Long Branch Creek

Bacterial Pollution Control Plan

Draft Report

January 2017

Special Acknowledgements

Thank you to Pinellas County Environmental Management volunteers Michelle Monteclaro and Michelle Robertson for their time, effort and involvement in assisting with this Bacterial Pollution Control Plan including field sampling, public outreach for pet waste, GIS analysis, and report writing and editing.

Table of Contents

List of Figures

List of Tables

1.0 Background

1.1 Purpose of Report

This report outlines the Bacterial Pollution Control Plan (BPCP) for the Long Branch Creek watershed developed by Pinellas County and the City of Largo. This report fulfills the requirements in Part VIII.B.4 of the National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) permit for Pinellas County and the City of Largo to address the Long Branch Creek Total Maximum Daily Load (TMDL) for fecal and total coliform bacteria.

1.2 Identification of Waterbody

The Long Branch Creek watershed is located in central Pinellas County and covers nearly 1,808 acres with approximately 77% of the area consisting of residential and commercial land uses. A large portion of the basin was developed prior to stormwater management requirements resulting in untreated runoff discharging directly into the creek.

The creek originates west of Belcher Road and aligns in a southwest to northeast direction ultimately discharging into Old Tampa Bay. The channel length is approximately 3.3 miles with a north and south branch merging into a main channel near US Highway 19.

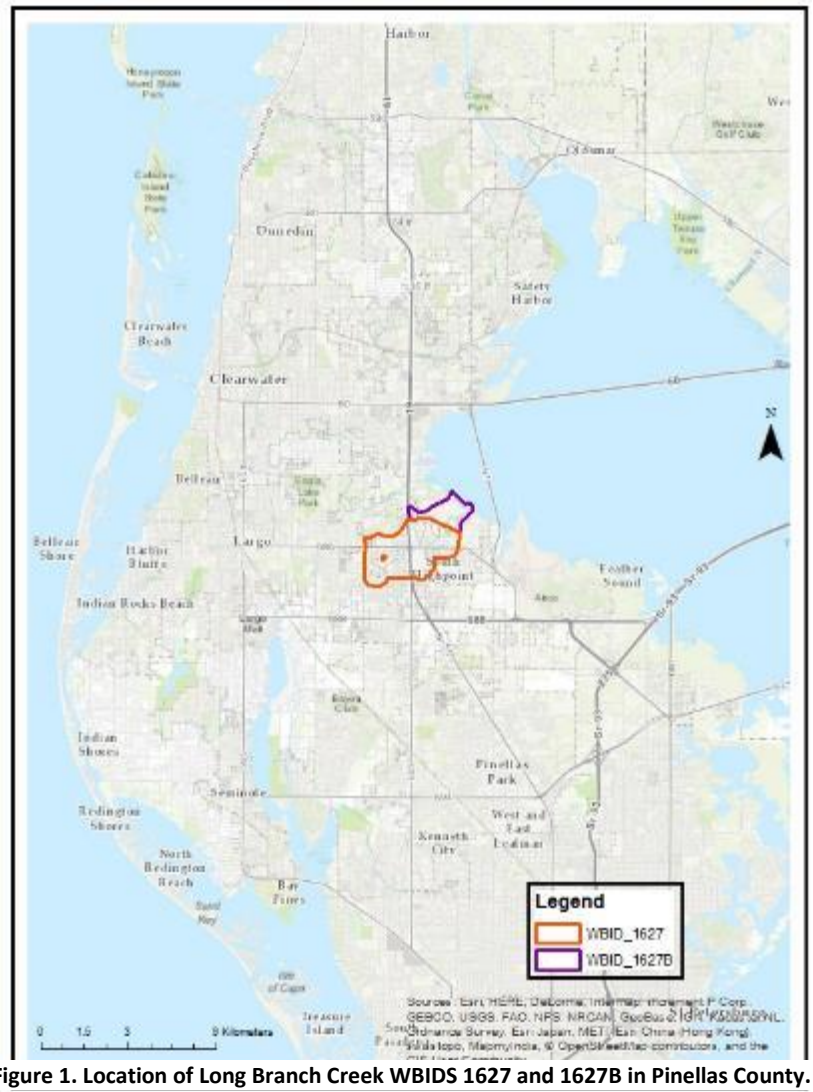

Figure 1. Location of Long Branch Creek WBIDS 1627 and 1627B in Pinellas County.

The majority of the creek consists of open channels and ditches. Long Branch Creek is divided into a tidal segment (WBID 1627b) and freshwater segment (WBID 1627), see Figure 1.

The Long Branch Creek watershed falls under the jurisdiction of Pinellas County and the City of Largo. Approximately 36% of the watershed is within unincorporated Pinellas County and the City of Largo has a larger portion with 64% jurisdiction (Figure 2).

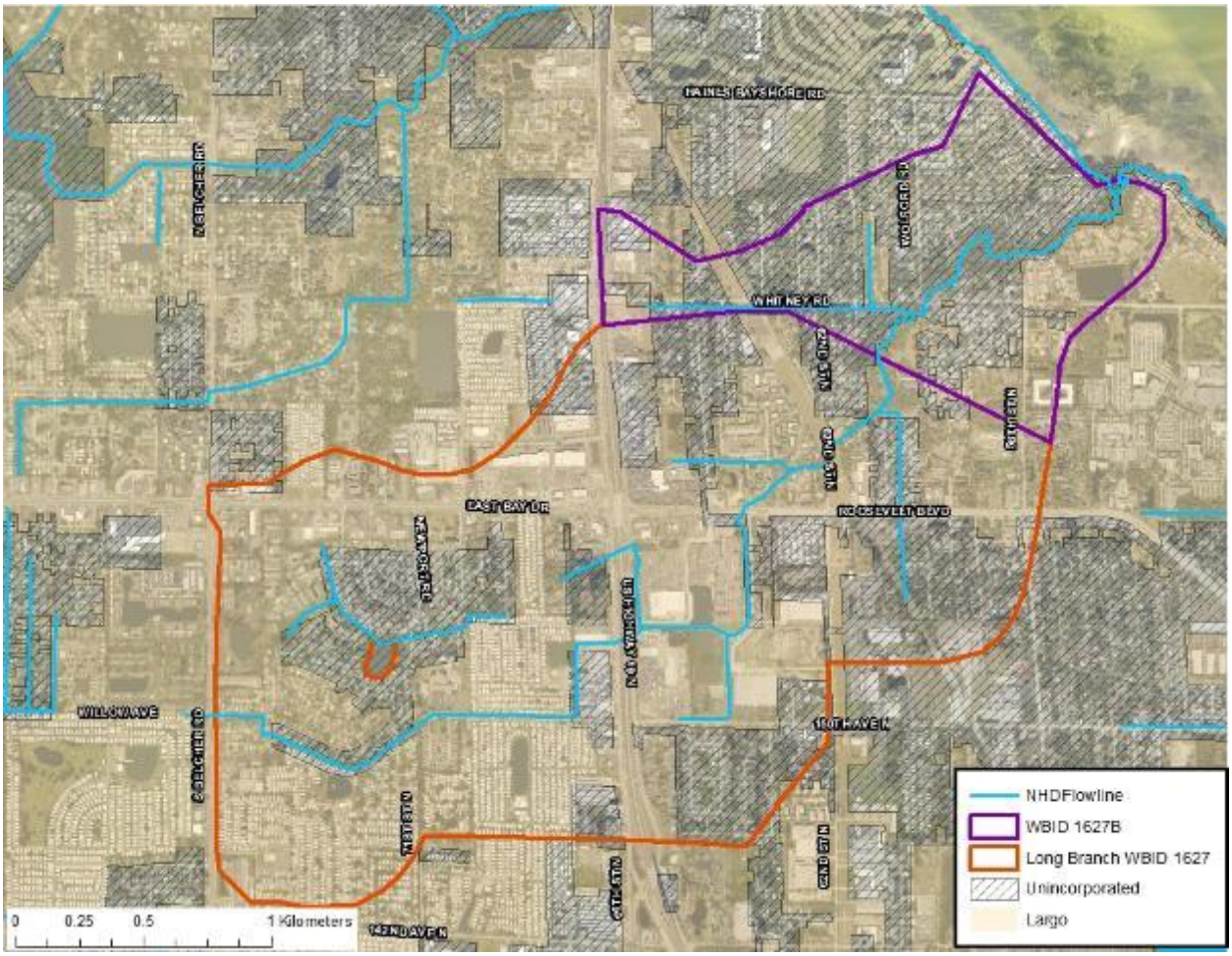

Figure 2. Jurisdiction in Long Branch Creek WBID 1627.

1.3 Bacteria Impairment and TMDL

Long Branch Creek (WBID 1627) was identified as impaired for Total and fecal coliform by Florida Department of Environmental Protection (FDEP) and included on the 1998 303 (d) list of Impaired Waters and the Verified List of Impaired Waters adopted by Secretarial Order in 2002. A TMDL was developed in 2005 by the Environmental Protection Agency (EPA) to establish load reductions to the freshwater segment of Long Branch Creek that would result in achievement of the creek's designated uses.

No permitted wastewater treatment facilities discharge in the basin. The TMDL load allocations for stormwater and nonpoint sources are a 44.2% reduction for total coliform and a 56.5% reduction in fecal coliform. Potential sources listed in the TMDL document include wildlife, agricultural animals, pets in residential areas, septic tanks, and land application of domestic residuals, urban development, and leaking sanitary sewer lines.

1.3 Steps to Developing a Bacterial Pollution Control Plan

Potential bacteria sources of bacteria in urban areas can include but are not limited to pet waste, homeless camps, bacterial re-growth in storm sewers and sediments, leaking sanitary sewer and septic systems, and illicit discharges. Pinellas County and the City of Largo used the assessment tools and methodology in the FDEP's fecal coliform TMDL Guidance On-Line Tool Kit that is available online at: http://www.dep.state.fl.us/water/watersheds/docs/fcg_toolkit.pdf to develop the BPCP.

The general steps followed in accordance with the FDEP guidance document included:

1. Understanding the Basin
   - Compile and evaluate existing data
   - Identify stakeholders
2. Potential Source Identification
   - Strategic sampling and microbial source identification
   - Field investigations
3. Develop Management Actions
   - Structural solutions: sanitary sewer upgrades
   - Nonstructural activities: inspection and maintenance of sanitary sewer and stormwater infrastructure, stormwater pond compliance and enhancement, litter and debris removal, public outreach and education, and policy implementation.
4. Documentation and Reporting
   - Bacterial Pollution Control Plan
   - Monitoring Plan

2.0 Bacteria Source Identification

Identifying bacteria sources in the Long Branch Creek watershed required analyzing existing data, coordinating with the Department of Health, microbial source tracking, and conducting detailed field investigations. The potential sources identified in the TMDL that were confirmed during this process include wildlife, pets, stormwater infrastructure associated with urban development, and leaking sanitary sewer lines.

2.1 Planning and Data Collection

The first step in developing the Bacterial Pollution Control Plan (BPCP) for Long Branch Creek was to collect existing information on the watershed by gathering data from various sources. Data collected for this effort included:

- Ambient water quality data (FDEP IWR database, Pinellas County Environmental Management)
- Sampling locations (FDEP IWR database and Pinellas County Environmental Management)
- Stormwater GIS data (Pinellas County and City of Largo)
- Wastewater GIS data (City of Largo)
- National Hydrography Dataset (USGS)
- Septic tank locations (Florida Department of Health (FDOH), Pinellas County and City of Largo)
- Previous Studies (ERD, 2012)

Stakeholders identified included:

- NPDES staff (Pinellas County and City of Largo)
- Stormwater operations and maintenance (Pinellas County and City of Largo)
- Wastewater operations and maintenance (City of Largo)

2.2 Ambient Water Quality Monitoring

The FDEP IWR database contains fecal coliform data from Pinellas County and the FDEP at eleven sites in the freshwater portion of Long Branch Creek and one site just downstream in the tidal portion from 1995 to 2014. Additional data is available at the four current County sites in the County database for 2015. Sites are shown on the map in Figure 3. A summary of the available fecal coliform data is in Table 1 and results are seen in Figure 4. The occurrence of highly elevated results appears to increase in recent years. The County began monitoring for *E. coli* in mid-2015. Figure 5 shows fecal coliform and *E. coli* results. Out of fourteen samples in 2015, eleven fecal

coliform samples are above the previous fecal coliform standard of 400 MPN/100ml, while only three *E. coli* samples are above the current *E. coli* standard of 410 MPN/100ml.

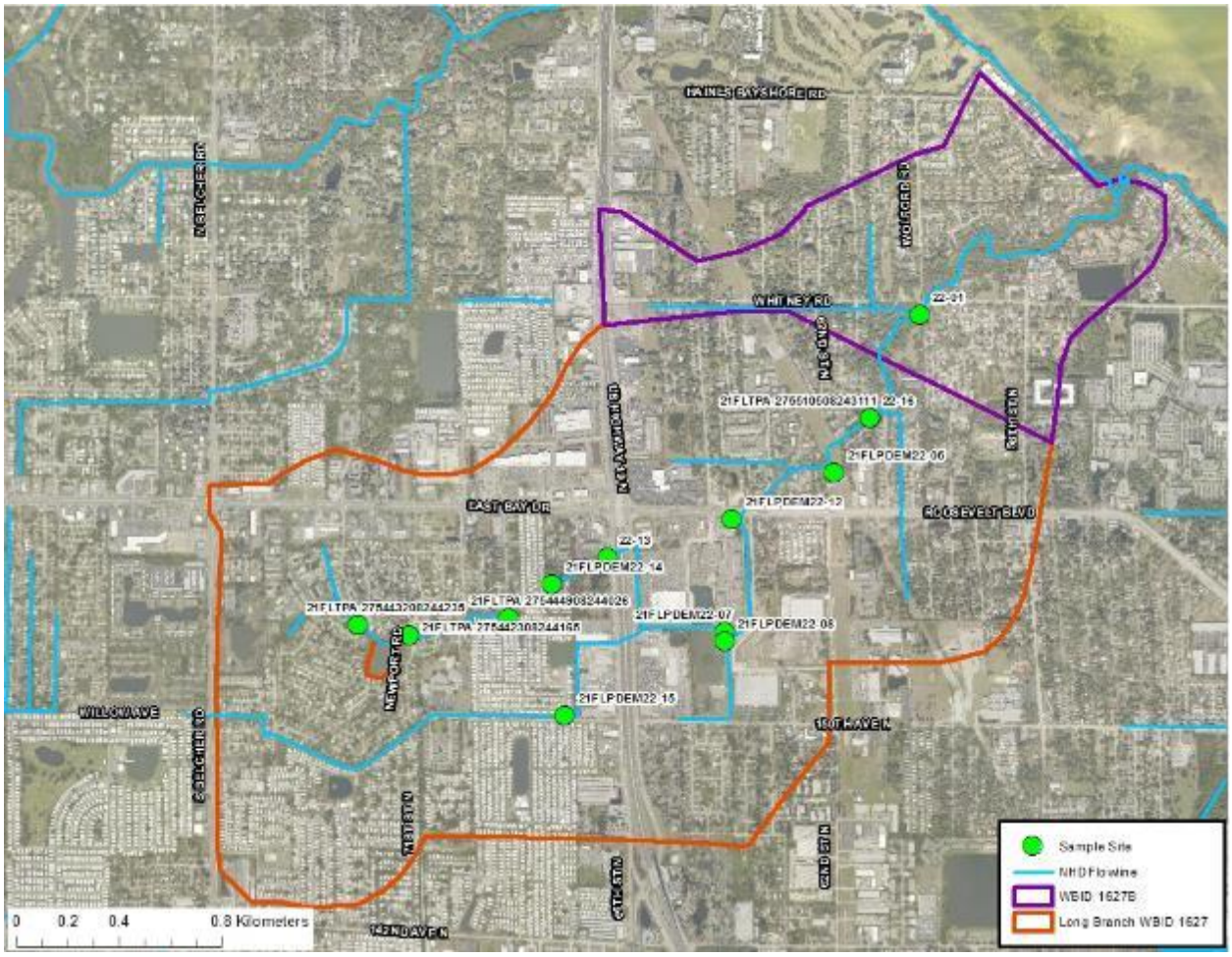

Figure 3. Long Branch WBID 1627 Pinellas County and FDEP sample sites

Table 1. Summary of fecal coliform and *E. coli* data from the IWR database run 52 and Pinellas County database.

Site	Agency	Date Range	Fecal coliform (MPN/100ml)				*E. coli* (MPN/100ml)	
			N	Mean	Wet Season Mean	Dry Season Mean	N	Mean
22-01*	Pinellas	1991 - 2015	98	2125	2331	1971	5	1878
22-05	Pinellas	1995 - 2008	54	752	1069	550	0	-
22-07	Pinellas	2005 - 2008	22	726	1386	270	0	-
22-08	Pinellas	2005 - 2008	28	477	1271	101	0	-
22-12*	Pinellas	2008 - 2015	52	874	1311	643	4	316
22-13*	Pinellas	2014 - 2015	8	8213	9350	7075	2	714
22-14	Pinellas	2008 - 2014	28	3043	2847	3152	0	-
22-15*	Pinellas	2008 - 2015	33	957	1708	403	3	168
22-16*	Pinellas	2015	8	2631	2490	2716	5	220
275442308244165 (FDEP1)	FDEP	2002	9	1022	668	1306	0	-
275443208244235 (FDEP2)	FDEP	2002 - 2006	11	482	753	328	0	-
275444908244026 (FDEP3)	FDEP	2006	2	665	-	665	0	-
275510508243111 (FDEP4)	FDEP	2006	2	825	570	1080	0	-

*Current County sites. Note site 22-01 is in the tidal portion of Long Branch in WBID 1627B.

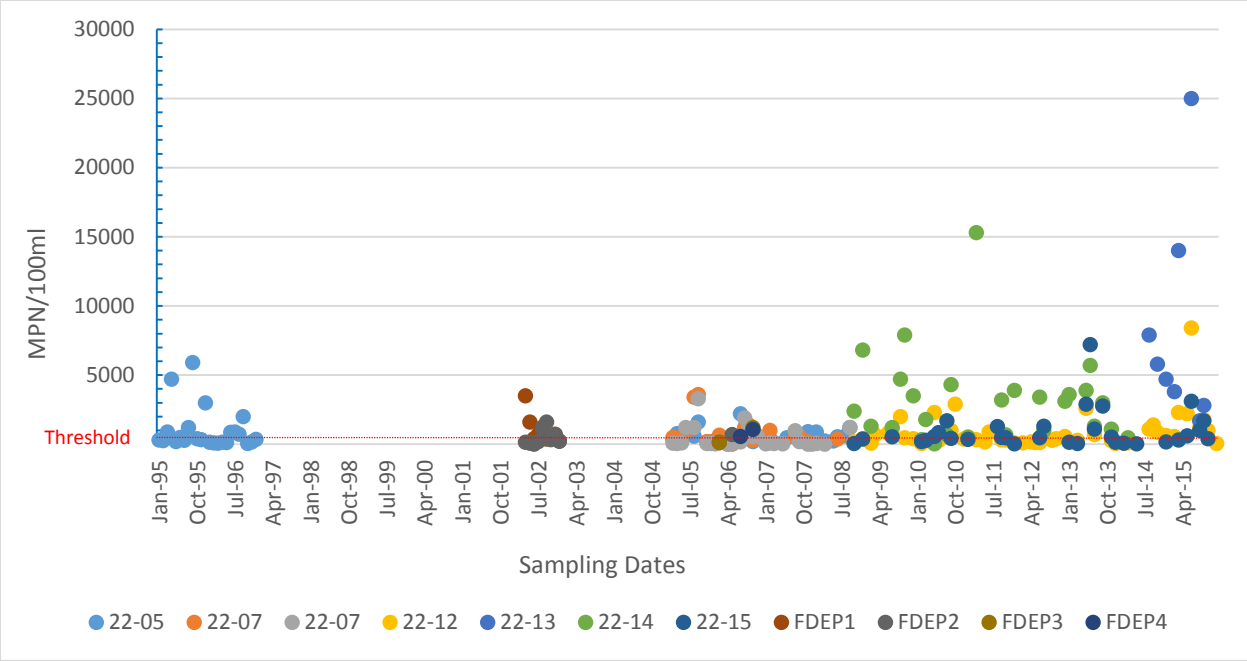

Figure 4. Fecal coliform data for Long Branch Creek WBID 1627 from the IWR and County databases.

