Solicitation 276-11831

Engineering Services -Master Drainage/Conceptual Environmental Resources Permit

Bid Designation: Public

CITY OF FORT LAUDERDALE

City of Fort Lauderdale

Bid 276-11831
Engineering Services -Master Drainage/Conceptual Environmental Resources Permit

Bid Number	276-11831
Bid Title	Engineering Services -Master Drainage/Conceptual Environmental Resources Permit
Bid Start Date	Sep 21, 2016 12:01:33 PM EDT
Bid End Date	Oct 28, 2016 2:00:00 PM EDT
Question & Answer End Date	Oct 17, 2016 5:00:00 PM EDT

Bid Contact Jim Hemphill
Sr. Procurement Specialist
Procurement Department
954-828-5143
jhemphill@fortlauderdale.gov

Addendum # 2

New Documents **GENERAL TERMS CONDITIONS - Rev 9-9-2016.doc**

Changes were made to the following items:
Engineering Services -Master Drainage/Conceptual Environmental Resources Permit

Addendum # 1

Removed Documents **GENERAL TERMS CONDITIONS - Rev 9-9-2016**

Addendum # 3

Previous End Date Oct 25, 2016 2:00:00 PM EDT New End Date Oct 28, 2016 2:00:00 PM EDT

Changes were made to the following items:
Engineering Services -Master Drainage/Conceptual Environmental Resources Permit

Description
The City of Fort Lauderdale is looking for a professional engineering firm or team to prepare applications for and provide a Master Drainage/Conceptual Environmental Resources Permit (ERP) for the Fort Lauderdale Executive Airport. (CCNA).
Added on Sep 21, 2016:
NOTE: A glitch caused an unintentional deletion of the General terms and Conditions , which caused the issuance of Addendum #1. To add the Document back, Addendum #2 has been issued.

Added on Oct 4, 2016:
The FXE Master Drainage Plan has been added to the Documents Page for informational purposes
Added on Oct 25, 2016:
Bid end date has changed to Oct 28th, 2016 · 2:00 PM EDT

Addendum # 2

Addendum # 3

Section I – Introduction and Information

1.1 Purpose

The City of Fort Lauderdale, FL (City) is actively seeking qualified, experienced, and licensed firm(s) to provide services to prepare applications and provide a Master Drainage / Conceptual Environmental Resources Permit (ERP) for the Fort Lauderdale Executive Airport as further described in Section III – Scope of Services. Those firms who are interested in submitting Statements of Qualification (SOQ) in response to this Request for Qualifications (RFQ) shall comply with Section IV– Submittal Requirements.

1.2 Submission Deadline

Sealed responses shall be delivered during the City's normal business hours in a sealed envelope and addressed to the City of Fort Lauderdale Procurement Services Division, 100 N. Andrews Avenue, #619, Fort Lauderdale, FL 33301 (City Hall) no later than date and time indicated, at which time and place the responses will be publicly opened and the names of the firms will be read. After the deadline, responses will not be accepted. Firms are responsible for making certain that their proposal is received at the location specified by the due date and time. The City of Fort Lauderdale is not responsible for delays caused by any mail, package or courier service, including the U.S. mail, or caused by any other occurrence or condition. The City's normal business hours are Monday through Friday, 8:00 a.m. through 5:00 p.m. excluding holidays observed by the City.

1.3 INFORMATION AND CLARIFICATION

For information concerning procedures for responding to this RFQ, technical specifications, etc., utilize the question / answer feature provided by BidSync. Such contact shall be for clarification purposes only. Material changes, if any, to the scope of services or bidding procedures will only be transmitted by written addendum (See addendum section of BidSync Site). No variation in Scope or conditions shall be permitted based upon a claim of ignorance. Submission of a SOQ will be considered evidence that the proposer has familiarized themselves with the nature and extent of the work, and the equipment, materials, and labor required.

1.3 Pre-Proposal Meeting

A Pre-proposal meeting is not currently scheduled for this

IF MANDATORY Statements of qualifications received from firms who have failed to attend the mandatory pre-bid conference will be deemed non-responsive, will not be opened or accepted, and will be returned to the firm unopened.

1.4 BIDSYNC

The City of Fort Lauderdale uses BIDSYNC (www.bidsync.com) to administer the competitive solicitation process, including but not limited to soliciting responses, issuing addenda, posting results and issuing notification of an intended decision. There is no charge to register and download the RFQ from BIDSYNC. Proposers are strongly encouraged to read the various vendor Guides and Tutorials available in BIDSNYC well in advance of their intention of submitting a response to ensure familiarity with the use of BIDSYNC. The City shall not be responsible for an Offeror's inability to submit a response by the end date and time for any reason, including issues arising from the use of BIDSYNC.

1.5 Point of Contact

City of Fort Lauderdale, Procurement Services Division
Attn: James Hemphill. Sr. Procurement Specialist
100 N. Andrews Avenue, 6th Floor
Fort Lauderdale, FL 33301
Fax: (954) 828-5576
E-mail: jhemphill@fortlauderdale.gov

All inquiries concerning this RFQ, questions, and requests for additional information shall be sent via the BIDSNYC question and answer feature.

Section II – General Terms and Conditions

2.1 Addenda, Changes, and Interpretations

It is the sole responsibility of each firm to notify the Buyer utilizing the question / answer feature provided by BIDSYNC and request modification or clarification of any ambiguity, conflict, discrepancy, omission or other error discovered in this competitive solicitation. Requests for clarification, modification, interpretation, or changes must be received prior to the Question and Answer (Q & A) Deadline. Requests received after this date may not be addressed. Questions and requests for information that would not materially affect the scope of services to be performed or the solicitation process will be answered within the question / answer feature provided by BIDSNYC and shall be for clarification purposes only. Material changes, if any, to the scope of services or the solicitation process will only be transmitted by official written addendum issued by the City and uploaded to BIDSYNC as a separate addendum to the Request for Qualifications (RFQ). Under no circumstances shall an oral explanation given by any City official, officer, staff, or agent be binding upon the City and should be disregarded. All addenda are a part of the competitive solicitation documents and each firm will be bound by such addenda. It is the responsibility of each to read and comprehend all addenda issued.

2.2 Changes and Alterations

Consultant may change or withdraw a Statement of Qualifications (SOQ) at any time prior to SOQ submission deadline; however, no oral modifications will be allowed. Modifications shall not be allowed following the SOQ deadline.

2.3 Consultants' Costs

The City shall not be liable for any costs incurred by consultants in responding to this RFQ, including costs incurred in connection with evaluation and award proceedings.

2.4 Mistakes, Discrepancies, Errors and Omissions

The consultant shall examine this RFQ carefully. The submission of a SOQ shall be prima facie evidence that the consultant has full knowledge of the scope, nature, and quality of the work to be performed; the detailed requirements of the specifications; and the conditions under which the work is to be performed. Ignorance of the requirements will not relieve the consultant from liability and obligations under the Contract. Any discrepancies, errors, or ambiguities in the RFQ or addenda (if any) should be reported in writing to the City's Procurement Services Division. Should it be necessary, a written addendum will be incorporated to the RFQ. The City will not be responsible for any oral instructions, clarifications, or other communications.

2.5 Acceptance of Responses / Minor Irregularities

2.5.1 The City reserves the right to accept or reject any or all responses, part of responses, and to waive minor irregularities or variances to specifications contained in responses which do not make the response conditional in nature, and minor irregularities in the solicitation process. A minor irregularity shall be a variation from the solicitation that does not affect the price of the contract or does not give a respondent an advantage or benefit not enjoyed by other respondents, does not adversely impact the interests of other firms or, does not affect the fundamental fairness of the solicitation process. The City also reserves the right to reissue a Request for Qualifications.

2.5.2 The City reserves the right to disqualify Consultant during any phase of the competitive solicitation process and terminate for cause any resulting contract upon evidence of collusion with intent to defraud or other illegal practices on the part of the Consultant.

2.6 Responsiveness

In order to be considered responsive to the solicitation, the firm's response shall fully conform in all material respects to the solicitation and all of its requirements, including all form and substance.

2.7 Responsibility

In order to be considered as a responsible firm, firm shall be fully capable to meet all of the requirements of the solicitation and subsequent contract, must possess the full capability, including financial and technical, to perform as contractually required, and must be able to fully document the ability to provide good faith performance.

2.8 Minimum Qualifications

Firms shall be in the business of general engineering services and must possess sufficient licenses, certifications, financial support, equipment and organization to insure that it can satisfactorily perform the services if awarded a Contract.

2.8.1 Firm or principals shall have no record of judgments, pending lawsuits against the City or criminal activities involving moral turpitude and not have any conflicts of interest that have not been waived by the City Commission.

2.8.2 Neither Firm nor any principal, officer, or stockholder shall be in arrears or in default of any debt or contract involving the City, (as a party to a contract, or otherwise); nor have failed to perform faithfully on any previous contract with the City.

2.9 Lobbyist Ordinance

Any consultant submitting a response to this solicitation is responsible for being aware of, and complying with City of Fort Lauderdale Ordinance No. 00-27, Lobbying Activities. A Copy of Ordinance No. C-00-27 may be obtained from the City Clerk's Office on the 7th floor of City Hall, 100 N. Andrews Avenue, Fort Lauderdale, FL, or the ordinance may be viewed on the City's website at http://www.fortlauderdale.gov/clerk/LobbyistDocs/lobbyistord1009.pdf. If you have questions concerning whether you may or may not need to comply with said ordinance, please contact the City of Fort Lauderdale City Clerk's Office at 954-828-5002.

2.10 Local Business Preference

2.10.1 Section 2-199.2, Code of Ordinances of the City of Fort Lauderdale, provides for a local business preference. In order to be considered for a local business preference, a proposer

must include the Local Business Preference Certification Statement of this RFQ, as applicable to the local business preference class claimed at the time of SOQ submittal:

2.10.2 Upon formal request of the City, based on the application of a Local Business Preference the Proposer shall within ten (10) calendar days submit the following documentation to the Local Business Preference Class claimed:

a. Copy of City of Fort Lauderdale current year business tax receipt, or Broward County current year business tax receipt, and

b. List of the names of all employees of the proposer and evidence of employees' residence within the geographic bounds of the City of Fort Lauderdale or Broward County, as the case may be, such as current Florida driver license, residential utility bill (water, electric, telephone, cable television), or other type of similar documentation acceptable to the City.

2.10.3 Failure to comply at time of SOQ submittal shall result in the Proposer being found ineligible for the local business preference.

2.10.4 The complete local business preference ordinance may be found on the City's web site at the following link: http://www.fortlauderdale.gov/home/showdocument?id=6422

2.10.5 Definitions

The term "Business" shall mean a person, firm, corporation or other business entity which is duly licensed and authorized to engage in a particular work in the State of Florida. Business shall be broken down into four (4) types of classes:

a. Class A Business – shall mean any Business that has established and agrees to maintain a permanent place of business located in a non-residential zone and staffed with full-time employees within the limits of the City and shall maintain a staffing level of the prime contractor for the proposed work of at least fifty percent (50%) who are residents of the City.

b. Class B Business - shall mean any Business that has established and agrees to maintain a permanent place of business located in a non-residential zone and staffed with full-time employees within the limits of the City or shall maintain a staffing level of the prime contractor for the proposed work of at least fifty percent (50%) who are residents of the City.

c. Class C Business - shall mean any Business that has established and agrees to maintain a permanent place of business located in a non-residential zone and staffed with full-time employees within the limits of Broward County.

d. Class D Business – shall mean any Business that does not qualify as either a Class A, Class B, or Class C business.

2.11 Protest Procedure

2.11.1 Any proposer or bidder who is not recommended for award of a contract and who alleges a failure by the city to follow the City's procurement ordinance or any applicable law may protest to the director of procurement services division (director), by delivering a letter of protest to the director within five (5) days after a notice of intent to award is posted on the City's web site at the following link: http://www.fortlauderdale.gov/purchasing/notices_of_intent.htm

2.11.2 The complete protest ordinance may be found on the City's web site at the following link: http://www.fortlauderdale.gov/purchasing/protestordinance.pdf

2.12 Sub-Consultants

2.12.1 A Sub-Consultant is an individual or firm contracted by the Consultant or Consultant's firm to assist in the performance of services required under this RFQ. A Sub-Consultant shall be paid through Consultant or Consultant's firm and not paid directly by the City. Sub-Consultants are permitted by the City in the performance of the services pursuant to the Agreement. Consultant must clearly reflect in its SOQ the major Sub-Consultant(s) to be utilized in the performance of required services. The City retains the right to accept or reject any Sub-Consultant proposed in the response of Successful Consultant(s) or prior to contract execution. Any and all liabilities regarding the use of a Sub-Consultant shall be borne solely by the successful consultant and insurance for each Sub-Consultant must be maintained in good standing and approved by the City throughout the duration of the Contract. Neither Successful Consultant nor any of its Sub-Consultants are considered to be employees or agents of the City. Failure to list all Sub-Consultants and provide the required information may disqualify any proposed Sub-Consultant from performing work under this RFQ.

2.12.2 Consultants shall include in their responses the requested Sub-Consultant information and include all relevant information required of the Consultant. In addition, within five (5) working days after the identification of the award to the successful Consultant(s), the Consultant shall provide a list confirming the Sub-Consultant(s) that the successful Consultant intends to utilize in the Contract, if applicable. The list shall include, at a minimum, the name, and location of the place of business for each Sub-Consultant, the services Sub-Consultant will provide relative to any contract that may result from this RFQ, Sub-consultants hourly rates or fees, any applicable licenses, insurance, references, ownership, and other information required of Consultant.

2.13 Insurance Requirements

2.13.1 Consultant will be required and shall require all of its Sub-Consultants and Sub-Contractors to provide, pay for, and maintain in force at all times during the term of an agreement, such insurance, including Professional Liability Insurance, Workers' Compensation Insurance, Comprehensive General or Commercial Liability Insurance, Business Automobile Liability Insurance, and Employer's Liability Insurance as stated below.

2.13.2 Companies authorized to do business in the State of Florida and having agents upon whom service of process may be made in the State of Florida shall issue such policy or policies. Consultant shall specifically protect City and the City Commission by naming City and the City Commission as additional insured under the Comprehensive Liability Insurance policy hereinafter described.

a. Workers' Compensation Insurance to apply for all employees in compliance with the "Workers' Compensation Law" of the State of Florida and all applicable Federal laws, for the benefit of the Consultant's employees.

b. Sub-Consultants not eligible for Professional Liability Coverage, by virtue of their

trade, shall provide Commercial General Liability coverage acceptable to the Contract Administrator and City's Risk Manager. Sub-consultant and sub-contractors eligible for professional liability coverage shall be required to provide professional liability coverage acceptable to the contract administrator and City's Risk Manager on a task order by task order basis.

c. The Consultant shall provide the Risk Manager of the City an original certificate of insurance for policies required by Article 11.10. All certificates shall state that the City shall be given ten (10) days prior to cancellation or modification of any stipulated insurance. The insurance provided shall be endorsed or amended to comply with this notice requirement. In the event that the insurer is unable to accommodate, it shall be the responsibility of the Consultant to provide the proper notice. Such notification will be in writing by registered mail, return receipt requested and addressed to the Procurement Services Division. Such policies shall: (1) name the insurance company or companies affording coverage acceptable to the City, (2) state the effective and expiration dates of the policies, and (3) include special endorsements where necessary. Such policies provided under Article 11 shall not be affected by any other policy of insurance, which the CITY may carry in its own name.

d. Consultant shall as a condition precedent of this Agreement furnish to the City of Fort Lauderdale, c/o Procurement Services Division, 100 N. Andrews Avenue, #619, Fort Lauderdale, FL 33301, certificate(s) of insurance upon execution of this Agreement which indicate that insurance coverage has been obtained which meets the requirements as outlined below:

Commercial General Liability

i. Limits of Liability:

Bodily Injury and Property Damage Liability
Combined Single Limit
Each Occurrence $1,000,000
General Aggregate Limit $2,000,000
Personal Injury $1,000,000
Products/Completed Operations $1,000,000

ii. Endorsements Required:

City of Fort Lauderdale included as an Additional Insured
Employees included as insured
Broad Form Contractual Liability
Waiver of Subrogation
Premises/Operations
Products/Completed Operations
Independent Contractors

Automobile business

i. Limits of Liability:

Bodily Injury and Property Damage Liability
Combined Single Limit $1,000,000
Any Auto
Including Hired, Borrowed or Non-Owned Autos

ii. Endorsements Required:
Waiver of Subrogation

Workers' Compensation

Limits of Liability: Statutory-State of Florida

Professional Liability/Errors And Omissions Coverage

Combined Single Limit
Each Occurrence $1,000,000
General Aggregate Limit $2,000,000
Deductible not to exceed 10%
Must be in effect for at least five (5) years after Project completion

2.13.3 The above insurance requirements are only required to be carried by the Consultant during the term of the assigned Project and provided upon award of the task order, except for Professional Liability/Errors and Omissions insurance which must be in effect for at least five (5) years after Project completion.

2.13.4 The City is required to be named as additional insured under the Commercial General Liability insurance policy. BINDERS ARE UNACCEPTABLE. The insurance coverage required shall include those classifications, as listed in standard liability insurance manuals, which most nearly reflect the operations of the Consultant. Any exclusions or provisions in the insurance maintained by the Consultant that precludes coverage for the work contemplated in an agreement shall be deemed unacceptable, and shall be considered a breach of contract.

2.13.5 All insurance policies required above shall be issued by companies authorized to do business under the laws of the State of Florida and must be rated no less than “A” as to management, and no less than “Class X” as to financial strength, by the latest edition of A. M. Best’s Key Rating Insurance Guide which holds a valid Florida Certificate of Authority issued by the State of Florida, Department of Insurance, and are members of the Florida Guarantee Fund. Compliance with the foregoing requirements shall not relieve the Consultant of his liability and obligation under this section or under any other section of this Agreement.

Note: City contract number must appear on each certificate.

2.13.6 The Consultant shall be responsible for assuring that the insurance certificates required in conjunction with this section remain in force for the duration of the project. If insurance certificates are scheduled to expire during the contractual period, the Consultant shall be responsible for submitting new or renewed insurance certificates to the City at a minimum of thirty (30) calendar days in advance of such expiration.

2.14 Contract Agreement
Any subsequent contract will be subject to the Agreement included as an attachment and made a part of this Request for Qualifications.

2.15 Award of Contract
A Contract (the “Agreement”) will be awarded in accordance with Florida Statues, by the City

Commission. The City reserves the right to execute or not execute, as applicable, a contract with the Consultant(s) that is determined to be in the City's best interests. The draft agreement is provided herein as an attachment to this RFQ. The City reserves the right to award a contract to more than one Consultant as is in the City's best interest.

2.16 Scrutinized Companies

Subject to *Odebrecht Construction, Inc., v. Prasad*, 876 F.Supp.2d 1305 (S.D. Fla. 2012), *affirmed*, *Odebrecht Construction, Inc., v. Secretary, Florida Department of Transportation*, 715 F.3d 1268 (11th Cir. 2013), with regard to the "Cuba Amendment," the Contractor certifies that it is not on the Scrutinized Companies with Activities in Sudan List or the Scrutinized Companies with Activities in the Iran Petroleum Energy Sector List or the Scrutinized Companies that Boycott Israel List created pursuant to Section 215.4725, Florida Statutes (2016), that it is not engaged in a boycott of Israel, and that it does not have business operations in Cuba or Syria, as provided in section 287.135, Florida Statutes (2016), as may be amended or revised. The City may terminate this Agreement at the City's option if the Contractor is found to have submitted a false certification as provided under subsection (5) of section 287.135, Florida Statutes (2016), as may be amended or revised, or been placed on the Scrutinized Companies with Activities in Sudan List or the Scrutinized Companies with Activities in the Iran Petroleum Energy Sector List or the Scrutinized Companies that Boycott Israel List created pursuant to Section 215.4725, Florida Statutes (2016), or is engaged in a boycott of Israel or has been engaged in business operations in Cuba or Syria, as defined in Section 287.135, Florida Statutes (2016), as may be amended or revised.

2.17 Payment Method

The City of Fort Lauderdale has implemented a Procurement Card (P-Card) program which changes how payments are remitted to its vendors. The City has transitioned from traditional paper checks to payment by credit card via MasterCard or Visa. This allows you as a vendor of the City of Fort Lauderdale to receive your payment fast and safely. No more waiting for checks to be printed and mailed.

Payments will be made utilizing the City's P-Card (MasterCard or Visa). Accordingly, firms must presently have the ability to accept credit card payment or take whatever steps necessary to implement acceptance of a credit card before the commencement of a contract.

2.18 Debarred or Suspended Bidders or Proposers

The bidder or proposer certifies, by submission of a response to this solicitation, that neither it nor its principals and subcontractors are presently debarred or suspended by any Federal department or agency.

2.19 Public Records / Trade Secrets / Copyright:

The Proposer's response to the RFP is a public record pursuant to Florida law, which is subject to disclosure by the City under the State of Florida Public Records Law, Florida Statutes Chapter 119.07 ("Public Records Law"). The City shall permit public access to all documents, papers, letters or other material submitted in connection with this RFP and the Contract to be executed for this RFP, subject to the provisions of Chapter 119.07 of the Florida Statutes.

Any language contained in the Proposer's response to the RFP purporting to require confidentiality of any portion of the Proposer's response to the RFP, except to the extent that certain information is in the City's opinion a Trade Secret pursuant to Florida law, shall be

void. If a Proposer submits any documents or other information to the City which the Proposer claims is Trade Secret information and exempt from Florida Statutes Chapter 119.07 ("Public Records Laws"), the Proposer shall clearly designate that it is a Trade Secret and that it is asserting that the document or information is exempt. The Proposer must specifically identify the exemption being claimed under Florida Statutes 119.07. The City shall be the final arbiter of whether any information contained in the Proposer's response to the RFP constitutes a Trade Secret. The city's determination of whether an exemption applies shall be final, and the proposer agrees to defend, indemnify, and hold harmless the city and the city's officers, employees, and agent, against any loss or damages incurred by any person or entity as a result of the city's treatment of records as public records. Proposals purporting to be subject to copyright protection in full or in part will be rejected.

EXCEPT FOR CLEARLY MARKED PORTIONS THAT ARE BONA FIDE TRADE SECRETS PURSUANT TO FLORIDA LAW, DO NOT MARK YOUR RESPONSE TO THE RFP AS PROPRIETARY OR CONFIDENTIAL. DO NOT MARK YOUR RESPONSE TO THE RFP OR ANY PART THEREOF AS COPYRIGHTED.

2.20 Unauthorized Work

The Successful Consultant(s) shall not begin work until a Contract has been awarded by the City Commission and a notice to proceed has been issued. Consultant(s) agree and understand that the issuance of a Purchase Order and/or Task Order shall be issued and provided to the Consultant(s) following Commission award; however, receipt of a purchase order and/or task order shall not prevent the Consultant(s) from commencing the work once the City Commission has awarded the contract and notice to proceed is issued.

2.21 Prohibition Against Contingent Fees

The architect (or registered surveyor and mapper or professional engineer, as applicable) warrants that he or she has not and will not employ or retain any company or person, other than a bona fide employee working solely for the architect (or registered surveyor and mapper, or professional engineer, as applicable) to solicit or secure an agreement pursuant to this competitive solicitation and that he or she has not and will not pay or agree to pay any person, company, corporation, individual, or firm, other than a bona fide employee working solely for the architect (or registered surveyor and mapper or professional engineer, as applicable) any fee, commission, percentage, gift, or other consideration contingent upon or resulting from an award or making of an agreement pursuant to this competitive solicitation.

2.22 Indemnity/Hold Harmless Agreement

The Contractor agrees to protect, defend, indemnify, and hold harmless the City of Fort Lauderdale and its officers, employees and agents from and against any and all losses, penalties, damages, settlements, claims, costs, charges for other expenses, or liabilities of every and any kind including attorney's fees, in connection with or arising directly or indirectly out of the work agreed to or performed by Contractor under the terms of any agreement that may arise due to the bidding process. Without limiting the foregoing, any and all such claims, suits, or other actions relating to personal injury, death, damage to property, defects in materials or workmanship, actual or alleged violations of any applicable Statute, ordinance, administrative order, rule or regulation, or decree of any court shall be included in the indemnity hereunder.

2.23 Debarred or Suspended Bidders or Proposers

The bidder or proposer certifies, by submission of a response to this solicitation, that neither it nor its principals and subcontractors are presently debarred or suspended by any Federal

department or agency.

2.24 PUBLIC RECORDS

IF THE CONTRACTOR HAS QUESTIONS REGARDING THE APPLICATION OF CHAPTER 119, FLORIDA STATUTES, TO THE CONTRACTOR'S DUTY TO PROVIDE PUBLIC RECORDS RELATING TO THIS CONTRACT. CONTACT THE CUSTODIAN OF PUBLIC RECORDS AT: (954-828-5002, PRRCONTRACT@FORTLAUDERDALE.GOV, CITY CLERK'S OFFICE, 100 NORTH ANDREWS AVENUE, FORT LAUDERDALE, FLORIDA 33301)

Contractor shall:

1. Keep and maintain public records that ordinarily and necessarily would be required by the City in order to perform the service.

2. Upon request from the City's custodian of public records, provide the City with a copy of the requested records or allow the records to be inspected or copied within a reasonable time at a cost that does not exceed the cost provided in Chapter 119, Florida Statutes (2016), as may be amended or revised, or as otherwise provided by law.

3. Ensure that public records that are exempt or confidential and exempt from public records disclosure requirements are not disclosed except as authorized by law for the duration of the contract term and following completion of this contract if the Contractor does not transfer the records to the City.

4. Upon completion of the Contract, transfer, at no cost, to the City all public records in possession of the Contractor or keep and maintain public records required by the City to perform the service. If the Contractor transfers all public records to the City upon completion of this Contract, the Contractor shall destroy any duplicate public records that are exempt or confidential and exempt from public records disclosure requirements. If the Contractor keeps and maintains public records upon completion of this Contract, the Contractor shall meet all applicable requirements for retaining public records. All records stored electronically must be provided to the City, upon request from the City's custodian of public records, in a format that is compatible with the information technology systems of the City.

Section III - Scope of Services

3.1 Purpose

The City of Fort Lauderdale is seeking the services of a qualified consulting firm to provide Professional Services related to a contract for General Engineering Consultant Services relating to providing a Master Drainage / Conceptual Environmental Resources Permit (ERP) for the Fort Lauderdale Executive Airport. The following is a list of services that may be required. This list shall not be construed as an exclusive list of activities that successful firm(s) may be engaged in. City shall have the right, in its sole and absolute discretion, to require additional services that are consistent with the scope of services and those activities typically performed by a general Engineering Consultant, and for which the firm(s) are experienced, qualified, and able to perform.

SCOPE

Environmental Resources Permit (ERP) for FXE. The project boundary is as described in the attached Exhibit A, and is within the jurisdiction of the South Florida Water Management District (SFWMD). The ERP is intended to be a guide for improving FXE's stormwater drainage systems performance and to ensure that FXE continues to meet the requirements of all applicable environmental regulatory agencies. The ERP will include a preliminary schedule of prioritized capital improvements necessary to allow FXE's stormwater systems to meet the increasing performance and regulatory demands. The ERP will also provide guidance for modernizing the existing systems while maintaining a high level of service as well as set guidelines for future development.

Development of the ERP will involve consultant coordination with airport staff, the Broward County Environmental Protection Department (BCEPD), as well as SFWMD personnel. The selected consultant shall be responsible for preparing and filing the ERP application(s) with the above regulatory agencies (including forms, sketches, and hydraulic calculations to be signed and sealed by a Professional Engineer licensed in the State of Florida), responding to agency comments, providing required notifications to the public, responding to public comments, development of a design standards manual summarizing the requirements of the ERP, and providing surveying and geotechnical services as required during the permitting process. FXE completed a Master Drainage Plan Study and Storm Water Pollution Prevention Plan Study in 2012. Copies of these two studies will be made available to the consultants.

Interested firms must demonstrate a minimum of 5 years' experience in the provision of developing ERP's for airports located in geographic environments similar to that found in South Florida. Interested firms will be expected to demonstrate that their proposed project staff will be committed to the development of the ERP and are skilled and experienced in the referenced areas of competence as well as knowledgeable about current and planned regulatory requirements regarding stormwater collection and disposal.

Firms interested in responding to the Request for Qualifications (RFQ) must indicate any sub-consultants that would be part of the team.

Section IV – Submittal Requirements

4.1 Instructions

4.1.1 All proposals must be submitted in a sealed package with the RFQ number, due and open date, and Request for Qualifications (RFQ) title clearly marked on the outside. If more than one package is submitted they should be marked 1 of 2, etc.

4.1.2 **THIS IS A PAPER RFQ SUBMITTAL WITH CDs.** All Statements of Qualifications (SOQs) must be received by the City of Fort Lauderdale, in the Procurement Services Division, Room 619, City Hall, 100 North Andrews Avenue, Fort Lauderdale, Florida, 33301 prior to 2:00 pm on the date specified. Submittal of response by fax or e-mail will NOT be acceptable.
PROPOSERS MUST SUBMIT AN IDENTIFIED ORIGINAL HARD COPY, PLUS (1) ADDITIONAL HARD COPIES OF THEIR PROPOSAL PAGES INCLUDING ANY ATTACHMENTS.

THE ABOVE REQUIREMENTS TOTAL (2) HARD COPIES OF YOUR PROPOSAL. CONTRACTORS SHOULD SUBMIT YOUR PROPOSAL ALSO ON A CD. CONTRACTOR SHOULD PROVIDE (6) CD COPIES OF YOUR PROPOSAL. CD COPIES MUST MATCH THE ORIGINAL HARDCOPY. IN CASE OF ANY DISCREPENCY BETWEEN THE ORIGINAL HARD COPIES AND THE CD, THE ORIGINAL HARD COPY PREVAILS. FAILURE TO PROVIDE PROPOSALS AS STATED ABOVE, MAY BE GROUNDS TO FIND CONTRACTOR NON-RESPONSIVE.

The proposer understands that the information contained in these Proposal Pages is to be relied upon by the City in awarding the proposed Agreement, and such information is warranted by the proposer to be true. The proposer agrees to furnish such additional information, prior to acceptance of any proposal, relating to the qualifications of the proposer, as may be required by the City.

A representative who is authorized to contractually bind the Contractor shall sign the STATEMENT OF QUALIFICATION CERTIFICATION. Omission of a signature on that page may result in rejection of your proposal.

Although proposals are accepted 'hard copy', the City of Fort Lauderdale uses BIDSYNC (www.bidsync.com) to administer the competitive solicitation process, including but not limited to soliciting responses, issuing addenda, responding to questions / requests for information. There is no charge to register and download the RFQ from BIDSYNC. Proposers are strongly encouraged to read the various vendor Guides and Tutorials available in BIDSNYC well in advance of their intention of submitting a response to ensure familiarity with the use of BIDSYNC. The City shall not be responsible for an Offeror's inability to submit a response by the end date and time for any reason, including issues arising from the use of BIDSYNC.

4.1.2 Careful attention must be given to all requested items contained in this RFQ. Consultants are invited to submit responses in accordance with the requirements of this RFQ. Please read entire solicitation before submitting a SOQ. Consultants must provide a response to each requirement of the RFQ. Responses should be prepared in a concise manner with an emphasis on completeness and clarity. Consultant's notes, exceptions, and comments may be rendered on an attachment, provided the same format of this RFQ text is followed.

All Responses shall be submitted in a sealed envelope or package with the RFQ number and opening date clearly noted on the outside of the envelope.

4.1.3 All information submitted by Offeror shall be typewritten or provided as otherwise instructed to in the RFQ. Proposers shall use and submit any applicable or required forms provided by the City and attach such to their response. Failure to use the forms may cause the response to be rejected and deemed non-responsive.

4.1.4 Responses shall be submitted by an authorized representative of the firm. Responses must be submitted in the business entities name by the President, Partner, Officer or Representative authorized to contractually bind the business entity. Responses shall include an attachment evidencing that the individual submitting the response, does in fact have the required authority stated herein.

4.1.5 All responses will become the property of the City. The Proposer's response to the RFP is a public record pursuant to Florida law, which is subject to disclosure by the City under the State of Florida Public Records Law, Florida Statutes Chapter 119.07 ("Public Records Law"). The City shall permit public access to all documents, papers, letters or other material submitted in connection with this RFP and the Contract to be executed for this RFP, subject to the provisions of Chapter 119.07 of the Florida Statutes. Any language contained in the Proposer's response to the RFP purporting to require confidentiality of any portion of the Proposer's response to the RFP, except to the extent that certain information is in the City's opinion a Trade Secret pursuant to Florida law, shall be void. If a Proposer submits any documents or other information to the City which the Proposer claims is Trade Secret information and exempt from Florida Statutes Chapter 119.07 ("Public Records Laws"), the Proposer shall clearly designate that it is a Trade Secret and that it is asserting that the document or information is exempt. The Proposer must specifically identify the exemption being claimed under Florida Statutes 119.07. The City shall be the final arbiter of whether any information contained in the Proposer's response to the RFP constitutes a Trade Secret. The City's determination of whether an exemption applies shall be final, and the proposer agrees to defend, indemnify, and hold harmless the City and the City's officers, employees, and agent, against any loss or damages incurred by any person or entity as a result of the City's treatment of records as public records. In the event of Contract award, all documentation produced as part of the Contract shall become the exclusive property of the City.

The following information and documents are required to be provided with Consultants response to this Request for Qualifications (RFQ). Failure to do so may deem your Statements of Qualifications (SOQs) non-responsive.

4.2 Contents of the Statement of Qualification

The City deems certain documentation and information important in the determination of responsiveness and for the purpose of evaluating responses. Responses should seek to avoid information in excess of that requested, must be concise, and must specifically address the issues of this RFQ. The City prefers that responses be no more than fifty (50) pages double-sided, be bound in a soft cover binder, and utilize recyclable materials as much as practical. Elaborate binders are neither necessary nor desired. Please place the labeled DVD/CD in a paper sleeve. The responses shall be organized and divided into the sections indicated herein. These are not inclusive of all the information that may be necessary to properly evaluate the response and meet the requirements of the scope of work and/or specifications. Additional

documents and information should be provided as deemed appropriate by the respondent in response to specific requirements stated herein or through the RFQ.

Note: Do not include pricing - Compensation will be requested and considered only during the competitive negotiations process.

4.2.1 Table of Contents

The table of contents should outline in sequential order the major areas of the submittal, including enclosures. All pages should be consecutively numbered and correspond to the Table of Contents.

4.2.2 Executive Summary

Each Offeror must submit an executive summary that identifies the business entity, its background, main office(s), and office location that will service this contract. Identify the officers, principals, supervisory staff and key individuals who will be directly involved with the work and their office locations. The executive summary should also summarize the key elements of the SOQ.

4.2.3 Firm Qualifications and Experience

Respondents are to submit a complete Standard Form 330 and provide any other documentation that demonstrates their ability to satisfy all of the minimum qualification requirements. Indicate the firm's number of years of experience in providing the professional services as it relates the work contemplated. Provide details of past projects for agencies of similar size and scope, including information on your firm's ability to meet time and budget requirements. Indicate the firm's initiatives towards its own sustainable business practices that demonstrate a commitment to conservation. Indicate business structure, IE: Corp., Partnership, LLC. Firm should be registered as a legal entity in the State of Florida; Minority or Woman owned Business (if applicable); Company address, phone number, fax number, E-Mail address, web site, contact person(s), etc. Relative size of the firm, including management, technical and support staff; licenses and any other pertinent information shall be submitted.

4.2.4 Organizational Profile and Project Team

This section shall include a detailed profile of the organization and identify the project team. (may be on Standard Form 330). Providing this information on an organizational chart is recommended. This section shall also include resumes of the project team. Lastly this section shall include details of how each project team member will contribute to the project, in what capacity, and the level of involvement they will have. Provide a comprehensive summary of the experience and qualifications of the individual(s) who will be selected to serve as the project manager(s) for the City.

4.2.6 Approach to Scope of Work

Provide in concise narrative form, your understanding of the City's needs, goals and objectives as they relate to the project, and your overall approach to accomplishing the project. Give an overview on your proposed vision, ideas and methodology. Describe your proposed approach to the project. As part of the project approach, the firm shall propose a scheduling methodology (time line) for effectively managing and executing the work in the optimum time. Also provide information on your firm's current workload and how this project will fit into your workload. Describe available facilities, technological capabilities and other available resources you offer for the project.

4.2.7 References

Provide at least three references, preferably government agencies, for projects with similar scope as listed in this RFQ. Information should include:

- Client Name, address, contact person telephone and current E-mail addresses (E-mail will be primary means of contact).
- Description of work.
- Year the project was completed.
- Total cost of the construction, estimated and actual.

Note: Do not include City of Fort Lauderdale work or staff as references to demonstrate your capabilities. The Committee is interested in work experience and references other than the City of Fort Lauderdale.

4.2.8 Minority (MBE) Participation

If your firm is a certified minority business enterprise as defined by the Florida Small and Minority Business Assistance Act of 1985, provide copies of your certification(s). If your firm is not a certified MBE, describe your company's previous efforts, as well as planned efforts in meeting MBE procurement goals under Florida Statutes 287.09451.

4.2.8 Subconsultants

Consultant must clearly identify any Subconsultants that may be utilized during the term of this contract. All information requested in sections 4.2.3 through 4.2.8 shall be provided for each proposed subconsultant.

4.2.9 Required Forms

a. Statement of Qualification Certification
Complete and attach the Statement of Qualification Certification provided herein in Section 6 - Required Forms

b. Non-Collusion Statement
This form is to be completed, if applicable, and inserted in this section.

c. Local Business Preference (LBP)
This form is to be completed, if applicable, and inserted in this section

d Contract Payment Method
This form must be completed and returned with your SOQ. Proposers must presently have the ability to accept these credit cards or take whatever steps necessary to implement acceptance of a card before the start of the contract term, or contract award by the City.

e. Sample Insurance Certificate
Demonstrate your firm's ability to comply with insurance requirements. Provide a previous certificate or other evidence listing the Insurance Companies names for both Professional Liability and General Liability and the dollar amounts of the coverage.

4.3 By submitting a SOQ each firm is confirming that the firm has not been placed on the convicted vendors list as described in Section §287.133 (2) (a) Florida Statues.

4.4 Before awarding a contract, the City reserves the right to require that a firm submit such evidence of his/her qualifications as the City may deem necessary. Further, the City may consider any evidence of the financial, technical, and other qualifications and abilities of a firm or principals, including previous experiences of same with the City and performance evaluation for services, in making the award in the best interest of the City.

Section V - Evaluation and Award

5.1 Evaluation Procedure

5.1.1 Evaluation of the submittals will be conducted by an Evaluation Committee, consisting of a minimum of three members of City Staff, or other persons selected by the City Manager or designee. All committee members must be present at scheduled evaluation meetings. Submittals shall be evaluated based upon the information and references contained in the SOQs as submitted. Evaluation procedures shall be regulated by F.S. § 287.055, referred to as Consultants' Competitive Negotiations Act (CCNA). Any firm(s) involved in a joint venture in its Statement of Qualifications (SOQ) will be evaluated individually, as each firm of the joint venture would have to stand on its own merits.

5.1.2 The committee shall short list no less than three (3) submittals, assuming that three submittals have been received, that it deems best satisfy the weighted criteria set forth herein and attempt to select the best qualified firm(s) for the particular discipline. The committee shall then hold discussions, conduct interviews, and/or require oral presentations with all short-listed firms. The committee shall then re-rank the short-listed firms based upon the information provided in interviews and/or presentations, the materials presented, the firm's responses to the Request for Qualifications (RFQ), and deliberations of the Evaluation Committee at publically advertised Evaluation Meetings. The City may request and the firm shall provide additional information deemed necessary by the evaluation committee to conduct evaluations.

5.1.3 The final ranking and the Evaluation Committee's recommendation shall be reported to the City Commission through and with the concurrence of the City Manager, who shall request the City Commission approve the final ranking and authorize staff to commence negotiations with the number first ranked firm.

5.1.4 If the City manager or his/her designee is unable to negotiate a satisfactory contract with the first ranked firm, negotiations with that firm shall be formally terminated. Upon termination of said negotiations, negotiations shall then be undertaken with the second ranked firm, with this process being repeated until an agreement is reached which is then recommended and formally approved by the City Commission or until the short-list is exhausted in which case a new Request for Qualifications may be undertaken.

5.2 Evaluation Criteria

5.2.1 Pre Florida Statute 287.055, in determining whether a firm is qualified, the agency shall consider such factors as the ability of professional personnel; whether a firm is a certified minority business enterprise; past performance; willingness to meet time and budget requirements; location; recent, current, and projected workloads of the firms; and the volume of work previously awarded to each firm by the agency, with the object of effecting an equitable distribution of contracts among qualified firms, provided such distribution does not violate the principle of selection of the most highly qualified firms. The agency may request, accept, and consider proposals for the compensation to be paid under the contract only during competitive negotiations.

5.2.2 The City uses a mathematical formula to determine the scoring for each individual responsive and responsible firm based on the weighted criteria stated herein. Each

evaluation committee member will rank each firm by criteria, giving their first ranked firm as number 1, the second ranked firm a number 2, and so on. The City shall average the ranking for each criterion, for all evaluation committee members, and then multiply that average ranking by the weighted criteria identified herein. The lowest average final ranking score will determine the recommendation by the evaluation committee to the City Manager.

5.2.3 Weighted Criteria

Criteria	Percentage
Qualifications: To include Firm and Project team. Including principals and staff. licenses, any related certifications, etc., insurance and other pertinent information.	15
Experience in Permitting Services: To include planning and design development, preparing permitting applications, developing master drainage permits for general aviation airports, surveying, and coordinating with permitting agencies.	35
History and Past Performance of the Firm: To include references, to previous and similar projects, ability to meet time and budget requirements.	15
Approach to Scope of Work To include all requirements as indicated in the scope of work. Including current and projected workloads of your firm.	35

5.3 Contract Award

5.3.1 The City reserves the right to award a contract to that Consultant who will best serve the interest of the City. The City reserves the right, based upon its deliberations and in its opinion, to accept or reject any or all submittals. The City also reserves the right to waive minor irregularities or variations of the submittal requirements and RFQ process.

5.3.2 Upon award of a Contract by the City Commission, the City Manager is authorized to execute the Contract on behalf of the City.

5.3.3 The City Manager shall appoint a contract administrator or project manager for each contract to assure compliance with the contract and applicable law. The contract administrator or project manager shall review all pay requests or deny same as required prior to approval by the City Manager.

Section VI

Required Forms

THE REMAINDER OF THIS PAGE LEFT INTENTIONALLY BLANK

City of Fort Lauderdale
FXE Master Drainage / Conceptual Environmental Resources Permit
RFQ Number #266-11831

STATEMENT OF QUALIFICATION CERTIFICATION

Please Note: All fields below must be completed. If the field does not apply to you, please note N/A in that field.

If you are a foreign corporation, you may be required to obtain a certificate of authority from the department of state, in accordance with Florida Statute §607.1501 (visit http://www.dos.state.fl.us/).

Company: (Legal Registration) _____

Address: _____

City: _____ State: _____ Zip: _____

Telephone No. _____ FAX No. _____ Email: _____

Does your firm qualify for MBE or WBE status: MBE _____ WBE _____

ADDENDUM ACKNOWLEDGEMENT - Proposer acknowledges that the following addenda have been received and are included in the proposal:

Addendum No.	Date Issued	Addendum No.	Date Issued
_____	_____	_____	_____
_____	_____	_____	_____

VARIANCES: State any variations to specifications, terms and conditions in the space provided below or reference in the space provided below all variances contained on other pages of bid, attachments or bid pages. No variations or exceptions by the Proposer will be deemed to be part of the bid submitted unless such variation or exception is listed and contained within the bid documents and referenced in the space provided below. If no statement is contained in the below space, it is hereby implied that your bid/proposal complies with the full scope of this solicitation. If this section does not apply to your bid, simply mark N/A. **If submitting your response electronically through BIDSYNC you must click the exception link if any variation or exception is taken to the specifications, terms and conditions.**

_____

_____

The below signatory hereby agrees to furnish the following article(s) or services at the price(s) and terms stated subject to all instructions, conditions, specifications addenda, legal advertisement, and conditions contained in the bid/proposal. I have read all attachments including the specifications and fully understand what is required. By submitting this signed proposal I will accept a contract if approved by the City and such acceptance covers all terms, conditions, and specifications of this bid/proposal. The below signatory also hereby agrees, by virtue of submitting or attempting to submit a response, hereby agrees that in no event shall the City's liability for respondent's indirect, incidental, consequential, special or exemplary damages, expenses, or lost profits arising out of this competitive solicitation process, including but not limited to public advertisement, bid conferences, site visits, evaluations, oral presentations, or award proceedings exceed the amount of five hundred dollars ($500.00). This limitation shall not apply to claims arising under any provision of indemnification or the City's protest ordinance contained in this competitive solicitation.

Submitted by:

_____ _____
Name (printed) Signature

_____ _____
Date: Title

City of Fort Lauderdale
FXE Master Drainage / Conceptual Environmental Resources Permit
RFQ Number #266-11831

NON-COLLUSION STATEMENT

By signing this offer, the vendor/contractor certifies that this offer is made independently and *free* from collusion. Vendor shall disclose below any City of Fort Lauderdale, FL officer or employee, or any relative of any such officer or employee who is an officer or director of, or has a material interest in, the vendor's business, who is in a position to influence this procurement.

Any City of Fort Lauderdale, FL officer or employee who has any input into the writing of specifications or requirements, solicitation of offers, decision to award, evaluation of offers, or any other activity pertinent to this procurement is presumed, for purposes hereof, to be in a position to influence this procurement.

For purposes hereof, a person has a material interest if they directly or indirectly own more than 5 percent of the total assets or capital stock of any business entity, or if they otherwise stand to personally gain if the contract is awarded to this vendor.

In accordance with City of Fort Lauderdale, FL Policy and Standards Manual, 6.10.8.3,

3.3. City employees may not contract with the City through any corporation or business entity in which they or their immediate family members hold a controlling financial interest (e.g. ownership of five (5) percent or more).

3.4. Immediate family members (spouse, parents and children) are also prohibited from contracting with the City subject to the same general rules.

Failure of a vendor to disclose any relationship described herein shall be reason for debarment in accordance with the provisions of the City Procurement Code.

NAME	**RELATIONSHIPS**
_____	_____
_____	_____
	_____
	_____

In the event the vendor does not indicate any names, the City shall interpret this to mean that the vendor has indicated that no such relationships exist.

LOCAL BUSINESS PREFERENCE CERTIFICATION STATEMENT

The Business identified below certifies that it qualifies for the local BUSINESS preference classification as indicated herein, and further certifies and agrees that it will re-affirm it's local preference classification annually no later than thirty (30) calendar days prior to the anniversary of the date of a contract awarded pursuant to this ITB. Violation of the foregoing provision may result in contract termination.

(1) _____ Business Name is a **Class A** Business as defined in City of Fort Lauderdale Ordinance No. C-12-04, Sec.2-199.2. A copy of the City of Fort Lauderdale current year Business Tax Receipt **and** a complete list of full-time employees and their addresses shall be provided within 10 calendar days of a formal request by the City.

(2) _____ Business Name is a **Class B** Business as defined in the City of Fort Lauderdale Ordinance No. C-12-04, Sec.2-199.2. A copy of the Business Tax Receipt **or** a complete list of full-time employees and their addresses shall be provided within 10 calendar days of a formal request by the City.

(3) _____ Business Name is a **Class C** Business as defined in the City of Fort Lauderdale Ordinance No. C-12-04, Sec.2-199.2. A copy of the Broward County Business Tax Receipt shall be provided within 10 calendar days of a formal request by the City.

(4) _____ Business Name requests a **Conditional Class A** classification as defined in the City of Fort Lauderdale Ordinance No. C-12-04, Sec.2-199.2. Written certification of intent shall be provided within 10 calendar days of a formal request by the City.

(5) _____ Business Name requests a **Conditional Class B** classification as defined in the City of Fort Lauderdale Ordinance No. C-12-04, Sec.2-199.2. Written certification of intent shall be provided within 10 calendar days of a formal request by the City.

(6) _____ Business Name is considered a **Class D** Business as defined in the City of Fort Lauderdale Ordinance No. C-12-04, Sec.2-199.2. and does not qualify for Local Preference consideration.

BIDDER'S COMPANY: _____

AUTHORIZED COMPANY PERSON: _____
NAME SIGNATURE DATE

City of Fort Lauderdale
FXE Master Drainage / Conceptual Environmental Resources Permit
RFQ Number #276-11831

CONTRACT PAYMENT METHOD BY P-CARD

The City of Fort Lauderdale has implemented a Procurement Card (P-Card) program which changes how payments are remitted to its vendors. The City has transitioned from traditional paper checks to payment by credit card via MasterCard or Visa. This allows you as a vendor of the City of Fort Lauderdale to receive your payment fast and safely. No more waiting for checks to be printed and mailed.

In accordance with Article 7, item 7.4.3 of the consultant agreement attached herein, payments for all services will be made utilizing the City's P-Card program (MasterCard or Visa). Accordingly, firms must presently have the ability to accept credit card payment or take whatever steps necessary to implement acceptance of a credit card before the commencement of the agreement.

Please indicate with which credit card you prefer to be paid:

_____ Master Card

_____ Visa Card

Company Name: _____

_____ _____
Name (printed) Signature

_____ _____
Date: Title

AGREEMENT

Between

City of Fort Lauderdale

and

_____

for

CONSULTANT SERVICES

for

_____

THIS IS AN AGREEMENT made and entered into this ___ day of _____ 20__, by and between:

City of Fort Lauderdale, a Florida municipality,
(hereinafter referred to as "CITY")

and

_____., a
_____ _____
(hereinafter [State] if not Florida add - authorized to do business in the State of Florida. [Entity type]
referred to as "CONSULTANT").

WHEREAS, the City Commission of the City of Fort Lauderdale, Florida at its meeting of _____, 20__ authorized by motion the execution of this Agreement between CONSULTANT and CITY authorizing the performance of _____, RFQ No._____ (the "Agreement") ; and

WHEREAS, the CONSULTANT is willing and able to render professional services for such project for the compensation and on the terms hereinafter set forth;

NOW, THEREFORE, in consideration of the mutual covenants, agreements, terms, and conditions contained herein, the parties hereto, do agree as follows:

ARTICLE 1

DEFINITIONS AND IDENTIFICATIONS

For the purposes of this Agreement and the various covenants, conditions, terms and provisions which follow, the DEFINITIONS and IDENTIFICATIONS set forth below are assumed to be true and correct and are therefore agreed upon by the parties.

1.1 AGREEMENT: Means this document between the CITY and CONSULTANT dated _____, 20__ and any duly authorized and executed Amendments to Agreement.

1.2 CERTIFICATE FOR PAYMENT: A statement by CONSULTANT based on observations at the site and on review of documentation submitted by the Contractor that by its issuance recommends that CITY pay identified amounts to the Contractor for services performed by the Contractor at the Project.

1.3 CHANGE ORDER: A written order to the CONSULTANT approved by the CITY authorizing a revision to this agreement between the CITY and the CONSULTANT that is directly related to the original scope of work or an adjustment in the original contract price or the contract time directly related to the original scope of work, issued on or after the effective date of his Agreement.

The CONSULTANT may review and make recommendations to the CITY on any proposed

Change Orders, for approval or other appropriate action by the CITY.

1.4 CITY: The City of Fort Lauderdale, a Florida municipality.

1.5 CITY MANAGER: The City Manager of the City of Fort Lauderdale, Florida.

1.6 COMMISSION: The City Commission of the City of Fort Lauderdale, Florida, which is the governing body of the CITY government.

1.7 CONSTRUCTION COST: The total construction cost to CITY of all elements of the Project designed or specified by the CONSULTANT.

1.8 CONSTRUCTION COST LIMIT: A maximum construction cost limit established by the CITY defining the maximum budget amount to which the final construction documents should be designed so as not to exceed.

1.9 CONSTRUCTION DOCUMENTS: Those working drawings and specifications and other writings setting forth in detail and prescribing the work to be done, the materials, workmanship and other requirements for construction of the entire Project, including any bidding information.

1.10 CONSULTANT: _____, the CONSULTANT selected to perform professional services pursuant to this Agreement.

1.11 CONTRACT ADMINISTRATOR: The Public Works Director of the City of Fort Lauderdale, or his designee. In the administration of this Agreement, as contrasted with matters of policy, all parties may rely upon instructions or determinations made by the Contract Administrator.

1.12 CONTRACTOR: One or more individuals, firms, corporations or other entities identified as such by a written agreement with CITY ("Contract for Construction") to perform the construction services required to complete the Project.

1.13 ERROR: A mistake in design, plans and/or specifications that incorporates into those documents an element that is incorrect and is deficient from the standard of care that a professional engineer in similar circumstances, working on a similar project and location would have exercised. Also includes mistakes in design, plans, specifications and/or shop drawings review that lead to materials and/or equipment being ordered and/or delivered where additional costs are incurred.

1.14 FINAL STATEMENT OF PROBABLE CONSTRUCTION COSTS: A final cost estimate prepared by CONSULTANT during the Final Design Phase of the Project, based upon the final detailed Construction Documents of the Project.

1.15 NOTICE TO PROCEED: A written Notice to Proceed with the Project issued by the Contract Administrator.

1.16 OMISSION: A scope of work missed by the CONSULTANT that is necessary for the Project, including a quantity miscalculation, which was later discovered and added by Change Order and which is deficient from the standard of care that a professional engineer in similar circumstances, working on a similar project and location would have exercised. Also includes

design that was wrong, but was corrected after award to the Contractor, but before the construction process was materially affected.

1.17 ORIGINAL CONTRACT PRICE: The original bid and/or contract price as awarded to a Contractor based upon the CONSULTANT'S final detailed Construction Documents of the Project.

1.18 PLANS AND SPECIFICATIONS: The documents setting forth the final design plans and specifications of the Project, including architectural, civil, structural, mechanical, electrical, communications and security systems, materials, lighting equipment, site and landscape design, and other essentials as may be appropriate, all as approved by CITY as provided in this Agreement.

1.19 PRELIMINARY PLANS: The documents prepared by the CONSULTANT consisting of preliminary design drawings, renderings and other documents to fix and describe the size and character of the entire Project, and the relationship of Project components to one another and existing features.

1.20 PROJECT: An agreed scope of work for accomplishing a specific plan or development. This may include, but is not limited to, planning, architectural, engineering, and construction support services. The services to be provided by the CONSULTANT shall be as defined in this Agreement and further detailed in Task Orders for individual projects or combinations of projects. The Project planning, design and construction may occur in separate phases and Task Orders at the CITY's discretion.

1.21 RESIDENT PROJECT REPRESENTATIVE: Individuals or entities selected, employed, compensated by and directed to perform services on behalf of CITY, in monitoring the Construction Phase of the Project to completion.

1.22 TASK ORDER: A document setting forth a negotiated detailed scope of services to be performed by the CONSULTANT at fixed contract prices in accordance with this Agreement between the CITY and the CONSULTANT.

1.23 TIME OF COMPLETION: Time in which the entire work shall be completed for each Task Order.

ARTICLE 2

PREAMBLE

In order to establish the background, context and frame of reference for this Agreement and to generally express the objectives and intentions of the respective parties hereto, the following statements, representations and explanations shall be accepted as predicates for the undertakings and commitments included within the provisions of this
Agreement which follow and may be relied upon by the parties as essential elements of the mutual considerations upon which this Agreement is based.

2.1 Pursuant to Section 287.055, Florida Statutes, CITY has formed a Committee to evaluate the CONSULTANT's statement of qualifications and performance data to ensure that the CONSULTANT has met the requirements of the Consultants' Competitive Negotiation Act, as set forth in Section 287.055, Florida Statutes, and has selected CONSULTANT to perform services hereunder.

ARTICLE 3
SCOPE OF SERVICES

3.1 The CONSULTANT shall perform the following professional services: _____ as more specifically described in Exhibit "A," Scope of Services, attached hereto and incorporated herein. CONSULTANT shall provide all services set forth in Exhibit "A" including all necessary, incidental and related activities and services required by the Scope of Services and contemplated in CONSULTANT's level of effort.

3.2 CITY and CONSULTANT acknowledge that the Scope of Services does not delineate every detail and minor work tasks required to be performed by CONSULTANT to complete the Project. If, during the course of the performance of the services included in this Agreement, CONSULTANT determines that work should be performed to complete the Project which is in the CONSULTANT's opinion, outside the level of effort originally anticipated, whether or not the Scope of Services identifies the work items, CONSULTANT shall notify Contract Administrator and obtain written approval by the CITY in a timely manner before proceeding with the work. If CONSULTANT proceeds with said work without notifying the Contract Administrator, said work shall be deemed to be within the original level of effort, whether or not specifically addressed in the Scope of Services. Notice to Contract Administrator does not constitute authorization or approval by CITY to perform the work. Performance of work by CONSULTANT outside the originally anticipated level of effort without prior written CITY approval is at CONSULTANT's sole risk.

3.3 CITY and CONSULTANT acknowledge that Basic Services described in Exhibit "A" are included in the fee agreed upon. The CITY and CONSULTANT may negotiate additional scopes of services, compensation, time of performance and other related matters for future phases of Project. If CITY and CONSULTANT cannot contractually agree, CITY shall have the right to immediately terminate negotiations at no cost to CITY and procure services for future Project phases from another source.

ARTICLE 4
GENERAL PROVISIONS

4.1 Negotiations pertaining to the professional design, engineering, architectural and project management services to be performed by the CONSULTANT have been undertaken between CONSULTANT and a committee of CITY representatives pursuant to Section 287.055, Florida Statutes, and this Agreement incorporates the results of such negotiation.

4.2 CONSULTANT shall include CITY's specific Task Order number as part of the heading on all correspondence, invoices and drawings. All correspondence shall be directed specifically to

the Contract Administrator.

ARTICLE 5
TASK ORDERS FOR ADDITIONAL SERVICES

5.1 Task Orders for additional services shall be jointly prepared by the CITY and CONSULTANT defining the detailed scope of services to be provided for the Project. Each Task Order shall be separately numbered and approved in accordance with this Agreement and all applicable CITY code requirements. These Task Orders shall be considered supplemental to the general description of basic services as described in Exhibit "A".

5.2 Under all Task Orders and Projects, CITY may require the CONSULTANT, by specific written authorization, and for mutually agreed upon additional compensation, to provide or assist in obtaining one or more of the following special services. These services may include, at the discretion of the CITY, the following items:

5.2.1 Providing additional copies of reports, contract drawings and documents; and

5.2.2 Assisting CITY with litigation support services arising from the planning, development, or construction.

5.3 Prior to initiating the performance of any services under this Agreement, CONSULTANT must receive a written Notice to Proceed / Purchase Order from the CITY. The CONSULTANT must receive the approval of the Contract Administrator or his designee in writing prior to beginning the performance of services in any subsequent Task Order under this Agreement.

5.4 In the event CONSULTANT is unable to complete the services on the date or dates as provided in this Agreement, or subsequent Task Orders, because of delays resulting from the untimely review and approval by CITY and other governmental authorities having jurisdiction over the Project, CITY may grant an appropriate extension of time for completion of the work. It shall be the responsibility of the CONSULTANT to notify the CITY promptly in writing whenever a delay in approval by a governmental agency is anticipated or experienced, and to inform the CITY of all facts and details related to the delay.

5.5 If, in the opinion of the CITY, the CONSULTANT is improperly performing the services under a specific supplemental Task Order, or if at any time the CITY shall be of the opinion that said supplemental Task Order is being unnecessarily delayed and will not be completed within the agreed upon time, the CITY shall notify the CONSULTANT in writing. The CONSULTANT has within ten (10) working days thereafter to take such measures as will, in the judgment of the CITY, ensure satisfactory performance and completion of the work. If the CONSULTANT fails to cure within the ten (10) working days, the CITY may notify the CONSULTANT to discontinue all work under the specified Task Order. The CONSULTANT shall immediately respect said notice and stop said work and cease to have any rights in the possession of the work and shall forfeit the Task Order and any remaining monies. The CITY may then decide, after City Commission approval, to issue a new supplemental Task Order for the uncompleted work to another consultant using the remaining funds. Any excess costs arising therefrom over and above the original supplemental Task Order price shall be charged against CONSULTANT, as the original CONSULTANT.

ARTICLE 6

TERM OF AGREEMENT; TIME FOR PERFORMANCE

6.1 CONSULTANT shall perform the basic services described in Exhibit "A" within the time periods specified in a mutually agreed upon Project schedule, developed before commencement of work and made a part of this Agreement. The Project schedule, once complete, shall be automatically incorporated into this Agreement; said time periods shall commence from the date of the Notice to Proceed for such services.

