CHAPTER 11: WATER QUALITY TREATMENT LEVEL OF SERVICE

11.1 Overview

This chapter describes the results of the pollutant loading analysis performed in Chapter 10. Based on these results, a water quality treatment level of service was determined at the subbasin and watershed levels within the Double Branch Creek watershed. This type of analysis will facilitate prioritization of water quality improvement alternatives (projects) for the Double Branch Creek watershed.

Water quality treatment levels-of-service (LOS) criteria were used as part of this watershed study to allow comparisons of existing and proposed stormwater treatment conditions to pollutant loading goals and to help prioritize alternatives throughout the watershed.

Excess nitrogen can stimulate algal growth resulting in reduced light penetration through the water column and subsequent shading and loss of seagrasses. The nitrogen reduction goal is based on loads generated by several potential inputs including point sources, atmospheric deposition, and non-point source runoff from various land uses. The intent of this management effort is to protect water quality and, ultimately, valuable natural resources in the Double Branch Creek watershed. Other factors that affect light availability in the bay are also of concern, including excess total suspended solids (TSS) loads.

11.2 Water Quality Treatment Level of Service

The identification of problem areas and pollutant load reduction goals is an important step in protecting the river, reservoir, lakes, and groundwater within the watershed, as well as the downstream estuary. For this analysis three specific pollutants were identified and discussed in greater detail due to their importance in local water (quality) management programs. These parameters include total suspended solids (TSS), total phosphorus, and total nitrogen. In addition, based on specific concerns, some subbasins required assessment of other parameters, including heavy metals and bacteria. The results of this modeling effort and the implementation of alternatives proposed in later chapters of this report will be an important step in restoring and protecting the surface water within the Double Branch Creek watershed.

The modeling effort in this plan focuses on land use and soil conditions as a basis for evaluating sources of pollutant loads and does not include any routing of pollutants. For comparison purposes, pollutant loads based on stormwater runoff from single family (low to medium density) residential land use were selected as the standard (benchmark) for comparison. In this manner, the calculation of pollutant loads is consistent with the concept of standard residential unit (SRU) sometimes used for stormwater utility assessments.

The procedure to identify a treatment level-of-service designation for each subbasin consisted of the following steps:

1. Net pollutant loads were calculated for each pollutant of interest based on 2004 land uses, soils, and existing stormwater treatment best management practices (BMPs) (completed in Chapter 10);

2. Benchmark pollutant loads were calculated for each pollutant based on the assumption that 100% of the watershed area was developed for low/medium residential land uses and there is no existing stormwater treatment;

3. Ratios of net load/gross load were calculated;

4. Criteria described below were applied to each subbasin for each pollutant to determine the LOS for the subbasin.

Based on the following ranges, water quality LOS criteria were defined as a score from A through F:

- **LOS A**, net load equivalent to 20% or less of untreated single family residential. A LOS equal to A for a subbasin would indicate the presence of a high percentage of undisturbed natural systems, or high percentages of developed areas treated with BMPs capable of removing pollution levels to those representing natural systems. Areas where typical land uses (residential) exhibit stormwater treatment levels above the minimum required per 62-40.432(5) F.A.C. (Water Policy) would also receive LOS A.

- **LOS B**, net load equivalent to between 20 and 40% of untreated single family residential areas. A LOS equal to B would indicate the presence of BMPs with removal efficiencies consistent with those representing adequately designed and maintained conditions and a relatively even mix of developed and natural land uses.

- **LOS C**, net load equivalent to between 40 and 70% of untreated single family residential areas. A LOS equal to C would indicate the presence of treatment systems showing removal efficiencies consistent with those representing average to poorly maintained conditions and a greater percentage of developed versus natural land uses.

- **LOS D**, net load equivalent to between 70 and 100% of untreated single family residential areas. A LOS equal to D would indicate minimal treatment of sub-basin discharges and relatively high percentage of developed land uses.

- **LOS F**, net load equal to or greater than 100% of untreated single family residential areas. A LOS equal to F would indicate no treatment for sub-basin discharges, or the presence of extensive areas of land uses producing larger pollution loads per unit area than typical residential land uses.

11.2.1 Water Quality Level-of-Service Pollutant Load Calculations

Benchmark pollutant loads were calculated for each pollutant based on the assumption that 100% of the watershed area was developed for low/medium residential land uses and no existing stormwater treatment existed in any of the subbasins. Table 11-1 provides a summary of the benchmark loads by subbasin for Double Branch Creek watershed.

11.2.2 Water Quality Level-of-Service Scores

Based on the criteria described above, the treatment level of service designation were developed for each parameter for each subbasin, which are summarized in Table 11-2.

As mentioned earlier, the three most important parameters of concern in this watershed are total suspended solids, total nitrogen and total phosphorus. The observations on these three parameters are discussed in detail in the following section.

Total Suspended Solids

Total suspended solids (TSS) LOS values were highest in areas dominated by existing natural systems (wetlands and uplands) and open land (Figure 11-1). These land uses do not contribute any loads based on the model's EMC value input dataset. On an areal basis, subbasins to the north of the Double Branch Creek watershed had the greatest coverage of A scores. These areas are comprised of mainly wetlands, upland forests and rangeland. Other areas dominated by A or B scores included subbasins to the south of the watershed that drain directly into Old Tampa Bay and are dominated by wetlands.

The remaining subwatersheds were dominated by the scores of either C or F and were primarily characterized by agricultural, residential, or small patches of other land use types. Developed land uses are characterized by relatively large impervious surface area (such as roads, buildings, parking lots, etc.) which have relatively high runoff coefficients and TSS loads.

Total Nitrogen

Total nitrogen LOS values were also highest in areas dominated by existing natural systems (wetlands and uplands) and open land (Figure 11-2). These land uses do not contribute any loads based on the model's EMC value input dataset, and are concentrated within the northern portion of the watershed. Unlike the distribution of TSS scores, fewer A scores occurred throughout the watershed for TN. This is mainly due to greater contributions of total nitrogen from agricultural and residential land uses than TSS. The remaining areas surrounding the Double Branch Creek watershed had predominantly D or F scores. Lower scores in the central subbasins were primarily due to extensive residential land uses surrounding contained within the Westchase neighborhood.

Table 11-1 Pollutant loads (lbs/year) by subbasin

Subbasin ID	Basin ID	Area (acres)	Volume (acre feet)	Runoff coefficient	BOD5	TSS	TKN	NO3 +NO2	TN	TP	TDP	Oil and Grease	Cd	Cu	Pb	Zn
480001	DBR	1059.783	1643.462617	0.394593867	4468.608711	84903.56551	4835.034625	1255.679048	6090.713673	1791.912093	1260.147656	4826.097408	4.468608711	58.09191324	35.74886969	98.30939164
480002	DBR	136.892	194.27551	0.361116588	528.2391137	10036.54316	571.554721	148.4351909	719.9899119	211.8238846	148.9634301	570.4982427	0.528239114	6.867108478	4.225912909	11.6212605
480010	DBR	199.678	281.8664696	0.359187031	766.4007374	14561.61401	829.2455979	215.3586072	1044.604205	307.3266957	216.1250079	827.7127964	0.766400737	9.963209586	6.131205899	16.86081622
480020	DBR	12.391	15.68031486	0.322	42.63509912	810.0668833	46.13117725	11.98046285	58.1116401	17.09667475	12.02309795	46.04590705	0.042635099	0.554256289	0.341080793	0.937972181
480030	DBR	94.15	119.6231006	0.323297377	325.2576749	6179.895823	351.9288042	91.39740664	443.3262109	130.4283276	91.72266432	351.2782889	0.325257675	4.228349773	2.602061399	7.155668847
480040	DBR	27.608	34.96101276	0.322222979	95.05971389	1806.134564	102.8546104	26.7117796	129.56639	38.11894527	26.80683932	102.664491	0.095059714	1.235776281	0.760477711	2.091313706
480050	DBR	45.281	61.25919726	0.344241117	166.5650193	3164.735366	180.2233509	46.80477042	227.0281213	66.79257274	46.97133544	179.8902208	0.166565019	2.165345251	1.332520154	3.664430424
480060	DBR	476.183	684.0235976	0.365514531	1859.874253	35337.6108	2012.383941	522.624665	2535.008606	745.8095753	524.4845393	2008.664193	1.859874253	24.17836529	14.87899402	40.91723356
480080	DBR	33.051	41.82471846	0.322	113.7222711	2160.723151	123.0474973	31.95595817	155.0034555	45.6026307	32.06968045	122.8200528	0.113722271	1.478389524	0.909778169	2.501889964
480090	DBR	12.83	16.2358518	0.322	44.1456155	838.7666946	47.76555597	12.40491796	60.17047393	17.70239182	12.44906357	47.67726474	0.044145616	0.573893002	0.353164924	0.971203541
480100	DBR	137.203	173.9644604	0.322629724	473.0129514	8987.246077	511.8000135	132.9166394	644.7166528	189.6781935	133.3896523	510.8539876	0.473012951	6.149168369	3.784103612	10.40628493
480110	DBR	37.913	49.10384874	0.329560256	133.5143763	2536.773149	144.4625551	37.51753973	181.9800948	53.53926488	37.65105411	144.1955264	0.133514376	1.735686891	1.06811501	2.937316278
481001	DBR	647.009	880.977151	0.346466918	2395.395022	45512.50541	2591.817414	673.1060011	3264.923415	960.5534037	675.5013961	2587.026623	2.395395022	31.14013528	19.16316017	52.69869048
481020	DBR	32.557	44.08067994	0.344517554	119.8562768	2277.26926	129.6844915	33.67961379	163.3641053	48.062367	33.79947006	129.444779	0.119856277	1.558131599	0.958850215	2.63683809
481030	DBR	29.327	39.98560422	0.346931292	108.7216816	2065.71195	117.6368595	30.55079252	148.187652	43.59739431	30.6595142	117.4194161	0.108721682	1.413381861	0.869773453	2.391876995
481050	DBR	197.714	264.9628794	0.341000536	720.4395273	13688.35102	779.5155686	202.4435072	981.9590757	288.8962505	203.1639467	778.0746895	0.720439527	9.365713855	5.763516219	15.8496696
481065	DBR	57.884	73.24988664	0.322	199.1679507	3784.191064	215.4997227	55.96619415	271.4659168	79.86634824	56.1653621	215.1013868	0.199167951	2.589183359	1.593343606	4.381694916
481070	DBR	121.5	159.3589691	0.333739556	433.3003197	8232.706075	468.8309459	121.7573898	590.5883358	173.7534282	122.1906902	467.9643453	0.43330032	5.632904156	3.466402558	9.532607034
481080	DBR	32.931	44.66474082	0.345117792	121.4443504	2307.442657	131.4027871	34.12586246	165.5286496	48.6991845	34.24730681	131.1598984	0.12144435	1.578776555	0.971554803	2.671775708
481090	DBR	26.593	33.76697658	0.323096529	91.81310492	1744.448993	99.34177952	25.79948248	125.141262	36.81705507	25.89129559	99.15815331	0.091813105	1.193570364	0.734504839	2.019888308
481100	DBR	24.859	31.67029014	0.324172251	86.1121713	1636.131255	93.17336935	24.19752013	117.3708895	34.53098069	24.28363231	93.001145	0.086112171	1.119458227	0.68889737	1.894467769
481110	DBR	51.062	67.32542343	0.335497062	183.0592132	3478.125051	198.0700687	51.43963891	249.5097076	73.4067445	51.62269813	197.7039503	0.183059213	2.379769772	1.464473706	4.027302691
481112	DBR	55.849	80.43543969	0.366470895	218.7056175	4155.406732	236.6394781	61.45627851	298.0957566	87.70095261	61.67498413	236.2020669	0.218705617	2.843173027	1.74964494	4.811523585
481130	DBR	145.055	187.8952571	0.329602551	510.8910748	9706.930421	552.7841429	143.560392	696.344535	204.867321	144.0712831	551.7623608	0.510891075	6.641583972	4.087128598	11.23960365
481140	DBR	52.177	81.80009682	0.398916649	222.4161483	4225.906818	240.6542725	62.49893768	303.1532102	89.18887548	62.72135383	240.2094402	0.222416148	2.891409928	1.779329187	4.893155263
481145	DBR	11.631	18.18694746	0.397878256	49.45068479	939.5630111	53.50564095	13.89564243	67.40128338	19.8297246	13.94509311	53.40673958	0.049450685	0.642858902	0.395605478	1.087915065
481150	DBR	75.908	113.0102115	0.37882409	307.277093	5838.264767	332.4738146	86.34486313	418.8186778	123.2181143	86.65214023	331.8592604	0.307277093	3.994602209	2.458216744	6.760096046
481170	DBR	13.627	20.21295678	0.377430542	54.95944587	1044.229472	59.46612043	15.44360429	74.90972472	22.03873779	15.49856374	59.35620154	0.054959446	0.714472796	0.439675567	1.209107809
481180	DBR	70.76	95.48950512	0.343380215	259.6379315	4933.120699	280.9282419	72.95825875	353.8865006	104.1148105	73.21789668	280.408966	0.259637932	3.37529311	2.077103452	5.712034493
481190	DBR	18.464	27.45983748	0.378424827	74.66386378	1418.613412	80.78630061	20.98054572	101.7668463	29.94020938	21.05520959	80.63697288	0.074663864	0.970630229	0.59731091	1.642605003
481200	DBR	27.213	39.80358234	0.372180134	108.2267603	2056.308446	117.1013547	30.41171965	147.5130743	43.39893089	30.51994641	116.8849012	0.10822676	1.406947884	0.865814083	2.380988727
481205	DBR	25.555	37.45418118	0.372933907	101.8386902	1934.935114	110.1894628	28.61667194	138.8061347	40.83731476	28.71851063	109.9857854	0.10183869	1.323902972	0.814709521	2.240451184
481210	DBR	46.946	78.69441432	0.426533123	213.9717336	4065.462939	231.5174158	60.12605715	291.643473	85.80266519	60.34002889	231.0894723	0.213971734	2.781632537	1.711773869	4.70737814
481220	DBR	175.876	258.6664849	0.374232095	703.319501	13363.07052	760.9917001	197.6327798	958.6244799	282.0311199	198.3360993	759.5850611	0.703319501	9.143153513	5.626556008	15.47302902
481225	DBR	423.967	635.7855514	0.381580392	1728.714011	32845.56622	1870.46856	485.7686372	2356.237198	693.2143186	487.4973512	1867.011132	1.728714011	22.47328215	13.82971209	38.03170825
481230	DBR	70.441	97.36803726	0.351721043	264.7456991	5030.168283	286.4548464	74.39354144	360.8483879	106.1630253	74.65828714	285.925355	0.264745699	3.441694088	2.117965593	5.82440538
481235	DBR	120.477	166.6410626	0.351953535	453.100482	8608.909157	490.2547215	127.3212354	617.5759569	181.6932933	127.7743359	489.3485205	0.453100482	5.890306265	3.624803856	9.968210603
481240	DBR	29.134	43.5630282	0.38047436	118.4487711	2250.52665	128.1615703	33.28410467	161.445675	47.4979572	33.40255344	127.9246728	0.118448771	1.539834024	0.947590169	2.605872964
481250	DBR	30.639	45.53927586	0.378197787	123.8222292	2352.622354	133.975652	34.7940464	168.7696984	49.6527139	34.91786863	133.7280075	0.123822229	1.609688979	0.990577833	2.724089042
481260	DBR	95.865	129.0275199	0.342475669	350.8284846	6665.741207	379.5964203	98.58280417	478.1792245	140.6822223	98.93363265	378.8947633	0.350828485	4.560770299	2.806627877	7.718226661
481270	DBR	207.316	293.0371174	0.359664242	796.7739587	15138.70521	862.1094233	223.8934824	1086.002906	319.5063574	224.6902563	860.5158754	0.796773959	10.35806146	6.374191669	17.52902709
481275	DBR	16.406	25.83913692	0.400758503	70.25714557	1334.885766	76.01823151	19.74225791	95.76048941	28.17311537	19.81251505	75.87771722	0.070257146	0.913342892	0.562057165	1.545657203
481278	DBR	57.042	80.09168652	0.357272957	217.7709455	4137.647965	235.6281631	61.1936357	296.8217988	87.32614916	61.41140664	235.1926212	0.217770946	2.831022292	1.742167564	4.790960802
481280	DBR	69.333	92.06275734	0.337871403	250.3205337	4756.09014	270.8468175	70.34006997	341.1868874	100.378534	70.5903905	270.3461764	0.250320534	3.254166938	2.00256427	5.507051741
481281	DBR	86.701	110.0829392	0.323075005	299.3177793	5687.037807	323.8618372	84.10829599	407.9701332	120.0264295	84.40761377	323.2632017	0.299317779	3.891131131	2.394542235	6.584991145
481290	DBR	86.28	126.5587646	0.373241168	344.1158882	6538.201875	372.333391	96.69656457	469.0299556	137.9904712	97.04068046	371.6451592	0.344115888	4.473506546	2.752927105	7.57054954
481295	DBR	66.803	84.56283966	0.322100235	229.928103	4368.633958	248.7822075	64.60979695	313.3920044	92.20116932	64.83972505	248.3223513	0.229928103	2.989065339	1.839424824	5.058418267
481300	DBR	243.38	331.061911	0.346124053	900.1641558	17103.11896	973.9776165	252.9461278	1226.923744	360.9658265	253.8462919	972.1772882	0.900164156	11.70213403	7.201313246	19.80361143
481310	DBR	154.927	223.451099	0.36699727	607.5681412	11543.79468	657.3887288	170.7266477	828.1153765	243.6348246	171.3342158	656.1735925	0.607568141	7.898385836	4.86054513	13.36649911
481320	DBR	99.245	140.1098212	0.359225694	380.9614902	7238.268313	412.2003324	107.0501787	519.2505111	152.7655576	107.4311402	411.4384094	0.38096149	4.952499372	3.047691921	8.381152784
481330	DBR	85.495	114.2672102	0.340085689	310.6948984	5903.203069	336.1718801	87.30526645	423.4771465	124.5886543	87.61596134	335.5504903	0.310694898	4.039033679	2.485559187	6.835287764
481350	DBR	163.406	207.5592086	0.32320752	564.357764	10722.79752	610.6351007	158.5845317	769.2196323	226.3074634	159.1488895	609.5063851	0.564357764	7.336650932	4.514862112	12.41587081
481360	DBR	11.815	14.9514099	0.322	40.65319152	772.4106388	43.98675322	11.42354682	55.41030004	16.3019298	11.46420001	43.90544684	0.040653192	0.52849149	0.325225532	0.894370213
481370	DBR	64.903	84.49925226	0.331280249	229.7552076	4365.348944	248.5951346	64.56121333	313.1563479	92.13183824	64.79096854	248.1356242	0.229755208	2.986817699	1.838041661	5.054614567
481390	DBR	60.138	79.72228224	0.337316971	216.7665277	4118.564026	234.541383	60.91139428	295.4527772	86.9233776	61.12816081	234.1078499	0.216766528	2.81796486	1.734132222	4.768863609
481400	DBR	22.185	29.22488694	0.335197566	79.46306962	1509.798323	85.97904133	22.32912256	108.3081639	31.86469092	22.40858563	85.82011519	0.07946307	1.033019905	0.635704557	1.748187532
481410	DBR	62.711	80.13668502	0.325158489	217.8932974	4139.97265	235.7605478	61.22801657	296.9885643	87.37521225	61.44590986	235.3247612	0.217893297	2.832612866	1.743146379	4.793652542
481415	DBR	23.334	29.52824364	0.322	80.28790274	1525.470152	86.87151076	22.56090067	109.4324114	32.195449	22.64118857	86.71093496	0.080287903	1.043742736	0.642303222	1.76633386
481420	DBR	21.251	26.89229046	0.322	73.12069174	1389.293143	79.11658846	20.54691438	99.66350284	29.32139739	20.62003507	78.97034708	0.073120692	0.950568993	0.584965534	1.608655218
481430	DBR	69.061	108.3918287	0.399366039	294.7196152	5599.672689	318.8866237	82.81621188	401.7028355	118.1825657	83.11093149	318.2971844	0.294719615	3.831354998	2.357756922	6.483831535
481440	DBR	23.144	31.58954436	0.347306084	85.89262186	1631.959815	92.93581685	24.13582674	117.0716436	34.44294137	24.22171936	92.76403161	0.085892622	1.116604084	0.687140975	1.889637681

Table 11-1 Pollutant loads (lbs/year) by subbasin

Subbasin ID	Basin ID	Area (acres)	Volume (acre feet)	Runoff coefficient	BOD5	TSS	TKN	NO3 +NO2	TN	TP	TDP	Oil and Grease	Cd	Cu	Pb	Zn
481450	DBR	49.434	74.02808952	0.381046729	201.2839004	3824.394107	217.7891802	56.56077601	274.3499562	80.71484405	56.76205991	217.3866124	0.2012839	2.616690705	1.610271203	4.428245808
481480	DBR	25.438	33.50823324	0.335178395	91.10957645	1731.081953	98.58056172	25.60179098	124.1823527	36.53494016	25.69290056	98.39834257	0.091109576	1.184424494	0.728876612	2.004410682
481484	DBR	51.105	64.6713333	0.322	175.8426875	3341.011062	190.2617878	49.41179518	239.673583	70.51291768	49.58763787	189.9101025	0.175842687	2.285954937	1.4067415	3.868539124
481490	DBR	27.519	34.82419374	0.322	94.68770016	1799.066303	102.4520916	26.60724374	129.0593353	37.96976776	26.70193144	102.2627162	0.0946877	1.230940102	0.757501601	2.083129403
481492	DBR	144.504	197.4868387	0.347748879	536.9707827	10202.44487	581.0023869	150.8887899	731.8911768	215.3252839	151.4257607	579.9284453	0.536970783	6.980620175	4.295766262	11.81335722
481497	DBR	28.981	37.39923978	0.328364998	101.6893034	1932.096764	110.0278263	28.57469425	138.6025205	40.77741066	28.67638355	109.8244477	0.101689303	1.321960944	0.813514427	2.237164674
481499	DBR	32.19	40.97157048	0.323868779	111.4025441	2116.648339	120.5375528	31.30411491	151.8416677	44.6724202	31.41551745	120.3147477	0.111402544	1.448233074	0.891220353	2.450855971
481500	DBR	182.059	236.8691565	0.331057789	644.052116	12236.9902	696.8643895	180.9786446	877.8430341	258.2648985	181.6226967	695.5762853	0.644052116	8.372677508	5.152416928	14.16914655
481520	DBR	71.962	91.11554088	0.322178594	247.7450326	4707.15562	268.0601253	69.61635417	337.6764795	99.34575809	69.8640992	267.5646352	0.247745033	3.220685424	1.981960261	5.450390718
481530	DBR	56.547	75.25483902	0.338635365	204.6194575	3887.769693	221.3982531	57.49806757	278.8963206	82.05240248	57.70268703	220.9890141	0.204619458	2.660052948	1.63695566	4.501628066
481540	DBR	37.523	50.71384398	0.343903366	137.8919865	2619.947743	149.1991294	38.7476482	187.9467776	55.29468658	38.88554019	148.9233454	0.137891986	1.792595824	1.103135892	3.033623703
481550	DBR	53.28	77.27199012	0.369033108	210.1041329	3991.978526	227.3326718	59.03926136	286.3719332	84.25175731	59.24936549	226.9124636	0.210104133	2.731353728	1.680833064	4.622290925
481560	DBR	53.209	72.49717374	0.346691687	197.1213088	3745.304868	213.2852562	55.39108778	268.676344	79.04564485	55.58820909	212.8910135	0.197121309	2.562577015	1.576970471	4.336668794
481580	DBR	36.187	55.09220982	0.387387017	149.7968534	2846.140215	162.0801954	42.09291581	204.1731112	60.06853821	42.24271266	161.7806017	0.149796853	1.947359094	1.198374827	3.295530775
481590	DBR	120.954	166.2401672	0.349722184	452.0104392	8588.198345	489.0752952	127.0149334	616.0902286	181.2561861	127.4669439	488.1712743	0.452010439	5.876135709	3.616083514	9.944229662
481610	DBR	231.882	316.8062132	0.347643491	861.40262	16366.64978	932.0376348	242.0541362	1174.091771	345.4224506	242.9155388	930.3148296	0.86140262	11.19823406	6.89122096	18.95085764
481630	DBR	334.659	438.2821006	0.333241189	1191.69806	22642.26314	1289.417301	334.8671549	1624.284456	477.8709221	336.058853	1287.033905	1.19169806	15.49207478	9.533584481	26.21735732
481640	DBR	83.843	107.789234	0.327126725	293.0811476	5568.541805	317.1138018	82.35580249	399.4696042	117.5255402	82.64888364	316.5276395	0.293081148	3.810054919	2.344649181	6.447785248
481650	DBR	154.865	201.0271478	0.330300236	546.596956	10385.34216	591.4179064	153.5937446	745.011651	219.1853793	154.1403416	590.3247125	0.546596956	7.105760428	4.372775648	12.02513303
481660	DBR	60.002	79.084569	0.335377154	215.0325723	4085.618873	232.6652432	60.4241528	293.089396	86.22806147	60.63918538	232.235178	0.215032572	2.795423439	1.720260578	4.73071659
481670	DBR	189.451	257.2686389	0.345539258	699.518729	13290.85585	756.8792648	196.5647629	953.4440276	280.5070103	197.2642816	755.4802273	0.699518729	9.093743477	5.596149832	15.38941204
481680	DBR	33.228	43.9132698	0.33627844	119.4010852	2268.620619	129.1919742	33.55170494	162.7436791	47.87983517	33.67110603	128.953172	0.119401085	1.552214108	0.955208682	2.626823874
481695	DBR	30.689	39.61921818	0.328496399	107.7254704	2046.783937	116.558959	30.27085718	146.8298161	43.19791363	30.37858265	116.343508	0.10772547	1.400431115	0.861803763	2.369960349
481700	DBR	99.599	142.7237114	0.364626814	388.0687114	7373.305516	419.8903457	109.0473079	528.9376536	155.6155533	109.4353766	419.1142083	0.388068711	5.044893248	3.104549691	8.53751165
481710	DBR	49.44	68.33502864	0.3517	185.8043506	3530.282661	201.0403073	52.21102251	253.2513298	74.50754458	52.39682686	200.6686986	0.185804351	2.415456557	1.486434805	4.087695713
481730	DBR	44.511	59.95500318	0.342740581	163.0188887	3097.358886	176.3864376	45.80830773	222.1947453	65.37057438	45.97132662	176.0603998	0.163018889	2.119245553	1.30415111	3.586415552
481740	DBR	153.6	209.6370468	0.347283594	570.0074488	10830.14153	616.7480596	160.1720931	776.9201527	228.572987	160.7421006	615.6080447	0.570007449	7.410096834	4.56005959	12.54016387
481750	DBR	9.607	12.15727422	0.322	33.05587904	628.0617018	35.76646113	9.288702011	45.05516314	13.2554075	9.32175789	35.70034937	0.033055879	0.429726428	0.264447032	0.727229339
481760	DBR	153.396	221.8059774	0.367931237	603.0950218	11458.80541	652.5488135	169.4697011	822.0185147	241.8411037	170.0727961	651.3426235	0.603095022	7.840235283	4.824760174	13.26809048
481770	DBR	10.674	13.50752004	0.322	36.72722524	697.8172796	39.73885771	10.32035029	50.05920801	14.72761732	10.35707752	39.66540326	0.036727225	0.477453928	0.293817802	0.807998955
481780	DBR	44.684	56.54581464	0.322	153.7492348	2921.235462	166.3566721	43.20353499	209.5602071	61.65344317	43.35728423	166.0491736	0.153749235	1.998740053	1.229993879	3.382483167
481790	DBR	93.333	120.3340927	0.328065765	327.1908768	6216.62666	354.0205287	91.94063639	445.9611651	131.2035416	92.26782726	353.366147	0.327190877	4.253481399	2.617527015	7.19819929
481800	DBR	54.819	72.4522617	0.3363011	196.9991921	3742.984649	213.1531258	55.35677297	268.5098988	78.99667602	55.55377217	212.7591274	0.196999192	2.560989497	1.575993537	4.333982226
481810	DBR	77.459	98.07262338	0.322168709	266.6614833	5066.568182	288.5277249	74.9318768	363.4596017	106.9312548	75.19853828	287.9944019	0.266661483	3.466599282	2.133291866	5.866552632
481820	DBR	59.26	83.63722641	0.359124823	227.4113415	4320.815489	246.0590715	63.90258697	309.9616585	91.19194796	64.12999831	245.6042489	0.227411342	2.95634744	1.819290732	5.003049514
481830	DBR	56.853	73.94218758	0.330937787	201.0503312	3819.956294	217.5364584	56.49514308	274.0316015	80.62118283	56.69619341	217.1343577	0.201050331	2.613654306	1.60840265	4.423107287
481840	DBR	75.397	102.2238195	0.344989191	277.948671	5281.02475	300.7404621	78.10357656	378.8440386	111.4574171	78.38152523	300.1845647	0.277948671	3.613332723	2.223589368	6.114870763
481850	DBR	101.316	132.4114621	0.332548502	360.0294932	6840.56037	389.5519116	101.1682876	490.7201992	144.3718268	101.5283171	388.8318526	0.360029493	4.680383411	2.880235945	7.92064885
481860	DBR	85.111	113.6356081	0.339731797	308.9775593	5870.573627	334.3137192	86.82269416	421.1364133	123.9000013	87.13167172	333.695764	0.308977559	4.016708271	2.471820474	6.797506304
481870	DBR	34.583	43.76340318	0.322	118.9935948	2260.878301	128.7510695	33.43720013	162.1882697	47.7164315	33.55619373	128.5130824	0.118993595	1.546916732	0.951948758	2.617859085
481880	DBR	48.81	65.26090404	0.340213645	177.4457425	3371.469107	191.9962933	49.86225363	241.858547	71.15574273	50.03969937	191.6414019	0.177445742	2.306794652	1.41956594	3.903806334
481890	DBR	23.92	30.2698032	0.322	82.30421846	1563.780151	89.05316437	23.12748539	112.1806498	33.0039916	23.20978961	88.88855594	0.082304218	1.06995484	0.658433748	1.810692806
481900	DBR	66.189	87.31056204	0.335651362	237.3992168	4510.585119	256.8659526	66.70917992	323.5751325	95.19708593	66.94657913	256.3911541	0.237399217	3.086189818	1.899193734	5.222782769
481910	DBR	14.054	19.12719603	0.346305038	52.00724003	988.1375605	56.27183371	14.61403445	70.88586816	20.85490325	14.66604169	56.16781923	0.05200724	0.67609412	0.41605792	1.144159281
481920	DBR	71.478	99.51401376	0.354257702	270.5806534	5141.032415	292.768267	76.03316361	368.8014306	108.502842	76.30374426	292.2271057	0.270580653	3.517548494	2.164645227	5.952774375
481930	DBR	204	313.2255077	0.390691897	851.6666079	16181.66555	921.5032698	239.3183168	1160.821587	341.5183098	240.1699834	919.7999365	0.851666608	11.0716659	6.813332863	18.73666537
481940	DBR	95.69	139.3352772	0.370511746	378.8554889	7198.25429	409.921639	106.4583924	516.3800314	151.9210511	106.8372479	409.163928	0.378855489	4.925121356	3.030843911	8.334820757
481950	DBR	95.053	141.2750584	0.378187453	384.1297939	7298.466085	415.6284371	107.9404721	523.5689091	154.0360474	108.3246019	414.8601775	0.384129794	4.993687321	3.073038352	8.450855467
481960	DBR	20.009	29.75441907	0.378384677	80.90287839	1537.154689	87.53691442	22.73370883	110.2706232	32.44205424	22.81461171	87.37510866	0.080902878	1.051737419	0.647223027	1.779863325
481970	DBR	86.392	128.8709055	0.379567309	350.4026467	6657.650288	379.1356637	98.46314373	477.5988075	140.5114613	98.81354637	378.4348585	0.350402647	4.555234407	2.803221174	7.708858228
481980	DBR	137.309	208.6157302	0.386594346	567.2304679	10777.37889	613.7433662	159.3917615	773.1351277	227.4594176	159.9589919	612.6089053	0.567230468	7.373996082	4.537843743	12.47907029
481990	DBR	79.776	117.0226079	0.373254425	318.1868814	6045.550747	344.2782057	89.41051368	433.6887194	127.5929394	89.72870056	343.6418319	0.318186881	4.136429458	2.545495051	7.000111391
481995	DBR	55.494	71.64561348	0.328511839	194.805899	3701.31208	210.7799827	54.74045761	265.5204403	78.11716548	54.9352635	210.3903709	0.194805899	2.532476686	1.558447192	4.285729777
482010	DBR	178.503	232.7308036	0.331753718	632.7998493	12023.19714	684.6894369	177.8167577	862.5061946	253.7527396	178.4495575	683.4238372	0.632799849	8.226398041	5.062398794	13.92159668
482020	DBR	43.199	69.36581262	0.408582004	188.6070734	3583.534396	204.0728535	52.99858764	257.0714411	75.63143645	53.18719471	203.6956393	0.188607073	2.451891955	1.508856588	4.149355616
482030	DBR	53.443	79.54570734	0.378733192	216.2864169	4109.441921	234.0219031	60.77648315	294.7983862	86.73085318	60.99276957	233.5893303	0.216286417	2.81172342	1.730291335	4.758301172
482040	DBR	170.493	235.6213815	0.351654027	640.6593901	12172.52841	693.1934601	180.0252886	873.2187487	256.9044154	180.665948	691.9121413	0.64065939	8.328572071	5.125275121	14.09450658
482046	DBR	25.271	32.57068458	0.327953227	88.56036233	1682.646884	95.82231204	24.88546181	120.7077739	35.51270529	24.97402218	95.64519132	0.088560362	1.15128471	0.708482899	1.948327971
482050	DBR	67.83	89.1722502	0.334514816	242.4611852	4606.76252	262.3430024	68.13159305	330.4745955	97.22693528	68.37405424	261.8580801	0.242461185	3.151995408	1.939689482	5.334146075
482060	DBR	71.418	91.20725136	0.324959422	247.9943953	4711.893511	268.3299357	69.68642508	338.0163608	99.44575252	69.93441948	267.8339469	0.247994395	3.223927139	1.983955163	5.455876697
482070	DBR	19.113	24.2792649	0.323231832	66.01582142	1254.300607	71.42911877	18.55044582	89.97956459	26.47234439	18.61646164	71.29708713	0.066015821	0.858205678	0.528126571	1.452348071