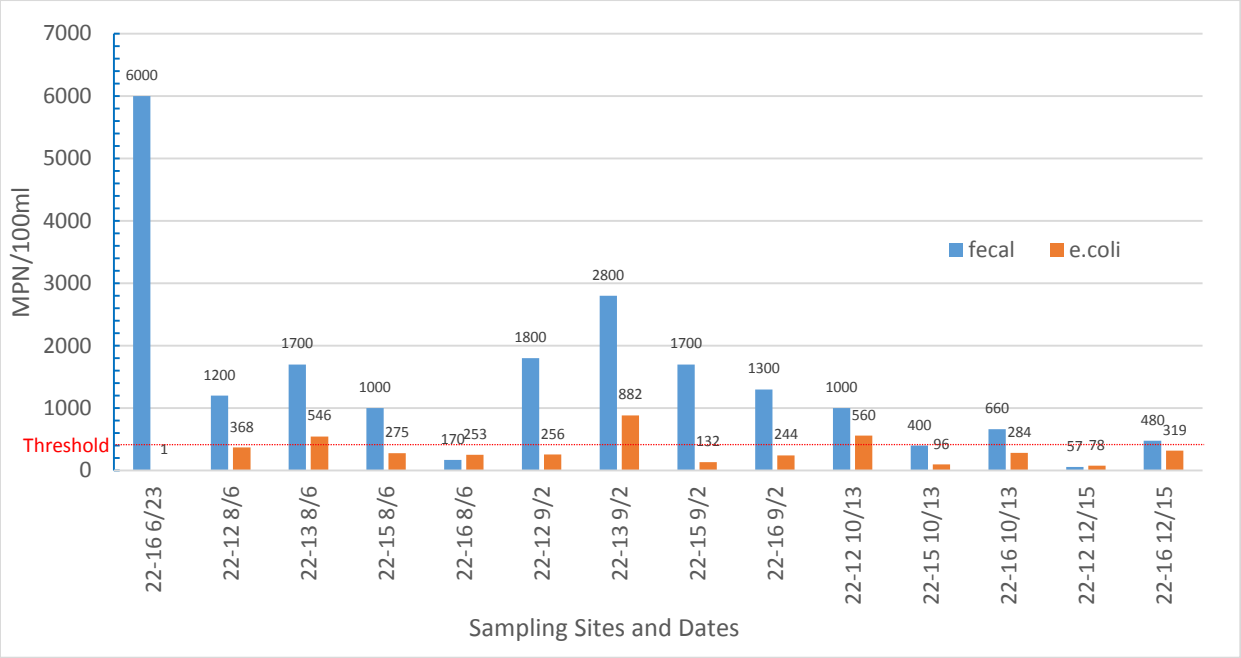

Figure 5. Fecal and E. coli data for County Long Branch Creek WBID 1627 data from mid-2015.

2.2 Previous Studies: Long Branch Creek Targeted Monitoring Study

Pinellas County and the City of Largo conducted a targeted monitoring study in Long Branch Creek in 2010 to identify the sources of elevated nutrients, some of which may also be sources of bacteria. The County's consultant, Environmental Research & Design, Inc. (ERD), developed the sampling program design and conducted field sampling activities, laboratory analysis, and data analysis and reporting. Eighteen surface water sites were monitored on a biweekly basis for eight weeks during the dry season, which included measurement of field parameters, discharge rates, and sample collection for laboratory analyses. The site locations were located strategically along Long Branch Creek to quantify nutrients and fecal coliform bacteria within the system. Twelve sites were located on the main branch and six tributary sites to the main channel were monitored to assist in identifying potential sources of elevated nutrients and fecal coliform bacteria. Site locations are shown in Figure 6 and descriptions are in Table 2. All samples were analyzed for general parameters, nutrients, and fecal coliform bacteria by the NELAC certified ERD Laboratory (E1031026).

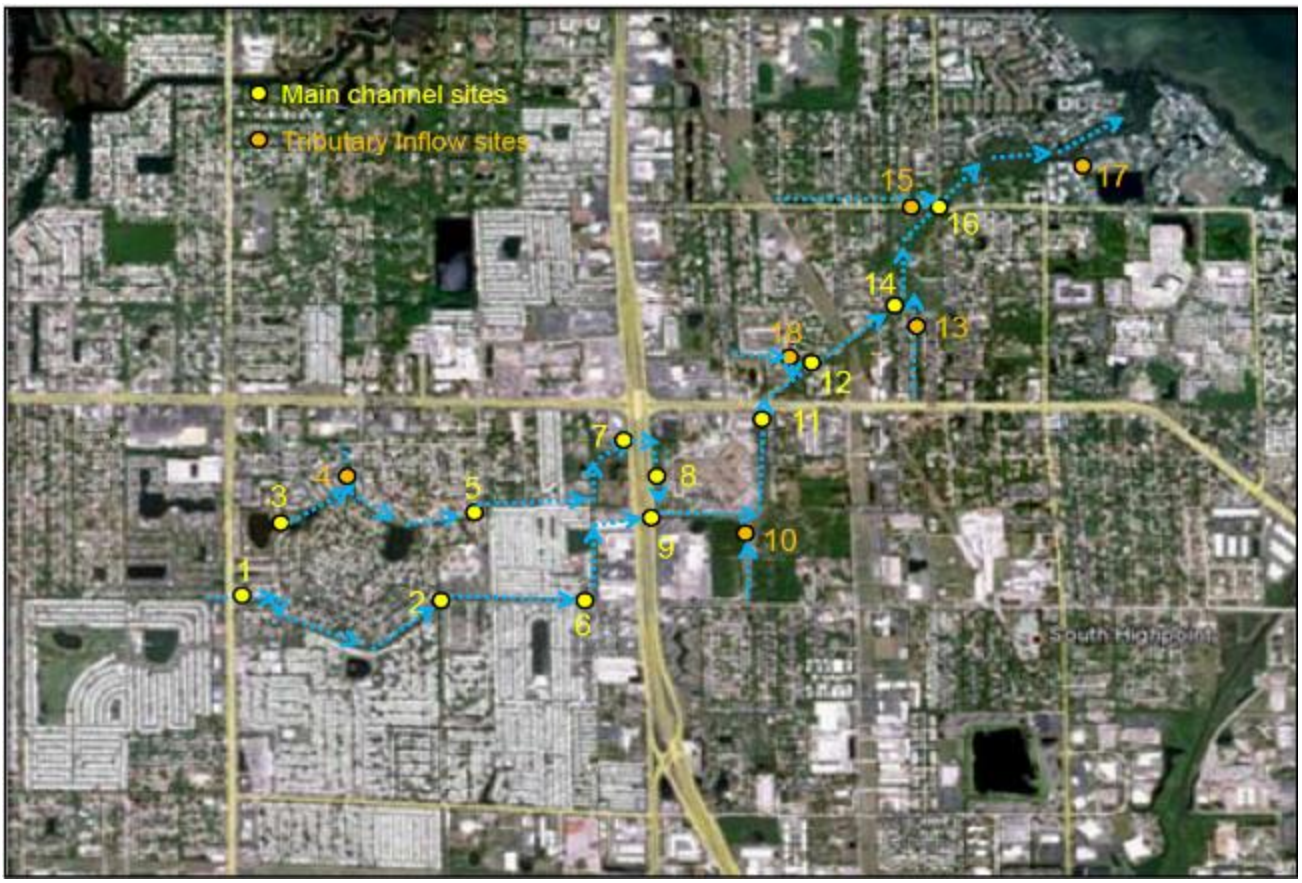

Figure 6. Targeted monitoring sites (ERD, 2012).

Table 2. Targeted monitoring site descriptions.

Site	Description	Purpose
1	Inflow to South Main Channel from areas west of South Belcher Rd	Primary inflow in upstream portion of south headwaters segment
2	South Main Channel at wooden bridge crossing	South headwaters segment site
3	Discharge from lake into North Main Channel	Primary inflow to north headwaters segment
4	Open ditch inflow to North Main Channel	Tributary inflow to north headwaters segment
5	North Main Channel at Hopedale Lane	North headwaters segment site
6	South Main Channel at 3rd St.	South headwaters segment site
7	North Main Channel at 65th St. N.	North headwaters segment site
8	North Main Channel prior to confluence with South Main Channel	Final north headwaters segment site
9	South Main Channel prior to confluence with North	South headwaters segment site prior to entering main channel
10	Tributary inflow to main channel	Tributary inflow to main channel
11	Main channel south of East Bay Dr.	Main channel site
12	Main channel at Briarwood Dr.	Main channel site
13	Tributary inflow to main channel – Poinciana Ditch	Tributary inflow to main channel
14	Main channel upstream from Site 13 tributary inflow	Main channel site
15	Open ditch inflow along south side of Whitney Rd. – Whitney Rd Ditch	Tributary inflow to main channel
16	Main channel at Whitney Rd.	Main channel site
17	Discharge from pond into main channel	Pond discharge to main channel
18	Tributary inflow to main channel	Tributary inflow just upstream from Site 12

Fecal coliform results were highly variable at each of the monitoring sites with substantially elevated results at site 7 and 8 on the northern branch, 16 on the main channel, and at the smaller tributary ditches at 13 and 15. Fecal coliform results are in Table 3 and Figures 7 and 8.

Table 3. Targeted monitoring fecal coliform results 2010.

Site	Short Site Description	Fecal coliform Results by date (CFU/100 ml)					
		10/19	11/1	11/16	12/7	1/18	Mean
3	North branch	743	480	782	736	2,700	1,088
5	North branch	614	530	809	27	2,100	816
7	North branch	1,200	5,500	5,100	5,300	3,800	4,180
8	North branch	2,408	6,000	700	5,800	4,900	3,962
1	South branch	510	400	330	310	664	443
2	South branch	606	250	540	440	3,800	1,127
6	South branch	500	410	530	520	2,100	812
9	South branch	254	420	1,060	340	1,145	644
11	Main channel	390	194	300	63	1,054	400
12	Main channel	697	2,200	718	618	3,000	1,447
14	Main channel	869	2,100	800	500	2,800	1,414
16	Main channel	1,546	6,600	8,200	1,283	2,550	4,036
4	Tributary ditch	440	3,900	1,018	360	560	1256
10	Tributary ditch	300	156	191	136	1,120	381
13	Tributary ditch	711	10,300	7,100	3,800	4,700	5,322
15	Tributary ditch	1,597	10,600	5,100	ND	2,000	4,824
17	Lake outfall	44	128	540	57	330	220
18	Tributary ditch	ND	ND	560	1,020	1,204	928

ND= no data

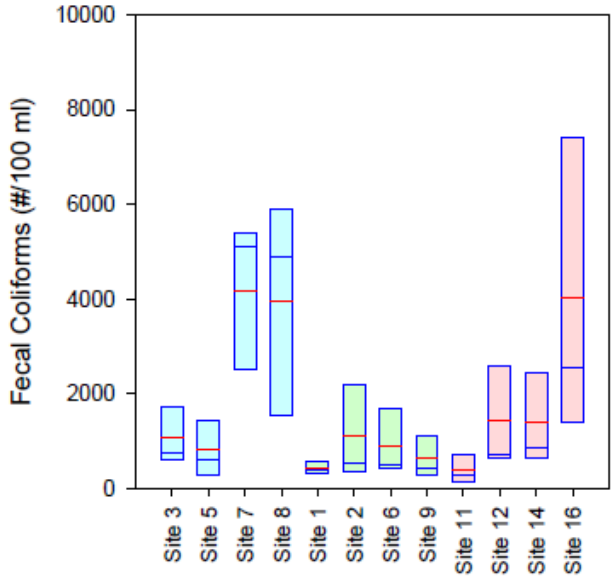

Figure 7. Box and whisker plots of main branch sites (ERD, 2012).

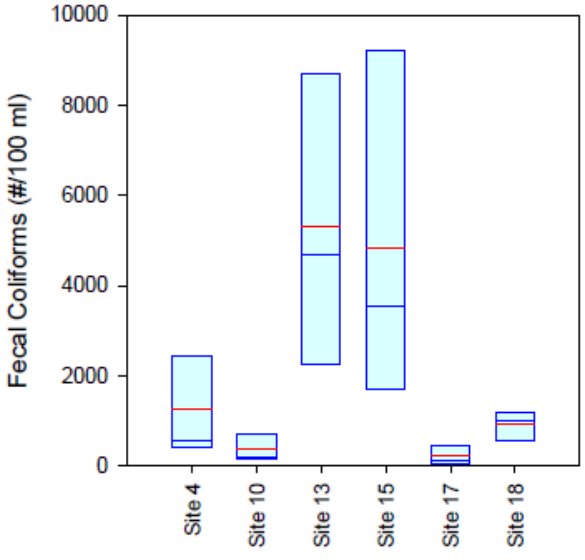

Figure 8. Box and whisker plot of tributary ditch sites (ERD, 2012).

Fecal coliform results were relatively low in the upstream portions of the creek in both the northern and southern branches; however, substantial increases were observed in the northern branch just upstream of the confluence (sites 7 and 8). This spike in fecal coliform does not appear to significantly impact downstream water quality given that site 11, just downstream of the confluence of the two branches, has the lowest mean fecal coliform results of all of the main channel sites. Fecal coliform remains relatively low in the main channel until site 16 which is the most downstream site. The source of the elevated results appear to be the two ditches that discharge to the creek between sites 14 and 16 as seen depicted as green triangles in Figure 9. Site 13 is Poinciana ditch and Site 15 is Whitney Rd. ditch; both are described in more detail later in the report.

One sampling event on January 18, 2011 was conducted following a 2.88 inch rain event. In general, under these high flow conditions, results were elevated compared to other sampling events which occurred during more typical dry season flow conditions (Figure 10). The spike in the southern branch at site 2 did not occur during other sampling events and the spike at site 12 in the main channel occurred only during one other sampling event, but was not as extreme as during high flow conditions.

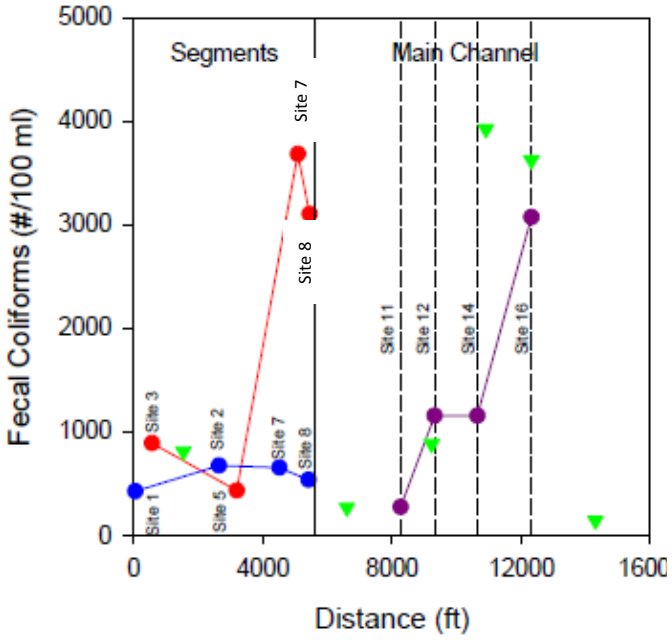

Figure 9. Mean fecal coliform for all sampling event plotted by distance from the headwaters (ERD, 2010).

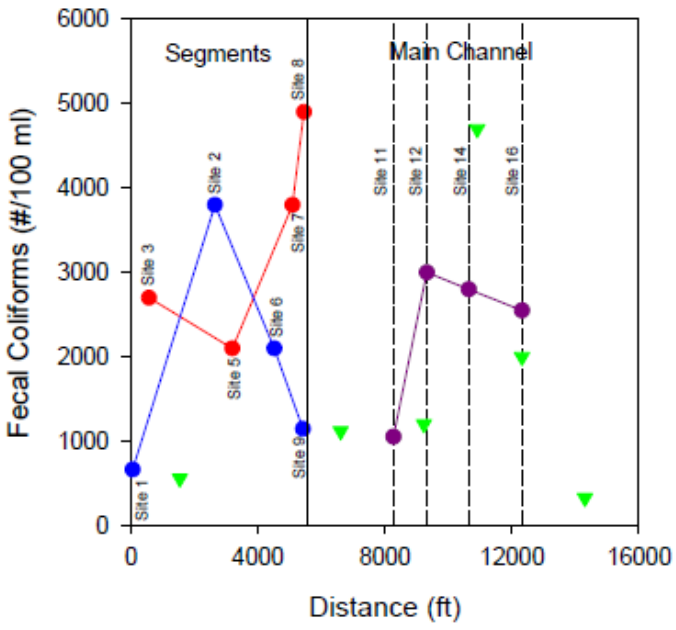

Figure 10. Mean fecal coliform during high flow event plotted by distance from the headwaters (ERD, 2010).

Discharge was also measured during each sampling event allowing for the calculation of fecal coliform loads. Estimates of mass loads discharging through the Long Branch Creek watershed

were calculated for each of the monitoring sites (Table 4). During all events except the January 18th sampling which followed a storm event, loadings in the creek remained relatively low until site 16. The spike at site 16 is due to both increases in concentration and discharge at the site. The two tributary inflows (site 13 and 15) between sites 14 and 16 do not explain the spike in loading observed at site 16, suggesting that an additional significant source of fecal coliform bacteria is present in the area. It should be noted that this site is tidally influenced, so the source in not necessarily upstream from the site and the increase in discharge could be due to tidal water outflow. During the high flow event on January 18th, fecal coliform loads spiked at both site 12 and site 16 (ERD, 2012).

Table 4. Targeted monitoring fecal coliform loads 2010.

Site	Short Site Description	Fecal coliform Loads by date (CFU x 10^8/day)					
		10/19	11/1	11/16	12/7	1/18	Mean
3	North branch	20	1	0	1	1	4
5	North branch	0	0	1	0	199	40
7	North branch	71	125	62	26	3,712	799
8	North branch	187	1	18	60	2,880	629
1	South branch	152	3	8	0	464	125
2	South branch	23	0	30	5	1,044	220
6	South branch	33	6	29	10	1,968	409
9	South branch	30	7	27	7	1,573	329
11	Main channel	116	34	24	3	1,349	305
12	Main channel	104	398	212	68	9,521	2,060
14	Main channel	140	191	178	35	5,700	1,249
16	Main channel	1,982	7,091	11,977	1,007	12,787	6,969
4	Tributary ditch	0	1	0	0	0	0
10	Tributary ditch	16	8	10	3	111	30
13	Tributary ditch	13	228	254	93	348	187
15	Tributary ditch	28	3	10	ND	373	103
17	Lake outfall	0	0	0	0	367	73
18	Tributary ditch	ND	ND	18	20	182	74

ND= no data

In general, discharge rates through Long Branch Creek increase with increasing distance downstream, with observed increases exceeding the inflows of the tributaries. This suggests that there are additional inputs from either tributaries or stormwater discharges that were not monitored during the study or the influx of groundwater into the system.

Nitrogen and oxygen isotopic analysis was used to differentiate between nitrogen sources in the watershed. The data from this effort indicate manure or sewage sources throughout the creek. All sites except site 7 indicated manure or sewage as a nitrogen source during at least one sample event and site 15 (Whitney Rd ditch) was positive during all five sampling events (Table 5). Positive results did not appear to be related to stormwater inputs because the correlation

between the presence of sewage indicators and discharge rate appears to be negative, suggesting that sewage impacts may be on-going. UV absorption analysis indicated the presence of non-natural organic material in the majority of the samples (ERD, 2012). This study ultimately guided the additional work needed to complete this Bacterial Pollution Control Plan as described in the following sections.

Table 5. Targeted monitoring stable isotopes testing positive for manure or sewage (ERD, 2012).

