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September 5, 2008

Mr. Steven J. Sentes
Supervising Lead Project Manager
South Florida Water Management District
2301 McGregor Blvd.
Ft. Myers, FL 33901

Subject: SFWMD Contract #4600000791-WO01
Update to South Lee County Watershed Plan – Deliverable 1B

Dear Mr. Sentes:

Enclosed is draft Deliverable 1B, a 100% Report for the Data Collection Task of the Contract referenced above. Our site visit last week was extremely helpful in identifying locations where additional information is needed. We appreciate the time that both SFWMD and Lee County staff spent with Roger Copp and myself.

Please review our draft Report and forward any comments or additional information that you may be aware of that we are missing.

Sincerely,

Boyle Engineering Corporation

Karen D. Brandon, P.E.
Senior Engineer

KDB/dw

cc: Damon Meiers, P.E.
Roger Copp, ADA
Pradeep Nagarajan

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South Lee County Watershed Plan Update
Work Order C-4600000791 WO01
Deliverable 1B
Task 1 - Project Orientation and Data Collection

South Florida Water Management District

Client Representative Steven Sentes

Boyle Engineering Corporation

Project Manager Karen Brandon

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Project Manager Roger Copp

September 5, 2008

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1.0 Introduction

This memorandum provides a summary of the data collection activities as part of Task I-B of the South Lee County Watershed Plan (SLCWP) Update. The SLCWP Update is being conducted for SFWMD and Lee County to verify and validate the findings and material assumptions of the original SLCWP (July, 1999) for Halfway Creek, Spring Creek and the South Branch of the Estero River region. The Update will be utilized to evaluate the potential impacts of possible additional culverts under I-75 on:

- environmental conditions in wetlands east of I-75, and
- hydrologic and hydraulic conditions west of I-75.

2.0 Data Collection Requirements from the Statement of Work

This work is being conducted in accordance with Work Order C-4600000791 WO01 issued to Boyle Engineering Corporation on May 8, 2008 and received by Boyle on June 25, 2008. **Table 1** provides a listing of the data collection task requirements and the completion status.

Table 1 – Status of Data Collection Activities

No.	Task	Status
1	Identify, review, and compile data such as past studies	See Table 2
	Identify, review, and compile GIS data	Complete
	Identify, review, and compile data from outside agencies, NRCS, NWI	Complete
	Identify, review, and compile data from recent Density Reduction/Groundwater Recharge (DRGR) Study	Complete
2	Review array of sub-basin studies	See Table 3
3	Compile and review historical flow data for Halfway Creek, South Branch of the Estero, Spring Creek, and the Imperial River	Complete
4	Verify, through review of as-built drawings and permit records, the installed conveyance capacity from I-75 to tidal waters	Complete
5	Identify the available format of data	Complete
6	Identify SFWMD and Lee County GIS data for topography, current land use/land cover, meteorological, surface, and groundwater monitoring stations	Complete

7	Identify prominent data gaps	Complete
8	Provide clear maps showing the location of data reference points with respect to roads, and key hydraulic conveyance features	Complete

3.0 Prior Studies Conducted in the Study Area

Table 2 provides a listing of known hydrologic studies that have been conducted or are in progress within the study area and the status of acquisition. **Figure 1** presents a map of the study area for this project.

Table 2 – Previous Hydrologic Studies, as Identified in SOW Attachment A

No	Study	Status
1	Link to SLCWP on Lee County's web site	Provided
2	Copy of staff report with addendum for Permit No. 36-03802-P	Provided
3	Map of project region with SFWMD permit boundaries, permit numbers, and pending permit application numbers	Provided
4	Copy of cost share agreement between SFWMD and Lee County	Provided
5	Information supporting the SWFFS	Partially provided
6	Electronic copy of SLCWP	Provided
7	Electronic copies of stormwater mgt models	See Table 3 below
8	Scope of Work for DRGR	Provided
9	Topographic information for DRGR	Provided
10	Any other DRGR Study data	Provided
11	Lee County water table monitoring network	Provided

The model files from the DRGR study and an initial calibration report for the DRGR model have been obtained. The DRGR model covers all of Lee County, however the focus of the model calibration was the DRGR area, which is east of I-75, south of SR 82 (Immokalee Road), and north of Bonita Beach Road. The model calibration focused on surficial aquifer conditions rather than flooding issues west of I-75. There are several existing culverts and bridges in the Estero River and Halfway Creek watersheds, which are not included in the DRGR Model. Therefore, additional information is necessary to include the structures in the model to evaluate flooding impacts west of I-75. A majority of the missing structure information has been obtained, as discussed below in **Section 4.0**. The source of the additional information is provided below in **Table 3**, which lists prior studies or project information west of I-75.

