

Appendix B-2
SONIR Model,
Existing Conditions



SIMULATION OF NITROGEN IN RECHARGE (SONIR)

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

NAME OF PROJECT

Deforest Williams Estates

DATA INPUT FIELD

Existing Conditions

SHEET 1

A	Site Recharge Parameters	Value	Units
1	Area of Site	42.02	acres
2	Precipitation Rate	42.82	inches
3	Acreage of Lawn	3.21	acres
4	Fraction of Land in Lawn	0.076	fraction
5	Evapotranspiration from Lawn	24.20	inches
6	Runoff from Lawn	0.90	inches
7	Acreage of Impervious	1.05	acres
8	Fraction of Land Impervious	0.025	fraction
9	Evaporation from Impervious	4.28	inches
10	Runoff from Impervious	0.00	inches
11	Acreage of Unvegetated	0.00	acres
12	Fraction of Land Unvegetated	0.000	fraction
13	Evapotrans. from Unvegetated	24.20	inches
14	Runoff from Unvegetated	2.1	inches
15	Acreage of Water	0.00	acres
16	Fraction of Site in Water	0.000	fraction
17	Evaporation from Water	30.00	inches
18	Makeup Water (if applicable)	0.00	inches
19	Acreage of Natural Area	37.76	acres
20	Fraction of Land Natural	0.899	fraction
21	Evapotrans. from Natural Area	24.20	inches
22	Runoff from Natural Area	0.30	inches
23	Acreage of Other Area	0.00	acres
24	Fraction of Land Other Area	0.000	fraction
25	Evapotrans. from Other Area	0.00	inches
26	Runoff from Other Area	0.00	inches
27	Acreage of Land Irrigated	3.21	acres
28	Fraction of Land Irrigated	0.076	fraction
29	Irrigation Rate	5.50	inches
30	Number of Dwellings	2	units
31	Water Use per Dwelling	0	gal/day
32	Wastewater Design Flow	0	gal/day
33	Commercial /STP Design Flow	0	gal/day

B	Nitrogen Budget Parameters	Value	Units
1	Persons per Dwelling	4.00	persons
2	Nitrogen per Person per Year	10.0	lbs
3	a. Sanitary Nitrogen Leaching Rate	50%	percent
3	b. Sanitary Nitrogen Leaching Rate	0%	percent
4	Area of Land Fertilized 1	3.21	acres
5	Fertilizer Application Rate 1	2.30	lbs/1000 sq ft
6	Fertilizer Nitrogen Leaching Rate 1	14%	percent
7	Area of Land Fertilized 2	0.00	acres
8	Fertilizer Application Rate 2	0.00	lbs/1000 sq ft
9	Fertilizer Nitrogen Leaching Rate 2	0%	percent
10	Pet Waste Application Rate	3.19	lbs/pet
11	Pet Waste Nitrogen Leaching Rate	50%	percent
12	Area of Land Irrigated	3.21	acres
13	Irrigation Rate	5.50	inches
14	Irrigation Nitrogen Leaching Rate	15%	percent
15	Nitrogen in Precipitation	1.00	mg/l
16	Precipitation Nitrogen Leaching Rate	15%	percent
17	Nitrogen in Water Supply	1.00	mg/l
18	Nitrogen in Commercial/STP Flow	40.00	mg/l

C	Comments
1)	Please refer to user manual for data input instructions.
2)	Sanitary Nitrogen Leaching Rate 3.a.) is for residential wastewater and 3.b.) is for commercial or STP which varies from 50 percent for conventional systems to 10 percent for STP effluent discharge.
3)	Under existing conditions there are 2 residences with 4 persons/residence.

SIMULATION OF NITROGEN IN RECHARGE (SONIR)

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

SITE RECHARGE COMPUTATIONS

Existing Conditions

SHEET 2

<i>A Lawn Area Recharge</i>			<i>B Impervious Area Recharge</i>				
	<i>Value</i>	<i>Units</i>		<i>Value</i>	<i>Units</i>		
1	A = Fraction of Land in Lawn	0.076	fraction	1	A = Fraction of Land in Impervious	0.025	fraction
2	P = Precipitation Rate	42.82	inches	2	P = Precipitation Rate	42.82	inches
3	E = Evapotranspiration Rate	24.20	inches	3	E = Evapotranspiration Rate	4.28	inches
4	Q = Runoff Rate	0.90	inches	4	Q = Runoff Rate	0.00	inches
5	R(l) = P - (E + Q)	17.72	inches	5	R(i) = P - (E + Q)	38.54	inches
6	R(L) = R(l) x A	1.35	inches	6	R(I) = R(i) x A	0.96	inches

