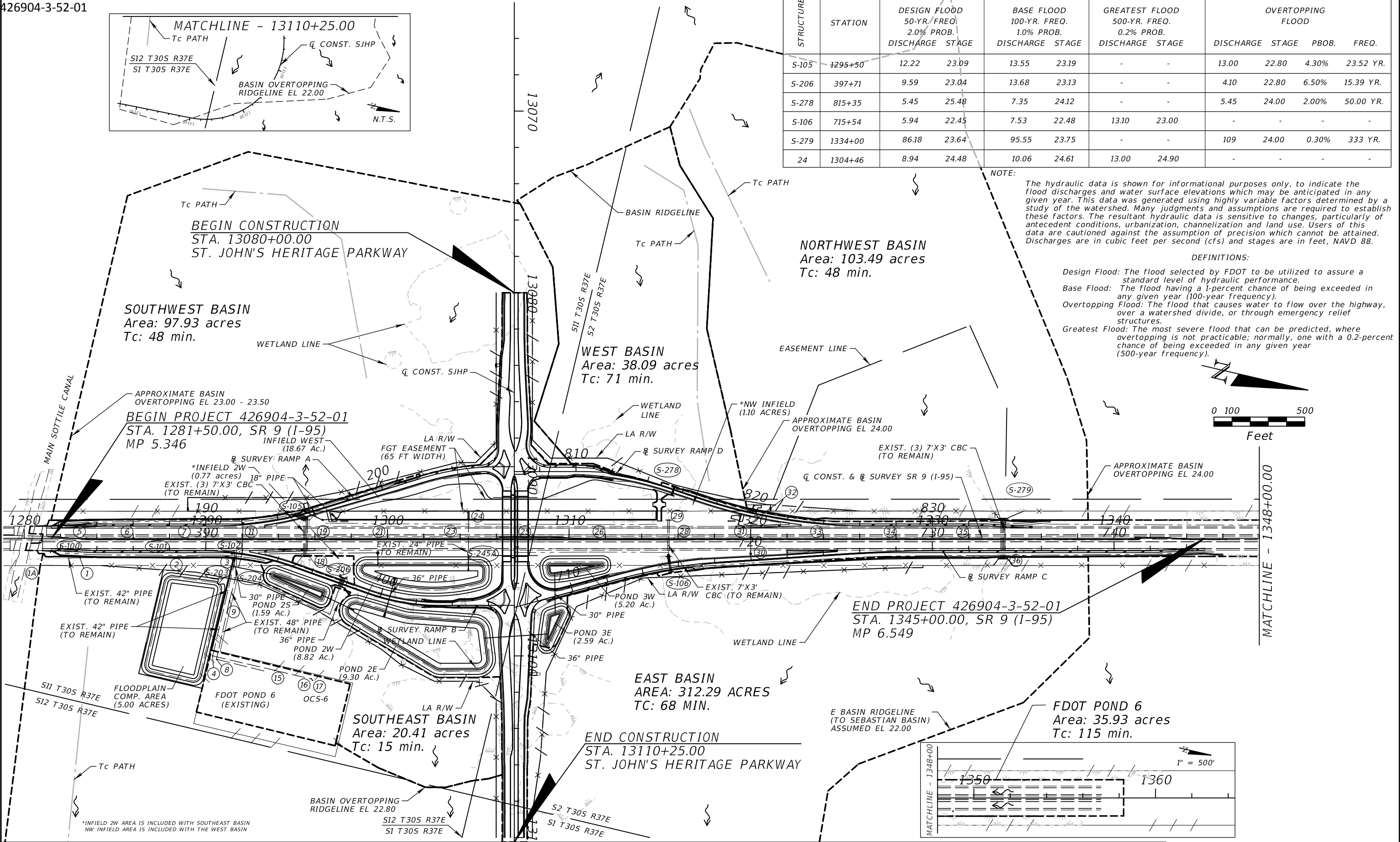
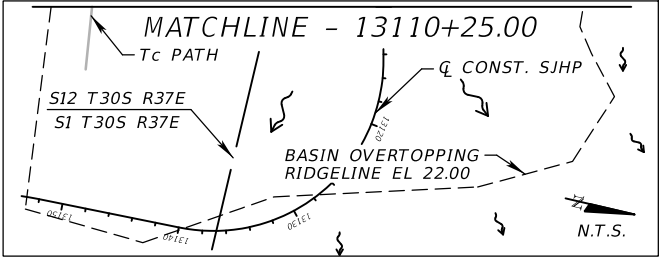