Table 3 – Sub-basin Studies and Project Information West of I-75

No.	Study	Consultant	Status
1	Halfway Creek FPL Crossing	Hole Montes	Obtained. Cross sections available
2	Water Quality Weirs, Brooks Ditch to South Branch Estero	Barraco & Associates	Obtained
3	Villages at Country Creek	Wilson Miller	Obtained
	Via Villagio Parkway Halfway Creek Culverts	Hole Montes	**Currently in search of permit files**
5	Halfway Creek RR Culverts		**Not found**
6	Via Coconut Point Road Culverts	David Plummer & Assoc., Inc.	Obtained
7	Rookery Pointe Development, North Branch Estero River at Rookery Drive	Community Engineering Services, Inc.	**Field measurements, no invert elevation. Microfilm Permit files unreadable**
8	Brooks Development	Wilson Miller and Johnson Engineering	Obtained
9	Brooks North Emergency Structure	Brooks of Bonita Springs II Community Dev. Dist.	Obtained
10	SWFFS Estero River Basin Modification of Hydrologic Model, July 2006	DHI, Inc.	Report and model files Obtained
11	SWFFS Integrated Hydrologic Model – Model Documentation Report, January, 2008	SDI Inc., DHI, Inc., and BPC Group, Inc.	Report and model files obtained
12	SWMM Model of Halfway Creek, 1999 SLCWP	JEI, AB&B	Model files obtained

4.0 Structures in the Estero River, Halfway Creek, and Spring Creek Watersheds

Figures 2 and 3 present locations of the structures and the stream network along Estero River and Halfway Creek, west of I-75. **Table 4** provides a detailed listing of stream crossings in the Estero and Halfway Creek basins from I-75 to tide and summarizes structure details and dimensions. The following sub-sections 4.1 through 4.3 describe structures in the Estero River, Halfway Creek, and Spring Creek watersheds. Structures from Table 4 are shown in ***bold italics*** when discussed within the body of this report. A complete GIS geodatabase was

developed for all structures within the project limits and was provided to SFWMD as part of this Data Collection effort. **Table 4 Recent Structure Information for the Estero and Halfway Creek Basins** is taken from the geodatabase and is provided at the end of the report.

