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Water Quality Monitoring Project for Demonstration of Canal Remediation Methods Florida Keys- Preliminary Report #3: Assessment of Canal Remediation Methods Canal using Water Quality Data Before and After Remediation

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WATER QUALITY MONITORING PROJECT FOR DEMONSTRATION OF CANAL REMEDIATION METHODS FLORIDA KEYS

Preliminary Report #3: Assessment of Canal Remediation Methods Canal using Water Quality Data Before and After Remediation

May 6, 2016

Presented to:

Water Quality Program Canal Restoration Advisory Committee



Henry O. Briceño, Alexandra Serna,
Michael Absten, Sandro Stumpf, James Duquesnel

Objective

- To provide data needed to make unbiased, statistically rigorous statements about the status and temporal trends of water quality parameters in the remediated canals

Conceptual model

The execution of the project includes two phases:

- 1) Before remediation
- 2) After remediation

Water quality testing parameters

- Vertical profiles
- Continuous 24-hour recording (Diels) of physical-chemical data:



%DO (Dissolved Oxygen) sat exceedances calculations: % readings below 42% saturation in a full day of diel data

- Water sampling for total nutrients analysis

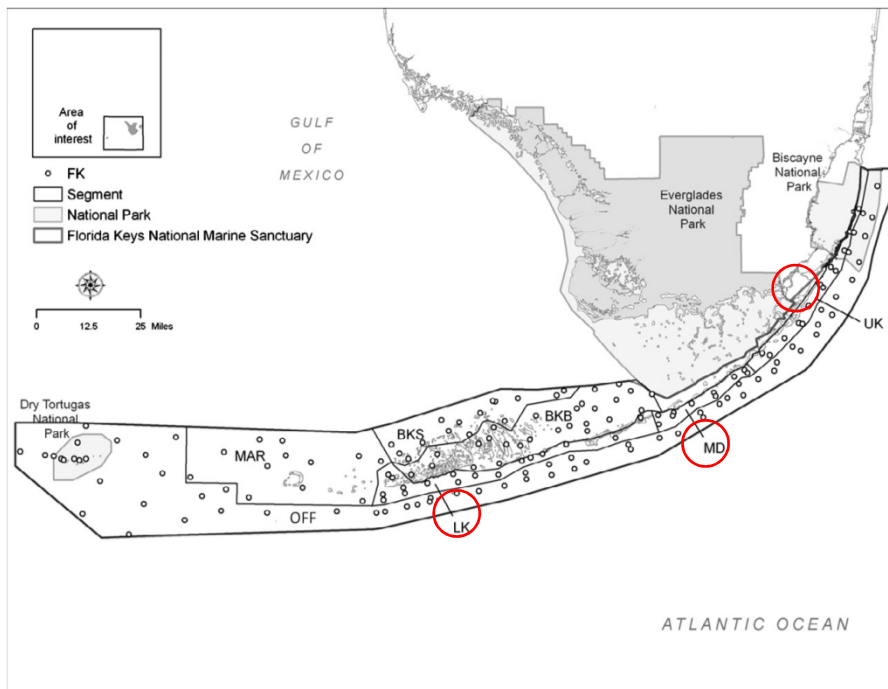
Demonstration canals included in this report



- Canal #29 in Key Largo. Backfilled to reduce canal depth
- Canal #137 in Plantation Key. A weed barrier was installed to prevent input of wrack
- Canal #472 in Geiger Key. A culvert was installed to enhance circulation

Water quality criteria

- 62-302.533 DO (Dissolved Oxygen) criteria for Class III Waters
- 62-302.532 Estuary-Specific Criterion for Total Phosphorus (TP) and Total Nitrogen (TN), by biogeochemical subdivisions of South Florida coastal and estuarine waters (Briceno et al, 2013)



Canal #29 Manatee Bay-Barnes Sound segment of Biscayne Bay

Canal #137 Middle Keys

Canal #472 Lower Keys

Canal #29. Remediation technology: Backfilling. Completed Jul-15

CRITERIA	Depth	SHORT TERM		LONG TERM		
		Pre-remediation		Post-remediation		
		31-Mar-14	16-Oct-14	4-Feb-16	28-Apr-16	
No more than 10% of the daily measured values should fall below 42 %DO saturation	S	0%	0%	0%	0%	No definitive improving trend yet
	B	43%	100%	0%	0%	

LEGEND

	Stable within favorable range		Stable within negative range	Depth	Water sample depth
	Declining within favorable range		Declining within negative range	SHORT TERM	Relative position of last survey
	Improving within favorable range		Increasing within negative range	LONG TERM	Linear trend for whole period of record

S: Surface water Measurements ~ 2 ft below water surface
 B: Bottom water Measurements ~ 1ft above canal bottom
 † A full day of diel data consist of 24 hours of measurements collected every 10 min

- Surface waters in compliance during the whole monitoring period
- Post-remediation surveys showed %DO saturation in compliance in shallower new bottom waters

Canal #29. Remediation technology: Backfilling. Completed Jul-15

CRITERIA	Depth	SHORT TERM		LONG TERM
		Pre-remediation		Post-remediation
		31-Mar-14	16-Oct-14	4-Feb-16
TP	S	0.021	0.004 ▼	0.043 ▲
	B	0.030	0.003 ▼	0.045 ▲
TN	S	0.28	0.62 ▲	0.51 ▼
	B	0.39	0.59 ▲	0.51 ▼

No definitive
improving trend yet

- Stable within favorable range
- Declining within favorable range
- Improving within favorable range

