

Reclaimed Wetland Hydroperiod (water-balance) Modeling

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I. Introduction & Overview

ECT developed a wetland hydroperiod water balance (Wetland HP) model for Mosaic with its fundamental application for estimating the post reclamation hydrology of reclaimed wetlands. The Wetland HP model accounts for numerous hydrologic interactions between the atmosphere, vegetation, surface water, the vadose zone, and the water table.



Bay Swamp

Freshwater Marsh

Targeted Wetland Hydroperiods

Post Reclamation Wetlands and Expected Hydrologic Conditions

Wetland FLUFCS	Wetland Type	Expected Water Depth (feet)	Expected Hydro-period (months)
611	Bay Swamp	0.5	8 to 11
617	Mixed Wetland Hardwoods	0.5 - 1	3 to 9
617	Mixed Wetland Hardwoods-Fringe/Slope	0.5 - 1	3 to 9
641	Freshwater Marsh	1 - 1.5	7 to 12
643	Wet Prairie - Depression	0.5	2 to 8
643	Wet Prairie - Fringe/Slope	0.5	2 to 8
6417	Shrub Marsh	0.5 - 1.5	7 to 12

Note: Fringe/Slope wetlands are anticipated to be near the bottom of the water depth and hydroperiod duration estimates.

II. Model Description

Model Domain

- Upland Contributing Area
- Wetland Area
- Downgradient Area (either upland or wetland)

Reference Data Worksheet

- REF- contains ranges of typical input parameters

Input Data Worksheets

- D&I- design & initial conditions input parameters
- PRI- daily rainfall with runoff/infiltration calculation
- ET- daily pot ET variables & crop coefficients
- GW- daily groundwater flux & recharge variables

II. Model Description (cont.)

Output Data Tables

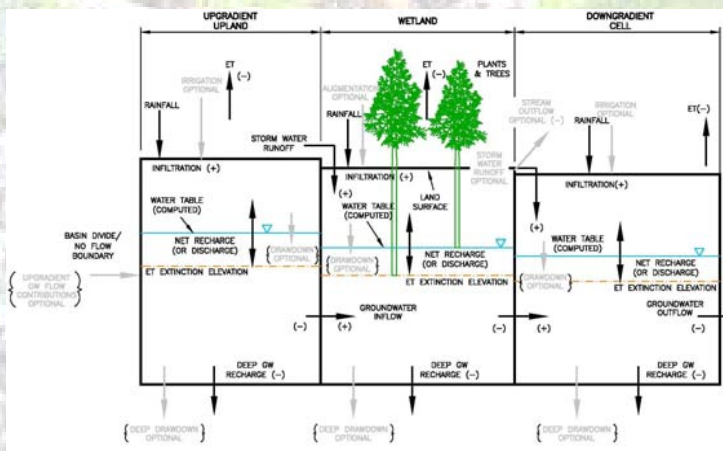
- **Wetland**- water balance for Wetland Cell
- **Upland**- water balance for Upland Cell
- **DG-Cell**- water balance for Down-gradient Cell
- **WB Summary**- Annual water balance summary

