01-4-36	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0	100.0	43.1	6.7	4.32	0.43	0.00056	0.5	0.14
GRE-01-4-37	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0	100.0	28.3	5.6	4.17	0.42	0.00056	0.5	0.14
GRE-01-4-38	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0	100.0	42.5	6.7	4.32	0.43	0.00056	0.5	0.14
GRE-01-4-39	0.0	0.0	0.0	0.0	0.0	0.0	0.0	87.0	87.0	13	100.0	41.3	5.5	4.41	0.44	0.00056	0.5	0.15
GRE-01-4-391	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0	100.0	60.0	8.0	4.41	0.44	0.00056	0.5	0.15
GRE-01-4-40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0	100.0	41.3	9.9	4.03	0.40	0.00056	0.5	0.13
GRE-01-4-41	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0	100.0	46.2	9.4	4.16	0.42	0.00056	0.5	0.14
GRE-01-4-42	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0	100.0	48.1	9.2	4.20	0.42	0.00056	0.5	0.14
GRE-01-4-43	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0	100.0	60.0	8.0	4.41	0.44	0.00056	0.5	0.15
GRE-01-4-44	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0	100.0	60.0	8.0	4.41	0.44	0.00056	0.5	0.15
GRE-01-4-45	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0	100.0	60.0	8.0	4.41	0.44	0.00056	0.5	0.15
GRE-01-4-46	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0	100.0	60.0	8.0	4.41	0.44	0.00056	0.5	0.15
GRE-01-4-47	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0	100.0	60.0	8.0	4.41	0.44	0.00056	0.5	0.15

TABLE A-3 - Soil Parameter Calculations
 Project: City of Naples - Basin V Stormwater System Improvement Plan, Phase I
 Scenario: Existing System

Hydrologic Soil Group	Max. Infiltration Rate (in/hr)	Min. Infiltration Rate (in/hr)	Infiltration Decay Rate (hr-1)
A	10.00	2.00	2.00
B	7.50	1.00	2.00
C	5.00	0.50	2.00
D	3.00	0.25	2.00

Hydrologic Soil Group	Average Depth to Water Table (ft)
A	5.0
B	4.0
C	2.5
D	0.0
A/D	0.5
B/D	0.5
C/D	0.5
C,B/D	0.5

Hydrologic Unit ID	Percent By Hydrologic Unit											Percent Pervious	Percent NDCIA	Max. Infiltration Rate (in/hr)	Min. Infiltration Rate (in/hr)	Infiltration Decay Rate (s-1)	Average Depth To Water Table (ft)	Soil Storage Capacity (in)
	Group A	Group B	Group C	Group D	Group A/D	Group B/D	Group C/D	Group C,B/D	All Groups	Water	Total							
GRE-01-4-50	0.0	0.0	0.0	0.0	0.0	36.5	0.0	63.5	100.0	0	100.0	59.4	4.1	4.00	0.38	0.00056	0.5	0.15
GRE-01-4-60	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0	100.0	60.0	8.0	4.41	0.44	0.00056	0.5	0.15
GRE-01-4-65	0.0	0.0	0.0	0.0	0.0	0.0	0.0	80.4	80.4	20	100.0	42.4	6.0	4.38	0.44	0.00056	0.5	0.14
GRE-01-4-70	0.0	0.0	0.0	0.0	0.0	0.0	0.0	93.6	93.6	6	100.0	47.5	7.1	4.35	0.43	0.00056	0.5	0.14
Area-wtd Avg:	0	0	0	0	0	12	0	86	98	2	100	44.6	6.8	4.1	0.4	0.00056	0.5	0.1

Note: If Urban Land Classification 'Group C,B/D' is used, values must be updated in Columns AX through BB

Table A-4
 City of Naples - Basin V Stormwater System Improvement Plan, Phase I
 Hydraulic Model Data Inventory

