Florida Department of Environmental Protection

Evaluating Stormwater Management Program Effectiveness

NPDES Stormwater Program
2/9/2017

Assessment Requirements

Assessment Requirements in Cycle 4 Phase I MS4 permits

- *Primary Change in Cycle 4:* Must have an assessment program which explains how monitoring data and/or load estimates will be used to evaluate SWMP (Stormwater Management Program) effectiveness.
- The purpose of the assessment program is to provide information for each permittee to determine the overall effectiveness of their SWMP in reducing Stormwater pollutant loadings from the MS4.
- *Submit an Assessment Program within 12 months of permit reissuance (Cycle 4).*

Assessment Requirements (cont.)

- Development of the assessment program shall address:
  - a) A water quality monitoring plan, intended to identify local sources where urban stormwater is impacting surface water resources; or
  - b) Pollutant Loadings/Event Mean Concentrations (EMCs) calculations.

- A description of how the data from a) and/or b) above will be used to:
  - Evaluate trends in pollutant loadings from the MS4 and in water quality; and
  - Identify portions of the MS4 which can be targeted for loading reduction / corrective action with additional pollutant reduction measures.

Annual Report Requirements

- *Primary Change:* Each permittee must evaluate the effectiveness of its SWMP using its assessment program.
- The Annual Report shall include the following:
  - Status of water quality monitoring plan implementation. Status may include sampling frequency changes, monitoring location changes, or sampling waiver conditions.
  - Brief discussion of the assessment program results to date, which includes a summary of the water quality monitoring data and/or stormwater pollutant loading changes from the reporting year. *Note: Analysis must be specific to each permittee's SWMP.*
  - An analysis of the data discussing changes in water quality and/or stormwater pollutant loading from previous reporting years. *Note: Analysis must be specific to each permittee's SWMP.*

Year 3 Requirements

- *Primary Change:* Comparing estimated loads during the current permit cycle with those generated in the previous cycle. Determine whether loads are increasing or decreasing; where increasing, suggested changes in the SWMP must be submitted in Year 4.
    - Each permittee shall provide a table of average annual pollutant loadings and EMCs. Each permittee shall compare the current cycle's average annual pollutant loadings with those from the previous cycle's Year 3 Annual Report.
    - If the total annual pollutant loadings for each parameter has not decreased since the issuance of the previous MS4 permit, each permittee shall re-evaluate its SWMP and identify and submit revisions to its SWMP, as appropriate, to reduce pollutant loadings, especially to impaired waters, in the Year 4 Annual Report.

Year 4 Requirements

- *Primary Change:* Requires identification of areas needing corrective action, including a timetable for implementation.

- The permittee shall attach to the Year 4 Annual Report and reapplication a summary of the SWMP evaluation, including the following:

  - An evaluation of the effectiveness of the SWMP in reducing pollutant loading from the MS4.

  - A description of whether stormwater pollutant loadings discharged from the MS4 have decreased, to include results and annual loadings from Part V.

  - Recommended SWMP revisions for each of the elements in Part III of the permit as a result of the SWMP evaluation. Based on an analysis of the assessment results, identify any areas or drainage basins within the boundaries of the MS4 that should be targeted for corrective actions(s). If applicable, specify what corrective actions should be completed and a timetable for implementation. Corrective actions(s) include retrofits, structural BMPs, and non-structural BMPs (e.g., public education, street sweeping).