6.2 Prior to beginning the performance of any services under this Agreement, CONSULTANT must receive a Notice to Proceed and a purchase order. CONSULTANT must receive written approval from the Contract Administrator prior to beginning the performance of services in any subsequent phases of the Agreement. Prior to granting approval for CONSULTANT to proceed to a subsequent phase, the Contract Administrator may, at his or her sole option, require CONSULTANT to submit itemized deliverables for the Contract Administrator's review.

6.3 In the event CONSULTANT is unable to complete the above services because of delays resulting from untimely review by CITY or other governmental authorities having jurisdiction over the Project, and such delays are not the fault of CONSULTANT, or because of delays which were caused by factors outside the control of CONSULTANT, CITY shall grant a reasonable extension of time for completion of the services and shall provide reasonable compensation, if appropriate. It shall be the responsibility of the CONSULTANT to notify CITY promptly in writing whenever a delay in approval by a governmental agency is anticipated or experienced, and to inform CITY of all facts and details related to the delay.

6.4 The time for the performance of services described in Exhibit "A," Scope of Services and supplemental Task Orders shall be negotiated by the CITY and the CONSULTANT as the services are requested and authorized by the CITY.

6.5 The Term of this Agreement shall be limited to the time required to complete the Basic Services of the Project and any additional Project related Task Orders for additional services.

ARTICLE 7

COMPENSATION AND METHOD OF PAYMENT

7.1 AMOUNT AND METHOD OF COMPENSATION

7.1.1 Not To Exceed Amount Compensation

CITY agrees to pay CONSULTANT as compensation for performance of basic services as related to Exhibit "A" required under the terms of this Agreement up to a Not to Exceed Amount of $_____, and to reimburse CONSULTANT for Reimbursables as described in Section 7.2, up to a Not to Exceed Amount of $_____, for a total Not to Exceed Amount of $_____. It is agreed that the method of compensation is that of "Not to Exceed Amount" which means that CONSULTANT shall perform all services set forth in Exhibit "A" for total compensation in the amount of or less than that stated above. The total hourly rates payable by CITY for each of CONSULTANT's employee categories are shown on Exhibit "B." The total hourly rates payable by CITY for each of CONSULTANT's employee categories are shown on Exhibit "B."

7.2 REIMBURSABLES

7.2.1 Direct non-salary expenses, entitled Reimbursables, directly attributable to the Project will be charged at actual cost, in the total Not-to-Exceed amount of $_____. Reimbursable expenses are in addition to the compensation for basic services and include actual expenditures made by the CONSULTANT and the CONSULTANT'S employees directly attributable to the Project and will be charged at actual cost, without reference to the professional service fees above. CITY shall not withhold retainage from payments for Reimbursable Expenses. CONSULTANT shall be compensated for Reimbursables associated with a particular Task Order only up to the amount allocated for such Task Order. Any reimbursable or portion thereof which, when added to the Reimbursables related to a particular Task Order previously billed, exceeds the amount allocated for such Task Order shall be the responsibility of the CONSULTANT unless otherwise agreed to in writing by the Contract Administrator. Travel and subsistence expenses for the CONSULTANT, his staff and subconsultants as well as communication expenses, long distance telephone, courier and express mail, between CONSULTANT's offices as well as between CONSULTANT and subconsultants' various offices are not reimbursable under this Agreement. Reimbursables shall include only the following listed expenses unless authorized in writing by the Contract Administrator:

A. Cost of reproduction, postage and handling of drawings and specifications which are required to deliver services set forth in this Agreement, excluding reproductions for the office use of the CONSULTANT. Reimbursable printing and photocopying expenses shall include only those prints or photocopies of original documents which are (i) exchanged among CONSULTANT, CITY and other third parties retained or employed by any of them or (ii) submitted to CITY for review, approval or further distribution. Documents, which are reproduced for CONSULTANT's internal drafts, reviews, or other purposes, are not eligible for reimbursement.

B. Identifiable testing costs approved by Contract Administrator.

C. All permit fees paid to regulatory agencies for approvals directly attributable to the Project. These permit fees do not include those permits required for the construction Contractor.

D. Overnight Delivery/Courier Charges (when CITY requires/requests this service).

7.2.2 Reimbursable subconsultant expenses are limited to the items described above when the subconsultant agreement provides for reimbursable expenses. A detailed statement of expenses must accompany any request for reimbursement. Local travel to and from the Project site or within the Tri-County Area will not be reimbursed.

7.2.3 It is acknowledged and agreed to by CONSULTANT that the dollar limitation set forth in each Task Order is a limitation upon, and describes the maximum extent of CITY's obligation to reimburse CONSULTANT for direct, nonsalary expenses, but does not constitute a limitation, of any sort, upon CONSULTANT's obligation to incur such expenses in the performance of services hereunder. If CITY or Contract Administrator requests CONSULTANT to incur expenses not contemplated in the amount for Reimbursables, CONSULTANT shall notify Contract Administrator in writing before incurring such expenses. Any such expenses shall be reviewed and approved by CITY prior to incurring such expenses.

7.3 METHOD OF BILLING

7.3.1 Not To Exceed Amount Compensation

CONSULTANT shall submit billings, which are identified by the specific project number on a monthly basis in a timely manner for all salary costs and Reimbursables attributable to the Project. These billings shall identify the nature of the work performed for each phase, subtask, deliverable and item identified in the Exhibit "A" Scope of Services or Task Order, the total hours of work performed and the employee category of the individuals performing same. Billings shall itemize and summarize Reimbursables by category and identify same as to the personnel incurring the expense and the nature if the work with which such expense was associated. Where prior written approval by Contract Administrator is required for Reimbursables, a copy of said approval shall accompany the billing for such Reimbursables. The statement shall show a summary of salary costs with accrual of the total and credits for portions paid previously. Subconsultant fees must be documented by copies of invoices or receipts, which describe the nature of the expenses and contain a project number or other identifier, which clearly indicates the expense, as identifiable to the Project. Except for meals and travel expenses, it shall be deemed unacceptable for the CONSULTANT to modify the invoice or receipt by adding a project number or other identifier. Internal expenses must be documented by appropriate CONSULTANT's cost accounting forms with a summary of charges by category. When requested, CONSULTANT shall provide backup for past and current invoices that records hours and salary costs by employee category and Subconsultant fees on a task basis, so that total hours and costs by task may be determined.

7.4 METHOD OF PAYMENT

7.4.1 CITY shall pay CONSULTANT in accordance with the Florida Prompt Payment Act. To be deemed proper, all invoices must comply with the requirements set forth in this Agreement and must be submitted on the form and pursuant to instructions prescribed by Contract Administrator.

7.4.2 CITY will review CONSULTANT's invoices and, if inaccuracies or errors are discovered in said invoice, CITY will inform CONSULTANT within ten (10) working days by fax and/or by email of such inaccuracies or errors and request that revised copies of all such documents be re-submitted by CONSULTANT to CITY.

7.4.3 Payments are made by CITY to CONSULTANT using a CITY P-Card (MasterCard or Visa credit card).

ARTICLE 8

AMENDMENTS AND CHANGES IN SCOPE OF SERVICES

8.1 No modification, amendment or alteration in the terms or conditions contained herein shall be effective unless contained in a written Amendment prepared with the same formality as this Agreement and executed by the CITY and CONSULTANT.

8.2 CITY or CONSULTANT may request changes that would increase, decrease, or otherwise modify the Scope of Services to be provided under a Task Order. Such changes must be contained in a written amendment, executed by the parties hereto, with the same formality and of equal dignity herewith, prior to any deviation from the terms of the Task Order including the initiation of any additional services. CITY shall compensate CONSULTANT for such additional services as provided in Article 7.

8.3 In the event a dispute between the Contract Administrator and CONSULTANT arises over whether requested services constitute additional services and such dispute cannot be resolved by the Contract Administrator and CONSULTANT, such dispute shall be promptly presented to the City Manager for resolution. The City Manager's decision shall be final and binding on the parties for amounts in the aggregate under $100,000 per project. In the event of a dispute in an amount over $100,000, the parties agree to use their best efforts to settle such dispute. To this effect, they shall consult and negotiate with each other, in good faith and, recognizing their mutual interests, attempt to reach a just and equitable solution satisfactory to both parties. If they do not reach such solution within a period of sixty (60) days, then upon notice to the other, either party may commence litigation to resolve the dispute in Broward County, Florida. Any resolution in favor of CONSULTANT shall be set forth in a written document in accordance with Section 8.2 above. During the pendency of any dispute, CONSULTANT shall promptly perform the disputed services.

ARTICLE 9
CONSULTANT'S RESPONSIBILITIES

9.1 The CONSULTANT, following the CITY's approval of the Construction Documents and of the Final Statement of Probable Construction Costs, shall, when so directed and authorized by the CITY, assist the CITY in obtaining bids or negotiated proposals and assist in awarding and preparing contracts for construction. If requested, the CONSULTANT shall review and analyze the proposals received by the CITY, and shall make a recommendation for any award based on CITY's Purchasing Ordinance.

9.2 Should the lowest responsible, responsive proposal exceed the Final Statement of Probable Construction Costs by less than 10%, CONSULTANT, at no additional cost to the CITY, shall meet with the CITY's representatives and work to reduce costs to bring the Original Contract Price within the Final Statement of Probable Construction Costs. Should the lowest responsible, responsive proposal exceed the Final Statement of Probable Construction Costs by 10% or more, CONSULTANT shall, at the CITY's direction, redesign each Project and/or work with the CITY to reduce the costs to within the Final Statement of Probable Construction Costs at no additional expense to the CITY. If negotiations between the CITY and the CONSULTANT have not commenced within three months after completion of the final design phase, or if industry-wide prices are changed because of unusual or unanticipated events affecting the general level of prices or times of delivery in the construction industry, the established Construction Cost Limit may be adjusted in accordance with the applicable change in the Construction Cost Index for Twenty Cities from the date of completion of the final design phase and the date on which proposals are sought, as published monthly in "Engineering News Record". If each Project scope and design is expanded by the CITY after the CONSULTANT renders the estimated Construction Cost of the Plans and Specifications, the CONSULTANT shall not be responsible for any redesign without compensation.

9.3 The CONSULTANT shall provide the CITY with a list of recommended, prospective proposers.

9.4 The CONSULTANT shall attend all pre-proposal conferences.

9.5 The CONSULTANT shall recommend any addenda, through the Contract Administrator, as appropriate to clarify, correct, or change proposal documents.

9.6 If pre-qualification of proposers is required as set forth in the request for proposal, CONSULTANT shall assist the CITY, if requested, in developing qualification criteria, review qualifications and recommend acceptance or rejection of the proposers. If requested, CONSULTANT shall evaluate proposals and proposers, and make recommendations regarding any award by the CITY.

9.7 The CITY shall make decisions on all claims regarding interpretation of the Construction Documents, and on all other matters relating to the execution and progress of the work after receiving a recommendation from the CONSULTANT. The CONSULTANT shall check and approve samples, schedules, shop drawings and other submissions for conformance with the concept of each Project, and for compliance with the information given by the Construction Documents. The CONSULTANT may also prepare Change Orders, assemble written guarantees required of the Contractor, and approve progress payments to the Contractor based on each Project Schedule of Values and the percentage of work completed.

9.8 The CITY shall maintain a record of all Change Orders which shall be categorized according to the various types, causes, etc. that it may be determined are useful or necessary for its purpose. Among those shall be Change Orders identified as architectural/engineering Errors or Omissions.

9.8.1 Unless otherwise agreed by both parties in writing, it is specifically agreed that any change to the work identified as an Error on the part of the CONSULTANT shall be considered for purposes of this Agreement to be an additional cost to the CITY which would not be incurred without the Error.

9.8.2 Unless otherwise agreed by both parties in writing, it is further specifically agreed for purposes of this Agreement that fifteen percent (15%) of the cost of Change Orders for any item categorized as an Omission shall be considered an additional cost to the CITY which would not be incurred without the Omission. So long as the total of those two numbers (Change Order costs of Errors plus fifteen percent (15%) of Omissions) remains less than two percent (2%) of the total Construction Cost of the Project, the CITY shall not look to the CONSULTANT for reimbursement for Errors and Omissions.

9.8.3 Should the sum of the two as defined above (cost of Errors plus fifteen percent (15%) of the cost of Omissions) exceed two percent (2%) of the Construction Cost, the CITY shall recover the full and total additional cost to the CITY as a result of CONSULTANT's Errors and Omissions from the CONSULTANT, that being defined as the cost of Errors plus fifteen percent (15%) of the cost of Omissions above two percent (2%) of the Construction Cost.

9.8.4 To obtain such recovery, the CITY shall deduct from the CONSULTANT's fee a sufficient amount to recover all such additional cost to the CITY.

9.8.5 In executing this Agreement, the CONSULTANT acknowledges acceptance of these calculations and to the CITY's right to recover same as stated above. The recovery of additional costs to the CITY under this paragraph shall not limit or preclude recovery for other separate and/or additional damages which the CITY may otherwise incur.

9.8.6 The Contract Administrator's decision as to whether a Change Order is caused by an Error or caused by an Omission, taking into consideration industry standards, shall be final and binding on both parties for amounts in the aggregate under $100,000 per project. In the event of a dispute in an amount over $100,000, the parties agree to use their best efforts to settle such dispute. To this effect, they shall consult and negotiate with each other, in good faith and,

recognizing their mutual interests, attempt to reach a just and equitable solution satisfactory to both parties. If they do not reach such solution within a period of sixty (60) days, then upon notice to the other, either party may commence litigation to resolve the dispute in Broward County, Florida.

ARTICLE 10
CITY'S RESPONSIBILITIES

10.1 CITY shall assist CONSULTANT by placing at CONSULTANT's disposal all information CITY has available pertinent to the Project including previous reports and any other data relative to design or construction of the Project.

10.2 CITY shall arrange for access to, and make all provisions for, CONSULTANT to enter upon public and private property as required for CONSULTANT to perform its services.

10.3 CITY shall review the itemized deliverables/documents identified per Task Order.

10.4 CITY shall give prompt written notice to CONSULTANT whenever CITY observes or otherwise becomes aware of any development that affects the scope or timing of CONSULTANT's services or any defect in the work of the Contractor.

ARTICLE 11
MISCELLANEOUS

11.1 OWNERSHIP OF DOCUMENTS

All documents including, but not limited to, drawings, renderings, models, and specifications prepared or furnished by CONSULTANT, its dependent professional associates and consultants, pursuant to this Agreement shall be owned by the CITY.

Drawings, specifications, designs, models, photographs, reports, surveys and other data prepared in connection with this Agreement are and shall remain the property of the CITY whether the Project for which they are made is executed or not, and are subject to reuse by the CITY in accordance with Section 287.055(10) of the Florida Statutes. They are not intended or represented to be suitable for reuse by the CITY or others on extensions of this Project or on any other project without appropriate verification or adaptation. This does not, however, relieve the CONSULTANT of liability or legal exposure for errors, omissions, or negligent acts made on the part of the CONSULTANT in connection with the proper use of documents prepared under this Agreement. Any such verification or adaptation may entitle the CONSULTANT to further compensation at rates to be agreed upon by the CITY and the CONSULTANT. This shall not limit the CITY's reuse of preliminary or developmental plans or ideas incorporated therein, should the Project be suspended or terminated prior to completion.

11.2 TERMINATION

11.2.1 Termination for Cause. It is expressly understood and agreed that the CITY may terminate this Agreement at any time for cause in the event that the CONSULTANT (1) violates any provisions of this Agreement or performs same in bad faith or (2) unreasonably delays the performance of the services or does not perform the services in a timely manner upon written

notice to the CONSULTANT. Notice of termination shall be provided in accordance with Section 11.27. In the case of termination by the CCITY for cause, the CONSULTANT shall be first granted a 10 working day cure priod after receipt of written notice from the CITY. In the event that the Agreement is terminated, the CONSULTANT shall be entitled to be compensated for the services rendered from the date of execution of the Agreement up to the time of termination. Such compensation shall be based on the fee as set forth above, wherever possible. For those portions of services rendered to which the applicable fee cannot be applied, payment shall be based upon the appropriate rates for the actual time spent on the project. In the event that the CONSULTANT abandons this Agreement or through violation of any of the terms and conditions of this Agreement, causes it to be terminated, CONSULTANT shall indemnify the CITY against any loss pertaining to this termination.

All finished or unfinished documents, data, studies, surveys, drawings, maps, models, photographs and reports prepared by CONSULTANT shall become the property of CITY and shall be delivered by CONSULTANT to the CITY within five (5) days of CITY's request. Upon payment of such sum by CITY to CONSULTANT, CITY shall have no further duties or obligations pursuant to or arising from this Agreement.

11.2.1 It is expressly understood and agreed that the CITY may terminate this Agreement at any time by giving the CONSULTANT notice by telephone, or personally to one of the officers of the CONSULTANT, confirmed by certified mail, return receipt requested, to the principal office of the CONSULTANT. In the event that the Agreement is terminated, the CONSULTANT shall be entitled to be compensated for the services rendered from the date of execution of the Agreement up to the time of termination. Such compensation shall be based on the fee as set forth above, wherever possible. For those portions of services rendered to which the applicable fee cannot be applied, payment shall be based upon the appropriate rates for the actual time spent on the project. In the event that the CONSULTANT abandons this Agreement or through violation of any of the terms and conditions of this Agreement, causes it to be terminated, CONSULTANT shall indemnify the CITY against any loss pertaining to this termination. All finished or unfinished documents, data, studies, surveys, drawings, maps, models, photographs and reports prepared by CONSULTANT shall become the property of CITY and shall be delivered by CONSULTANT to the CITY within five (5) days of CITY's request. Upon payment of such sum by CITY to CONSULTANT, CITY shall have no further duties or obligations pursuant to or arising from this Agreement. CONSULTANT shall have the right to terminate this Agreement upon the substantial breach by the CITY of its obligations under this Agreement such as unreasonable delay in payment or non-payment of undisputed amounts.

11.2.2 This Agreement may also be terminated by CITY upon such notice as CITY deems appropriate in the event CITY or Contract Administrator determines that termination is necessary to protect the public health, safety, or welfare.

11.2.3 Notice of termination shall be provided in accordance with Section 11.27, NOTICES, except that Contract Administrator may provide a prior verbal stop work order if the Contract Administrator deems a stop work order of this Agreement in whole or in part is necessary to protect the public's health, safety, or welfare. A verbal stop work order shall be promptly confirmed in writing as set forth in Section 11.27, NOTICES.

11.2.4 Termination for Convenience. In the event this Agreement is terminated for convenience, CONSULTANT shall be paid for any services performed to the date the Agreement is terminated. Compensation shall be withheld until all documents specified in Section 11.3 of this Agreement are provided to the CITY. Upon being notified of CITY's election to terminate, CONSULTANT shall refrain from performing further services or incurring additional expenses under the terms of

this Agreement. Under no circumstances shall CITY make payment for services which have not been performed.

11.2.5 Termination by Consultant. CONSULTANT shall have the right to terminate this Agreement upon substantial breach by the CITY of its obligation under this Agreement as to unreasonable delay in payment or non-payment of undisputed amounts. CONSULTANT shall have no right to terminate this Agreement for convenience of the CONSULTANT

11.3 AUDIT RIGHT AND RETENTION OF RECORDS

CITY shall have the right to audit the books, records, and accounts of CONSULTANT that are related to this Project. CONSULTANT shall keep such books, records, and accounts as may be necessary in order to record complete and correct entries related to the Project.

CONSULTANT shall preserve and make available, at reasonable times for examination and audit by CITY all financial records, supporting documents, statistical records, and any other documents pertinent to this Agreement for the required retention period of the Florida Public Records Act (Chapter 119, Florida Statutes), if applicable, or, if the Florida Public Records Act is not applicable, for a minimum of three (3) years after termination of this Agreement. If any audit has been initiated and audit findings have not been resolved at the end of the retention period or three (3) years, whichever is longer, the books, records, and accounts shall be retained until resolution of the audit findings. If the Florida Public Records Act is determined by CITY to be applicable to CONSULTANT's records, CONSULTANT shall comply with all requirements thereof; however, no confidentiality or non-disclosure requirement of either federal or state law shall be violated by CONSULTANT. Any incomplete or incorrect entry in such books, records, and accounts shall be a basis for CITY's disallowance and recovery of any payment upon such entry.

CONSULTANT shall:

a) Keep and maintain public records that ordinarily and necessarily would be required by the CITY in order to perform the service.

(b) Provide the public with access to public records on the same terms and conditions that the CITY would provide the records and at a cost that does not exceed the cost provided in Chapter 119, Florida Statutes (2013), as may be amended or revised, or as otherwise provided by law.

(c) Ensure that public records that are exempt or confidential and exempt from public records disclosure requirements are not disclosed except as authorized by law.

(d) Meet all requirements for retaining public records and transfer, at no cost, to the CITY, all public records in possession of the CONSULTANT upon termination of this contract and destroy any duplicate public records that are exempt or confidential and exempt from public records disclosure requirements. All records stored electronically must be provided to the CITY in a format that is compatible with the information technology systems of the CITY.

11.4 NON DISCRIMINATION, EQUAL EMPLOYMENT OPPORTUNITY, AND AMERICANS WITH DISABILITIES ACT

CONSULTANT shall not unlawfully discriminate against any person in its operations and activities in its use or expenditure of the funds or any portion of the funds provided by this Agreement and shall affirmatively comply with all applicable provisions of the Americans with

Disabilities Act (ADA) in the course of providing any services funded in whole or in part by CITY, including Titles I and II of the ADA (regarding nondiscrimination or the basis of disability), and all applicable regulations, guidelines, and standards.

CONSULTANT's decisions regarding the delivery of services under this Agreement shall be made without regard to or consideration of race, age, religion, color, gender, sexual orientation, national origin, marital status, physical or mental disability, political affiliation, or any other factor which cannot be lawfully or appropriately used as a basis for service delivery.

CONSULTANT shall comply with Title I of the Americans with Disabilities Act regarding nondiscrimination on the basis of disability in employment and further shall not discriminate against any employee or applicant for employment because of race, age, religion, color, gender, sexual orientation, national origin, marital status, political affiliation, or physical or mental disability. In addition, CONSULTANT shall take affirmative steps to ensure nondiscrimination in employment against disabled persons. Such actions shall include, but not be limited to, the following: employment, upgrading, demotion, transfer, recruitment or recruitment advertising, layoff, termination, rates of pay, other forms of compensation, terms and conditions of employment, training (including apprenticeship), and accessibility.

CONSULTANT shall take affirmative action to ensure that applicants are employed and employees are treated without regard to race, age, religion, color, gender, sexual orientation, national origin, marital status, political affiliation, or physical or mental disability during employment. Such actions shall include, but not be limited to, the following: employment, upgrading, demotion, transfer, recruitment or recruitment advertising, layoff, termination, rates of pay, other forms of compensation, terms and conditions of employment, training (including apprenticeship), and accessibility.

11.5 MINORITY PARTICIPATION

Historically, the CITY has been able to achieve participation levels of approximately twelve percent (12%) by MBE/WBE firms in CITY projects, and in the purchase of goods and services. The CONSULTANT shall make a good faith effort to help the CITY maintain and encourage MBE/WBE participation levels consistent with such historical levels and market conditions. The CONSULTANT will be required to document all such efforts and supply the CITY with this documentation at the end of the Project, or in cases where projects are longer than one year, each CITY fiscal year.

11.6 PUBLIC ENTITY CRIMES ACT

CONSULTANT represents that the execution of this Agreement will not violate the Public Entity Crimes Act (Section 287.133, Florida Statutes), which essentially provides that a person or affiliate who has been placed on the convicted vendor list following a conviction for a public entity crime may not submit a bid, proposal, or reply on a contract to provide any goods or services to a public entity; may not submit a bid, proposal, or reply on a contract with a public entity for the construction or repair of a public building or public work; may not submit bids, proposals, or replies on leases of real property to a public entity; may not be awarded or perform work as a contractor, supplier, subcontractor, or consultant under a contract with any public entity; and may not transact business with any public entity in excess of the threshold amount provided in s. 287.017 for CATEGORY TWO for a period of 36 months following the date of being placed on the convicted vendor list. Violation of this section shall result in termination of this Agreement and recovery of all monies paid hereto, and may result in debarment from CITY's competitive procurement activities.

In addition to the foregoing, CONSULTANT further represents that there has been no determination, based on an audit, that it committed an act defined by Section 287.133, Florida Statutes, as a "public entity crime" and that it has not been formally charged with committing an act defined as a "public entity crime" regardless of the amount of money involved or whether CONSULTANT has been placed on the convicted vendor list.

11.7 SUBCONSULTANTS

11.7.1 CONSULTANT may subcontract certain items of work to subconsultant. The parties expressly agree that the CONSULTANT shall submit pertinent information regarding the proposed subconsultant, including subconsultant's scope of work and fees, for review and approval by the CITY prior to sub-consultants proceeding with any work.

11.7.2 CONSULTANT shall utilize the subconsultants identified in the proposal that were a material part of the selection of CONSULTANT to provide the services for this Project. CONSULTANT shall obtain written approval of Contract Administrator prior to changing or modifying the list of subconsultants submitted by CONSULTANT.

The list of subconsultants submitted is as follows:

_____
_____
_____
_____
(or attach as an exhibit if more appropriate)

11.8 ASSIGNMENT AND PERFORMANCE

Neither this Agreement nor any interest herein shall be assigned, transferred, or encumbered without the written consent of the other party, and CONSULTANT shall not subcontract any portion of the work required by this Agreement except as authorized pursuant to Section 11.7.

CONSULTANT represents that all persons delivering the services required by this Agreement have the knowledge and skills, either by training, experience, education, or a combination thereof, to adequately and competently perform the duties, obligations, and services set forth in the Scope of Services and to provide and perform such services to CITY's satisfaction for the agreed compensation.

CONSULTANT shall perform its duties, obligations, and services under this Agreement in a skillful and respectable manner. The quality of CONSULTANT's performance and all interim and final product(s) provided to or on behalf of CITY shall meet or exceed all professional standards of the State of Florida.

11.9 INDEMNIFICATION OF CITY

11.9.1 CONSULTANT shall defend, counsel being subject to CITY's approval, and indemnify and hold harmless CITY, and CITY's officers and employees from any and all claims, liabilities, damages, losses, penalties, fines, judgments, and costs, including, but not limited to, any award of attorneys' fees and any award of litigation costs, in connection with or arising directly or indirectly out of any act or omission by the CONSULTANT or by any officer, employee, agent,

invitee, subcontractor, or subconsultant of the CONSULTANT. The provisions of this Section shall survive the expiration or early termination of this Agreement. To the extent considered necessary by Contract Administrator and CITY's city attorney, any sums due the CONSULTANT under this Agreement may be retained by CITY until all of CITY's claims for indemnification pursuant to this Agreement have been settled or otherwise resolved, and any amount withheld shall not be subject to payment of interest by CITY.

11.9.2 It is specifically understood and agreed that the consideration inuring to the CONSULTANT for the execution of this Agreement are the promises, payments, covenants, rights and responsibilities contained herein and the award of this Agreement to the CONSULTANT.

11.9.3 The execution of this Agreement by the CONSULTANT shall obligate the CONSULTANT to comply with the foregoing indemnification provision.

11.10 LIMITATION OF CITY'S LIABILITY

The CITY desires to enter into this Agreement only if in so doing the CITY can place a limit on the CITY'S liability for any cause of action arising out of this Agreement, so that the CITY'S liability for any breach never exceeds the sum of $100.00. For other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, the CONSULTANT expresses its willingness to enter into this Agreement with the knowledge that the CONSULTANT'S recovery from the CITY to any action or claim arising from the Agreement is limited to a maximum amount of $100.00 less the amount of all funds actually paid by the CITY to the CONSULTANT pursuant to this Agreement. Accordingly, and notwithstanding any other term or condition of this Agreement that may suggest otherwise, the CONSULTANT agrees that the CITY shall not be liable to the CONSULTANT for damages in an amount in excess of $100.00, which amount shall be reduced by the amount actually paid by the CITY to the CONSULTANT pursuant to this Agreement, for any action or claim arising out of this Agreement. Nothing contained in this paragraph or elsewhere in this Agreement is in any manner intended either to be a waiver of the limitation placed upon the CITY'S liability as set forth in Section 768.28, Florida Statutes, or to extend the CITY'S liability beyond the limits established in said Section 768.28; and no claim or award against the CITY shall include attorney's fees, investigative costs, extended damages, expert fees, suit costs or pre-judgment interest. Notwithstanding the foregoing, the parties agree and understand that the provisions of this Article 11.10 do not apply to monies owed, if any, for services rendered to CONSULTANT by the CITY under the provisions of this Agreement.

11.11 INSURANCE

11.11.1 Consultant will be required and shall require all of its Sub-Consultants and Sub-Contractors to
provide, pay for, and maintain in force at all times during the term of an agreement, such insurance, including Professional Liability Insurance, Workers' Compensation Insurance, Comprehensive General or Commercial Liability Insurance, Business Automobile Liability Insurance, and Employer's Liability Insurance as stated below.
Companies authorized to do business in the State of Florida and having agents upon whom service of process may be made in the State of Florida shall issue such policy or policies. Consultant shall specifically protect City and the City Commission by naming City and the City Commission as additional insured under the Comprehensive Liability Insurance policy hereinafter described.

A. Workers' Compensation Insurance to apply for all employees in compliance with the "Workers' Compensation Law" of the State of Florida and all applicable Federal laws, for the benefit of the Consultant's employees.

B. Sub-Consultants not eligible for Professional Liability Coverage, by virtue of their trade, shall provide Commercial General Liability coverage acceptable to the Contract Administrator and City's Risk Manager. Sub-consultant and sub-contractors eligible for professional liability coverage shall be required to provide professional liability coverage acceptable to the contract administrator and City's Risk Manager on a task order by task order basis.

C. The Consultant shall provide the Risk Manager of the City an original certificate of insurance for policies required by Article 11.10. All certificates shall state that the City shall be given ten (10) days prior to cancellation or modification of any stipulated insurance. The insurance provided shall be endorsed or amended to comply with this notice requirement. In the event that the insurer is unable to accommodate, it shall be the responsibility of the Consultant to provide the proper notice. Such notification will be in writing by registered mail, return receipt requested and addressed to the Procurement Services Division. Such policies shall: (1) name the insurance company or companies affording coverage acceptable to the City, (2) state the effective and expiration dates of the policies, and (3) include special endorsements where necessary. Such policies provided under Article 11 shall not be affected by any other policy of insurance, which the CITY may carry in its own name.

D. Consultant shall as a condition precedent of this Agreement furnish to the City of Fort Lauderdale, c/o Procurement Services Division, 100 N. Andrews Avenue, #619, Fort Lauderdale, FL 33301, certificate(s) of insurance upon execution of this Agreement which indicate that insurance coverage has been obtained which meets the requirements as outlined below:

COMMERCIAL GENERAL LIABILITY

A. Limits of Liability:

Bodily Injury and Property Damage Liability	
Combined Single Limit	
Each Occurrence	$1,000,000
General Aggregate Limit	$2,000,000
Personal Injury	$1,000,000
Products/Completed Operations	$1,000,000

B. Endorsements Required:

City of Fort Lauderdale included as an Additional Insured
Employees included as insured
Broad Form Contractual Liability
Waiver of Subrogation
Premises/Operations
Products/Completed Operations
Independent Contractors

AUTOMOBILE BUSINESS

A. Limits of Liability:

Bodily Injury and Property Damage Liability	
Combined Single Limit	$1,000,000
Any Auto	
Including Hired, Borrowed or Non-Owned Autos	

B. Endorsements Required:

Waiver of Subrogation

WORKERS' COMPENSATION

Limits of Liability: Statutory-State of Florida

PROFESSIONAL LIABILITY/ERRORS AND OMISSIONS COVERAGE

Combined Single Limit	
Each Occurrence	$1,000,000
General Aggregate Limit	$2,000,000
Deductible not to exceed 10%	
Must be in effect for at least five (5) years after Project completion	

The above insurance requirements are only required to be carried by the Consultant during the term of the assigned Project and provided upon award of the task order, except for Professional Liability/Errors and Omissions insurance which must be in effect for at least five (5) years after Project completion.

The City is required to be named as additional insured under the Commercial General Liability insurance policy. BINDERS ARE UNACCEPTABLE. The insurance coverage required shall include those classifications, as listed in standard liability insurance manuals, which most nearly reflect the operations of the Consultant. Any exclusions or provisions in the insurance maintained by the Consultant that precludes coverage for the work contemplated in an agreement shall be deemed unacceptable, and shall be considered a breach of contract.

All insurance policies required above shall be issued by companies authorized to do business under the laws of the State of Florida, with the following qualifications:

The Company must be rated no less than “A” as to management, and no less than “Class X” as to financial strength, by the latest edition of A. M. Best’s Key Rating Insurance Guide which holds a valid Florida Certificate of Authority issued by the State of Florida, Department of Insurance, and are members of the Florida Guarantee Fund.

NOTE: CITY CONTRACT NUMBER MUST APPEAR ON EACH CERTIFICATE.

Compliance with the foregoing requirements shall not relieve the Consultant of his liability and obligation under this section or under any other section of this Agreement.

The Consultant shall be responsible for assuring that the insurance certificates required in conjunction with this section remain in force for the duration of the project. If insurance certificates are scheduled to expire during the contractual period, the Consultant shall be responsible for submitting new or renewed insurance certificates to the City at a minimum of thirty (30) calendar days in advance of such expiration.

11.12 REPRESENTATIVE OF CITY AND CONSULTANT

11.12.1 The parties recognize that questions in the day-to-day conduct of the Project will arise. The Contract Administrator, upon CONSULTANT’s request, shall advise CONSULTANT in writing of one (1) or more CITY employees to whom all communications pertaining to the day-to-day conduct of the Project shall be addressed.

11.12.2 CONSULTANT shall inform the Contract Administrator in writing of CONSULTANT’s representative to whom matters involving the conduct of the Project shall be addressed.

11.13 ALL PRIOR AGREEMENTS SUPERSEDED

This document incorporates and includes all prior negotiations, correspondence,

conversations, agreements or understandings applicable to the matters contained herein; and the parties agree that there are no commitments, agreements or understandings concerning the subject matter of this Agreement that are not contained in this document. Accordingly, the parties agree that no deviation from the terms hereof shall be predicated upon any prior representations or agreements whether oral or written.

It is further agreed that no modification, amendment or alteration in the terms or conditions contained herein shall be effective unless contained in a written document executed with the same formality and of equal dignity herewith.

11.14 CONSULTANT'S STAFF

CONSULTANT will provide the key staff identified in their proposal for the Project as long as said key staff are in CONSULTANT's employment.

CONSULTANT will obtain prior written approval of Contract Administrator to change key staff. CONSULTANT shall provide Contract Administrator with such information as necessary to determine the suitability of any proposed new key staff. Contract Administrator will be reasonable in evaluating key staff qualifications.

If Contract Administrator desires to request removal of any of CONSULTANT's staff, Contract Administrator shall first meet with CONSULTANT and provide reasonable justification for said removal.

11.15 INDEPENDENT CONTRACTOR

CONSULTANT is an independent contractor under this Agreement. Services provided by CONSULTANT shall be subject to the supervision of CONSULTANT. In providing the services, CONSULTANT or its agents shall not be acting and shall not be deemed as acting as officers, employees, or agents of the CITY. Personnel policies, tax responsibilities, social security and health insurance, employee benefits, purchasing policies and other similar administrative procedures applicable to services rendered under this Agreement shall be those of CONSULTANT. The parties expressly acknowledge that it is not their intent to create any rights or obligations in any third person or entity under this Agreement.

11.16 THIRD PARTY BENEFICIARIES

Neither CONSULTANT nor CITY intends to directly or substantially benefit a third party by this Agreement. Therefore, the parties agree that there are no third party beneficiaries to this Agreement and that no third party shall be entitled to assert a claim against either of them based upon this Agreement.

11.17 CONFLICTS

Neither CONSULTANT nor its employees shall have or hold any continuing or frequently recurring employment or contractual relationship that is substantially antagonistic or incompatible with CONSULTANT's loyal and conscientious exercise of judgment related to its performance under this Agreement.

CONSULTANT agrees that none of its officers or employees shall, during the term of this Agreement, serve as expert witness against CITY in any legal or administrative proceeding in which he or she is not a party, unless compelled by court process, nor shall such persons give

sworn testimony or issue a report or writing, as an expression of his or her expert opinion, which is adverse or prejudicial to the interests of CITY or in connection with any such pending or threatened legal or administrative proceeding. The limitations of this Section shall not preclude such persons from representing themselves in any action or in any administrative or legal proceeding.

In the event CONSULTANT is permitted to utilize subconsultants to perform any services required by this Agreement, CONSULTANT agrees to prohibit such subconsultants, by written contract, from having any conflicts as within the meaning of this Section.

11.18 CONTINGENCY FEE

CONSULTANT warrants that it has not employed or retained any company or person, other than a bona fide employee working solely for CONSULTANT, to solicit or secure this Agreement and that it has not paid or agreed to pay any person, company, corporation, individual or firm, other than a bona fide employee working solely for CONSULTANT, any fee, commission, percentage, gift, or other consideration contingent upon or resulting from the award or making of this Agreement. For a breach or violation of this provision the CITY shall have the right to terminate this Agreement without liability at its discretion, or to deduct from the Agreement price or otherwise recover the full amount of such fee, commission, percentage, gift or consideration.

11.19 WAIVER OF BREACH AND MATERIALITY

Failure by CITY to enforce any provision of this Agreement shall not be deemed a waiver of such provision or modification of this Agreement.

CITY and CONSULTANT agree that each requirement, duty, and obligation set forth herein is substantial and important to the formation of this Agreement and, therefore, is a material term hereof.

11.20 COMPLIANCE WITH LAWS

CONSULTANT shall comply with all federal, state, and local laws, codes, ordinances, rules, and regulations in performing its duties, responsibilities, and obligations related to this Agreement.

11.21 SEVERANCE

In the event this Agreement or a portion of this Agreement is found by a court of competent jurisdiction to be invalid, the remaining provisions shall continue to be effective unless CITY or CONSULTANT elects to terminate this Agreement. The election to terminate this Agreement based upon this provision shall be made within seven (7) days after the findings by the court become final.

11.22 JOINT PREPARATION

Preparation of this Agreement has been a joint effort of CITY and CONSULTANT and the resulting document shall not, solely as a matter of judicial construction, be construed more severely against one of the parties than any other.

11.23 PRIORITY OF PROVISIONS

If there is a conflict or inconsistency between any term, statement, requirement, or provision of any exhibit attached hereto, any document or events referred to herein, or any document incorporated into this Agreement by reference and a term, statement, requirement, or provision of this Agreement, the term, statement, requirement, or provision contained in Articles 1-11 of this Agreement shall prevail and be given effect.

11.24 APPLICABLE LAW AND VENUE

This Agreement shall be construed in accordance with and governed by the laws of the State of Florida. Venue for any lawsuit by either party against the other party or otherwise arising out of this Agreement and for any other legal proceeding shall be in Broward County, Florida, or in the event of federal jurisdiction, in the Southern District of Florida. . BY ENTERING INTO THIS AGREEMENT, CONSULTANT AND CITY EXPRESSLY WAIVE ANY RIGHTS EITHER PARTY MAY HAVE TO A TRIAL BY JURY OF ANY CIVIL LITIGATION RELATED TO, OR ARISING OUT OF, THIS AGREEMENT.

11.25 EXHIBITS

Each Exhibit referred to in this Agreement forms an essential part of this Agreement. The Exhibits, if not physically attached, should be treated as part of this Agreement, and are incorporated herein by reference.

11.26 THREE ORIGINAL AGREEMENTS

This Agreement shall be executed in three (3), signed Agreements, with each one treated as an original.

11.27 NOTICES

Whenever either party desires to give notice unto the other, it must be given by written notice, sent by certified United States mail, with return receipt requested, addressed to the party for whom it is intended, at the place last specified, and the place for giving of notice in compliance with the provisions of this paragraph. For the present, the parties designate the following as the respective places for giving of notice, to-wit:

CITY: City Engineer
City of Fort Lauderdale
100 North Andrews Avenue
Fort Lauderdale, FL 33301
Telephone: (954) 828-5772

With a copy to: City Manager
City of Fort Lauderdale
100 North Andrews Avenue
Fort Lauderdale, FL 33301
Telephone: (954) 828-5364

City Attorney
City of Fort Lauderdale
100 North Andrews Avenue
Fort Lauderdale, FL 33301
Telephone : (954) 828-5037

CONSULTANT: _____
_____
_____

11.28 ATTORNEY FEES

If CITY or CONSULTANT incurs any expense in enforcing the terms of this Agreement through litigation, the prevailing party in that litigation shall be reimbursed for all such costs and expenses, including but not limited to court costs, and reasonable attorney fees incurred during litigation.

11.29 PERMITS, LICENSES AND TAXES

CONSULTANT shall, at its own expense, obtain all necessary permits and licenses, pay all applicable fees, and pay all applicable sales, consumer, use and other taxes required to comply with local ordinances, state and federal law. CONSULTANT is responsible for reviewing the pertinent state statutes regarding state taxes and for complying with all requirements therein. Any change in tax laws after the execution of this Agreement will be subject to further negotiation and CONSULTANT shall be responsible for complying with all state tax requirements.

11.30 TRUTH-IN-NEGOTIATION CERTIFICATE

Signature of this Agreement by CONSULTANT shall act as the execution of a
Truth-in-Negotiation Certificate stating that wage rates and other factual unit costs supporting the compensation of this Agreement are accurate, complete, and current at the time of contracting. The original contract price and any additions thereto shall be adjusted to exclude any significant sums, by which the CITY determines that contract price was increased due to inaccurate, incomplete, or non-current wage rates and other factual unit costs. All such contract adjustments must be made within 1 year following the end of the contract.

11.31 EVALUATION

The CITY maintains the right to periodically review the performance of the CONSULTANT. This review will take into account the timely execution of Task Orders, the quality of the work performed, the cost to the CITY and the good faith efforts made by the CONSULTANT to maintain MBE/WBE participation in CITY projects. Any deficiencies in performance will be described in writing and an opportunity afforded, where practicable, for the CONSULTANT to address and/or remedy such deficiencies.

11.32 STATUTORY COMPLIANCE

CONSULTANT shall prepare all documents and other materials for the Project in accordance with all applicable rules, laws, ordinances and governmental regulations of the State of Florida, Broward County, the City of Fort Lauderdale, Florida and all governmental agencies having jurisdiction over the services to be provided by CONSULTANT under this Agreement or over any aspect or phase of the Project.

11.33 SCRUTINIZED COMPANIES

Subject to *Odebrecht Construction, Inc., v. Prasad*, 876 F.Supp.2d 1305 (S.D. Fla. 2012), *affirmed*, *Odebrecht Construction, Inc., v. Secretary, Florida Department of Transportation*, 715 F.3d 1268 (11th Cir. 2013), with regard to the "Cuba Amendment," the Contractor certifies that it is not on the Scrutinized Companies with Activities in Sudan List or the Scrutinized Companies with Activities in the Iran Petroleum Energy Sector List or the Scrutinized Companies that Boycott Israel List created pursuant to Section 215.4725, Florida Statutes (2016), that it is not engaged in a boycott of Israel, and that it does not have business operations in Cuba or Syria, as provided in section 287.135, Florida Statutes (2016), as may be amended or revised. The City may terminate this Agreement at the City's option if the Contractor is found to have submitted a false certification as provided under subsection (5) of section 287.135, Florida Statutes (2016), as may be amended or revised, or been placed on the Scrutinized Companies with Activities in Sudan List or the Scrutinized Companies with Activities in the Iran Petroleum Energy Sector List or the Scrutinized Companies that Boycott Israel List created pursuant to Section 215.4725, Florida Statutes (2016), or is engaged in a boycott of Israel or has been engaged in business operations in Cuba or Syria, as defined in Section 287.135, Florida Statutes (2016), as may be amended or revised.

11.34 PUBLIC RECORDS

IF THE CONTRACTOR HAS QUESTIONS REGARDING THE APPLICATION OF CHAPTER 119, FLORIDA STATUTES, TO THE CONTRACTOR'S DUTY TO PROVIDE PUBLIC RECORDS RELATING TO THIS CONTRACT, CONTACT THE CUSTODIAN OF PUBLIC RECORDS AT:

Telephone Number: **(954) 828-5002**
Mailing Address: **City Clerk's Office**
100 N. Andrews Avenue
Fort Lauderdale, FL 33301
E-mail: **prrcontract@fortlauderdale.gov**

Contractor shall:

1. Keep and maintain public records that ordinarily and necessarily would be required by the City in order to perform the service.

2. Upon request from the City's custodian of public records, provide the City with a copy of the requested records or allow the records to be inspected or copied within a reasonable time at a cost that does not exceed the cost provided in Chapter 119, Florida Statutes (2016), as may be amended or revised, or as otherwise provided by law.

3. Ensure that public records that are exempt or confidential and exempt from public records disclosure requirements are not disclosed except as authorized by law for the duration of the contract term and following completion of this contract if the Contractor does not transfer the records to the City.

4. Upon completion of the Contract, transfer, at no cost, to the City all public records in possession of the Contractor or keep and maintain public records required by the City to perform the service. If the Contractor transfers all public records to the City upon completion of this Contract, the Contractor shall destroy any duplicate public records that are exempt or confidential and exempt from public records disclosure requirements. If the Contractor keeps and maintains

public records upon completion of this Contract, the Contractor shall meet all applicable requirements for retaining public records. All records stored electronically must be provided to the City, upon request from the City's custodian of public records, in a format that is compatible with the information technology systems of the City.

REMAINDER OF THIS PAGE INTENTIONALLY LEFT BLANK]
[SIGNATURE PAGES FOLLOW]

IN WITNESS OF THE FOREGOING, the parties execute this Agreement as follows:.

CITY:

CITY OF FORT LAUDERDALE, a Florida municipality

By _____
LEE R. FELDMAN, City Manager

(CORPORATE SEAL)

ATTEST:

_____
JONDA K. JOSEPH
City Clerk

Approved as to form:

_____
RHONDA MONTOYA HASAN
Assistant City Attorney

CONSULTANT

WITNESSES:

_____

_____
(Witness print name)

_____

_____
(Witness print name)

_____

By_____

Name: _____

Title: _____

ATTEST:

By_____

(CORPORATE SEAL)

STATE OF _____:
COUNTY OF _____:

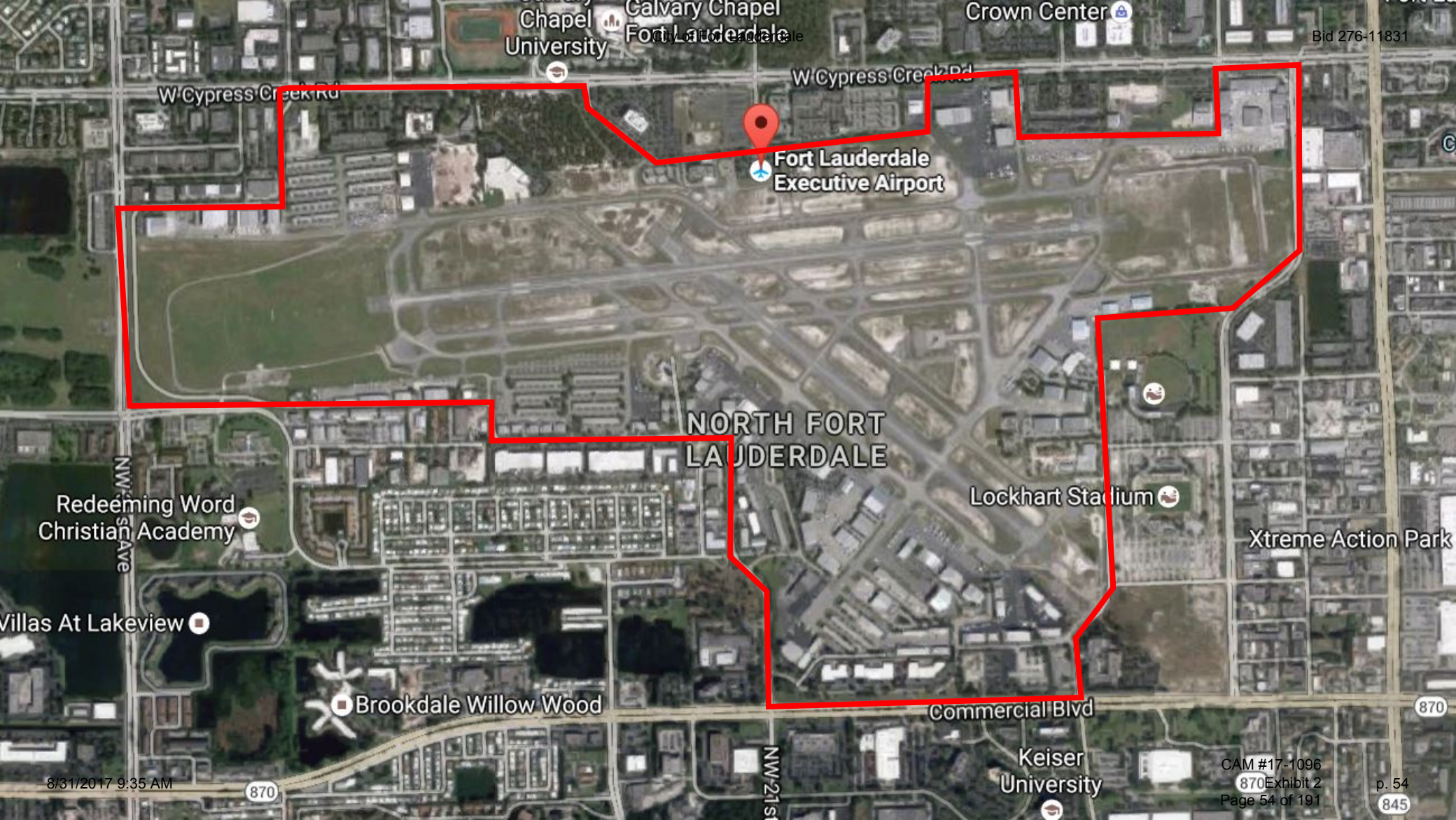
The foregoing instrument was acknowledged before me this ____ day of _____, 2014, by _____ as _____ for _____ a Florida corporation.

_____
(SEAL) Notary Public, State of Florida
(Signature of Notary Public)

_____
Name of Notary Typed, Printed or Stamped

Personally Known ____ OR Produced Identification_____

Type of Identification Produced _____


Calvary Chapel Fort Lauderdale
Crown Center
Bid 276-11831
W Cypress Creek Rd
Fort Lauderdale Executive Airport
NORTH FORT LAUDERDALE
Redeeming Word Christian Academy
Lockhart Stadium
Xtreme Action Park
Villas At Lakeview
Brookdale Willow Wood
Commercial Blvd
Keiser University
870
845

CITY OF FORT LAUDERDALE
GENERAL CONDITIONS

These instructions are standard for all contracts for commodities or services issued through the City of Fort Lauderdale Procurement Services Division. The City may delete, supersede, or modify any of these standard instructions for a particular contract by indicating such change in the Invitation to Bid (ITB) Special Conditions, Technical Specifications, Instructions, Proposal Pages, Addenda, and Legal Advertisement. In this general conditions document, Invitation to Bid (ITB), Request for Qualifications (RFQ), and Request for Proposal (RFP) are interchangeable.

PART I BIDDER PROPOSAL PAGE(S) CONDITIONS:

1.01 **BIDDER ADDRESS**: The City maintains automated vendor address lists that have been generated for each specific Commodity Class item through our bid issuing service, BidSync. Notices of Invitations to Bid (ITB'S) are sent by e-mail to the selection of bidders who have fully registered with BidSync or faxed (if applicable) to every vendor on those lists, who may then view the bid documents online. Bidders who have been informed of a bid's availability in any other manner are responsible for registering with BidSync in order to view the bid documents. There is no fee for doing so. If you wish bid notifications be provided to another e-mail address or fax, please contact BidSync. If you wish purchase orders sent to a different address, please so indicate in your bid response. If you wish payments sent to a different address, please so indicate on your invoice.

1.02 **DELIVERY:** Time will be of the essence for any orders placed as a result of this ITB. The City reserves the right to cancel any orders, or part thereof, without obligation if delivery is not made in accordance with the schedule specified by the Bidder and accepted by the City.

1.03 **PACKING SLIPS:** It will be the responsibility **of** the awarded Contractor, to attach all packing slips to the OUTSIDE of each shipment. Packing slips must provide a detailed description of what is to be received and reference the City of Fort Lauderdale purchase order number that is associated with the shipment. Failure to provide a detailed packing slip attached to the outside of shipment may result in refusal of shipment at Contractor's expense.

1.04 **PAYMENT TERMS AND CASH DISCOUNTS:** Payment terms, unless otherwise stated in this ITB, will be considered to be net 45 days after the date of satisfactory delivery at the place of acceptance and receipt of correct invoice at the office specified, whichever occurs last. Bidder may offer cash discounts for prompt payment but they will not be considered in determination of award. If a Bidder offers a discount, it is understood that the discount time will be computed from the date of satisfactory delivery, at the place of acceptance, and receipt of correct invoice, at the office specified, whichever occurs last**.**

1.05 **TOTAL BID DISCOUNT:** If Bidder offers a discount for award of all items listed in the bid, such discount shall be deducted from the total of the firm net unit prices bid and shall be considered in tabulation and award of bid**.**

1.06 **BIDS FIRM FOR ACCEPTANCE:** Bidder warrants, by virtue of bidding, that the bid and the prices quoted in the bid will be firm for acceptance by the City for a period of one hundred twenty (120) days from the date of bid opening unless otherwise stated in the ITB**.**

1.07 **VARIANCES:** For purposes of bid evaluation, Bidder's must indicate any variances, no matter how slight, from ITB General Conditions, Special Conditions, Specifications or Addenda in the space provided in the ITB. No variations or exceptions by a Bidder will be considered or deemed a part of the bid submitted unless such variances or exceptions are listed in the bid and referenced in the space provided on the bidder proposal pages. If variances are not stated, or referenced as required, it will be assumed that the product or service fully complies with the City's terms, conditions, and specifications**.**

By receiving a bid, City does not necessarily accept any variances contained in the bid. All variances submitted are subject to review and approval by the City. If any bid contains material variances that, in the City's sole opinion, make that bid conditional in nature, the City reserves the right to reject the bid or part of the bid that is declared, by the City as conditional.

1.08 **NO BIDS:** If you do not intend to bid please indicate the reason, such as insufficient time to respond, do not offer product or service, unable to meet specifications, schedule would not permit, or any other reason, in the space provided in this ITB. Failure to bid or return no bid comments prior to the bid due and opening date and time, indicated in this ITB, may result in your firm being deleted from our Bidder's registration list for the Commodity Class Item requested in this ITB.

1.09 **MINORITY AND WOMEN BUSINESS ENTERPRISE PARTICIPATION AND BUSINESS DEFINITIONS:** The City of Fort Lauderdale wants to increase the participation of Minority Business Enterprises (MBE), Women Business Enterprises (WBE), and Small Business Enterprises (SBE) in its procurement activities. If your firm qualifies in accordance with the below definitions please indicate in the space provided in this ITB.

Minority Business Enterprise (MBE) "A Minority Business" is a business enterprise that is owned or controlled by one or more socially or economically disadvantaged persons. Such disadvantage may arise from cultural, racial, chronic economic circumstances or background or other similar cause. Such persons include, but are not limited to: Blacks, Hispanics, Asian Americans, and Native Americans.

The term "Minority Business Enterprise" means a business at least 51 percent of which is owned by minority group members or, in the case of a publicly owned business, at least 51 percent of the stock of which is owned by minority group members. For the purpose of the preceding sentence, minority group members are citizens of the United States who include, but are not limited to: Blacks, Hispanics, Asian Americans, and Native Americans.

Women Business Enterprise (WBE) a "Women Owned or Controlled Business" is a business enterprise at least 51 percent of which is owned by females or, in the case of a publicly owned business, at least 51 percent of the stock of which is owned by females.

Small Business Enterprise (SBE) "Small Business" means a corporation, partnership, sole proprietorship, or other legal entity formed for the purpose of making a profit, which is independently owned and operated, has either fewer than 100 employees or less than $1,000,000 in annual gross receipts.

BLACK, which includes persons having origins in any of the Black racial groups of Africa.
WHITE, which includes persons whose origins are Anglo-Saxon and Europeans and persons of Indo-European decent including Pakistani and East Indian.
HISPANIC, which includes persons of Mexican, Puerto Rican, Cuban, Central and South American, or other Spanish culture or origin, regardless of race.
NATIVE AMERICAN, which includes persons whose origins are American Indians, Eskimos, Aleuts, or Native Hawaiians.
ASIAN AMERICAN, which includes persons having origin in any of the original peoples of the Far East, Southeast Asia, the Indian subcontinent, or the Pacific Islands.

1.10 MINORITY-WOMEN BUSINESS ENTERPRISE PARTICIPATION

It is the desire of the City of Fort Lauderdale to increase the participation of minority (MBE) and women-owned (WBE) businesses in its contracting and procurement programs. While the City does not have any preference or set aside programs in place, it is committed to a policy of equitable participation for these firms. Proposers are requested to include in their proposals a narrative describing their past accomplishments and intended actions in this area. If proposers are considering minority or women owned enterprise participation in their proposal, those firms, and their specific duties have to be identified in the proposal. If a proposer is considered for award, he or she will be asked to meet with City staff so that the intended MBE/WBE participation can be formalized and included in the subsequent contract.

1.11 SCRUTINIZED COMPANIES

Subject to *Odebrecht Construction, Inc., v. Prasad*, 876 F.Supp.2d 1305 (S.D. Fla. 2012), *affirmed*, *Odebrecht Construction, Inc., v. Secretary, Florida Department of Transportation*, 715 F.3d 1268 (11th Cir. 2013), with regard to the "Cuba Amendment," the Contractor certifies that it is not on the Scrutinized Companies with Activities in Sudan List or the Scrutinized Companies with Activities in the Iran Petroleum Energy Sector List or the Scrutinized Companies that Boycott Israel List created pursuant to Section 215.4725, Florida Statutes (2016), that it is not engaged in a boycott of Israel, and that it does not have business operations in Cuba or Syria, as provided in section 287.135, Florida Statutes (2016), as may be amended or revised. The City may terminate this Agreement at the City's option if the Contractor is found to have submitted a false certification as provided under subsection (5) of section 287.135, Florida Statutes (2016), as may be amended or revised, or been placed on the Scrutinized Companies with Activities in Sudan List or the Scrutinized Companies with Activities in the Iran Petroleum Energy Sector List or the Scrutinized Companies that Boycott Israel List created pursuant to Section 215.4725, Florida Statutes (2016), or is engaged in a boycott of Israel or has been engaged in business operations in Cuba or Syria, as defined in Section 287.135, Florida Statutes (2016), as may be amended or revised.

1.12 DEBARRED OR SUSPENDED BIDDERS OR PROPOSERS

The bidder or proposer certifies, by submission of a response to this solicitation, that neither it nor its principals and subcontractors are presently debarred or suspended by any Federal department or agency.

