TMDL FOR FECAL COLIFORMS FOR BAYOU SEGNETTE, LOUISIANA

(SUBSEGMENT 020701)

January 2, 2004

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(SUBSEGMENT 020701)

Prepared for

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EXECUTIVE SUMMARY

Section 303(d) of the Federal Clean Water Act requires states to identify waterbodies that are not meeting water quality standards and to develop total maximum daily pollutant loads for those waterbodies. A total maximum daily load (TMDL) is the amount of a pollutant that a waterbody can assimilate without exceeding the established water quality standard for that pollutant. Through a TMDL, pollutant loads can be allocated to point sources and nonpoint sources discharging to the waterbody. This report presents a TMDL that has been developed for fecal coliforms for Bayou Segnette (subsegment 020701).

Bayou Segnette is located in the Barataria basin in southern Louisiana. Subsegment 020701 covers an area of approximately 35 square miles that consists mostly of wetlands. However, the subsegment receives stormwater runoff from urban areas along the southern edge of the New Orleans metropolitan area. This stormwater enters Bayou Segnette and its tributaries through five pumping stations. Bayou Segnette is tidally influenced and has numerous connections with the surrounding marshes and with other waterbodies.

The designated uses for this subsegment include primary contact recreation (which applies only during May through October) and secondary contact recreation (which applies all months of the year). During summer (May through October), the water quality standards for fecal coliforms are a log mean of no more than 200/100 mL (for at least five samples within 30 days), no more than 25% of the values exceeding 400/100 mL on an annual basis, and no more than 10% of the values exceeding 400/100 mL during any 30-day period. During the remainder of the year, the water quality standards for fecal coliforms are a log mean of no more than 1,000/100 mL (for at least five samples within 30 days), no more than 25% of the values exceeding 2,000/100 mL on an annual basis, and no more than 10% of the values exceeding 2,000/100 mL during any 30-day period. The water quality standards for the log mean and for the 75th percentile were used to set numerical water quality targets for this TMDL.

Long term monitoring data for fecal coliforms in Bayou Segnette and two adjoining canals were collected by the US Geological Survey (USGS) during 1981 through 1991 and by Louisiana Department of Environmental Quality (LDEQ) during 1991 through 2000. Analyses

and plots of both the USGS data and the LDEQ data showed that locations closer to the five pumping stations tended to have noticeably higher fecal coliform concentrations than other locations farther from the pumping stations. Analysis of the LDEQ data showed that during May through October, 38% of the observed fecal coliform values exceeded 400/100 mL; therefore, the designated use of primary contact recreation is not being met (the standard allows only 25% of the observed values to exceed 400/100 mL during summer). During winter, though, only 18% of the observed values exceeded 2,000/100 mL, indicating that the designated use of secondary contact recreation is being supported.

This subsegment was listed as not fully supporting all designated uses on both the February 29, 2000 Modified Court Ordered 303(d) List for Louisiana and LDEQ's Final 2002 303(d) List. The suspected causes for impairment included fecal coliforms (pathogen indicators). This subsegment was ranked as priority #3 on the Modified Court Ordered 303(d) List.

The target loads for this TMDL are summarized in Table ES.1. This TMDL consists of a 65% reduction of summer (May through October) fecal coliform loads and no reduction of winter loads. Stormwater runoff from adjacent urban areas that is pumped into Bayou Segnette is included in the TMDL as a wasteload allocation (WLA) because these stormwater discharges are regulated under the Phase II Stormwater Management Program.

Table ES.1. Fecal coliform TMDL for Bayou Segnette (subsegment 020701).

Source	Current Load 10^8 colonies/day	Summer Reduction Percentage	Summer Target Load 10^8 colonies/day	Winter Reduction Percentage	Winter Target Load 10^8 colonies/day
WLA					
Point Sources	1.51	0%	1.51	0%	1.51
Urban Stormwater	1123	81%	217	0%	1123
Wildlife	288	0%	288	0%	288
Septic Systems	79.5	81%	15.4	0%	79.5
Total Load	1492	65%	522	0%	1492
Future Growth			65.3		186.5
MOS			65.3		186.5
TMDL			652.5		1865

Because permit limits for point source discharges require them to meet water quality standards at the end of the pipe, the wasteload allocation (WLA) for all point source discharges consists of no reductions (both summer and winter). Because no reductions are required for point sources, the reductions in the TMDL must come from nonpoint sources. Because almost 20% of the total fecal coliform contributions are considered natural and therefore cannot be reduced, the man-made contributions would have to be reduced by approximately 81% in order to achieve the 65% overall reduction required for this TMDL.

Twenty percent of the total allowable loading was set aside for the explicit margin of safety (MOS) and future growth. This was done by calculating the percent reductions so that the log mean and 75th percentile values were no greater than 80% of the water quality standards.

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1.0 INTRODUCTION

This report presents a total maximum daily load (TMDL) for fecal coliforms for Bayou Segnette from its origin to Bayou Villars (subsegment 020701). This subsegment was listed as not fully supporting all designated uses on both the February 29, 2000 Modified Court Ordered 303(d) List for Louisiana (EPA 2000a) and the Louisiana Department of Environmental Quality (LDEQ) Final 2002 303(d) List (LDEQ 2003a). Table 1.1 shows the suspected sources and suspected causes for impairment in the Modified Court Ordered 303(d) List as well as the priority ranking. The TMDL in this report was developed in accordance with Section 303(d) of the Federal Clean Water Act and the Environmental Protection Agency's (EPA) regulations in 40 CFR 130.7. The 303(d) listings for other pollutants in this subsegment are being addressed by EPA and LDEQ in other documents.

The purpose of a TMDL is to determine the pollutant loading that a waterbody can assimilate without exceeding the water quality standard for that pollutant and to establish the load reduction that is necessary to meet the standard in a waterbody. The TMDL is the sum of the wasteload allocation (WLA), the load allocation (LA), and a margin of safety (MOS). The WLA is the load allocated to point sources of the pollutant of concern, and the LA is the load allocated to nonpoint sources (NPS). The MOS is a percentage of the TMDL that takes into account any lack of knowledge concerning the relationship between pollutant loadings and water quality.

Table 1.1. Summary of 303(d) Listing of subsegment 020701 (EPA 2000a)

Subsegment number	Waterbody description	Suspected sources	Suspected causes	Priority ranking (1 = highest)
020701	Bayou Segnette - origin to Bayou Villars	Municipal point sources Collection system failure Inflow and infiltration Urban runoff/storm sewers Other urban runoff Other Natural sources	Organic enrichment/low DO Pathogen indicators Oil & grease Nutrients	3

2.0 BACKGROUND INFORMATION

2.1 General Description

Bayou Segnette (subsegment 020701) is located in the Barataria basin in southern Louisiana (Figure 2.1). Bayou Segnette begins along the south edge of Westwego and extends generally southward for approximately 12 miles to Bayou Villars. The northern and northeastern boundaries of the subsegment are formed by levees that protect Westwego and other developed areas from flooding due to backwater from the Gulf of Mexico. This subsegment is not heavily populated, but is adjacent to heavily populated areas. Subsegment 020701 includes the entire length of Bayou Segnette and covers an area of approximately 35 square miles.

2.2 Land Use

The predominant land use in the Bayou Segnette subsegment is wetland. Approximate percentages of each land use in the subsegment are shown in Table 2.1 and a map of land use is shown on Figure 2.2. Most of the urban/residential land is along the outer edges of the subsegment, except for some camps concentrated along the middle portion of Bayou Segnette.

Table 2.1. Land uses in subsegment 020701 based on GAP data (USGS 1998).