Conduit ID	Upstream Node	Downstream Node	Length (ft)	Description	Height (in)	Width (in)	Material	Upstream Node Elevation (ft-NGVD)	Downstream Node Elevation (ft-NGVD)	Top-of-Road Elevation (ft-NGVD)	Data Source	Road Name	Comment
BV12010	BV12010	GRE01020	286	42-inch ?	42	-	?	-0.75	?	?	Naples Inv.	Office Park	Control elev. = 2.62, top of HW = 4.39
BV12019	BV12019	BV12010	-	Control Weir	204	180	Concrete	2.07	-0.65	n/a	ABB/Naples Inv.	N/A	x Control structure from 6th Ave pond (17' x 15')
BV13020	BV13020	BV13021	250	15-inch RCP	15	-	RCP	4.91	3.81	7.10	ABB	10th Street N	
BV13021	BV13021	BV12019	140	15-inch CMP	15	-	CMP	3.78	0.63	6.43	ABB	10th Street N	
BV13010	BV13010	BV12019	99	54-inch RCP	54	-	RCP	?	-1.80	5.87	ABB	6th Ave N	
BV14005	BV14005	BV13010	420	54-inch RCP	54	-	RCP	-0.05	-0.97	8.35	FDA	6th Ave N	
BV14010	BV14010	BV14005	324	30-inch RCP	30	-	RCP	2.62	2.06	8.07	FDA	US 41	
BV14015	BV14015	BV14010	787	24-inch RCP	24	-	RCP	2.46	2.28	7.88	FDA	US 41	
BV14020	BV14020	BV14005	95	54-inch RCP	54	-	RCP	-0.88	-0.41	9.14	FDA	US 41	
BV14025	BV14025	BV14020	358	54-inch RCP	54	-	RCP	-0.49	-0.65	10.32	FDA	US 41	
BV14030	BV14030	BV14025	332	54-inch RCP	54	-	RCP	-0.35	-0.56	9.60	FDA	US 41	
BV14040	BV14040	BV14030	287	54-inch RCP	54	-	RCP	0.87	-0.44	?	FDA	US 41	
BV14045	BV14045	BV14040	238	54-inch RCP	54	-	RCP	0.69	0.83	10.44	FDA	US 41	
BV14050	BV14050	BV14045	90	54-inch RCP	54	-	RCP	0.82	0.69	10.22	FDA	US 41	
BV14055	BV14055	BV14050	578	54-inch RCP	54	-	RCP	1.03	0.89	10.41	FDA	US 41	
BV14060	BV14060	BV14055	193	54-inch RCP	54	-	RCP	1.41	1.00	10.01	FDA	US 41	
BV14065	BV14065	BV14060	41	54-inch RCP	54	-	RCP	1.35	1.31	9.90	FDA	US 41	
BV14070	BV14070	BV14065	252	54-inch RCP	54	-	RCP	1.37	1.30	10.41	FDA	US 41	
BV14075	BV14075	BV14070	501	54-inch RCP	54	-	RCP	1.26	1.38	10.53	FDA	US 41	
BV26005	BV26005	BV14075	292	48-inch RCP	48	-	RCP	1.86	1.06	9.77	FDA	US 41	
BV26010	BV26010	BV26005	184	48-inch RCP	48	-	RCP	1.78	1.57	10.20	FDA	US 41	
BV26015	BV26015	BV26010	310	48-inch RCP	48	-	RCP	1.96	1.78	10.49	FDA	US 41	
BV26020	BV26020	BV26015	198	48-inch RCP	48	-	RCP	2.39	1.95	?	FDA	US 41	
BV26025	BV26025	BV26020	56	24-inch RCP	24	-	RCP	4.76	5.19	n/a	FDA	US 41	
BV26030	BV26030	BV26020	235	48-inch RCP	48	-	RCP	2.48	2.43	?	FDA	US 41	
BV26035	BV26035	BV26030	521	42-inch RCP	42	-	RCP	2.56	2.55	N/A	FDA	US 41	GR = 2.8
BV26040	BV26040	BV26035	273	42-inch RCP	42	-	RCP	3.24	2.30	3.00	FDA	US 41	
BV34010	BV34010	BV26040	331	42-inch RCP	42	-	RCP	3.36	3.29	3.20	FDA	US 41	
BV34020	BV34020	BV34010	456	36-inch ?	36	-	?	3.80	?	11.32	Naples Inv.	US 41	
BV34030	BV34030	BV34020	358	30-inch ?	30	-	?	4.90	3.80	10.30	Naples Inv.	US 41	
BV34040	BV34040	BV34030	277	24-inch ?	24	-	?	5.60	4.90	11.50	Naples Inv.	US 41	
BV12020	BV12020	BV12019	46	16-inch PVC	16	-	PVC	2.67	2.07	5.11	ABB	12th St N	outlet to pond
BV12030	BV12030	BV12020	181	15-inch RCP	15	-	RCP	2.90	2.51	5.50	ABB	12th St N	
BV12040	BV12040	BV12030	454	15-inch RCP	15	-	RCP	3.81	2.95	7.50	ABB	7th Ave N	(RIM = 7.50)
BV11005	BV11005	GRE01050	63	48-inch RCP	48	-	RCP	?	1.29	7.19	ABB	8th Ave N	(RIM = 7.19), Top of box = 6.69, bottom of box = 1.13
BV11007	BV11007	BV11005	21	18-inch RCP	18	-	RCP	2.62	2.86	5.79	ABB	8th Ave N	THROAT = 5.01
BV11010	BV11010	BV11007	551	18-inch CMP	18	-	CMP	4.10	2.59	6.24	ABB	8th Ave N	THROAT = 5.66
BV11020	BV11020	BV11010	389	12-inch RCP	12	-	RCP	5.31	4.14	7.18	ABB	8th Ave N	THROAT = 6.69, surveyor needs to identify area to the left of junction
BV11030	BV11030	GRE01070	308	12-inch RCP	12	-	RCP	4.20	1.50	1.75	ABB	13th St N	THROAT = 5.88, 12' of 308' is 15" RCP
BV11040	BV11040	BV11030	134	12-inch RCP	12	-	RCP	4.78	4.17	n/a	ABB	n/a	from pond toward 13th St N