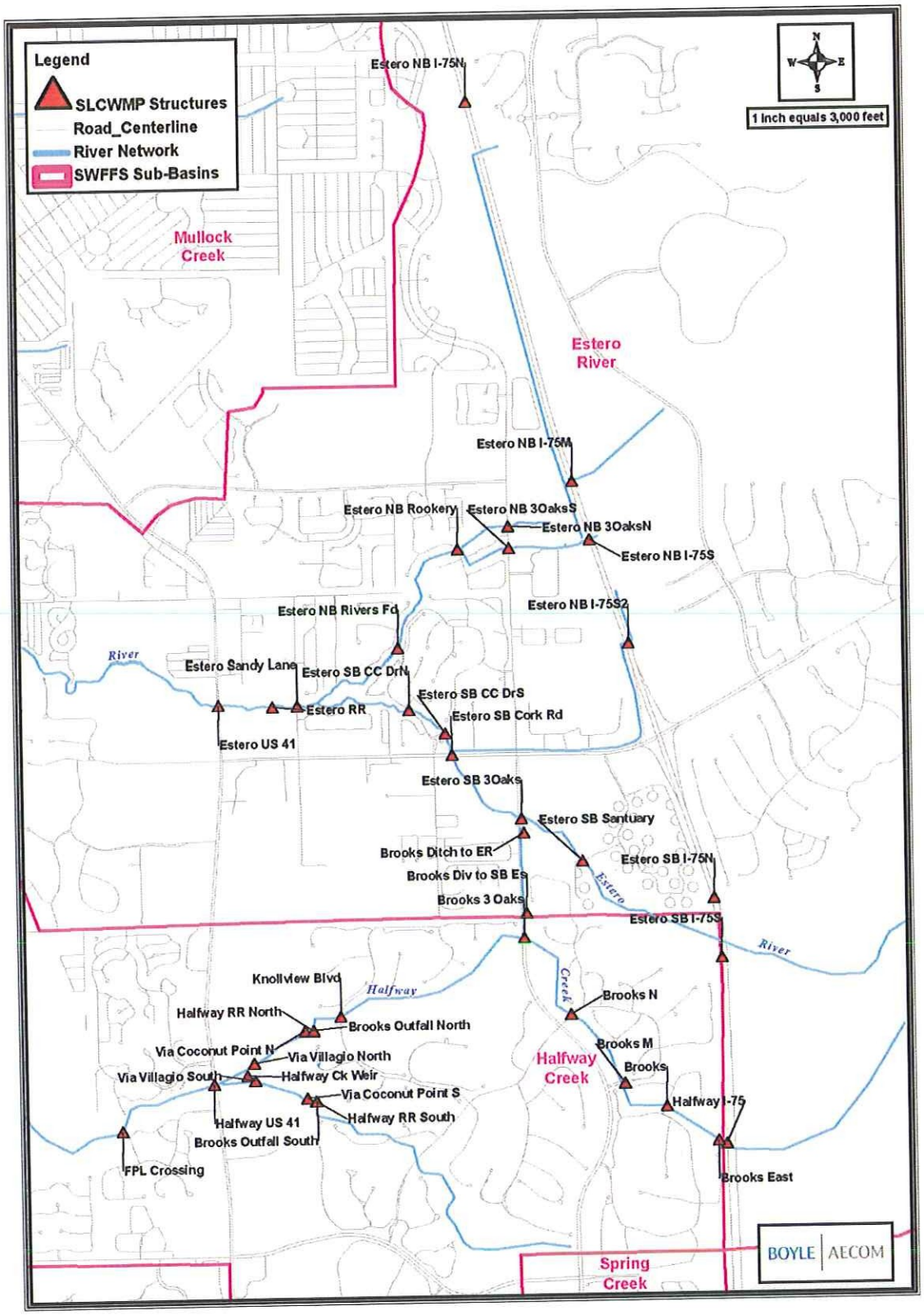

Figure 2A – Structures in Estero River and Portions of Halfway Creek

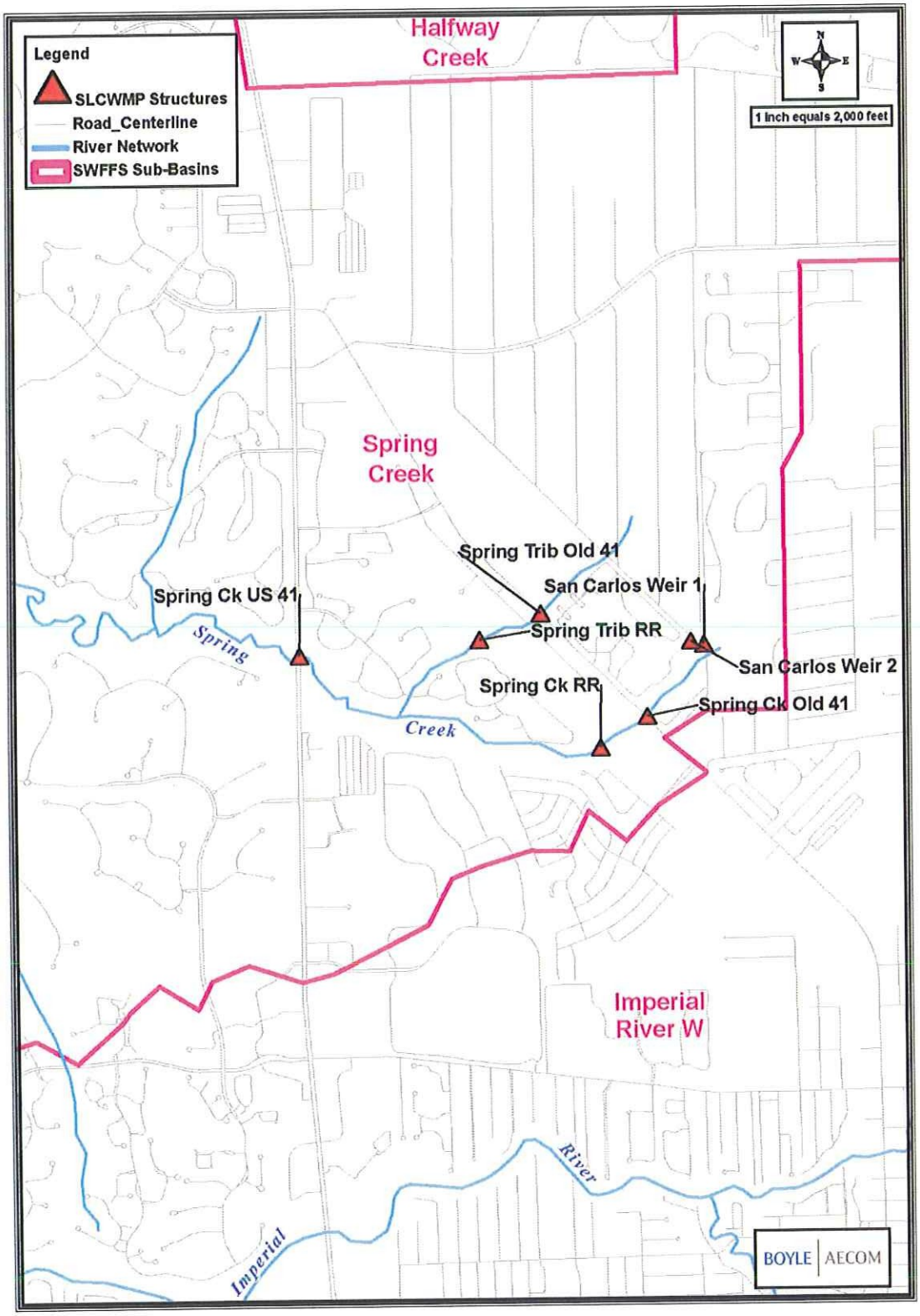

Figure 2B – Structures in Spring Creek

4.1 Estero River

The Estero River headwaters are located east of I-75 in a broad system of wetlands. Flows from this area pass under I-75 north of Corkscrew Road to the North Branch of the Estero River, and south of Corkscrew Road to the South Branch of the Estero River. The North Branch of the Estero River crosses I-75 at three locations referred to as ***Estero NB I-75M, Estero NB I-75S***, and ***Estero NB I-75S2***. These conveyances consist of a bridge, two 10' x 6' culverts, and two 10' x 7' culverts, respectively. ***Estero NB I-75M*** and ***Estero NB I-75S*** enter two flow-ways to the North Branch of the Estero that flow under Three Oaks Parkway and then flow through a bridge in the Rookery Pointe development and then through a bridge in the Villages at Country Creek development. ***Estero NB I-75S2*** flows either to the Rookery Pointe flowway or enters a ditch on the north side of Corkscrew Road that enters the South Branch of the Estero River.