Land Use	Percent Area
Open Wetland	52.7%
Forested Wetland	27.5%
Forest	1.2%
Cropland/Pasture	2.2%
Water	11.7%
Urban/Residential	4.7%
Total	100.0%

2.3 Flow Characteristics

Bayou Segnette receives runoff from within subsegment 020701 as well as runoff from Westwego and other developed areas where runoff is pumped over the levees at five pumping stations along the north and northeast edges of the subsegment. The locations of the five pumping stations are shown on Figure 2.1 and information for the pumping stations is listed in Table 2.2.

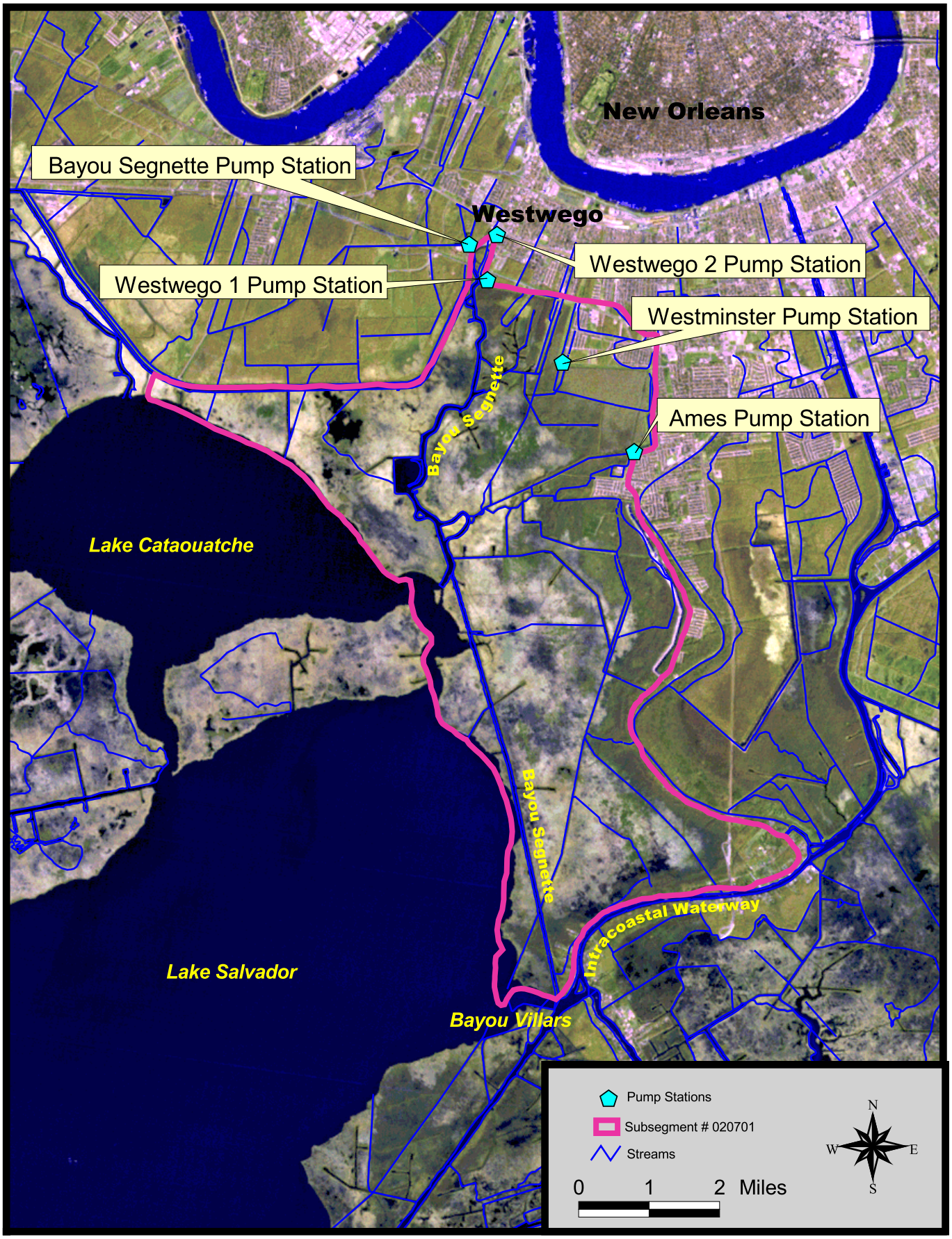

Figure 2.1. Subsegment map for Bayou Segnette.

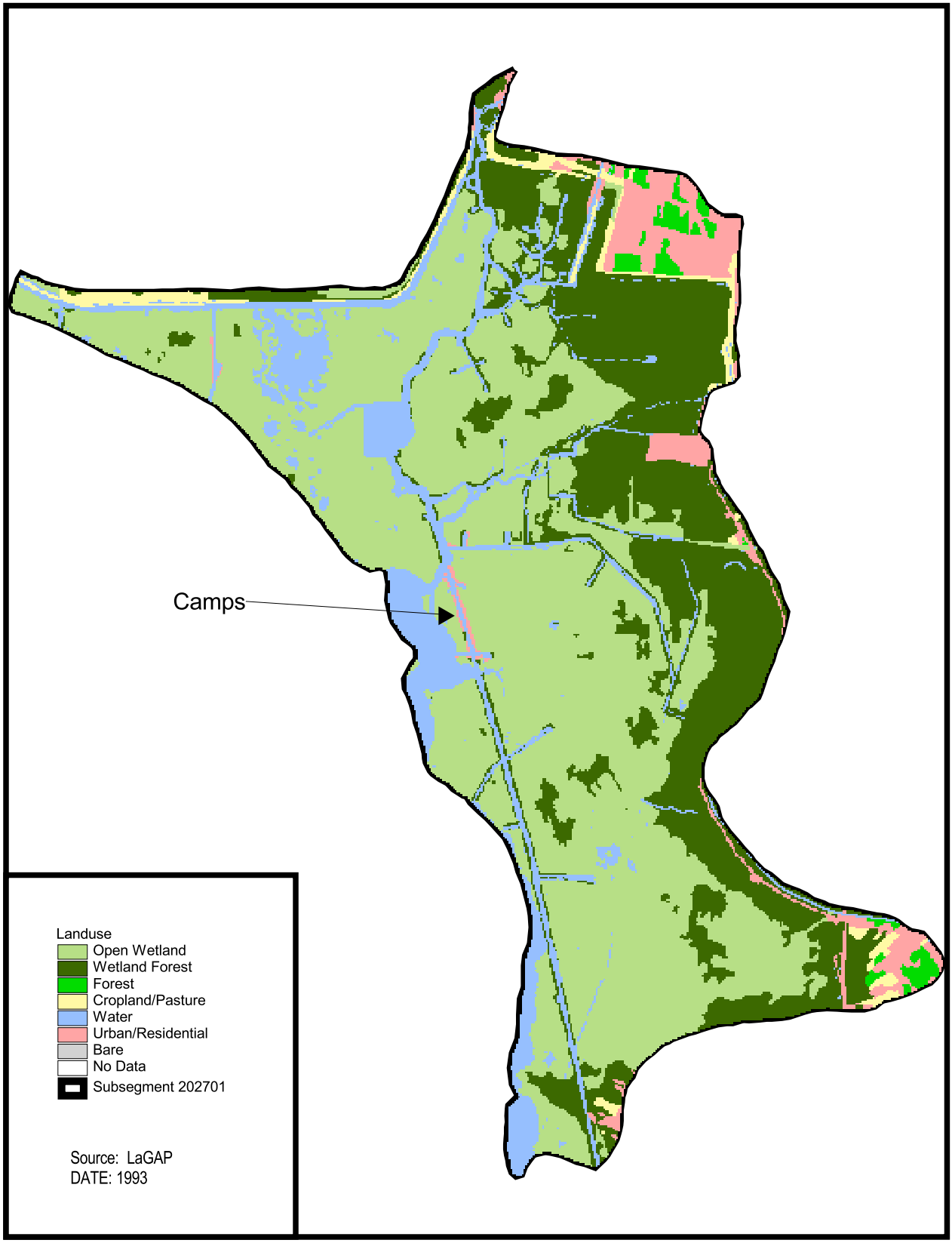

Figure 2.2. Land use map for subsegment 020701.