Table 11-1 Pollutant loads (lbs/year) by subbasin

Subbasin ID	Basin ID	Area (acres)	Volume (acre feet)	Runoff coefficient	BOD5	TSS	TKN	NO3 +NO2	TN	TP	TDP	Oil and Grease	Cd	Cu	Pb	Zn
482100	DBR	34.637	44.18402322	0.324587984	120.1372693	2282.608117	129.9885254	33.75857268	163.7470981	48.175045	33.87870995	129.7482509	0.120137269	1.561784501	0.961098155	2.643019925
482120	DBR	110.395	139.7789781	0.322180986	380.0619209	7221.176497	411.2269984	106.7973998	518.0243982	152.4048303	107.1774617	410.4668746	0.380061921	4.940804972	3.040495367	8.36136226
482140	DBR	163.375	211.8968047	0.330024557	576.1517769	10946.88376	623.3962227	161.8986493	785.294872	231.0368626	162.4748011	622.2439191	0.576151777	7.4899731	4.609214216	12.67533909
482160	DBR	132.41	182.4111386	0.350540352	495.9796436	9423.613229	536.6499744	139.3702799	676.0202543	198.8878371	139.8662595	535.6580151	0.495979644	6.447735367	3.967837149	10.91155216
482180	DBR	198.572	256.0726063	0.328135004	696.2666917	13229.06714	753.3605604	195.6509404	949.0115008	279.2029434	196.3472071	751.968027	0.696266692	9.051466992	5.570133533	15.31786722
482200	DBR	114.611	149.6212858	0.332180803	406.8233583	7729.643809	440.1828737	114.3173637	554.5002374	163.1361667	114.7241871	439.369227	0.406823358	5.288703658	3.254586867	8.950113884
482230	DBR	54.652	72.23753436	0.336328991	196.415344	3731.891536	212.5214022	55.19271167	267.7141139	78.76255295	55.38912701	212.1285715	0.196415344	2.553399472	1.571322752	4.321137568
482250	DBR	217.177	324.1402456	0.379775179	881.3440051	16745.5361	953.6142136	247.6576654	1201.271879	353.4189461	248.5390094	951.8515255	0.881344005	11.45747207	7.050752041	19.38956811
482270	DBR	316.753	402.9180074	0.323670702	1095.542362	20815.30488	1185.376836	307.8474038	1493.22424	439.3124872	308.9429461	1183.185751	1.095542362	14.24205071	8.764338897	24.10193197
482280	DBR	136.411	182.7179695	0.340831179	496.813923	9439.464536	537.5526646	139.6047123	677.157377	199.2223831	140.1015263	536.5590368	0.496813923	6.458580998	3.974511384	10.9299063
482300	DBR	34.788	45.48162276	0.332670231	123.6654692	2349.643915	133.8060377	34.74999685	168.5560345	49.58985315	34.87366232	133.5587067	0.123665469	1.6076511	0.989323754	2.720640323
482310	DBR	64.814	98.87870568	0.388187367	268.8532376	5108.211515	290.8992031	75.54775978	366.4469629	107.8101483	75.81661302	290.3614967	0.268853238	3.495092089	2.150825901	5.914771228
482320	DBR	60.382	87.4918608	0.368695307	237.8921718	4519.951265	257.3993299	66.84770029	324.2470302	95.39476091	67.08559246	256.9235456	0.237892172	3.092598234	1.903137375	5.233627781
482330	DBR	41.217	54.4279455	0.336010627	147.990705	2811.823396	160.1259428	41.58538811	201.711331	59.34427272	41.73337882	159.8299614	0.147990705	1.923879165	1.18392564	3.255795511
482340	DBR	30.805	38.9824953	0.322	105.9942078	2013.889947	114.6857328	29.78437238	144.4701052	42.50367731	29.89036659	114.4737444	0.105994208	1.377924701	0.847953662	2.331872571
482360	DBR	57.2	72.384312	0.322	196.8144354	3739.474273	212.9532192	55.30485636	268.2580755	78.92258861	55.5016708	212.5595903	0.196814435	2.558587661	1.574515484	4.32991758
482380	DBR	35.239	44.59354494	0.322	121.2507673	2303.764579	131.1933302	34.07146562	165.2647959	48.62155769	34.19271638	130.9508287	0.121250767	1.576259975	0.970006139	2.667516881
482400	DBR	6.476	8.19511896	0.322	22.28269727	423.3712482	24.10987845	6.261437933	30.37131638	8.935361606	6.283720631	24.06531305	0.022282697	0.289675065	0.178261578	0.49021934
482410	DBR	60.575	76.94003874	0.323196335	209.2015503	3974.829456	226.3560774	58.78563563	285.1417131	83.88982167	58.99483718	225.9376743	0.20920155	2.719620154	1.673612402	4.602434107
482420	DBR	19.281	25.28216946	0.333650848	68.74273957	1306.112052	74.37964422	19.31670982	93.69635404	27.56583857	19.38545256	74.24215874	0.06874274	0.893655614	0.549941917	1.512340271
482425	DBR	53.155	67.35694989	0.322437645	183.1449343	3479.753752	198.1628189	51.46372654	249.6265455	73.44111866	51.64687147	197.796529	0.183144934	2.380884146	1.465159474	4.029188555
482440	DBR	83.797	106.0417516	0.322	288.3297071	5478.264435	311.9727431	81.0206477	392.9933908	115.6202126	81.30897741	311.3960837	0.288329707	3.748286192	2.306637657	6.343253557
482460	DBR	68.026	85.23492861	0.318823347	231.7555267	4403.355008	250.7594799	65.12330301	315.8827829	92.93396622	65.35505854	250.2959689	0.231755527	3.012821847	1.854044214	5.098621588
482480	DBR	121.074	159.3529798	0.334901234	433.2840346	8232.396658	468.8133255	121.7528137	590.5661392	173.7468979	122.1860978	467.9467574	0.433284035	5.63269245	3.466272277	9.532248762
482500	DBR	25.248	33.37871616	0.336395437	90.75741684	1724.39092	98.19952502	25.50283413	123.7023592	36.39372415	25.59359155	98.01801019	0.090757417	1.179846419	0.726059335	1.99666317
482510	DBR	160.721	211.1549464	0.334299774	574.1346491	10908.55833	621.2136903	161.3318364	782.5455267	230.2279943	161.905971	620.065421	0.574134649	7.463750438	4.593077193	12.63096228
482520	DBR	65.236	89.15231724	0.347738488	242.4069871	4605.732755	262.2843601	68.11636338	330.4007234	97.20520183	68.35877037	261.7995461	0.242406987	3.151290832	1.939255897	5.332953716
482540	DBR	48.19	61.85516604	0.326607761	168.1854707	3195.523943	181.9766793	47.26011726	229.2367965	67.44237374	47.42830273	181.6403083	0.168185471	2.186411119	1.345483765	3.700080355
482560	DBR	30.285	39.07466559	0.328303219	106.2448207	2018.651593	114.956896	29.85479461	144.8116906	42.60417309	29.96103943	114.7444063	0.106244821	1.381182669	0.849958565	2.337386055
482580	DBR	51.511	79.04075343	0.390443808	214.9134368	4083.355299	232.5363386	60.39067575	292.9270144	86.18028816	60.60558918	232.1065118	0.214913437	2.793874679	1.719307495	4.72809561
482600	DBR	47.626	61.03684965	0.326103494	165.9604516	3153.24858	179.5692086	46.63488689	226.2040955	66.55014107	46.80084734	179.2372877	0.165960452	2.15748587	1.327683612	3.651129934
482620	DBR	113.003	155.7229409	0.350646956	423.4138843	8044.863802	458.1338228	118.9793015	577.1131243	169.7889676	119.4027154	457.2869951	0.423413884	5.504380496	3.387311074	9.315105455
482640	DBR	155.632	227.1578632	0.371395234	617.6469095	11735.29128	668.293956	173.5587816	841.8527376	247.6764107	174.1764285	667.0586622	0.617646909	8.029409823	4.941175276	13.58823201
482660	DBR	113.459	166.6434795	0.373729021	453.1070537	8609.03402	490.2618321	127.3230821	617.5849142	181.6959285	127.7761891	489.355618	0.453107054	5.890391698	3.62485643	9.968355181
482680	DBR	102.765	137.7092397	0.340977171	374.4342595	7114.25093	405.1378687	105.2160269	510.3538957	150.148138	105.5904612	404.3890002	0.374434259	4.867645373	2.995474076	8.237553708
482700	DBR	132.587	193.7218516	0.371779224	526.7337051	10007.9404	569.9258689	148.0121711	717.93804	211.2202157	148.5389048	568.8724015	0.526733705	6.847538166	4.21386964	11.58814151
482720	DBR	140.18	198.5093697	0.360331645	539.7510655	10255.27024	584.0106529	151.6700494	735.6807023	216.4401773	152.2098005	582.9311507	0.539751066	7.016763852	4.318008524	11.87452344
482740	DBR	44.175	63.94984425	0.368358234	173.8809439	3303.737934	188.1391813	48.86054523	236.9997265	69.7262585	49.03442617	187.7914194	0.173880944	2.26045227	1.391047551	3.825380765
482760	DBR	156.546	203.9149825	0.331447396	554.4490381	10534.53172	599.9138592	155.8001797	755.714039	222.3340643	156.3546287	598.8049612	0.554449038	7.207837496	4.435592305	12.19787884
482780	DBR	55.244	75.23145552	0.346514807	204.5558773	3886.561669	221.3294593	57.48020153	278.8096608	82.02690681	57.68475741	220.9203475	0.204555877	2.659226405	1.636447019	4.500229301
482790	DBR	40.126	50.92767528	0.322950107	138.4733982	2630.994566	149.8282168	38.91102489	188.7392417	55.52783268	39.04949829	149.5512701	0.138473398	1.800154177	1.107787186	3.04641476
482800	DBR	36.455	54.79253553	0.382447428	148.9820328	2830.658624	161.1985595	41.86395123	203.0625108	59.74179517	42.01293326	160.9005955	0.148982033	1.936766427	1.191856263	3.277604722
482820	DBR	74.228	100.0024774	0.342807606	271.9087961	5166.267125	294.2053174	76.4063717	370.611689	109.0354272	76.67828049	293.6614998	0.271908796	3.534814349	2.175270369	5.981993514
482840	DBR	236.035	343.7470942	0.370569848	934.6554304	17758.45318	1011.297176	262.6381759	1273.935352	374.7968276	263.5728314	1009.427865	0.93465543	12.15052059	7.477243443	20.56241947
482850	DBR	174.029	259.728253	0.379756328	706.2064704	13417.92294	764.1154009	198.4440182	962.5594191	283.1887946	199.1502246	762.702988	0.70620647	9.180684115	5.649651763	15.53654235
482860	DBR	43.82	64.4252367	0.374102921	175.1735457	3328.297369	189.5377765	49.22376635	238.7615429	70.24459184	49.3989399	189.1874294	0.175173546	2.277256095	1.401388366	3.853818006
482870	DBR	15.44	21.92887731	0.36139035	59.62506914	1132.876314	64.51432481	16.75464443	81.26896924	23.90965273	16.8142695	64.39507467	0.059625069	0.775125899	0.477000553	1.311751521
482890	DBR	170.541	253.8126716	0.37869707	690.1218826	13112.31577	746.711877	193.924249	940.6361261	276.7388749	194.6143709	745.3316333	0.690121883	8.971584474	5.520975061	15.18268142
482900	DBR	134.184	205.4961198	0.389681996	558.7481829	10616.21547	604.5655339	157.0082394	761.5737733	224.0580213	157.5669876	603.4480375	0.558748183	7.263726377	4.469985463	12.29246002
482920	DBR	50.428	75.46082604	0.38076521	205.1795405	3898.411269	222.0042628	57.65545088	279.6597137	82.27699574	57.86063042	221.5939037	0.20517954	2.667334026	1.641436324	4.513949891
482930	DBR	40.759	60.14903514	0.375502294	163.5464656	3107.382847	176.9572758	45.95655684	222.9138326	65.58213271	46.1201033	176.6301829	0.163546466	2.126104053	1.308371725	3.598022244
482940	DBR	72.445	112.0743409	0.393645441	304.7324417	5789.916392	329.7205019	85.62981612	415.350318	122.1977091	85.93454856	329.111037	0.304732442	3.961521742	2.437859534	6.704113717
482950	DBR	24.6	36.23140098	0.374763659	98.51392563	1871.764587	106.5920675	27.6824131	134.2744806	39.50408418	27.78092703	106.3950397	0.098513926	1.280681033	0.788111405	2.167306364
482960	DBR	66.019	96.72336006	0.372794832	262.9928085	4996.863362	284.5582188	73.90097919	358.459198	105.4601162	74.163972	284.0322332	0.262992809	3.418906511	2.103942468	5.785841787
482970	DBR	54.203	81.659505	0.38334594	222.0338763	4218.643649	240.2406541	62.39151923	302.6321734	89.03558439	62.61355311	239.7965864	0.222033876	2.886440392	1.77627101	4.884745278
482980	DBR	40.318	60.37000332	0.381004117	164.1472826	3118.79837	177.6073598	46.12538642	223.7327463	65.82306034	46.28953371	177.2790653	0.164147283	2.133914674	1.313178261	3.611240218
482990	DBR	23.76	35.19358623	0.376898611	95.69208595	1818.149633	103.538837	26.88947615	130.4283131	38.37252646	26.98516824	103.3474528	0.095692086	1.243997117	0.765536688	2.105225891
482995	DBR	113.335	172.8056567	0.387972868	469.8621402	8927.380664	508.3908357	132.0312614	640.4220971	188.4147182	132.5011235	507.4511114	0.46986214	6.108207823	3.758897122	10.33696709

Table 11-2 Subbasin Treatment Level of Service

Subbasin ID	Basin ID	BOD5	TSS	TKN	NO3 +NO2	TN	TP	TDP	Oil and Grease	Cd	Cu	Pb	Zn
480001	DBR	D	B	A	A	A	A	A	A	F	B	F	C
480002	DBR	A	A	A	A	A	A	A	A	A	A	A	A
480010	DBR	F	F	C	C	C	C	C	B	F	F	F	F
480020	DBR	F	F	F	F	F	A	C	A	F	F	F	F
480030	DBR	F	F	C	C	C	A	B	A	F	F	F	F
480040	DBR	A	A	A	A	A	A	A	A	B	A	D	A
480050	DBR	F	D	B	B	B	A	A	A	F	C	F	F
480060	DBR	F	D	B	B	B	A	B	A	F	C	F	F
480080	DBR	F	F	F	F	F	F	F	F	F	F	F	F
480090	DBR	F	D	F	B	F	F	F	F	F	F	F	F
480100	DBR	F	F	F	F	F	F	F	F	F	F	F	F
480110	DBR	F	F	F	F	F	F	F	F	F	F	F	F
481001	DBR	F	F	D	D	D	F	D	C	F	F	F	F
481020	DBR	F	F	F	F	F	D	D	C	F	F	F	F
481030	DBR	F	F	F	F	F	F	F	F	F	F	F	F
481050	DBR	F	C	D	F	D	F	F	C	F	F	C	D
481065	DBR	F	F	F	F	F	D	F	D	F	F	F	F
481070	DBR	F	F	C	C	C	A	B	A	F	D	F	F
481080	DBR	A	A	A	A	A	A	A	A	A	A	A	A
481090	DBR	D	D	D	D	D	D	D	D	D	F	D	D
481100	DBR	F	B	F	B	F	F	F	F	F	F	C	F
481110	DBR	D	C	D	C	C	C	C	D	C	C	C	C
481112	DBR	F	F	F	F	F	C	C	F	F	F	F	F
481130	DBR	F	C	D	D	D	B	B	C	F	F	C	B
481140	DBR	F	B	F	F	F	A	B	C	F	F	C	A
481145	DBR	F	B	F	F	F	A	B	C	F	F	C	A
481150	DBR	F	F	D	F	D	A	B	A	F	F	F	F
481170	DBR	F	B	F	F	F	A	B	C	F	F	C	A
481180	DBR	F	B	C	C	C	A	A	B	F	C	F	B
481190	DBR	F	F	F	F	F	A	B	C	F	F	F	F
481200	DBR	F	F	F	F	F	A	C	B	F	F	F	F
481205	DBR	F	F	F	F	F	A	C	A	F	F	F	F
481210	DBR	F	A	D	B	D	A	B	C	F	F	B	A
481220	DBR	F	F	F	D	F	A	C	A	F	F	F	F
481225	DBR	C	A	B	B	B	A	A	A	B	A	C	A
481230	DBR	F	F	F	F	F	B	D	B	F	F	F	F
481235	DBR	F	C	D	B	C	B	B	B	F	D	F	D
481240	DBR	F	C	F	C	F	C	C	C	D	F	B	C

Table 11-2 Subbasin Treatment Level of Service

Subbasin ID	Basin ID	BOD5	TSS	TKN	NO3 +NO2	TN	TP	TDP	Oil and Grease	Cd	Cu	Pb	Zn
481250	DBR	F	D	F	F	F	C	C	C	D	F	C	D
481260	DBR	F	F	F	F	F	F	F	C	F	F	F	F
481270	DBR	F	B	F	A	F	C	D	F	F	F	F	F
481275	DBR	D	C	A	A	A	A	A	A	F	B	F	C
481278	DBR	D	A	C	A	C	A	A	C	B	C	A	B
481280	DBR	F	C	F	C	F	F	F	F	F	F	C	F
481281	DBR	F	B	F	A	D	F	F	F	F	F	B	D
481290	DBR	F	C	D	D	D	F	F	B	F	F	F	F
481295	DBR	F	F	F	F	F	F	F	F	F	F	D	F
481300	DBR	F	C	D	D	D	F	F	D	F	F	B	F
481310	DBR	F	B	D	C	D	F	F	D	D	F	B	D
481320	DBR	F	D	D	F	D	F	F	C	C	F	C	F
481330	DBR	F	B	F	B	F	F	F	F	F	F	C	D
481350	DBR	D	D	D	D	D	D	D	D	D	D	D	D
481360	DBR	F	B	D	C	C	A	B	B	F	F	B	A
481370	DBR	D	C	D	C	D	C	C	D	F	D	C	C
481390	DBR	F	D	D	D	D	D	D	D	F	D	D	D
481400	DBR	F	B	D	B	D	D	F	D	F	D	D	C
481410	DBR	F	F	F	F	F	F	F	F	F	F	D	F
481415	DBR	F	D	F	F	F	F	F	F	F	F	D	F
481420	DBR	F	C	F	B	F	F	F	F	F	F	C	F
481430	DBR	F	D	B	C	B	B	B	A	F	D	F	F
481440	DBR	F	F	F	F	F	F	F	F	F	F	C	F
481450	DBR	F	F	C	C	C	B	B	B	F	D	F	F
481480	DBR	F	B	D	A	C	F	F	C	F	F	F	C
481484	DBR	D	B	D	B	C	C	C	C	F	D	C	B
481490	DBR	C	B	B	B	B	A	A	B	C	A	F	B
481492	DBR	F	F	D	D	D	B	C	B	F	F	F	F
481497	DBR	F	F	F	F	F	A	C	B	F	F	F	F
481499	DBR	F	F	F	F	F	F	F	F	F	F	F	F
481500	DBR	F	F	F	F	F	F	F	F	F	F	F	F
481520	DBR	F	F	F	F	F	F	F	D	F	F	F	F
481530	DBR	F	F	F	F	F	F	F	F	F	F	F	F
481540	DBR	F	F	F	F	F	F	F	F	F	F	F	F
481550	DBR	F	C	D	D	D	F	F	D	F	F	C	F
481560	DBR	F	D	F	F	F	F	F	D	F	F	C	F
481580	DBR	F	B	C	C	C	D	C	B	D	D	A	C
481590	DBR	F	B	B	C	C	D	C	B	C	D	A	C

Table 11-2 Subbasin Treatment Level of Service

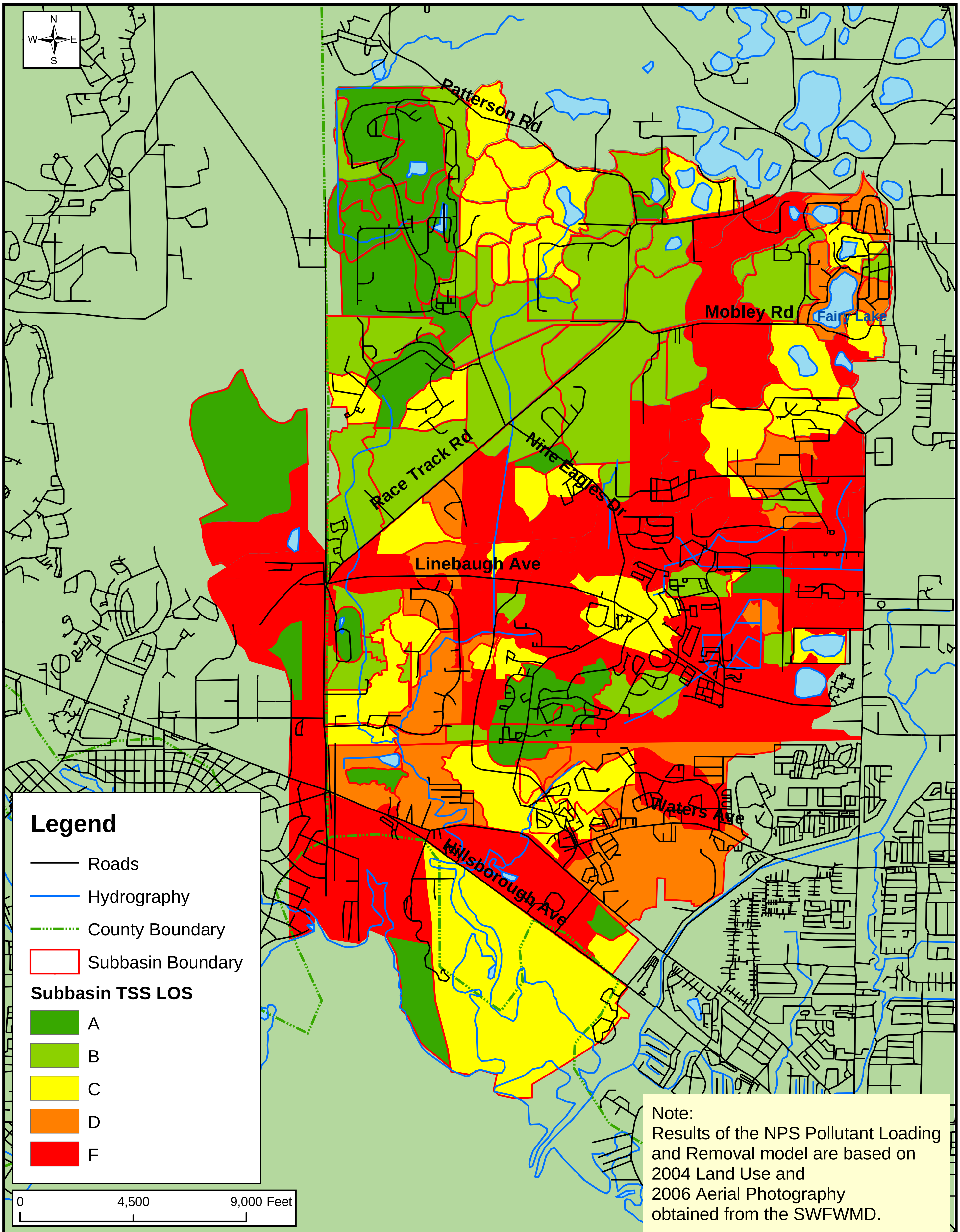
Subbasin ID	Basin ID	BOD5	TSS	TKN	NO3 +NO2	TN	TP	TDP	Oil and Grease	Cd	Cu	Pb	Zn
481610	DBR	D	B	C	B	C	C	C	C	D	C	C	B
481630	DBR	F	C	D	D	D	F	F	B	F	F	F	C
481640	DBR	D	A	D	A	C	C	D	D	F	D	C	B
481650	DBR	F	C	F	C	D	F	F	D	F	F	C	C
481660	DBR	D	A	C	A	C	C	D	C	C	F	A	B
481670	DBR	C	A	C	A	B	C	C	C	D	D	A	B
481680	DBR	C	A	C	A	C	B	C	C	F	C	B	A
481695	DBR	C	A	C	A	C	B	C	C	F	C	B	A
481700	DBR	B	A	B	A	A	A	A	B	D	B	A	A
481710	DBR	D	A	D	A	C	C	C	C	F	F	B	B
481730	DBR	C	A	B	A	B	A	A	A	B	A	A	A
481740	DBR	D	A	C	A	C	A	B	C	F	C	A	A
481750	DBR	D	A	D	A	C	B	C	C	F	D	B	A
481760	DBR	D	A	D	A	C	A	B	C	F	D	B	A
481770	DBR	F	A	F	A	D	F	F	B	F	F	A	A
481780	DBR	F	A	D	C	D	F	F	C	F	F	B	B
481790	DBR	D	A	C	A	C	B	C	C	F	D	A	A
481800	DBR	F	A	F	A	D	F	F	D	F	F	B	C
481810	DBR	F	C	F	F	F	F	F	C	F	F	C	D
481820	DBR	F	B	F	F	F	F	F	B	F	F	A	C
481830	DBR	F	C	F	F	F	F	F	B	F	F	B	C
481840	DBR	F	C	F	F	F	F	F	B	F	F	A	C
481850	DBR	F	C	F	F	F	F	F	D	F	F	C	F
481860	DBR	F	C	F	F	F	F	F	B	F	F	B	C
481870	DBR	F	B	F	F	F	F	F	C	F	F	B	C
481880	DBR	F	C	D	F	D	F	F	C	F	F	C	C
481890	DBR	F	C	F	F	F	F	F	B	F	F	B	C
481900	DBR	F	C	D	C	D	D	D	C	F	D	C	C
481910	DBR	F	C	D	D	D	F	F	C	F	D	C	C
481920	DBR	F	C	D	F	D	F	F	B	F	F	B	C
481930	DBR	F	B	C	C	C	D	D	B	F	C	B	B
481940	DBR	F	B	D	F	D	F	F	B	F	F	B	B
481950	DBR	F	B	D	F	D	F	F	B	F	F	B	C
481960	DBR	C	B	C	A	C	C	D	D	D	C	C	B
481970	DBR	F	B	D	F	D	F	F	B	F	F	B	C
481980	DBR	F	B	C	C	C	F	D	B	F	C	B	B
481990	DBR	F	B	D	F	D	F	F	B	F	F	B	B
481995	DBR	F	F	F	F	F	F	F	D	F	F	F	F

Table 11-2 Subbasin Treatment Level of Service

Subbasin ID	Basin ID	BOD5	TSS	TKN	NO3 +NO2	TN	TP	TDP	Oil and Grease	Cd	Cu	Pb	Zn
482010	DBR	D	B	C	B	B	C	C	C	D	C	B	B
482020	DBR	A	A	A	A	A	A	A	A	A	A	A	A
482030	DBR	F	C	C	C	C	F	D	C	C	F	B	D
482040	DBR	D	A	C	A	C	C	C	C	D	D	B	B
482046	DBR	F	C	F	C	F	F	F	F	F	F	C	F
482050	DBR	F	F	F	F	F	F	F	F	F	F	D	F
482060	DBR	F	C	F	B	F	F	F	F	F	F	F	F
482070	DBR	F	C	F	C	F	F	F	F	F	F	C	F
482100	DBR	F	D	F	D	F	F	F	F	F	F	C	F
482120	DBR	F	D	F	C	F	F	F	F	F	F	F	F
482140	DBR	F	F	F	F	F	F	F	D	F	F	F	F
482160	DBR	F	D	D	D	D	F	F	C	F	F	F	F
482180	DBR	F	F	F	F	F	F	F	F	F	F	F	F
482200	DBR	D	B	D	C	C	D	D	C	F	F	D	C
482230	DBR	F	F	D	C	D	A	C	C	F	F	F	F
482250	DBR	F	C	C	C	C	D	C	B	F	D	F	D
482270	DBR	F	F	F	F	F	F	F	F	F	F	F	F
482280	DBR	F	F	F	F	F	F	F	C	F	F	F	F
482300	DBR	F	B	C	A	C	C	C	B	F	F	F	F
482310	DBR	F	F	D	C	C	B	C	B	F	F	F	F
482320	DBR	F	C	D	A	C	B	C	C	F	F	F	F
482330	DBR	F	B	C	A	C	F	F	A	F	F	F	C
482340	DBR	F	F	F	D	F	D	F	C	F	F	F	F
482360	DBR	F	F	F	F	F	F	F	C	F	F	F	F
482380	DBR	F	D	F	D	F	C	C	C	D	F	C	D
482400	DBR	F	F	F	F	F	F	F	F	F	F	D	F
482410	DBR	D	B	C	B	C	D	D	C	D	D	B	C
482420	DBR	F	F	F	F	F	F	F	F	F	F	F	F
482425	DBR	F	B	D	B	C	F	F	C	D	F	C	C
482440	DBR	F	F	F	F	F	F	F	F	F	F	F	F
482460	DBR	F	F	F	F	F	F	F	D	F	F	F	F
482480	DBR	F	F	F	F	F	F	F	C	F	F	F	F
482500	DBR	F	F	F	F	F	F	F	D	F	F	F	F
482510	DBR	F	F	D	D	D	C	C	B	F	F	F	F
482520	DBR	F	F	F	F	F	A	C	B	F	F	F	F
482540	DBR	F	F	F	F	F	D	D	C	F	F	F	F
482560	DBR	F	D	D	D	D	D	D	B	F	D	F	D
482580	DBR	D	B	C	C	C	D	C	B	B	F	B	C