Contact Information

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NPDES Stormwater Program

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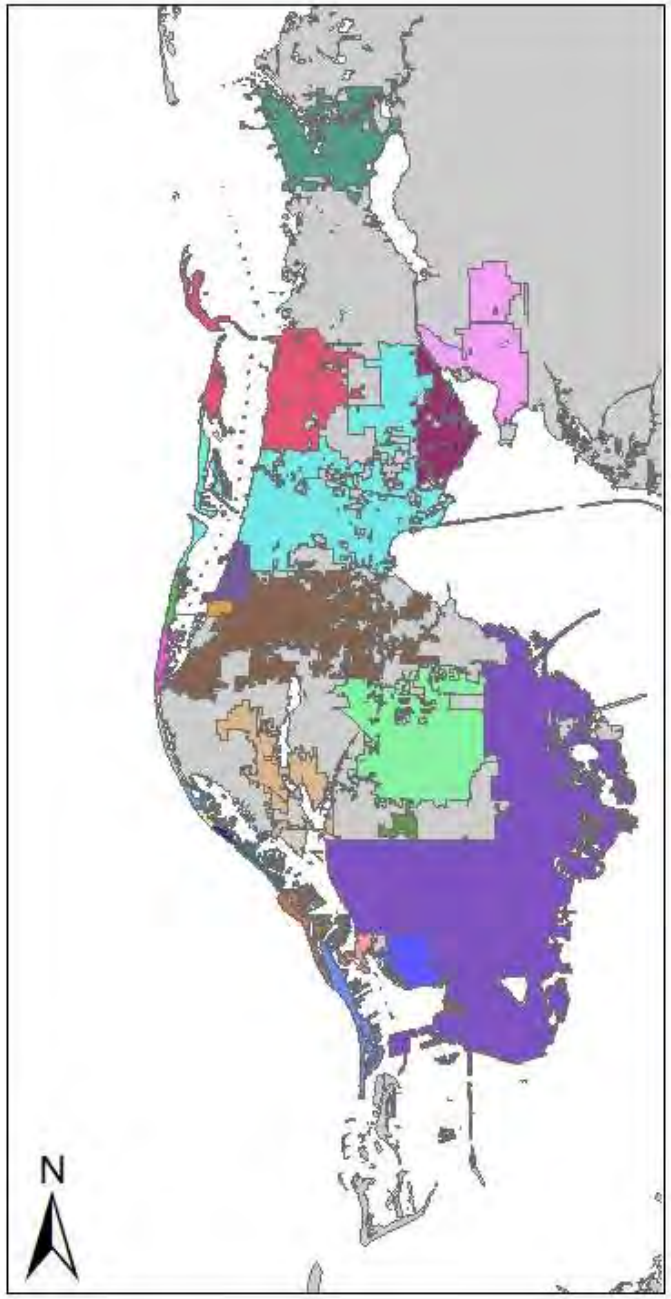
EVALUATING STORMWATER MANAGEMENT PROGRAM EFFECTIVENESS

Pinellas County Environmental Management

- 608 square mile
- Peninsula between Gulf of Mexico and Tampa Bay
- Second smallest county in FL

PINELLAS COUNTY CHALLENGES

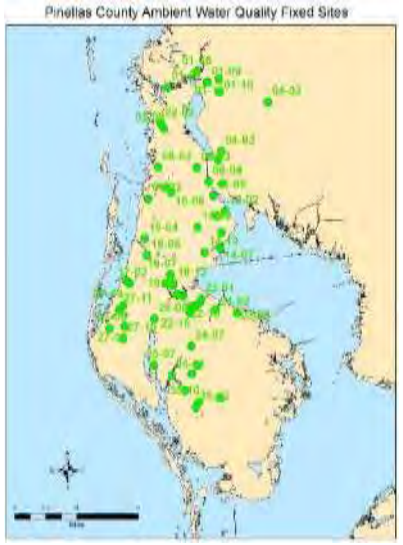


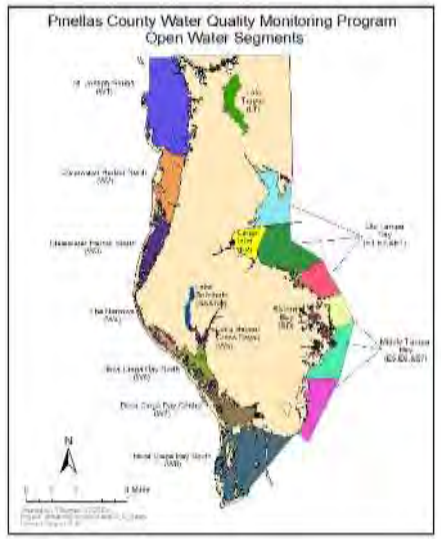
- Most densely populated county > Broward & Miami Dade
- Multi-jurisdictional
- Interconnected urban MS4
- 22 co-permittees, including FDOT District 7

Cooperation with Co-Permittees

Interlocal Agreement for the County to perform monitoring duties, including Event Mean Concentrations (EMCs) and loading estimates for all co-permittees.