Site	Short Site Description	d^{15}N-NOx (samples with a 90% CI of manure or sewage as N source)				
		10/19	11/1	11/16	12/7	1/18
3	North branch		X	X	X	
5	North branch			X		
7	North branch					
8	North branch		X	X		
1	South branch				X	
2	South branch	X				
6	South branch		X			
9	South branch	X	X	X	X	
11	Main channel			X		
12	Main channel	X	X	X		
14	Main channel	X	X	X		
16	Main channel	X	X	X		
4	Tributary ditch			X	X	X
10	Tributary ditch			X	X	
13	Tributary ditch	X		X	X	
15	Tributary ditch	X	X	X	X	X
17	Lake outfall	X	X	X		
18	Tributary ditch			X	X	

2.3 Microbial Source Tracking

In 2015, additional monitoring sites were selected based on several factors: elevated sampling results from previous studies (Whitney Rd. and Poinciana ditches), potential bacteria sources (horse stables), and other strategic locations to identify target areas for follow-up investigations (north and south branches). Location descriptions are in Table 6. On June 18, 2015 staff from Pinellas County and the City of City of Largo conducted a field reconnaissance to determine sampling logistics at the selected sites. A total of six sampling sites were identified for wet season, dry season, and storm event sampling. An overview map of the sampling sites is shown presented in Figure 11. Sites were sampled once during the wet season in 2015, once during the dry season in 2016, and once immediately following a storm event in 2016. Samples were analyzed for *E. coli* and fecal coliform by the Pinellas County Utilities Laboratory and Source Molecular Corporation for microbial source DNA tracking (MST) analysis. Samples sent to Source Molecular Corporation

were analyzed using polymerase chain reaction (qPCR) for detection and quantification of human-specific bacteroides *B. dorei* genetic marker, horse and dog bacteroides gene biomarkers, and bird helicobacter genetic biomarkers (Table 6). Host markers for each site and event were selected according to expected sources while adhering to budget constraints.

Table 6. MST site descriptions.

Sampling Sites	Site Description	Host markers analyzed		
		Wet Season	Dry Season	Storm Event
Whitney Ditch	Tributary ditch with high fecal results during Targeted Study	none	Dog, Bird, Human	Human
LB-1	Main channel, downstream from horse stable	Dog, Bird, Horse, Human	Dog, Bird, Horse, Human	Human
LB-2 (Poinciana Ditch)	Tributary ditch with high fecal results during Targeted Study	Dog, Bird, Human	Dog, Bird, Human	Human
LB-3	Main channel, upstream from horse stable and Poinciana ditch	Dog, Bird, Horse, Human	Dog, Bird, Horse, Human	Human
LB-4	South headwater branch	Dog, Bird, Human	Dog, Bird, Human	Human
LB-5	North headwaters branch	Dog, Bird, Human	Dog, Bird, Human	Human

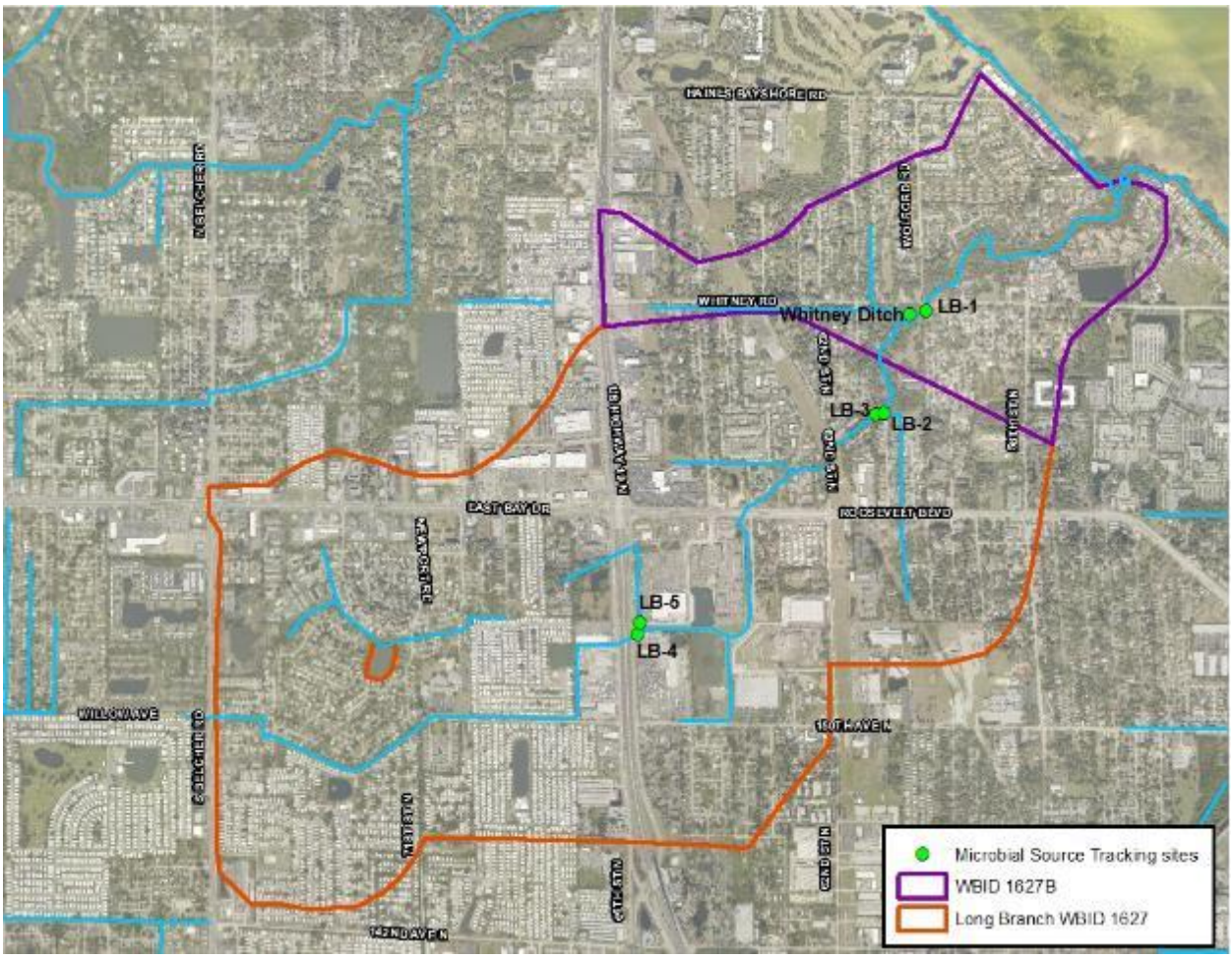

Figure 9. MST sampling site map.

2.3.1 Wet Season Results

Results from wet season sampling on September 1, 2015 are presented in Figure 12 and Table 7. Fecal coliform results for all six sites were elevated at levels above the 2015 water quality standard of 400 MPN/100 ml with most sites more than three times the standard. The highest levels occurred at site LB-5 in the north branch at 6,930 MPN/100 ml. E. *coli* results for all samples were still above the current criteria of 410 MPN/100 ml with LB-4 having the lowest concentration just above the limit.

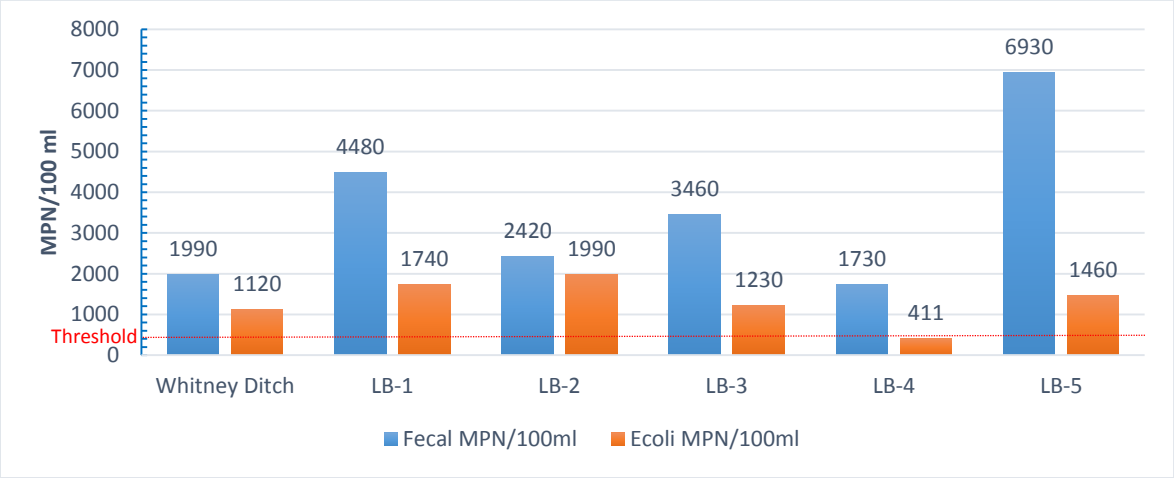

Figure 10. Wet season bacteria results.

The human genetic marker was only detected at sites LB-1, the most downstream site, and LB-2 at Poinciana ditch at moderate levels. Dog markers were found at all five sites in moderate to low concentrations. Horse DNA was not detected at the two sites sampled and bird markers were only found at trace levels, if at all.

Table 7. Wet season MST results.

Site	Copies / 100 ml			
	Bird	Dog	Horse	Human
Whitney Ditch	n/a	n/a	n/a	n/a
LB-1	<LOQ	4440	ND	2490
LB-2	<LOQ	2700	n/a	1090
LB-3	<LOQ	964	ND	ND
LB-4	ND	762	n/a	ND
LB-5	ND	688	n/a	ND

n/a = sample not tested for marker, ND = not detected, <LOQ = trace levels detected below the limit of quantification

2.3.2 Dry Season Sampling

Sampling was repeated near the end of the dry season on April 14, 2016. Results are presented in Figure 13 and Table 8. Both fecal coliform and *E. coli* results for two of the sites, LB-1 and Whitney, were elevated at levels above both the 2015 and current water quality standards. Four sites (LB-2, LB-3, LB-4, and LB-5) were at or below acceptable levels for both fecal coliform and *E. coli* during the dry season. Both fecal coliform and *E. coli* concentrations were lower at every site during the dry season than the wet season.

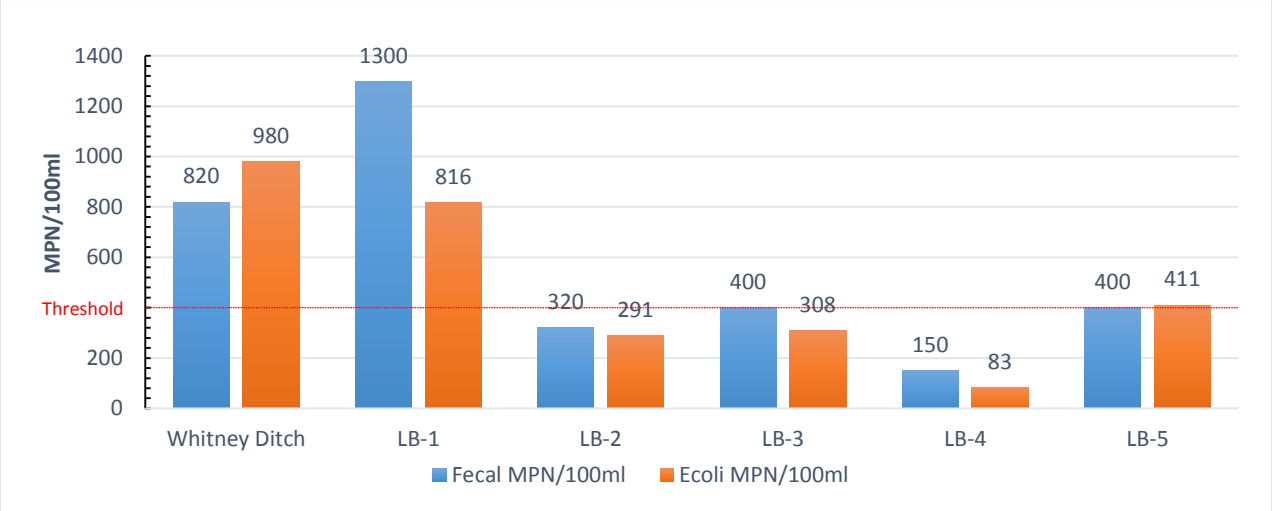

Figure 11. Dry season bacteria results.

The human genetic marker was only detected at site LB-3 at trace levels. Dog markers were found in low concentrations at sites LB-1 and Whitney, trace concentrations at sites LB-2, LB-3 and LB-4 and were not present at site LB-5. Similarly to the wet season, horse DNA was not detected at the two sites sampled (LB-1 and LB-3) and bird markers were only found at trace levels if at all during the dry season.

Table 8. Dry season MST results.

Site	Copies / 100 ml			
	Bird	Dog	Horse	Human
Whitney Ditch	ND	238	n/a	ND
LB-1	<LOQ	607	ND	ND
LB-2	ND	<LOQ	n/a	ND
LB-3	<LOQ	<LOQ	ND	<LOQ
LB-4	<LOQ	<LOQ	n/a	ND
LB-5	<LOQ	ND	n/a	ND

n/a = sample not tested for marker, ND = not detected, <LOQ = trace levels detected below the limit of quantification

2.3.3 Storm Event Sampling

To further investigate bacteria levels in the creek, County staff sampled following a storm event on August 8, 2016. The nearby St. Petersburg/Clearwater Airport NOAA station reported 0.51 inches between 9 am and 1 pm on August 7th and an additional 1.09 inches between 6 am and 10 am on August 8th for a two day total of 1.6 inches of rain preceding sampling. According to the USGS gage 02307780 in the basin, the creek was discharging at a rate of 71 to 73 cfs at a gage height of approximately 45 ft during the sampling event (Figures 14 and 15). Mean discharge at this site for the period of record (2003 to 2015) is 8.2 cfs with a gage height of 41.29 ft. Annual peak streamflow at this site ranges from 136 to 682 cfs with peak gage heights of 43.17 to 49.59 ft. Samples were taken at the same 6 sites (Figure 12) and analyzed for fecal coliform, *E. coli* and human genetic markers.

The storm event results indicate high levels of bacteria at each sampling site (Figure 16) and that all sites were impacted by human source of bacteria (Table 9).

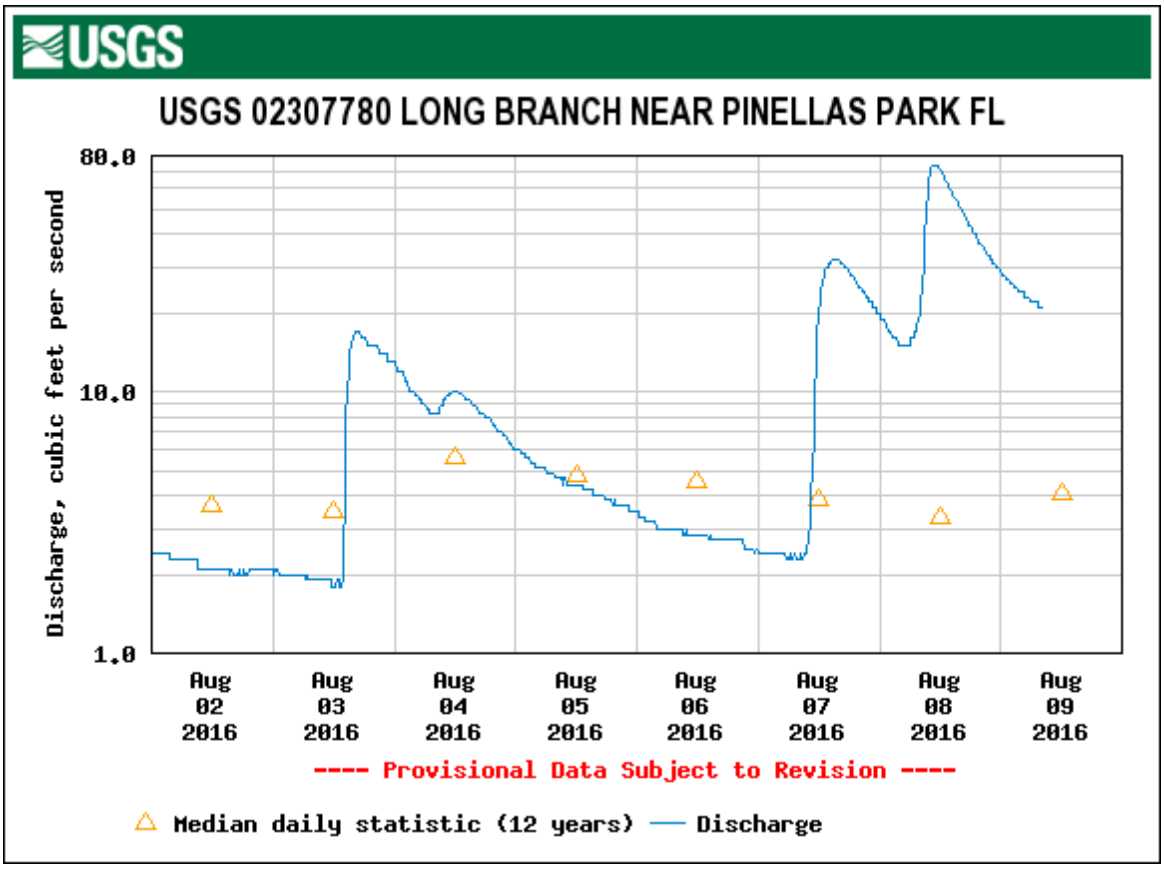

Figure 12. USGS discharge at site 02307780 in Long Branch Creek during storm event sampling.

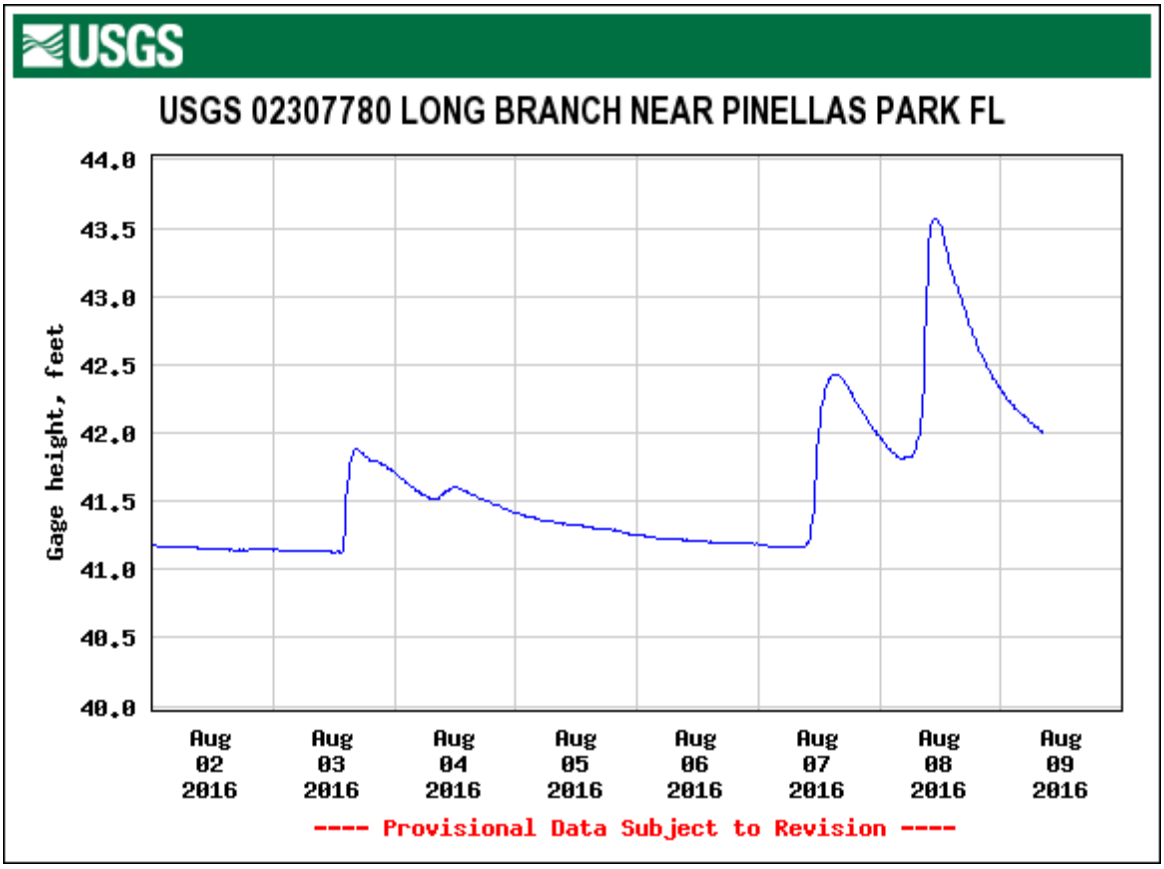

Figure 13. USGS gage height at site 02307780 in Long Branch Creek during storm event sampling.