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BV11080	BV11080	GRE01090	11	15-inch RCP	15	-	RCP	3.89	3.00	5.79	ABB	10th Ave N	RIM = 7.67, Top of box = 7.16, bottom of box = 1.53, assumed d/s elev.
BV11070	BV11070	BV11080	165	18-inch RCP	18	-	RCP	5.31	2.19	7.67	ABB	10th Ave N	THROAT = 6.91
BV11060	BV11060	BV11070	33	12"x22" RCP	12	22	RCP	5.70	5.50	7.87	ABB	10th Ave N	Top of Box = 7.87, THROAT = 7.20, assumed u/s elev.
BV15010	BV15010	BV11060	505	24-inch RCP	24	-	RCP	6.24	5.70	9.48	ABB	10th Ave N	Top of Box (d/s) = 7.87, THROAT (d/s) = 7.20, assumed d/s elev.
BV15020	BV15020	BV15010	42	15-inch CMP	15	-	CMP	6.40	6.32	9.50	ABB	10th Ave N	THROAT = 9.34, Top of box = 10.09, assumed u/s and top of road elev.
BV15021	BV15020	BV15010	42	15-inch CMP	15	-	CMP	6.40	6.33	9.50	ABB	10th Ave N	THROAT = 9.34, Top of box = 10.09, assumed u/s and top of road elev.
BV15030	BV15030	BV15020	113	24-inch RCP	24	-	RCP	6.68	?	N/A	ABB	N/A	THROAT (d/s) = 9.34, top of box (d/s) = 10.09, water elev. = 6.70
BV15070	BV15070	BV15030	140	18-inch RCP	18	-	RCP	4.90	4.65	9.03	ABB	N/A	from 11th St N to pond
BV15080	BV15080	BV15070	230	18-inch RCP	18	-	RCP	5.48	5.06	8.62	ABB	11th St N	
BV15090	BV15090	BV15080	50	15-inch RCP	15	-	RCP	5.94	5.84	9.18	ABB	10th St N	(RIM = 9.18)
BV15040	BV15040	BV15030	?	30-inch RCP	30	-	RCP	3.98	?	9.08	ABB	11th St N	from 11th St N to pond
BV15050	BV15050	BV15040	177	18-inch RCP	18	-	RCP	4.31	4.03	10.11	ABB	10th Ave N	
BV15060	BV15060	BV15050	136	18-inch RCP	18	-	RCP	4.63	4.79	8.68	ABB	10th Ave N	
BV22010	BV22010	GRE01110	170	12-inch CMP	12	-	CMP	5.15	4.00	7.20	ABB	14th Ave N	d/s invert assumed, as manhole was inaccessible.
BV23005	BV23005	GRE01120	578	24"x36" CMP	24	36	CMP	3.23	3.60	8.74	ABB	15th Ave N	THROAT = 7.38
BV23010	BV23010	BV23005	350	24"x36" CMP	24	36	CMP	4.02	3.65	7.41	ABB	15th Ave N	
BV27010	BV27010	BV23011	106	12-inch Clay	12	-	Clay	5.57	5.61	N/A	ABB	15th Ave N	pipe coming from pond
BV27011	BV27010	BV23011	106	12-inch Clay	12	-	Clay	5.61	5.31	N/A	ABB	15th Ave N	pipe coming from pond
BV23011	BV23011	BV23010	82	30-inch RCP	30	-	RCP	3.73	3.67	7.24	ABB	15th Ave N	
BV27020	BV27020	BV27010	49	15-inch RCP	15	-	RCP	4.75	4.25	6.63	ABB	15th Ave N	
BV23015	BV23015	BV23011	332	24-inch RCP	24	-	RCP	5.25	4.03	7.37	ABB	12th St N	THROAT = 6.70
BV23020	BV23020	BV23015	71	18-inch ?	18	-	?	4.50	4.31	7.89	ABB/Naples Inv.	12th St N	THROAT = 7.19
BV23025	BV23025	BV23020	96	18-inch ?	18	-	?	4.68	4.50	7.90	ABB	12th St N	THROAT = 7.37
BV23030	BV23030	BV23025	50	15-inch ?	15	-	?	4.82	4.64	7.65	ABB/Naples Inv.	12th St N	GR = 7.65
BV23035	BV23035	BV23040	50	15-inch ?	15	-	?	5.19	5.47	7.43	ABB/Naples Inv.	12th St N	GR = 7.43
BV23040	BV23040	BV23025	41	18-inch ?	18	-	?	4.96	4.90	8.10	ABB	12th St N	TROAT = 7.43
BV23045	BV23045	BV23040	79	18-inch ?	18	-	?	5.14	4.97	8.38	ABB	12th St N	THROAT = 7.85
BV23050	BV23050	BV23045	83	18-inch ?	18	-	?	5.34	5.13	8.15	ABB	12th St N	THROAT = 7.40
BV23055	BV23055	BV23050	?	15-inch ?	15	-	?	5.43	5.28	?	ABB/Naples Inv.	12th St N	
BV23060	BV23060	BV23055	?	15-inch ?	15	-	?	5.66	5.43	7.66	Naples Inv.	12th St N	
BV23065	BV23065	BV23060	?	12-inch ?	12	-	?	6.00	5.66	7.71	Naples Inv.	12th St N	

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BV35010	BV35010	GRE01150	243	42-inch RCP	42	-	RCP	4.20	3.67	?	Golden Gate Pkwy Site Plans	Golden Gate Pkwy	
BV35020	BV35020	BV35010	648	24"x38" RCP	24	38	RCP	4.20	4.20	?	Golden Gate Pkwy Site Plans	Golden Gate Pkwy	
BV35030	BV35030	BV35020	549	24"x38" RCP	24	38	RCP	4.20	4.20	8.55	Golden Gate Pkwy Site Plans	Golden Gate Pkwy	
BV35040	BV35040	BV35030	46	29"x45" RCP	29	45	RCP	4.45	4.07	10.00	Golden Gate Pkwy Site Plans	Golden Gate Pkwy	RIM = 10.06
BV35050	BV35050	BV35045	140	24-inch RCP	24	-	RCP	4.54	4.40	8.31	Golden Gate Pkwy Site Plans	Golden Gate Pkwy	
BV35045	BV35045	BV35030	560	24"x38" RCP	24	38	RCP	4.40	4.20	7.95	Golden Gate Pkwy Site Plans	Golden Gate Pkwy	
BV42010	BV42010	BV42020	656	24"x38" RCP	24	48	RCP	4.20	4.55	4.20	Golden Gate Pkwy Site Plans	Golden Gate Pkwy	
BV42020	BV42020	GRE01160	231	42-inch RCP	42	-	RCP	4.55	4.20	?	Golden Gate Pkwy Site Plans	Golden Gate Pkwy	
BV35041	BV35040	BV42010	549	24"x38" RCP	24	38	RCP	4.28	4.20	10.00	Golden Gate Pkwy Site Plans	Golden Gate Pkwy	RIM = 10.06
BV44005	BV44005	GRE01170	170	15-inch RCP	15	-	RCP	5.70	?	9.18	ABB	22nd Ave N	RIM = 9.18
BV44010	BV44010	BV44005	300	18-inch RCP	18	-	RCP	6.13	6.31	8.54	ABB	22nd Ave N	
BV44015	BV44015	GRE01180	190	18-inch CMP	18	-	CMP	5.50	5.22	8.28	ABB	14th St N	THROAT = 7.80
BV44020	BV44020	BV44015	152	18-inch CMP	18	-	CMP	5.91	5.54	9.09	ABB	14th St N	THROAT = 8.51
BV44025	BV44025	BV44020	297	18-inch CMP	18	-	CMP	6.49	6.92	9.49	ABB	Royal Palm Dr	THROAT = 8.91
BV44030	BV44030	BV44025	305	12-inch RCP	12	-	RCP	7.13	6.48	9.81	ABB	Royal Palm Dr	THROAT = 9.27
BV44035	BV44035	BV44030	385	12-inch RCP	12	-	RCP	8.06	7.17	10.07	ABB	Royal Palm Dr	THROAT = 9.54
BV44040	BV44040	GRE01192	210	18-inch CMP	18	-	CMP	7.19	5.23	9.54	ABB	14th St N	THROAT = 9.54
BV44045	BV44045	BV44040	331	12-inch RCP	12	-	RCP	7.90	7.14	9.80	ABB/Naples Inv.	Diana Ave	assumed u/s and top of road elev.
BV44050	BV44050	GRE01200	240	24-inch CMP	24	-	CMP	7.87	?	10.48	ABB	26th Ave N	
BV44055	BV44055	BV44050	335	18-inch CMP	18	-	CMP	9.04	8.20	11.59	ABB	26th Ave N	39' of 335' is RCP
BV43045	BV43045	GRE01220	143	24-inch ADS	24	-	ADS	5.59	5.36	10.84	ABB	28th Ave N	
BV43050	BV43050	BV43045	70	24-inch PVC	24	-	PVC	5.73	5.71	11.00	ABB	28th Ave N	THROAT = 10.29
BV43055	BV43055	BV43050	644	24-inch PVC	24	-	PVC	7.09	5.74	11.39	ABB	28th Ave N	THROAT = 10.72
BV43060	BV43060	BV43055	187	18-inch PVC	18	-	PVC	8.16	6.96	10.79	ABB	28th Ave N	THROAT = 10.16
BV46010	BV46010	BV43060	97	12-inch CMP	12	-	CMP	8.71	8.19	n/a	ABB	n/a	Lake to 28th Ave
BV46020	BV46020	BV46010	99	19"x30" ?	19	30	?	7.41	6.93	9.76	ABB	12th St N	
BV46030	BV46030	BV46020	?	?	?	?	?	?	?	?	Naples Inv.	12th St N	
BV46040	BV46040	BV46030	?	15"x23" ?	15	23	?	?	?	?	Naples Inv.	n/a	
BV43063	BV43063	BV43055	479	24-inch PVC	24	-	PVC	7.59	7.02	11.94	ABB	28th Ave N	THROAT = 11.30
BV43065	BV43065	BV43063	159	24-inch RCP	24	-	RCP	7.55	7.39	11.99	ABB	28th Ave N	THROAT = 11.31
BV43067	BV43067	BV43065	204	15-inch RCP	15	-	RCP	8.26	7.53	12.31	ABB	28th Ave N	THROAT = 11.75
BV43070	BV43070	BV43067	370	15-inch RCP	15	-	RCP	8.65	8.21	12.47	ABB	28th Ave N	THROAT = 11.86