The South Branch of the Estero River receives flows from two sets of I-75 conveyances that are referred to as ***Estero SB I-75N*** (a bridge) and ***Estero SB I-75S*** (two 8' x 8' box culverts). Dense vegetation restricts flows to the 8x8 box culverts. The South Branch then flows under a bridge at Sanctuary Road, under Three Oaks Parkway, and under Corkscrew Road (USGS gaging station), under two bridges in the Villages at County Creek development, and then merges with the North Branch in the Villages at Country Creek development. There is a tributary ditch to the South Branch of the Estero River from the Brooks development that enters from the south just east of Three Oaks Parkway. A double gate controls this diversion and is referred to as ***Brooks Div to SB Es***. See Section 4.2 for additional details on this diversion. The Estero River then flows under Sandy Lane, the railroad, and U.S. 41 bridges.

4.2 Halfway Creek

Halfway Creek originates in a broad marsh system east of I-75. Flows pass under I-75 through two 9' x 8' box culverts (***Halfway I-75***) and then flow through the Brooks development. A recent field inspection indicates that the I-75 culverts are approximately half-filled with sediment. There are six sets of box culverts within the Brooks. Each set consists of four submerged 10' x 6' box culverts.

Brooks Diversion Gate to the South Branch of the Estero River. As mentioned above, the Brooks development has an emergency gate to divert flood flows from the Brooks development north to the South Branch of the Estero River just east of Three Oaks Parkway (***Brooks Ditch to ER***). **Figure 4** presents a diagram of this structure. Operational protocols from 2003 for this structure are presented in **Table 5**. The gate operations were modified in 2006. There are two gate openings in the concrete box structure with vertical lift gates that can operate either as overflow or underflow gates. In a fully open position, the opening is 4.5' wide x 6' high with an invert elevation of 12 ft-NGVD. The east gate is now left open as an overflow gate with the weir crest set at 14 ft-NGVD.

The west underflow gate opens to elevation 14 if the headwater elevation exceeds 15 ft-NGVD and the Estero River at Corkscrew Road is less than elevation 12 ft-NGVD. Under these same high water level conditions, the west gate opens fully so that the bottom elevation of the vertical lift gate is 18 ft-NGVD (SFWMD Permit No. 36-00288-S-02, Brooks North Outfall OS-1, April 3, 2006).

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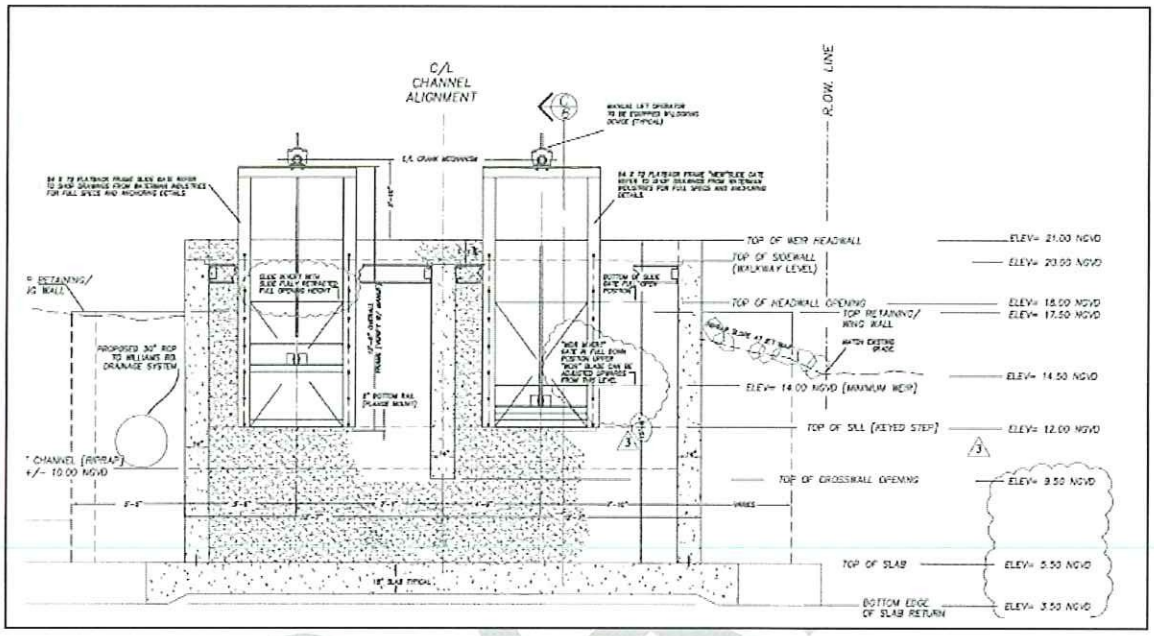