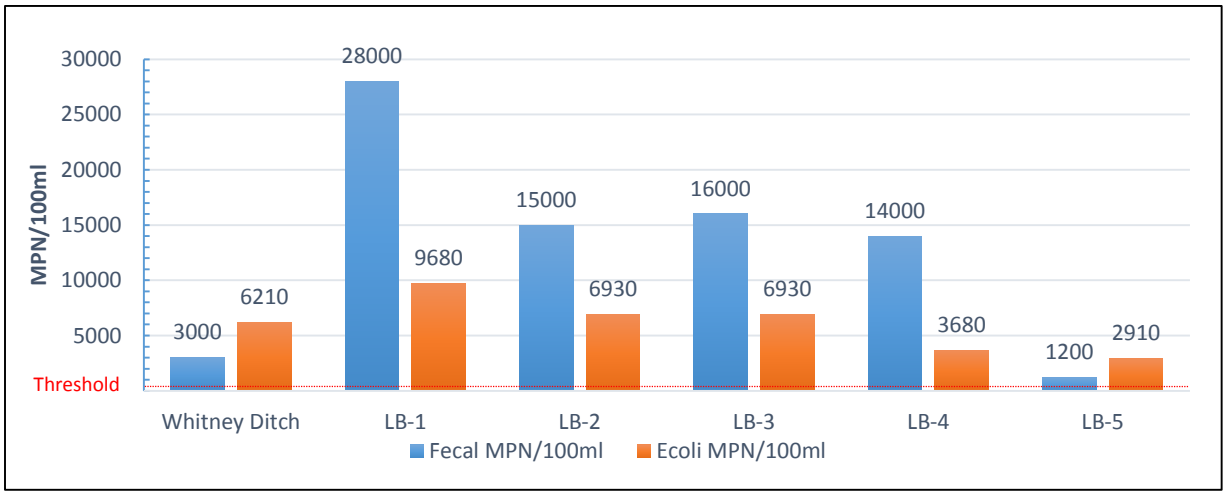

Figure 14. Storm event bacteria results.

Table 9. Storm event MST results.

Sites	Copies / 100 ml			
	Bird	Dog	Horse	Human
Whitney Ditch	n/a	n/a	n/a	950
LB-1	n/a	n/a	n/a	946
LB-2	n/a	n/a	n/a	<LOQ
LB-3	n/a	n/a	n/a	374
LB-4	n/a	n/a	n/a	<LOQ
LB-5	n/a	n/a	n/a	<LOQ

n/a = sample not tested for marker, ND = not detected, <LOQ = trace levels detected below the limit of quantification

2.4 Summary of Monitoring Results

Results indicate fecal coliform and *E. coli* concentrations are lower during the dry season, increase during the wet season, and are highest following a rain event with one exception at LB-5 (Figures 17 and 18). Fourteen of the eighteen samples exceeded the 2015 fecal coliform criteria with the four meeting the criteria all occurring during the dry season. Thirteen samples exceeded the *E. coli* criteria.

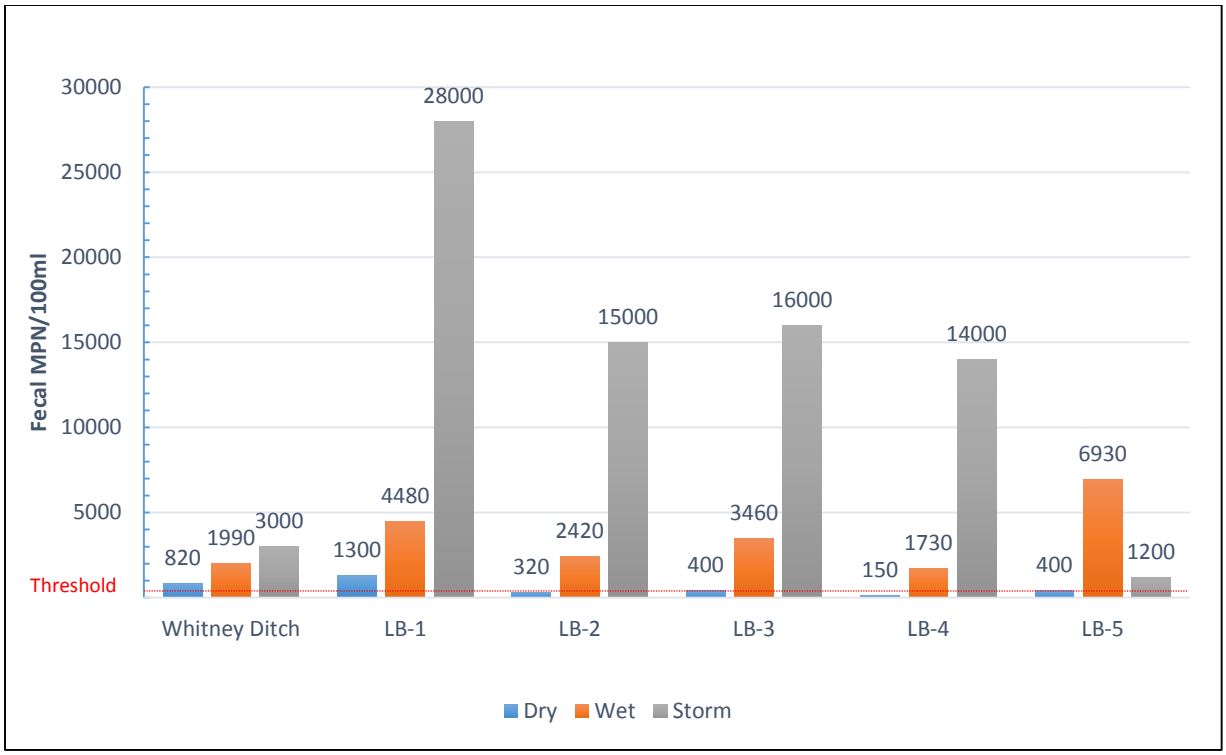

Figure 15. Fecal coliform results for all three sampling events.

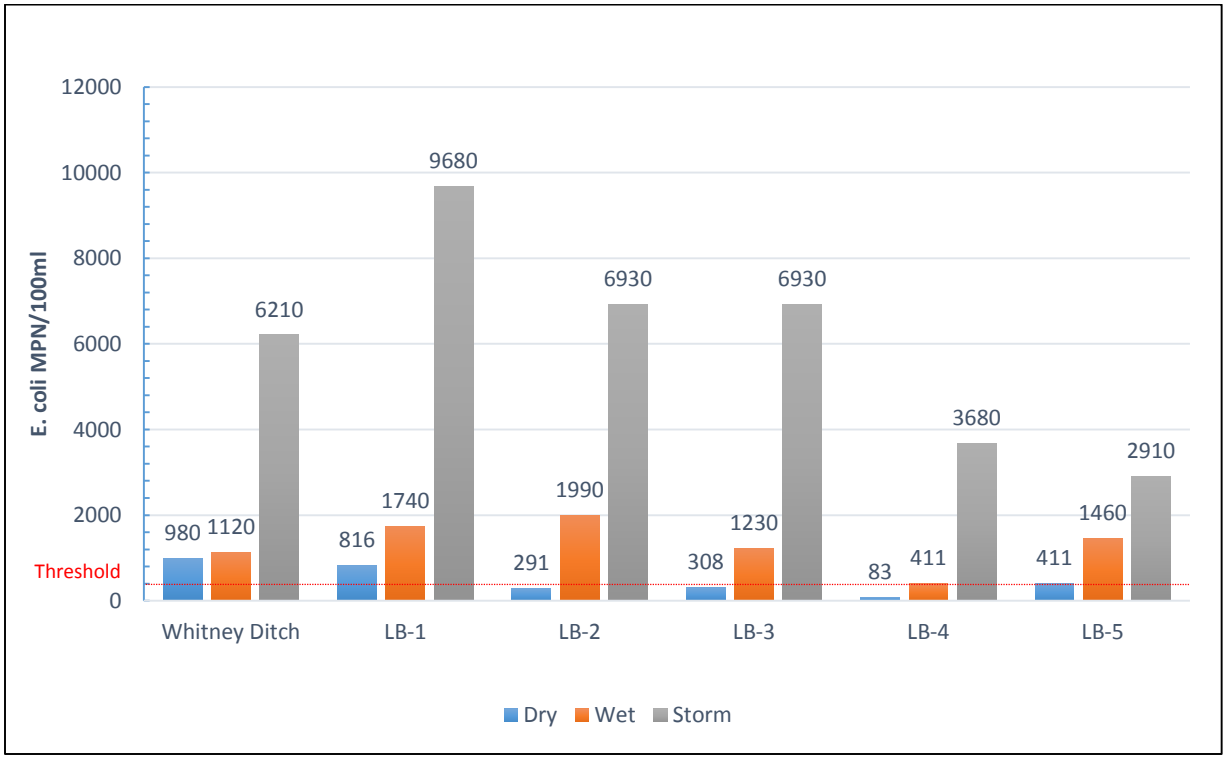

Figure 16. E. coli results for all three sampling events.

The Whitney site was not sampled for DNA microbial source tracking during the wet season, but results for the dry season indicate dogs contribute to the high levels of fecal coliform and *E. coli*. Dogs might contribute to high levels during the wet season as well since this is when more dog waste left of the landscape is likely to wash into the creek but potential non-point sources may exist also. Human DNA was not tested during the wet season at this site, but was present during the storm event sampling, although not present during the dry season. This indicates there is a contribution from the sanitary sewer or other human sources of bacteria at this site. Stable isotope analysis also found sanitary sewer influence at this site during all five sampling events. The Whitney ditch site had some of the highest fecal coliform concentrations during the targeted monitoring study, but sampling results in 2015 and 2016 were not as elevated as the previous study. Recent ditch maintenance as described in Section 3.2.2 may be partially responsible for the reductions.

Site LB-1 corresponds to ambient site 22-01 and targeted monitoring site 16. MST results indicate dog waste is a contributor to bacteria at this site. Both MST and stable isotope results indicate sanitary sewer is also a contributor at this site, especially during the wet season. The nearby horse stables are not suspected to be a contributor to bacteria at this site based on field investigations and MST results. This site is tidally influenced and although all sampling was conducted during an outgoing tide, downstream sources may influence results at this site.

Site LB-2 and targeted monitoring site 13 represent tributary inflows from Poinciana ditch. Elevated bacteria results well above water quality standards were detected during both studies, although recent results were much lower for fecal coliform than the 2012 study and 2016 dry season results met standards for both fecal coliform and *E. coli*. This decrease may be influenced by recent management activities including ditch clearing, debris removal and educational outreach that occurred in-between the dry and wet seasons (see Section 3.2.5). Based on MST sampling, dogs are a source of bacteria at this site during both wet and dry season. Both stable isotope and MST results indicate sanitary sewer impacts this site as well.

Site LB-3 and targeted monitoring site 14 represent the main branch of the creek upstream from the horse stable and Poinciana ditch. Other main channel sites upstream from the Poinciana ditch include targeted monitoring sites 11 and 12 and ambient sites 22-05, 22-07, 22-08, and 22-12. Dry season MST results for fecal coliform and *E. coli* were below water quality standards, but wet season and storm event results were elevated. Ambient and Targeted Monitoring results for this section of the main channel, while often above the water quality standard, are typically much lower than the north tributary branch. Based on MST sampling, dogs appear to be a source of bacteria at this site and both MST and stable isotope results indicate some wastewater impacts are present (although not during all sampling events).

Site LB-4, Targeted Monitoring sites 1, 2, 6, and 9, and ambient site 22-15 represent the south tributary branch. Although some ambient results are elevated, both the MST and Targeted Monitoring results had the lowest values for fecal coliform and *E. coli* during non-storm event sampling, with many events meeting water quality standards. Dog DNA was detected during both wet and dry season MST sampling events. Human DNA was detected at low levels only during the storm event sampling, but stable isotope analysis detected wastewater sources here in four of five events. In general, bacteria concentrations and loads are lower in the south branch than the north branch.

Site LB-5, Targeted Monitoring sites 3, 5, 8, and 8 and ambient sites 22-13, 22-14, and 22-16 are located on the north tributary branch. In general, bacteria concentrations and loads are higher in the north branch than the south branch and are likely contributing to downstream exceedances. DNA analyses detected dogs as a source of bacteria during the wet season. Human DNA was only detected at trace levels during the storm event, but stable isotope analysis indicated wastewater may be an intermittent source of bacteria in the north branch.

2.5 Field Inspections

Following the 2010 Targeted Monitoring Study, several areas were inspected in the Long Branch Creek watershed to investigate the wastewater or manure sources of elevated nutrients and fecal coliform. Several mobile home parks in the area were inspected to determine whether or not they used package plants and it was found that all are connected to the sanitary sewer. However, the collection systems might reside within the mobile home park and private maintenance might be an issue. Investigations also confirmed there are very few septic tanks in use in the basin. The study identified a horse stable and riding area as a possible contributor to increased nutrient and fecal coliform loadings in a portion on the Creek; however, an inspection found the layout and management of the property sufficient to limit bacterial pollution to the Creek. Follow up inspections in 2015 confirmed this finding and it was also later backed by microbial source tracking analysis as described in the previous section. Therefore, it is not thought that horses contribute significantly to bacteria levels in the creek. During the inspections, it was noted that aging City of Largo sanitary sewer infrastructure runs parallel to and in very close proximity to water conveyances, but no leaks were found during Largo's follow-up inspections of areas of concern forwarded by the County (Section 2.6.1). Largo will continue to monitor pipe condition during routine inspections and address any issues as they are found.

Additional field investigations were performed in 2015, primarily in the Poinciana and Whitney Rd. ditch areas because these areas were found to be large contributors to elevated bacteria results to the downstream portions of the creek during the targeted monitoring study. However, recent investigations did not find any obvious sources in the Whitney Rd. ditch area and follow ups with the City of Largo and Department of Health ruled out any septic tanks in the area. Several

issues were found along Poinciana ditch and in the Highpoint neighborhood upstream, including trash, illicit connections, and pet waste as described in the following sections. These areas are shown in Figure 17.

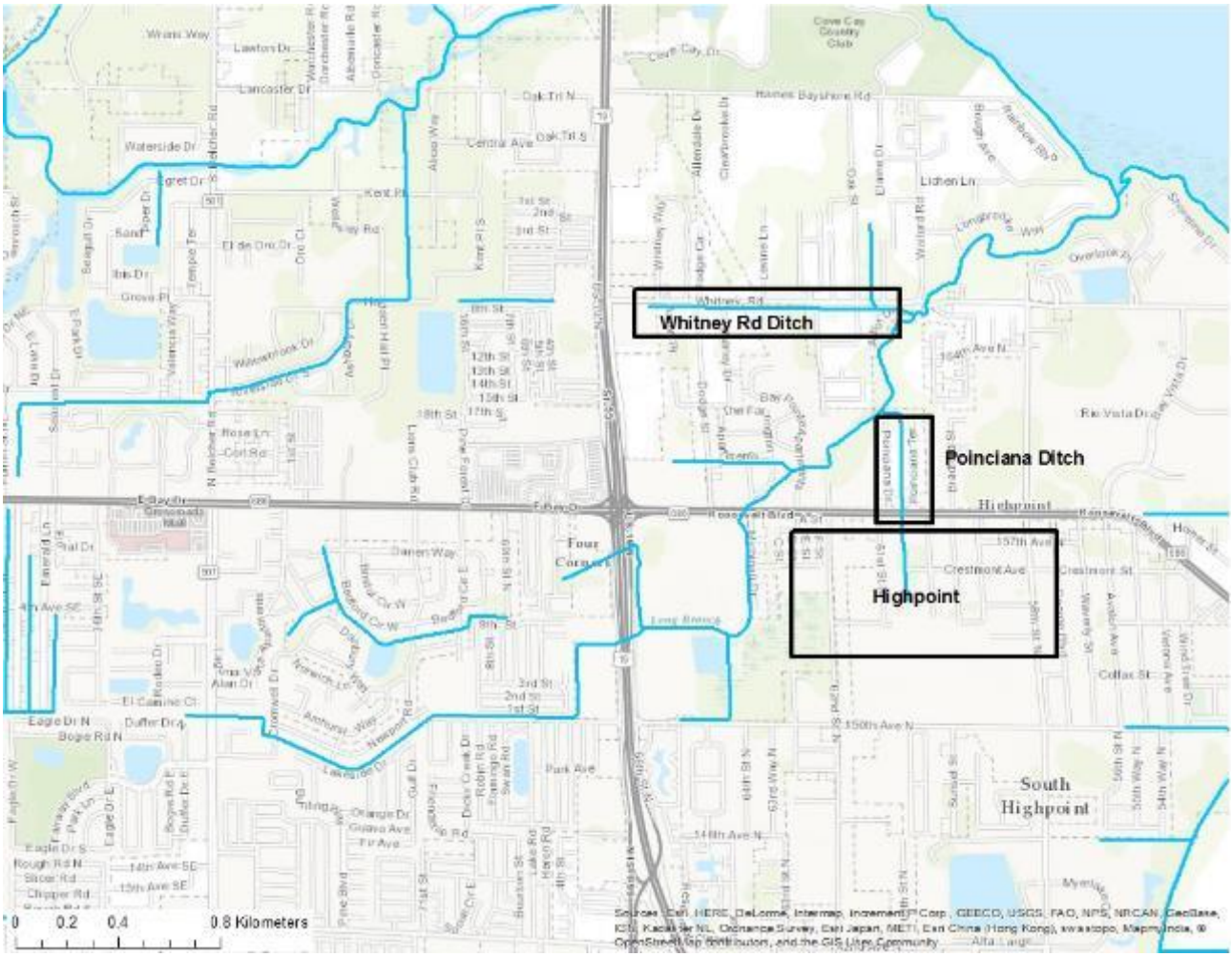

Figure 17. Whitney Rd ditch, Poinciana ditch, and the Highpoint neighborhood locations.

2.6 Sources Identified

2.6.1 Sanitary Sewer Issues

The stable isotope sampling conducted in 2010 and the MST sampling completed in 2015 and 2016 indicated human sources of bacteria in Long Branch Creek. The isotope results indicated wastewater or manure, but manure was ruled out during follow-up field inspections. Septic tanks were also ruled out during follow-up inspections and this was confirmed by the City of Largo and Department of Health. There are currently only two known septic tanks in the watershed. Many older septic tanks have been abandoned following state procedures under the authority of the Department of Health.

2.6.2 Homeless and Transient Populations

Pinellas County staff did not observe any evidence of homeless activity in the watershed during field investigations, other than a single-person dwelling which was removed in November 2016. However, the City of Largo's Police Department does have report of homeless activity in the area. According to the Largo Police Department, the area is subject to homeless activity. In November 2016 a homeless encampment was removed from an area just downstream from LB-4, and LB-3 (and upstream from LB-3). LB-3 tested positive for human biomarker during sampling.

Other potential human sources of bacteria could be City sanitary sewer infrastructure and/or privately owned wastewater collection systems. Also, reclaimed water use in the area could have influenced the isotope results and should be investigated further especially considering a reclaimed water pipe bisects site LB-1.

