


Meeting Date
August 18, 2015



AGENDA	
Section	Public Hearing
Item No.	IV.6.

AGENDA REPORT
BREVARD COUNTY BOARD OF COUNTY COMMISSIONERS

SUBJECT:	Public Hearing to Consider Approval of Resolution for Adoption of State Revolving Fund (SRF) Fund #WW05110 Wastewater Facility Plan for the South Central Regional Wastewater Treatment Facility (SCWWTF) Expansion and Improvements required by the Florida Department of Environmental Protection (Districts 1, 2, & 4) (Fiscal Impact: \$30,000,000)				
DEPT/OFFICE:	Utility Services Department				
Requested Action:	It is requested that the Board of County Commissioners conduct a public hearing for approval of a resolution adopting the State Revolving Fund #WW05110 Wastewater Facility Plan for the South Central Regional Wastewater Treatment Facility Expansion and Improvements.				
Summary Explanation & Background:	<p>The South Central Wastewater Treatment Facility located at 10001 N. Wickham Road in Viera is scheduled for expansion as part of the Utility Services Capital Improvement program.</p> <p>The proposed SCWWTF expansion will provide wastewater treatment capacity for the county's South Central utility service area. The need and timing for expansion is directly a function of population growth and development within the service area. The Wastewater Facility Plan demonstrates that the construction and operation of the proposed improvements are in the public interest and will not cause adverse health and environmental impacts.</p> <p>The Utility Services Department has contracted Quentin L. Hampton Associates, Inc. Consulting Engineers to design the project and assist with the process of obtaining funding from the Florida Department of Environmental Protection managed Clean Water State Revolving Fund Program. This funding option affords the Department the opportunity to secure lower interest rates and substantial savings in the financing of the facility improvements and expansion. Recent SRF loans approved by the State have been financed at a rate of less than 1% compared with 3½ to 4% for traditional bond financing.</p> <p>Fiscal Impact: This project is expected to cost approximately \$30,000,000 and is in the approved Capital Improvements Program in Fund 4153/CC 365320, South Central CIP</p> <p>Contact: Jim Helmer, Interim Utility Services Director Phone/e-mail: 321-633-2091 jim.helmer@brevardcounty.us</p>				
Clerk to the Board Instructions: Return 3 Certified Resolutions to Utility Services Department along with extended minutes of item					
Exhibits Attached: Resolution, Wastewater Treatment Facility Plan, Permission to Advertise, Proof of Advertisement					
Contract /Agreement (If attached): Reviewed by County Attorney Yes <input type="checkbox"/> No <input type="checkbox"/> PR <input type="checkbox"/>					
County Manager	Assistant County Manager				Department Director / Extension
Stockton Whitten	Assistant County Manager				 James Helmer, Interim Utility Services Director, x52091



August 19, 2015

MEMORANDUM

TO: James Helmer, Interim Utility Services Director

RE: Item IV.G., Resolution for Adoption of State Revolving Fund (SRF) Fund #WW05110 Wastewater Facility Plan for the South Central Regional Wastewater Treatment Facility (SCWWTF) Expansion and Improvements Required by Florida Department of Environmental Protection

The Board of County Commissioners, in regular session on August 18, 2015, conducted a public hearing and adopted Resolution No. 15-136, adopting the State Revolving Fund (SRF) Fund #WW05110 Wastewater Facility Plan for the South Central Regional Wastewater Treatment Facility Expansion and Improvements required by Florida Department of Environmental Protection. The public hearing process was used to explain the project and present the financial impacts to the public. The Board unanimously approved the Resolution and there were no speakers or opposition to the Item. Enclosed are three certified copies of the Resolution for your action.

Your continued cooperation is always appreciated.

Sincerely,

BOARD OF COUNTY COMMISSIONERS
SCOTT ELLIS, CLERK

Tammy Etheridge

Tammy Etheridge, Deputy Clerk

/kg

Encls. (3)

cc: Finance
Budget

A RESOLUTION OF THE BOARD OF COUNTY COMMISSIONERS OF BREVARD COUNTY, FLORIDA, APPROVING THE WASTEWATER FACILITY PLAN (2015) AS REQUIRED BY THE FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION STATE REVOLVING FUND PROGRAM AND PROVIDING FOR AN EFFECTIVE DATE.

WHEREAS, local government agencies are allowed under the general laws of Florida to apply for public loans through the State of Florida in order to finance the construction of wastewater treatment facility expansion and improvements, and

WHEREAS, the administrative regulations of the Florida Department of Environmental Protection ("FDEP"), the state agency that oversees the State Revolving Fund Program, requires the Board of County Commissioners, as the local governing body of Brevard County, to formally approve a Wastewater Facility Plan describing the South Central Regional Wastewater Treatment Facility (SCRWWTF) Expansion and Improvements project in order to comply with the funding requirements of the State of Florida; and

WHEREAS, formal approval of a Wastewater Facility Plan is required in order for Brevard County to participate in the State Revolving Fund Program; and

WHEREAS, the Florida Department of Environmental Protection requires a public hearing in conjunction with the adoption of the Wastewater Facility Plan;

WHEREAS, the Board of County Commissioners of Brevard County has held such public hearing on August 18, 2015; and

WHEREAS, there does not appear to be significant public objection to the Plan as presented at the public hearing; and

WHEREAS, the Board of County Commissioners of Brevard County, Florida, desires to formally approve the Wastewater Facility Plan (2015), a copy being attached hereto and incorporated herein by reference, and desires to make certain improvements to its wastewater system as more fully described in the said plan, and

WHEREAS, the Board of County Commissioners concurs with the findings and summary of necessary improvements that are described in the Facility Plan for the purpose of wastewater system improvements.

NOW, THEREFORE, BE IT RESOLVED BY THE BOARD OF COUNTY COMMISSIONERS OF BREVARD COUNTY, FLORIDA, THAT:

Section 1. The foregoing recitals are incorporated herein by reference.

Section 2. The Board of Commissioners of the Brevard County, Florida, is authorized to approve, and does hereby approve, the Wastewater Facility Plan (2015), a copy being attached hereto and incorporated herein by reference. The said Facility Plan is approved pursuant to the State Revolving Fund Program for the purpose of making various improvements to the County's wastewater facilities. A copy of the County's Facility Plan shall be maintained by the County Clerk.

Section 3. The County Manager is hereby authorized and directed to execute the said Facility Plan, including any and all papers and documents necessary and incidental thereto.

Section 4. The County Manager is further designated to be the County's representative who is authorized to provide the assurance and commitments that will be required by the said Facility Plan; and to represent the County in carrying out the County's responsibilities under the said Facility Plan, including the authority to delegate responsibility to appropriate County staff

members to carry out the various technical, financial, and administrative activities associated with implementing the said Facility Plan.

Section 5. All Resolutions or part of Resolutions in conflict with any of the provisions of this Resolution are hereby repealed to the extent of such conflict. If any section or portion of a section of this Resolution proves to be invalid, unlawful, or unconstitutional, it shall not be held to invalidate or impair the validity, force, or effect or any other section or part of this Resolution.

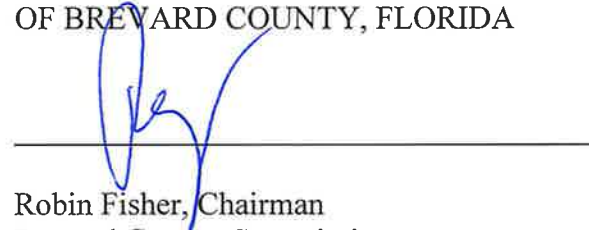
Section 6. This Resolution is PASSED AND ADOPTED in Regular Session, this 18th day of August, 2015.

ATTEST:



Scott Ellis, Clerk

BOARD OF COUNTY COMMISSIONERS
OF BREVARD COUNTY, FLORIDA



Robin Fisher, Chairman
Brevard County Commission

(As approved by the Board on August 18, 2015)

Legal Notice • Call (888) 516 - 9220

hearing or meeting is made, at his own expense, which record includes the testimony and evidence upon which the appeal is based. The needs of hearing or visually impaired persons shall be met if the Planning & Development Department is contacted at 321-633-2069 at least five (5) days prior to the public hearing. Brevard County Planning & Development Department; Robin M. Sobrino, AICP, Director. By: Jennifer Jones, Special Projects Coordinator II.

AD#618012 7/30/2015

PUBLIC NOTICE

NOTICE IS HEREBY GIVEN that the Board of County Commissioners of Brevard County, Florida, on August 18, 2015 at 9:00 A.M., in the Board Room at 2725 Judge Fran Jamieson Way, Building C, First Floor, Viera, Florida, 32940 will hold a public hearing on the following resolution:

**RESOLUTION NO. 15-
A RESOLUTION OF THE BOARD OF COUNTY COMMISSIONERS OF BREVARD COUNTY, FLORIDA, APPROVING THE WASTEWATER FACILITY PLAN (2015) AS REQUIRED BY THE FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION STATE REVOLVING FUND PROGRAM AND PROVIDING FOR AN EFFECTIVE DATE.**

The Board will hold a Public Hearing to allow the County to receive comments regarding the proposed South Central Regional Wastewater Treatment Facility (SCRWWTF) Expansion and Improvements capital construction project that is included in the County's Wastewater Facility Plan which has been submitted in support of an application to receive a State Revolving Fund Loan for funding assistance for this project. Financial impacts for the Plan's proposed project will be discussed at a future Commission meeting.

All persons for or against said resolution can be heard at said time and place. If a person decides to appeal any decision made by the Board with respect to such hearing or meeting, he will need to ensure that a verbatim record of the proceedings is made, which record includes the testimony and evidence upon which the appeal is to be based.

A copy of the resolution and Facility Plan may be inspected at the following locations:

Clerk to the Board of County Commissioners

North Brevard Library

Central Brevard Library

Melbourne Library

Micco Library

Website: www.brevardcounty.us/utilityservices

By order of the Board of County Commissioners of Brevard County, Florida.

SCOTT ELLIS, CLERK

**BOARD OF COUNTY COMMISSIONERS
BREVARD COUNTY, FLORIDA**

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Website: www.brevardcounty.us/utilityservices

By order of the Board of County Commissioners of Brevard County, Florida.

SCOTT ELLIS, CLERK
BOARD OF COUNTY COMMISSIONERS
BREVARD COUNTY, FLORIDA



BOARD OF COUNTY COMMISSIONERS

Utility Services Department

2725 Judge Fran Jamieson Way

Building A, Room 213

Viera, Florida 32940

Inter-Office Memo

TO: Stockton Whitten, County Manager
FROM: Jim Helmer, Interim Utility Services Director
DATE: July 22, 2015
RE: Request to Advertise Public Hearing

Per AO-23, I am requesting County Manager permission to advertise a Public Hearing of a resolution requesting adoption of the State Revolving Fund #WW05110 Wastewater Facility Plan for the South Central Regional Wastewater Treatment Facility Expansion and Improvements.

State Revolving Fund rules require the plan must be advertised for 14 days prior to the Public Hearing which I would like to schedule for the August 18, 2015 Board of County Commissioner's meeting.

Our consulting firm, Quentin L. Hampton, has produced the Facility Plan and is assisting the Utility Services Department in the State Revolving Fund process which has potential to save the Department a substantial amount of money on the financing of the plant expansion.

Your signature below approves issuing permission to advertise the Public Hearing.


Stockton Whitten, County Manager


Date

BREVARD COUNTY UTILITY SERVICES

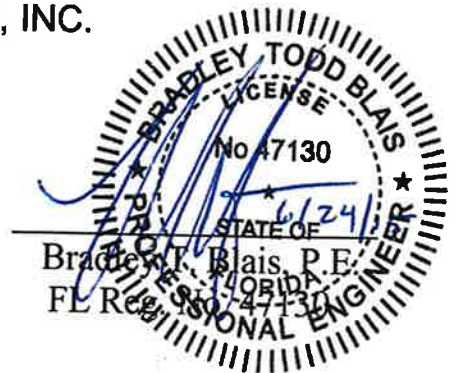
WASTEWATER FACILITY PLAN

SOUTH CENTRAL REGIONAL WASTEWATER
TREATMENT FACILITY (SCRWWTF)
EXPANSION AND IMPROVEMENTS
SRF# WW05110



Prepared by:
QUENTIN L. HAMPTON ASSOCIATES, INC.
-Consulting Engineers-

June 2015



**BREVARD COUNTY
SOUTH CENTRAL REGIONAL WASTEWATER
TREATMENT FACILITY (SCRWWTF) EXPANSION AND IMPROVEMENTS
SRF# WW05110 FACILITY PLAN**

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- Appendix A – Ovivo Bardenpho Process Proposal**
- Appendix B – Veolia IFAS Process Proposal**
- Appendix C – Audubon’s Crested Caracara 2015 Survey**

Section 1

1. Executive Summary

The County of Brevard will require many improvements to its South Central wastewater treatment facility for the planning period. The types of improvements can be divided into two separate areas:

- Existing WWTF Renewal and Replacement
- WWTF Capacity Expansion

The proposed WWTF Renewal and Replacement project is needed to maintain existing plant operations to ensure WWTF compliance.

The WWTF expansion will provide wastewater treatment capacity for the County's utility service area. The need and timing for expansion is directly a function of population growth and development within the service area.

This document demonstrates that the construction and operation of the proposed improvements are in the public interest and will not cause adverse health and environmental impacts. Terrestrial and aquatic communities will not be negatively affected. Threatened or endangered species will be unaffected. This project will not impact any known archeologically sensitive areas. Construction involves only lands that have been previously disturbed from their natural condition and are included existing site boundaries. Furthermore, there are no environmental justice concerns with this project.

The County is familiar with the requirements of the State Revolving Fund Program. They understand program requirements and will fully comply with the planning and design submittal guidelines.

QLH

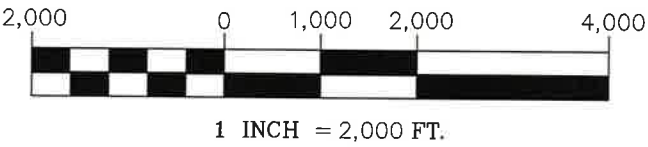
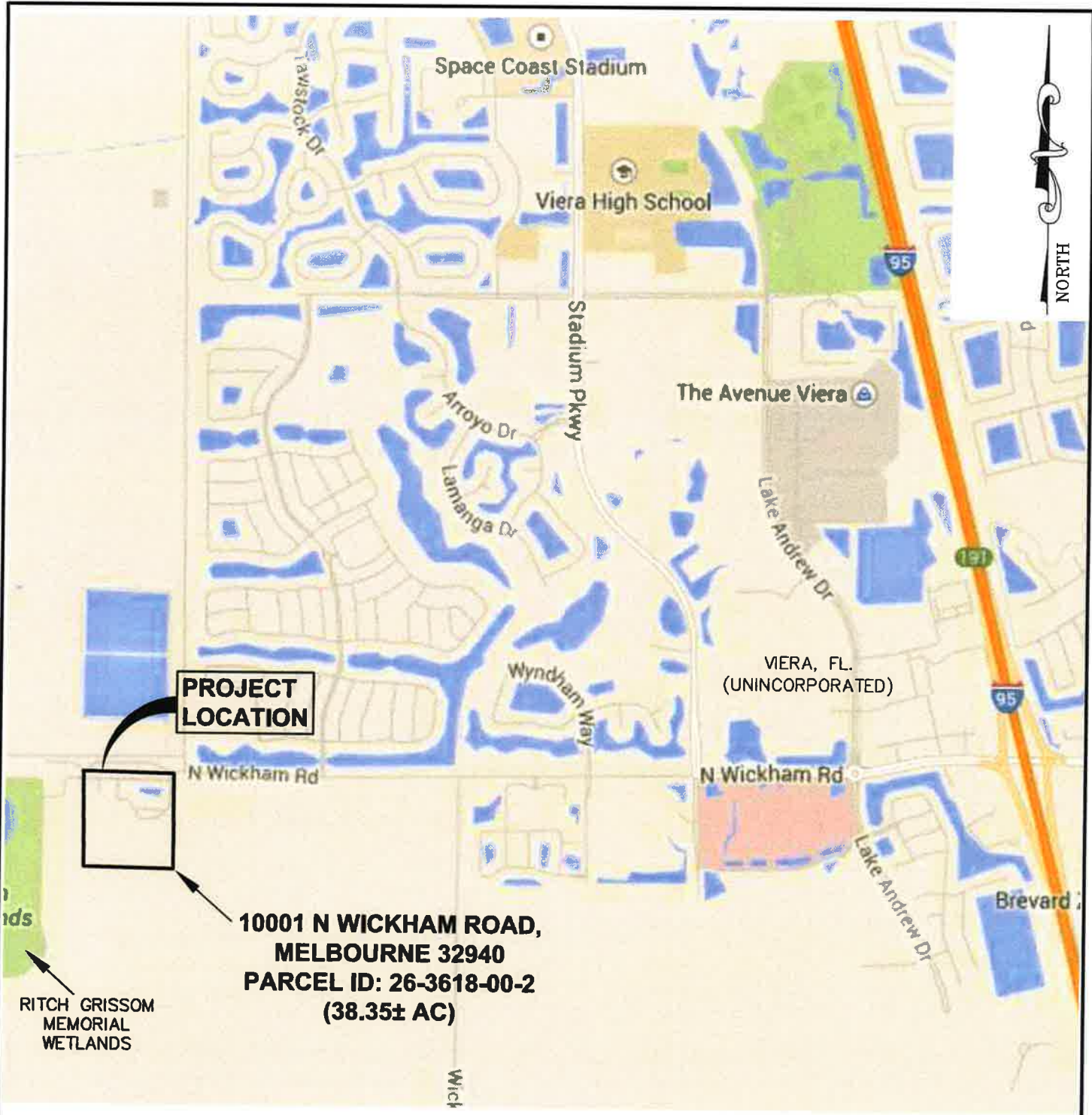
*Brevard County SCRWWTF
SRF Facility Plan*

1.1. Project Description and Location

The County of Brevard provides wastewater service to residential and commercial customers throughout the County's service areas. The South Central Regional Wastewater Treatment Facility (SCRWWTF) provides service to customers in the south central and southwest region of Brevard County. Areas served by the SCRWWTF include: Viera, Suntree and West Cocoa. **Figures 1 and 2** depict the location of the WWTF and service area respectively.

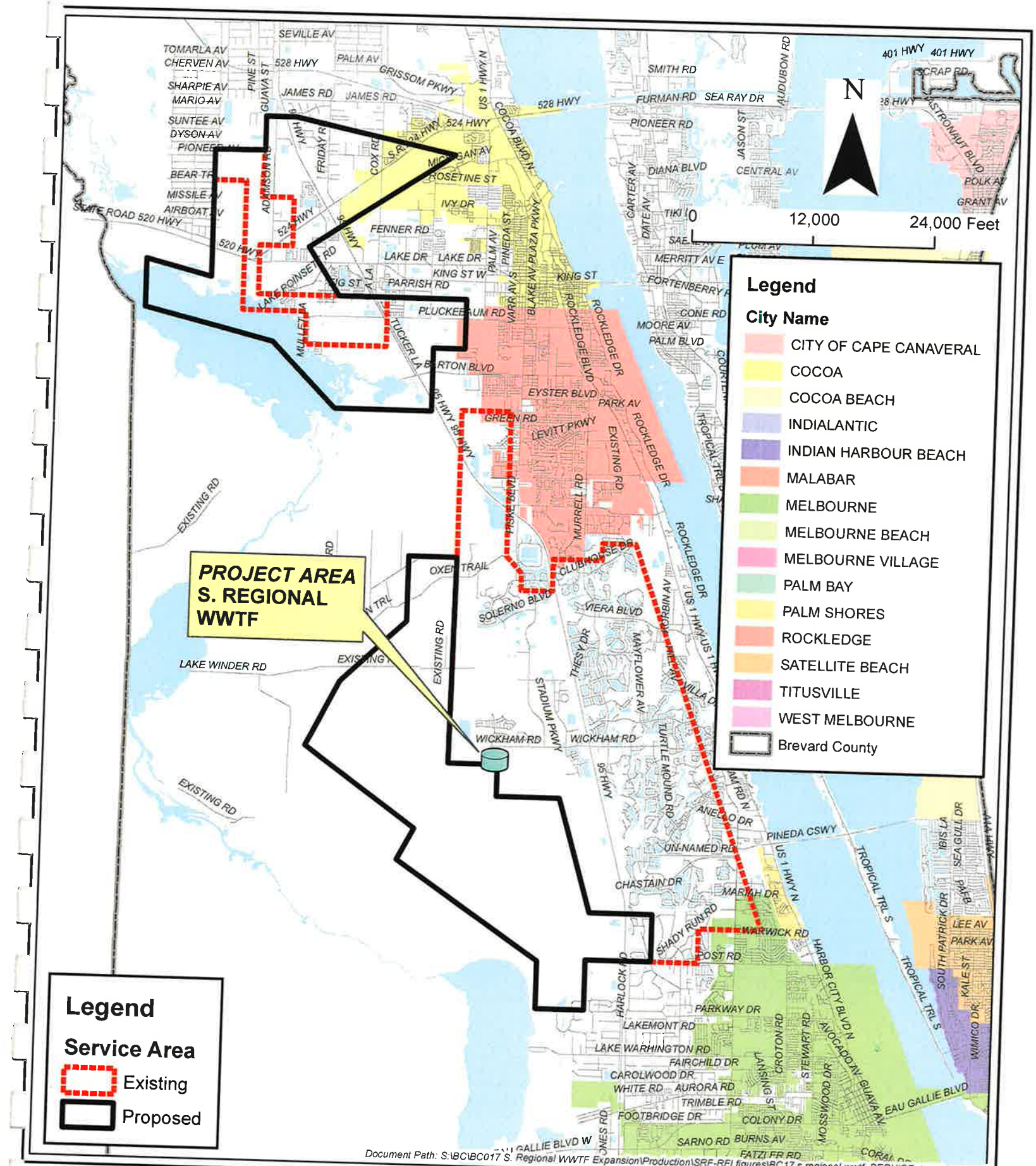
The existing SCRWWTF has a rated capacity of 5.5 MGD, annual average daily flow (AADF). The aerators are currently being upgraded to provide total installed horsepower of 600, this upgrade will allow the existing treatment plant to be rated at 6.0 MGD AADF capacity with FDEP. The SCRWWTF is an Advanced Wastewater Treatment (AWT) facility developed around the Bardenpho activated sludge process with Class I reliability and consists of mechanical influent screening, grit removal, anaerobic tanks, first anoxic tanks, extended oxidation ditches, second anoxic tanks, re-aeration tanks, clarification, filtration, chlorination, solids handling, and reclaimed water storage and pumping. However, the plant is in need of further expansion for future growth.

This project will provide renewal and replacement of specific existing unit processes and a plant expansion consisting of a new process train with a Moving Bed Biological Reactor (MBBR) and Integrated Fixed Film Activated Sludge (IFAS) systems.



<p>QUENTIN L. HAMPTON ASSOCIATES, INC. CONSULTING ENGINEERS</p> <p>FLORIDA CERTIFICATE OF AUTHORIZATION NUMBER: 626 P.O. DRAWER 290247 PORT ORANGE, FLORIDA 32129-0247 PH: 386 761-6810 FAX: 386 761-3977</p>	<p>BREVARD COUNTY SOUTH CENTRAL REGIONAL WWTP</p>	<p>LOCATION MAP</p>	<p>FIGURE 1</p> <p>DATE: 2-15</p>
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S:\BC\BC017 S. Regional WWTF Expansion\Production\Design\PDRA\Report Figures\BC17-FIG 1-LOCATION MAP.dwg, FIG 1-LOCATION MAP, 2/27/2015 1:55:01 PM, QLH



QUENTIN L. HAMPTON ASSOCIATES, INC.
 CONSULTING ENGINEERS
 FLORIDA CERTIFICATE OF AUTHORIZATION NUMBER: 626
 FAX: 386.761.3977
 P.O. DRAWER 290247 PORT ORANGE, FL 32129-0247
 PHONE: 386.761.6810

**BREVARD COUNTY
 S REGIONAL WWTF
 IMPROVEMENTS**

**FIGURE 2
 SERVICE AREA
 MAP**

1.2. Need or Justification for Projects

The WWTF capacity expansion and improvements project discussed within this document are needed for the reasons listed below.

- To meet demands of expanding development and population within service area
- To maintain existing plant operations to ensure WWTF compliance
- To address security, site traffic and power outages
- To offset future potable water demands with an increase in reclaimed water

1.2.1. Population Growth

The population and development information presented herein is based upon information derived from the planning document entitled, "South Central Regional Wastewater Treatment Facility Expansion Plan and Infrastructure Conditions Assessment", (Tetra Tech, June 2013). Brevard County's equivalent residential connection (ERC) factor is 200 GPD/unit. Based upon this estimate, and current annual average daily flow (AADF) of 4.5 MGD, the treatment plant currently serves approximately 22,500 equivalent residential units. The BEBR at the University of Florida conducted a Florida Population Study for counties within the state of Florida which was updated based on the recent 2010 census information. The number of households and average household size in Brevard County was provided as an estimate for 2011. The estimated number of households in 2011 was approximately 230,492 units and the average household size was 2.33 persons (BEBR Factor). Utilizing this estimate, the total equivalent population currently being served is approximately 52,425. The 'Build-out' projections for the SCRWWTF service area indicate that an additional 42,000 ERU's are anticipated for a total estimated ultimate flow of **12.9 MGD** at AADF.

Historical flow increases of approximately 140,000 GPD/YR, over the past 10 years, equate to an average population increase of approximately 700 ERU/YR or 1,631 persons per year.

QLH

*Brevard County SCRWWTF
SRF Facility Plan*

This growth rate has decreased over the past 5 years and is generally attributed to economic conditions and related changes in growth patterns throughout central Florida. The referenced report utilized historical flow analyses, with trend lines extrapolated forward, as the selected methodology for consideration of future expansion projects. Relevant data supporting these projections is described herein.

1.2.2. Flow Estimates

The SCRWWTF has a design treatment capacity of 5.5 MGD. Annual average influent flow in 2014 was 4.58 MGD thus utilizing over 80% of the available capacity. Max 3-month flows are in excess of 5.1 MGD utilizing greater than 90% of the available treatment capacity. Historical and projected flows are detailed in tables below.

**Table 1
Historical Flows**

Year	AADF (MGD)	Maximum 3-Month ADF (MGD)	Maximum Month ADF (MGD)	Maximum Month ADF Peaking Factor
2002	2.86	2.99	3.12	1.1
2003	2.98	3.07	3.17	1.1
2004	3.14	3.44	3.56	1.1
2005	3.37	3.70	3.88	1.2
2006	3.34	3.70	3.68	1.1
2007	3.52	3.64	3.80	1.1
2008	3.65	3.77	3.90	1.1
2009	3.63	3.77	3.94	1.1
2010	3.82	4.01	4.43	1.2
2011	4.29	4.39	4.72	1.1
2012	4.24	5.05	5.24	1.2
2013	4.22	4.32	4.34	1.0

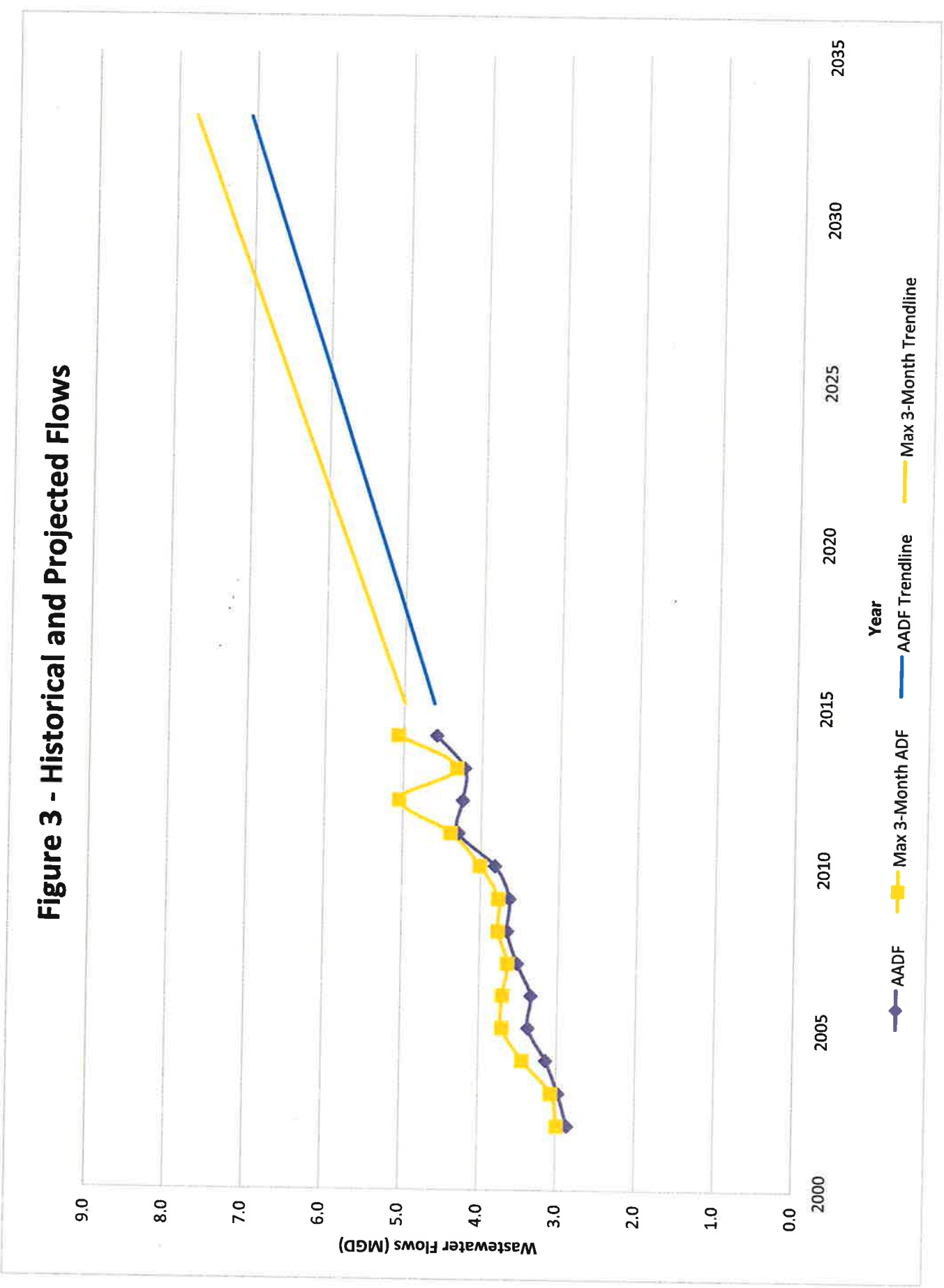
Year	AADF (MGD)	Maximum 3-Month ADF (MGD)	Maximum Month ADF (MGD)	Maximum Month ADF Peaking Factor
2014	4.58	5.07	5.09	1.1

**Table 2
Projected Flows**

Year	AADF (MGD)	Maximum 3-Month ADF (MGD)	Maximum Month ADF (MGD)	Maximum Month ADF Peaking Factor
2015	4.62	4.99	5.54	1.2
2016	4.75	5.15	5.70	1.2
2017	4.89	5.30	5.87	1.2
2018	5.02	5.45	6.03	1.2
2019	5.16	5.61	6.19	1.2
2020	5.30	5.76	6.36	1.2
2021	5.43	5.92	6.52	1.2
2022	5.57	6.07	6.68	1.2
2023	5.70	6.22	6.85	1.2
2024	5.84	6.38	7.01	1.2
2025	5.98	6.53	7.17	1.2
2026	6.11	6.69	7.33	1.2
2027	6.25	6.84	7.50	1.2
2028	6.38	6.99	7.66	1.2
2029	6.52	7.15	7.82	1.2
2030	6.66	7.30	7.99	1.2
2031	6.79	7.45	8.15	1.2
2032	6.93	7.61	8.31	1.2
2033	7.06	7.76	8.48	1.2
2034	7.20	7.92	8.64	1.2

As shown above, projected flow increases are expected to mirror historical conditions and additional treatment capacity is necessary. **Figure 3** illustrates the historical and projected AADF and Max 3-month flows through 2034.

Figure 3 - Historical and Projected Flows



Section 2

2. Cost Comparison

2.1. WWTF Expansion Alternatives

The existing SCRWWTF has a rated capacity of 5.5 MGD, annual average daily flow (AADF). The treatment plant is currently treating approximately 4.5 MGD at AADF with max 3-month flows of 5.1 MGD and peak month flows of approximately 5.2 MGD. The aerators are currently being upgraded to provide total installed horsepower of 600, this upgrade will allow the existing treatment plant to be rated at 6.0 MGD AADF capacity. However, The County desires to increase the rated capacity of the SCRWWTF to continue to provide wastewater service to the growing service area.

The capacity expansion has an initial design of 3.0 MGD with an ultimate build out of 6.0 MGD additional capacity. Based upon the wastewater flow projections, it is evident that immediate action should be taken to initiate expansion of treatment capacity. The following options are evaluated herein:

- No Action Alternative
- Two (2) biological process expansion alternatives:
 - 5-stage Bardenpho Oxidation Ditch
 - 5-stage Intergrated Fixed Film Activated Sludge (IFAS) Process

A comparison of alternatives is based on cost, performance/reliability and infrastructure capacity. Each of the alternatives are evaluated and ranked from lowest to highest, 1 to 3. The points are totaled and the highest point total is the recommended alternative.

Lowest cost projects have the highest ranking. Best performing and/or most reliable options receive priority. Those requiring the least change to existing infrastructure, i.e. tankage and site plan, are beneficially ranked.

QLH

*Brevard County SCRWWTF
SRF Facility Plan*

2.1.1. No Action Alternative

Brevard County can elect to delay further expansion plants at the South Central WWTF until average daily flow exceeds 4.80 MGD (80% of 6.0 MGD), approximately 2015. At that time, the County will be required to identify how it intends to meet the needs of future growth. The primary drawback to this approach once growth picks up again the County may not have sufficient capacity to meet growth demands.

Based upon the projected flows, it appears that maximum month flows will not exceed available capacity prior to 2018. As such, it is possible to delay construction of a new facility beyond 2018. Advantages and disadvantages associated with this option are as follows:

Advantages:

- Lowest Cost
- No additional equipment

Disadvantages:

- Preventive maintenance is difficult
- Performance and reliability is reduced
- Significant existing infrastructure upgrades required
- Future capacity increase required

2.1.2. Biological Process Expansion Alternatives

The wastewater treatment facility is designed to treat 5.5 MGD; the existing plant will be re-rated to 6.0 MGD, this capacity will be expanded by 3.0 MGD with construction of the a new process train. The new process train will be designed to accommodate an additional 3.0 MGD expansion in the future. Consideration of the 'future' 3.0 MGD is included within

this evaluation of process alternatives. The primary reasons to consider expanding capacity by additional 3.0 MGD, at this time, are: economies of scale, reliability and preventive maintenance. The average day, peak month and peak hour flows for the new process train are listed below:

Average Daily Flow (ADF) = 3.0 MGD

Peak Month Flow (PMF) = 1.3 (3.0)
= 3.9 MGD

Peak Hour Flow (PHF) = 2.0 (3.0)
= 6.0 MGD

Influent wastewater characteristics were estimated based on historical data recorded on SCRWWTF Discharge Monitoring Reports submitted to FDEP. The design criteria for each biological process were the same and are provided in the table below.

**Table 3
Influent Wastewater
Design Characteristics**

Parameter	Value
cBOD5, mg/L	300
TSS, mg/L	300
TKN, mg/L	55
TP, mg/L	7
Design Temperature, *C	18
Site Elevation, ft	20

Effluent design criteria for each process were standardized to Advanced Wastewater Treatment standards provided below.