<i>C Unvegetated Area Recharge</i>			<i>D Water Area Loss</i>				
	<i>Value</i>	<i>Units</i>		<i>Value</i>	<i>Units</i>		
1	A = Fraction of Land Unveg.	0.000	fraction	1	A = Fraction of Site in Water	0.000	fraction
2	P = Precipitation Rate	42.82	inches	2	P = Precipitation Rate	42.82	inches
3	E = Evapotranspiration Rate	2.10	inches	3	E = Evaporation Rate	30.00	inches
4	Q = Runoff Rate	0.00	inches	4	Q = Runoff Rate	0.00	inches
5	R(u) = P - (E + Q)	40.72	inches	5	M = Makeup Water	0.00	inches
6	R(U) = R(u) x A	0.00	inches	6	R(w) = {P - (E+Q)} - M	12.82	inches
				7	R(W) = R(w) x A	0.00	inches

<i>E Natural Area Recharge</i>			<i>F Other Area Recharge</i>				
	<i>Value</i>	<i>Units</i>		<i>Value</i>	<i>Units</i>		
1	A = Fraction of Land in Natural	0.899	fraction	1	A = Fraction of Land in Other	0.000	fraction
2	P = Precipitation Rate	42.82	inches	2	P = Precipitation Rate	42.82	inches
3	E = Evapotranspiration Rate	24.20	inches	3	E = Evapotranspiration Rate	0.00	inches
4	Q = Runoff Rate	0.30	inches	4	Q = Runoff Rate	0.00	inches
5	R(n) = P - (E + Q)	18.32	inches	5	R(o) = P - (E + Q)	42.82	inches
6	R(N) = R(n) x A	16.46	inches	6	R(O) = R(o) x A	0.00	inches

<i>G Irrigation Recharge</i>			<i>H Wastewater Recharge</i>				
	<i>Value</i>	<i>Units</i>		<i>Value</i>	<i>Units</i>		
1	A = Fraction of Land Irrigated	0.076	fraction	1	WDF = Wastewater Design Flow	0	gal/day
2	I = Irrigation Rate	5.50	inches	2	WDF = Wastewater Design Flow	0	cu ft/yr
3	E = Evapotranspiration Rate	3.11	inches	3	A = Area of Site	1,830,391	sq ft
4	Q = Runoff Rate	0.90	inches	4	R(ww) = WDF/A	0.00	feet
5	R(irr) = I - (E + Q)	1.49	inches	5	R(WW) = Wastewater Recharge	0.00	inches
6	R(IRR) = R(irr) x A	0.11	inches				

Total Site Recharge		
R(T) =	R(L) + R(I) + R(U) + R(W) + R(N) + R(O) + R(IRR) + R(WW)	
R(T) =	18.89	inches

SIMULATION OF NITROGEN IN RECHARGE (SONIR)

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

SITE NITROGEN BUDGET

Existing Conditions SHEET 3

A Sanitary Nitrogen-Residential			<i>Value</i>	<i>Units</i>	B Pet Waste Nitrogen			<i>Value</i>	<i>Units</i>
1	Number of Dwellings	2		units	1	AR = Application Rate	3.19		lbs/pet
2	Persons per Dwelling	4.00		capita	2	Human Population	8		capita
3	P = Population	8.00		capita	3	Pets = 17 percent of capita	1		pets
4	N = Nitrogen per person	10		lbs	4	N(p) = AR x pets	4.34		lbs
5	LR = Leaching Rate	50%		percent	5	LR = Leaching Rate	50%		percent
6	N(S) = P x N x LR	40.00		lbs	6	N(P) = N(p) x LR	2.17		lbs
7	N(S) = Sanitary Nitrogen	40.00		lbs	7	N(P) = Pet Waste Nitrogen	2.17		lbs