Table 11-2 Subbasin Treatment Level of Service

Subbasin ID	Basin ID	BOD5	TSS	TKN	NO3 +NO2	TN	TP	TDP	Oil and Grease	Cd	Cu	Pb	Zn
482600	DBR	F	F	F	F	F	F	F	F	F	F	F	F
482620	DBR	F	F	F	C	F	C	D	B	F	F	F	F
482640	DBR	F	C	D	D	D	F	D	B	F	F	C	C
482660	DBR	F	D	D	F	D	F	F	C	C	F	C	F
482680	DBR	F	F	F	F	F	F	F	F	F	F	F	F
482700	DBR	F	C	D	D	D	F	D	C	F	F	B	C
482720	DBR	F	C	D	F	F	F	F	B	F	F	B	B
482740	DBR	F	F	F	F	F	F	F	C	F	F	C	F
482760	DBR	F	F	F	F	F	F	F	B	F	F	F	F
482780	DBR	F	B	D	D	D	F	F	B	F	F	D	C
482790	DBR	F	F	F	C	F	C	F	C	F	F	F	F
482800	DBR	F	F	F	F	F	F	F	A	F	F	F	F
482820	DBR	F	B	D	F	D	F	F	B	F	F	A	B
482840	DBR	F	B	D	D	D	F	F	B	F	F	B	B
482850	DBR	F	F	F	F	F	F	F	B	F	F	F	F
482860	DBR	F	F	F	F	F	F	F	C	F	F	F	F
482870	DBR	F	B	F	F	F	F	F	B	F	F	A	C
482890	DBR	F	B	D	D	D	F	F	B	F	D	B	B
482900	DBR	F	C	C	C	C	D	C	C	F	C	C	C
482920	DBR	F	C	D	F	F	F	F	C	F	F	C	C
482930	DBR	D	D	D	D	D	D	D	D	D	D	D	D
482940	DBR	F	F	C	D	C	C	C	C	F	F	F	F
482950	DBR	F	B	D	C	D	F	F	D	F	D	C	C
482960	DBR	F	D	F	D	F	F	F	D	F	F	F	F
482970	DBR	D	B	C	B	C	B	B	C	C	C	B	B
482980	DBR	C	C	C	C	C	C	C	C	C	C	C	C
482990	DBR	F	F	F	F	F	C	D	C	F	F	F	F
482995	DBR	F	C	D	D	D	F	F	C	F	D	C	C



Water Quality Treatment Level of Service by Subbasin for Double Branch Watershed: TSS

Figure 11-1

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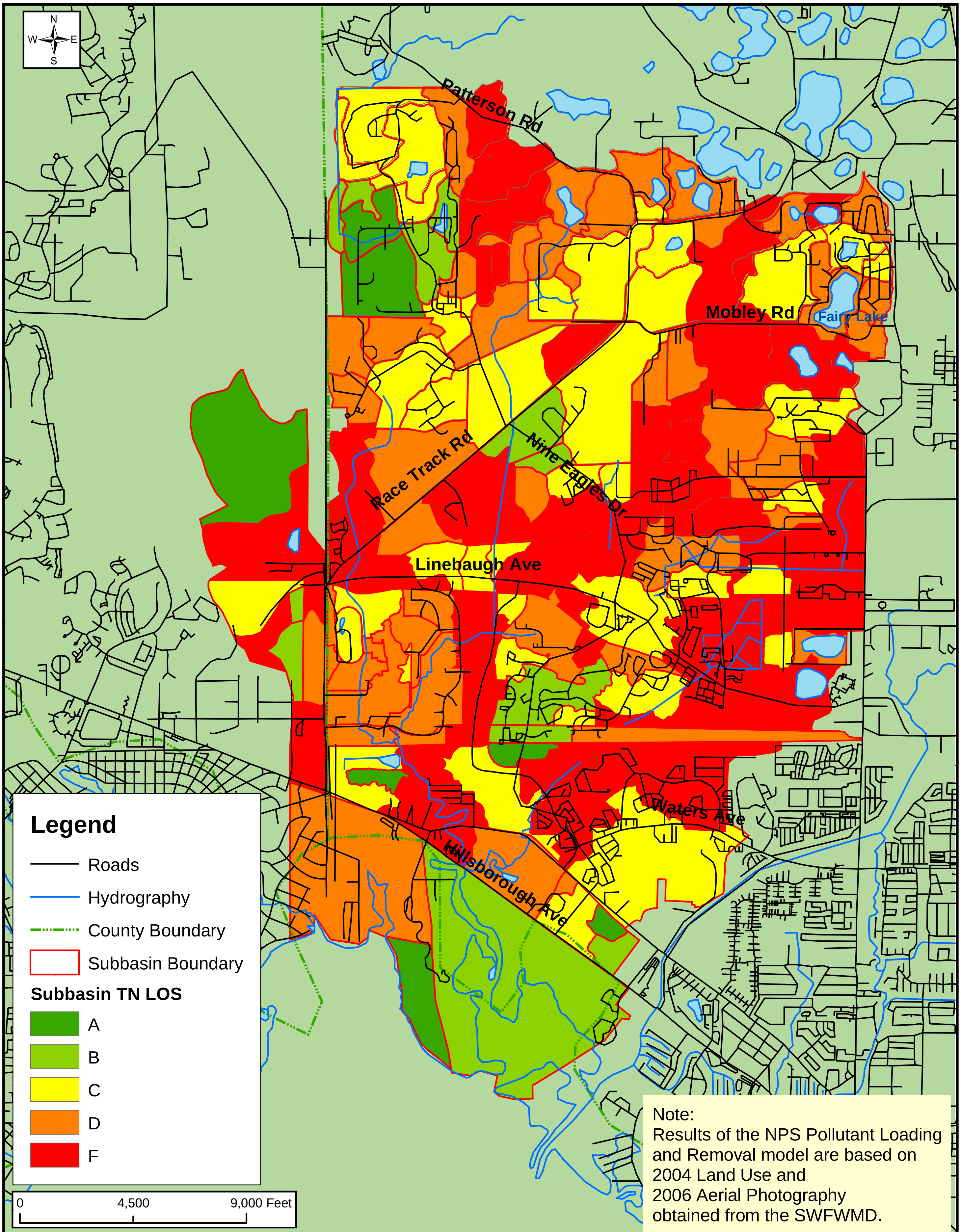

Water Quality Treatment Level of Service by Subbasin for Double Branch Watershed: TN

Figure 11-2

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The remaining subbasins with low scores were primarily dominated by agriculture, low density residential, and natural land uses. The distribution of poor scores was consistent with total nitrogen loading calculations for representative stations based on actual concentration and discharge data described in Chapter 7.

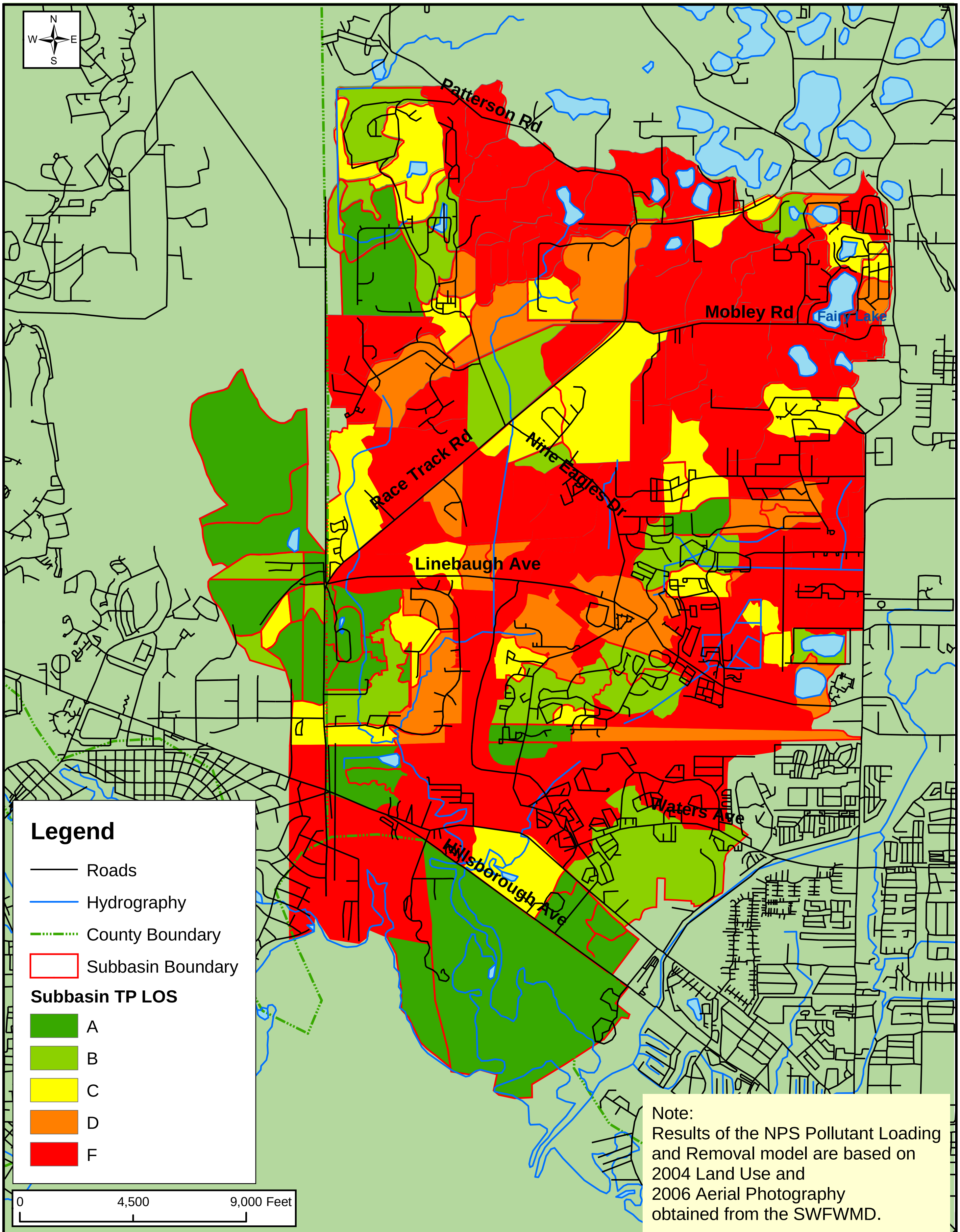
Total Phosphorus

A number of subbasins containing concentration of A LOS scores for total phosphorus are located in the northern portion of the watershed (area to the north of Race Track Road and to the west of Nine Eagles Drive), the southern portion of the watershed (area to the south of Hillsborough Avenue draining into the Old Tampa Bay), and the area to the west of the watershed (that falls into Pinellas county) (Figure 11-3). These areas are almost entirely comprised of forested wetlands and upland forests. A few scattered subbasins with LOS scores of B and C are located to the north and in the center of the watershed (subbasins near Grace Lake and scattered retention ponds within the Westchase subdivision). These subbasins include water and low density residential lands. The remaining areas were dominated by D and F scores due to the presence of either agricultural or high-density residential land uses.

Overall Water Quality

The overall LOS score for the entire watershed is an F (using an average score for all parameters combined). The greatest concentration of D and F scores for total nitrogen, total phosphorus, and TSS, was located in the central region of the watershed primarily surrounding the Westchase neighborhood. This area is predominantly comprised of various density residential land uses. These land uses contribute large quantities of various pollutants into surface water bodies. The overall low LOS score for the entire watershed (F) indicates that many subbasins surrounding large areas of contiguous remnant natural systems have been developed to some degree, resulting in low LOS scores for seemingly large undeveloped subwatershed.

Unless appropriate treatment measures are implemented, continued loading to surface waters in the watershed, eventually, into Old Tampa Bay may result in significant water quality degradation in the future. Efforts to reduce loading of pollutants to the Double Branch Creek watershed and its tributaries, lakes, sinkholes, and groundwater should be incorporated into future management activities for the watershed. Future efforts to reduce pollutant loading may include: implementation of local and regional stormwater best management practices (BMPs - wet detention ponds, baffle boxes, alum treatment, etc.), low impact development, source reduction (e.g., education programs for home and business owners to reduce fertilizers and illicit discharges), improved wastewater treatment practices (extending centralized sewer systems to areas treated by on-site disposal systems or septic tanks), and restoration/conservation of natural lands and riparian buffer areas to reduce current and future pollutant loads.



Water Quality Treatment Level of Service by Subbasin for Double Branch Watershed: TP

Figure 11-3

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In order to determine the magnitude of pollutant load reduction needed to achieve an LOS score of A, differences between net loads (from Chapter 10) and benchmark loads that would result in an LOS score of A were calculated (Table 11-3). It was observed that average reductions of pollutants would need to be very high (>84%) for all 12 parameters to achieve A scores. Considering the removal efficiencies of the available stormwater BMPs, achieving these goals would require an extremely aggressive implementation program. In some cases, it may not even be possible to achieve the extent of reduction needed if the options are limited to the BMPs considered in this model. For example, the Double Branch Creek watershed exhibited low LOS scores for total nitrogen. Figure 11-4 compares the percent reduction of TN loading in the Double Branch watershed necessary to achieve an LOS score of A with the removal efficiencies of various BMPs. The load reduction required to achieve an LOS score of A in this subwatershed is over 77%. Only with the best BMP available in the model for total nitrogen (percolation), such reduction can theoretically be achieved. For some individual subbasins, the load reduction required to achieve an LOS score of A is over 80%. This means that if all of the runoff in those subbasins is treated through percolation ponds, only 80% reduction in loading would be realized as opposed to the higher percent reduction that would be necessary to achieve an LOS A designation.

Table 11-3 Estimated Pollutant Loads (lbs/year/acre) and Percent Reductions needed to equal LOS A loads for Double Branch Creek Watershed

	BOD 5	TSS	TKN	NO3 +NO 2	TN	TP	TDP	Oil and Grease	Cd	Cu	Pb	Zn
Benchmark Loads	3.78	71.81	4.09	1.06	5.15	1.52	1.07	4.08	0.00	0.05	0.03	0.08
Allowable Load to Achieve LOS A	0.75	14.29	0.81	0.21	1.03	0.30	0.21	0.81	0.00	0.01	0.01	0.02
Net Loads Based on Existing Land Use and Treatment	13.83	73.89	3.67	0.92	4.53	1.84	1.12	2.26	0.02	0.09	0.20	0.13
Percent Reduction Required to Achieve LOS A	95%	81%	78%	77%	77%	84%	81%	64%	95%	89%	97%	87%
Load Reduction Required to Achieve LOS A	13.08	59.60	2.86	0.71	3.51	1.54	0.91	1.45	0.02	0.08	0.19	0.11

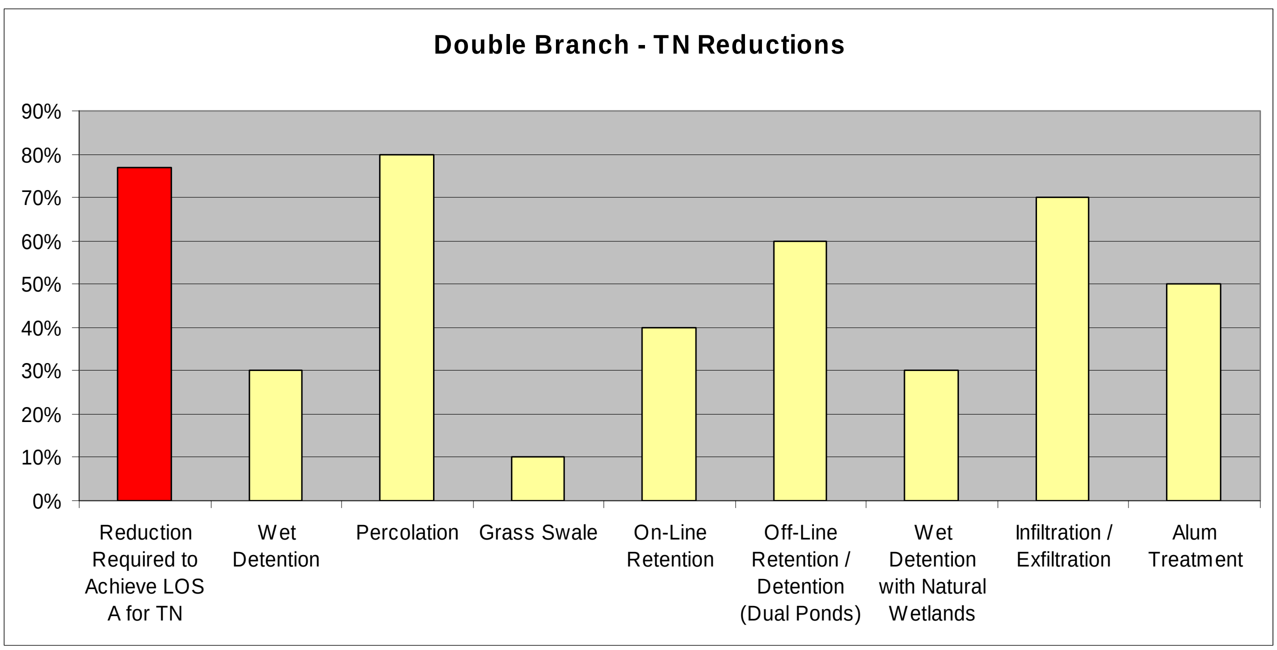
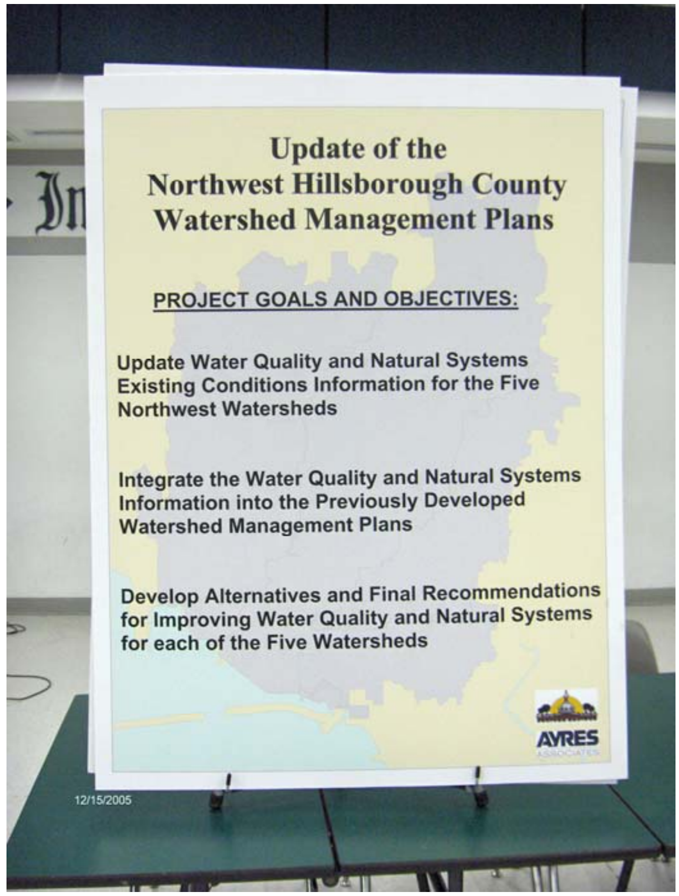


Figure 11-4 Comparison of the Reduction required to achieve an LOS A Designation with the removal efficiencies of various best management practices for TN.

CHAPTER 12: PUBLIC MEETING

The first public meeting was held on December 14, 2005 at Sickles High School (Hillsborough County, Florida). The meeting began at approximately 6:30 p.m. and ended at approximately 8:30 p.m. EDT.

A handout containing the project description, project history, and a list of project contacts was made available to the public (Appendix 12-1), along with comment forms.



The format of the public meeting was relatively informal and was conducted for the purposes of sharing information about the project and providing the public with information about the state of water quality in the Brooker Creek, Double Branch, Rocky/Brushy Creek, Sweetwater, and Lower Sweetwater watersheds. The meeting agenda included the following topics:

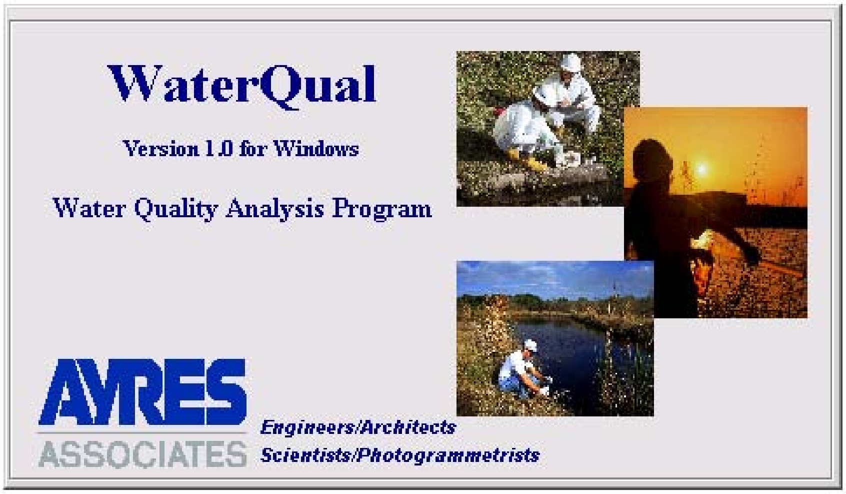
- Introduction
- Goals and objectives of the project
- Description and purpose of the project
- Brief description of other similar projects currently conducted in the area
- Description of the current state of water quality within the project area.
- Questions and answers
- Answering individual questions at the stations.

The first portion of the meeting was in the form of a speech, which helped acquaint the local residents with the water quality state of their watersheds and the objectives of the project. A number of poster-sized maps were positioned around the room.

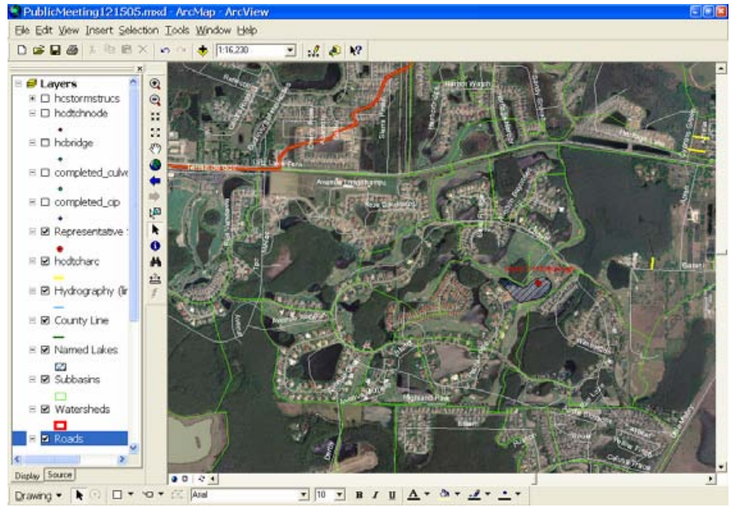
They included:

- Goals and objectives of the project.
- Detailed location map of the project area.
- Aerial photography map of the project area.
- Brooker Creek watershed: location of selected water quality sampling stations and TSI and dissolved oxygen concentration graphs for those locations.
- Double Branch watershed: location of selected water quality sampling stations and TSI and dissolved oxygen concentration graphs for those locations.
- Rocky/Brushy Creek watershed: location of selected water quality sampling stations and TSI and dissolved oxygen concentration graphs for those locations.
- Sweetwater Creek watershed: location of selected water quality sampling stations and TSI and dissolved oxygen concentration graphs for those locations.
- Lower Sweetwater Creek watershed: location of selected water quality sampling stations and TSI and dissolved oxygen concentration graphs for those locations.

Two laptops with GIS capabilities were connected to projectors. One of them contained a GIS database with the following data layers: aerial photography, land use (1999), ELAPP, watershed and subbasin boundary, lakes, water quality stations, CIPs, culverts, and bridge locations. Knowing the name of a lake or a street intersection, an interested resident could obtain a variety of information about a specific area of concern. The second laptop was geared with the WaterQual, a software capable of quickly analyzing and graphically presenting water quality data for different contaminants. By obtaining the name of a water quality station from either the GIS database or one of the posters, an interested resident had an ability to view various historical and recent water quality data trends for a specific location.



Following the Hillsborough County personnel presentation regarding the general description of the project, as well as the state of water quality in the aforementioned watersheds, the floor was opened for questions. The residents of the area asked a number of interesting questions regarding various concerns. One participant asked about the impacts of leaking septic systems on water quality in the watershed. She also requested additional information regarding the preventive maintenance of her septic system that could prevent bacteria from entering ground and surface waters. Another resident requested additional description of the TMDL process. Other questions were pointing at the sufficiency of existing regulations for accidental or deliberate release of chemicals.



After the question and answer session, residents were encouraged to look at the posters and utilize the laptop stations that presented additional information about water quality in the area. Hillsborough County and Ayres Associates staff assumed positions at different stations around the room and spent the next hour answering individual questions of the meeting participants.

For further information about the state of the watershed, the public was encouraged to visit the Hillsborough County Watershed Atlas website at: http://www.hillsborough.wateratlas.usf.edu.

CHAPTER 13: IDENTIFICATION OF POTENTIAL SOURCES OF CONTAMINATION

13.1 Overview

This chapter describes the potential sources of contamination within the Double Branch Creek watershed. Identifying sources of contamination for the area will facilitate prioritization of water quality improvement alternatives for the Double Branch Creek watershed.

13.1.1 Dairy Farms

Dairy farming is an important part of Florida's agricultural industry. Milk and cattle sales from dairies contributed about $459 million to Florida's economy in 2001, about $45 million more than in 2000 (Geisy et al., 2003). However, some elements of today's agriculture, such as dairy farms tend to contribute large amounts of nutrients (primarily nitrogen and phosphorus) into the environment.

According to the US EPA, agriculture was reported to be the most common pollutant of rivers and streams. Nutrients were identified to be among the five leading pollutants causing water quality impairments in lakes, streams, and estuaries of the U.S. (US EPA, 2002).

While searching for potential sources of nutrients in the Double Branch Creek watershed, we analyzed the existence and locations of dairy farms in the watershed. Eight dairy farm related facilities have been identified in the vicinity of Hillsborough County; however, none were located within the proximity to Double Branch Creek watershed.

Figure 13-1 shows a map of the Tampa Bay area designating dairy farms in the area. Table 13-1 shows the corresponding numbers from the map which gives the names and addresses of these dairy farms.

While agriculture may still be a major contributor of nutrient pollution in the watershed and will be discussed in more detail in the next section of this chapter, dairy farms were not identified as major sources of pollution in the Double Branch Creek watershed.

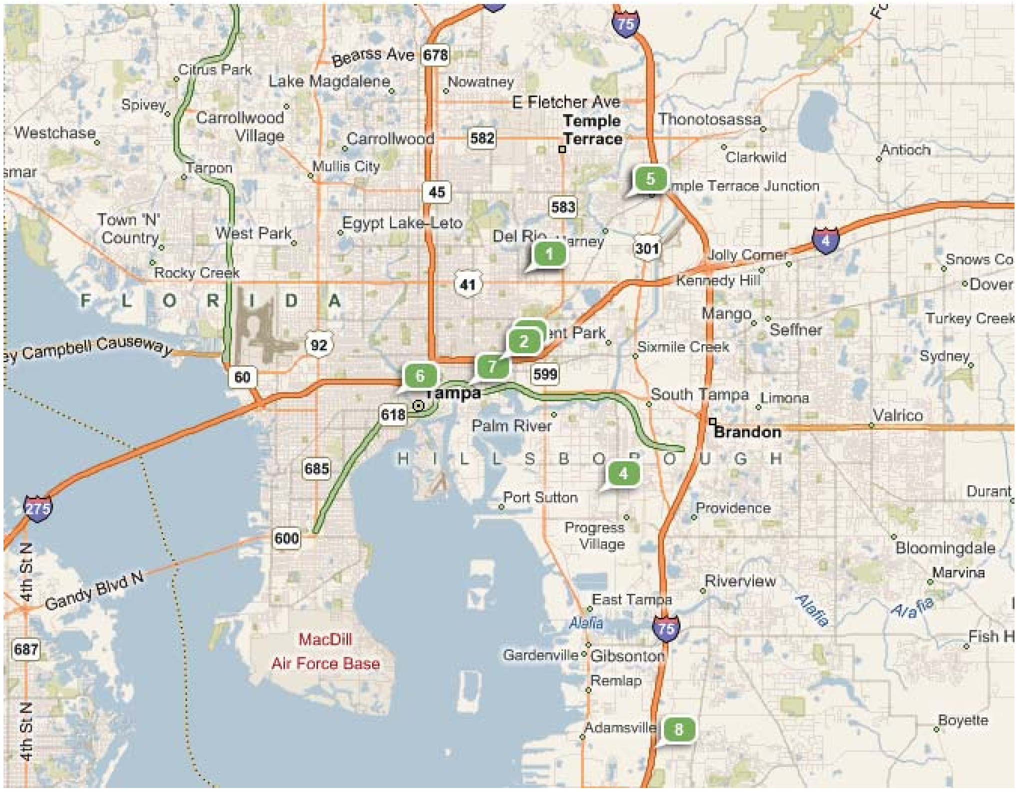


Figure 13-1 Location Map of Dairy Farms Located in the Tampa Bay Area

Table 13-1 Dairy Farm Name and Address from Location Map

1	Sweetheart Dairy & Foods	5610 North 50th Street Tampa, FL 33610
2	Sunny Florida Dairy Inc	2209 North 40th Street Tampa, FL 33605
3	TG Lee Foods	4219 E 19th Avenue Tampa, FL 33605
4	Tower Dairy No 1	4221 78th Street South Tampa, FL 33619
5	Gustafson Dairy	8601 Harney Road Tampa, FL 33637
6	Sunny Florida Dairy	Adamo Drive and N 28th Street Tampa, FL 33605
7	Aprile Farms	11513 Balm Riverview Road Tampa, FL 33602
8	Aprile Farms	9914 Cowley Road Tampa, FL 33602

13.1.2 High Pollutant Contributor Land Use Types

Double Branch Creek watershed exhibits extremely high concentrations of a number of different pollutants, such as total nitrogen, total phosphorus, and total suspended solids.

The highest contributor of total nitrogen appears to be Highway/Utility land use category, following by Agricultural, Commercial, High Density Residential, Institutional, and Light Industrial land use types.

The highest contributors of total phosphorus are Agricultural and High Density Residential, while contribution of total suspended solids seems to depend largely on the presence of Highway/Utilities land use category.