- Stable within negative range
- Declining within negative range
- Increasing within negative range

†Manatee Bay-Barnes Sound
segment of Biscayne Bay

- First post-remediation survey rendered TP concentrations out of compliance
- Surface and Bottom TN concentrations in compliance after remediation

Canal #137. Remediation technology: Weed gate installation. Completed Nov-14

CRITERIA	Depth	SHORT TERM				LONG TERM	
		Pre-remediation		Post-remediation			
		1-Apr-14	14-Sep-14	30-Jun-15	7-Feb-16		
No more than 10% of the daily measured values should fall below 42 %DO saturation†	S	83%	0% ▼	29% ▲	0% ▼	No definitive improving trend yet	
	B	100%	5% ▼	74% ▲	0% ▼		

LEGEND

- Stable within favorable range
- Stable within negative range
- Declining within favorable range
- Declining within negative range
- Improving within favorable range
- Increasing within negative range

Second post-remediation survey showed both surface and bottom waters %DO saturation in compliance

Canal #137. Remediation technology: Weed gate installation. Completed Nov-14

CRITERIA	Depth	SHORT TERM				LONG TERM	
		Pre-remediation		Post-remediation			
		1-Apr-14	14-Sep-14	30-Jun-15	7-Feb-16		
TP less than 0.007 ppm	S	0.028	0.010 ▼	0.019 ▲	0.020 ▲		
	B	0.027	0.010 ▼	0.018 ▲	0.019 ▲		
TN less than 0.22 ppm	S	0.12	0.35 ▲	0.20 ▼	0.37 ▲		No definitive improving trend yet
	B	0.12	0.34 ▲	0.19 ▼	0.28 ▲		

LEGEND

- Stable within favorable range
- Declining within favorable range
- Improving within favorable range
- Stable within negative range
- Declining within negative range
- Increasing within negative range

- Post-remediation surveys rendered TP concentrations out of compliance
- Surface and Bottom TN concentrations returned to out of compliance in Feb-16

Canal #472. Remediation technology: Culvert installation. Completed May-15 and was closed shortly after

CRITERIA	Depth	SHORT TERM				LONG TERM
		Pre-remediation		Post-remediation		
		22-May-14	25-Sep-14	4-May-15	7-May-15	21-Jul-15
				Culvert open		Culvert closed
No more than 10% of the daily measured values should fall below 42 %DO saturation†	S	0%	0%	0%	0%	3%
	B	91%	100%	0%	0%	100%

No definitive improving trend yet

LEGEND

- Stable within favorable range
- Stable within negative range
- Declining within favorable range
- Declining within negative range
- Improving within favorable range
- Increasing within negative range

Post-remediation surveys showed %DO saturation in compliance and a return to values out of compliance in bottom waters after the culvert was closed

Canal #472. Remediation technology: Culvert installation. Completed May-15 and was closed shortly after

CRITERIA	Depth	SHORT TERM				LONG TERM		
		Pre-remediation		Post-remediation		Culvert open	Culvert closed	
		22-May-14	25-Sep-14	4-May-15	7-May-15			
TP	less than 0.008 ppm	S	0.019	0.004	0.014		0.015	No definitive improving trend yet
	B	0.020	0.004	0.012		0.013		
TN	less than 0.21 ppm	S	0.20	0.25	0.36		0.21	
		B	0.19	0.24	0.28		0.24	

LEGEND

- Stable within favorable range
- Stable within negative range
- Declining within favorable range
- Declining within negative range
- Improving within favorable range
- Increasing within negative range

- Post-remediation surveys rendered TP concentrations out of compliance
- TN concentrations in bottom water have bounced in and out of compliance

Score cards by canal

<http://serc.fiu.edu/wqmnetwork/Canals/index.htm>

Canal #29

Canal #137

Canal #472

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http://serc.fiu.edu/wqmnetwork/Canals/index.htm

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Canal #29 (Key Largo): Backfilling

CRITERIA	Depth	SHORT TERM		LONG TERM		COMMENTS
		Pre-remediation		Post-remediation		
		31-Mar-14	16-Oct-14	4-Feb-16	28-Apr-16	
No more than 10% of the daily measured values should fall below 42 %DO saturation†	S	0%	0%	0%	0%	Summary Remediation technology: Backfilling. Completed Jul-15 Surface waters in compliance during the whole monitoring period Post-remediation surveys showed %DO saturation in compliance in shallower new bottom waters
	B	43%	100%	0%	0%	
TP less than 0.007 ppm	S	0.021	0.004	0.043		First post-remediation survey rendered TP concentrations out of compliance
	B	0.030	0.003	0.045		
TN less than 0.58 ppm	S	0.28	0.62	0.51		Surface and Bottom TN concentrations in compliance after remediation
	B	0.39	0.59	0.51		

Criteria Based on 62-302.533 Dissolved oxygen (DO) criteria for Class III Waters and on 62-302.532 Estuary-Specific Criterion for Total Phosphorus (TP) and Total Nitrogen (TN), Manatee Bay-Barnes Sound segment of Biscayne Bay

LONG TERM Linear trend for whole period of record

SHORT TERM Relative position of last survey

Depth Water sample depth

S: Surface water Measurements ~ 2 ft below water surface

B: Bottom water Measurements ~ 1ft above canal bottom

† A full day of diel data consist of 24 hours of measurements collected every 10 minutes

LEGEND

- Stable within favorable range
- Declining within favorable range
- Improving within favorable range
- Stable within negative range
- Declining within negative range
- Increasing within negative range

Update: May 5, 2016

No definitive improving trend yet

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