APPENDIX C



STRUCTURE	STATION	DESIGN FLOOD 50-YR. FREQ. 2.0% PROB.		BASE FLOOD 100-YR. FREQ. 1.0% PROB.		GREATEST FLOOD 500-YR. FREQ. 0.2% PROB.		OVERTOPPING FLOOD			
		DISCHARGE	STAGE	DISCHARGE	STAGE	DISCHARGE	STAGE	DISCHARGE	STAGE	PBOB.	FREQ.
S-105	1295+50	12.22	23.09	13.55	23.19	-	-	13.00	22.80	4.30%	23.52 YR.
S-206	397+71	9.59	23.04	13.68	23.13	-	-	4.10	22.80	6.50%	15.39 YR.
S-278	815+35	5.45	25.48	7.35	24.12	-	-	5.45	24.00	2.00%	50.00 YR.
S-106	715+54	5.94	22.45	7.53	22.48	13.10	23.00	-	-	-	-
S-279	1334+00	86.18	23.64	95.55	23.75	-	-	109	24.00	0.30%	333 YR.
24	1304+46	8.94	24.48	10.06	24.61	13.00	24.90	-	-	-	-

NOTE:
The hydraulic data is shown for informational purposes only, to indicate the flood discharges and water surface elevations which may be anticipated in any given year. This data was generated using highly variable factors determined by a study of the watershed. Many judgments and assumptions are required to establish these factors. The resultant hydraulic data is sensitive to changes, particularly of antecedent conditions, urbanization, channelization and land use. Users of this data are cautioned against the assumption of precision which cannot be attained. Discharges are in cubic feet per second (cfs) and stages are in feet, NAVD 88.

DEFINITIONS:
Design Flood: The flood selected by FDOT to be utilized to assure a standard level of hydraulic performance.
Base Flood: The flood having a 1-percent chance of being exceeded in any given year (100-year frequency).
Overtopping Flood: The flood that causes water to flow over the highway, over a watershed divide, or through emergency relief structures.
Greatest Flood: The most severe flood that can be predicted, where overtopping is not practicable; normally, one with a 0.2-percent chance of being exceeded in any given year (500-year frequency).

THIS SHEET HAS BEEN INCLUDED FOR DOCUMENTATION ONLY
AND IS NOT TO BE USED FOR CONSTRUCTION PURPOSES.

REVISIONS				KEVIN M. CANN, P.E. P.E. LICENSE NUMBER 77549 WANTMAN GROUP INC. 4371 US HIGHWAY 17, SUITE 203 FLEMING ISLAND, FL 32003 CERTIFICATE OF AUTHORIZATION 6091	STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION			INTERCHANGE DRAINAGE MAP	SHEET NO.
DATE	DESCRIPTION	DATE	DESCRIPTION		ROAD NO.	COUNTY	FINANCIAL PROJECT ID		
					SR 9	BREVARD	426904-3-52-01		

Wantman Group, Inc.

Engineering • Planning • Surveying • Environmental

POST-DEVELOPMENT CURVE NUMBER

Project: I-95 at St. John's Heritage Parkway
 Financial Project Number: 426904-3-52-01
 County: Brevard