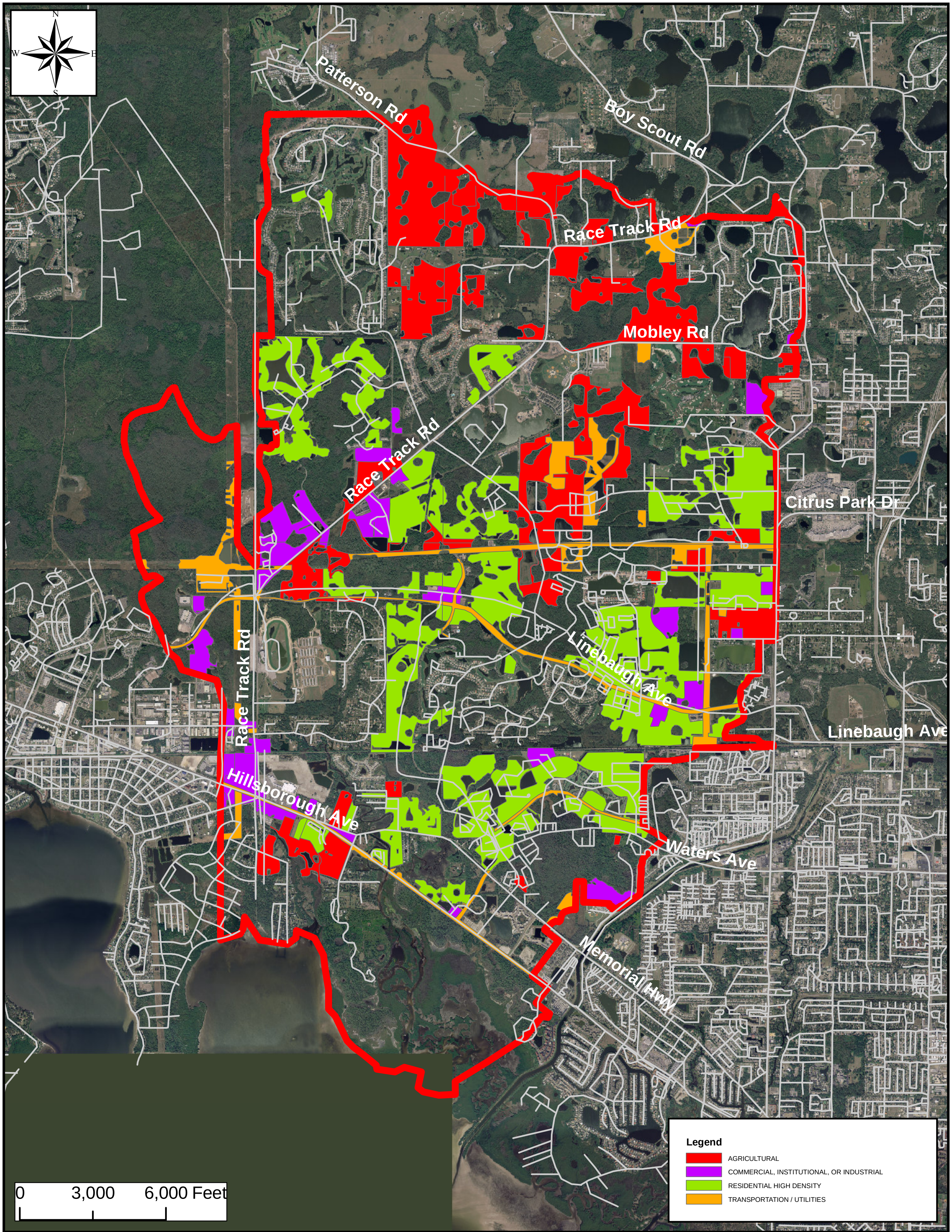
This information is summarized in Table 13-2.

Table 13-2 High Pollutant Contributor Land Use Types per Individual Pollutants

	Total Nitrogen	Total Phosphorus	Total Suspended Solids
Highway/Utility	X		X
Agricultural	X	X	
Commercial	X		
High Den. Residential	X	X	
Institutional	X		
Light Industrial	X		

Figure 13-2 shows the distribution of high pollutant contributor land use types in the Double Branch Creek watershed.

It is evident from Figure 13-2 that the center of the watershed is dominated by the high-density residential land use category, while the northern part of the watershed contains large agricultural parcels. Western part of the watershed contains a number of built-up (industrial, institutional, or commercial parcels). In addition, the watershed is crossed by a number of major highways with a few larger highway/utilities areas spread throughout the watershed.



High Pollutant Contributor Land Use Types in the Double Branch Creek Watershed

Figure 13-2

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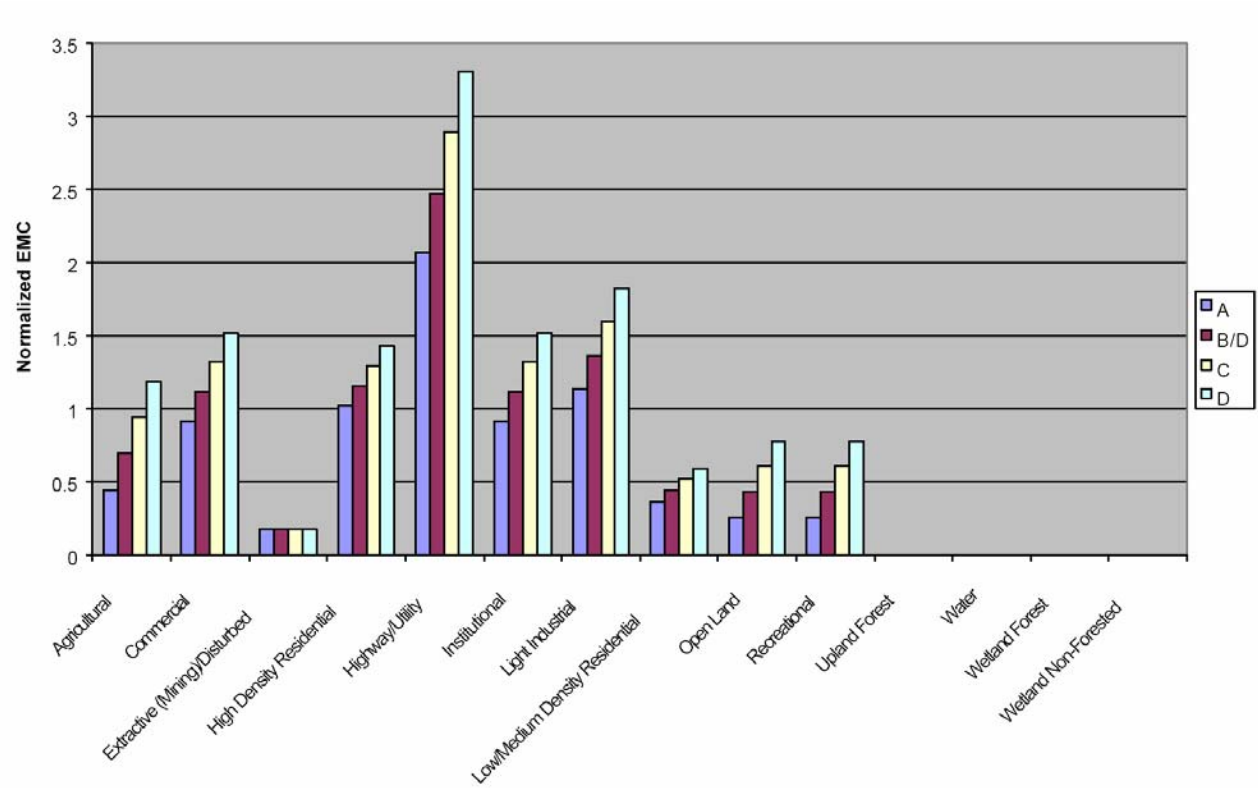
Total Nitrogen



Total Nitrogen Loading Potential by Land Use and Hydrologic Group

As evident from the bar graph above, which shows the total nitrogen loading potential by various land use types and hydrologic groups, the majority of total nitrogen is contributed by the Highway/Utilities land use category.

Figure 13-3 shows the visual correlation between land use types and high concentrations of total nitrogen. When comparing the TN LOS map with the land use distribution map, it is evident that high concentrations of total nitrogen correlates with the distribution of Highway/Utilities and high density residential land uses in the watershed. Subbasins with TN LOS scores of F encompass such roadway features as Linebaugh Avenue, Waters Avenue, Race Track Road, and Countryway Boulevard.

The areas dominated by residential, commercial, and institutional land uses also correlate with high concentrations of total nitrogen load. Double Branch Creek watershed encompasses a number of residential neighborhoods, such as Fawn Lake, Westchase, Countryway, and many others. These neighborhoods contribute large amounts of TN into surface waters of the Double Branch Creek watershed.

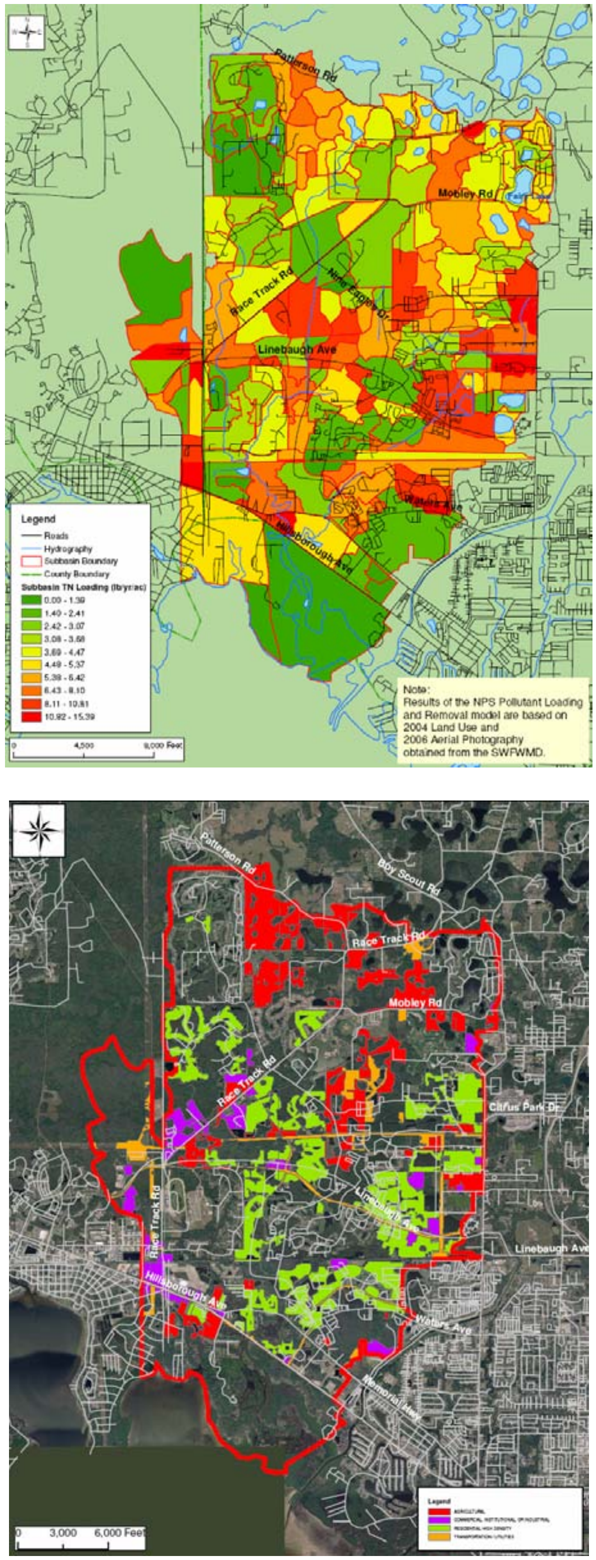
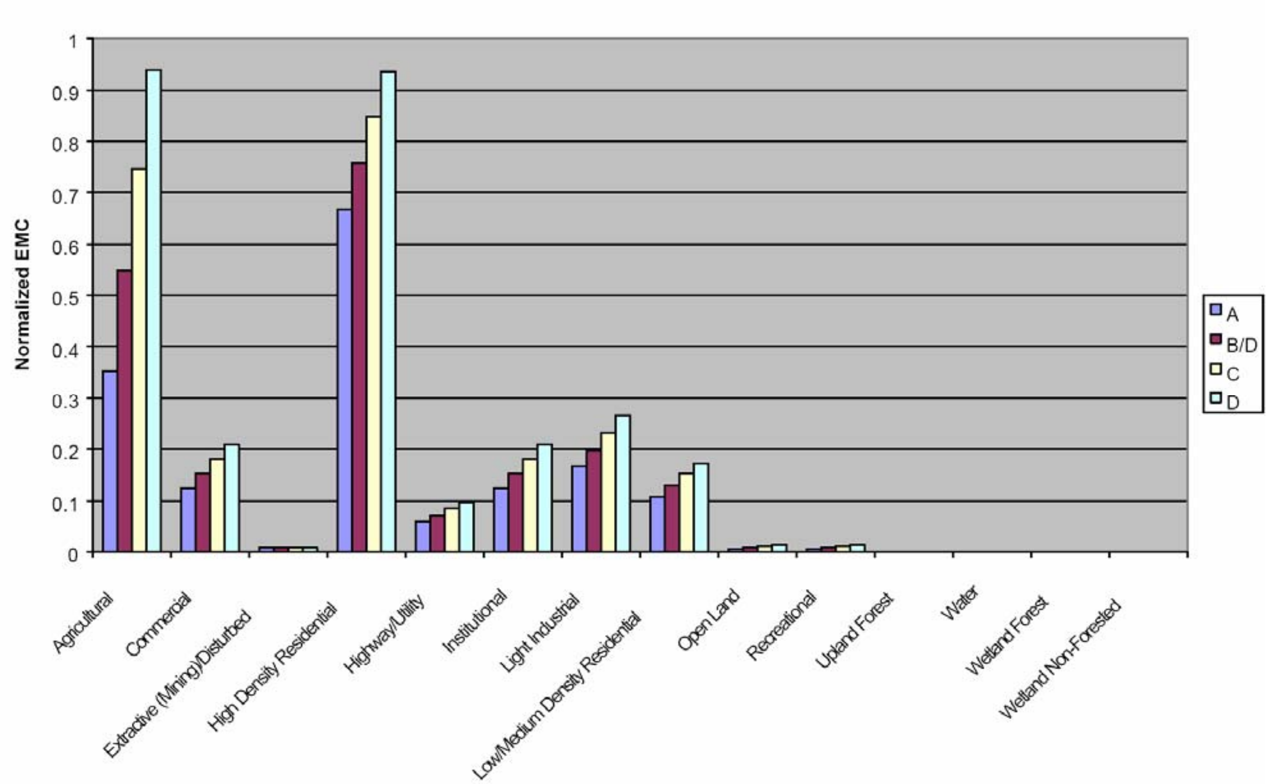


Figure 13-3 Visual Correlation between Land Use and High Concentrations of TN

Total Phosphorus



Total Phosphorus Loading Potential by Land Use and Hydrologic Group

High concentrations of total phosphorus is greatly correlated with agricultural and high density residential land uses. As Figure 13-2 shows, Double Branch watershed contains agriculture as well as many residential parcels.

When comparing the map of the total phosphorus level of service to the land use distribution map, the pattern is evident (Figure 13-4). Concentrations of total phosphorus are high throughout the watershed and almost perfectly correlate with locations of agricultural parcels as well as large residential neighborhoods. Agricultural parcels are found in the northern part of the watershed, as well as some subbasins in the center of the watershed. In almost all cases, these subbasins have a TP LOS score of F. Similarly, the center of the watershed is dominated by large residential neighborhoods, and subbasins encompassing such areas as Westchase or Countryway, exhibit unfavorable TP characteristics.

In contrast to areas with poor TP scores, subbasins located to the west and to the south of the watershed are dominated by natural land use types and therefore exhibit more favorable TP LOS scores.

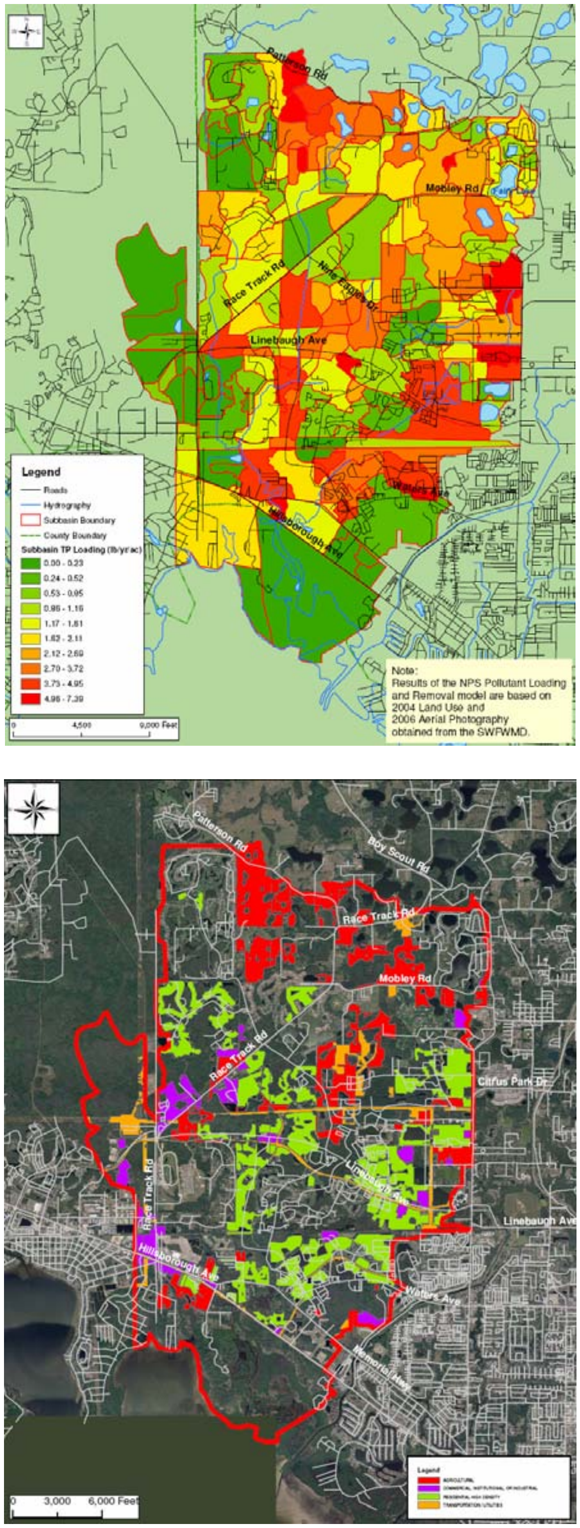
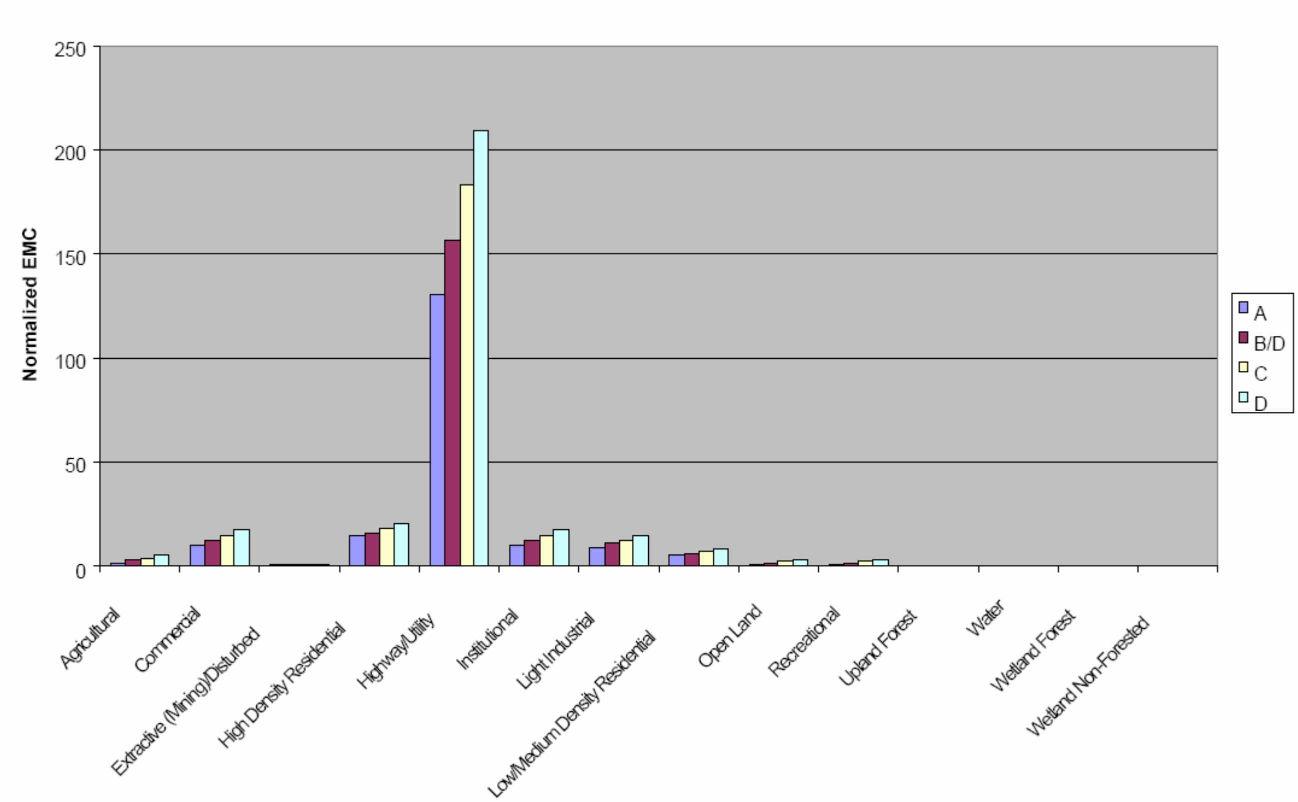


Figure 13-4 Visual Correlation between Land Use and High Concentrations of TP

Total Suspended Solids



Total Suspended Solids Loading Potential by Land Use and Hydrologic Group

Concentrations of total suspended solids are high toward the eastern and southern parts of the Double Branch Creek watershed. Subbasins with LOS TSS scores of F create narrow corridors throughout the watershed. As the graph above indicates, Highway/Utilities land use type is the dominant contributor of TSS into surface waterways. Not surprisingly, this watershed is crossed by a number of major roadway segments, such as Hillsborough Avenue, Linebaugh Avenue, Waters Avenue, Countryway Boulevard, and a dense network of local roads. Subbasins that encompass those roadway segments show poor TSS LOS scores.

In contrast to areas dominated by Highway/Utilities land use category, subbasins located to the north of the watershed are dominated by agriculture, low-density residential, and recreational land uses (such as golf courses). These land uses tend to contribute less total suspended solids and therefore subbasins dominated by such land uses exhibit more favorable TSS LOS scores. Figure 13-5 shows the visual correlation between land use types and high concentrations of total suspended solids. In addition, two larger subbasins located to the south of the watershed are adjacent to the Old Tampa Bay, and are dominated by wetlands and waterways that contribute no TSS. The presence of Hillsborough Avenue in the subbasin lowers the otherwise favorable LOS score for TSS.

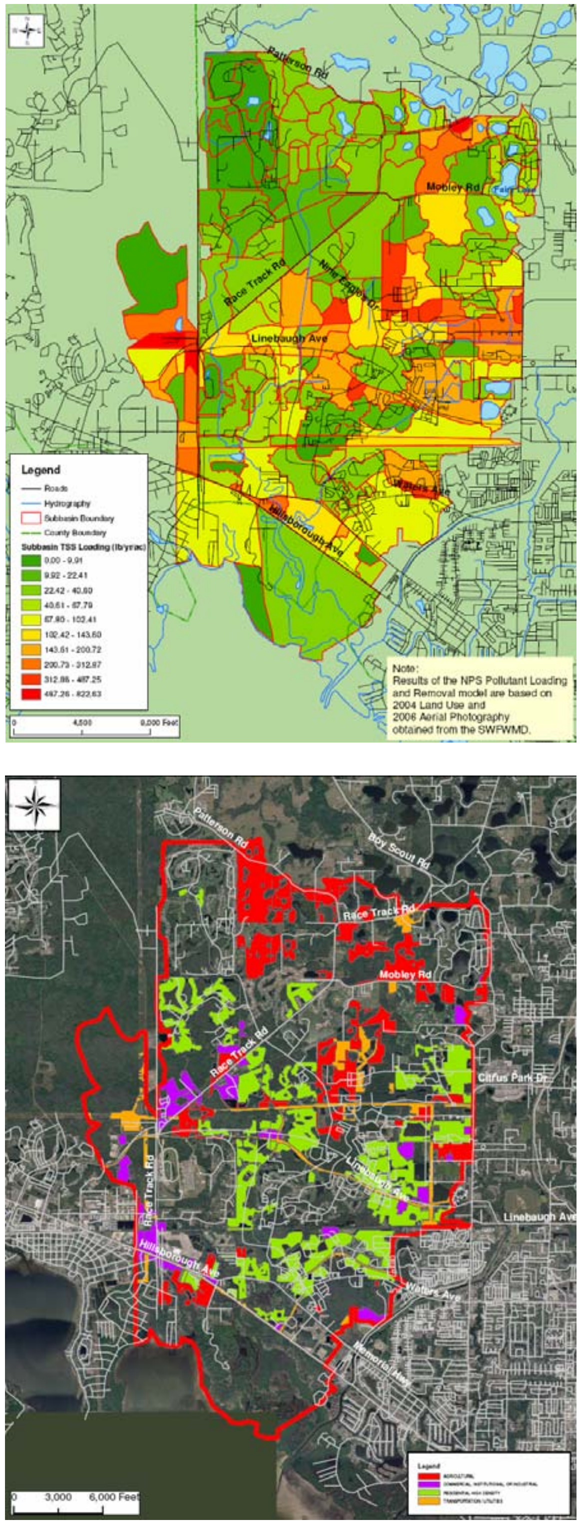


Figure 13-5 Visual Correlation between Land Use and High Concentrations of TSS

13.1.3 Other Contamination Sources - Brownfield Sites, Superfund sites, Sewage and Solid Waste Treatment Facilities

As Figure 13-6 shows, there are no Superfund sites within the Double Branch Creek watershed.

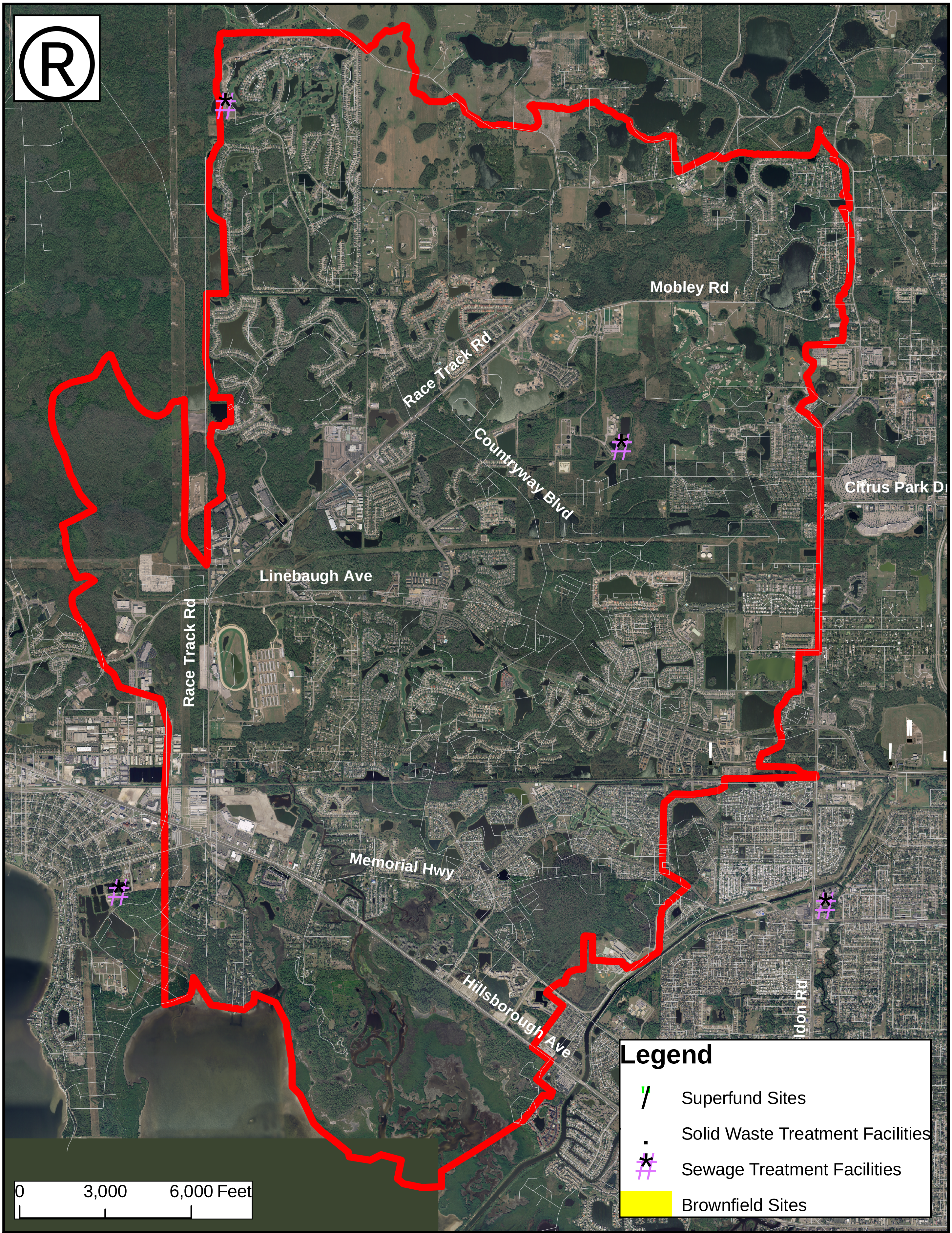
The watershed also does not contain brownfield areas (Figure 13-7).

As Figure 13-6 shows, a solid waste treatment facility is located west of Sheldon Road and north of Waters Avenue. This is a TECO composting facility that has been closed since April of 1986.

One sewage treatment facility is located in the central-eastern part of the Double Branch watershed. The Northwest Regional Water Reclamation Facility, located in Odessa, Florida, was designed for flow of 5.0 MGD and an annual average daily flow of 0.3 MGD. Treatment of the wastewater includes screening, degritting, the Bardenpho ® process, filtration, chlorination, dechlorination using sulfur dioxide, and reaeration. After treatment the effluent is discharged into the Class III fresh waters of Rocky Creek via Channel A (ftp://ftp.dep.state.fl.us/pub/labs/lds/reports/1589.pdf).

The Northwest Regional Water Reclamation Facility is currently undergoing the expansion from 5.0 to 10.0 MGD. This project is scheduled to be completed in 2010 (http://nwrwrf-expansion.com/files/schedule/schedule.pdf).

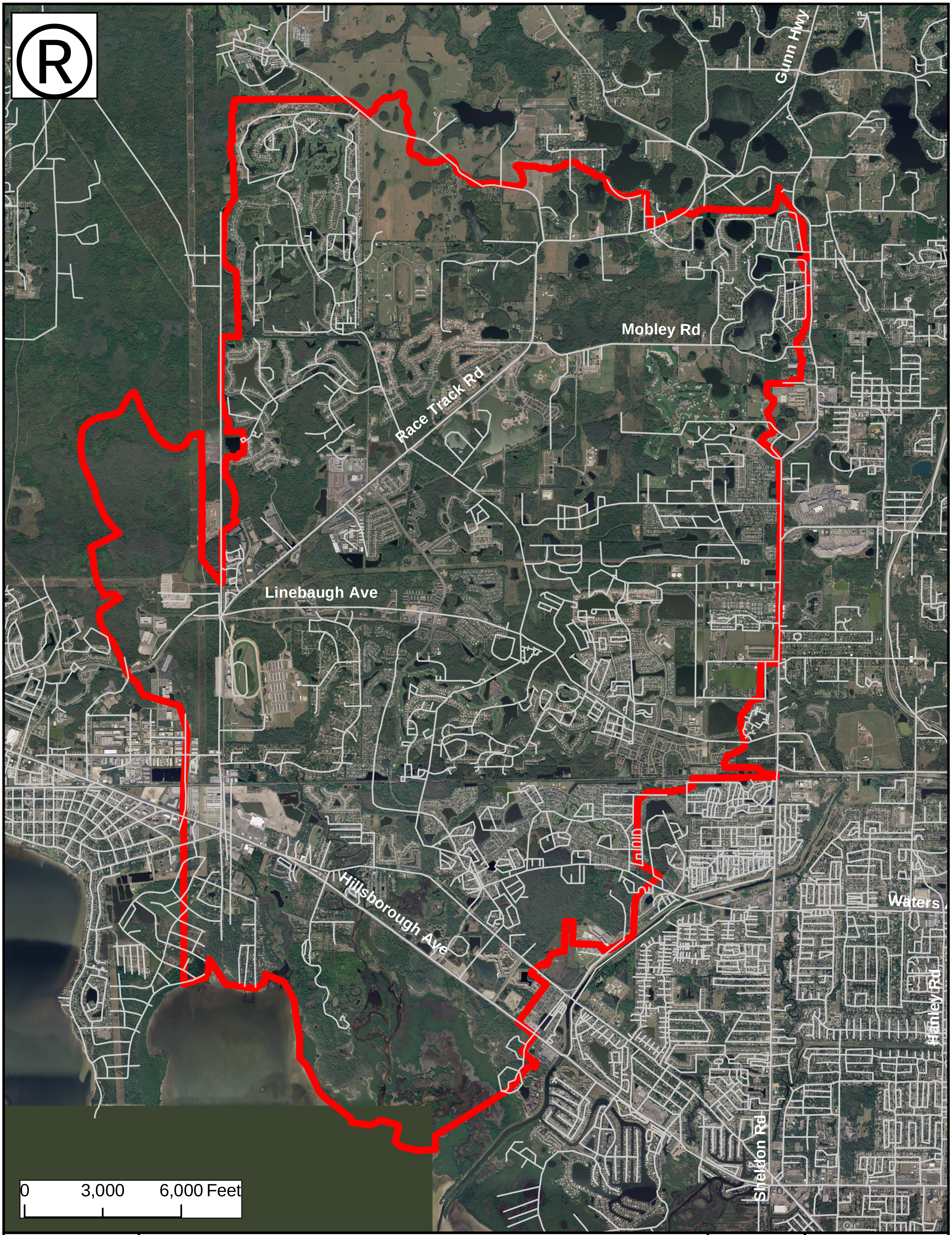
See Appendix 13-1 for additional information.