Figure 4 – Diagram of Brooks Diversion to the South Branch Estero River

A south branch of Halfway Creek originates within the Brooks. Flows out of the Brooks are controlled by two weirs with invert elevations at 13.6 ft-NGVD (***Brooks Outfall North*** and ***Brooks Outfall South***). The crest length of the south weir is 11.4 ft and the width of the weir (parallel to the axis of flow) is 24 inches. The north weir crest length is 200 feet and the width of the weir is 16 feet. The top of the embankment on either side of the north weir is 16.2 ft-NGVD, and the length from the top elevation of the two ends of the weirs is 210.4 ft (perpendicular to the flow-line). The South Weir has vertical endwalls with a top elevation of 16.2 ft-NGVD. Meeting notes have been obtained that discuss concerns regarding these weirs (SFWMD, 3/5/07). During this meeting, concerns were expressed regarding fallen trees blocking the railroad culverts downstream of the weirs. Stakeholders report that water level readings on the tailwater side of the weirs are higher than expected, which supports this concern.

Halfway Creek then flows under railroad culverts (four 10' x 4' box culverts for the main branch and two 7' x 4' culverts for the south branch) and Via Coconut Point. The existing railroad culverts were installed in the late 1990s and replaced a set of variously sized culverts that restricted flows during the 1995 floods.

The Via Coconut Point culverts have the same dimensions as the railroad culverts. Flows then pass through two wetland flow-ways and pass under Via Villagio. There are two 4' x 7' culverts at two separate locations that convey Halfway Creek under Via Villagio. Note that design drawings of these culverts have not yet been identified. The two branches of Halfway Creek merge downstream of Via Villagio and then through a weir (***Halfway Ck Weir***) with a 200-foot section with an invert of 12 ft-NGVD and a 460-foot section with an invert of 16 ft-NGVD. This weir was installed in the late 1980's as part of the initial Brooks development (which was called Sweetwater Ranch). Halfway Creek then flows under U.S. 41 through a double set of 10' x 7' box culverts with an invert elevation of 7 ft-NGVD (***Halfway US 41***). The final constriction is the ***FPL Crossing***, which has an invert elevation of 5 ft-NGVD. Hole Montes is currently designing a new pipeline crossing that will not constrict flows. Cross sections from this design work have been obtained.

4.3 Spring Creek

Spring Creek is located south of the Brooks and west of I-75. Runoff from San Carlos Estates is the primary source of Spring Creek, and there are two 29-foot weirs (invert at 10 ft-NGVD) just east of Old U.S. 41 which control runoff from San Carlos Estates. Spring Creek passes under Old U.S. 41 at two locations and then under a railroad bridge (also at two locations). The Spring Creek tributaries merge before flowing under U.S. 41.

5.0 Calibration Data Available for the Study Area

Flow and stage data is available from the SFWMD DBHYDRO data base from February, 1987 through December, 1999 for the Imperial River at Orr Road, Spring Creek at Old U.S. 41, South Branch of the Estero River at Corkscrew Road, and the North Branch of the Estero River just east of the end of Broadway Avenue. Stage and flow data are still being measured and are available from USGS at these same four stations. Lee County also has measured flows at the Kehl Canal gate in the Imperial River continuously since 2003. **Figure 5** presents a map of stream gaging stations in the study area. **Figures 6 and 7** presents USGS measured stage and flow data for study area gages. **Figure 8** presents water level measurements in Halfway Creek that are taken by the Brooks of Bonita Springs & Brooks II Community Drainage District.