**Table 4
Effluent Wastewater
Design Standards**

Parameter	Value
cBOD5, mg/L	≤5.0
TSS, mg/L	≤5.0
TN, mg/L	≤3.0
NH3-N, mg/L	≤1.0
TP, mg/L	≤1.0

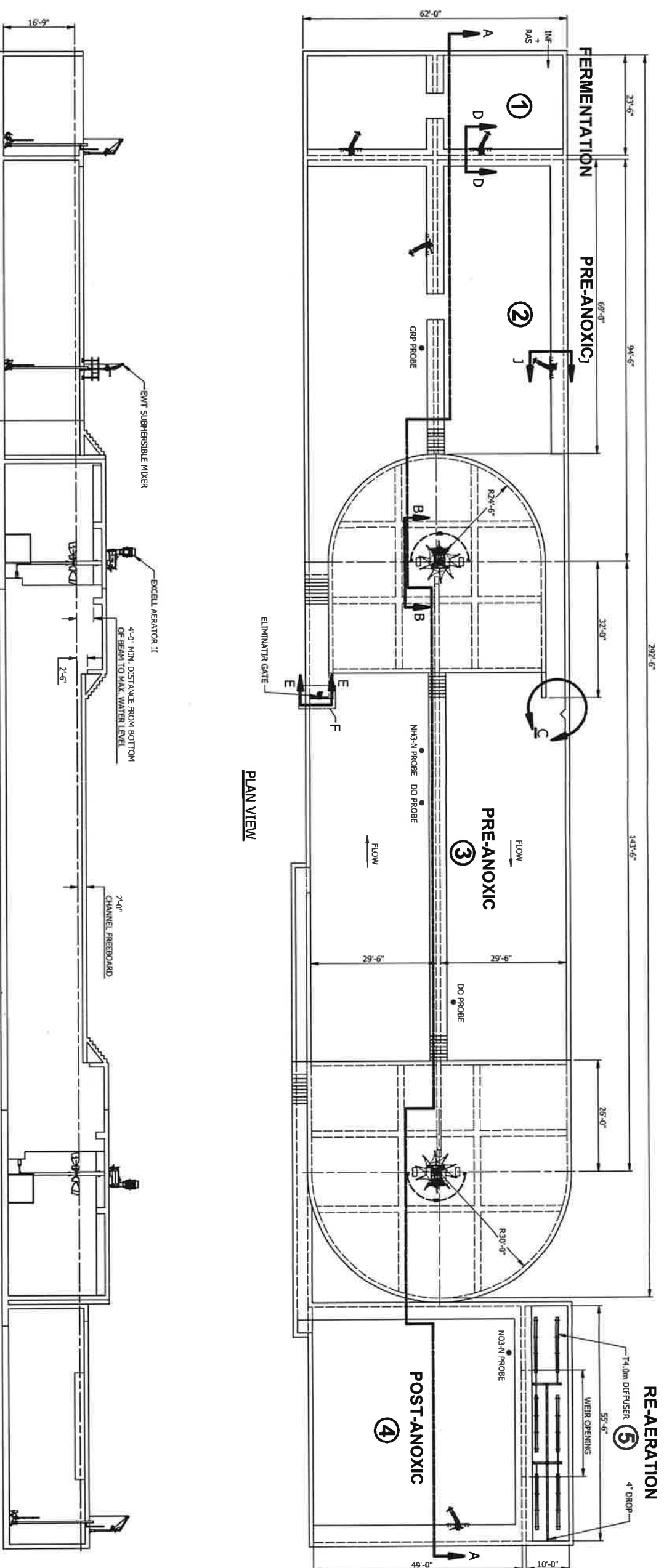
2.1.2.1. 5-Stage Bardenpho Oxidation Ditch

The biological nutrient removal process used at the SCRWWTF consists of two (2) trains of 5-Stage Bardenpho Activated Sludge with oxidation ditch style reactors. The existing process trains consist of anaerobic reactors, pre-anoxic reactors, carrousel oxidation ditch reactors, post-anoxic reactors and re-aeration. A conceptual flow schematic for the proposed expansion utilizing the 5-Stage Bardenpho process is provided as *Figure 4*.

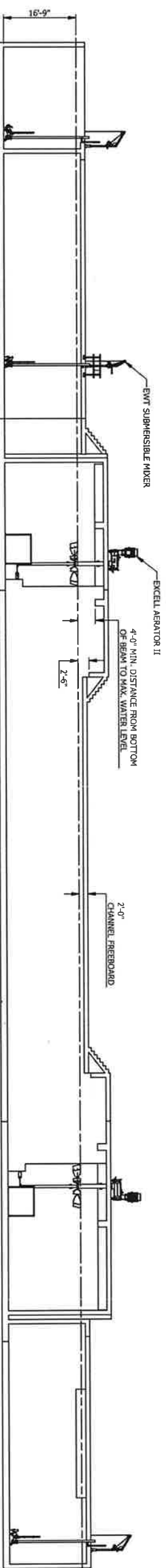
The proposed 5-Stage Bardenpho process will consist; a single treatment train for 3.0 MGD capacity and two (2) trains for 6.0 MGD with the same size process basins as the existing process. Basin sizing for the proposed Bardenpho process train are detailed below.

**Table 5
5-Stage Bardenpho Process
Basin Size**

Treatment Zone	Total Volume FT³
Anaerobic Basin	12,500
First Anoxic Basin	68,300
Oxidation Ditch Reactor	181,300
Second Anoxic Basin	46,500
Re-aeration Basin	8,400
TOTAL BASIN VOLUME	248,700



SECTION A-A



NOTE
 1. BEAMS, FOOTINGS, AND WALL THICKNESSES SHOWN TO ILLUSTRATE CRITICAL CHANNEL DIMENSIONS AND FREEBOARD. DRAWING IS NOT INTENDED TO BE USED FOR STRUCTURAL DESIGN. BEAMS, FOOTINGS, SLAB, AND WALL DESIGN IS NOT THE RESPONSIBILITY OF OVIVO USA, LLC AND SHALL BE DESIGNED BY THE ENGINEER'S STRUCTURAL ENGINEER.

No.		BY		REVISIONS		DATE		BY		REVISIONS		DATE		BY		REVISIONS		DATE		BY	
<p>QUENTIN L. HAMPTON ASSOCIATES, INC. CONSULTING ENGINEERS FLORIDA CERTIFICATE OF AUTHORIZATION No. 829 PHONE: (386) 761-8810 FAX: (386) 781-3877 P.O. DRAWER 280247, FORT ORANGE, FL 32128-0247</p> <p>COUNTY of BREVARD BREVARD COUNTY, FLORIDA</p> <p>SOUTH CENTRAL REGIONAL WWTF EXPANSION PROJECT No. BC17</p> <p>5-STAGE BARDENPHO FLOW SCHEMATIC</p> <p>KENN A. LEE, P.E. FLORIDA REGISTRATION #71501</p>																					
SHEET No.																					
FIGURE 4																					

Internal recycle is provided by the DenitIR gate in the oxidation ditch portion of the process. Flow velocity around the Carrousel conveys activated sludge upstream to the first anoxic basin, through the DenitIR gate. The oxygen requirement in the Carrousel basin is met by mechanical surface aerators. The design proposes two (2) 150 hp aerators for each 3.0 MGD treatment train.

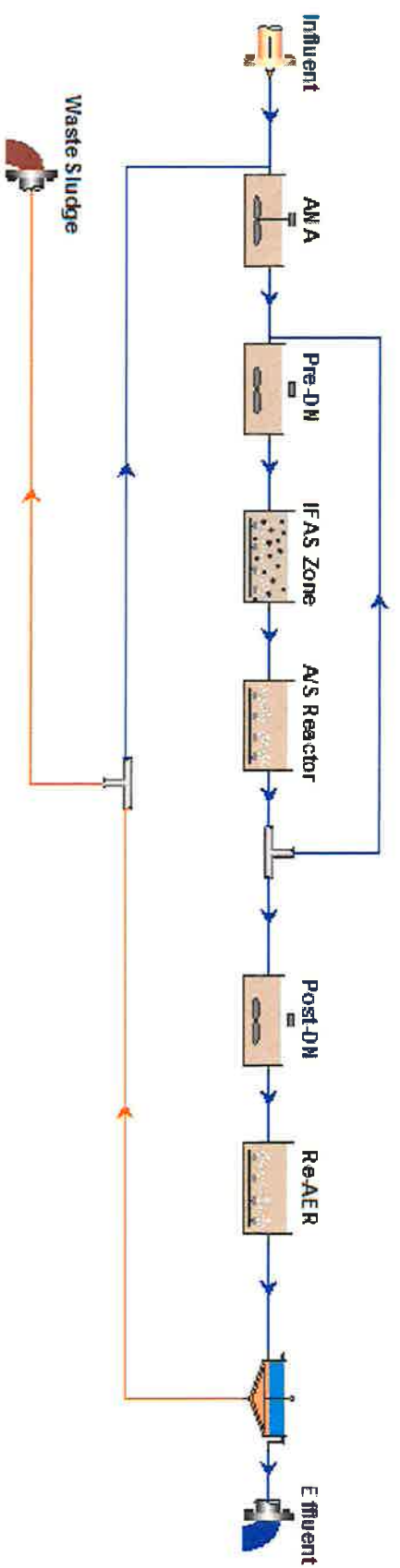
A detailed biological design report for the proposed 5-Stage Bardenpho process was provided by Ovivo. This design report is included as Appendix A.

2.1.2.2. 5- Stage Integrated Fixed Film Activated Sludge Process

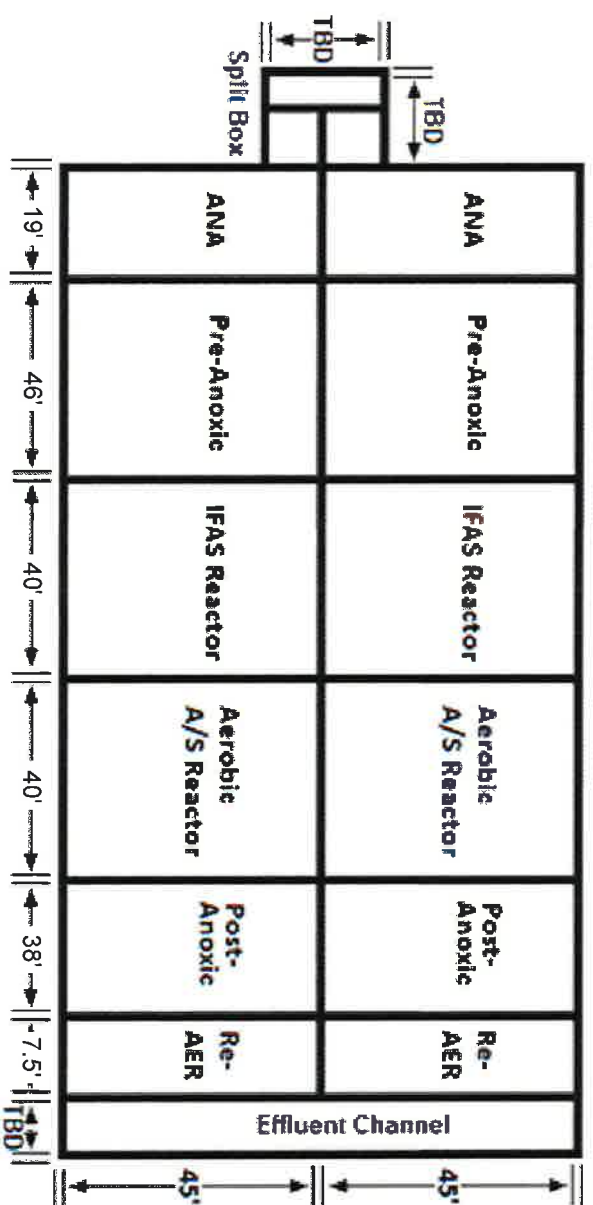
The alternate biological process evaluated for the SCRWWTF is the Integrated Fixed Film Activated Sludge (IFAS) process. The process includes a 5-Stage treatment train with addition of a Moving Bed Bioreactor (MBBR) in the oxidation zone, to decrease overall footprint. A conceptual flow schematic for the proposed expansion utilizing the IFAS process is provided as *Figure 5*.

Similar to the 5-stage ditch evaluation, this option considers constructing two (2) 3.0 MGD process trains. Each 3.0 MGD IFAS process train will consist of the following treatment zones: anaerobic, pre-anoxic, aerobic IFAS reactor, aerobic activated sludge, post-anoxic and re-aeration zone. Basin volumes were established based on biological calculations and the proposed tankage was sized to accommodate the prescribed residence times. Tank sidewater depth was set at 20ft to accommodate the existing site and WWTF hydraulic profile. Tank volumes are shown in table below.

IFAS System Configuration



IFAS Process Configuration



IFAS system Layout Sketch

No.	BY	REVISIONS	DATE	No.	BY	REVISIONS	DATE	QUENTIN I. HAMPTON ASSOCIATES, INC. CONSULTING ENGINEERS FLORIDA CERTIFICATE OF AUTHORIZATION No. 628 PHONE: (386) 761-6810 FAX: (386) 761-3877 P.O. DRAWER 290247, PORT ORANGE, FL 32129-0247	COUNTY of BREVARD BREVARD COUNTY, FLORIDA	SOUTH CENTRAL REGIONAL WWTF EXPANSION PROJECT No. BC17	IFAS PROCESS FLOW SCHEMATIC DRAWN BY: PEJ	KEN A. LEE, P.E. FLORIDA REGISTRATION #71501	SHEET No. FIGURE 5
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Table 6
5-Stage IFAS Process
Basin Size

Treatment Zone	Dimensions	Total Volume FT³
Anaerobic Selector	19ft x 45ft x 20ft	16,900
Pre-Anoxic Reactor	46ft x 45ft x 20ft	41,625
Aerobic IFAS Reactor	40ft x 45ft x 20ft	36,000
Aerobic Activated Sludge Reactor	40ft x 45ft x 20ft	36,000
Post-Anoxic Reactor	38ft x 45ft x 20ft	33,750
Re-Aeration Reactor	7.5ft x 45ft x 20ft	6,750
TOTAL BASIN VOLUME		171,025

Internal recycle will be pumped from the aerobic activated sludge reactor back to the pre-anoxic reactor. Per the process design, these pumps are capable of recycling 600% of the design ADF of 3.0 MGD. Therefore the two (2) wall pumps will have a combined capacity of 18.0 MGD. Each pump is capable of pumping 6,300 GPM.

The overall air requirement for the aerobic basins and re-aeration was calculated to be 5,300 SCFM. This project will install two (2) blowers to meet the processes air requirement. The two (2) blowers will consist of one duty blower and one as a standby.

A detailed biological design report for the IFAS process was provided by Veolia. This design report is included as Appendix B

2.1.3. Cost Comparison

Costs estimates provided herein are based on budgetary equipment pricing provided by each process manufacturer, as detailed in the Appendices of this report. Additional costs for concrete tankage, ancillary equipment, electrical gear, control panels, piping, etc are based on recent construction bids of similar projects and/or pricing provided by

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contractors and vendors. As stated previously the 3.0 MGD and 6.0 MGD costs are considered in this evaluation.

**Table 7
5-Stage
Bardenpho Oxidation Ditch
Conceptual Cost Estimate**

ITEM	DESCRIPTION	3.0 MGD COST	6.0 MGD COST
1	STRUCTURAL	\$1,235,722	\$2,471,444
2	PROCESS EQUIPMENT (installed cost)	\$1,200,000	\$2,400,000
3	MCC BUILDING	\$200,000	\$200,000
3	ELECTRICAL EQUIPMENT	\$300,000	\$450,000
4	WEIRS,GATES AND VALVES	\$150,000	\$300,000
5	PIPE, VALVES AND FITTINGS	\$150,000	\$300,000
	Sub-total	\$3,235,722	\$6,121,444
	GC OH & Profit @ 20%	\$647,144	\$1,224,289
	TOTAL	\$3,882,866	\$7,345,733

**Table 8
5-Stage IFAS Process
Conceptual Cost Estimate**

ITEM	DESCRIPTION	3.0 MGD COST	6.0 MGD COST
1	STRUCTURAL	\$650,000	\$1,060,000
2	PROCESS EQUIPMENT (installed cost)	\$1,300,000	\$2,600,000
3	BLOWERS AND AIR PIPING	\$400,000	\$750,000
4	MCC/BLOWER BUILDING	\$250,000	\$350,000
5	ELECTRICAL EQUIPMENT	\$300,000	\$450,000
6	WEIRS,GATES AND VALVES	\$150,000	\$300,000
7	PIPE, VALVES AND FITTINGS	\$150,000	\$300,000
	Sub-total	\$3,200,000	\$5,810,000
	GC OH & Profit @ 20%	\$640,000	\$1,162,000
	TOTAL	\$3,840,000	\$6,972,000

2.1.4. Conclusions

This evaluation includes no action alternative and process design comparisons with cost estimates for the SCRWWTF expansion with a 3.0 MGD process train with a future 6.0 MGD ultimate capacity. The biological processes evaluated included 5-Stage Bardenpho Activated Sludge and the IFAS Process. Both options have similar cost estimates when considering the current 3.0 MGD cost, but the 6.0 MGD build out scenario is less expensive with the IFAS option. Additional evaluation criteria for each process are provided below.

A. 5-Stage Bardenpho Activated Sludge

- Process is similar to existing used at the SCRWWTF, operations staff familiar with process and equipment.
- Larger footprint which negatively effects limited site available for this expansion.
- Aeration equipment utilizes surface impellers which limits basin design and increases energy consumption.

B. 5-Stage IFAS Process

- Smaller footprint allows for full utilization of existing site with expansion and proposed septage and grease processing facility.
- Energy efficient design with deeper aeration basin sidewater depth and air diffuser controls
- Treatment process different than existing, training required. However, the biological process controls are the same as conventional activated sludge processes.

A tabular listing of evaluation criteria for each alternative to expand treatment capacity is presented in **Table 9**

**Table 9
South Central Facilities Plan
WWTF Expansion Alternatives Evaluation**

Alternative	Evaluation Criteria			
	Cost*	Compatibility/ Reliability	Infrastructure Capacity	Total
No Action	3	1	1	8
5-Stage Bardenpho Activated Sludge Process	1	3	2	7
5- Stage IFAS Process	2	2	3	9

* Cost factor multiplied by 2.0

Based on the evaluation contained herein it is recommended that the IFAS 5-Stage Process Alternative be utilized for the expansion of SCRWWTF.

2.1.5. Conceptual Cost Estimate

**Table 10
South Central Regional Wastewater Treatment Facility Expansion and Improvements
Conceptual Cost Estimate**

ITEM No.	Description	3.0 MGD	6.0 MGD
1	Mobilization & General Conditions	\$1,050,000	\$1,300,000
2	Sitework	\$840,000	\$840,000
3	Yard Piping	\$1,000,000	\$1,200,000
4	Pretreatment Structure/Headworks	\$3,759,576	\$3,759,576
5	5-stage Biological Treatment Unit (IFAS)	\$3,840,000	\$ 6,792,000
6	Replace mixers at existing BNR and recycle gate	\$600,000	\$600,000
7	(2) 90' Clarifiers w/ RAS & WAS	\$2,520,000	\$2,520,000
8	New Filters and Replace Existing Filters	\$1,680,000	\$3,060,000
9	Chlorine Contact and Effluent Transfer Pumps	\$1,224,000	\$1,224,000
10	Sludge Thickening and Mixing at Extg Thcknr.	\$984,000	\$984,000
11	Belt Press, Polymer Feed & relocate press feed	\$750,000	\$750,000
12	Reclaimed Water Storage Tank and Pump Station	\$2,040,000	\$2,040,000
13	Electrical and Instrumentation	\$2,100,000	\$2,100,000

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ITEM No.	Description	3.0 MGD	6.0 MGD
14	Maintenance and Storage Building	\$1,857,264	\$1,857,264
15	Laboratory	\$486,384	\$486,384
	Sub-total	\$24,731,224	\$29,513,224
	Contingency @ 10%	\$2,473,122	\$2,951,322
	Total Construction Cost Estimate	\$27,204,346	\$32,464,546

After expansion and improvements of the facility, the estimated operation and maintenance cost is approximately \$600,000 per year, 2% of construction cost, and will have a 50 year design life.

Section 3

3. Environmental Effects

3.1. Physiography

Brevard County has three (3) major physiographic regions: (1) the Atlantic Coastal Ridge/Coastal Zone; (2) the St. Johns Valley; and (3) the Barrier Islands. The Atlantic Coastal Ridge parallels the Indian River. The Ridge ranges in east-west width from one and one-half to three miles. The Coastal Zone is the area between the Atlantic Coastal Ridge and the Indian River. The area comprising the Atlantic Coastal Ridge and the Coastal Zone is characterized by parallel, north-south elongated ridges and intervening swales. The swales contain shallow ponds, lakes and long, narrow sloughs. The area contains some of the higher elevations in the county ranging to forty feet. The Coastal Ridge forms the drainage divide between the St. Johns River and Indian River basins.

The St. Johns River Valley includes all of the area west of the Atlantic Coastal Ridge and covers approximately two thirds of the Brevard County mainland. Its most prominent feature is the St. Johns River which has its headwaters in South Brevard and flows north the full length of the County, eventually discharging into the Atlantic Ocean near Jacksonville.

The Barrier Island is separated from the Brevard County mainland by the Indian River and is bordered on the east by the Atlantic Ocean. Merritt Island varies in width from less than one mile to about ten miles. The Barrier Islands range in elevation from sea level to about twenty feet.

(1) Soils

The soil survey prepared by the United States Department of Agriculture indicates that the soils in eastern Brevard County are varied and complex and include twelve major

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soil associations and their associated sub-series or families. These twelve associations are further divided into forty-three soil series and then into the soils found in the respective series. For the purposes of this Facility Plan the twelve associations are grouped into six general landscapes or categories which give an overview of the soils in the service area.

Soils of the Sand Ridges: The two soil associations in this group consist of excessively drained to moderately well drained, nearly level to strongly sloping soils that are sandy to a depth of eighty inches or more. They occur on ridges along the Indian River on the mainland, on Merritt Island and on the Atlantic Coastal Ridge.

Soils of the Broad Grassy Flats: The one soil association on the broad grassy flats consists of poorly drained nearly level soils that are sandy to a depth of eighty inches or more. This association is on the mainland at the eastern edge of the lowlands along the St. Johns River.

Soils of the Flatwoods: The two soil associations in this group consist of poorly drained nearly level sandy soils over dark-colored, weakly cemented sandy layers that are underlain by sandy or loamy material. These associations occur on the mainland, generally between the coastal ridge and the lowlands along the St. Johns River and on Merritt Island. They are interspersed with grassy sloughs, ponds and swamps.

Soils of the Hammocks and Low Ridges: The two soil associations in this group consist of poorly drained and very poorly drained, nearly level soils in hammocks and along low ridges. Some of these soils have loamy subsoil, some contain dark colored weakly cemented layers, and some are less than forty inches deep over limestone. These associations occur on low marine terraces on Merritt Island.

Soils of the St. Johns River Flood Plain: The two soil associations in this group consist of poorly and very poorly drained, nearly level soils that have loamy subsoil. These associations are on lowlands along the St. Johns River on the mainland.

Soils of the Swamps and Marshes and Very Wet Areas: The three soil associations in this group consist of broad expanses of organic soils, freshwater swamps, tidal marshes, and tidal swamps. They occur throughout the Thousand Islands and on the flood plain along the St. Johns River.

3.2. Terrestrial and Aquatic plant and Animal Communities

(1) Coastal

Very few coastal vegetative resources remain in the service area. The remaining mangroves, seagrass beds, and estuarine marshes located within the developed portions of the service area boundaries are stressed.

Each of these vegetative communities perform important natural functions. Mangroves and estuarine marshes improve water quality, control erosion, and provide protection from storms by trapping sediments and debris, removing excess nitrogen and phosphorous nutrients, stabilizing shorelines, and buffering winds. Seagrass beds trap and bind sediments, improving water quality and stabilizing the shoreline.

Mangroves provide a habitat for many types of fish, crustaceans, and birds. Several species of the birds which frequent mangroves in Brevard County are threatened or endangered such as the Snowy Egret, the Brown Pelican, the Roseate Spoonbill and the Least Tern.

Estuarine marshes serve as habitat for many types of birds and a nursery habitat for many fish. Threatened or endangered fowl include the Snowy Egret and the Least Tern. The seagrass beds provide food and protection for many kinds of juvenile fish.

The pinewoods vegetative community is dominated by the slash pine and includes pine flatwoods. These trees form the highest layer of vegetation above the ground and the floor is usually covered by palmetto bushes. Threatened or endangered wildlife found in the pine flatwoods are the Gopher Frog, the Gopher Tortoise, the Scrub Jay and the Indigo Snake. In addition, nesting Bald Eagles and Osprey have been found in these communities.

Freshwater marshes occur in seasonally-flooded depressions and along streams, creeks, lakes and drainage ways. The dominant plant growth is emergent water plants and water tolerant grasses and sedges. Few trees inhabit marsh areas except for low growing, water tolerant species such as the coastal plains willow. Marshes are well suited for wading birds and aquatic wildlife. Threatened or endangered species found in freshwater marshes are the Florida Sandhill Crane, the Snowy Egret, and the Silver Rice Bat. Occasionally, Bald Eagles inhabit freshwater marshes.

The deciduous communities are characterized by pure or mixed stands of mature hardwood dominant trees. Historically, the upland forest or hardwood hammocks occupy the ridges. Today, small stands (less than 100 acres) are scattered throughout the service area. Vegetation consists of live oak, laurel oak, hickory trees and, if conditions are suitable, red cedar, cabbage palm, magnolia, and red bay. Threatened or endangered wildlife associated with these communities are the Indigo Snake and the Gopher Tortoise, the Osprey nests in these areas.

Improved pasture sites are 75 to 95 percent open grasslands with a few scattered trees. Few native wildlife species inhabit these areas because of the lack of available food. Common garden varieties of birds, such as the house sparrow and starling, make up the majority of wildlife in these areas.

Terrestrial and aquatic communities will not be negatively affected by the proposed project. There are no potential adverse impacts to flora, fauna in the recommended and proposed project locations.

(2) Climate

The climate in the South Central service area is characterized as humid sub-tropical. This classification includes the following features:

- a. Long, relatively humid summers and mild winters.
- b. Precipitation is unevenly distributed with about sixty-five percent of the annual total falling from June through October, resulting from convective afternoon and evening thunderstorms. The remaining thirty-five percent of the precipitation occurs during the winter and spring and is usually associated with cool frontal systems which result in light rains over a broad area over a long period of time.
- c. Average daily maximum summer temperatures range into the low 90's with temperatures sometimes exceeding 95°F. Summer average daily minimums are in the range of 68°F to 71°F. During the coolest winter months of December and January, average daily maximums are in the low 70° range and average daily minimums in the 48° to 49° range.
- d. Prevailing winds are generally from the north and east. Wind speeds are usually between ten and fifteen miles per hour in the afternoon and five and ten miles per hour at night.

The expected average temperature and precipitation for the service area is summarized in **Table 11**.

**TABLE 11
EXPECTED TEMPERATURE
AND PRECIPITATION
SOUTH CENTRAL REGIONAL SERVICE AREA**

Month	Average Temperature (°F)	Average Precipitation (inches)
January	59.8	2.6
February	62.4	2.7
March	66.5	3.8
April	70.5	2.4
May	76.4	3.3
June	80.7	7.5
July	82.3	6.7
August	82.2	7.8
September	80.4	6.3
October	75.1	3.7
November	68.3	2.6
December	62.1	2.5
Average	72.2	51.9

(3) Geology

The Floridan aquifer in Brevard County includes the Avon Park limestone and the overlying Ocala Group. The Avon Park limestone is the deepest member of the Floridan aquifer and the principal source of ground water. The Avon Park is late Middle Eocene Age, greater than 300 feet thick, and primarily a light colored, soft, dense limestone with zones of less permeable dolomite.

The Ocala Group is a series of limestone formations of Eocene age which are hydrologically connected. The Group is the upper part of the Floridan aquifer and unconformably overlies the Avon Park limestone and unconformably underlies the Hawthorn Formation. The major subdivisions from deepest to shallowest are the

Inglis, Williston, and Crystal River Formations. The Inglis Formation is a cream colored to white marine fossiliferous granular limestone which ranges in thickness from 50 to 100 feet. The Williston Formation is a cream colored fossiliferous marine limestone which averages about 30 feet in thickness. The Crystal River Formation is a white to cream colored massive, friable, fossiliferous limestone.

The confining beds which overlie the Floridan aquifer are the Hawthorn Formation and the upper Miocene or Pliocene deposits. The Hawthorn Formation, underlies all of Central Brevard County, and is composed of calcareous and phosphatic clay, phosphatic limestone, and phosphorite. The Miocene or Pliocene Deposits overlie the Hawthorne Formation and consist of unconsolidated beds of fine sand, shells, clay and calcareous clay.

The surface deposits in Brevard County consist primarily of materials of Pleistocene and Recent Age. These deposits range in thickness from less than 20 feet in the St. Johns Valley to more than 100 feet in the Coastal Ridge area.

(4) Hydrogeology

Ground water in the Floridan aquifer flows from the major recharge zones in Orange County and Osceola County east through Brevard County towards the major discharge zones in the Atlantic Ocean. Changes in the potentiometric service occur seasonally. Water level changes have resulted from well withdrawals and climatic effects.

The bedrock topography in Brevard County is dominated by a vertical displacement trending north-south below the St. Johns River Valley and by an anticlinal structure which begins just north of the City of Cocoa and continues east below the Atlantic Ocean.

The north-south vertical displacement structure has been interpreted by Brown (1962), Frazee (1977), and others as a fault with approximately 150 feet displacement and it is designated the St. Johns fault. The fault appears to be post-Oligocene and pre-Miocene age.

The crest of the anticlinal structure trends east-west and the dip of its flank becomes steeper towards the Atlantic Ocean. This structure has been described by Brown (1962) as a ridge like structure. Both the St. Johns fault and the anticlinal structure appear to have significant effects upon ground water flow within the Floridan aquifer.

(5) Potentiometric Surface

The potentiometric surface maps show the greatest stress occurs in the central coastal area where potentiometric contours are tightly spaced and angular. The general direction of ground water flow can be determined from a potentiometric map. Ground water flows from higher potentiometric level to lower potentiometric level, approximately perpendicular to the potentiometric contours. Ground water flow in the Floridan aquifer is generally southwest to northeast in Brevard County.

In areas that are subject to artesian flow, ground water from the Floridan aquifer can move upward into the shallow aquifer and thus, become susceptible to drainage by canals. However, the effects of canals upon ground water flow within the Floridan aquifer appear to be negligible.

(6) Shallow Aquifer Hydrogeology

Ground water flows from zones of recharge in the uplands to zones of discharge in the lowlands. Because of this recharge-discharge relationship the water table shape mimics the shape of the land surface.

The elevation of the water table is controlled by the relative amounts of recharge and discharge from the ground water system, the permeability of the materials, and stratigraphic factors. The water table rises to a height controlled by the rate at which water moves through the soil and by the topography. The higher water tables are found in the low areas where sediments generally have lower permeability. The sediments of the Coastal Ridge highlands have generally high permeability and a resultant deeper water table.

In Brevard County, rainfall is the principal means of recharge to the shallow aquifer. The amount of precipitation that recharges the shallow aquifer is a function of the following: (1) elevation of the water table and land surface, (2) available sand column thickness, (3) soil permeability, (4) depth to water table, (5) permeability of subsurface deposits, (6) the intensity and duration of the rainfall, (7) the vegetation cover.

The shallow aquifer is comprised of an upper sequence of surficial sand with some shell and coquina, and deeper lenses of sand, shell and coquina isolated by beds of clay and clayey materials. Ground water occurs under unconfined water table conditions in the surficial sand, while the isolated zones are semi-confined by less permeable clays. The upper unconfined sand component of the shallow aquifer is generally the most productive and has a better quality.

Quality in the shallow aquifer is controlled by the source of recharge. If precipitation is the only source of recharge the water usually has chloride concentrations less than 250 mg/l. If vertical leakage from the deeper formations occurs, the water usually has a chloride content of 1200 mg/l or more.

(7) Ground Water Flow

The direction of ground water flow in the shallow aquifer is controlled by the configuration of the water table. Ground water moves down gradient at right angles to

the water table contours and indirectly, the topographic contours. The general direction of ground water movement can be estimated from a topographic contour map.

The ground water divide for land west of the Indian River follows the topographic high of the Atlantic Coastal Ridge. Water flows towards the St. Johns River and the Indian River. Generally, ground water flows west to the St. Johns River in the South Central region of Brevard County.

(8) Aquifer Recharge

Recharge of the Floridan aquifer is caused by the relationship between the potentiometric surface and the water table. Surface recharge to the Floridan aquifer may occur only when the potentiometric surface is below the water table. Discharge occurs when the potentiometric surface is above the water table. Within zones of equal potential, recharge is regulated by the soils. If overlying material are permeable, the magnitude of recharge or discharge will be greater than a similar zone with less permeable materials.

The primary recharge area in Central Brevard is an area where the potentiometric surface is below the water table and the land elevation is above 30 feet. The secondary recharge area is where the potentiometric surface is below the water table and the land elevation is below 30 feet. Recharge to the Floridan aquifer is enhanced by permeable soils and thin or non-continuous confining beds.

The major potential recharge areas for the Floridan aquifer are located along the Central Brevard Coastal Ridge. The South Central Regional area is not considered to be a site of significant recharge. The few areas that have recharge head available also have high lateral permeability and lateral flow.

The water quality in the Floridan aquifer in recharge zones is better than the quality in other areas. This conclusion is well supported by the water quality testing of wells within recharge areas.

(9) Aquifer Source Protection

An important objective of ground water resource management is the retention of the productivity of zones of aquifer recharge. Development in prime recharge areas must avoid the contamination of the surficial aquifer. In this regard, Brevard County must depend upon the actions of adjoining counties to protect the aquifer. The water supply for South Central service area is provided by City of Cocoa and is derived from wells in Orange County.

As commercial and residential development infringes upon recharge areas steps must be taken to limit septic tank areas, chemical storage areas and petroleum storage facilities. Containment facilities should be required to protect the quality of the surficial aquifer.

Agricultural activities have been identified as potential pollution sources. Over fertilization in exceptionally permeable soils can allow nutrients to enter the surficial aquifer and eventually the Floridan. The Soil Conservation Service should be utilized by agricultural interests. They can provide assistance in the development of best management practice for both fertilization and pesticides.

Septic tank density is important to aquifer source protection. Septic tank density should be limited to one per acre in zones of high recharge. Central wastewater collection and treatment should be utilized on residential densities exceeding one per acre.

The underground storage of chemicals and fuels has been identified as a potential threat to ground water quality. Throughout Florida, leaking tanks have been identified and ground water decontamination has been mandated. The installation of anti-corrosion systems and leak detection programs are essential to aquifer source protection. The cost to clean up contaminated ground water far exceeds the cost to prevent and/or monitor leaks.

(10) Water Resources

Brevard County's major surface water bodies are the Indian, Banana and St. Johns Rivers. Although these rivers represent an abundant water resource, they have experienced measurable degrees of water quality degradation. This has primarily been the result of population and urban density increases.

The Indian River, which separates the Brevard County mainland from Merritt Island, can be described as a series of shallow, poorly flushed, brackish lagoons separated by manmade barriers in the form of causeways. The river system contains both Class II and Class III waters, as currently classified by the Florida Department of Environmental Protection. The Indian River was given additional protection by legislative act. The river has historically been a very productive estuarine system. Pollution loads, cannot be readily assimilated by the river system. This is generally due to the poor water circulation within the system caused by indiscriminate dredging, filling and bulk heading (including causeway construction). The lack of assimilative capacity has resulted in increased stress to the system.

The Banana River, which separates Merritt Island from the beaches, is similar in nature to the Indian River. It is shallow, brackish and has very little circulation of water. The river contains only Class III waters. The Banana River is hydraulically connected to the Atlantic Ocean through the Port Canaveral Inlet. The lock system and causeways severely restrict water exchange.

The St. Johns River, which forms the western boundary of the service area, is the County's major surface freshwater system. The river contains both Class I (potable water) and Class III waters. The Class I water is located south of the service area. The St. Johns River has shown signs of stress due to the influence of man. While there is currently no direct sewage effluent or urban stormwater discharge to the river system, the river has been slowly degraded as a result of dredging, diking, marsh reclamation and runoff from agricultural areas.