C Sanitary Nitrogen (Commercial/STP)			
1	CF = Commercial/STP Flow	0	gal/day
2	CF = Commercial/STP Flow	0	liters/yr
3	N = Nitrogen in Commercial	40.00	mg/l
4	LR = Leaching Rate	50%	percent
5	N(S) = CF x N x LR	0	milligrams
6	N(S) = Sanitary Nitrogen	0.00	lbs

D Water Supply Nitrogen (other than wastewater, if applicable)			
1	WDF = Wastewater Design Flow	0	gal/day
2	WDF = Wastewater Design Flow	0	liters/yr
3	N = Nitrogen in Water Supply	1.00	mg/l
4	N(WW) = WDF x N	0	milligrams
5	N(WW) = Wastewater Nitrogen	0.00	lbs

E Fertilizer Nitrogen 1			
1	A = Area of Land Fertilized 1	139,828	sq ft
2	AR = Application Rate	2.30	lbs/1000 sf
3	LR = Leaching Rate	14%	percent
4	N(F1) = A x AR x LR	45.02	lbs
5	N(F1) = Fertilizer Nitrogen	45.02	lbs

F Fertilizer Nitrogen 2			
1	A = Area of Land Fertilized 2	0	sq ft
2	AR = Application Rate	0.00	lbs/1000 sf
3	LR = Leaching Rate	0%	percent
4	N(F2) = A x AR x LR	0.00	lbs
5	N(F2) = Fertilizer Nitrogen	0.00	lbs

G Precipitation Nitrogen			
1	R(n) = Natural Recharge (feet)	1.56	feet
2	A = Area of Site (sq ft)	1,830,391	sq ft
3	R(N) = R(n) x A	2,864,474	cu ft
4	R(N) = Natural Recharge (liters)	81,121,914	liters
5	N = Nitrogen in Precipitation	1.00	mg/l
6	LR = Leaching Rate	15%	percent
7	N(ppt) = R(N) x N x LR	12,168,287	milligrams
8	N(ppt) = Precipitation Nitrogen	26.83	lbs

H Irrigation Nitrogen			
1	R = Irrigation Recharge (inches)	1.49	inches
2	R = Irrigation Rate (feet)	0.12	feet
3	A = Area of Land Irrigated	139,828	sq ft
4	R(I) = R(irr) x A	17,381	cu ft
5	R(I) = Site Precipitation (liters)	492,231	liters
6	N = Nitrogen in Water Supply	1.00	mg/l
7	LR = Leaching Rate	15%	percent
8	N(irr) = R(I) x N x LR	73,835	milligrams
9	N(irr) = Irrigation Nitrogen	0.16	lbs

Total Site Nitrogen	
N=	N(S) + N(P) + N(WW) + N(F1) + N(F2) + N(ppt) + N(irr)
N=	114.19 lbs

SIMULATION OF NITROGEN IN RECHARGE (SONIR)

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

NAME OF PROJECT

Deforest Williams Estate

Existing Conditions

FINAL COMPUTATIONS

SHEET 4

<i>A</i>	<i>Nitrogen in Recharge</i>	<i>Value</i>	<i>Units</i>
1	N = Total Nitrogen (lbs)	114.19	lbs
2	N = Total Nitrogen (milligrams)	51,841,155	milligrams
3	R(T) = Total Recharge (inches)	18.89	inches
4	R(T) = Total Recharge (feet)	1.57	feet
5	A = Area of Site	1,830,391	sq ft
6	R = R(T) x A	2,881,855	cu ft
7	R = Site Recharge Volume	81,614,145	liters
9	NR = N/R	0.64	mg/l

FINAL CONCENTRATION OF
NITROGEN IN RECHARGE

0.64

<i>B</i>	<i>Site Recharge Summary</i>	<i>Value</i>	<i>Units</i>
1	R(T) = Total Site Recharge	18.89	inches/yr
2	R = Site Recharge Volume	2,881,855	cu ft/yr
3	R = Site Recharge Volume	21,557,777	gal/yr
4	R = Site Recharge Volume	21.56	MG/yr

<i>Conversions used in SONIR</i>
Acres x 43,560 = Square Feet
Cubic Feet x 7.48052 = Gallons
Cubic Feet x 28.32 = Liters
Days x 365 = Years
Feet x 12 = Inches
Gallons x 0.1337 = Cubic Feet
Gallons x 3.785 = Liters
Grams / 1,000 = Milligrams
Grams x 0.002205 = Pounds
Milligrams / 1,000 = Grams