WETLAND	Rainfall	Wetland Inp Agmt	Wetland Runoff	Wetland Inflow	Wetland Discharge	ET	Wetland Outflow	Wetland Outflow	Wetland Outflow	Wetland Outflow	Calculated Storage Change	Modeled Storage Change	Calculation Error
	A (+)	B (+)	C (+)	D (+)	E (+)	F (-)	G (-)	H (-)	I (-)	J (-)	(A+B+C+D-E-F-G-H)	(I+J-G+H-E-F-G-H)	(J)
1990 (12)	20.63	0.00	0.02	10.87	0.00	20.83	0.76	0.33	-10.34	-0.73	-0.73	0.00	0.00
1997	50.57	0.00	0.11	12.36	0.00	39.34	1.59	0.91	-26.46	0.75	0.75	0.00	0.00
1998	13.92	0.00	0.10	21.54	0.00	41.61	1.58	0.91	-32.11	0.07	0.07	0.00	0.00
1999	40.95	0.00	0.06	8.54	0.00	37.31	1.68	0.90	-10.53	-0.89	-0.89	0.00	0.00
2000	35.24	0.00	0.07	3.80	0.00	31.14	1.79	0.89	-6.93	-1.64	-1.64	0.00	0.00
2001	47.29	0.00	0.07	8.33	0.00	33.49	1.68	0.89	-18.77	0.85	0.85	0.00	0.00
2002	04.09	0.00	0.13	14.27	0.00	38.01	1.57	0.90	-35.69	2.32	2.32	0.00	0.00
2003	48.39	0.00	0.07	19.19	0.00	40.34	1.53	0.91	-25.39	0.52	0.52	0.00	0.00
2004	12.56	0.00	0.12	12.53	0.00	44.02	1.05	0.90	-19.21	-0.57	-0.57	0.00	0.00
2005	42.47	0.00	0.23	18.80	0.00	48.07	1.56	0.91	-29.77	0.40	0.40	0.00	0.00
Average	38.78	0.00	0.10	13.80	0.00	39.26	1.62	0.89	-22.68	0.07	0.07	0.00	0.00

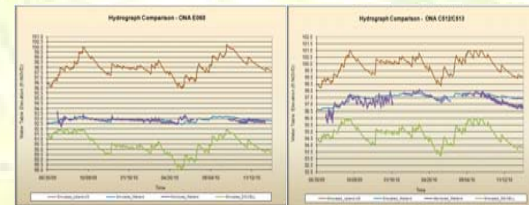
Output Data Graphs

- **Hydro Check**- comparison of three hydrographs
- **Upland Hydrograph**- model predicted hydrograph
- **Wetland Hydrograph**- model predicted hydrograph
- **Wetland SDC**- model predicted stage-duration curve
- **DG-Cell Hydrograph**- model predicted hydrograph
- If present/applicable
 - **Wetland Outflow**- model predicted channel outflow
 - **Fringe Hydrograph**- model predicted hydrograph
 - **Fringe SDC**- model predicted stage-duration curve

III. Conceptual Model Design



IV. Verification Examples



Bay Swamp - FLUFCS 611

Sample Space Size = 1101

Mean Error (ME) = -0.06

Absolute Mean Error (MAE) = 0.15

Root Mean Sq Error (RMS) = 0.20

Correlation Coeff. (R) = -1

Freshwater Marsh - FLUFCS 641

Sample Space Size = 1169

Mean Error (ME) = -0.23

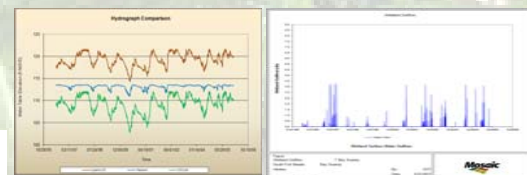
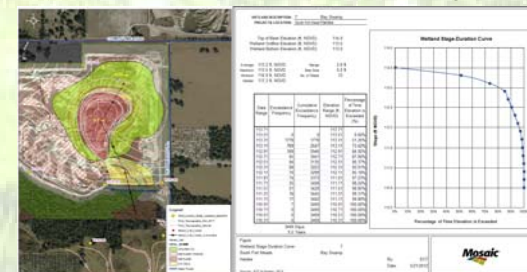
Absolute Mean Error (MAE) = 0.28

Root Mean Sq Error (RMS) = 0.35

Correlation Coeff. (R) = -1

V. Application Example

Bay Swamp - FLUFCS 611 with 617 Fringe



VI. Summary

The Wetland HP model was successfully applied for Mosaic's permitting efforts at its South Fort Meade extension property in Hardee County, Florida. Also, the model was recently verified against 18 months of actual field monitoring data for selected wetlands at their Ona property in Hardee County, Florida.

When properly applied the Wetland HP model is capable of being an effective tool for estimating the hydroperiods for existing and/or post-reclamation wetlands.