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BV43075	BV43075	BV43070	76	15-inch RCP	15	-	RCP	8.70	8.70	12.42	ABB	28th Ave N	THROAT = 11.84
BV47010	BV47010	GRE01230	228	24-inch CMP	24	-	CMP	7.74	6.72	n/a	ABB	14th St N	65 LF of 228 LF is 24-inch RCP
BV47020	BV47020	BV47010	27	18-inch DIP	18	-	DIP	6.89	6.54	9.09	ABB	28th Ave N	Outfall to lake
BV47030	BV47030	BV47020	559	18-inch RCP	18	-	RCP	8.50	6.93	10.40	ABB	12th St N	assumed u/s and top of road elev.
BV47040	BV47040	BV47030	762	12-inch RCP	12	-	RCP	9.20	8.50	10.60	ABB	29th Ave N	assumed elevations
BV43035	BV43035	BV43030	185	12-inch CMP	12	-	CMP	8.43	8.28	10.74	ABB	Diana Ave	Outfall to Pond, THROAT = 10.03, 43' of the 185' is RCP
BV43036	BV43035	BV43040	95	12-inch RCP	12	-	RCP	8.53	8.40	10.74	ABB	Diana Ave	THROAT = 10.03
BV43017	BV43017	BV43010	53	42-inch RCP	42	-	RCP	2.44	2.58	10.02	ABB	10th St N	
BV43018	BV43018	BV43017	52	18- & 24-inch RCP	18/24	-	RCP	7.15	7.14	10.79	ABB	10th St N	33-ft of 24" RCP, 19-ft of 18" RCP
BV43040	BV43040	BV43018	485	12-inch RCP	12	-	RCP	8.40	7.63	10.68	ABB	10th St N	THROAT = 10.21
BV43014	BV43010	BV43015	154	24-inch RCP	24	-	RCP	5.25	5.25	n/a	Naples H.S. Site Plans	10th St N	next to baseball fields
BV43011	BV43010	BV43005	154	29"x45" RCP	29	45	RCP	6.30	6.30	n/a	Naples H.S. Site Plans	22nd Ave N	next to baseball fields
BV43012	BV43010	BV43005	162	29"x45" RCP	29	45	RCP	6.30	6.30	n/a	Naples H.S. Site Plans	22nd Ave N	next to baseball fields
BV43013	BV43010	BV43005	170	29"x45" RCP	29	45	RCP	6.30	6.30	n/a	Naples H.S. Site Plans	22nd Ave N	next to baseball fields
BV43020	BV43020	BV43017	414	15-inch RCP	15	-	RCP	7.55	7.00	9.65	ABB	22nd Ave N	
BV43025	BV43025	BV43020	305	12-inch RCP	12	-	RCP	8.10	7.50	?	ABB/Naples Inv.	11th St N	
BV43015	BV43015	BV43080	311	24-inch RCP	24	-	RCP	5.25	5.25	n/a	Naples H.S. Site Plans		Naples High School
BV43085	BV43085	BV43005	195	30-inch RCP	30	-	RCP	3.30	3.09	n/a	Naples H.S. Site Plans		Naples High School
BV43090	BV43090	BV43085	128	24-inch RCP	24	-	RCP	6.20	4.30	n/a	Naples H.S. Site Plans		Naples High School
BV43095	BV43095	BV43090	185	18-inch RCP	18	-	RCP	7.30	6.60	n/a	Naples H.S. Site Plans		Naples High School
BV43097	BV43097	BV43095	90	15-inch RCP	15	-	RCP	7.70	7.50	n/a	Naples H.S. Site Plans		Naples High School
BV43005	BV43005	BV44060	696	54-inch RCP	54	-	RCP	3.00	3.00	?	Naples H.S. Site Plans		Naples High School
BV44060	BV44060	GRE01165	696	54-inch RCP	54	-	RCP	3.00	3.00	?	Naples H.S. Site Plans		Naples High School
BV31040	BV31040	BV31010	442	24"x38" RCP	24	38	RCP	5.88	?	10.55	Deni Assoc. Survey	Coastland Mall	Coastland Mall System
BV31030	BV31030	BV31020	44	24"x38" RCP	24	38	RCP	5.82	5.45	10.57	Deni Assoc. Survey	Coastland Mall	Coastland Mall System, RIM = 10.57
BV31041	BV31040	BV31030	124	30-inch RCP	30	-	RCP	5.33	5.17	8.40	Deni Assoc. Survey	Coastland Mall	Coastland Mall System, RIM = 8.40
BV31050	BV31050	BV31040	240	48-inch RCP	48	-	RCP	5.08	3.02	12.57	Deni Assoc. Survey	Coastland Mall	Coastland Mall System, RIM = 12.57

