PRESENTATION OVERVIEW

• Timeline of Work Completed
• Assessment FDEP TMDL Approach
• Development of Technical Approach for TMDL Modification
• Next Steps
TIMELINE

• June 2011 to October 2012
  – Completion of Tasks 1A to 1D
  – Task 1D – Technical Approach Document submitted to FDEP

• October 2012 to July 2013
  – Review of Technical Approach by FDEP
  – Revision of NNC Targets submitted to FDEP and included in Governor’s Report
  – Updated Technical Approach to FDEP (June 2014)

• September 2013 to February 2014
  – Assessment of FDEP TMDL Approach
  – Awaiting FDEP response on assessment
ASSESSMENT OF FDEP TMDL
SJRWMD REGRESSIONS

• Annual TN and TP loads developed for years with seagrass data
• Determined target seagrass depth based on the deepest that seagrasses were found
• Developed relationships between unit area annual load for year and departure of seagrasses measured that year from target depth
• TMDL was equal to the load that equated to a seagrass depth limits within 10% of target depth
The methodology utilized for accounting for antecedent moisture conditions in the PLSM model is too simplistic and is not sufficient for hydrologic load determination. The correction of the runoff coefficients for time-varying conditions is based on the assumption that the runoff coefficients vary proportional to annual deviations from the long-term mean annual rainfall.
The use of a unit area load by watershed area neglects to account for dramatic variation in watershed-to-receiving-water area ratios. Rather, it is the total load to the estuary and how that load is diluted and assimilated within each estuarine segment based on volume or area of the receiving water body and exchange with the Atlantic Ocean that is ecologically meaningful to seagrass and other biotic response.
The regression relationships need to be segment specific, especially in the NIRL. This would require more data from more years with a reliable watershed loading model to confidently model the segment-specific relationships.
• The regression relationships need to be segment-specific, especially in the NIRC.
The regression relationships more similar than seen in NIRL, but still vary by segment.
The regression relationships more similar than seen in NIRL, but still vary by segment.
Removal of “outlier” data points has a dramatic effect on the predicted relationship. For example, using all data results in a non-significant effect, but removing one observation results in a predictive equation very similar to the one reported.
• NIRL - could not replicate the regression reported by Steward and Green without removing an outlier.
• BRL - could not replicate the regression reported by Steward and Green without removing an outlier

Regression Equation:
\[ L10_{fn} = 0.198859 - 2.195024 \times DL \]

Regression Equation:
\[ L10_{fn} = 0.011878 - 3.3231 \times DL \]
• CIRL - could not replicate the regression reported by Steward and Green without removing an outlier
The relative frequency of data points that fall outside the predicted confidence intervals of the regression equations invalidates the use of these equations for predicting regulatory targets or compliance parameters.
• NIRD - relationship between DL and TN load varies by year and that only a single year (1996) has a negative slope
• Relationship between DL and TN load varies by year and only 1996-1999 have a negative slope
• Relationship between DL and TN load is similar (negative) across all years
Based on the analyses, small differences in the loads result in significant differences in the regression coefficients and the resulting implementation of load reduction mandates. This model sensitivity leads to unreasonable uncertainty regarding load reductions needed to meet seagrass depth limit targets.
Comparison of Steward and Green regressions to the regressions developed here.

### Nirl

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PHASE 1 - TASK 1.D
DEVELOPMENT OF TECHNICAL APPROACH FOR TMDL REVISION
DATA ANALYSES
DATA ANALYSES SUPPORTING APPROACH

• Trends
  – Seagrasses Improving
  – Water Quality Improving

• Spatial Analyses
  – Data show that Basin Segmentation appropriate for development of load-response relationships
  – Future transport assessment may alter load distribution

• Relationships
  – Developed statistically significant relationships between Basin Segment loads and Chl a
Banana River Trends
Monthly Data Time Series
Total Nitrogen
Not Adjusted for Seasonal Medians