(11) Historic or Archeological Site

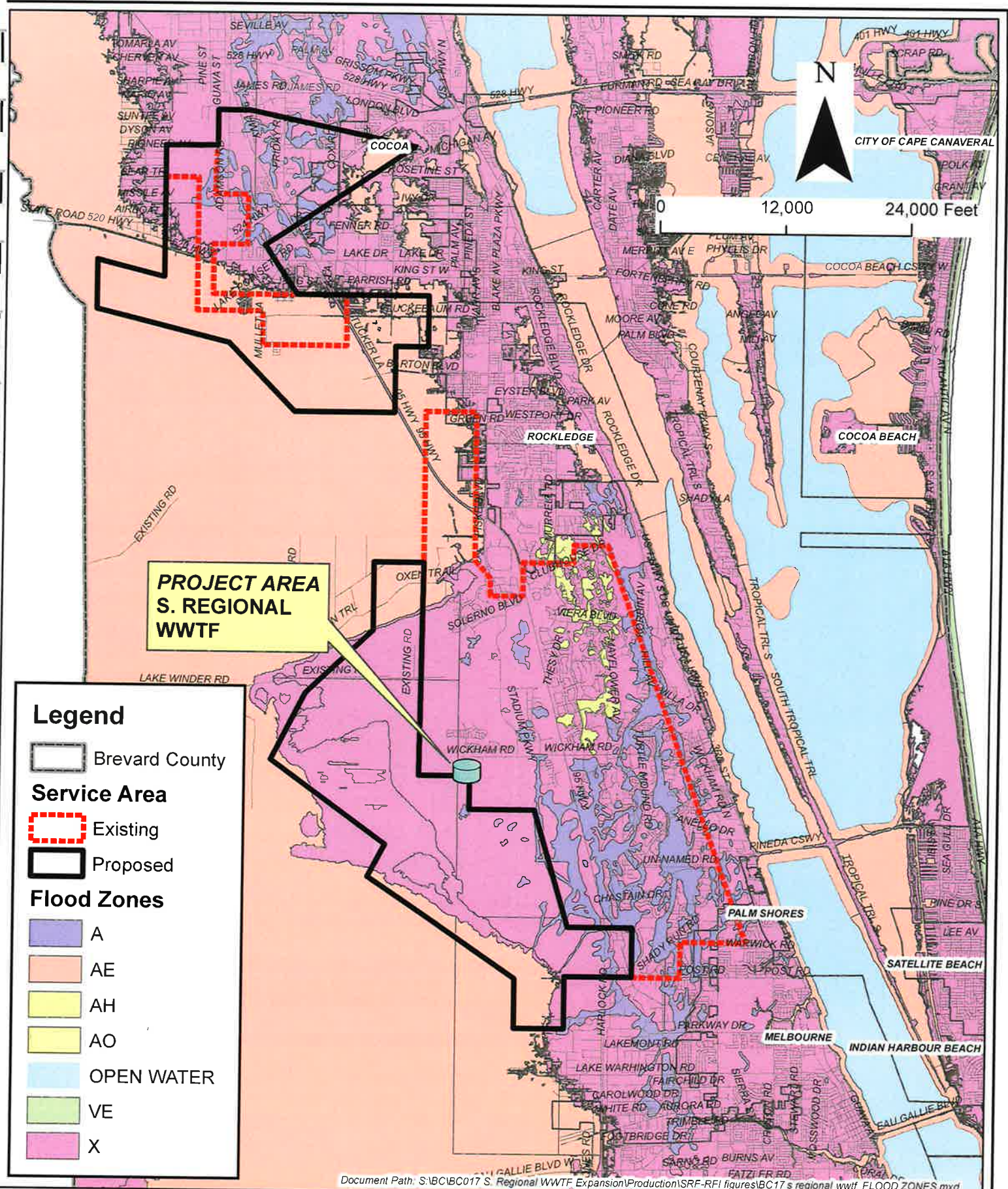
Brevard County is planning a South Central Regional Wastewater Treatment Facility improvements project that involves expansion and rehabilitation of systems within the existing site boundaries. There are no known archeological or historic sites that will be affected by the project proposed in this plan.

(12) Floodplains

The Federal Emergency Management Agency (FEMA) has established flood plains throughout the country and maintains their Flood Insurance Rate Maps (FIRMs). The water service areas are graphically represented in **Figure 6**. These maps have been reviewed in conjunction with projects identified in this Facility Plan. There are no detrimental effects to flood plain development resulting from projects in this plan.

(13) Wildlife and Endangered Species

There are several mammals, birds, amphibians, and reptiles listed as endangered, threatened, or species of special concern that nest, breed, feed or winter in Brevard County. The proposed project identified in this Facility Plan will have no impact upon the endangered or threatened species in the South Central Regional service area. A



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 PHONE: 386.761.6810

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**FIGURE 6
 FLOOD ZONES**

full list of Florida's federally listed species can be found at: <http://www.freshfromflorida.com/Divisions-Offices/Florida-Forest-Service/Our-Forests/Forest-Health/Florida-Statewide-Endangered-and-Threatened-Plant-Conservation-Program/Florida-s-Federally-Listed-Plant-Species>.

The proposed project is wholly within the U.S. Fish and Wildlife Service (FWS) consultation area for the Audubon's Crested Caracara (*Polyborus plancus audubonii*). A species specific survey was conducted by the Brevard County Natural Resource Management Department. Only one active nesting pair was located over the course of the study. However, it is Brevard County's opinion that the proposed infrastructure development will have No Effect on Audubon's Crested Caracara. This survey performed for the proposed project area is included as Appendix C.

Endangered and threatened animal species and species of special concern associated with the Saltwater Marshes include the Little Blue Heron, Tricolored Heron, Snowy Egret, Brown Pelican, Reddish Egret, and American Alligator. A full list of the FWC's listed species may be viewed by visiting FWC website at: <http://myfwc.com/wildlifehabitats/imperiled/profiles/>. Many of these listed species can be found in areas nearby the proposed project; however, because the project construction areas are primarily within cleared existing project boundaries, there are no listed species that would be directed affected by the proposed project.

The following *Table 12 and Table 13* summarize wildlife found in Brevard County and the protection status of the species.

TABLE 12
Wildlife Found in Brevard County South Central Regional Service Area
Reptiles

Diamondback Terrapin	Leatherback Turtle	Coral Snake
Green Turtle	Anole	Southern Water Snake
Eastern Indigo Snake	Lizard	Scarlet King snake
Hawksbill Turtle	Eastern Diamondback	Atlantic Salt-marsh Snake
Banded Water Snake	Skinks	Soft-shell Turtle

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Alligator	Legless Lizard	Garter Snake
Atlantic Loggerhead Turtle	Cottonmouth	Rat Snake

Fishes

Atlantic Stingray	Silver Perch	Striped Mullet
Sea Catfish	Leatherjacket	Lemon Shark
Rainwater Killifish	Lined Sole	Ladyfish
Sailfin Molly	Chain Pipefish	Striped Anchovy
Gray Snapper	Irish Pompano	Pigfish
White Mullet	Code Goby	Mojarra
Bull Shark	Darter Goby	Southern Kingfish
Scaled Sardine	Gulf Flounder	Red Drum
Gulf Pipefish	Striped Burrfish	Mosquito Fish
Silver Jenny	Atlantic Thread Herring	Spot
Spotted Sea Trout	Atlantic Menhaden	Permit
Black Drum	Cownose Ray	Tidewater Silverside
Pin Fish	Gulf Killifish	Jack Crevalle
Great Barracuda	Sheepshead	Gulf Pipefish
Clown Goby	Snook	Bay Whiff
Bighead Searobin	Gafftopsail Catfish	Yellowfin Menhaden
Southern Puffer		

Invertebrates

Pink Shrimp	Stone Crab	Blue Crab
Spiny Lobster	Mangrove Tree Crab	Fiddler Crab
Oysters	Shrimp	Snails
Mosquitoes	Quahog Clam	

**TABLE 13
PROTECTION STATUS OF
WILDLIFE FOUND IN BREVARD COUNTY**

Common Name	Status
Florida Mink	Species of special concern
Round Tailed Muskrat	UR2
Florida Mouse	UR2
Fox Squirrel	Species of special concern
West Indian Manatee	UR2
American Alligator	Species of special concern

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Common Name	Status
Atlantic Loggerhead Turtle	UR2
Atlantic Green Turtle	UR2
Leatherneck Turtle	Species of special concern
Atlantic Hawksbill Turtle	Threatened
Atlantic Ridley Turtle	Endangered
Atlantic Saltmarsh Snake	Endangered
Roseate Spoonbill	Endangered
Little Blue Heron	Endangered
Reddish Egret	Threatened
Snowy Egret	Species of special concern
Louisiana Heron	Species of special concern
Peregrin Falcon	Special of special concern
Southern Kestral	UR2
American Oyster Catcher	Threatened
Southern Bald Eagle	Species of special concern
Wood Stork	Endangered
Osprey	Threatened, UR2
Brown Pelican	Species of special concern
Llleast Tern	Endangered
Roseate Tern	Endangered
Coastal Vervain	Species of special concern
Sea Lavender	Species of special concern
Prickly Pear	Threatened
Common Snook	Species of special concern
Rivulus	Species of special concern
Crested Caracara	Threatened

Key: UR1 Under review for federal listing, with substantial evidence indicating at least some degree of biological vulnerability and/or threat.

UR2 Under review for listing, but substantial evidence of biological vulnerability and/or threat is lacking.

Source: Florida Natural Areas Inventory, 1998

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Section 4

4. Selected Alternative

4.1. Wastewater Treatment Facility Modifications

4.1.1. Capacity

The wastewater treatment facility is designed to treat 5.5 MGD; this capacity will be expanded by 6.0 MGD with upgraded aerators currently under construction. This project will expand the treatment capacity to 9.0 MGD with construction of a new 3.0 MGD process train. Future build out capacity of the facility is 12.0 MGD. The process train will be designed and permitted as a 6.0 MGD expansion; the new process train will consist of a biological nutrient removal (BNR) process, and new filters designed as (2) identical 3.0 MGD process trains (trains 3+4).

For budgetary purposes, the plans and specifications will be formatted to allow for construction of one or both of the BNR's, filters and associated equipment. The pretreatment structure, clarifiers, RAS/WAS pumping, chlorine contact, reclaimed water and sludge handling facilities will be designed to accommodate the total additional 6.0 MGD of flow. The average day, peak month and peak hour flows for the proposed treatment plant improvements are listed below:

Average Daily Flow (ADF) = 6.0 MGD

Peak Month Flow (PMF) = 1.2 (6.0)
= 7.2 MGD

Peak Hour Flow (PHF) = 2.0 (6.0)
= 12.0 MGD

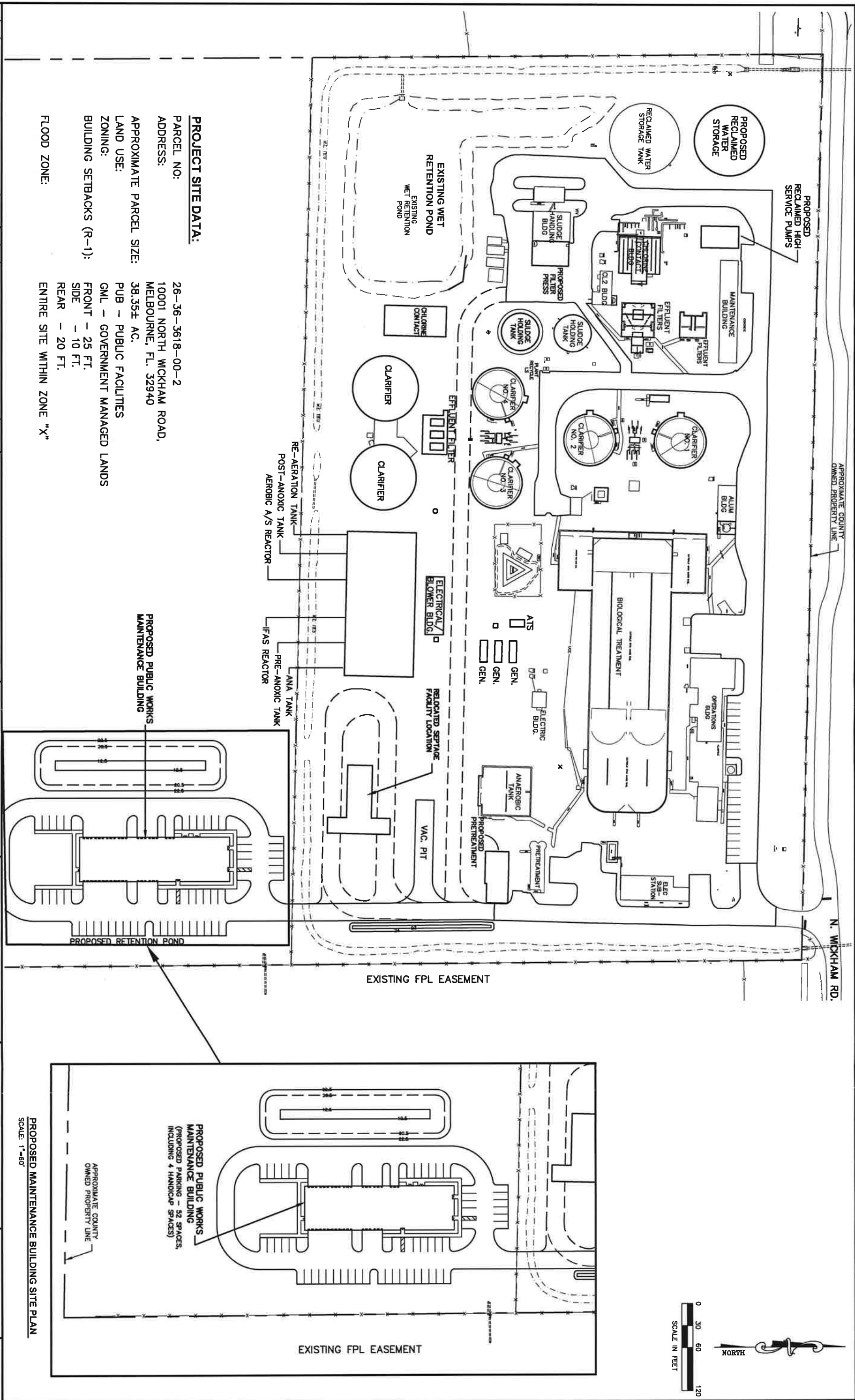
4.1.2. Process Design

The SCRWWTF utilizes biological nutrient removal for wastewater treatment to meet Advanced Wastewater Treatment (AWT) criteria. The current process is a 5-stage Oxidation Ditch process that will remain largely unchanged. The new process train will be a Moving Bed Bioreactor (MBBR) Integrated Fixed Film Activated Sludge (IFAS) process. Tertiary filtration is provided to reduce total suspended solids. A proposed site plan and hydraulic profile are provided as **Figures 7, 8 and 9**, respectively. The Hydraulic profile provides for gravity flow from the new pretreatment structure through the proposed chlorine contact chamber. Transfer pumps in the new chlorine contact chamber will transfer reclaimed water to the reclaimed water storage tanks. There is currently a single 1 MG ground storage tank. A second, identical tank is proposed.

4.1.3. Pretreatment Structure

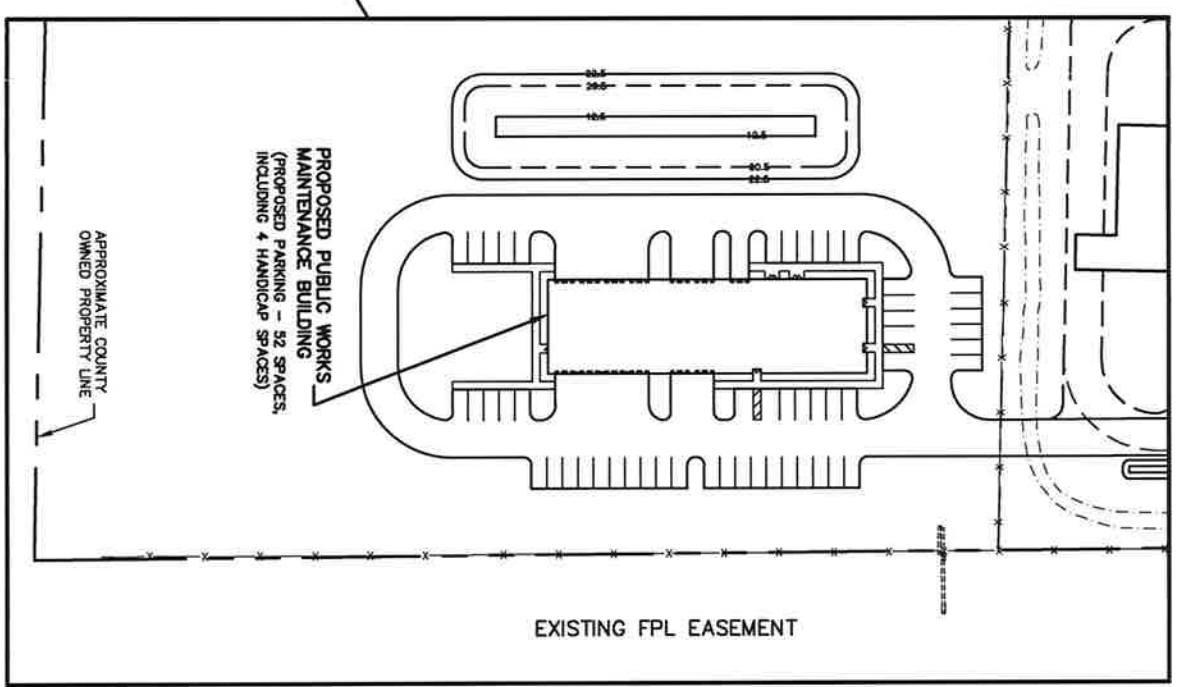
Raw sewage flows from the sewage collection/transmission network via lift stations and force mains into the existing pre-treatment structure. A new pre-treatment structure will be constructed adjacent to the existing; the existing structure will be demolished. The design capacity of the proposed structure is 12.0 MGD AADF and 24.0 MGD PHF. The following devices will be installed in the new structure:

- (2) self-cleaning, 3.0 mm 'Stepscreen' barscreens with compactors
- (2) centrifugal grit separators and (2) grit classifiers
- (2) 1.0 mm rotary drum fine screens



PROJECT SITE DATA:

PARCEL NO: 26-36-3618-00-2
 ADDRESS: 10001 NORTH WICKHAM ROAD, MELBOURNE, FL. 32940
 APPROXIMATE PARCEL SIZE: 38.35± AC.
 LAND USE: PUB - PUBLIC FACILITIES
 ZONING: GML - GOVERNMENT MANAGED LANDS
 BUILDING SETBACKS (R-1):
 FRONT - 25 FT.
 SIDE - 10 FT.
 REAR - 20 FT.
 FLOOD ZONE: ENTIRE SITE WITHIN ZONE "X"

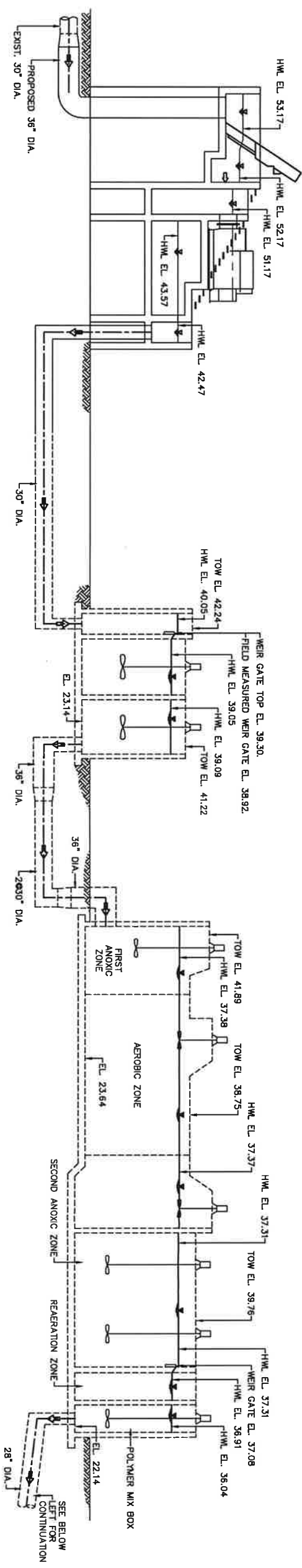


NO. BY	REVISIONS	DATE	NO. BY	REVISIONS	DATE
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COUNTY OF BREVARD FLORIDA			SOUTH CENTRAL REGIONAL WWTF EXPANSION PROJECT NO. BC17		
PROPOSED MAINTENANCE BUILDING SITE PLAN SCALE: 1"=60' DRAWN BY: QJH			BRADLEY T. BLAIS, P.E. FLORIDA REGISTRATION 47130		
Figure NO. FIGURE 7					

PRETREATMENT

ANAEROBIC TANKS

FIRST ANOXIC/AEROBIC/SECOND ANOXIC/REAERATION TANKS



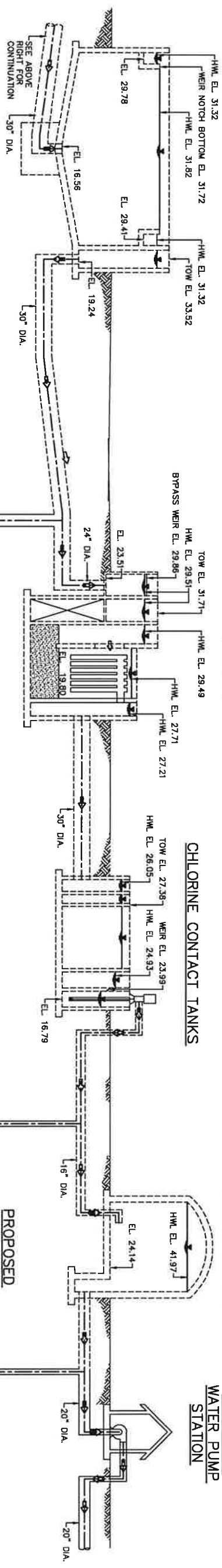
CLARIFIERS 1 & 2

FILTERS

CHLORINE CONTACT TANKS

EXISTING RECLAIMED WATER STORAGE TANK

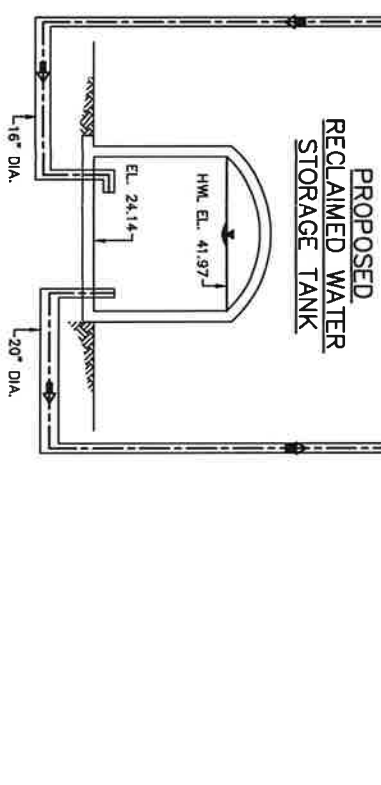
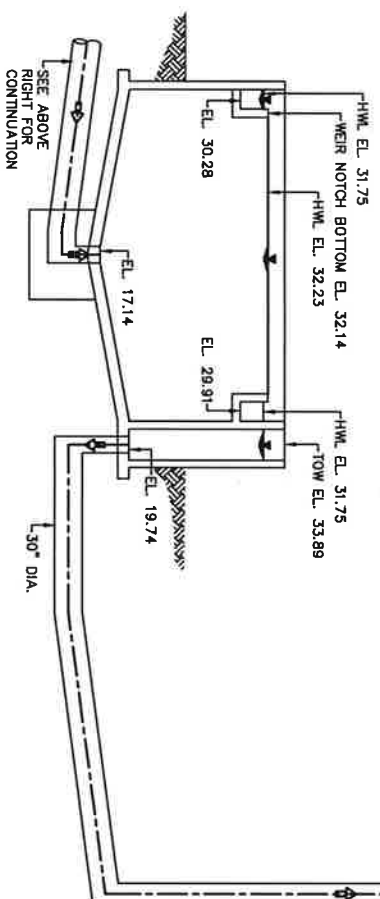
PROPOSED RECLAIMED WATER PUMP STATION



CLARIFIERS 3 & 4

- NOTES:**
1. ALL VERTICAL ELEVATIONS SHOWN HERE REFERENCE NORTH AMERICAN VERTICAL DATUM (NAVD) OF 1988.
 2. HWL ELEVATIONS ARE BASED ON 24MGD PEAK DAY FLOW (12MGD/PROCESS TRAIN)

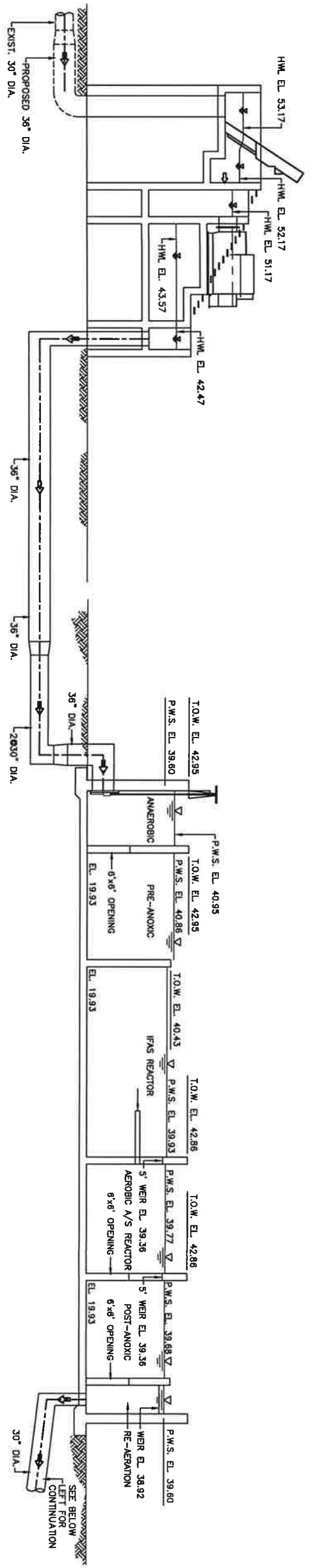
LEGEND:



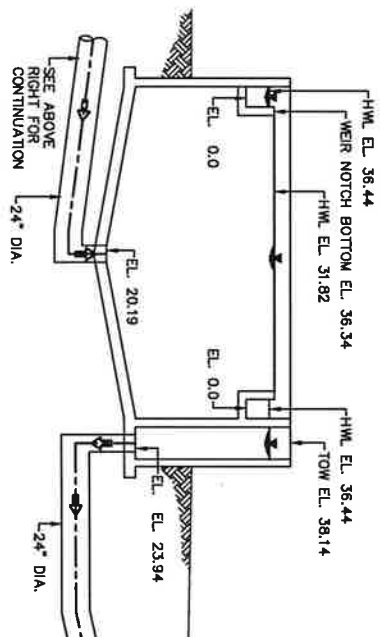
NO.	BY	REVISIONS	DATE	NO.	BY	REVISIONS	DATE	QUENTIN L. HAMPDEN ASSOCIATES, INC. CONSULTING ENGINEERS FLORIDA CERTIFICATE OF AUTHORIZATION NO. 658 PHONE: (904) 761-9810 FAX: (904) 741-3977 P.O. DRAWER 290247, PORT ORANGE, FL 32128-0247	COUNTY OF BREVARD FLORIDA	SOUTH CENTRAL REGIONAL WWTF EXPANSION	PROJECT NO. BC17	PROPOSED HYDRAULIC PROFILE PLANTS 1 & 2	BROADLEY T. BLAIS, P.E. FLORIDA CERTIFICATION #47730	SHEET NO. FIGURE 8 OF
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PRETREATMENT

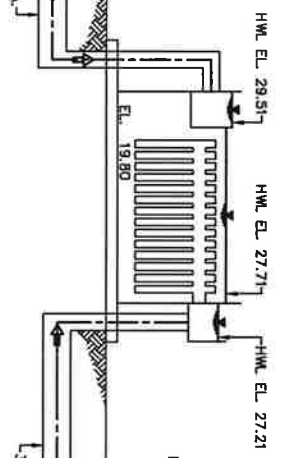
FIRST ANOXIC/AEROBIC/SECOND ANOXIC/REAERATION TANKS



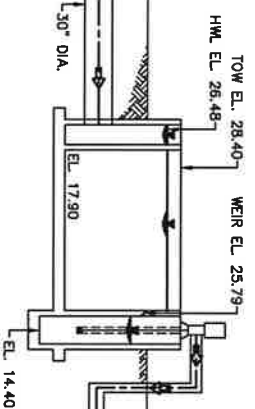
CLARIFIERS 5 & 6



FILTERS

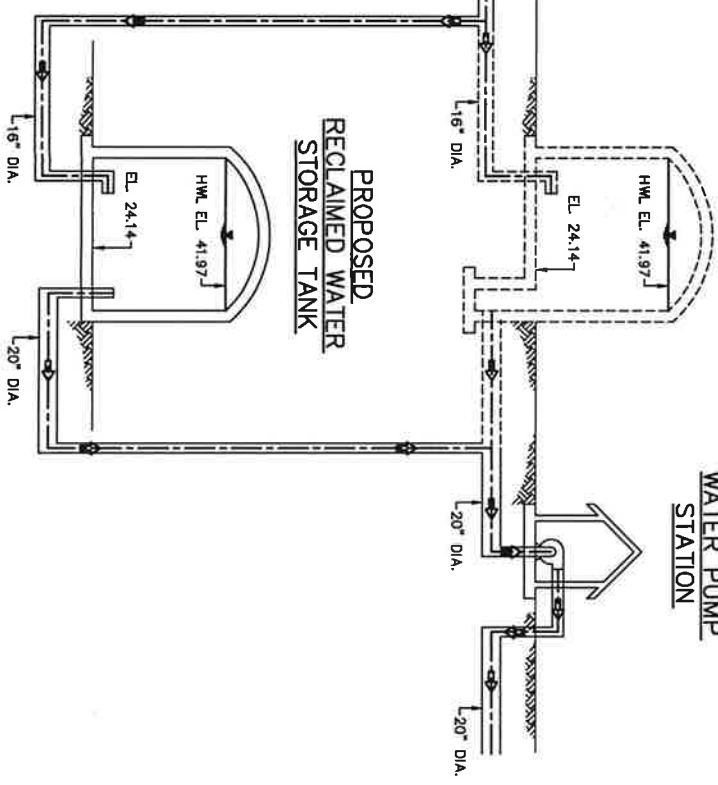


CHLORINE CONTACT TANKS



EXISTING RECLAIMED WATER STORAGE TANK

PROPOSED RECLAIMED WATER PUMP STATION



- NOTES:
1. ALL VERTICAL ELEVATIONS SHOWN HERE REFERENCE NORTH AMERICAN VERTICAL DATUM (NAVD) OF 1988.
 2. H.W.L. ELEVATIONS ARE BASED ON 24MGD PEAK DAY FLOW (12MGD/PROCESS TRAIN)

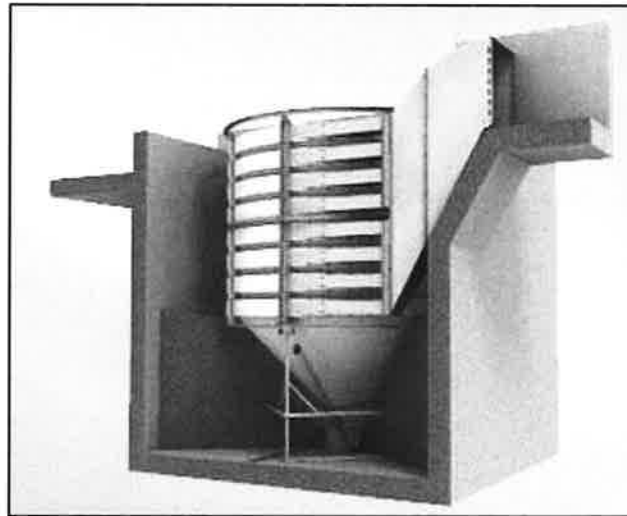
LEGEND:
 - - - - - PROPOSED
 - - - - - EXISTING

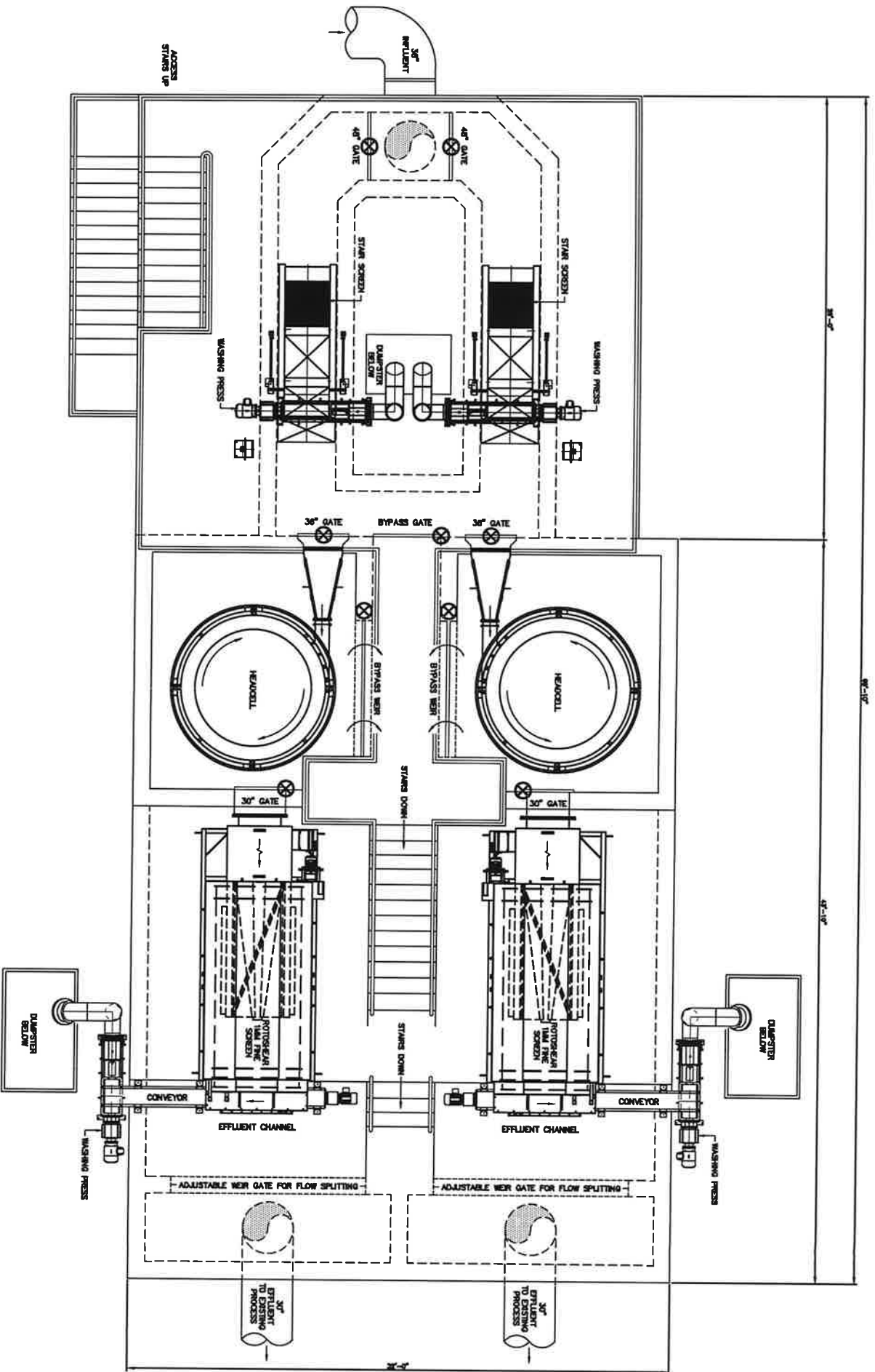
NO.		BY		REVISIONS		DATE		NO.		BY		REVISIONS		DATE	
<p>QUENTIN L. HAMPTON ASSOCIATES, INC. CONSULTING ENGINEERS FLORIDA CERTIFICATE OF AUTHORIZATION NO. 826 P.O. DRAWER 289247, PORT ORANGE, FL 32129-0247 PHONE: (386) 761-8810 FAX: (386) 761-2977</p>															
COUNTY OF BREVARD FLORIDA				SOUTH CENTRAL REGIONAL WWTFF EXPANSION				PROJECT NO. BC17				PROPOSED HYDRAULIC PROFILE PLANTS 3 & 4			
SHEET NO.												FIGURE 9			
DRAWN BY: ADK												BRADLEY T. BLAIS, P.E. FLORIDA #47130			

Figure 10 depicts the proposed structure and the layout of the proposed equipment. Flow enters (2) 3'-6" wide channels via a 36" diameter influent pipe. Gates in each channel allow each side to be isolated for routine maintenance. Each channel has a 42" wide stepscreen, depicted below. The basis of design information for each screen is as follows:

DEVICE	STEPSCREEN	COMPACTOR
MNFTR.	VULCAN	VULCAN
MODEL #	ESR-23	EWP 250/600
DIMENSIONS	42"w x 72"D	24"L x 10"W
PEAK 'Q'	12.0 MGD	n/a

Grit removal will be accomplished via (2) centrifugal grit separators. Each unit has a peak design flow of 6.0 mg at AADF and 12.0 MGD PHF. They will each consist of (12) 9' diameter nested trays with 764 FT² of total settling surface area. At a peak flow of 12.0 MGD, the loading rate will be 10.9 GPM/FT². The basis of design Headcell device is depicted below.