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BV31060	BV31060	BV31050	250	48-inch RCP	48	-	RCP	5.21	5.02	12.73	Deni Assoc. Survey	Coastland Mall	Coastland Mall System, RIM = 12.73
BV31070	BV31070	BV31060	122	48-inch RCP	48	-	RCP	5.49	5.24	12.43	Deni Assoc. Survey	Coastland Mall	Coastland Mall System, RIM = 12.43
BV32010	BV32010	BV31070	132	42-inch RCP	42	-	RCP	5.55	5.35	11.52	Deni Assoc. Survey	Coastland Mall	Coastland Mall System, RIM = 11.52
BV35060	BV35060	BV32010	132	42-inch RCP	42	-	RCP	5.73	5.87	11.44	Deni Assoc. Survey	Coastland Mall	Coastland Mall System, RIM = 11.44
BV35070	BV35070	BV35060	122	42-inch RCP	42	-	RCP	5.78	5.75	11.17	Deni Assoc. Survey	Coastland Mall	Coastland Mall System, RIM = 11.17
BV32020	BV32020	BV35070	300	42-inch RCP	42	-	RCP	6.02	5.73	12.35	Deni Assoc. Survey	Coastland Mall	Coastland Mall System, RIM = 12.35
BV33060	BV33060	BV32020	380	42-inch RCP	42	-	RCP	6.70	6.02	12.04	Deni Assoc. Survey	Coastland Mall	Coastland Mall System
BV32030	BV32030	BV31040	300	42-inch RCP	42	-	RCP	5.76	3.18	12.18	Deni Assoc. Survey	Coastland Mall	Coastland Mall System, RIM = 12.18
BV32040	BV32040	BV32030	422	42-inch RCP	42	-	RCP	5.94	5.85	11.74	Deni Assoc. Survey	Coastland Mall	Coastland Mall System, RIM = 11.74
BV33010	BV33010	BV32040	450	36-inch RCP	36	-	RCP	6.39	6.02	?	Deni Assoc. Survey	Coastland Mall	Coastland Mall System
BV33050	BV33050	BV33010	290	15-inch RCP	15	-	RCP	6.35	6.18	12.88	Deni Assoc. Survey	Coastland Mall	Coastland Mall System
BV33020	BV33020	BV33010	376	24-inch RCP	24	-	RCP	7.22	6.84	10.85	Deni Assoc. Survey	Coastland Mall	Coastland Mall System, RIM = 10.85
BV33040	BV33040	BV33020	40	18-inch RCP	18	-	RCP	7.41	7.62	11.46	Deni Assoc. Survey	Coastland Mall	Coastland Mall System, RIM = 11.46
BV33030	BV33030	BV33020	56	15-inch RCP	15	-	RCP	8.19	7.93	11.52	Deni Assoc. Survey	Coastland Mall	Coastland Mall System, RIM = 11.52

Note: "?" indicates data not shown on survey information.

TABLE A-5
City of Naples - Basin V Stormwater System Improvement Plan, Phase I
Level of Service Elevations

