

**Draft Final Report for Wekiva Onsite Nitrogen
Contribution Task 3: Assessment of Total Loading in
the Wekiva Study Area**

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The Wekiva Study Area (WSA) is comprised of about 304,000 acres covering portions of Lake, Orange, and Seminole Counties. A map of the land uses within the WSA, as identified by the 2004 Land Use Survey, is displayed in Figure 1. The proportions of land designated for categories of land uses are shown in Figure 2.

Figure 1: Map showing land uses within the Wekiva Study Area

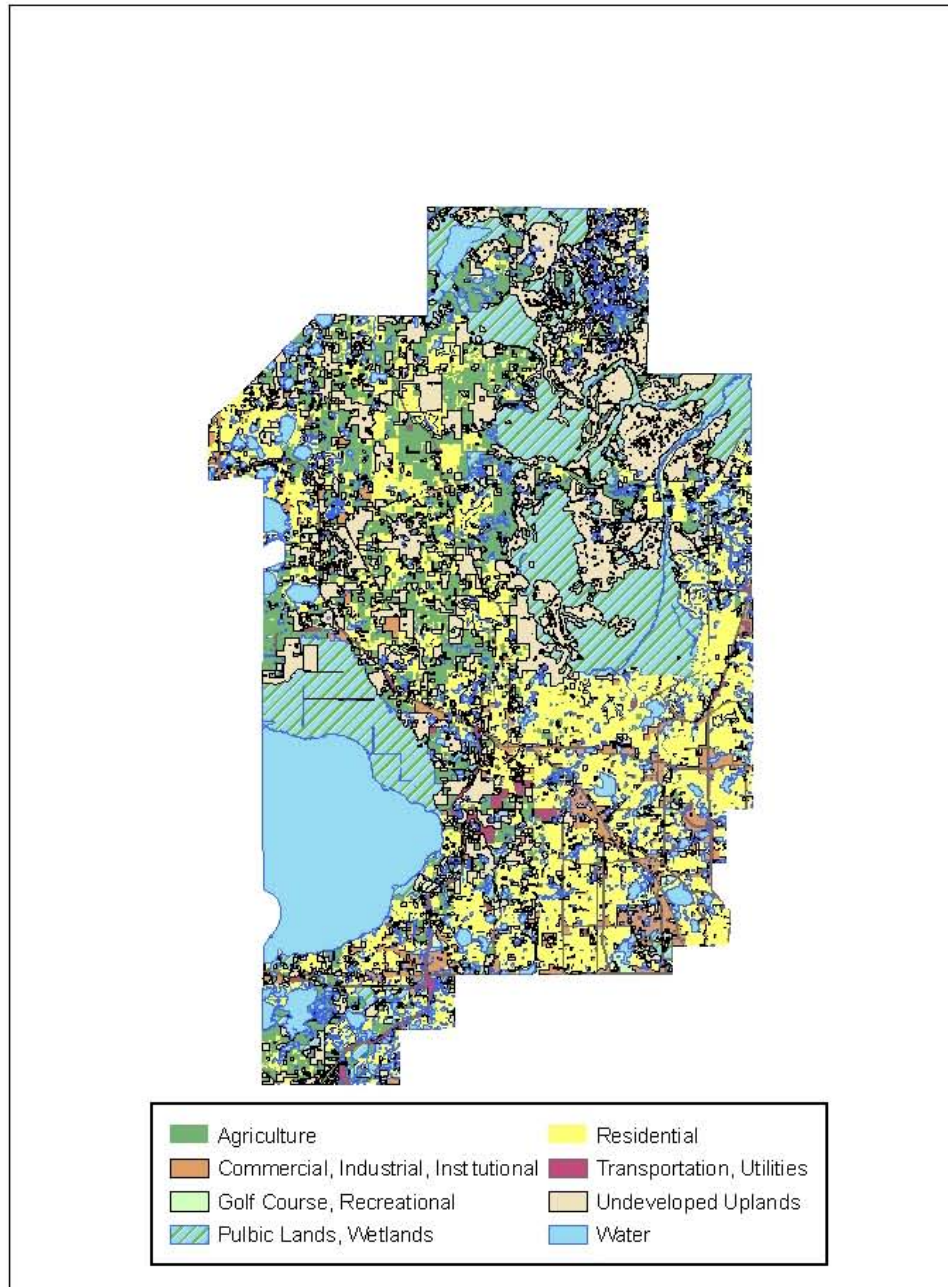
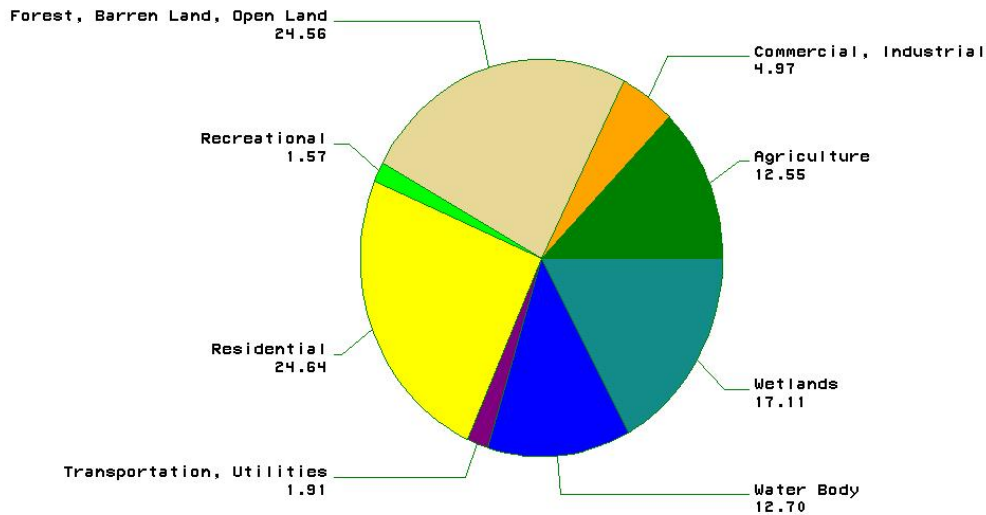