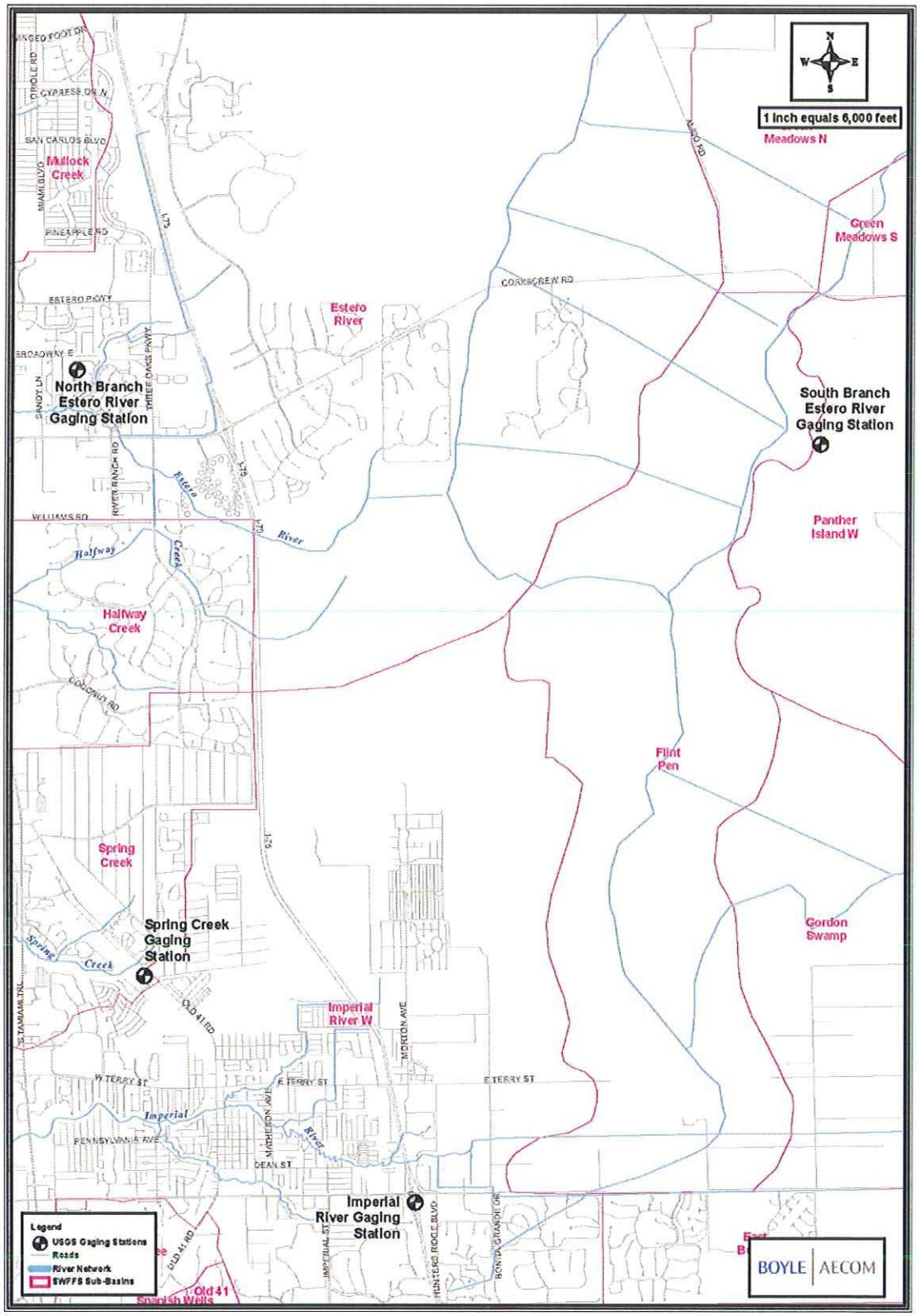

Figure 5 – Map of Stream Gaging Stations

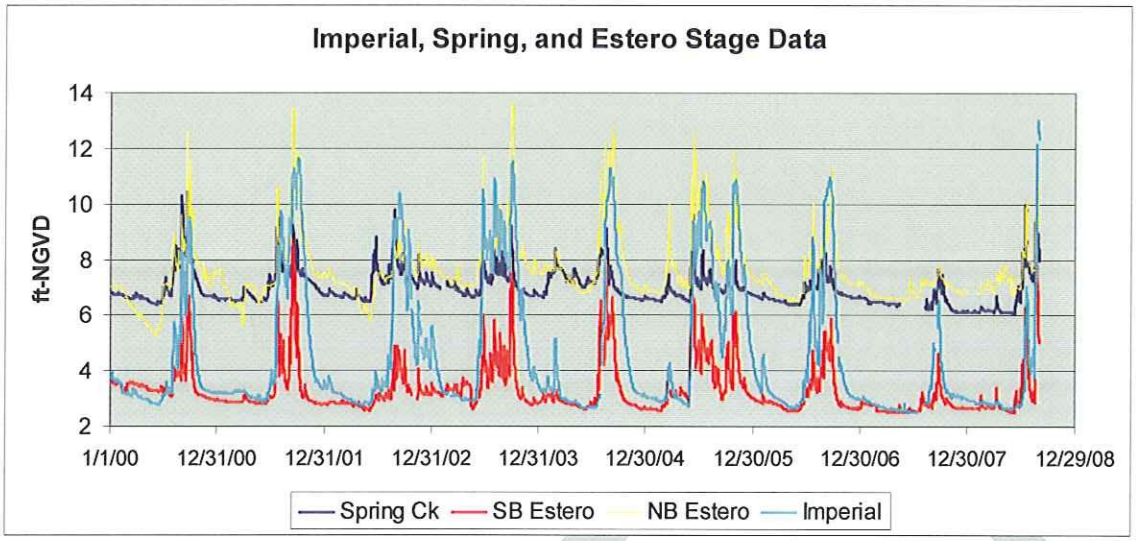

Figure 6 – USGS Water Level Measurements for the Imperial River, Spring Creek, South Branch Estero River, and North Branch Estero River