Designer: KMC 3/25/2017
 Reviewer: WS

Basin	Soil Symbol	Hydrologic Soil Group, HSG	Cover Condition		Observed HSG	Total	Area		Curve Number	Weighted CN
			Description	Hydrologic			Incremental	Percentage		
Southwest	17/ EauGallie sand	A/D	Woods-Grass	Fair	C	97.93	0.78	0.80%	76	0.6
	19/ Riviera sand, 0 to 2 percent slopes	C/D	Pasture-Grass	Good	D		21.94	22.40%	80	17.9
	28/ Immokalee sand	A/D	Brush-Weed	Good	C		18.12	18.50%	73	13.5
	36/ Myakka sand, 0 to 2 percent slopes	A/D	Brush-Weed	Good	C		20.37	20.80%	73	15.2
	38/ Myakka sand, depressional	B/D	Range	Good	C		6.95	7.10%	74	5.3
	49/ Pomello sand	A	Brush	Poor	A		29.77	30.40%	48	14.6
West	28/ Immokalee sand	A/D	Brush-Grass	Fair	C	38.09	8.42	22.10%	70	15.5
	36/ Myakka sand, 0 to 2 percent slopes	A/D	Brush	Good	D		16.30	42.80%	73	31.2
	49/ Pomello sand	A	Brush	Fair	A		2.21	5.80%	48	2.8
	55/ St. Johns sand, depressional	B/D	Woods-Brush	Good	D		11.16	29.30%	77	22.6
Northwest	18/ EauGallie, Winder, and Riviera soils, depressional	B/D	WoodsBrush	Good	D	103.49	20.08	19.40%	77	14.9
	36/ Myakka sand, 0 to 2 percent slopes	A/D	Brush	Good	D		72.65	70.20%	73	51.2
	49/ Pomello sand	A	Woods	Poor	A		4.76	4.60%	45	2.1
	55/ St. Johns sand, depressional	B/D	Pasture-Range	Fair	D		6.00	5.80%	84	4.9
Southeast	17/ EauGallie sand	A/D	Woods-Grass	Poor	C	20.41	0.12	0.60%	82	0.5
	18/ EauGallie, Winder, and Riviera soils, depressional	B/D	Brush-Range	Fair	C		9.29	45.50%	75	34.1
	19/ Riviera sand, 0 to 2 percent slopes	C/D	Woods-Brush	Good	D		6.14	30.10%	75	22.6
	71/ Wabasso sand	C/D	Brush	Good	D		4.86	23.80%	73	17.4

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POST-DEVELOPMENT CURVE NUMBER

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 Financial Project Number: 426904-3-52-01
 County: Brevard

Designer: KMC 3/25/2017
 Reviewer: WS

Basin	Soil Symbol	Hydrologic Soil Group, HSG	Cover Condition		Observed HSG	Total	Area		Curve Number	Weighted CN
			Description	Hydrologic			Incremental	Percentage		
East	17/ EauGallie sand	A/D	Brush	Good	C	312.29	75.89	24.30%	65	16
	18/ EauGallie, Winder, and Riviera soils, depressional	B/D	Brush	Good	C		19.99	6.40%	65	4.2
	19/ Riviera sand, 0 to 2 percent slopes	C/D	Brush	Good	D		10.62	3.40%	73	2.5
	36/ Myakka sand, 0 to 2 percent slopes	A/D	Brusj	Fair	C		18.11	5.80%	70	4.1
	47/ Pineda sand	A/D	Woods	Fair	A		53.71	17.20%	36	6.2
	55/ St. Johns sand, depressional	B/D	Brush	Good	D		0.94	0.30%	73	0.2
	62/ Samsula muck, depressional	A/D	Brush	Good	C		20.30	6.50%	65	4.2
	71/ Wabasso sand	C/D	Woods-Brush	Fair	D		111.18	35.60%	80	28.5
	99/ Water	-	-	-	-		1.56	0.50%	100	0.5
Post B6	Streets - Highway	B/C	Paved w Ditches	-	C	35.93	31.54	87.78%	92	80.8
	99/ Water	-	-	-	-		4.39	12.22%	100	12.2
Infield West										
Heritage-1	Streets	-	Paved w Curbs	-	-	18.67	4.87	26.08%	95	24.8
I-95 SB	Highway	B/C	Paved w Ditches	-	C		4.05	21.69%	89	19.3
	19/ Riviera sand, 0 to 2 percent slopes	C/D	Pasture-Grass	Good	C		9.75	52.22%	73	38.1
Basin 2W										
Heritage-2W ²	Streets	-	Paved w Curbs	-	-	8.82	1.61	18.25%	98	17.9
I-95 2W	Highway	B/C	Paved w Ditches	-	B		2.81	31.86%	89	28.4
Pond 2W	Open Space	B/C	Grass Area	Good	C		2.39	27.10%	74	20.1
	99/ Water	-	-	-	-		2.01	22.79%	100	22.8
Basin 2E										
Heritage-2E	Highway	-	Paved w Ditches	-	-	9.30	0.07	0.75%	98	0.7
Pond 2E	Open Space	B/C	Grass Area	Good	B		5.30	56.99%	74	42.2
	99/ Water	-	-	-	-		3.93	42.26%	100	42.3