Field inspections found several sanitary sewer pipes running along and across ditches in the watershed and in the creek. Two concerns were forwarded to the City of Largo - a pipe crossing the creek with what appeared to be a surface crack, near site LB-2, and a sagging pipe crossing a pond outfall to the creek, near site LB-1 (see Appendix A). The City has inspected both pipes. The cracked pipe was found structurally sound and the sagging pipe is not part of the City's infrastructure. County staff collected fecal coliform samples twice at both locations; all samples came back below state standards.

2.6.3 Pet Waste

Dog genetic markers were detected at low to moderate levels at all five sampling sites during the wet season and at low or trace levels at five of the six sites during the dry season. Dog waste is suspected to be a source of bacteria to the creek present throughout the watershed and likely throughout the entire County given its highly urban land uses. Based on the U.S. Pet Ownership and Demographics Sourcebook and the U.S. Census Bureau data, it is estimated that there are approximately 235,000 dogs in the Pinellas County. During field investigations near the Poinciana ditch area, owners were seen with dogs running loose in the neighborhood and not picking up their pet's waste.

2.6.4 Litter and Debris

Accumulated trash and debris were found in several ditches, in the creek, and in other areas throughout the watershed (Figure 18 and Figure 19). Each issue was either forwarded to the City of Largo or County crews for cleanup or County NPDES inspectors took enforcement actions if on private property (Appendix A).

A recent study performed by Environmental Science Associates demonstrated that grass clippings can present a significant source of bacterial contamination to our waterways (Tomasko, 2016). In just four days incubation time during the study, a bucket containing ambient lake water

Figure 18. Trash and debris found in Long Branch Creek

Figure 19. Leaky trash cans stored on top of storm drain.

and 100 grams of grass clippings tested in excess of 20,000,000 cfu. Pinellas County staff will work cooperatively with the City of Largo to target these neighborhoods for additional outreach pertaining to proper disposal and recycling of grass clippings and other vegetative debris. Doorhangers that specifically address leaves and yard debris have been created for this purpose.

In addition, any person or company providing landscape services must obtain a Best Management Practices certification from Pinellas County. To be certified, individuals must attend a course in proper landscaping management, which includes content about ensuring that grass clippings are never blown into the road, ditch, curb, or storm drain. Participants must pass an exam to receive a certification, and then receive a vehicle decal that must be displayed on any vehicle used during landscaping activities. The decal allows for enforcement of the certification requirement. Both Largo and County staff have been trained to verify that the decal is present when they observe landscaping crews working in the community.

2.6.5 Illicit Connections

Several illicit connections of an unknown origin were found in Poinciana ditch. The connections were from residential backyards on either side of the ditch (Figure 20). It is suspected that they were mainly from washing machines, pools, and yard or roof drains. These were forwarded to County NPDES inspectors for enforcement (Appendix A).

Figure 20. Illicit connections to Poinciana ditch

2.6.6 Wildlife

Although the MST sampling showed little to no bird sources impacting the creek, there was evidence of raccoon activity along the creek bank on several visits to the most downstream site at LB-1 and other wildlife in Poinciana ditch (Figure 21). Turtles have also been demonstrated to be a potential source of e coli in waterbodies (Bodden, Guffey, and Volk, *Turtle Populations as a Potential Source of E. Coli in Lake Elmendorf.*) 17 of 23 turtles tested produced a cloacal swab that was positive for E. coli. Coyotes have also been reported within the WBID, with 14 reported sightings since 2010. A map of sightings is presented in Figure 24. Wildlife is assumed to be a minor contributor to bacteria in the creek and is a natural source that cannot be addressed by management actions, therefore, it is not addressed in this Bacterial Pollution Control Plan.

Figure 21. Raccoon tracks near LB-1 on Long Branch Creek

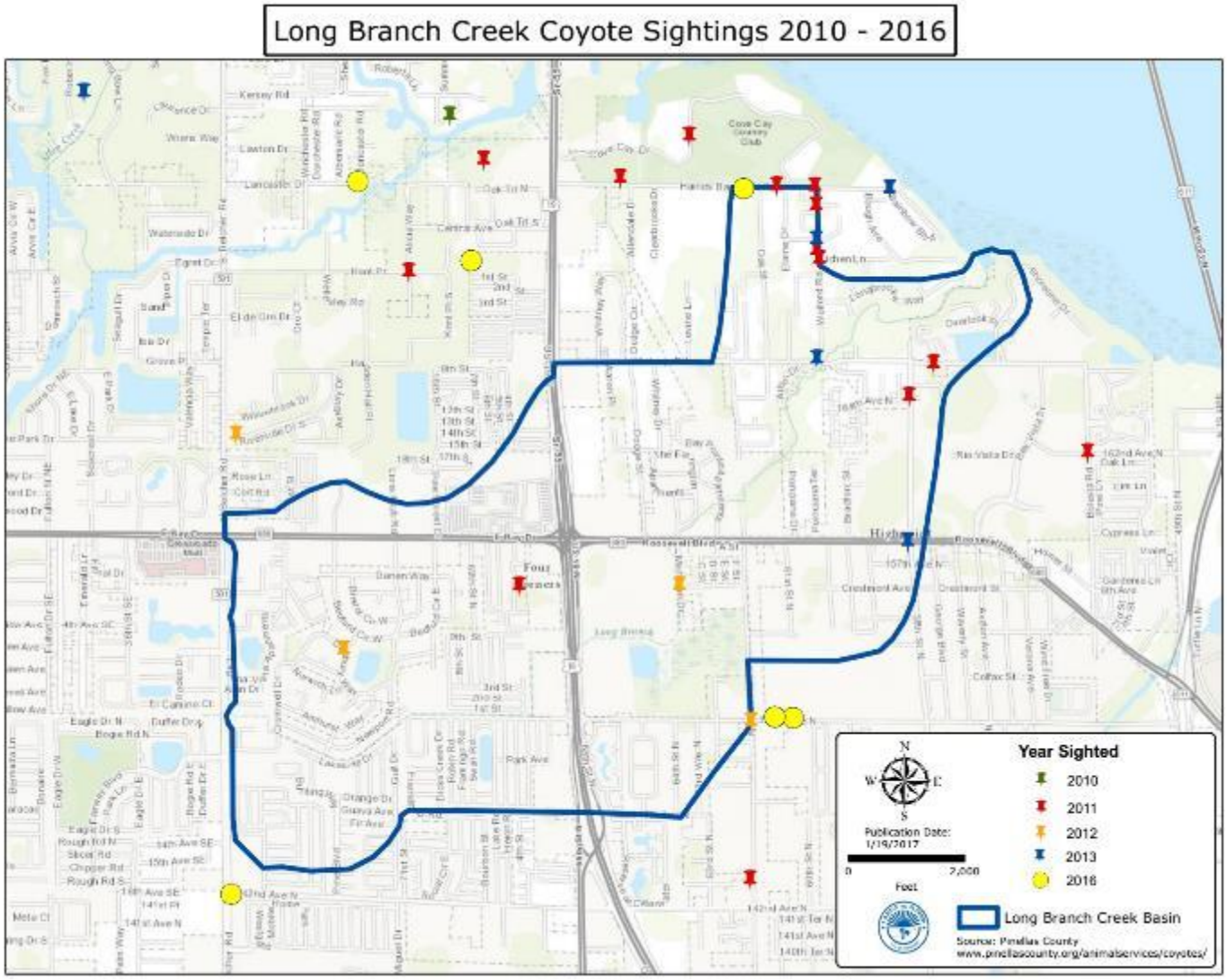

Figure 22: Long Branch Creek coyote sightings

3.0 Management Actions

Most management actions to reduce bacterial pollution are ongoing in the Long Branch basin and County-wide. In addition, several problems found during field investigations were corrected immediately. Some of the ongoing maintenance and operations work reported in this section is for the entire Long Branch basin used for county planning and operations, which includes the tidal portion of the creek. Management actions are divided into structural and nonstructural activities. A summary of management actions and the responsible entity linked to the sources of bacteria found in Long Branch Creek water are in Table 10.

Table 10. Management actions related to bacteria sources identified in Long Branch Creek.

Management Action	Entity	Sanitary Sewer	Pet Waste	Litter and Debris	Illicit Connections
Sanitary Sewer Inspection and Maintenance	Largo	X			
Stormwater Inspection and Maintenance	County, Largo			X	X
Stormwater Pond Compliance and Enhancement	County		X	X	
Code and Stormwater Enforcement	County, Largo	X	X	X	X
Street Sweeping	County, Largo			X	
Public Outreach and Education	County, Largo	X	X	X	X
Pet Waste Ordinance	County, Largo		X		
Stormwater Ordinance	County, Largo			X	X

3.1 Structural Management Actions

3.1.1 Sanitary Sewer Improvement Projects

Historically, sanitary sewer overflows (SSOs) have occurred within the WBID boundary. Research has demonstrated that fecal coliform can survive in sediments from weeks to months after introduction via a source such as an SSO (Burton and Pitt 2002). Therefore SSO prevention is a core component of Largo's plan to reduce bacterial contamination to the environment. The City has taken extensive measures, including maintenance activities and capital improvement projects, to prevent SSOs.

Sanitary Sewer Service Improvement Plan

In 2007, The City of Largo adopted a Sanitary Sewer Service Improvement Plan (Plan). The primary objectives of the Plan include:

- Proactively make sanitary sewer system improvements, resulting in the prevention of system failures and overflows;
- Meet current and future anticipated regulatory requirements;
- Provide sewer capacity in a timely fashion to accommodate system expansion and redevelopment; and
- Maintain level of service standards that are desired and acceptable to the community.

Influent and Headworks Project

Begun in January 2016, the Influent and Headworks Project consists of a new influent pump station, equalization tank, headworks facility, and odor control system with modifications to existing digester tanks and construction of a new gravity sludge thickener. The 5 million gallon equalization tank will hold excess water during storm events. The project will increase the influent capacity to 43 million gallon per day, provide flow equalization, and increase hydraulic capacity and reliability. The project is anticipated to be completed in October 2017.

Wet Weather Project

The 38.1 million dollar Wet Weather Project encompasses reconstruction and expansion of seven new lift stations, installation of a wet weather monitoring and control valve system, and 14 miles of new forcemain, 1.5 miles of which is located within the Long Branch Creek watershed. Begin in February 2015, the project is anticipated to be completed in April 2017. Figure 24 illustrates these wet weather projects within the Long Branch Creek watershed.

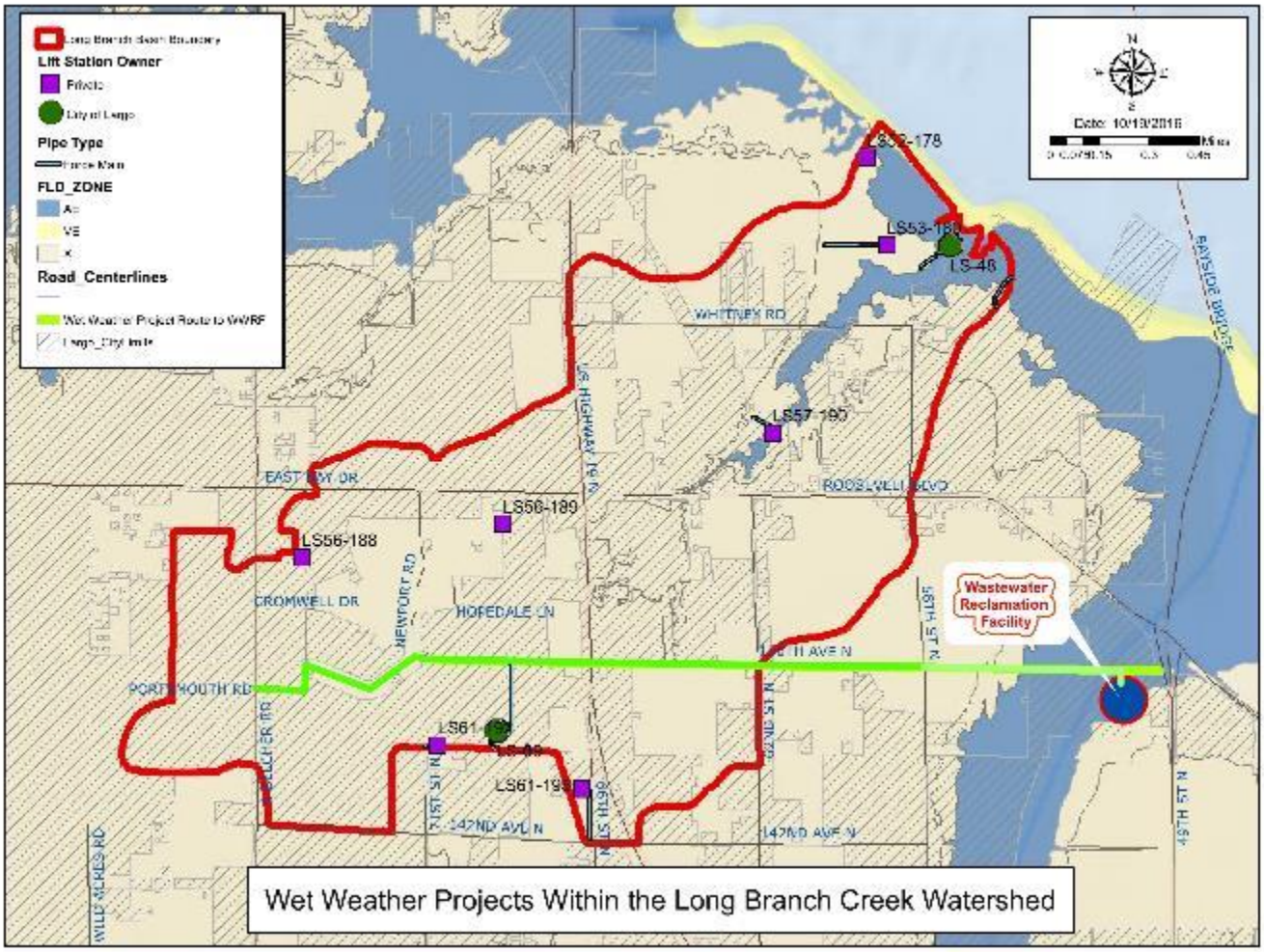

Figure 23: Wet Weather projects within the Long Branch Creek watershed

3.1.2 Sanitary Manhole and Pipe Improvements

Sanitary Interceptor Ring and Cover Replacement Project

Improperly sealed manholes allow for inflow of stormwater, contributing to SSOs. The City is expending $500,000 to replace 150 manhole rings and covers that are deteriorated and in poor condition, making them susceptible to leaking. Twenty one of these manholes are located within the Long Branch WBID. The notice to proceed for this project was issued in January 2017 and it is estimated to be complete by June 2017.

Pipe Lining and Repair

Since 2010, 39,696 linear feet of sanitary pipe have been lined or replaced in the City of Largo.

Largo continues to line, grout, and replace additional pipe each year. The aggregate data is presented in the following table:

Table 11: City of Largo sanitary sewer inspection and upgrade

Year	Pipe Inspected (linear feet)	Pipe Lined, Repaired, or Replaced (linear feet)	Inflow and Infiltration/ Seepage Incidents Resolved
2010	456,654	11,429	7
2011	471,452	637	91
2012	458,053	6,314	98
2013	300,552	1,053	191
2014	327,903	14,476	248
2015	302,363	5,787	8
Total	**2,316,977**	**39,696**	**643**

Furthermore, 8,569 linear feet (1.62 miles) of sanitary sewer pipe within the WBID have been lined or repaired by the City of Largo since the establishment of the TMDL. These projects are presented in the following table:

Table 12: City of Largo sanitary pipe lining and repair projects within the Long Branch WBID

Year	Location	Linear Feet
2006	Easement W of Whitney Rd	1,024
2007	Belcher Rd	902
2007	Bedford Circle W	400
2007	Bedford Circle E	280
2007	Quincy Lane	503
2007	Darrien Way	312
2007	Delta Way	609
2007	Newport Rd	604
2007	Amhurst Way	299
2007	Sunrise Blvd	384
2008	Bedford Circle E	302

2009	Rainbow Blvd	595
2009	Tri-City Plaza	347
2009	Norwich Ln	338
2009	Poinciana Terrace	335
2009	Evans Ave	315
2014	Farrington Apartments	370
2016	Amhurst Way	289
2016	59th St N	361
Total		**8,569 linear feet (1.62 miles)**

3.1.3 Storm Sewer Improvements

A portion of Long Branch Creek, in the area south of East Bay Drive and west of U.S. 19, is conveyed via large diameter corrugated metal storm sewer pipes. These pipes had reached the end of their useful service life and needed to be rehabilitated. The Long Branch Storm Sewer Rehabilitation Project provided for the lining of approximately 50 linear feet of 60 inch diameter pipe running under 69th Street North, and approximately 450 linear feet of 72 inch diameter pipe running through the Blue Horizon Mobile Home Park, located at 5145 East Bay Drive.

Figure 24: Long Branch Pipe Lining Project

The lining is anticipated to reduce sedimentation within the system. Research has demonstrated that bacteria can persist in sediments for weeks to months following introduction (Burton and Pitt 2002), so preventing sedimentation should be a key priority in a BPCP.

3.2 Nonstructural Management Actions

Pinellas County and the City of Largo perform maintenance on infrastructure that if not maintained properly, could discharge stormwater and/or wastewater carrying fecal coliform bacteria to the creek. Continuing effective maintenance programs will reduce fecal coliform

loading from sanitary sewer and other anthropogenic sources and reduce impacts to stormwater conveyances and the creek. This section describes on-going and recent maintenance activities in Long Branch Creek. Infrastructure maintenance and repair is an important element of the Bacteria Pollution Control Plan for Long Branch Creek.

3.2.1 Sanitary Sewer Inspection and Maintenance

As part of the City's preventative maintenance plan, a minimum of 20% of sanitary sewer conveyances are inspected each year using closed-circuit television (CCTV) cameras, with historic problem areas inspected more frequently. Line condition is assessed and repairs made as needed to prevent seepage, inflow and infiltration. The City hopes to continue to expand preventative maintenance and proactive inspection efforts in the future.

Sanitary Sewer Interceptor Cleaning

This project consists of by-pass pumping, cleaning, and video inspection of approximately 22 linear miles of main interceptor sewer pipe, a portion of which is located within the Long Branch watershed. Over time, sediment accumulates at the bottom of the sewer pipes, which reduces the flow capacity. Cleaning of the sewer lines is critical to maintain hydraulic line capacity and prevent SSOs. In 2008, the City of Largo established a program to clean the interceptor system. The system was divided into four segments, with the intent to clean one segment every other fiscal year. Because the City received favorable pricing from the selected cleaning contractor, the City was able to perform additional cleaning each year with the available funds. The results of the cleaning efforts are outlined in the following table:

Table 13: Sanitary sewer interceptor cleaning

Year	Budget	Miles Cleaned/Inspected	Tons of Debris Removed
2010	$640,000	5.32	155
2011	$450,000	6.91	187
2012	$425,000	12.11	267
2013	$450,000	11.53	55
2014	$425,000	15.42	23
2016	$300,000	7.13	48
Total	**$2,690,000**	**58.42**	**735**

As part of the Interceptor Cleaning Program, the quantity of debris removed from the pipe segments is recorded and entered into the City's geographic information system (GIS). This information is being analyzed to identify those sections of the interceptor system where greater

quantities of debris tend to accumulate, or accumulate more quickly. This will allow the City to better target future cleaning efforts. Interceptor cleaning was not conducted in 2105. The City awarded a new Interceptor Cleaning and Inspection contract in late 2016 and the work is ongoing.

Privately Owned Collection and Transmission Systems (POCTS)

The City of Largo Environmental Control Program continues to regulate and annually inspect 403 privately owned collection and transmission systems (POCTS) that connect to the City of Largo's municipal sewer system. Forty three of these systems are located within the Long Branch watershed boundary. In 2016, 32 systems passed inspection, while 11 failed.

