
APPENDIX F-3
SONIR Future Condition- Proposed Sewer District
and Central Pine Barrens Area (2015 DEIS)

SIMULATION OF NITROGEN IN RECHARGE (SONIR)

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

Theoretical Development Scenario
Average Turfgrass Leaching Rate

SITE RECHARGE COMPUTATIONS

A Fertilized Landscaped			B Non-fertilized Landscaped				
	<i>Value</i>	<i>Units</i>		<i>Value</i>	<i>Units</i>		
1	A = Fraction of Land in Cover Type	0.175	fraction	1	A = Fraction of Land in Cover Type	0.175	fraction
2	P = Precipitation Rate	49.90	inches	2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	23.00	inches	3	E = Evapotranspiration Rate	23.90	inches
4	Q = Runoff Rate	0.35	inches	4	Q = Runoff Rate	0.35	inches
5	R(a) = P - (E + Q)	26.55	inches	5	R(b) = P - (E + Q)	25.65	inches
6	R(A) = R(a) x A	4.66	inches	6	R(B) = R(b) x A	4.50	inches

C Unvegetated/Dirt Roads			D Water/Wetlands				
	<i>Value</i>	<i>Units</i>		<i>Value</i>	<i>Units</i>		
1	A = Fraction of Land in Cover Type	0.021	fraction	1	A = Fraction of Site in Water	0.042	fraction
2	P = Precipitation Rate	49.90	inches	2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	21.20	inches	3	E = Evaporation Rate	30.00	inches
4	Q = Runoff Rate	0.35	inches	4	Q = Runoff Rate	0.00	inches
5	R(c) = P - (E + Q)	28.35	inches	5	M = Makeup Water	0.00	inches
6	R(C) = R(c) x A	0.60	inches	6	R(d) = {P - (E+Q)} - M	19.90	inches
				7	R(D) = R(d) x A	0.83	inches

E Natural/Natural Revegetation			F Impervious/Paved/Roads				
	<i>Value</i>	<i>Units</i>		<i>Value</i>	<i>Units</i>		
1	A = Fraction of Land in Cover Type	0.234	fraction	1	A = Fraction of Land in Cover Type	0.352	fraction
2	P = Precipitation Rate	49.90	inches	2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	23.00	inches	3	E = Evapotranspiration Rate	4.99	inches
4	Q = Runoff Rate	0.35	inches	4	Q = Runoff Rate	0.00	inches
5	R(e) = P - (E + Q)	26.55	inches	5	R(f) = P - (E + Q)	44.91	inches
6	R(E) = R(e) x A	6.22	inches	6	R(F) = R(f) x A	15.80	inches

G Rain Gardens/Wetlands			H Irrigation Recharge				
	<i>Value</i>	<i>Units</i>		<i>Value</i>	<i>Units</i>		
1	A = Fraction of Land in Cover Type	0.000	fraction	1	A = Fraction of Land Irrigated	0.175	fraction
2	P = Precipitation Rate	49.90	inches	2	I = Irrigation Rate	24.00	inches
3	E = Evapotranspiration Rate	30.00	inches	3	E = Evaptranspiration Rate	23.00	inches
4	Q = Runoff Rate	0.50	inches	4	Q = Runoff Rate	0.35	inches
5	R(g) = P - (E + Q)	19.40	inches	5	R(h) = I - (E + Q)	0.65	inches
6	R(G) = R(g) x A	0.00	inches	6	R(H) = R(H) x A	0.11	inches

I Wastewater Recharge			J Runoff Recharge				
	<i>Value</i>	<i>Units</i>		<i>Value</i>	<i>Units</i>		
1	WDF = Wastewater Design Flow	709,137	gal/day	1	Q(A) = Runoff from Landscaped	0.061	inches
2	WDF = Wastewater Design Flow	34,606,240	cu ft/yr	2	Q(B) = Runoff from Non-fertilized Landscape	0.002	inches
3	A = Area of Site	20,366,914	sq ft	3	Q(C) = Runoff from Unvegetated	0.007	inches
4	R(j) = WDF/A	1.70	feet	4	Q(E) = Runoff from Natural	0.082	inches
5	R(I) = Wastewater Recharge	20.39	inches	5	Q(H) = Runoff from Rain Gardens	0.000	inches
				6	Q(I) = Runoff from Irrigation	0.06	inches
				7	Q(tot) = Q(A)+Q(B)+Q(C)+Q(E)+Q(H)+Q(I)	0.21	inches