Other Contamination Sources in the Double Branch Creek Watershed

Figure 13-6

AYRES ASSOCIATES



Brownfield Sites in the Double Branch Creek Watershed

Figure 13-7

13.2 Bibliography

The attached bibliography includes a list of references used for this study and additional references that could be cited by readers.

Giesy, R., de Vries, A., Zylstra, M., Kilmer, R., Bray, D., Webb, D. 2003. *Florida Dairy Farm Situation and Outlook 2003*. Department of Animal Sciences, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Document No. AN138. Gainesville, Florida.

US EPA, 2002. *Agriculture - Dairy Production*. Purdue Research Foundation, West Lafayette, Indiana. (http://www.epa.gov/agriculture/ag101/printdairy.html).

CHAPTER 14: SITE ANALYSIS FOR POTENTIAL STRUCTURAL ALTERNATIVES

14.1 Overview

This chapter describes a series of structural alternatives that could potentially be used to improve water quality and natural systems for the Double Branch Creek watershed. A series of analyses were performed using GIS to strategically locate water quality and natural systems alternatives. The methods used to identify these projects are also described.

Water quality conditions were evaluated using the County's Water Quality Treatment Level of Service criteria and pollutant loading model. The alternatives have been developed to improve water quality and natural systems and address the goals of the county in these areas.

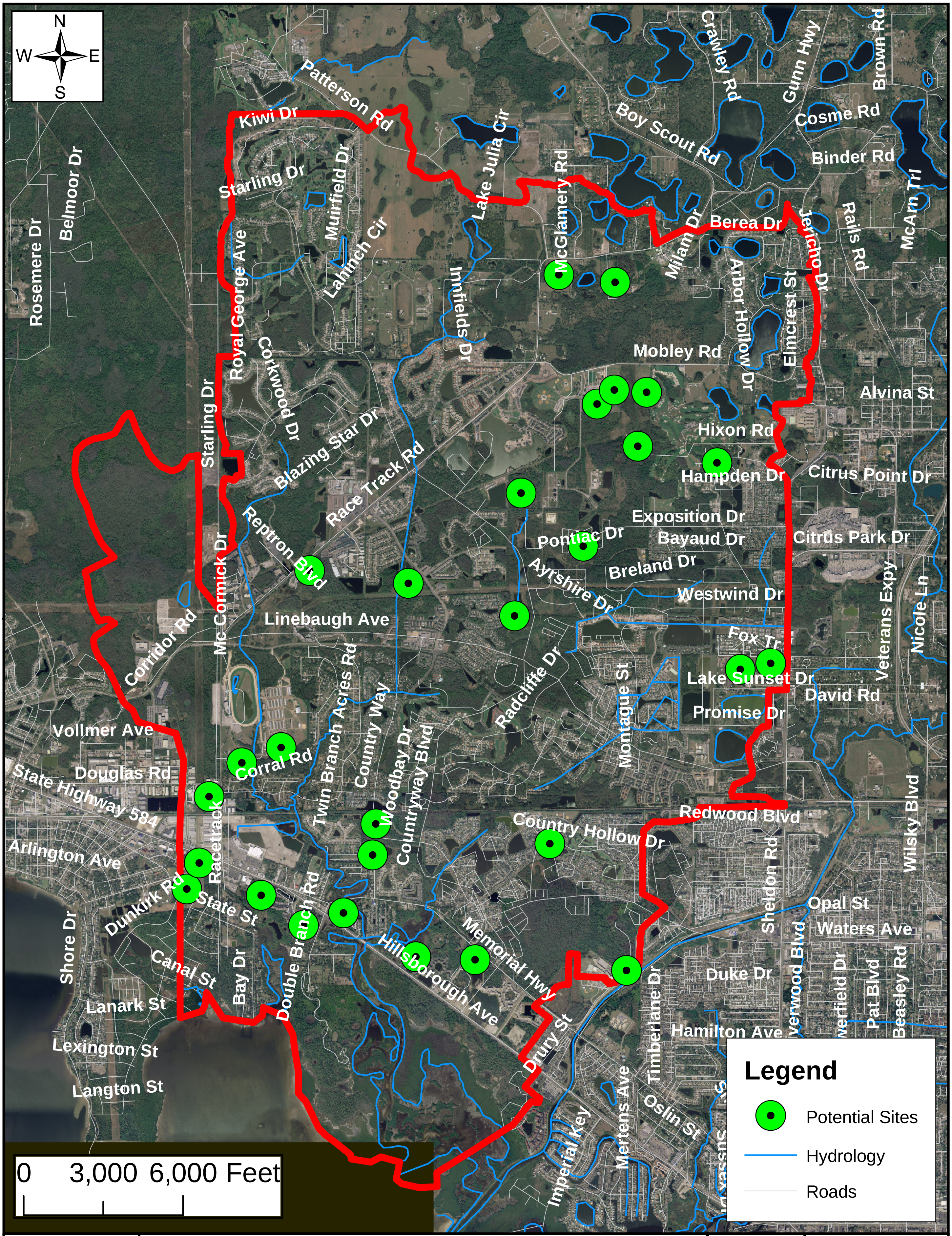
To facilitate locating undeveloped/open lands for construction of water quality treatment ponds, GIS land use data and most recent aerial photography were used to identify the most suitable and cost-effective sites within the watershed.

A similar methodology was used to identify potential wetland restoration areas within the Double Branch Creek watershed.

14.2 Identification and Prioritization of Sites

In order to determine the best possible locations for potential structural alternatives, analysis of the recent aerial photography (2006) of the area was conducted. The first step of the process involved visual identification of areas that could potentially serve as stormwater treatment locations or wetland restoration areas. In order to complete this task, aerial photographs were analyzed for location of areas/lands that appeared to be undeveloped and with sufficient areas suitable for installing a storm water basin. This analysis produced 28 locations for potential structural alternatives (Figure 14-1). This study did not include a comparative analysis for different types of treatment for water quality improvement (e.g., alum treatment, detention ponds).

In order to treat surface water effectively, it is beneficial to position alternatives in close proximity to a major stream network, in order to treat larger quantities of water. For completion of this task, the alternatives were prioritized based on their proximity to the major stream network. Using a variety of ArcView 8.3 spatial analysis functions, a 500-meter buffer was created around the major stream network. Next, locations of potential structural alternatives sites identified in the previous step of the process, were divided into two categories based on whether they fall within the 500-meter buffer or outside of the major stream network buffer.



Potential Project Locations in the Double Branch Creek Watershed

Figure 14-1

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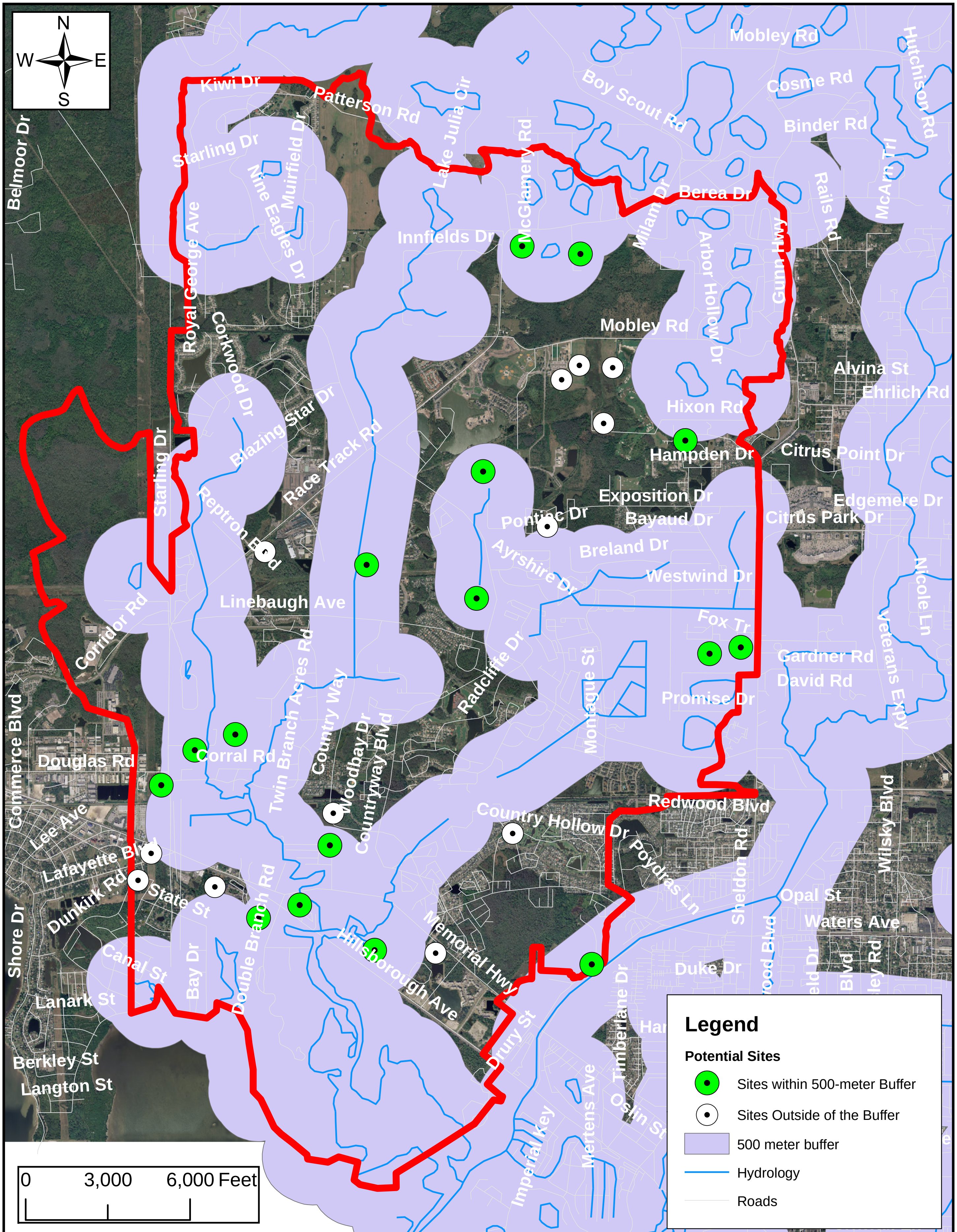
This step yielded 16 locations of potential structural alternatives that fall within 500 meters of the major stream network (Figure 14-2).

In order to verify that the sites we selected have no existing construction, land use information was used to identify locations classified as "open areas." In order to complete this task, the land use shapefile was analyzed and areas with FLUCFCS codes designating such land use categories as agricultural lands, open land, or upland forest were extracted as a separate layer. Next, 28 potential alternatives identified in the first step of the process were overlaid with the newly created "open areas" layer. Out of these locations, 11 fell within the "open areas" (Figure 14-3).

Whenever identifying a location for a new structural alternative, it is more appropriate to select parcels that are owned by the government and not private entities. Land acquisition process for the purpose of water quality and water quantity improvement is a process that is not only lengthy, but also very costly. Based on this fact, the alternatives were further prioritized based on their ownership. Hillsborough county parcels layer was used to identify lands that belong to governmental entities. In order to complete this task, we identified the Department of Revenue (DOR) Land Use codes that represent lands owned by the government (Governmental DOR Codes range between 80 and 89).

Once a new layer of "Governmentally owned lands" was extracted, we were able to separate the original 28 potential structural alternatives sites based on their ownership (governmentally owned lands vs. all others). This process identified a total of 8 potential parcels under government ownership that could potentially be utilized for stormwater treatment and wetland improvement purposes (Figure 14-4).

In order to identify the final selections, the results of all the steps of the aforementioned analysis were combined. In other words, while prioritizing the original 28 potential structural alternatives locations, more importance and consideration was given to locations that fell within the 500-meter buffer of the major stream network, that belonged to the "open areas" land use types, and that are owned by the governmental entities. Unfortunately, no original sites corresponded to all four criteria, therefore field inspection was conducted for those locations that fell within 500-m hydrologic buffer and either identified as "open land" category OR were governmentally owned (Figure 14-5). A total of eight sites were inspected for possibility of potential treatment alternative.



Double Branch Creek Watershed - 500 meter Buffer from Streams

Figure 14-2

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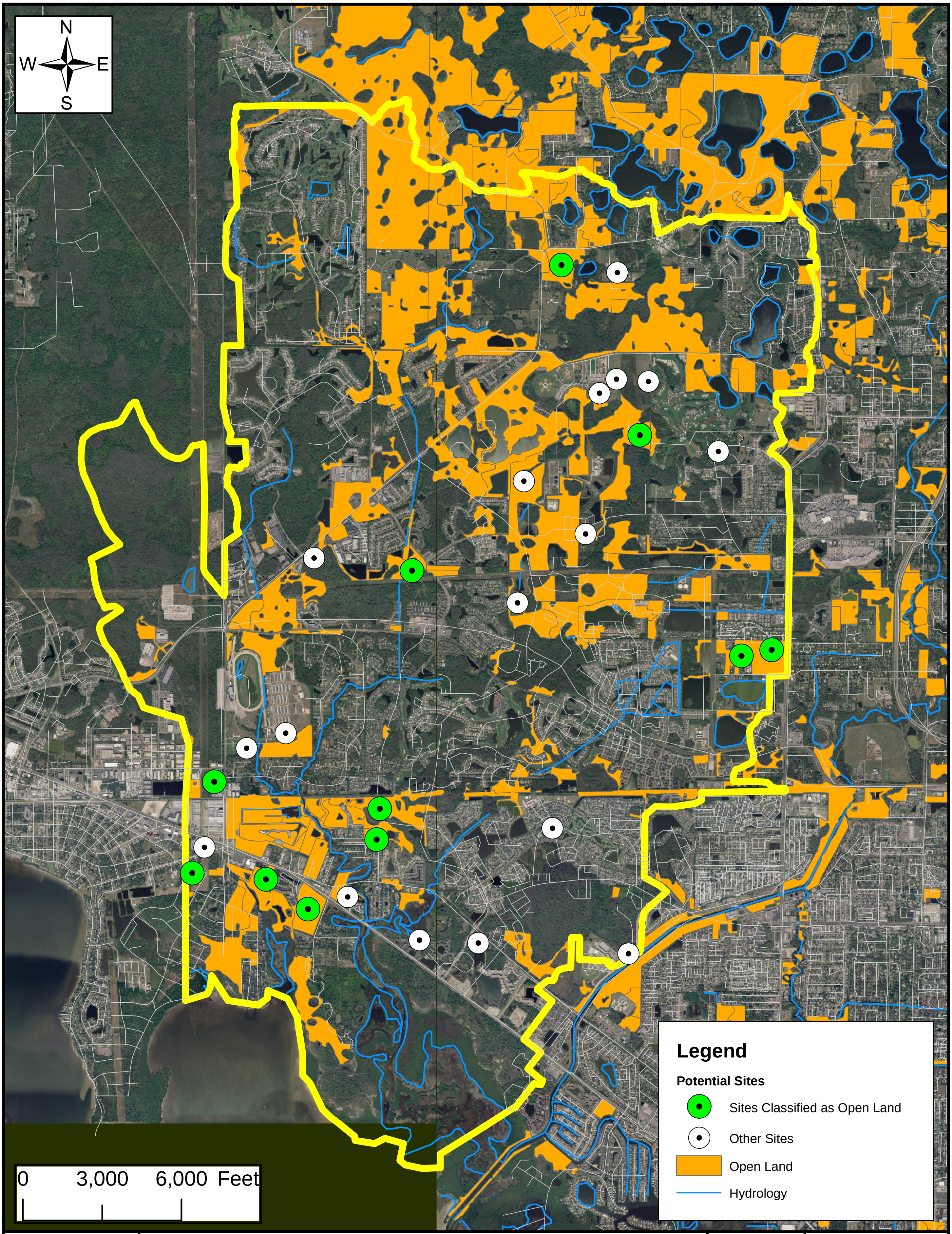
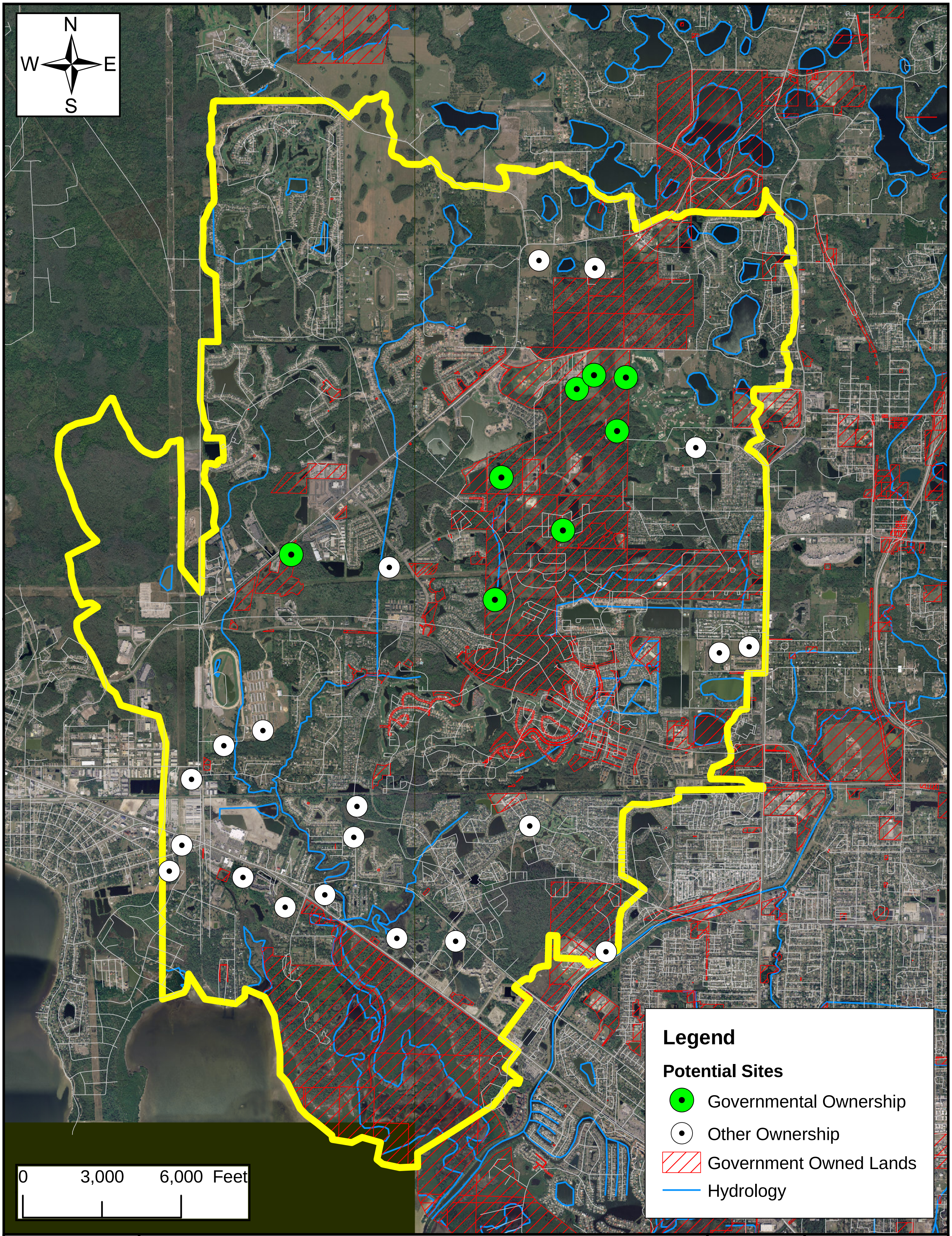


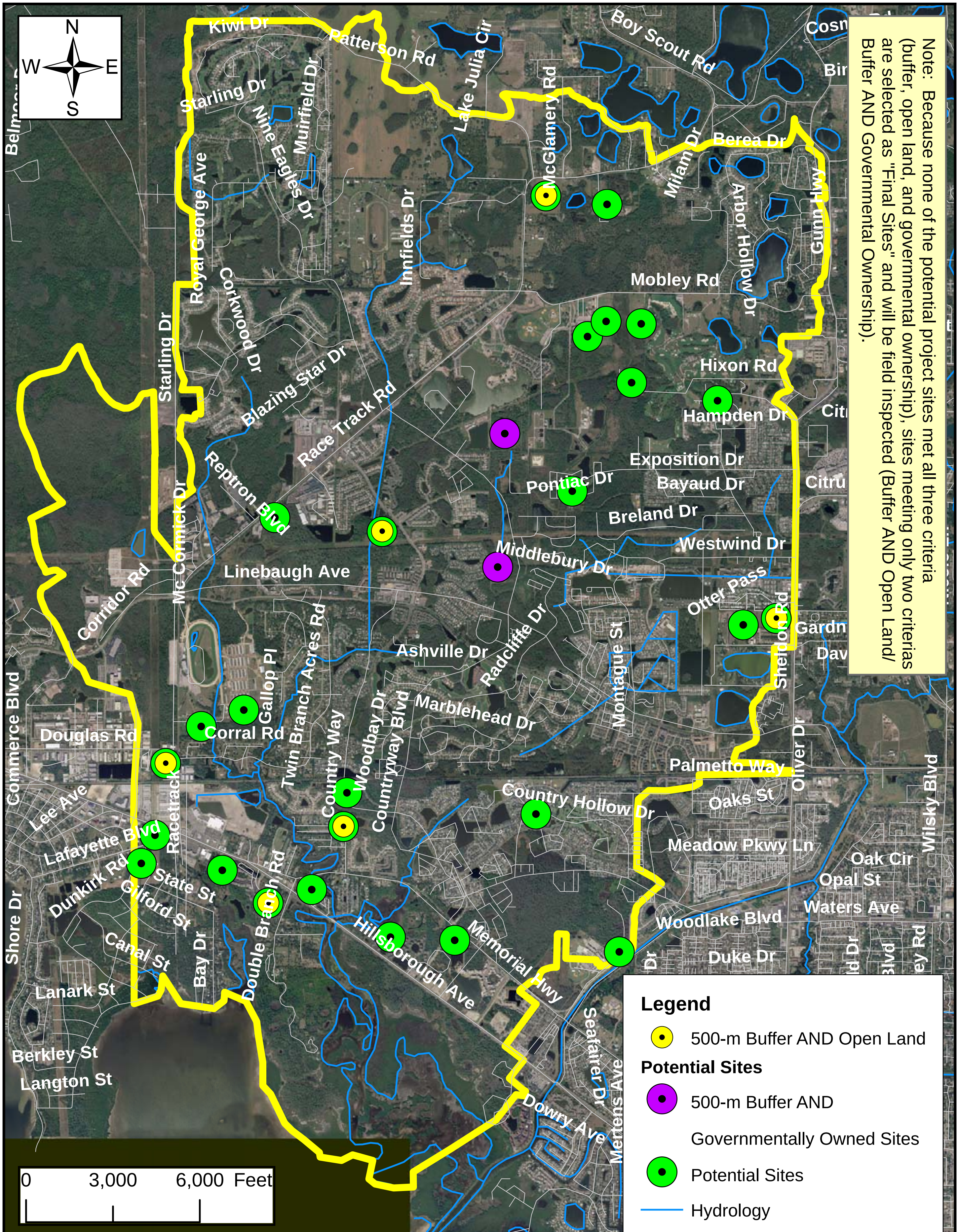
Double Branch Creek Watershed - Open Areas	Figure 14-3	AYRES ASSOCIATES



Double Branch Creek Watershed - Government Owned Lands

Figure 14-4

AYRES ASSOCIATES



Double Branch Creek Watershed - Final Selection

Figure 14-5

AYRES ASSOCIATES

14.2.1 Potential Project Site 1: Double Branch

Potential project site 1 is located in the southern portion of the Double Branch watershed (Figure 14-6). It is represented by a large parcel approximately 10 acres located in the southwest corner of Hillsborough Avenue and Double Branch Road intersection. It is located in close proximity of the major stream network. While the parcel is not governmentally owned, and therefore land acquisition may be required, it was classified as "open land" during the previous analysis and contains no built up features.

Based on analysis of the aerial photography and other GIS information, this location exists in the area that contributes large amounts of surface water pollution. Based on its size, proximity to the stream network, and land use classification, this location may be utilized for construction of a water treatment system.

14.2.2 Potential Project Site 2: River

Potential project site 2 is also located in the southern portion of the Double Branch watershed (Figure 14-7). It is represented by an approximately five-acre-parcel located near the junction of North River Road and Four Wheel Drive. The nearest major intersection is Hillsborough Avenue and Old Memorial Highway. It is located in close proximity of the major stream network. While the parcel is not governmentally owned, and therefore land acquisition may be required, it was classified as "open land" during the previous analysis and contains no built up features.

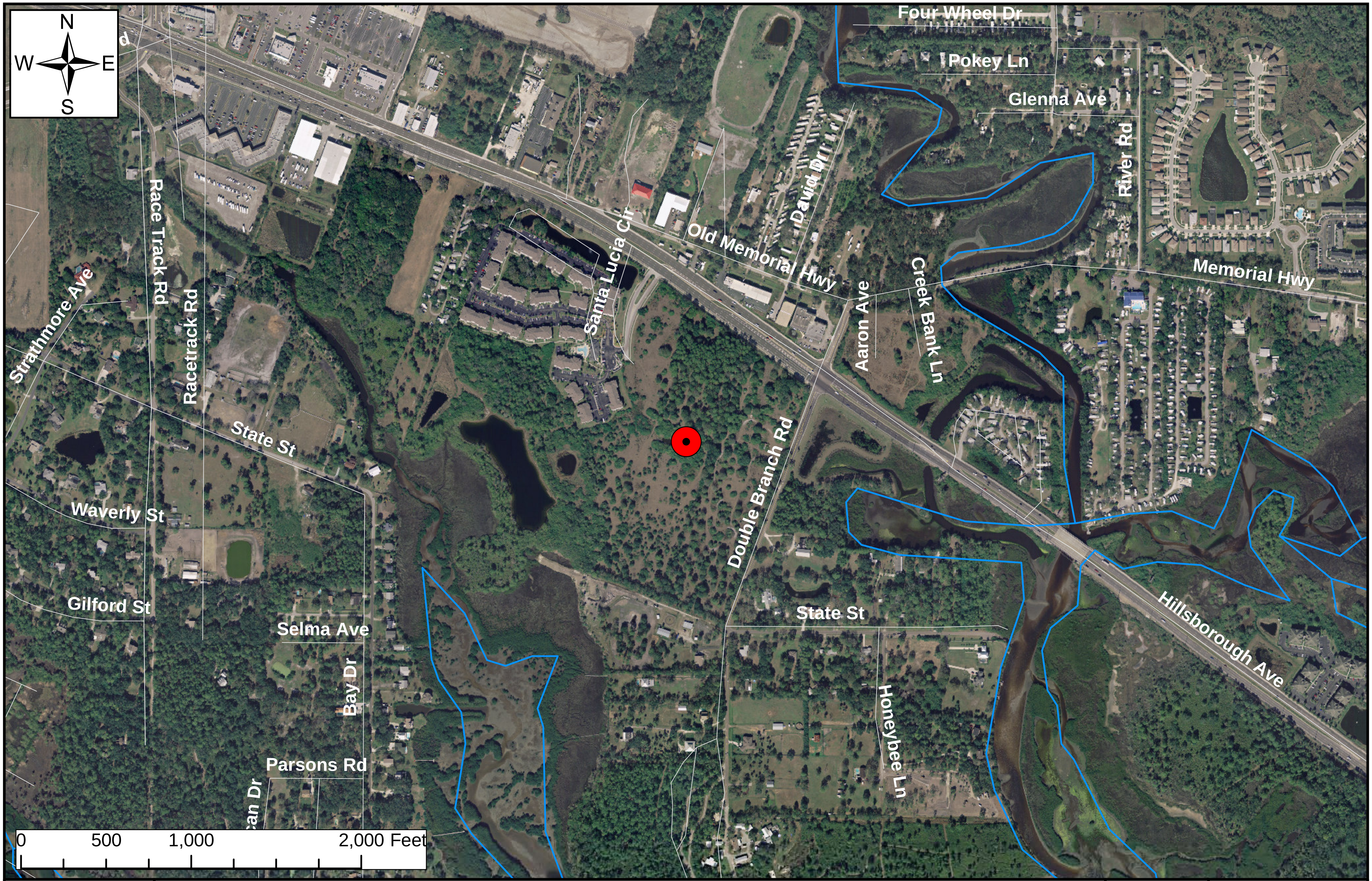
Based on analysis of the aerial photography and other GIS information, this location exists in the area that contributes large amounts of surface water pollution. Based on its size, proximity to the stream network, and land use classification, this location may be utilized for construction of a water treatment system.

14.2.3 Potential Project Site 3: Douglas

Potential project site 3 is located in the western part of the Double Branch watershed (Figure 14-8). This location is represented by a small parcel located at the southwestern corner of the Douglas Road and Race Track Road intersection. While the size of the parcel is relatively small, aerial photography shows possibility of a small wetland in the western part of the parcel. This parcel was classified as Open Land during the previous step of the analysis. However, it is privately owned and therefore land acquisition would be required. Field inspection will be conducted in order to determine the possibility of a water treatment system at this location.