PRETREATMENT STRUCTURE PLAN
SCALE: 1/4" = 1'-0"

NO.	BY	DATE	NO.	BY	DATE

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COUNTY OF
BREVARD
FLORIDA

SOUTH CENTRAL
REGIONAL WWTF
EXPANSION
PROJECT NO. BC17

PRETREATMENT
STRUCTURE PLAN

BRADLEY I. BLAIS, P.E.
FLORIDA REGISTRATION
#47130

SHEET NO.
FIGURE 10

The basis of design for the fine screening will be two 'Rotoshear' fine screens. Flow from each grit separator will enter the fine screen and the majority of all inorganic material will be removed by the 1.0 mm screens. Screened sewage flows through the screens and drops into a chamber below. The chamber will include flow splitting gates to direct sewage to either the existing oxidation ditch process or the proposed IFAS process. Each side is metered separately. An adjustable bypass weir will be constructed downstream of the grit separator that will allow flow to automatically 'pop off' if the fine screens become blinded or must be bypassed. The weir will discharge into the chamber under each screen.

4.1.4. Biological Process (Bardenpho Existing)

The existing biological units carry out nutrient removal with a 5-stage Bardenpho process. There are two parallel process trains each with fermentation, pre-anoxic, oxic, post-anoxic and re-aeration. The existing aerators are being upgraded for a total installed horsepower of 600. Calculations discussed below substantiate an increased permitted capacity of 6.0 MGD AADF. The mechanical mixing equipment will be replaced during this project; a list of replacement equipment, biological basins design conditions and calculated process design values are shown below:

Replacement Equipment

- (4) Fermentation Mixers (7.5 HP)
- (4) 1st Anoxic Mixers (15 HP)
- (4) 2nd Anoxic Mixers (15 HP)

**Table 14
Existing Bardenpho Process
Biological Basins Design Conditions**

Design Parameter	Design Value	Design Effluent *
Flow (MGD)	6.00	-
BOD - Biochemical Oxygen Demand (mg/L)	300	5
TSS - Total Suspended Solids (mg/L)	300	5
TKN - Total Kjeldahl Nitrogen (mg/L)	55	2.0
NH3-N - Ammonia Nitrogen (mg/L)	-	1.0
NO3-N - Nitrate Nitrogen (mg/L)	-	1.0
TN - Total Nitrogen (mg/L)	-	3.0
TP - Total Phosphorus (mg/L)	5	1.0

*after filtration

**Table 15
Existing Bardenpho
Process Calculation Values**

Design Parameter	Design Value Required	Existing Value
Aeration Carrousel Volume (MG)	2.887	2 @ 1.45 MG = 2.9 MG
Aeration Power Required (HP)	576	4 @ 150 HP = 600 HP
First Anoxic Volume (MG)	0.961	2 @ 0.48 MG = 0.96 MG
Second Anoxic Volume (MG)	0.713	2 @ 0.36 = 0.72 MG
Re-Aeration Volume (MG)	0.163	2 @ 0.08 = 0.16 MG

4.1.5. Biological Process (IFAS)

The proposed 6.0 MGD IFAS process will consist of the following treatment zones: anaerobic, pre-anoxic, aerobic IFAS reactor, aerobic activated sludge, post-anoxic and re-aeration zone. The design effluent quality is ≤ 5 mg/l soluble CBOD, ≤ 3 mg/l TN, ≤ 1 mg/l

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NH₃-N and <1 mg/l TP. Detailed design information is included as B, the required tank volumes, IR and RAS pumping rates and aeration requirements are detailed below.

Basin volumes were established based on biological calculations and the proposed tankage was sized to accommodate the prescribed residence times. Tank side water depth was set at 20 FT to accommodate the existing site and WWTP hydraulic profile. Tank volumes are shown below:

**Table 16
Proposed IFAS Process
Tank Volumes**

Treatment Zone	Dimensions	Total Volume FT ³
Anaerobic Selector	(2) 19ft x 45ft x 20ft	33,800
Pre-Anoxic Reactor	(2) 46ft x 45ft x 20ft	83,250
Aerobic IFAS Reactor	(2) 40ft x 45ft x 20ft	72,000
Aerobic Activated Sludge Reactor	(2) 40ft x 45ft x 20ft	72,000
Post-Anoxic Reactor	(2) 38ft x 45ft x 20ft	67,500
Re-Aeration Reactor	(2) 7.5ft x 45ft x 20ft	13,500
TOTAL BASIN VOLUME		342,050

Internal recycle (IR) will be pumped from the aerobic activated sludge reactor back to the pre-anoxic reactor. Per the process design, these pumps are capable of recycling 600% of the design ADF of 6.0 MGD. Therefore the two (2) wall pumps/train will have a combined capacity of 36.0 MGD. Each of the four (4) 7.5 HP Internal Recycle pumps are capable of pumping 6,250 GPM at 2.0 FT TDH.

The overall air requirement for the aerobic basins and re-aeration was calculated to be 5,300 SCFM at 9.8 psig at the top of each basin, (see Appendix B for detailed process calculations). This project will install three (3) turbo blowers to meet the processes air

requirement. Turbo blowers were selected based on energy efficiency and turndown ability with the 20 FT tank side water depth. The three (3) blowers will consist of two duty blowers and one standby. Each of (3) 150 HP blowers has a rated capacity of 2,650 SCFM at 9.8 psig.

4.1.6. Secondary Clarifiers

The existing process is served by four (4) 70 FT diameter clarifiers. The overflow rate at the new rated capacity of 6.0 MGD AADF is approximately 390 GPD/FT². Existing clarifier surface area is provided for the new rated capacity.

Solids separation for the IFAS process will be provided via sedimentation in two (2) 90 FT diameter clarifiers. Each clarifier is designed to handle 3.0 MGD (AADF). The overflow rate at design flow is approximately 470 GPD/FT², which remains within practical design range of 400-600 GPD/FT².

Two (2) 90 FT diameter pre-stressed, composite concrete tanks with a side water depth of 12'-6" are proposed for this project. The clarifier floor will be sloped at 1:12 and the center pier depth is approximately 16' deep. A baffled center stilling well design with a spiral blade collection mechanism is proposed. A center connection pipe will collect return activated sludge (RAS) and waste activated sludge (WAS) from both clarifiers. A single 24" header will serve (3) RAS pumps and (2) WAS pumps. The proposed clarifier plan is included herein as **Figure 11**. Perimeter walkways and weir covers will be included as part of this project. The perimeter walkways provide ease of access to all sections of the clarifier and the weir covers virtually eliminate ongoing maintenance associated with removing algae from weirs.

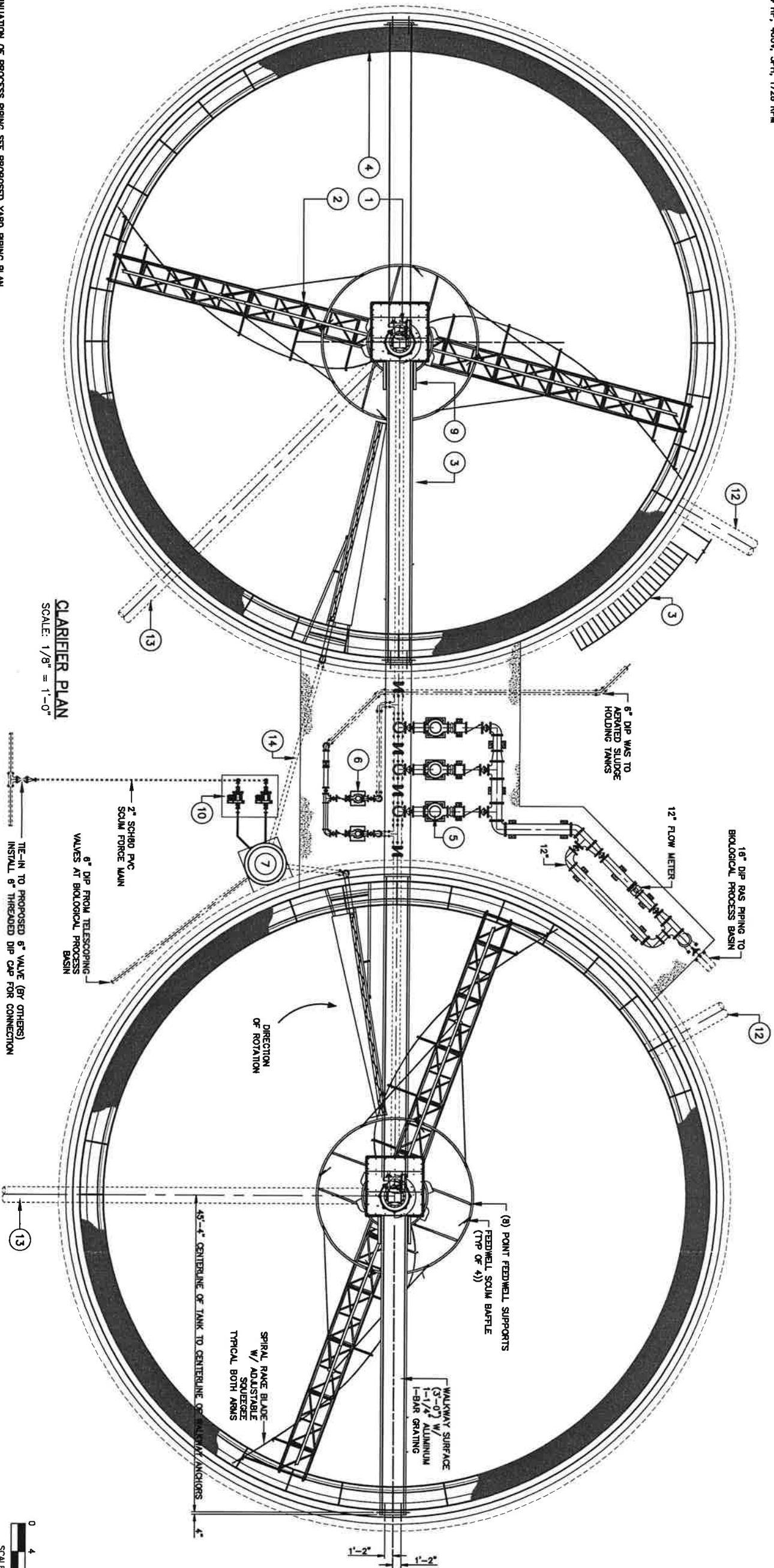
New RAS and WAS pumps will be installed to serve the proposed clarifiers. The biological treatment calculations require a return sludge flow rate equal to 100% influent flows, 6.0 MGD. The two (2) new clarifiers will share common RAS and WAS suction headers to feed

- 1 PROVIDE AND INSTALL CLARIFIER MECHANISMS (TYP OF 2) SPIRAL BLADE DESIGN RAKE ARMS, STILLING WELLS, CENTER PIERS, WALKWAYS, SCUM BOXES, DRIVE MECHANISM, ETC.
- 2 CLARIFIER DRIVE MECHANISMS (TYP OF 2) QVAO MODEL, COART 3/4 HP, 480V, 3PH DRIVE MOTOR
- 3 PROVIDE AND INSTALL ALUMINUM ACCESS STAIRS, ELEVATED WALKWAYS, ETC. AS DETAILED ON SHEETS M_____
- 4 PROVIDE AND INSTALL NERCO WEIR COVER SYSTEM. SEE DETAILS SHEET M_____
- 5 RAS PUMPS (TYP OF 2) GRUNDOS MODEL, S140.A50.134.4.50L.C.204.G.N.D. 13.4 HP, 480V, 3PH, 1728 RPM

- 6 WAS PUMPS (TYP OF 2) GRUNDOS MODEL, SE165.A120.270.6.52E.D.N.81G 26.8 HP, 480V, 3PH, 1153 RPM
- 7 SCUM LIFT STATION GRUNDOS _____ SEE DETAILS SHEET M_____
- 8 12" MAGNETIC FLOW METER FOR RAS PIPE
- 9 2" SCH80 PVC RECLAIMED WATER LINE WITH HOSE RACK, SPRIGOT, AND SCUM SPRAY. SUPPLY FROM _____ RECLAIMED WATER MAIN. SEE YARD PIPING PLAN AND SHT _____ FOR DETAILS.

- 10 SCUM PUMPS (TYP OF 2) RAIN VALLET MODEL # 200SK08 40 GPM AT 60' TDH
- 11 6" PVC SCUM DRAIN TO LIFT STATION
- 12 24" DIP CLARIFIER EFFLUENT TO FILTRATION
- 13 24" DIP CLARIFIER INFLUENT FROM BIOLOGICAL PROCESS

- 14 6" DIP SLUDGE COLLECTION PIPING
- 15 CONCRETE ENCASUREMENT
- 16 2" REUSE WATER FOR WASHDOWN



CLARIFIER PLAN
SCALE: 1/8" = 1'-0"



- NOTES:
1. FOR CONTINUATION OF PROCESS PIPING SEE PROPOSED YARD PIPING PLAN.
 2. INFLUENT AND SLUDGE COLLECTION PIPING TO BE CONCRETE ENCASED UNDER CLARIFIER SLAB AREA.

NO.	BY	REVISIONS	DATE	NO.	BY	REVISIONS	DATE				
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<p>COUNTY OF BREVARD FLORIDA</p>				<p>SOUTH CENTRAL REGIONAL WWTF EXPANSION</p>				<p>CLARIFIER PLAN</p>			
<p>PROJECT NO. BC17</p>											
<p>DRAWN BY: ADK</p>											
<p>BROUDLEY T. BLAIS, P.E. FLORIDA #77120</p>											
<p>SHEET NO. FIGURE 11 OF</p>											

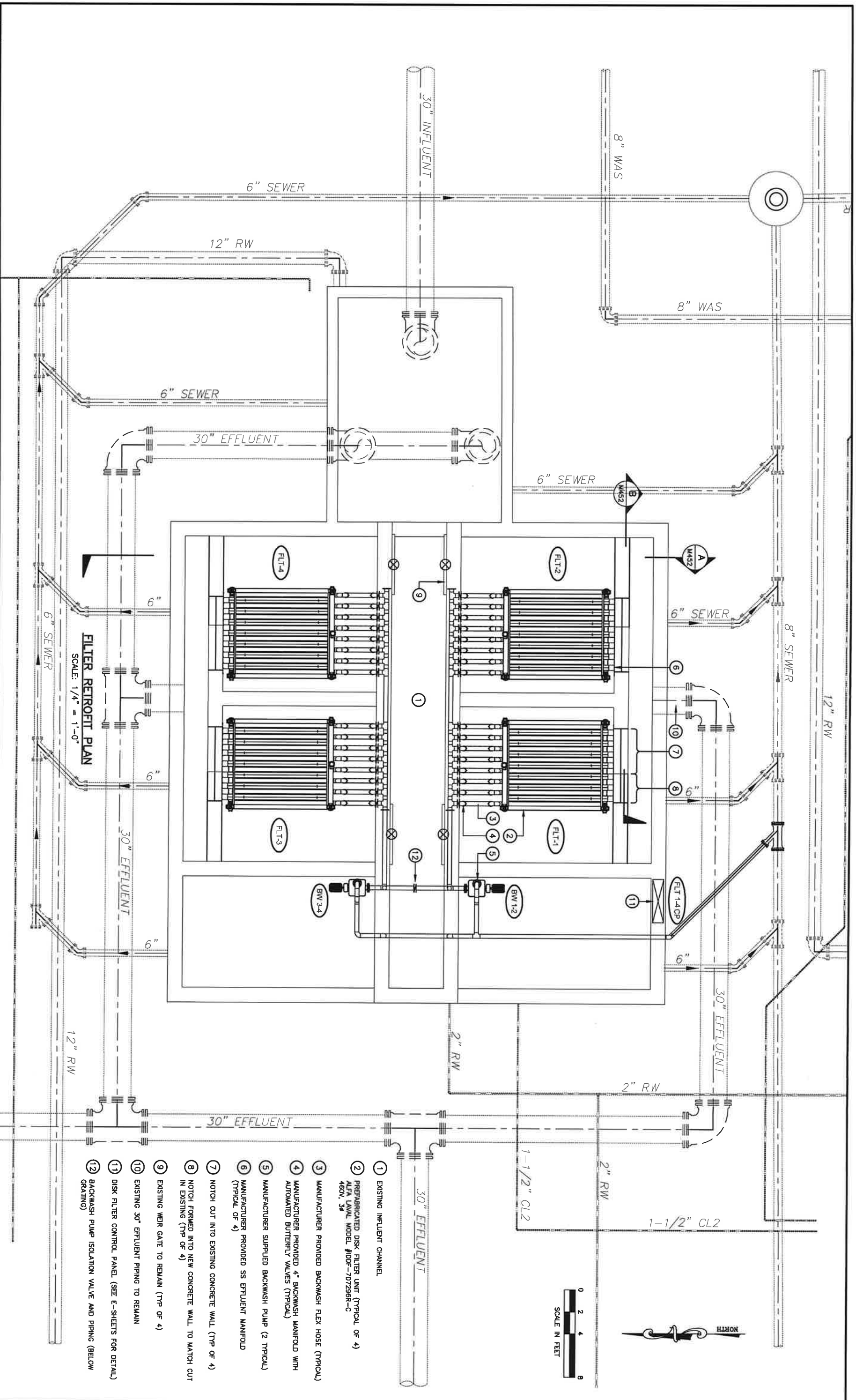
a common pumping station. The pumping station will consist of three (3) RAS and two (2) WAS pumps. In order to meet this pumping requirement with one pump out of service, the RAS pumps must have a capacity greater than 2,100 GPM. The RAS pumps will be dry pit submersible pumps each capable of pumping 2,400 GPM @ 16 FT TDH. The WAS pumping requirement was calculated as part of the biological design to be 250 GPM @ 22 FT TDH. Technical data for the proposed basis of design pumps is detailed below.

**Table 17
Secondary Clarifiers
Basis of Design Pumps**

	RAS PUMPS	WAS PUMPS
MANFTR.	Grundfos	Grundfos
MODEL #	98249182	97632002
CAPACITY (GPM)	2,100	640
HEAD (FT)	20	32
POWER (Hp)	26.8	13.4
INLET (inches)	12"	6"
DISCHARGE (inches)	12"	5"

4.1.7. Filtration

The basis of design for the existing sand filter basins will be Alfa Laval (model no: IDDF 7D7296R-C). Four (4) of the six (6) filter cells in the existing 'south' Dynasand filter structure will be retrofit to accommodate disk filters, the remaining will be abandoned. The 'north' filter structure will be demolished as part of the project. Each disk filter basin is designed to treat an average daily flow of 1.5 MGD. The proposed IFAS process train will be served by three (3) 2.0 MGD disk filters in freestanding stainless steel tanks. The proposed existing filter retrofit plan is included herein as **Figure 12**.



- ① EXISTING INFLUENT CHANNEL
- ② PREFABRICATED DISK FILTER UNIT (TYPICAL OF 4)
ALFA LVAL MODEL #100F-707296R-C
460V, 58
- ③ MANUFACTURER PROVIDED BACKWASH FLEX HOSE (TYPICAL)
- ④ MANUFACTURER PROVIDED 4" BACKWASH MANIFOLD WITH
AUTOMATED BUTTERFLY VALVES (TYPICAL)
- ⑤ MANUFACTURER SUPPLIED BACKWASH PUMP (2 TYPICAL)
- ⑥ MANUFACTURER PROVIDED SS EFFLUENT MANIFOLD
(TYPICAL OF 4)
- ⑦ NOTCH CUT INTO EXISTING CONCRETE WALL (TYP OF 4)
- ⑧ NOTCH FORMED INTO NEW CONCRETE WALL TO MATCH CUT
IN EXISTING (TYP OF 4)
- ⑨ EXISTING WEIR GATE TO REMAIN (TYP OF 4)
- ⑩ EXISTING 30" EFFLUENT PIPING TO REMAIN
- ⑪ DISK FILTER CONTROL PANEL (SEE E-SHEETS FOR DETAIL)
- ⑫ BACKWASH PUMP ISOLATION VALVE AND PIPING (BELOW
GRATING)

FILTER RETROFIT PLAN
SCALE: 1/4" = 1'-0"

NO.	BY	REVISIONS	DATE	NO.	BY	REVISIONS	DATE
QUENTIN I. HAMPTON ASSOCIATES, INC. CONSULTING ENGINEERS FLORIDA CERTIFICATE OF AUTHORIZATION NO. 928 P.O. DRAWER 280247, PORT ORANGE, FL 32128-0247 PHONE: (386) 761-9610 FAX: (386) 761-3977							
COUNTY OF BREVARD FLORIDA				SOUTH CENTRAL REGIONAL WWTF EXPANSION PROJECT NO. BC17			
SHEET NO. FIGURE 12 OF				DRAWN BY: JAK BRADLEY T. BLAIS, P.E. FLORIDA REGISTRATION #7130			

Influent flow enters the existing filter basins or new stainless steel tanks over the influent weir. As process water passes from outside the disk to inside, through the woven cloth filter media. Solids are retained on the outside of the disks while filtered water flows through the disk to the effluent trough. Filter backwash is accomplished one disk at a time with a by a vacuum header raising and lowering on both sides of the disk to remove solids from the filter media. Each filter basin will have five disk units with each disk having two faces with 6'x8' filter cloths. The design specifications allow a maximum peak loading rate of 6 GPM/FT². The following calculations illustrate filter capacity:

Existing Process Train

Filter Surface Area = 96ft²/disk (5 disks/filter) (4 filters) = 1,920 ft²

1.5 MGD (ADF) per filter (4 filters) = 6.0 MGD (ADF)

6.0 MGD = 4,167 GPM

Flux at ADF = 4,167 GPM / 1,920 ft² = 2.17 GPM/ft²

Peak Hour Flow = 6.0 MGD (2.0 PF) = 12.0 MGD (PF)

12.0 MGD = 8,333 GPM

Flux at PHF = 8,333 GPM / 1,920 ft² = 4.34 GPM/ft²

Proposed IFAS Train

Filter Surface Area = 96ft²/disk (7 disks/filter) (3 filters) = 2,016 ft²

2 MGD (ADF) per filter (3 filters) = 6.0 MGD (ADF)

6.0 MGD = 4,167 GPM

Flux at ADF = 4,167 GPM / 2,016 ft² = 2.07 GPM/ft²

Peak Hour Flow = 6.0 MGD (2.0 PF) = 12.0 MGD (PF)

12.0 MGD = 8,333 GPM

Flux at PHF = 8,333 GPM / 2,016 ft² = 4.13 GPM/ft²

4.1.8. Disinfection

Disinfection for the existing process trains is provided in the chlorine contact chamber. A new chlorine contact chamber is proposed to serve the IFAS process train. The existing chlorine contact will remain unchanged other than pumping upgrades discussed further in the reclaimed water section of this report.

The existing CCC has a basin volume of 134,640 gallons which provides 16 min contact time at a peak flow rate of 12 MGD. This is greater than the 15 min required by FDEP. Therefore, the new rating of the existing process train of 6.0 MGD AADF is met.

A new chlorine contact chamber will be constructed to serve the proposed IFAS process train. The new CCC will consist of an influent chamber for chemical addition and two (2) flow channels for disinfection. The total basin volume is 125,000 gallons which provides 15 min contact time at a peak flow rate of 12 MGD.

The new CCC will include three (3) transfer pumps sized to convey peak flows to the reclaimed water storage tanks or other disposal facilities utilized by the WWTP. These pumps have a primary design point of 4,200 GPM @ 35 FT TDH. Pumps will be float operated and discharge to the disposal facilities via 24" piping. Technical data for the proposed basis of design pumps is detailed below.

Table 18
Basis of Design Transfer Pumps
Detail

	TRANSFER PUMPS
MANFTR.	Peerless
MODEL #	18HH
CAPACITY (GPM)	4,200

	TRANSFER PUMPS
HEAD (FT)	35
POWER (Hp)	47
COLUMN (inches)	14"
DISCHARGE (inches)	14"

4.1.9. Residuals Management

The project includes installing a second aerated sludge holding tank adjacent to the existing. The proposed tank will match existing dimensions with a 50 ft diameter and 11'-6" sidewater depth. Both the existing and proposed digesters will have new submersible mixer aerators installed which will be served by two (2) positive displacement blowers. The existing and proposed digester volumes are shown below:

Existing Digester Volume 50 ft diameter @ 11.5 ft depth = 169,000 gal
Proposed Digester Volume 50 ft diameter @ 11.5 ft depth = 169,000 gal
Total Digester Volume = 338,000 gal

Sludge will be mixed and aerated with a proposed hyperboloid mixer and air ring beneath. The existing air diffusers will be removed. This system provides the mixing energy for the basin with the mechanical mixer and greatly reduces the air requirement that is needed for the aerated environment only. Two (2) 7.5 HP positive displacement blowers are proposed. Each blower is capable of providing up to 1,400 SCFM to the mixer aerator. The basis of design for mixer aerator is aquatorbo and blowers are universal blower pac.

Aerated sludge is pumped to the belt press building which consists of two (2) existing 2m belt presses. This project will expand the existing building to add one (1) additional belt press for a total of three (3). The belt presses dewater sludge to approximately 14-16%, dewatered sludge is hauled by truck to the Brevard County landfill for disposal.

4.1.10. Effluent Disposal Facilities

The current reclaimed water system consists of one (1) existing 1.0 MG reclaimed water ground storage tank (GST) and two (2) reuse pump stations. A small 'in-plant' process pump station and a high service pump station. This project will add an additional 1.0 MG GST adjacent to the existing with a 95ft diameter and 18ft storage height. The design will match the existing tank dimensions and working elevations.

The existing vertical turbine high service pumps will be removed and the wet well will be demolished. All proposed high service distribution will be served from a new pump house. The existing 'in-plant' pump station will remain in service. The proposed high service pump station will have room for installation of five (5) high service pumps in the future. This project will install three (3) 4,200 GPM high service pumps and one (1) 2,100 GPM jockey pump. Firm capacity of the new pump station will be 10,500 GPM (15 MGD). The proposed pumps will be horizontal split case as detailed in the table below. Technical data for the proposed basis of design pumps is detailed below.

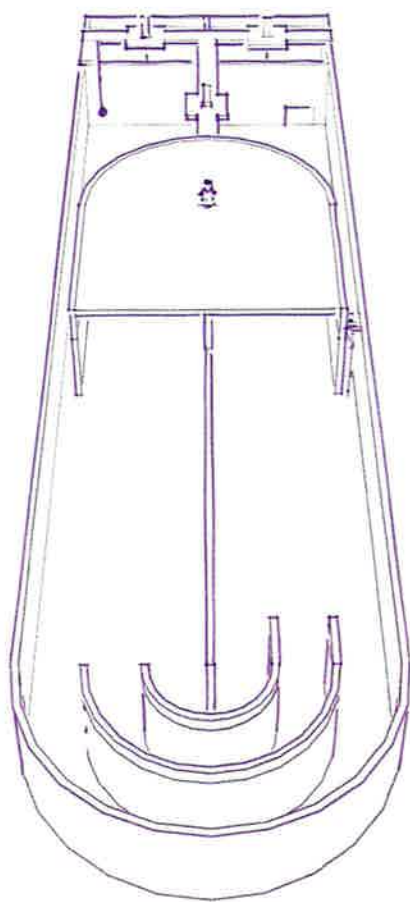
**Table 19
Effluent Disposal Facilities
Basis of Design Pumps**

	HIGH SERVICE PUMPS	JOCKEY PUMP
MANFTR.	Peerless	Peerless
MODEL #	8AE17A	6AE16
CAPACITY (GPM)	4,200	2,100
HEAD (FT)	175	175
POWER (Hp)	225	120
INLET (inches)	10"	8"
DISCHARGE (inches)	8"	6"

Effluent not distributed as reclaimed water will use the existing alternate disposal methods: reuse/reject storage ponds, RIBs, or wetland outfall. Transfer to these disposal methods will remain unchanged during this project.

Appendix A

QLH
*Brevard County SCRWWTF
Preliminary Design Report*



Carrousel® System Design Detail Package

For

Quentin L Hampton

And the

**Brevard County South Central WWTP,
Florida**

Provided on **December 15, 2014**

By

Ovivo USA, LLC

4246 Riverboat Road

Salt Lake City, Utah

84123

USA

www.ovivowater.com

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December 15, 2014

Brad T. Blais, P.E.
President
Quentin L. Hampton Associates, Inc.
4401 Eastport Pkwy
PO Drawer 290247
Port Orange, FL 32129

Subject: Brevard County South Central WWTP, Florida Carrousel® System Design Detail Package

Dear Brad,

We are pleased to provide you with this design detail package for the Brevard County South Central, Florida WWTP. The package is divided into four sections:

No	Title	Comments
1	Design Summary and Recommendations	The basis of our design recommendations and a summary of basin volume and equipment sizes.
2	Process Calculations	Detailed calculations we used to arrive at basin, weir and equipment sizing.
3	Critical Design Detail List	Details that we wish to highlight as critical components of the design. We suggest you go through these carefully, and contact us if you have any questions.
4	Carrousel® Basin Drawings	These are dimensioned drawings to facilitate preparation of your construction drawings. They are based on hydraulic modeling of your specific project (based on motor, impeller, gear box, basin depth, power turndown requirements, etc. selected for this project). These drawings are not transferable to other projects. You may find reason to alter some of our dimensions based on structural or site constraints— <u>please contact us to discuss alterations as soon as these become known.</u>

Ovivo provides this detailed design information for confidential use by you and your client. Given the ease of transferring information today, we appreciate your help in maintaining confidentiality. If you have any questions relating to this proposal, you may reach me at (801) 931-3242 (Mountain Time).

Ovivo USA, and I, personally, look forward to making this project a success for you and your client.

Sincerely,

Tom Leland, P.E.
Product Group Manager
Carrousel® Systems

SECTION 1

DESIGN SUMMARY AND RECOMMENDATIONS

Design Summary

Design Basis

The 5-Stage Bardenpho system described in this proposal has been designed to treat an influent wastewater flow of **3.000 MGD** with the following wastewater characteristics, in a flow sheet with no primary clarification.

Parameter	Influent	Effluent	Notes
Average Flow (MGD)	3.000	-	
BOD – Biochemical Oxygen Demand (mg/L)	250	5	
TSS – Total Suspended Solids (mg/L)	175	5	After filtration
TKN – Total Kjeldahl Nitrogen (mg/L)	55	2.0	
NH ₃ -N – Ammonia Nitrogen (mg/L)	-	1.0	
NO ₃ -N – Nitrate Nitrogen (mg/L)	-	1.0	
TN – Total Nitrogen (mg/L)	-	3.0	Includes est. refractory Org-N
TP – Total Phosphorus (mg/L)	7	1.0	May require chemical polishing

Design Criteria

Design Parameter	Design Value
Process SRT – Nitrification (days)	9.0
Minimum Wastewater Temperature (°C)	18.0
Maximum Wastewater Temperature (°C)	30.0
MLSS Concentration (mg/L)	4,000
Net Yield (lb TSS/lb BOD _{removed})	0.82
Oxygen Coefficient	
lb O ₂ / lb BOD _{removed}	1.16
lb O ₂ / lb N _{oxidized}	4.60
Alpha (α)	0.89
Beta (β)	0.96
Elevation (feet above sea level)	100
Design Standard Oxygen Transfer Rate (lbs O ₂ /motorHP/Hr)	3.65

Average Aeration Power Requirement = 208 HP without accounting for denitrification
Average Flow (3 MGD) = 157 HP with denitrification credit

MMF Aeration Power Requirement = 259 HP without accounting for denitrification
MMF (3.75 MGD) = 196 HP with denitrification credit

MDF Aeration Power Requirement = 260 HP without accounting for denitrification
MDF (4.5 MGD) = 197 HP with denitrification credit

Aeration Power Proposed = 2 units at 150 HP each = 300 HP Total

Process Recommendations

Anaerobic Basin

Total Carrousel Basin Volume, M.G.	0.188
Number of Trains	1 with three (3) cells
Volume per cell	0.094

1st Anoxic Basin

Total Carrousel Basin Volume, M.G.	0.511
Number of Trains	1

Carrousel Basin

Total Carrousel Basin Volume, M.G.	1.356
Number of Trains	1

2nd Anoxic Basin

Total Carrousel Basin Volume, M.G.	0.348
Number of Trains	1

Reaeration Basin

Total Carrousel Basin Volume, M.G.	0.063
Number of Trains	1

Equipment Recommendations

Anaerobic Basin

Anaerobic Basins Mixers	2@ 4.9 hp
Slide Gates	By Others

1st Anoxic Basin

1 st Anoxic Basins Mixers	2@ 5.2 hp
EliminatIR Gates	1 each

Carrousel Basin

Carrousel Basin Aerators	2 @150 hp each
Aerator Speed	Single speed with VFD control
Additional Equipment	
Dual Impeller Aerator	Yes
Variable Frequency Drives (VFD's)	Yes
Oculus Control System	Yes with two D.O and one ORP Probe.