Private lift stations connected to POCTS are inspected concurrent with regular annual POCTS inspections. Other private lift stations are inspected at least annually, and more frequently if a known problem exists.

Operators are also required to conduct monthly inspections of their systems, and these records are reviewed during annual inspections. These efforts minimize the potential for illicit discharges from privately owned systems into Long Branch Creek.

This program actively pursues sanitary sewer overflows (SSOs), inflow and infiltration (I&I) problems within privately owned systems. Additionally, the Commercial User Program ensures solids and grease are not discharged from commercial and institutional facilities, creating blockages in the sanitary sewer system.

Environmental Control Specialists conduct studies of lift station run times to evaluate the impact of rain events on the wastewater flow. Those communities with elevated flows during wet weather events were required to conduct video inspections to identify sources of inflow and infiltration and re-mediate the system as necessary. The section below identifies the status of actions taken to mitigate inflow and infiltration found in systems located within the Long Branch Creek watershed:

Fairway Village

1100 Belcher Road S, Largo, Florida 33771

- Smoke tested by Environmental Services Department.
- Inflow repairs detected are being addressed in preparation for CCTV inspection.
- Rehabilitation work on the sanitary sewer lines has been completed (1,400 linear feet). Manhole that was a cause of significant source of I & I at the property during the reporting period June 2012 – November 2012 has been repaired by the property management and was inspected by the City's staff.
- 900 to 1000 feet of line replaced in 2014.

- Ongoing – Continual improvements identified as road construction is performed.

Blue Horizon Mobile Home Park

5145 East Bay Drive, Largo, Florida 33764

- Inflow and Infiltration evaluation completed in 2015 to evaluate necessary improvements and provide for quantification of reduction efforts.
- Smoke test completed in 2016, with minor defects corrected.
- Six (6) rain trays were installed.
- Draw-down test scheduled completed in late 2016.
- Compliance Order will be issued as appropriate for line inspections and defect identification.

Fats, Oils, and Greases

When they accumulate in sanitary sewer lines, fats, oils, and greases (FOG) and non-dispersibles can create sanitary sewer blockages and SSOs. In order to prevent these blockages, the City issues permits for applicable commercial users that discharge to the sanitary sewer. These facilities, which typically have grease traps, grease interceptors, lint traps, or oil/water separators, are inspected by the City's Environmental Control Division at least annually. The inspectors verify that the systems are functioning correctly and appropriately maintained. When necessary, corrective actions are taken in response to inspection findings.

Environmental Control also identifies hotspots for FOG blockages and conducts targeted outreach activities in those areas (doorhangers). Should such areas be identified in the Long Branch Creek WBID, a line cleaning inspection will be conducted before and after the events to assess outreach effectiveness.

3.2.2 Asset Management

Condition and risk assessment of sanitary infrastructure is critical to preventing leakage or SSOs that contribute fecal contamination to the environment. In 2012 the City made substantial progress in planned improvements to management systems through selection and procurement of a Computerized Work and Asset Management System (WAMS). City Environmental Services staff have been using the WAMS to generate work orders, and track asset conditions since the first quarter of 2012.

WAMS use by Environmental Services staff continues to improve. WAMS is continually being deployed in the field with the addition of mobile computers to improve the flow of information from the work activity into the system. Environmental Services staff have begun reporting on

Key Performance Indicators (KPIs) on a monthly basis and are utilizing benchmarks established by the Florida Benchmarking Consortium for industry comparison.

The city is currently in procurement for a new Enterprise-based asset management system that will replace WAMS. The system will integrate or replace 11 systems within the City, including its stormwater asset tracking system. The new system will allow the City to better track condition and risk assessments of sanitary infrastructure with the goal of preventing pipe failures and SSOs through proactive lining, replacement, and repair. The system will ultimately assist the city in determining priority improvement projects and problem areas in the Long Branch Creek watershed.

3.2.3 Inflow and Infiltration Evaluation Plan

Begun in June 2016, the goal of the Sanitary Sewer System Basin Inflow and Infiltration Evaluation Plan is to develop an inflow and infiltration (I & I) evaluation and reduction plan for overall City collection system basins and privately-owned collection system sub-basins. The project is currently underway and will identify basins and sub-basins, providing basin-focused systematic framework to identify, reduce or eliminate recurring problems caused by I & I. It will also include basin mapping and prioritization, a monitoring plan, and recalibration of the City's hydraulic model. Ultimately, the City will develop a methodology for assessing private systems and incorporate it into its code of ordinance. The Plan is expected to be complete by February 2017.

3.2.4 Stormwater Inspection and Maintenance

The County Stormwater and Vegetation Division and the City of Largo Streets and Stormwater Division perform regular maintenance on stormwater pipes, culverts, ditches and County/City permitted stormwater facilities. The County and City respond to requests and complaints and have a rotating schedule for proactive maintenance and inspections. Specialized equipment is used to regularly maintain stormwater conveyances to remove trash, debris, accumulated sediment, and any other types of blockages that occur. The County adopted a Surface Water Utility fee in 2013. This fee enabled the County to increase its stormwater operation and maintenance budget to include additional crews, funding for contract ditch cleaning, and purchasing equipment to allow access to ditches that previously had to be cleaned by hand. Equipment purchases included a Keiser machine. Many ditches that were previously cleaned by hand were only cleared enough to allow some flow but remained primarily overgrown with vegetation and canopy that blocked sunlight. With the new equipment, these ditches can now be properly maintained increasing the exposure to sunlight and reducing bacteria levels. Long Branch Creek was made a priority basin for maintenance in anticipation of this Bacterial Pollution Control Plan.

Since approximately 2008, Pinellas County uses asset numbers to track maintenance activities enabling staff to query for work completed in the Long Branch Creek watershed. From 2012 to Aug. 2016, the County mechanically cleaned approximately 2.5 miles of 8 total miles of ditches in the basin. Mechanical cleanout typically includes removal of accumulated sediments, debris, vegetation, and grading and sodding. Out of 19 miles of stormwater pipe in the basin, approximately 3.6 miles of pipes and structures have been cleaned from 2012 to Aug. 2016. This maintenance, along with permitted facilities cleanouts, totaled approximately 5,500 cubic yards of sediment and debris removed from the stormwater system in Long Branch Creek from 2012 to Aug. 2016. See Figure below.

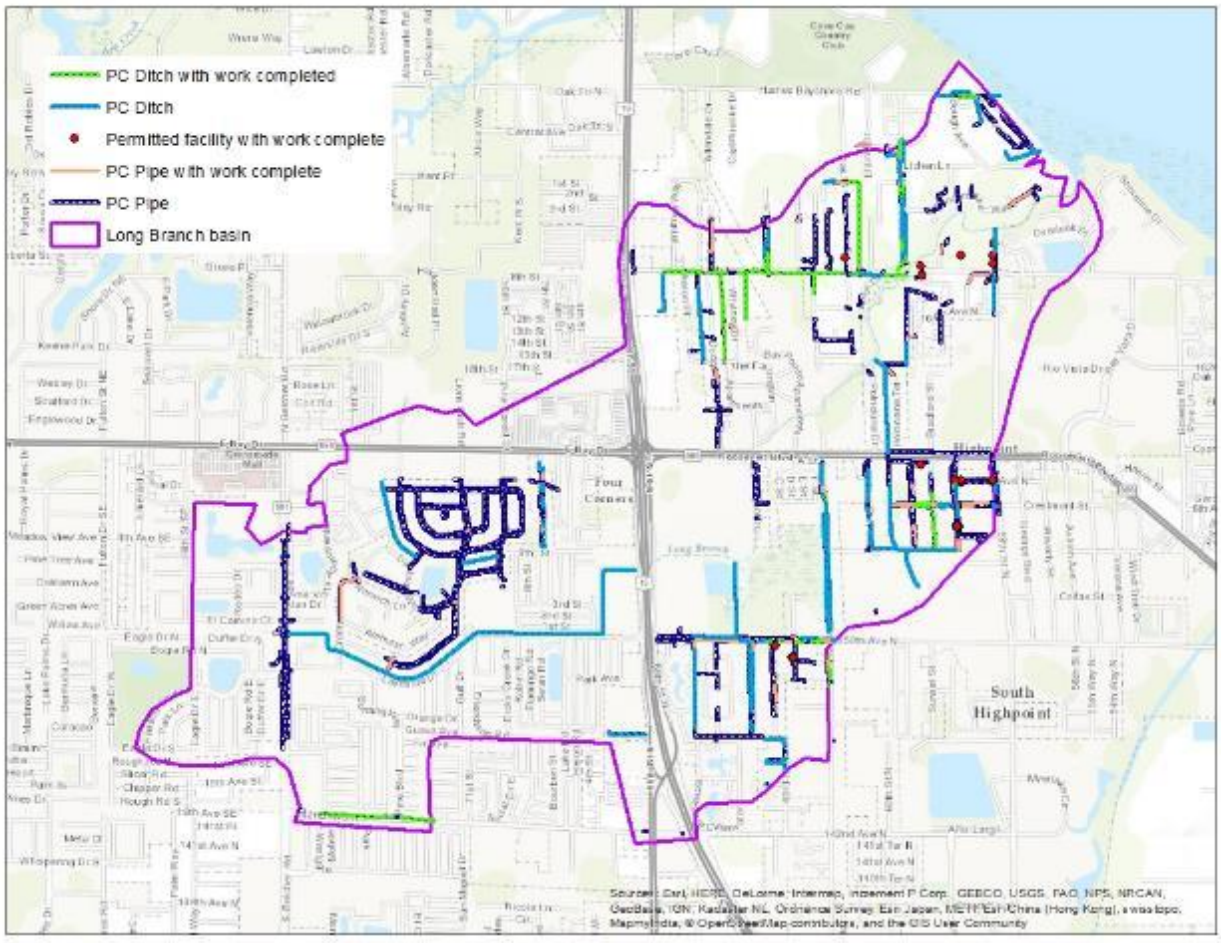

Figure 25: Map of stormwater maintenance work completed by Pinellas County

In addition to in-house work, three major capital improvement projects were completed by County. In July, 2014 approximately 3,280 feet of open drainage conveyance was restored along Whitney Rd. from US Hwy. 19 to Wolford Rd. In January of 2015, maintenance of approximately 1,300 feet of open drainage conveyance behind Whitney Place and Dodge Street was completed.

Maintenance work includes nuisance vegetation and tree removal, sediment removal, hauling debris and sediment, re-grading ditch bottoms and side banks, repairing erosion by fortifying banks (installing coco fiber mat, rubble rip rap, geotextiles, etc.), repairing stormwater pipe outfalls along the banks, and sodding or seeding.

In the Whitney Rd. area, sediment accrual under Whitney Rd. in the creek was observed. Approximately 200 feet of open drainage conveyance was cleared of exotic vegetation equating to 30 tons removed in March 2015. Sediment under the box culvert was excavated and disposed of in the spring 2016. A total of 300 tons of sediment was removed. See figures below.

Figure 26: Sediment accrual under Whitney Rd.
Figure 27: Workers removing sediment from Long Branch Creek under Whitney Rd.

The City of Largo has a proactive inspection program that falls within the requirements of the Municipal Separate Storm Sewer Permit each year. In 2015, the City performed a total of 1,675 inspections of its inventoried inlets, catch basins, and grates. Inspections of 7.1 miles of storm pipe also occurred in 2015. Largo inspected 100% of ditches, conveyance, and swales, based off the current inventory within its jurisdiction.

Largo has hired a consultant to develop a citywide comprehensive Stormwater Asset Management Plan. Begun in September 2015, the Plan will provide the City with a framework for achieving sustainable stormwater management, operations, maintenance, and capital improvement programs. A primary goal is to develop a stormwater program that meets regulatory requirements for water quality. Phase I of the initiative, which was completed in late 2016, included Aug. 2016 development of a stormwater asset inventory (hard and natural assets), condition assessment, and state of the system report. This was done initially through the creation of a comprehensive map that includes all stormwater infrastructure such as canals, culverts, ditches, ponds, pipes, inlets, and manholes, to name a few, as well as their condition.

The inventory is currently about 85% complete, and mapping efforts are ongoing. Phase II of the initiative, expected to begin in February 2017, includes analysis of management resources and systems (soft assets), level of service evaluation, and stakeholder and public outreach, and is estimated to be complete by mid to late 2017.

The comprehensive inventory is instrumental to anthropogenic source reduction for multiple reasons. In order to comply with TMDL requirements, the City must first and foremost fully understand its storm sewer system. Now that the system has been mapped, existing sanitary sewer maps have been overlain onto the stormwater inventory map in order to identify potential areas of concern, such as areas where the systems are located in close proximity and seepage may occur. The map also identifies sanitary lines with potential to discharge to Long Branch Creek so that their condition may be monitored closely and repairs/upgrades made in order to prevent potential discharge. Furthermore, the map will assist in identifying optimal locations for structural stormwater best management practices.

3.2.5 Stormwater Pond Compliance and Enhancement

Improved function of stormwater ponds can reduce fecal coliform loads in Long Branch. In 2014, the County created a new program and hired an Engineering Specialist 2 for site plan compliance and enforcement. Long Branch Creek has been designated a priority basin for proactive site plan compliance reviews. Once the stormwater inventory for privately owned systems is complete, the facilities will be prioritized for inspections. The owners of any facilities deemed out of compliance with associated site plans will be notified and the County will work cooperatively with the owners to develop and implement an improvement plan. Problems with facilities permitted by the Southwest Florida Water Management District (SWFWMD) will be forwarded to SWFWMD for follow up. Three facilities have been inspected to date in the Long Branch Creek watershed either in response to complaints or following a Surface Water Assessment credit application. Corrective actions were developed for these ponds which include system restoration to original designed and permitted conditions, vegetation management, removal of trash, removal of sediment and organic detritus, repair of piping & structures, and shoreline stabilization.

In addition to enforcement, the County's Adopt-A-Pond program assists citizens in unincorporated areas to improve the function of privately owned stormwater ponds. This program seeks to educate homeowners to reduce nutrient and bacteria pollution and empower citizens to responsibly manage their stormwater ponds. Pond improvements might include removing exotic vegetation, planting native plants and stabilizing banks. While no stormwater ponds have been adopted in this basin to date, there are many opportunities for the future.

3.2.6 Code and NPDES Enforcement

The Pinellas County Division of Environmental Management, Watershed Protection Section, is responsible for the enforcement of the County's Stormwater Ordinance. Dedicated staff investigate complaints from citizens and County staff and proactively inspect areas of concern looking for potential illicit discharges and connections. One of the activities included in proactive inspections is conducting source-tracking investigations of areas with high bacteria counts. This typically involves working closely with local utilities to check sewer lines and locating any potential animal inputs such as veterinary offices, pet care centers or farms, and wildlife areas. Once a source is identified, Pinellas County staff work on eliminating it through public education and enforcement action. For larger and wide-ranging problems, staff and volunteers conduct neighborhood outreach events such as marking storm drains, distributing flyers and door hangers, and conducting community events to engage residents to reduce pet waste.

During the field reconnaissance in June 2015, some problems were observed and documented for later follow-up (see Appendix A). In the Poinciana Ditch area (sites LB-2 and LB-3) problems included illicit connections, evidence of animal waste, trash, vegetation debris and a possible SSO discharge. Pinellas County's NPDES inspectors followed up by inspecting this area again in September 2015 and issuing warning notices to property owners and capping illicit connections into the ditch. Trash and other debris were cleared and hauled away for proper disposal by Pinellas County staff (see section 3.2.5). Educational door hangers about the importance of picking up after pets were distributed to property owners adjacent to Poinciana Ditch.

In October, 2015 the NPDES inspectors also followed up in the "Highpoint" neighborhood upstream of the Poinciana ditch area where stormwater inputs connect the two systems. In this neighborhood, trash, pet waste and vegetative debris were found. The inspectors issued warning notices to property owners in this area to control dog waste problems, clear yard debris piles correctly and stop placing garbage bins on top of stormdrains. The city of Largo was also contacted about a sanitary cleanout pipe that would overflow into a ditch if backup occurred due to blockages. The City of Largo arranged to have the pipe capped.

Pinellas County NPDES inspectors also noted what could possibly be a sanitary sewer riser pipe located just south of Roosevelt Blvd in the Highpoint neighborhood. County inspectors sent the possible infraction to Largo staff. As of August, 2016 the pipe was capped and no issues were reported.

Largo prioritizes commercial sites for proactive inspection based on proximity to waterbodies and frequency of violations. This includes locations along Long Branch Creek, for which the City has issued Notices of Violation for issues such as litter control.

Largo also has a rigorous construction site inspection program. Sites are typically inspected daily to ensure sedimentation and erosion controls are properly installed and maintained.

3.2.7 Litter and Debris Removal

The County street sweeping program maintains arterial roads at least twelve times per year and local roads were recently increased from six to ten times per year. A County contractor was sweeping local roads, but that service will be brought in-house in 2016 to allow more flexibility in sweeping activities.

Largo's street sweeping frequency is 6 weeks, unless more frequent sweeping is required in a particular area. In addition, litter and other debris have been removed during exotics removal activities at multiple locations throughout the creek. The locations of these activities are depicted in by the circled areas in the figure below.

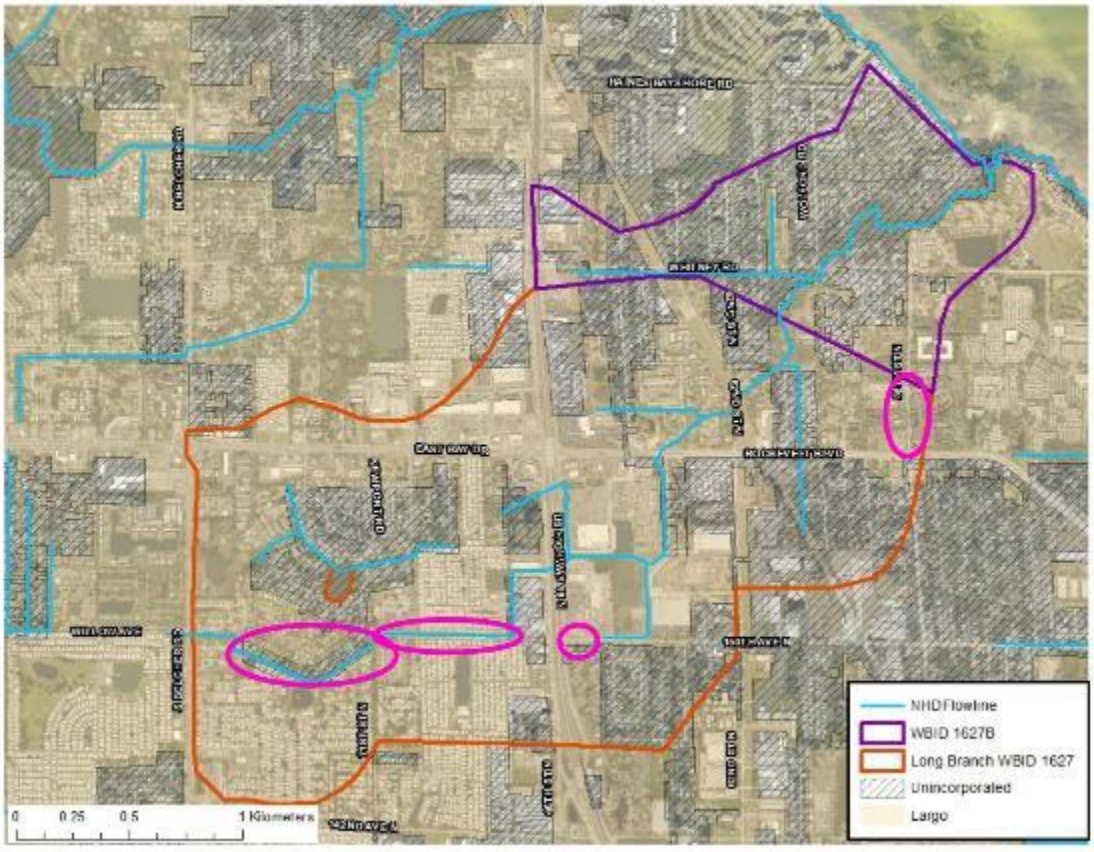

Figure 28: Long Branch Creek maintenance and litter control areas

3.2.8 Public Outreach and Education

Educational campaigns can enhance the public's understanding of water quality challenges in an urban setting. Outreach activities were completed as a direct response to problems found during Long Branch Creek investigations. Addressing pet waste is a main priority for this Bacterial Pollution Control Plan.