Table 2.2. Information for pumping stations affecting Bayou Segnette.

Name of pumping station	Receiving water	Pumping capacity	Area draining to pump station	Other miscellaneous information
Bayou Segnette	Bayou Segnette	936 cfs	5,170 acres	Some of the runoff within this drainage area probably flows westward in Main Canal and is pumped into Lake Cataouatche.
Westwego 1	Bayou Segnette	300 cfs	1,816 acres is combined drainage area for Westwego 1 & 2 (drainage is interconnected)	Westwego 1 is a backup for Westwego 2 (it is operated only when Westwego 2 can not keep water levels low enough).
Westwego 2	Bayou Segnette	936 cfs		
Westminster	Unnamed canal draining to Bayou Segnette	1,248 cfs	4,041 acres is combined drainage area for Ames and Westminster (drainage is interconnected)	Westminster is a backup for Ames (it is operated only when Ames can not keep water levels low enough).
Ames	Millaudon Canal (drains to Bayou Segnette)	1,930 cfs		

Bayou Segnette has numerous connections with the surrounding marshes and with other waterbodies (e.g., Lake Cataouatche, Lake Salvador, canals along the east side of Bayou Segnette, Bayou Villars on the south end). Some of the flow from the upper end of Bayou Segnette may be directed into Lake Salvador (LDEQ 1990). Bayou Segnette is influenced by tides from the Gulf of Mexico and is also influenced by wind tides. Based on hourly stage data from the Corps of Engineers gage for Bayou Segnette at Lapalco Boulevard (essentially the same location as LDEQ sampling station 0296), a typical diurnal water level fluctuation is 0.2 ft. There are no flow gages in the Bayou Segnette subsegment.

2.4 Designated Uses and Water Quality Standards

The designated beneficial uses that have been established by the LDEQ for Bayou Segnette (subsegment 020701) are primary contact recreation, secondary contact recreation, and propagation of fish and wildlife. The primary contact recreation use applies only during May through October; the secondary contact recreation use applies during all months. In order to

protect the primary and secondary contact recreation uses, the water quality standards for fecal coliforms have been set as follows (LDEQ 2003b):

Summer (May through October):

- The log mean of fecal coliform values shall not exceed 200 /100 mL, based on not less than five samples collected during not more than 30 days.
- No more than 25% of fecal coliform values collected during a year may exceed 400/100 mL.
- No more than 10% of fecal coliform values collected during any 30-day period may exceed 400/100 mL.

Winter (November through April):

- The log mean of fecal coliform values shall not exceed 1,000/100 mL, based on not less than five samples collected during not more than 30 days.
- No more than 25% of fecal coliform values collected during a year may exceed 2,000/100 mL.
- No more than 10% percent of fecal coliform values collected during any 30-day period may exceed 2,000/100 mL.

Note: the log mean and geometric mean are mathematically equivalent.

The Louisiana water quality standards also include an antidegradation policy (LAC 33: IX.1109.A). This policy states that state waters exhibiting high water quality should be maintained at that high level of water quality. If this is not possible, water quality of a level that supports the designated uses of the waterbody should be maintained. Changing the designated uses of a waterbody to allow a lower level of water quality can only be achieved through a use attainability study.

2.5 Point Sources

A database of point source discharges in the Barataria and Terrebonne basins was previously compiled by EPA Region 6. This database was used to develop a list of point source discharges for subsegment 020701; this list is shown in Appendix A. Only six point source discharges were identified within subsegment 020701 and they are all small discharges (i.e.

<2,500 gallons per day (GPD). There are additional point sources whose effluent is discharged outside the subsegment but their effluent drains to the pump stations and eventually gets pumped into the Bayou Segnette subsegment. The most significant point source discharge outside the subsegment is the City of Westwego sewage treatment plant, which has a design flow of approximately 3 MGD and discharges just outside the subsegment boundary between the Westwego 1 and 2 pump stations.

For the six facilities discharging within subsegment 020701, information about permitted flows and fecal coliform limits were provided by LDEQ (Appendix A). Only four of the discharges included sanitary wastewater and had permit limits for fecal coliforms. Fecal coliform contributions from these four permitted discharges were included in this TMDL.

2.6 Nonpoint Sources

Suspected nonpoint sources for subsegment 020701 have been listed in the EPA Modified Court Ordered 303(d) List for Louisiana (EPA 2000a). These sources included collection system failure, inflow and infiltration, urban runoff / storm sewers, other urban runoff, and natural sources. "Collection system failure" apparently refers to overflows or other failures of wastewater collection systems. "Inflow and infiltration" refers to ambient stormwater leaking into sewer pipes, which can cause the wastewater collection system to overflow, or the wastewater treatment plant to be overloaded (resulting in some wastewater bypassing the treatment facility and entering the receiving water without treatment). According to a report by LDEQ (1990), "the upper section of Bayou Segnette is impacted by sewage treatment plant bypasses during periods of heavy rain".

"Natural sources" include wildlife and waterfowl. According to personnel at the Jean Lafitte National Historical Park and Preserve (which includes the southern part of Bayou Segnette), Bayou Segnette does not attract large populations of waterfowl.

One other nonpoint source that was not mentioned in the EPA 303(d) List is the domestic wastewater from approximately 150 camps and houses along the banks of Bayou Segnette. These camps and houses are all located within approximately 1.3 miles of the middle portion of Bayou Segnette (see Figure 2.2). It is not known whether these camps and houses have individual

wastewater treatment systems ("package plants") or whether they discharge untreated wastewater to the bayou.

2.7 Previous Water Quality Studies

The following is a list of relevant water quality studies that were identified for this TMDL for Bayou Segnette:

1. "Upper Barataria Estuarine Survey: A Survey of the Bacteriological Quality of Waters Entering Barataria Bay, November 1983 - October 1984" (LDEQ 1990). This report includes monthly fecal coliform data for one year at four stations along Bayou Segnette and one station in Millaudon Canal. The primary emphasis of the report was to examine the effect of different sources of fecal coliforms entering the oyster producing areas within the Barataria estuary.
2. "Water Quality of the Barataria Unit, Jean Lafitte National Historical Park, Louisiana (April 1981 – March 1982)" (USGS 1982). This report includes monthly fecal coliform data for one year at three stations along Bayou Segnette and three stations on canals on the east side of Bayou Segnette.
3. "Bacteriological Criteria for Recreational Waters Along the Tangipahoa River" (Anderson et al 1990). This study was conducted in the Tangipahoa River basin, which is in southeastern Louisiana. The primary emphasis of the report is the comparison of various bacteriological indicator criteria. The sampling and analysis do not provide any information for estimating relative magnitudes of different sources of fecal coliforms in southern Louisiana.

3.0 CHARACTERIZATION OF EXISTING WATER QUALITY

3.1 Comparison of Observed Data to Standards

Three sets of observed fecal coliform data were identified for Bayou Segnette and adjacent canals within subsegment 020701. The most recent data set is the LDEQ routine ambient monitoring data collected during 1991-2000 in the upper end of Bayou Segnette (station 0296). The locations of the water quality sampling stations are shown on Figure 3.1. Another data set is the USGS data collected during 1981-1991 at five locations (three in Bayou Segnette, one in Millaudon Canal, and one in Kenta Canal). The third data set is from the Upper Barataria Estuarine Survey (UBES), which was an LDEQ project that included data collected during 1983-1984 at five locations (four in Bayou Segnette and one in Millaudon Canal).