2nd Anoxic Basin

2 nd Anoxic Basin Mixer	1@ 5.2 hp
------------------------------------	-----------

Reaeration Basin

Aeration System	Diffused Aeration (Aerostrip)
Effluent Adjustable Weir	By Others

SECTION 2

PROCESS CALCULATIONS

Calculations for Biological Basin (Average Condition)

1. DESIGN CONDITIONS

Design Parameter	Design Value	Design Effluent	Notes
Flow (MGD)	3.000	-	
BOD – Biochemical Oxygen Demand (mg/L)	250	5	
TSS – Total Suspended Solids (mg/L)	175	5	After filtration
TKN – Total Kjeldahl Nitrogen (mg/L)	55	2.0	
NH ₃ -N – Ammonia Nitrogen (mg/L)	-	1.0	
NO ₃ -N – Nitrate Nitrogen (mg/L)	-	1.0	
TN – Total Nitrogen (mg/L)	-	3.0	Includes estimated refractory organic nitrogen
TP – Total Phosphorus (mg/L)	7	1.0	May require chemical polishing and effluent filtration

2. DESIGN ASSUMPTIONS

Design Parameter	Design Value
Process SRT – Nitrification (days)	9.0
Minimum Wastewater Temperature (°C)	18.0
Maximum Wastewater Temperature (°C)	30.0
MLSS Concentration (mg/L)	4,000
Net Yield (lb TSS/lb BOD _{removed})	0.82
Oxygen Coefficient	
lb O ₂ / lb BOD _{removed}	1.16
lb O ₂ / lb N _{oxidized}	4.60
Alpha (α)	0.89
Beta (β)	0.96
Elevation (feet above sea level)	100

3. PROCESS CALCULATIONS

a. AERATION VOLUME

$$\begin{aligned} \text{BOD Removal} &= Q \times (\text{BOD}_{\text{in}} - \text{BOD}_{\text{eff}}) \times 8.34 \\ &= 3.000 \times (250 - 5) \times 8.34 \\ &= 6,130 \text{ lbs BOD/day} \end{aligned}$$

$$\begin{aligned} \text{Sludge Production} &= Y \times Q \times (\text{BOD}_{\text{in}} - \text{BOD}_{\text{eff}}) \times 8.34 \\ &= 0.82 \times 3.000 \times (250 - 5) \times 8.34 \\ &= 5,027 \text{ lbs TSS/day} \end{aligned}$$

$$\begin{aligned} \text{System Mass} &= \text{SRT} \times Y \times Q \times (\text{BOD}_{\text{in}} - \text{BOD}_{\text{eff}}) \times 8.34 \\ &= 9.0 \times 0.82 \times 3.000 \times (250 - 5) \times 8.34 \\ &= 45,239 \text{ lbs TSS} \end{aligned}$$

$$\begin{aligned} \text{Carrousel Volume} &= \frac{\text{SRT} \times Y \times Q \times (\text{BOD}_{\text{in}} - \text{BOD}_{\text{eff}})}{\text{MLSS}} \\ &= \frac{9.0 \times 0.82 \times 3.000 \times (250 - 5)}{4,000} \\ &= 1.356 \text{ M.G.} \end{aligned}$$

b. AERATION POWER

$$\begin{aligned} \text{Nitrogen Synthesis} &= 6.9\% \text{ of WAS} \\ &= 13.8 \text{ mg/L} \end{aligned}$$

$$\begin{aligned} \text{Nitrogen Oxidized (N}_{\text{ox}}) &= \text{TKN}_{\text{in}} - \text{TKN}_{\text{eff}} - N_{\text{assimilation}} \\ &= 55 - 2.0 - 13.8 \\ &= 39.2 \text{ mg/L} \\ &= 981 \text{ lbs} \cdot \text{N/day} \end{aligned}$$

$$\text{Actual Oxygen Requirement @ } 1.16 \text{ lbs O}_2/\text{lbs BOD}_{\text{removed}} \text{ \& } 4.60 \text{ lbs O}_2/\text{lbs N}_{\text{oxidized}}$$

$$\begin{aligned} \text{AOR} &= (1.16 \times 6,130) + (4.60 \times 981) \\ &= 11,624 \text{ lbs O}_2/\text{day} \end{aligned}$$

$$\text{STD O}_2\text{Requirement} = \text{AOR} \times \frac{9.02}{\alpha \times (\beta \times C_{\text{sw}} - C_0)} \times 1.024^{(20 - T_{\text{MAX}})}$$

$$\begin{aligned} \alpha &= 0.89 \quad \beta = 0.96 \quad C_0 = 2.0 \\ C_{\text{swat } 30.0^\circ\text{C and 100 feet elevation}} &= 7.41 \text{ mg/L O}_2 \end{aligned}$$

$$\begin{aligned} \text{SOR} &= 11,624 \times \frac{9.02}{0.89 \times (0.96 \times 7.41 - 2.0)} \times 1.024^{(20 - 30.0)} \\ &= 18,182 \text{ lbs O}_2/\text{day} \end{aligned}$$

$$\begin{aligned} \text{Power Required} &= \frac{18,182}{3.65 \times 24} \\ &= 208 \text{ HP} \quad 2 @ 150.0 \text{ HP} = 300 \text{ HP Installed} \end{aligned}$$

Denitrification Credit @ $2.86 \text{ lbs O}_2/\text{lbs NO}_3\text{-N}_{\text{reduced}}$

$$\text{lbs NO}_3\text{-N}_{\text{reduced}} = (\text{TKN}_{\text{in}} - \text{TKN}_{\text{eff}} - N_{\text{assimilation}} - \text{NO}_3\text{-N}_{\text{eff}}) \times Q \times 8.34$$

$$= (55 - 2.0 - 13.8 - 1.0) \times 3.000 \times 8.34$$

$$= 956 \text{ lbs/day}$$

$$\text{O}_2\text{Credit} = 2.86 \times (\text{lbs NO}_3 - N_{\text{reduced}})$$

$$= 2,734 \text{ lbs O}_2/\text{day}$$

$$\text{SOR Credit} = \text{O}_2\text{Credit} \times \frac{9.02}{\alpha(\beta \times C_{\text{SW}} - C_0)} \times 1.024^{(20 - T_{\text{MAX}})}$$

$$= \frac{4,277}{3.65 \times 24}$$

$$\text{Horsepower Credit} = (51 \text{ HP})$$

c. FIRST ANOXIC VOLUME (Bardenpho 5-Stage)

$$\text{NO}_3\text{-N Reduced in Carrousel Basin} \quad \begin{aligned} (\text{mg/L}) &= \text{Not Considered} \\ (\text{lbs/day}) &= 0.00 \end{aligned}$$

$$\text{Active Biomass} = 3200.0 \text{ mg VSS/L}$$

$$\text{Specific Denitrification Rate SDNR} = 0.0559 \text{ gNO}_3\text{-N/gVSS} \cdot \text{day}$$

$$\begin{aligned} \text{lb NO}_3\text{-N}_{\text{red. in 1st Anx}} &= \text{NO}_{\text{OX}} \times \frac{\text{IR/Q}}{(1 + \text{IR/Q} + \text{Q}_{\text{RAS}}/\text{Q})} \\ &= 981 \times \frac{6.09}{1 + 6.09 + 0.75} \\ &= 762 \text{ lbs/day} \end{aligned}$$

$$\begin{aligned} \text{Anoxic Volume} &= \frac{\text{lb NO}_3\text{-N}_{\text{reduced 1st Anx}}}{\text{SDNR} \times \text{MLVSS} \times 8.34} \\ &= \frac{762}{0.0559 \times 3200.0 \times 8.34} \\ &= 0.511 \text{ M.G.} \end{aligned}$$

$$\begin{aligned} \text{NO}_3\text{-N}_{\text{eff from Carrousel Tank}} &= \frac{\text{N}_{\text{OX}} - \text{N}_{\text{red in 1st Anx}}}{[(\text{Q} + \text{Q}_{\text{RAS}}) \times 8.34]} \\ &= \frac{981 - 762}{[3.000 \times (1 + 0.75) \times 8.34]} \end{aligned}$$

$$\text{NO}_3\text{-N}_{\text{eff 1st Anx}} = 5.0 \text{ mg/L}$$

d. SECOND ANOXIC VOLUME (Bardenpho 5-Stage)

$$\text{Active Biomass} = 3200.0 \text{ mg VSS/L}$$

$$\text{Specific Denitrification Rate SDNR} = 0.0212 \text{ gNO}_3\text{-N/gVSS} \cdot \text{day}$$

Nitrate Entering 2nd Anoxic

$$\text{NO}_3\text{-N}_{\text{eff 1st Anx}} = \text{Use } 5.5 \text{ mg/L [5.0 mg/L is calculated in (c)]}$$

$$\text{lb NO}_3\text{-N}_{\text{red. in 2nd Anx}} = Q \times \left[\left(1 + \left(\frac{Q_{\text{RAS}}}{Q} \right) \right) \times (\text{NO}_3\text{-N}_{\text{eff 1st Anx}} - \text{NO}_3\text{-N}_{\text{eff}}) \times 8.34 \right]$$

$$= 3.000 \times (1 + 0.75) \times (5.5 - 1.0) \times 8.34$$

$$= 197 \text{ lbs/day}$$

$$\text{Anoxic Volume} = \frac{\text{lb NO}_3\text{-N}_{\text{reduced in 2nd Anx}}}{\text{SDNR} \times \text{MLVSS} \times 8.34}$$

$$= \frac{197}{0.0212 \times 3200.0 \times 8.34}$$

$$= 0.348 \text{ M.G.}$$

e. ANAEROBIC VOLUME (Bardenpho 5-Stage)

$$\text{Anaerobic Volume} = \frac{\text{HDT} \times Q}{24} \quad (\text{HDT in hours; Q in MGD})$$

$$= \frac{1.5 \times 3.000}{24}$$

$$= 0.188 \text{ M.G.}$$

$$\begin{aligned} \text{NO}_3\text{-N}_{\text{Removed from RAS}} &= (Q_{\text{RAS}}/Q) \times \text{NO}_3\text{-N}_{\text{eff}} \times 8.34 \\ &= 0.75 \times 3.000 \times 1.0 \times 8.34 \\ &= 19.0 \text{ lbs/day} \end{aligned}$$

e. RE-AERATION VOLUME (Bardenpho 5-Stage)

$$\begin{aligned} \text{RE-Aeration Volume} &= \frac{\text{HDT} \times Q}{24} \quad (\text{HDT in hours; Q in MGD}) \\ &= \frac{0.50 \times 3.000}{24} \\ &= 0.063 \text{ M. G. (Re-aeration Diffusers Provided by Others)} \end{aligned}$$

Calculations for Biological Basin (Max Month Flow Condition)

1. DESIGN CONDITIONS

Design Parameter	Design Value	Design Effluent	Notes
Flow (MGD)	3.750	-	
BOD – Biochemical Oxygen Demand (mg/L)	250	5	
TSS – Total Suspended Solids (mg/L)	175	5	After filtration
TKN – Total Kjeldahl Nitrogen (mg/L)	55	2.0	
NH ₃ -N – Ammonia Nitrogen (mg/L)	-	1.0	
NO ₃ -N – Nitrate Nitrogen (mg/L)	-	1.0	
TN – Total Nitrogen (mg/L)	-	3.0	Includes estimated refractory organic nitrogen
TP – Total Phosphorus (mg/L)	7	1.0	May require chemical polishing and effluent filtration

2. DESIGN ASSUMPTIONS

Design Parameter	Design Value
Maximum Wastewater Temperature (°C)	30.0
Oxygen Coefficient	
lb O ₂ / lb BOD _{removed}	1.16
lb O ₂ / lb N _{oxidized}	4.60
Alpha (α)	0.89
Beta (β)	0.96
Elevation (feet above sea level)	100

3. PROCESS CALCULATIONS

a. AERATION POWER

$$\begin{aligned} \text{BOD Removal} &= Q \times (\text{BOD}_{\text{in}} - \text{BOD}_{\text{eff}}) \times 8.34 \\ &= 3.750 \times (250 - 5) \times 8.34 \\ &= 7,662 \text{ lbs BOD/day} \end{aligned}$$

$$\begin{aligned} \text{Nitrogen Synthesis} &= 6.9\% \text{ of WAS} \\ &= 13.8 \text{ mg/L} \end{aligned}$$

$$\begin{aligned} \text{Nitrogen Oxidized (N}_{\text{ox}}) &= \text{TKN}_{\text{in}} - \text{TKN}_{\text{eff}} - \text{N}_{\text{assimilation}} \\ &= 55 - 2.0 - 13.8 \\ &= 39.2 \text{ mg/L} \\ &= 1,226 \text{ lbs} \cdot \text{N/day} \end{aligned}$$

Actual Oxygen Requirement @ $1.16 \text{ lbs O}_2/\text{lbs BOD}_{\text{removed}}$ & $4.60 \text{ lbs O}_2/\text{lbs N}_{\text{oxidized}}$

$$\begin{aligned} \text{AOR} &= (1.16 \times 7,662) + (4.60 \times 1,226) \\ &= 14,530 \text{ lbs O}_2/\text{day} \end{aligned}$$

$$\text{STD O}_2\text{Requirement} = \text{AOR} \times \frac{9.02}{\alpha \times (\beta \times C_{\text{SW}} - C_0)} \times 1.024^{(20 - T_{\text{MAX}})}$$

$$\begin{aligned} \alpha &= 0.89 \quad \beta = 0.96 \quad C_0 = 2.0 \\ C_{\text{SWat } 30.0^\circ\text{C and 100 feet elevation}} &= 7.41 \text{ mg/L O}_2 \end{aligned}$$

$$\text{SOR} = 14,530 \times \frac{9.02}{0.89 \times (0.96 \times 7.41 - 2.0)} \times 1.024^{(20 - 30.0)}$$

$$= 22,728 \text{ lbs O}_2/\text{day}$$

$$\text{Power Required} = \frac{22,728}{3.65 \times 24}$$

$$= 259 \text{ HP } 2 @ 150.0 \text{ HP} = 300 \text{ HP Installed}$$

$$\text{Denitrification Credit @ } 2.86 \text{ lbs O}_2/\text{lbs NO}_3\text{-N}_{\text{reduced}}$$

$$\text{lbs NO}_3\text{-N}_{\text{reduced}} = (\text{TKN}_{\text{in}} - \text{TKN}_{\text{eff}} - N_{\text{assimilation}} - \text{NO}_3\text{-N}_{\text{eff}}) \times Q \times 8.34$$

$$= (55 - 2.0 - 13.8 - 1.0) \times 3.750 \times 8.34$$

$$= 1,195 \text{ lbs/day}$$

$$\text{O}_2\text{Credit} = 2.86 \times (\text{lbs NO}_3 - \text{N}_{\text{reduced}})$$

$$= 3,418 \text{ lbs O}_2/\text{day}$$

$$\text{SOR Credit} = \text{O}_2\text{Credit} \times \frac{9.02}{\alpha(\beta \times C_{\text{SW}} - C_0)} \times 1.024^{(20 - T_{\text{MAX}})}$$

$$= \frac{5,347}{3.65 \times 24}$$

$$\text{Horsepower Credit} = (64 \text{ HP})$$

Calculations for Biological Basin (Max Day Flow Condition)

1. DESIGN CONDITIONS

Design Parameter	Design Value	Design Effluent	Notes
Flow (MGD)	4.500	-	
BOD – Biochemical Oxygen Demand (mg/L)	250	5	
TSS – Total Suspended Solids (mg/L)	175	5	After filtration
TKN – Total Kjeldahl Nitrogen (mg/L)	55	2.0	
NH ₃ -N – Ammonia Nitrogen (mg/L)	-	1.0	
NO ₃ -N – Nitrate Nitrogen (mg/L)	-	1.0	
TN – Total Nitrogen (mg/L)	-	3.0	Includes estimated refractory organic nitrogen
TP – Total Phosphorus (mg/L)	7	1.0	May require chemical polishing and effluent filtration

2. DESIGN ASSUMPTIONS

Design Parameter	Design Value
Maximum Wastewater Temperature (°C)	30.0
Oxygen Coefficient	
lb O ₂ / lb BOD _{removed}	1.16
lb O ₂ / lb N _{oxidized}	4.60
Alpha (α)	0.89
Beta (β)	0.96
Elevation (feet above sea level)	100

3. PROCESS CALCULATIONS

a. AERATION POWER

$$\begin{aligned} \text{BOD Removal} &= Q \times (\text{BOD}_{\text{in}} - \text{BOD}_{\text{eff}}) \times 8.34 \\ &= 4,500 \times (250 - 5) \times 8.34 \\ &= 9,195 \text{ lbs BOD/day} \end{aligned}$$

$$\begin{aligned} \text{Nitrogen Synthesis} &= 6.9\% \text{ of WAS} \\ &= 13.8 \text{ mg/L} \end{aligned}$$

$$\begin{aligned} \text{Nitrogen Oxidized (N}_{\text{ox}}) &= \text{TKN}_{\text{in}} - \text{TKN}_{\text{eff}} - N_{\text{assimilation}} \\ &= 55 - 2.0 - 13.8 \\ &= 39.2 \text{ mg/L} \\ &= 1,472 \text{ lbs} \cdot \text{N/day} \end{aligned}$$

$$\text{Actual Oxygen Requirement @ } 1.16 \text{ lbs O}_2/\text{lbs BOD}_{\text{removed}} \text{ \& } 4.60 \text{ lbs O}_2/\text{lbs N}_{\text{oxidized}}$$

$$\begin{aligned} \text{AOR} &= (1.16 \times 9,195) + (4.60 \times 1,472) \\ &= 17,436 \text{ lbs O}_2/\text{day} \end{aligned}$$

$$\text{STD O}_2\text{Requirement} = \text{AOR} \times \frac{9.02}{\alpha \times (\beta \times C_{\text{SW}} - C_0)} \times 1.024^{(20 - T_{\text{MAX}})}$$

$$\begin{aligned} \alpha &= 0.89 \quad \beta = 0.96 \quad C_0 = 1.0 \\ C_{\text{SWat } 30.0^\circ\text{C and 100 feet elevation}} &= 7.41 \text{ mg/L O}_2 \end{aligned}$$

$$\text{SOR} = 17,436 \times \frac{9.02}{0.89 \times (0.96 \times 7.41 - 1.0)} \times 1.024^{(20 - 30.0)}$$

$$= 22,811 \text{ lbs O}_2/\text{day}$$

$$\text{Power Required} = \frac{22,811}{3.65 \times 24}$$

$$= 260 \text{ HP } 2 @ 150.0 \text{ HP} = 300 \text{ HP Installed}$$

$$\text{Denitrification Credit @ } 2.86 \text{ lbs O}_2/\text{lbs NO}_3\text{-N}_{\text{reduced}}$$

$$\text{lbs NO}_3\text{-N}_{\text{reduced}} = (\text{TKN}_{\text{in}} - \text{TKN}_{\text{eff}} - N_{\text{assimilation}} - \text{NO}_3\text{-N}_{\text{eff}}) \times Q \times 8.34$$

$$= (55 - 2.0 - 13.8 - 1.0) \times 4.500 \times 8.34$$

$$= 1,434 \text{ lbs/day}$$

$$\text{O}_2\text{Credit} = 2.86 \times (\text{lbs NO}_3 - N_{\text{reduced}})$$

$$= 4,102 \text{ lbs O}_2/\text{day}$$

$$\text{SOR Credit} = \text{O}_2\text{Credit} \times \frac{9.02}{\alpha(\beta \times C_{\text{SW}} - C_0)} \times 1.024^{(20 - T_{\text{MAX}})}$$

$$= \frac{5,366}{3.65 \times 24}$$

$$\text{Horsepower Credit} = (64 \text{ HP})$$

Weir Calculations

WEIR LENGTH CALCULATION

PROJECT NAME Brevard County SC, FL			
DATE 12/12/2014			
ALL VALUES PER BASIN			
		CREST (IN)	Q+RAS FLOW (MGD)
Average flow, MGD	3.000	2.48	5.100
Peak flow, MGD	7.500	4.21	11.250
Recycle rate at average flow, %	70	DELTA= 1.73	
Recycle rate @ average flow, % of AVERAGE	125		
Max impeller submergence, cm	20.1		
DELTA requested in inches	1.75		
Minimum impeller submergence, cm	0.6		
MAXIMUM basin water surface elevation, ft	16.75		
The calculated minimum weir length is	24.95	ft	
What length should be used for design?	25.00	ft	
ACTUAL impeller submergence at average flow, cm	15.71	=	77%
*****WEIR DESIGN*****			
WEIR OPERATES FROM	15.90	TO	16.75 FT
	MIN	MAX	MIN
	SUBM @	SUBM @	SUBM @
	AVG FLOW	AVG FLOW	PEAK FLOW
WATER SURFACE ELEVATIONS, FT:	16.11	16.61	16.25
	16.11	16.61	16.75
OPERATIONAL WEIR ELEVATION, FT:	15.90	16.40	15.90
	15.90	16.40	16.40
WEIR LENGTH:	25.00	FT	Based on Q (cfs); h,L (ft):
			Q=3.33L_{weir}(h_{crest})^{3/2}

SECTION 3

CRITICAL DESIGN DETAIL LIST

Critical Design Detail List

Refer to the Drawings SA14AE021

- Sheet 1: Carrousel® Basin 3-D Isometric Drawing**
- Sheet 2: Carrousel® Basin Layout Drawing**
- Sheet 3: 150 hp EXCELL® Aerator II Drawing**
- Sheet 4: Anaerobic, First Anoxic & Second Anoxic Mixer**
- Sheet 5: Carrousel® EliminatIR® Gate**

- (Sheets 2) The freeboard that is required throughout the aeration zone is 4'-0". We define this freeboard as the distance between maximum liquid level and the bottom of the lowest beam in the aeration zone. This freeboard must extend beyond the centerline of the impeller into the channel zone for 26'-0".
- (Sheet 2) Outside of the aeration zone, the freeboard shall be 2' above maximum water level.
- (Sheet 2) The aeration zone cover shall end 26'-0" feet from the aerator centerline. The aeration zone cover may be constructed of concrete, or fiberglass or aluminum covers may be used. At the end of this cover, a vertical skirt shall be constructed such that the distance between the bottom of the vertical skirt and the maximum water level is 2'-6".
- Do not use concrete piers/columns in the aeration zone. Columns in the aeration zone negatively affect aerator performance.
- (Sheet 3) The jackstuds of the aerator gearbox must be properly imbedded in concrete. The minimum concrete thickness required for proper jackstud imbedment is 12 inches (illustrated on the Section B-B), and is required only in the vicinity of the gearbox. Your structural engineers may determine that a thinner concrete slab is sufficient elsewhere on the covered aeration zone (or you may decide to use fiberglass covers).
- (Sheet 3) See the General Note 5 on the aerator general arrangement drawing Section B-B regarding the concrete platform tolerance. There is only +/- three inches of elevation adjustment for the aeration impeller once the aerator is manufactured, so making this tolerance clear to the contractor is critical. Keep this in mind when designing drainage of the concrete platform!
- (Sheet 3) Maintain 2 inches plus or minus ½ inch between the aerator impeller and the partition wall as shown on Section B-B. Maintain 2-1/2" plus or minus ½ inch between the lower impeller and the partition wall extension.
- (Sheet 3) Equipment access openings of 1'-0" x 2'-0" are required for the covered aeration zone. The dimensions of the equipment access openings are shown on Section F-F. These should be covered with checkered plate.
- (Sheet 2) The partition wall thickness is shown as 12 inches. The partition wall thickness shall not exceed 12 inches in front of the aerator impeller. If the structural requirements necessitate construction of a partition wall thicker than 12 inches, the partition wall should be tapered down to 12 inches in front of the aerator impeller.

- (Sheet 2) If wall thicknesses are adjusted, maintain the large channel dimension of 29'-6" and inside IR bypass channel dimension of 4'-6".
- (Sheet 2) Based on the proposed design flows and treatment requirements, we recommend a 4'-6" wide bypass channel (denitIR channel) to deliver flow from the Carrousel basin to the anoxic basin.
- (Sheet 2 and 5) The bypass channel will be provided with a 4'-6" wide motorized EliminatIR™ flow control gate to allow for adjustment of internal recirculation rates. The gate will be mounted on the aeration zone wall at a distance 32'-0" from the aerator impeller centerline. The wall thickness must be at least 12 inches in this location.
- (Sheet 2) The bypass channel exiting the anoxic basins should be provided with a hydraulic bump. The purpose of this hydraulic feature is to ensure recycle flows are adequately mixed with the Carrousel basin contents in order to prevent short-circuiting. See Detail C on Sheet 2.
- (Sheet 2 and 4) We recommend geared submersible mixers for each anaerobic cell, for each stage of the first anoxic zone, and for each second anoxic zone. The submersible mixers should be mounted as shown on the general arrangement drawings. The location of the submersible mixers is shown on Sheet 2.
- (Sheet 2) Influent flow shall be delivered to the anaerobic cells as shown. Slide gates installed at the entrance and exit of each cell and floor drains in each cell shall allow each cell to be dewatered if needed. Slide gates to close off the wall pumps in the first anaerobic cells are also required to allow dewatering. With this arrangement, one or two can be operated at any time. Influent flow can also be withheld from a given cell while continuing delivery to the remaining cell.
- (Sheet 2) Effluent shall exit the Carrousel basins to the second anoxic basins via a flow delivery trough (static water level). This effluent trough shall be sized by the consulting engineer so that head loss is negligible and so that water surface elevations will be set for the upstream basins using the variable-height effluent weirs in the second anoxic basins. We have estimated the trough is 2'-6" wide with 2'-6" SWD.
- We recommend an effluent weir length of 25 feet for the Carrousel basin. Weir length calculations are included in the Section 2 of this package. The appropriate weir length was determined based on the following objectives: 1) maximize aerator power draw at average operating conditions; and 2) protect the aerators from excessive power draw during peak flow events. The weir length calculations were based on a design average flow of 5.10 MGD (Q=3.0; RAS= 2.10 MGD) per basin and a design peak flow of 11.25 MGD (Q=7.5; RAS=3.75 MGD) per basin. **Please review the design values used in calculations included in Section 2 and notify us as soon as possible if there are any changes.**
- (Sheet 1) We recommend that the effluent weir be placed as shown on sheet 1- on the wall separating the 2nd anoxic basin and the re-aeration basin. Note the SWD depth of the re-aeration basin is 15', or less to maintain free fall over the weir and avoid a submerged weir condition.
- We are recommending two (2) 5.2 HP submersible mixer for each of the 2-stage 1st anoxic basins.
- The anaerobic basin should be compartmentalized into a minimum of 2 cells as shown. We are recommending one (1) 4.9 HP submersible mixer for each of the anaerobic cells.
- We are recommending one (1) 5.2 HP submersible mixer for the 2nd anoxic basin.

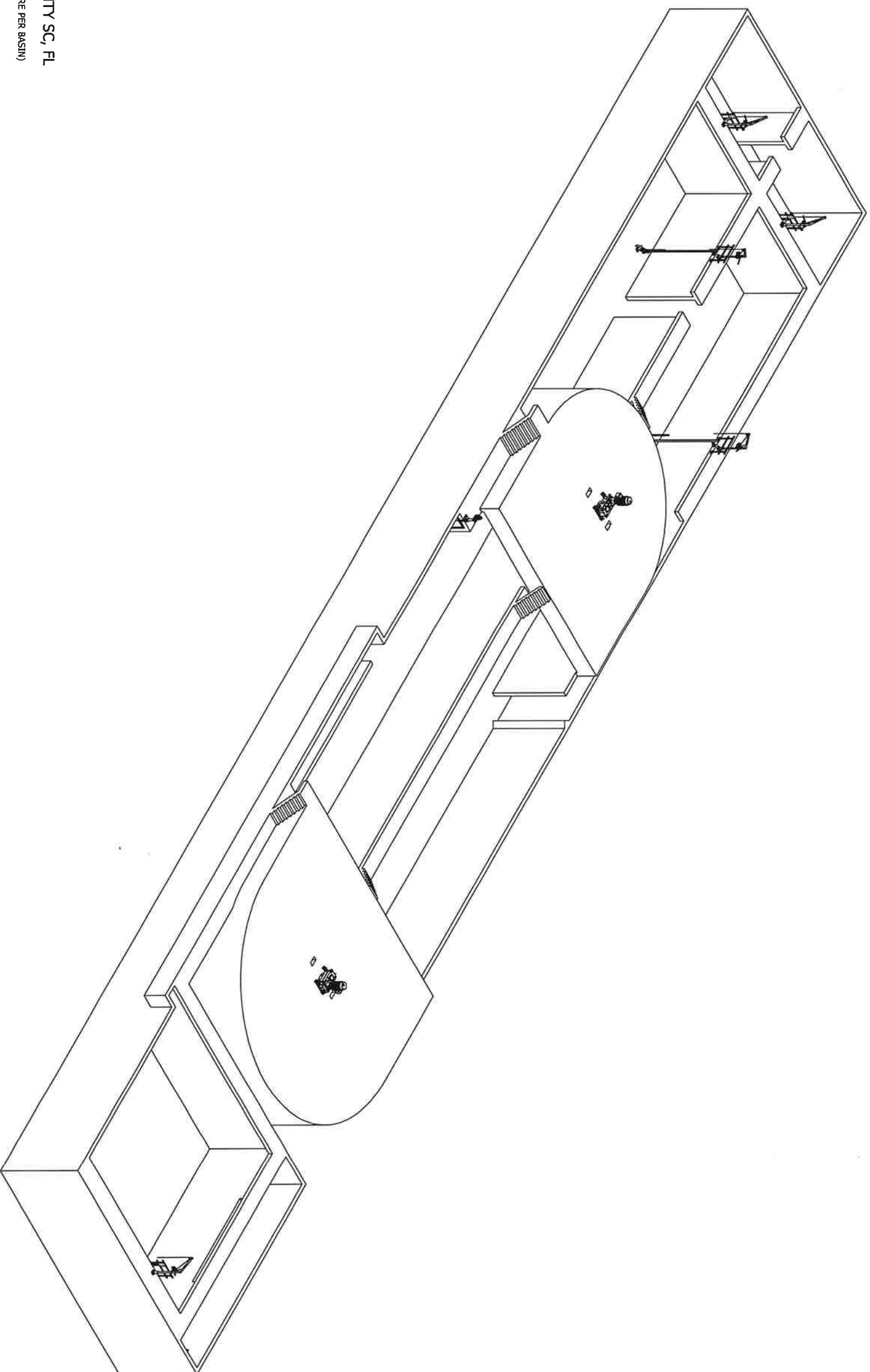
- For the ReAeration Basin, airflow is 110 scfm at 8.00 psi (based on 15 ft SWD).

Important Process Considerations:

- We are recommending highly energy efficient mixers that were selected by closely matching HP draw with HP ratings. These mixers have maximum protection against moisture intrusion for use in the anoxic and anaerobic basins. We have used these mixers on over 50 Ovivo Carrousel plants in the U.S. Please refer to our discussion in the last three pages of this section for more details.
- Preventing excessive sludge blanket rise during peak flow events is critical to maintain stable clarifier operation. This is especially important when operators are not on-site full-time. Based on the analysis we performed for this project, we strongly encourage the use of automated flow-paced RAS control.
- Avoid adding oxygen to the anaerobic basins. For example, minimize free fall of influent into the anaerobic basin and do not use aerated grit removal systems upstream.
- Avoid scum traps in the anaerobic basins. Allow flow to pass between cells and between the third cell and the anoxic basin through openings that have a free water surface, and avoid the use of underflow weirs.
- Do not recycle scum from the clarifiers to the headworks; rather send the scum directly to solids processing (e.g., to the digester). This is to prevent excessive scum build-up in the biological basins.
- Design for back up chemicals (e.g. alum, ferric) to ensure reliable phosphorus removal. Both the Carrousel effluent weir and the Carrousel basin just upstream from the aeration zone are recommended as chemical addition points.
- Decants and internal plant recycles can negatively impact biological phosphorus removal. For example, decants from sludge holding tanks and digesters often contain very high concentrations of nitrates and soluble phosphorus. High concentrations of nitrates sent to the anaerobic tanks will prevent selection of bio-P bacteria and can cause effluent P to rise. Slug loads of P sent to the Carrousel system may exceed the amount bacteria can incorporate into their biomass, causing effluent P to rise. For these reasons, we recommend you give serious consideration to the following:
 - Allow operators to send decants/recycles containing high concentrations of **nitrates** directly to the Carrousel basin with dedicated piping (rather than having to send these streams to the headworks or anaerobic basins).
 - Include provisions to add chemicals (alum, ferric) directly to decants/recycles that may contain high concentrations of **phosphorus** before they are returned to the Carrousel system or headworks.
 - Minimize the potential for introduction of slug nitrate and P loads to the Carrousel system by allowing decants to be “bled” into the Carrousel system over time, for example, by using a small decant equalization tank.
 - Allow operators to cycle air on/off in sludge holding tanks and aerobic digesters. This will allow for denitrification (conversion of nitrate to nitrogen gas) and minimize the potential for poisoning anaerobic tanks with nitrates. It is important to minimize the time the air is off to avoid re-release of excessive phosphorus from cells. A redox (ORP) probe or nitrate probe installed in these tanks may assist operators in controlling the process.

SECTION 4

CARROUSEL® BASIN DRAWINGS



JOB NAME: BREVARD COUNTY SC, FL
Basin Volume: (All volumes are per basin)
 Anaerobic Volume : 0.188 MG
 1st Anoxic Volume : 0.511 MG
 Carrousel Volume : 1.356 MG
 2nd Anoxic Volume : 0.348 MG
 Reaeration Volume : 0.063 MG
Number of Aerators: 2
Number of Submersible Mixers: 5
Number of Eliminator Gates: 1

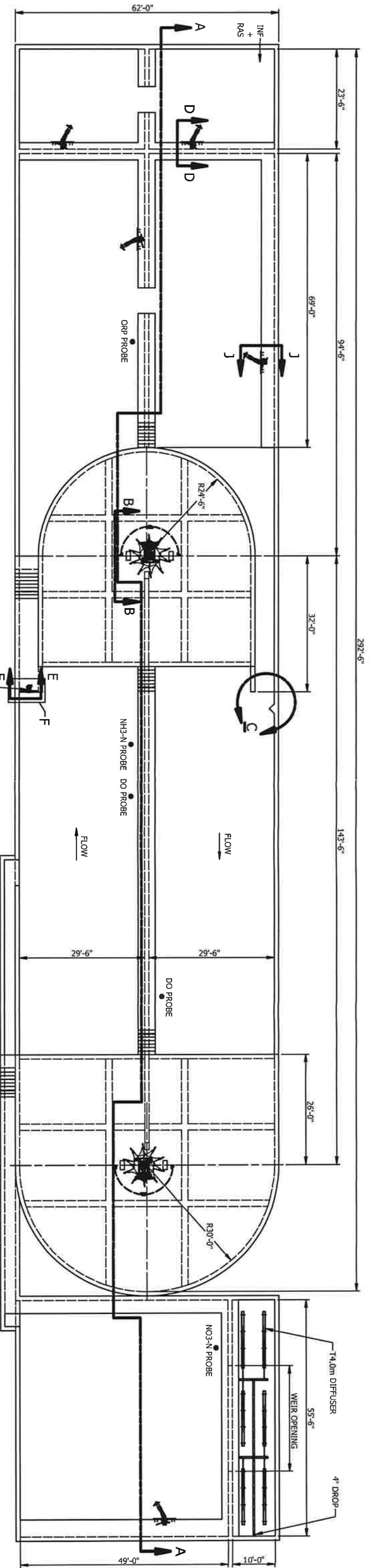
INITIAL RELEASE		EN/ECO		BY		CHECKD		DATE		REV	
REVISION DESCRIPTION										A	
DRAWN		EWR		ORIGINAL S.O.		DATE: 12/10/2014		REF: FROM		DO NOT SCALE PRINTS	
CHECKD		JM		EWR		DATE: 12/10/2014		REF: FROM		DO NOT SCALE PRINTS	
DWG. NO.		S114AED21		SHEET		1 OF 5		REV		A	



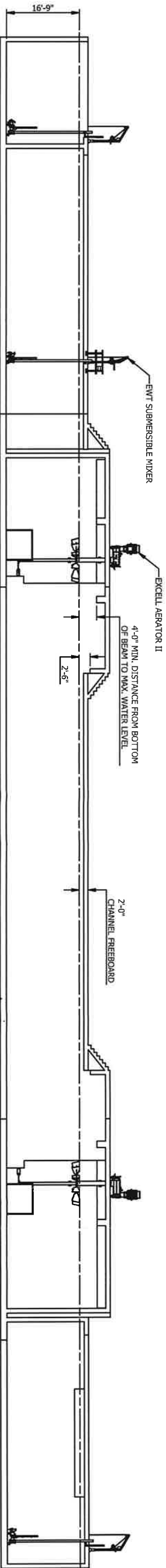
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BREVARD COUNTY SC, FL
 EXCELL® AERATOR II
 150 HP

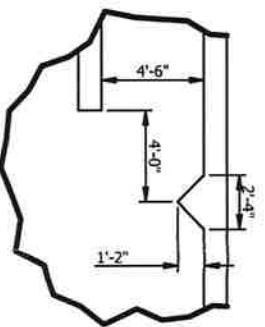
D
 ALL DIMENSIONS ARE IN FEET AND INCHES UNLESS OTHERWISE SPECIFIED.
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 OVIYO SHALL BE RESPONSIBLE FOR THE ACCURACY OF THE INFORMATION PROVIDED IN THIS DRAWING.
 REF: FROM
 DATE: 12/10/2014
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PLAN VIEW



SECTION A-A



DETAIL C
(BERNOULLI BUMP TYPICAL)

NOTE

1. BEAMS, FOOTINGS, AND WALL THICKNESSES SHOWN TO ILLUSTRATE CRITICAL CHANNEL DIMENSIONS AND FREEBOARD. DRAWING IS NOT INTENDED TO BE USED FOR STRUCTURAL DESIGN. BEAMS, FOOTINGS, SLAB, AND WALL DESIGN IS NOT THE RESPONSIBILITY OF OVIVO USA, LLC AND SHALL BE DESIGNED BY THE ENGINEER'S STRUCTURAL ENGINEER.