Part II DEFINITIONS/ORDER OF PRECEDENCE:

2.01 BIDDING DEFINITIONS The City will use the following definitions in its general conditions, special conditions, technical specifications, instructions to bidders, addenda and any other document used in the bidding process:
INVITATION TO BID (ITB) when the City is requesting bids from qualified Bidders.
REQUEST FOR PROPOSALS (RFP) when the City is requesting proposals from qualified Proposers.
REQUEST FOR QUALIFICATIONS (RFQ) when the City is requesting qualifications from qualified Proposers.
BID – a price and terms quote received in response to an ITB.
PROPOSAL – a proposal received in response to an RFP.
BIDDER – Person or firm submitting a Bid.
PROPOSER – Person or firm submitting a Proposal.
RESPONSIVE BIDDER – A person whose bid conforms in all material respects to the terms and conditions included in the ITB.
RESPONSIBLE BIDDER – A person who has the capability in all respects to perform in full the contract requirements, as stated in the ITB, and the integrity and reliability that will assure good faith performance.
FIRST RANKED PROPOSER – That Proposer, responding to a City RFP, whose Proposal is deemed by the City, the most advantageous to the City after applying the evaluation criteria contained in the RFP.
SELLER – Successful Bidder or Proposer who is awarded a Purchase Order or Contract to provide goods or services to the City.
CONTRACTOR – Successful Bidder or Proposer who is awarded a Purchase Order, award Contract, Blanket Purchase Order agreement, or Term Contract to provide goods or services to the City.
CONTRACT – A deliberate verbal or written agreement between two or more competent parties to perform or not to perform a certain act or acts, including all types of agreements, regardless of what they may be called, for the procurement or disposal of equipment, materials, supplies, services or construction.
CONSULTANT – Successful Bidder or Proposer who is awarded a contract to provide professional services to the City.
The following terms may be used interchangeably by the City: ITB and/or RFP; Bid or Proposal; Bidder, Proposer, or Seller; Contractor or Consultant; Contract, Award, Agreement or Purchase Order**.**

2.02 SPECIAL CONDITIONS: Any and all Special Conditions contained in this ITB that may be in variance or conflict with these General Conditions shall have precedence over these General Conditions. If no changes or deletions to General Conditions are made in the Special Conditions, then the General Conditions shall prevail in their entirety,

PART III BIDDING AND AWARD PROCEDURES:

3.01 SUBMISSION AND RECEIPT OF BIDS: To receive consideration, bids must be received prior to the bid opening date and time. Unless otherwise specified, Bidders should use the proposal forms provided by the City. These forms may be duplicated, but failure to use the forms may cause the bid to be rejected. Any erasures or corrections on the bid must be made in ink and initialed by Bidder in ink. All information submitted by the Bidder shall be printed, typewritten or filled in with pen and ink. Bids shall be signed in ink. Separate bids must be submitted for each ITB issued by the City in separate sealed envelopes properly marked. When a particular ITB or RFP requires multiple copies of bids or proposals they may be included in a single envelope or package properly sealed and identified. Only send bids via facsimile transmission (FAX) if the ITB specifically states that bids sent via FAX will be considered. If such a statement is not included in the ITB, bids sent via FAX will be rejected. Bids will be publicly opened in the Procurement Office, or other designated area, in the

presence of Bidders, the public, and City staff. Bidders and the public are invited and encouraged to attend bid openings. Bids will be tabulated and made available for review by Bidder's and the public in accordance with applicable regulations.

3.02 **MODEL NUMBER CORRECTIONS:** If the model number for the make specified in this ITB is incorrect, or no longer available and replaced with an updated model with new specifications, the Bidder shall enter the correct model number on the bidder proposal page. In the case of an updated model with new specifications, Bidder shall provide adequate information to allow the City to determine if the model bid meets the City's requirements.

3.03 **PRICES QUOTED:** Deduct trade discounts, and quote firm net prices. Give both unit price and extended total. In the case of a discrepancy in computing the amount of the bid, the unit price quoted will govern. All prices quoted shall be F.O.B. destination, freight prepaid (Bidder pays and bears freight charges, Bidder owns goods in transit and files any claims), unless otherwise stated in Special Conditions. Each item must be bid separately. No attempt shall be made to tie any item or items contained in the ITB with any other business with the City.

3.04 **TAXES:** The City of Fort Lauderdale is exempt from Federal Excise and Florida Sales taxes on direct purchase of tangible property. Exemption **number for EIN is 59-6000319, and State Sales tax exemption number is 85-8013875578C-1.**

3.05 **WARRANTIES OF USAGE:** Any quantities listed in this ITB as estimated or projected are provided for tabulation and information purposes only. No warranty or guarantee of quantities is given or implied. It is understood that the Contractor will furnish the City's needs as they arise.

3.06 **APPROVED EQUAL:** When the technical specifications call for a brand name, manufacturer, make, model, or vendor catalog number with acceptance of APPROVED EQUAL, it shall be for the purpose of establishing a level of quality and features desired and acceptable to the City. In such cases, the City will be receptive to any unit that would be considered by qualified City personnel as an approved equal. In that the specified make and model represent a level of quality and features desired by the City, the Bidder must state clearly in the bid any variance from those specifications. It is the Bidder's responsibility to provide adequate information, in the bid, to enable the City to ensure that the bid meets the required criteria. If adequate information is not submitted with the bid, it may be rejected. The City will be the sole judge in determining if the item bid qualifies as an approved equal.

3.07 **MINIMUM AND MANDATORY TECHNICAL SPECIFICATIONS:** The technical specifications may include items that are considered minimum, mandatory, or required. If any Bidder is unable to meet or exceed these items, and feels that the technical specifications are overly restrictive, the bidder must notify the Procurement Services Division immediately. Such notification must be received by the Procurement Services Division prior to the deadline contained in the ITB, for questions of a material nature, or prior to five (5) days before bid due and open date, whichever occurs first. If no such notification is received prior to that deadline, the City will consider the technical specifications to be acceptable to all bidders.

3.08 **MISTAKES:** Bidders are cautioned to examine all terms, conditions, specifications, drawings, exhibits, addenda, delivery instructions and special conditions pertaining to the ITB. Failure of the Bidder to examine all pertinent documents shall not entitle the bidder to any relief from the conditions imposed in the contract.

3.09 **SAMPLES AND DEMONSTRATIONS:** Samples or inspection of product may be requested to determine suitability. Unless otherwise specified in Special Conditions, samples shall be requested after the date of bid opening, and if requested should be received by the City within seven (7) working days of request. Samples, when requested, must be furnished free of expense to the City and if not used in testing or destroyed, will upon request of the Bidder, be returned within thirty (30) days of bid award at Bidder's expense. When required, the City may request full demonstrations of units prior to award. When such demonstrations are requested, the Bidder shall respond promptly and arrange a demonstration at a convenient location. Failure to provide samples or demonstrations as specified by the City may result in rejection of a bid.

3.10 **LIFE CYCLE COSTING**: If so specified in the ITB, the City may elect to evaluate equipment proposed on the basis of total cost of ownership. In using Life Cycle Costing, factors such as the following may be considered: estimated useful life, maintenance costs, cost of supplies, labor intensity, energy usage, environmental impact, and residual value. The City reserves the right to use those or other applicable criteria, in its sole opinion that will most accurately estimate total cost of use and ownership.

3.11 **BIDDING ITEMS WITH RECYCLED CONTENT:** In addressing environmental concerns, the City of Fort Lauderdale encourages Bidders to submit bids or alternate bids containing items with recycled content. When submitting bids containing items with recycled content, Bidder shall provide documentation adequate for the City to verify the recycled content. The City prefers packaging consisting of materials that are degradable or able to be recycled. When specifically stated in the ITB, the City may give preference to bids containing items manufactured with recycled material or packaging that is able to be recycled.

3.12 **USE OF OTHER GOVERNMENTAL CONTRACTS:** The City reserves the right to reject any part or all of any bids received and utilize other available governmental contracts, if such action is in its best interest**.**

3.13 **QUALIFICATIONS/INSPECTION:** Bids will only be considered from firms normally engaged in providing the types of commodities/services specified herein. The City reserves the right to inspect the Bidder's facilities, equipment, personnel, and organization at any time, or to take any other action necessary to determine Bidder's ability to perform. The Procurement Director reserves the right to reject bids where evidence or evaluation is determined to indicate inability to perform**.**

3.14 **BID SURETY:** If Special Conditions require a bid security, it shall be submitted in the amount stated. A bid security can be in the form of a bid bond or cashier's check. Bid security will be returned to the unsuccessful bidders as soon as practicable after opening of bids. Bid security will be returned to the successful bidder after acceptance of the performance bond, if required; acceptance of insurance coverage, if required; and full execution of contract documents, if required; or conditions as stated in Special Conditions**.**

3.15 **PUBLIC RECORDS/TRADE SECRETS/COPYRIGHT:** The Proposer's response to the RFP is a public record pursuant to Florida law, which is subject to disclosure by the City under the State of Florida Public Records Law, Florida Statutes Chapter 119.07 ("Public Records Law"). The City shall permit public access to all documents, papers, letters or other material submitted in connection with this RFP and the Contract to be executed for this RFP, subject to the provisions of Chapter 119.07 of the Florida Statutes.

Any language contained in the Proposer's response to the RFP purporting to require confidentiality of any portion of the Proposer's response to the RFP, except to the extent that certain information is in the City's opinion a Trade Secret pursuant to Florida law, shall be void. If a Proposer submits any documents or other information to the City which the Proposer claims is Trade Secret information and exempt from Florida Statutes Chapter 119.07 ("Public Records Laws"), the Proposer shall clearly designate that it is a Trade Secret and that it is asserting that the document or information is exempt. The Proposer must specifically identify the exemption being claimed under Florida Statutes 119.07. The City shall be the final arbiter of whether any information contained in the Proposer's response to the RFP constitutes a Trade Secret. The city's determination of whether an exemption applies shall be final, and the proposer agrees to defend, indemnify, and hold harmless the city and the city's officers, employees, and agent, against any loss or damages incurred by any person or entity as a result of the city's treatment of records as public records. Proposals purporting to be subject to copyright protection in full or in part will be rejected.

EXCEPT FOR CLEARLY MARKED PORTIONS THAT ARE BONA FIDE TRADE SECRETS PURSUANT TO FLORIDA LAW, DO NOT MARK YOUR RESPONSE TO THE RFP AS PROPRIETARY OR CONFIDENTIAL. DO NOT MARK YOUR RESPONSE TO THE RFP OR ANY PART THEREOF AS COPYRIGHTED.

3.16 **PROHIBITION OF INTEREST:** No contract will be awarded to a bidding firm who has City elected officials, officers or employees affiliated with it, unless the bidding firm has fully complied with current Florida State Statutes and City Ordinances relating to this issue. Bidders must disclose any such affiliation. Failure to disclose any such affiliation will result in disqualification of the Bidder and removal of the Bidder from the City's bidder lists and prohibition from engaging in any business with the City**.**

3.17 **RESERVATIONS FOR AWARD AND REJECTION OF BIDS:** The City reserves the right to accept or reject any or all bids, part of bids, and to waive minor irregularities or variations to specifications contained in bids, and minor irregularities in the bidding process. The City also reserves the right to award the contract on a split order basis, lump sum basis, individual item basis, or such combination as shall best serve the interest of the City. The City reserves the right to make an award to the responsive and responsible bidder whose product or service meets the terms, conditions, and specifications of the ITB and whose bid is considered to best serve the City's interest. In determining the responsiveness of the offer and the responsibility of the Bidder, the following shall be considered when applicable: the ability, capacity and skill of the Bidder to perform as required; whether the Bidder can perform promptly, or within the time specified, without delay or interference; the character, integrity, reputation, judgment, experience and efficiency of the Bidder; the quality of past performance by the Bidder; the previous and existing compliance by the Bidder with related laws and ordinances; the sufficiency of the Bidder's financial resources; the availability, quality and adaptability of the Bidder's supplies or services to the required use; the ability of the Bidder to provide future maintenance, service or parts; the number and scope of conditions attached to the bid**.**

If the ITB provides for a contract trial period, the City reserves the right, in the event the selected bidder does not perform satisfactorily, to award a trial period to the next ranked bidder or to award a contract to the next ranked bidder, if that bidder has successfully provided services to the City in the past. This procedure to continue until a bidder is selected or the contract is re-bid, at the sole option of the City.

3.18 **LEGAL REQUIREMENTS:** Applicable provisions of all federal, state, county laws, and local ordinances, rules and regulations, shall govern development, submittal and evaluation of all bids received in response hereto and shall govern any and all claims and disputes which may arise between person(s) submitting a bid response hereto and the City by and through its officers, employees and authorized representatives, or any other person, natural or otherwise; and lack of knowledge by any bidder shall not constitute a cognizable defense against the legal effect thereof**.**

3.19 **BID PROTEST PROCEDURE: ANY PROPOSER OR BIDDER WHO IS NOT RECOMMENDED FOR AWARD OF A CONTRACT AND WHO ALLEGES A FAILURE BY THE CITY TO FOLLOW THE CITY'S PROCUREMENT ORDINANCE OR ANY APPLICABLE LAW MAY PROTEST TO THE DIRECTOR OF PROCUREMENT SERVICES DIVISION (DIRECTOR), BY DELIVERING A LETTER OF PROTEST TO THE DIRECTOR WITHIN FIVE (5) DAYS AFTER A NOTICE OF INTENT TO AWARD IS POSTED ON THE CITY'S WEB SITE AT THE FOLLOWING LINK: http://www.fortlauderdale.gov/purchasing/notices_of_intent.htm**

THE COMPLETE PROTEST ORDINANCE MAY BE FOUND ON THE CITY'S WEB SITE AT THE FOLLOWING LINK: http://www.fortlauderdale.gov/purchasing/protestordinance.pdf

PART IV BONDS AND INSURANCE

4.01 **PERFORMANCE BOND:** If a performance bond is required in Special Conditions, the Contractor shall within fifteen (15) working days after notification of award, furnish to the City a Performance Bond, payable to the City of Fort Lauderdale, Florida, in the face amount specified in Special Conditions as surety for faithful performance under the terms and conditions of the contract. If the bond is on an annual coverage basis, renewal for each succeeding year shall be submitted to the City thirty (30) days prior to the termination date of the existing Performance Bond. The Performance Bond must be executed by a surety company of recognized standing, authorized to do business in the State of Florida and having a resident agent.

Acknowledgement and agreement is given by both parties that the amount herein set for the Performance Bond is not intended to be nor shall be deemed to be in the nature of liquidated damages nor is it intended to limit the liability of the Contractor to the City in the event of a material breach of this Agreement by the Contractor**.**

4.02 **INSURANCE:** If the Contractor is required to go on to City property to perform work or services as a result of ITB award, the Contractor shall assume full responsibility and expense to obtain all necessary insurance as required by City or specified in Special Conditions**.**

The Contractor shall provide to the Procurement Services Division original certificates of coverage and receive notification of approval of those certificates by the City's Risk Manager prior to engaging in any activities under this contract. The Contractors insurance is subject to the approval of the City's Risk Manager. The certificates must list the City as an ADDITIONAL INSURED for General Liability Insurance, and shall have no less than thirty (30) days written notice of cancellation or material change. Further modification of the insurance requirements may be made at the sole discretion of the City's Risk Manager if circumstances change or adequate protection of the City is not presented. Bidder, by submitting the bid, agrees to abide by such modifications**.**

PART V PURCHASE ORDER AND CONTRACT TERMS:

5.01 COMPLIANCE TO SPECIFICATIONS, LATE DELIVERIES/PENALTIES: Items offered may be tested for compliance to bid specifications. Items delivered which do not conform to bid specifications may be rejected and returned at Contractor's expense. Any violation resulting in contract termination for cause or delivery of items not conforming to specifications, or late delivery may also result in:

- Bidders name being removed from the City's bidder's mailing list for a specified period and Bidder will not be recommended for any award during that period.
- All City Departments being advised to refrain from doing business with the Bidder.
- All other remedies in law or equity.

5.02 ACCEPTANCE, CONDITION, AND PACKAGING: The material delivered in response to ITB award shall remain the property of the Seller until a physical inspection is made and the material accepted to the satisfaction of the City. The material must comply fully with the terms of the ITB, be of the required quality, new, and the latest model. All containers shall be suitable for storage and shipment by common carrier, and all prices shall include standard commercial packaging. The City will not accept substitutes of any kind. Any substitutes or material not meeting specifications will be returned at the Bidder's expense. Payment will be made only after City receipt and acceptance of materials or services.

5.03 SAFETY STANDARDS: All manufactured items and fabricated assemblies shall comply with applicable requirements of the Occupation Safety and Health Act of 1970 as amended, and be in compliance with Chapter 442, Florida Statutes. Any toxic substance listed in Section 38F-41.03 of the Florida Administrative Code delivered as a result of this order must be accompanied by a completed Safety Data Sheet (SDS).

5.04 ASBESTOS STATEMENT: All material supplied must be 100% asbestos free. Bidder, by virtue of bidding, certifies that if awarded any portion of the ITB the bidder will supply only material or equipment that is 100% asbestos free.

5.05 OTHER GOVERNMENTAL ENTITIES: If the Bidder is awarded a contract as a result of this ITB, the bidder may, if the bidder has sufficient capacity or quantities available, provide to other governmental agencies, so requesting, the products or services awarded in accordance with the terms and conditions of the ITB and resulting contract. Prices shall be F.O.B. delivered to the requesting agency.

5.06 VERBAL INSTRUCTIONS PROCEDURE: No negotiations, decisions, or actions shall be initiated or executed by the Contractor as a result of any discussions with any City employee. Only those communications which are in writing from an authorized City representative may be considered. Only written communications from Contractors, which are assigned by a person designated as authorized to bind the Contractor, will be recognized by the City as duly authorized expressions on behalf of Contractors.

5.07 INDEPENDENT CONTRACTOR: The Contractor is an independent contractor under this Agreement. Personal services provided by the Proposer shall be by employees of the Contractor and subject to supervision by the Contractor, and not as officers, employees, or agents of the City. Personnel policies, tax responsibilities, social security, health insurance, employee benefits, procurement policies unless otherwise stated in this ITB, and other similar administrative procedures applicable to services rendered under this contract shall be those of the Contractor.

5.08 INDEMNITY/HOLD HARMLESS AGREEMENT: The Contractor agrees to protect, defend, indemnify, and hold harmless the City of Fort Lauderdale and its officers, employees and agents from and against any and all losses, penalties, damages, settlements, claims, costs, charges for other expenses, or liabilities of every and any kind including attorney's fees, in connection with or arising directly or indirectly out of the work agreed to or performed by Contractor under the terms of any agreement that may arise due to the bidding process. Without limiting the foregoing, any and all such claims, suits, or other actions relating to personal injury, death, damage to property, defects in materials or workmanship, actual or alleged violations of any applicable Statute, ordinance, administrative order, rule or regulation, or decree of any court shall be included in the indemnity hereunder.

5.09 TERMINATION FOR CAUSE: If, through any cause, the Contractor shall fail to fulfill in a timely and proper manner its obligations under this Agreement, or if the Contractor shall violate any of the provisions of this Agreement, the City may upon written notice to the Contractor terminate the right of the Contractor to proceed under this Agreement, or with such part or parts of the Agreement as to which there has been default, and may hold the Contractor liable for any damages caused to the City by reason of such default and termination. In the event of such termination, any completed services performed by the Contractor under this Agreement shall, at the option of the City, become the City's property and the Contractor shall be entitled to receive equitable compensation for any work completed to the satisfaction of the City. The Contractor, however, shall not be relieved of liability to the City for damages sustained by the City by reason of any breach of the Agreement by the Contractor, and the City may withhold any payments to the Contractor for the purpose of setoff until such time as the amount of damages due to the City from the Contractor can be determined.

5.10 TERMINATION FOR CONVENIENCE: The City reserves the right, in its best interest as determined by the City, to cancel contract by giving written notice to the Contractor thirty (30) days prior to the effective date of such cancellation.

5.11 CANCELLATION FOR UNAPPROPRIATED FUNDS: The obligation of the City for payment to a Contractor is limited to the availability of funds appropriated in a current fiscal period, and continuation of the contract into a subsequent fiscal period is subject to appropriation of funds, unless otherwise authorized by law.

5.12 RECORDS/AUDIT: The Contractor shall maintain during the term of the contract all books of account, reports and records in accordance with generally accepted accounting practices and standards for records directly related to this contract. The Contractor agrees to make available to the City Auditor or designee, during normal business hours and in Broward, Miami-Dade or Palm Beach Counties, all books of account, reports and records relating to this contract should be retained for the duration of the contract and for three years after the final payment under this Agreement, or until all pending audits, investigations or litigation matters relating to the contract are closed, whichever is later.

5.13 PERMITS, TAXES, LICENSES: The successful Contractor shall, at their own expense, obtain all necessary permits, pay all licenses, fees and taxes, required to comply with all local ordinances, state and federal laws, rules and regulations applicable to business to be carried out under this contract.

5.14 LAWS/ORDINANCES: The Contractor shall observe and comply with all Federal, state, local and municipal laws, ordinances rules and regulations that would apply to this contract.

5.15 NON-DISCRIMINATION: There shall be no discrimination as to race, sex, color, creed, age or national origin in the operations conducted under this contract.

5.16 UNUSUAL CIRCUMSTANCES: If during a contract term where costs to the City are to remain firm or adjustments are restricted by a percentage or CPI cap, unusual circumstances that could not have been foreseen by either party of the contract occur, and those circumstances significantly affect the Contractor's cost in providing the required prior items or services, then the Contractor may request adjustments to the costs to the City to reflect the changed circumstances. The circumstances must be beyond the control of the Contractor, and the requested adjustments must be fully documented. The City may, after examination, refuse to accept the adjusted costs if they are not properly documented, increases are considered to be excessive, or decreases are considered to be insufficient. In the event the City does not wish to accept the adjusted costs and the matter cannot be resolved to the satisfaction of the City, the City will reserve the following options:

1. The contract can be canceled by the City upon giving thirty (30) days written notice to the Contractor with no penalty to the City or Contractor. The Contractor shall fill all City requirements submitted to the Contractor until the termination date contained in the notice.

2. The City requires the Contractor to continue to provide the items and services at the firm fixed (non-adjusted) cost until the termination of the contract term then in effect.

3. If the City, in its interest and in its sole opinion, determines that the Contractor in a capricious manner attempted to use this section of the contract to relieve them of a legitimate obligation under the contract, and no unusual circumstances had occurred, the City reserves the right to take any and all action under law or equity. Such action shall include, but not be limited to, declaring the Contractor in default and disqualifying him for receiving any business from the City for a stated period of time.

If the City does agree to adjusted costs, these adjusted costs shall not be invoiced to the City until the Contractor receives notice in writing signed by a person authorized to bind the City in such matters.

5.17 ELIGIBILITY: If applicable, the Contractor must first register with the Department of State of the State of Florida, in accordance with Florida State Statutes, prior to entering into a contract with the City.

5.18 PATENTS AND ROYALTIES: The Contractor, without exception, shall indemnify and save harmless the City and its employees from liability of any nature and kind, including cost and expenses for or on account of any copyrighted, patented or un-patented invention, process, or article manufactured or used in the performance of the contract, including its use by the City. If the Contractor uses any design, device, or materials covered by letters, patent or copyright, it is mutually agreed and understood without exception that the bid prices shall include all royalties or costs arising from the use of such design, device, or materials in any way involved in the work.

5.19 ASSIGNMENT: Contractor shall not transfer or assign the performance required by this ITB without the prior written consent of the City. Any award issued pursuant to this ITB, and the monies, which may become due hereunder, are not assignable except with the prior written approval of the City Commission or the City Manager or City Manager's designee, depending on original award approval.

5.20 LITIGATION VENUE: The parties waive the privilege of venue and agree that all litigation between them in the state courts shall take place in Broward County, Florida and that all litigation between them in the federal courts shall take place in the Southern District in and for the State of Florida.

5.21 LOCATION OF UNDERGROUND FACILITIES: If the Contractor, for the purpose of responding to this solicitation, requests the location of underground facilities through the Sunshine State One-Call of Florida, Inc. notification system or through any person or entity providing a facility locating service, and underground facilities are marked with paint, stakes or other markings within the City pursuant to such a request, then the Contractor, shall be deemed non-responsive to this solicitation in accordance with Section 2-184(5) of the City of Fort Lauderdale Code of Ordinances.

5.22 PUBLIC RECORDS

IF THE CONTRACTOR HAS QUESTIONS REGARDING THE APPLICATION OF CHAPTER 119, FLORIDA STATUTES, TO THE CONTRACTOR'S DUTY TO PROVIDE PUBLIC RECORDS RELATING TO THIS CONTRACT. CONTACT THE CUSTODIAN OF PUBLIC RECORDS AT: (954-828-5002, PRRCONTRACT@FORTLAUDERDALE.GOV, CITY CLERK'S OFFICE, 100 NORTH ANDREWS AVENUE, FORT LAUDERDALE, FLORIDA 33301)

Contractor shall:

1. Keep and maintain public records that ordinarily and necessarily would be required by the City in order to perform the service.

2. Upon request from the City's custodian of public records, provide the City with a copy of the requested records or allow the records to be inspected or copied within a reasonable time at a cost that does not exceed the cost provided in Chapter 119, Florida Statutes (2016), as may be amended or revised, or as otherwise provided by law.

3. Ensure that public records that are exempt or confidential and exempt from public records disclosure requirements are not disclosed except as authorized by law for the duration of the contract term and following completion of this contract if the Contractor does not transfer the records to the City.

4. Upon completion of the Contract, transfer, at no cost, to the City all public records in possession of the Contractor or keep and maintain public records required by the City to perform the service. If the Contractor transfers all public records to the City upon completion of this Contract, the Contractor shall destroy any duplicate public records that are exempt or confidential and exempt from public records disclosure requirements. If the Contractor keeps and maintains public records upon completion of this Contract, the Contractor shall meet all applicable requirements for retaining public records. All records stored electronically must be provided to the City, upon request from the City's custodian of public records, in a format that is compatible with the information technology systems of the City.

FINAL REPORT

Fort Lauderdale Executive Airport
Master Drainage Plan and Study

City of Fort Lauderdale

June 2012

CDM Smith

Contents

Appendices

Tables

Figures

Section 1 Introduction

1.1 Background

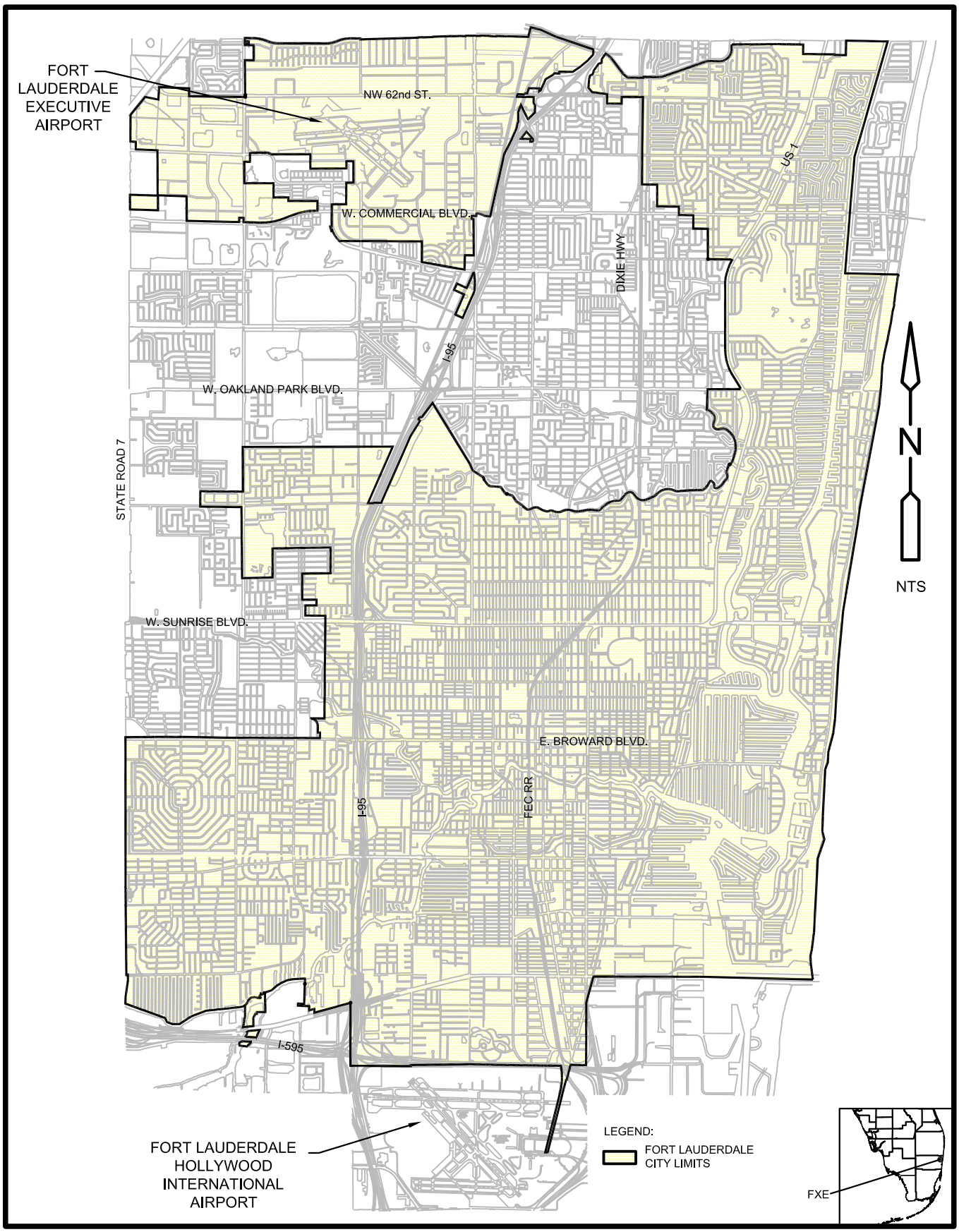
The Fort Lauderdale Executive Airport (FXE) is a general aviation airport owned and operated by the City of Fort Lauderdale (City), and is located within the northwest corporate limits of the city of Fort Lauderdale, Broward County, Florida. The approximately 900-acre site (Airport) provides fueling, maintenance, and avionics services to the general aviation community. In addition to these facilities FXE features a 200-acre Industrial Park (Airpark) providing office, warehouse, and manufacturing space. Please refer to **Figure 1-1** for the project site location and these facilities.

In February 2011, the City authorized the preparation of a Master Drainage Plan and Study for the FXE facilities. The most recent Master Drainage Plan and Study for the facilities was completed in 1999. As there have been a number of modifications made to the Airport and Airpark since the completion of that study, it was the City's desire to update this document to assess the current state of stormwater management system performance and use that understanding as a guide for the planning and design of future facility improvements.

1.2 Purposes and Goals

On February 24, 2010, the City advertised Request for Qualifications #606-10451 (RFQ), which specified required engineering services to develop a Master Drainage Plan and Study. Outlined in the RFQ scope of services were five primary service requirements for the project. The City's intentions as listed in the RFQ were:

- Assess the Airport's entire stormwater system performance and evaluate its capabilities to fulfill its long-term drainage needs. Identify, catalog and categorize existing airport wide stormwater problems. Drainage criteria for the airfield shall be based on the Federal Aviation Administration (FAA) Advisory Circular 150 (AC-150) recommendations, specifically for the 5-year storm. Offsite discharges shall be governed by the South Florida Water Management District (SFWMD).
- Develop planning level improvement recommendations and cost estimates for existing stormwater problems. Address funding methods for the improvements based on existing or proposed funding resources.
- Review the current status of the Airport's stormwater-related funding mechanisms, policies and procedures. Review current ordinances and expenditures for capital improvements (including design, project management, and construction of improvements), maintenance and operations. Make recommendations on ordinances, project delivery strategies (including funding mechanisms, policies and procedures), maintenance and operations. Prepare a plan for scheduling, budgeting and funding a long-term implementation plan for the recommendations.



CDM Smith

Figure 1-1
Site Location

- Review existing and proposed stormwater regulatory issues that may affect the Airport and Airpark stormwater program, particularly as they relate to the City of Fort Lauderdale Municipal Separate Storm Sewer System National Pollution Discharge Elimination System (MS4 NPDES) Permit. This will include an analysis of the Airport and Airpark current Land Development Regulations to determine where changes can be made to reduce the stormwater impact of new development. Make recommendations, including funding resources to address the regulatory requirements.

- Provide recommendations to increase use and quality of stormwater captured and used for the supply and enhancement of the municipal water supply system.

The Master Drainage Plan and Study is intended to be a guide for improving the Airport and Airpark storm drainage system performance and meeting regulatory compliance through the year 2026, based on the *Strategic Business Plan & Master Plan Update* prepared by Kimley-Horn and Associates in 2009. This report will provide a preliminary schedule of prioritized capital improvements necessary to allow the City's stormwater systems to meet the increasing performance and regulatory demands and modernize existing systems while maintaining the high level of service expected in a modern general aviation and urban environment.

1.3 Organization

The primary purpose of any master plan is to take a comprehensive look at existing conditions, forecast changes, and propose improvements. The master plan process is a systemic approach to planning facilities and programs. It proceeds from data collection and evaluation of the physical, legal, and regulatory environments to conceptualization and modeling of the general stormwater flow and water quality characteristics of the system. These general characteristics can be further evaluated to better define problem areas and identify technical solutions to improve flood control and water quality. Following the adoption of a master plan, a capital improvements program should be established or ordinances and management programs should be implemented. That is why it is critical to include cost estimates of the proposed facilities to determine what can be accomplished within the resources available and prioritize those projects.

The Master Drainage Plan and Study is organized as follows:

- Regulations, Policies, and Procedures – Presenting an overview of the regulatory history and requirements of the stormwater pollution control program at the federal and state levels, and entailing a review of stormwater standards and criteria of the FAA, United States Environmental Protection Agency (EPA), SFWMD, and Broward County to determine the impact on FXE stormwater facility planning. A review and assessment is provided regarding the ordinances and regulations relative to land development regulations for consistency with storm water quantity (flood) and water quality control within these facilities, as well as relative to the control of stormwater pollutant discharges from the Airport and Airpark and to confirm that the City has adequate authority to control discharges.

- Data Collection and Evaluation – Entailing an overview of the data obtained for subsequent use in the modeling and conversion and modification details for hydrologic units and topography; rainfall and design storms; stage, discharge and monitoring data; soils data; land use and impervious areas; overland flow data; stage-area-storage data; boundary conditions; cross section data; conduit and control structure data; water quality data; and previous reports and studies.

- Stormwater System Modeling – Entailing the development of an EPA Stormwater Management Model (SWMM) version 5 to evaluate the Airport and Airpark Primary Stormwater Management System (PSMS) for the 5-year, 24-hour; 25-year, 72-hour; and 100-year, 72-hour storms using aerial photography and eyewitness accounts for verification to identify serious Airport flooding problem areas.

- Alternatives Evaluation, Costs and Recommendations – Entailing the definition of three alternatives, including cost estimates, to provide the Airport a desired Level of Service (LOS) for the PSMS and serious problem areas. These will be based on implementation constraints for both structural and non-structural alternatives, including present condition retrofits and/or modifications and future growth planning. This will focus on FAA AC 150-5320-5C requirements for siting stormwater facilities as well as the applicable SFWMD and Broward County regulations (erosion and sedimentation control and run-off treatment) for stormwater management. The ability to implement integrated water quality improvements with these water quantity management alternatives will also be considered.

Section 2 Regulations, Policies, and Procedures

It is necessary to review the applicable regulations for the Airport's stormwater management system to guide and support the Master Drainage Plan and Study. In addition, it is necessary to review the regulatory requirements in relation to the City's legal capabilities for enforcement and evaluate how the City operates and funds the stormwater management system. This section addresses these areas by focusing on regulatory design standards and criteria, discharge permit requirements, City ordinances, policies, procedures, and funding mechanisms as they pertain to Airport activities, and the benefits of a conceptual master drainage permit.

2.1 Regulatory Design Standards and Criteria

This section presents an overview of the federal, state, and local stormwater design standards and specific criteria applicable to the Airport. These standards will act as a basis for the alternatives and recommendations presented in this study.

2.1.1 Federal Aviation Administration Standards

The most current Federal Aviation Administration (FAA) Advisory Circular for the surface drainage systems at the time of writing this report is the AC 150/5320-5C Surface Drainage Design. This circular provides criteria for the design of storm drainage systems that collect, convey, and discharge stormwater on and around pavement and other transportation facilities. Other applicable Advisory Circular's include: 150/5200-33B Hazardous Wildlife Attractants, 150/5370-2E Operational Safety in Airports during Construction, and 150/5300-13 Airport Design. Through these Circulars, the FAA sets minimum design criteria. Individual states or local governing bodies may require facilities to meet higher design standards.

For commercial airports, the FAA recommends designing for a minimum 5-year design storm with no runoff encroachment on runways or taxiways. The recommended maximum ponding limit is 4-inches around inlets. Additionally, the FAA recommends that the center 50 percent of runway, taxiway and helipad surfaces should be free from ponding for the 10-year design storm along the centerlines. Areas other than airfields (i.e., landside facilities) are required to meet a 10-year design storm standard. Storm durations for all cases are recommended to be 24 hours unless local requirements are greater. Extended detention dry ponds are expected to meet the 48-hour maximum drawdown time criteria identified in AC 150. For other facilities, such as drainage layers, the design criterion calls for 85 percent of the water to be drained from the drainage layer within 24 hours.

Additional controls and measures may be required for wildlife control in all parts of the stormwater and drainage system, including ponds, basins, filter strips, ditches, canals, and natural conveyances. Measures could include vegetation management, modified maintenance practices, modified stormwater facility operations, shape and configuration modifications, covers and flight-disruption devices (i.e. wires and netting), and other population reduction measures to reduce attractants. These additional controls would be identified in a wildlife hazard assessment and management plan.

2.1.2 South Florida Water Management District Criteria

Environmental Resource Permits (ERPs) are required for any activity that may impact wetlands, alter surface water flows, or contribute to water pollution. Although they are required for the design and construction of stormwater treatment facilities with drainage areas greater than 1 acre, unless specific exemptions apply, they are also used to regulate other activities such as filling in wetlands, constructing flood protection facilities, and site grading. In Broward County particularly, ERPs are also required for any project related to sanitary sewers, water mains, and pump station installations, repairs, and removals. Prior to implementation of the Stormwater Rule by the South Florida Water Management District (SFWMD) in 1983, Management and Storage of Surface Waters (MSSW) permits preceded ERPs to regulate stormwater treatment.

The SFWMD design criteria states that developments should provide: a wet detention water quality treatment volume for the first inch of runoff or the total runoff of 2.5 inches times the percentage of imperviousness, whichever is greater. If dry detention is used, the treatment volume should be equal to 75 percent of the wet detention volume. In the case of retention, the treatment volume to be provided corresponds to 50 percent of the wet detention volume.

The design criteria call for a pretreatment volume of at least half an inch of dry detention or retention for the following areas:

- Commercial or industrial areas such as at the Airport;
- Projects having 40 percent impervious area or more, which also applies to some areas at the Airport; and
- Projects discharging to waterbodies within a permitted public water supply wellfield cone-of-depression that are not separated from the aquifer by at least ten feet of thickness, such as the Broward County Wellfield Protection Ordinance contour for Zone 3.

For exfiltration systems, the SFWMD criteria calls for a retention system-type design, exfiltrated over one hour prior to overflow based on permeability test data for the site, and using the SFWMD exfiltration volume equation.

When estimating off-site discharge rates, the SFWMD criteria requires using a 3-day, 25-year storm event, if a local government or drainage district does not request for a more stringent criteria. Building floor elevations should be at or above the 3-day, 100-year flood elevation. For road flood protection, and where criteria are not specified by the local government, the SFWMD criteria call for using the 5-year return period and the 1-day (for road centerlines) and the 1-hour (for parking lots served by exfiltration systems) duration storm events, as necessary.

2.1.3 Broward County Ordinances

Applying for a general license is necessary in order to include several typical calculations, of which some of them should demonstrate that the proposed development will not remove net storage from the basin for events up to the 100-year frequency. Calculations for compensation for floodplain encroachment and minimum building floor and road elevations are also to be included.

Broward County design criteria for local drainage facilities, excluding culverts or crossings in the main secondary canal systems, call for using the 3-day, 10-year storm event for establishing minimum road elevations. Also, the County regulations call for one inch of runoff detention or one-half inch of dry runoff retention for commercial and industrial projects and that retention/detention areas on projects located within the zone of influence of

wellfields should not reduce hydraulic recharge distances to public water supply wells less than three hundred feet.

As for exfiltration trenches, the Broward County ordinances establish that no exfiltration system should be allowed within the contour for a wellfield protection Zone 1. Also, only dry exfiltration systems are permitted in well field protection Zones 2 and 3.

2.2 Discharge Permit Requirements

This section presents an overview of the regulatory history and requirements of the stormwater pollution control program at the federal and state levels. For the purposes of this section, the term "Airport" refers to areas zoned as General Aviation Airport (GAA), while the term "Airpark" includes all areas zoned as Airport Industrial Park (AIP). **Figure 2-1** shows the delineation between the Airport and Airpark within the study area's property line. This becomes a key distinction when reviewing applicable stormwater discharge regulations because permitting is based on activities performed onsite, which differ for both areas based on the separate zoning districts.

2.2.1 U.S. Environmental Protection Agency Requirements

In 1972, the Federal Water Pollution Control Act, which became the Clean Water Act (CWA), was amended to require that pollutant discharges to waters of the United States from any point source be regulated by a National Pollutant Discharge Elimination System (NPDES) permit issued by the U.S. Environmental Protection Agency (EPA). In 1987, amendments to the CWA added Section 402(p) – establishing a framework for regulating municipal and industrial discharges of stormwater under the NDPES program.

On November 16, 1990, final regulations were published in the Federal Register that established application requirements for regulated stormwater discharges. The regulations required that both operators of specific industrial activities and large municipal separate storm sewer systems (MS4s) that discharge stormwater obtain NPDES permits. Under these regulations, airport operations are considered "industrial activities".

Industrial activity at a transportation facility (i.e., airports) as described in the federal regulations, is defined as those portions of the facility involved in vehicle maintenance (including vehicle rehabilitation, mechanical repairs, deicing, painting, fueling, and lubrication), equipment cleaning operations, or any operations otherwise identified in the regulations. This is an important distinction as it creates dual criteria for coverage under the industrial NPDES program. Only areas on the Airport property that 1) potentially discharge stormwater to the waters of the State and 2) engage in industrial activities are required to be permitted under the industrial NPDES program. Therefore, any Airport areas identified in this report as generating zero offsite discharge do not require coverage under the industrial NPDES permit, regardless of the area's activity. Conversely, areas not engaging in the specified industrial activity are not regulated by an industrial NPDES permit. However, nonindustrial discharges are still regulated by the City's General MS4 NPDES permit. In addition, federal regulations allow states the authority to implement the NPDES program and issue permits to regulate stormwater discharges, and Florida is a delegated state.

2.2.2 Florida Department of Environmental Protection Requirements

The State of Florida has been delegated the authority by the EPA to implement the NPDES program. Effective October 22, 2000, the Florida Department of Environmental Protection Agency (FDEP) adopted the *Multi-Sector Generic Permit for Stormwater Discharge Associated with Industrial Activity* (MSGP) under Rule 62-621.300(5) of the Florida Administrative Code (FAC). The MSGP covers all discharges of stormwater associated with industrial activity from stormwater point sources to receiving waters of the State of Florida.

City of Fort Lauderdale

Application of City Zoning Designation Pending*

Fort Lauderdale Executive Airport

6000 NW 21st Avenue
Fort Lauderdale, FL 33309

Figure 2-1
Zoning Map

1 inch equals 900 feet

0 450 900 1,800 Feet

Legend

- Water
- FXE Property Line
- Zoning
- Parcels
- Wetlands

FXE

8/31/2017 9:35 AM
P:\Projects\Fort Lauderdale\FXE\Data\GIS\2_MXDs\FXE_Zones.mxd GBC 6/22/09

The permit requires that a Stormwater Pollution Prevention Plan (SWPPP) be developed, or updated as required, for each facility covered under the permit. It is specified that the plan shall identify potential sources of pollution that may reasonably be expected to affect the quality of stormwater discharges associated with industrial activities at the facility. The permit also specifies that measures to reduce the amount of pollutants in stormwater discharges be presented and implemented as part of the SWPPP.

Under the MSGP, FDEP allows the following non-stormwater discharges to the stormwater management system – provided that the discharge complies with the measures and controls for the non-stormwater discharges portion of the SWPPP:

- Discharges from firefighting activities;
- Fire hydrant flushing;
- Potable water sources, including waterline flushing;
- Drinking fountain water, uncontaminated compressor condensate, and irrigation runoff;
- Lawn watering;
- Routine external building wash down that does not use detergents or other compounds;
- Pavement wash water outside containment zones where spills or leaks of toxic or hazardous materials have not occurred (unless all spilled material has been removed) and where detergents are not used;
- Air conditioning condensate;
- Compressor condensate;
- Uncontaminated groundwater; and
- Foundation and footing drains where flows are not contaminated with process materials, such as solvents.

In addition, the MSGP requires facilities that use 100,000 gallons or more of glycol-based deicing/anti-icing chemicals and/or 100 tons or more of urea on an average annual basis to collect and analyze samples of their stormwater discharges from areas where deicing/anti-icing activities occur. In discussions with FDEP, it was indicated that no airport within the state meets these thresholds for deicing/anti-icing chemical usage.

The Airport currently does not have a notice of coverage for its industrial stormwater discharge; however, CDM Smith is currently developing the Airport's SWPPP. Once this is complete, all that remains for industrial NPDES coverage is submitting a Notice of Intent (NOI) and applicable fee.

2.3 City Stormwater Ordinances and Operations

In light of the federal and state regulations, this section will evaluate the City's legal requirements relative to its regulatory obligations. The City provided the following documents for review and assessment: the City Code of Ordinances, the Unified Land Development Regulations (ULDR), the Airport's 2005 *Minimum Standards*, and a blank standard tenant contract for review. Recommendations for alterations and additions to these ordinances, policies, and procedures are included in their respective sections.

2.3.1 Code of Ordinances

The City Code of Ordinances consists of 29 Chapters and the ULDR, this section focuses on Chapter 7, Aviation, and Chapter 28, Water, Wastewater, and Stormwater, as they are the Chapters pertinent to this report.

2.3.1.1 Chapter 7 – Aviation

Chapter 7 contains three Articles, of which Article III, Municipal Airports, is the most relevant to stormwater. Article III can be summarized by requiring:

- All aircraft and motor vehicles be parked and stored in designated areas;
- All tenants sweep, pick up or remove all trash, waste, or other debris from outdoor areas;
- All aircraft remain attended at all times during fueling operations;
- All aircraft repairs and rebuilding be performed inside designated hangars;
- All disabled or abandoned aircraft be immediately removed from the airport movement area while specifically including containment and clean up of fuel spills as part of the removal process; and
- All aviation fuel and jet fuel be stored in underground storage tanks only.

Within Chapter 7 references are also made to incorporate all rules and regulations adopted by the Federal Aviation Administration (FAA), including the Airport's *Minimum Standards,* and any current or future federal, state, county or city rules or regulations pertaining to environmental pollution or the use and disposal of toxic materials.

These regulations all promote good stormwater pollution prevention practices by either limiting the outdoor areas exposed to potential pollutants, ensuring stormwater structures are free of debris, or improving the prevention and/or early detection of spills. However, CDM Smith recommends some changes and additions to this Chapter, as presented in the following section.

Recommendations

Listed below, by section, is the current language found in Chapter 7 followed by recommendations for potential alterations in italics.

Sec. 7-86.11. Handling, storing aircraft fuel, Fuel spills

Persons engaged in aircraft fuel handling shall exercise due care to prevent fuel spillage. In the event of fuel spillage, engines shall not be started until the spill area has been properly flushed or cleaned. The fuel truck driver shall be responsible to report any fuel spillage to the airport fire station and to arrange for the cleaning of such spillage to the satisfaction of the city. Fuel spill prevention and control shall be observed in accordance with National Fire Protection Association Code (NFPA) 402, 1978. In the event of any conflict between NFPS 402, and the provisions of this section, the provisions of NFPA 402 shall govern.

Remove reference to flushing fuel spills; add language to contain and clean up spills with adsorbents or equivalent methods; require all applicable authorities be contacted including but not limited to the Airport branch of the Fort Lauderdale Fire Department, Airport Manager, Broward County Development and Environmental Regulation Division (BC DERD); and reference SPCC plans and applicable environmental regulations in addition to NFPA 402.

Sec. 7-86.15. Handling, storing aircraft fuel, Personnel training

All persons who will participate in fueling shall be instructed and trained in the proper operations of fueling equipment, and the proper procedures for compliance with this section.

Specify additional training in spill prevention, clean-up, and reporting.

Sec. 7-99.c. Storage, repair areas

Any aircraft found by the airport manager to be in a state of disrepair which creates an image detrimental to the city and the airport shall be removed from view by the owner or person having direct charge of the aircraft… By definition "aircraft in disrepair" shall mean any aircraft that is not whole, or has missing parts, or has tears or rips in the outside skin, or is not airworthy, or any combination of the forgoing, including any such craft which, owning to its appearance detracts from the orderly appearance of the airport.

Include "visibly leaks fuel, oil, battery acid, or any other liquid harmful to the environment" to the definition of "aircraft in disrepair".

Sec. 7-112.h. Fire prevention; Periodic inspections

All premises and hangars on the airport shall be subject to periodic safety inspections. These inspections shall be made by the fire department personnel and airport staff at least once each year.

Consider adding similar language for SWPPP annual inspections

In addition to these recommended changes to the existing language, CDM Smith also recommends that the City should add language regulating washing, steam cleaning, degreasing and painting practices by designating areas for these activities and by requiring that run-off from these activities be treated and/or disposed of in a proper manner. The City should also consider requiring the use of drip pans for all maintenance and repair practices onsite, and requiring that outdoor storage areas are covered by either a permanent roof or temporary covering made of polyethylene, polypropylene, or hypalon.

2.3.1.2 Chapter 28 – Water, Wastewater, and Stormwater

In July 1992 the City passed Ordinance No. C-92-34, which created the City's current Stormwater Management Program found in Article IV, Sections 28-191 through 200. The Stormwater Management Program was established to implement and fund the functional requirements of the City's stormwater management system in order to meet the requirements of the City's MS4 NPDES permit.

The Stormwater Management Program is authorized to use its funds for the following activities:

- Stormwater Management Services – design, permit review, plan preparation and development review;
- Operation & Maintenance – operation, maintenance, repair and replacement of the stormwater collection, storage, treatment and conveyance infrastructure;
- Construction Costs – project costs related to constructing major or minor structural improvements to the stormwater-related infrastructure as provided in the city-wide stormwater management plan;
- Administration Costs – administrative costs associated with the management of the stormwater management program;
- Debt Services – debt service financing of stormwater-related capital improvements; and

- Studies – funding of studies associated with the planning of stormwater-related infrastructure.

The Stormwater Management Program's fee is based on three customer categories as defined in **Table 2-1** below.

Table 2-1: Stormwater Management Fees by Customer Category.

Customer Category	Definition	Monthly Stormwater Management Fee*
Category I	Residential Properties (e.g., developed properties including single family, mobile homes, multifamily, apartments and condominiums with 3 or less dwelling units)	$3.53 per unit
Category II	Developed Properties not in Categories I or III (e.g., residential properties with greater than 3 dwelling units and all developed non-residential properties)	$35.70 per acre
Category III	Undeveloped Properties (e.g., properties without impervious areas such as vacant property, parks, airports, and golf courses)	$11.32 per acre

*as defined in Sec. 28-197

It should be noted that airports are included as Undeveloped Properties in lieu of the fact that they contain large amounts of impervious area.

Recommendations

While airports maintain industrial NPDES permits separate from MS4 NPDES permits, the Airport may retain some services provided by the Stormwater Management Program, in which case a utility fee would be applicable. For instance the Airport may receive pavement sweeping or maintenance services through the Stormwater Management Program; however, once the Airport receives its industrial NPDES permit, it may provide its own permitting, record keeping, and inspection services funded by airport user fees. Once this occurs, CDM Smith recommends that the City evaluate the level of service provided by the Stormwater Management Program and the subsequent fee for services as defined in Chapter 28.

2.3.1.3 Unified Land Development Regulation

The ULDR is found in Section 47 of the Code of Ordinances. Article II, Zoning District Requirements, specifies the zoning uses allowed in General Aviation Districts (Airport) and in the Airport Industrial Park District (Airpark). Because the regulatory requirements depend directly on the activities within the two districts, the permitted and conditional uses of each are summarized in **Table 2-2** and **Table 2-3**.

Stormwater regulations are specifically found in Article III, Development Requirements, Article IV, Development Permits and Procedures, and Article V, Development Review Criteria, of the ULDR. CDM Smith reviewed this section and presents recommended changes in the following section.

Recommendations

Below is a listing of the ULDR's current language, by section, followed by recommendations for alterations in italics.

Sec. 47-19.1.G. General requirements

No accessory use or structure shall be permitted to be located in a manner which may cause runoff onto adjacent properties.

Include consideration of existing onsite storage and runoff and specify and define what is to be done on additions and modifications in terms of storage and treatment onsite.

Table 2-2: Zone GAA Permitted and Conditional Uses.

Category	Permitted Use
Aeronautical/ Aircraft/ Aviation	Aeronautical Research and Development
	Aircraft Manufacture
	Aircraft Conversions
	Aircraft Fitting
	Aircraft Fixed Base Operations, including storage
	Aircraft Repair
	Aircraft Leasing
	Aircraft Sale & Display
	Aviation Equipment Manufacture
	Aviation Instruction Facilities
	Flight Instruction & Ground Training
	Model Aircraft Sale & Display
	Aircraft Petroleum Sales
	Heliport, Helistop*
Automotive	Auto Rental and Leasing
Lodging	Hotel & Motel
Research & Development	Industrial Research Operation
	Scientific Research Operation
Services/ Office	Professional & Administrative Office
	Indoor Firearms Range*
Wholesale Ops	Regional Wholesale & Industrial Distribution Centers
Accessory Uses, Building Structures	Fuel Pumps, when with Auto Rental & Leasing
	Outdoor Display & Outdoor Aircraft Storage
	Restaurants, when with Motels or Fixed Base Operations

*Conditional Use

Table 2-3: Zone AIP Permitted and Conditional Uses.

Category	Permitted Use
Aeronautical/ Aircraft/ Aviation	Aircraft and Aviation Manufacture of Components, Parts & Accessories
	Automotive Service Station
	Heliport, Helistop*
Food & Beverage	Restaurants
Lodging	Hotel
Manufacturing	Boats
	Cabinets
	Canvas Products
	Electronic Appliances, Devices, Fixtures, & Components
	Luggage & Leather Products
	Medical & Orthopedic Instruments & Supplies
	Metal Furniture
	Optical Instruments & Goods
	Rubber Goods
	Phonographic Radio & Television Equipment & Supplies
	Plastic
	Precision Instruments
	Silverware
	Small Parts & Devices
Service/ Office	Professional & Administrative Offices
	Vocational Schools*
Wholesale Operations	Regional Wholesale & Industrial Distribution Centers
Accessory Uses	Electroplating
	Outdoor Display & Outdoor Storage
	Hotel Accessory Uses

*Conditional Use

Sec. 47-20.13.D. Paving and drainage, Drainage

On-site stormwater retention shall be provided in accordance with the requirements of the regulatory authority with jurisdiction over stormwater retention.

Specify South Florida Water Management District (SFWMD) and Broward County Department of Environmental Regulation (BC DERD) as regulatory authorities. Extend to detention, swale, wells, and exfiltration systems.

Sec. 47-20.13.E. Paving and drainage

Whenever the total pavement area in the swale area frontage on public right-of-way is fifty percent (50%) or more of the total frontage on that public right-of-way, a French drain stormwater system in the swale area in accordance with city construction standards and specifications will be required.

Consider rewording for clarity.

Sec. 47-24.5.EW.3.e.iv. Subdivision regulations, Sidewalks

The board, upon recommendation of the city engineer, may waive the requirements of sidewalks.

Specify that sidewalks may be waived if they cause a storm drainage problem.

Sec. 47-25.2.L. Adequacy requirements, Stormwater

Adequate stormwater facilities and systems shall be provided so that the removal of stormwater will not adversely affect adjacent streets and properties or the public stormwater facilities and systems in accordance with the Florida Building Code, city engineering standards and other accepted applicable engineering standards.

Remove reference to Florida Building Code and update to reference BC DERD or SFWMD.

2.3.2 Funding, Policies, and Procedures

For this section, CDM Smith met with City staff to discuss general Airport procedures and reviewed the 2005 *Minimum Standards,* a standard lease agreements, and the 2009 *Strategic Business Plan & Master Plan Update* prepared by Kimley-Horn and Associates, Inc. The Airport is staffed 24-hours a day with both operations and security staff. These staff act as the main compliance officers at the Airport by being observant while performing their daily tasks and reporting suspicious activities. Based on this, CDM Smith recommends that all operations staff be trained on current stormwater regulations in order to identify both correct and incorrect activities. The City should also consider formalizing a monthly inspection routine where a dedicated staff member tours the Airport specifically looking for potential stormwater violations. If implemented, the inspection time should be rotated through all operating hours in order to get a cross section of daily activities.

The Airport currently funds its operations, which include regulatory compliance, through the Airport Operating Fund (AOF). Revenue sources for the AOF are typically airport user fees such as fuel taxes, space-leasing fees, etc. Given that once an industrial NPDES permit is issued, the City will be required to perform annual site inspections and pollution prevention team training, as well as re-apply for the permit on a 5-year cycle, CDM Smith recommends assessing the Enterprise Fund to ensure it has adequate funding for these requirements.

In terms of capital improvements to the stormwater system, the Airport has a number of options. Airport improvements can obtain federal funding from the FAA's Airport Improvement Program (AIP), state funding from the Florida Department of Transportation (FDOT) or the State Revolving Fund (SRF), private funding from tenants, or surplus funding from revenues after the operating budget is funded. Grants for innovative Best Management Practices (BMPs), described in Section 3, may also be available from the FDEP and EPA. Stormwater improvements typically have the flexibility to be added to larger capital improvement projects, especially when pursuing FAA or FDOT funding.

2.4 Airport-wide Conceptual Master Drainage Permit

This section addresses the process, benefits, and criteria necessary to prepare an airport-wide master drainage conceptual permit application for the Airport in accordance with the agencies having jurisdiction, and analyzes the factors influencing whether or not it is in the Airport's best interest to pursue a master permit or to continue with the existing approach of securing individual stormwater improvement permits.

2.4.1 Conceptual Environmental Resource Permitting Overview

The permitting of surface water management systems of this magnitude is governed by the SFWMD via an ERP Application. ERPs are required by the water management districts for construction, alteration, operation, maintenance, repair and abandonment of surface water management systems, which are defined as a stormwater dam, impoundment, reservoir, or appurtenant work (i.e., any artificial structures such as ditches, canals, conduits, channels, culverts, pipes, and other construction that connects to, or drains surface waters). An applicant for an ERP must show that the proposed activities are consistent with 1) the goals and policies of F.S. 373.036 (State Water Use Plan); 2) that the construction or alteration of the surface water management system will not be harmful to the water resources of the District; 3) that the operation and maintenance of the system will be consistent with the objectives of the District and not harmful to the water resources of the District; and 4) that additional criteria for activities in surface waters and wetlands (commonly known as permit "special conditions") are met.

"Conceptual Approval" is defined as an ERP which approves a conceptual master plan for a surface water management system. Conceptual approvals constitute final District action and are binding to the extent that adequate data has been made available for review by the applicant during the review process. The conceptual approval process is normally applied for and issued for large projects that are to be developed in phases and are based on a final concept such as an approved future Airport Layout Plan. This permit type is chosen primarily when development is planned over a long period of time based on a master plan, and individual designs are not yet available. The conceptual application process provides a vehicle for all of the District's (and other joint reviewing agencies) questions and comments to be flushed out and addressed in a controlled and predictable manner by the owner/engineer-agent at one time, leaving less risk for the individual applicants who may not have the knowledge, expertise, or authority for these types of responses, and minimizes potential legal issues between the owner and tenants/developers at a later date after time critical schedules for construction may be already in place. This is especially true with secondary impact issues and anti-degradation policy issues which can vary depending on the dynamic re-classification of priority water bodies, vicinity to environmentally sensitive areas, and proposed more stringent surface water pollution control criteria.

The application procedure for a conceptual permit mirrors the general permit procedure. The conceptual ERP Joint Application is completed (with applicable permit fees) and submitted to the District for processing. The District then has 30 days to review and respond as to whether sufficient information to evaluate the permit application has been provided, after which time the applicant has 90 days to respond to correct deficiencies. The District reserves the right to request additional or new information during the review process. Once deemed complete, the District has 90 days for "action" which includes either the notice of intent to grant the permit, denial, or other ruling. Following that, there is a public notification and comment period, followed by a final decision by the governing board usually based on permitting staff recommendations.

A conceptual approval does not authorize construction or modification to a surface water management system, rather it defines the parameters for, and greatly expedites, the application process for the designers and the reviewers for the individual permits applied for in the construction phases because the review process is primarily verifying that the individual permit applications are in conformance with the overall approved

conceptual plan, which should have been the basis of the design. This can be an attractive consideration for developers when considering the location for their business. Certain circumstances may require that individual projects construct a portion of, or an extension to, the backbone of the primary stormwater management systems as well as on site stormwater management facilities for permit approval, based on the overall conceptual plan.

The conceptual permit expiration date is usually expressly stated/negotiated in the permit special conditions and is based on the specific anticipated project duration. Otherwise, the default permit duration is two years. Conceptual permit extensions can be filed and approved for good cause, and permit modification applications must be issued for any "substantial modifications" to the conceptual plan. Individual permits approved under the conceptual permit will receive operating permits following construction certification and final acceptance by the District inspectors or delegates Broward County Surface Water Permitting Division).