Total Site Recharge	
R(T) =	R(A)+R(B)+R(C)+R(D)+R(E)+R(F)+R(G)+R(H)+R(I)+R(J)+Q(tot)
R(T) =	53.33 inches
R(T)(adj) =	53.33 inches

SIMULATION OF NITROGEN IN RECHARGE (SONIR)

NELSON, POPE & VOORHIS, LLC MICROCOMPUTER MODEL

Theoretical Development Scenario

Average Turfgrass Leaching Rate

SITE NITROGEN BUDGET

A Sanitary Nitrogen (Wastewater Flow)(untreated)		
1	CF = Wastewater Flow	171,072 gal/day
2	CF = Wastewater Flow	236,340,245 liters/yr
3	N = Nitrogen (untreated)	50.00 mg/l
4	N = Nitrogen (untreated)	26056.51 lbs
7	LR = Leaching Rate	50% percent
8	N(S) = CF x N x LR	5,908,506,120 milligrams
9	N(S) = Sanitary Nitrogen	13028.26 lbs
10	N = loss/removed	13028.26 lbs

B Pet Waste Nitrogen		Value	Units
1	AR = Application Rate	3.19	lbs/pet
2	Human Population	7303	capita
3	Pets = 17 percent of capita	1242	pets
4	N(p) = AR x pets	3960.53	lbs
5	LR = Leaching Rate	50%	percent
6	N(P) = N(p) x LR	1980.26	lbs
7	N = (loss/removed)	1980.26	lbs

C Sanitary Nitrogen (Wastewater Flow)(treated)		
1	CF = Wastewater Flow	538,065 gal/day
2	CF = Wastewater Flow	743,350,249 liters/yr
3	N = Nitrogen (untreated)	50.00 mg/l
4	N = Nitrogen (untreated)	81954.36 lbs
5	N = Nitrogen (treated)	6.00 mg/l
7	LR = Leaching Rate	90% percent
8	N(S) = CF x N x LR	4,014,091,345 milligrams
9	N(S) = Sanitary Nitrogen	8851.07 lbs
10	N = loss/removed	73103.29 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	2.00 mg/l
4	N(WW) = WDF x N	0 milligrams
5	N(WW) = Wastewater Nitrogen	0.00 lbs

E Fertilized Land		
1	A = Area of Land Fertilized	3,572,138 sq ft
2	AR = Application Rate	2.10 lbs/1000 sf
3	N(T) = Nitrogen (total applied)	7501.49 lbs
4	LR = Leaching Rate	10% percent
5	N(F1) = A x AR x LR	750.15 lbs
6	N = loss/removed	6751.34 lbs

F Non-Fertilized Land		
1	A = Area of Land Non-Fertilized	3,572,138 sq ft
2	AR = Application Rate	0.00 lbs/1000 sf
3	N(T) = Nitrogen (total applied)	0.00 lbs
4	LR = Leaching Rate	10% percent
5	N(F2) = A x AR x LR	0.00 lbs
6	N = loss/removed	0.00 lbs

G Precipitation Nitrogen (existing condition)		
1	R(n) = Natural Recharge (feet)	1.12 feet
2	A = Area of Site (sq ft)	20,366,914 sq ft
3	R(N) = R(n) x A	22,861,202 cu ft
4	R(N) = Natural Recharge (liters)	647,429,248 liters
5	N = Nitrogen in Precipitation	1.00 mg/l
6	N(T) = Nitrogen (total)	1,428 lbs
7	LR = Leaching Rate	10% percent
8	N(ppt) = R(N) x N x LR	64,742,924.81 milligrams
10	N(irr) = Irrigation Nitrogen	142.76 lbs
9	N = loss/removed	1284.82 lbs

H Irrigation Nitrogen		
1	R = Irrigation Recharge (inches)	0.11 inches
2	R = Irrigation Rate (feet)	0.01 feet
3	A = Area of Land Irrigated	3,572,138 sq ft
4	R(I) = R(irr) x A	33,973 cu ft
5	R(I) = Site Precipitation (liters)	962,108 liters
6	N = Nitrogen in Water Supply	2.00 mg/l
7	N(T) = Nitrogen (total applied)	4.24 lbs
8	LR = Leaching Rate	10% percent
9	N(irr) = R(I) x N x LR	192,422 milligrams
10	N(irr) = Irrigation Nitrogen	0.42 lbs
11	N = loss/removed	3.82 lbs