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D	<small>DO NOT SCALE PRINTS</small>
<small>NO.</small>	SAT14AE021
<small>DWG.</small>	SAT14AE021
<small>SHEET</small>	2 OF 5
<small>REV</small>	A

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GENERAL NOTES:

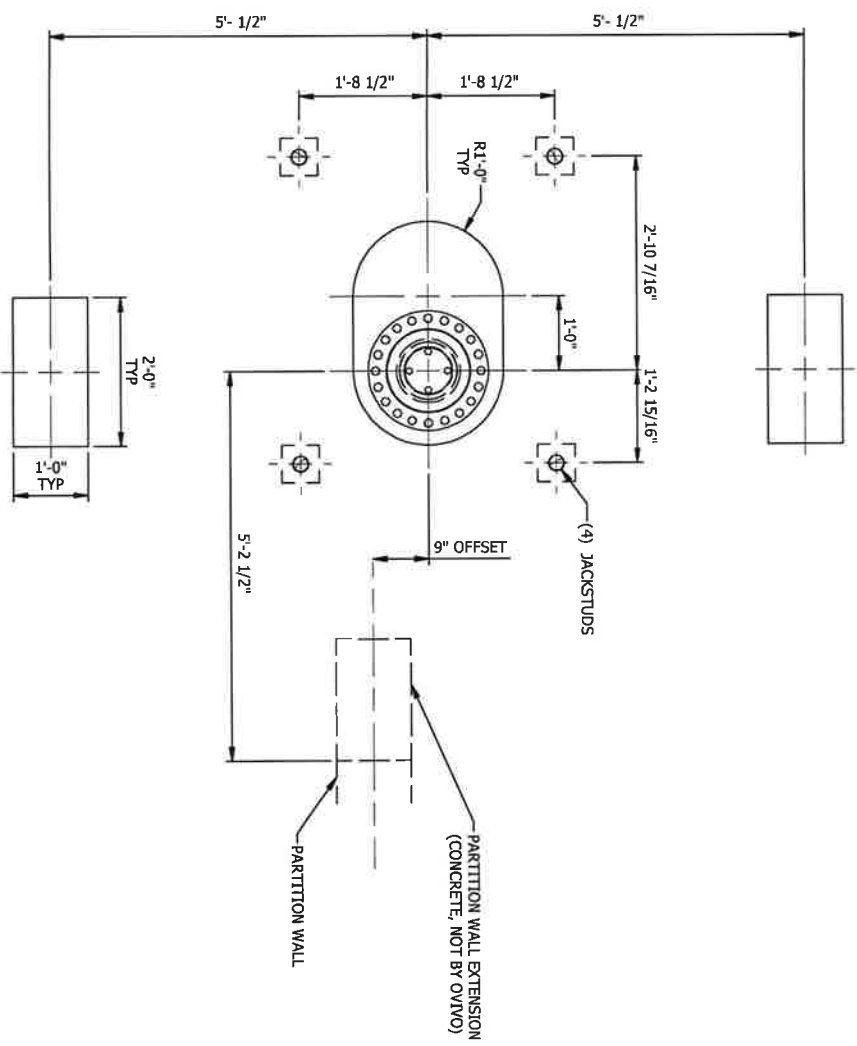
1. OVIVO USA, LLC (OVIVO) DOES NOT FURNISH ELECTRICAL WIRING, CONDUIT, OR ELECTRICAL CONTROL EQUIPMENT. THE CONTRACT DRAWINGS SHOULD INDICATE THE REQUIREMENTS FOR CONDUIT, POWER CABLE, AND CONTROL WIRING (FOR 120 V OPTIONS SELECTED FOR THE MOTOR AND REDUCER, SUCH AS: SPACE HEATERS, THERMAL SENSORS, PRESSURE SWITCHES, ETC.) FOR INCLUSION IN THE ELECTRICAL CONTRACTOR'S BID.
2. OVIVO IS NOT RESPONSIBLE FOR PLATFORM DESIGNS FINISHED BY OTHERS. AERATOR MECHANISM DEAD LOAD INCLUDES IMPELLER, IMPELLER SHAFT, JACKSTUDS, COUPLING, BASEPLATE, REDUCER AND MOTOR.
3. IMPELLERS ARE FURNISHED FOR ONE DIRECTION ONLY (CLOCKWISE OR COUNTER CLOCKWISE). TORQUE REACTION IS OPPOSITE TO DIRECTION OF IMPELLER ROTATION.
4. IMPELLER SUBMERGENCE CAN BE VARIED BY FOUR JACKSTUDS AND/OR EFFLUENT WEIR ADJUSTMENTS. WATER LEVELS IN EXCESS OF THE MAXIMUM LEVEL WILL OVERLOAD THE AERATOR DRIVE.
5. WITHIN AN APPROXIMATE AREA OF 3' RADIUS CENTERED AT THE JACKSTUD, THE CONTRACTORS SHALL HOLD THE ELEVATION OF THE CONCRETE PLATFORM TO WITHIN $\pm 1/2"$ OF THE ELEVATION SHOWN ON STRUCTURAL DRAWINGS. THE AERATOR WILL BE FABRICATED IN ACCORDANCE TO THAT ELEVATION AND WILL HAVE $\pm 3"$ OF VERTICAL ADJUSTMENT.
6. STATIC DESIGN LOADS TO BE DETERMINED BY OTHERS.
7. PLEASE SHOW PARTITION WALL EXTENSION CLEARLY ON STRUCTURAL DRAWINGS. DIMENSIONED AS SHOWN.

DYNAMIC DESIGN LOADS:

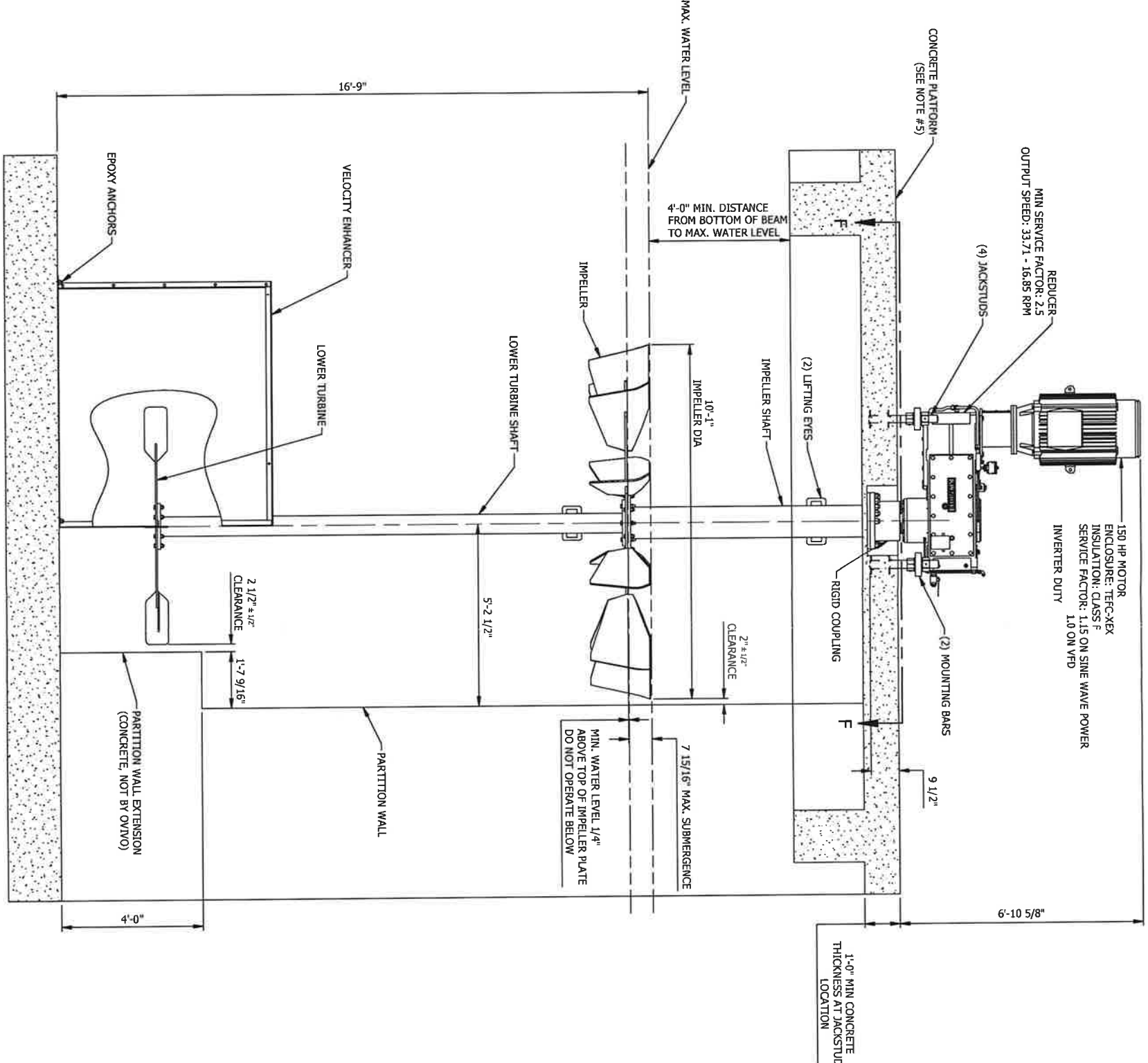
DEAD LOAD: 9260 LBS.
 TORQUE: 26873 FT-LBS
 FORCE UP/MAR: 3018 LBS
 SIDE LOAD: 1064 LBS
 MOMENT LOAD: 10169 FT-LBS (AS A RESULT OF SIDE LOAD)
 WE RECOMMEND THAT THE PLATFORM BE TIED INTO THE DIVIDING WALL AND SIDE WALLS SO THAT DEFLECTIONS AND STRESSES WILL NOT EXCEED THOSE ALLOWED BY THE FOLLOWING
 1. STEEL PLATFORMS AISC MANUAL OF STEEL CONSTRUCTION LATEST EDITION OR SUPERSEEDING SPECIFICATIONS.
 2. CONCRETE PLATFORMS = ACI 350.4, BUILDING CODE FOR ENVIRONMENTAL ENGINEERING CONCRETE STRUCTURES OR SUPERSEEDING SPECIFICATIONS.

NOTE: THE MECHANICAL COMPONENTS OF THIS AERATOR OPERATE AT THE FOLLOWING ROTATING REQUIRENCIES (CRS):

MOTOR:	2976 - 14.88
SHAFT:	0.56 - 0.28
IMPELLER:	3.93 - 1.96
LOWER IMPELLER:	1.57 - 0.78



SECTION F-F



SECTION B-B

150 HP EXCELL® AERATOR II

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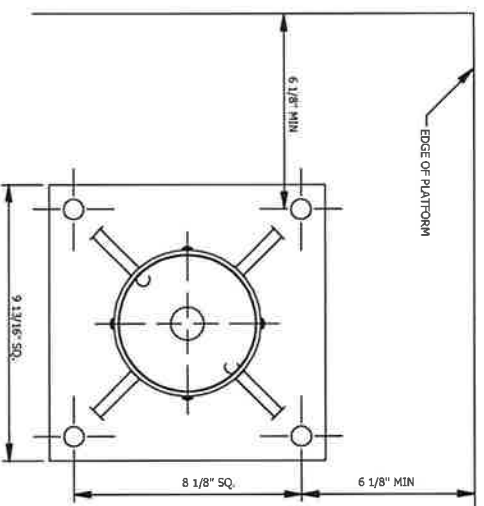
DO NOT SCALE PRINTS DWG. NO. SA14AE021

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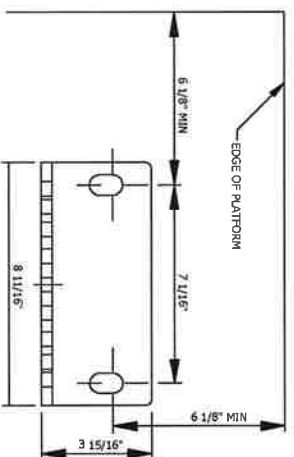
SHEET 3 OF 5

GR = 52.976 (H38V12)
 PR = 4451P
 MA = 9.5532 FT

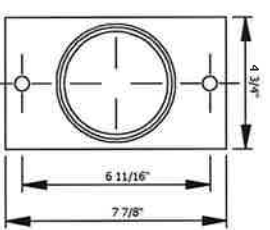
FIXING ELEMENTS



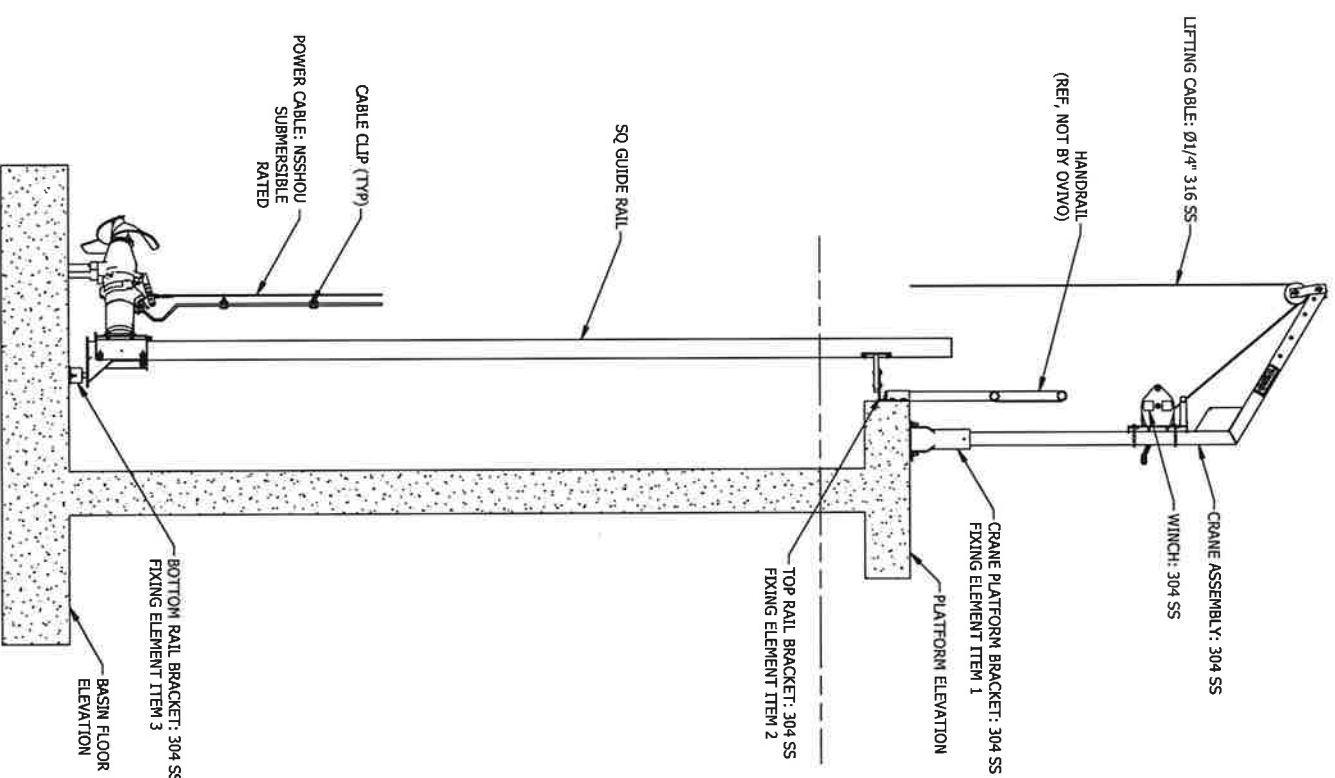
ITEM 1 - CRANE PLATFORM BRACKET



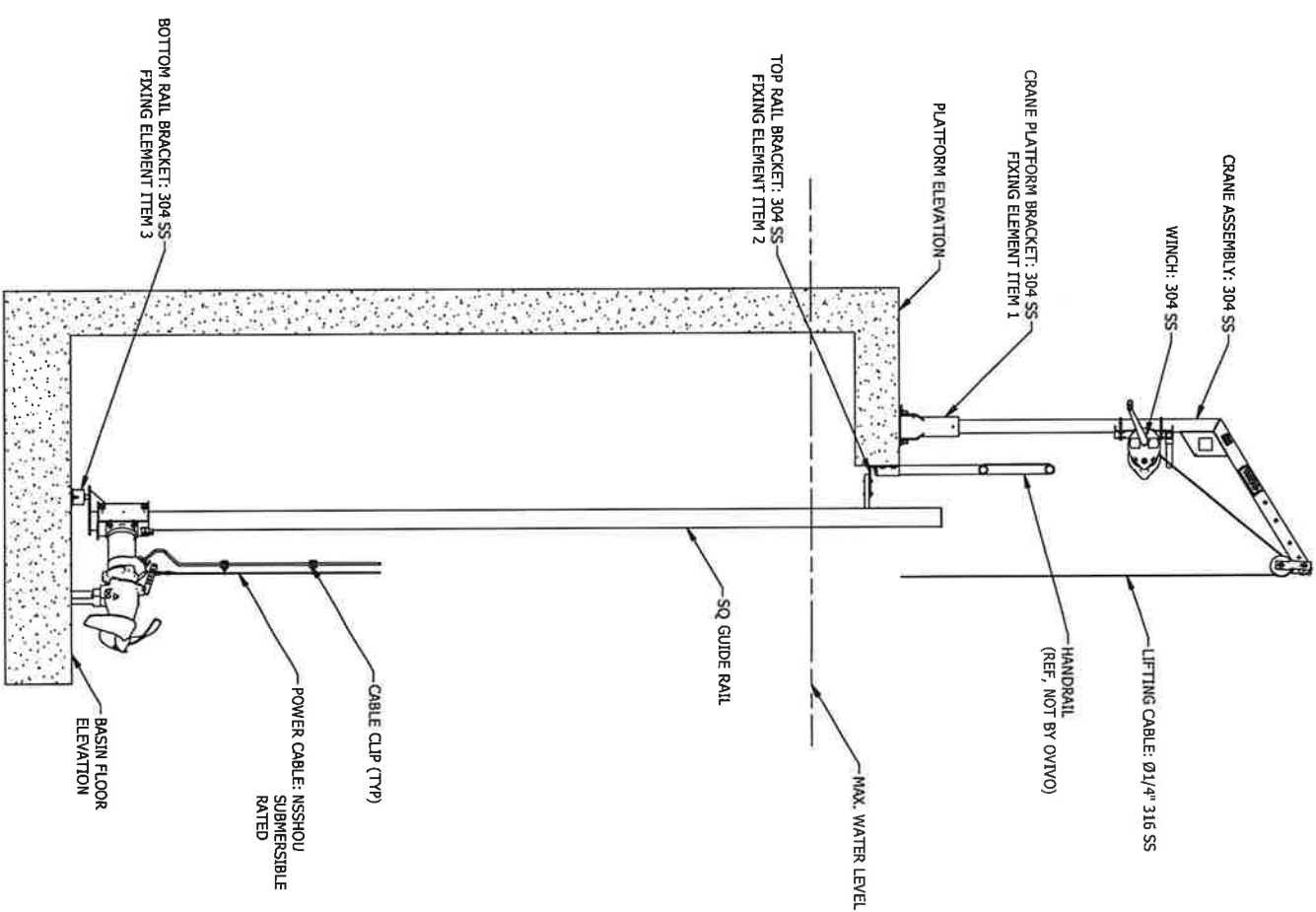
ITEM 2 - TOP RAIL BRACKET



ITEM 3 - BOTTOM RAIL BRACKET



SECTION D-D



SECTION J-J

- NOTES:
1. MIXER MOUNT ASSEMBLIES (RAILS, CRANES, AND BRACKETS TO BE 304 SS. MIXERS ARE CERAMIC COATED.
 2. ALL ANCHOR BOLTS PROVIDED AS 304 SS.
 3. 30' POWER CABLE AND CLIPS INCLUDED.
 4. PROPELLER MATERIAL & DESIGN PER APPLICATION.

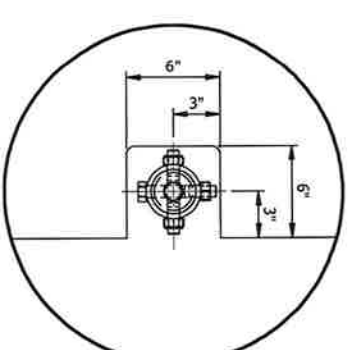
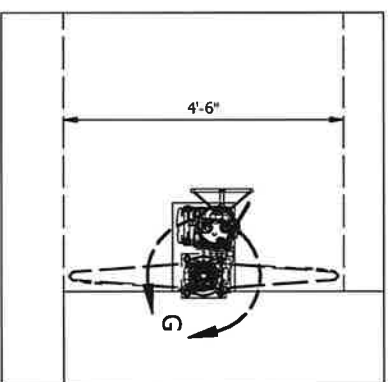
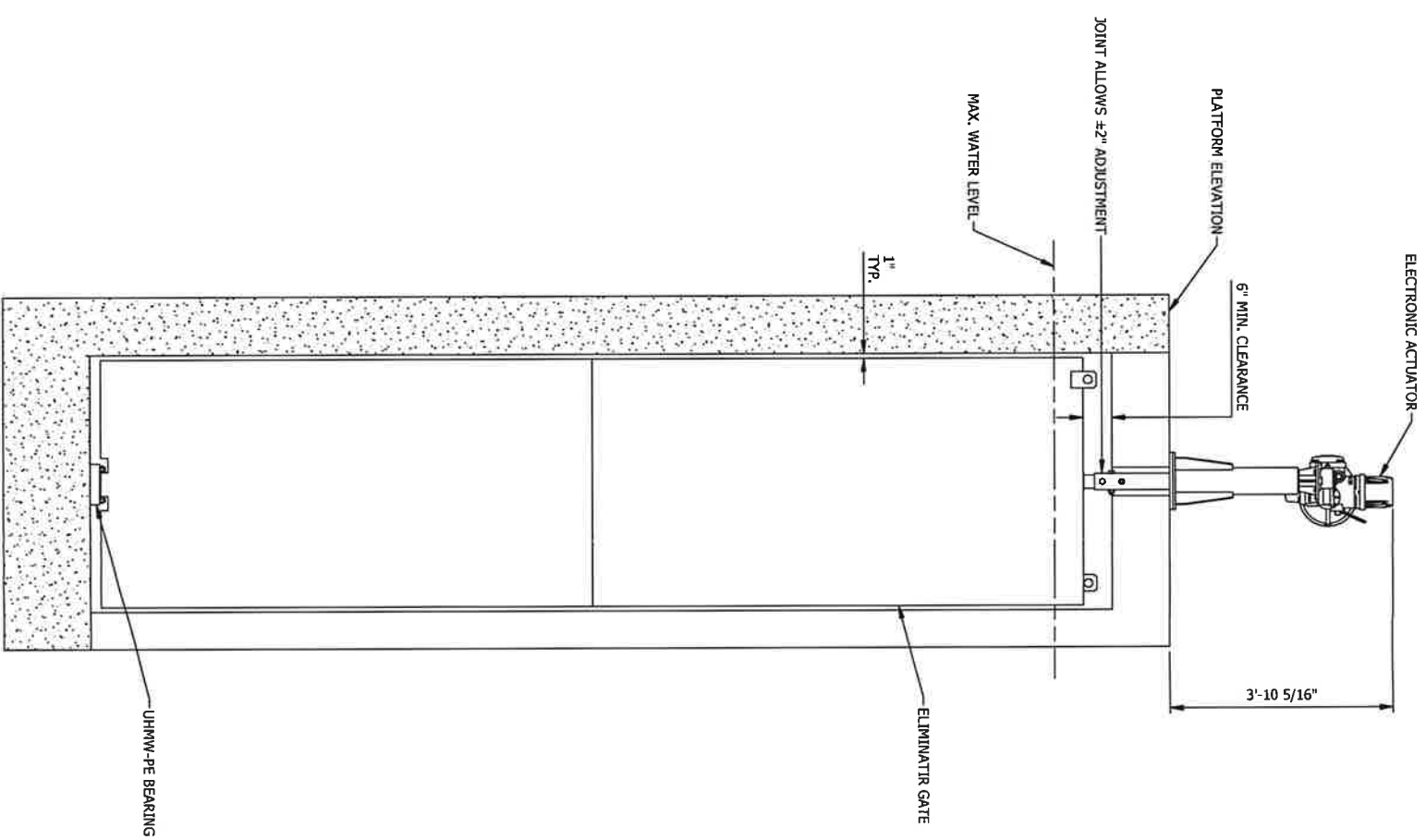
- EQUIPMENT NOTES:
1. UNIT IS 351 OUTPUT RPM. UNIT IS DRIVEN BY A 1690 RPM MOTOR WITH A 1.15 SERVICE FACTOR
 2. UNIT HAS 3 BLADE DESIGN PROPELLER OF POLYURETHANE CONSTRUCTION.
- ANAEROBIC SUBMERSIBLE MIXER**
 MIXER SIZE: TR 60-2.35-4/8
 RATED MOTOR HP: 4.9 HP
 MIXER HP DRAW: 3.8 HP

- EQUIPMENT NOTES:
1. UNIT IS 175 OUTPUT RPM. UNIT IS DRIVEN BY A 1100 RPM MOTOR WITH A 1.15 SERVICE FACTOR
 2. UNIT HAS 3 BLADE DESIGN PROPELLER OF POLYURETHANE CONSTRUCTION.
- 1st ANOXIC AND 2nd ANOXIC SUBMERSIBLE MIXER**
 MIXER SIZE: TR 75-2.17-6/16
 RATED MOTOR HP: 5.2 HP
 MIXER HP DRAW: 3.9 HP

SUBMERSIBLE MIXERS

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	SAL1AAE021
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	REV A

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DETAIL - F

DETAIL G

SECTION E-E

1. THE FOLLOWING DEFINES THE RESPONSIBILITY OF OVIVO USA, LLC (OVIVO) WITH REGARD TO THE INFORMATION AND DIMENSIONS SHOWN ON THIS DRAWING. (A) DIMENSIONS, LOADS AND OTHER INFORMATION ARE PROVIDED TO ACCOMMODATE THE EQUIPMENT TO THE STRUCTURE AS SHOWN. (B) THE CUSTOMER IS TO PROVIDE REINFORCING STEEL AND DESIGN FOR CONCRETE STRUCTURES AND IS TO DETERMINE SIZES TO SUIT LOCAL CONDITIONS. (C) THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION OR INSTALLATION PURPOSES UNLESS IT BEARS THE APPROVAL OF THE OWNER, THE ENGINEER OR THEIR AUTHORIZED REPRESENTATIVE. (D) THE MECHANISM SHOWN IS DESIGNED FOR OPERATION OVER THE RANGE INDICATED. OVIVO DOES NOT ASSUME RESPONSIBILITY FOR DAMAGE IF OPERATED OUTSIDE THIS RANGE. (E) CHARGES FOR MODIFICATIONS, ADDITIONS OR CORRECTIONS TO THE EQUIPMENT WILL NOT BE ACCEPTED BY OVIVO UNLESS PRIOR APPROVAL IS OBTAINED, IN WRITING, FROM AN AUTHORIZED OVIVO REPRESENTATIVE.
2. SHOP PRIMER PAINT IS INTENDED TO SERVE AS A PROTECTIVE OR SEALING COAT ONLY. AS SUCH, IT AFFORDS THE METAL ONLY MINIMAL PROTECTION AGAINST THE ELEMENTS. OVIVO CANNOT BE RESPONSIBLE FOR DETERIORATION OF SHOP-PRIMED EQUIPMENT DURING TRANSIT, JOB STORAGE, OR OTHER EXPOSURE TO THE ELEMENTS PRIOR TO APPLICATION OF FINISH COAT(S).
3. SURFACE PREPARATION TO CONSIST OF:
- ALL FABRICATED STEEL TO RECEIVE SSPC-SP-10 (NEAR WHITE METAL BLAST) REDUCER TO RECEIVE MANUFACTURER'S STANDARD PAINT SYSTEM
 - ALL FABRICATED STEEL TO RECEIVE ONE (1) SHOP COAT OF TENEHC 161-1211 PRIMER AT 3.0 - 5.0 MILS DRY FILM THICKNESS.
 - OVIVO TO SUPPLY ONE (1) GATE MECHANISM AS SHOWN AND NOTED.
 - ALL WELDING SHALL BE PERFORMED IN ACCORDANCE WITH THE LATEST EDITION OF A.W.S. WELDING PROCEDURES WITH QUALIFICATION RECORDS PER A.W.S. D1.1.
 - ALL STRUCTURAL SHAPES AND PLATES TO BE ASTM A36. ALL PIPES TO BE ASTM A-53. ALL RECTANGULAR TUBING TO BE A500 STEEL.
 - ANCHOR BOLTS: 304 STAINLESS STEEL EPOXY ANCHORS.
 - ASSEMBLY BOLTS: 304 STAINLESS STEEL.

NOTES:

ELIMINAT[®]R GATE

THIS DRAWING CONTAINS CONFIDENTIAL PROPRIETARY INFORMATION OF OVIVO, AND ITS ASSOCIATED COMPANIES. IT IS TO BE USED ONLY FOR THE PROJECT AND SITE SPECIFICALLY IDENTIFIED HEREIN. IT IS NOT TO BE REPRODUCED, COPIED, OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, WITHOUT THE EXPRESS WRITTEN PERMISSION OF OVIVO. UNAUTHORIZED USE OR REPRODUCTION OF THIS DRAWING IS STRICTLY PROHIBITED AND WILL BE PROSECUTED TO THE FULL EXTENT OF THE LAW.

COMPANY: OVIVO USA, LLC	PROJECT NO.:	NO.	NO.	NO.	NO.
DATE: 08/14/2024	REV:	5	OF	5	
<p>DO NOT SCALE PRINTS</p>			<p>NO.</p>	<p>NO.</p>	<p>NO.</p>
<p>SA144AE021</p>			<p>NO.</p>	<p>NO.</p>	<p>NO.</p>
<p>OVIVO</p>			<p>NO.</p>	<p>NO.</p>	<p>NO.</p>
<p>Bringing Water to life</p>			<p>NO.</p>	<p>NO.</p>	<p>NO.</p>
<p>SHEET</p>			<p>NO.</p>	<p>NO.</p>	<p>NO.</p>
<p>5 OF 5</p>			<p>NO.</p>	<p>NO.</p>	<p>NO.</p>
<p>REV</p>			<p>NO.</p>	<p>NO.</p>	<p>NO.</p>
<p>A</p>			<p>NO.</p>	<p>NO.</p>	<p>NO.</p>

Appendix B



Proposal
Brevard County, FL BNR
WWTP Upgrade
AnoxKaldnes™ IFAS
Proj. No. 5700109407

Submitted to: Brad Blais, PE, President
Quentin L. Hampton Associates Inc.

Submitted by: Daniel Hurt
Application Engineer

Date: 12/18/2014

This document is confidential and may contain proprietary information.

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Water Technologies

Quentin L. Hampton Associates, Inc.
Brevard County, FL BNR WWTP Upgrade - 5700109407
12/18/2014

CONFIDENTIAL

Introduction

I. Kruger Inc. is pleased to resubmit this budgetary proposal for our AnoxKaldnes IFAS System. In order to achieve the effluent limits as requested, we propose constructing two (2) IFAS process train. Each process train would consist of one (1) anaerobic selector, one (1) pre-anoxic reactor, one (1) Hybas reactor, one (1) aerobic activated sludge (A/S) reactor, one (1) post-anoxic reactor, and one (1) re-aeration reactor. A layout sketch is included in the Configuration Section on page 4.

Please note that we have sized a relative large pre-anoxic reactor and have increased the IR ratio to 600%, allowing most of nitrogen to be removed in pre-anoxic reactors, which in turn will reduce or totally eliminate consumption of external carbon source. We also recommend building up sludge blanket depth in the secondary clarifiers for P removal and denitrification. As a result of it, we have included a sludge blanket sensor for controlling sludge blanket depth in our scope of supply.

Meanwhile, our design includes an air scour system to aid in purging media away from the screens during periods of peak flow. The air scour system consists of a set of small air diffusers located just below the top row of screens in the IFAS reactors which can be connected to a small regenerative blower station. The regenerative blowers do not operate at normal flow conditions but would be activated in the event of high flow or a water level rise in the basins. This control feature will be linked to the PLC.

We appreciate the opportunity to provide this proposal to you. If you have any questions or need further information, please contact our local Representative, John Versharen of TSC-Jacobs, or our Regional Sales Manager, Tony Freed, at (229)-516-0570 (tony.freed@veolia.com).

cc: CT, AJF, LGW, JH, project file (Kruger)
John Versharen (TSC-Jacobs)

Revision	Date	Process Eng.	Comments
0	11/16/2013	JH, LGW	Initial, budgetary proposal.
1	12/18/2014	JH, LGW	Revised, Process Configuration

We Know Water

I. Kruger Inc. (Kruger) is a water and wastewater solutions provider specializing in advanced and differentiating technologies. Kruger provides complete processes and systems ranging from biological nutrient removal to mobile surface water treatment. The ACTIFLO® Microsand Ballasted Clarifier, BioCon® Dryer, BIOSTYR® Biological Aerated Filter (BAF) and NEOSEP™ MBR are just a few of the innovative technologies offered by Kruger.

Kruger Inc. is a Veolia Water Solutions & Technologies' (VWS) company providing innovative water and wastewater treatment solutions for the U.S. municipal market. As a global company with 135 Business Units in 57 countries, **Veolia Water** with nearly 10,000 employees worldwide and with over 250 proprietary technologies is the world leader in water and wastewater treatment.

Kruger delivers unequalled **S**ervice to our customers delivering and creating **V**alue while being environmentally **R**esponsible with a focus on safety. Since 1986, Kruger has been providing leading edge technologies for biological wastewater treatment, High Rate Clarification for phosphorus removal and water treatment, filtration for TSS removal, water reuse and drinking water and Biosolids processing. Based in Cary, North Carolina, Kruger's 120 plus professionals are dedicated to providing the most technically sound solution to meet our customers' needs while following our principles of **SVR**.

Energy Focus

Kruger, along with Veolia Water Solutions & Technologies (VWS) is dedicated to delivering sustainable and innovative technologies and solutions. We offer our customers integrated solutions which include resource-efficient technology to improve operations, reduce costs, achieve sustainability goals, decrease dependency on limited resources, and comply with current and anticipated regulations. Our focus is on delivering Veolia's investments in R&D outpace that of our competition. Our focus is on delivering

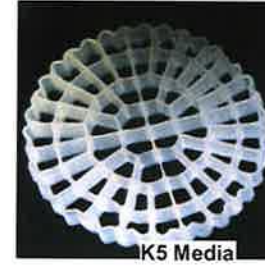
- neutral or positive energy solutions
- migration towards green chemicals or zero chemical consumption
- water-footprint-efficient technologies with high recovery rates

Our carbon footprint reduction program drives innovation, accelerates adoption and development of clean technologies, and offers our customers sustainable solutions. Kruger is benchmarking its technologies and solutions by working with our customers and performing total carbon cost analysis over the lifetime of the installation. By committing to the innovative development of clean and sustainable technologies and solutions worldwide, Kruger and VWS will continue to maximize the financial benefits for every customer.

Process Description

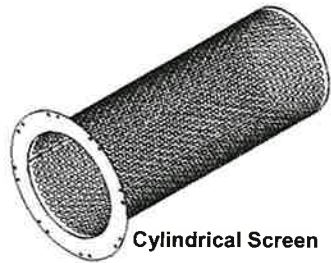
AnoxKaldnes MBBR and IFAS

Kruger's AnoxKaldnes process design is based on more than 20 years of experience with Moving Bed Biological Reactors (MBBR) and Integrated Fixed Film Activated Sludge (IFAS) systems. Our knowledge is supported by lab and pilot scale studies and data from more than 475 AnoxKaldnes operating systems for BOD, nitrification, and TN removal.



The MBBR and IFAS (or Hybas™ – Hybrid Biofilm Activated Sludge) processes are continuous flow through, non-clogging bio-film reactors containing “carrier elements” or media with a high specific surface. The media does not require backwashing or cleaning.