2.4.2 Conceptual Environmental Resource Permit Requirements

The information required to develop the conceptual ERP application to the District is derived from the site facilities data and results sections of this report. The application would reference the future land use scenario in the approved Airport Layout Plan, and the primary stormwater management system capital improvements. A pre-meeting with the District is normally held to discuss the intent for conceptual approval, introduce the airport wide conceptual approach, and negotiate the permit duration. This meeting also provides airport staff a chance to discuss competing interests of the FAA (the fast and efficient movement of stormwater runoff from the airport operations area and the minimization of open water bodies in the approach zones to mitigate fog production and bird attraction) with the District's water quantity/quality detention retention policy (requiring some intentional ponding on-site).

The application generally follows the process described in Section 2.4.1 above. Requests for additional information are expected as the District reviews the concept in greater detail. Following District Staff and Board approval, the document becomes the guideline for all future stormwater management designs at the airport until a substantive change is desired.

A design standards manual is then developed to be used by all airport designers as a guide, summarizing the requirements of the conceptual permit and incorporating any of the permit's special conditions. Following the requirements and data tables in the design standards manual for stage-storage, conveyance, and water quality requirements will allow designers to obtain stormwater construction permits for airport development in an expedited manner.

2.4.3 Benefits of a Conceptual Airport-wide Environmental Resource Permit

There are several benefits realized by obtaining an airport-wide conceptual master drainage permit for the airport as summarized below:

1. Expedited individual construction permits for developers. Once the master permit is in place, the individual permit applications become a simpler matter of reviewing the submitted designs for conformance to the master permit conditions. If the design guidelines and standards as developed from the master conceptual permit are followed properly by the designer, there is significantly less chance of receiving a schedule delay to respond to requests for additional information to address airport-wide issues; as theoretically, all unforeseen issues have been discussed in sufficient detail to the satisfaction of the regulators in the approval process for the conceptual master permit. This can be a strong selling point in attracting new development to the airport.

2. Control of the Airport-wide primary and secondary stormwater management systems. Once the conceptual permit is approved, the Airport will have a focused guidance document for growth and expansion with regard to the stormwater management system, and it will be much less likely that any individual development will (accidentally/unknowingly) result in an airport-wide or possibly off-site impact to water quantity or water quality, cancelling out other future plans for expansion.

3. Potential rejection of future individual permit applications. As has occurred at other airports locally, the District may mandate an end to the piecemeal submittal of individual permits at FXE citing that there is not enough detailed information on the site as a whole, and require an airport wide conceptual permit which takes into account the entire site stormwater quantity and quality. In the past, stormwater plans have been implemented for individual projects at the airport. These plans addressed the needs for the individual areas but likely did not consider in sufficient detail the overall impact of the development at the airport. Should this occur, any further planned development will be put on hold until the conceptual permit is approved.

An excerpt from the Florida Administrative Code regarding the conceptual ERP process is included below.

Figure 3-1 Chapter 40E-4.305 (F.A.C.) - Conceptual Permit Approvals

(1) Conceptual approvals constitute final District action and are binding to the extent that adequate data has been submitted for review by the applicant during the review process.

(2) A conceptual approval does not authorize construction, alteration, operation, maintenance, removal or abandonment of a surface water management system or the establishment and operation of a mitigation bank.

(3) A permit application submitted pursuant to a conceptual approval must be consistent with the staff report and conditions of the conceptual approval. Primary areas for consistency comparisons include type of land use, percent imperviousness, allowable discharge, wetland and other surface water impacts and proposed mitigation, control elevations, sources of water supply and detention/retention volumes. To the extent that there is any inconsistency between the permit and staff report and other information in the application file, the permit and staff report shall control.

(4) For phased projects, the approval process must begin with an application for a conceptual approval which shall be the first permit issued for the project. An application for construction authorization of the first phase(s) may also be included as a part of the initial application. As the permittee desires to construct additional phases, new applications shall be processed as individual or standard general environmental resource permit applications pursuant to the conceptual approval. The conceptual approval, individual and standard general permits shall be modified in accordance with conditions contained in Chapters 40E-4 and 40E-40, F.A.C.

(5) Issuance of a conceptual approval permit pursuant to Chapter 40E-4, F.A.C., shall not relieve the applicant of any requirements for obtaining a permit to construct, alter, operate, maintain, remove or abandon a surface water management system or establish or operate a mitigation bank, nor shall the conceptual approval permit applicant be relieved of the District's informational requirements or the need to meet the standards of issuance of permits pursuant to Chapters 40E-4 or 40E-40, F.A.C.

(6) An applicant may seek conceptual approval under this chapter concurrently with a Development of Regional Impact (DRI) application for development approval (ADA) and a local government comprehensive plan amendment as allowed by Section Chapter 40E-4 Environmental Resource Permits Effective Date: July 4, 2010 Minor corrections incorporated September 9, 2010 Page 25 - (40E-4) 380.06(9)(a)1., F.S. For projects which have

filed an application for a Conceptual Approval concurrently with an Application for Development Approval (ADA) for a Development of Regional Impact (DRI), conceptual approval also means "conceptual agency review" as defined in Section 380.06(9)(a)2., F.S.

(7) In the District's evaluation of permit applications, rules and criteria in effect at the time of the issuance of the conceptual approval, or at the time of the most recent modification of the Conceptual Approval, shall apply unless particular aspects of the project were not previously addressed in the Conceptual Approval. In such a case, rules and criteria in effect at the time of the individual or general permit application is completed shall apply to review of the previously unaddressed aspects.

(8) Any delineation of the extent of a wetland or other surface water submitted as part of the permit application, including supporting documentation, shall not be considered binding unless a specific condition of this permit or a formal determination under Rule 40E-4.042, F.A.C., provides otherwise.

(9) An individual environmental resource permit application cannot be used alone to modify a Conceptual Approval. The intention to modify the conceptual approval must be explicitly stated or requested. Conceptual approval and individual environmental resource permits can be modified or issued concurrently under a single application.

(10) Applications for individual project phases, where no conceptual approval has been obtained, shall be considered only when the phases are totally independent of, or make sufficient provisions for, adjacent lands.

Rulemaking Authority 373.044, 373.113, 373.171, 380.06(9) FS. Law Implemented 373.413, 373.416, 373.421(2), 380.06(9) FS. History–New 10-3-95, Amended 4-14-03.

Section 3 Data Collection and Evaluation

Data collection is required to compile the necessary information for the modeling of the existing stormwater system, its evaluation, and the development of alternative solutions for water quantity problem areas identified through the surface water modeling phase. The collection also includes surface water quality data, implemented best management practices (BMPs), and identified impaired waterbodies.

This section presents a description of the data obtained, its role in the modeling effort, and the necessary modifications for its use in the stormwater evaluation. The City and local and state agencies were the major sources consulted for these data. Most of the data were received in digital format and geographically referenced, other data was converted to a usable format for further processing and evaluation. The vertical datum used for the modeling task is the North American Vertical Datum 1988 (NAVD88); therefore, data collected in a different datum was converted accordingly.

3.1 Topography

Topography in stormwater evaluations is used to identify runoff patterns, above ground storage, and depressions, which in terms of modeling translates into defining overland flows and storage elements necessary to simulate the connectivity between basins. For this purpose, high resolution Light Detection and Ranging (LiDAR) data were obtained for this project. The LiDAR data were available from the International Hurricane Research Center (IHRC) at the Florida International University (FIU) in Miami, Florida. These data were produced for the State of Florida Division of Emergency Management LiDAR Project to support the creation of FEMA FIRM with 199 flight lines flown from July 12, 2007 to December 22, 2007.

Airborne LiDAR systems usually obtain measurements for the horizontal coordinates (x, y) and elevation (z) of the reflective objects scanned by the laser beneath the flight path (IHRC, 2004). The laser-scanned objects include buildings, vehicles, vegetation, and bare ground. The IHRC provides both bare ground data and unfiltered data, which includes buildings, vehicles, and vegetation. The data downloaded from the IHRC website was in LAS point-data format of a 4-ft resolution digital elevation model (DEM) grouped in 5,000 by 5,000 feet tiles in bare ground format. For the Airport, four of these tiles were downloaded from the IHRC website. The vertical datum used by the IHRC is NAVD88.

The Airport has undergone a number of development changes since 2007, the year the LiDAR data was flown. Ground surveys of these modifications were used to both verify the LiDAR data in unmodified portions of the Airport property and to update the LiDAR data to include recent changes. Some of the surveys included:

- The relocation of Taxiway Alpha. The survey provided for this project was not representative of the existing conditions. It did not match the most current aerial photography (2010), but it did

match the conditions when the LiDAR was flown. For that reason, it was used to verify LiDAR data;

- The survey of Taxiway Charlie. The survey provided for this project matched the features included in the LiDAR data. Therefore, it was used to verify and replace LiDAR data;
- The Survey of Taxiway Bravo. The survey was used to verify and update LiDAR data;
- The Modifications along Taxiway Foxtrot. The survey was used to verify and update LiDAR data;
- The Survey along Taxiway Golf. The survey was used to verify and update LiDAR data;
- The Survey of Runway 826. The survey was used to verify and update LiDAR data;
- The Construction of the new Maintenance Facility. The survey was used to update LiDAR data;
- The Survey of the Stadium and Perimeter Road. The survey was used to verify and update LiDAR data; and
- The Construction of the new Fire Department Building. The survey provided for this project was not representative of the existing conditions. It was used to verify LiDAR data only.

The LiDAR was updated with the survey data as indicated above when the LiDAR elevations were reasonably close to those in the survey and located within a predeterminted short distance. The resulting DEM is a combination of survey points (where coverage is available and in agreement with existing conditions), LiDAR data (where ground survey data does not exist), and a combination of the two around the edges of ground survey.

In **Figure 3-1**, a 20-ft resolution DEM of the Airport is shown, representing the topographic data collected for the project.

3.2 Soils

Information on soil types, lateral and vertical extents, and soil characteristics were obtained in digital format from the National Resources Conservation Services (NRCS) website. The NRCS soil data is based on the Soil Survey of Broward County, Eastern Part, published in May, 1984. The most common soil units in the study area are the fine sands from the groups: St. Lucie fine sand (49%), Pomello fine sand (13%), Immokalee fine sand (12%), and Urban Land (12%).

Figure 3-2 shows the soil distribution based on hydrologic soil group (HSG) classification. **Table 3-1** provides the percent area of each HSG present in the study area.

The soil percentages in Table 3-1 indicate that hydrologic Group A is the most predominant with 58% of the area, followed by the hydrologic Group D with 32% of the area. These two groups alone account for 80% of the area. A portion of the hydrologic Group D corresponds to the dual hydrologic Group B/D, the first letter applies to the drained condition of the soil, the second to the undrained condition. The natural condition of the soil is Group D; however, the soil can be adequately drained for practical purposes (i.e., low to moderate runoff potential or moderate to high infiltration capacity). For the purpose of modeling, the dual hydrologic Group B/D was converted to Group D, as it better describes the drainage capacity of the natural condition of the soil.

8/31/2017 9:35 AM

N

Legend

20 ft Cell DEM
Elevation (ft - NAVD)
High : 31.0
Low : -6.0

Minor Roads
Major Roads
Hydrologic Units (HUs)

FXE

Fort Lauderdale Executive Airport

6000 NW 21st Avenue
Fort Lauderdale, FL 33309

1 inch = 950 feet

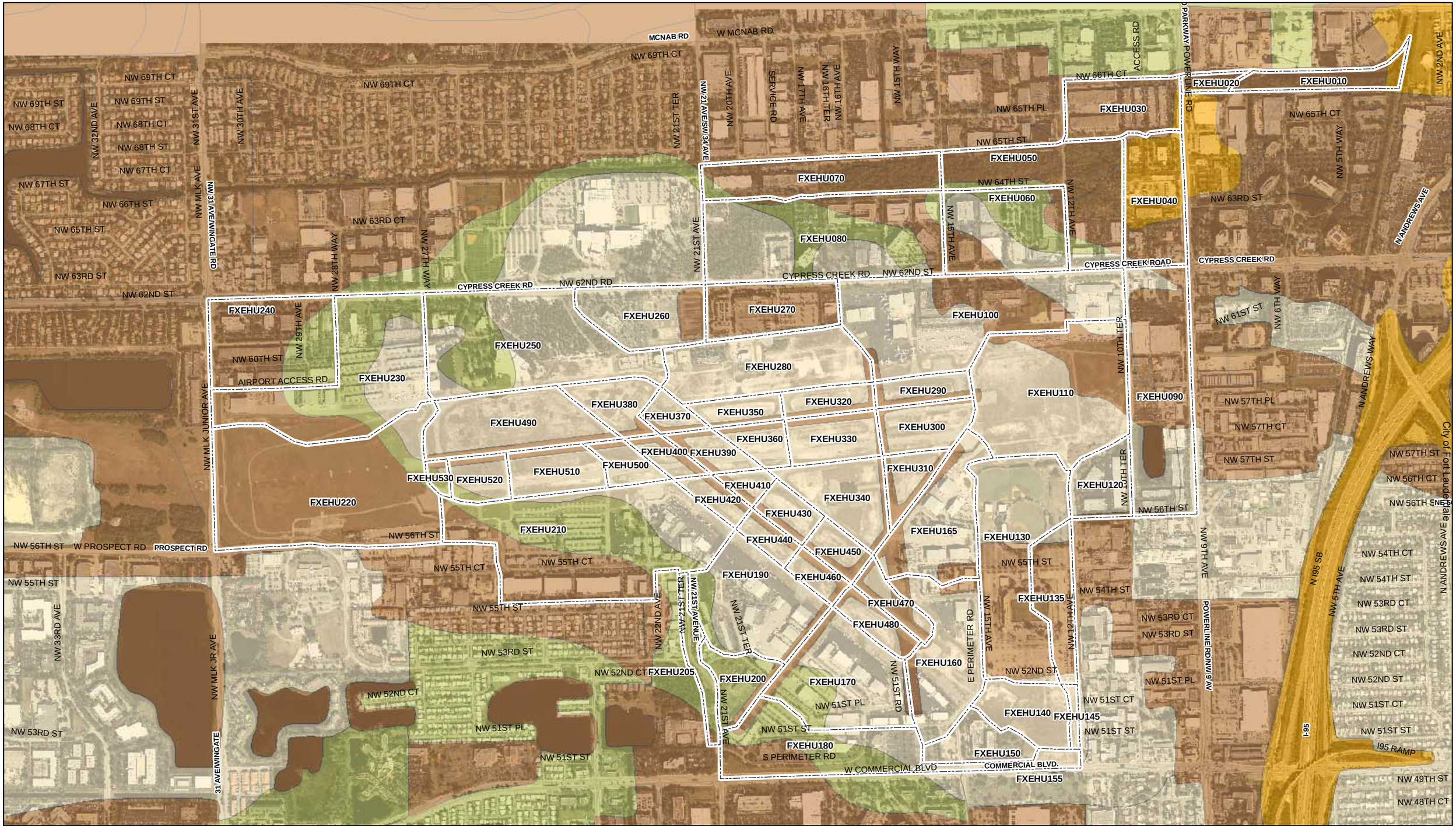
0 475 950 1,900 *Feet*

Figure 3-1
20 ft Digital Elevation Model and Hydrologic Units

Source: IHRC, Survey Provided by City

CDM Smith

Bid 276-11831



N

Legend

Hydrologic Soil Group

HSG

- A
- B
- C
- D
- Hydrologic Units (HUs)
- Roads

FXE

Fort Lauderdale Executive Airport

6000 NW 21st Avenue
Fort Lauderdale, FL 33309

1 inch equals 950 feet

0 475 950 1,900 *Feet*

Figure 3-2
Hydrologi Soil Group Classification (NRCS)

Bid 276-11834

CDM Smith

CAM #17-1096
Exhibit 2
Page 89 of 191

p. 89

\\Projects\Fort-Lauderdale\FXE\Data\GIS\2_MXDs\FXE_soils.mxd GBC 5/03/09

Table 3-1: Area Percentage of Hydrologic Soil Groups over the Pervious Area per HU.

Hydrologic Unit (HU)	Hydrologic Soil Group				Total Pervious Area (acres)
	A	B	C	D	
FXEHU010	0%	17%	0%	83%	9.1
FXEHU020	0%	8%	0%	92%	2.6
FXEHU030	0%	17%	0%	83%	2.6
FXEHU040	2%	65%	0%	33%	4.3
FXEHU050	2%	2%	7%	89%	25.5
FXEHU060	31%	0%	33%	36%	4.1
FXEHU070	0%	0%	4%	96%	14.9
FXEHU080	71%	0%	16%	13%	22.8
FXEHU090	66%	0%	0%	34%	3.8
FXEHU100	67%	0%	0%	33%	12.8
FXEHU110	75%	0%	0%	25%	39.7
FXEHU120	78%	0%	0%	22%	1.8
FXEHU130	71%	0%	0%	29%	24.6
FXEHU135	30%	0%	0%	70%	3.8
FXEHU140	100%	0%	0%	0%	12.9
FXEHU145	100%	0%	0%	0%	1.3
FXEHU150	100%	0%	0%	0%	3.4
FXEHU155	100%	0%	0%	0%	2.5
FXEHU160	94%	0%	0%	6%	10.4
FXEHU165	72%	0%	0%	28%	5.1
FXEHU170	68%	0%	21%	11%	7.9
FXEHU180	10%	0%	47%	43%	8.6
FXEHU190	80%	0%	13%	6%	6.7
FXEHU200	1%	0%	93%	6%	2.9
FXEHU205	0%	0%	89%	11%	3.9
FXEHU210	23%	0%	51%	26%	21.4
FXEHU220	5%	0%	4%	91%	54.0
FXEHU230	22%	0%	32%	46%	18.7
FXEHU240	0%	0%	29%	71%	6.4
FXEHU250	79%	0%	21%	0%	30.1
FXEHU260	91%	0%	0%	9%	6.9
FXEHU270	27%	0%	0%	73%	2.9
FXEHU280	100%	0%	0%	0%	23.5
FXEHU290	86%	0%	0%	14%	3.9
FXEHU300	99%	0%	0%	1%	6.5
FXEHU310	93%	0%	0%	7%	3.8
FXEHU320	99%	0%	0%	1%	3.6
FXEHU330	100%	0%	0%	0%	6.7
FXEHU340	100%	0%	0%	0%	11.8
FXEHU350	100%	0%	0%	0%	3.7
FXEHU360	100%	0%	0%	0%	2.9
FXEHU370	100%	0%	0%	0%	2.1
FXEHU380	99%	0%	0%	1%	7.0
FXEHU390	99%	0%	0%	1%	2.7
FXEHU400	98%	0%	0%	2%	1.7

Hydrologic Unit (HU)	Hydrologic Soil Group				Total Pervious Area (acres)
	A	B	C	D	
FXEHU410	98%	0%	0%	2%	1.5
FXEHU420	98%	0%	0%	2%	2.8
FXEHU430	98%	0%	0%	2%	3.7
FXEHU440	100%	0%	0%	0%	2.5
FXEHU450	93%	0%	0%	7%	3.4
FXEHU460	100%	0%	0%	0%	2.1
FXEHU470	61%	0%	0%	39%	2.8
FXEHU480	86%	0%	0%	14%	3.6
FXEHU490	98%	0%	0%	2%	19.4
FXEHU500	100%	0%	0%	0%	1.6
FXEHU510	100%	0%	0%	0%	7.0
FXEHU520	86%	0%	14%	0%	3.9
FXEHU530	21%	0%	79%	0%	0.8
Total	**58%**	**1%**	**9%**	**32%**	**513.1**

* This group includes water soil types and areas where data was not available

3.2.1 Soil Storage

Soil storage plays an important role on the amount of runoff generated by a storm event due to the relatively high topography of the site and the proximity to the City's Prospect Wellfield, located West of NW 31st Avenue, which exerts a cone of depression on the groundwater table around the site. Therefore, a relationship that was determined for South Florida by the Soil Conservation Service, now the NRCS, between soil storage and depth to water table (DWT) was applied to the project area. This relationship is referenced in the SFMWD Environmental Resource Permit Information Manual Volume IV (2010) for both naturally occurring and compacted soils up to depths of four feet. The term "compacted soils" refers to soils in areas where development has occurred and have been relocated and compacted around the development. This version of the relationship was used in the study area and was extended to cover the expected depths to water table at the site, which could be as much as 10-12 ft.

Figure 3-3 depicts the relationship between cumulative soil storage and depth to water table as identified by NRCS for South Florida.

The depth to water table was determined with respect to the water control elevation of 2.4 ft NAVD used as a criterion by the South Florida Water Management District (SFWMD) to estimate soil storage as part of the calculations necessary to issue an Environmental Resource Permit (ERP) in the area. This water control elevation was applied over the entire model area. The soil storage for each hydrologic unit (HU) was then estimated by area-weighting the DWT values from the pervious areas and consequently apply the relationship described in Figure 3-3 to the DWT area-weighted value.

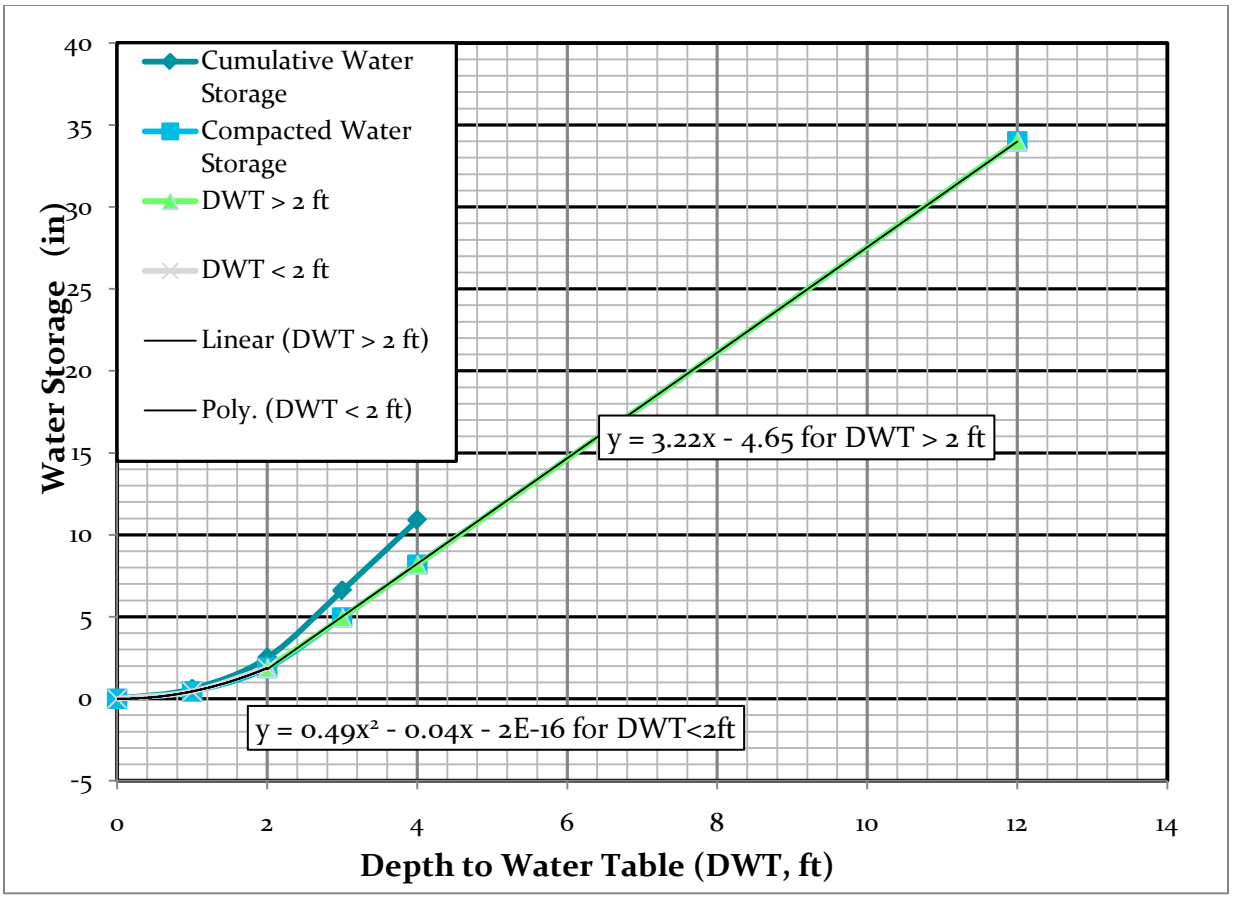


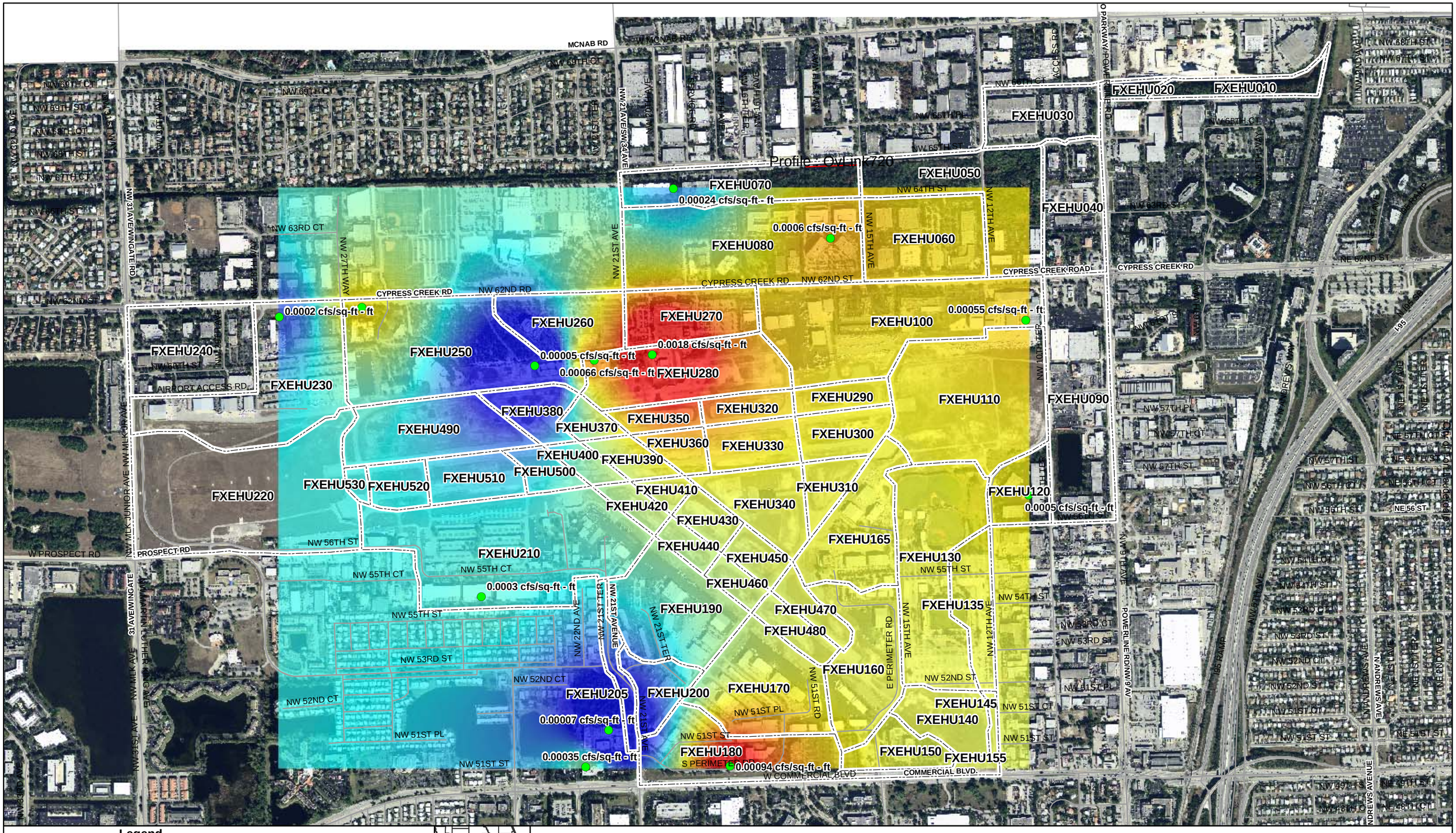
Figure 3-3: Cumulative Soil Storage and Depth to Water Table Relationship (NRCS, SFWMD).

3.2.2 Soil Permeability

As previously stated, the soils on the study area are fine sands, predominately of the St. Lucie type, which are characterized as being well drained with depths of more than 80 inches (6.7 ft) and as having rapid permeability throughout. Immokalee sands consist of poorly drained soils, and their permeability is moderate to moderately rapid in the subsoil and rapid in all other layers. Pomello sands consist of moderately well drained soils. Their permeability is very rapid to a depth of three feet, moderate between three and six feet, and very low between six and seven feet.

In order to further understand the infiltration rates expected at the study area, ERP applications were consulted from the SFWMD database to collect permeability tests conducted at several parcels that provide a means to estimate the required length of exfiltration trench systems, which are widely used within the Airport. **Figure 3-4** was created using an inverse distance weighted method for spatially distributing the logarithmic value of the hydraulic conductivity (Kv) found from the available permeability tests. This figure shows that, as expected, the eastern half of the study area has a higher infiltration rate than the western half. This pattern is also identifiable in Figure 3-2 showing the distribution of the soil classifications, where half of the study area is HSG type A soil. The Kv values depicted in Figure 3-4 were used to estimate the treated water quality volume of existing and proposed exfiltration trenches considered in this report.

8/31/2017 9:35 AM



Legend

Hydraulic Conductivity (Log10)

Log Base 10

High : -2.75

Low : -4.3

Percolation Test Locations

Hydrologic Units (HUs)

Roads

Fort Lauderdale Executive Airport

6000 NW 21st Avenue
Fort Lauderdale, FL 33309

1 inch equals 950 feet

0 475 950 1,900 *Feet*

Figure 3-4
Vertical Hydraulic Conductivity (Log10)
Estimated Spatial Distribution

Bid 276-11831

CDM Smith

CAM #17-1096
Exhibit 2
Page 93 of 191

\\Projects\Fort-Lauderdale\FXE\Data\GIS\2_MXDs\FXE_topo.mxd GBC 5/03/09

3.3 Aerial Photography

The City provided high resolution aerial photography for the study area. The 2011 aerial photography was useful for land use verification, basin delineation, and delineation of impervious areas.

3.4 Impervious and Pervious Areas

Land use is typically used as a means of estimating the level of imperviousness, which is a major driver in the amount of runoff generated in a parcel. Each land use has a range of expected percent imperviousness. The project area comprises a mixture of industrial and commercial land uses located around the runways and taxiways. However, considering the scale of the project the level of imperviousness was estimated directly by delineating the impervious areas using the latest aerial photographs from 2010 and 2011 provided by the City.

In **Table 3-2**, the land use coverage for the Airport is presented. This land use mosaic is according to the City land coverage.

Table 3-2: Land use coverage of the modeled area at the Airport.

Land Use Category	Area (ac)	% of Total
Commercial	707.9	63%
Industrial	251.3	22%
Institutional	70.3	6%
Roads	86.7	8%
Total	1,117.0	100%

Table 3-3 provides a summary of the impervious and pervious area percentages that were estimated from aerial photograph for both existing and future conditions for each HU. The future conditions were obtained from the Airport Layout Plan (ALP). Adjustments to the ALP were made in conjunction with Airport staff in order to accommodate the proposed development due to recently constructed development.

Table 3-3 also shows the change in percent imperviousness from existing to future conditions for each HU and the entire study area.

At some specific HUs, the level of imperviousness shows a significant increase in the future condition ranging from 5% (FXEHU230 and FXEHU430) to 147% (FXEHU280). However, this high localized change in percent imperviousness does not reflect on an equivalent change in the overall percent impervious area which increased by 4% in the future condition for the study area.

Figure 3-5 and **Figure 3-6** show the delineated impervious areas for the existing and future conditions, respectively.

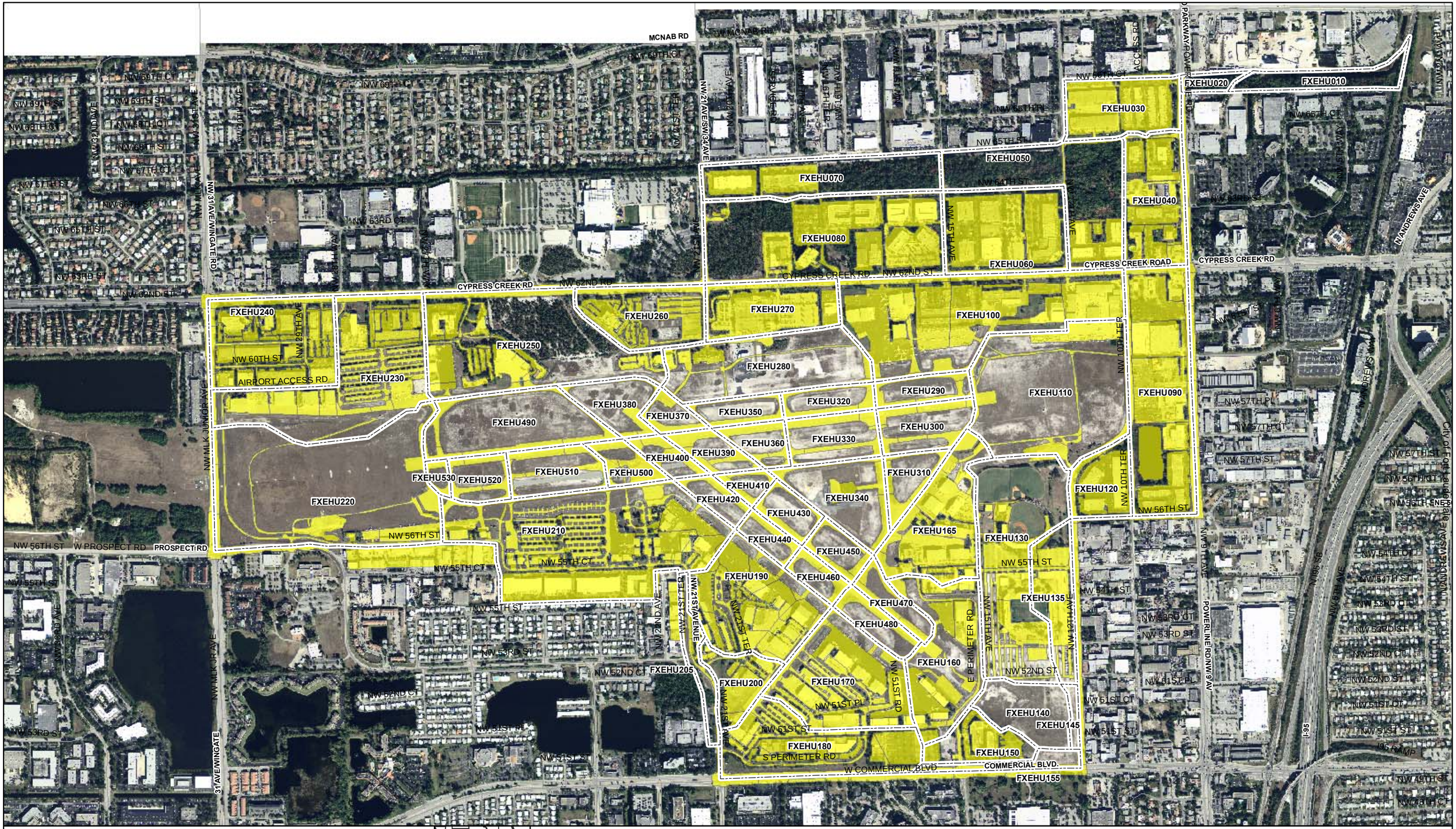
Table 3-3: Impervious and Pervious Areas for Existing and Future (ALP) Conditions

Hydrologic Unit (HU)	Total Area (Ac)	Existing Land-use Condition				Future Land-use Condition				Change in Imperv. Area (%)
		Impervious Area (Ac)	Pervious (%)	DCIA* (%)	NDCIA** (%)	Impervious Area (Ac)	Pervious (%)	DCIA* (%)	NDCIA** (%)	
FXEHU010	9.1	0.6	93.0	0.0	7.0	0.0	100.0	0.0	0.0	-100.0
FXEHU020	2.8	0.1	94.7	4.2	1.1	0.1	94.7	4.2	1.1	0.0
FXEHU030	17.8	15.2	14.8	76.7	8.5	15.2	14.8	76.7	8.5	0.0
FXEHU040	21.7	17.4	20.0	64.0	16.0	17.4	20.0	64.0	16.0	0.0
FXEHU050	33.4	7.9	76.3	10.8	12.9	7.9	76.3	10.8	12.9	0.0
FXEHU060	27.5	23.3	15.1	65.7	19.2	23.3	15.1	65.7	19.2	0.0
FXEHU070	23.6	8.7	63.1	27.3	9.6	8.7	63.1	27.3	9.6	0.0
FXEHU080	53.3	30.5	42.7	37.4	19.9	30.5	42.7	37.4	19.9	0.0
FXEHU090	42.1	38.4	8.9	84.3	6.8	38.4	8.9	84.3	6.8	0.0
FXEHU100	55.7	42.9	23.0	53.9	23.1	46.5	16.5	58.5	25.1	8.4
FXEHU110	50.8	9.8	80.7	8.1	11.2	10.8	78.8	8.9	12.3	9.8
FXEHU120	11	9.2	16.0	67.2	16.8	9.2	16.0	67.2	16.8	0.0
FXEHU130	42.3	17.7	58.1	31.4	10.5	17.8	57.9	31.6	10.5	0.5
FXEHU135	13.6	9.8	28.0	54.0	18.0	9.8	28.0	54.0	18.0	0.0
FXEHU140	13	0.1	99.2	0.6	0.2	0.1	99.2	0.6	0.2	0.0
FXEHU145	1.7	0.4	74.4	20.5	5.1	0.4	74.4	20.5	5.1	0.0
FXEHU150	10.1	6.7	33.9	54.3	11.8	6.4	37.0	51.7	11.3	-4.7
FXEHU155	4.9	2.4	51.8	39.6	8.6	2.4	51.8	39.6	8.6	0.0
FXEHU160	27.1	16.7	38.5	39.3	22.2	16.9	37.5	39.9	22.6	1.6
FXEHU165	25.1	20.0	20.4	50.9	28.7	20.3	19.1	51.7	29.2	1.6
FXEHU170	31.1	23.2	25.3	52.9	21.8	22.6	27.2	51.5	21.3	-2.5
FXEHU180	28.6	20.0	30.0	63.0	7.0	19.7	31.1	62.0	6.9	-1.6
FXEHU190	30.6	23.9	21.8	60.7	17.5	23.9	21.8	60.7	17.5	0.0
FXEHU200	9.9	7.0	29.5	50.1	20.4	3.9	60.5	28.0	11.5	-44.0
FXEHU205	6.4	2.5	61.1	27.6	11.3	2.5	61.1	27.6	11.3	0.0
FXEHU210	8.8	4.7	46.2	10.8	43.0	4.7	46.1	10.8	43.1	0.2
FXEHU212	43.3	27.3	36.9	12.6	50.5	27.6	36.3	12.7	51.0	1.0
FXEHU214	13.5	12.2	10.0	81.0	9.0	12.2	10.0	81.0	9.0	0.0
FXEHU220	68.3	14.3	79.1	2.1	18.8	15.4	77.5	2.3	20.3	7.7
FXEHU230	46.2	27.5	40.4	46.6	13.0	28.9	37.4	49.0	13.6	5.0
FXEHU240	30.4	24.0	20.9	71.1	8.0	24.0	20.9	71.1	8.0	0.0
FXEHU250	50.3	20.2	59.9	17.0	23.1	22.5	55.3	19.0	25.7	11.5
FXEHU260	18.9	12.0	36.3	51.9	11.8	12.0	36.3	51.9	11.8	0.0
FXEHU270	18.8	15.9	15.6	67.5	16.9	16.0	14.7	68.2	17.1	1.1
FXEHU280	30.3	6.8	77.6	8.7	13.7	16.8	44.7	21.6	33.7	146.9
FXEHU290	7.1	3.2	54.5	0.0	45.5	3.2	54.5	0.0	45.5	0.0
FXEHU300	11.3	4.8	57.5	0.0	42.5	4.8	57.5	0.0	42.5	0.0
FXEHU310	7.4	3.6	51.2	0.0	48.8	4.0	46.1	0.1	53.8	10.5
FXEHU320	6.9	3.4	51.3	0.0	48.7	3.4	51.3	0.0	48.7	0.0
FXEHU330	11.6	4.9	57.4	0.0	42.6	4.9	57.4	0.0	42.6	0.0
FXEHU340	17.1	5.3	68.9	1.7	29.4	13.0	23.8	4.1	72.1	145.0
FXEHU350	6.3	2.7	57.9	0.0	42.1	2.7	57.9	0.0	42.1	0.0
FXEHU360	6.1	3.2	47.4	0.0	52.6	3.2	47.4	0.0	52.6	0.0
FXEHU370	4.6	2.5	45.1	0.0	54.9	2.5	45.1	0.0	54.9	0.0
FXEHU380	9.8	2.8	71.9	0.0	28.1	2.8	71.9	0.0	28.1	0.0
FXEHU390	6.4	3.7	41.6	0.0	58.4	3.7	41.6	0.0	58.4	0.0
FXEHU400	4.8	3.1	35.6	0.0	64.4	3.1	35.6	0.0	64.4	0.0
FXEHU410	3.4	2.0	42.6	0.0	57.4	2.0	42.6	0.0	57.4	0.0
FXEHU420	5	2.2	57.0	0.0	43.0	2.2	57.0	0.0	43.0	0.0
FXEHU430	6.2	2.5	59.3	0.0	40.7	2.7	57.2	0.0	42.8	5.2
FXEHU440	4.6	2.1	54.4	0.0	45.6	2.1	54.4	0.0	45.6	0.0
FXEHU450	6.1	2.7	55.1	0.0	44.9	3.0	50.6	0.0	49.4	10.0
FXEHU460	4.7	2.6	44.5	0.0	55.5	2.6	44.5	0.0	55.5	0.0
FXEHU470	6.2	3.4	45.7	0.0	54.3	2.6	57.4	0.0	42.6	-21.5
FXEHU480	6.8	3.2	52.6	0.0	47.4	3.2	52.6	0.0	47.4	0.0
FXEHU490	25.9	6.6	74.6	0.0	25.4	6.6	74.6	0.0	25.4	0.0
FXEHU500	5.9	4.3	26.8	0.0	73.2	4.3	26.8	0.0	73.2	0.0
FXEHU510	11.5	4.5	60.8	0.0	39.2	4.5	60.8	0.0	39.2	0.0
FXEHU520	7.2	3.3	54.7	0.0	45.3	3.3	54.7	0.0	45.3	0.0
FXEHU530	1.9	1.1	42.9	0.0	57.1	1.1	42.9	0.0	57.1	0.0

* DCIA = Directly Connected Impervious Area, estimate of % of total area that is impervious and routes to hydrulic system

** NDCIA = Non-Directly Connected Impervious Area, estimate of total area that is impervious and routed to pervious layer with PctRouted Input

8/31/2017 9:35 AM



N

Legend

- Hydrologic Units (HUs)
- Existing Impervious Areas
- Roads

FXE

Fort Lauderdale Executive Airport

6000 NW 21st Avenue
Fort Lauderdale, FL 33309

1 inch equals 950 feet

0 475 950 1,900 *Feet*

Figure 3-5
Existing Impervious Areas

Bid 276-11834

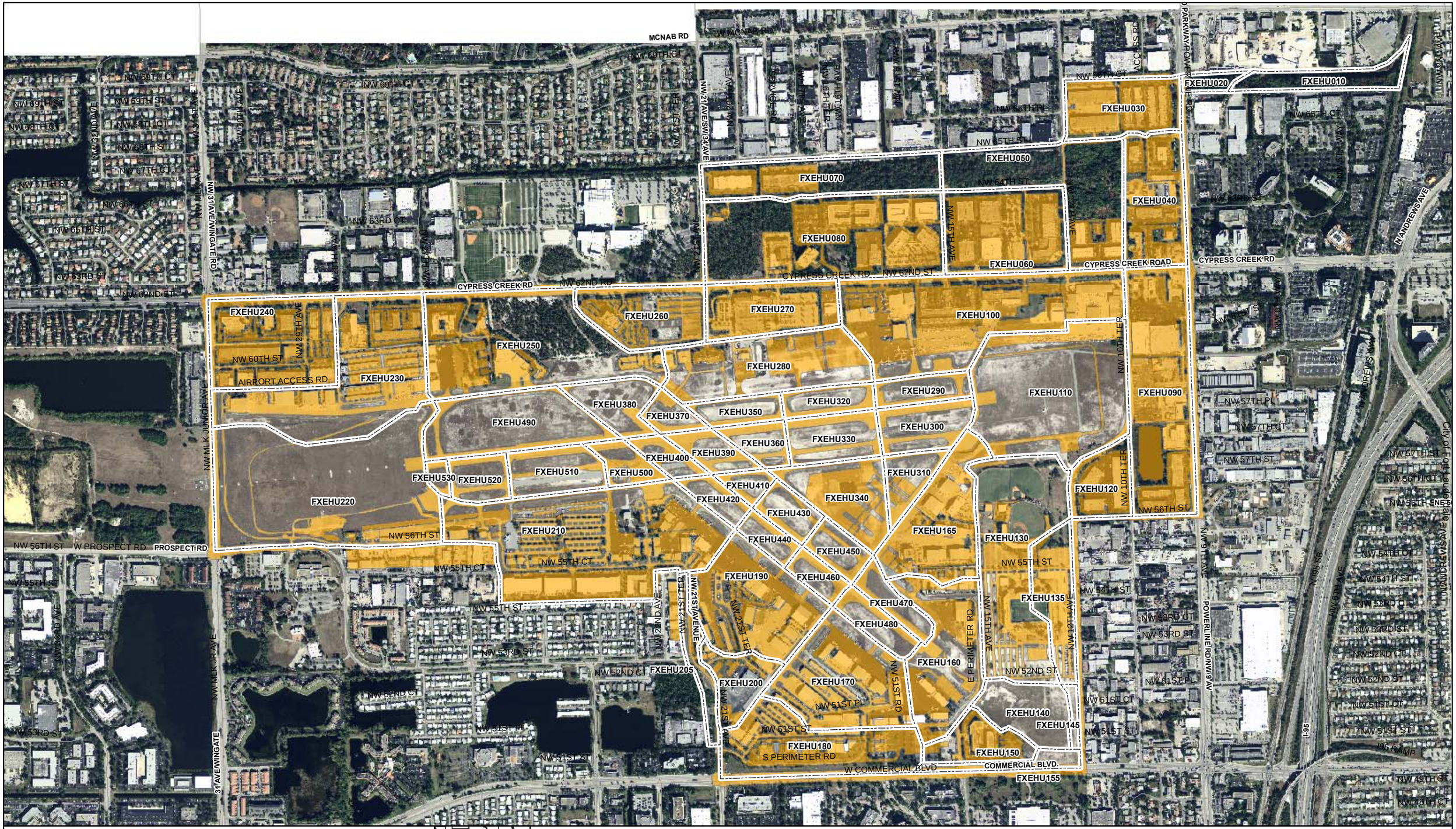
CAM #17-1096
Exhibit 2
Page 96 of 191

CDM Smith

p. 96

\\Projects\Fort-Lauderdale\FXE\Data\GIS\2_MXDs\FXE_ImpervEx.mxd GBC 5/03/09

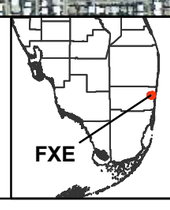
8/31/2017 9:35 AM



N

Legend

- Hydrologic Units (HUs)
- Roads
- Future Impervious Areas



Fort Lauderdale Executive Airport

6000 NW 21st Avenue
Fort Lauderdale, FL 33309

1 inch equals 950 feet

0 475 950 1,900 *Feet*

Figure 3-6
Future Impervious Areas
(Source: FXE ALP)

Bid 276-11821

CDM Smith

CAM #17-1096
Exhibit 2
Page 97 of 191

p. 97

\\Projects\Fort-Lauderdale\FXE\Data\GIS\2_MXDs\FXE_ImpervEx.mxd GBC 5/03/09

3.5 Rainfall Data

Two types of rainfall data were evaluated for this project, daily and 15-minute interval rainfall. Both of which are useful for water quantity modeling. The SFWMD was the main source of these data. **Figure 3-7** shows the location of the rainfall gauges identified within the study area. **Table 3-4** provides information on the rainfall gauges shown in Figure 3-7 identified by station name and DBKEY.

Table 3-4: Rainfall Gauges Located within the Study Area.

Station Name	DBKEY	Agency	Period	Location	Frequency
S36_R	16681	WMD	1991-2011	Canal C-13	DA,15m
S37A_R	16680	WMD	1991-2011	Canal C-14 – East (Cypress Creek)	DA,15m
S37B_R	16612	WMD	1991-2011	Canal C-14 – West (Cypress Creek)	DA,15m

Note: "DA" and "15m" stand for daily and 15-minute interval data frequency, respectively.

These rainfall stations are located on the salinity-control and diverting structures of the Canal C-13 and Canal C-14, where stage and streamflow data are also available.

3.6 Stage, Discharge Monitoring Data

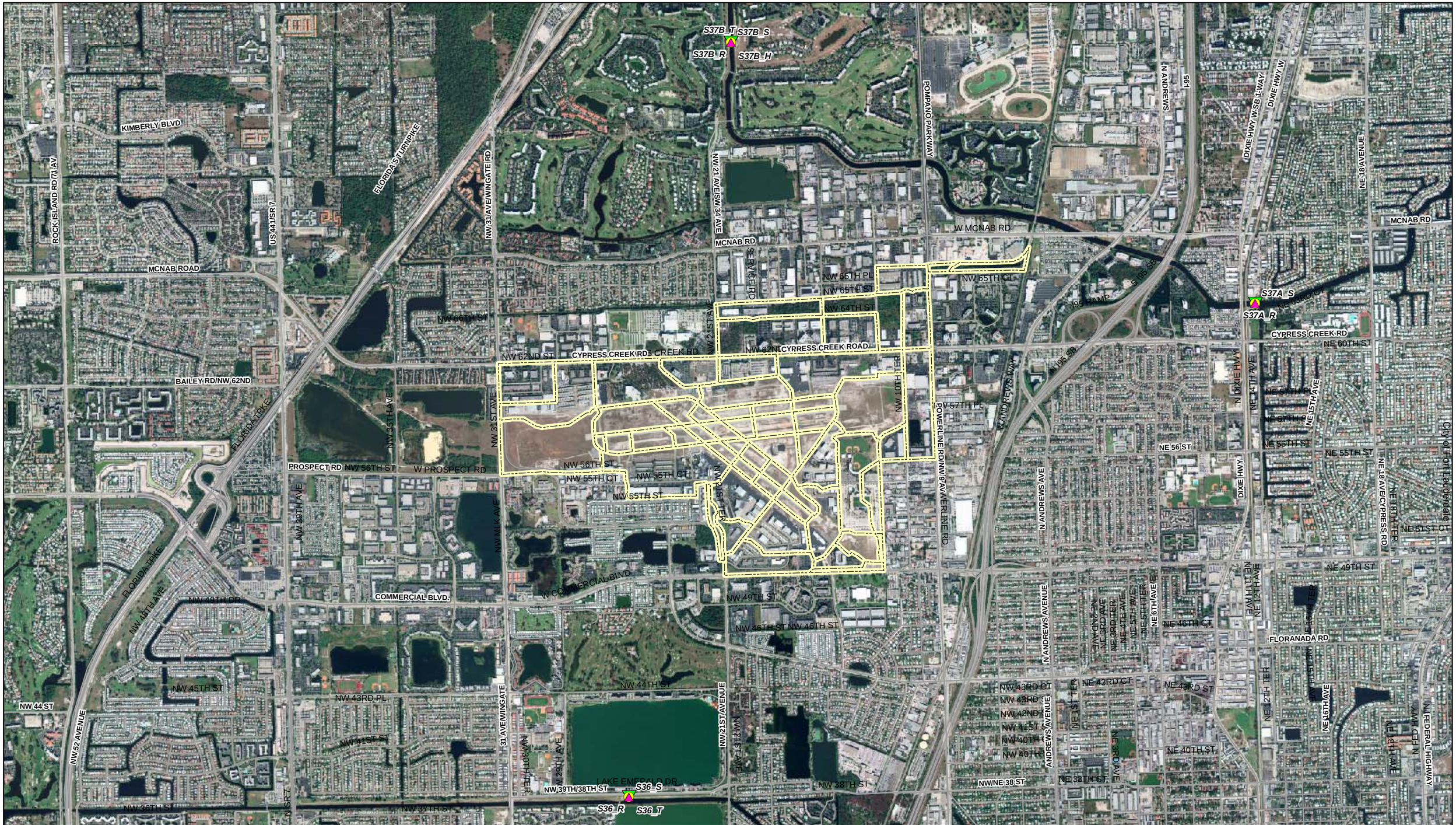
The SFWMD is the main source available in the area for streamflow and stage data. Upstream and downstream stage data of the salinity-control structures and estimated discharge through the structures is available on a daily and 15-minute time step. Flow discharges through these salinity-control structures are computed using theoretical discharge-coefficient ratings based on manual readings of gate openings, stages by the SFWMD and the US Army Corp of Engineers (USACE).

Table 3-5 provides a summary of flow and stage gauges identified within the study area. At the stage gauges located on gate (G) and spillway (S) structures, headwater and tailwater elevations are measured to estimate discharge passing through the structure. The location of these gauges is shown in Figure 3-7.

Table 3-5: Flow and Stage Stations Identified within the Study Area.

Station	Data Type	Reported Statistic	Starting Date	Ending Date	Easting	Northing
S36_S	Flow	Mean	1/1/1978	6/30/2008	925637	669573
S37A_S	Flow	Mean	1/1/1978	6/30/2008	940883	681556
S37B_S	Flow	Mean	1/1/1978	6/30/2008	928114	687893
S36_H	Stage - Headwater	Mean	5/31/1985	4/17/2011	925637	669573
S36_T	Stage -Tailwater	Mean	5/31/1985	4/17/2011	925637	669573
S37A_H	Stage -Headwater	Mean	5/31/1985	4/17/2011	940883	681556
S37A_T	Stage -Tailwater	Mean	5/31/1985	4/17/2011	940883	681556
S37B_H	Stage -Headwater	Mean	8/31/1985	4/17/2011	928114	687893
S37B_T	Stage -Tailwater	Mean	8/31/1985	4/17/2011	928114	687893

8/31/2017 9:35 AM



Fort Lauderdale Executive Airport

6000 NW 21st Avenue
Fort Lauderdale, FL 33309

1 inch equals 2,150 feet

0 1,075 2,150 4,300 Feet

Figure 3-7
Rainfall, Flow, and Stage Gauges
(Source: SFWMD)

Bid 276-11824

CDM Smith

CAM #17-1096
Exhibit 2
Page 99 of 191

p. 99

\\Projects\Fort-Lauderdale\FXE\Data\GIS\2_MXDs\FXE_RFlowStg.mxd GBC 5/03/09

3.7 Stormwater Infrastructure Data

The City provided information from several sources and formats regarding the existing stormwater infrastructure in the study area. The location of the stormwater infrastructure was included in AutoCAD files and information on pipe materials, type of infrastructure (pipe or exfiltration trench), and size, when available, was included in record drawings distributed in PDF format. The above information was extracted from each source and compiled into a Geographic Information System (GIS) shapefile for further use modeling.

The final shapefile includes the following stormwater pipe information:

- 219 total stormline conduits, of which 70% have identified pipe diameters and 20% have identified pipe invert elevations;
- 30,530 LF of stormline conduits, from which 50% correspond to exfiltration trenches; and
- 92 exfiltration trenches totaling 15,265 LF, equaling 42% of the total conduits and 50% of the total length.

Figure 3-8 shows the geographic location of the stormwater infrastructure.

3.8 Best Management Practices

Best management practices (BMPs) are structural and non-structural measures used for the protection of natural resources and to comply with established water quality regulations for new and existing developments. The ERP is the means of regulating stormwater quantity and quality compliance for new or improved developments. Locally, the SFWMD together with the Florida Department of Environmental Protection (FDEP) regulate the ERP application procedure through Broward County.

3.8.1 Existing Best Management Practices

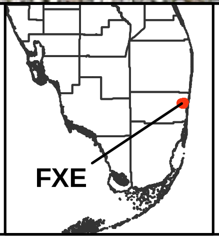
The SFWMD ERP database was consulted to obtain information about existing BMPs in the study area. **Table 3-6** provides a summary of the existing BMPs.

Not all parcels at the Airport had an available ERP file in the SFWMD library. In order to complement this information, the design drawings of most Airport parcels were used to extract information on existing BMPs, such as exfiltration trenches and dry retention areas (i.e. swales). **Table 3-7** shows the total length of exfiltration trenches identified from different sources for each HU. **Table 3-8** presents the total area of retention and swales located within parcels and in between runways/taxiways for each HU.

Due to the location of the project area with respect to the Prospect Wellfield, dry and wet retention areas are widely used as stormwater treatment alternatives, which limit discharge to surrounding State waters.

N

Legend
- Exfiltration Trenches
- Drainlines
- Hydrologic Units (HUs)



Fort Lauderdale Executive Airport

6000 NW 21st Avenue
Fort Lauderdale, FL 33309

1 inch = 950 feet

0 475 950 1,900 Feet

Figure 3-8
Stormwater Infrastructure
(Source: FXE, FDOT, FTL)

CDM Smith

Table 3-6: BMPs from SFWMD Database.

Permit No.	Application No.	Current Ownership	Year	Permitted Area (ac)	Parcel/Lot	BMP Implemented	Offsite Discharge
06-00907-S	07067-4	Liberty Property Ltd.	1988	17.0	Lots 4, 5 – Industrial Airpark	Exfiltration Trenches – 5,102 LF	BCWCD Canal No. 4
06-03018-P	000214-11	Sheltair Exec. South	2000	7.9	Parcel 16	Swales & Exfiltration Trenches – 1,087 LF (Treatment Provided = 1.26 ac-ft)	No
06-03330-P	010726-3	Performance Trading Inc.	2001	3.5	Parcel 8D	Swale & Exfiltration Trenches – 510 LF	No
06-01048-S-02	000626-17	Wells Operating Partnership	2000	4.3	Lots 18, 19 – Industrial Airpark	Swales & Exfiltration Trenches – 1,250 LF	BCWCD Canal No. 4
06-01048-S-02	000829-6	The Alter Group/Cypress Concourse, LLC	2000	12.1	Lots 25, 26, 38, 39 – Industrial Airpark	Swales & Exfiltration Trenches – 1,419 LF	BCWCD Canal No. 4
06-00757-S	12095-E	Airport Executive Center Partner	1986	6.1	Parcel 21A	Swales	To Adjacent Lake
06-00803-S		Citicorp N.A.	1986	7.4	Parcel 19A	Offsite Retention Area – 3.0 ac	No
06-00641-S	11014-C	Executive Airport Business Center	1985	11.6	Parcel 1A	Swale & Exfiltration Trenches – 608 LF	MSS4 (City Culvert – Canal C-13)
84-00001-S		World Jet	1984	9.3	Parcel 11A, 11B	Swales & Exfiltration trenches – 900 LF	No
06-00896-S	05197-A	Sheltair	1988	12.5	Parcel 5	Exfiltration Trenches – 1,250 LF	No

Notes: Broward County Water Control District (BCWCD)

Table 3-7: Total length of identified exfiltration trenches per hydrologic unit.

Hydrologic Unit (HU)	Length of Exfiltration Trenches (ft)
FXEHU030	5,102
FXEHU050	216
FXEHU070	1,272
FXEHU080	1,416
FXEHU100	1,172
FXEHU110	1,116
FXEHU120	966
FXEHU165	1,970
FXEHU170	1,421
FXEHU190	1,034
FXEHU230	1,356
FXEHU250	118
FXEHU260	483
FXEHU280	525
Total	**17,582**

Table 3-8: Retention and swale areas identified per hydrologic unit.