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POST-DEVELOPMENT CURVE NUMBER

Project: I-95 at St. John's Heritage Parkway
Financial Project Number: 426904-3-52-01
County: Brevard

Designer: KMC
Reviewer: WS

3/25/2017

Basin	Soil Symbol	Hydrologic Soil Group, HSG	Cover Condition Description	Hydrologic	Observed HSG	Total	Area Incremental	Percentage	Curve Number	Weighted CN
Basin 2S										
Ramp B	Highway	B/C	Paved w Ditches	-	C		0.21	12.94%	98	12.7
Pond 2S	Open Space	B/C	Grass Area	Good	B	1.59	0.95	60.01%	74	44.4
	99/ Water	-	-	-	-		0.43	27.04%	100	27.0
Basin 3W										
I-95 3W	Highway	B/C	Paved w Ditches	-	C		1.06	20.38%	98	20.0
Heritage-3W ²	Streets	-	Paved w Curbs	-	-	5.20	1.26	24.23%	98	23.7
Pond 3W	Open Space	B/C	Grass Area	Good	B		2.43	46.73%	74	34.6
	99/ Water	-	-	-	-		0.45	8.65%	100	8.7
Basin 3E										
Heritage-3E	Streets	-	Paved w Curbs	-	-		1.56	50.00%	98	49.0
Pond 3E	Open Space	B/C	Grass Area	Good	B	2.59	0.73	38.42%	74	28.4
	99/ Water	-	-	-	-		0.30	11.58%	100	11.6

Total Area 654.31

Composite Runoff Values					
Basin	CN	Basin	CN	Basin	CN
Southwest	67	East	66	Basin 2E	85
West	72	Post B6	93	Basin 2S	84
Northwest	73	Infield West	82	Basin 3W	87
Southeast	75	Basin 2W	89	Basin 3E	89

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Required Treatment Volume

Project: I-95 at St. John's Heritage Parkway
Financial Project Number: 426904-3-52-01
County: Brevard

Designer: KMC 8/7/2017
Reviewer: WS

BASIN	Total Area (ac)	Proposed Impervious Area (ac)	Water Surface Area (ac)	1" Times Drainage Area (ac-ft)	2.5" Times Impervious Area (ac-ft)	Required Treatment Volume (ac-ft)
Post B6	35.94	12.46	4.39	3.00	2.60	3.00
Heritage	Infield West	18.67	9.52	-	1.56	1.98
	Pond 2S	1.59	0.94	0.43	0.13	0.20
	Pond 2W	8.82	2.31	2.01	0.74	0.74
	Pond 2E	9.30	2.12	3.93	0.78	0.78
	Pond 3W	5.20	2.14	0.45	0.43	0.45
	Pond 3E	2.59	1.84	0.30	0.22	0.38
Heritage Basins Grand Total		46.17	18.87	7.12	3.85	4.52

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Permanent Pool Calculations

Project: I-95 at St. John's Heritage Parkway
Financial Project Number: 426904-3-52-01
County: Brevard