Total Site Nitrogen	
N=	N(S) + N(P) + N(WW) + N(F1) + N(F2) + N(ppt) + N(irr)
N=	24,752.92 lbs

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Average Turfgrass Leaching Rate

SITE RECHARGE COMPUTATIONS

<i>A</i>	<i>Fertilized Landscaped</i>	<i>Value</i>	<i>Units</i>
1	A = Fraction of Land in Cover Type	0.199	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	23.00	inches
4	Q = Runoff Rate	0.35	inches
5	R(a) = P - (E + Q)	26.55	inches
6	R(A) = R(a) x A	5.29	inches

<i>B</i>	<i>Non-fertilized Landscaped</i>	<i>Value</i>	<i>Units</i>
1	A = Fraction of Land in Cover Type	0.199	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	23.90	inches
4	Q = Runoff Rate	0.35	inches
5	R(b) = P - (E + Q)	25.65	inches
6	R(B) = R(b) x A	5.11	inches

<i>C</i>	<i>Unvegetated/Dirt Roads</i>	<i>Value</i>	<i>Units</i>
1	A = Fraction of Land in Cover Type	0.015	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	21.20	inches
4	Q = Runoff Rate	0.35	inches
5	R(c) = P - (E + Q)	28.35	inches
6	R(C) = R(c) x A	0.44	inches

<i>D</i>	<i>Water/Wetlands</i>	<i>Value</i>	<i>Units</i>
1	A = Fraction of Site in Water	0.012	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evaporation Rate	30.00	inches
4	Q = Runoff Rate	0.00	inches
5	M = Makeup Water	0.00	inches
6	R(d) = {P - (E+Q)} - M	19.90	inches
7	R(D) = R(d) x A	0.23	inches

<i>E</i>	<i>Natural/Natural Revegetation</i>	<i>Value</i>	<i>Units</i>
1	A = Fraction of Land in Cover Type	0.207	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	23.00	inches
4	Q = Runoff Rate	0.35	inches
5	R(e) = P - (E + Q)	26.55	inches
6	R(E) = R(e) x A	5.49	inches

<i>F</i>	<i>Impervious/Paved/Roads</i>	<i>Value</i>	<i>Units</i>
1	A = Fraction of Land in Cover Type	0.368	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	4.99	inches
4	Q = Runoff Rate	0.00	inches
5	R(f) = P - (E + Q)	44.91	inches
6	R(F) = R(f) x A	16.53	inches

<i>G</i>	<i>Rain Gardens/Wetlands</i>	<i>Value</i>	<i>Units</i>
1	A = Fraction of Land in Cover Type	0.000	fraction
2	P = Precipitation Rate	49.90	inches
3	E = Evapotranspiration Rate	30.00	inches
4	Q = Runoff Rate	0.50	inches
5	R(g) = P - (E + Q)	19.40	inches
6	R(G) = R(g) x A	0.00	inches

<i>H</i>	<i>Irrigation Recharge</i>	<i>Value</i>	<i>Units</i>
1	A = Fraction of Land Irrigated	0.199	fraction
2	I = Irrigation Rate	24.00	inches
3	E = Evaptranspiration Rate	23.00	inches
4	Q = Runoff Rate	0.35	inches
5	R(h) = I - (E + Q)	0.65	inches
6	R(H) = R(h) x A	0.13	inches

<i>I</i>	<i>Wastewater Recharge</i>	<i>Value</i>	<i>Units</i>
1	WDF = Wastewater Design Flow	627,427	gal/day
2	WDF = Wastewater Design Flow	30,618,751	cu ft/yr
3	A = Area of Site	16,773,214	sq ft
4	R(j) = WDF/A	1.83	feet
5	R(I) = Wastewater Recharge	21.91	inches

<i>J</i>	<i>Runoff Recharge</i>	<i>Value</i>	<i>Units</i>
1	Q(A) = Runoff from Landscaped	0.070	inches
2	Q(B) = Runoff from Non-fertilized Landscape	0.002	inches
3	Q(C) = Runoff from Unvegetated	0.005	inches
4	Q(E) = Runoff from Natural	0.072	inches
5	Q(H) = Runoff from Rain Gardens	0.000	inches
6	Q(I) = Runoff from Irrigation	0.07	inches
7	Q(tot) = Q(A)+Q(B)+Q(C)+Q(E)+Q(H)+Q(I)	0.22	inches