Pinellas County Monitoring Program





- Fixed station monitoring of water quality in tributaries since 1991, flow since 2003
- Probabilistic design to characterize water quality in open bay waters and large lakes since 2003
- Biological monitoring for impairment confirmation since 2014

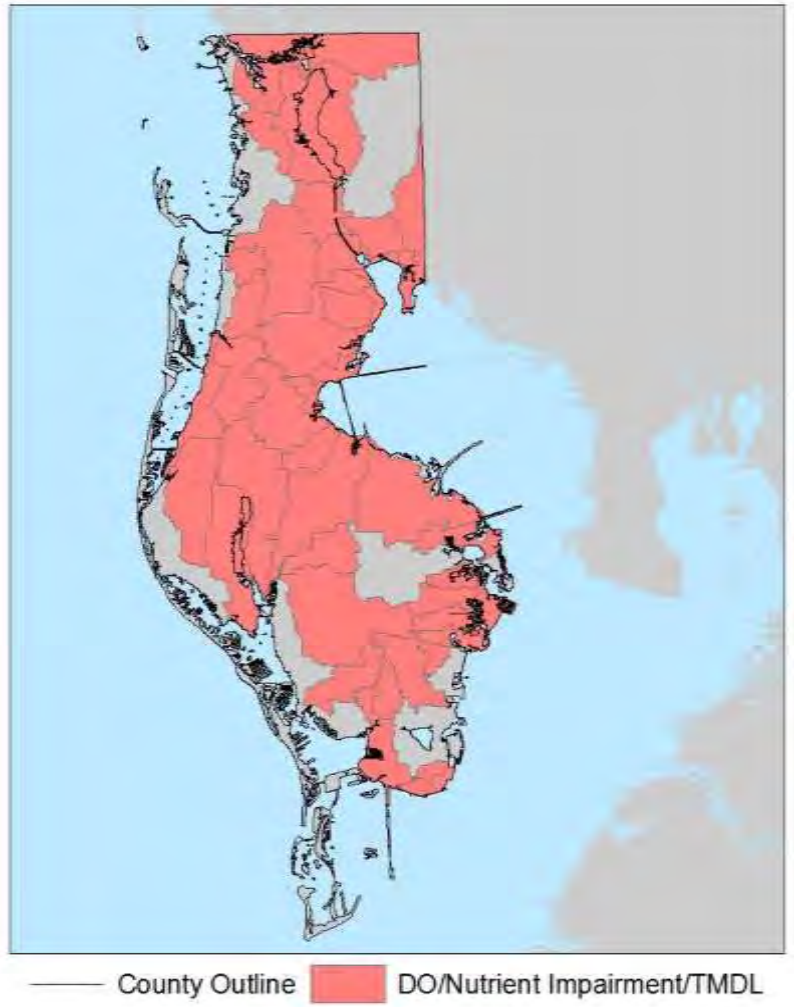
Pinellas County Impairments and TMDLs

Out of 55 watersheds -

40 have a DO or nutrient impairment, TMDL, or RAP

Out of 157 WBIDs:

- 66 impaired for bacteria
- 45 impaired for DO
- 41 impaired for nutrients
- 26 bacteria TMDLs
- 24 DO/nutrient TMDLs
- 2 RAPs for nutrients



STORMWATER MANAGEMENT PROGRAM
BEST MANAGEMENT PRACTICES

- Structural BMPs
- Stormwater Maintenance
- Street Sweeping
- Stormwater Ordinance
- Fertilizer Ordinance
- Public Outreach/Education
- Land Development Codes/ Stormwater Manual for Green Infrastructure