14.2.4 Potential Project Site 4: Citrus/Country

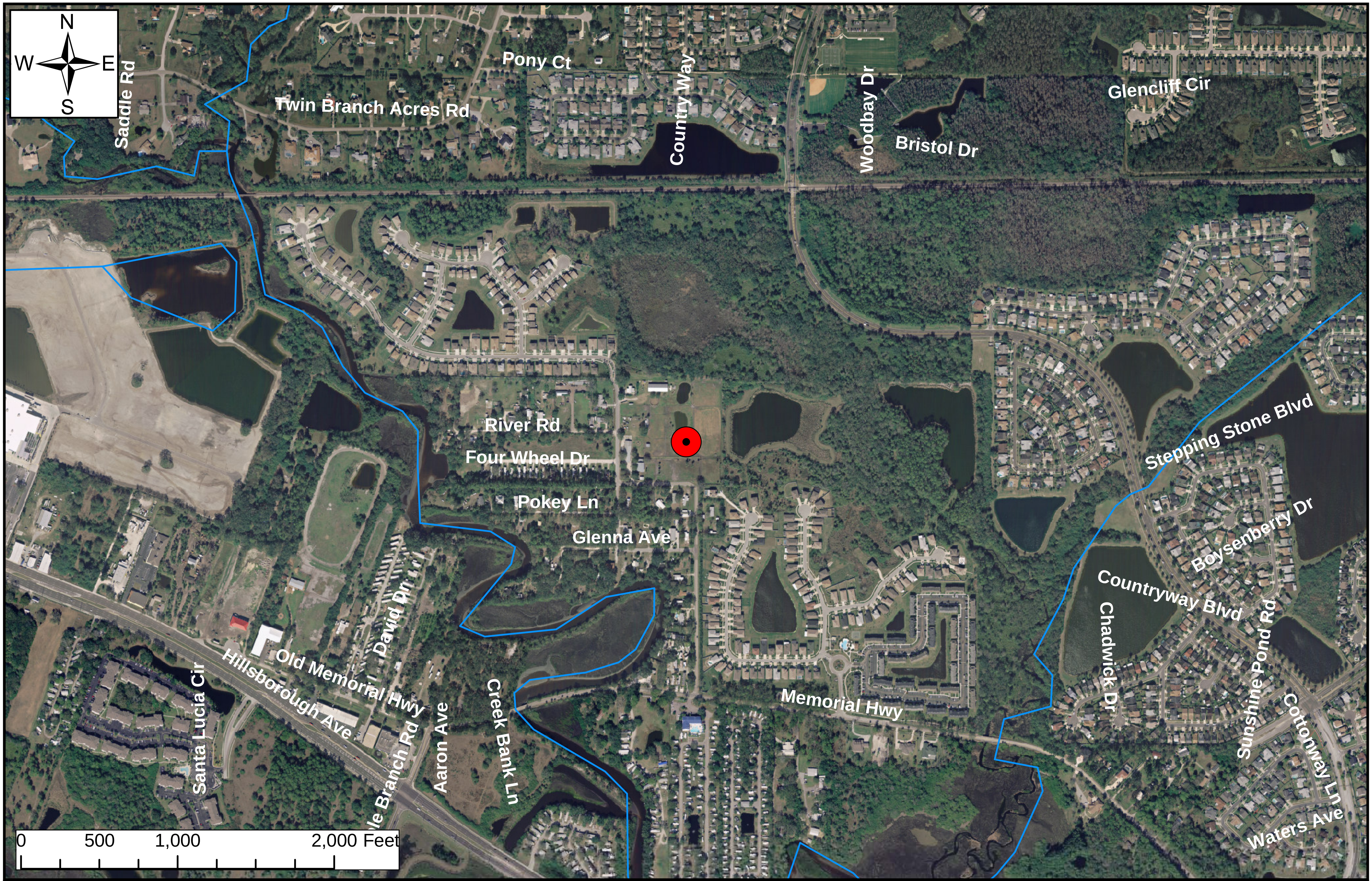
Potential project site 4 is located in the central portion of the Double Branch watershed (Figure 14-9). This parcel is located at the Countryway Boulevard and Citrus Park Drive intersection. The parcel is almost 10 acres in size and is located within close proximity to a major stream feature.



Potential Project Site 1: Double Branch

Figure 14-6

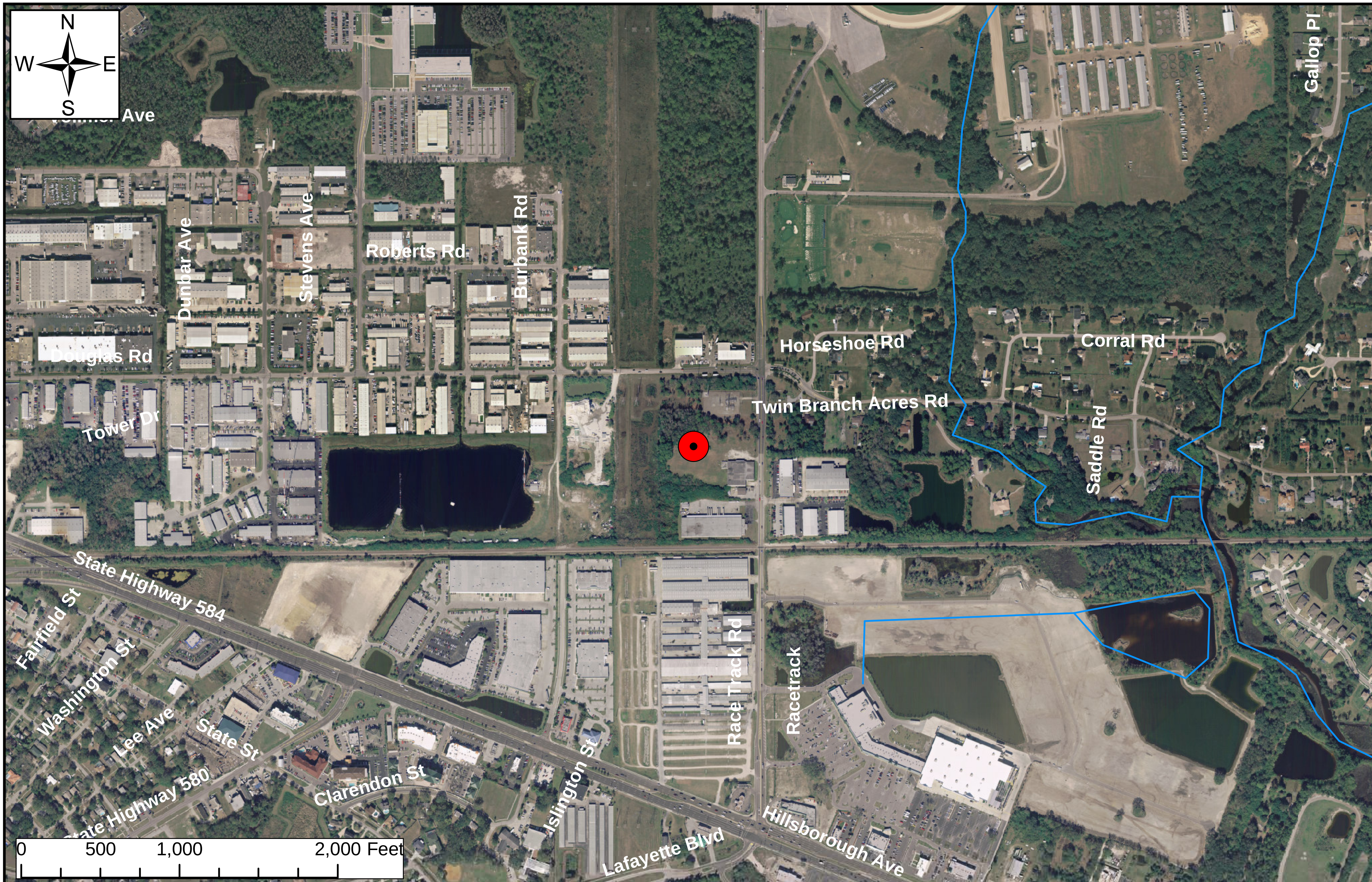
AYRES ASSOCIATES



Potential Project Site 2: River

Figure 14-7

AYRES ASSOCIATES



Potential Project Site 3: Douglas

Figure 14-8

The area is surrounded by many residential neighborhoods that contribute large amounts of pollutants into the watershed surface waters. Because this area is not governmentally owned, land acquisition may be required. The area's size, openness, and proximity to the steam network make it an acceptabale candidate for a possible water treatment system.

14.2.5 Potential Project Site 5: Countryway 1

Potential project site 5 is located in the central part of the Double Branch watershed (Figure 14-10). It is represented by a relatively large elongated parcel (approximately 5 acres) located to the west of the Countryway Boulevard and Citrus Park Drive intersection. The site is located in close proximity of the major stream network. This parcel is an ideal candidate for a potential water treatment site because it is located in an area surrounded by many residential neighborhoods contributing high loads of pollutants into the watershed surface waters.

Based on its size, proximity to the stream network, governmental ownership, and land use classification, this location may be utilized for construction of a water treatment system. A small wetland feature exists to the north of the parcel, which could be expanded for more effective water retention.

14.2.6 Potential Project Site 6: Countryway 2

Potential project site 6 is located in the central part of the Double Branch watershed (Figure 14-11). It is represented by a large wooded parcel (approximately 20 acres) located at the intersection of Lucky Me Lane and Whisper Lake Trail. The nearest major intersection is Race Track Road and Countryway Boulevard. The site is located in close proximity of the major stream network. This parcel is an ideal candidate for a potential water treatment site because it is located in an area surrounded by many residential neighborhoods contributing high loads of pollutants into the watershed surface waters.

Based on its size, proximity to the stream network, governmental ownership, and land use classification, this location may be utilized for construction of a water treatment system. A small wetland feature exists to the north of the parcel, which could be expanded for more effective water retention.

14.2.7 Potential Project Site 7: Race Track

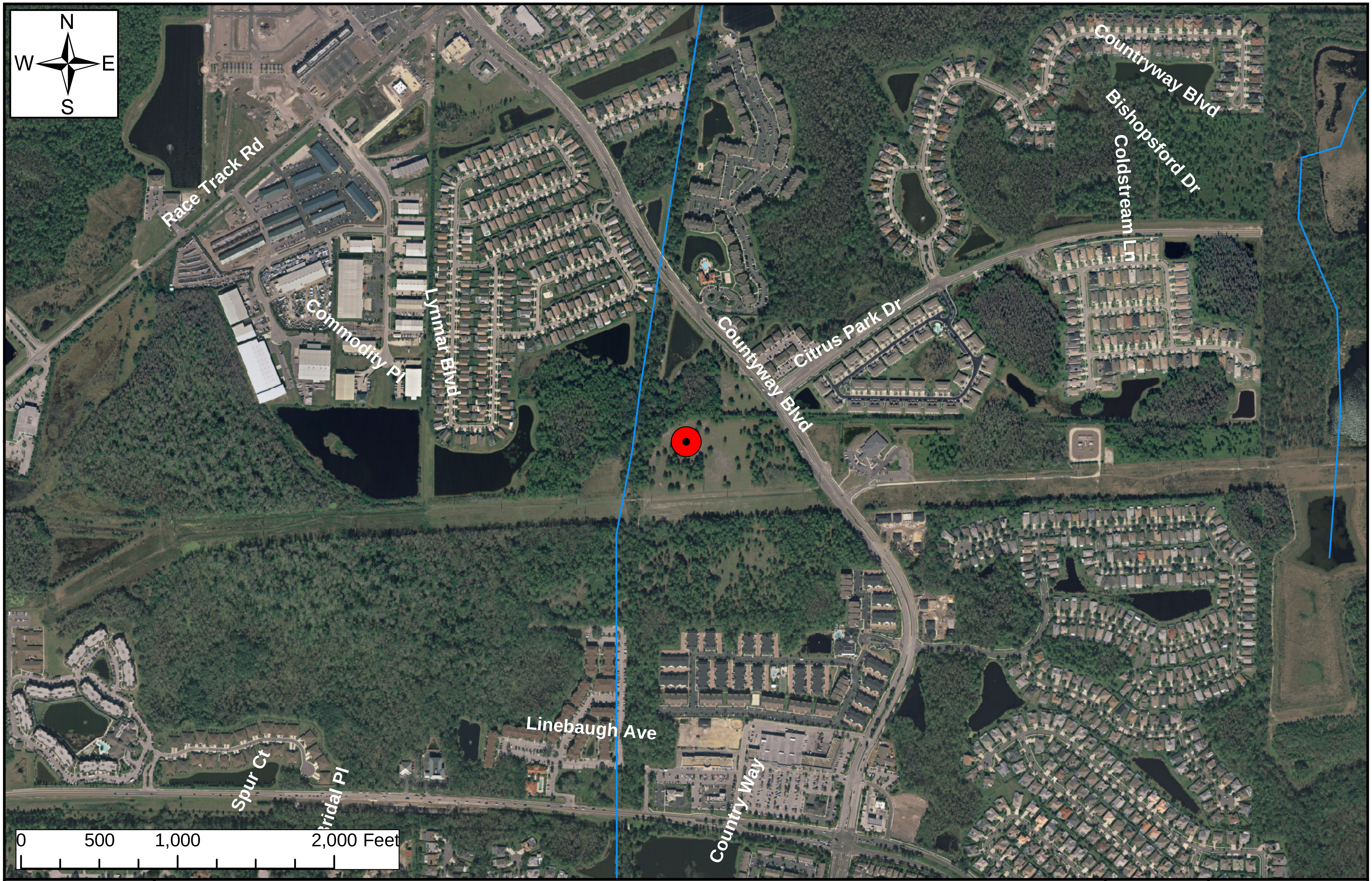
Potential project site 7 is located in the north part of the Double Branch watershed (Figure 14-12). It is represented by a large open parcel (approximately 10 acres) located at the intersection of Race Track Road and Patterson Road. The site is located in proximity of a stream network. This parcel is located to the north of the watershed, an area dominated by agricultural land use that contributes large amounts of nutrients into the watershed surface waters. The parcel is not governmentally owned and land acquisition would be necessary.

Based on the parcel's size, proximity to the stream network, and land use classification (open land), this location may be utilized for construction of a water treatment system.

14.2.8 Potential Project Site 8: Lake Sunset

Potential project site 8 is located in the east part of the Double Branch watershed (Figure 14-13). It is represented by two large open parcels (about 10 acres each) located at the intersection of Lake Sunset Drive and Sheldon Road. In addition to being located in close proximity to a major stream network, this parcel is surrounded by residential and up-built lands that contribute high amounts of pollutants into the watershed's surface waters. The sites are not governmentally owned and land acquisition may be necessary.

Based on the parcel's size, proximity to the stream network, and land use classification (open land), this location may be utilized for construction of a water treatment system.



Potential Project Site 4: Citrus / Country

Figure 14-9

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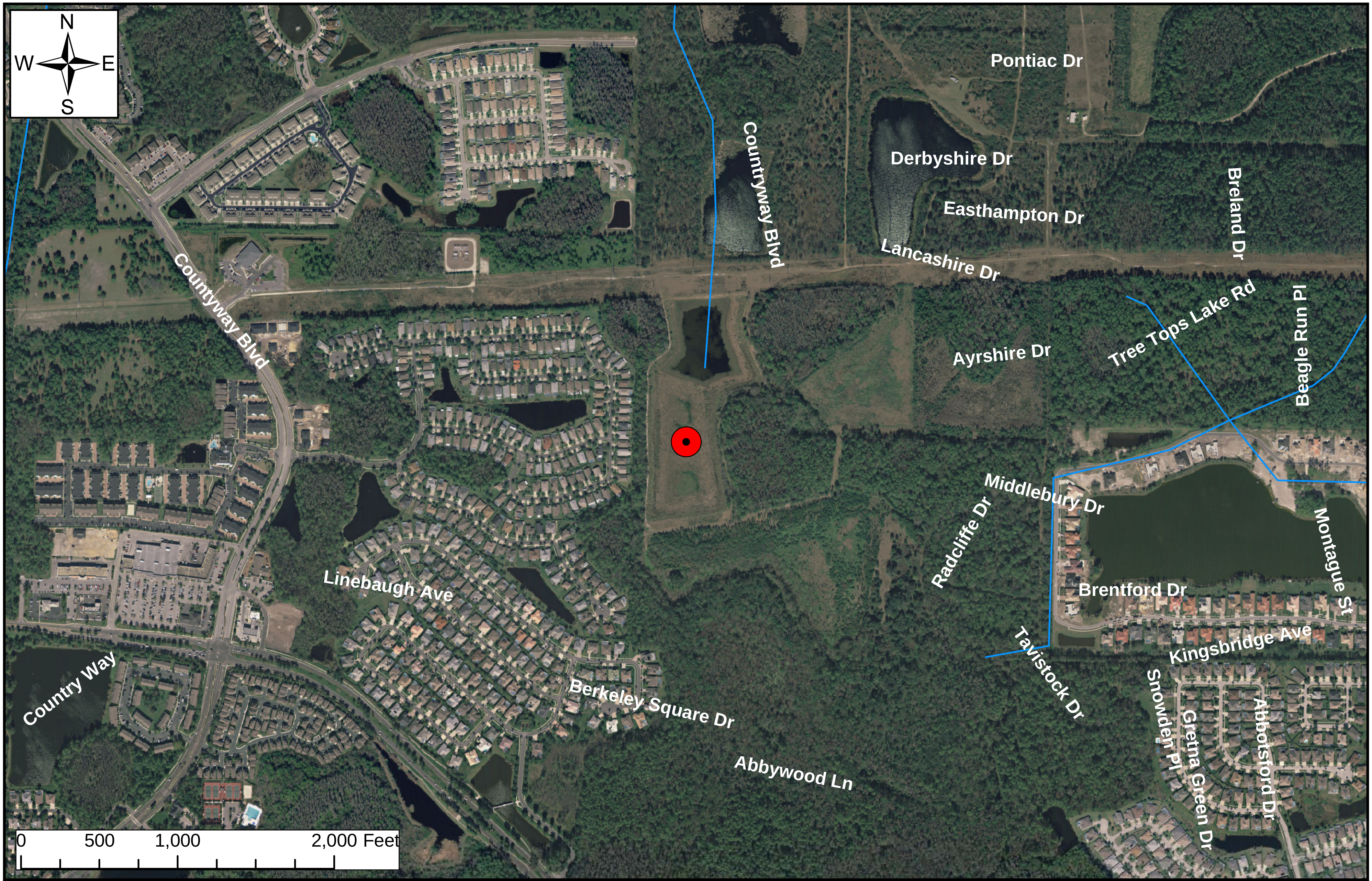
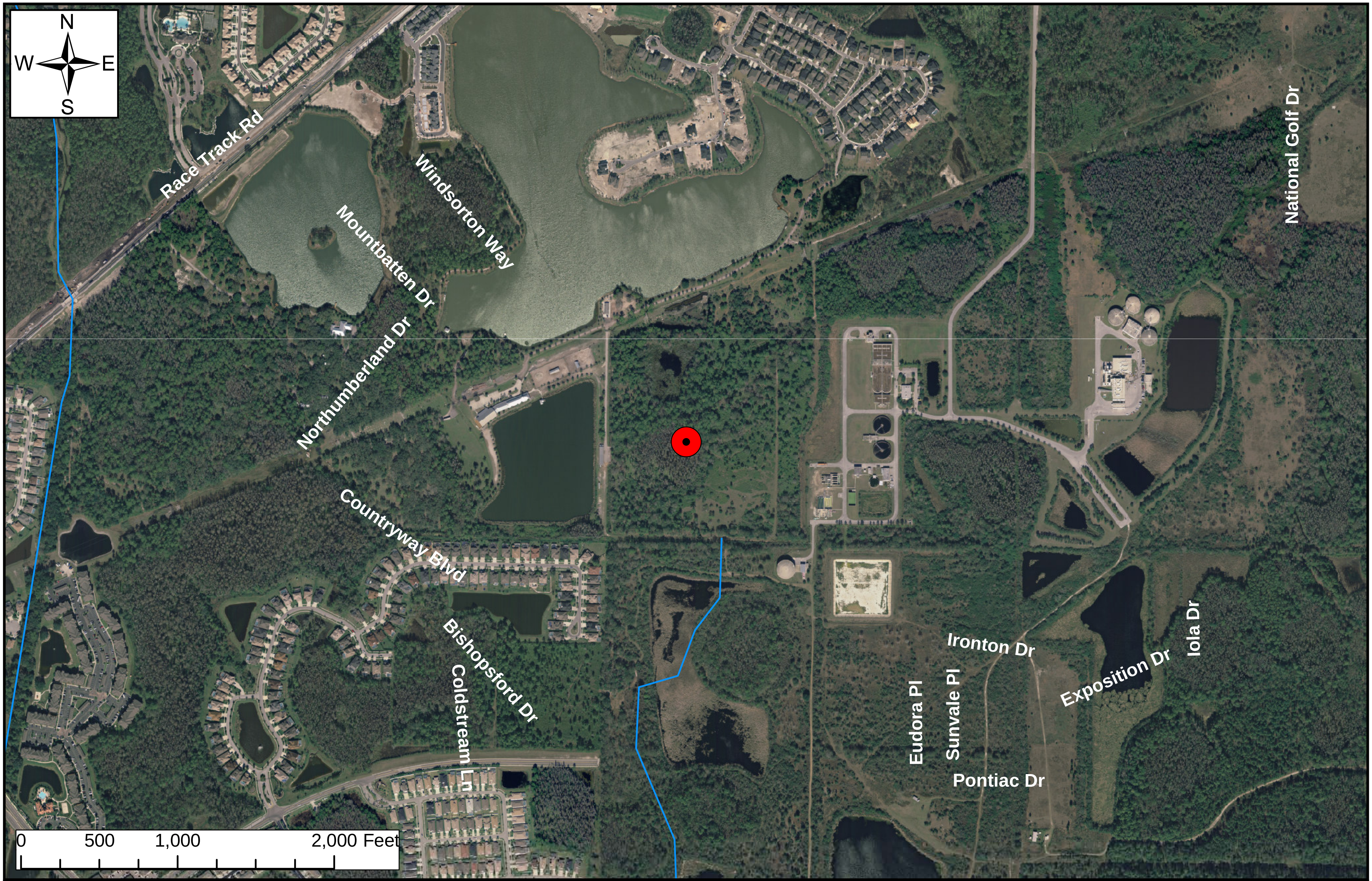


Potential Project Site 5: Countryway 1

Figure 14-10

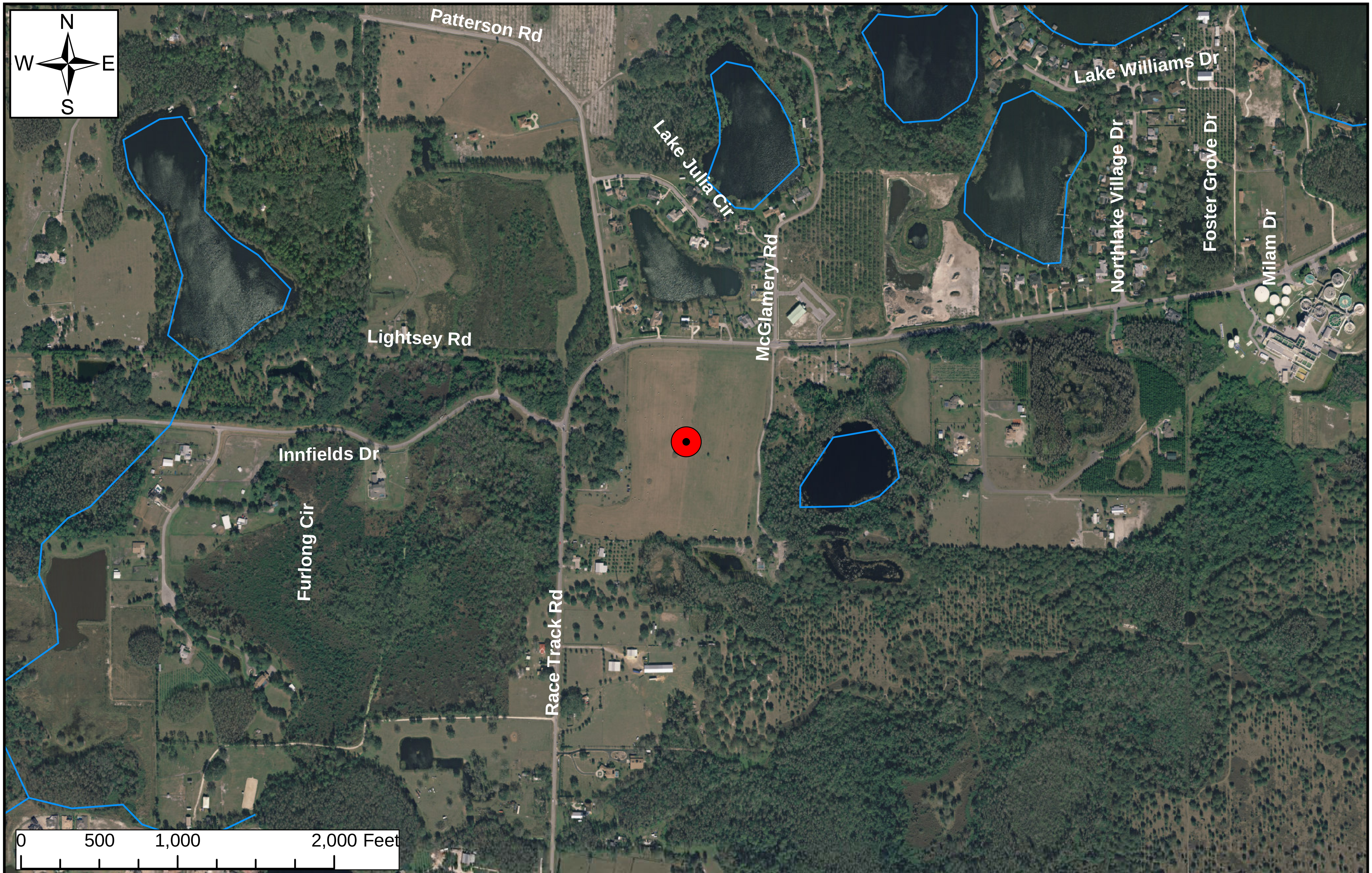
AYRES ASSOCIATES



Potential Project Site 6: Countryway 2

Figure 14-11

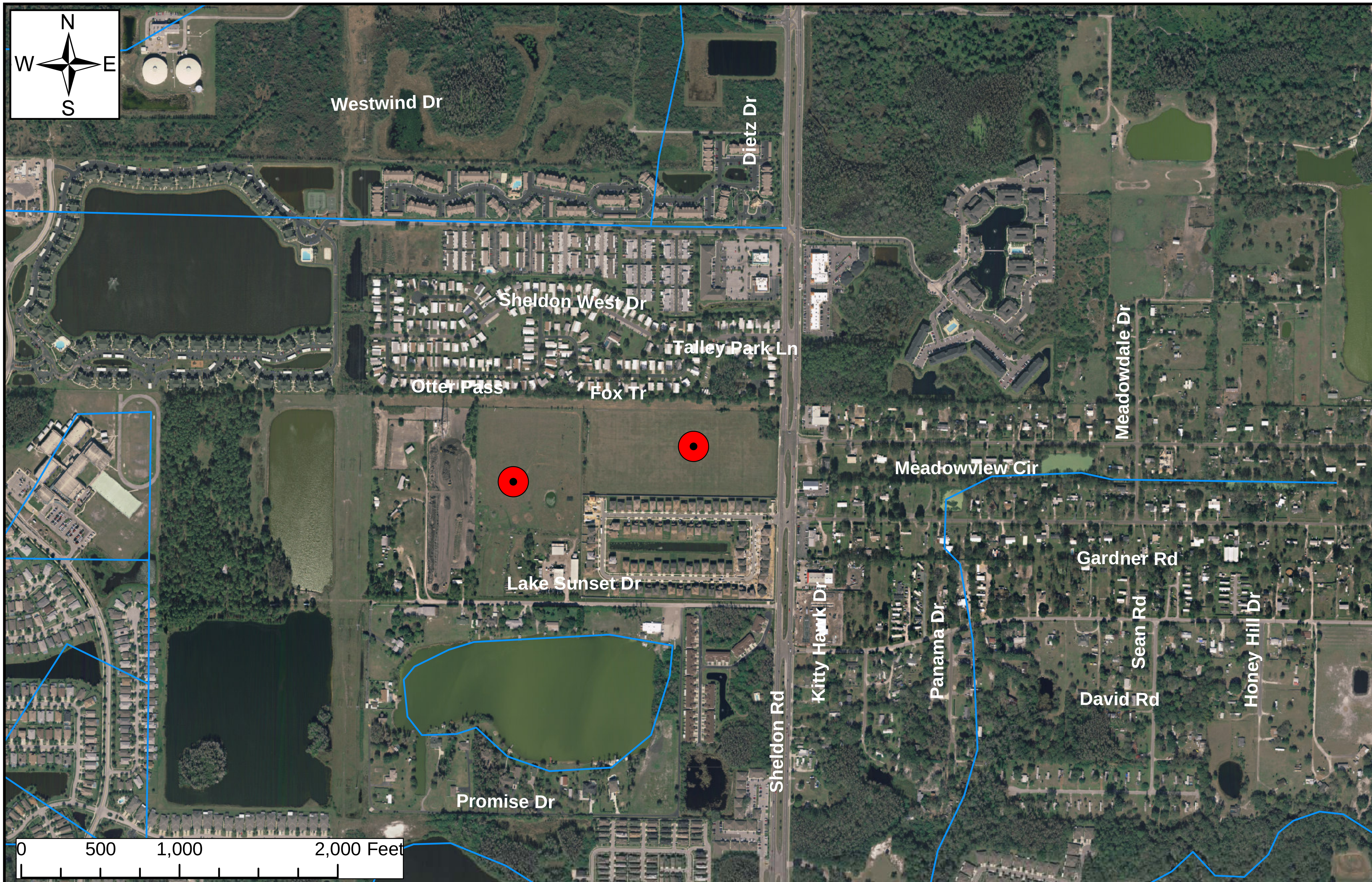
AYRES ASSOCIATES



Potential Project Site 7: Race Track

Figure 14-12

AYRES ASSOCIATES



Potential Project Site 8: Lake Sunset

Figure 14-13

AYRES ASSOCIATES

14.3 Field Inspection of Potential Sites

14.3.1 Potential Project Site 1: Double Branch

This parcel is located at the corner of Double Branch Road and Hillsborough Avenue. Field inspection identified it as a very large undeveloped and heavily wooded parcel. An open land area is visible in the center of the parcel. There is no visible sign of a wetland feature, therefore wetland improvement / expansion project would not be possible. Billboards and signs located on the property indicate that it may be zoned for commercial development. There are also signs of some exotic plants (Brazilian pepper) on the premises.

Although this site is privately owned and land acquisition costs may be substantial, it should be considered as a potential water quality project improvement location. The size of the site and its openness would allow for construction of a substantially sized retention pond.

14.3.2 Potential Project Site 2: River

This parcel is located at the corner of North River Road and Four Wheel Drive. Field inspection identified it as a large parcel utilized for agricultural and pasture purposes. The land is mostly open with a small wetland feature in the center of the property. The area is fenced out; what appears to be a stable is located to the west of the property. This site is surrounded by a number of residential subdivisions that contribute various pollutants into the watershed's surface waters.

Although this site is privately owned and land acquisition costs may be substantial, it should be considered as a potential water quality project improvement location. The size of the site and its openness would allow for construction of a substantially sized retention pond.

14.3.3 Potential Project Site 3: Douglas

This parcel is located at the corner of Douglas Road and Race Track Road. Field inspection identified it as a small undeveloped and heavily wooded parcel (pine and live/water oak present). An open land area is visible in the center of the parcel and a small wetland feature appears on edge of the property (bald cypress dome is present). This location may have been zoned for development. The location is in close proximity to a small power transfer station.

Although this site may be privately owned and land acquisition may be required, this site should be considered as a potential water quality improvement project location. The size of the site and its openness would allow for a water retention system or a wetland improvement/expansion project.

14.3.4 Potential Project Site 4: Citrus/Country

This site is located at the intersection of Countryway Boulevard and Citrus Park Drive. This is a large upland tract that could easily encompass a structural BMP. The parcel is partially wooded with pines, palmetto, and underbrush. The size and location of the parcel make it a perfect location for a large treatment pond. In addition, a small wetland is located in the center of the site. The area is fenced out and is privately owned; however, the size of the site, the lack of built-up features, and its proximity to the stream network make it a good choice for a potential water quality structural alternative.

The size of the site allows for construction of a large retention/treatment pond and existence of a small wetland offers a possibility of a wetland improvement project. This site is also surrounded by many residential neighborhoods and may provide much needed water quality improvement to the surrounding areas.

14.3.5 Potential Project Site 5: Countryway 1

Staff was unable to access this site.

14.3.6 Potential Project Site 6: Countyway 2

While aerial photography inspection identified this location as an acceptable site for a structural alternative, field inspection determined the site is difficult to access and is located in close proximity to a large existing pond. This location will not be further considered for a potential water treatment site.

14.3.7 Potential Project Site 7: Race Track

This site is located at the intersection of Race Track Road and Patterson Road. This is a large open parcel that could easily encompass a structural BMP. The parcel is cleared and undeveloped, designated as pasture land. The size and location of the parcel make it a favorable area for a large treatment pond. No wetland features are visible on the site. The area is fenced out and is privately owned; however, the sized of the site, the lack of built-up features, and its proximity to stream network make it a good choice for a potential water quality structural alternative.