Total Site Recharge	
R(T) =	R(A)+R(B)+R(C)+R(D)+R(E)+R(F)+R(G)+R(H)+R(I)+R(J)+Q(tot)
R(T) =	55.34 inches
R(T)(adj) =	55.34 inches

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Theoretical Development Scenario

Average Turfgrass Leaching Rate

SITE NITROGEN BUDGET

A Sanitary Nitrogen (Wastewater Flow)(untreated)		
1	CF = Wastewater Flow	152,049 gal/day
2	CF = Wastewater Flow	210,059,495 liters/yr
3	N = Nitrogen (untreated)	50.00 mg/l
4	N = Nitrogen (untreated)	23159.06 lbs
7	LR = Leaching Rate	50% percent
8	N(S) = CF x N x LR	5,251,487,368 milligrams
9	N(S) = Sanitary Nitrogen	11579.53 lbs
10	N = loss/removed	11579.53 lbs

B Pet Waste Nitrogen		Value	Units
1	AR = Application Rate	3.19	lbs/pet
2	Human Population	6514	capita
3	Pets = 17 percent of capita	1107	pets
4	N(p) = AR x pets	3532.33	lbs
5	LR = Leaching Rate	50%	percent
6	N(P) = N(p) x LR	1766.16	lbs
7	N = (loss/removed)	1766.16	lbs

C Sanitary Nitrogen (Wastewater Flow)(treated)		
1	CF = Wastewater Flow	475,378 gal/day
2	CF = Wastewater Flow	656,746,591 liters/yr
3	N = Nitrogen (untreated)	50.00 mg/l
4	N = Nitrogen (untreated)	72406.31 lbs
5	N = Nitrogen (treated)	6.00 mg/l
7	LR = Leaching Rate	90% percent
8	N(S) = CF x N x LR	3,546,431,594 milligrams
9	N(S) = Sanitary Nitrogen	7819.88 lbs
10	N = loss/removed	64586.43 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	2.00 mg/l
4	N(WW) = WDF x N	0 milligrams
5	N(WW) = Wastewater Nitrogen	0.00 lbs

E Fertilized Land		
1	A = Area of Land Fertilized	3,339,310 sq ft
2	AR = Application Rate	2.10 lbs/1000 sf
3	N(T) = Nitrogen (total applied)	7012.55 lbs
4	LR = Leaching Rate	10% percent
5	N(F1) = A x AR x LR	701.26 lbs
6	N = loss/removed	6311.30 lbs

F Non-Fertilized Land		
1	A = Area of Land Non-Fertilized	3,339,310 sq ft
2	AR = Application Rate	0.00 lbs/1000 sf
3	N(T) = Nitrogen (total applied)	0.00 lbs
4	LR = Leaching Rate	10% percent
5	N(F2) = A x AR x LR	0.00 lbs
6	N = loss/removed	0.00 lbs

G Precipitation Nitrogen (existing condition)		
1	R(n) = Natural Recharge (feet)	0.90 feet
2	A = Area of Site (sq ft)	16,773,214 sq ft
3	R(N) = R(n) x A	15,021,690 cu ft
4	R(N) = Natural Recharge (liters)	425,414,271 liters
5	N = Nitrogen in Precipitation	1.00 mg/l
6	N(T) = Nitrogen (total)	938 lbs
7	LR = Leaching Rate	10% percent
8	N(ppt) = R(N) x N x LR	42,541,427.13 milligrams
10	N(irr) = Irrigation Nitrogen	93.80 lbs
9	N = loss/removed	844.23 lbs

H Irrigation Nitrogen		
1	R = Irrigation Recharge (inches)	0.13 inches
2	R = Irrigation Rate (feet)	0.01 feet
3	A = Area of Land Irrigated	3,339,310 sq ft
4	R(I) = R(irr) x A	36,049 cu ft
5	R(I) = Site Precipitation (liters)	1,020,916 liters
6	N = Nitrogen in Water Supply	2.00 mg/l
7	N(T) = Nitrogen (total applied)	4.50 lbs
8	LR = Leaching Rate	10% percent
9	N(irr) = R(I) x N x LR	204,183 milligrams
10	N(irr) = Irrigation Nitrogen	0.45 lbs
11	N = loss/removed	4.05 lbs

Total Site Nitrogen	
N=	N(S) + N(P) + N(WW) + N(F1) + N(F2) + N(ppt) + N(irr)
N=	21,961.08 lbs