Permit Requirement - Part V.A. Event Mean Concentrations

- *Provide estimates of EMCs and annual pollutant load for required constituents, for each major outfall or major watershed*
- *Use locally derived EMCs or State EMCs*
- *Repeat every permit cycle*
- *If the total annual pollutant loadings have not decreased over the past two permit cycles, each permittee shall re-evaluate its SWMP and submit revisions to its SWMP to reduce pollutant loadings in the Year 4 ANNUAL REPORT.*

Pinellas County EMCs and Annual Loadings

- EMCs based on local/regional data and projects
- Data going back all the way to the early 90's
- Loads generated using GIS
- Analysis by jurisdiction and watershed

	2016 PINELLAS COUNTY EMC's											
	Constituents											
Land Use Type	BOD5	COD	TSS	TDS	TN	TKN	TP	disP	Cd	Cu	Pb	Zn
Agricultural	3.8[2]	-	53.3[2]	-	2.32[2]	-	0.344[2]	0.288[2]	-	-	0.025[2]	0.028[2]
Commercial	12.1[2]	47[3]	83[2]	104	1.95[2]	1.64[3]	0.285[2]	0.225[2]	0[5]	0.07[3]	0.19[3]	0.125[3]
Industrial	9.6[2]	51.33[1]	94[2]	305[1]	1.57[1]	1.48[1]	0.14[1]	0.05[1]	0[1]	0[1]	0[1]	0.02[1]
Multi Family Residential	6.24[1]	40[3]	41[1]	126[3]	1.57[1]	1.3[1]	0.31[1]	0.2[1]	0[1]	0[1]	0.01[1]	0.08[1]
Public/Semi Public	12.1[4]	47[4]	83[4]	104[4]	1.95[4]	1.64[4]	0.37[4]	0.265[4]	0[4]	0.07[4]	0.208[4]	0.146[4]
Recreational/Open Space	1.45[2]	-	11[2]	-	1.25[2]	-	0.053[2]	0.004[2]	-	-	0.025[2]	0.006[2]
Roads	-	-	50[5]	-	1.67[5]	2.76[5]	0.34[5]	-	-	0.43[5]	0.211[5]	0.13[5]
Single Family Residential	3.63[1]	54[1]	20[1]	207.75[1]	1.62[1]	1.51[1]	0.23[1]	0.19[1]	0[1]	0.01[1]	0.01[1]	0.05[1]
Vacant	-	-	-	-	-	-	-	-	-	-	-	-

1 Based on Pinellas County characterization studies.
2 Based on Dames and Moore. 1990. Urban Stormwater Analysis and Improvement. Study for the Tampa Bay Watershed Tampa, Florida.
3 Based on City of St. Petersburg characterization data.
4 Estimates based on similarity to high and medium intensity commercial.
5 Based on Rushton, Betty T, Ph.D., C.W. Dye. 1993. An In-Depth Analysis of a Wet Detention Stormwater System. Southwest Florida Water Management District. Brooksville, Florida.

Basin: **W6 - Coastal Boca Ciega Bay North**

Landuse	BOD5	Cd	COD	Cu	disP	Pb	TDS	TKN	TN	TP	TSS	Zn	Acres
Commercial	114.85	0.00	446.13	0.66	2.14	1.80	987.18	15.57	18.46	2.71	784.52	1.18	0.04
Multi Fam. Res.	46.07	0.00	295.31	0.00	1.48	0.07	930.23	9.60	11.59	2.29	304.47	0.59	0.83
Pub/Semi Public	108.47	0.00	421.34	0.58	2.38	1.86	932.34	14.70	17.44	3.32	740.94	1.31	2.15
Rec/Open Space	3.06				0.01	0.05			2.64	0.11	23.41	0.01	37.80
Roads				4.31		2.11		27.65	16.73	3.41	500.97	1.30	0.27
Total Load (lb/ac):	**272.5**	**0.0**	**1,162.8**	**5.6**	**6.0**	**5.9**	**2,849.7**	**67.5**	**66.9**	**11.8**	**2,354.3**	**4.4**	**41.1**