Designer: KMC 8/9/2017
Reviewer: WS

BASIN	Total Area (ac)	Impervious Area (ac)	Runoff Coefficient	Wet Pond Area (ac)	Runoff Coefficient	Pervious Area (ac)	Runoff Coefficient	Composite Runoff Coefficient	Wet Season Normal Rainfall (in)	Permanent Pool Volume	Permanent Pool Volume (No Littoral Zone)
Infield West	18.67	9.52	0.95	0.00	1	9.15	0.2	0.58	31	2.57	3.86
Pond 2S	1.59	0.94	0.95	0.43	1	0.22	0.2	0.86	31	0.32	0.48
Pond 2W	8.82	2.31	0.95	2.01	1	4.50	0.2	0.58	31	1.21	1.81
Pond 2E	9.30	2.12	0.95	3.93	1	3.25	0.2	0.71	31	1.56	2.34
Pond 3W	5.20	2.14	0.95	0.45	1	2.61	0.2	0.58	31	0.71	1.07
Pond 3E	2.59	1.84	0.95	0.30	1	0.45	0.2	0.83	31	0.51	0.76
Grand Total:	46.17	18.87	-	7.12	-	20.18	-	4.13	31.00	6.87	10.31

Prop. PPV = 37.71 ac-ft
See Pond Storage Calculations

$$PPV = \frac{DA * C * R * RT}{WS * CF}$$

*Reference: Formula from St. Johns River Water Management District Permit
Information Manual (Part 26.1 Calculating Permanent Pool Volumes)

Where:
PPV = Permanent Pool Volume (ac – ft)
DA = Drainage Area to pond (ac) (Total Area)
C = Composite Runoff Coefficient
R = Wet Season Rainfall Depth (in)
RT = Residence Time (14 days) (if no littoral zone RT = 21 days)
WS = Length of Wet Season (days) (June – October = 153 days)
CF = Conversion Factor (12 in/ft)

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STAGE/AREA STAGE/VOLUME CALCULATIONS FOR WATER QUALITY TREATMENT

Project: I-95 at St. John's Heritage Parkway

Financial Project Number: 426904-3-52-01

County: Brevard

Designer: KMC

8/9/2017

Reviewer: WS

<i>Pond 2W</i>	Elevation (ft. NAVD)	Area (Ac)	Incr. Vol (ac-ft)	Cumulative Volume (ac-ft)	Treatment Volume (ac-ft)	
Pond Bottom	0.00	0.60	0.00	-		
	14.00	1.46	20.43	0.00		Anoxic Zone
Slope Break	18.00	1.73	6.37	6.37		
NWL	20.30	2.06	4.35	10.72		PPV
Weir	21.00	2.16	1.47	12.19	1.47	Tv Provided
TOB	24.50	2.66	8.42	20.61		

<i>Pond 2E</i>	Elevation (ft. NAVD)	Area (Ac)	Incr. Vol (ac-ft)	Cumulative Volume (ac-ft)	Treatment Volume (ac-ft)	
Pond Bottom	0.00	2.11	0.00			
	14.00	3.23	45.28	0.00		Anoxic Zone
Slope Break	18.00	3.58	13.62	13.62		
NWL	20.30	3.99	8.70	22.32		PPV
Weir	21.00	4.11	2.83	25.16	2.83	Tv Provided
TOB	24.50	4.74	15.49	40.64		

<i>Pond 2S</i>	Elevation (ft. NAVD)	Area (Ac)	Incr. Vol (ac-ft)	Cumulative Volume (ac-ft)	Treatment Volume (ac-ft)	
Pond Bottom	11.00	0.09	0.00			
	14.00	0.17	0.51	0.00		Anoxic Zone
Slope Break	18.00	0.30	0.93	0.93		
NWL	20.30	0.46	0.87	1.80		PPV
Weir	21.00	0.51	0.34	2.14	0.34	Tv Provided
TOB	24.50	0.76	2.22	4.36		

Basin 3

<i>Pond 3E</i>	Elevation (ft. NAVD)	Area (Ac)	Incr. Vol (ac-ft)	Cumulative Volume (ac-ft)	Treatment Volume (ac-ft)	
Pond Bottom	11.00	0.07	0.00			
	14.00	0.12	0.36	0.00		Anoxic Zone
Slope Break	18.00	0.13	0.50	0.50		
NWL	20.30	0.22	0.40	0.90	0.00	PPV
Weir	21.00	0.24	0.16	1.06	0.16	Tv Provided
TOB	24.50	0.37	1.08	2.14		