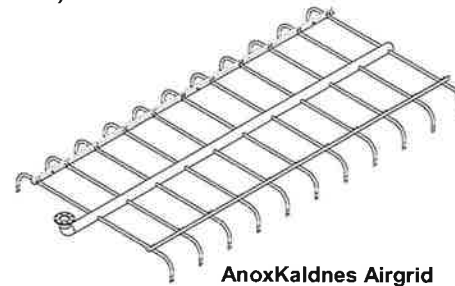
The biomass that treats the wastewater is attached to the surfaces of the media. The media is designed to provide a large protected surface area for the biofilm and optimal conditions for biological activity when suspended in water. Media of different shapes and sizes provide flexibility to use the most suitable type depending on wastewater characteristics, discharge standards and available volumes. AnoxKaldnes media is made from polyethylene and has a density slightly less than water.



In the MBBR process, all of the biomass is attached to the media and retained in the reactor, with no returned sludge. In the Hybas process, the reactor contains both free-floating biomass (activated sludge) and biomass attached to the media. The free-floating biomass passes through the reactor, is settled and recycled back to the reactor. The media and attached biofilm remain in the reactor as in a MBBR.

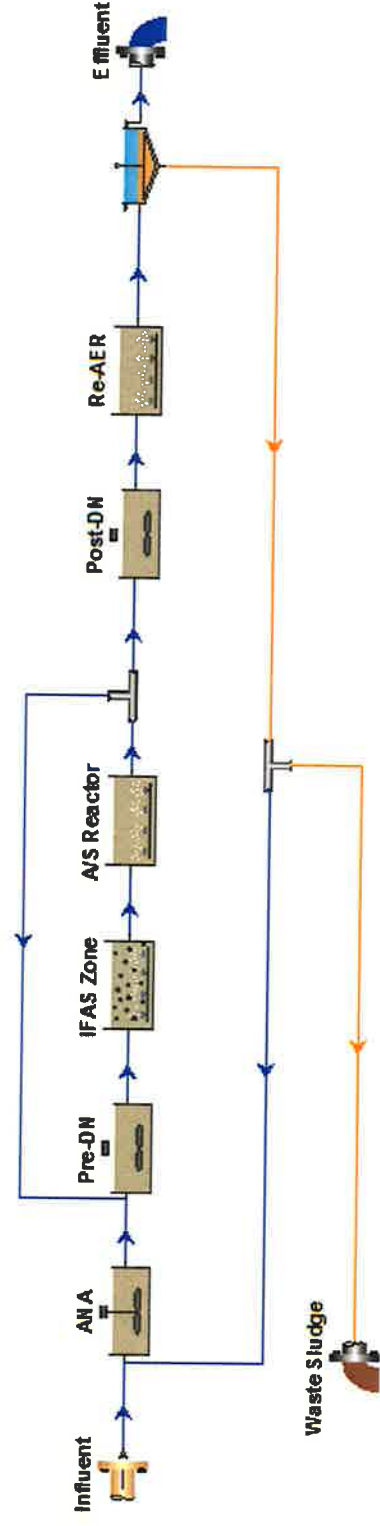
The Hybas process is often considered for upgrading existing conventional activated sludge systems within the existing tankage for either maintaining nitrification at new higher flow rates or loads or upgrading a plant to meet new nitrification requirements. It is accomplished by adding the media directly into the activated sludge reactors to enhance the growth of the autotrophic bacteria. The Hybas system is capable of meeting these new effluent requirements at low solids retention times (SRTs) and short hydraulic retention times (HRTs).

The mixing of the media within MBBR and Hybas reactors is provided by AnoxKaldnes' medium bubble aeration system in aerobic application, whereas specially designed submersible mixers are used in anoxic environments for denitrification.

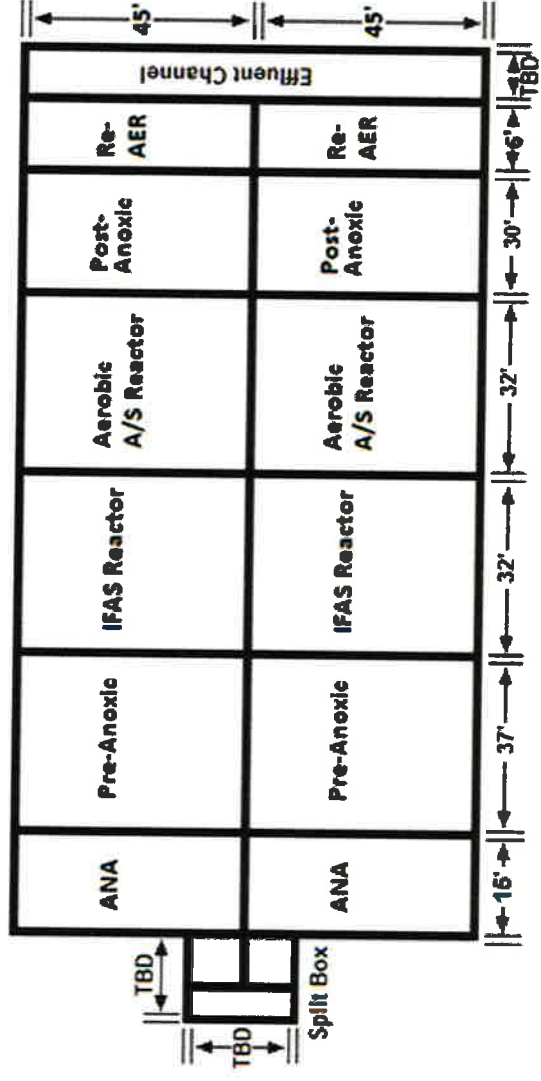


Kruger's minimum scope of supply for MBBR and Hybas systems includes the AnoxKaldnes media, screen assemblies (to keep media in each reactor), medium bubble aeration grid assemblies and submersible mixers for the anoxic zones. In cases where they are needed, Kruger also provides the blowers, instrumentation and controls, SCADA, and field instruments (dissolved oxygen, nitrate, ammonia, etc.) for single source responsibility.

IFAS System Configuration



IFAS Process Configuration



IFAS system Layout Sketch

Design Summary

The proposed design is based on the following influent wastewater characteristics and incorporating peak flow conditions for screen design purposes only. The design assumes that the raw influent wastewater is biodegradable, no toxic compounds are present, sufficient alkalinity is available to avoid pH depressions, that the COD/BOD ratio is between 1.7 and 2.3, and that none of the equipment provided would be used in a classified area (e.g. Class 1, Division 1 or Class 1, Division 2).

Facilities with primary clarification will require screening with a maximum of 6 mm (1/4 inch) openings for removal of particulate matter (rags, debris, etc.) prior to entering the AnoxKaldnes IFAS treatment reactors. Facilities that lack primary clarification will require screening with a maximum of 3 mm (1/8 inch) openings.

Table 1: AnoxKaldnes Influent Design Basis

Parameter	Unit	Value (Summer)
Flow, Max. Month	MGD	6.0
Flow, Peak Hourly Flow	MGD	12.0
BOD ₅ , Max. Month	mg/L	250
TSS, Max. Month	mg/L	175
TKN, Max. Month	mg/L	55
TP, Max. Month	mg/L	7.0
Design Temperature	°C	18
Site Elevation	ft	20

Table 2: AnoxKaldnes Effluent Objectives

Parameter	Units	Value ¹
cBOD ₅	mg/L	≤ 5.0
TSS	mg/L	≤ 5.0
TN ²	mg/L	≤ 3.0
NH ₃ -N	mg/L	≤ 1.0
TP ³	mg/L	≤ 1.0

- ¹ Following Tertiary Filtration
² Kruger assumes total refractory organic nitrogen is less than 1.0 mg/L
³ Chemical trimming may be required to meet this limit

Table 3: AnoxKaldnes Process Design Summary

Parameter	Units	Values
Number of Process Trains	-	2
Number of Anaerobic Reactors	-	1
Number of Pre-Anoxic Reactors	-	1
Number of IFAS Reactors per Train	-	1
Number of Aerobic Activated Sludge Reactors per Train	-	1
Number of Post-Anoxic Reactors per Train	-	1
Number of Re-Aeration Reactors per Train	-	1
Anaerobic Selector		
Dimensions (Each)	ft	15' L x 45' W x 25' SWD
Volume (Each)	ft ³	16,875
Total Volume (All Reactors, All Trains)	ft ³	33,750
Number of Mixers Per Reactor	-	1
Total Number of Mixers (All Reactors, All Trains)	-	2
Pre-Anoxic Reactor		
Dimensions (Each)	ft	37' L x 45' W x 25' SWD
Volume (Each)	ft ³	41,625
Total Volume (All Reactors, All Trains)	ft ³	83,250
Number of Mixers Per Reactor	-	1
Total Number of Mixers (All Reactors, All Trains)	-	2
Aerobic IFAS Reactor		
Dimensions (Each)	ft	32' L x 45' W x 25' SWD
Volume (Each)	ft ³	36,000
Total Volume (All Reactors, All Trains)	ft ³	72,000
Media Type	-	K5
Media Surface Area	ft ² /ft ³	244
Fill of Biofilm Carriers	%	40
Media Volume	ft ³	28,800
Total Media Surface	ft ²	7,021,00
Aeration System Type	-	Medium Bubble
Residual DO, Max. Month	mg/L	4.0
Total Air Requirement, Max. Month	SCFM	4,200
Discharge Pressure (From Top of Drop Pipe)	psi	10.50

Parameter	Units	Values
<u>Aerobic Activated Sludge Reactor</u>		
Dimensions (Each)	ft	32' L x 45' W x 25' SWD
Volume (Each)	ft ³	36,000
Total Volume (All Reactors, All Trains)	ft ³	72,000
Aeration System Type	-	Medium Bubble
Residual DO, Max. Month	mg/L	1.0 – 2.0
Total Air Requirement, Max. Month	SCFM	900
Discharge Pressure (From Top of Drop Pipe)	psi	10.50
<u>Post-Anoxic Reactor</u>		
Dimensions (Each)	ft	30' L x 45' W x 25' SWD
Volume (Each)	ft ³	33,750
Total Volume (All Reactors, All Trains)	ft ³	67,500
Number of Mixers Per Reactor	-	1
Total Number of Mixers (All Reactors, All Trains)	-	2
<u>Re-Aeration Reactor</u>		
Dimensions (Each)	ft	6' L x 45' W x 25' SWD
Volume (Each)	ft ³	6,750
Total Volume (All Reactors, All Trains)	ft ³	13,500
Aeration System Type	-	Medium Bubble
Residual DO, Max. Month	mg/L	2.0
Total Air Requirement, Max. Month	SCFM	200
Discharge Pressure (From Top of Drop Pipe)	psi	10.50
Recommended Freeboard	ft	2-3
RAS, Max. Month	%	~50 – 75
IR, Max. Month	%	~600
Recommended Freeboard	ft	2-3
Estimated Sludge Production, Maximum Month	lb/day	~9,000

Scope of Supply

Kruger is pleased to present our scope of supply which includes process engineering design, equipment procurement, and field services required for the proposed treatment system, as related to the equipment specified. The work will be performed to Kruger's high standards under the direction of a Project Manager. All matters related to the design, installation, or performance of the system shall be communicated through the Kruger representative giving the Engineer and Owner ready access to Kruger's extensive capabilities.

Process and Design Engineering

Kruger will provide process engineering and design support for the system as follows:

- Process Engineering consisting of aeration system sizing and configuration, sieve and outlet design.
- Review and approval of P&I Diagram for the AnoxKaldnes IFAS portion of the process. Preliminary General Arrangement Drawings and review and approval of final General Arrangement Drawings for the process. Review of reactor drawings with respect to penetrations and dimensions, excluding structural design.
- Equipment installation instructions for all equipment supplied by Kruger.

Field Services

Kruger will furnish a Service Engineer to perform the following tasks:

- Inspect installation of key pieces of equipment during construction.
- Inspect the completed system prior to startup.
- Assist the Contractor with initial startup of the system.
- Train the Owner's staff in the proper operation and maintenance of the AnoxKaldnes IFAS system.
- Test and start any Kruger-supplied control equipment, including PLC programming and SCADA systems.

AnoxKaldnes IFAS System Equipment – Limited to In-Basin Equipment Only

Mechanical Equipment Items	Total Qty	Description
AnoxKaldnes K5 Media, (ft ³)	28,800	High density polyethylene carrier elements.
Air scour system	Yes	An air sparging system in 304L SS will be provided to scour the cylindrical screens.
Regenerative Blowers	2	Regenerative blowers for screen air sparging. Blowers will be rated for 150 SCFM and 3.5 NPHP.
Cylindrical Screen Assemblies	60	Thirty (30) per Hybas reactor. 304L SS. 23" ø perforated plate pipes terminated in ANSI flanges for mounting directly to the tank wall.
Medium Bubble Aeration system	6	One for each aerobic reactor. 304L SS including header, lateral piping, and hardware (excluding anchor bolts).
Submersible Mixers (Anaerobic Selector)	2	One (1) for each anaerobic zone. Submersible Propeller Mixer, 304SS Rails, Hoist, and Receiving Bracket.
Submersible Mixers (Pre-Anoxic Reactor)	2	One (1) for each pre-anoxic zone. Submersible Propeller Mixer, 304SS Rails, Hoist, and Receiving Bracket.
Submersible Mixers (Post-Anoxic Reactor)	2	One (1) for each post-anoxic zone. Submersible Propeller Mixer, 304SS Rails, Hoist, and Receiving Bracket.
IMLR Wall Pumps	2	One (1) per rated at 18 MGD @ 2 feet TDH.
Airflow Control Valves	4	Valves for air flow control.
Instrumentation and Controls Equipment Items	Qty	Description
PLC Control Panel	1	NEMA 12 Freestanding or Wall Mount Control Panel (For Indoor Use). ControlLogix PLC; Panelview HMI; 120V Feed.
High Level Float Switch	2	One (1) for each IFAS reactor.
Thermal Mass Flow Meter	4	One thermal mass flow meter per IFAS reactor
DO Probe (LDO)	4	One (1) for each Aerobic reactor. Aerobic reactor DO Monitoring

Notes Regarding System Design and Installation

- For any MBBR or IFAS system, regardless of manufacturer, the quality and finish of reactor surfaces is important for the long-term longevity of the system. AnoxKaldnes has years of experience in the design and manufacture of MBBR and IFAS systems, with the quality and texture of the finished reactor walls is important. It is particularly important to prevent chipping, holidays, or rough areas that would leave open any annular spaces around media retention screens.

Scope of Supply BY INSTALLER/PURCHASER

The contractor's scope of supply for the AnoxKaldnes IFAS system should include, but is not limited to, the following items:

- All civil/site and electrical work.
- A concrete foundation for the tanks.
- Reactors to house the Hybas treatment equipment.
- All provisions for interconnecting piping.
- Unloading, storage and installation of equipment.

Design Options

In addition to the proposed system as detailed herein, Kruger is able to further incorporate our process and controls expertise into wastewater treatment plants, allowing municipalities to meet stringent effluent requirements and future plant upgrades. Kruger is also able to offer our instrumentation and controls expertise to build upon the proposed system by providing a **customized plant-wide SCADA system** or designing a **Motor Control Center (MCC)**, providing clients a single source responsibility for plant controls. Please contact Kruger if the options above are of interest or to be included in the current proposed system or future upgrades. **Please note that the design options listed above are not included in the pricing noted herein.

Schedule

- Shop drawings will be submitted within 6-8 weeks of receipt of an executed contract by all parties.
- All equipment will be delivered within 18-20 weeks after receipt of written approval of the shop drawings.
- Installation manuals will be furnished upon delivery of equipment.
- Operation and Maintenance Manuals will be submitted within 90 days after receipt of approved shop drawings.

Pricing

The "order-of-magnitude" price for the AnoxKaldnes IFAS system, as defined herein, including process and design engineering, field services, and equipment is: _____.

Pricing is FOB shipping point, with freight allowed to the job site. This pricing does not include any sales or use taxes. In addition, pricing is valid for ninety (90) days from the date of issue and is subject to negotiation of a mutually acceptable contract.

Please note that the above pricing is expressly contingent upon the items in this proposal and are subject to I. Kruger Inc. Standard Terms of Sale detailed herein.

Kruger Standard Terms of Payment

The terms of payment are as follows:

- 10% on receipt of fully executed contract
- 15% on submittal of shop drawings
- 75% on the delivery of equipment to the site

Payment shall not be contingent upon receipt of funds by the Contractor from the Owner. There shall be no retention in payments due to I. Kruger Inc. All other terms per our Standard Terms of Sale are attached.

All payment terms are net 30 days from the date of invoice. Final payment not to exceed 120 days from delivery of equipment.

I. Kruger Inc. Standard Terms of Sale

1. Applicable Terms. These terms govern the purchase and sale of the equipment and related services, if any (collectively, "Equipment"), referred to in Seller's purchase order, quotation, proposal or acknowledgment, as the case may be ("Seller's Documentation"). Whether these terms are included in an offer or an acceptance by Seller, such offer or acceptance is conditioned on Buyer's assent to these terms. Seller rejects all additional or different terms in any of Buyer's forms or documents.

2. Payment. Buyer shall pay Seller the full purchase price as set forth in Seller's Documentation. Unless Seller's Documentation provides otherwise, freight, storage, insurance and all taxes, duties or other governmental charges relating to the Equipment shall be paid by Buyer. If Seller is required to pay any such charges, Buyer shall immediately reimburse Seller. All payments are due within 30 days after receipt of invoice. Buyer shall be charged the lower of 1 ½% interest per month or the maximum legal rate on all amounts not received by the due date and shall pay all of Seller's reasonable costs (including attorneys' fees) of collecting amounts due but unpaid. All orders are subject to credit approval.

3. Delivery. Delivery of the Equipment shall be in material compliance with the schedule in Seller's Documentation. Unless Seller's Documentation provides otherwise, Delivery terms are F.O.B. Seller's facility.

4. Ownership of Materials. All devices, designs (including drawings, plans and specifications), estimates, prices, notes, electronic data and other documents or information prepared or disclosed by Seller, and all related intellectual property rights, shall remain Seller's property. Seller grants Buyer a non-exclusive, non-transferable license to use any such material solely for Buyer's use of the Equipment. Buyer shall not disclose any such material to third parties without Seller's prior written consent.

5. Changes. Seller shall not implement any changes in the scope of work described in Seller's Documentation unless Buyer and Seller agree in writing to the details of the change and any resulting price, schedule or other contractual modifications. This includes any changes necessitated by a change in applicable law occurring after the effective date of any contract including these terms.

6. Warranty. Subject to the following sentence, Seller warrants to Buyer that the Equipment shall materially conform to the description in Seller's Documentation and shall be free from defects in material and workmanship. The foregoing warranty shall not apply to any Equipment that is specified or otherwise demanded by Buyer and is not manufactured or selected by Seller, as to which (i) Seller hereby assigns to Buyer, to the extent assignable, any warranties made to Seller and (ii) Seller shall have no other liability to Buyer under warranty, tort or any other legal theory. If Buyer gives Seller prompt written notice of breach of this warranty within 18 months from delivery or 1 year from beneficial use, whichever occurs first (the "Warranty Period"), Seller shall, at its sole option and as Buyer's sole remedy, repair or replace the subject parts or refund the purchase price therefore. If Seller determines that any claimed breach is not, in fact, covered by this warranty, Buyer shall pay Seller its then customary charges for any repair or replacement made by Seller. Seller's warranty is conditioned on Buyer's (a) operating and maintaining the Equipment in accordance with Seller's instructions, (b) not making any unauthorized repairs or alterations, and (c) not being in default of any payment obligation to Seller. Seller's warranty does not cover damage caused by chemical action or abrasive material, misuse or improper installation (unless installed by Seller). THE WARRANTIES SET FORTH IN THIS SECTION ARE SELLER'S SOLE AND EXCLUSIVE WARRANTIES AND ARE SUBJECT TO SECTION 10 BELOW. SELLER MAKES NO OTHER WARRANTIES OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR PURPOSE.

7. Indemnity. Seller shall indemnify, defend and hold Buyer harmless from any claim, cause of action or liability incurred by Buyer as a result of third party claims for personal injury, death or damage to tangible property, to the extent caused by Seller's negligence. Seller shall have the sole authority to direct the defense of and settle any indemnified claim. Seller's indemnification is conditioned on Buyer (a) promptly, within the Warranty Period, notifying Seller of any claim, and (b) providing reasonable cooperation in the defense of any claim.

8. Force Majeure. Neither Seller nor Buyer shall have any liability for any breach (except for breach of payment obligations) caused by extreme weather or other act of God, strike or other labor shortage or disturbance, fire, accident, war or civil disturbance, delay of carriers, failure of normal sources of supply, act of government or any other cause beyond such party's reasonable control.

9. Cancellation. If Buyer cancels or suspends its order for any reason other than Seller's breach, Buyer shall promptly pay Seller for work performed prior to cancellation or suspension and any other direct costs incurred by Seller as a result of such cancellation or suspension.

10. LIMITATION OF LIABILITY. NOTWITHSTANDING ANYTHING ELSE TO THE CONTRARY, SELLER SHALL NOT BE LIABLE FOR ANY CONSEQUENTIAL, INCIDENTAL, SPECIAL, PUNITIVE OR OTHER INDIRECT DAMAGES, AND SELLER'S TOTAL LIABILITY ARISING AT ANY TIME FROM THE SALE OR USE OF THE EQUIPMENT SHALL NOT EXCEED THE PURCHASE PRICE PAID FOR THE EQUIPMENT. THESE LIMITATIONS APPLY WHETHER THE LIABILITY IS BASED ON CONTRACT, TORT, STRICT LIABILITY OR ANY OTHER THEORY.

Miscellaneous. If these terms are issued in connection with a government contract, they shall be deemed to include those federal acquisition regulations that are required by law to be included. These terms, together with any quotation, purchase order or acknowledgement issued or signed by the Seller, comprise the complete and exclusive statement of the agreement between the parties (the "Agreement") and supersede any terms contained in Buyer's documents, unless separately signed by Seller. No part of the Agreement may be changed or cancelled except by a written document signed by Seller and Buyer. No course of dealing or performance, usage of trade or failure to enforce any term shall be used to modify the Agreement. If any of these terms is unenforceable, such term shall be limited only to the extent necessary to make it enforceable, and all other terms shall remain in full force and effect. Buyer may not assign or permit any other transfer of the Agreement without Seller's prior written consent. The Agreement shall be governed by the laws of the State of North Carolina without regard to its conflict of laws

Appendix C

AUDUBON'S CRESTED CARACARA
(POLYBORUS PLANCUS AUDUBANII)

2015 SURVEY

SOUTH CENTRAL WATER TREATMENT PLANT

FOR

Brevard County Utility Services
2725 Judge Fran Jamieson Way
Bldg A, Rm 213
Viera, Florida, 32940

BY

Susan Gosselin
Senior Environmental Scientist
Brevard County Natural Resource Management Department
2725 Judge Fran Jamieson Way,
Bldg A, Rm 219
Viera, FL 32940

May 20, 2015



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1.0 PROJECT DESCRIPTION

1.1 INTRODUCTION

The South Central Water Treatment Plant Expansion Project is located in Brevard County Florida (Figure 1). Proposed plant expansion includes increased capacity for treatment to meet rising demand from development within the Viera West DRI. Proposed treatment systems include improved treatment systems with a minimal of increase of plant size and an employee parking lot. The proposed project is wholly within the U.S. Fish and Wildlife Service (FWS) Consultation Area for the Audubon's crested caracara (*Polyborus plancus audubonii*). As such, there is potential for this species' habitat to be impacted by this project.

This report summarizes the methods and results of the species specific survey, conducted from March 2015-May 2015.

2.0 AUDUBON'S CRESTED CARACARA

2.1 SPECIES DESCRIPTION

The crested caracara is a large, boldly patterned raptor with a crest, naked face, heavy bill, elongated neck, and long legs. It has a body length of about 50-60 cm (20-24 inches) and a wingspan of about 124 cm (50 inches). The adult is blackish-brown on the crown upper abdomen, rump, wings, and thighs. The lower part of the head, throat, upper breast, lower abdomen, and under tail coverts are white or cream. The lower breast has blackish barring with a buff background color. The back is also heavily barred with black and white. The tail is white with 11 to 14 narrow dark crossbars and a broad terminal band; there are conspicuous white patches in the outer part of the wing in flight. The bill is bluish-gray which contrasts with the bright yellow facial skin, which turns reddish-orange when flushed with blood. The legs and feet are deep yellow. Juveniles have a similar color pattern but are brownish and buff with the breast and upper back streaked instead of barred. In addition, facial skin of juveniles is pinkish in color and the legs are gray.

2.2 HABITAT

The caracara is a bird of open xeric to mesic habitats. Its preferred habitat is native dry or wet prairie with associated marshes, cabbage palm (*Sabal palmetto*), and cabbage palm-live oak (*Quercus virginiana*) hammocks. Native prairie habitats have been greatly reduced in Florida by housing developments and conversion to improved pasture. Consequently, the caracara are making good use of unimproved and improved pastures.

Adult caracaras maintain and defend large territories, usually with their mates. Breeding activity can occur from September through June with the primary season being November through April. Suitable nest trees are an important component of caracara habitat. Cabbage palms are most frequently utilized followed by live oaks, cypress (*Taxodium* spp.), and occasionally Australian pine (*Casuarina* spp.) and black gum (*Nyssa sylvatica*). Caracaras usually construct their nests 12-50 feet (3.66 to 15.24 meters) above the ground; their

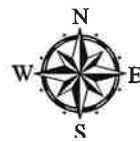


Figure 1
Project Location
Caracara Survey
South Central Water Treatment Plant
Brevard County

Legend

 Project Location

0 0.5 1 Miles



nests consist primarily of haphazardly woven vines trampled to form a depression (Humphrey and Morrison 1997). Caracara pairs sometimes have two or three alternate nest trees that may be used in different years or for a second nesting effort within the first year. All nest trees are typically situated in the same general vicinity, usually within 0.3 miles (0.5 kilometers) of each other.

Caracaras forage extensively on the ground with a foraging range average of 3,000 acres and a radius of approximately 1.2 miles (2.0 kilometers). Caracaras are opportunistic feeders with a diet consisting of carrion as well as a wide variety of live invertebrate and vertebrate prey. The birds also closely follow mowers in pastures, tractors plowing fields, etc., in order to capitalize on prey that may be exposed. Agricultural drainage ditches, cattle ponds, roadside ditches, and other shallow water features also provide good feeding conditions for caracaras (Morrison 2001). Within native habitats, caracaras regularly scavenge in recently burned areas and forage along the margins of wetlands within dry prairie communities.

2.3 STATUS

Audubon's crested caracara is federally designated as a Threatened species by the USFWS and protected by the Endangered Species Act (ESA), as amended (16 U.S.C. 1531 et seq.) and the Migratory Bird Treaty Act. Also, the Florida Fish and Wildlife Conservation Commission (FWC) currently list the caracara as Threatened. The caracara's decline in Florida is primarily due to habitat loss. In particular, the caracara was listed as Threatened because its dry prairie habitat has been largely destroyed or modified for agriculture and residential development. Prior to its listing, regulatory mechanisms did not adequately prevent the destruction or modification of the caracara's habitat, which is mainly located on private land.

Caracaras are sensitive to human disturbance, particularly humans on foot. Disturbances to a nesting pair during nesting and incubation can lead to abandonment of the nest and mortality of eggs or young. In order to reduce the potential for nest abandonment and loss of eggs and small chicks from human disturbance, the USFWS recommends that a nest protection zone (i.e., the primary zone) be placed around nest trees. The primary zone encompasses a 360° area extending 985 feet (300 meters) outward from the nest tree. Caracaras are most sensitive to disturbance during nest building, incubation, and early nestling stages (first 3 to 4 weeks). Year-round restrictions in the primary zone typically include activities such as removal of pasture, wetlands, nest trees and other vegetation, as well as construction, changes in land management activities, and chemical applications that are harmful to wildlife. Nesting season (November through April) restrictions also include limited human activities in the primary zone including low flyovers by aircraft.

A 360° secondary zone is recommended as a foraging protection zone and extends 4,920 feet (1,500 meters) outward from the nest tree. Year-round restrictions in the secondary zone typically include construction and development activities, removal of trees and vegetation,

conversion of pasture and wetlands to other agricultural land uses or hardwood forests, and application of chemicals.

3.0 SITE HISTORY

3.1 SOUTH CENTRAL WATER TREATMENT PLANT

The South Central Water Treatment plant went on line in 1990 and is an advanced wastewater treatment plant consisting of anaerobic tanks, anoxic tanks, extended oxidation ditches, re-aeration tanks and clarifiers with return activated sludge. This plant serves the Viera, Suntree and nearby neighborhoods in south central Brevard County.

The nearby Rich Grissom Memorial Wetlands consist of 200 acres divided into four marsh "cells" of approximately 35 acres each, plus a deep central lake. The constructed wetland system further polishes reclaimed water for irrigation or overflow into the adjacent Four-mile Canal. The capacity of the wetland is 2.5 MGD (million gallons per day) with influent characteristics of 0.3 mg/L of total phosphorus and 3.0 mg/L total nitrogen. The wetlands reduce the total phosphorous down to around 0.10 mg/L. The four cells were designed to maintain differing depths of water, flowing generally from the southeast, through the lake, to the northwest; providing an opportunity to support diverse wetland vegetation suitable to the conditions in each cell. 200,000 plants composed of 19 wetland species were installed in the cells and along the shoreline of the lake. Each of the four cells encircles an island of at least one acre, with each island designed to resemble a specific different natural community: a cypress hammock, a pine and hardwood forest, a shell substrate for shorebird nesting, and a hardwood hammock. Over 2,600 plants composed of 14 upland species were planted on the islands and along the upper bank of the lake.

3.2 AUDUBON'S CRESTED CARACARA

Audubon's crested caracara have been documented nesting near the plant through the Viera West DRI (DRI) (2012 USFWS Biologic Opinion(BO)), Brevard County staff tasked with managing the treatment ponds, and through various birders posting on birding list servers. These birds, CC03, have been documented using the treatment ponds for foraging and nearby cabbage palms for nesting. The 2006 and 2009 survey conducted by Glatting Jackson within the DRI BO documents showed a nest tree south of the southwest treatment pond. The 2009 DRI BO survey conducted by Glatting Jackson showed this same pair nesting just south of the wetland parking area between the plant and the treatment ponds. The 2009 nest location was also utilized by the pair in 2010 as discovered by Raleigh Berry, Natural Resources Management Department. In 2014, on routine survey, Mr. Berry found this pair nesting in a palm tree in the parking area between the plant and the treatment ponds.

4.0 SURVEY METHODOLOGY

4.1 PRELIMINARY DATA COLLECTION

The Draft Species Conservation Guidelines South Florida Audubon's Crested Caracara (USFWS, 2004a) for Audubon's Crested Caracara and Draft Survey Protocol for Finding Caracara Nests (USFWS, 2004b), were used for survey protocol to determine presence or absence of crested caracara within the project area.

This project occurs within the Caracara Consultation Area, as defined by the USFWS, and within a region known to support Audubon's crested caracara. Consistent with USFWS guidelines, a land use map was created for the study area utilizing FDOT's Florida Land Use Cover and Forms Classification System (FLUCFCS) (Figure 2) to identify potential caracara habitat. The study area included the plant and a mile radius circle around the plant to capture any potentially unknown birds. Areas which were highly developed, such as residential areas or areas under intense construction, were removed from the study. Observation blocks were set Wickham Road from Judge Fran Jamieson Way to west of the treatment ponds and on the electrical utility right of way north and south of the plant until gates barred access. Observers did a 360 scan of the area using binoculars and spotting scopes.

4.2 EXISTING ENVIRONMENTAL CHARACTERISTICS

Land Use categories were defined by the FDOT FLUCFCS (1999). Table 1 below has a description of each of the FLUCFCS classification within the 1 mile radius circle. The habitats listed in the table were reduced to those habitats recognized as suitable for caracara by the FWS. Suitable habitat is defined at those areas that can provide for feeding, breeding and shelter. Suitable habitat within the survey circle is 65% of the 4845 acres. Although the FWS doesn't recognize the treatment ponds as suitable habitat, they were considered within this study since caracara have been documented successfully foraging along the shoreline.

The following is a textual description of each of these suitable habitat types and the acreage within the survey:

Woodland Pasture (FLUCFCS 2130) – Areas of forest lands which are used as pastures. Signs of cattle usage such trails to food bunkers and water sources are present. 1.22 acres

Improved Pasture (FLUCFCS 2110) – Land which has been cleared, tilled and reseeded with specific grass types and periodically improved with brush control and fertilizer application. 683.79 acres

Sod Farms (FLUCFCS 2420) – Areas of land which have been cleared, tilled and reseeded with specific grass types. Signs of harvest and regular irrigation can be seen at regular intervals. 919.85

Mixed upland, non-forested (FLUCFCS 3300) – also known as Mixed Rangeland. Where no one upland non-forested type dominates. May be any combination of shrub, grassland and brushland. 12.42 acres

Upland mixed coniferous/hardwoods (FLUCFCS 4340) – Those areas where neither upland conifers nor hardwoods achieve a greater than 66% dominance. 16.47 acres

Streams and waterways (FLUCFCS 5100) – This category includes streams, rivers, canals and other waterbodies where water flow through channels is evident. 9.96 acres

Mixed wetland hardwoods (FLUCFCS 6170) – Those wetland hardwood communities which are comprised of a mix of hardwood species tolerant of hydric conditions and where no one species achieves a greater than 66% dominance. 3.65 acres

Wetland forested, mixed (FLUCFCS 6300) – Those forested communities where neither hardwoods or conifers achieve a greater than 66% dominance and species present are tolerant of hydric conditions. 9.33 acres

Fresh water marshes (FLUCFCS 6410) – Fresh water systems dominated by herbaceous species tolerant of hydric conditions. 22.74 acres

Wet prairies (FLUCFCS 6330) – This system is dominated by grassy vegetation on hydric soils and is distinguished from fresh water marshes by having less water and a shorter hydroperiod. 18.11 acres

Mixed scrub-shrub wetland (FLUCFCS 6460) – Those systems dominated by shrubby vegetation such as Carolina willow and wax myrtle. 138.57 acres

TABLE 1 FLUCFCS DESCRIPTIONS AND PERCENT COVER

LAND USE CODE	ACRES	LAND USE DESCRIPTION	PERCENT OF TOTAL	POTENTIAL HABITAT
1190	49.33	1190: Low density under construction	1.73	NO
1200	1.17	1200: Residential, medium density - 2-5 dwelling units/acre	0.04	NO
1290	99.39	1290: Medium density under construction	3.49	NO
1390	59.20	1390: High density under construction	2.08	NO
1300	211.19	1300: Residential, high density - 6 or more dwelling units/acre	7.42	NO
1700	49.49	1700: Institutional	1.74	NO
1820	50.99	1820: Golf courses	1.79	NO
2130	34.63	2130: Woodland pastures	1.22	YES
2110	683.79	2110: Improved pastures (monocult, planted forage crops)	24.04	YES
2420	919.85	2420: Sod farms	32.34	YES
3300	12.42	3300: Mixed upland nonforested	0.44	YES
4340	14.67	4340: Upland mixed coniferous/hardwood	0.52	YES
5100	9.96	5100: Streams and waterways	0.35	YES
5300	89.90	5300: Reservoirs - pits, retention ponds, dams	3.16	NO
6170	3.65	6170: Mixed wetland hardwoods	0.13	YES
6300	9.33	6300: Wetland forested mixed	0.33	YES
6410	20.74	6410: Freshwater marshes	0.73	YES
6430	18.11	6430: Wet prairies	0.64	YES
6460	138.57	6460: Mixed scrub-shrub wetland	4.87	YES

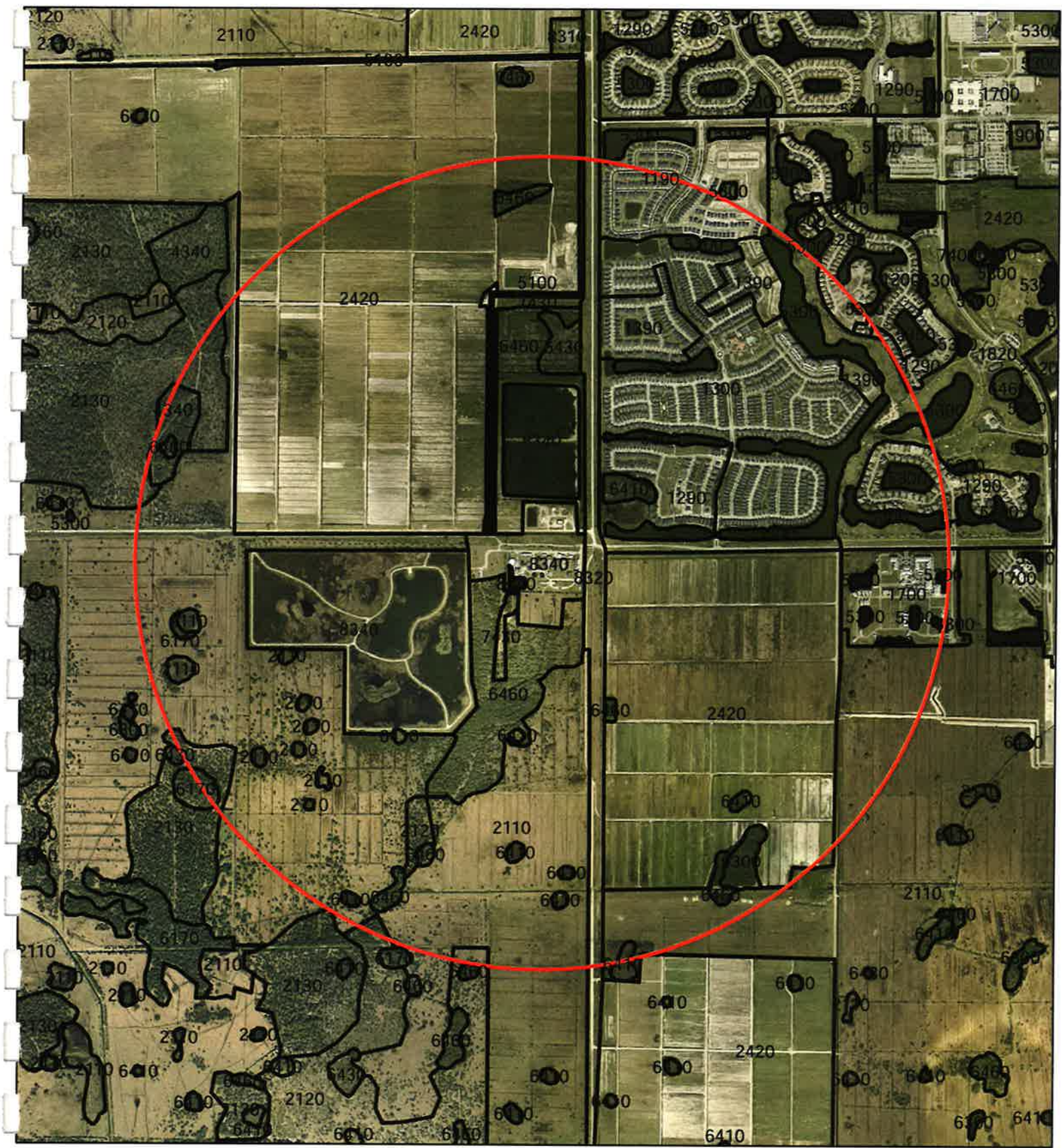
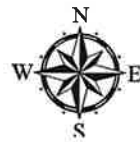


Figure 2

- Land Use Map
- Caracara Survey
- South Central Water Treatment Plant
- Brevard County

0 1,000 2,000 Feet



Legend

□ Land Use Polygon



7430	18.14	7430: Spoil areas	0.64	NO
8320	71.45	8320: Electrical power transmission lines	2.51	NO
8340	51.91	8340: Sewage treatment	1.82	NO
8360	226.61	8360: Treatment ponds	7.97	NO

4.3 SURVEY METHODOLOGY

A caracara survey must be conducted a minimum of twice a month (every two weeks) for three consecutive months between January and April before a determination on the absence of a nesting pair can be determined. Surveys were conducted in both early morning and in the afternoon. In accordance with the survey season and frequency established in the USFWS survey protocol for finding caracara nests, NRM biologist Chris Koepfel surveyed the study area according FWS protocols.