Basin: **W7 - Coastal Boca Ciega Bay Central**

Landuse	BOD5	Cd	COD	Cu	disP	Pb	TDS	TKN	TN	TP	TSS	Zn	Acres
Multi Fam. Res.	46.07	0.00	295.31	0.00	1.48	0.07	930.23	9.60	11.59	2.29	304.47	0.59	1.68
Rec/Open Space	3.06				0.01	0.05			2.64	0.11	23.41	0.01	1.78
Total Load (lb/ac):	**49.1**	**0.0**	**295.3**	**0.0**	**1.5**	**0.1**	**930.2**	**9.6**	**14.2**	**2.4**	**327.9**	**0.6**	**3.5**

Basin: **W8 - Coastal Boca Ciega Bay South**

Landuse	BOD5	Cd	COD	Cu	disP	Pb	TDS	TKN	TN	TP	TSS	Zn	Acres
Single Fam. Res.	13.40	0.00	199.33	0.04	0.70	0.04	766.88	5.57	5.98	0.85	73.38	0.18	22.69
Commercial	114.85	0.00	446.13	0.66	2.14	1.80	987.18	15.57	18.46	2.71	784.52	1.18	19.71
Multi Fam. Res.	46.07	0.00	295.31	0.00	1.48	0.07	930.23	9.60	11.59	2.29	304.47	0.59	470.41
Rec/Open Space	3.06				0.01	0.05			2.64	0.11	23.41	0.01	1,346.44
Roads				4.31		2.11		27.65	16.73	3.41	500.97	1.30	170.37
Total Load (lb/ac):	**177.4**	**0.0**	**940.8**	**5.0**	**4.3**	**4.1**	**2,684.3**	**58.4**	**55.4**	**9.4**	**1,686.8**	**3.3**	**2,029.6**

UNINCORPORATED TOTAL													
Total Load (lb/ac):	**13,340.2**	**0.0**	**64,453.8**	**227.1**	**290.6**	**228.3**	**210,457.7**	**3,256.5**	**3,441.2**	**561.0**	**119,244.7**	**186.1**	**66,807.5**

Pinellas County EMCs and Annual Loadings (cont.)

The Challenge:

- To hydrologically normalize loads, used static SWFWMD 100-yr average annual rainfall = 51.7"/yr
- Pinellas County's urban area is 98% built out – very little change in land use
- Some jurisdictional changes (annexations)

Therefore, EMCs and EMC-derived loadings do not provide a good representation of the effectiveness of the SWMP.

Permit Requirement - Part V.B. Monitoring Program

- *Intended to assist in determining SWMP effectiveness*
- *Evaluate load reductions*
- *Prioritize areas in need of additional controls*
- *Identify any areas that should be targeted for corrective action*
- *Identify evidence of improvements or degradation over the permit period or a statement indicating that the results are inconclusive.*

Load Estimate Data Analysis

HOLISTIC APPROACH

- Basin by basin, with jurisdictional breakdown
- Utilizing all available information:
  - Trend analysis (Janicki Environmental)
  - Explanation of outliers (field conditions)
  - Rain patterns and extreme rainfall years
  - Passing biological scores
  - Passing water quality criteria

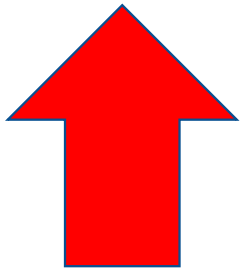
Monitoring Analysis – Example Write-ups

Stratum Number	Stratum Name	Municipality Contribution	Analysis
SA	Lake Seminole	Seminole, Unincorporated	Recent studies have shown a statistically significant decreasing trend in TN and TP in the northern portion (SA) of the lake. Chl-a appears to be decreasing for the period of record as well. This is likely due to the SWMP and the specific best management activities recommended by the watershed management plan for the lake.