Hydrologic Unit (HU)	HU Area (ac)	Retention Area (ac)	% HU Area
FXEHU060	27.49	1.42	5%
FXEHU070	23.64	2.18	9%
FXEHU080	53.27	1.67	3%
FXEHU090	42.14	0.00	0%
FXEHU100	55.67	4.30	8%
FXEHU110	50.84	1.01	2%
FXEHU120	11.01	0.47	4%
FXEHU130	42.34	1.79	4%
FXEHU140	12.97	3.92	30%
FXEHU150	10.13	0.00	0%
FXEHU160	27.14	2.21	8%
FXEHU165	25.09	0.35	1%
FXEHU170	31.08	3.06	10%
FXEHU180	28.56	3.00	10%
FXEHU190	30.63	1.79	6%
FXEHU200	9.86	0.64	6%
FZEHU205	6.37	1.70	27%
FXEHU210	65.67	0.93	1%
FXEHU220	68.31	0.00	0%

Hydrologic Unit (HU)	HU Area (ac)	Retention Area (ac)	% HU Area
FXEHU230	46.20	7.82	17%
FXEHU250	50.28	2.77	6%
FXEHU270	18.75	0.55	3%
FXEHU280	30.30	1.69	6%
FXEHU290	7.10	3.91	55%
FXEHU300	11.30	6.21	55%
FXEHU310	7.40	3.65	49%
FXEHU320	6.93	3.51	51%
FXEHU330	11.63	6.30	54%
FXEHU340	17.11	11.46	67%
FXEHU350	6.31	3.54	56%
FXEHU360	6.13	2.77	45%
FXEHU370	4.59	2.00	44%
FXEHU380	9.78	6.56	67%
FXEHU390	6.45	2.45	38%
FXEHU400	4.77	1.66	35%
FXEHU410	3.43	1.40	41%
FXEHU420	4.96	2.76	56%
FXEHU430	6.21	3.62	58%
FXEHU440	4.56	2.42	53%
FXEHU450	6.13	3.32	54%
FXEHU460	4.70	2.05	44%
FXEHU470	6.17	2.74	44%
FXEHU480	6.85	3.44	50%
FXEHU490	25.94	18.40	71%
FXEHU500	5.86	2.49	43%
FXEHU510	11.49	6.60	57%
FXEHU520	7.20	3.67	51%
FXEHU530	1.94	0.78	40%
Total	**962.7**	**151.0**	**16%**

3.8.2 Structural Best Management Practices

3.8.2.1 First-Flush Inlets, Baffle Boxes, and Oil Water Separators

First-flush inlets are designed to prevent sediment, oil, and grease from entering storm drains and stormwater infiltration systems. These inlets are typically used on sites where high loads of sediments and/or oil and grease are generated (e.g., fuel stations, commercial areas, and small parking lots). First-flush inlets are typically installed at catch basins, while baffle boxes are typically installed further downstream in the storm sewer. **Figure 3-9** shows photographs of this system installed at the Miami International Airport.

Baffle boxes are concrete or fiberglass structures containing a series of sediment settling chambers separated by baffles. The primary function of a baffle box is to remove sediment, suspended particles, and associated pollutants from storm water. These systems are sometimes coupled with screens or skimmers to capture larger materials. The design concept of a baffle box is similar to the design of a three-chamber water quality inlet, also known as an oil-grit separator, where stormwater enters the box and begins to fill the first chamber, slowing down velocity allowing for settling. Larger particles settle in the first chamber whereas smaller particles settle in subsequent chambers. Typical baffle boxes are 10 to 15 feet long, 2 feet wider than the pipe, and 6 to 8 feet high. In order to maintain this structure, manholes should be located over each chamber for easy access.

Baffle boxes, when used in conjunction with pretreatment measures such as pavement sweeping, may be the most feasible water quality control device in areas where other, more traditional, measures may not be applicable due to various constraints. Target pollutant sizes are fine sands and larger particles. Baffle boxes have shown to remove from 500 to 50,000 pounds of sediment per month, depending on sediment load entering the baffle box, which could yield a percent reduction as high as 85% and 45% for total phosphorus and BOD_5, respectively. A major disadvantage of baffle boxes is that they require significant maintenance to remove accumulated sediment with recommended maintenance frequencies of 2-3 months during the dry season and every month during the wet season.

Precast oil/water separators are also available and can be installed on small commercial and industrial sites at the Airport. The new coalescent plate separators are relatively efficient (50 percent to 80 percent removals are reported). These could be used at fuel stations and industrial areas at the Airport. According to the FAA regulations, these systems should be installed where there is an oil/water separation problem. **Figure 3-10** shows an oil/water separator schematic depicting design elements and maintenance activities, including a baffle box (grit chamber) and oil recovery and disposal. **Figure 3-11** shows a typical baffle box section view. **Figure 3-12** presents a section of the oil/water separator itself.

Maintenance requirements vary by type and application, but generally require cleaning the chambers four to six times a year to remove pollutants. Frequent maintenance is essential for the effective removal of pollutants for these systems. The cleaning process includes pumping out the contents of each chamber into a tank truck. If the entire contents are pumped out as slurry, they are then transferred to a sewage treatment system. If the runoff is separated from the sediments by onsite siphoning, the sediments can be trucked to a landfill for final disposal.

One of the limitations to first-flush inlets and baffle boxes is their size, particularly in areas where the seasonal high water table is close to the surface. In order to achieve 85 percent capture of the average annual rainfall volume, a baffle box needs to be approximately 8 feet high by 10 feet wide and 1.5 feet long for each acre of drainage. Costs vary widely, but are in the range of $2,000 - $5,000 per foot. The CDS, Stormceptor and Vortechnics units are relatively smaller, but still require a significant space for installation. For example, the smallest Stormceptor, currently listed, extends 5.3 feet below the pipe invert.

Figure 3-9: Photographs of First Flush Inlet Systems. (Source: Miami International Airport, MIA)

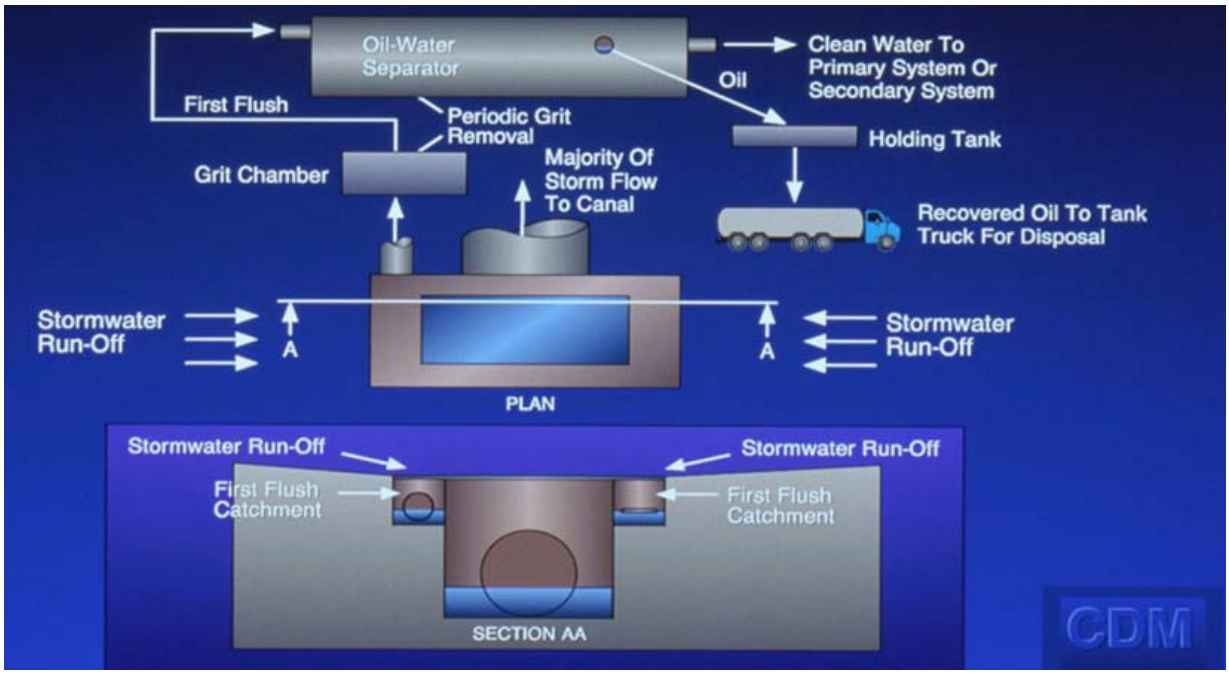


Figure 3-10: Schematic of Oil/Water Separator Flow Chart.

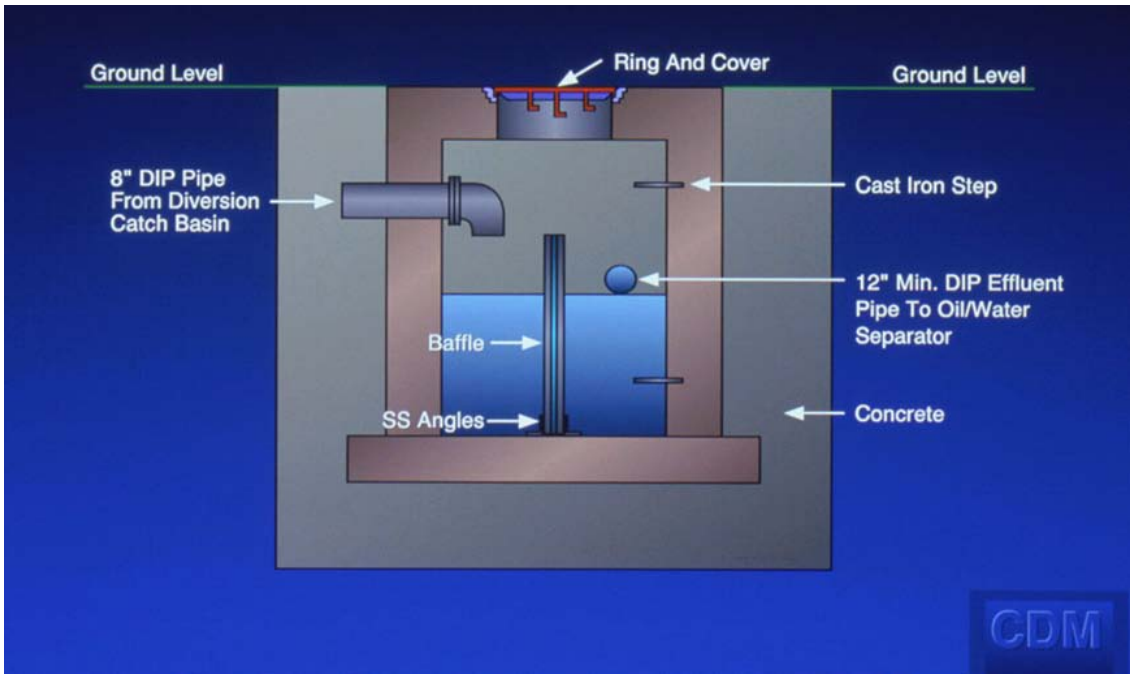


Figure 3-11: Baffle Box (Grit Chamber) Section View.

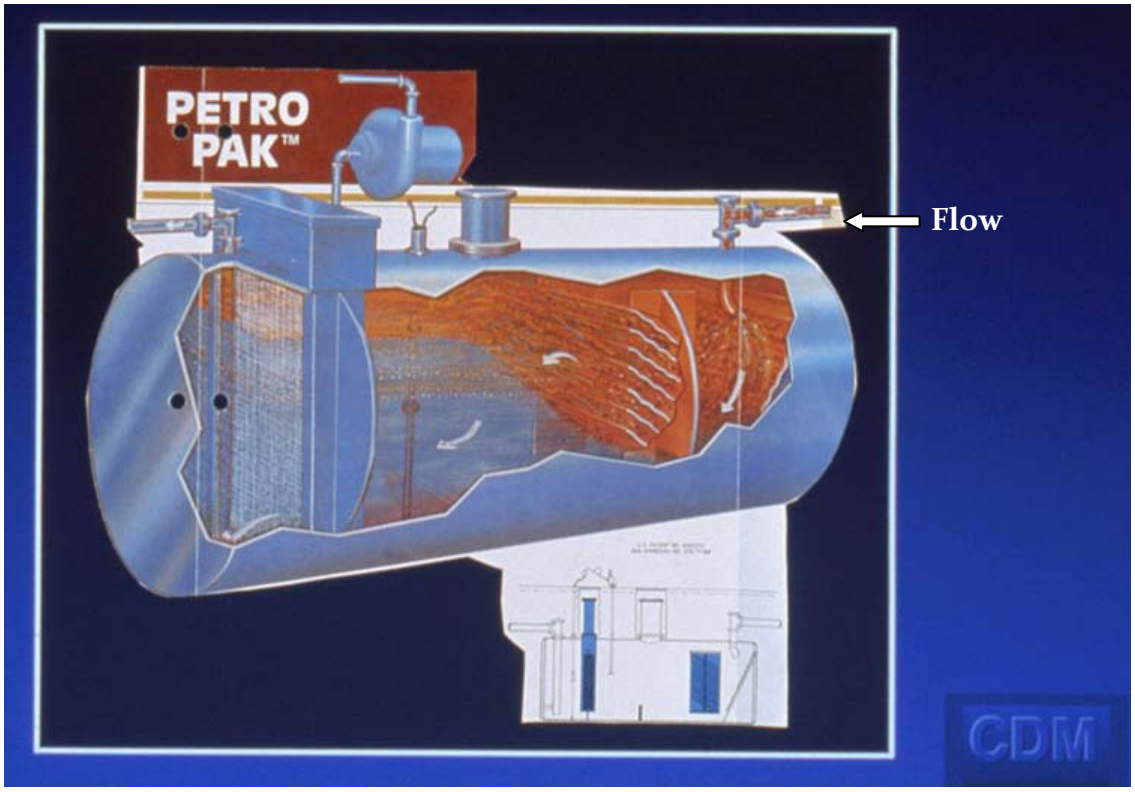


Figure 3-12: Oil/Water Separator Section View.

3.8.2.2 Dry Detention Ponds

Dry detention basins (and extended dry detention basins) are designed to increase detention times of runoff to provide treatment for the captured first-flush runoff, which enhances solids settling and the removal of suspended pollutants. The basins are designed to be dry prior to storm events and to return to a dry condition after holding runoff for a period of time. In an extended dry detention facility, runoff is detained longer than in a simple detention system (e.g. swale). The captured runoff is released through a control structure at a rate that is slow enough to achieve maximum pollutant removal by sedimentation. These types of detention basins can be designed to achieve heavy metal loading reductions (e.g., 75 percent for lead and 45 percent for zinc) that are similar to wet detention basins, since heavy metals in urban runoff tend to be primarily in suspended form. Dry detention basins require much less storage, and they cost less than wet detention basins because they rely solely on sedimentation processes without the expense of additional storage for the pool (i.e., portion of the basin that holds water at all times in wet detention systems). Extended dry detention may be useful in areas where retrofitting BMPs is required. **Figure 3-13** shows a typical cross-section.

Potential Benefits of a Dry Detention Basin

- Reduction of downstream flooding by attenuating the peak rate of flow;
- Removal of some suspended pollutant loadings to receiving bodies of water;
- Reduction in cost for downstream channel improvements;
- Creation of fill that may be used on site or be sold (basin sediment removal); and
- Low frequency of failure compared to exfiltration and retention systems.

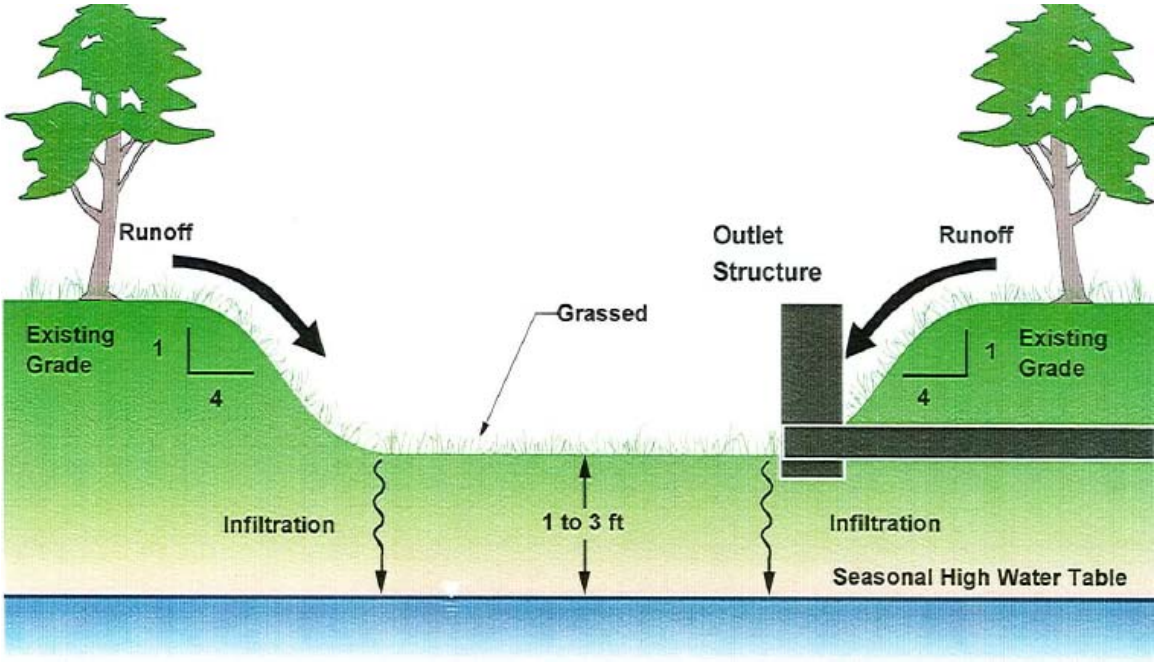


Figure 3-13: Dry Detention Diagram.

Potential Limitations of a Dry Detention Basin

- Does not remove dissolved pollutants (nutrients);
- Requires frequent clean-outs to minimize "eye-sore" potential;
- Potential safety hazards, if not designed and constructed properly;
- No permanent pool to store sediment inflow;
- Occasional nuisance problems such as debris and mosquitoes; and
- Requires regular maintenance to prevent nuisance plant species and to remove accumulated sediments.
- Must have reasonably good depth to seasonally high water table in order to have dry conditions.

SFWMD Dry Detention Design Criteria

- *Treatment Volume* – The dry detention treatment volume must be 75 percent of the treatment volume required for wet detention (e.g. the greater of 0.75 inches of runoff from the project or 1.9 inches times the percent impervious). Commercial and industrial projects must provide 0.5-inches of retention/detention pretreatment prior to discharge into a dry retention facility.
- *Detention Volume Recovery* – Basin outlets should be designed to discharge no more than 0.5 inches of the detention volume in the first 24 hours following a storm event.
- *Skimmers* – Facilities that receive stormwater from contributing areas with more than 50 percent impervious surface area, or that are a potential source of oil and grease contamination, must include a baffle, skimmer, and grease trap to prevent these substances from being discharged from the facility.

3.8.2.3 Exfiltration Trenches

An exfiltration trench is an onsite retention of stormwater accomplished through underground exfiltration. The trench can be off-line or on-line, with on-line volume requirements being greater than off-line. The subsurface retention facilities most commonly used are excavated trenches with perforated pipe backfilled with coarse graded aggregate. Stormwater runoff is collected for temporary storage and infiltration. Water is exfiltrated from the pipe and trench walls for groundwater recharge and treatment. The addition of pipe increases the available storage and promotes infiltration by causing the runoff to be more effectively and evenly distributed over the entire length of the trench.

Exfiltration trenches are used to retain the first flush of stormwater runoff. This promotes pollutant load reductions to receiving waters, reduces the runoff volume and peak discharge rate from the site, filters suspended pollutants out of groundwater discharges, and promotes the recharge of groundwater.

Exfiltration trenches are likely to have a satisfactory level of performance at the Airport due to the relatively deep seasonal high groundwater table when compared to other areas in the City. Exfiltration trenches are practical in highly permeable soils (Hydrologic Group A or B), where the subsoil is sufficiently permeable to provide a reasonable rate of infiltration, and where the water table is sufficiently lower than the design depth of the facility, to allow for recovery of storage prior to the next storm event (generally required in 72 hours). It is frequently used for the disposal of runoff from roof drains, parking lots, and roadways. This practice is not recommended where runoff contains high concentrations of suspended materials, unless a pre-settling or

filtering mechanism is provided. Likewise, grease and oil traps are also highly recommended prior to discharge to these systems. Providing sediment sumps in inlets or raising inlet tops above grade for pretreatment in swales will reduce sediment buildup in the trench. These precautions are primarily for maintenance since exfiltration systems are very susceptible to clogging and sediment buildup, which reduces their hydraulic efficiency and storage capacity to unacceptable levels. **Figure 3-14** shows a profile view of a typical exfiltration trench.

Potential Benefits of an Exfiltration Trench

- Mimic the natural groundwater recharge capabilities of the site;
- Are relatively easy to fit into the margins, perimeters, and other space-constrained areas of a development site, including under pavement;
- Provide off-line treatment for environmentally sensitive waters; and
- Are used to retrofit already developed sites where space is limited.
- Often more costly than other treatment alternatives, especially when operation and maintenance costs are considered.

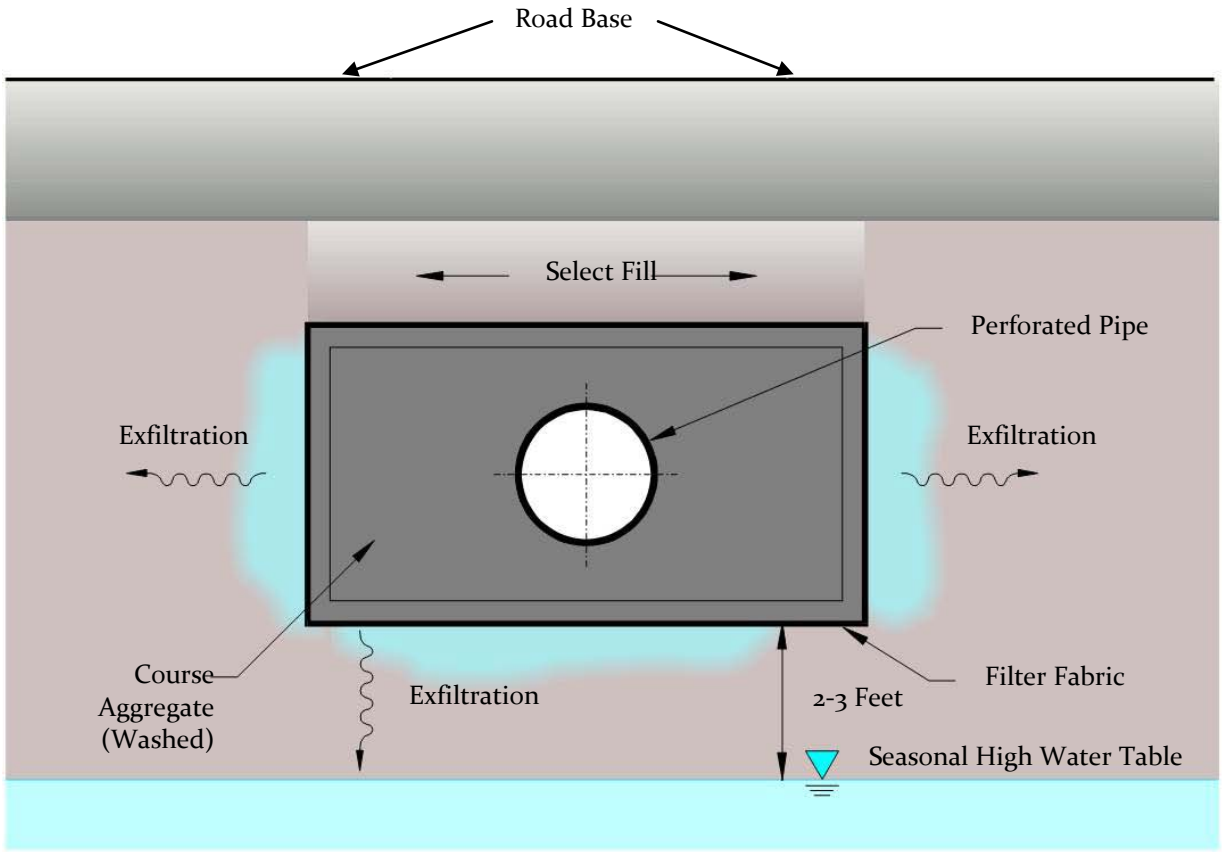


Figure 3-14: Exfiltration Trench Diagram.

Potential Limitations of an Exfiltration Trench

- Very susceptible to clogging;
- Have relatively short life spans before replacement or extensive restoration/ maintenance of system is required;
- Require highly permeable soils to function properly;
- Have difficulties keeping sediment out of the structure during site construction;
- Not recommended for clayey or highly erodible soils; and

SFWMD Design Criteria for Exfiltration Trench

- *Treatment Volume* – Exfiltration trenches must have the same treatment volume as retention systems. The retention treatment volume shall be 50 percent of the treatment volume required for wet detention (e.g. the greater of 0.5 inches of runoff from the project or 1.25 inches times the percent impervious). Commercial or industrial projects must provide 0.5 inches of retention/detention pretreatment prior to discharge into a dry retention facility,
- *Minimum Pipe Diameter* – The minimum allowable pipe diameter is 18 inches;
- *Trench Width* – The minimum trench width is 3 feet;
- *Filter Media* – Rock in the trench must be enclosed in filter material on top and sides; and
- *Exfiltration Rate* – Must exfiltrate treatment volume over one hour, prior to overflow.

3.8.2.4 Shallow Grassed Swales

Shallow grassed swales are shallow trenches graded and planted with suitable vegetation for the storage, treatment, and potentially the conveyance of runoff. Shallow grassed swales are the most common detention/retention facilities for controlling storm water peak discharges and are typically designed to provide the dual functions of stormwater quantity and quality control. A swale can be defined as a man-made trench that:

- Has a top cross section width to depth ratio equal to or greater than 6:1, or side slopes equal to or greater than 3:1;
- Contains contiguous areas of standing or flowing water only following a rainfall event;
- Is planted with or has stabilized vegetation suitable for soil stabilization, stormwater treatment, and nutrient uptake;
- Is designed to take into account the soil erodability, soil percolation, slope length, and drainage area to prevent erosion and reduce the pollutant concentration of any discharge; and
- Typically have V-shaped or circular cross sections.

Swales are normally used for retention and detention for runways and taxiways in airside areas and can be used landside with landscaping. They are best suited for soils of moderate to high infiltration capacity (usually Hydrologic Groups A or B and sometimes C). With slight modifications (e.g., check dams, raised inlets, or swale blocks), swales can be used to add retention storage, control erosion, provide aquifer recharge, and/ or further reduce the pollutant load from concentrated stormwater runoff in urban areas. They may also be used as pretreatment in the overall stormwater system. **Figure 3-15** shows an example of a typical swale.

Potential Benefits of Shallow Grassed Swales

- Usually less expensive than installing curbs and gutters and other water quality treatment controls;
- Hardly noticeable if shallow swales (0.5 to 1.0 foot maximum depth) are designed and constructed with gradual slopes (4:1 to 6:1);
- Can provide off-line treatment for environmentally sensitive waters;
- Can reduce peak rates of discharge by storing, detaining, or attenuating flows;
- Can reduce the volume of runoff discharged by infiltrating runoff with a raised inlet or check dam;
- Maintenance can be performed by the adjacent owner;
- Can be used in space-constrained areas such as along lot lines, rear of lots, and along roadside;
- Can be used as water quality treatment or pretreatment with other BMPs;
- Recovers storage and treatment volumes quickly, where soils are permeable; and
- Can be used as recessed residential or commercial landscape areas (part of green space requirement), and runoff collection can become the source for irrigation and some nutrients (saving money), provided the use does not impact long-term maintenance or existing trees.

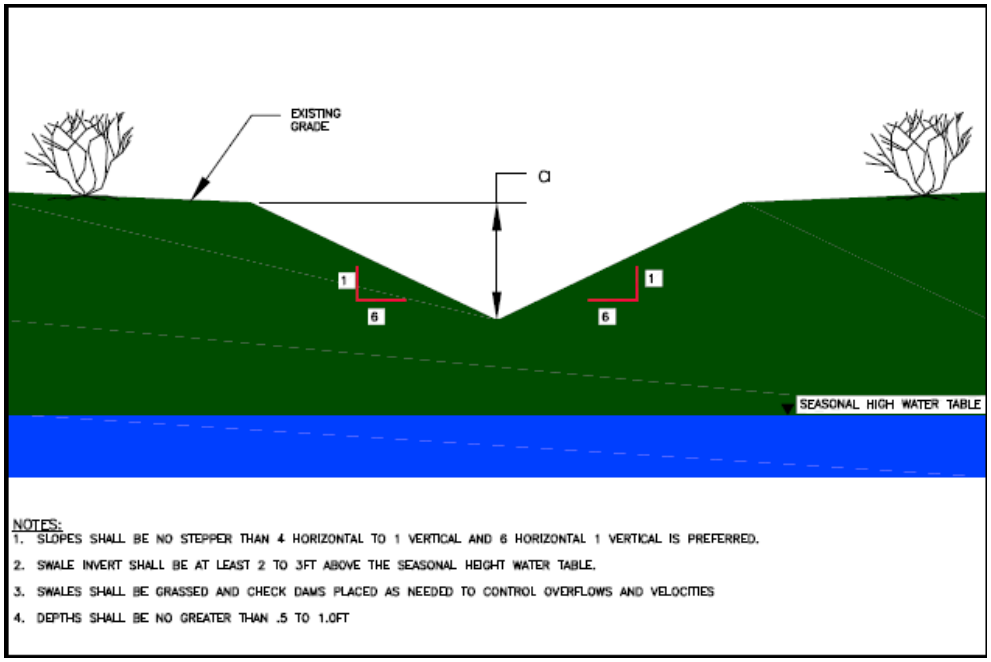


Figure 3-15: Shallow Grassed Swale Diagram.

Potential Limitations of Shallow Grassed Swales

- Effective only as a conveyance system in unsuitable soils;
- Possible nuisances such as odors, mosquitoes, or nuisance plant species can occur if not designed, constructed, or maintained properly;
- Aesthetically unpleasing and a hazard if improperly designed and constructed (deep with steep side slopes); and
- May not be suitable, or may require geotextile matting, in areas that serve as vehicle parking areas.

3.8.3 Nonstructural Best Management Practices

3.8.3.1 Land Use Planning

Land use planning and management during redevelopment presents an important opportunity to reduce/minimize pollutants in stormwater runoff and control flooding. Management measures may include modifications or restrictions of certain land use activities, or requirements regarding onsite flood control. Greater restrictions may be warranted where development can affect impaired, threatened, or significant waterbodies. Because increased pollutant loadings and flooding correspond to increases in impervious cover, land use planning can become an effective control measure.

3.8.3.2 Directly Connected Impervious Areas Minimization

Another non-structural BMP available is minimizing the amount of directly connected impervious areas (DCIA) on site and promoting the use of green buffer zones around paved areas for infiltration. For example, roof runoff from structures can be directed to green buffer zones or shallow swales around buildings instead of parking lots and driveways. In addition, runways, taxiways, and aprons can be graded to landscaped/grassed areas or swales, reducing direct runoff to the storm drainage system.

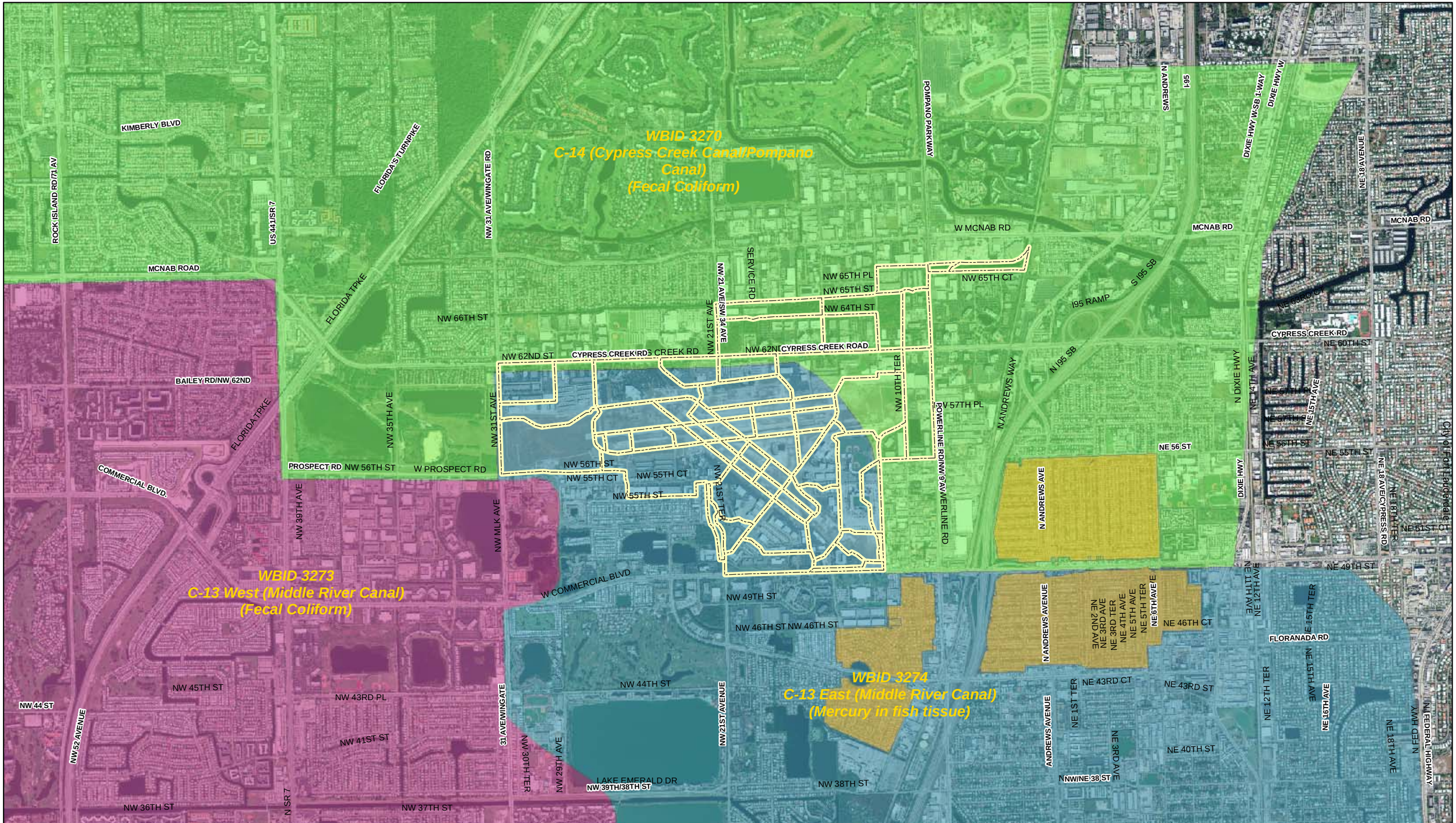
3.9 Water Quality Data

According to the Section 303 (d) list of Group 4 adopted on November 2, 2010, developed by requirement of the Clean Water Act, three waterbody identification (WBID) segments neighbor the boundaries of the Airport. These listed waterbodies are classified as impaired waters in the Southeast Coast – Biscayne Bay Basin by the FDEP. **Figure 3-16** and **Table 3-9** show the WBID segments near the Airport and give the reasons for their impairment.

Table 3-9: Impaired Waterbody Identification (WBIDs) segments near the Airport.

WBID	Name	Parameters of Impairment	Priority for TMDL Development	Discharge from Airport
3270	C-14 (Cypress Creek Canal/Pompano Canal)	Fecal Coliform	2010	Yes, through four outfalls
3273	C-13 West (Middle River Canal)	Fecal Coliform	High	No, indirectly by overland flow
3274	C-13 East (Middle River Canal)	Mercury (in fish tissue)	High	Yes, through one outfall

8/31/2017 9:35 AM



N

Legend

Impaired WBIDs

WBID

- 3270
- 3273
- 3274

- Septic Tank Land Use
- Hydrologic Units (HUs)
- Roads

FXE

Fort Lauderdale Executive Airport

6000 NW 21st Avenue
Fort Lauderdale, FL 33309

1 inch equals 2,150 feet

0 1,075 2,150 4,300 Feet

Figure 3-16
Impaired Waterbody Identification Segments (WBIDs)

Bid 276-118

CDM Smith

CAM #17-1096
Exhibit 2
Page 114 of 191

p. 114

\\Projects\Fort-Lauderdale\FXE\Data\GIS\2_MXDs\FXE_WBIDs.mxd GBC 5/03/09

Total Maximum Daily Loads (TMDLs) were developed for the Pompano Canal (WBID 3271) by the EPA for nutrients requiring a 55 percent reduction for total nitrogen, and 45 percent reduction for total phosphorus. No other TMDL has been established in the area yet.

Fecal coliforms are the impairment parameter in two of the WBIDs listed in Table 3-10 and are the reason for impairment in other WBIDs within the City. Due to its prevalence, this parameter has been studied locally by researchers; one of such studies is summarized in the next subsection. Figure 3-13 shows the location of residential land uses within the mentioned WBIDs which are not yet discharging wastewater through sewers, but instead still through septic tanks. Bacterial contamination is not known for traveling great distances through the porous, aqueous media in the groundwater, since it has been observed that the particulate material of the ground formation adsorbs the bacteria. However, if bacteria reach a waterbody through surface runoff, it can travel great distances. The main potential source of fecal coliforms at the Airport may be from birds and other animals that commonly surround nearby waterbodies. This source has been proposed in two studies, which also identified a tidal pattern of bacterial growth producing high concentrations at low tide and low concentrations at high tide (Solo-Gabriele, H., et. al, 2002).

3.10 Previous Reports and Studies

Previous reports and studies were evaluated to determine if the data contained within them could be useful for this study. Below is a summary of the most beneficial reports.

Fort Lauderdale Executive Airport Master Drainage Study and Plan (Williams, Hatfield & Stoner, 1990)

This study evaluated the current and future drainage infrastructure needs of the Airport and Airpark at the time of its completion. These needs were evaluated with respect to the FAA's 5-year storm and the SFWMD's 25-year, 3-day storm criteria for off-site discharges. The following is a summary of the proposed systems in this study:

- The proposed gravity system that drains the areas east of NW 21st Terrace and north of Commercial Boulevard, corresponding to hydrologic units FXEHU190, FXEHU200, FXEHU170, FXEHU180, and part of FXEHU210 in this report, was constructed in 1996 together with an on-site detention area along Commercial Boulevard. These measures were not anticipated to resolve the flooding issues in these areas but rather to significantly reduce the duration of the flooding;

- Additional retention was proposed for Basins 14 and 15 in the 1990 report, corresponding to FXEHU140 and FXEHU160 in this report. Existing low-lying areas in the 1990 drainage study were deepened to provide additional volume retention. The perimeter road running in between these two hydrologic units was proposed to be raised from an average elevation of 6.4 ft NAVD to an elevation of 11.4 ft NAVD, and the installation of a 24-inch drainage pipe from Parcel 22 to the retention area was also proposed. From these recommendations, the road was actually raised to an average elevation of 8.7 ft NAVD and the existing depression located within Parcel 25 (Basin 25) was extended and deepened. However, the existing 12-inch pipe has not been upgraded to a 24-inch diameter.

- The study anticipated that any further development in the Airpark would require a positive drainage discharge to the adjacent Broward County WCD No. 4 Canal B-1 and its respective permit approval.

- The study also proposed an increase in positive drainage into the southeast area of Runway 1331, which has not been implemented yet.

Strategic Business Plan & Master Plan Update for the Fort Lauderdale Executive Airport (Kimley-Horn and Associates, Inc., 2009)

This master plan provides a 20-year period guidance for future Airport development identifying improvements focused on short (5-year), intermediate (10-year), and long-term (20-year) periods. The major improvements proposed for future Airport development were outlined into the updated Airport Layout Plan (ALP) including new taxiways and areas to be reserved for future landside development such as hangars and various ramp areas. The ALP is used in the present study to evaluate future land use conditions and determine how the existing drainage system responds to the expected additional runoff.

Broward County Flooding Insurance Study (FEMA, 1992) and Flooding Insurance Rate Maps

FEMA Flooding Insurance Study (FIS) report was initially developed in 1992 for the entire county, and it was revised county-wide in October, 1997. The 1992 FIS studied shallow flooding areas located along Pompano Canal, Cypress Creek Canal (Canal C-14), Middle River Canal (Canal C-13), North Fork Canal (Canal C-12), North New River Canal, South New River Canal (Canal C-11), and others in detail. For the 1997 revision, coastal high hazard areas (V zones) were redelineated to include inland limits of the primary frontal dunes within the Town of Hillsboro Beach. In addition, the effects of wave height, wave runup, and beach erosion were identified by detailed methods to narrowly establish the location of the primary frontal dune in conjunction to restudying the effects of flooding east of the Intracoastal Waterway. Consequently, the boundary conditions at the Atlantic Ocean were refined and interpolated between transects with a contour interval of 2 feet at scales of 1”=40’ and 1”=50’. According to the FIRM, the Airport is located in the Zone AH, which corresponds to a 100-year base flood elevation of 8 ft NGVD.

Sources of Escherichia coli in a Coastal Subtropical Environment (Solo-Gabriele, H. et. al., 2000)

Initial analysis of the North Fork of the New River showed that 90% of the samples collected exceeded the allowable standards for recreational use for E. coli. Based on this finding, spatial and temporal data were collected from the river between Gate S33 and the South Fork junction. The data showed that E. coli concentrations fluctuated with the tide. The highest concentrations corresponded with high tide, while the lowest concentrations corresponded with low tide. During high tide the water level rises to include previously dry soils, where E. coli is known to populate. The decreased moisture content of the elevated soil allows E. coli to survive where predators cannot. Notably, the tidal pattern did not occur until two days after rain events, presumably because it takes two days for the bacteria to recover from the stormwater flushing. The suggestion to further investigate the source of E. coli in the New River, by analyzing stormwater flows before entering the river system, was made.

Section 4 Stormwater System Model

4.1 Introduction

The stormwater system at the Airport was evaluated by developing a hydrologic and hydraulic (H&H) model to facilitate the analysis of conveyance and storage capacity problems, ponding, levels of service, and system improvement planning. Specifically, the purpose of the modeling phase of this study was to use the H&H models to:

- Identify probable causes of known flooding;
- Analyze stormwater improvement alternatives including conveyance, storage, retention/detention areas, and other potential BMPs; and
- Develop and prioritize stormwater improvement alternatives.

To accomplish these goals, the H&H modeling was performed using the U.S. Environmental Protection Agency (EPA) Storm Water Management Model Version 5 (SWMM). The hydraulic flow routing routine of SWMM uses a link-node representation of the primary stormwater management system (PSMS) to dynamically route flows by continuously solving the complete one-dimensional Saint-Venant flow equations. The hydrologic routine operates by applying precipitation across distinct hydrologic units (HUs), and then through overland flow and infiltration, conveying surface runoff to loading points on the user-defined PSMS.

At the Airport, the airfield area does not have a hydraulic system of pipes and inlets. Instead, storage in the swales and infiltration are the primary means of stormwater management. In 1990, Williams, Hatfield & Stoner provided a drainage plan that was based on precipitation versus storage (both above ground and soil storage). For the airfield, this study is similar in that the infiltration capacity of the soils and the above ground storage are the primary components of the model. However, the model also allows for overflows from one HU to another based on topography, uses boundary conditions from a regional citywide model, uses the Horton Infiltration algorithm, and uses detailed storage curves based on the digital elevation map (DEM) described in the previous section.

In the parcels surrounding the airfield, the PSMS primarily consists of a combination of conveyance pipes, exfiltration trenches, and dry retention-detention areas. The detention provides the required storage and water quality treatment for individual parcels.

Most of the Airport retains runoff on-site through these systems, taking advantage of the abundant soil infiltration and storage capacity available within the project area. Other areas, mainly those along 21st NW Avenue and in the Airpark, discharge excess runoff to adjacent canals.

This section details the methods used to establish data for, and to perform, the stormwater management evaluations.

4.1.1 Project Location

The model boundary contains the Airport property including the Airpark, and neighboring blocks where there is the potential to flood, possibly due in part to runoff from the airfield. **Figure 4-1** shows a site map of the project. The model area is bounded by NW 31st Avenue on the west, NW 56th Street to NW 21st Avenue to Commercial Boulevard on the south, and NW 12th Avenue to NW 56th Street to Powerline Road on the east. The north side is bounded by Cypress Creek Road to NW 21st Avenue, follows NW 21st Avenue north to the Broward County WCD No. 4 Canal, then is bounded by the canal to NW 12th Avenue north for a block, then follows the C-14 Spur Canal to the railroad tracks and the outfall to the Cypress Creek Canal (C-14).

As shown previously in Figure 3-1, the airfield is relatively high compared to adjacent areas; in fact, the highest elevations approaching 13 ft NAVD are among the highest in the City. However, there are lower areas within the site boundary that are prone to flooding. The low-lying areas have less infiltration capacity because the water table is closer to ground level, which limits soil storage, and are more likely to receive waters overflowing from adjacent higher areas. The flood-prone areas include parts of the Airpark, the eastern end of the airfield near NW 10th Terrace and Cypress Creek Road (including the off-property areas east of NW 10th), the southern side of the property near the corner of NW 21st Avenue and Commercial Boulevard, and the western end of the runway near NW 56th Street and NW 31st Avenue.

4.2 Model Development

SWMM is a dynamic hydrologic/hydraulic model capable of solving the complete one-dimensional Saint Venant flow equations, which consist of the continuity and momentum equations for conduits and a volume continuity equation at nodes. The dynamic flow routing allows for representation of channel storage, branched or looped networks, backwater effects, free surface flow, pressure flow, entrance and exit losses, weirs, orifices, pumping facilities, rating curves, and other special structures/links. Control rules may be used to operate the structures based on timing and/or stage and flow conditions within the model.

The hydrologic layer simulates the rates of runoff developed from HUs using a non-linear reservoir approximation (using Manning's equation). The runoff hydrographs developed by this layer provide input for hydraulic routing in downstream reaches. The hydrologic and hydraulics layers of SWMM are described below.

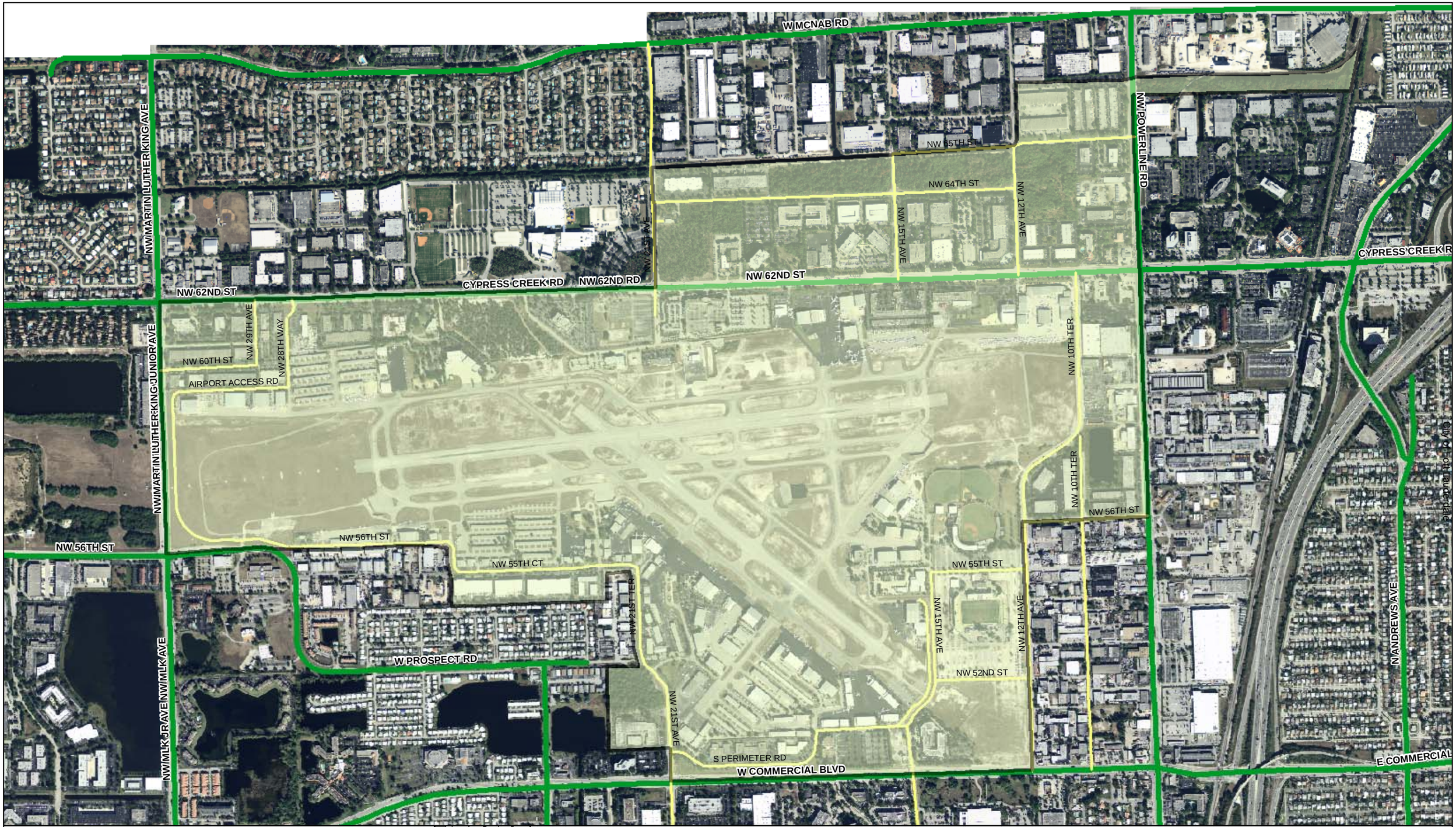
4.2.1 Hydrology

4.2.1.1 Hydrologic Units

The model boundary shown in Figure 4-1 was originally developed using the Airport property line, including the Airpark. Other, off-property areas were included where flow off the site may influence flooding via either overland flow or underground connectivity based on the existing stormwater system infrastructure (as shown previously in Figure 3-9). The model boundary was extended slightly off the property boundary based on topography.

The study area was then subdivided into hydrologically distinct subbasins defined as HUs based on a combination of topographic information, stormwater pipes and catchments, and inspections of aerial photography. For each HU, the following hydrologic parameters were determined: area, width, slope, directly connected impervious areas (DCIA), roughness, initial abstraction, and infiltration parameters. **Appendix A** provides a table of hydrologic parameters used to represent existing and future conditions. **Figure 4-2** displays the model schematic, including the HU delineation. There are 60 distinct HUs in the model covering a total area of 1,117 acres, with an average size of 18.6 acres, ranging from a minimum of 1.7 acres to a maximum of 68.3 acres.

8/31/2017 9:35 AM



N

Legend

- Model Boundary
- Minor Roads
- Major Roads

FXE

Fort Lauderdale Executive Airport

6000 NW 21st Avenue
Fort Lauderdale, FL 33309

1 inch = 950 feet

0 475 950 1,900 *Feet*

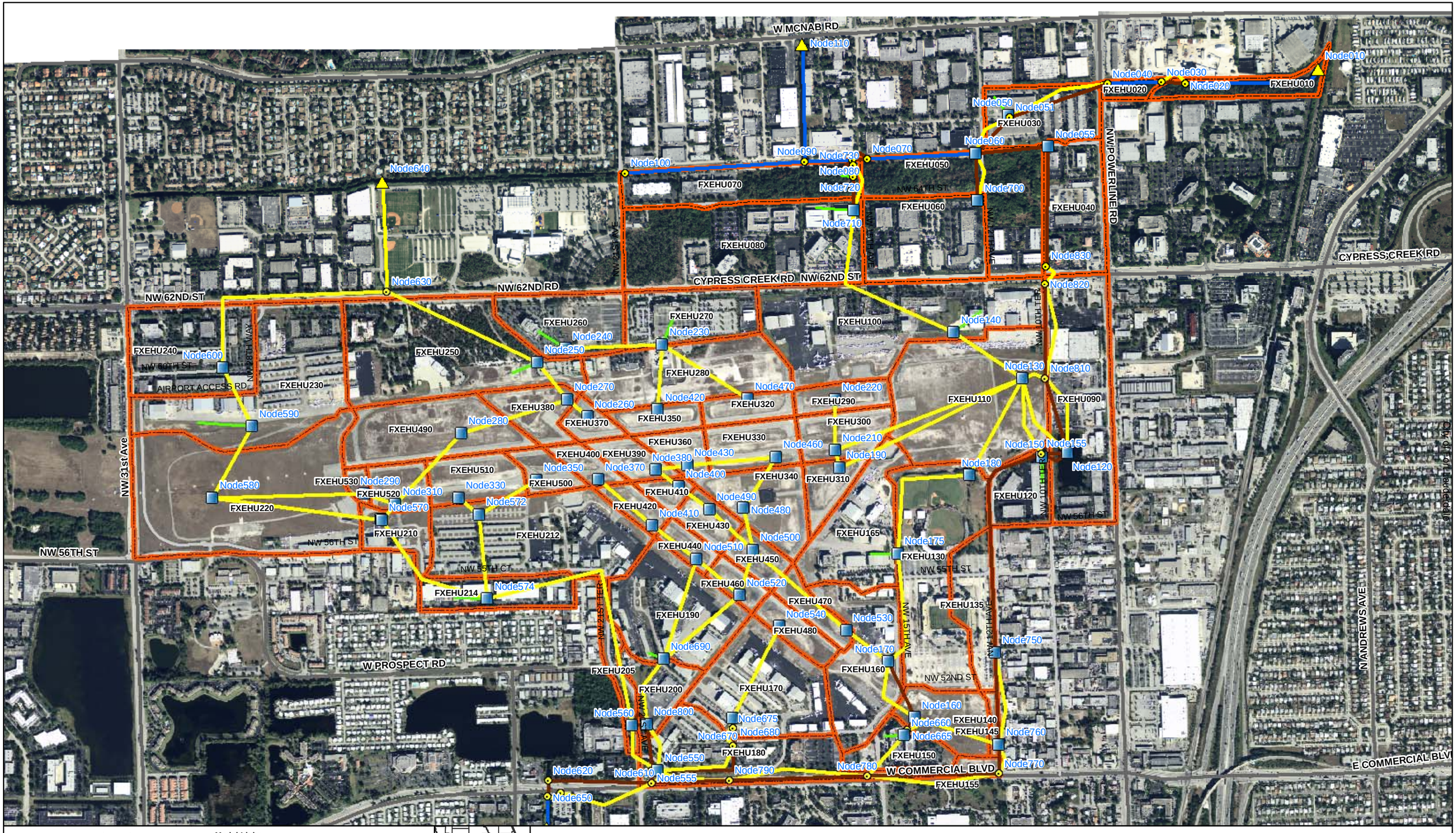
Figure 4-1
Site Map

Bid 276-11834

CDM Smith

\\C:\COFL_FXE\Report\Figures\FXE_Figure4-1.mxd

8/31/2017 9:35 AM



N

Legend

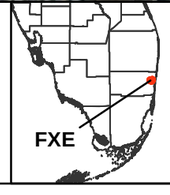
Model Nodes

Type
- Junction
- Outfall
- Storage
- Hydrologic Units (HUs)

Model Links

Type
- Pipe
- Channel
- Orifice
- Overland
- Weir
- Exfiltration

- Minor Roads
- Major Roads



Fort Lauderdale Executive Airport

6000 NW 21st Avenue
Fort Lauderdale, FL 33309

1 inch = 950 feet

0 475 950 1,900 *Feet*

Figure 4-2
Model Schematic

Bid 276-11831

CAM #17-1096
Exhibit 2
Page 120 of 191

\\C:\COFL_FXE\Report\Figures\FXE_Figure4-2.mxd

4.2.1.2 Area

The tributary areas for each HU were determined directly from Geographic Information System (GIS) mapping using the Florida East coordinate system.

4.2.1.3 Width

This refers to the width of the overland flow path for sheet flow runoff. The HU width was computed by dividing the HU area by a representative flow path length. This length was found by averaging three likely flow paths within a given HU.

4.2.1.4 Slope

The slope for each HU was determined by using the flow path lengths and the start and end-point elevations of each flow path. The average slope of the multiple flow paths was selected as representative of the HU.

4.2.1.5 Imperviousness

Imperviousness may be entered in SWMM as directly connected impervious area (DCIA, also known as effective impervious area). This methodology separates the basin into two separate planes, both using the non-linear reservoir approximation. For the impervious plane, the portion of the area represented by the DCIA uses impervious parameters and zero infiltration. The second plane, the pervious areas and the non-directly connected impervious areas (NDCIA), uses the pervious parameters and the Horton Infiltration Method. NDCIA may be considered as areas such as building footprints, where the runoff is directed to open (non-paved) areas before entering the PSMS.

SWMM allows for a second methodology where the total impervious area is entered into the impervious field, and then a given percentage of this area is routed to the pervious area using the ROUTE TO function. This method more explicitly simulates the runoff path (building to yard) described above. The percentage to route to the pervious layer may be used as a calibration parameter. This second method was used for this project because the total impervious areas could be determined from aerial photography, increasing the model resolution from the City of Fort Lauderdale citywide model, for which estimates of DCIA were made from a GIS land-use layer. It should be noted that only the soil storage under the pervious layer is made available to the infiltration routine. This second method (where DCIA and NDCIA are combined), allow for a quicker, more transparent calculation of soil storage.

The percent impervious areas were determined by creating a GIS shapefile delineating the impervious areas from the most current aerial photograph (year 2011). This shapefile was then intersected with the HU delineations to identify the impervious area per HU. A table summarizing this parameter for each HU is presented in Section 3 (Table 3-4).

The percentage of runoff that was routed to the pervious layer (ROUTE TO), was also determined via aerial photography inspection for each HU. In particular, for HUs located along taxiways and runways that are clearly surrounded by pervious dry retention areas, the routed percentage was 100 %. For parcels with parking lot inlets and raised pervious islands, the routed percentage was set to between 0 and 10 %. This was to allow for a small amount of runoff to overflow to these pervious areas, where applicable. Note that as a BMP, depressed swales are more desirable because a larger portion of the impervious plane runoff may be routed to pervious areas prior to entry to the PSMS. For HUs with a combination of scenarios, the routed percentage was estimated by proportion of type and engineering judgment.

4.2.1.6 Evaporation

The evaporation used for this project was based on monthly averages as developed by CDM Smith for a project in adjacent northern Miami-Dade County. The average evaporation is approximately 0.1 inches per day. Variations in these values do not significantly affect the model results, as design storm simulations are not sensitive to evaporation due to short durations and lack of dry periods.

4.2.1.7 Overland Roughness and Depression Storage

The overland Manning's roughness values were set to 0.015 for impervious areas and 0.3 for pervious areas. The expected depth of flow across pervious areas is small compared to that from the bottom of a natural channel; therefore, the roughness is expected to be greater. Depression storage, also known as initial abstraction, represents the volume of water that does not flow off the surface into the drainage network due to ponding on pervious and impervious areas. The values are set to 0.05 inches over impervious areas and 0.1 inches over pervious areas.

4.2.1.8 Infiltration

SWMM provides three methods for modeling infiltration: Horton's method, the Green-Ampt method, and the Curve Number method. These methods use soil characteristics to define infiltration parameters. The Horton soil infiltration method was used for this project.

The Horton equation is based on empirical observations showing that infiltration decreases exponentially with time from a maximum rate and ultimately reaches a constant minimum rate over the course of a long rainfall event. These maximum and minimum infiltration rates, as well as soil storage and a decay coefficient that describes how rapidly the rate decreases over time, are parameters to be provided for each HU based on available soil data. Table 3-2 in the previous section presented the initial and final infiltration rates per hydrologic soil group (HSG) to be used in this project.

Soil storage corresponds to the maximum infiltration volume possible (in inches), and it was determined for each HU in Section 3 based on the depth to the seasonal high water table (SHGWT = 2.4 ft NAVD) and the cumulative soil storage and depth to water table relationship. For areas with Group D soils (except for the far western area near the Prospect Wellfield), soil type was used to determine soil storage as opposed to the depth to the water table. This was done to improve model validation in the eastern areas and to more closely match the regional model where the soils are Group D and the elevations are relatively low.

4.2.1.9 Rainfall

The model uses measured rainfall for the October 1999 validation storm (Hurricane Irene) and the SFWMD 24-hour and 72-hour storm distributions and volumes for the design storm simulations (see Section 3).