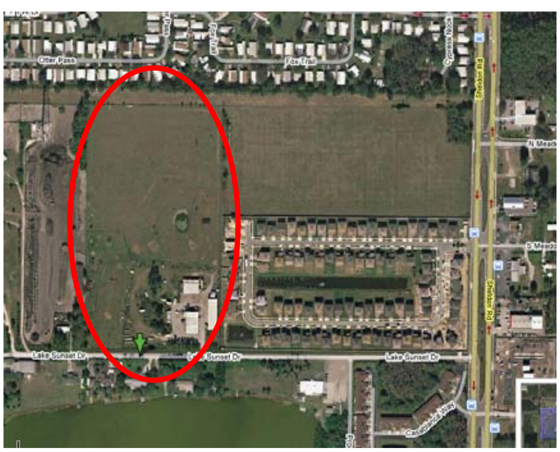
This site is located in the northern part of the Double Branch watershed – an area dominated by agricultural lands contributing large amounts of nutrients into the watershed's surface waters. A retention/treatment pond would provide much needed water quality improvement to the surrounding areas.

14.3.8 Potential Project Site 8: Lake Sunset

Site 1

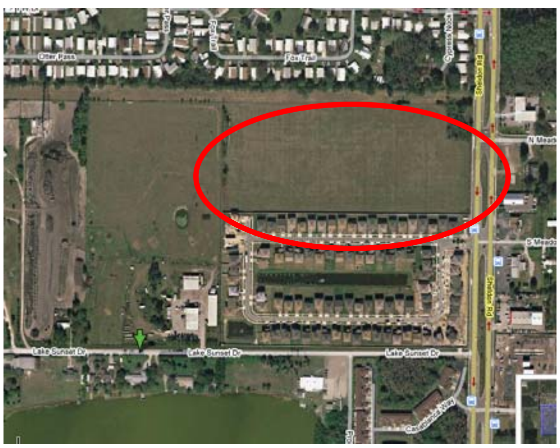
This site is located at the intersection of Lake Sunset Drive and Sheldon Road. This is a large open parcel that could easily encompass a structural BMP. The parcel is cleared and undeveloped. Land designation of this purpose is unclear, however the size and location of the parcel make it a favorable site for a large treatment pond. A small water feature is located in the middle of the site. The area is privately owned; however, the sized of the site, the lack of built-up features, and its proximity to a stream network make it a good choice for a potential water quality structural alternative.

This site is located to the east of the Double Branch watershed – an area dominated by residential and built-up lands contributing large amounts of pollutants into the watershed's surface waters. This particular site is adjacent to a two residential communities. A retention/treatment pond would provide much needed water quality improvement to the surrounding areas.



Site 2

This area is attached to the previous site. It is located on the other side of a residential neighborhood, directly along the Sheldon Road. Similarly to the previous parcel, this site is large in size, open (no built-up features visible), and is located in an area that is in need for water quality improvement. This site is large enough to encompass a substantial structural BMP, capable of providing the necessary water quality treatment.



CHAPTER 15: FINAL RECOMMENDATIONS

15.1 Overview

This chapter describes the final recommendations of the alternatives that were developed for water quality and natural systems for the Double Branch Creek watershed. Generally, two different sets of BMPs may be applied to reduce stormwater impact and/or improve water quality: (1) non-structural BMPs; and (2) structural BMPs. A combination of these two techniques may also be used. One of the most important elements of non-structural BMPs is public education. It focuses on preventative measures while structural BMPs mostly relies on existing or constructed systems for treating stormwater. Following are two sets of discussions associated with water quality improvement.

The first point of discussion will cover various resources for public education. An important part of a watershed management plan is public support and to help promote a greater awareness within the community regarding the importance of minimizing stormwater impacts by focusing on preventative measures.

The second section will discuss the proposed alternatives based on the series of analyses that were performed using GIS to strategically locate stormwater quality improvement facilities and natural systems alternatives enhancements.

15.2 Public Education

Various toolboxes, documents, programs, and information are available at the national agency level down to local governments regarding information on watersheds, water quality, stormwater runoff, and BMPs, which are designed to educate and inform the general public and students and faculty at educational institutions.

US EPA Watershed Outreach
http://www.epa.gov/owow/watershed/outreach/outreachnonjs.html

The Nonpoint Source (NPS) Outreach Toolbox is intended for use by state and local agencies and other organizations interested in educating the public on nonpoint source pollution or stormwater runoff. The Toolbox contains a variety of resources to help develop an effective and targeted outreach campaign.

US EPA - Public Education and Outreach on Stormwater Impacts

Because stormwater runoff is generated from dispersed land surfaces--pavements, yards, driveways, and roofs--efforts to control stormwater pollution must consider individual, household, and public behaviors and activities that can generate pollution from these surfaces.

Florida Department of Environmental Protection - Best Management Practices, Public Information, and Environmental Education Resources

http://www.dep.state.fl.us/Water/nonpoint/pubs.htm

Reports, brochures, handouts, videos, and training aids are available to governments, teachers, general public with ideas and resources to reduce and educate about non-point source pollution in Florida.

Southwest Florida Water Management District

http://www.swfwmd.state.fl.us/

SWFWMD has various educational and public education programs relating to watersheds and how to improve water quality.

Tampa Bay Water

http://www.tampabaywater.org/conservation/conservation.aspx

TBW website has links to documents regarding water conservation that will give ideas to member governments and the public in making a difference in conserving the region's water resources.

Pinellas County – Department of Environmental Management

http://www.pinellascounty.org/Environment/default.htm

The Water Resources Management Section is dedicated to public outreach and education. The sites offers outreach activities that range from answering citizens' questions and concern about their aquatic environment to formal presentations.

Hillsborough County Watershed Atlas

http://www.hillsborough.wateratlas.usf.edu/

The education section is geared towards educating the public about water resources and has links to access various documents, citizen based water management organizations, and classroom tools. There is an area for educators regarding watersheds and water quality with student activities and the general education section has documents and links to help citizens understand the data on the Atlas and teach about maintaining the health of area waterbodies.

Hillsborough County Stormwater Public Education Awareness Campaign (SPEAC)
This is an educational outreach program in which volunteers do monitoring, education, and restoration such as The Lake Management Program (LaMP), Streamwaterwatch, Adopt-A-Pond, Stormwater Ecologist, and Officer Snook.

Hillsborough County – Public Works- Adopt-A-Pond
http://www.hillsboroughcounty.org/publicworks/engineering/stormwater/adoptapond.cfm

Hillsborough County encourages the local community to take care of area lakes, creeks, and ponds. They feel the restoration or rehabilitation of stormwater ponds is essential to the health of local lakes, creeks, rivers and bays. This program educates the public about aquatic vegetation that can stabilize a pond and remove pollutants in order to help maintain water quality. The Adopt-A-Pond program shows how a properly designed pond may have increased wildlife habitat, recreation areas, and aesthetic views.

15.3 Proposed Alternatives

As is the case for most watershed management plans for water quality improvements and environmental enhancements, a combination of measures consisting of structural and non-structural alternatives are applicable depending on availability of resources and cost-effectiveness. Unless a comprehensive hydraulic and water quality analysis is performed, it will be difficult to determine the effectiveness of BMPs in improving water quality accurately. Nevertheless, these BMPs are expected to improve water quality.

15.3.1 Structural BMPs

In Chapter 14, a number of locations for potential structural BMPs were analyzed based on the following parameters:

- Visual identification
- Proximity to steam network
- Land availability
- Property ownership

After field review of every location described in Chapter 14, seven feasible locations for potential alternative sites were recommended for further consideration. This chapter contains a Summary Sheet for the seven locations described earlier:

- DBR1 – Lake Sunset 1
- DBR2 – Lake Sunset 2
- DBR3 – Double Branch
- DBR4 – River

- DBR5 – Douglas
- DBR6 – Citrus/Country
- DBR7 – Race Track

Summary sheets, located at the end of the chapter, contain such information as general description of the site based on the field visit, site location map in relationship to the Double Branch watershed, aerial view of the proposed site, and a cost estimate for pond installation at the proposed site. The cost estimate is based on the following assumptions:

- The costs are limited to the pond installation
- Ponds are assumed to be 5 feet deep, covering the largest possible area in the selected parcels

In addition, the cost estimates include sod covering a buffer of 30 ft around the pond perimeter, an inlet and outlet structure (just a rough market average price), a silt fence around the construction area, and a fence around the pond and gate.

Cost estimates are based on August 16, 2007 Hillsborough County Unit Price (WORCS), and as noted, some unit costs are based on estimated market prices. If a pre-design analysis is required, its associated cost needs to be added to the project cost (approximately 15 to 20 percent of the total project cost).

It should be noted that since a water quality analysis could not be performed as part of this project, it is recommended that such a task be performed during the design process. The results of such analysis may suggest adjustments to sizing of the system, consequently changing the project cost. Furthermore, the availability of recommended sites may change over time. Therefore, prior to initiating any project, a complete investigation is recommended to identify legal, financial, and other constraints that could not be identified under this study.

15.3.2 Non-Structural BMPs/Public Outreach and Education

There are various state and local agencies that provide educational and outreach materials for the public at large and academic institutions. Experience has shown that teaching student populations from early years in elementary school is the most effective way of producing citizens who are respectful of quality of life issues and the environment. It is recommended that the County form a partnership with schools to provide them with educational materials to assist teachers in classroom instruction. The County should also provide volunteer staff to participate in teaching days during the academic year to explain the importance of preventing water pollution and improving water quality to the students and teachers.

DBR-1 Lake Sunset 1

This alternative is located at the intersection of Lake Sunset Dr and Sheldon Rd. This large, open parcel is cleared and undeveloped and could easily encompass a structural BMP. Land designation of this purpose is unclear; however, the size and location of the parcel make it a good site for a large treatment pond. A small water feature is located in the middle of the site. The area is privately owned; however, the size of the site, the lack of built-up features, and its proximity to the stream network make it a good choice for a potential water quality structural alternative.

This site is located in the eastern part of the Double Branch watershed – an area dominated by residential and built-up lands contributing large amounts of pollutants into the watershed's surface waters. This particular site is adjacent to a two residential communities. A retention/treatment pond would provide much needed water quality improvement to the surrounding areas.

Site Photo & Location Map

CONCEPTUAL OPINION OF PROBABLE CONSTRUCTION COST
SITE ID: DBR 1

ITEM#	DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST	NOTES
101-1	MOBILIZATION	LS	$ 19,000.00	1	$ 19,000.00	(1)
102-1	MAINTENANCE OF TRAFFIC	LS	$ 3,000.00	1	$ 3,000.00	(1)
110-1-1	CLEARING AND GRUBBING	AC	$ 11,000.00	14.74	$ 162,085.00	(2)
104-13	SILT FENCE STAKED	LF	$ 1.63	3,500	$ 5,705.00	(1)
120-1	EXCAVATION REGULAR	CY	$ 10.73	118,861	$ 1,275,383.09	(1)
550-2	FENCING, TYPE B	LF	$ 17.00	3,600	$ 61,200.00	(1)
550-76-162	FENCE GATE (TYPE B) (DOUBLE 8') (16' OPENING)	EA	$ 977.73	1	$ 977.73	(1)
575-1-1	SODDING (BAHIA)	SY	$ 3.43	12,000	$ 41,160.00	(1)
	INLET STRUCTURE	EA	$ 12,000.00	1	$ 12,000.00	(2)
	OUTLET STRUCTURE	EA	$ 15,000.00	1	$ 15,000.00	(2)

CONSTRUCTION SUBTOTAL	$ 1,595,510.82
CONTINGENCIES (20%)	$ 319,102.16
CONSTRUCTION COST	$ 1,914,612.98
ENGINEERING SERVICES (25% OF CONSTRUCTION COST)	$ 478,653.25
SURVEY AND GEOTECHNICAL SERVICES (15% OF CONSTRUCTION COST)	$ 287,191.95
ACQUISITION COST	$ 515,479.00
TOTAL	**$ 3,195,937.17**

(1) UNIT COSTS ARE BASED ON THE August 16, 2007 HILLSBOROUGH COUNTY UNIT PRICE (WORCS)
(2) UNIT COSTS ARE BASED ON THE ESTIMATED AVERAGE MARKET PRICE

DBR-2 Lake Sunset 2

This alternative is located at the intersection of Lake Sunset Dr and Sheldon Road. This large, open parcel is cleared and undeveloped and could easily encompass a structural BMP. Land designation of this purpose is unclear; however, the size and location of the parcel make it a good site for a large treatment pond. A small water feature is located in the middle of the site. The area is privately owned; however, the size of the site, the lack of built-up features, and its proximity to the stream network make it a good choice for a potential water quality structural alternative.

This site is located in the eastern part of the Double Branch watershed – an area dominated by residential and built-up lands contributing large amounts of pollutants into the watershed's surface waters. This particular site is adjacent to a two residential communities. A retention/treatment pond would provide much needed water quality improvement to the surrounding areas.

Site Photo & Location Map

CONCEPTUAL OPINION OF PROBABLE CONSTRUCTION COST SITE ID: DBR 2						
ITEM#	DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST	NOTES
101-1	MOBILIZATION	LS	$ 19,000.00	1	$ 19,000.00	(1)
102-1	MAINTENANCE OF TRAFFIC	LS	$ 3,000.00	1	$ 3,000.00	(1)
110-1-1	CLEARING AND GRUBBING	AC	$ 11,000.00	11.96	$ 131,527.00	(2)
104-13	SILT FENCE STAKED	LF	$ 1.63	2,900	$ 4,727.00	(1)
120-1	EXCAVATION REGULAR	CY	$ 10.73	96,452	$ 1,034,934.21	(1)
550-2	FENCING, TYPE B	LF	$ 17.00	3,000	$ 51,000.00	(1)
550-76-162	FENCE GATE (TYPE B) (DOUBLE 8') (16' OPENING)	EA	$ 977.73	1	$ 977.73	(1)
575-1-1	SODDING (BAHIA)	SY	$ 3.43	10,000	$ 34,300.00	(1)
	INLET STRUCTURE	EA	$ 12,000.00	1	$ 12,000.00	(2)
	OUTLET STRUCTURE	EA	$ 15,000.00	1	$ 15,000.00	(2)
				CONSTRUCTION SUBTOTAL	$ 1,306,465.94	
				CONTINGENCIES (20%)	$ 261,293.19	
				CONSTRUCTION COST	$ 1,567,759.13	
				ENGINEERING SERVICES (25% OF CONSTRUCTION COST)	$ 391,939.78	
				SURVEY AND GEOTECHNICAL SERVICES (15% OF CONSTRUCTION COST)	$ 235,163.87	
				ACQUISITION COST	$ 4,973,800.00	
				TOTAL	**$ 7,168,662.78**	

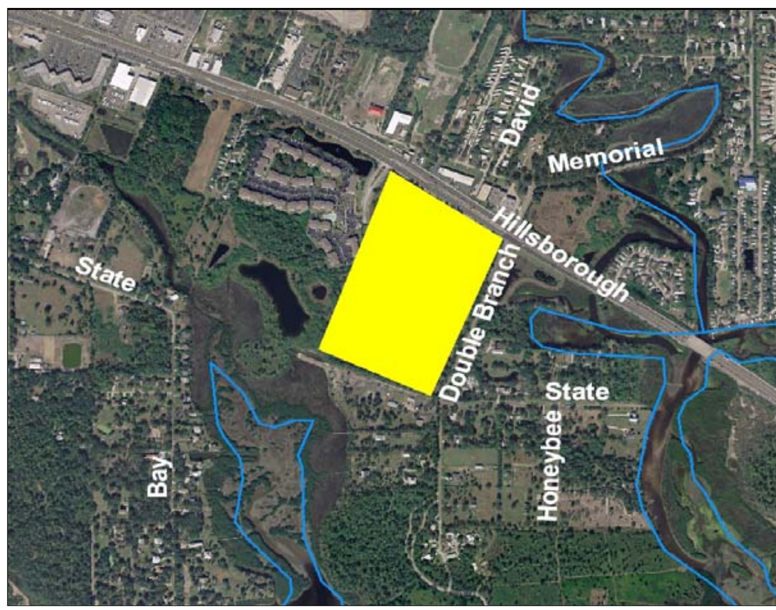
(1) UNIT COSTS ARE BASED ON THE August 16, 2007 HILLSBOROUGH COUNTY UNIT PRICE (WORCS)
(2) UNIT COSTS ARE BASED ON THE ESTIMATED AVERAGE MARKET PRICE

DBR-3 Double Branch

This parcel is located at the corner of Double Branch Road and Hillsborough Avenue. Field inspection identified it as a very large undeveloped and heavily wooded parcel. An open land area is visible in the center of the parcel. There is no visible signs of a wetland feature, therefore wetland improvement / expansion project would not be possible. Billboards and signs located on the property indicate that it may be zoned for commercial development. There are also signs of some exotic plants (Brazilian pepper) on the premises.

Although this site is privately owned and land acquisition costs may be substantial, it should be considered as a potential water quality project improvement location. The size of the site and its openness would allow for construction of a substantially sized retention pond.

Site Photo & Location Map



CONCEPTUAL OPINION OF PROBABLE CONSTRUCTION COST SITE ID: DBR 3						
ITEM#	DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST	NOTES
101-1	MOBILIZATION	LS	$ 19,000.00	1	$ 19,000.00	(1)
102-1	MAINTENANCE OF TRAFFIC	LS	$ 3,000.00	1	$ 3,000.00	(1)
110-1-1	CLEARING AND GRUBBING	AC	$ 11,000.00	36.57	$ 402,314.00	(2)
104-13	SILT FENCE STAKED	LF	$ 1.63	5,200	$ 8,476.00	(1)
120-1	EXCAVATION REGULAR	CY	$ 10.73	295,028	$ 3,165,650.56	(1)
550-2	FENCING, TYPE B	LF	$ 17.00	5,300	$ 90,100.00	(1)
550-76-162	FENCE GATE (TYPE B) (DOUBLE 8') (16' OPENING)	EA	$ 977.73	1	$ 977.73	(1)
575-1-1	SODDING (BAHIA)	SY	$ 3.43	17,667	$ 60,596.67	(1)
	INLET STRUCTURE	EA	$ 12,000.00	1	$ 12,000.00	(2)
	OUTLET STRUCTURE	EA	$ 15,000.00	1	$ 15,000.00	(2)
				CONSTRUCTION SUBTOTAL	$ 3,777,114.96	
				CONTINGENCIES (20%)	$ 755,422.99	
				CONSTRUCTION COST	$ 4,532,537.95	
				ENGINEERING SERVICES (25% OF CONSTRUCTION COST)	$ 1,133,134.49	
				SURVEY AND GEOTECHNICAL SERVICES (15% OF CONSTRUCTION COST)	$ 679,880.69	
				ACQUISITION COST	$ 3,982,875.00	
				TOTAL	**$ 10,328,428.13**	

(1) UNIT COSTS ARE BASED ON THE August 16, 2007 HILLSBOROUGH COUNTY UNIT PRICE (WORCS)
(2) UNIT COSTS ARE BASED ON THE ESTIMATED AVERAGE MARKET PRICE

PREFERRED SITES

DBR-4 River

This parcel is located at the corner of North River Road and Four Wheel Drive. Field inspection identified it as a large parcel utilized for agricultural and pasture purposes. The land is mostly open with a small wetland feature in the center of the property. The area is fenced out; what appears to be a stable is located to the west of the property. This site is surrounded by a number of residential subdivisions that contribute various pollutants into the watershed's surface waters.

Although this site is privately owned and land acquisition costs may be substantial, it should be considered as a potential water quality project improvement location. The size of the site and its openness would allow for construction of a substantially sized retention pond.

Site Photo & Location Map

CONCEPTUAL OPINION OF PROBABLE CONSTRUCTION COST
SITE ID: DBR 4

ITEM#	DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST	NOTES
101-1	MOBILIZATION	LS	$ 19,000.00	1	$ 19,000.00	(1)
102-1	MAINTENANCE OF TRAFFIC	LS	$ 3,000.00	1	$ 3,000.00	(1)
110-1-1	CLEARING AND GRUBBING	AC	$ 11,000.00	1.95	$ 21,494.00	(2)
104-13	SILT FENCE STAKED	LF	$ 1.63	1,300	$ 2,119.00	(1)
120-1	EXCAVATION REGULAR	CY	$ 10.73	15,762	$ 169,127.83	(1)
550-2	FENCING, TYPE B	LF	$ 17.00	1,400	$ 23,800.00	(1)
550-76-162	FENCE GATE (TYPE B) (DOUBLE 8') (16' OPENING)	EA	$ 977.73	1	$ 977.73	(1)
575-1-1	SODDING (BAHIA)	SY	$ 3.43	4,667	$ 16,006.67	(1)
	INLET STRUCTURE	EA	$ 12,000.00	1	$ 12,000.00	(2)
	OUTLET STRUCTURE	EA	$ 15,000.00	1	$ 15,000.00	(2)

CONSTRUCTION SUBTOTAL	$ 282,525.23
CONTINGENCIES (20%)	$ 56,505.05
CONSTRUCTION COST	$ 339,030.27
ENGINEERING SERVICES (25% OF CONSTRUCTION COST)	$ 84,757.57
SURVEY AND GEOTECHNICAL SERVICES (15% OF CONSTRUCTION COST)	$ 50,854.54
ACQUISITION COST	$ 456,322.00
TOTAL	**$ 930,964.38**

(1) UNIT COSTS ARE BASED ON THE August 16, 2007 HILLSBOROUGH COUNTY UNIT PRICE (WORCS)
(2) UNIT COSTS ARE BASED ON THE ESTIMATED AVERAGE MARKET PRICE

DBR-5 Douglas

This parcel is located at the corner of Douglas Road and Race Track Road. Field inspection identified it as a small undeveloped and heavily wooded parcel (pine and live/water oak present). An open land area is visible in the center of the parcel and a small wetland feature appears on edge of the property (bald cypress dome present). This location may have been zoned for development. The location is in close proximity to a small power transfer station.

Although this site may be privately owned and land acquisition may be required, this site should be considered as a potential water quality improvement project location. The size of the site and its openness would allow for a water retention system or a wetland improvement/expansion project.

Site Photo & Location Map

CONCEPTUAL OPINION OF PROBABLE CONSTRUCTION COST SITE ID: DBR 5								
ITEM#	DESCRIPTION	UNIT	UNIT COST		QUANTITY	COST		NOTES
101-1	MOBILIZATION	LS	$	19,000.00	1	$	19,000.00	(1)
102-1	MAINTENANCE OF TRAFFIC	LS	$	3,000.00	1	$	3,000.00	(1)
110-1-1	CLEARING AND GRUBBING	AC	$	11,000.00	2.82	$	31,031.00	(2)
104-13	SILT FENCE STAKED	LF	$	1.63	1,400	$	2,282.00	(1)
120-1	EXCAVATION REGULAR	CY	$	10.73	22,756	$	244,170.73	(1)
550-2	FENCING, TYPE B	LF	$	17.00	1,500	$	25,500.00	(1)
550-76-162	FENCE GATE (TYPE B) (DOUBLE 8') (16' OPENING)	EA	$	977.73	1	$	977.73	(1)
575-1-1	SODDING (BAHIA)	SY	$	3.43	5,000	$	17,150.00	(1)
	INLET STRUCTURE	EA	$	12,000.00	1	$	12,000.00	(2)
	OUTLET STRUCTURE	EA	$	15,000.00	1	$	15,000.00	(2)
					CONSTRUCTION SUBTOTAL	$	370,111.46	
					CONTINGENCIES (20%)	$	74,022.29	
					CONSTRUCTION COST	$	444,133.75	
					ENGINEERING SERVICES (25% OF CONSTRUCTION COST)	$	111,033.44	
					SURVEY AND GEOTECHNICAL SERVICES (15% OF CONSTRUCTION COST)	$	66,620.06	
					ACQUISITION COST	$	-	
					TOTAL	$	621,787.25	

(1) UNIT COSTS ARE BASED ON THE August 16, 2007 HILLSBOROUGH COUNTY UNIT PRICE (WORCS)
(2) UNIT COSTS ARE BASED ON THE ESTIMATED AVERAGE MARKET PRICE

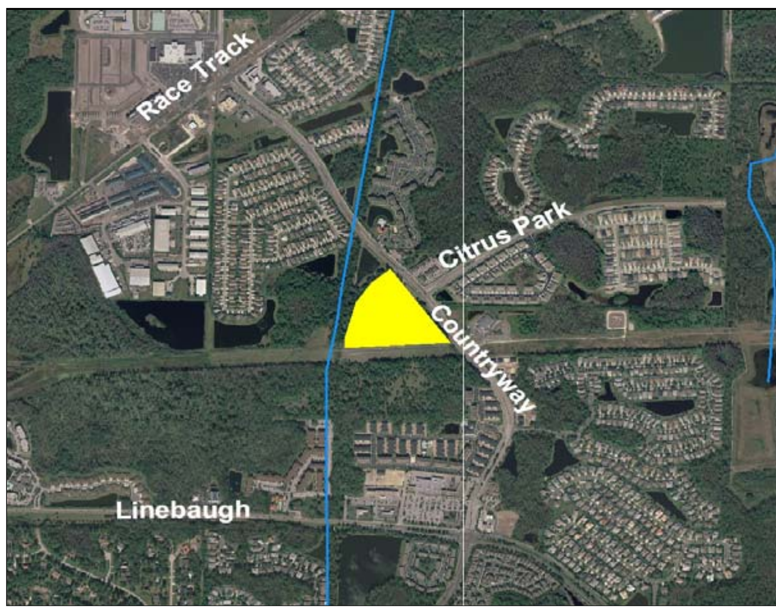
PREFERRED SITES

DBR-6 Citrus/Country

This alternative is located at the intersection of Countryway Boulevard and Citrus Park Drive. This is a large upland tract that could easily encompass a structural BMP. The parcel is partially wooded with pines, palmetto, and underbrush. The size and location of the parcel make it a perfect location for a large treatment pond. In addition, a small wetland is located in the center of the site. The area is fenced out and is privately owned, however the size of the site, the lack of built-up features, and its proximity to the stream network make it a good choice for a potential water quality structural alternative.

The size of the site allows for construction of a large retention/treatment pond and existence of a small wetland offers a possibility of a wetland improvement project. This site is also surrounded by many residential neighborhoods and may provide much needed water quality improvement to the surrounding areas.

Site Photo & Location Map



CONCEPTUAL OPINION OF PROBABLE CONSTRUCTION COST
SITE ID: DBR 6

ITEM#	DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST	NOTES
101-1	MOBILIZATION	LS	$ 19,000.00	1	$ 19,000.00	(1)
102-1	MAINTENANCE OF TRAFFIC	LS	$ 3,000.00	1	$ 3,000.00	(1)
110-1-1	CLEARING AND GRUBBING	AC	$ 11,000.00	13.34	$ 146,751.00	(2)
104-13	SILT FENCE STAKED	LF	$ 1.63	3,200	$ 5,216.00	(1)
120-1	EXCAVATION REGULAR	CY	$ 10.73	107,617	$ 1,154,725.87	(1)
550-2	FENCING, TYPE B	LF	$ 17.00	3,300	$ 56,100.00	(1)
550-76-162	FENCE GATE (TYPE B) (DOUBLE 8') (16' OPENING)	EA	$ 977.73	1	$ 977.73	(1)
575-1-1	SODDING (BAHIA)	SY	$ 3.43	11,000	$ 37,730.00	(1)
	INLET STRUCTURE	EA	$ 12,000.00	1	$ 12,000.00	(2)
	OUTLET STRUCTURE	EA	$ 15,000.00	1	$ 15,000.00	(2)

CONSTRUCTION SUBTOTAL $ 1,450,500.60
CONTINGENCIES (20%) $ 290,100.12
CONSTRUCTION COST $ 1,740,600.73
ENGINEERING SERVICES (25% OF CONSTRUCTION COST) $ 435,150.18
SURVEY AND GEOTECHNICAL SERVICES (15% OF CONSTRUCTION COST) $ 261,090.11
ACQUISITION COST $ 1,843,245.00
TOTAL $ 4,280,086.02

(1) UNIT COSTS ARE BASED ON THE August 16, 2007 HILLSBOROUGH COUNTY UNIT PRICE (WORCS)
(2) UNIT COSTS ARE BASED ON THE ESTIMATED AVERAGE MARKET PRICE

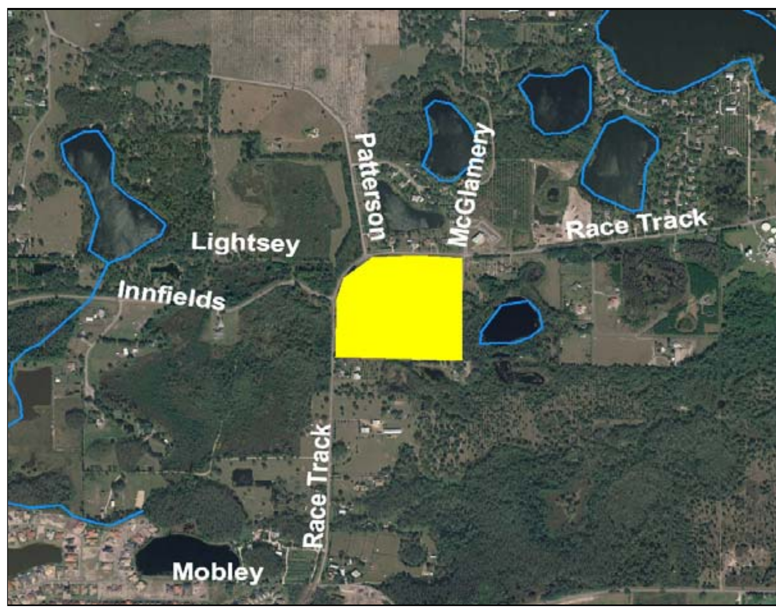
PREFERRED SITES

DBR-7 Race Track

This alternative is located at the intersection of Race Track Road and Patterson Road. This is a large open parcel that could easily encompass a structural BMP. The parcel is cleared and undeveloped, and designated as pasture land. The size and location of the parcel make it a good site for a large treatment pond. No wetland features are visible on the site. The area is fenced out and is privately owned; however, the size of the site, the lack of built-up features, and its proximity to the stream network make it a good choice for a potential water quality structural alternative.

This site is located in the north part of the Double Branch watershed – an area dominated by agricultural lands contributing large amounts of nutrients into the watershed's surface waters. A retention/treatment pond would provide much needed water quality improvement to the surrounding areas.