The two data sets that included long term monitoring are summarized in Table 3.1 (the UBES data were not include because there were only a few samples for each site). The individual data points are listed in Tables B.1 and B.2 located in Appendix B. The stations with the highest fecal coliform values were the ones closest to the Ames and Westwego 2 pumping stations (the USGS station on Millaudon Canal and the LDEQ station near the northern end of Bayou Segnette). The stations with the lowest coliform values were the ones farthest from the pumping stations (Kenta Canal and Bayou Segnette near Barataria). These data suggest that urban runoff that is pumped into the Bayou Segnette subsegment has a significant impact.

The 303(d) listing for Bayou Segnette was presumably based on the data at LDEQ station 0296 because the other data were old. Table 3.2 shows a comparison of the observed data at LDEQ station 0296 and water quality standards. The water quality standards used for the comparison are the values that should not be exceeded more than 25% of the time on an annual basis (400/100 mL for summer and 2,000/100 mL for winter as described in Section 2.4). The standards used in this comparison are the same as the criteria used by LDEQ in their assessment methodology presented in their 305(b) report (LDEQ 2002). As shown in Table 3.2, the percent exceedance during winter was less than 25%; therefore, the designated use of secondary contact recreation is being supported during winter. For summer, though, the percent exceedance was greater than 25%, indicating that the primary contact recreation use is not being met.

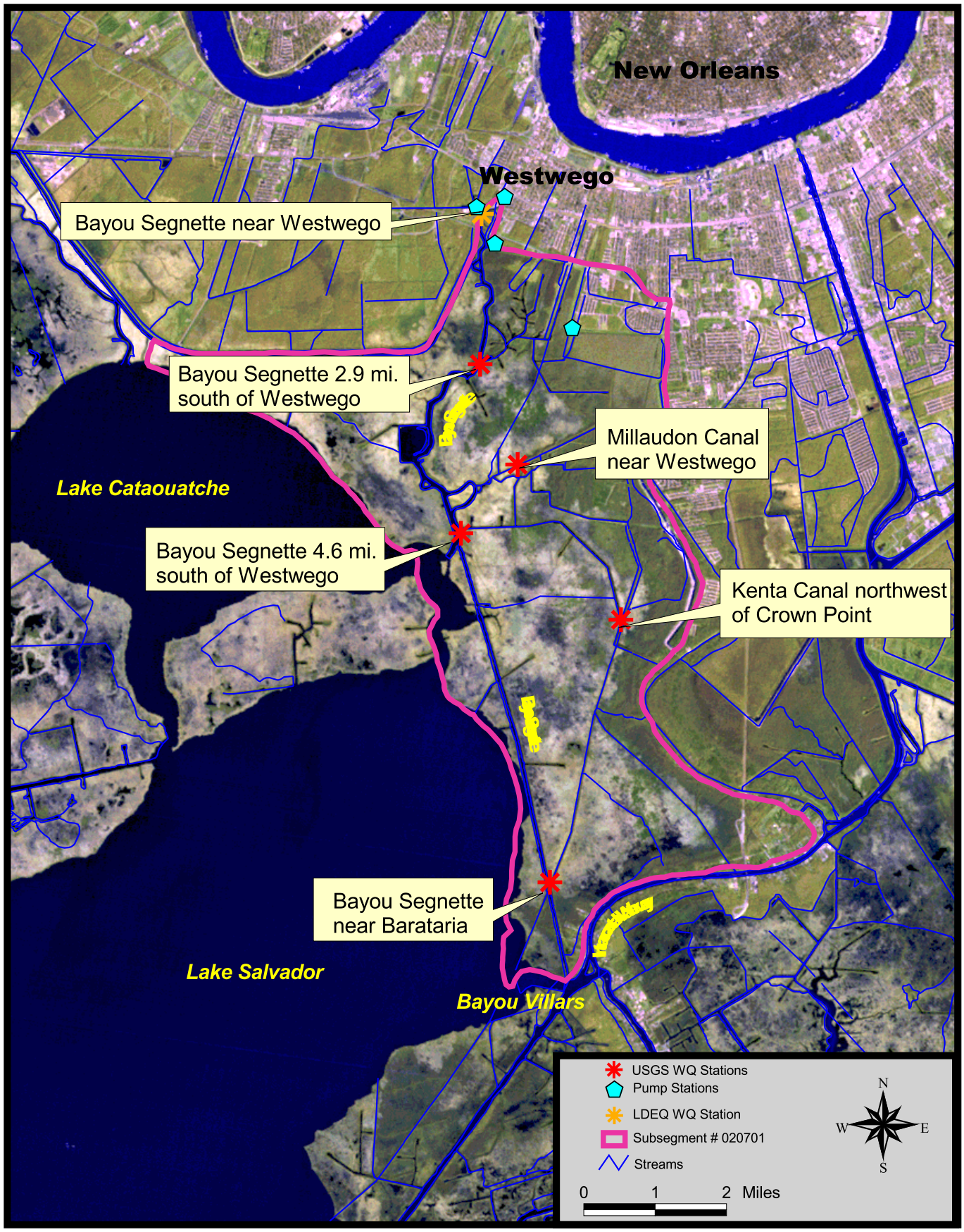

Figure 3.1. Long term monitoring stations in subsegment 020701.

Table 3.1. Summary of long term monitoring data for fecal coliforms in subsegment 020701.

Station Description	Period of Record	No. of Data	Log mean of data (per 100 mL)		75th percentile of data (per 100 mL)	
			Summer	Winter	Summer	Winter
Bayou Segnette near Westwego (LDEQ Station 0296)	1991 to 2000	97	259	289	800	1100
Bayou Segnette 2.9 miles S of Westwego (USGS No. 295202090093200)	1981 to 1991	50	36	178	67	555
Millaudon Canal near Westwego (USGS No. 295040090091600)	1981 to 1991	50	704	3895	4600	16000
Bayou Segnette 4.6 miles S of Westwego (USGS No. 294957090095300)	1981 to 1991	53	81	266	130	505
Kenta Canal NW of Crown Point (USGS No. 294844090073900)	1981 to 1991	47	19	114	47	180
Bayou Segnette near Barataria (USGS No. 294539090084500)	1981 to 1991	51	23	112	45	208
Applicable Water Quality Standards:			200	1000	400	2000

Table 3.2. Evaluation of monitoring data for attainment of designated uses.

Station Description	Period of Record Used	No. of Data	Percent of Values Exceeding Standard for 75th Percentile		Supports Designated Use?	
			Summer	Winter	Summer	Winter
Bayou Segnette near Westwego (LDEQ Station 0296)	1991 to 2000	97	38%	18%	No	Yes

Notes: 1. For summer, the 75th percentile standard is 400/100 mL (primary contact recreation).
2. For winter, the 75th percentile standard is 2000/100 mL (secondary contact recreation).

3.2 Trends and Patterns in Observed Data

The long term monitoring data for the LDEQ and USGS stations are shown graphically in Figures B.1 through B.6 located in Appendix B. These plots show the large variability that is typical for most fecal coliform data. In general, most of the data do not show any long term trends. The plot for Millaudon Canal (Figure B.3) shows lower values towards the end of the period of record, but more recent data would be needed to confirm any significant long term trend.

To provide further insight, the long term monitoring data were plotted against 3-day antecedent precipitation as shown in Figures B.7 through B.12. In general, large storms tended to result in high fecal coliform values (compared to other values for that station). During dry weather and small storms, there was large variability of fecal coliform values.

The long term monitoring data were also plotted by day of the year to examine any seasonal patterns (Figures B.13 through B.18). Some of the data showed slightly higher values during the winter than in the summer. For the LDEQ data for Bayou Segnette near Westwego (Figure B.13), all but one of the wet weather fecal coliform values exceeded the log mean water quality standard, while the majority of the dry weather values were below the log mean water quality standard. For the USGS data (Figure s B.14 through B.18), nearly all of the dry weather values were below the log mean water quality standard, except for Millaudon Canal (Figure B.15). Most of the values for Millaudon Canal (both wet weather and dry weather) exceeded the log mean water quality standard.