4.2.2 Hydraulics

The SWMM hydrologic/hydraulic model uses a node/link (junction/conduit) representation of the PSMS. In general, a PSMS may be comprised of canals, rivers, streams, lakes, bridges, culverts, pipes, pump stations, weirs, and other hydraulic structures. For this project, the PSMS is almost entirely made up of overland flow links connecting the retention swales. The PSMS also consists of detention basins, reinforced concrete pipes (RCPs), and natural channels. The existing model schematic as developed in GIS is shown in Figure 4-2. HU boundaries are shown in orange, while the model nodes (retention basins, inlets, pipe ends, etc.) are shown in blue for storage junctions and yellow for the other types. For the links, open channels are shown in blue, pipes and culverts in brown, and links representing overflows from one HU to another in yellow. The model consists of 85 junctions, including 4 outfalls and 55 storage elements, and 119 links. **Appendix B** provides a list of link hydraulic parameters including: alphanumeric identification, type, length, Manning's roughness values, width, depth,

inverts, and number of barrels. **Appendix C** provides a list of node hydraulic parameters including: alphanumeric identification, type, invert elevation, and infiltration parameters for storage junctions (see below).

4.2.2.1 Model Nodes

The model incorporates three basic types of nodes: simple junctions, storage junctions, and outfalls.

Junctions

Model junctions may represent:

- The ends of culverts;
- Points along canals where the geometry, direction, and/or slope of the channel varies significantly;
- Canal intersections;
- Either side of a structure, including weirs and orifices;
- Ends of stormwater pipes;
- Locations where the stormwater pipes change diameter; and
- Loading points for the hydrologic layer (including inlets, gutters, etc.).

In general, model junctions are given invert data, maximum depth (such as ground elevation), and initial depths. Due to the presence of hydraulic overland links at nearly every junction, the maximum depths are all set to 20 ft. This removes the possibility of stormwater surcharges out of the model. All surcharges are maintained in the overland links or storage units.

For this project, most of the system inverts were unknown. For this reason, many node (and pipe) inverts were set to 0.0 ft NAVD. This is far enough below ground such that the pipes flow full during the storm events. Initial depths were set for junctions along the canals in order to match boundary conditions (see below).

Storage Junctions

Model storage junctions may represent any of the same elements as simple junctions. The difference is that a storage junction is given either a functional storage area versus depth, or a lookup table of storage area versus depth. In this model, lookup tables have been developed from the detailed topography using GIS tools (see Section 3). Storage junctions are generally provided with the same data as junctions, namely invert elevation, maximum depth, and initial depth. Often, the maximum depth is set to the highest depth in the stage-storage curve, or at a depth well above the top of the curve (to not allow surcharge). Except for the canals, initial depths are not set in this model, except for in the canals. However, since there is no storage below the ground level, the model adjusts the initial level to ground level in the first few time steps that include runoff.

With SWMM, evaporation and infiltration of the ponded water in a retention-detention area may be calculated. Generally, this would not be used for design storms, as it is more commonly used for continuous simulations. However, for this project, the validation storm had multiple days of rainfall and a mechanism was necessary to allow the ponded areas to recede. Because most of the retention areas have no other hydraulic connections, evaporation and infiltration are the only means of receding the flooding.

Not all of the storage junctions were allowed to infiltrate. Where the ground levels were low, it is expected that the groundwater table would be very close to land surface for days after a given storm, and further infiltration would not be possible within the time frame of these models. These junctions were only allowed to evaporate,

which is a much slower process than infiltration. The detention areas at higher elevations were given Green-Ampt infiltration parameters (see Appendix C), based on common values for the soil type, and the saturated (Horton minimum) infiltration rate, which may be found for the surrounding HU in Appendix A.

Note that this infiltration and evaporation is separate from those in the Hydrologic layer. Those values help determine the shape and volume of the runoff. These values help determine the recession of the stage in the detention areas after the runoff has reached the storage junction (possibly from multiple HUs).

Outfalls

There is only one outfall where stormwater is conveyed off the Airport through the PSMS, namely the 54-inch circular pipe from the detention area south of Parcel 1A to the system along Commercial Boulevard. All other flows off the airport property are a result of sheetflow during extreme events such as the 100-year design storm. Sheetflows eventually reach the off-airport stormwater systems such as the Broward County WCD No. 4 Canal system along Commercial Boulevard. Points along the regional system have been set as the boundary for the model and hence there are model outfalls at the locations where these canals and pipes intersect the model boundary. Note: the Airpark has three additional piped outfalls to the Broward County WCD No. 4 Canal ranging in size from 18-inches to 36-inches in diameter.

Model outfalls are locations where the flow leaves the model as shown in Figure 4-2. Generally, the type of outfall is determined by the model boundary conditions (see Section 4.2.3 for more details on boundary conditions). In this case, the model is bounded on all sides by the City of Fort Lauderdale regional model developed by CDM Smith. A time series of stage (hydrograph) is supplied to each outfall based on the regional model results at that location for each design storm.

4.2.2.2 Pipes and Culverts

The City provided CDM Smith with a GIS layer of storm pipes as discussed in Section 3. Most of the data were missing pipe invert elevations. Since this model was built to analyze high intensity design storms, it is likely that these pipes will be fully submerged during the timeframe of interest. Therefore, estimated pipe inverts should produce similar model results as the actual inverts. Many of the pipe inverts were simply set to zero in the model; however, if this did not allow for ample cover from the top of the pipe to land surface, the inverts were lowered.

For this type of planning model, the pipes are evaluated in a clean condition; therefore, all reinforced concrete pipes were set to a Manning's roughness value of 0.013 unless the pipe was known to be a corrugated metal pipe (CMP), then the roughness was set to 0.024. The pipe lengths were determined using GIS. Entrance losses were set to 0.2 – 0.25 unless there were special circumstances. Exit losses ranged from 0.3 for straight sections of pipe to 1.0 for outfalls to lakes or ponds, and 0.5 for canal outlets.

For culverts under roadways along the canals, data was collected from the available MIKE SHE/11 model of Broward County and from site visits (CDM Smith staff, April-May, 2011). For the most part, size of the culverts were found from these sources, whiles culvert inverts were estimated based on engineering judgment. The culvert lengths were determined using GIS.

4.2.2.3 Exfiltration Trenches

The City provided CDM Smith with a GIS layer of exfiltration trenches, which CDM Smith augmented, where applicable, from Environmental Resource Permit (ERP) applications (see Section 3). These exfiltration trenches are expected to perform as designed based on SFWMD criteria. Therefore, the same criteria were used to back calculate the expected volume capture for each trench based on the following parameters: trench length, depth to water table, size, and saturated hydraulic conductivity. There were multiple in-situ measurements of hydraulic

conductivity within the project boundary. These values were converted into a raster surface (as described in Section 3), and thus an estimate of hydraulic conductivity could be made at the location of each trench. The SFWMD design criteria are derived from the trenches operating at their design rate for one hour. Therefore, a maximum efficiency exfiltration rate may be calculated from the design volume. Example calculations of the design rates and capture volumes are given in **Appendix D**.

For both existing and proposed exfiltration trenches (see Section 5), it was desirable to model exfiltration as a flow out of the hydraulic system as opposed to a volume captured in the hydrologic portion of the model. Analyzing exfiltration as flow improves the estimates of exfiltration trench effectiveness, and also allows for more accurate estimates of the reduction in flooding duration.

Exfiltration trenches work better when the depth to water table is high so that there is an effective gradient between the catchment and the groundwater. However, during storms in South Florida, the water table rises and this gradient is reduced as the storm progresses. It was therefore necessary to build the model to mimic this response. This was accomplished by developing rating curves that reduce the expected flows as the water table rises. The rating curves are developed from an estimate of groundwater depth versus time for a given storm, and then applied to the maximum efficiency design rate described above from the SFWMD criteria.

The water table rise will be site specific and be dependent upon geological factors such as porosity and permeability; however, a generalized shape should produce reasonable results. The water table rise becomes sharper as the intensity of the storm increases, but lags the peak of the rainfall. Rainfall peak intensities are at 12 hours and 60 hours, respectively for the 24-hour and 72-hour design storms. By allowing the flow rates to fall as the water table rises, this method is more representative than using a constant rate, and will more closely approximate actual conditions. Three curves were used for each storm:

- High: where the trench inlets are above 10.0 ft NAVD and the rate loss from maximum efficiency is comparatively muted (approximately 50 - 55% at the low point);
- Medium: trench inlets around 8.0 ft NAVD, rate loss reduced to 40% of maximum efficiency at the lowest point; and
- Low: trench inlets from 6.0 – 6.5 ft NAVD, the rate falls to nearly zero just after the peak of the storm.

Exfiltration trenches are modeled using pumps to virtual outfalls (removing water from the model) set at the maximum efficiency rates. Control rules are used to multiply the time series of rate reductions to the design rate for each trench area. The pump curves are set such that there is no flow when stages are below the bottom of the exfiltration pipe.

4.2.2.4 Channels

The natural channel sections in the model represent the Broward County WCD No. 4 Canal and the C-14 Spur Canal along the northern boundary, and the Oakland Park Lakes Canal south of Commercial Boulevard. The channel sections from bank to bank were imported from the regional model, converted from NGVD datum to NAVD datum using a constant 1.6 ft offset, then spliced with the local topography for overbank (floodplain) elevations. This was necessary because the topography had been updated since the regional model was built and because the cross-sections are set at shorter intervals along each canal.

4.2.2.5 Hydraulic Overland Flow

Hydraulic overland flow conduits are created in one-dimensional (link-node) models to represent flow paths over roads or over land when pipes and culverts surcharge above ground. For this project, much of the PSMS consists solely of overland flow links. The overland flow link is a natural cross-section, which is a profile

representative of the topographic ridge along the boundary between the two adjacent HUs. The length of these channels is relatively short, typically 50 feet, while the widths may be on the order of hundreds of feet. The links act similar to a weir, which only begins to flow when the ponding on either side of the link reaches the height of the topographic ridge boundary. During high intensity events, surface ponding is prevalent and transfer may occur from one HU to another. It is desirable to keep these lengths relatively short to represent the connection between storage areas.

Road overflows, as parallel conduits to culverts, are modeled with these types of links as well to simulate over-topping the road.

In cases where there are not defined topographic high points for the flow to overtop, such as where there is a general downhill direction from one HU to another, the overland flow is better modeled using the actual length of channel between nodes. In this case, the overland link will be used for storage as well as conveyance and it is therefore necessary to remove this storage from the adjacent storage node to avoid “double counting” model storage.

4.2.3 Boundary Conditions

The Airport model is bounded on all sides by the calibrated regional citywide model. Along NW 31st Avenue, Powerline Road, and parts of Commercial Boulevard and Cypress Creek Road, there are reasonable no-flow boundaries due to topography (or because the flow had been diverted as modeled to lower areas where boundary conditions are set). Note that the eastern model boundary has been moved east of the property boundary because of topography.

In the southwest corner, NW 56th Street provides a reasonable no flow boundary based upon topography, but where this road jogs south to NW 56th Court, the road is no longer a topographic boundary. However, the no flow boundary has been set just south of the road based on a retaining wall south of a commercial parking lot in this area. This wall is not built for flood protection, but inherently should retain much of the off-site flows during storm peaks.

There are four outfalls and one inflow node in the model for which boundary conditions are provided (see Figure 4-2). These are: Outfall Node 640 to the Broward County WCD No. 4 Canal west of NW 21st Avenue, Outfall Node 110 to the Broward County WCD No. 4 Canal east of NW 21st Avenue, Node 010 to the C-14 Spur Canal, just upstream of a structure to the Cypress Creek (C-14) Canal (this outfall has very similar stages as the C-14 stages), Outfall Node 655 to the Oakland Park Lakes Canal south of Commercial Boulevard, and Inflow Node 100 in the Broward County WCD No. 4 Canal at NW 21st Avenue. The inflow node represents flow from this canal from west to east of NW 21st Avenue as simulated in the regional model. This flow immediately outfalls at Node 110, but may affect stages in the canal east of NW 21st Avenue and therefore has been added.

For each outfall node, there is a time series boundary condition in the model representing the regional model result for the three design storms and the validation storm, respectively. The boundary condition at each outfall must be changed as the storm is changed in the simulations. The regional model results have been converted from NGVD datum to NAVD datum using a constant 1.6-foot offset.

An inflow boundary condition has been added to Node 100 as a time series representing the regional model result for the three design storms and the validation storm, respectively. The boundary condition must be changed as the storm is changed in the simulations.

Since the regional model is coarse in this area, minor changes were made to it to better match the Airport model. However, it is beyond the scope of this project to incorporate the Airport model into the regional model.

4.3 Model Validation

Calibration refers to the process where model parameters are adjusted so that simulated flows and stages during a rainfall event reasonably match observed or measured values. In the absence of high water marks or gauged flow data, models typically cannot be properly calibrated. Model validation generally refers to the process of applying the precipitation of a known storm event and comparing the model results (calibrated or not) to measured values, observations, or anecdotal information. For example, a model where stages and flows are measured may be calibrated to two storms, and validated with a third. For this project, since there are no measured high water marks, the model was built using the most likely hydrologic and hydraulic parameters, and then validated using one high intensity event, Hurricane Irene. The recorded rainfall volumes for Hurricane Irene ranged from 9.1 to 14.0 inches over the simulation period from October 10, 1999 to October 21, 1999. The bulk of the rainfall occurred over a two-day period from the 14th through the 15th. The validation was performed using comparisons to photos taken above the airfield the day after the storm, and confirmed by the eyewitness accounts of City personnel. Minor adjustments were performed for the areas where high water elevations could be estimated from the photos. These adjustments were applied project-wide where applicable, such as the storage junction infiltration parameters discussed in Section 4.2.2.1.

The Airport lies between the rainfall gauges at SFWMD Structure S-36 and SFWMD Structure S-37A; therefore, the southwestern HUs were provided the rainfall distribution measured at Gauge S-36, and the northeastern HUs were provided the rainfall distribution for Gauge S-37A. Gauge S-37A has higher intensities than the 5-year, 24-hour design storm for Hurricane Irene; however, Gauge S-36 has lower intensities for the same storm. Therefore, flooding for Hurricane Irene may be less than the expected 5-year storm in some parts of the project area, while more than the 5-year storm in others.

The model was run for several days prior to the onset of the storm to establish the antecedent moisture conditions, then three days to encompass the storm event, then an additional five days to simulate the receding stormwater levels. In Fort Lauderdale, rainfall from Hurricane Irene began late in the day on October 13, 1999, although the peak of the storm did not occur until the afternoon of the 15th.

4.3.1 Observations

The City supplied CDM Smith with the photographs shown in **Figure 4-3**, which were taken aerially from above the Airport, most likely in the early afternoon of October 16, 1999. The time the photos were taken was not supplied; however, shadows indicate that the time was early afternoon and rainfall records indicate that the storm ended around 9:00 PM on the 15th. The flood elevations estimated from the photographs were determined by correlating the flooded area shown in the aerial photographs and the topographic features that were not flooded with the help of the Digital Elevation Model (DEM).

The photos in Figure 4-3A show significant flooding on the apron at the east of the runway (south of Parcel 11), including portions of NW 10th Terrace. Even though these photos were taken well after the storm, water marks higher up on the apron cannot be identified. The observed stage was estimated to be approximately 6.8 ft NAVD, but may be anywhere between 6.5 to 7.0 ft NAVD.

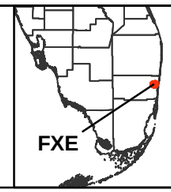
The photos also showed flooding at Parcel 32 (south of the ditch that is east of Fire Station 53 - Figure 4-3B), west of the Lockhart Stadium and NW 15th Avenue in the southeast corner of the study area (Figure 4-3C), and at the retention area and adjacent parcel 19A in the southeast corner of the study area (Figure 4-3D). Again, higher water marks were not identifiable for these areas. The observed stages for these areas were estimated to be 9.5 ft NAVD +/- 0.5 ft, 6.8 ft NAVD +/- 0.5 ft and 7.5 ft NAVD +/- 0.5 ft, respectively.

A - West of NW 10th Ter / Node130:
The flooded area in these pictures was matched to the LiDAR in order to determine an approximated flood elevation of 6.8 ft NAVD. The pictures were taken approximately 12 to 18 hours after the storm.

B - Parcel 32 / Node230:
The flooded area in these pictures was matched to the LiDAR in order to determine an approximated flood elevation of 9.5 ft NAVD. The pictures were taken approximately 12 to 18 hours after the storm.

C - Parcel 22 & Stadium/ Node170:
The flooded area in this picture was matched to the LiDAR in order to determine an approximated flood elevation of 7.5 ft NAVD. The pictures was taken approximately 12 to 18 hours after the storm.

D - Retention Area/ Node160:
The flooded area in this picture was matched to the LiDAR in order to determine an approximated flood elevation of 6.8 ft NAVD. The pictures was taken approximately 12 to 18 hours after the storm.



Fort Lauderdale Executive Airport

6000 NW 21st Avenue
Fort Lauderdale, FL 33309

Figure 4-3
Aerial Photographs of Storm Irene Used for Validation

\\Projects\Fort-Lauderdale\FXE\Data\GIS\2_MXDs\FXE_Aerial1999.mxd GBC 5/03/09

4.3.2 Validation Results

The Airport SWMM was run with the Hurricane Irene precipitation hyetographs, and boundary conditions were extracted from the regional model as discussed in Section 4.2.3. **Figure 4-4** displays a map of flood depths from this simulation overlaid on the recent aerial photograph of the site and the parcel layer to better identify problem areas. Peak flood depths are calculated by finding the difference between the peak flood stage within each HU and ground elevation from the Light Detection and Ranging (LiDAR) topography.

This model used the existing condition land use, imperviousness, and topography as opposed to the 1999 condition. There was not enough observed information with which to compare the model to require a separate 1999 version be built. Flood elevations were estimated from the photos in Figure 4-3 and compared to the model simulations.

The model shows good matches in flood stages at sites A (Node 130, south of Parcel 11), C (Node 170, Parcel 22), and D (Node 160, retention area). The match was not as good for site B (Node 230, Parcel 32).

For Site B, there has been significant development since Hurricane Irene and the difference in peak stage (an estimated drop of approximately 1.1 ft) may be attributed to new swales and retention areas, a reconfigured ditch, additional exfiltration, error in the estimate of the observed stage, error in the estimation of rainfall, or a combination thereof.

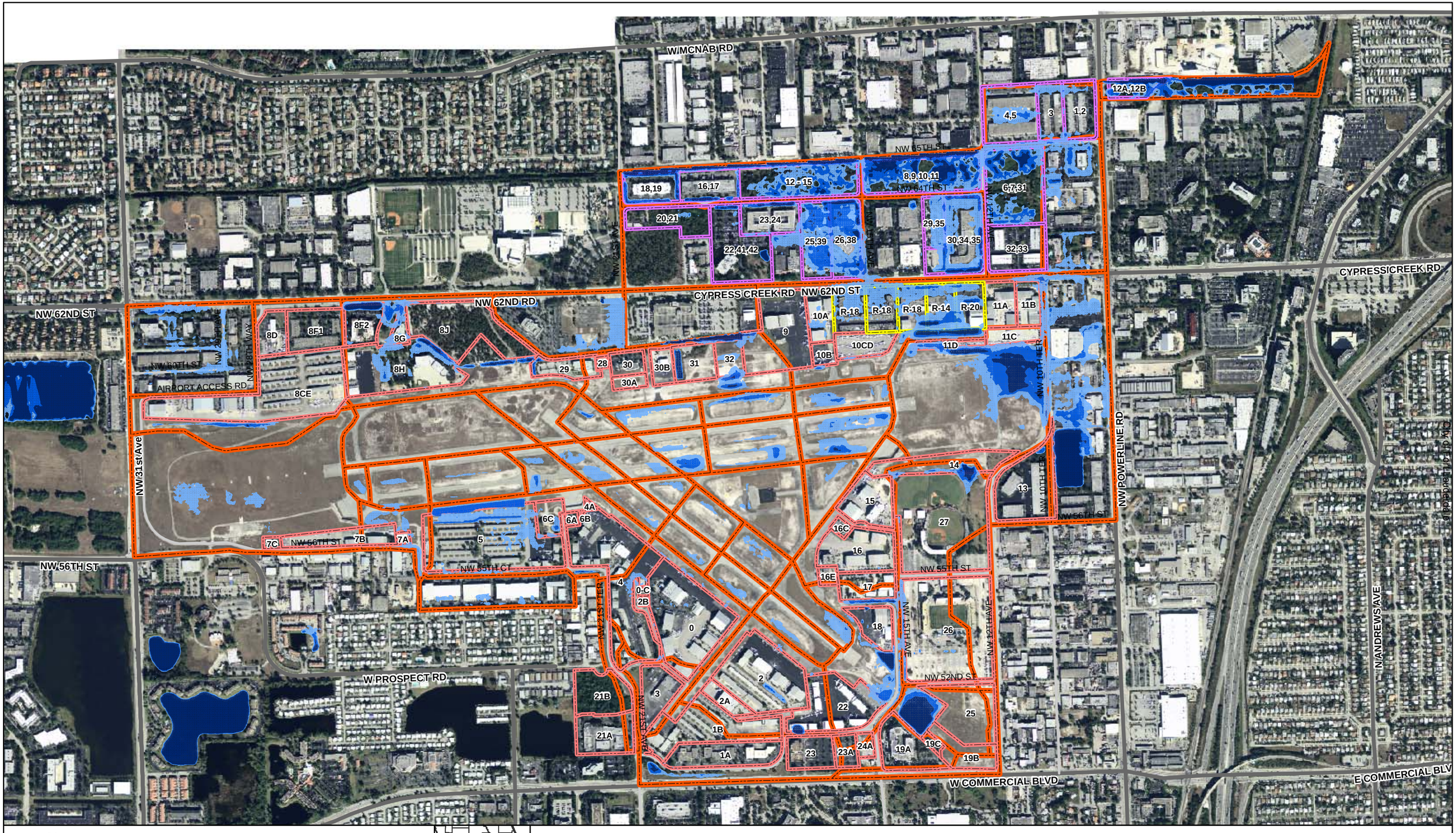
For site A, the peak observed stage estimated from the photos and the peak model stage are the same, 6.8 ft NAVD. The model shows that the stage should have receded by a few tenths of a foot by the time the photo was taken; however, higher water marks are not apparent on the photo. At most, there are a few tenths of a foot difference from the stage in the model at the time the photo was taken and the estimate of the observed stage. This is well within the potential error of the observed estimate.

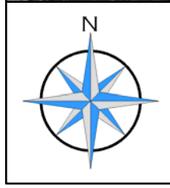
For site C, the simulated peak stage was 7.8 ft NAVD, which was slightly higher than the estimate of the observed stage (7.5 ft NAVD), but at the likely time the photo was taken, after the peak of the storm, the stages matched.

For site D, the simulated peak stage was 7.0 ft NAVD, which was slightly higher than the estimate of the observed stage (6.8 ft NAVD), and has approximately 0.2 ft difference at the likely time the photo was taken as well. This is well within the error in the estimate of the observed stage.

On May 23, 2011, CDM Smith met with City personnel to confirm the model validation. The flooded locations and flood depths were deemed reasonable by the staff, as were the locations showing little or no ponding. Minor adjustments to the topography were made to account for the lack of survey data at the Airport Administration Building. The LiDAR bare earth approximation was low, originally showing flooding at this location. The topography adjustment removed this flooding, thus it does not appear in Figure 4-4. Additional changes were made to the model after the May meeting, but the modeled problem areas, for the validation storm and the design storms remains the same, although peak stages did change in some locations. Due to the limited nature of the available observed data, model calibration was not possible.

8/31/2017 9:35 AM

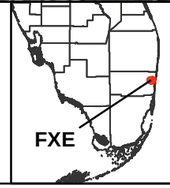




Legend

Irene 1999
Peak Flood Depth
- > 2
- 1 - 2
- 0 - 1

- Airport Parcel
- Industrial Airpark
- Released Land
- Minor Roads
- Major Roads



Fort Lauderdale Executive Airport

6000 NW 21st Avenue
Fort Lauderdale, FL 33309

1 inch = 950 feet

0 475 950 1,900 *Feet*

Figure 4-4
Validation Storm Flood Map
Hurricane Irene, October 1999

Bid 276-11844

CDM Smith

4.4 Model Results

4.4.1 Existing Land Use Condition

The Airport SWMM was run with the 5-year, 24-hour; 25-year, 72-hour; and the 100-year, 72-hour SFWMD design storms for the existing land use condition. The rainfall distributions and volumes of these storms are provided in Section 3.

The simulations of the 5-year, 24-hour storm are used to meet FAA recommendations of no ponding in the taxiways and runways for this storm. The simulations of the 25-year, 72-hour storm are used to examine offsite flows for potential SFWMD limitations, and the simulations of the 100-year, 72-hour storm are used to examine peak flood stages versus building finished floor elevations (FFEs). These Levels of Service (LOS) for the project area are found by comparing model node peak stage to indicator elevations and model peak flows at the outfalls to existing conditions peak flows, although the peak flows are more important for the future condition models and examinations of alternatives.

Figures 4-5 through **4-7** show the peak flood depth maps for the 5-year, 24-hour; 25-year, 72-hour; and the 100-year, 72-hour SFWMD design storms, respectively. The volumes and peak intensities of the 25-year and 100-year storms are greater than Hurricane Irene at this location; therefore, the airside retention areas are much fuller at the peak. Even for the 5-year storm, the intensities at the peak cause most of the retention areas to fill briefly. It should be noted that the aerial photograph provided for this project is more recent than the LiDAR and the survey data for Taxiway Alpha. The model has been built to match the taxiway and swales, which have recently been relocated, but the topography does not match the aerial (in the east – the western topography has been revised by hand to match as-builts as part of the alternatives analysis (see Section 5). **Table 4-1** below provides a better indication of whether these taxiways are flooding.

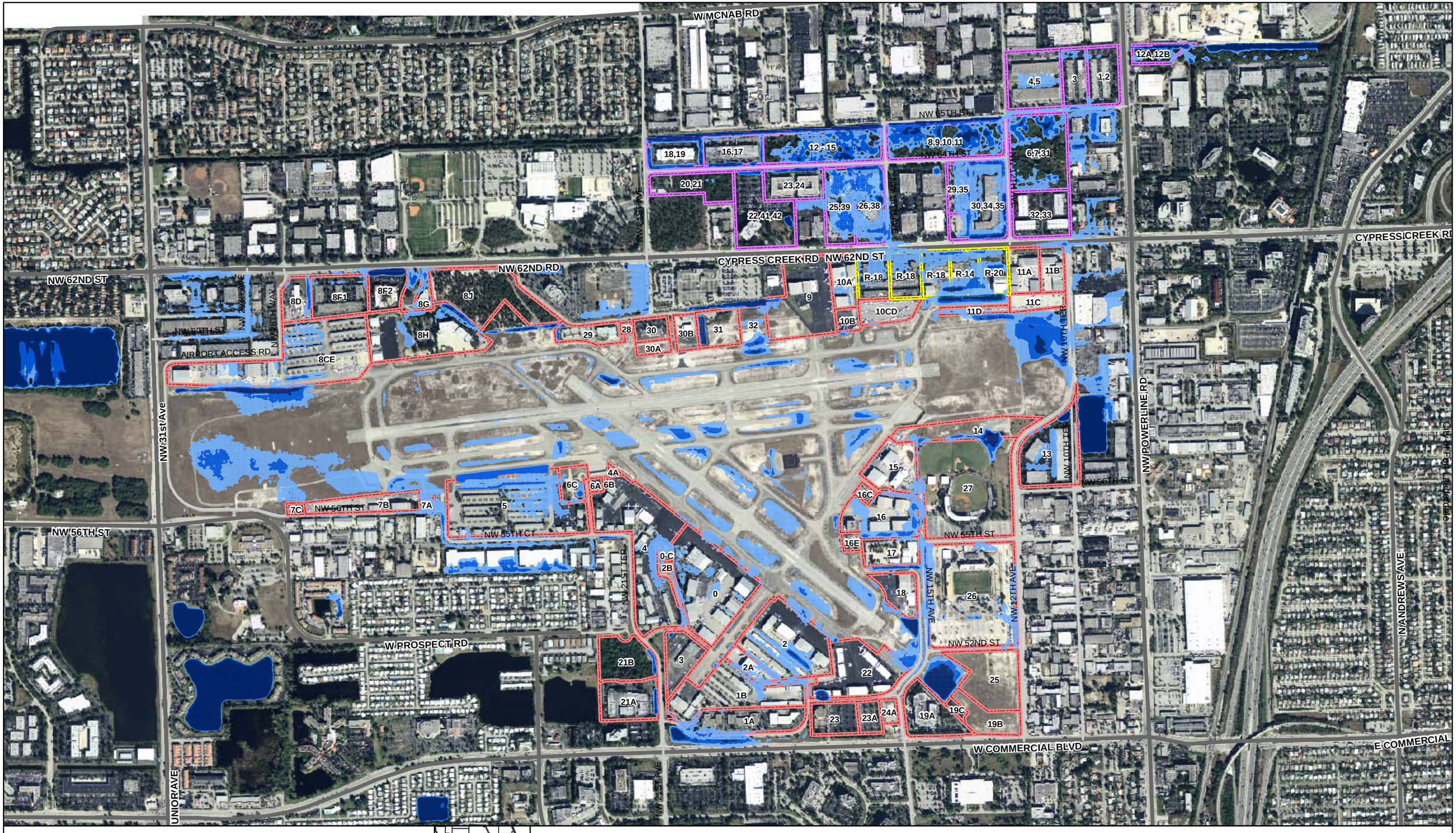
The southern portion of Taxiway Alpha appears to have ponding at the peak of the 5-year storm in the far western portion, as shown. The rest of the runways and taxiways are clear. Other problem areas for the 5-year storm are: NW 26th Avenue between NW 55th Street and NW 56th Court, and a portion of NW 55th Street are expected to flood, South Perimeter Road is expected to flood east of NW 21st Avenue, East Perimeter Road is expected to flood west of the stadium, NW 10th Terrace is expected to flood from Cypress Creek Road to where it becomes NW 12th Avenue, and multiple aprons have at least minor flooding, the most severe being in Parcel 11 next to NW 10th Terrace and Parcel 5 and 7 north of NW 55th Court.

For the 25-year, 72-hour and 100-year, 72-hour storms, much of the project area is expected to flood. However, the runways and most of the taxiways are clear even at the peak of the 100-year storm. Much of this flooding, especially in the Airpark may be attributed to the boundary conditions. The Cypress Creek Canal and the smaller tributary canals are expected to be very high at the peak of these storms. Multiple buildings are expected to flood due to the 100-year storm as indicated in the flood map. The most serious flooding occurs in the east near Parcel 11 and NW 10th Terrace, in the south along Commercial Boulevard (Parcel 19 in particular), and in the southwest along NW 55th Street and NW 56th Court. Further comparisons between the model simulations and building 1st floor elevations are made below.

Table 4-1 provides a comparison of peak stages at the model nodes for each storm to indicator elevations for existing land use conditions. If there was more than one indicator elevation adjacent to a given node, the lowest elevation is provided in this table. For taxiways and runways, the edge of pavement is used as the indicator elevation.

The table shows that there are probable problem areas in Taxiway Echo near Node 290, Node 310 and Node 570 for the 5-year, 24-hour design storm. This taxiway is located south of the western end of the runway.

8/31/2017 9:35 AM



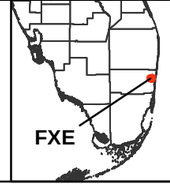
N

Legend

5-yr, Existing Cond.
Peak Flood Depth

- > 2
- 1 - 2
- 0 - 1

- Airport Parcel
- Industrial Airpark
- Released Land
- Minor Roads
- Major Roads



Fort Lauderdale Executive Airport

6000 NW 21st Avenue
Fort Lauderdale, FL 33309

1 inch = 950 feet

0 475 950 1,900 *Feet*

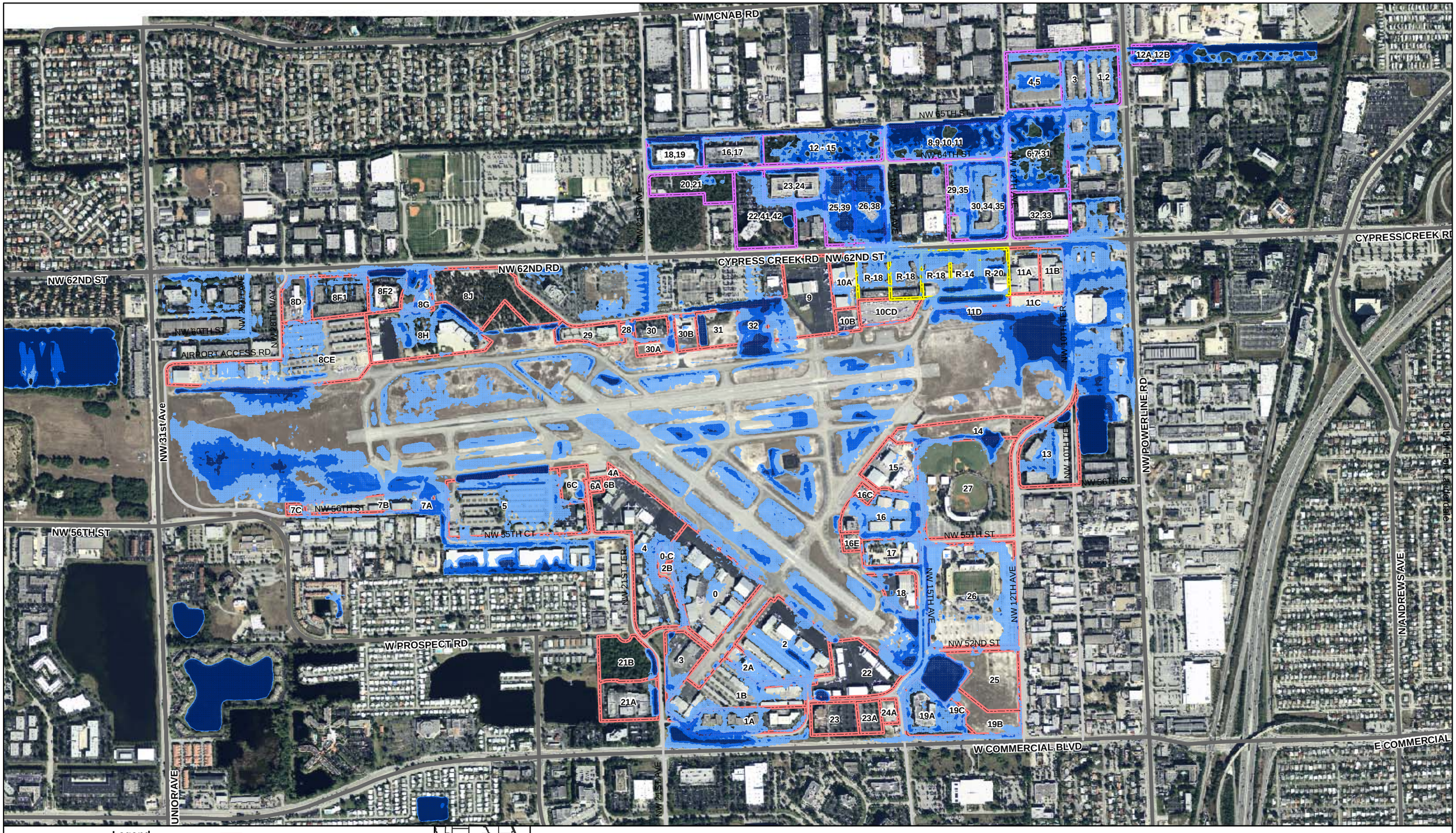
Figure 4-5
5-yr, 24-hr Design Storm Flood Map
Existing Conditions

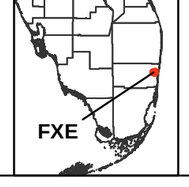
Bid 276-11834

CDM Smith

CAM #17-1096
Exhibit 2
Page 132 of 191

\\C:\COFL_FXE\Report\Figures\FXE_Figure4-5.mxd





Legend

25-yr, Existing Cond.
Peak Flood Depth
- > 2
- 1 - 2
- 0 - 1

- Airport Parcel
- Industrial Airpark
- Released Land
- Minor Roads
- Major Roads

Fort Lauderdale Executive Airport

6000 NW 21st Avenue
Fort Lauderdale, FL 33309

1 inch = 950 feet

0 475 950 1,900 *Feet*

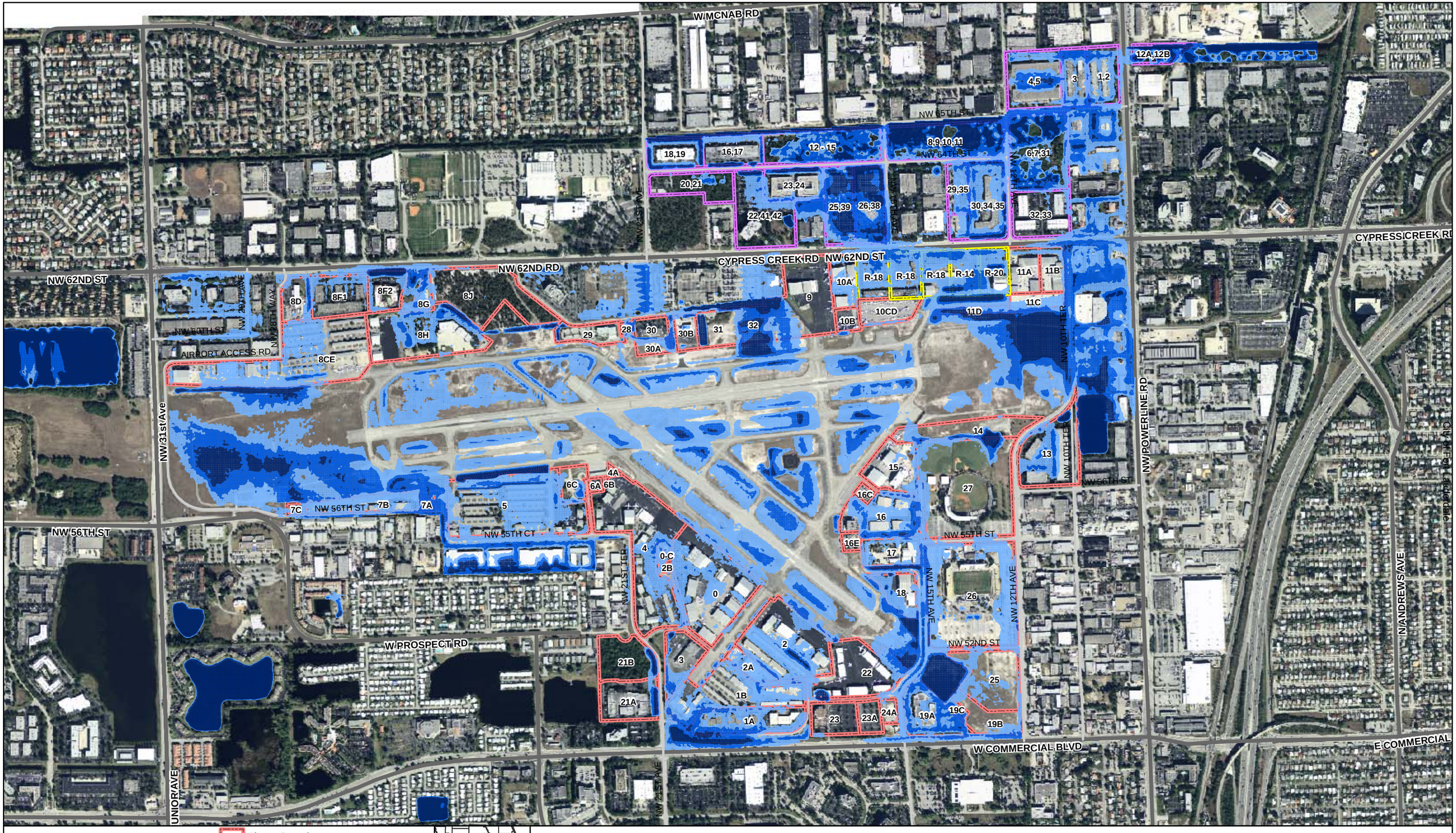
Figure 4-6
25-yr, 72-hr Design Storm Flood Map
Existing Conditions

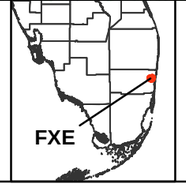
Bid 276-11831

CAM #17-1096
Exhibit 2
Page 133 of 191

\\C:\COFL_FXE\Report\Figures\FXE_Figure4-6.mxd

8/31/2017 9:35 AM





N

Legend

100-yr, Existing Cond.
Peak Flood Depth
- > 2
- 1 - 2
- 0 - 1

- Airport Parcel
- Industrial Airpark
- Released Land
- Minor Roads
- Major Roads

Fort Lauderdale Executive Airport

6000 NW 21st Avenue
Fort Lauderdale, FL 33309

1 inch = 950 feet

0 475 950 1,900 *Feet*

Figure 4-7
100-yr, 72-hr Design Storm Flood Map
Existing Conditions

CDM Smith

Bid 276-1831

CAM #17-1096
Exhibit 2
Page 134 of 191

\\C:\COFL_FXE\Report\Figures\FXE_Figure4-7.mxd

Table 4-1: Building and Road SWMM Flooding Depths for Existing Conditions Model.

Hydrologic Unit	Node	FFE	Road Elevation	Location	Peak Flood Stage			Building Flooding Depth			Road Flooding Depth		
					5-Year	25-Year	100-Year	5-Year	25-Year	100-year	5-Year	25-Year	100-Year
FXEHU010	Node010	--	6.7	Railroad	5.1	6.6	6.9	--	--	--	No	No	0.2
FXEHU020	Node030	--	6.7	Railroad	5.1	6.6	6.9	--	--	--	No	No	0.2
FXEHU030	Node050	9.0	5.3	Parking lot	5.9	6.8	7.2	No	No	No	0.6	1.5	1.9
FXEHU040	Node055	--	5.4	Parking lot	6.4	6.8	7.2	--	--	--	0.9	1.4	1.8
FXEHU050	Node060	--	6.1	NW 15th Ave	5.7	6.8	7.2	--	--	--	No	0.7	1.1
FXEHU060	Node700	--	6.7	Parking lot	7.2	7.4	7.5	--	--	--	0.5	0.7	0.8
FXEHU070	Node090	10.5	7.1	Parking lot	5.7	6.8	7.2	No	No	No	No	No	0.1
FXEHU080	Node710	10.0	6.1	Parking lot	6.6	7.6	8.0	No	No	No	0.5	1.5	1.9
FXEHU090	Node120	--	6.5	Parking lot	6.4	7.5	8.0	--	--	--	No	1.0	1.5
FXEHU100	Node140	10.1	8.2	Taxiway	7.5	7.7	8.0	No	No	No	No	No	No
FXEHU110	Node130	12.0	6.1	Perimeter Rd	6.2	7.5	8.0	No	No	No	0.1	1.4	1.9
FXEHU120	Node150	13.5	8.0	Parking lot	8.4	9.0	9.1	No	No	No	0.4	1.0	1.1
FXEHU130	Node180	--	8.8	Stadium Parking	8.8	9.2	9.3	--	--	--	No	0.4	0.5
FXEHU135	Node750	--	9.0	NW 12th Ave	9.6	9.9	10.1	--	--	--	0.6	0.9	1.1
FXEHU140	Node160	--	8.6	Perimeter Rd	6.6	8.7	9.2	--	--	--	No	0.1	0.6
FXEHU145	Node760	--	9.0	NW 12th Ave	8.1	8.8	9.2	--	--	--	No	No	0.2
FXEHU150	Node660	11.0	7.5	Parking lot	6.6	8.7	9.2	No	No	No	No	1.2	1.7
FXEHU155	Node780	--	7.8	Commercial Blvd	7.2	8.7	9.2	--	--	--	No	0.9	1.4
FXEHU160	Node170	10.6	8.3	Parking lot	7.9	8.7	9.2	No	No	No	No	0.4	0.9
FXEHU170	Node680	10.8	7.8	Paved Access Area	8.3	8.7	8.9	No	No	No	0.5	0.9	1.1
FXEHU180	Node550	10.0	6.5	S Perimeter Rd	7.1	7.9	8.3	No	No	No	0.6	1.4	1.8
FXEHU190	Node690	12.0	9.1	Aircraft Parking	9.6	9.9	10.1	No	No	No	0.5	0.8	1.0
FXEHU200	Node800	11.8	7.5	Aircraft Parking	7.1	8.4	8.6	No	No	No	No	0.9	1.1
FXEHU205	Node560	13.5	8.9	NW 21st Ave	7.2	8.5	8.8	No	No	No	No	No	No
FXEHU210	Node570	10.3	6.7	Taxiway E	7.5	8.3	8.6	No	No	No	0.8	1.6	1.9
FXEHU212	Node572	10.3	8.2	Taxiway E Access	8.4	8.6	8.8	No	No	No	0.2	0.4	0.6
FXEHU214	Node574	10.3	7.4	Perimeter Rd	7.4	8.3	8.6	No	No	No	No	0.9	1.2
FXEHU220	Node580	--	10.3	Perimeter Rd	7.2	8.1	8.6	--	--	--	No	No	No
FXEHU230	Node590	11.9	10.4	Taxiway	9.8	10.1	10.2	No	No	No	No	No	No
FXEHU240	Node600	--	9.2	NW 29th Avenue	9.7	9.8	9.9	--	--	--	0.5	0.6	0.7
FXEHU250	Node250	13.0	9.5	NW 24th Way	9.4	10.1	10.2	No	No	No	No	0.6	0.7
FXEHU260	Node240	14.5	10.2	Parking lot	10.8	11.1	11.2	No	No	No	0.6	0.9	1.0
FXEHU270	Node230	12.9	10.1	Parking lot	8.5	10.2	10.7	No	No	No	No	0.1	0.6
FXEHU280	Node230	15.0	10.1	Access ramp	8.5	10.2	10.7	No	No	No	No	0.1	0.6
FXEHU290	Node220	--	10.9	Runway	10.4	10.9	11.1	--	--	--	No	No	0.2
FXEHU300	Node210	--	10.5	Taxiway A	9.1	9.8	10.1	--	--	--	No	No	No
FXEHU310	Node190	--	10.3	Taxiway C	9.4	9.9	10.1	--	--	--	No	No	No
FXEHU320	Node470	--	10.0	Taxiway F	10.1	10.3	10.7	--	--	--	0.1	0.3	0.7

Table 4-1: Building and Road SWMM Flooding Depths for Existing Conditions Model.

Hydrologic Unit	Node	FFE	Road Elevation	Location	Peak Flood Stage			Building Flooding Depth			Road Flooding Depth		
					5-Year	25-Year	100-Year	5-Year	25-Year	100-year	5-Year	25-Year	100-Year
FXEHU330	Node460	--	11.0	Taxiway E	10.3	11.0	11.3	--	--	--	No	No	0.3
FXEHU340	Node480	--	10.6	Taxiway A	8.4	9.5	9.9	--	--	--	No	No	No
FXEHU350	Node420	--	11.3	Taxiway F	10.6	11.2	11.4	--	--	--	No	No	0.1
FXEHU360	Node430	--	10.9	Taxiway E	10.7	11.3	11.4	--	--	--	No	0.4	0.5
FXEHU370	Node260	--	11.3	Runway	10.0	10.8	11.1	--	--	--	No	No	No
FXEHU380	Node270	--	10.5	Taxiway B	9.9	10.8	11.1	--	--	--	No	0.3	0.6
FXEHU390	Node380	--	10.9	Taxiway E	10.6	11.1	11.4	--	--	--	No	0.2	0.5
FXEHU400	Node370	--	11.2	Taxiway E	11.1	11.4	11.6	--	--	--	No	0.2	0.4
FXEHU410	Node400	--	11.5	Taxiway E	10.6	11.0	11.4	--	--	--	No	No	No
FXEHU420	Node410	--	10.8	Taxiway B	10.7	11.1	11.2	--	--	--	No	0.3	0.4
FXEHU430	Node490	--	10.9	Taxiway G	9.8	10.3	10.6	--	--	--	No	No	No
FXEHU440	Node510	--	9.8	Taxiway B	10.0	10.4	10.5	--	--	--	0.2	0.6	0.7
FXEHU450	Node500	--	9.5	Taxiway G	9.3	9.7	10.1	--	--	--	No	0.2	0.6
FXEHU460	Node520	--	9.6	Taxiway B	9.7	10.3	10.5	--	--	--	0.1	0.7	0.9
FXEHU470	Node530	--	10.2	Taxiway G	10.0	10.1	10.1	--	--	--	No	No	No
FXEHU480	Node540	--	9.5	Taxiway B	9.3	9.8	9.9	--	--	--	No	0.3	0.4
FXEHU490	Node280	--	10.6	Taxiway P	9.8	10.6	10.8	--	--	--	No	No	0.2
FXEHU500	Node350	--	10.4	Taxiway E	10.2	10.2	10.2	--	--	--	No	No	No
FXEHU510	Node330	--	9.2	Taxiway E	9.2	9.7	9.7	--	--	--	No	0.5	0.5
FXEHU520	Node310	--	7.5	Taxiway E	7.9	8.3	8.6	--	--	--	0.4	0.8	1.1
FXEHU530	Node290	--	8.4	Taxiway A	8.8	8.9	8.9	--	--	--	0.4	0.4	0.5

The critical elevations were based on design and as-built drawings provided by the City. In particular, the low elevation near Node 570 was found on the CAD drawing 10398FXEtopo.dwg, which shows edge of pavement as low as 6.7 ft NAVD (8.3 ft NGVD). It is recommended that additional survey be taken in this area prior to potential design improvements. The table also shows minor encroachment on Taxiway Bravo near Node 510 and Node 520. Outside the airfield, parking lots and roads are expected to flood by as much as 0.9 ft for the 5-year storm.

For the larger design storms, parking lots and roads are expected to flood by as much as 1.9 ft; however, none of the buildings for which finished floor elevations were supplied are expected to flood in the existing condition for up to the 100-year storm.

4.4.2 Future Land Use Condition

The future Airport Layout Plan (ALP) was considered for this analysis. The model was edited to accommodate the future ALP by updating the impervious area. The Airport SWMM was then run with the 5-year, 24-hour; 25-year, 72-hour; and the 100-year, 72-hour SFWMD design storms for the future land use condition.

Figures 4-8 through **4-10** show the peak flood depth maps for the 5-year, 24-hour; 25-year, 72-hour; and the 100-year, 72-hour SFWMD design storms, respectively. For most of the project area, the future condition model and the existing condition model are nearly the same. Thus, the flood maps are similar to those in the preceding section. Increases in flood depth may be noted in the center of the airfield near node Node 480 west of Parcel 16. This increase should not adversely impact the surrounding taxiways for the 5-year, 24-hour storm.

Table 4-2 provides a comparison of peak stages at the model nodes for each storm to indicator elevations for future land use conditions.

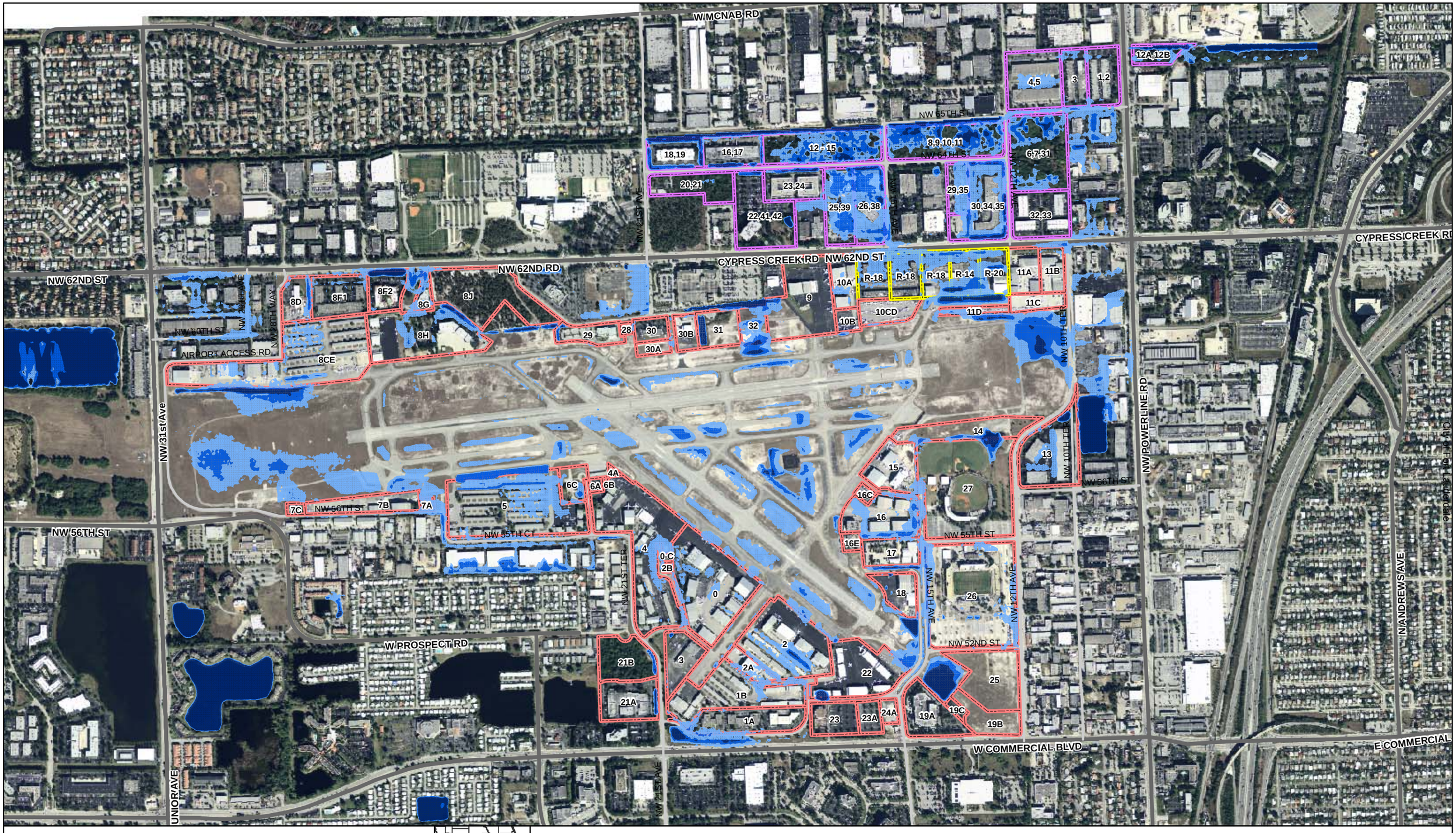
The table shows that there are slight increases in peak stage versus the existing condition. It also shows that no additional taxiways or runways are expected to be encroached during the 5-year storm, and no additional building finished floors are expected to flood during the 100-year storm.

4.5 Identification of Problem Areas

CDM Smith met with the City on May 23, 2011. The following problem areas were confirmed with the model analyses and identified for further evaluation:

- The northeast corner of the Airport, adjacent to and including NW 10th Terrace and parts of Parcel 11;
- The southeast corner of the Airport, on either side of NW 15th Avenue, including Parcel 19 and parts of Parcels 18 and 22, and NW 15th Avenue; and
- The southwest corner of the Airport, including parts of Taxiway Echo, NW 56th Street, NW 26th Avenue and NW 56th Court.

In the next section, three stormwater management alternatives will be evaluated to provide the City with the desired LOS for the PSMS.



Fort Lauderdale Executive Airport

6000 NW 21st Avenue
Fort Lauderdale, FL 33309

1 inch = 950 feet

0 475 950 1,900 Feet

Figure 4-8
5-yr, 24-hr Design Storm Flood Map
Future ALP Conditions

Bid 276-11824

CDM Smith

\\C:\COFL_FXE\Report\Figures\FXE_Figure4-8.mxd

8/31/2017 9:35 AM

N

Legend

25-yr, Future Cond.
Peak Flood Depth

- > 2
- 1 - 2
- 0 - 1

- Airport Parcel
- Industrial Airpark
- Released Land
- Minor Roads
- Major Roads

Fort Lauderdale Executive Airport

6000 NW 21st Avenue
Fort Lauderdale, FL 33309

1 inch = 950 feet

0 475 950 1,900 Feet

Figure 4-9
25-yr, 72-hr Design Storm Flood Map
Future ALP Conditions

BID 276-11831

CAM #17-1096
Exhibit 2

CDM Smith

\\C:\COFL_FXE\Report\Figures\FXE_Figure4-9.mxd

8/31/2017 9:35 AM

Legend

100-yr, Future Cond. Peak Flood Depth

- > 2
- 1 - 2
- 0 - 1

- Airport Parcel
- Industrial Airpark
- Released Land
- Minor Roads
- Major Roads

FXE

Fort Lauderdale Executive Airport

6000 NW 21st Avenue
Fort Lauderdale, FL 33309

1 inch = 950 feet

0 475 950 1,900 Feet

Figure 4-10
100-yr, 72-hr Design Storm Flood Map
Future ALP Conditions

CDM Smith

Bid 276-1831

CAM #17-1096
Exhibit 2
Page 140 of 191

p. 140

\\C:\COFL_FXE\Report\Figures\FXE_Figure4-10.mxd

Table 4-2: Building and Road SWMM Flooding Depths for Future Conditions Model.

Hydrologic Unit	Node	FFE	Road Elevation	Location	Peak Flood Stage			Building Flooding Depth			Road Flooding Depth		
					5-Year	25-Year	100-Year	5-Year	25-Year	100-year	5-Year	25-Year	100-Year
FXEHU010	Node010	--	6.7	Railroad	5.1	6.6	6.9	--	--	--	No	No	0.2
FXEHU020	Node030	--	6.7	Railroad	5.1	6.6	6.9	--	--	--	No	No	0.2
FXEHU030	Node050	9.0	5.3	Parking lot	5.9	6.8	7.2	No	No	No	0.6	1.5	1.9
FXEHU040	Node055	--	5.4	Parking lot	6.4	6.8	7.2	--	--	--	0.9	1.4	1.8
FXEHU050	Node060	--	6.1	NW 15th Ave	5.7	6.8	7.2	--	--	--	No	0.7	1.1
FXEHU060	Node700	--	6.7	Parking lot	7.2	7.4	7.5	--	--	--	0.5	0.7	0.8
FXEHU070	Node090	10.5	7.1	Parking lot	5.7	6.8	7.2	No	No	No	No	No	0.1
FXEHU080	Node710	10.0	6.1	Parking lot	6.7	7.6	8.0	No	No	No	0.6	1.5	1.9
FXEHU090	Node120	--	6.5	Parking lot	6.4	7.5	8.0	--	--	--	No	1.0	1.5
FXEHU100	Node140	10.1	8.2	Taxiway	7.5	7.7	8.0	No	No	No	No	No	No
FXEHU110	Node130	12.0	6.1	Perimeter Rd	6.2	7.5	8.0	No	No	No	0.1	1.4	1.9
FXEHU120	Node150	13.5	8.0	Parking lot	8.4	9.0	9.1	No	No	No	0.4	1.0	1.1
FXEHU130	Node180	--	8.8	Stadium Parking	8.8	9.2	9.3	--	--	--	No	0.4	0.5
FXEHU135	Node750	--	9.0	NW 12th Ave	9.6	9.9	10.1	--	--	--	0.6	0.9	1.1
FXEHU140	Node160	--	8.6	Perimeter Rd	6.5	8.7	9.1	--	--	--	No	0.1	0.5
FXEHU145	Node760	--	9.0	NW 12th Ave	7.9	8.8	9.2	--	--	--	No	No	0.2
FXEHU150	Node660	11.0	7.5	Parking lot	6.5	8.7	9.1	No	No	No	No	1.2	1.6
FXEHU155	Node780	--	7.8	Commercial Blvd	7.0	8.7	9.1	--	--	--	No	0.9	1.3
FXEHU160	Node170	10.6	8.3	Parking lot	7.9	8.7	9.1	No	No	No	No	0.4	0.8
FXEHU170	Node680	10.8	7.8	Paved Access Area	8.3	8.7	8.9	No	No	No	0.5	0.9	1.1
FXEHU180	Node550	10.0	6.5	S Perimeter Rd	7.0	7.9	8.3	No	No	No	0.5	1.4	1.8
FXEHU190	Node690	12.0	9.1	Aircraft Parking	9.6	9.9	10.1	No	No	No	0.5	0.8	1.0
FXEHU200	Node800	11.8	7.5	Aircraft Parking	6.9	8.3	8.6	No	No	No	No	0.8	1.1
FXEHU205	Node560	13.5	8.9	NW 21st Ave	7.1	8.4	8.8	No	No	No	No	No	No
FXEHU210	Node570	10.3	6.7	Taxiway E	7.5	8.3	8.6	No	No	No	0.8	1.6	1.9
FXEHU212	Node572	10.3	8.2	Taxiway E Access	8.4	8.6	8.8	No	No	No	0.2	0.4	0.6
FXEHU214	Node574	10.3	7.4	Perimeter Rd	7.4	8.3	8.6	No	No	No	No	0.9	1.2
FXEHU220	Node580	--	10.3	Perimeter Rd	7.3	8.1	8.6	--	--	--	No	No	No
FXEHU230	Node590	11.9	10.4	Taxiway	9.8	10.1	10.2	No	No	No	No	No	No
FXEHU240	Node600	--	9.2	NW 29th Avenue	9.7	9.8	9.9	--	--	--	0.5	0.6	0.7
FXEHU250	Node250	13.0	9.5	NW 24th Way	9.6	10.1	10.2	No	No	No	0.1	0.6	0.7
FXEHU260	Node240	14.5	10.2	Parking lot	10.8	11.1	11.2	No	No	No	0.6	0.9	1.0
FXEHU270	Node230	12.9	10.1	Parking lot	9.0	10.4	10.8	No	No	No	No	0.3	0.7
FXEHU280	Node230	15.0	10.1	Access ramp	9.0	10.4	10.8	No	No	No	No	0.3	0.7
FXEHU290	Node220	--	10.9	Runway	10.4	10.9	11.1	--	--	--	No	No	0.2
FXEHU300	Node210	--	10.5	Taxiway A	9.1	9.8	10.1	--	--	--	No	No	No
FXEHU310	Node190	--	10.3	Taxiway C	9.5	9.9	10.1	--	--	--	No	No	No
FXEHU320	Node470	--	10.0	Taxiway F	10.1	10.4	10.8	--	--	--	0.1	0.4	0.8

Table 4-2: Building and Road SWMM Flooding Depths for Future Conditions Model.