<i>Pond 3W</i>	Elevation (ft. NAVD)	Area (Ac)	Incr. Vol (ac-ft)	Cumulative Volume (ac-ft)		
Pond Bottom	11.00	0.12	0.00			
	14.00	0.20	0.60	0.00		Anoxic Zone
	18.00	0.32	1.05	1.05		
NWL	20.30	0.48	0.93	1.98	0.00	PPV
Weir	21.00	0.53	0.35	2.33	0.35	Tv Provided
TOB	24.50	0.77	2.28	4.61		

Total PPV Provided =	37.71	ac-ft
Total Tv Provided =	5.16	ac-ft

CONTROL STRUCTURE BLEEDER CALCULATIONS

Project: I-95 at St. John's Heritage Parkway
Financial Project Number: 426904-3-52-01
County: Brevard

Designer: KMC 8/10/2017
Reviewer: WS

Control Structure Bleeder

1. Flow Rate (Q) to Drain Half of the Treatment Volume within 24-30 hours

$$Q = \frac{Tv}{(2tCF)}$$

Where:
Q = Discharge Rate, cfs
Tv = Treatment Volume (Provided), ft³
CF = Conversion Factor
t = Recovery Time, 24 hrs

Tv = 5.16 ac-ft
t = 24 hrs

Q = 1.30 cfs

2. Determine Groundwater Flow Rate Into Pond:

Seasonal High Water influence on the average discharge rate (Q) required for the bleed down:

$$Q_{GW} = KiA$$

Where:
Q_{GW} = Groundwater inflow, cfs
K = Soil Permeability, ft/hr
i = Hydraulic Gradient, ft/ft
*A = Area of Influence (A = p * h)*
p = Perimeter of Influence
h = height of drawdown (Average Seasonal Water Table – Normal Water Table)

K = 0.006 ft/hr (from Roadway Geotechnical Report)
i = 0.01 ft/ft
SHWT = 23.50 ft
NWL = 20.30 ft
h = 3.20 ft
p = 5964 ft

*Note: Perimeter of Influence (p) calculated using seasonal high water contour for all wet ponds

Q_{GW} = 0.0003 cfs

3. Determine Total Flow:

0

$$Q_{Total} = Q + Q_{GW}$$

Q_{Total} = 1.30 cfs

4. Design Head (h):

$$h = \frac{(h_1 + h_2)}{2}$$

Where:
h₁ = Depth of water between the top of the treatment volume and the orifice flow line ft
h₂ = Depth of water between the stage when half of the treatment volume has been released and the orifice flow line, ft

Calculate h₁ :

Weir El. = 21.00 ft
Orifice CL El = 20.30 ft
h1 = 0.70 ft

Calculate h₂ :

Stage at 1/2 TV = 20.65 ft
Orifice CL El = 20.30 ft
h2 = 0.35 ft

5. Circular Bleeder:

$$A = \frac{Q_{Total}}{C\sqrt{2gh}}$$

Where:
C = Orifice Coefficient (Assumed = 0.6)
h = height between the normal water line and the orifice centroid, ft
A = Orifice Area, ft²
D = Orifice Diameter, ft

$$D = \sqrt{\frac{4A}{\pi}}$$

h = 0.525 ft
g = 32.2 ft/s²
A = 0.373 ft²

D = 0.69 ft → 8.27 inches

Provided: 3" X 18" Rectangular Slot (A = 0.375 ft²)

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Anoxic Depth Calculation

Project: I-95 at St. John's Heritage Parkway
 Financial Project Number: 426904-3-52-01
 County: Brevard

Designer: KMC
 Reviewer: WS

8/9/2017

Annual Runoff, Q: Ci A
 Runoff Coefficient, C: 0.75
 Annual Rainfall, i: 50.3 inches
 Area, A: 46.17 acres