Site Photo & Location Map



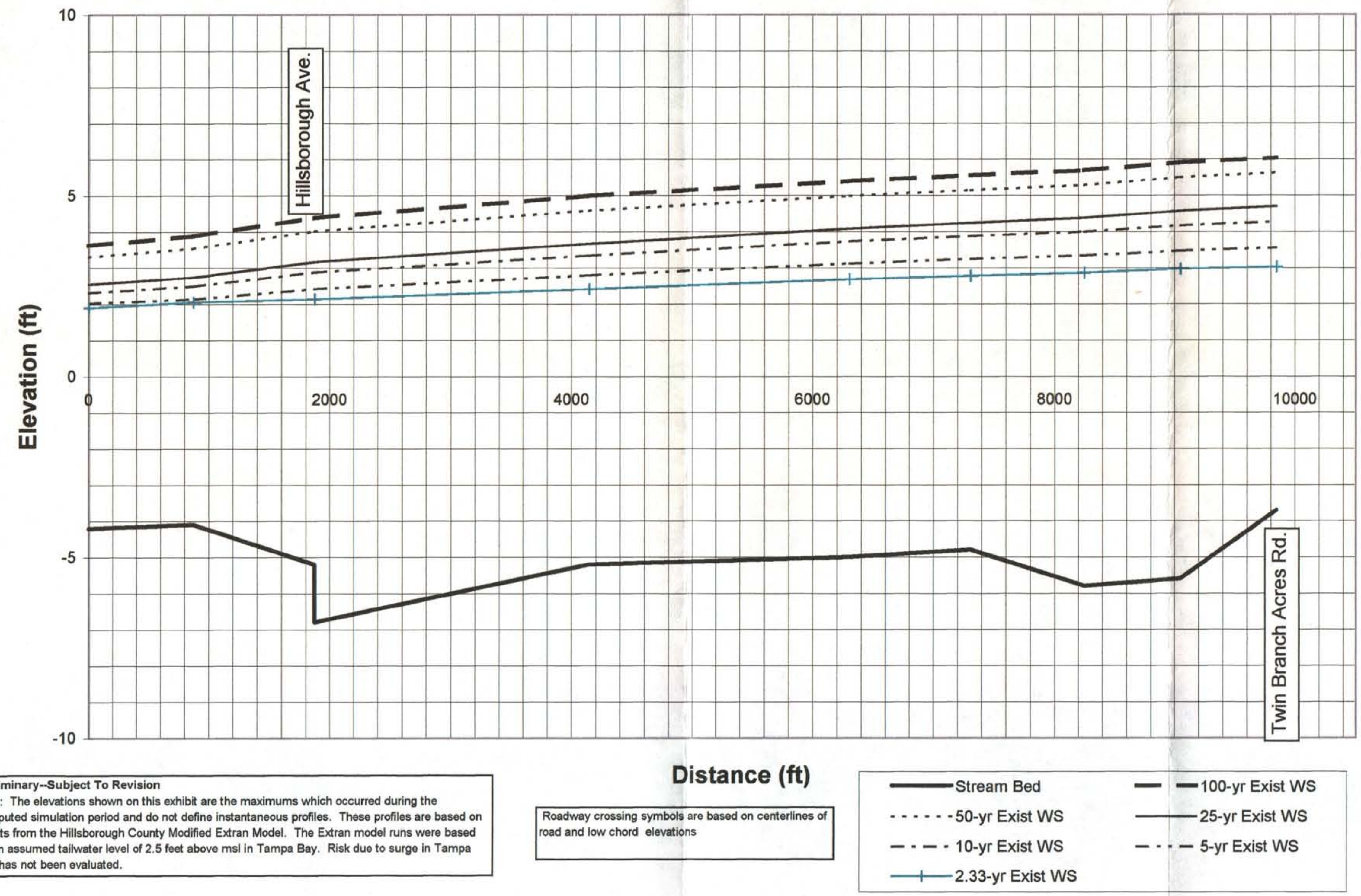
CONCEPTUAL OPINION OF PROBABLE CONSTRUCTION COST
SITE ID: DBR 7

ITEM#	DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST	NOTES
101-1	MOBILIZATION	LS	$ 19,000.00	1	$ 19,000.00	(1)
102-1	MAINTENANCE OF TRAFFIC	LS	$ 3,000.00	1	$ 3,000.00	(1)
110-1-1	CLEARING AND GRUBBING	AC	$ 11,000.00	34.73	$ 382,008.00	(2)
104-13	SILT FENCE STAKED	LF	$ 1.63	4,800	$ 7,824.00	(1)
120-1	EXCAVATION REGULAR	CY	$ 10.73	280,137	$ 3,005,870.64	(1)
550-2	FENCING, TYPE B	LF	$ 17.00	4,900	$ 83,300.00	(1)
550-76-162	FENCE GATE (TYPE B) (DOUBLE 8') (16' OPENING)	EA	$ 977.73	1	$ 977.73	(1)
575-1-1	SODDING (BAHIA)	SY	$ 3.43	16,333	$ 56,023.33	(1)
	INLET STRUCTURE	EA	$ 12,000.00	1	$ 12,000.00	(2)
	OUTLET STRUCTURE	EA	$ 15,000.00	1	$ 15,000.00	(2)

CONSTRUCTION SUBTOTAL	$ 3,585,003.70
CONTINGENCIES (20%)	$ 717,000.74
CONSTRUCTION COST	$ 4,302,004.44
ENGINEERING SERVICES (25% OF CONSTRUCTION COST)	$ 1,075,501.11
SURVEY AND GEOTECHNICAL SERVICES (15% OF CONSTRUCTION COST)	$ 645,300.67
ACQUISITION COST	$ 1,860,391.00
TOTAL	$ 7,883,197.22

(1) UNIT COSTS ARE BASED ON THE August 16, 2007 HILLSBOROUGH COUNTY UNIT PRICE (WORCS)
(2) UNIT COSTS ARE BASED ON THE ESTIMATED AVERAGE MARKET PRICE

EXHIBITS 1-5



Preliminary--Subject To Revision
Note: The elevations shown on this exhibit are the maximums which occurred during the computed simulation period and do not define instantaneous profiles. These profiles are based on results from the Hillsborough County Modified Extran Model. The Extran model runs were based on an assumed tailwater level of 2.5 feet above msl in Tampa Bay. Risk due to surge in Tampa Bay has not been evaluated.

Roadway crossing symbols are based on centerlines of road and low chord elevations

Exhibit1
Double Branch Creek Main Channel
Computed Water Surface Profiles
Sheet 1of 5

Double Branch Creek
Existing Conditions Model
(January 2002)

Exhibit 2

Double Branch Creek- West Branch

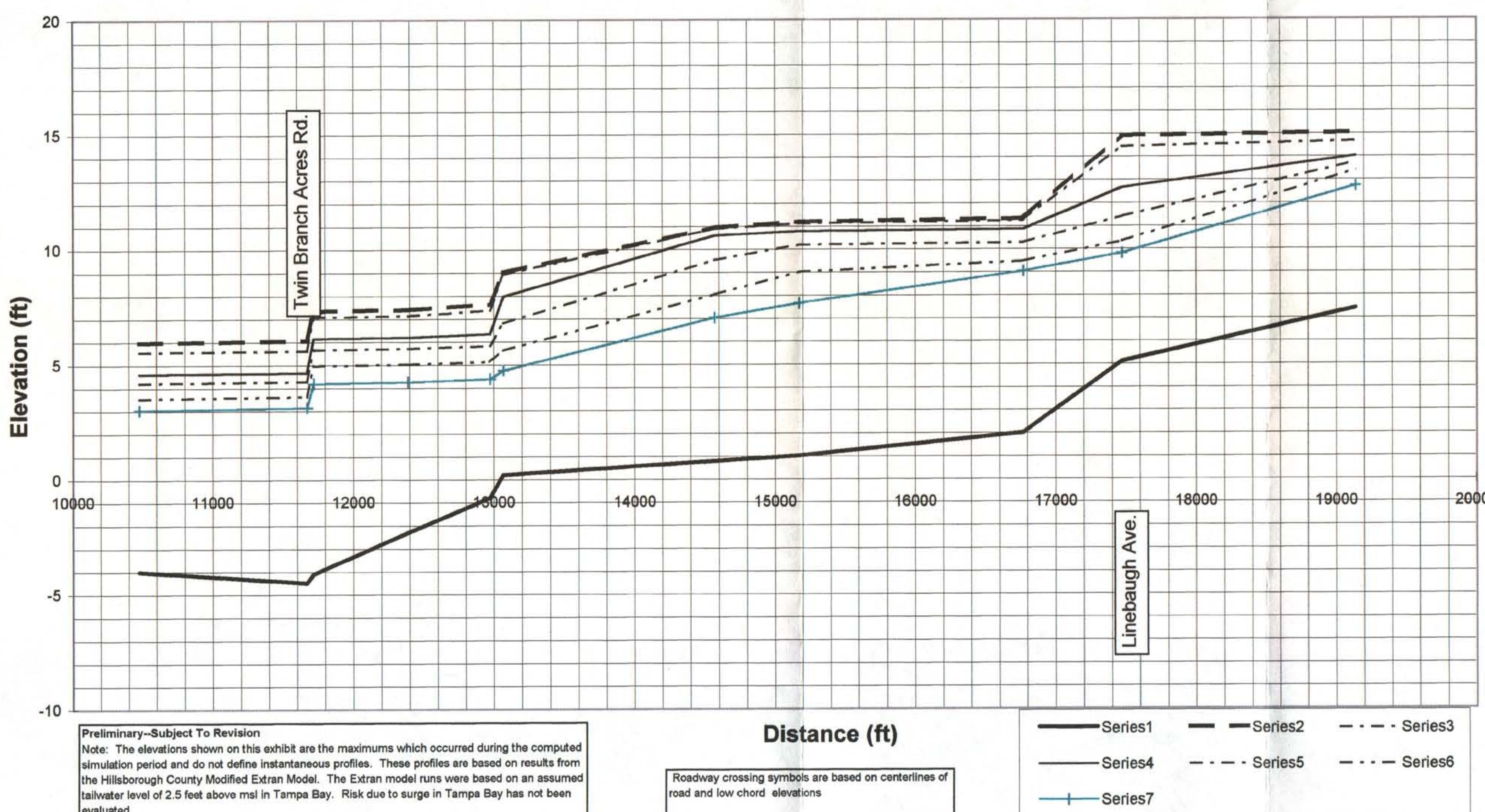
Computed Water Surface Profiles

Sheet 2 of 5

Double Branch Creek

Existing Conditions Model

(January 2002)



Preliminary--Subject To Revision

Note: The elevations shown on this exhibit are the maximums which occurred during the computed simulation period and do not define instantaneous profiles. These profiles are based on results from the Hillsborough County Modified Extran Model. The Extran model runs were based on an assumed tailwater level of 2.5 feet above msl in Tampa Bay. Risk due to surge in Tampa Bay has not been evaluated.

Roadway crossing symbols are based on centerlines of road and low chord elevations

Exhibit 3

Double Branch Creek- East Branch

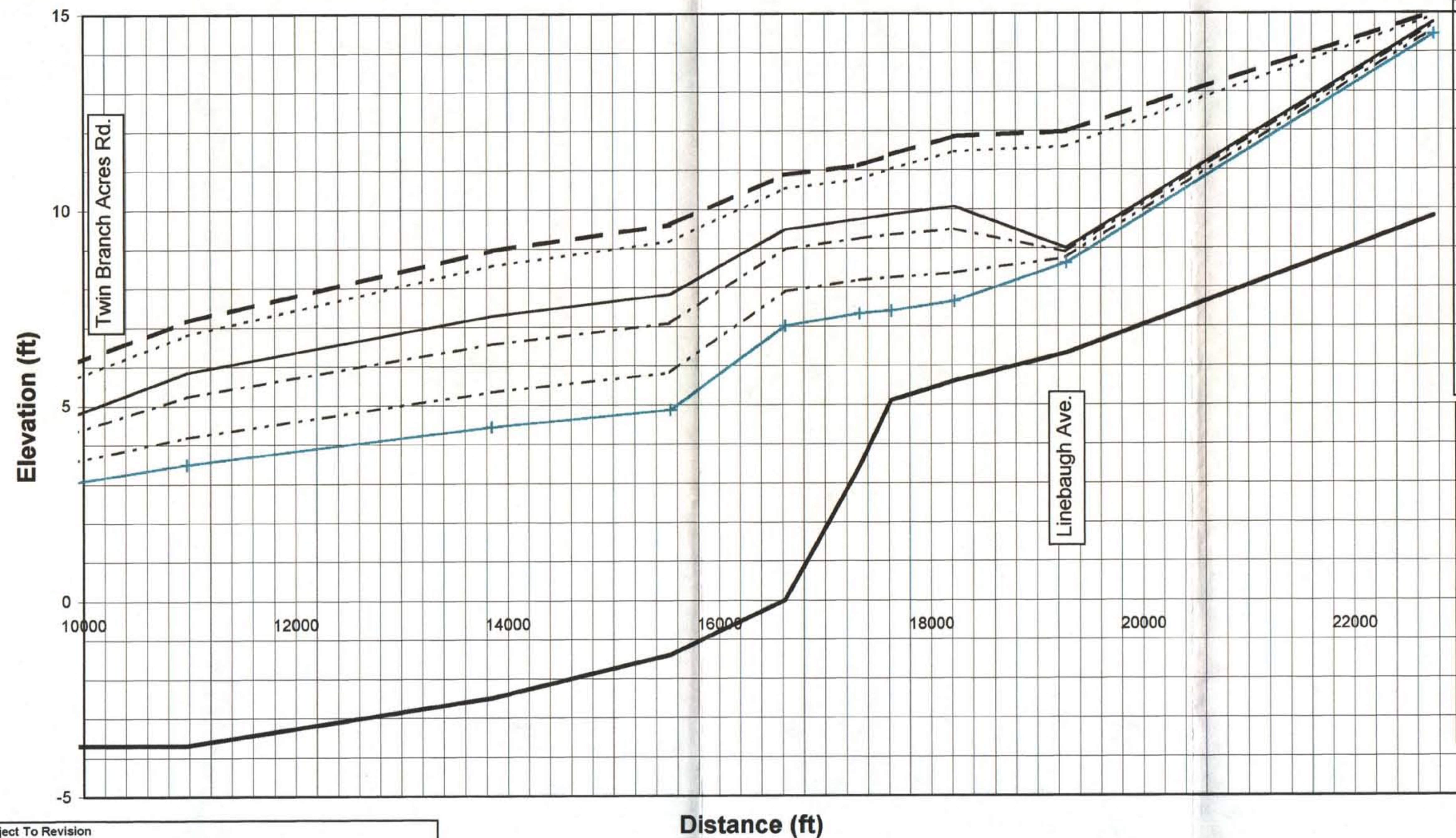
Computed Water Surface Profiles

Sheet 3 of 5

Double Branch Creek

Existing Conditions Model

(January 2002)



Stream Bed
50-yr Exist WS
10-yr Exist WS
2.33-yr Exist WS
100-yr Exist WS
25-yr Exist WS
5-yr Exist WS

Preliminary--Subject To Revision

Note: The elevations shown on this exhibit are the maximums which occurred during the computed simulation period and do not define instantaneous profiles. These profiles are based on results from the Hillsborough County Modified Extran Model. The Extran model runs were based on an assumed tailwater level of 2.5 feet above msl in Tampa Bay. Risk due to surge in Tampa Bay has not been evaluated.

Roadway crossing symbols are based on centerlines of road and low chord elevations

Exhibit 4

Double Branch Creek- East Branch Nine Eagles Fork

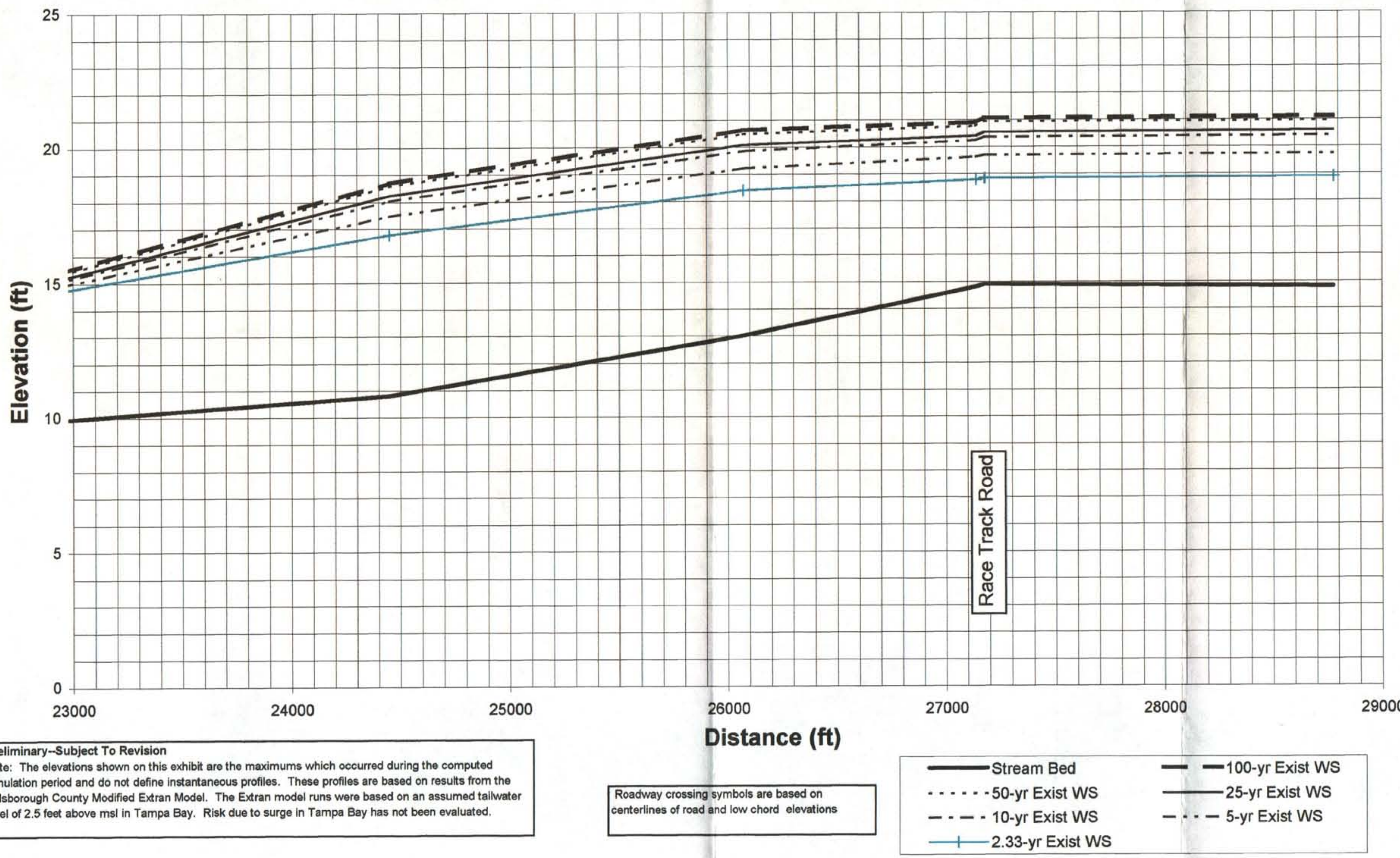
Computed Water Surface Profiles

Sheet 4 of 5

Double Branch Creek

Existing Conditions Model

(January 2002)



Preliminary--Subject To Revision

Note: The elevations shown on this exhibit are the maximums which occurred during the computed simulation period and do not define instantaneous profiles. These profiles are based on results from the Hillsborough County Modified Extran Model. The Extran model runs were based on an assumed tailwater level of 2.5 feet above msl in Tampa Bay. Risk due to surge in Tampa Bay has not been evaluated.

Roadway crossing symbols are based on centerlines of road and low chord elevations

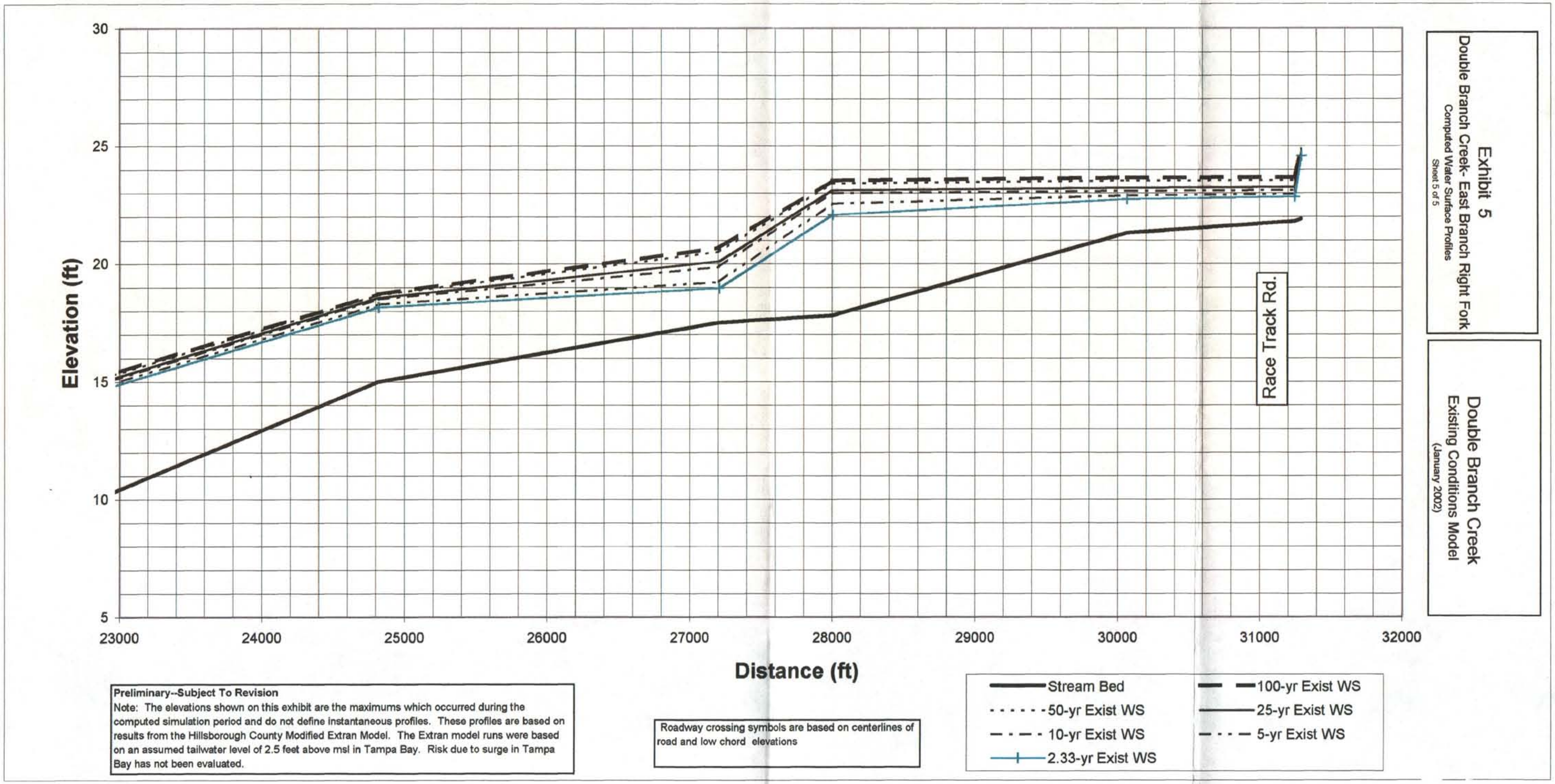
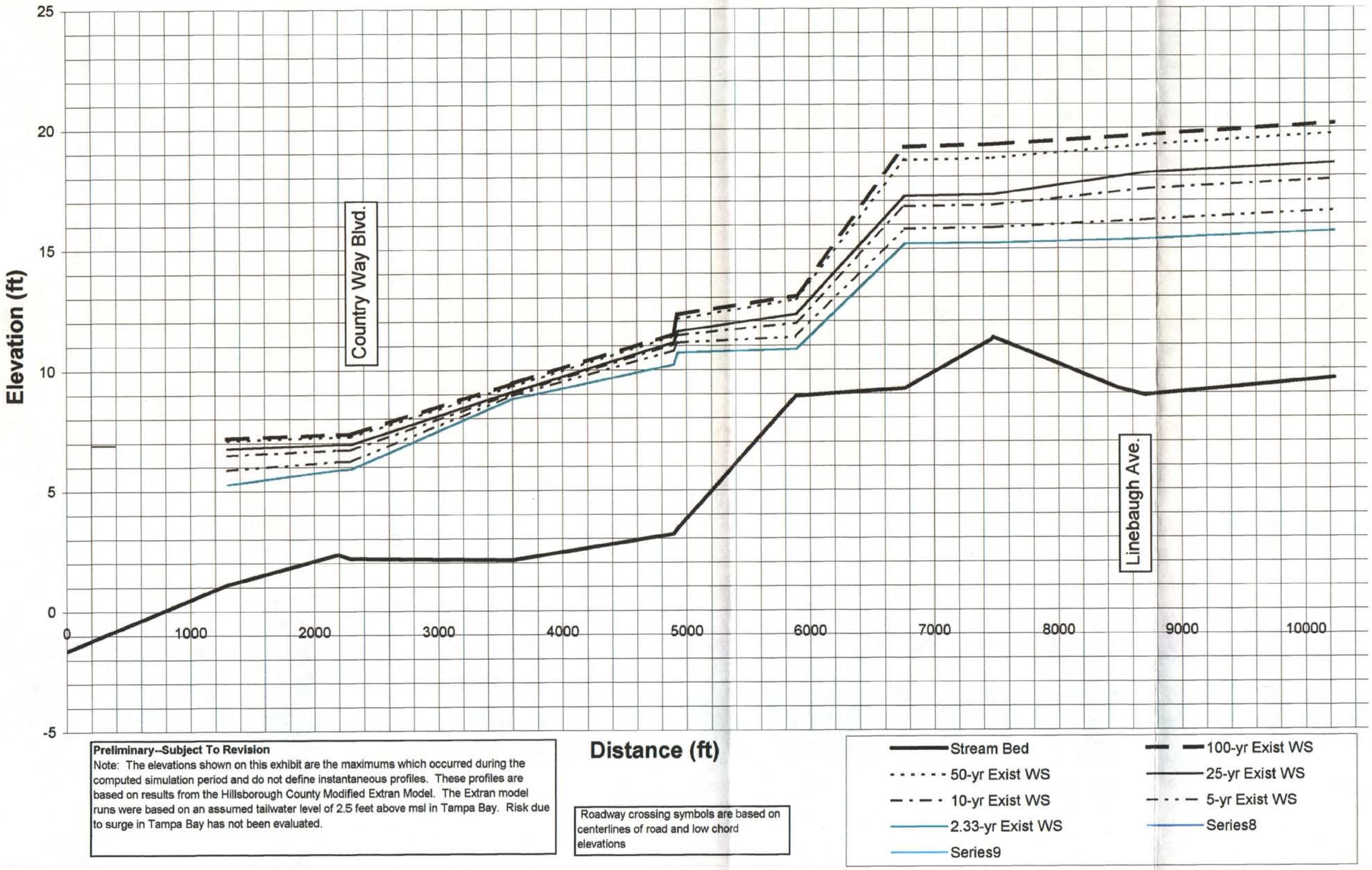


Exhibit 5
Double Branch Creek- East Branch Right Fork
Computed Water Surface Profiles
Sheet 5 of 5
Double Branch Creek
Existing Conditions Model
(January 2002)
Elevation (ft)
Distance (ft)
30
25
20
15
10
5
23000
24000
25000
26000
27000
28000
29000
30000
31000
32000
Race Track Rd.
Stream Bed
100-yr Exist WS
50-yr Exist WS
25-yr Exist WS
10-yr Exist WS
5-yr Exist WS
2.33-yr Exist WS
Preliminary--Subject To Revision
Note: The elevations shown on this exhibit are the maximums which occurred during the computed simulation period and do not define instantaneous profiles. These profiles are based on results from the Hillsborough County Modified Extran Model. The Extran model runs were based on an assumed tailwater level of 2.5 feet above msl in Tampa Bay. Risk due to surge in Tampa Bay has not been evaluated.
Roadway crossing symbols are based on centerlines of road and low chord elevations

EXHIBITS 6-7



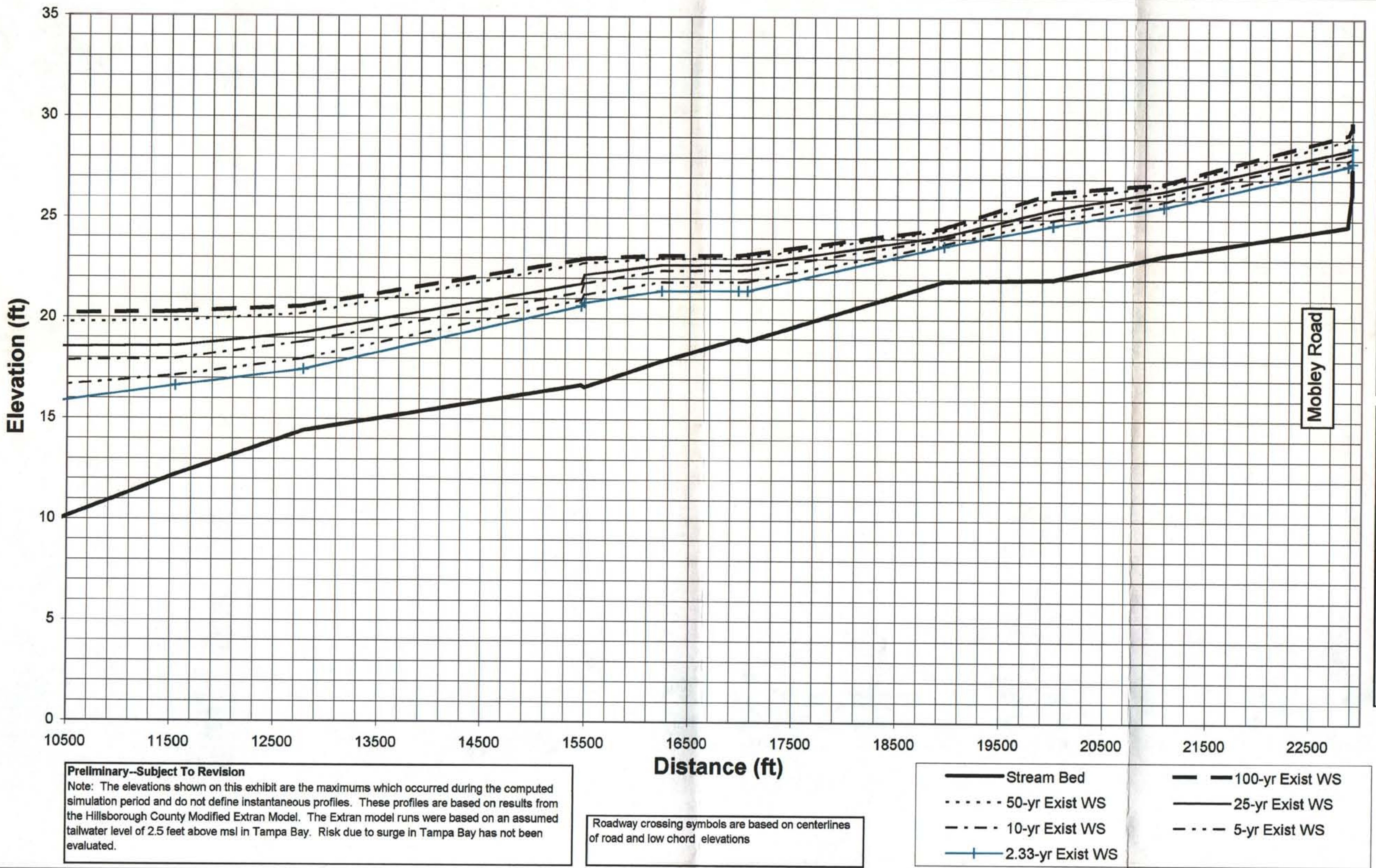
Preliminary--Subject To Revision

Note: The elevations shown on this exhibit are the maximums which occurred during the computed simulation period and do not define instantaneous profiles. These profiles are based on results from the Hillsborough County Modified Extran Model. The Extran model runs were based on an assumed tailwater level of 2.5 feet above msl in Tampa Bay. Risk due to surge in Tampa Bay has not been evaluated.

Roadway crossing symbols are based on centerlines of road and low chord elevations

Exhibit 6
Memorial Channel
Computed Water Surface Profiles
Sheet 1 of 2

Double Branch Creek
Existing Conditions Model
(August 1998)



Preliminary--Subject To Revision
Note: The elevations shown on this exhibit are the maximums which occurred during the computed simulation period and do not define instantaneous profiles. These profiles are based on results from the Hillsborough County Modified Extran Model. The Extran model runs were based on an assumed tailwater level of 2.5 feet above msl in Tampa Bay. Risk due to surge in Tampa Bay has not been evaluated.

Roadway crossing symbols are based on centerlines of road and low chord elevations

Exhibit 7
Memorial Channel
Computed Water Surface Profiles
Sheet 2 of 2

Double Branch Creek
Existing Conditions Model
(August 1996)

EXHIBIT 8
Double Branch Creek Area Link-Node and Subbasin Map

this figure is missing