Figure 2. Land uses in Wekiva Study Area



Inputs to WSA

The methods and results from the Phase I Report: Wekiva River Basin Nitrate Sourcing Study have been followed here. Inputs to the WSA include direct application of fertilizer, livestock waste (which is assumed to be released to the environment), atmospheric deposition (wet and dry) of total nitrate (nitrate + nitric acid); domestic and industrial wastewater effluents, and septic tank discharges. Each source has been quantified. The quantities reported in the Phase I Report were used here for the most part. The primary departure is the determination of septic system discharge. For this the information was supplied by Richard Otis.

Fertilizer Use

Fertilizer was assumed to be applied at rates recommended by the University of Florida's (UF) Institute of Food and Agricultural Sciences (IFAS) unless it was determined that actual practice deviated from that. The following equation was used to estimate residential, commercial, institutional, and transportation land uses:

$$Fertilizer\ Use_{LU} = \frac{Pervious\ Fraction_{LU} \times Application\ Rate_{LU} \times Area_{LU}}{CF}$$

where $Fertilizer\ Use_{LU}$ = Total Nitrogen contained in fertilizer applied for a specific land use (LU), totaled for that land use over the entire Wekiva Basin (MT/year);

$Pervious\ Fraction_{LU}$ = Fraction of the land use area that is not paved or under roof;

$Application\ Rate_{LU}$ = Application rate of Total Nitrogen in fertilizer (kg/ha/yr);

$Area_{LU}$ = Area within a given land use classification totaled over the entire Wekiva Basin (ha); and
 CF = Conversion factor to achieve desired units of measurement, 1000 (kg/MT)

The application rate and impervious fraction by land use are taken from Phase I Report's Appendix D, Table 2. These as well as the total area within each land use and the fertilizer use in kg/year and MT/year are displayed in Table 1.

Livestock

Again based on the Phase I Report, livestock waste on pasture land is 41 kg/ha/year and that on feedlot land uses is taken to be 4100 kg/ha/year. Based on these values, the inputs from nitrogen from land use sources are displayed in Table 2.

Septic Systems

Richard Otis has estimated the contribution of N from septic systems to be 8.2 kg/home/year. The distribution of the 55,417 septic systems in the Wekiva Study Area by Drainage Class, Midpoint Between the Low and High Season Depths to the Water Table, Organic Matter Class and Soil is shown in Table 3. The nitrogen contributed by each category. Thus, the total nitrogen input to the Wekiva Study Area is estimated to be 454.42 MT/year.

Acid Deposition

Again, according to the Phase I Report, the nitrogen input from acid deposition is estimated to be 2.57 and 4.18 kg/ha/year for rural and urban areas, respectively. The results by Land Use are shown in Table 4. Thus the estimated nitrogen input to WSA from acid deposition is 263.78 MT/year.

Domestic and Industrial Wastewater Discharge

In the Phase I Report, waste water discharges of NO_3-N to surface water and groundwater were estimated using monitored discharge rates and NO_3-N effluent concentrations obtained from FDEP. They estimated 189 MT/year were input to the Wekiva River Basin. The basin has an area of 415,000 and encompasses the Wekiva Study Area, which has about 304,000 acres. We take the proportion of nitrogen loading from domestic and industrial waste water to the WSA to be proportional to the land area; that is, the input from these sources is estimated to be $189 (304,000/415,000) = 138$ MT/year.