Although the UBES data set did not contain a large number of samples at each site, the report (LDEQ 1990) rated the bacteriological water quality in Millaudon Canal and the northern end of Bayou Segnette in the lowest of seven categories. Bacteriological water quality in other portions of Bayou Segnette (farther away from the pumping stations) was rated as significantly better than Millaudon Canal and the northern end of Bayou Segnette. Also, a report by the USGS (1982) analyzed one year of the long term monitoring data that was discussed above and concluded that “samples from Millaudon Canal near Westwego consistently contained higher concentrations of fecal coliforms than samples from other sites”.

4.0 TMDL DEVELOPMENT

4.1 Seasonality and Critical Conditions

Federal regulations in 40 CFR 130.7 require TMDLs to include seasonal variations and take into account critical conditions for stream flow, loading, and water quality parameters. For this TMDL, seasonality was accounted for by developing a seasonal TMDL based on the water quality standards that are applicable for each season. Additionally, the observed fecal coliform data were plotted by day of the year to check for any seasonal patterns (see Section 3.2).

The requirement to account for critical conditions is intended to make sure that water quality standards are maintained not just for average conditions, but also for critical conditions that occur infrequently. This limits the frequency of occurrence of standards violations to an acceptably low level. For most water quality parameters, the water quality standard is listed as a single value that must be maintained at all times except when conditions are more critical than a certain set of conditions. For example, the DO standards for non-tidal waterbodies in Louisiana are applicable at all times except when the flow is less than the 7Q10 flow. Therefore, DO TMDLs require the estimation of allowable loads for 7Q10 flow conditions.

For fecal coliforms, though, the water quality standards include values that should not be exceeded more than 25% of the time based on all data collected during applicable periods of the year (i.e., based on data collected during both critical and non-critical conditions). Because they are written this way, these standards allow a fecal coliform TMDL to be developed by looking at all conditions within applicable periods of the year and evaluating the percent of values exceeding the standard. For this TMDL, critical conditions for flow, temperature, etc. were not determined, but critical conditions were accounted for by setting the numeric water quality target based on the standards that should not be exceeded more than 25% of the time. The 75th percentile of water quality values was compared to the numeric target to determine compliance with water quality standards.

4.2 Assessment of Pollutant Sources

A list of sources of fecal coliforms to Bayou Segnette was developed and the relative contribution of each source was estimated. The potential sources, their locations, and miscellaneous comments concerning the sources are listed in Table 4.1.

Table 4.1. Sources of fecal coliforms to Bayou Segnette (subsegment 020701).

Source	Location	Comments
Point sources	In the northern end of the subsegment	Should not cause any violations of water quality standards because there are only a few discharges, they are each small, and their permit limits are based on meeting standards at end of pipe
Water pumped into subsegment from 5 pumping stations	In the northern end of the subsegment (as shown on Figure 2.2)	As noted in Section 2.6, this includes urban runoff as well as sewage treatment plant bypasses during periods of heavy rain. Long term monitoring data and the UBES report both indicate that water pumped into the subsegment from developed areas is high in fecal coliforms.
Home sewage systems (includes failing or nonexistent septic systems)	Concentrated within 1.3 mile reach (as shown on Figure 2.2)	No data have been collected within this reach to determine local effects of the 150 camps. Long term monitoring data several miles south of this reach do not suggest that the camps are having a significant effect on fecal coliform levels in other parts of the Bayou Segnette.
Wildlife and waterfowl	Distributed along the entire length of the subsegment	Expected to be small. Subsegment does not attract large numbers of waterfowl. Some of the fecal coliforms from wildlife in the eastern portion of the subsegment probably die off before they can be transported into Bayou Segnette.

The EPA Bacterial Indicator Tool spreadsheet (EPA 2000b) was used to estimate relative contributions of different sources of fecal coliforms for Bayou Segnette. The spreadsheet is designed to estimate fecal coliform accumulation rates for input to a watershed model such as HSPF. For this TMDL, though, the spreadsheet was used to estimate relative loadings to the stream. To estimate the percentage of fecal coliforms that actually enter the stream would require a detailed analysis such as applying the HSPF model to the Bayou Segnette drainage area. A detailed analysis was not feasible for this TMDL due to the lack of available data and resources. Therefore, for simplicity, it was assumed that all fecal coliforms accumulating on the land surface would enter the stream. A printout of the spreadsheet showing values used for Bayou Segnette is included in Appendix C.

Contributions of fecal coliforms from water pumped into the subsegment at the pumping stations were estimated using the combined drainage area for all five pumping stations and accumulation rates from Horner (1992). The developed areas in Westwego and other areas draining to the pump stations were assumed to be 50% commercial, 25% mixed commercial and residential, 20% residential, and 5% roads and utilities. Subcategories of urban land uses (commercial, mixed, residential, roads and utilities) were assigned different fecal coliform accumulation rates. These estimates did not account for sewage treatment plant bypasses because no quantitative information was available concerning the frequency or volume of water for bypasses. Since the areas draining to the pump stations are regulated under the Phase II stormwater management program (EPA 2000c), their fecal coliform contributions were classified as wasteload allocations in the TMDL.

Contributions from home sewage systems were calculated based on the following assumptions:

1. There are 150 camps and houses along the banks of Bayou Segnette (counted from recent aerial photography available as digital ortho quarter quads (DOQQs)).
2. Each camp has an average of 2 people (intended to account for occupancy of more than 2 people, but on an intermittent basis).
3. None of the camps have effective treatment.
4. Each camp with no effective treatment generates 70 gallons per day per person with a fecal coliform concentration of 10,000/100 mL (default values in the spreadsheet based on information from Horsley & Whitten (1996)).

Contributions from wildlife and waterfowl were estimated based on assumed animal densities (i.e., animals per acre) and default values in the spreadsheet for fecal coliform production per animal. The assumed animal densities were 10 animals per square mile for ducks and for geese, and 1 animal per square mile for deer, for beavers, and for raccoons.

The spreadsheet was modified slightly to include fecal coliform contributions from point sources. Fecal coliform permit limits and permitted flows were the same for all of the point source discharges. Therefore, contributions from point source discharges were estimated by multiplying the monthly maximum permit limit for fecal coliforms (400/100 mL) by the

permitted flow (2,500 GPD) and then multiplying by the total number of point source discharges for this subsegment (4).

A summary of the estimated relative contributions of point sources and nonpoint sources of fecal coliforms is shown in Table 4.2. The largest source is water pumped into the subsegment from Westwego and other developed areas.

Table 4.2. Relative magnitudes of different sources of fecal coliforms for subsegment 020701.

Source	Percent of total loading	
	Summer	Winter
Point sources	0.1%	0.1%
Water pumped into subsegment at pumping stations	77.3%	77.3%
Camps and houses along middle portion of bayou	2.7%	2.7%
Wildlife and waterfowl	19.8%	19.8%

4.3 TMDL

This TMDL was developed by calculating a percent reduction from existing levels and then estimating maximum allowable "loads" of fecal coliforms (i.e., number of fecal coliforms per unit of time). The overall percent reduction needed in fecal coliforms was determined by taking the most recent long term monitoring data (the LDEQ data for 1991-2000) and multiplying the values within each season by a reduction factor until the geometric mean and 75th percentile values of the data were less than the target values. The target values were set to 80% of the seasonal water quality standards (to incorporate a 20% combined explicit MOS and future growth component). The percent reduction was applied only to observed data that were greater than the log mean water quality standard (200/100 mL for summer and 1000/100 mL for winter) because it was not considered feasible to reduce fecal coliform counts that were already below the water quality standard. For summer, the required percent reduction was 65%, but no reductions were required for winter. These calculations are shown in Appendix D.