Annual Runoff, Q: 1741.76 ac-in/yr
 145.15 ac-ft/yr

Phosphorus Loading Concentration⁽²⁾ TP = 0.20 mg/l (Highway)

Annual Nutrient Loading:

$$(Q) \left(\frac{\text{ac} \cdot \text{ft}}{\text{yr}} \right) \times 43560 \frac{\text{ft}^2}{\text{ac}} \times 7.48 \frac{\text{gal}}{\text{ft}^3} \times 3.785 \frac{\text{l}}{\text{gal}} \times 0.20 \frac{\text{mg}}{\text{l}} \times \frac{1 \text{ kg}}{10^6 \text{ mg}} = \text{Annual Phosphorus Loading} \left(\frac{\text{kg} \cdot \text{TP}}{\text{yr}} \right)$$

$$\text{Annual Phosphorus Load} = 35.80 \frac{\text{kg TP}}{\text{yr}}$$

Annual TP Concentration in Pond:

$$\text{Annual Wet Detention Phosphorus Removal Efficiency}^{(3)} = 40.13 + 6.372 \cdot \ln(td) + 0.213(\ln(td))^2$$

$$\text{Annual Phosphorus Loading} \times (1 - \text{Removal Efficiency}) = \text{Annual TP Remaining} \left(\frac{\text{kg} \cdot \text{TP}}{\text{yr}} \right)$$

$$\text{Annual TP Remaining: } 13.78 \frac{\text{kg TP}}{\text{yr}}$$

where:
 td = Detention Time (days)

Mean Pond Concentration:

$$(TP \text{ Remaining}) \left(\frac{\text{kg TP}}{\text{yr}} \right) \times \frac{1 \text{ yr}}{(Q + PV)} \times \frac{1 \text{ ac}}{43560 \text{ ft}^2} \times \frac{\text{ft}^3}{7.48 \text{ gal}} \times \frac{1 \text{ gal}}{3.785 \text{ ft}^3} \times \frac{10^6 \text{ mg}}{\text{kg}} = \text{Mean Concentration} \left(\frac{\text{mg TP}}{\text{liter}} \right)$$

where:

Q = Annual Flow (ac-ft/yr)

PV⁽⁴⁾ = Pond Volume (ac-ft)

$$\text{Mean Concentration: } 0.0611 \frac{\text{mg TP}}{\text{liter}} = 61.120 \frac{\mu\text{g TP}}{\text{liter}}$$

Mean chlorophyll-a Pond Concentration:

Secchi Disc Depth:

$$\ln(chl - a) = 1.058 \ln(TP) - 0.934$$

$$SD = \frac{24.2386 + [(0.3041)(chl - a)]}{(6.032 + chl - a)}$$

$$\ln(chl - a) = 3.42$$

$$SD = 0.918 \text{ m}$$

$$chl - a = e^{2.16} \quad chl - a = 30.490 \frac{\text{mg}}{\text{mg}^3}$$

where:

chl-a = Chlorophyll-a Concentration (mg/m³)

TP = Total P Concentration (μg/l)

SD = Secchi Disc Depth (m)

Calculate Pond Depth of Anoxic Conditions:

$$\text{Depth of DO} < 1 = 3.035 \times \text{Secchi} + 0.02164 \times (chl - a) - 0.004979 \times \text{Total P}$$

$$\text{Anoxic Depth}^{(5)} \quad 3.14 \text{ m} \quad 10.30 \text{ ft}$$

Notes:

- 1 - Reference: Evaluation of Current Stormwater Design Criteria within the State of Florida, Final Report June 2007
- 2 - Highway nutrient loading per BMPTRAIN Version 8.6.
- 3 - Figure 5-9: Removal Efficiency of Total Phosphorus in Wet Detention Ponds as a Function of Residence Time.
- 4 - The Permanent Pool Volume is provided above the water surface elevation 14.00. See Pond Storage Calculations.
- 5 - The equivalent water column elevation of the Anoxic Zone is elevation 10.00 ft.

Post-Development Heritage Interchange