Junction Name	Location	Surveyed/Estimated Elevations ⁽¹⁾					Elevations Used in Evaluation ⁽⁸⁾		
		Centerline Road Elevation ⁽²⁾ (ft-NGVD)	Edge of Pavement Road Elevation (ft-NGVD)	Yard Elevation ^{(3), (4), (5)} (ft-NGVD)	Structure Elevation ^{(6), (7)} (ft-NGVD)	Garage Elevation (ft-NGVD)	Centerline Road Elevation (ft-NGVD)	Yard Elevation (ft-NGVD)	Structure Elevation (ft-NGVD)
GRE01020	Outfall to Golden Gate Canal Confluence	6.5		6.3	7.0		6.5	6.3	7.0
BV12010		n/a					n/a	n/a	n/a
BV12019	control structure from 6th Avenue Pond	n/a					n/a	n/a	n/a
BV13020	Alley	7.1/7.25		7.9/8.6	9.5		7.1	7.9	9.5
BV13021	10th Street North	6.43/6.75		6.6/8.0	8.8	8.0	6.4	6.6	8.8
BV13010	6th Avenue North	5.87/5.98		5.5/5.6		6.2	5.9	5.5	n/a
BV14005	intersection of 6th Avenue North and Tamiami Tr N	9.0					9.0	n/a	n/a
BV14010	intersection of US 41 and 5th Avenue North	8.1	7.5				8.1	n/a	n/a
BV14015	intersection of US 41 and 3rd Avenue North	7.9					7.9	n/a	n/a
BV14020	intersection of US 41 and 6th Avenue North	9.8					9.8	n/a	n/a
BV14025	US 41, u/s of 6th Avenue North	10.9					10.9	n/a	n/a
BV14030	US 41, d/s of 7th Avenue North	9.6	9.3				9.6	n/a	n/a
BV14040	intersection of US 41 and 7th Avenue North		9.8				n/a	n/a	n/a
BV14045	US 41, d/s of 8th Avenue North	10.4	9.9				10.4	n/a	n/a
BV14050	intersection of US 41 and 8th Avenue North	10.2	9.8				10.2	n/a	n/a
BV14055	US 41, u/s of 8th Avenue North	10.4	9.8				10.4	n/a	n/a
BV14060	d/s end of crossing at intersection of US 41 and 10th Avenue	10.0	10.2				10.0	n/a	n/a
BV14065	u/s end of crossing at intersection of US 41 and 10th Avenue	10.8					10.8	n/a	n/a
BV14070	US 41, u/s of 10th Avenue	10.4	9.8				10.4	n/a	n/a
BV14075	US 41, d/s of 12th Avenue North	10.5	10.2				10.5	n/a	n/a
BV26005	US 41, u/s of 12th Avenue North	9.8	10.2				10.4	n/a	n/a
BV26010	US 41, d/s of 14th Avenue North	10.2	7.5				10.2	n/a	n/a
BV26015	US 41, d/s of 14th Avenue North	10.5	10.1				10.5	n/a	n/a
BV26020	US 41, u/s of 14th Avenue North	11.21					11.2	n/a	n/a
BV26025	pond west of US 41	n/a		n/a	n/a		n/a	n/a	n/a
BV26030	US 41, u/s of 14th Avenue North		9.3				n/a	n/a	n/a
BV26035	US 41, d/s of Fleischmann Boulevard	7.4	10.2	n/a	n/a		11.7	n/a	n/a
BV26040	intersection of US 41 and Fleischmann Boulevard	11.9					11.9	n/a	n/a
BV34010	US 41, u/s of Fleischmann Boulevard	10.5	9.8				11.5	n/a	n/a
BV34020	US 41, west of Coastland Mall	11.3	10.9				11.3	n/a	n/a
BV34030	US 41, west of Coastland Mall	10.3	9.8				11.4	n/a	n/a
BV34040	south of US 41 and Golden Gate Parkway intersection	11.5	10.7				11.5	n/a	n/a
BV12020	12th Street North	5.11/5.29		5.3/6.4	7.5	6.3	5.3	5.3	7.5
BV12030	intersection of 7th Avenue North and 12th Street North	5.5/6.26		5.9/6.7	7.6		5.5	5.9	7.6
BV12040	7th Avenue North	7.5/7.01		6.3/7.4	8.4	7.7	7.0	6.3	8.4
BV24010	east of 11th Street North	9.5		9.0/10.3	11.4	10.4	9.5	9.0	11.4
GRE01050	Goodlette-Frank Road	7.1		6.9	7.5		7.1	6.9	7.5
BV11007	u/s of intersection of 8th Ave N and Goodlette-Frank Road	5.8	4.5	4.5/7.6			5.8	4.5	n/a
BV11010	intersection of 8th Avenue North and 12th Street North	6.2		5.7			6.2	5.7	n/a
BV11020	8th Avenue North	7.18/7.94		6.9/8.0	8.8	8.0	7.2	6.9	8.8
GRE01070	Goodlette-Frank Road	7.5		7.3	8.8		7.5	7.3	8.8
BV11030	13th Street North	7.4		5.9			7.4	5.9	n/a
BV11040	Pond west of 13th Street North	n/a					n/a	n/a	n/a
BV11050	north of 12th Avenue North	9.1		8.2/8.8	10.0		9.1	8.2	10.0
GRE01090	Goodlette-Frank Road	7.7		7.5	8.0		7.7	7.5	8.0
BV11070	d/s end of crossing at 10th Ave N and 13th St N	7.7		6.9			7.7	6.9	n/a

TABLE A-5
City of Naples - Basin V Stormwater System Improvement Plan, Phase I
Level of Service Elevations

