

TO: Lake Belt Mitigation Committee

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SUBJECT: L-31N Seepage Barrier – WRAP Scoring Approach Update

Introduction

This project contemplates enhanced hydrology in portions of the Northeast Shark River Slough (NESRS), a 107,600-acre northeastern expansion of Everglades National Park (ENP). NESRS is bordered on the north by the Tamiami Trail, on the east by the L-31N levee and southward by the 8.5 Square Mile Area. Within ENP, the northern end of NESRS is bordered on the west by the L-67 Extension. Elsewhere, NESRS is contiguous with the original, unmodified lands of ENP. Of importance in this document is the eastern boundary along the L-31N where ground water seeps eastward out of NESRS. This hydrologic loss is known to have impaired the ecology of NESRS.

In pre-drainage times, the NESRS carried over 60% of the flows of the entire Shark River Slough. With construction of the Central and Southern Florida Project for Flood Control and Other Purposes (C&SF Project), flows were greatly reduced. Water Conservation Area 3B (WCA-3B), located north of NESRS was sealed off by levees without surface-water outlets, and WCA-3A, abutting the Tamiami Trail west of NESRS, had four outlets into Everglades National Park's western portion of the Shark River Slough, as well as a gated-structure outlet into the portion of the Tamiami Canal that carried water eastward along the north side of the Tamiami Trail where it bordered NESRS. Surface water entering ENP via the four structures was restricted from moving eastward into NESRS by the L-67 Extension, a southward extension of the levee (L-67) that separates WCA-3A from WCA-3B. This configuration diverted the historic route of Everglades surface flows to the west, leaving NESRS with relatively little water. Reduced water flows through NESRS, in turn, reduced flows through Taylor Slough to Florida Bay. What waters were available in this flow path came from local rainfall and culverts under the Tamiami Trail connecting to the Tamiami Canal, in which the stage was controlled low enough to prevent ecologically beneficial higher water levels in NESRS.

With reduced water levels and flows, the NESRS terrain changed from its historic ridge-and-slough character to dominance by sawgrass marsh, concurrent with a flattening of the landscape. Slough habitat degradation began with spikerush (*Eleocharis* spp.) invasion and has proceeded to isolated patches amid widespread sawgrass. Everglades science is increasingly associating slough connectivity with important ecological functions. Reduced water levels and flows are both known to be responsible for spikerush and sawgrass encroachment into slough habitat. Relevant demonstration has been recognized in the

difference between WCA-3A (much connected slough habitat remaining due to high water and some flow) and WCA-3B (little remaining slough habitat, associated with lower water levels and minimal flow).

After NESRS was added to Everglades National Park, the Modified Water Deliveries Project (Mod Waters) was initiated to reverse damaging ecological succession by restoring beneficial water levels and flows. Mod Waters sought to improve the hydrology of NESRS by providing for flows from WCA-3A into NESRS through improvements in the Tamiami Trail and other features. At present, a one-mile bridge is under construction that will allow flows from the Tamiami Canal to move south into the northeastern portion of NESRS. Concurrent with this project are higher stages in the Tamiami Canal. Additional bridging of the Tamiami Trail and further elevation of stages in the Tamiami Canal has passed through the NEPA process and is awaiting funding/contracting. Whatever version of improvements are made as a result of Mod Waters and Everglades Restoration, it is assumed that ecological functions in NESRS will be greatly improved, but still inhibited where seepage diminishes water levels and flows.

Seepage-Barrier Alternatives / Evaluation

To estimate the performance of a seepage barrier west of the L-31N Canal over a range of hydrologic conditions, a computer model was created utilizing the MODFLOW program developed by the USGS and calibrated over a 9-year period (2000-2008). Several configurations of the seepage barrier were evaluated. Two full-length barriers extend from Tamiami Trail to the G-211 structure, about 7 miles south of the Trail. One was modeled as a 30-foot-deep barrier and the other as 18 feet deep. Three smaller lengths were also modeled in order to estimate the impact of various sizes of potential deep test barriers that could be constructed and tested before deciding on the construction of the full project. The smaller lengths were 1, 1.5, and 2 miles. The effect of these barriers on the water levels and flows within the NESRS are discussed in the modeling report submitted to the Committee.