To increase awareness in residential areas and attempt to change behavior through public education, outreach materials were distributed door-to-door as a response to the presence of dog DNA markers in Long Branch Creek. The distribution began by targeting densely populated areas including apartments and mobile home parks that lie within a 100 ft. buffer of the creek or contributing ditches. In total, 16 residential areas and 6 apartment complexes were initially identified as possible sources of pet waste. The outreach efforts were later expanded to the entire watershed and also included parks and pet related businesses (Figure 29).

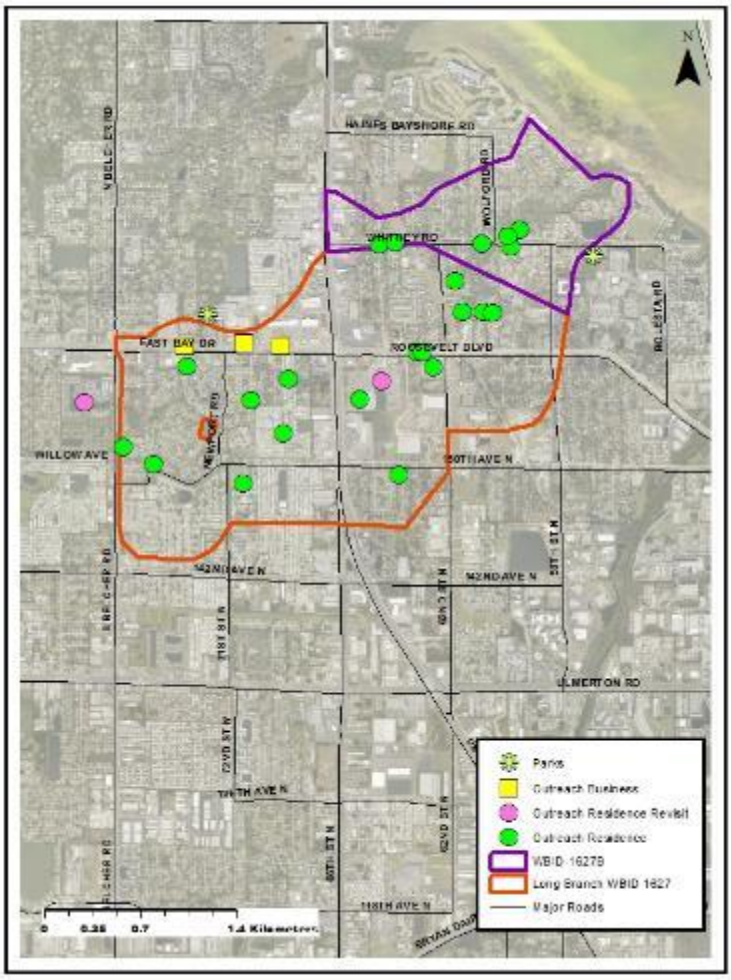

Figure 29. Pet waste outreach locations.

Interns and volunteers walked door-to-door and distributed a "Scoop the Poop" door-hanger along with a letter explaining the water quality impact from pet waste identified in their local watershed (

Figure 30). A total of 1,306 letters and/or door-hangers were distributed in residential areas and apartments located within the watershed. Volunteers were prepared to explain and answer

questions from the residents they encountered along the way. The follow-up distribution targeted local pet stores, dog parks, and an animal clinic. Volunteers provided educational

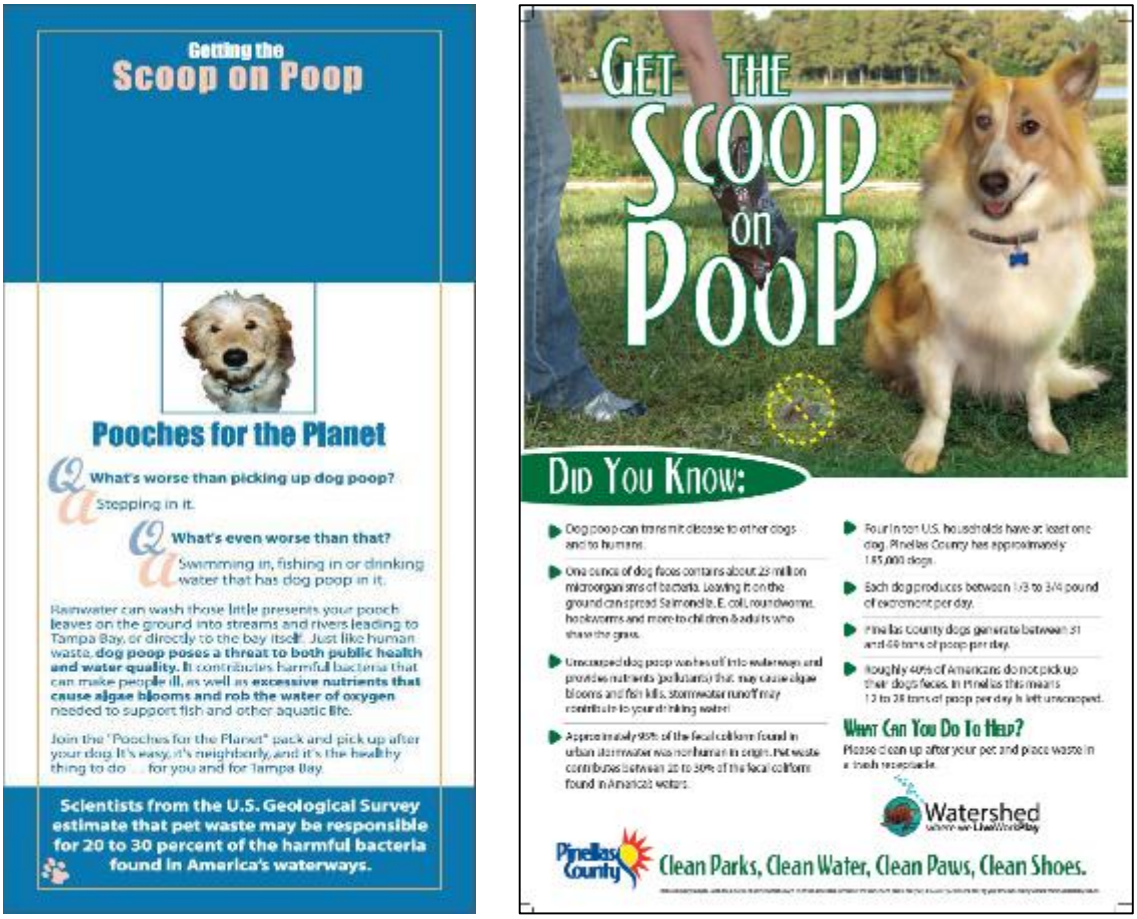

Figure 30. Examples of pet waste educational materials distributed in Long Branch.

posters for pet stores and animal clinics to hang in or outside of their store. The overall goal was to promote consumer education on picking up after your pet. Posters were also displayed in two parks known for having frequent pet walkers. A total of 2 pet stores, 2 parks, and 1 animal clinic all within the Long Branch Creek basin received public outreach material.

Pinellas County began setting up displays at pet related events in 2015. The first event was hosted in 2016 with the Human Society of Pinellas Pet Festival held on January 21st. This is an annual event Pinellas County will participate in with the next Pet Festival scheduled for February, 2017. Pinellas County volunteers, interns, and staff helped educate the public on the importance of properly cleaning up pet waste in order to protect water quality in their local waterways. Information on pet waste and impacts to surface waters were distributed along with pet waste

bags and other related items. Staff was on site to talk to residents and answer questions. The County partnered with the Humane Society of Pinellas for these events and will continue to work with the Humane Society and other local agencies to increase pet owner awareness. An initial target of two to three events per year has been established. During the Spring Pet Festival, Pinellas County staff handed 105 pet waste bag containers, 78 brochures and spoke to 94 people. Many people understood that you 'should' pick up after your pet, but many did not know why. The educational board, materials, and conversations helped address the 'why' (Figure 31).

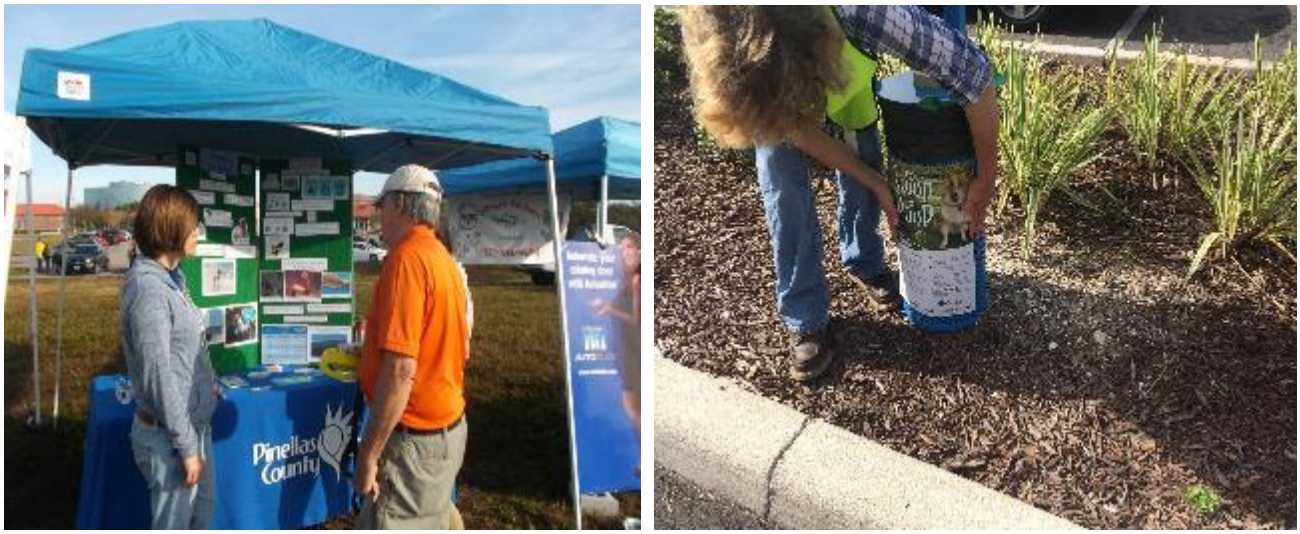

Figure 31. Volunteers speaking with dog owners about the importance of picking up after their pets.

Pinellas County Division of Environmental Management currently has an extensive public outreach and education program. As part of the County's Bacterial Pollution Control Plans, bacterial pollution is incorporated into educational messages where appropriate. The County's website has been available to residents and visitors for several years. In 2010, the website was redesigned to coincide with the County's Watershed Education Campaign initiatives. The website can be found at www.pinellascounty.org/watershed. The website includes explanations of various monitoring and protection activities. Assortments of brochures regarding protection of water resources from stormwater pollution are available, some for free download, from the website. Examples of educational materials include information on pet waste and other sources of fecal coliform bacteria. New materials specific to pet waste are currently being developed and will be included on the website in 2017.

In addition to being available on the website, printed brochures are utilized by staff during complaint response, proactive residential and commercial inspections, and distributed to interested citizens through outreach events. There are also a variety of door-hangers utilized by volunteers for proactive or complaint-driven distribution to communities. Some of these door hangers include topics such as storm drain marking, pollution prevention, pet waste pollution

prevention, erosion prevention, landscape maintenance, and fertilizer application for nutrient pollution prevention.

Public Service Announcements are also available for viewing on the website. Newly released PSA by J.C. Pritchett III titled, "Love Your Watershed Selfie 360 PSA" helped promote awareness regarding water quality concerns in Pinellas County watershed. Six videos have been created since 2012, which promote the Public Works motto of "Pinellas County is a Watershed, where we Live, Work, and Play". Each video advertises how we live, work, and play in Pinellas County and how every activity has the potential to impact our waterways. In 2014, the videos ran on local cable network television (a variety of channels) and in three local movie theaters on both the lobby televisions and during the large-screen movie preview sessions. These videos, along with interactive banners and education messages, were also utilized for digital advertising outreach. In 2013 and 2014, the County advertised the Watershed Campaign on Facebook, Twitter, Tampa Bay Online, and BayNews 9 Online (a local news affiliate). Pet waste and litter are topics covered in several of the videos.

Pinellas County developed a Facebook page in 2015 devoted to environmental news: https://www.facebook.com/PinellasEnviroNews. Activities, events, and other news related to stormwater pollution will continue to be posted to this site. Posts specific to bacteria pollution prevention will be included in this effort.

Dozens of communities within Pinellas County have their own local newspapers, which have weekly and monthly issues. In 2014, the Watershed Campaign poster was published in color in each of these newspapers as well as larger, regionally distributed, newspapers on multiple occasions. Several of these newspapers are distributed throughout the Long Branch watershed (Suncoast News, St. Pete Tribune, The Weekly Challenger, and Tampa Bay Times).

Storm drain marking placards and door-hangers have been distributed for years to volunteers as requested throughout the County and municipalities, specifically for Long Branch.

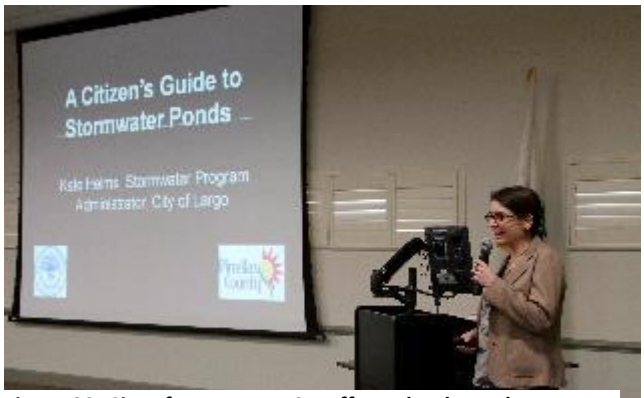

Figure 32. City of Largo NPDES staff speaks about the importance of stormwater ponds at Lakes & Ponds Day.

Each spring, Pinellas County partners with the City of Largo to host Lakes & Ponds Education Day. This half-day seminar is open to all interested citizens in Pinellas County. The event includes exhibitor displays and presentations from local government agencies related to the function and maintenance of stormwater ponds in Pinellas County (Figure 32). Attendees also have the opportunity to take home materials

(educational brochures, door hangers, and native plants) to assist them in managing their privately-owned stormwater ponds. Properly functioning stormwater ponds can help reduce fecal coliform loads. This event has occurred annually since 2006.

Largo's public outreach and education component of the BPCP is also currently underway. The City has vastly expanded its outreach program in 2016. Topics include fats, oils, and greases, pet waste reduction, and education regarding the proper handling of grass clippings and yard debris. In 2016 alone, 55,000 newsletters and over 24,000 fact sheets covering these topics have been distributed to Largo residents. City employees have also interacted one-on-one with over 10,500 residents at special events. A pet waste reduction Facebook ad generated nearly 15,000 impressions, and a grass clippings ad is planned for the 2017 growing season. Compared to the previous year, visits to Largo webpages with bacterial reduction-related content have risen 812 percent in 2016.

Figure 33: City of Largo outreach booth

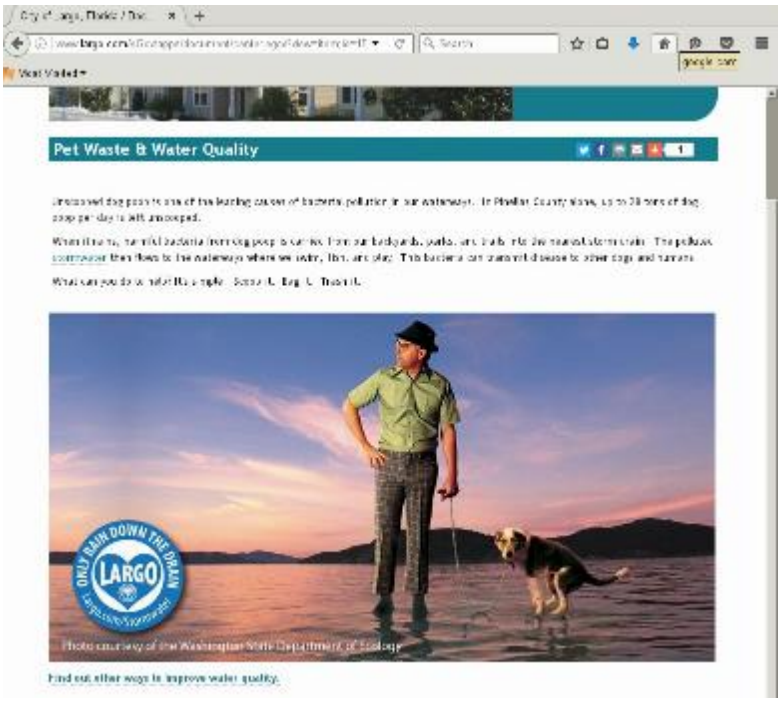

Figure 34: City of Largo pet waste webpage

The City's Environmental Services Department also has residential customer outreach programs geared toward the prevention of SSOs. These include "Fight F.O.G." and "Cool it. Can it. Trash it." campaigns. If hotspots for fats, oils and grease clogging are discovered, educational doorhangers are distributed within that sanitary sewer drainage basin.

Figure 35: City of Largo pet waste rack card

A detailed table of 2016 outreach activities is presented below. Cumulatively, the City has generated 122,960 engagements with area residents regarding topics related to bacterial reduction.

Table 14: City of Largo 2016 outreach program data

Outreach Activity	Topic	Number of Impressions to Date
"Scoop Poop" Facebook ad	Proper pet waste disposal	14,786 impressions
Sustainability Newsletter	Proper pet waste disposal, yard debris	50,000 recipients
Largo Leader Insert	Proper pet waste disposal, proper management of grass clippings and yard waste	24, 281 recipients
Stormwater Guides (various)	Proper pet waste disposal, proper management of grass clippings and yard waste	1,043 recipients
"Scoop Poop" Facebook post	Proper pet waste disposal	1,260 Facebook subscribers
Stormwater website- main page	Proper pet waste disposal, grass clippings	4,346 visits
Stormwater website- pet waste page	Pet waste reduction	404 visits
Stormwater website- lawncare page	Proper management of grass clippings and yard waste	1241 visits
Stormwater website- grass clippings	Proper management of grass clippings	80 visits
Special Events (8)	Pet waste reduction, proper management of grass clippings, fats, oils and greases, proper disposal of sanitary waste.	10,507 participants
McGough Nature Center display (touch screen)	Proper pet waste disposal	1,150 users
Pet waste bag dispensers	Proper pet waste disposal	2,000 (est) dispensers
Pet waste rack cards	Proper pet waste disposal	500 (est) rack cards

Coloring Books	Proper pet waste disposal	730 coloring books
"Only Rain Down the Drain" and "I Protect Stormwater" promotional items	Ensuring only rain goes down the storm drain	3460 items
School Presentations	"Only Rain Down the Drain," proper disposal of pet waste	751 Students
"Only Rain Down the Drain" sign in Building office	Proper pet waste disposal	5600 applicants (est)
Fight F.O.G. website	Proper disposal of fats, oils, and greases (SSO prevention)	397 visits
C.O.R.E. (cooking oil recycling) website	Proper disposal of oils (SSO prevention)	153 visits
Toilet is Not a Trashcan Website	Proper disposal of materials that clog sanitary sewer system (SSO prevention)	87 visits
Toilet is Not a Trashcan flyers to Oak Creek Apartments	Proper disposal of materials that clog sanitary sewer system (SSO prevention)	184 flyers
Total number of engagements:		**122,960**

3.2.9 Wastewater Stormwater Task Force

Both Largo and the County are participating in the Pinellas County Wastewater/Stormwater Task Force, which was convened in October 2016 to address the challenge of managing wastewater infrastructure within the complex network of city, county and investor-owned systems. The following is an excerpt from the Task Force's 90-day Report's Executive Summary:

> At the outset, the Task Force was asked to address three key goals:
>
> - Avoid and mitigate spills, overflows and releases of sewage into the environment, particularly water bodies.
> - Increase the capacity and resiliency of the collective sewer system and wastewater treatment infrastructure.
> - Seek opportunities to address drainage and stormwater issues that impact the sewer system.
>
> The Task Force was expected to create long-term, comprehensive solutions for stormwater inflow and groundwater infiltration issues, and to identify the potential need for increased

countywide system capacity. Capacity is directly impacted by the amounts of stormwater and groundwater entering the sewer system. The Task Force was charged with seeking solutions that can be implemented on both a short-term and long-term basis, as well as ways to mitigate emergency situations.