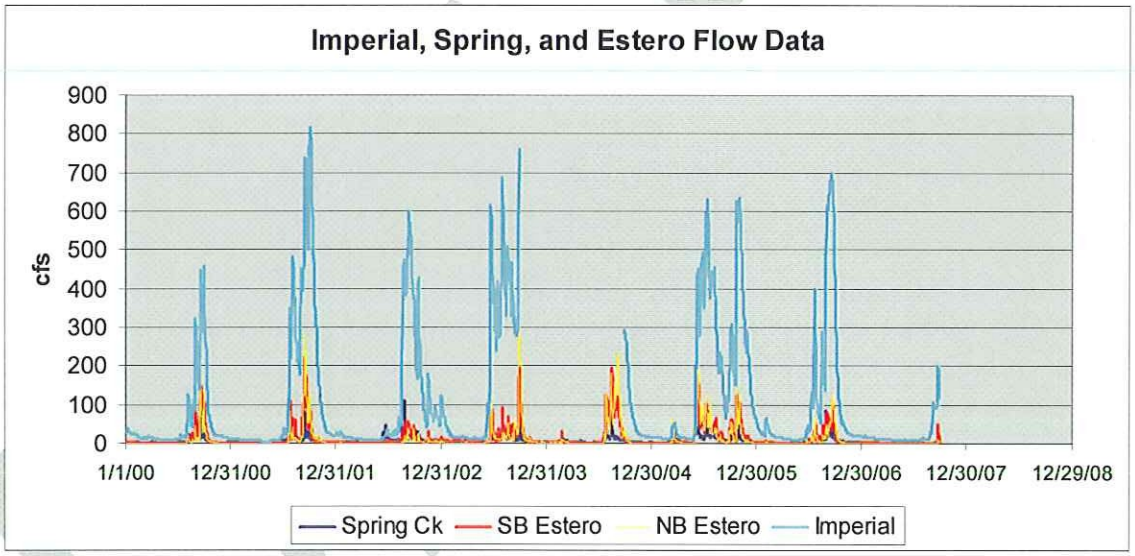

Figure 7 – USGS Flow Measurements for the Imperial River, Spring Creek, South Branch Estero River, and North Branch Estero River

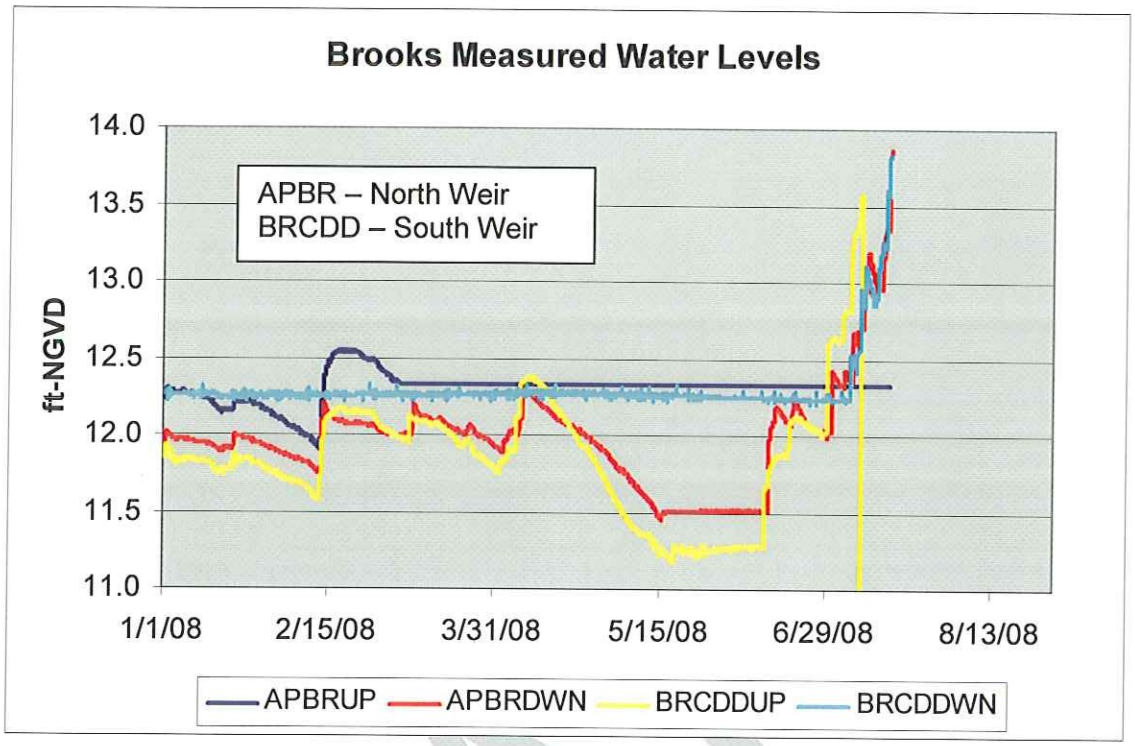

Figure 8 – Measured Water Levels for Halfway Creek Upstream and Downstream of the Brooks Development

6.0 Data Gaps

In the course of this data collection effort, a number of data gaps have been identified and they are presented in **Table 6**. Boyle and ADA will continue to pursue collection of the available information while this deliverable is under review.