Stratum Number	Stratum Name	Municipality Contribution	Analysis
W2	Clearwater Harbor North	Dunedin, Clearwater	Trends for Chl-a, TP and TN concentrations generally follow annual rain patterns during the period of record. Chl-a, TN, and TP are well below the criterion, indicating that the SWMP in contributing watersheds is effective.

Monitoring Analysis – Challenges

Data heavily influenced by variability in rainfall



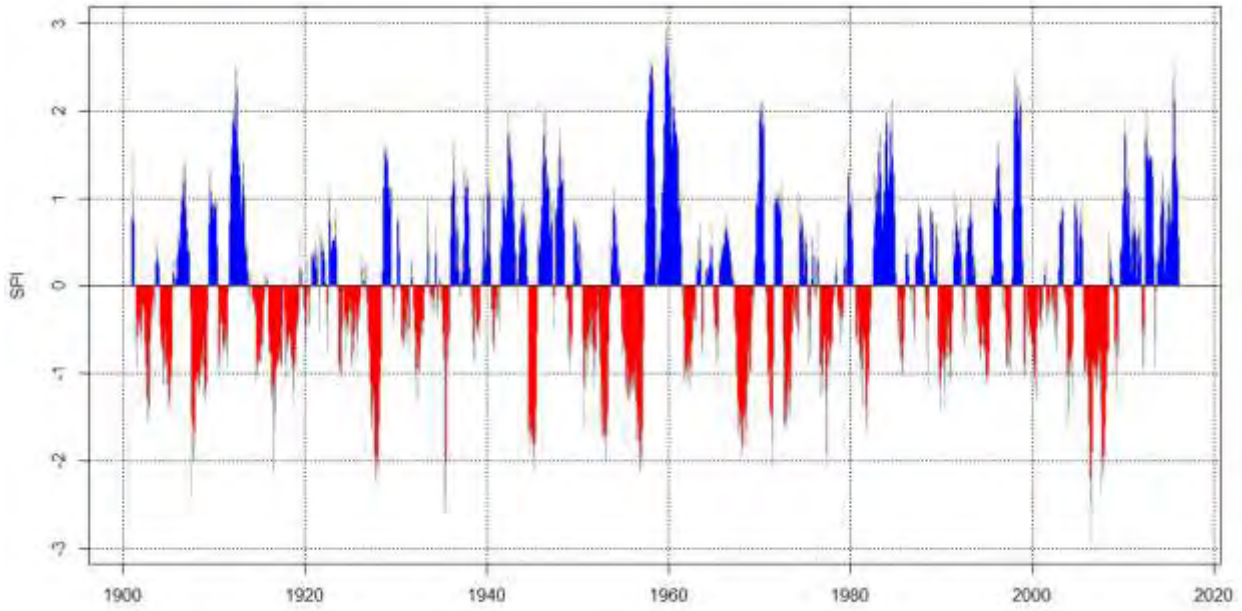
Looking to Improve - Rainfall Normalization

GOAL: To develop Hydrologically Normalized Loads for Pinellas County Watersheds:

- Adjust ("Normalize") annual pollutant loading estimates to remove influence of the variability in rainfall on loadings
- Baseline load will be established using ambient water quality concentrations and model-based hydrologic loads.
- Evaluate future data against this "Baseline" load.

Developing the Baseline Loads

- 2016: developed the baseline load
- Strong regression relationship for 18/33 basins for TN and TP
- 2017: Will compare 2016 data to baseline load in those 18 basins
- Will investigate the reason for lack of regression relationship in the other basins.



BASELINE LOADS – LONG TERM GOALS

- Refine methodology for more basin-specific estimates with Next Generation Radar (NEXRAD) Rainfall Data

- Any Questions, "Ask Mike" – Mike Wessel, Janicki Environmental
mwessel@janickienvironmental.com

CONCLUSION – A WORK IN PROGRESS

- Pinellas County will continue with the multi-pronged approach, utilizing all data and information available to characterize the effectiveness of the SWMP within each basin.
- Normalizing the loads will assist in removing rain influence in some basins.
- Process will need to be refined and investigated to be applicable to all basins.

Contact Information

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