3.2.10 Policy

Pinellas County and the City of Largo all have several ordinances to protect water quality including fecal coliform pollution. Each entity has an ordinance related to pet waste. For example, Section 5-34 of City of Largo code states:

> *It shall be unlawful for any dog owner or person in custody of a dog to fail to remove deposits of dog excreta made by a dog in that person's charge when the deposit of dog excreta is known or should be known to the dog owner or person in custody of the dog on any public property including, but not limited to, municipal parks and public rights-of-way; or on private property not owned or occupied as a residence by the dog owner or person in custody of the dog as provided in Section 5-34.*

Article VI of Pinellas County Code addresses stormwater and surface pollution including illicit discharges and connections. Per County code, fines of up to $10,000 per violation, plus cleanup costs can be levied. The County is also currently reviewing and updating Land Development Codes to reflect new policies being developed in conjunction with a new Stormwater Manual. The manual and code updates will include Low Impact Development design options for development and redevelopment and establish the required stormwater quality performance standards. These new design options and performance standards will reduce pollutant loads from development.

4.0 Anticipated Load Reductions

The majority of management actions included in this plan and the strategies that will likely have the most impact on fecal coliform loads are structural controls including sanitary sewer and stormwater maintenance and non-structural controls including public outreach and education. Fecal coliform load reductions from these types of management activities cannot be directly measured and the County and City are unaware of any existing guidance for estimating load reductions from these programs. Therefore, the anticipated load reductions resulting from this plan cannot be estimated with any meaningful accuracy.

Evaluating the effectiveness of this plan will therefore rely on the results of the ambient water quality monitoring program and future assessments against the water quality standards for bacteria. Reduction in the number of exceedances over time will be used as an indication of plan effectiveness.

5.0 Monitoring and Reporting

Monitoring in support of this Bacterial Pollution Control Plan will be conducted through the Pinellas County Division of Environmental Management's ambient water quality monitoring program. Samples are collected eight times per year and analyzed for a suite of parameters including *E. coli* at five sites in Long Branch Creek (Figure 36). All samples are collected according to FDEP standard operating procedures and analyzed by NELAC certified Pinellas County Utilities Laboratory (E54357). Data is uploaded to FDEP's STORET database quarterly. Annual *E. coli* exceedances, an assessment of the effectiveness of this plan, and any plan updates will be included in the NPDES annual report or in updates to the Stormwater Management Plan.

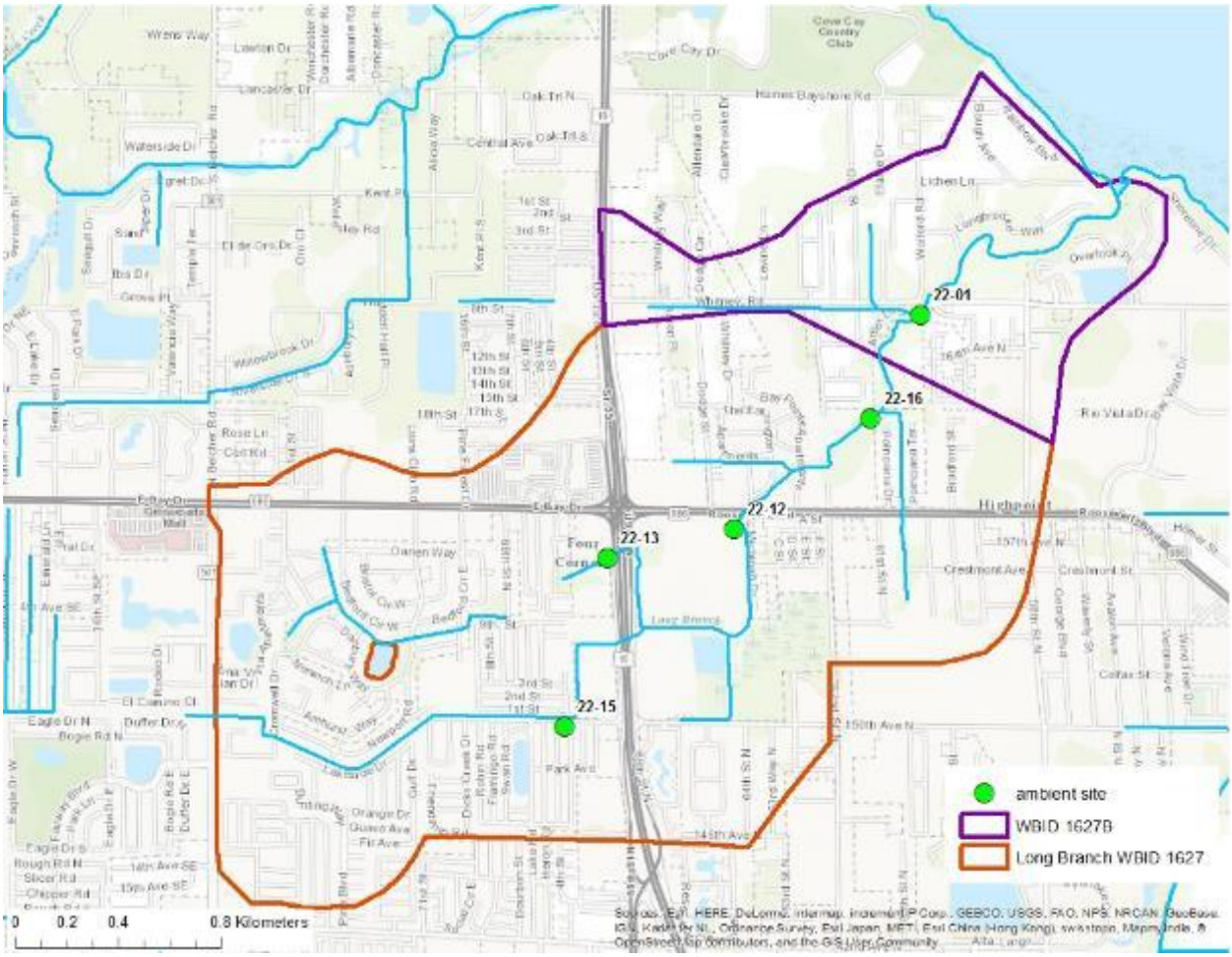

Figure 36. Current Pinellas County ambient sites in Long Branch Creek.

6.0 Summary

The efforts in Long Branch to identify bacteria sources through targeted sampling and field investigations was successful in identifying and reducing fecal coliform sources to the creek. Potential anthropogenic sources of fecal coliform bacteria found in Long Branch Creek include:

1. Sanitary Sewer issues
2. Pet Waste
3. Litter and debris
4. Illicit connections

Many sources were eliminated through corrective actions that occurred immediately following their identification. However, additional management strategies are needed to restore Long Branch to its designated use and meet water quality targets. Ongoing and future management actions by the stakeholders to reduce fecal coliform pollution in Long Branch include:

Structural Management Actions

- Sanitary Sewer Improvement Projects
    - The Sanitary Sewer Service Improvement Plan continues to be implemented, with a primary goal of preventing SSOs. The Influent and Headworks Project, which is anticipated to be complete by October 2017 will allow for the plant to better manage flow, while the Wet Weather Project, anticipated to be completed in April 2017, will install new forcemain and lift stations.
- Sanitary Manhole and Pipe Improvements
    - The city is expending $500,000 to replace 150 manhole rings by June 2017.
    - The City has lined, replaced, or repaired 9, 144 feet of sanitary sewer pipe within the WBID since the establishment of the TMDL, and will continue to line pipe where deficiencies are noted during inspection.
- Storm Sewer Improvements
    - Approximately 50 linear feet of Long Branch conveyance pipe was lined in 2014. Lining will be considered in the future should additional problem areas be uncovered.

Nonstructural Management Actions

- Sanitary Sewer Inspection and Maintenance
    - Sanitary sewer inspection and maintenance will continue in the watershed conducted by the City of Largo.
    - Sanitary sewer interceptor cleaning will continue.

    - Privately owned collection and transmission systems (POCTS) will continue to be monitored and inspected annually. The City will also ensure that repairs and upgrades to Fairway Village and Blue Horizon Mobile Home Park are completed properly and in a timely fashion.
    - Any FOG hotspots identified within the Long Branch Creek watershed will be promptly addressed, with targeted outreach activities conducted where necessary.
- Stormwater Inspection and Maintenance
    - Stormwater inspection and maintenance will continue at no less than the current level of service.
    - Long Branch was designated as a high priority for ditch maintenance in 2014 by Pinellas County. A large volume of work has been completed since that time and it will remain a high priority until bacteria levels decrease.
    - Removal of accumulated sediment and vegetation in Long Branch from 46th St. N to 37th St. N is planned for completion in within the next five years.
- Stormwater Pond Compliance and Enhancement
    - Pinellas County began a Stormwater Pond Compliance and Enforcement Program and reestablished the Adopt-A-Pond program in 2014. Both programs are aimed towards improving privately owned stormwater ponds and will continue to work in the Long Branch basin(s).
- Code and NPDES Enforcement
    - Code and NPDES enforcement will continue in the watershed.
    - The Poinciana ditch and Highpoint neighborhood will be inspected no less than annually by NDPES staff.
    - Elevated results from ambient or NPDES water quality sampling events will be investigated. Corrective actions will be implemented as appropriate.
- Litter and Sediment Removal
    - Pinellas County is working to identify target street sweeping areas for Long Branch along with a more frequent sweeping schedule and will be initiated in 2017.
- Public Outreach and Education
    - Public outreach and education on water quality and stormwater issues will continue County-wide and bacterial pollution information will be added to existing outreach campaigns wherever feasible.
    - Popular dog walking spots and public access areas will continue to be monitored and signage will be posted in problem areas when needed.
    - Pinellas County will continue setting up educational booths at dog-related events and will attend at least two events per year to reach the target audience for pet waste related issues.

- Policy
    - Both Pinellas County and the City of Largo will continue to enforce their respective Ordinances with regards to water quality and pet waste specifically.

Furthermore, Long Branch creek will continue to be monitored through the ambient program in support of this Bacterial Pollution Control Plan.

- Monitoring and Reporting
    - Pinellas County will continue monitoring fecal coliform and *E. coli* at the five existing sites on Long Branch Creek.
    - Monitoring data will be submitted and available for viewing and download at the Pinellas County Water Atlas and STORET.
    - Annual exceedances of the water quality standards will be used to track the success of this plan and included in the NPDES annual report.
    - Investigations will be conducted to determine potential causes for results elevated above the typical range and corrective actions will be implemented as appropriate.
    - Additional targeted or MST monitoring will be considered if bacteria exceedance rates do not improve.

Appendix A – Long Branch Creek Management Actions

Date	Location Description	Problems Found	Jurisdiction	Follow up needed?	Actions taken	Additional Findings	Action Completion Date
6/18/2015	Recon- Poinciana Ditch	White foam on water's surface	County	Yes	NPDES inspection and enforcement		9/1/2015
6/18/2015	Recon- Poinciana Ditch	Trash and clothes near parking lot	County	Yes	Trash and debris cleared out		6/30/2015
6/18/2015	Recon- Poinciana Ditch	PVC pipe into ditch (east side)	County	Yes	Illicit connection capped		7/14/2015
6/18/2015	Recon- Poinciana Ditch	Homeless living in shed with PVC into creek	County	Yes	Illicit connection capped		7/14/2015
6/18/2015	Recon- Poinciana Ditch	chickens with owner possibly throwing waste into creek	County	Yes	NPDES inspection & Warning Notice		6/30/2015
6/18/2015	Recon- Poinciana Ditch	construction and veg debris dumped over fence	County	Yes	NPDES inspection & Warning Notice		6/30/2015
6/18/2015	Recon- Poinciana Ditch	backyard with 5 PVC pipes into creek (half way down east side)	County	Yes	Illicit connection capped		7/14/2015
6/18/2015	Recon- Poinciana Ditch	brown foam/sludge on water near sac of concrete	County	Yes	NPDES inspection & Warning Notice		6/30/2015
6/18/2015	Recon- Poinciana Ditch	old mattress with animal waste	County	Yes	NPDES inspection & Warning Notice		6/30/2015
6/18/2015	Recon- Poinciana Ditch	pipe crossing ditch with sewage odor	County	Yes	Follow-up Sampling and forward to City of Largo		9/1/2015

Date	Location Description	Problems Found	Jurisdiction	Follow up needed?	Actions taken	Additional Findings	Action Completion Date
9/1/2015	(Septic Tanks) Wet Season Sampling- Whitney Rd. Culvert downstream (tidal)		Largo	Yes	Contacted FDOH for septic records. Largo might have sewer connection.	Mostly abandoned septic systems cannot be confirmed they were properly disconnected. Permits pulled for one active system. Largo to TV the pipe to confirm if it is hooked up to sanitary sewer.	
9/1/2015	Wet Season Sampling-Whitney Rd. ditch upstream (tidal) (Site: LB-1)		Largo/County	Yes	Educational door hanging	Dog and Human DNA markers	1/14/2016
9/1/2015	Wet Season Sampling-Poinciana Ditch Southern section (near horse stables) (Site: LB-2)		Largo/County	Yes	Educational door hanging	Dog DNA markers	1/14/2016
9/1/2015	Wet Season Sampling-Poinciana Ditch Northern section (Site: LB-3)		Largo/County	Yes	Educational door hanging	Dog DNA markers	1/14/2016
9/1/2015	Wet Season Sampling-US 19 Walmart northern branch (near stormwater pond) (Site: LB-5)		Largo/County	Yes	Educational door hanging	Dog DNA markers	1/14/2016
9/1/2015	Wet Season Sampling-US 19 Walmart southern branch (Site: LB-4)		Largo/County	Yes	Educational door hanging	Dog DNA markers	1/14/2016
10/1/2015	Recon- Neighborhood south of Poinciana ditch	Dense vegetation and invasive fruit tree	County	Yes	Ditch clean out and invasive tree removal		. July 2017
10/1/2015	Recon- Neighborhood south of Poinciana ditch	Trash and veg. debris	County	Yes	NPDES inspection & Warning Notice		10/8/2015
10/1/2015	Recon- Neighborhood south of Poinciana ditch	Illicit discharge into MS4	County	Yes	NPDES inspection & Warning Notice		10/8/2015

Date	Location Description	Problems Found	Jurisdiction	Follow up needed?	Actions taken	Additional Findings	Action Completion Date
10/12/2015	Follow-up (Highpoint) Neighborhood south of Poinciana ditch		County	Yes	Inmates cleared trash including mattress in ditch		10/12/2015
10/12/2015	Follow-up (Highpoint) Neighborhood south of Poinciana ditch	sanitary sewer riser pipe	Largo	Yes	Largo staff to determine if the pvc pipe is an overflow and if so could it modified/repaired to prevent possible backups of sanitary discharges to the ditch. Pipe was capped as of 8/11/16.		8/11/2016
10/23/2015	Blockage and trash build up just upstream of the Biology site in Largo.	Downstream of the footbridge on Oak Creek Apartments near the SCI Biology site.	Largo	Yes	Sent to Largo staff for cleanup and trash removal		10/23/2015
4/14/2016	Dry Season Sampling-Whitney Rd. ditch upstream (tidal) (Site: LB-1)		Largo/County	No	Education – door hangers and posters	Dog DNA marker	8/2/2016
4/14/2016	Dry Season Sampling-Whitney Rd. Ditch (Site: Whitney Ditch)		Largo/County	No	Education – door hangers and posters	Dog DNA marker	8/2/2016
4/14/2016	Dry Season Sampling-Poinciana Ditch Southern section (near horse stables) (Site: LB-2)		Largo/County	No	Education – door hangers and posters	Dog DNA marker	8/2/2016
4/14/2016	Dry Season Sampling-Poinciana Ditch Northern section (Site: LB-3)		Largo/County	No	Education – door hangers and posters	Dog and human DNA markers	8/2/2016
4/14/2016	Dry Season Sampling-US 19 Walmart northern branch (near stormwater pond) (Site: LB-5)		Largo/County	No	Education – door hangers and posters		8/2/2016

Date	Location Description	Problems Found	Jurisdiction	Follow up needed?	Actions taken	Additional Findings	Action Completion Date
4/14/2016	Dry Season Sampling-US 19 Walmart southern branch (Site: LB-4)		Largo/County	No	Education – door hangers and posters	Dog DNA marker	8/2/2016
8/8/2016	Storm Event Sampling-Whitney Rd. ditch upstream (tidal) (Site: LB-1)		Largo/County	No	Forwarded to City of Largo, no reported SSOs	Human DNA marker	8/9/2016
8/8/2016	Storm Event Sampling-Whitney Rd. Ditch (Site: Whitney Ditch)		Largo/County	No	Forwarded to City of Largo, no reported SSOs	Human DNA marker	8/9/2016
8/8/2016	Storm Event Sampling-Poinciana Ditch Southern section (near horse stables) (Site: LB-2)		Largo/County	No	Forwarded to City of Largo, no reported SSOs	Human DNA marker	8/9/2016
8/8/2016	Storm Event Sampling-Poinciana Ditch Northern section (Site: LB-3)		Largo/County	No	Forwarded to City of Largo, no reported SSOs	Human DNA marker	8/9/2016
8/8/2016	Storm Event Sampling-US 19 Walmart northern branch (near stormwater pond) (Site: LB-5)		Largo/County	No	Forwarded to City of Largo, no reported SSOs	Human DNA marker	8/9/2016
8/8/2016	Storm Event Sampling-US 19 Walmart southern branch (Site: LB-4)		Largo/County	No	Forwarded to City of Largo, so reported SSOs	Human DNA marker	8/9/2016
12/14/16	Special Sampling sagging pipe near LB-1	Sagging pipe crossing stream	Largo	Yes	Fecal coliform samples collected.	Results below detectable limits at 67 U.	12/14/16
12/14/16	Special Sampling cracked pipe near LB-2	Apparent cracked pipe bisecting stream	Largo	Yes	Fecal coliform samples collected.	Results below detectable limits at 67 U.	12/14/16
12/21/16	Special Sampling sagging pipe near LB-1	Sagging pipe crossing stream	Largo	No	Fecal coliform samples collected.	Results outside acceptable range at 270 B.	12/21/16
12/21/16	Special Sampling cracked pipe near LB-2	Apparent cracked pipe bisecting stream	Largo	No	Fecal coliform samples collected.	Results below detectable limits at 33U.	12/21/16

References

Bodden, M., Guffey, C., Volk, S. (2012, June). *Turtle Populations as a Potential Source of E. Coli in Lake Elmendorf.* Bacterial Source Tracking State of the Science Conference. Texas Water Resources Institute. [PDF document]. Retrieved from http://twri.tamu.edu/reports/2012/tr427.pdf.

Burton, A., Pitt, R. (2002). *Stormwater Effects Handbook: A Toolbox for Watershed Managers, Scientists, and Engineers*. Boca Raton, FL: Lewis Publishers.

Tomasko, D. (2016, May). *Finding Sources of Fecal coliform Bacteria in Stormwater Runoff*. Florida Stormwater Association Winter Conference. Innisbrook Golf and Spa. [PDF document]. Retrieved from http://www.florida-stormwater.org/assets/MemberServices/Webinars/fsa%20webinar%20presenter%20ppt%20-%20tomasko%20may%2012.pdf.