This methodology (applying a percent reduction to individual data points) addresses the variability associated with both the observed data and the water quality standards. The water quality standards specify that the log mean should be calculated using not less than five samples collected during not more than 30 days. Although none of the fecal coliform data being used in

this TMDL consisted of five samples collected within a 30-day period, it was still considered useful to calculate the percent reductions based on meeting the log mean standard as well as the 75th percentile standard. Requiring the data to meet both standards made the analysis slightly more conservative; the required percent reduction would have been only 60% if the log mean standard had not been used.

Table 4.3 shows an estimate of current fecal coliform loads to the subsegment and the load allocations for the TMDL. Note that estimated current loads are the same for both summer and winter. The TMDL load allocations and calculation of target loads are discussed below.

Table 4.3. Fecal coliform TMDL for Bayou Segnette (subsegment 020701).

Source	Current Load 10^8 colonies/day	Summer Reduction Percentage	Summer Target Load 10^8 colonies/day	Winter Reduction Percentage	Winter Target Load 10^8 colonies/day
WLA					
Point Sources	1.51	0%	1.51	0%	1.51
Urban Stormwater	1123	81%	217	0%	1123
LA					
Wildlife	288	0%	288	0%	288
Septic Systems	79.5	81%	15.4	0%	79.5
Total Load	1492	65%	522	0%	1492
Future Growth			65.3		186.5
MOS			65.3		186.5
TMDL			652.5		1865

4.4 Wasteload Allocation

Point sources in the subsegment account for less than 1% of the estimated fecal coliform load to the subsegment based on their permitted flow rates and maximum fecal coliform limits. Therefore, no reductions were assigned to the point sources in the subsegment for the TMDL.

Stormwater runoff from the adjacent urban areas that is pumped into Bayou Segnette was included in the WLA because it is regulated under the Phase II Stormwater Management Program. Fecal coliform loads estimated for the water pumped into the subsegment from adjacent urban areas accounted for the majority of the load to the subsegment, so it was necessary to assign a load reduction to this source. In order to achieve the 65% reduction in the

summer total allocated fecal coliform load, the urban area stormwater load needed to be reduced 81%.

4.5 Load Allocation

Septic systems in the subsegment are the only man-made nonpoint fecal coliform source. Even though they are expected to account for a fairly small portion of the estimated fecal coliform load to the subsegment they were assigned a load reduction for this TMDL. The load reduction was the same as for the urban area stormwater load (81%).

4.6 Margin of Safety

Section 303(d) of the Federal Clean Water Act and EPA's regulations at 40 CFR 130.7 both require the inclusion of a MOS in the development of a TMDL. A combined explicit MOS and future growth component of 20% was incorporated in this TMDL by calculating the percent reductions so that the log mean and 75th percentile values were no greater than 80% of the seasonal water quality standards. In the TMDL, the MOS and future growth are both set to 10% of the TMDL.

5.0 OTHER RELEVANT INFORMATION

Utilizing funds under Section 106 of the Federal Clean Water Act and under the authority of the Louisiana Environmental Quality Act, LDEQ has established a program for monitoring the quality of the state's surface waters. The LDEQ Surveillance Section collects surface water samples at various locations, utilizing appropriate sampling methods and procedures for ensuring the quality of the data collected. The objectives of the surface water monitoring program are to determine the quality of the state's surface waters, to develop a long-term database for water quality trend analysis, and to monitor the effectiveness of pollution controls. The data obtained through the surface water monitoring program is used to develop the state's biennial 305(b) report (*Water Quality Inventory*) and the 303(d) list of impaired waters. This information is also utilized in establishing priorities for the LDEQ nonpoint source program.

LDEQ has implemented a watershed approach to surface water quality monitoring. Through this approach, the entire state is sampled over a five-year cycle with two targeted basins sampled each year. Long-term trend monitoring sites at various locations on the larger rivers and Lake Pontchartrain are sampled throughout the five-year cycle. Sampling is conducted on a monthly basis or more frequently if necessary to yield at least 12 samples per site each year. Sampling sites are located where they are considered to be representative of the waterbody. Under the current monitoring schedule, targeted basins follow the TMDL priorities. In this manner, the first TMDLs will have been established by the time the first priority basins will be monitored again in the second five-year cycle. This will allow LDEQ to determine whether there has been any improvement in water quality following implementation of the TMDLs. As the monitoring results are evaluated at the end of each year, waterbodies may be added to or removed from the 303(d) list. The sampling schedule for the current five-year cycle follows.

2003 – Mermentau and Vermilion-Teche River Basins
2004 – Calcasieu and Ouachita River Basins
2005 – Barataria and Terrebonne Basins
2006 – Lake Pontchartrain Basin and Pearl River basin
2007 – Red and Sabine River Basins

(Atchafalaya and Mississippi rivers will be sampled continuously.)

6.0 FUTURE WATERSHED ACTIVITIES

Point source wasteload allocations will be implemented through LPDES permit procedures.

In Louisiana, nonpoint source load allocations will be addressed through the LDEQ Nonpoint Source Management Program. The *Louisiana's Nonpoint Source Management Plan* (Plan) (LDEQ 2000) states that TMDLs are being developed through a close relationship between LDEQ and EPA Region 6. It further states that, "management strategies outlined within this document (both statewide and watershed) will be implemented in each of the watersheds where water quality problems have been attributed to nonpoint sources of pollution." On page ii, Objective 3 of the watershed management strategies is to "utilize pollutant load reductions of the TMDL to develop nonpoint source pollution reduction strategies for each of the watersheds ... that have water quality problems identified." Also, Objective 7 provides a tracking process for evaluating progress in reduction in loadings of fecal coliform bacteria.

The Plan includes a discussion of a number of nonpoint source activities and provides Best Management Practices (BMPs) that can be used to achieve the nonpoint source load reductions for fecal coliform as established in the TMDLs. The Plan broadly discusses programs including agriculture, forestry, home sewerage systems, hydromodification, urban runoff, construction, and resource extraction.

The Plan provides fourteen different BMPs that can be used to reduce fecal coliform loads. Also provided with each of these BMPs is an evaluation of the effectiveness of the BMP given as a high, medium, or low ranking. Additional evaluations should be conducted to determine the most likely source of fecal contamination in this watershed and to identify localized hot spots to be targeted for effective BMP implementation. These and other BMPs may be implemented at a scale adequate to achieve the load reductions as established in the TMDL.

7.0 PUBLIC PARTICIPATION

When EPA establishes a TMDL, federal regulations require EPA to notify the public and seek comment concerning the TMDL. This TMDL has been prepared under contract to EPA. After development of this TMDL, EPA and/or a designated state agency will commence preparation of a notice seeking comments, information, and data from the general public and affected public. If comments, data, or information are submitted during the public comment period, then EPA may revise the TMDL accordingly. After considering public comment, information, and data, and making any appropriate revisions, EPA will transmit the revised TMDL to the LDEQ for implementation and incorporation into LDEQ's current water quality management plan.

8.0 REFERENCES

Anderson, A.C, A. Abdelghani, J. Stumpf, and J.C. Rice. 1990. Bacteriological Criteria for Recreational Waters Along the Tangipohoa River. Report prepared for LDEQ under Contract No. 24022-90-01 by Tulane University School of Public Health and Tropical Medicine. November 30, 1990.

EPA. 2000a. Modified Court Ordered 303(d) List for Louisiana. Downloaded from EPA Region 6 website (http://www.epa.gov/earth1r6/6wq/ecopro/latmdl/modifiedcourtorderdlist.xls).

EPA. 2000b. Bacterial Indicator Tool User's Guide. EPA-823-B-01-003. U.S. Environmental Protection Agency, Office of Water. March 2000.

EPA. 2000c. Storm Water Phase II Compliance Assistance Guide. EPA 833-R-00-002. US Environmental Protection Agency. March 2000.