Junction Name	Location	Surveyed/Estimated Elevations ⁽¹⁾				Elevations Used in Evaluation ⁽⁸⁾			
		Centerline Road Elevation ⁽²⁾ (ft-NGVD)	Edge of Pavement Road Elevation (ft-NGVD)	Yard Elevation ^{(3), (4), (5)} (ft-NGVD)	Structure Elevation ^{(6), (7)} (ft-NGVD)	Garage Elevation (ft-NGVD)	Centerline Road Elevation (ft-NGVD)	Yard Elevation (ft-NGVD)	Structure Elevation (ft-NGVD)
BV11060	u/s end of crossing at 10th Ave N and 13th St N	7.87/8.93		8.2	9.5		7.9	8.2	9.5
BV15010	d/s end of 12th Street North crossing	9.48/10.24		9.5/10.6	11.4	11.0	9.5	9.5	11.4
BV15020	u/s end of 12th Street North crossing ⁽¹⁾	10.2		9.3			10.2	9.3	n/a
BV15030	pond at 12th Street North	n/a		n/a	n/a		n/a	n/a	n/a
BV15070	11th Street North(8)	9.03/10.28		9.7/10.8	11.53/11.56	10.7	9.0	9.7	11.5
BV15080	intersection of 11th Street North and 10th Street North	8.6					8.6	n/a	n/a
BV15090	intersection of 11th Street North and 10th Street North	9.18/9.51			12.9		9.2	n/a	12.9
BV15040	intersection of 11th Street North and 10th Avenue North	9.1					9.1	n/a	n/a
BV15050	10th Avenue North	10.11/11.51		10.3/11.9	12.6		10.1	10.3	12.6
BV15060	intersection of 10th Avenue North and 10th Street North	9.5		9.4/9.8	11.1	10.2	9.5	9.4	11.1
GRE01110	Goodlette-Frank Road	7.9		7.7	8.5		7.9	7.7	8.5
BV22010	14th Avenue North	7.2/7.29		6.94/9.4	9.9		7.2	6.9	9.9
GRE01120	Goodlette-Frank Road	8.0		7.8	8.5		8.0	7.8	8.5
BV23005	north of Lake Park Elementary School	8.7		7.4			8.7	7.4	n/a
BV23010	corner of 15th Avenue North and 12th Street North	7.4					7.4	n/a	n/a
BV23011	15th Avenue North	7.2					7.2	n/a	n/a
BV27010	Pond north of 14th Avenue North	n/a		n/a	n/a		n/a	n/a	n/a
BV27020	15th Avenue North	6.6					6.6	n/a	n/a
BV23015	d/s end of 14th Avenue North crossing	7.37/8.13		7.6/9.0	9.6	9.1	7.4	7.6	9.6
BV23020	u/s end of 14th Avenue North crossing	7.9		7.2			7.9	7.2	n/a
BV23025	intersection of 12th Street North and 14th Avenue North	7.9		7.4			7.9	7.4	n/a
BV23030	intersection of 12th Street North and 14th Avenue North	7.65/7.85		7.5/9.0	10.0	9.1	7.7	7.5	10.0
BV23035	intersection of 12th Street North and 14th Avenue North	7.9					7.9	n/a	n/a
BV23040	intersection of 12th Street North and 14th Avenue North	8.1		7.4			8.1	7.4	n/a
BV23045	12th Street North, south of 14th Avenue North	8.4		7.9			8.4	7.9	n/a
BV23050	12th Street North, south of 14th Avenue North	8.15/8.19		7.9/9.3	10.6	9.4	8.2	7.9	10.6
BV23055	12th Street North, north of 13th Avenue North	8.2					8.2	n/a	n/a
BV23060	d/s end of 13th Avenue North crossing	7.7					7.7	n/a	n/a
BV23065	u/s end of 13th Avenue North crossing	7.7					7.7	n/a	n/a
BV23070	south of 13th Avenue North	8.2		7.9/9.3	10.0		8.2	7.9	10.0
GRE01130	intersection of Fleschmann Ave and Goodlette-Frank Road	8.2		7.6			8.2	7.6	n/a
GRE01150	along Goodlette-Frank Road	9.9		8.3	10.0		9.9	8.3	10.0
BV35010	Golden Gate Parkway	11.1					11.1	n/a	n/a
BV35020	Golden Gate Parkway		8.5				n/a	n/a	n/a
BV35030	Golden Gate Parkway	8.6	8.6				8.6	n/a	n/a
BV35040	Golden Gate Parkway	10.0	8.6				9.1	n/a	n/a
BV35045	Golden Gate Parkway	8.0	7.3				8.3	n/a	n/a
BV35050	Golden Gate Parkway	8.3	8.4				8.5	n/a	n/a
GRE01160	along Goodlette-Frank Road	10.0		9.8	10.5		10.0	9.8	10.5
BV42020	Golden Gate Parkway	9.0	7.9				9.0	n/a	n/a
BV42010	Golden Gate Parkway	10.0	8.5				9.2	n/a	n/a
GRE01170	along Goodlette-Frank Road	9.7		9.5	10.5		9.7	9.5	10.5
BV44005	intersection of 22nd Avenue North and 14th Street North	9.2					9.2	n/a	n/a
BV44010	22nd Avenue North	8.54/9.48		9.4/10.7	11.4	10.7	9.5	9.4	11.4
GRE01180	along Goodlette-Frank Road	9.7		9.5	10.5		9.7	9.5	10.5
BV44015	14th Street North, north of 22nd Avenue North	8.3		7.8			8.3	7.8	n/a
BV44020	intersection of 14th Street North and Royal Palm Drive	9.09/9.51		8.51/8.8/10.7	12.3	10.5	9.1	8.5	12.3

TABLE A-5
City of Naples - Basin V Stormwater System Improvement Plan, Phase I
Level of Service Elevations