The study area was surveyed twice daily for five days to ensure no other nesting pair were present in the project area. The nesting pair known as CC003 were easily located and their nesting tree determined. The male of this pair is distinctly banded. The survey then changed to address the activity of the pair in addition to looking for any other birds. Also, the survey was reduced to once every two weeks until May 1, 2015.

5.0 Results

Only one active nesting pair was located over the course of the study. The caracara pair known as CC003 fledged two young and were actively feeding across the project area. Adults were seen foraging within demolition trailers on site and then feeding juvenile caracara on May 1, 2015. The cell tower within the project area was commonly used by the male for loafing. See Appendix B for survey data sheets.

No other birds or nests were found within the study area.




6.0 DISCUSSION

Caracara foraging within the demolition trailers used for disposal of biosolids has been recognized as a potential risk to the breeding pair and their offspring by Brevard County Utility Services through biological agents within the solids and the physical dumping of the solids in the trailer. The trailers have been covered to remove the risk to the caracara.

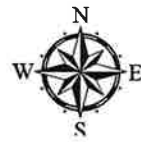
The 1000m Secondary Zone, as defined in the BO, places the proposed plant upgrades out of the Secondary Zone (Figure 3). Loss of Tier 4 habitat with the infrastructure upgrades will not have a direct impact on the Caracara's ability to forage, breed or shelter. Therefore, it is Brevard County's Opinion that the proposed infrastructure development will have No Effect on Audubon's Crested Caracara.



Figure 3
 CC003 Nest Location
 Caracara Survey
 South Central Water Treatment Plant
 Brevard County

-  Nest Location
-  Primary Zone
-  Secondary Zone

0 0.5 1 Miles



7.0 REFERENCES

Humprey, S.R. and J.L. Morrison. 1997 Habitat associations, reproduction, and foraging ecology of Audubon's crested caracaras in south-central Florida. Final Report. Florida Game and Freshwater Fish Commission (Florida Fish and Wildlife Conservation Commission) Nongame Program Project No. NG91-007 (August 8,1997).

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Morrison, J.L. 2001. Recommended management practices and survey protocols for Audubon's crested caracara (*Polyborus plancus audubonii*)in Florida. Technical Report No. 18. Florida Fish and Wildlife Conservation Commission, Tallahassee, Fl.

U.S. Fish and Wildlife Service. 2004a. Species Conservation Guidelines South Florida Audubon's Crested Caracara. South Florida Ecological Services Office, Vero Beach, Florida.

U.S. Fish and Wildlife Service. 2004b. Survey Protocols for finding caracara nests. South Florida Ecological Services Office. Bero Beach, Florida.

U.S. Fish and Wildlife Service. 2012. Programmatic Biological Opinion, Viera Development of Regional Impact, FWS Log No. 04EF1000-2012-F-0099, North Florida Ecological Services Office, Jacksonville, Florida.

APPENDIX A

USFWS SPECIES CONSERVATION GUIDELINES FOR AUDUBON'S CRESTED CARACARA (2004)

APPENDIX B
2015 SPECIES SPECIFIC SURVEY DATA

5/1/15

♂ Adult-TAGGED 1/2

(5pm)

♀ Adult

FLEDGLING = JUVENILE

1700-1720 - WETLANDS DRIVE AROUND - NO BIRDS SIGHTED

17:20 - ♂ in SENTINEL TREE BY PARKING LOT

17:24 - (2) JUVENILE BIRDS @ BLUE DUMPSTER in PLANT PROPER

(3) BIRDS total in sight at one time. 1 ♂ ADULT, 2 FLEDGLINGS.

FLEDGLINGS - JUST FLEDGED. AWKWARD FLYING, COORDINATION MISSING.

17:38 - (1) Juv bird flies south to spoil pile on property

17:48 ♂ flies to Dumpster (Blue)

- (2) Birds @ Dumpster

♂ CLEANING FACE AND FEEDING JUVENILE

17:53 - ♀ flies in from SENTINEL TREE (W) to BLUE DUMPSTER

- (3) BIRDS @ Dumpster

- Dumpster is Full

1800 - ♂ moves to white dumpster by GREASE PIT

1810 - ♀ moves to white dumpster

♂ - moves to ground - wanders to VEHICLE to HUNT RABBIT
Approx. 200' EAST of Dumpster.

1812 - ♀ - Joins ♂ to hunt RABBIT

1816 - ♀ - flies to CELL TOWER

♂ - flies to WETLANDS,

1820 - I moved to spoil pile, SPOTTED FLEDGLING BEGGING from Adult (♀)

1821 ♀ - flies to plant proper

- JUVENILE DISAPPEARED INTO UNDERBRUSH

- WATCHED ♀ Fly BACK to white Dumpster? location.

1/2

Crested Caracara Monitoring
Field Data Form

Date: 5/1/15 Start Time 1700 Stop Time 2000 Monitor Koepfel

Site Name and Location: **Include latitude and longitude, section, township, and range, and county.**

SOUTH CENTRAL REGIONAL WASTEWATER SYSTEM - VICRA

Weather Data

Time	Temp	Wind Speed/Direction	% Cloud Cover	Cloud Type	Rain
Start	81°	7-10	10%		N/A
Finish	80°	7-10	10%		N/A

Flight Data

#	Age A/Im	Time	Description
			SEE REVERSE

Nesting Data: Observed Activity

(perching, preening, courtship, feeding, nest building, incubation, head color change, head throwback, diving)

#	Age A/Im	Time	Description

General Observations

(crested caracara reaction to passing planes, trains, trucks, pedestrians, other birds, etc.)

#	Age A/Im	Time	Description

5/1/15 - CONTINUED

2/2

18:36 - ♀ on small white dumpster (AS SUSPECTED DESTINATION)

- SAME JUV BIRD STILL ON BLUE DUMPSTER. NEVER LEFT, FULL CRAP

18:53 - ♀ flies from white dumpster to blue dumpster. JOINS TUVU AND JUVENILE.

- JUV CRCA SCOLDING TUVU. TUVU, BACKS DOWN SHOWING SUBMISSIVE BEHAVIOR, FROM DOMINANT JUV.

18:59 - ♀ flies TO SPOIL PILE FROM WHITE DUMPSTER FEEDING OTHER JUVENILE. SKULL OF HERBIVORE AND TORN-UP CARRION PLACED AT BASE OF SPOIL PILE FOR JUVENILE.

19:04 - JUVENILE @ SPOIL PILE FLIES SE IN DIRECTION OF NEST + NEST HAMMOCK.

19:05 - PLANT SURVEY - NO BIRDS PRESENT

19:10 - 19:40 - WETLAND SURVEY - NO BIRDS PRESENT

20:00 - END OF SURVEY

Crested Caracara Monitoring Field Data Form

Date: 3/1/15 Start Time 1700 Stop Time 2000 Monitor Koepfel

Site Name and Location: **Include latitude and longitude, section, township, and range, and county.**

SCRWS - UERTA

Weather Data

Time	Temp	Wind Speed/Direction	% Cloud Cover	Cloud Type	Rain
Start					
Finish					

Flight Data

#	Age A/Im	Time	Description
			<u>SEE SHEET 1 of 2</u>

Nesting Data: Observed Activity

(perching, preening, courtship, feeding, nest building, incubation, head color change, head throwback, diving)

#	Age A/Im	Time	Description

General Observations

(crested caracara reaction to passing planes, trains, trucks, pedestrians, other birds, etc.)

#	Age A/Im	Time	Description

**Crested Caracara Monitoring
Field Data Form**

Date: 4/30/15 Start Time 030 Stop Time 1134 Monitor Koepfel

Site Name and Location: **Include latitude and longitude, section, township, and range, and county.**

SOUTH CENTRAL REGIONAL WASTEWATER PLANT 10001 WICKHAM RD.

Weather Data

Time	Temp	Wind Speed/Direction	% Cloud Cover	Cloud Type	Rain
Start	81	WSW 15	0		n/a
Finish	82	WNW 20	0		n/a

Flight Data

#	Age A/Im	Time	Description
			NO BIRDS SEEN

Nesting Data: Observed Activity

(perching, preening, courtship, feeding, nest building, incubation, head color change, head throwback, diving)

#	Age A/Im	Time	Description

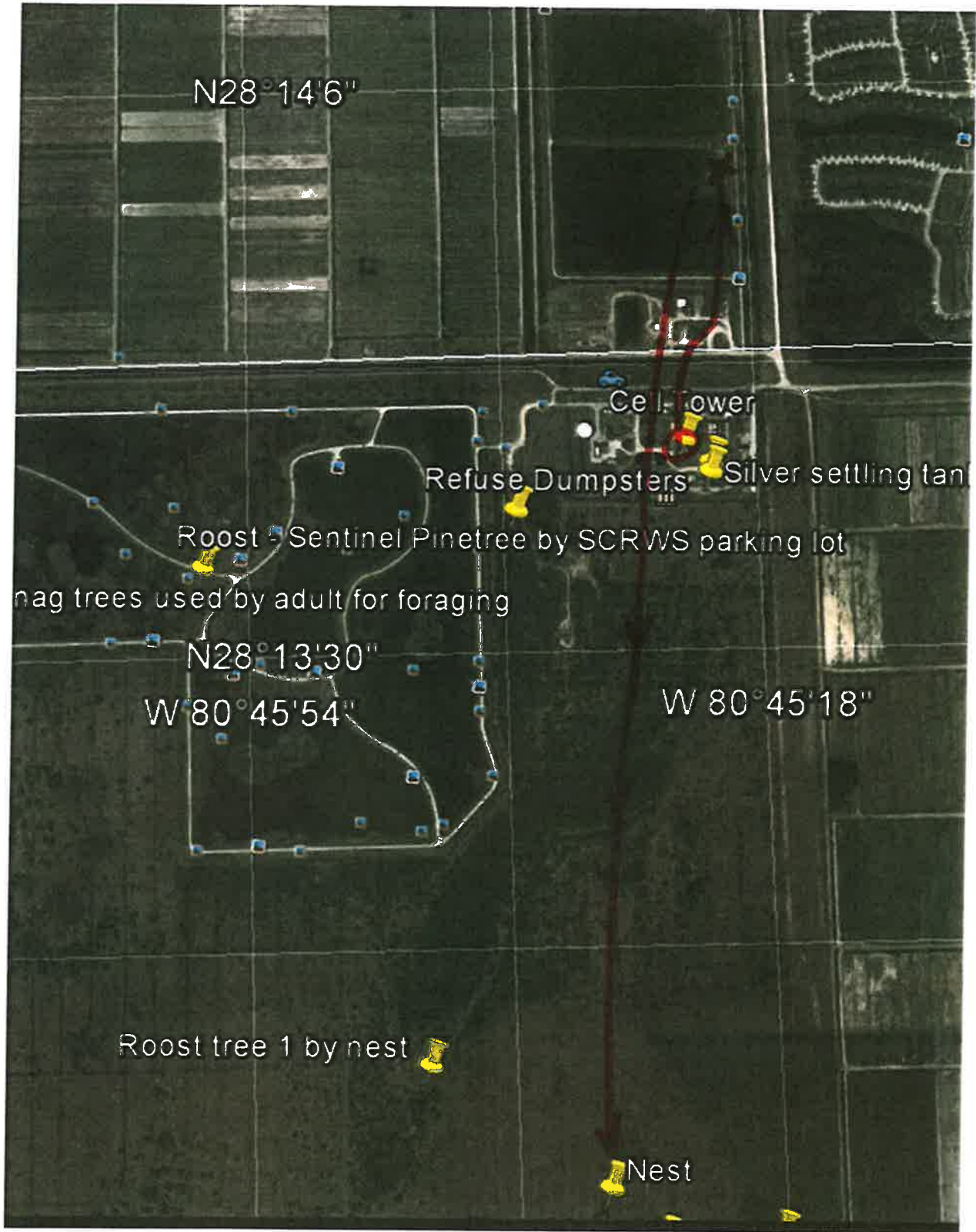
General Observations

(crested caracara reaction to passing planes, trains, trucks, pedestrians, other birds, etc.)

#	Age A/Im	Time	Description
			NICE DAY - NO BIRDS IN MORNING NS
			ANTICIPATION. MOST ACTIVITY IS IN EARLY

EVENING, AT OR AROUND THE WETLANDS/PLANT

Friday 4/17/15
2/2



Friday

Crested Caracara Monitoring
Field Data Form

Date: 4/17/15 Start Time 1700 Stop Time 2000 Monitor Koepfel

Site Name and Location: **Include latitude and longitude, section, township, and range, and county.**

SOUTH CENTRAL Wastewater Plant 10001 WICKHAM RD UICRA

Weather Data

Time	Temp	Wind Speed/Direction	% Cloud Cover	Cloud Type	Rain
Start	81	12-15 E	80%		INTERMITTENT
Finish	75	12 w/gusts	100%		"

Flight Data

#	Age A/Im	Time	Description
	A	1800	Left tower roost and flew low to north and "Click" ponds. IMMEDIATELY RETURNED WITH PREY ITEM IN BILL AND FLEW DUE SOUTH TO WEST.

Nesting Data: Observed Activity

(perching, preening, courtship, feeding, nest building, incubation, head color change, head throwback, diving)

#	Age A/Im	Time	Description
1	A ♂	1800	Flying from Click Ponds to nest with food item in bill. Bee lined for nest hammock. Flight directly to nest tree. NO SENTINAL or safety roost before ENTERING TREE (NEST)

General Observations

(crested caracara reaction to passing planes, trains, trucks, pedestrians, other birds, etc.)

#	Age A/Im	Time	Description
1	A	1700	♂ Perched on 3rd horizontal of cell tower
1	A	1800	♂ Flew to "Click" Ponds AND RETURNED to nest flying over plant. DUE SOUTH

**Crested Caracara Monitoring
Field Data Form**

Date: 4/10/15 Start Time 1700 Stop Time _____ Monitor Koepfel

Site Name and Location: **Include latitude and longitude, section, township, and range, and county.**

RAIN out - WEATHER MONSORY BAD WEATHER!

Weather Data

NO ACTIVITY NOTICED AND SAFETY ISSUES (lightning)

Time	Temp	Wind Speed/Direction	% Cloud Cover	Cloud Type	Rain
Start					
Finish					

Flight Data

#	Age A/Im	Time	Description

Nesting Data: Observed Activity

(perching, preening, courtship, feeding, nest building, incubation, head color change, head throwback, diving)

#	Age A/Im	Time	Description

General Observations

(crested caracara reaction to passing planes, trains, trucks, pedestrians, other birds, etc.)

#	Age A/Im	Time	Description

Crested Caracara Monitoring
Field Data Form

Date: 3/30/15 Start Time 1615 Stop Time 1930 Monitor Koepke

Site Name and Location: Include latitude and longitude, section, township, and range, and county.

SOUTH CENTRAL REGIONAL WASTEWATER PLANT - VIERA FL

Weather Data

Time	Temp F	Wind Speed/Direction	% Cloud Cover	Cloud Type	Rain
Start	74°	ESE 6	60	-	N/A
Finish	73°	"	60	-	N/A

Flight Data

#	Age A/Im	Time	Description
1	A	1810	♂ left tower headed NE toward Clickpond Access Road (A)
1	A	1843	♂ flew back over plant from Ponds due South to nest site area (B)
1	A	1910	♂ flew in from North along Power Pole line to fence post. (C)
1	A	1912	♂ flies into adjacent sod field - just BATHING

1 A 1920 ♀ flies from post along Road to nest direction (to the SW) (D)

Nesting Data: Observed Activity

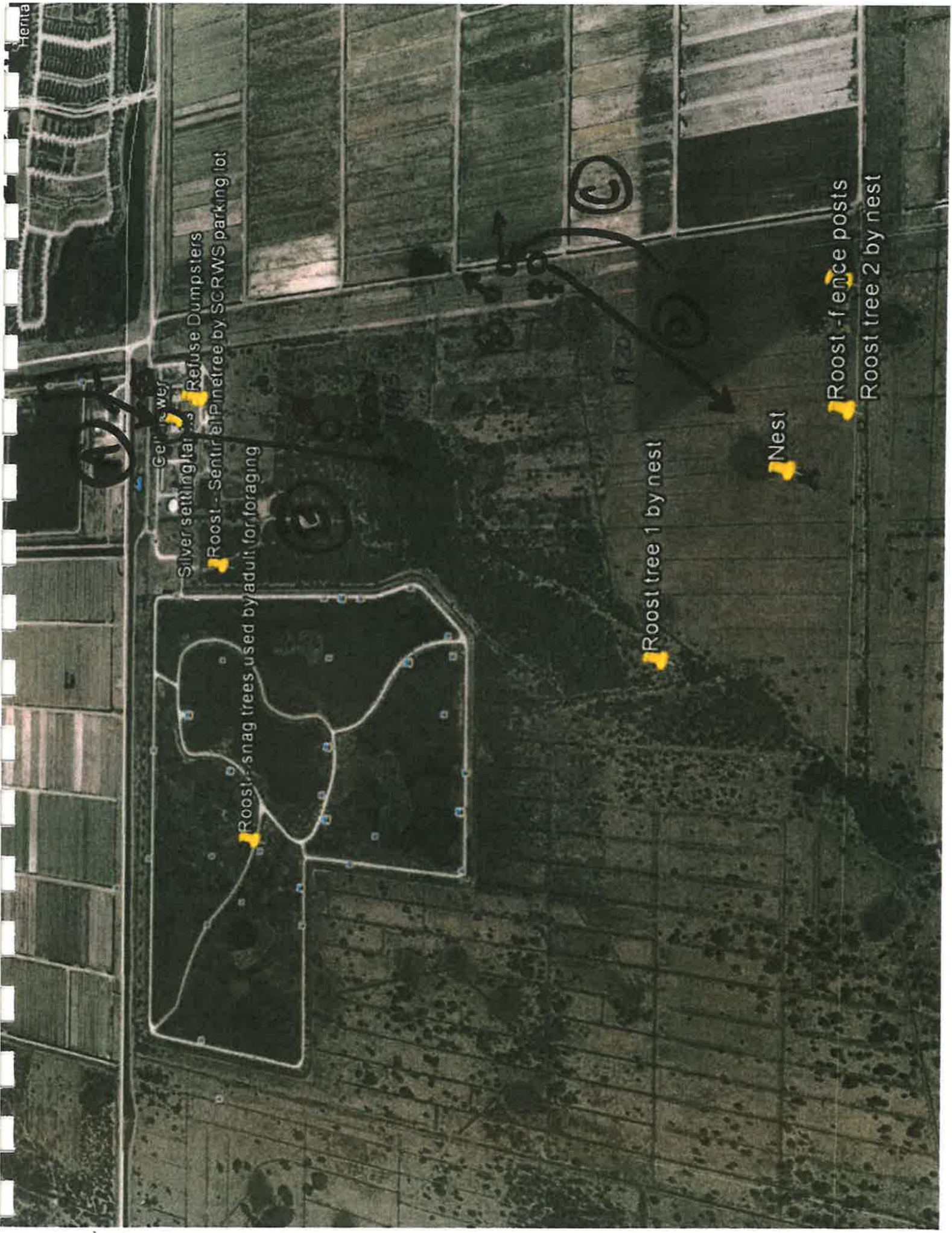
(perching, preening, courtship, feeding, nest building, incubation, head color change, head throwback, diving)

#	Age A/Im	Time	Description
1	A	1615	arrived onsite - noticed ♂ - TAGGED on 3rd rung of cell tower
2	A	1910	Female already on fencepost, ♂ joins her. SAW ♂ fly in (see above)

General Observations

(crested caracara reaction to passing planes, trains, trucks, pedestrians, other birds, etc.)

#	Age A/Im	Time	Description
1	A	1912	♂ Dust bath - Bird was on back with legs in air.
			Nightly herd of Deer present. ♀ all gravid. close to birth.



INITIAL SURVEY
TUESDAY

Crested Caracara Monitoring
Field Data Form

Date: 3/10/15 Start Time 8:30 Stop Time 12:30 Monitor KOEPPEL
15:30(p.m) 19:30(p.m)

Site Name and Location: Include latitude and longitude, section, township, and range, and county.

SOUTH CENTRAL REGIONAL WASTE WATER PLANT 10001 WICKHAM RD.
VIERA/MCCLENNAN FL 32940

Weather Data

Time	Temp	Wind Speed/Direction	% Cloud Cover	Cloud Type	Rain
Start	<u>78</u>	<u>8-10</u>	<u>80%</u>		
Finish					

Flight Data

#	Age A/Im	Time	Description
<u>2</u>	<u>A</u>	<u>18:30</u>	<u>BOTH ADULTS LEFT TOWER FLEW DUE SOUTH</u> <u>UNTIL OUT OF SIGHT FROM PROPOSED CONSTRUCTION</u> <u>AREA WHERE OBSERVING BIRDS ON TOWER</u> <u>ROOSTING</u>

Nesting Data: Observed Activity

(perching, preening, courtship, feeding, nest building, incubation, head color change, head throwback, diving)

#	Age A/Im	Time	Description
<u>SEE ABOVE</u>			<u>ROOSTING ON THIRD FROM BOTTOM HOR.</u> <u>SUPPORT OF CELL TOWER. WELL KNOWN</u> <u>LOCATION OVER LAST 6 YEARS OF</u> <u>CASUAL OBSERVATION WHEN ON SITE.</u>

General Observations

(crested caracara reaction to passing planes, trains, trucks, pedestrians, other birds, etc.)

#	Age A/Im	Time	Description
		<u>8:30</u> <u>-12:30</u>	<u>DRIVING WETLANDS + PLANT PROPERTY - NO OBSERVATION of Birds</u>
		<u>18:20</u>	<u>BOTH ADULTS (BANDED MALE) IN SENTINEL TREE (PL) + TOWER</u>

INITIAL SURVEY
WEDNESDAY

Crested Caracara Monitoring
Field Data Form

Date: 3/11/15 Start Time 800 Stop Time 1930 Monitor KOEPPEL

Site Name and Location: Include latitude and longitude, section, township, and range, and county.

SCRWS - WWTP - VIERA FL

Weather Data

Time	Temp	Wind Speed/Direction	% Cloud Cover	Cloud Type	Rain
Start	<u>80</u>	<u>8-10 S-NE</u>	<u>30%</u>		<u>RAIN - 1130</u>
Finish	<u>-</u>	<u>NE</u>	<u>70%</u>		

Flight Data

#	Age A/Im	Time	Description
<u>2</u>	<u>A</u>	<u>17:15</u>	<u>FEMALE FLIES IN TO SENTINEL TREE (PL) TO JOIN ♂</u>
<u>2</u>	<u>A</u>	<u>17:20</u>	<u>Adults fly to Tower; Roost on #3+4 Hor. BEAMS</u>
<u>2</u>	<u>A</u>	<u>17:40</u>	<u>Adults fly to NEARBY Dumpster for foraging</u>
<u>2</u>	<u>A</u>	<u>18:10</u>	<u>Adults fly from Dumpster DUE SOUTH, SAME PATH</u>

♂ on 4

AS 3/10/15 DEPARTURE

Nesting Data: Observed Activity

(perching, preening, courtship, feeding, nest building, incubation, head color change, head throwback, diving)

#	Age A/Im	Time	Description
	<u>A</u>	<u>17:45</u>	<u>Both adults look towards Dumpster diving and</u>
		<u>18:10</u>	<u>lookout, SEVERAL TIMES BOTH WENT IN AT</u>
			<u>SAME TIME. FEMALE LEFT FIRST. FLEW SOUTH.</u>
	<u>A ♂</u>		<u>MALE LEAVES LAST WITH FOOD ITEM IN BILL</u>

Full crops on Both Birds

General Observations

(crested caracara reaction to passing planes, trains, trucks, pedestrians, other birds, etc.)

#	Age A/Im	Time	Description
<u>1</u>	<u>A ♂</u>		<u>VERY CURIOUS OF WHITE TRUCK IN LOCATIONS THAT ARE</u>
			<u>UNCOMMON.</u>

- UNDER TREE, BY TRACTOR - OBSERVATION AREA MOST OF DAY
- SURVEYED ALL TREES DUE SOUTH OF PLANT WHERE ADULTS LEFT VISUAL.

Crested Caracara Monitoring
Field Data Form

INITIAL SURVEY
THURSDAY
PAGE 1/2

Date: 3/12/15 Start Time 900 Stop Time 2000 Monitor KOEPPEL

Site Name and Location: **Include latitude and longitude, section, township, and range, and county.**

SCRWS - WWTP - UICRA

Weather Data

Time	Temp	Wind Knots Speed/Direction	% Cover	Cloud	Cloud Type	Rain
Start	81	10-12 SW	10%			NA
Finish		gusts to 14	40%			NA

Flight Data

#	Age A/Im	Time	Description
1	A ♂	1115	Flew SE from ROAST TREE (C3). HEADING IS IN SAME ^{GENERAL} DIRECTION AS PREVIOUS TWO SUNSET FLIGHTS BY DEPARTING ADULTS. SEE ATTACHMENT (A)
↓	A ♀	1715	FLYING FROM HAMMOCK (DUDA NEST) DUE N TO CELL TOWER (B)
↓	A ♀	1817	FLYING DUE N FROM CELL TOWER AREA, TO NEST TREE (C)

Nesting Data: Observed Activity

(perching, preening, courtship, feeding, nest building, incubation, head color change, head throwback, diving)

#	Age A/Im	Time	Description
1	A ♂	1100	Foraging from Cell 3 sentinel tree. Fly into wetland cells area ON ROADWAY.
2	A	18:40	BOTH BIRDS BY NEST HAMMOCK. FROM NEST TO SENT. TREE 1 (D)
2	A	19:40	BOTH FLY TO PINE TREE BY ROADWAY. (E)

~~General Observations~~ - NESTING DATA - CONT.

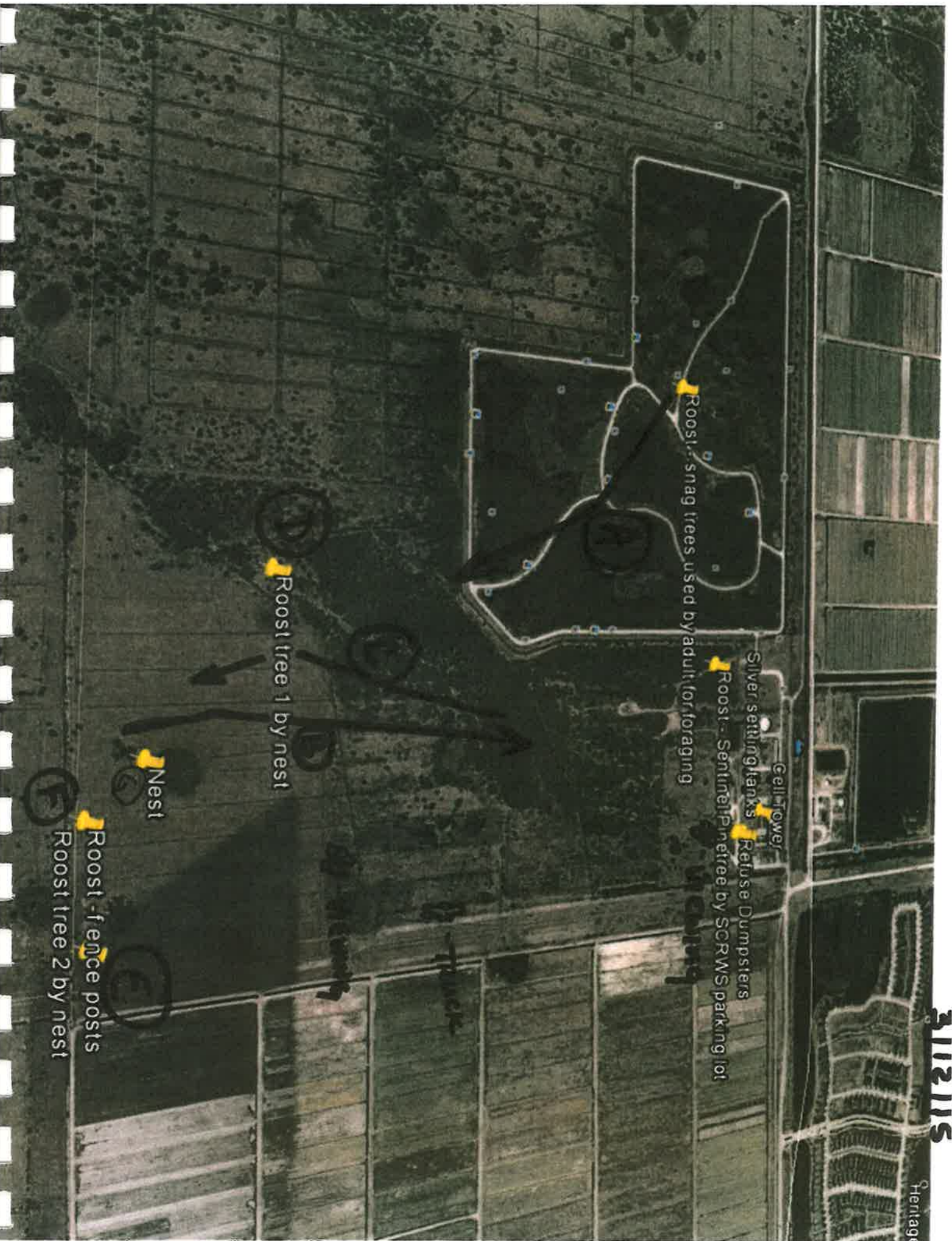
(crested caracara reaction to passing planes, trains, trucks, pedestrians, other birds, etc.)

#	Age A/Im	Time	Description
2	A	20:00	BOTH ADULTS FLEW FROM PINE TO FENCE POSTS (F)
2	A	20:05	BOTH ADULTS FLEW FROM POSTS TO NEST TREE (G)

SURVEYING FROM AREA IN CONSTRUCTION ZONE, AND FROM SE
CORNER OF PROPERTY

3112115

Heritage



Crested Caracara Monitoring
Field Data Form

INITIAL SURVEY
FRIDAY

Date: 3/13/15 Start Time 9:15 Stop Time 2:00 Monitor KOEPPPEL

Site Name and Location: 1700-1600-office
Include latitude and longitude, section, township, and range, and county.

SCRWS - WWTP - VIEIRA

Weather Data

Time	Temp	Wind Speed/Direction	% Cloud Cover	Cloud Type	Rain
Start	79	14-16	90		NA
Finish	81	12-14	10		NA

Flight Data

#	Age A/Im	Time	Description
1	A♂	10:40	Flying S. DEVIATES FP to check out my viewing AREA.
1	A♂	9:30	MALE NOTICED Flying to truck where I JUST PARKED
1	A♂	12:35	Bird Flying in from NW. AGAIN CHECKED TRUCK OUT.
			SEE REVERSE →

Nesting Data: Observed Activity

(perching, preening, courtship, feeding, nest building, incubation, head color change, head throwback, diving)

#	Age A/Im	Time	Description
1	A	9:30	PARKED TRUCK at SE CORNER of Property.
			Adult male flew DIRECTLY AT ME AND
			CIRCLED TRUCK SEVERAL TIMES UPON
			ARRIVING.

General Observations

(crested caracara reaction to passing planes, trains, trucks, pedestrians, other birds, etc.)

#	Age A/Im	Time	Description
-	-	9-1800	FREQ HEAVY EQUIPMENT USING DUDA ROAD

VIEWING AREA IS SOUTH BORDER of PROPERTY, NEAR FP. CAMO, clothes, netting, UNDER TREE. TRUCK 300 yds AWAY. →

* BOTH TIMES COULD NOT TELL CIRCLING EGRESS. (SNEAKED AWAY)

Speedway Press

From: "Marcia Turner" <MTurner@qlha.com>
To: "Speedway Press" <speedprs@bellsouth.net>
Sent: Monday, July 27, 2015 6:14 AM
Subject: RE: Richard Nation Business Card
Phone is 334-5072

-----Original Message-----

From: Speedway Press [mailto:speedprs@bellsouth.net]
Sent: Friday, July 24, 2015 5:00 PM
To: Marcia Turner <MTurner@qlha.com>
Subject: Fw: Richard Nation Business Card

Hi Marcia;

Enclosed is the business card for Richard. Please proof read carefully and email me back with changes or say ok to print.

Thank you,
Evan
Speedway Press
speedwaypress@bellsouth.net
386-255-1565

7/27/2015