Nonparametric Trend: Decreasing
Kendall Tau Slope Coef: -0.031
Test Statistic: -0.309
p-value: 0.031

Banana River Trends
Monthly Data Time Series
Total Phosphorus
Not Adjusted for Seasonal Medians

Nonparametric Trend: Decreasing
Kendall Tau Slope Coef: -0.002
Test Statistic: -0.304
p-value: 0.015

Banana River Trends
Monthly Data Time Series
Chlorophyll a
Not Adjusted for Seasonal Medians

Nonparametric Trend: Decreasing
Kendall Tau Slope Coef: -0.440
Test Statistic: -0.358
p-value: 0.009
Nonparametric Trend: Decreasing
Kendall Tau Slope Coef: -0.030
Test Statistic: -0.395
p-value: < 0.001

Nonparametric Trend: Decreasing
Kendall Tau Slope Coef: -0.004
Test Statistic: -0.31
p-value: < 0.001

Nonparametric Trend: Decreasing
Kendall Tau Slope Coef: -0.443
Test Statistic: -0.446
p-value: 0.007
TECHNICAL APPROACH
WHAT WE LEARNED

• Seagrasses and water quality showing improvement over specified period (2001 to 2008)
  – Reference Period

• Statistically significant relationships established by Basin Segment between loads and Chl a.
  – Stressor/Response
GOALS

• Define appropriate endpoints that are protective of seagrass
• Define quantitative relationships between nutrients and the endpoints
CHL A TARGETS AND THRESHOLDS

• **Recommended endpoints (2-levels)**
  – Target
  – Threshold

• **Target**
  – a desired Chl a concentration
  – early warning

• **Threshold**
  – Concentration above which undesirable conditions exist
  – Regulatory target
REFERENCE CONDITION APPROACH

• General concept - desirable conditions either in time or space

• Space: Estuary A is in good shape, therefore assume those nutrient conditions are necessary to achieve desirable conditions in other estuaries

• Time: desirable conditions were observed in the estuary of concern some time on the past – set these conditions as the endpoints
\[
Y = \alpha + X_1 \beta_1 + X_2 \beta_2 + X_3 \beta_3
\]
RESULTS

- IRL North: $R^2 = 0.58$
- Banana River: $R^2 = 0.49$
- IRL Central: $R^2 = 0.70$
SUMMARY

• **Reference period approach**
  – Establish appropriate Chl a endpoint
  – Basin specific targets

• **Empirical Stressor-Response Relationship**
  – Regression approach
  – Equate loads to Chl a targets
FDEP COMMENTS

• use of chlorophyll a as the sole indicator and endpoint, and
• the use of the full 2001 to 2008 reference period to establish the targets versus specific years where targets met.
REVISED APPROACH

• Spring of 2013 FDEP Proposed NNC Approach
• Site-specific seagrass depth (Zc) and water clarity (Kd) targets to achieve 20% of surface light at the deep edge of seagrass beds;
• A chlorophyll a target to prevent nuisance algal blooms
• Dissolved Oxygen (DO) targets to protect aquatic life
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REVISED APPROACH

• Develop NNC type targets based on statistical analyses of passing years
• Utilize relationships developed under Task 1.D to link loadings to established targets by basin group (NIRL, BRL, CIRL)
INTERBASIN TRANSFER OF LOADS

• Assessments to date have assumed load-response relationships are isolated to specified segments

• IRL has some significant net transport components that may mean loads from other basins may influence relationships

• This is coupled with residence time issues
FDEP COMMENTS

• Concern over the fact that the approach does not deal with all aspects of nutrient dynamics, especially “storage”

• Identified that original method dealt with all components by making direct connection between loadings and seagrass depth limits on an annual basis
NEXT STEPS

• Complete assessment of old TMDL method with FDEP to identify that regressions utilized are not appropriate
• Test of the existing regressions using new years
• Work with FDEP to utilize components of methods proposed to develop agreed upon approach for TMDL development