WRAP - An Introductory Description

The Wetland Rapid Assessment Procedure (WRAP, see references) is a scoring methodology developed to assess mitigation requirements for projects under review in wetland permitting. By agreement among the agencies involved in permitting and program oversight, WRAP was selected as the means of measuring impacts of mining activities and in determining appropriate mitigation for projects in the Miami-Dade County Lake Belt – the basis for its use in the present project.

WRAP calls for the assessment of the following six variables:

- Wildlife utilization
- Wetland Overstory/Shrub Canopy
- Wetland Vegetative Ground Cover

- Adjacent Upland/Wetland Buffer
- Field Indicators of Wetland Hydrology
- Water Quality Input and Treatment Systems

Each variable is scored from zero to 3. For a particular wetland area or polygon, the WRAP score is computed as the sum of all the variables divided by the maximum possible score, so that scores theoretically range from zero to 1.00, using two decimal places. For non-forested wetlands, the variable “Wetland Overstory/Shrub Canopy” can be omitted, giving a maximum possible score of 15 (instead of 18 where all variables are used).

WRAP Application to Seepage Barrier Changes

The application of WRAP to reduced seepage and attendant improved hydrology (water level and flow) clearly involves three of WRAP’s six variables for the very large area of NESRS. Field hydrology is the most obviously affected variable and is directly shown in the modeling results. However, wildlife utilization and wetland ground cover should show positive responses due to improved hydrology, but the magnitude of changes will likely be more subtle than the hydrology. In this regard, it is important to realize that WRAP was not intended to score subtle changes. For the application of WRAP in this project, it is suggested that 1/3rd steps, and in some cases, half of that for a 1/6th step, should be used, as detailed below.

A brief explanation of all six WRAP variables follows, beginning with the three variables that are involved and their scoring basis for seepage improvements and WRAP scoring steps:

- 1) **Wildlife utilization** – The higher water levels and improved flows resulting from seepage control are expected to further enhance the production of aquatic organisms, notably fish and invertebrates, that support wading birds and other top Everglades predators. For areas where model results show that wet season water levels are improved by at least 0.1 feet or more, the following WRAP scoring refinements for this variable will be used:

Wet season water depth increase (feet)	Wildlife WRAP score adjustment
0.3 or more	1/2 step (+0.50)
0.2 to 0.3	1/3 step (+0.33)
0.1 to 0.2	1/6 step (+0.17)
Less than 0.1	none

- 2) **Wetland ground cover** – Increased water levels and flows are predicted to reverse the succession of spikerush and sawgrass into slough habitat. Increased flows should begin to restore slough connectivity in a flow-oriented direction. For areas where model results show that wet season water levels are improved by at least 0.1 feet or more, the following WRAP scoring refinements for this variable will be used:

Wet season water depth increase (feet)	Wetland cover WRAP score adjustment
0.3 or more	1/2 step (+0.50)
0.2 to 0.3	1/3 step (+0.33)
0.1 to 0.2	1/6 step (+0.17)
Less than 0.1	none

- 3) **Field hydrology** - Everglades science has documented the beneficial effects of increasing water levels in water-deprived marsh habitats and has recently elucidated the role of flow in the process, showing that flow is required to maintain the distinct edges between sloughs and sawgrass ridges. Modeling for this project has produced graphic results of improved water levels, and has also shown that improved flows are increased as far west as the L-67 Extension, considerably farther than the area shown to be enhanced by 0.05 to 0.1 ft. increased water levels. For that reason, a modest positive score (1/6 WRAP step) is shown for this small increase, as a proxy to represent that measurable improvements extend much farther. The following WRAP scoring refinements for hydrology will be used:

Wet season water depth increase (feet)	Hydrology WRAP score adjustment
0.3 or more	2/3 step (+0.67)
0.2 to 0.3	1/2 step (+0.50)
0.1 to 0.2	1/3 step (+0.33)
0.05 to 0.1	1/6 step (+0.17)

The remaining three variables, wetland canopy, habitat support/buffer, and water quality input and treatment, are not involved because no change would be expected with or without seepage control. Explanations of these unaffected WRAP variables are as follows:

- 4) **Wetland canopy** - Higher water levels and flows may improve the integrity of remaining tree islands in NESRS, but the relative area of tree islands in potentially affected northeastern portions of NESRS is very small. Therefore, no attempt is made in this evaluation to score potential improvements, with the category disregarded as N/A.
- 5) **Habitat support/buffer** - Relative to the size of the potentially affected northeastern portion of NESRS, the adjacent upland/wetland buffers around the perimeter are negligible. Further, there is no anticipated change between the proposed project and no project (no seepage barrier) conditions. As such, this variable is scored the maximum of 3.0 for all alternatives.
- 6) **Water quality input and treatment** - The northeastern portion of NESRS lies along the Tamiami Trail and Canal on the north, the L-31N on the east and the 8.5-SMA on the southeast, and other portions of NESRS to the south and west. None of these edges are proposed to change with respect to water quality and treatment as a result of the project. Thus, all scores for these variables are given the maximum of 3.0 for all edges.

Baseline WRAP Scoring - Geographic and Future Considerations

As introduced above, it is important to note that the full extent of improvements from Mod Waters and possible CERP changes to NESRS is unknown at this time. However, seepage to the L-31N Canal would impair ecological functions within NESRS no matter what changes are made, by siphoning away water intended for the slough. Thus, WRAP “lift” or “delta” attributed to seepage control can be judged relative to any suite of improvements made by future projects, i.e. seepage control would contribute a significant positive delta compared to any benefits derived from future changes. In addition, this concept means that the existing or baseline condition (WRAP baseline score) does not need to be adjusted for sub-area variations in the area of interest within NESRS. A generalized baseline condition should suffice. Thus, while an attempt is made here to anchor wrap scores based on existing conditions, a change to another set of baseline conditions should not be important – seepage improvements will be judged as a WRAP score addition to whatever baseline is used, using the refined scoring levels presented above.

WRAP Spreadsheets and Summary Sheet

Five WRAP scoring spreadsheets are attached. The first WRAP scoring sheet shows the “averaged” existing baseline for the entire NESRS area. It is followed by four WRAP scoring sheets for increasing distances from the L-31N where modeling results show tiered effects of seepage control, from elevated wet-season water levels of 0.3 feet or more, proceeding westward to the area where results show a 0.05 to 0.1-foot increase in water levels. A summary of the individual WRAP scoring sheets for baseline and successive water-elevation results is presented in Table 1. It shows the WRAP scores, the resulting lift from the baseline condition, and the mitigation credits that would result using the examples of both a 7-mile-long and a 2-mile-long deep seepage barrier during wet-season conditions. We believe that these WRAP scores are best applied to seasonal wet conditions when benefits from water depth and flow are realized.

Table 1. WRAP scoring summary table for a 7 mile and 2 mile seepage barrier, 30 feet deep.

Stage Change	Scoring Categories						WRAP		Acreage		Mitigation Credits	
	WU	WC	GC	HSB	HYD	WQ	Score	Lift	7-mile	2-mile	7-mile	2-mile
Baseline	2.00	0.00	2.00	3.00	2.00	3.00	0.80	N/A	N/A	N/A	N/A	N/A
>0.3 ft.	2.50	0.00	2.50	3.00	2.67	3.00	0.91	0.111	3,376	0	376	0
0.2 to 0.3 ft.	2.33	0.00	2.33	3.00	2.50	3.00	0.88	0.077	5,429	415	420	32
0.1 to 0.2 ft.	2.17	0.00	2.17	3.00	2.33	3.00	0.84	0.045	11,930	2,723	533	122
0.05 to 0.1 ft.	2.00	0.00	2.00	3.00	2.17	3.00	0.81	0.011	12,242	9,537	139	108
									Totals		1467	262

References

WRAP: Miller, R.E. and G.E. Gunsalus. 1997 (updated 8/1999). Wetland Rapid Assessment Procedure (WRAP). SFWMD Natural Resource Management Division, Regulation Department, Tech. Pub. REG-001.