Junction Name	Location	Surveyed/Estimated Elevations ⁽¹⁾					Elevations Used in Evaluation ⁽⁸⁾		
		Centerline Road Elevation ⁽²⁾ (ft-NGVD)	Edge of Pavement Road Elevation (ft-NGVD)	Yard Elevation ^{(3), (4), (5)} (ft-NGVD)	Structure Elevation ^{(6), (7)} (ft-NGVD)	Garage Elevation (ft-NGVD)	Centerline Road Elevation (ft-NGVD)	Yard Elevation (ft-NGVD)	Structure Elevation (ft-NGVD)
BV44025	intersection of Royal Palm Drive and 13th Street North	9.5		8.9			9.5	8.9	n/a
BV44030	Royal Palm Drive, u/s of 13th Street North	9.81/10.15		9.6/10.8	11.7	11.2	9.8	9.6	11.7
BV44035	Royal Palm Drive, u/s of 13th Street North	10.1		9.5			10.1	9.5	n/a
GRE01192	along Goodlette-Frank Road	11.0		10.8	11.5		11.0	10.8	11.5
BV44040	intersection of 14th Street North and Diana Avenue			9.5			n/a	9.5	n/a
BV44045	intersection of Diana Avenue and 13th Street North	9.8/10.10		9.5/11.7	12.7		9.8	9.5	12.7
GRE01200	along Goodlette-Frank Road	11.0		10.8	11.5		11.0	10.8	11.5
BV44050	intersection of 14th Street North and 26th Avenue North	10.5					10.5	n/a	n/a
BV44055	intersection of 13th Street North and 26th Avenue North	11.59/11.48		11.6/13.3	13.8	13.5	11.5	11.6	13.8
GRE01220	along Goodlette-Frank Road	11.0		10.8	11.5		11.0	10.8	11.5
BV43045	d/s end of 14th Street North & 28th Ave N crossing	10.8					10.8	n/a	n/a
BV43050	u/s end of 14th Street North & 28th Ave N crossing	11.0		10.3			11.0	10.3	n/a
BV43055	intersection of 28th Avenue North and 12th Street North	11.4		10.7			11.0	10.7	n/a
BV43060	d/s end of 28th Avenue North & 12th St N crossing	10.8		10.2			10.8	10.2	n/a
BV46010	Pond south of 28th Avenue North	n/a		n/a	n/a		n/a	n/a	n/a
BV46020	12th Street North, east of Pond	9.76/11.12		10.07/11.7	12.6	12.1	9.8	10.1	12.6
BV46040	east of 12th Street North						n/a	n/a	n/a
BV43063	intersection of 28th Avenue North and 12th Street North	11.9		11.3			11.9	11.3	n/a
BV43065	28th Avenue north, west of 12th Street North	11.99/11.07		10.8/13.0	13.5		12.0	10.8	13.5
BV43067	28th Avenue north, d/s of 10th Street North	12.3		11.9			12.3	11.9	n/a
BV43070	d/s end of 10th Street North & 28th Ave N crossing	12.47/12.57		12.1/12.2	13.0		12.5	12.1	13.0
BV43075	u/s end of 10th Street North & 28th Ave N crossing	12.6		11.8			12.6	11.8	n/a
GRE01230	along Goodlette-Frank Road	11.0		10.8	11.5		11.0	10.8	11.5
BV47010	pond north of 28th Avenue North	n/a		n/a	n/a		n/a	n/a	n/a
BV47020	east of 12th Street North	9.09/11.54		11.0/12.1	12.7	12.2	10.2	11.0	12.7
BV47030	south of 12th St North and 29th Ave North intersection	10.4					10.4	n/a	n/a
BV47040	south of 29th Ave North and 10th St North intersection	10.6/11.66		11.4/12.2	13.0		10.6	11.4	13.0
BV43030	pond north of Diana Avenue	n/a		n/a	n/a		n/a	n/a	n/a
BV43035	Diana Avenue, d/s of 10th Street North	10.74/10.83		9.7/12.0	12.6	12.1	10.7	9.7	12.6
BV43040	intersection of Diana Avenue and 10th Street North	10.7		10.2			10.7	10.2	n/a
BV43010	10th Street North, Naples High School baseball fields	n/a		n/a	n/a		n/a	n/a	n/a
BV43017	22nd Avenue North, south of 10th Street North	10.0					10.0	n/a	n/a
BV43018	intersection of 10th Avenue North and 22nd Avenue	10.8					10.8	n/a	n/a
BV43015	baseball fields at Naples High School	n/a					n/a	n/a	n/a
BV43005	baseball fields at Naples High School	n/a					n/a	n/a	n/a
BV43020	intersection of 22nd Avenue North and 11th Street North	9.7					9.7	n/a	n/a
BV43025	intersection of 11th Street North and Royal Palm Drive	10.7		10.5/11.5	12.1		10.7	10.5	12.1
BV43080	baseball fields at Naples High School	n/a		n/a	n/a		n/a	n/a	n/a
BV43085	baseball fields at Naples High School	n/a		n/a	n/a		n/a	n/a	n/a
BV43090	baseball fields at Naples High School	n/a		n/a	n/a		n/a	n/a	n/a
BV43095	baseball fields at Naples High School	n/a		n/a	n/a		n/a	n/a	n/a
BV43097	baseball fields at Naples High School	n/a		n/a	n/a		n/a	n/a	n/a
BV44060	Naples High School						n/a	n/a	n/a
GRE01165	along Goodlette-Frank Road						9.0	n/a	n/a
BV31010	Goodlette-Frank Road, east of Coastland Mall						n/a	n/a	n/a
BV31040	Coastland Mall	10.6					10.6	n/a	n/a
BV31020	Goodlette-Frank Road, east of Coastland Mall						n/a	n/a	n/a

TABLE A-5
 City of Naples - Basin V Stormwater System Improvement Plan, Phase I
 Level of Service Elevations

Junction Name	Location	Surveyed/Estimated Elevations ⁽¹⁾					Elevations Used in Evaluation ⁽⁸⁾		
		Centerline Road Elevation ⁽²⁾ (ft-NGVD)	Edge of Pavement Road Elevation (ft-NGVD)	Yard Elevation ^{(3), (4), (5)} (ft-NGVD)	Structure Elevation ^{(6), (7)} (ft-NGVD)	Garage Elevation (ft-NGVD)	Centerline Road Elevation (ft-NGVD)	Yard Elevation (ft-NGVD)	Structure Elevation (ft-NGVD)
BV31030	Coastland Mall	10.6					10.6	n/a	n/a
BV31050	Coastland Mall	12.6					12.6	n/a	n/a
BV31060	Coastland Mall	12.7					12.7	n/a	n/a
BV31070	Coastland Mall	12.4					12.4	n/a	n/a
BV32010	Coastland Mall	11.5					11.5	n/a	n/a
BV35060	Coastland Mall	11.4					11.4	n/a	n/a
BV35070	Coastland Mall	11.2					11.2	n/a	n/a
BV32020	Coastland Mall	12.4					12.4	n/a	n/a
BV33060	Coastland Mall	12.0					12.0	n/a	n/a
BV32030	Coastland Mall	12.2					12.2	n/a	n/a
BV32040	Coastland Mall	11.7					11.7	n/a	n/a
BV33010	Coastland Mall						n/a	n/a	n/a
BV33050	Coastland Mall	12.9					12.9	n/a	n/a
BV33020	Coastland Mall	10.9					10.9	n/a	n/a
BV33040	Coastland Mall	11.5					11.5	n/a	n/a
BV33030	Coastland Mall	11.5					11.5	n/a	n/a

Notes:

- (1) - Elevations have been rounded to the nearest tenth of a foot and were based on data obtained from the following sources:

Color Code	Survey Data Source
	ABB (Agnoli Barber & Brundage, Inc.)
	Naples Inventory
	Various Construction Plans and Record Drawings
	Deni Associates
	FDA
	Gordon River Study

- (2) - Road elevations with two values given reflects the data from the original ABB survey and data from the survey including reported and observed flooding locations.
 (3) - Yard elevations with no color code have been estimated from the one-foot contour data derived by Kucera International from the February 10, 1989 aerial photographs and from the five-foot contour data provided by the SFWMD based on the USGS 1:24000 data.
 (4) - Yard elevation with two values given reflects both the lowest ground elevation and ground elevation at the house for all ABB survey data.
 (5) - Yard elevations were generally estimated as the surveyed throat elevation where specific survey data were lacking.
 (6) - The critical structure elevation at these locations is the lowest finished floor elevation in the vicinity of the respective model junction. In cases where more than one structure is adjacent to the respective junction, the lowest structure was used in the evaluation.
 (7) - Junction BV15070 has a finished floor elevation for the house and a guest house.
 (8) - Threshold LOS elevations used in the existing system evaluation (Table 5-1). Highlighted entries indicate values have been edited.

APPENDIX B

Figure Depicting the Four LOS Classes