Hydrologic Unit	Node	FFE	Road Elevation	Location	Peak Flood Stage			Building Flooding Depth			Road Flooding Depth		
					5-Year	25-Year	100-Year	5-Year	25-Year	100-year	5-Year	25-Year	100-Year
FXEHU330	Node460	--	11.0	Taxiway E	10.3	11.0	11.3	--	--	--	No	No	0.3
FXEHU340	Node480	--	10.6	Taxiway A	9.5	10.2	10.5	--	--	--	No	No	No
FXEHU350	Node420	--	11.3	Taxiway F	10.6	11.2	11.4	--	--	--	No	No	0.1
FXEHU360	Node430	--	10.9	Taxiway E	10.7	11.3	11.4	--	--	--	No	0.4	0.5
FXEHU370	Node260	--	11.3	Runway	10.0	10.8	11.1	--	--	--	No	No	No
FXEHU380	Node270	--	10.5	Taxiway B	9.9	10.8	11.1	--	--	--	No	0.3	0.6
FXEHU390	Node380	--	10.9	Taxiway E	10.6	11.1	11.4	--	--	--	No	0.2	0.5
FXEHU400	Node370	--	11.2	Taxiway E	11.1	11.4	11.6	--	--	--	No	0.2	0.4
FXEHU410	Node400	--	11.5	Taxiway E	10.6	11.0	11.4	--	--	--	No	No	No
FXEHU420	Node410	--	10.8	Taxiway B	10.7	11.1	11.2	--	--	--	No	0.3	0.4
FXEHU430	Node490	--	10.9	Taxiway G	9.8	10.3	10.6	--	--	--	No	No	No
FXEHU440	Node510	--	9.8	Taxiway B	10.0	10.4	10.5	--	--	--	0.2	0.6	0.7
FXEHU450	Node500	--	9.5	Taxiway G	9.3	9.8	10.2	--	--	--	No	0.3	0.7
FXEHU460	Node520	--	9.6	Taxiway B	9.7	10.3	10.5	--	--	--	0.1	0.7	0.9
FXEHU470	Node530	--	10.2	Taxiway G	10.0	10.0	10.1	--	--	--	No	No	No
FXEHU480	Node540	--	9.5	Taxiway B	9.3	9.8	9.9	--	--	--	No	0.3	0.4
FXEHU490	Node280	--	10.6	Taxiway P	9.8	10.6	10.8	--	--	--	No	No	0.2
FXEHU500	Node350	--	10.4	Taxiway E	10.2	10.2	10.2	--	--	--	No	No	No
FXEHU510	Node330	--	9.2	Taxiway E	9.2	9.7	9.7	--	--	--	No	0.5	0.5
FXEHU520	Node310	--	7.5	Taxiway E	7.9	8.3	8.6	--	--	--	0.4	0.8	1.1
FXEHU530	Node290	--	8.4	Taxiway A	8.8	8.9	8.9	--	--	--	0.4	0.4	0.5

Section 5 Alternatives Evaluation, Costs and Recommendations

In Section 4, a U.S. Environmental Protection Agency (EPA) Stormwater Management Model Version 5 (SWMM) hydrologic and hydraulic model was developed, validated, and used to evaluate the existing stormwater system at the Airport for the 5-year, 24-hour and the 25-year and 100-year, 72-hour South Florida Water Management District (SFWMD) design storms. The purpose of the modeling phase of the study was to:

- Identify locations and probable causes of known flooding;
- Analyze stormwater improvement alternatives including conveyance, storage, exfiltration, retention areas, and other potential Best Management Practices (BMPs); and
- Develop and prioritize stormwater improvement alternatives.

In Section 4.5, three flooding locations (Problem Areas) were identified:

1. In the southeast corner of the project area, along the South Perimeter Road and East Perimeter Road, including parts of Parcels 1, 2, and 3 and Taxiway Bravo;
2. In the northeast corner of the project area, adjacent to and including NW 10th Terrace and parts of Parcel 11; and
3. In the southwest corner of the project area, including parts of Taxiway Echo, NW 56th Street, NW 26th Avenue, and NW 56th Court (Parcels 5, 6C, 7A, 7B, and 7C).

In this section, stormwater improvement alternatives are evaluated with conceptual cost estimations and recommendations.

5.1 Southeast Problem Area

The Southeast Problem Area is bounded by Commercial Boulevard to the south, NW 21st Avenue to the west, and NW 15th Avenue to the east. This area is comprised of the following Parcels: 0, 1A, 1B, 2, 2A, 3, 4, 21A, 21B, 23, and part of 22; and hangar numbers 31 through 34, 39 through 50, 55 through 63, and 1 through 6.

This area was the focus of the proposed improvements made in the 1990 Master Drainage Study and Plan. As modeled with the existing system, the implemented improvements from the 1990 recommendations still allow for relatively significant flooding along South Perimeter Road and other areas in the southeast vicinity as identified in **Figure 5-1**.

Figure 5-1 shows six flooding locations in the southeast for the 5-year, 24-hour design storm under future land use conditions and the existing Primary Stormwater Management System (PSMS). Note this is a detailed map of Figure 4-8, with focus on the Southeast Problem Area.

8/31/2017 9:35 AM

N

Legend

5-yr, Future Cond. Peak Flood Depth
- > 2
- 1 - 2
- 0 - 1

Model Nodes
- Junction
- Outfall
- Storage

Existing System
- Exfiltration
- Pipe

Parcels and Lots
- Airport Parcel
- Industrial Airpark
- Released Land

FXE

Fort Lauderdale Executive Airport

6000 NW 21st Avenue
Fort Lauderdale, FL 33309

1 inch = 300 feet

0 150 300 600 Feet

Figure 5-1
5-yr, 24-hr Design Storm Flood Map
Future Conditions - Southeast Area

CDM Smith

Bid 276-14931

\\C:\COFL_FXE\Report\Figures\FXE_Figure5-1.mxd

Table 5-1, a subset of Table 4-2, provides a comparison of peak stages at model nodes to indicator elevations in the Southeast Problem Area.

Table 5-1: Flood Depths for the Future Land Use, Existing PSMS, Southeast Area.

Node	Reference Elevation (ft NAVD)	Location	Peak Flood Stage (Ft NAVD)			Road/ Taxiway/ Apron Flood Depth (ft)		
			5-yr Storm	25-yr Storm	100-yr Storm	5-yr Storm	25-yr Storm	100-yr Storm
Node 160	8.6	Perimeter Rd	6.5	8.7	9.1	-	0.1	0.5
Node 760	9.0	NW 12th Ave	7.9	8.8	9.2	-	-	0.2
Node 660	7.5	Parking lot	6.5	8.7	9.1	-	1.2	1.6
Node 780	7.8	Commercial Blvd	7.0	8.7	9.1	-	0.9	1.3
Node 170	8.3	Parking lot	7.9	8.7	9.1	-	0.4	0.8
Node 680	7.8	Paved Access Area	8.3	8.7	8.9	0.5	0.9	1.1
Node 550	6.5	S Perimeter Rd	7.0	7.9	8.3	0.5	1.4	1.8
Node 690	9.1	Aircraft Parking	9.6	9.9	10.1	0.5	0.8	1.0
Node 800	7.5	Aircraft Parking	6.9	8.3	8.6	-	0.8	1.1
Node 560	8.9	NW 21st Ave	7.1	8.4	8.8	-	-	-
Node 490	10.9	Taxiway G	9.8	10.3	10.6	-	-	-
Node 510	9.8	Taxiway B	10.0	10.4	10.5	0.2	0.6	0.7
Node 500	9.5	Taxiway G	9.3	9.8	10.2	-	0.3	0.7
Node 520	9.6	Taxiway B	9.7	10.3	10.5	0.1	0.7	0.9
Node 530	10.2	Taxiway G	10.0	10.0	10.1	-	-	-
Node 540	9.5	Taxiway B	9.3	9.8	9.9	-	0.3	0.4

Note – All stages and depths rounded to nearest 0.1 ft.

5.1.1 Flooding Problems

There are six general locations with flooding problems in the southeast area for the 5-year design storm.

Taxiway Bravo near Node 510 and Node 520

These two locations are similar in that the peak flood stage is expected to encroach on the taxiway for the 5-year design storm, which is not recommended in Federal Aviation Administration (FAA) Advisory Circular (AC) 150. This encroachment is noted on Figure 5-1 and in Table 5-1 for both areas. Note that the amount of encroachment is small, one to two tenths of a foot. A storage solution is presented as part of the alternative, but monitoring the area and potentially improving the model with calibration maybe appropriate.

Apron/Parking/Roads near Node 690 (Parcel 3)

This area has some existing exfiltration trenches, but still is expected to flood over a large area and up to 0.5 ft above the reference elevation for the 5-year storm.

Apron/ Parking/ Roads near Node 680 (Parcel 2)

This area has some existing exfiltration trench, but is expected to flood over a large area and up to 0.5 ft above the reference elevation for the 5-year storm.

South Perimeter Road and Parking Lots near Node 550 (Parcel 1A)

The proposed improvements in the 1990 Master Drainage Study and Plan conveyed flows into this area and provided the swale along Commercial Boulevard for storage. This storage is inadequate for the combination of direct runoff and conveyed flows for the 5-year storm. South Perimeter Road is likely impassible for most vehicles at the peak of this storm.

East Perimeter Road near Node 170

The peak stages are above the reference elevation in this location only for the larger storms; therefore, this area is not as high priority as the South Perimeter Road.

5.1.2 Existing Primary Stormwater Management System

Two major pipes collect runoff from this area, the first is a 54-inch diameter Reinforced Concrete Pipe (RCP) along NW 21st Avenue and the second drains part of Parcel 2 near Node 690 with a 36-inch diameter RCP. This latter pipe directly discharges into the swale at Node 550 and then connects to the Florida Department of Transportation (FDOT) system through a water control structure. The water control structure retains water until an elevation of 5.4 NAVD is reached. The structure is modeled as an orifice with a 10-ft by 12-ft bottom outlet.

5.1.3 Southeast Area Alternative

The alternative developed for the Southeast Problem Area consists of extending the dry detention area between South Perimeter Road and Commercial Boulevard, constructing additional exfiltration, and re-grading the two airfield swales adjacent to Taxiway Bravo to a 50:1 grade from the edge of pavement. **Figure 5-2** shows the proposed elements of the Southeast Area Alternative.

5.1.3.1 Southeast Area Alternative Implementation

Extension of the Dry Detention between South Perimeter Road and Commercial Boulevard

This component of the Southeast Area Alternative has a footprint of approximately 2 acres, with the detention area bottom covering about 1.2 acres of the total footprint. The elevation of the bottom is designed to be approximately 4.0 ft NAVD, which matches the lower elevations of the existing detention area at the corner of Commercial Boulevard and NW 21st Avenue. This elevation is more than 1.0 ft above the seasonal high water table, thus the component should be permittable as dry detention.

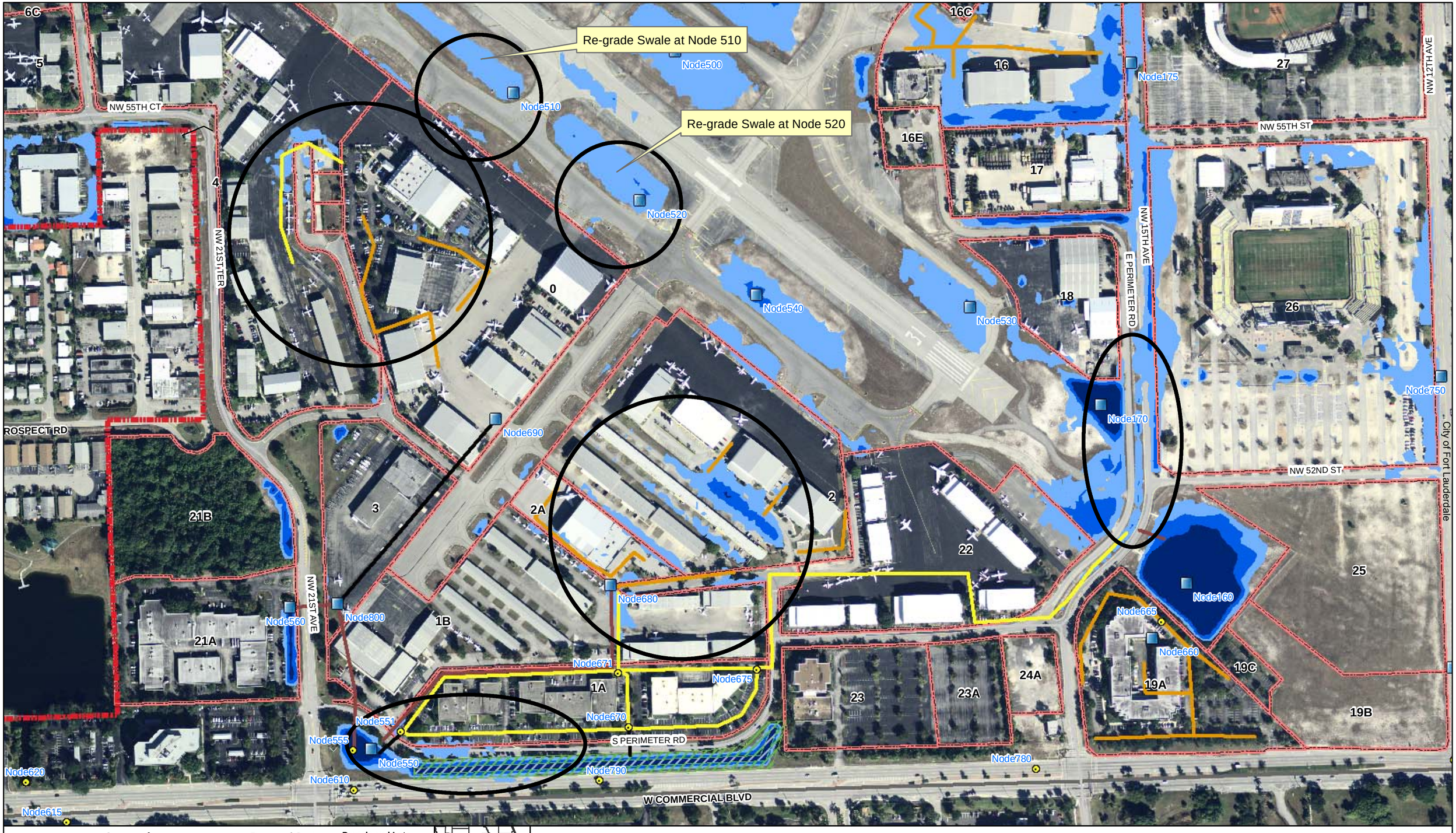
The width of the detention area bottom should be approximately 30-45 ft, which leaves the side slopes ranging from 4:1 to 6:1, which is appropriate for landside slopes. The side slopes are steeper than the east end of the existing dry detention area, but at a commonly used grade. It is not expected that steeper slopes would create enough extra storage volume to significantly alter results.

Because the existing topography between South Perimeter Road and Commercial Boulevard is already low in places, the volume of excavated material should be approximately 8,000 cubic yards.

This component is modeled as a natural channel with a constant cross-section in SWMM, to allow for storage, but also with conveyance from two separate points of entry. The stage-storage relationship attributed to Node 550 has been adjusted to include the proposed dry detention, less the storage volume in the natural channel link to avoid double counting this storage.

It should be noted that the significant undeveloped area at the corner of Commercial Boulevard and NW 12th Avenue (Parcels 19B and 25) have been reserved for future development. If this development does not move further, this area could serve as better dry retention or detention storage for the Southeast Problem Area due to its 12-acre size.

8/31/2017 9:35 AM



N

Legend

5-yr, SE Alt Peak Flood Depth
- > 2
- 1 - 2
- 0 - 1

Model Nodes
- Junction
- Outfall
- Storage

Existing System
- Exfiltration
- Pipe

Proposed System
- Exfiltration
- Pipe

Dry Detention
- Bottom
- Side

Parcels and Lots
- Airport Parcel
- Industrial Airpark
- Released Land

FXE

Fort Lauderdale Executive Airport

6000 NW 21st Avenue
Fort Lauderdale, FL 33309

1 inch = 300 feet

0 150 300 600 Feet

Figure 5-2
5-yr, 24-hr Design Storm Flood Map
Southeast Area Alternative

CDM Smith

Bid 276-11831

CAM #17-1096
Exhibit 2
Page 147 of 191

p. 147

\\C:\COFL_FXE\Report\Figures\FXE_Figure5-2.mxd

Exfiltration Trenches

The Southeast Area Alternative includes a proposed total of 5,645 linear feet of additional exfiltration trench. The exfiltration trenches should be designed similar to the existing trenches, with 3-ft diameter perforated pipe in a 5-ft by 5-ft trench. It is recommended that the perforated pipe and the rock trench both be wrapped with filter fabric to extend system life. SFWMD design standards would be used for sizing and treatment calculations.

The soil types in the southeast portion of the project site range from Group A to Group D. There are multiple geotechnical investigations in the area with measured saturated hydraulic conductivities (K) ranging from 2.0 x 10^{-5} to 1.7 x 10^{-3} (cfs/ft^2-ft). Three of these measurements were taken in the parking lots north of South Perimeter Road (Parcel 1A) where a portion of the additional exfiltration is proposed. The measurements at these locations were 1.0 x 10^{-3}, 1.7 x 10^{-3}, and 1.4 x 10^{-4} (cfs/ft^2-ft), with the smaller value being recorded where the Natural Resources Conservation Service (NRCS) soils map shows Group A or sandy soils, where one would expect a higher value. The method of modeling exfiltration with SWMM and the calculations used were the same as those used for the existing exfiltration, to be consistent. Prior to final design, additional geotechnical investigations are recommended to more accurately estimate site specific exfiltration potential.

Three segments of proposed inline exfiltration trenches are upstream of Node 670 totaling 1,595 feet in length, with expected catchment inverts ranging from 6.5 ft NAVD to 7.5 ft NAVD and K values ranging from 1.4 x 10^{-4} to 5.0 x 10^{-4} (cfs/ft^2-ft). The exfiltration rate from these segments is estimated to reach a maximum of 20 cfs. Refer to **Appendix E** for proposed exfiltration calculations.

Two segments of proposed inline exfiltration trenches are upstream of Node 551 totaling 1,960 feet in length, with expected catchment inverts ranging from 7.5 ft NAVD to 8.5 ft NAVD and K values ranging from 5.0 x 10^{-4} to 1.0 x 10^{-3} (cfs/ft^2-ft). The exfiltration rate from these segments is estimated to reach a maximum of 25.6 cfs.

One segment of inline exfiltration trench is proposed upstream of Node 165. The segment is 1,490 feet in length, with an expected catchment inverts of approximately 8.0 ft NAVD and a K value of 2.8 x 10^{-4} (cfs/ft^2-ft). The exfiltration rate from this segment is estimated to reach a maximum of 11.6 cfs.

One additional segment of offline exfiltration trench is proposed upstream of Node 690. The segment is 600 feet in length, with an expected catchment inverts of approximately 9.0 ft NAVD and a K value of 3.0 x 10^{-4} (cfs/ft^2-ft). The exfiltration rate from this segment is estimated to reach a maximum of 5.3 cfs.

The proposed exfiltration is modeled the same as the existing exfiltration (see Section 4 of this report). Inline exfiltration means that the system is connected to the area's PSMS, typically through a weir. The invert elevation of the weir is set near the top of the pipe to treat a given volume of runoff before allowing flow to the PSMS. The weirs are modeled as 3-ft wide boxes with 3-ft tall openings above the weir invert. The bottom of the weir structure should coincide with the bottom of the trench. Because the top of the weir structure may be above ground, it should be placed at locations where is does not obstruct traffic and is accessible. The structure may be design with a wider, lower profile as well. Offline exfiltration means the trench does not have a downstream connection to the rest of the stormwater system.

The locations of the proposed trenches, as shown in Figure 5-2, were chosen to convey flows to the dry detention areas, along roads and through parking lots, and generally where the topography showed lower elevations so that the runoff flows to the trench inlets.

Re-grade Airside Swales Adjacent to Taxiway Bravo

The existing grade in the swales adjacent to Taxiway Bravo, modeled as Node 510 and Node 520, was found to be slightly shallower than 2% (50:1). Since the level of service (LOS) in these nodes are close to the desired LOS

(peak stages 0.1 – 0.2 ft too high), re-grading the swales to a 50:1 slope from the edge of all runway and taxiway pavement, although a minor change, is expected to reduce stages enough to meet LOS. Refer to **Appendix F** for figures showing the locations of the existing topography profiles and the proposed dimensions. Approximately 1,050 cubic yards of material would be removed from the swale at Node 510, and 900 cubic yards from the swale at Node 520.

Pipe from Node 690 to the PSMS

A 1,000-ft long, 48-in diameter concrete pipe has been added between Node 690 and Node 800 to connect the flooded apron areas to the existing PSMS. In this analysis, the runoff from basin FXEHU190 loads the proposed system at Node 690. It is expected that there would be several inlets along the proposed system in Parcel 0 and Parcel 3, which are represented in the model by the single load point.

5.1.3.2 Southeast Area Alternative Results

Table 5-2 presents the peak stages and estimated depth of flooding for the Southeast Problem Area after the implementation of Southeast Area Alternative for the 5-year, 24-hour design storm and the 25-year and 100-year, 72-hour design storms; this table is similar to Table 5-1, but with the recommended improvements. The results show that peak stages surpass reference elevations, even for the 5-year storm, at Node 680. However, the peaks have been reduced and the duration of flooding above the reference elevation has been significantly reduced from approximately 2.5 hours to just under one hour. Since no reference finished floor elevations (FFE) of buildings were exceeded for the 100-year storm, this column has been removed from this table. Refer Tables 4-1 and 4-2 in the previous section for the reference FFEs.

Table 5-2: Flood Depths for the Southeast Area Alternative.

Node	Reference Elevation (ft NAVD)	Location	Peak Flood Stage (Ft NAVD)			Road/ Taxiway/ Apron Flood Depth (ft)		
			5-yr Storm	25-yr Storm	100-yr Storm	5-yr Storm	25-yr Storm	100-yr Storm
Node 160	8.6	Perimeter Rd	6.5	8.6	9.1	-	-	0.5
Node 760	9.0	NW 12th Ave	7.6	8.8	9.1	-	-	0.1
Node 660	7.5	Parking lot	6.5	8.6	9.1	-	1.1	1.6
Node 780	7.8	Commercial Blvd	6.2	8.6	9.1	-	0.8	1.3
Node 170	8.3	Parking lot	7.9	8.6	9.1	-	0.3	0.8
Node 680	7.8	Paved Access Area	8.1	8.6	8.8	0.3	0.8	1.0
Node 550	6.5	S Perimeter Rd	6.3	7.6	8.3	-	1.1	1.8
Node 690	9.1	Aircraft Parking	9.1	9.6	9.8	-	0.5	0.7
Node 800	7.5	Aircraft Parking	6.9	8.4	8.6	-	0.9	1.1
Node 560	8.9	NW 21st Ave	7.1	8.5	8.9	-	-	-
Node 490	10.9	Taxiway G	9.8	10.3	10.6	-	-	-
Node 510	9.8	Taxiway B	9.6	10.3	10.5	-	0.5	0.7
Node 500	9.5	Taxiway G	9.3	9.8	10.2	-	0.3	0.7
Node 520	9.6	Taxiway B	9.4	9.9	10.4	-	0.3	0.8
Node 530	10.2	Taxiway G	10.0	10.0	10.1	-	-	-
Node 540	9.5	Taxiway B	9.3	9.8	9.9	-	0.3	0.4

Note – All stages and depths rounded to nearest 0.1 ft.

The results indicate that there is not enough available land for the extended storage and proposed exfiltration to completely meet the desired LOS, which was to reduce flooding below the reference elevations for the 5-year storm. Potentially, more exfiltration could be proposed in the hangar areas of Parcel 2A (near Node 680), but there already is significant existing and proposed exfiltration in this area. The extended dry detention area by itself only produced a reduction of about one to two tenths of a foot in peak stage and little change in the duration of flooding. Therefore, the extension of the dry detention basin should be coordinated with the construction of additional exfiltration trenches.

Possible improvements to the Southeast Area Alternative include using the open space at the corner of Commercial Boulevard and NW 12th Avenue, if the proposed development does not occur and the land becomes available. Additionally, the soils may allow for higher exfiltration than the model estimates, which would also improve the performance of this alternative. This can be verified with field testing, if desired.

5.2 Northeast Problem Area

The Northeast Problem Area is bounded by NW 12th Avenue and NW 10th Terrace to the east and southeast and Parcels 11C and 11D to the north. The extent of flooding does not reach the airfield to the west. **Figure 5-3** displays a flood map of this problem area, which consists of persistent flooding of Parcel 11C and 11D aprons, NW 10th Terrace, and the businesses east of NW 10th Terrace. The flooded area consists of Group D soils and drains slowly, which is noticeable in the photos taken the day after Hurricane Irene (October 1999) as shown in Figure 4-3 of the previous section.

Table 5-3, a subset of Table 4-2, provides a comparison of peak stages at model nodes to indicator elevations in the Northeast Problem Area.

Table 5-3: Flood Depths for the Future Land Use, Existing PSMS, Northeast Area.

Node	Reference Elevation (ft NAVD)	Location	Peak Flood Stage (Ft NAVD)			Road/ Taxiway/ Apron Flood Depth (ft)		
			5-yr Storm	25-yr Storm	100-yr Storm	5-yr Storm	25-yr Storm	100-yr Storm
Node 120	6.5	Parking lot	6.4	7.5	8.0	-	1.0	1.5
Node 130	6.1	Perimeter Rd	6.2	7.5	8.0	0.1	1.4	1.9
Node 140	8.2	Taxiway	7.5	7.7	8.0	-	-	-
Node 180	8.8	Stadium Parking	8.8	9.2	9.3	-	0.4	0.5
Node 210	10.5	Taxiway A	9.1	9.8	10.1	-	-	-
Node 220	10.9	Runway	10.4	10.9	11.1	-	-	0.2

Note – All stages and depths rounded to nearest 0.1 ft.

5.2.1 Flood Problems

There are three locations of flooding problems in this region for the 5-year design storm; all are adjacent to Node 130.

Parcels 11C and 11D

These two parcels are encroached upon by the 5-year design storm.

NW 10th Terrace

The peak stage is 0.1 ft above the reference elevation in this location.

8/31/2017 9:35 AM

R-18
R-18
R-18
R-14
R-20
11A
11B
10A
Node140
11C
NW 10TH TER
10CD
11D
10B
Node130
Node810
NW POWERLINE RD
City of Fort Lauderdale
Node220
26
Node210
Node120
Node155
Node150
NW 12TH AVE
NW 10TH TER
Node190
14
13
Node180
27
15

N

Legend

5-yr, Future Cond.
Peak Flood Depth
- > 2
- 1 - 2
- 0 - 1

Model Nodes
- Junction
- Outfall
- Storage

Existing System
- Exfiltration
- Pipe

Parcels and Lots
- Airport Parcel
- Industrial Airpark
- Released Land

FXE

Fort Lauderdale Executive Airport

6000 NW 21st Avenue
Fort Lauderdale, FL 33309

1 inch = 200 feet

0 100 200 400 *Feet*

Figure 5-3
5-yr, 24-hr Design Storm Flood Map
Future Conditions - Northeast Area

Bid 276-1831

CDM Smith

\\C:\COFL_FXE\Report\Figures\FXE_Figure5-3.mxd

Airfield Access Road

The access road is likely impassible during the 5-year storm in multiple locations. The peak stage is predicted to be more than one foot above the elevation of the road near NW 10th Terrace. Note the elevation of this road is not the reference elevation for Node 130.

In general, the land between the east end of the runway and NW 10th Terrace drains slowly due to soils and topography. One goal of this alternative is to move the location of the ponding to an area with better soil infiltration capacity, thereby reducing overall depth and duration of the ponding.

5.2.2 Existing Primary Stormwater Management System

There is an existing stormwater system under NW 10th Terrace connecting to NW 12th Avenue consisting of a 24-inch diameter pipe. This pipe is not large enough to move significant quantities of water from this area offsite. If it were significantly upgraded, the conveyed flows would need to be stored at some point downstream to not cause adverse offsite impacts. In this case, onsite dry detention is a more efficient solution.

5.2.3 Northeast Area Alternative

The alternative developed for the Northeast Problem Area consists of constructing a dry detention basin south of the end of the runway, adjacent to NW 12th Avenue and the baseball fields as shown in **Figure 5-4**. Other components of this alternative include a shallow ditch adjacent to Parcel 11 and NW 10th Terrace to convey runoff south to the detention area and a 24-inch diameter pipe from the existing PSMS along NW 10th Terrace to the proposed ditch, to both alleviate flooding in the street at the peak of the storm and help the detention area drain post-storm.

5.2.3.1 Northeast Area Alternative Implementation

Construction of Dry Detention Adjacent to NW 12th Avenue

This component of the Northeast Area Alternative has a footprint of approximately 15 acres, with the detention area bottom covering about 6 acres of the total footprint. The elevation of the bottom is designed to be approximately 4.0 ft NAVD, which matches the lower elevations of the existing detention areas at the Airport. This elevation is more than 1.0 ft above the wet season water table, thus the component should be permittable as dry detention.

The grade from the runways and taxiways to the west is 2% (50:1). The area directly east of the runway, which contains Airport infrastructure, is not part of the basin design and the grade off this area is also 2%. The slopes are steeper adjacent to the road and ball field and range from 4:1 to 10:1 in the model. For the design, the slopes should be closer to 4:1; however, the difference in volume from these boundaries is not expected to significantly alter results.

For this alternative, the soil removed from the detention area would be hauled offsite. The volume of excavated material is estimated to be about 125,000 cubic yards, which includes the total excavated volume and the proposed ditches below. Most of this material is sandy soils and could potentially be sold to help offset construction costs.

The stage-storage relationship attributed to Node 130 has been adjusted to include the proposed dry detention and the natural low ground, less the storage volume in the natural channel links to avoid double counting this storage.

Another option would be to retain the excavated material onsite and fill in the lower areas adjacent to Parcel 11 and NW 10th Terrace. This second option was also tested with the model.

8/31/2017 9:35 AM

R-18 R-18 R-18 R-14 R-20 11A 11C 11B

Node140

10CD 11D

Node138 Node136

NW POWERLINE RD

Node134 Node810

D Soils >>>

<<< A Soils

Node132

Node130

Node155 Node150

Node120

NW 12TH AVE

NW 10TH TER

14 13

Node180

15 27

City of Fort Lauderdale

N

Legend

5-yr, NE Alt

Peak Flood Depth

- > 2
- 1 - 2
- 0 - 1

Model Nodes

- Junction
- Outfall
- Storage

Existing System

- Exfiltration
- Pipe

Proposed System

- Ditch
- Pipe

Dry Detention

- Bottom
- Side

Parcels and Lots

- Airport Parcel
- Industrial Airpark
- Released Land
- Soils Delineation

FXE

Fort Lauderdale Executive Airport

6000 NW 21st Avenue
Fort Lauderdale, FL 33309

1 inch = 200 feet

0 100 200 400 *Feet*

Figure 5-4
5-yr, 24-hr Design Storm Flood Map
Northeast Area Alternative

Bid 276-11831

CDM Smith

\\C:\COFL_FXE\Report\Figures\FXE_Figure5-4.mxd

Stormwater Ditches

The Northeast Area Alternative includes a proposed total of 1,500 ft of stormwater ditches to convey the runoff from the Parcel 11 area to the proposed detention area. These ditches were modeled as an extension of the existing ditch south of Parcel 11, with bottom elevation of approximately 4.0 ft NAVD, which is more than one foot above the seasonal high groundwater table. Therefore, the ditches are dry prior to the storm and should not be a wildlife attractant. The bottom widths of the ditches are approximately 20 ft with approximately 10:1 side slopes. The gentle side slopes and shallow profile match the existing ditch and allow for conveyance and some additional storage. Note that the total estimated excavation volume described above includes the volume of these ditches.

Pipe from Existing PSMS to Stormwater Ditch

A 50-ft long, 24-in diameter concrete pipe has been added between Node 810 and Node 34 to reduce peak stages in NW 10th Terrace at the peak of the storm by allowing access to the proposed storage, and to provide an outlet for the detention area after the storm has passed.

5.2.3.2 Northeast Area Alternative Results

Table 5-4 presents the peak stages and estimated depth of flooding for the Northeast Problem Area after the implementation of the alternative for the 5-year, 24-hour design storm and the 25-year and 100-year, 72-hour design storms; this table is similar to Table 5-3, but with improvements. The results show that the peak stage in the problem area around Node 130 has been reduced by approximately 0.8 ft for the 5-year storm, 0.3 ft for the 25-year storm and 0.2 ft for the 100-year storm (refer back to Table 5-3). The surrounding nodes show slight reductions or remain the same. Figure 5-4 shows the simulated flood inundation map for the 5-year storm under the Northeast Area Alternative condition.

This alternative provides significant improvement for the smaller storms, but only a slight improvement for the larger storms (25-yr and above). This is partly due to the regional condition during the larger storms, where the boundary conditions are high and most of the City is severely flooded.

As noted above, the model was also tested for the case where the excavated soil was retained on site and the lower areas south of Parcel 11 and west of NW 1st Terrace was filled. This was modeled by simply using the proposed detention area storage in the model, supposing all other areas were graded to above 8.0 ft NAVD (i.e. above the peak stage of the 100-year storm). The results of this test showed a 0.1 ft increase in peak stage above the Northeast Area Alternative result for the 5-year storm (-0.7 ft from the existing condition), and 0.1 increase for the 100-year storm, which remains a small amount, but is about half the improvement from the alternative.

Table 5-4: Flood Depths for the Northeast Area Alternative.

Node	Reference Elevation (ft NAVD)	Location	Peak Flood Stage (Ft NAVD)			Road/ Taxiway/ Apron Flood Depth (ft)		
			5-yr Storm	25-yr Storm	100-yr Storm	5-yr Storm	25-yr Storm	100-yr Storm
Node 120	6.5	Perimeter Rd	6.3	7.2	7.8	-	0.7	1.3
Node 130	6.1	NW 12th Ave	5.4	7.2	7.8	-	1.1	1.7
Node 140	8.2	Parking lot	7.5	7.7	7.8	-	-	-
Node 180	8.8	Commercial Blvd	8.8	9.2	9.3	-	0.4	0.5
Node 210	10.5	Parking lot	9.1	9.8	10.1	-	-	-
Node 220	10.9	Paved Access Area	10.4	10.9	11.1	-	-	0.2

Note – All stages and depths rounded to nearest 0.1 ft.

As shown in Figure 5-4, the proposed dry detention area has been located over Group A soils, which should drain well after the storm. The expected saturated infiltration rate is approximately one inch per hour. At this rate, the detention pond should empty in less than 48 hours. The proposed pipe to the existing PSMS should help accelerate the draining of this pond once the elevated offsite stages recede. However, the pipe and the existing PSMS are not large enough to drain the pond within 48 hours without infiltration. Since the NRCS soils map shows Group D soils close to the proposed pond, it may be that these soils do not drain at one inch per hour under at least a portion of the pond. The soils should be tested to confirm site-specific infiltration parameters prior to design. It is also recommended that the detention area be monitored to determine the infiltration rate once constructed. Depending on the test results, additional exfiltration may be needed under the pond bottom to aid in storage recovery.

5.3 Southwest Problem Area

The Southwest Problem Area is bounded by NW 56th Street, NW 26th Avenue and NW 55th Court (South Perimeter Road) to the south, Taxiway Alpha to the north, the west end of the runways and taxiways to the west, and the Tower Area to the east. This area is comprised of the following Parcels: 5, 6C, 7A, 7B, and 7C. The model of the existing system with future land use conditions indicate relatively significant flooding along South Perimeter Road, Taxiway Echo near Parcel 7B, and the parking and hangar area in Parcel 5, as identified in **Figure 5-5**.

Figure 5-5 shows four locations of flooding in the southwest area for the 5-year, 24-hour design storm under future land use conditions and the existing hydraulic PSMS. As discussed in Section 4, the aerial photo does not match the LiDAR-based digital elevation map (DEM) in all locations due to the recent relocation of Taxiway Alpha. For the three westernmost swales adjacent to Taxiway Alpha, which were noted as potential problem areas in Table 4-2 of the previous section, the DEM was revised by hand to match City-supplied as-built drawings. Note that the apparent flooding at Node 350 is not a problem area according to the model, as the DEM was not revised in this area. Figure 5-5 is a detailed map of Figure 4-8, with focus on the Southwest Problem Area.

Table 5-5, a subset of Table 4-2, provides a comparison of peak stages at model nodes to indicator elevations in the Southwest Problem Area.

Table 5-5: Flood Depths for the Future Land Use, Existing PSMS, Southwest Area.

Node	Reference Elevation (ft NAVD)	Location	Peak Flood Stage (Ft NAVD)			Road/ Taxiway/ Apron Flood Depth (ft)		
			5-yr Storm	25-yr Storm	100-yr Storm	5-yr Storm	25-yr Storm	100-yr Storm
Node 570	6.7	Taxiway E	7.5	8.4	8.6	0.8	1.7	1.9
Node 572	8.2	Taxiway E Access	8.4	8.7	8.8	0.2	0.5	0.6
Node 574	7.4	Perimeter Rd	7.4	8.4	8.6	-	1.0	1.2
Node 580	10.3	Perimeter Rd	7.3	8.1	8.6	-	-	-
Node 290	8.4	Taxiway A	8.8	8.9	8.9	0.4	0.4	0.5
Node 310	7.5	Taxiway E	7.9	8.4	8.6	0.4	0.9	1.1
Node 330	9.2	Taxiway E	9.2	9.7	9.7	-	0.5	0.5

Note – All stages and depths rounded to nearest 0.1 ft.

8/31/2017 9:35 AM

Node290
Node310
Node570
Node330
Node350
Node572
Node574
7B
6C
6B
6A
4A
5
4
NW 56TH ST
NW 55TH CT

N

Legend

5-yr, Future Cond.
Peak Flood Depth
> 2
1 - 2
0 - 1

Model Nodes
Junction
Outfall
Storage

Existing System
Exfiltration
Pipe

Parcels and Lots
Airport Parcel
Industrial Airpark
Released Land

FXE

Fort Lauderdale Executive Airport

6000 NW 21st Avenue
Fort Lauderdale, FL 33309

1 inch = 200 feet

0 150 300 600 *Feet*

Figure 5-5
5-yr, 24-hr Design Storm Flood Map
Future Conditions - Southwest Area

Bid 276-11831

CDM Smith

CAM #17-1096
Exhibit 2
Page 156 of 191

p. 156

\\C:\COFL_FXE\Report\Figures\FXE_Figure5-5.mxd

5.3.1 Flooding Problems

There are four general locations of flooding problems in the southwest area for the 5-year design storm.

Taxiway Alpha near Node 290

In this location, the peak flood stage is expected to encroach on the taxiway for the 5-year design storm, which is not recommended in FAA AC 150. This encroachment is noted on Figure 5-5 and in Table 5-5. Note that the amount of the encroachment is over a very small area. This is based on the as-built drawing of Taxiway Alpha provided by the City (Taxiway Alpha Relocation West Phase Project No. 10802 – Sheet C9-02).

A hydraulic solution is presented as part of the alternative solution, but locally increasing the taxiway pavement elevation by 0.4 feet to 8.8 ft NAVD (10.4 ft NGVD) may serve as an alternative.

Taxiway Echo near Node 570 and Node 310

In this location, the peak flood stage is expected to encroach on the taxiway for the 5-year design storm, which is not recommended in FAA AC 150. Again, this encroachment is noted both on Figure 5-5 and in Table 5-5. The critical elevations in this area have been confirmed by the CAD drawing supplied by the City (10398FXEtopo.dwg), which shows edge of pavement as low as 6.7 ft NAVD (8.3 ft NGVD).

Taxiway Echo Access and Apron/Parking/Roads near Node 572 (Parcel 5)

This area has some existing swales as shown on the City-supplied record drawings (FXE Parcel 5 Paving and Drainage Plan, July 2007); however, the modeling indicates some flooding above the critical elevation (Taxiway E Access) as shown in Figure 5-5 and Table 5-5.

Perimeter Road (NW 56th Street, NW 26th Avenue, and NW 55th Court) near Nodes 570 and 574

The Perimeter Road is expected to flood near the corner of NW 56th Street and NW 26th Avenue, with some encroachment onto NW 55th Court.

5.3.2 Existing Primary Stormwater Management System

There is 1,250 LF of existing exfiltration in the parcel south of NW 55th Court near Node 574, although the exact location was not provided and thus not shown in Figure 5-5. There is an existing roadside swale adjacent to NW 26th Avenue. There are no other existing stormwater system components that apply to this problem area.

5.3.3 Southwest Area Alternative

The alternative developed for the Southwest Problem Area consists of providing a shallow (one foot deep) ditch adjacent to NW 56th Street from the existing swale along NW 26th Avenue to a proposed dry detention area between NW 56th Street and West Prospect Road, constructing additional exfiltration, and providing pipes from the taxiway swales to the proposed exfiltration. **Figure 5-6** shows the proposed elements of the Southeast Area Alternative.

5.3.3.1 Southwest Area Alternative Implementation

Proposed Ditch along NW 56th Street

This component of the Southwest Area Alternative consists of a one-foot deep triangular ditch along the southern right-of way adjacent to NW 56th Street, from the jog at NW 26th Avenue to the intersection with West Prospect Road. The top width of the ditch would average about 8 ft and the ditch would have 4:1 side slopes. The ditch would be approximately 1,950 ft long and would connect the existing swale adjacent to

8/31/2017 9:35 AM

N

Legend

5-yr, SW Alt
Peak Flood Depth
- > 2
- 1 - 2
- 0 - 1

Model Nodes
- Junction
- Outfall
- Storage

Existing System
- Exfiltration
- Pipe

Proposed System
- Exfiltration
- Pipe

Dry Detention
- Bottom
- Side

Parcels and Lots
- Airport Parcel
- Industrial Airpark
- Released Land

FXE

Fort Lauderdale Executive Airport

6000 NW 21st Avenue
Fort Lauderdale, FL 33309

1 inch = 275 feet

0 150 300 600 *Feet*

Figure 5-6
5-yr, 24-hr Design Storm Flood Map
Southwest Area Alternative

CDM Smith

Bid 276-11831

CAM #17-1096
Exhibit 2
Page 158 of 191

p. 158

\\C:\COFL_FXE\Report\Figures\FXE_Figure5-6.mxd

NW 26th Avenue to a proposed swale at the intersection of NW 56th Street and West Prospect Road. The expected volume of excavated material should be about 300 cubic yards.

Proposed Swale between NW 56th Street and West Prospect Road

This component of the Southwest Area Alternative has a relatively small footprint of approximately 0.55 acres, with the detention area bottom covering about 0.2 acres of the total footprint.

The elevation of the bottom is designed to be approximately 4.0 ft NAVD, which matches the lower elevations of the existing and proposed detention areas around the Airport. This elevation is more than 1.0 ft above the seasonal high water table, thus the component should be permittable as dry detention.

The width of the detention area bottom ranges from approximately 5 ft to 25 ft, with 4:1 side slopes. The total length is approximately 500 ft and the expected volume of excavated material should be about 3,800 cubic yards.

These first two components have minor effects on the design storm simulations as they are only expected to reduce the stage about 0.1 ft. However, these two components should reduce the flooding along NW 56th Street for smaller storms.

Exfiltration Trenches

The Southwest Area Alternative includes a proposed total of 7,380 linear feet of additional exfiltration trench, 2,930 ft of which are double the normal width. The regular width exfiltration trenches should be designed similar to the existing trenches, with 3-ft diameter perforated pipe in a 5-ft by 5-ft trench. It is recommended that the perforated pipe and the rock trench both be wrapped with filter fabric to extend system life. SFWMD design standards would be used for sizing and treatment calculations.

The soil types in the southwest portion of the project site range from Group C to the dual class Group B/D soils. For the dual class soils, there is a low permeability layer near the surface that must be cut through to provide the higher infiltration rates (in this case, Group B-type infiltration rates). The exfiltration trenches should cut through this layer to provide the higher infiltration rates. There are multiple geotechnical investigations in the area with measured saturated hydraulic conductivities (K) ranging from 1.8×10^{-4} to 5.0×10^{-4} (cfs/ft2-ft).

For consistency the method of modeling exfiltration with SWMM and the calculations used were the same as those used for the existing exfiltration. Prior to final design, additional geotechnical investigations are recommended to more accurately estimate site-specific exfiltration potential.

Three segments of exfiltration trenches are included for this alternative:

- The first is along NW 56th Avenue beneath the proposed ditch described above. This segment totals 1,950 feet in length, with expected catchment inverts near 7.0 ft NAVD and K values of 2.0×10^{-4} (cfs/ft^2-ft). Refer to Appendix E for proposed exfiltration calculations.
- The second is within Parcel 5 under the driveways. This segment totals 2,500 feet in length, with expected catchment inverts near 8.5 ft NAVD and K values of 3.2×10^{-4} (cfs/ft^2-ft). Refer to Appendix E for proposed exfiltration calculations.
- The third segment is a double-wide trench dug from the edge of the Taxiway Echo Access ramp for Parcel 7B, along the maintenance road that encircles the open western area of the Airport. This exfiltration trench serves this open area, but more importantly, drains the swale at Node 570. The size of the exfiltration is larger in order to allow flow from the eastern area to reach the entire trench, and to provide a larger

footprint of infiltration. The path is along the existing road as the proposed construction is least likely to disturb gopher tortoise and burrowing owl nesting in this location; the open space cannot be used for dry detention because of the tortoise and owl nesting. This segment totals 2,930 feet in length, with expected catchment inverts near 6.5 ft NAVD and K values ranging from 2.5 x 10^{-4} to 3.2 x 10^{-4} (cfs/ft^2-ft). Refer to Appendix E for proposed exfiltration calculations. The double-wide trench uses dual perforated 36-inch diameter pipes contained in a 10-ft filter wrapped rock envelope.

The proposed exfiltration is modeled the same as the existing exfiltration (see Section 4 of this report). These exfiltration trenches, particularly those in the west, should help recharge the Prospect Wellfield. Additionally, the wellfield should help the exfiltration work efficiently, even as the water table rises, since the water table is less likely to rise as high in this vicinity.

Pipes from Nodes 290, 310, and 570 to the Proposed Exfiltration

In order to reduce flooding in the taxiway swales represented by Node 290, Node 310, and the swale south of Taxiway Echo represented by Node 570, reinforced concrete pipes are proposed to connect these flooded problem areas to the proposed exfiltration.

- A 100 ft long dual 36-inch diameter RCP is proposed from the end of the double wide exfiltration trench to the swale at Node 570, under the Taxiway Echo access ramp;
- A 260-ft long, 36-in diameter RCP is proposed from Node 570 to the proposed exfiltration along NW 56th Street. This pipe should connect to the east end of the pipe above and 'T' into the exfiltration pipe.
- A 325-ft long, 30-in diameter RCP is proposed from the taxiway swale at Node 310 to the swale at Node 570, which should connect to the confluence of the above 2 pipes. This pipe should include multiple inlets within the Node 570 swale and an inlet in the Node 310 swale.
- A 300-ft long, 18-in diameter RCP is proposed from the taxiway swale at Node 290 to the swale at Node 310. This pipe should connect to the pipe above at Node 310 and include one inlet.

5.3.3.2 Southwest Area Alternative Results

Table 5-6 presents the peak stages and estimated depth of flooding for the Southwest Problem Area after the implementation of the Southwest Area Alternative for the 5-year, 24-hour design storm and the 25-year and 100-year, 72-hour design storms; this table is similar to Table 5-5, but with the recommended improvements. The modeling estimates that the problem area should meet LOS goals for the 5-year, 24-hour design storm and reduce peak stages and durations for the 25-year, and 100-year, 72-hour storms. The critical elevation for Node 572 was set from the FXE Parcel 5 Paving and Drainage Plan, July 2007 and is slightly higher than the LiDAR based topography used in the flood inundation map (Figure 5-6).

Since no reference finished floor elevations (FFE) of buildings were exceeded for the 100-year storm, this column has been removed from this table (see Tables 4-1 and 4-2 in the previous section for the reference FFEs).

Possible improvements to the Southwest Area Alternative include using the open space at the west end of the runway, if the tortoise and owl nesting grounds cease to be an issue at some later date, and the land becomes available. Additionally, the soils may allow for higher exfiltration than the model estimates, which would also improve the performance of this alternative.

Table 5-6: Flood Depths for the Southwest Area Alternative.

Node	Reference Elevation (ft NAVD)	Location	Peak Flood Stage (Ft NAVD)			Road/ Taxiway/ Apron Flood Depth (ft)		
			5-yr Storm	25-yr Storm	100-yr Storm	5-yr Storm	25-yr Storm	100-yr Storm
Node 570	6.7	Taxiway E	6.7	7.7	8.3	-	1.0	1.6
Node 572	8.2	Taxiway E Access	8.2	8.6	8.7	-	0.4	0.5
Node 574	7.4	Perimeter Rd	7.1	7.7	8.3	-	0.3	0.9
Node 580	10.3	Perimeter Rd	7.0	7.9	8.3	-	-	-
Node 290	8.4	Taxiway A	8.3	8.8	8.8	-	0.4	0.4
Node 310	7.5	Taxiway E	7.5	7.9	8.3	-	0.4	0.8
Node 330	9.2	Taxiway E	9.2	9.7	9.7	-	0.5	0.5

Note – All stages and depths rounded to nearest 0.1 ft.

5.4 Conceptual Capital Opinion of Probable Cost

Preliminary opinions of probable capital cost for the improvements for the Southeast, Northeast, and Southwest Area Alternatives are presented in **Table 5-7**, **Table 5-8**, and **Table 5-9**, respectively. These costs are based on a traditional design-bid-build method of project delivery under construction market conditions prevailing in South Florida in late 2011. All costs are presented in 2011 dollars. Opinions of cost are considered to be "order-of-magnitude estimates," as defined by the American Association of Cost Engineers. This is an approximate estimate made without detailed engineering data. An order-of-magnitude estimate is considered to be accurate within +50% or -30%, and is typically used for planning purposes.

The opinions of cost are based on estimated quantities of work and materials using the conceptual design information presented in this report, and standard unit prices that are considered to be consistent with current construction market conditions. Unit prices do not include contractor's overhead and profit, or construction contingency, which are listed separately. The following is a summary of the basis and assumptions of key unit prices used in these opinions:

- Excavation: Includes labor and equipment, hauling and off-site disposal of spoil materials. Unit price assumes relatively clean materials, with no large boulders, rock, garbage or old construction debris, etc. Does not include dewatering due to the fact that most of the proposed improvements constitute dry detention. Does not include restoration (estimated separately), or compaction.
- Finish grading: Includes labor and equipment. Assumes area is rough graded at the completion of excavation and installation of improvements.
- Seeding and mulching. All disturbed areas are assumed to be restored by finish grading and seeding and mulching. Unit price includes materials, labor, and equipment. A marginal allowance is made for the possibility that sodding may be necessary in some limited areas (e.g., steeper slopes), but unit price does not include irrigation of sod.
- Exfiltration trench: Includes materials, labor, and equipment for excavation of a 5-foot square cross section trench and installation of a 36-inch perforated pipe in crushed rock, hauling and off-site disposal of spoil material. Does not include restoration (estimated separately).

Table 5-7: Southeast Area Alternative Opinion of Probable Cost.

Description	Total Price
Extension of Dry Detention Between S Perimeter Rd & Commercial Blvd	$63,000
Exfiltration Trenches	$434,000
Re-grade Airside Swales Adjacent to Taxiway Bravo	$90,000
Pipe from Node 690 to the PSMS	$114,000
Contractor Overhead, Profit, Contingency & Engineering	$611,000
Total	**$1,312,000**

Note: All prices are rounded to nearest $1,000.

Table 5-8: Northeast Area Alternative Opinion of Probable Cost.

Description	Total Price
Construction of Dry Detention Adjacent to NW 12th Avenue	$870,000
Stormwater Ditches	$40,000
Pipe from Existing PSMS to Stormwater Ditch	$13,000
Contractor Overhead, Profit, Contingency & Engineering	$805,000
Total	**$1,728,000**

Note: All prices are rounded to nearest $1,000.

Table 5-9: Southwest Area Alternative Opinion of Probable Cost.

Description	Total Price
Proposed Ditch along NW 56th Street	$28,000
Proposed Swale Between NW 56th Street and West Prospect Road	$9,000
Exfiltration Trenches	$796,000
Pipes from Nodes 290, 310, and 570 to the Proposed Exfiltration	$71,000
Contractor Overhead, Profit, Contingency & Engineering	$789,000
Total	**$1,693,000**

Note: All prices are rounded to nearest $1,000.

- Concrete storm sewer (various sizes): Includes materials, labor, and equipment for excavation, backfill, and compaction of pipe installed to a depth with 3-foot to 4-foot earth cover. Does not include dewatering. Restoration is estimated separately.

- Individual structures (lump sum): Includes materials, labor, and equipment for the structure, installed.

As shown in Tables 5-7 through 5-9, the contractor's administrative costs and profit are estimated as 20 percent of the subtotal construction cost before overhead and profit. A 30 percent construction contingency is included in the total construction cost. The owner's costs for technical services (e.g., engineering design, permitting, surveying, engineering services during construction, etc.) are estimated as 20 percent of the total construction cost.

5.5 Conclusions and Recommendations

In this section, three alternative solutions to flooding problems were developed using the EPA SWMM to estimate flooding and LOS in portions of the Airport that were shown to have severe flooding problems in Section 4. These locations were chosen due to the severity of flooding as determined in Section 4, and through deliberations with the City at the meeting, which occurred on May 23, 2011. The alternatives were developed by location rather than BMP type based on an agreement between the City and CDM Smith during that meeting.

The model has been validated with the Hurricane Irene Storm, but there is little data to compare peak stages to, and what data was available was from at least 12 hours after the end of the storm. Much of the model has no existing stormwater system; therefore, it is difficult to quantify a potential error range for the model results.

The model condition used as a base condition for alternatives was future land use with the existing PSMS.

Evaluations indicate that the flooding in these locations is due to a combination of low-lying topography, lack of positive outfalls, soil infiltration properties, and lack of storage space. The following site-specific conclusions are offered:

Southeast Area

- The proposed Southeast Area Alternative includes extending the swale between Commercial Boulevard and South Perimeter Road, adding nearly 6,000 ft of exfiltration trench, providing a stormwater pipe and inlets through FXEHU200 (Parcels 0 and 3), and re-grading two Taxiway Bravo swales. The opinion of probably cost of this alternative is shown in Table 5-7.

- The re-grading of the Taxiway Bravo swales may be implemented separately from the other components of this alternative; however, the other three components work in conjunction with one another. In particular, the stormwater pipe and inlet system in FXEHU200 (Parcels 0 and 3) should not be implemented without first extending the dry detention.

- The model results indicate that the peak flood stages are reduced below critical elevations for the 5-year, 24-hour design storm, except for near Node 680 (Parcels 2 and 2A - see additional information on this location below).

- Extending the swale between Commercial Boulevard and South Perimeter Road and adding nearly 6,000 ft of exfiltration trench does not completely achieve the desired LOS at Node 680 (as defined by dropping the peak stage below the critical elevations for the 5-year storm). However, there is significant improvement in lowering the duration of the flooding, and the depth of flooding is reduced to where it is likely passable for most vehicles.

- The existing model shows peak stages near Taxiway Bravo at Node 510 and Node 520 to be slightly above the critical reference elevation. These were mitigated with swale grading to a 50:1 slope. The City may want to monitor this area to provide calibration data to improve the model, before designing/implementing this system to mitigate 0.1-0.2 ft encroachment on the taxiway during the 5-year, 24-hour design storm.

- There is a large (over 10 acres) open area at the corner of NW 12th Avenue and Commercial Boulevard that is slated for future development (a parking lot at the time of this writing). If this were to change, this large amount of additional storage would further improve the condition of the southeast area, although many of the areas are far enough away that the piping could be expensive. If a more costly option is desired, underground storage below the parking lot at this location may also be considered.

Northeast Area

- The proposed Northeast Area Alternative includes construction of a dry detention area, a wide, shallow ditch to convey water to the detention area, and a stormwater pipe connecting the ditch with the existing PSMS. The opinion of probably cost of this alternative is shown in Table 5-8.

- The proposed components of this alternative are designed to function collaboratively and should be constructed at the same time to provide flood relief.

- The model results indicate that the peak flood stages are reduced below critical elevations for the 5-year, 24-hour design storm for this area.

- For this area, the model is better validated because the storm event photos allowed more precision on the high water mark estimation. However, the photos were taken well past the peak of the storm.

- This alternative essentially moves the lowest area to the south, away from the path of the runway, away from the apron in Parcel 11 and away from NW 10th Terrace. The proposed detention area is also in Group A soils, which should provide better infiltration of the redirected runoff.

- A pipe has been added to allow NW 10th Terrace to drain to the detention area as well, and to aid in the recovery of the detention area post storm.

- An alternative solution of directing the runoff from this area to the existing PSMS is not feasible as the existing system is not large enough to provide significant flood reduction. If the entire conveyance system were enlarged, storage would still need to be provided somewhere downstream to not have adverse impacts to downstream neighbors. Therefore, onsite storage is a more efficient solution for this problem area.

Southwest Area

- The proposed Southwest Area Alternative includes construction of a relatively small dry detention area, a shallow ditch along NW 56th Street, adding nearly 7,400 ft of exfiltration trench, and providing stormwater pipes and inlets from the taxiway swales modeled as Node 290, Node 310, and Node 570 to the proposed exfiltration. The opinion of probable cost of this alternative is shown in Table 5-9.

- The proposed components of this alternative may be constructed at different times, although the exfiltration trenches should be in place prior to the construction of the pipes connecting the swales; otherwise, flooding may be worsened in Node 570.

- The model results indicate that the peak flood stages are reduced below critical elevations for the 5-year, 24-hour design storm for all nodes in this area.

- The peak stage at Node 290 near Taxiway Alpha is 0.4 ft above the edge of pavement elevation; however, the area of low elevation is relatively small. In lieu of the hydraulic solution, repaving the small area to 0.4 ft higher would allow the taxiway to comply with FAA regulations (the as-built elevation is 0.3 ft lower than the plan elevation in this location).
- The exfiltration through the western open area (FXEHU220) is proposed to be along the existing maintenance road to limit disturbance of tortoise and owl nesting grounds.
- Although the recently constructed swales in Parcel 5 (Node 572) were added to the existing condition model, the model indicated that additional exfiltration would be necessary to reduce peak stages below the critical elevation.