Totals

The total N input to WSA from all sources is estimated to be 7,281.91 MT/year. The relative contributions from all sources is shown in Figure 3.

Table 1. Environmental Nitrogen Loading Due to Fertilizer by Land Use

LU Code	Land Use	Acres	Hectares	Fertilizer (kg/ha/year)	Impervious (%)	Fertilizer Subtotal (kg/year)/	Fertilizer (MT/year)
2150	Agriculture-Field Crops	2627.96	1063.53	150	0.00	159530.20	159.53
2450	Agriculture-Floriculture	21.05	8.52	200	0.00	1703.73	1.70
2510	Agriculture-Horse Farms	2151.10	870.55	63	0.00	54844.55	54.84
2110	Agriculture-Improved Pasture	13267.69	5369.44	63	0.00	338274.46	338.27
2400	Agriculture-Nurseries	5564.90	2252.11	227	0.00	511229.87	511.23
2140	Agriculture-Row Crops	692.64	280.31	630	0.00	176596.17	176.60
2420	Agriculture-Sod Farms	120.32	48.69	200	0.00	9738.40	9.74
2500	Agriculture-Specialty Farms	86.60	35.05	200	0.00	7009.11	7.01
2200	Agriculture-Tree Crops	6016.14	2434.73	227	0.00	552684.54	552.68
8110	Agriculture-Unimproved Pasture	7505.32	3037.40	63	0.00	191356.30	191.36
1480	Airports	172.77	69.92	200	85.00	2097.56	2.10
1400	Commercial	8470.26	3427.91	200	94.25	39420.99	39.42
8200	Communications	128.85	52.15	200	85.00	1564.35	1.56
1820	Golf Courses	3174.04	1284.53	175	0.00	224793.61	224.79
1390	High Density Residential	7792.26	3153.53	148	67.00	154018.34	154.02
1700	Institutional	3311.45	1340.14	200	91.00	24122.57	24.12
1100	Low Density Residential	12739.00	5155.48	148	14.70	650847.79	650.85
1200	Medium Density Residential	44361.16	17952.96	148	27.80	1918381.69	1918.38
1800	Recreational	1807.25	731.39	200	1.50	144084.76	144.08
8100	Transportation	3319.16	1343.26	200	85.00	40297.94	40.30
8300	Utilities	2197.99	889.53	200	85.00	26685.81	26.69
1100	Very Low Density Residential	9906.01	4008.96	148	14.70	506107.39	506.11
	Totals	135,433.91	54,810.10			5,735,390.12	5,735.39

Table 2. Environmental Nitrogen Loading Due to Livestock Waste by Land Use

Land Use	Acres	Hectares	Livestock Waste (kg/ha/year)	Livestock Waste Subtotal (kg/year)	Livestock Waste (MT/year)
Agriculture-Feeding Operations	162.06	65.59	4150	269458.29	269.458
Agriculture-Horse Farms	2151.10	870.55	41	35335.56	35.336
Agriculture-Improved Pasture	13267.69	5369.44	41	217945.40	217.945
Agriculture-Unimproved Pasture	7505.32	3037.40	41	123288.13	123.288
Totals	23,086.17	9,342.97		652,552.91	652.55

Table 3. Estimated Nitrogen Inputs to the Wekiva Study Area from Septic Systems

Drainage	Water Class	OM	SOIL	Number of Septic Systems	Nitrates (MT/year)
	1	1		434	3.559
	1	1	URBAN LAND	8070	66.174
	2	1	PITS	17	0.139
E	2	1	LAKE	1126	9.233
E	2	1	PAOLA	412	3.378
E	2	1	ST. LUCIE	542	4.444
E	2	2	ASTATULA	2585	21.197
E	2	2	CANDLER	22146	181.597
MW	1	1	POMELLO	934	7.659
MW	2	1	ARCHBOLD	133	1.091
MW	2	1	ORSINO	63	0.517
MW	2	1	UDORTHENTS	2	0.016
MW	2	2	FLORAHOME	185	1.517
MW	2	2	MILLHOPPER	8	0.066
MW	2	2	TAVARES	10120	82.984
P	1	1	ADAMSVILLE	158	1.296
P	1	1	ARENTS	316	2.591
P	1	1	CASSIA	117	0.959
P	1	1	ZOLFO	702	5.756
P	1	2	ANCLOTE	19	0.156
P	1	2	BASINGER	959	7.864
P	1	2	BRIGHTON	64	0.525
P	1	2	CANOVA	2	0.016
P	1	2	CHOBEE	4	0.033
P	1	2	EAUGALLIE	49	0.402
P	1	2	EMERALDA	17	0.139
P	1	2	FELDA	27	0.221
P	1	2	GATOR	1	0.008
P	1	2	IMMOKALEE	433	3.551