Wetland Rapid Assessment Procedure

Application Number	Project Name	Date	Evaluator	Wetland ID
	L-31N 7-mi. seepage barrier for NESRS	9/15/2011	T.E. Lodge	NESRS baseline

Land Use	FLUCFCS Code	Acreage
National Park wetlands	641	Portion of northeastern NESRS extending west from the L-31N levee

Wildlife Utilization (WU)	Wetland Canopy (WC)	Wetland Ground Cover (GC)
2.00	N/A	2.00

Habitat Support/Buffer (HSB)			
Type	(Score) X	(%area)*	=subtotal
north	3.00	0.11	0.33
south	3.00	0.17	0.51
east	3.00	0.32	0.96
west	3.00	0.4	1.2
Total			3.00



Field Hydrology (HYD)
2.00

WQ Input & Treatment (WQ)
3.00

Check one No seepage barrier
 Proposed Conditions

Land Use Category (LU)			
Land Use	(Score) X	(%area)*	=subtotal
north	3.00	0.11	0.33
south	3.00	0.17	0.51
east	3.00	0.32	0.96
west	3.00	0.4	1.2
LU Total			3.00

Pretreatment Category (PT)			
PT	(Score) X	(%area)*	=subtotal
north	3.00	0.11	0.33
south	3.00	0.17	0.51
east	3.00	0.32	0.96
west	3.00	0.4	1.2
PT Total			3.00

 = calculation cells, do not enter data
 = variables changing with seepage

WRAP SCORE 0.80

* % expressed as decimal

Wildlife Utilization (WU):

Evidence of wetland utilization by small or medium-sized mammals and reptiles, and evidence of aquatic macroinvertebrates, amphibians and/or forage fishes during periods of flooding. Area known to be impaired from optimal functions, in part due to seepage.

Wetland Canopy (O/S):

While highly important to the ecology of NESRS, the relative area of canopy represented by tree islands in the seepage-affected northeastern NESRS is negligible. Improvements in flow and hydroperiod by the Tamiami Trail bridging projects are predicted to improve the integrity of tree islands in NESRS, but any contribution from seepage control is likely to be negligible. Thus, the relative contribution to overall changes in NESRS can be omitted as N/A.

Wetland Ground Cover (GC):

Historical habitat in NESRS has been heavily impacted by the expansion of sawgrass into historic lily-dominated sloughs, essentially eliminating them and breaking continuity of remnant sloughs, all judged to be significantly reduced from an optimal vegetation pattern. With improved flows into NESRS this trend should be reversed but impeded due to seepage.

Habitat Support/Buffer:

Relative to the size of northeastern NESRS, the adjacent upland/wetland buffers are negligible. Further, there is no anticipated change between the proposed project and no project (no seepage barrier) conditions. As such, this parameter is scored at 3.0 for with and w/o project.

Field Hydrology (HYD):

NESRS has been impaired by interruption of the historic flows through this area of the Everglades. The hydrology is in the process of being improved but still requires additional projects to provide more water. Seepage continues to impede NESRS hydrology.

WQ Input & Treatment (WQ) (averaged from LU and PT):

The northeastern NESRS lies along the Tamiami Trail/Tamiami Canal on the north, the L-31N levee on the east, the 8.5-square mile area to the south, and other portions of NESRS to the west. However, with the Tamiami Trail improvement projects and the fact that flow is generally southward, the east and south borders do not constitute deleterious land use or pretreatment considerations for northeastern NESRS. As such, all scores are set at 3.0 with or w/o seepage control.

Wetland Rapid Assessment Procedure

Application Number	Project Name	Date	Evaluator	Wetland ID
	L-31N 7-mi. seepage barrier for NESRS	9/15/2011	T.E. Lodge	0.3' increase

Land Use	FLUCFCS Code	Acreage
National Park wetlands	641	Portion of northeastern NESRS extending west from the L-31N levee

Wildlife Utilization (WU)	Wetland Canopy (O/S)	Wetland Ground Cover (GC)
2.50	N/A	2.50

Habitat Support/Buffer (HSB)

Type	(Score) X	(%area)*	=subtotal	
north	3.00	0.11	0.33	
south	3.00	0.17	0.51	
east	3.00	0.32	0.96	
west	3.00	0.4	1.2	
			Total	3.00

Field Hydrology (HYD)

2.67

WQ Input & Treatment (WQ)

3.00



Check one No seepage barrier
 Proposed Conditions

Land Use Category (LU)

Land Use	(Score) X	(%area)*	=subtotal
north	3.00	0.11	0.33
south	3.00	0.17	0.51
east	3.00	0.32	0.96
west	3.00	0.4	1.2
			LU Total
			3.00