Horner, R.R. 1992. Water quality criteria/pollutant loading estimation/treatment effectiveness estimation. In R.W. Beck and Associates. Covington Master Drainage Plan. King County Surface Water Management Division. Seattle, WA.

Horsley & Whitten, Inc. 1996. Identification and Evaluation of Nutrient and Bacteriological Loadings to Maquoit Bay, Brunswick, and Freeport, Maine. Final Report. Casco Bay Estuary Project, Portland, ME.

LDEQ. 1990. Upper Barataria Estuarine Survey: A Survey of the Bacteriological Quality of Waters Entering Barataria Bay, November 1983 - October 1984. Report prepared by K. M. St. Pe´ and J. Akielaszek. Louisiana Department of Environmental Quality. Baton Rouge, LA. June 1990.

LDEQ. 2000. State of Louisiana Nonpoint Source Management Plan. Louisiana Department of Environmental Quality. Baton Rouge, LA.

LDEQ. 2002. Water Quality Inventory Report, Prepared Pursuant to Section 305b of the Federal Water Pollution Control Act. Downloaded from LDEQ website (http://www.deq.state.la.us/planning/305b/2002/index.htm).

LDEQ. 2003a. Louisiana Final 2002 303(d) List. Dated August 20, 2003. Downloaded from LDEQ website (http://www.deq.state.la.us/technology/tmdl/303dlist-2002-final.pdf).

LDEQ. 2003b. Environmental Regulatory Code. Part IX. Water Quality Regulations. Chapter 11. Surface Water Quality Standards. Downloaded from LDEQ website (http://www.deq.state.la.us/planning/regs/title33/index.htm#Title).

USGS. 1982. Water Quality of the Barataria Unit, Jean Lafitte National Historical Park, Louisiana (April 1981 – March 1982). Report prepared by C. R. Garrison. Open File Report 82-691. U.S. Geological Survey. Baton Rouge, LA.

USGS. 1998. Louisiana GAP Land Use/Land Cover Data. Downloaded from Spatial Data and Metadata Server, National Wetlands Research Center, U.S. Geological Survey. (http://sdms.nwrc.gov/gap/landuse.html).

APPENDIX A

List of Point Source Discharges

LIST OF POINT SOURCE DISCHARGES FOR SUBSEGMENT 020701 (BAYOU SEGNETTE)

FILE_NUM	NPDES	LPDES	COMPANY	FACILITY	LOCATION	FACILITY TYPE	RECEIVING WATER	SIC	EXPECTED FLOW	PERMITTED FLOW	PERMITTED FECAL COLIFORM
LAG530881			MASTER LUBE OF LA INC		MARRERO 3046 BARATARIA BLVD	OIL LUBE CNTR	ESTELLE CANAL	4952	60 gpd	< 2,500 gpd	400 colonies/100mL (weekly average)
LAG530869			JEFFERSON PAR DEPT DRAINAGE PUMP STA	BAYOU SEGNETTE PUMP STA	WESTWEGO 801 LA ST	DRAINAGE PUMP STA	BAYOU SEGNETTE	4952	400 gpd	< 2,500 gpd	400 colonies/100mL (weekly average)
LAG530921			JEFFERSON PAR DEPT DRAINAGE PUMP STA	AMES PUMP STA	MARRERO 5100 ROCHESTER DR	DRAINAGE PUMP STA	BAYOU SEGNETTE	4952	80 gpd	< 2,500 gpd	400 colonies/100mL (weekly average)
LAG110008			LAFARGE CONST MATERIALS	WESTBANK PLT	MARRERO 1950 AMES BLVD	READY MIX CONCRETE PLT	BAYOU SEGNETTE	3273	10 gpm (average)		Not permitted for fecal coliform; permitted for discharge process wastewater and stormwater only, no sanitary wastewater discharge
LA0108022			HILCORP ENERGY CO		BAYOU SEGNETTE FIELD	OIL/GAS EXP. PROD. & DEV.	B SEGNETTE,DUGAS C,OUTER CATAOUATCH	1311			Not permitted for fecal coliform
LAG530923			JEFFERSON PAR DEPT DRAINAGE PUMP STA	WESTMINSTER & LINCOLNSHIRE PUMP STA	MARRERO 2050 WATLING DR	DRAINAGE PUMP STATION	BAYOU SEGNETTE	4952	80 gpd	< 2,500 gpd	400 colonies/100mL (weekly average)

APPENDIX B

Long Term Monitoring Data for Fecal Coliforms

Table B.1. LDEQ Fecal Coliform Data
for Bayou Segnette near Westwego (Station 0296)
from LDEQ web site

Date	Time	Season		Observed FC Data (MPN per 100 mL)
5/14/91	0807	summer		300
6/11/91	0756	summer	>	16000
7/16/91	0930	summer		1300
8/13/91	0909	summer		20
9/10/91	0912	summer		130
10/15/91	0852	summer		80
5/12/92	0911	summer		170
6/16/92	0855	summer		130
7/14/92	0939	summer		500
8/11/92	0928	summer		2400
9/14/92	1007	summer		800
10/13/92	0943	summer		500
5/11/93	0845	summer		9000
6/15/93	1305	summer		40
7/13/93	0923	summer		40
8/10/93	1029	summer		130
9/14/93	0905	summer		110
10/12/93	0901	summer		130
5/10/94	1014	summer		16000
6/14/94	1032	summer		500
7/12/94	0958	summer		1400
8/9/94	1046	summer		800
9/13/94	1003	summer		80
10/11/94	1008	summer		1300
6/13/95	0951	summer	<	20
7/11/95	0950	summer		80
8/15/95	1015	summer		80
9/12/95	0928	summer	<	20
10/10/95	0942	summer		20
5/14/96	0910	summer		70
6/11/96	0928	summer		300
7/9/96	1026	summer		3000
8/13/96	0954	summer		230
9/10/96	0942	summer		110
10/15/96	0931	summer		170
5/13/97	1002	summer		70
6/10/97	0950	summer		500
7/15/97	0919	summer		130
8/12/97	1041	summer		2400
9/9/97	1030	summer		500
10/14/97	0953	summer		800
5/12/98	1141	summer		70
6/27/00	1024	summer		3000
7/25/00	1008	summer		50
8/22/00	1045	summer		50
9/19/00	0936	summer		350
10/17/00	0942	summer		70
1/15/91	0908	winter		
2/5/91	0906	winter		2400
3/12/91	0833	winter		130
4/16/91	0815	winter		9000

Date	Time	Season	Observed FC Data (MPN per 100 mL)
12/10/91	1041	winter	110
1/7/92	1025	winter	170
2/11/92	0955	winter	300
3/10/92	0833	winter	5000
4/7/92	0925	winter	20
11/17/92	0926	winter	230
12/15/92	1108	winter	110
1/12/93	1128	winter	3000
2/9/93	0915	winter	40
3/9/93	0904	winter	230
4/13/93	0906	winter	70
11/16/93	0910	winter	> 16000
12/14/93	1008	winter	3000
1/11/94	0940	winter	120
2/8/94	1003	winter	220
3/15/94	1022	winter	130
4/12/94	1020	winter	300
11/15/94	1051	winter	500
12/13/94	1004	winter	130
1/10/95	1017	winter	500
2/14/95	0832	winter	800
3/14/95	0937	winter	> 16000
4/4/95	0905	winter	110
11/14/95	0910	winter	< 20
12/12/95	0908	winter	70
1/9/96	0937	winter	700
2/13/96	1027	winter	80
3/12/96	0912	winter	40
4/9/96	0931	winter	170
11/19/96	1005	winter	1100
12/10/96	0935	winter	40
1/7/97	1039	winter	3000
2/18/97	1120	winter	500
3/11/97	0908	winter	80
4/15/97	0907	winter	1300
11/18/97	1042	winter	80
12/9/97	1021	winter	1300
1/13/98	1024	winter	3000
2/10/98	0941	winter	80
3/10/98	1102	winter	1300
4/14/98	1117	winter	40
1/25/00	1042	winter	50
2/22/00	1022	winter	14
3/28/00	1009	winter	21
4/25/00	1001	winter	80
11/14/00	1005	winter	1100
12/19/00	0922	winter	1100