Drainage	Water Class	OM	SOIL	Number of Septic Systems	Nitrates (MT/year)
P	1	2	MALABAR	6	0.049
P	1	2	MYAKKA	645	5.289
P	1	2	NITTAW	128	1.050
P	1	2	OCOEE	1	0.008
P	1	2	OKEELANTA	3	0.025
P	1	2	ONA	851	6.978
P	1	2	PLACID	45	0.369
P	1	2	POMPANO	202	1.656
P	1	2	SAMSULA	88	0.722
P	1	2	SANIBEL	68	0.558
P	1	2	SEFFNER	152	1.246
P	1	2	SMYRNA	2657	21.787
P	1	2	SPARR	22	0.180
P	1	2	ST. JOHNS	287	2.353
P	1	2	WABASSO	339	2.780
P	1	2	WAUBERG	2	0.016
P	1	2	WAUCHULA	1	0.008
P	2	2	LOCHLOOSA	29	0.238
W	2	1	AOPKA	52	0.426
W	2	2	ORLANDO	194	1.591
Totals				55,417	454.42

Table 4. Environmental Nitrogen Loading Due to Atmospheric Deposition by Land Use

Land Use	Acres	Hectares	Atmospheric Deposition (kg/ha/year)	Atmospheric Deposition (kg/year)	Atmospheric Deposition (MT/year)
Agriculture-Aquaculture	15.23	6.16	2.57	15.69	0.0157
Agriculture-Feeding Operations	162.06	65.59	2.57	166.87	0.1669
Agriculture-Field Crops	2627.96	1063.53	2.57	2705.95	2.7060
Agriculture-Floriculture	21.05	8.52	2.57	21.67	0.0217
Agriculture-Horse Farms	2151.10	870.55	2.57	2214.94	2.2149
Agriculture-Improved Pasture	13267.69	5369.44	2.57	13661.46	13.6615
Agriculture-Nurseries	5564.90	2252.11	2.57	5730.05	5.7301
Agriculture-Row Crops	692.64	280.31	2.57	713.20	0.7132
Agriculture-Sod Farms	120.32	48.69	2.57	123.89	0.1239
Agriculture-Specialty Farms	86.60	35.05	2.57	89.17	0.0892
Agriculture-Tree Crops	6016.14	2434.73	2.57	6194.69	6.1947
Agriculture-Unimproved Pasture	7505.32	3037.40	2.57	7728.06	7.7281
Airports	172.77	69.92	2.57	178.79	0.1788
Barren Land	9427.61	3815.35	2.57	9756.43	9.7564
Cemetaries	203.70	82.44	4.18	342.86	0.3429
Commercial	8266.56	3345.48	4.18	2097.61	2.0976
Communications	128.85	52.15	4.18	32.70	0.0327
Extractive	634.46	256.77	2.57	98.98	0.0990
Forest	33070.72	13383.72	2.57	34224.18	34.2242
Golf Courses	3174.04	1284.53	2.57	2740.04	2.7400
High Density Residential	7792.26	3153.53	4.18	3822.71	3.8227
Industrial	2714.17	1098.42	2.57	423.44	0.4234
Institutional	3311.45	1340.14	2.57	1205.46	1.2055
Low Density Residential	12739.00	5155.48	2.57	9274.70	9.2747
Marinas and Fish Camps	28.89	11.69	2.57	29.89	0.0299
Medium Density Residential	44361.16	17952.96	4.18	47277.33	47.2773
Open Land	20202.82	8176.08	2.57	20907.47	20.9075
Recreational	1807.25	731.39	2.57	1870.29	1.8703

Land Use	Acres	Hectares	Atmospheric Deposition (kg/ha/year)	Atmospheric Deposition (kg/year)	Atmospheric Deposition (MT/hyear)
Swimming Beaches	2.38	0.96	2.57	2.46	0.0025
Transportation	3319.16	1343.26	2.57	0.00	0.0000
Tree Plantations	12098.73	4896.36	2.57	12457.80	12.4578
Utilities	2197.99	889.53	4.18	557.73	0.5577
Very Low Density Residential	9906.01	4008.96	2.57	8654.55	8.6545
Water Body	38687.88	15656.99	2.57	29172.88	29.1729
Wetlands	52103.30	21086.21	2.57	39288.87	39.2889
Totals	304,582.15	123,364.40		263,782.80	263.78

Figure 3. Nitrate Releases to WSA by Source