Pretreatment Category (PT)

PT	(Score) X	(%area)*	=subtotal
north	3.00	0.11	0.33
south	3.00	0.17	0.51
east	3.00	0.32	0.96
west	3.00	0.4	1.2
			PT Total
			3.00

 = calculation cells, do not enter data
 = variables changing with seepage

WRAP SCORE  **0.91**

* % expressed as decimal

Wildlife Utilization (WU):

Reduced seepage very close to the L-31N where wet season water depths will be increased by 0.3 ft. or more, a substantial wildlife benefit should occur, raising the baseline by 1/2 step (0.50).

Wetland Canopy (O/S):

N/A - see "Existing near" tab.

Wetland Ground Cover (GC):

Reduced seepage very close to the L-31N where wet season water depths will be increased by 0.3 ft. or more, a substantial wetland vegetation benefit should occur, raising the baseline by 1/2 step (0.50).

Habitat Support/Buffer:

No change - see existing baseline tab.

Field Hydrology (HYD):

Reduced seepage very close to the L-31N where wet season water depths will be increased by 0.3 ft. or more represents a substantial benefit, raising the baseline by 2/3 step (0.67).

WQ Input & Treatment (WQ):

No change - see existing baseline tab.

Wetland Rapid Assessment Procedure

Application Number	Project Name	Date	Evaluator	Wetland ID
	L-31N 7-mi. seepage barrier for NESRS	9/15/2011	T.E. Lodge	0.2' increase

Land Use	FLUCFCS Code	Acreage
National Park wetlands	641	Portion of northeastern NESRS extending west from the L-31N levee

Wildlife Utilization (WU)	Wetland Canopy (WC)	Wetland Ground Cover (GC)
2.33	N/A	2.33

Habitat Support/Buffer (HSB)			
Type	(Score) X	(%area)*	=subtotal
north	3.00	0.11	0.33
south	3.00	0.17	0.51
east	3.00	0.32	0.96
west	3.00	0.4	1.2
Total			3.00

Field Hydrology (HYD)
2.50

WQ Input & Treatment (WQ)
3.00

Check one No seepage barrier
 Proposed Conditions

Land Use Category (LU)			
Land Use	(Score) X	(%area)*	=subtotal
north	3.00	0.11	0.33
south	3.00	0.17	0.51
east	3.00	0.32	0.96
west	3.00	0.4	1.2
LU Total			3.00

Pretreatment Category (PT)			
PT	(Score) X	(%area)*	=subtotal
north	3.00	0.11	0.33
south	3.00	0.17	0.51
east	3.00	0.32	0.96
west	3.00	0.4	1.2
PT Total			3.00

= calculation cells, do not enter data
 = variables changing with seepage

WRAP SCORE 0.88

* % expressed as decimal

Wildlife Utilization (WU):

At a distance from the L-31N where wet season water depths will be 0.2 to 0.3 ft. higher, a moderate wildlife benefit should occur, raising the baseline by 1/3 step (0.33).

Wetland Canopy (O/S):

N/A - see "Existing near" tab.

Wetland Ground Cover (GC):

At a distance from the L-31N where wet season water depths will be 0.2 to 0.3 ft. higher, a moderate wetland vegetation benefit should occur, raising the baseline by 1/3 step (0.33).

Habitat Support/Buffer:

No change - see existing baseline tab.

Field Hydrology (HYD):

At a distance from the L-31N where wet season water depths will be 0.2 to 0.3 ft. higher, a moderate benefit should occur, raising the baseline by 1/2 step (0.50).

WQ Input & Treatment (WQ):

No change - see existing baseline tab.