5.5.1 Recommendations

CDM Smith recommends the following:

- For the Southeast Area Alternative, the construction should be performed in phases:
    1. Extend the existing dry detention, perform geotechnical tests of soils at the proposed locations of exfiltration, and monitor swales adjacent to Taxiway Bravo to develop data points of peak stage versus rainfall.
    2. Construct inline exfiltration trenches with weirs at the end for treatment and to improve performance. The downstream side of the weirs should convey to the proposed extended detention pond. Continue monitoring swales adjacent to Taxiway Bravo.
    3. Re-grade the swales adjacent to Taxiway Bravo if the calibrated model shows peak stages encroach on the edge of the taxiway for the 5-year design storm.
- The Northeast Area Alternative is recommended for implementation. Depending on an analysis of whether the excavated soils may be sold or used at other Airport locations versus re-grading, the soils should be removed for maximum benefit. This allows for storage of runoff in the existing low area, which should drain as the detention pond drains because it will be connect to the stormwater ditches.
- Monitor the Northeast Area Alternative detention area drawdown after storms to determine recession rate.
- For Southwest Area Alternative, the construction should be performed in phases:
    1. Construct the small detention area between NW 56th Street and West Prospect Road and perform geotechnical tests of soils at the proposed locations of exfiltration to confirm site specific performance criteria.
    2. Construct the shallow ditch along NW 56th Street and construct the exfiltration trenches. The exfiltration trench along NW 56th Street should be constructed at the same time as the ditch. The other locations of exfiltration may be constructed separately.
    3. Construct the stormwater system (pipes and inlets) connecting Taxiway Alpha Swale Node 290 and Taxiway Echo Swales Node 310 and Node 570, and the stormwater system that connects Node 570 to the proposed exfiltration in FXEHU220 and along NW 56th Street.
- The exfiltration in Parcel 5 may be constructed independently of the other components.

Appendix A

Hydrologic Parameters

HU	Load Junction	Area	DCIA	Width	Slope	Impervious Depression Storage	Pervious Depression Storage	Route To Pervious	Maximum Infiltration Rate	Minimum Infiltration Rate	Soil Storage
		(Ac)	(%)	(ft)	(%)	(in)	(in)	(%)	(in/hr)	(in/hr)	(in)
FXEHU010	Node020	9.1	7.0	1,848	4.24	0.05	0.1	100	4.8	0.2	1.7
FXEHU020	Node030	2.8	5.3	723	2.55	0.05	0.1	20	4.4	0.1	1.7
FXEHU030	Node050	17.8	85.2	1,611	1.07	0.05	0.1	10	4.9	0.2	2.9
FXEHU040	Node055	21.7	80.0	902	0.22	0.05	0.1	20	7.4	0.4	7.2
FXEHU050	Node060	33.4	23.7	2,162	1.04	0.05	0.1	54.5	4.4	0.1	2.0
FXEHU060	Node700	27.5	84.9	883	0.32	0.05	0.1	22.6	7.2	0.4	6.9
FXEHU070	Node720	23.6	36.9	2,475	0.90	0.05	0.1	26	4.1	0.1	1.6
FXEHU080	Node710	53.3	57.3	1,102	0.42	0.05	0.1	34.7	10.0	0.8	16.6
FXEHU090	Node120	42.1	91.1	3,479	1.26	0.05	0.1	7.5	9.3	0.7	8.7
FXEHU100	Node140	55.7	77.0	1,926	0.48	0.05	0.1	30	9.4	0.7	9.9
FXEHU110	Node130	50.8	19.3	1,580	0.62	0.05	0.1	58	10.0	0.8	10.3
FXEHU120	Node150	11.0	84.0	729	0.99	0.05	0.1	20	10.2	0.8	15.1
FXEHU130	Node180	42.3	41.9	7,378	0.38	0.05	0.1	25	9.7	0.7	14.4
FXEHU135	Node750	13.6	72.0	272	0.38	0.05	0.1	25	6.4	0.4	7.6
FXEHU140	Node160	13.0	0.8	869	0.94	0.05	0.1	20	12.0	1.0	13.3
FXEHU145	Node760	1.7	25.6	750	0.94	0.05	0.1	20	12.0	1.0	18.4
FXEHU150	Node660	10.1	66.1	1,022	0.66	0.05	0.1	17.9	12.0	1.0	18.3
FXEHU155	Node780	4.9	48.2	3,020	0.66	0.05	0.1	17.9	12.0	1.0	16.6
FXEHU160	Node170	27.1	61.5	1,250	0.52	0.05	0.1	36.1	11.5	0.9	10.0
FXEHU165	Node175	25.1	79.6	1,200	0.52	0.05	0.1	36.1	9.8	0.8	13.6
FXEHU170	Node680	31.1	74.7	1,220	0.20	0.05	0.1	29.2	9.9	0.7	13.8
FXEHU180	Node550	28.6	70.0	853	0.50	0.05	0.1	10	5.7	0.3	7.3
FXEHU190	Node690	30.6	78.2	1,348	0.19	0.05	0.1	22.4	10.7	0.8	18.1
FXEHU200	Node800	9.9	70.5	614	0.88	0.05	0.1	29	5.9	0.3	16.3
FXEHU205	Node560	6.4	38.9	1,110	0.88	0.05	0.1	29	5.8	0.2	14.2
FXEHU210	Node570	8.8	53.8	975	0.80	0.05	0.1	80	4.9	0.5	15.7
FXEHU212	Node572	43.3	63.1	1,100	0.80	0.05	0.1	80	7.7	0.5	15.7
FXEHU214	Node574	13.5	90.0	2,900	1.00	0.05	0.1	10	4.1	0.1	15.7
FXEHU220	Node580	68.3	20.9	2,836	0.67	0.05	0.1	64.2	4.5	0.2	14.4
FXEHU230	Node590	46.2	59.6	1,731	0.47	0.05	0.1	21.8	6.4	0.3	19.7
FXEHU240	Node600	30.4	79.1	1,349	0.28	0.05	0.1	10.1	4.6	0.1	20.5
FXEHU250	Node250	50.3	40.1	1,471	0.51	0.05	0.1	57.6	10.7	0.8	22.6
FXEHU260	Node240	18.9	63.7	1,175	0.31	0.05	0.1	18.5	11.3	0.9	22.2
FXEHU270	Node230	18.8	84.4	1,203	1.07	0.05	0.1	20	6.2	0.4	6.6

HU	Load Junction	Area	DCIA	Width	Slope	Impervious Depression Storage	Pervious Depression Storage	Route To Pervious	Maximum Infiltration Rate	Minimum Infiltration Rate	Soil Storage
		(Ac)	(%)	(ft)	(%)	(in)	(in)	(%)	(in/hr)	(in/hr)	(in)
FXEHU280	Node230	30.3	22.4	1,591	0.87	0.05	0.1	61	12.0	1.0	21.0
FXEHU290	Node220	7.1	45.5	1,186	1.35	0.05	0.1	100	10.9	0.9	19.5
FXEHU300	Node210	11.3	42.5	1,313	0.83	0.05	0.1	100	11.9	1.0	16.6
FXEHU310	Node190	7.4	48.8	865	0.92	0.05	0.1	99.9	11.5	0.9	16.9
FXEHU320	Node470	6.9	48.7	982	1.28	0.05	0.1	100	11.9	1.0	21.3
FXEHU330	Node460	11.6	42.6	1,511	0.94	0.05	0.1	100	12.0	1.0	22.6
FXEHU340	Node480	17.1	31.1	1,001	0.58	0.05	0.1	94.6	12.0	1.0	19.3
FXEHU350	Node420	6.3	42.1	1,273	1.14	0.05	0.1	100	12.0	1.0	22.6
FXEHU360	Node430	6.1	52.6	781	1.01	0.05	0.1	100	12.0	1.0	23.4
FXEHU370	Node260	4.6	54.9	783	1.98	0.05	0.1	100	12.0	1.0	20.7
FXEHU380	Node270	9.8	28.1	669	0.42	0.05	0.1	100	11.9	1.0	22.5
FXEHU390	Node380	6.4	58.4	878	0.75	0.05	0.1	100	11.9	1.0	21.7
FXEHU400	Node370	4.8	64.4	560	0.49	0.05	0.1	100	11.9	1.0	22.2
FXEHU410	Node400	3.4	57.4	672	1.31	0.05	0.1	100	11.9	1.0	20.8
FXEHU420	Node410	5.0	43.0	1,201	1.05	0.05	0.1	100	11.9	1.0	22.4
FXEHU430	Node490	6.2	40.7	1,300	1.31	0.05	0.1	100	11.9	1.0	19.5
FXEHU440	Node510	4.6	45.6	739	0.89	0.05	0.1	100	12.0	1.0	20.3
FXEHU450	Node500	6.1	44.9	1,743	1.41	0.05	0.1	100	11.4	0.9	16.5
FXEHU460	Node520	4.7	55.5	856	0.90	0.05	0.1	100	12.0	1.0	18.4
FXEHU470	Node530	6.2	54.3	453	0.62	0.05	0.1	100	8.9	0.7	13.4
FXEHU480	Node540	6.8	47.4	1,028	1.10	0.05	0.1	100	10.9	0.9	15.6
FXEHU490	Node280	25.9	25.4	1,428	0.17	0.05	0.1	100	11.8	1.0	21.7
FXEHU500	Node350	5.9	73.2	591	0.85	0.05	0.1	100	12.0	1.0	20.1
FXEHU510	Node330	11.5	39.2	1,160	0.67	0.05	0.1	100	12.0	1.0	20.7
FXEHU520	Node310	7.2	45.3	691	0.85	0.05	0.1	100	11.2	0.9	17.5
FXEHU530	Node290	1.9	57.1	459	1.38	0.05	0.1	100	7.2	0.4	16.6
Weighted Average		18.6	50.5	1,659	0.64	0.05	0.1	44.0	8.4	0.6	13.5
Total		**1117.0**									**933.2**

Appendix B

Hydraulic Link Parameters

Link	Upstream Node	Downstream Node	Length	Roughness*	Upstream Invert	Downsream Invert	Type	Depth*	Width*	Barrels
			(ft)		(ft NAVD)	(ft NAVD)		(ft)	(ft)	
CvLink30	Node030	Node020	222	0.013	-3.6	-4	CIRCULAR	5	0	1
CvLink550	Node555	Node610	190	0.013	0	0	CIRCULAR	4.5	0	1
CvLink610	Node610	Node620	870	0.013	0.8	0.5	CIRCULAR	4.5	0	1
CvLink620	Node620	Node650	150	0.013	0.5	-1.5	CIRCULAR	4.5	0	1
CvLink665	Node665	Node160	100	0.013	2.9	2.4	CIRCULAR	3	0	1
CvLink670	Node670	Node550	450	0.013	0	0	CIRCULAR	3	0	1
CvLink675	Node675	Node670	295	0.013	0	0	CIRCULAR	3	0	1
CvLink70	Node070	Node080	100	0.015	-3.9	-4	CIRCULAR	4.5	0	1
CvLink800-1	Node800	Node560	300	0.013	0	0	CIRCULAR	2	0	1
CvLink800-2	Node800	Node560	116	0.013	0	0	CIRCULAR	1.5	0	1
Pipe050-1	Node051	Node040	250	0.013	2	-0.7	CIRCULAR	3	0	2
Pipe050-2	Node051	Node060	40	0.013	1.3	1	CIRCULAR	3	0	1
Pipe120-1	Node120	Node155	550	0.013	3.3	3	CIRCULAR	2	0	1
Pipe120-2	Node120	Node810	700	0.013	3	0.5	CIRCULAR	2	0	1
Pipe155	Node155	Node750	1660	0.013	3	2.5	CIRCULAR	2	0	1
Pipe170	Node170	Node160	120	0.013	0	0	CIRCULAR	1	0	1
Pipe700	Node700	Node060	300	0.013	3	2.4	CIRCULAR	1.5	0	1
Pipe710	Node710	Node720	50	0.024	2.5	2	CIRCULAR	2	0	1
Pipe730	Node730	Node080	35	0.013	2.4	2.3	CIRCULAR	3	0	1
Pipe750	Node750	Node760	780	0.013	2.5	2.3	CIRCULAR	2	0	1
Pipe760	Node760	Node770	250	0.013	2.5	2	CIRCULAR	2	0	1
Pipe770	Node770	Node780	1430	0.013	2	1.5	CIRCULAR	3	0	1
Pipe780	Node780	Node790	1450	0.013	1.5	1.1	CIRCULAR	3.5	0	1
Pipe790	Node790	Node610	820	0.013	1.1	0.8	CIRCULAR	4	0	1
Pipe800	Node800	Node555	254	0.013	0	0	CIRCULAR	4.5	0	1
Pipe810	Node810	Node820	960	0.013	0.5	1	CIRCULAR	2	0	1
ChLink100	Node100	Node090	1950		-5.6	-5.7	IRREGULAR			1
CHLink110	Node090	Node110	1250		-5.6	-5.7	IRREGULAR			1
ChLink20	Node020	Node010	1400		-4.3	-4.4	IRREGULAR			1
ChLink40	Node040	Node030	590		-3.5	-3.6	IRREGULAR			1
ChLink60	Node060	Node070	1215		-5.6	-5.5	IRREGULAR			1
ChLink650	Node650	Node655	1800		-6.55	-6.6	IRREGULAR			1
ChLink80	Node080	Node090	540		-5.7	-5.6	IRREGULAR			1
OvLink600-2	Node600	Node630	50		9.2	9.1	IRREGULAR			1
OvLink720	Node720	Node080	50		5.6	5.5	IRREGULAR			1

Link	Upstream Node	Downstream Node	Length	Roughness*	Upstream Invert	Downsream Invert	Type	Depth*	Width*	Barrels
			(ft)		(ft NAVD)	(ft NAVD)		(ft)	(ft)	
OvlLink120	Node120	Node810	700		6.7	6	IRREGULAR			1
OvlLink130	Node130	Node120	50		6.1	6	IRREGULAR			1
OvlLink130-2	Node130	Node810	50		5.6	5.7	IRREGULAR			1
OvlLink140-1	Node140	Node130	50		7.4	7.3	IRREGULAR			1
OvlLink140-2	Node140	Node710	100		7.1	7	IRREGULAR			1
OvlLink150-1	Node150	Node120	50		9.3	9.2	IRREGULAR			1
OvlLink150-2	Node150	Node130	50		8.7	8.6	IRREGULAR			1
OvlLink160	Node160	Node760	400		9.2	9.1	IRREGULAR			1
OvlLink170	Node170	Node160	50		7.9	7.8	IRREGULAR			1
OvlLink175	Node175	Node170	1200		8.35	8.3	IRREGULAR			1
OvlLink180-1	Node180	Node130	50		8.5	8.4	IRREGULAR			1
OvlLink180-2	Node180	Node175	1400		8.4	8.35	IRREGULAR			1
OvlLink190	Node190	Node130	50		9.8	9.7	IRREGULAR			1
OvlLink210-1	Node210	Node130	50		10	9.9	IRREGULAR			1
OvlLink210-2	Node210	Node190	50		9.8	9.7	IRREGULAR			1
OvlLink220	Node220	Node210	50		11.3	11.2	IRREGULAR			1
OvlLink240	Node240	Node230	50		10.6	10.5	IRREGULAR			1
OvlLink250-1	Node250	Node270	50		11.3	11.2	IRREGULAR			1
OvlLink250-2	Node250	Node630	50		9.6	9.5	IRREGULAR			1
OvlLink260	Node420	Node230	50		11.4	11.3	IRREGULAR			1
OvlLink270-1	Node270	Node280	50		11.3	11.2	IRREGULAR			1
OvlLink270-2	Node270	Node260	50		11.5	11.4	IRREGULAR			1
OvlLink280	Node280	Node310	50		11.3	11.2	IRREGULAR			1
OvlLink290-1	Node290	Node580	50		9.1	9	IRREGULAR			1
OvlLink290-3	Node290	Node310	50		8.5	8.4	IRREGULAR			1
OvlLink30	Node030	Node020	50		4.9	4.8	IRREGULAR			1
OvlLink310	Node310	Node570	50		7.7	7.6	IRREGULAR			1
OvlLink330	Node330	Node570	50		9.5	9.4	IRREGULAR			1
OvlLink350	Node350	Node570	50		9.9	9.8	IRREGULAR			1
OvlLink370	Node370	Node410	50		11.2	11.1	IRREGULAR			1
OvlLink380-1	Node380	Node400	50		11.2	11.1	IRREGULAR			1
OvlLink380-2	Node380	Node430	50		11.1	11	IRREGULAR			1
OvlLink400	Node400	Node490	50		11.2	11.1	IRREGULAR			1
OvlLink410	Node410	Node510	50		10.9	10.8	IRREGULAR			1
OvlLink430	Node430	Node460	50		11.2	11.1	IRREGULAR			1
OvlLink460	Node460	Node480	50		11.1	11	IRREGULAR			1

Link	Upstream Node	Downstream Node	Length	Roughness*	Upstream Invert	Downsream Invert	Type	Depth*	Width*	Barrels
			(ft)		(ft NAVD)	(ft NAVD)		(ft)	(ft)	
OvlLink470	Node470	Node230	50		9.9	9.8	IRREGULAR			1
OvlLink480	Node480	Node500	50		10.4	10.3	IRREGULAR			1
OvlLink490	Node490	Node500	50		10.4	10.3	IRREGULAR			1
OvlLink500-1	Node500	Node530	50		11	10.9	IRREGULAR			1
OvlLink500-2	Node500	Node520	50		10.8	10.7	IRREGULAR			1
OvlLink50-1	Node050	Node040	50		6.9	6.8	IRREGULAR			1
OvlLink50-2	Node050	Node060	50		5.5	5.4	IRREGULAR			1
OvlLink510-1	Node510	Node520	50		10.2	10.1	IRREGULAR			1
OvlLink510-2	Node510	Node690	50		10.4	10.3	IRREGULAR			1
OvlLink520	Node520	Node690	50		10	9.9	IRREGULAR			1
OvlLink530	Node530	Node170	50		9.8	9.7	IRREGULAR			1
OvlLink540	Node540	Node680	50		9.6	9.5	IRREGULAR			1
OvlLink55	Node055	Node060	50		5.7	5.6	IRREGULAR			1
OvlLink550	Node550	Node610	50		7.4	7.3	IRREGULAR			1
OvlLink560	Node560	Node550	50		8.8	8.7	IRREGULAR			1
OvlLink570	Node570	Node574	50		7	6.9	IRREGULAR			1
OvlLink572	Node572	Node574	800		8	7.9	IRREGULAR			2
OvlLink580	Node580	Node570	50		8.1	8	IRREGULAR			1
OvlLink590	Node590	Node580	50		9.6	9.5	IRREGULAR			1
OvlLink600-1	Node600	Node590	50		10.6	10.5	IRREGULAR			1
OvlLink610	Node610	Node615	800		3.2	3.3	IRREGULAR			1
OvlLink615	Node615	Node650	50		6.9	6.8	IRREGULAR			1
OvlLink630	Node630	Node640	1100		5.5	5.4	IRREGULAR			1
OvlLink660-1	Node660	Node780	50		8	7.9	IRREGULAR			1
OvlLink660-2	Node660	Node160	50		7.9	7.8	IRREGULAR			1
OvlLink670	Node670	Node550	500		7.5	7	IRREGULAR			1
OvlLink680	Node680	Node670	50		8.1	8	IRREGULAR			1
OvlLink690	Node690	Node800	850		8.7	8	IRREGULAR			1
OvlLink70	Node070	Node080	50		5.9	5.8	IRREGULAR			1
OvlLink700	Node700	Node060	50		7	6.9	IRREGULAR			1
OvlLink710	Node710	Node080	50		7.7	7.6	IRREGULAR			1
OvlLink750	Node750	Node760	50		9.6	9.5	IRREGULAR			1
OvlLink760	Node760	Node770	320		8.3	8	IRREGULAR			1
OvlLink770	Node770	Node780	1400		7.8	8	IRREGULAR			1
OvlLink780	Node780	Node790	50		9.4	9.3	IRREGULAR			1
OvlLink790	Node790	Node550	50		6.6	6.5	IRREGULAR			1

Link	Upstream Node	Downstream Node	Length	Roughness*	Upstream Invert	Downsream Invert	Type	Depth*	Width*	Barrels
			(ft)		(ft NAVD)	(ft NAVD)		(ft)	(ft)	
OvlLink800	Node800	Node550	50		7.9	7.8	IRREGULAR			1
OvlLink810	Node810	Node820	960		6.6	6.5	IRREGULAR			1
OvlLink820	Node820	Node830	100		6.5	6.4	IRREGULAR			1
OvlLink830	Node830	Node055	1500		6.6	6	IRREGULAR			1
RDOvlLink570	Node570	Node560	1600		9.3	8.3	IRREGULAR			1

*Roughness, Depth, and Width may vary within the irregular cross-section type.

Weirs	Upstream Node	Downstream Node	Type	Invert (ft NAVD)	Height (ft)	Length (ft)	Coefficient
Weir050	Node050	Node051	TRANSVERSE	4.5	3	3	3.33
Weir150	Node150	Node155	TRANSVERSE	6.5	3	3	3.33
Weir660	Node660	Node665	TRANSVERSE	5.3	3	3	3.33
Weir680	Node680	Node675	TRANSVERSE	6.8	3	3	3.33
Weir720	Node720	Node730	TRANSVERSE	5.15	5	4.1	3.1
Orifices	**Upstream Node**	**Downstream Node**	**Type**	**Invert (ft NAVD)**	**Height (ft)**	**Length (ft)**	**Coefficient**
Orif720	Node720	Node730	SIDE	2.4	0.25	0	0.65
Orifice550	Node550	Node555	BOTTOM	5.4	10	12	0.65

Exfiltration (Pumps)	Upstream Node	Maximum Rate** (cfs)	Relative Depth from Invert to Water Table
Node050Ex	Node100	49.0	Low
Node140Ex	Node090	16.2	Medium
Node150Ex	Node020	12.5	Medium
Node175Ex	Node040	32.3	Medium
Node230Ex	Node060	22.6	High
Node240Ex	Node650	5.4	High
Node250Ex	Node080	1.5	High
Node570Ex	Node030	8.9	Low
Node590Ex	Node550	19.3	Medium
Node660Ex	Node560	22.3	Medium
Node680Ex	Node610	19.1	Medium
Node690Ex	Node620	9.2	Medium
Node710Ex	Node660	17.4	Low
Node720Ex	Node670	8.0	Low

** See Appendix D for maximum rate calculation

Appendix C

Hydraulic Mode Parameters

Appendix C

Hydraulic Node Parameters

Node	Type	Invert	Initial Depth	Evaporation Fraction	Suction Head	Conductvity	Initial Deficit
		(ft NAVD)	(ft)	(in/in)	(in)	(in/hr)	(in/in)
Node020	Junction	-4.3	5.0				
Node030	Junction	-3.6	4.5				
Node040	Junction	-3.5	4.4				
Node051	Junction	0.0	0.0				
Node070	Junction	-5.5	6.4				
Node080	Junction	-5.7	6.5				
Node090	Junction	-5.6	6.5				
Node100	Junction	-5.6	6.5				
Node155	Junction	0.0	0.0				
Node555	Junction	0.0	0.0				
Node610	Junction	0.0	0.0				
Node615	Junction	0.0	0.0				
Node620	Junction	0.0	0.0				
Node630	Junction	0.0	0.0				
Node650	Junction	-6.6	7.5				
Node665	Junction	0.0	0.0				
Node670	Junction	0.0	0.0				
Node675	Junction	0.0	0.0				
Node720	Junction	2.0	0.0				
Node730	Junction	2.4	0.0				
Node770	Junction	2.0	0.0				
Node780	Junction	1.5	0.0				
Node790	Junction	1.1	0.0				
Node810	Junction	0.5	0.0				
Node820	Junction	0.0	0.0				
Node830	Junction	0.0	0.0				
Node010	Outfall	-4.4					
Node050Ex	Outfall	0.0					
Node110	Outfall	-5.7					
Node140Ex	Outfall	0.0					
Node150Ex	Outfall	0.0					
Node175Ex	Outfall	0.0					
Node230Ex	Outfall	0.0					
Node240Ex	Outfall	0.0					
Node250Ex	Outfall	0.0					
Node570Ex	Outfall	0.0					
Node590Ex	Outfall	0.0					
Node640	Outfall	0.0					
Node655	Outfall	-6.6					
Node660Ex	Outfall	0.0					
Node680Ex	Outfall	0.0					
Node690Ex	Outfall	0.0					

Appendix C

Hydraulic Node Parameters

Node	Type	Invert	Initial Depth	Evaporation Fraction	Suction Head	Conductvity	Initial Deficit
		(ft NAVD)	(ft)	(in/in)	(in)	(in/hr)	(in/in)
Node710Ex	Outfall	0.0					
Node720Ex	Outfall	0.0					
Node050	Storage	0.0	0.0	0.9	0.0	0.0	0.0
Node055	Storage	0.0	0.0	0.0	2.0	0.7	0.4
Node060	Storage	-5.6	6.5	0.6	0.0	0.0	0.0
Node120	Storage	0.0	0.0	0.9	2.0	0.2	0.3
Node130	Storage	0.0	0.0	0.7	0.0	0.0	0.0
Node140	Storage	0.0	0.0	0.8	0.0	0.0	0.0
Node150	Storage	0.0	0.0	0.9	0.0	0.0	0.0
Node160	Storage	0.0	0.0	1.0	0.0	0.0	0.0
Node170	Storage	0.0	0.0	0.9	0.0	0.0	0.0
Node175	Storage	0.0	0.0	0.0	0.0	0.0	0.0
Node180	Storage	0.0	0.0	0.0	2.0	1.7	0.3
Node190	Storage	0.0	0.0	0.0	2.0	1.1	0.3
Node210	Storage	0.0	0.0	0.0	2.0	1.1	0.3
Node220	Storage	0.0	0.0	0.0	2.0	1.1	0.3
Node230	Storage	0.0	0.0	0.0	0.0	0.0	0.0
Node240	Storage	0.0	0.0	0.9	0.0	0.0	0.0
Node250	Storage	0.0	0.0	0.0	0.0	0.0	0.0
Node260	Storage	0.0	0.0	0.0	2.0	1.1	0.3
Node270	Storage	0.0	0.0	0.0	2.0	1.1	0.3
Node280	Storage	0.0	0.0	0.0	2.0	1.0	0.3
Node290	Storage	0.0	0.0	0.0	2.0	0.4	0.3
Node310	Storage	0.0	0.0	0.0	2.0	0.9	0.3
Node330	Storage	0.0	0.0	0.0	2.0	1.0	0.3
Node350	Storage	0.0	0.0	0.0	2.0	1.0	0.3
Node370	Storage	0.0	0.0	0.0	2.0	1.1	0.3
Node380	Storage	0.0	0.0	0.0	2.0	1.1	0.3
Node400	Storage	0.0	0.0	0.0	2.0	1.1	0.3
Node410	Storage	0.0	0.0	0.0	2.0	1.1	0.3
Node420	Storage	0.0	0.0	0.0	2.0	1.1	0.3
Node430	Storage	0.0	0.0	0.0	2.0	1.1	0.3
Node460	Storage	0.0	0.0	0.0	2.0	1.1	0.3
Node470	Storage	0.0	0.0	0.0	2.0	1.1	0.3
Node480	Storage	0.0	0.0	0.0	2.0	1.1	0.3
Node490	Storage	0.0	0.0	0.0	2.0	1.1	0.3
Node500	Storage	0.0	0.0	0.0	2.0	1.1	0.3
Node510	Storage	0.0	0.0	0.0	2.0	1.1	0.3
Node520	Storage	0.0	0.0	0.0	2.0	1.1	0.3
Node530	Storage	0.0	0.0	0.0	2.0	1.1	0.3
Node540	Storage	0.0	0.0	0.0	2.0	1.1	0.3
Node550	Storage	0.0	0.0	0.8	0.0	0.0	0.0

Appendix C

Hydraulic Node Parameters

Node	Type	Invert	Initial Depth	Evaporation Fraction	Suction Head	Conductvity	Initial Deficit
		(ft NAVD)	(ft)	(in/in)	(in)	(in/hr)	(in/in)
Node560	Storage	0.0	0.0	0.8	0.0	0.0	0.0
Node570	Storage	0.0	0.0	0.3	2.0	1.0	0.3
Node572	Storage	0.0	0.0	0.3	2.0	1.0	0.3
Node574	Storage	0.0	0.0	0.0	0.0	0.0	0.0
Node580	Storage	0.0	0.0	0.8	2.0	0.7	0.3
Node590	Storage	0.0	0.0	0.9	0.0	0.0	0.0
Node600	Storage	0.0	0.0	0.0	2.0	0.2	0.3
Node660	Storage	0.0	0.0	0.0	0.0	0.0	0.0
Node680	Storage	0.0	0.0	0.0	0.0	0.0	0.0
Node690	Storage	0.0	0.0	0.0	0.0	0.0	0.0
Node700	Storage	0.0	0.0	0.9	0.0	0.0	0.0
Node710	Storage	2.5	0.0	0.9	0.0	0.0	0.0
Node750	Storage	2.5	0.0	0.0	2.0	1.7	0.3
Node760	Storage	2.5	0.0	0.0	2.0	1.8	0.3
Node800	Storage	0.0	0.0	0.0	2.0	0.4	0.3

Appendix D

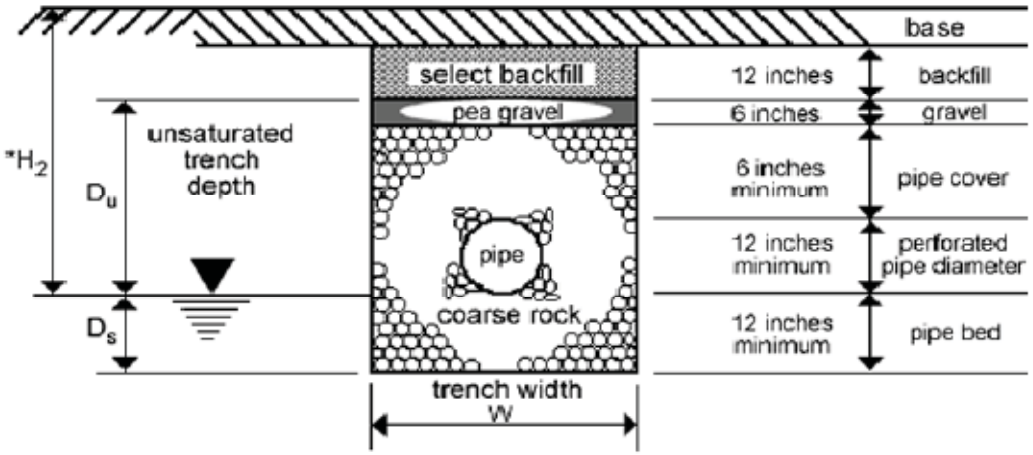
Estimation of Exfiltration Treatment Volume

Appendix D
Estimation of Exfiltration Treatment Volume

Loading Node	Catch Elev (ft)	H2 (ft)	Du (ft)	Ds (ft)	K (cfs/ft2-ft)	W (ft)	Length (ft)	SFWMD Equation* Vol (Ac-in)	Vol (Ac-ft)	Exfil. Rate over 1 Hr (cfs)
Node050	6.0	3.6	2.1	3.4	0.00050	5	5102	48.61	4.05	49.0
Node140	8.0	5.6	4.1	1.4	0.00055	5	1172	16.11	1.34	16.2
Node150	8.0	5.6	4.1	1.4	0.00051	5	966	12.41	1.03	12.5
Node170	8.8	6.4	4.9	0.7	0.00048	5	2501	32.02	2.67	32.3
Node230**	12.0	9.6	5.5	0.0	0.00066	5	525	22.37	1.86	22.6
Node240	11.5	9.1	5.5	0.0	0.00016	5	483	5.38	0.45	5.4
Node250	11.5	9.1	5.5	0.0	0.00019	5	118	1.52	0.13	1.5
Node570	6.5	4.1	2.6	2.9	0.00032	5	1250	8.80	0.73	8.9
Node590	9.8	7.4	5.5	0.0	0.00028	5	1356	19.17	1.60	19.3
Node660	7.8	5.4	3.9	1.7	0.00046	5	1930	22.13	1.84	22.3
Node680	8.3	5.9	4.4	1.2	0.00052	5	1421	18.93	1.58	19.1
Node690	9.3	6.9	5.4	0.2	0.00030	5	1034	9.17	0.76	9.2
Node710	6.5	4.1	2.6	2.9	0.00059	5	1416	17.29	1.44	17.4
Node720	7.0	4.6	3.1	2.4	0.00025	5	1272	7.89	0.66	8.0

* Due to high variability of K values, used factor of safety of 2, to be conservative

** Very high variability of measure K values near this area, used median measured K for node



Depth from inlet to top of trench = 1.5 ft

Most of the pipes are 3 ft in dia.: DU + DS = 5.5 ft

Initial GW Level = 2.4 ft NAVD (4.0 ft NGVD)

$$L = \frac{V}{K\,(H_2W + 2H_2D_u - D_u^2 + 2H_2D_s) + (1.39 \times 10^{-4})\,WD_u}$$

Appendix E

Estimation of Proposed Exfiltration Rates

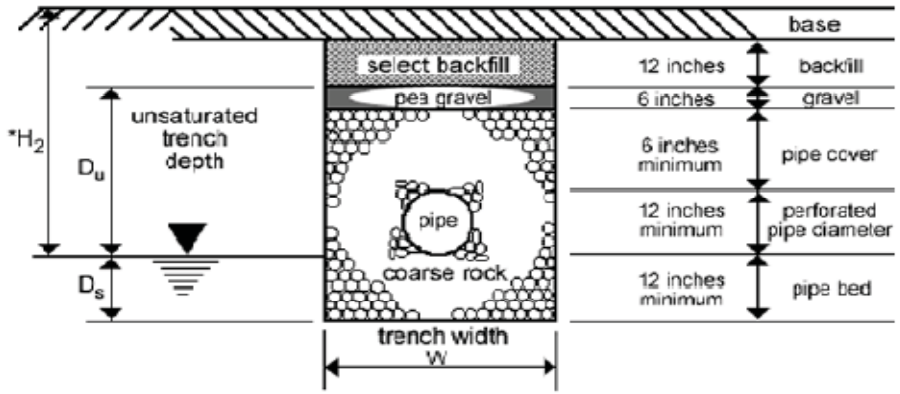
Appendix E
Estimation of Proposed Exfiltration Rates

Segment	Loading Node	Catch Elev (ft)	H2 (ft)	Du (ft)	Ds (ft)	K (cfs/ft^2-ft)**	W (ft)	Length (ft)	SFWMD Equation* Vol (Ac-in)	Vol (Ac-ft)	Exfil. Rate over 1 Hr (cfs)
1	Node670	8.5	6.1	4.6	0.9	0.00050	5	780	10.21	0.85	10.3
2	Node670	7.8	5.4	3.9	1.6	0.00014	5	615	2.74	0.23	2.8
3	Node670	7.5	5.1	3.6	1.9	0.00050	5	565	6.80	0.57	6.9
4	Node551	6.5	4.1	2.6	2.9	0.00100	5	770	15.46	1.29	15.6
5	Node551	7.5	5.1	3.6	1.9	0.00050	5	825	9.93	0.83	10.0
6	Node165	8.0	5.6	4.1	1.4	0.00028	5	1490	11.47	0.96	11.6
7	Node690	9.0	6.6	5.1	0.4	0.00030	5	600	5.26	0.44	5.3
SE Total								5645			
8	Node576	7.0	4.6	3.1	2.4	0.00020	5	950	4.92	0.41	5.0
9	Node582	7.0	4.6	3.1	2.4	0.00020	5	1000	5.18	0.43	5.2
10	Node572	8.5	6.1	4.6	0.9	0.00032	5	2500	22.37	1.86	22.6
11	Node580	6.5	4.1	2.6	2.9	0.00025	10	1430	9.44	0.79	9.5
12	Node584	6.5	4.1	2.6	2.9	0.00032	10	1500	11.91	0.99	12.0
SW Total								7380			

* Due to high variability of K values, used factor of safety of 2, to be conservative

**Notes on K by Segment No.:

1. Nearby K measurements of 10^{-3} and 10^{-4} - A soils
2. Nearby K measurements of 10^{-4} - C soils
3. Nearby K measurements of 10^{-3} and 10^{-4} - C soils
4. D soils, but 2 nearby K measurements above 0.001
5. Nearby K measurements of 10^{-3} and 10^{-4} - C soils
6. No close measurement, interpolated from K surface
7. To match existing Node690 exfiltration K



Depth from inlet to top of trench = 1.5 ft

Most of the pipes are 3 ft in dia.: DU + DS = 5.5 ft

Initial GW Level = 2.4 ft NAVD (4.0 ft NGVD)

$$L = \frac{V}{K\,(H_2W + 2H_2D_u - D_u^2 + 2H_2D_s) + (1.39 \times 10^{-4})\,WD_u}$$

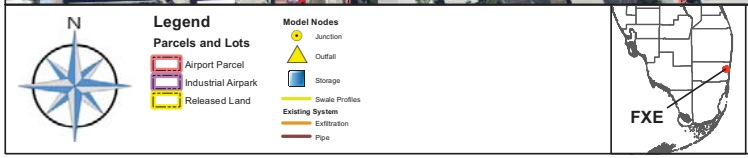
Appendix F

Swale Re-grading Profiles

Appendix F
Swale Re-grading Profiles

For the proposed re-grading of swales around junctions Node 510 and Node 520, profiles of the existing topography were compared to grades of 50:1 initiating at the edge of pavement of runways and taxiways. Multiple profiles were extracted in two directions to conform to the 50:1 slope. **Figure F-1** shows the locations of the profiles and **Figures F-2** through **F-6** display the existing topography and proposed grade.

For longitudnal profiles, the cross-profile is the limiting slope and therefore the swale “bottom” is set based on another sheet.



\\C:\COFL_FXE\Report\Figures\FXE_FigureF-1.mxd

Fort Lauderdale Executive Airport

6000 NW 21st Avenue
Fort Lauderdale, FL 33309

1 inch = 200 feet

0 150 300 600 Feet

Figure F-1
Location of Profiles of Swales
510 and 520

CDM Smith

Prj 276-11831

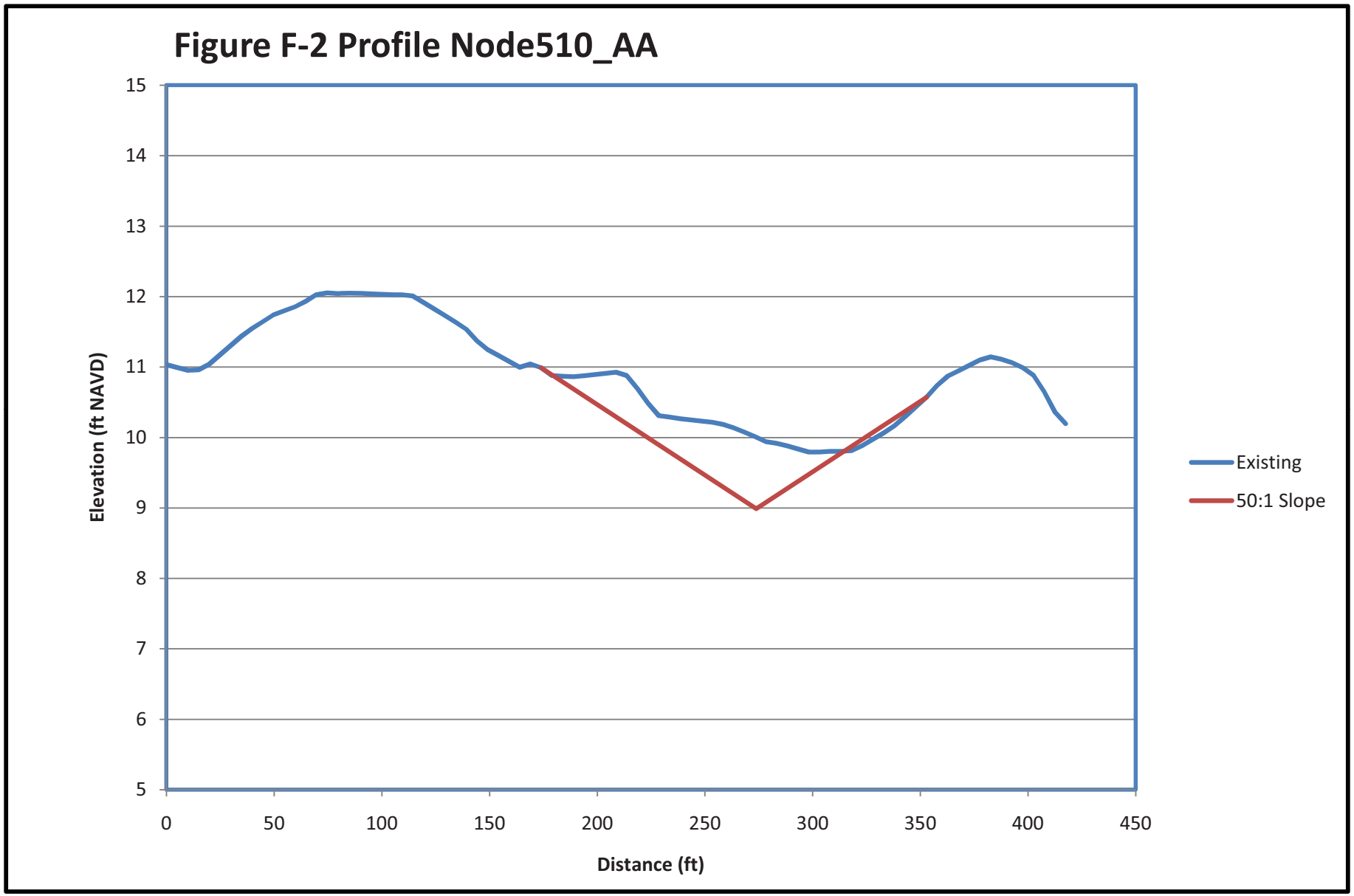


Figure F-2 Profile Node510_AA
Elevation (ft NAVD)
15
14
13
12
11
10
9
8
7
6
5
0
50
100
150
200
250
300
350
400
450
Distance (ft)
Existing
50:1 Slope

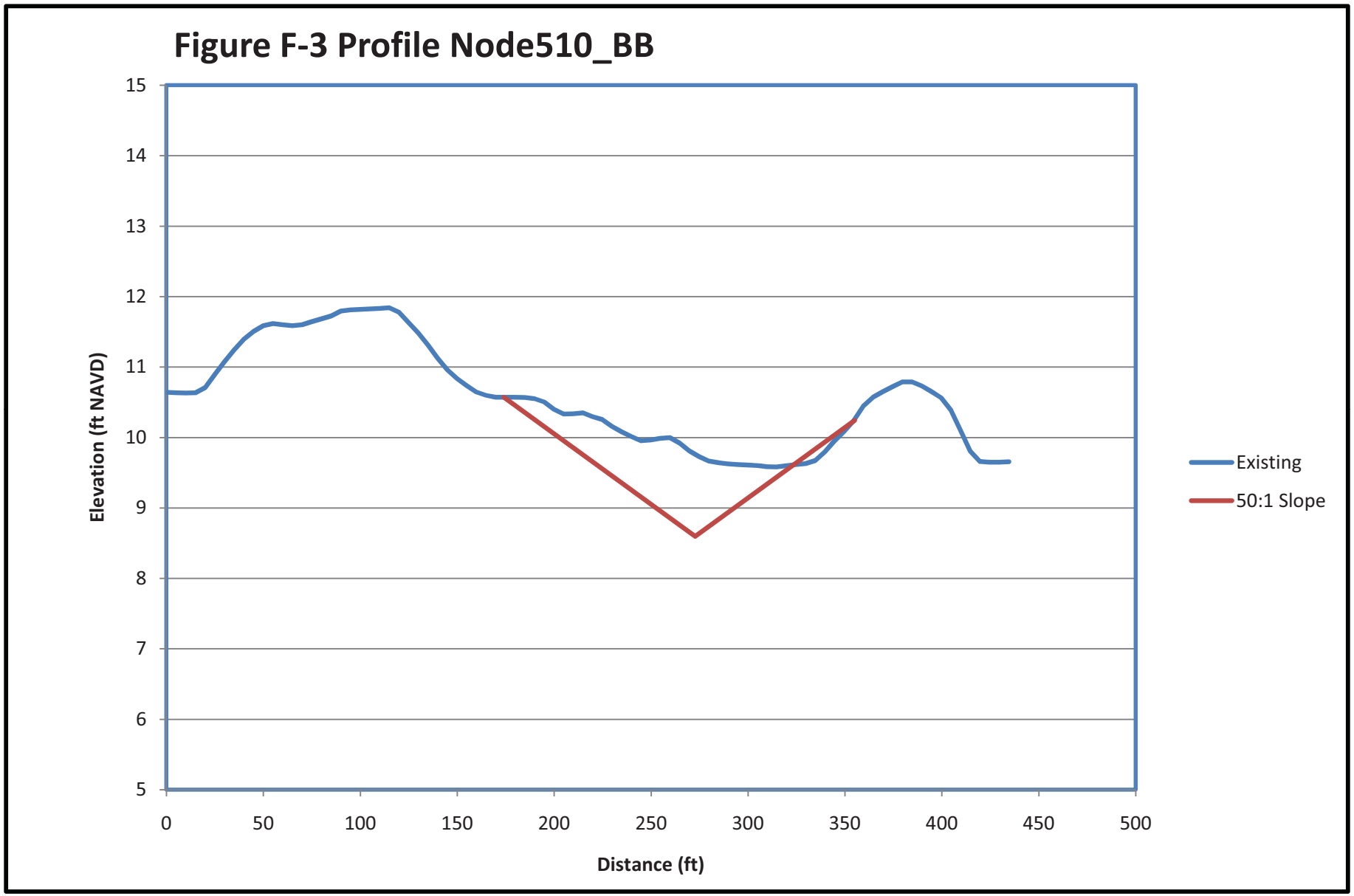
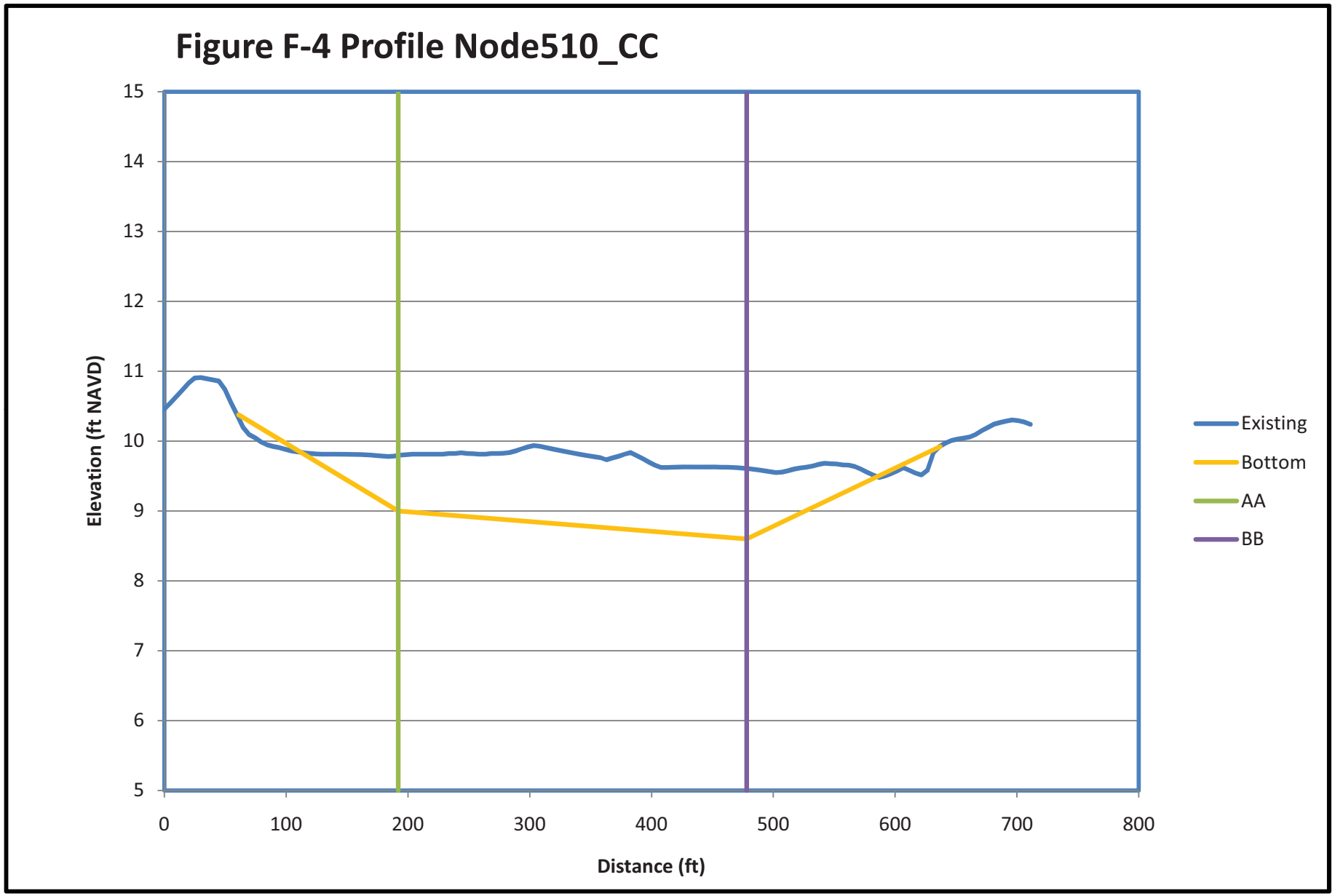
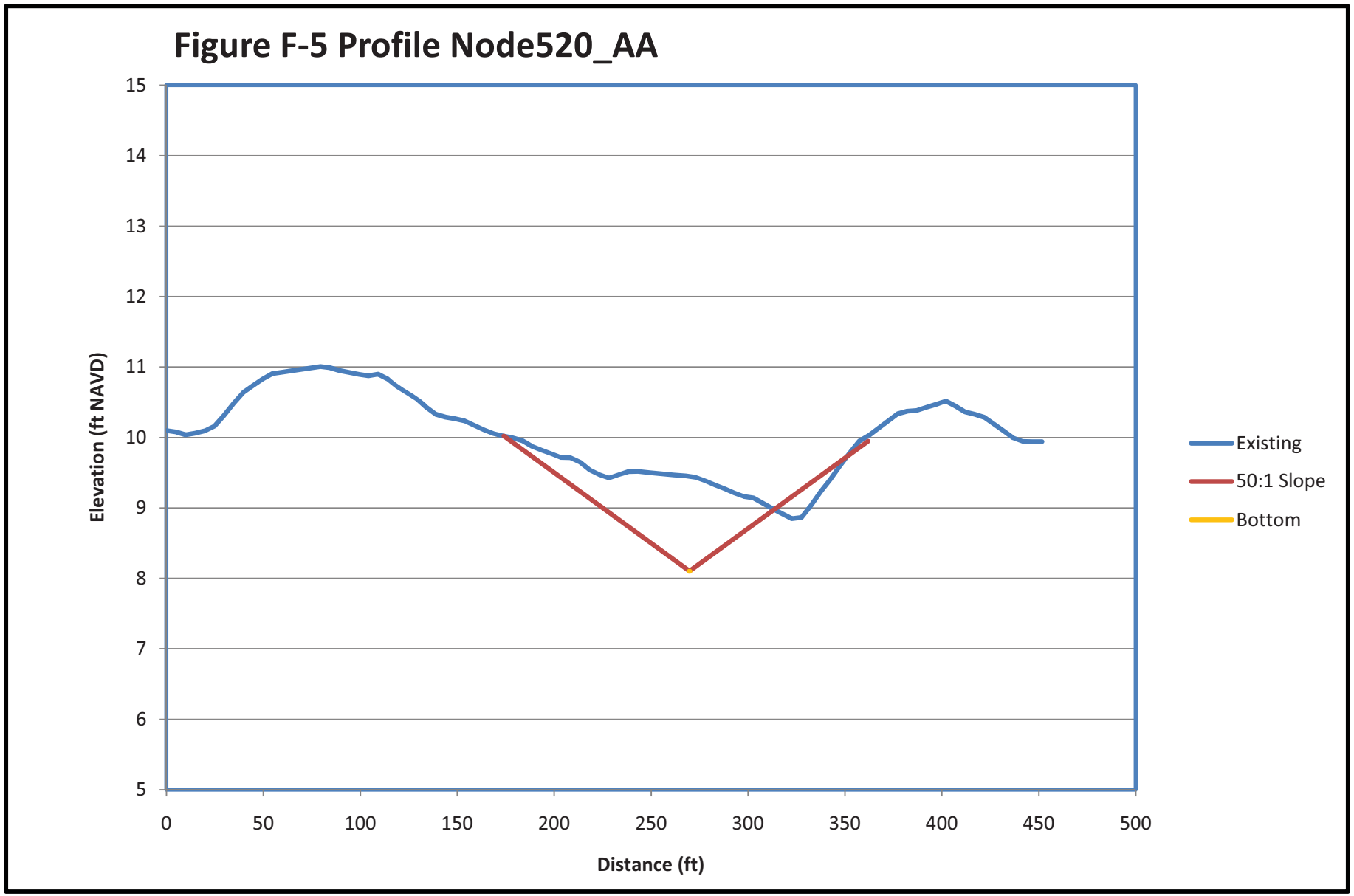
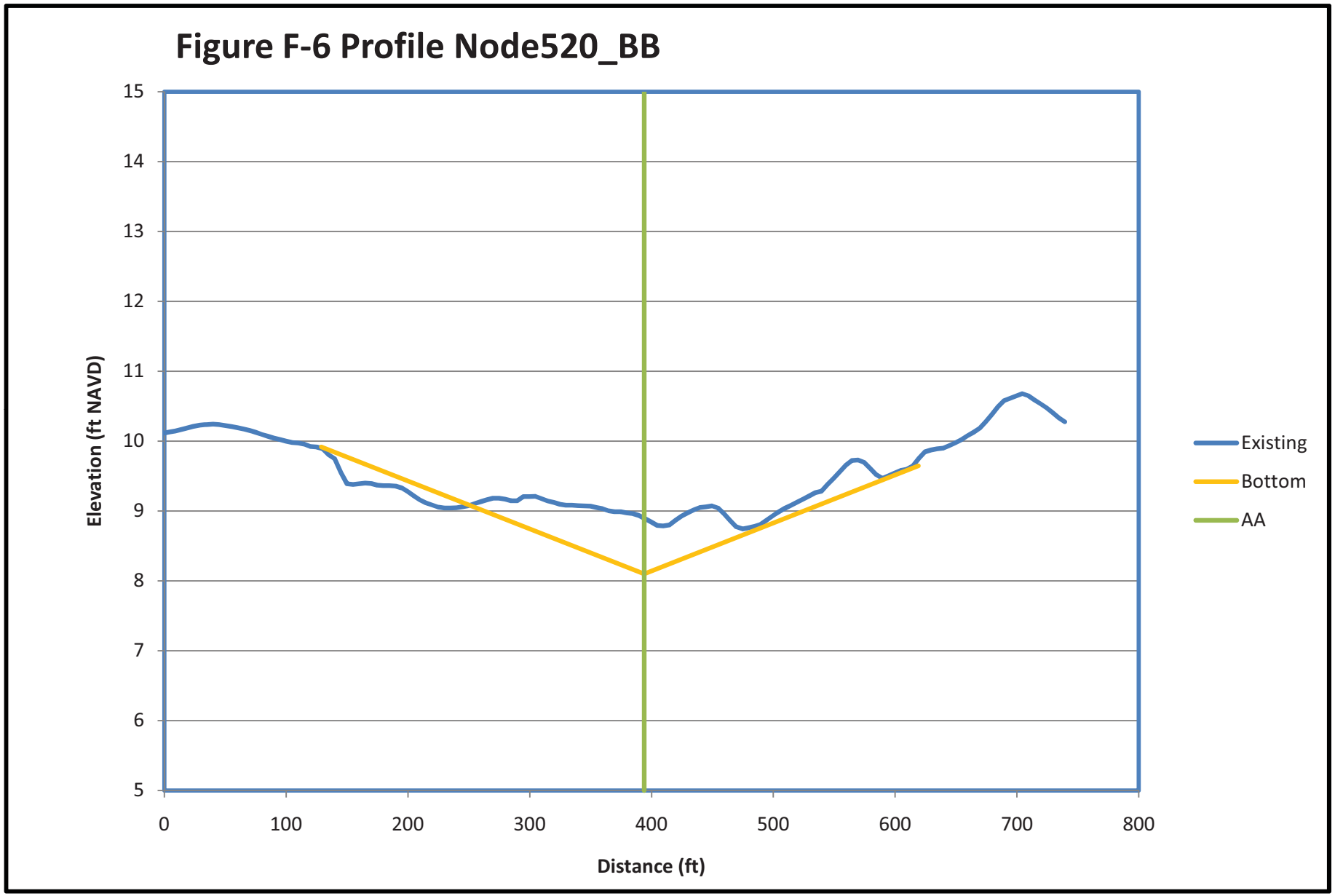


Figure F-3 Profile Node510_BB
Elevation (ft NAVD)
15
14
13
12
11
10
9
8
7
6
5
0
50
100
150
200
250
300
350
400
450
500
Distance (ft)
Existing
50:1 Slope







Question and Answers for Bid #276-11831 - Engineering Services -Master Drainage/Conceptual Environmental Resources Permit

Overall Bid Questions

Question 1

Is there an estimated budget for this? **(Submitted: Sep 29, 2016 9:33:15 AM EDT)**

Answer

- The budget is estimated at $250,000. **(Answered: Sep 29, 2016 10:42:02 AM EDT)**

Question 2

When will the completed copies of the 2012 Master Drainage Plan Study and Storm Water Pollution Prevention Plan Study be made available to the consultants? **(Submitted: Sep 30, 2016 5:26:25 PM EDT)**

Answer

- It has been added to the Documents Page of Bidsync **(Answered: Oct 4, 2016 3:08:36 PM EDT)**

Question 3

Regarding the page limit, the RFQ states we are allowed 50 pages double-sided. Can you please confirm if this is 50 pages total or if its 50 sheets of paper printed double sided for a total of 100 pages? **(Submitted: Oct 5, 2016 11:08:42 AM EDT)**

Answer

- 50 pages double sided is preferred. **(Answered: Oct 13, 2016 8:44:01 AM EDT)**

Question 4

Section 4.2.3 says to "provide any other documentation that demonstrates their ability to satisfy all of the minimum qualification requirements". Can you please clarify what "any other documentation" refers to? What other documentation should be or must be included? **(Submitted: Oct 5, 2016 12:56:16 PM EDT)**

Answer

- Any additional documentation your firm feels would be of benefit to the committee to evaluate your abilities. **(Answered: Oct 13, 2016 8:44:01 AM EDT)**

Question 5

Section 4.2.3 says "provide details of past projects for agencies of similar size and scope, including information on your firm's ability to meet time and budget requirements." The SF 330 required within this section includes project information. In regards to this reference to "details of past projects", are we to provide other projects' information, in addition to the projects that are in the SF 330 or would the projects included in the SF 330 suffice? **(Submitted: Oct 5, 2016 1:04:39 PM EDT)**

Answer

- As long as the information is provided. If provided in the SF330 there would be no need to provide it again. **(Answered: Oct 13, 2016 8:44:01 AM EDT)**

Question 6

Section 4.2.4, do we have to provide an organization chart and resumes in this section? **(Submitted: Oct 5, 2016 1:08:29 PM EDT)**

Answer

- Please read the paragraph and respond as requested **(Answered: Oct 14, 2016 2:01:10 PM EDT)**

Question 7

If including subconsultants, are we required to submit a full SF 330 for them? **(Submitted: Oct 5, 2016 1:15:19 PM EDT)**

Answer

- It would be helpful to demonstrate the capabilities of your subs. **(Answered: Oct 13, 2016 8:44:01 AM EDT)**

Question 8

In light of the disruption caused by hurricane Matthew, will the city consider extending the due date?

(Submitted: Oct 10, 2016 12:01:50 PM EDT)

Answer

- Has beed extended **(Answered: Oct 25, 2016 5:06:25 AM EDT)**

Question 9

Please confirm if three references are required for each subconsultant. **(Submitted: Oct 10, 2016 4:09:57 PM EDT)**

Answer

- No - just the Prime **(Answered: Oct 13, 2016 8:44:01 AM EDT)**

Question 10

Who is on the selection committee? If you cannot provide names, can you identify their departments? **(Submitted: Oct 11, 2016 4:42:45 PM EDT)**

Answer

- That information is not available at this time **(Answered: Oct 13, 2016 8:44:01 AM EDT)**