Table 6 – Known Data Gaps

Data Gap
Bridge elevations for North Branch Estero River in Rookery Pointe
South Branch Estero River I-75 Culvert Drawings
South Branch Estero River Sanctuary Road Bridge Survey
Inspection of the Halfway Creek Railroad for obstructions
Halfway Creek cross sections between Via Coconut Point and the Halfway Creek Weir
Via Villagio Culvert Drawings

New surveyed cross sections are recommended for Halfway Creek between Via Coconut Point and the Halfway Creek weir upstream of U.S. 41. This section of Halfway Creek conveys runoff from the Halfway Creek watershed downstream of the Brooks to U.S. 41. The hydraulic grade line is relatively flat from the railroad culverts (invert elevation = 10 ft-NGVD) to the Halfway Creek Weir (invert elevation = 12 ft-NGVD) and deposition of sediment, erosion control fence, and fallen trees is possible within this reach. Stakeholder measurements of Halfway Creek water levels downstream of the Brooks during low-flow conditions suggest that constrictions may be present. **Figure 9** illustrates the location of proposed cross sections. Probing should be conducted along the flow-line from Via Coconut Point to the Halfway Creek Weir to search for any major obstructions.

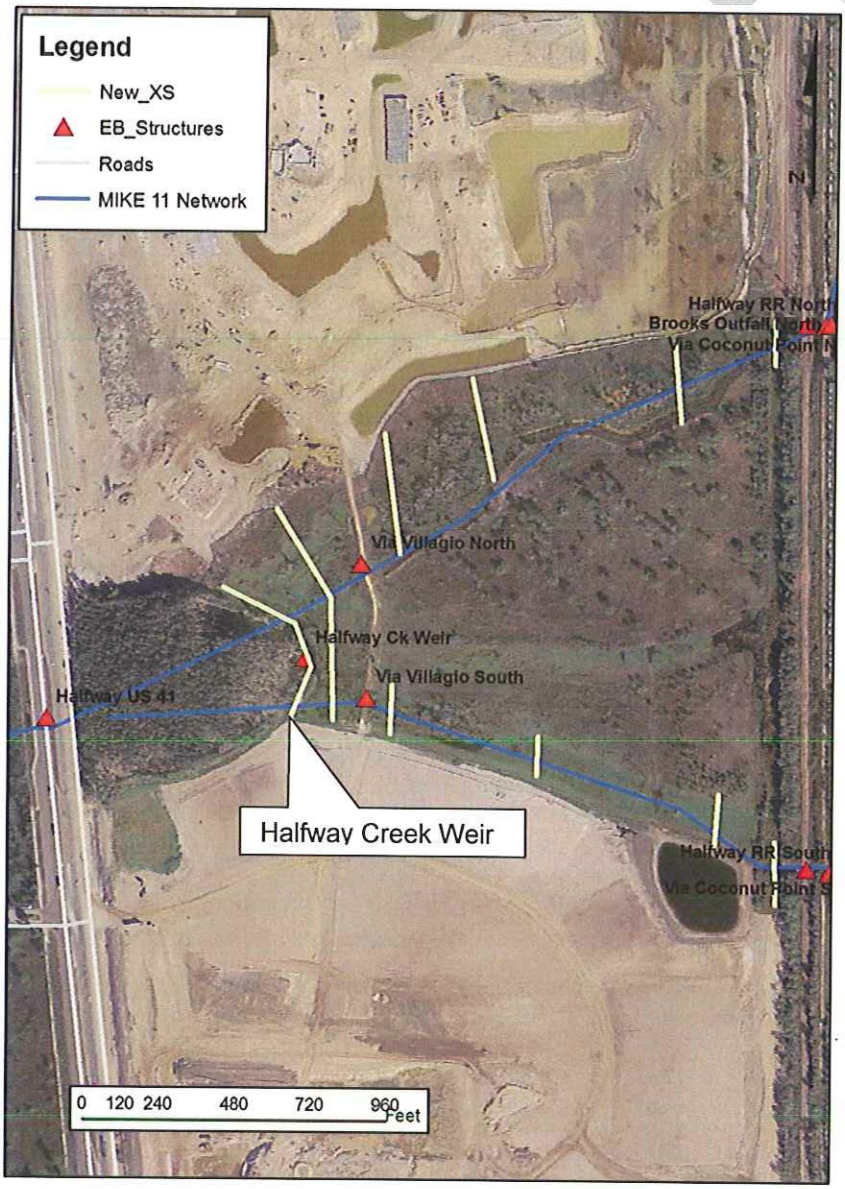

Figure 9 – Location of Proposed New Cross Sections of Halfway Creek

Attachment A from SOW

Attachment A

List of Documents to be Provided to Consultant
For Validation of South Lee County Watershed Plan

1. Link to South Lee County Watershed Plan on Lee County's Web site (provided)
2. Copy of staff report with addendum for Permit No. 36-03802-P (I-75 Collier/Lee County Line North to Corkscrew Road/Segment B) issued February 14, 2008 (provided)
3. Map of project region with SFWMD permit boundaries and permit numbers and pending permit application numbers (District)
4. Copy of cost share agreement between District and Lee County for this contract (District)
5. Information supporting the Southwest Florida Feasibility Study (District)
6. Pursue electronic copy of SLCWP model (District)
7. Pursue electronic copy of any stormwater management system models of projects west of I-75 (District)
8. Scope of Work for DRGR Hydrologic/Hydraulic Study (Lee County)
9. Topographic information to be used in the DRGR Study (Lee County)
10. Any other data compiled for DRGR Study (Lee County)
11. Access to Lee County's water table monitoring network data (Lee County)