Wetland Rapid Assessment Procedure

Application Number	Project Name	Date	Evaluator	Wetland ID
	L-31N 7-mi. seepage barrier for NESRS	9/15/2011	T.E. Lodge	0.1' increase

Land Use	FLUCFCS Code	Acreage
National Park wetlands	641	Portion of northeastern NESRS extending west from the L-31N levee

Wildlife Utilization (WU)	Wetland Canopy (WC)	Wetland Ground Cover (GC)
2.17	N/A	2.17



Habitat Support/Buffer (HSB)	Field Hydrology (HYD)	WQ Input & Treatment (WQ)
Type (Score) X (%area)* =subtotal	2.33	3.00

north	3.00	0.11	0.33	
south	3.00	0.17	0.51	
east	3.00	0.32	0.96	
west	3.00	0.4	1.2	
				Total
				3.00

Check one No seepage barrier
 Proposed Conditions

Land Use Category (LU)			
Land Use	(Score) X	(%area)*	=subtotal
north	3.00	0.11	0.33
south	3.00	0.17	0.51
east	3.00	0.32	0.96
west	3.00	0.4	1.2
LU Total			3.00

Pretreatment Category (PT)			
PT	(Score) X	(%area)*	=subtotal
north	3.00	0.11	0.33
south	3.00	0.17	0.51
east	3.00	0.32	0.96
west	3.00	0.4	1.2
PT Total			3.00

 = calculation cells, do not enter data
 = variables changing with seepage

WRAP SCORE  **0.84**

* % expressed as decimal

Wildlife Utilization (WU):

At a distance from the L-31N where wet season water depths will be 0.1 to 0.2 ft. higher, only a slight wildlife benefit should occur, raising the baseline by 1/6 step (0.17).

Wetland Canopy (O/S):

N/A - see "Existing near" tab.

Wetland Ground Cover (GC):

At a distance from the L-31N where wet season water depths will be 0.1 to 0.2 ft. higher, only a slight wetland vegetation benefit should occur, raising the baseline by 1/6 step (0.17).

Habitat Support/Buffer:

No change - see existing baseline tab.

Field Hydrology (HYD):

At a distance from the L-31N where wet season water depths will be 0.1 to 0.2 ft. higher, a small benefit should occur, raising the baseline by 1/3 step (0.33).

WQ Input & Treatment (WQ):

No change - see existing baseline tab.

Wetland Rapid Assessment Procedure

Application Number	Project Name	Date	Evaluator	Wetland ID
	L-31N 7-mi. seepage barrier for NESRS	9/15/2011	T.E. Lodge	0.05' increase

Land Use	FLUCFCS Code	Acreage
National Park wetlands	641	Portion of northeastern NESRS extending west from the L-31N levee

Wildlife Utilization (WU)	Wetland Canopy (WC)	Wetland Ground Cover (GC)
2.00	N/A	2.00

Habitat Support/Buffer (HSB)	Field Hydrology (HYD)	WQ Input & Treatment (WQ)
Type (Score) X (%area)* =subtotal	2.17	3.00

north	3.00	0.11	0.33	Total
south	3.00	0.17	0.51	
east	3.00	0.32	0.96	
west	3.00	0.4	1.2	
			3.00	

Check one No seepage barrier
 Proposed Conditions

Land Use Category (LU)			
Land Use	(Score) X	(%area)*	=subtotal
north	3.00	0.11	0.33
south	3.00	0.17	0.51
east	3.00	0.32	0.96
west	3.00	0.4	1.2
LU Total			3.00

Pretreatment Category (PT)			
PT	(Score) X	(%area)*	=subtotal
north	3.00	0.11	0.33
south	3.00	0.17	0.51
east	3.00	0.32	0.96
west	3.00	0.4	1.2
PT Total			3.00

 = calculation cells, do not enter data
 = variables changing with seepage

WRAP SCORE 0.81

* % expressed as decimal

Wildlife Utilization (WU):

At the distance from the L-31N where wet season water depths will be less than 0.1 ft. higher, it is improbable that a wildlife benefit would occur, thus there is no increase from baseline.

Wetland Canopy (O/S):

N/A - see "Existing near" tab.

Wetland Ground Cover (GC):

At the distance from the L-31N where wet season water depths will be less than 0.1 ft. higher, it is improbable that a wetland vegetation benefit would occur, thus there is no increase from baseline.

Habitat Support/Buffer:

No change - see existing baseline tab.

Field Hydrology (HYD):

At the distance from the L-31N where wet season water depths will be between 0.05 and 0.1 ft. higher, the hydrologic benefit is small, but modeling shows that flows would increase in this area and farther west all the way to the L-67 levee. Thus, raising the baseline by 1/6 step (0.17) for this area represents a proxy for improved flows over a wider area.

WQ Input & Treatment (WQ):

No change - see existing baseline tab.