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Table B.2. USGS Fecal Coliform Data for Bayou Segnette and Adjacent Canals (from USGS web site)

Notes: 1. USGS parameter code = 31625 (Fecal coliform, M-FC MF (0.7 micron) method, water, colonies per 100 milliliters)
2. E = estimated value

Date	Bayou Segnette 2.9 miles south of Westwego (295202090093200)		Bayou Segnette 4.6 miles south of Westwego (294957090095300)		Bayou Segnette near Barataria (294539090084500)		Millaudon Canal near Westwego (295040090091600)		Kenta Canal northwest of Crown Point (294844090073900)	
4/28/81	E	90		180	E	40		29000	E	110
5/19/81	E	30		140	E	6		1400	E	32
7/1/81	E	33	E	40	E	30	E	13000	E	10
7/20/81	E	22	E	40	E	15	E	900	E	2
8/6/81	E	32		410	E	40		1900		190
9/1/81			E	7700	E	340			E	85
10/22/81	E	10	E	60	E	35	E	300	<	10
11/19/81	E	5		300	E	15		4400		
12/17/81	E	55		540		400	E	65000		180
1/27/82	E	60		120		110				110
2/24/82		220	E	75	E	80		3500	E	40
3/4/82		660	E	80	E	25	>	800	E	80
10/28/82	E	90	E	25	E	40		20000	E	30
11/23/82	E	85		660	E	30	E	46000	E	70
12/16/82	E	15000		9600		210	E	72000		280
1/26/83	E	60	E	60	E	35		10000	E	95
2/23/83	E	60		400		420	E	9300	E	180
3/23/83	E	18		240	E	80	E	7700		120
4/21/83		120	E	90		170		7400	E	160
5/26/83	E	40		180		400		8000	E	60
6/16/83	E	14	E	30	E	6		18000	E	8
7/28/83		38		96	E	16		3600	E	4
8/25/83		44		52		78		4100		48
9/27/83		96		100		150	E	45000	E	20
10/27/83	E	180		44		64		27000		50
11/29/83	E	85		840		460		20000		
1/5/84		110		120		200	E	100	E	30
4/16/84	E	24		120		60	E	16000	E	14
6/28/84	E	38		100	E	45		4600		46
8/28/84	E	9	E	40	<	2	E	1300	E	2
8/27/85	E	20	E	25	E	20	E	70	E	30
10/23/85		240		64	E	4	E	70	E	22
12/17/85		300		180		42	E	75		
2/6/86		4700		220		150	E	800		270
8/19/87				54				96		
9/30/87				60				290		
4/7/88		45		120	E	90		680	E	40
5/26/88	E	20	E	120	E	30		240	E	40
6/16/88		100		90	E	6	E	90	E	16
7/12/88		60		100	E	12		120	E	8
7/27/88	E	4	E	16	E	4	E	38	E	10
8/18/88	E	18		58	E	22	>	5000		
9/20/88	E	55		160	E	20		330	E	90
3/23/89	E	5500		3000		680	E	9600	E	170
5/23/89	<	4	<	20	<	10	<	20	<	4
7/20/89	E	76	E	200	E	10	E	50	E	24
9/27/89	E	340		230		92		160	E	23
3/22/90		120		90	E	150		600		80
6/14/90	E	20	E	38	<	2		78	E	8
9/6/90		64		56	E	40		48	E	8
2/7/91	E	2500		580		420	E	2000		1000
4/29/91	E	640	E	350	E	130		410		460
7/24/91	E	50	E	190	E	56				84

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Figure B.1. Long Term Plot of LDEQ Data for Bayou Segnette near Westwego

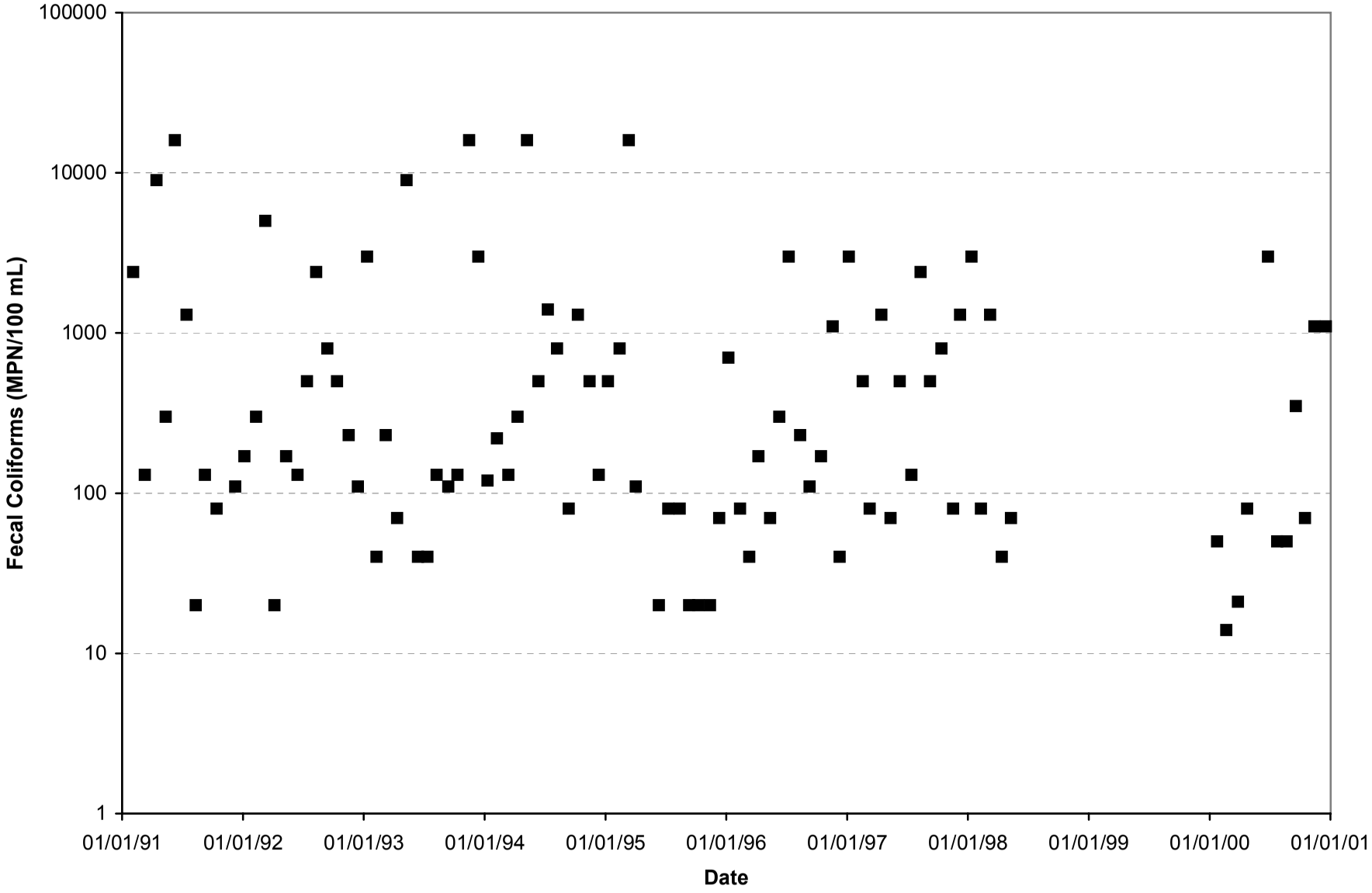


Figure B.2. Long Term Plot of USGS Data for Bayou Segnette 2.9 miles S of Westwego

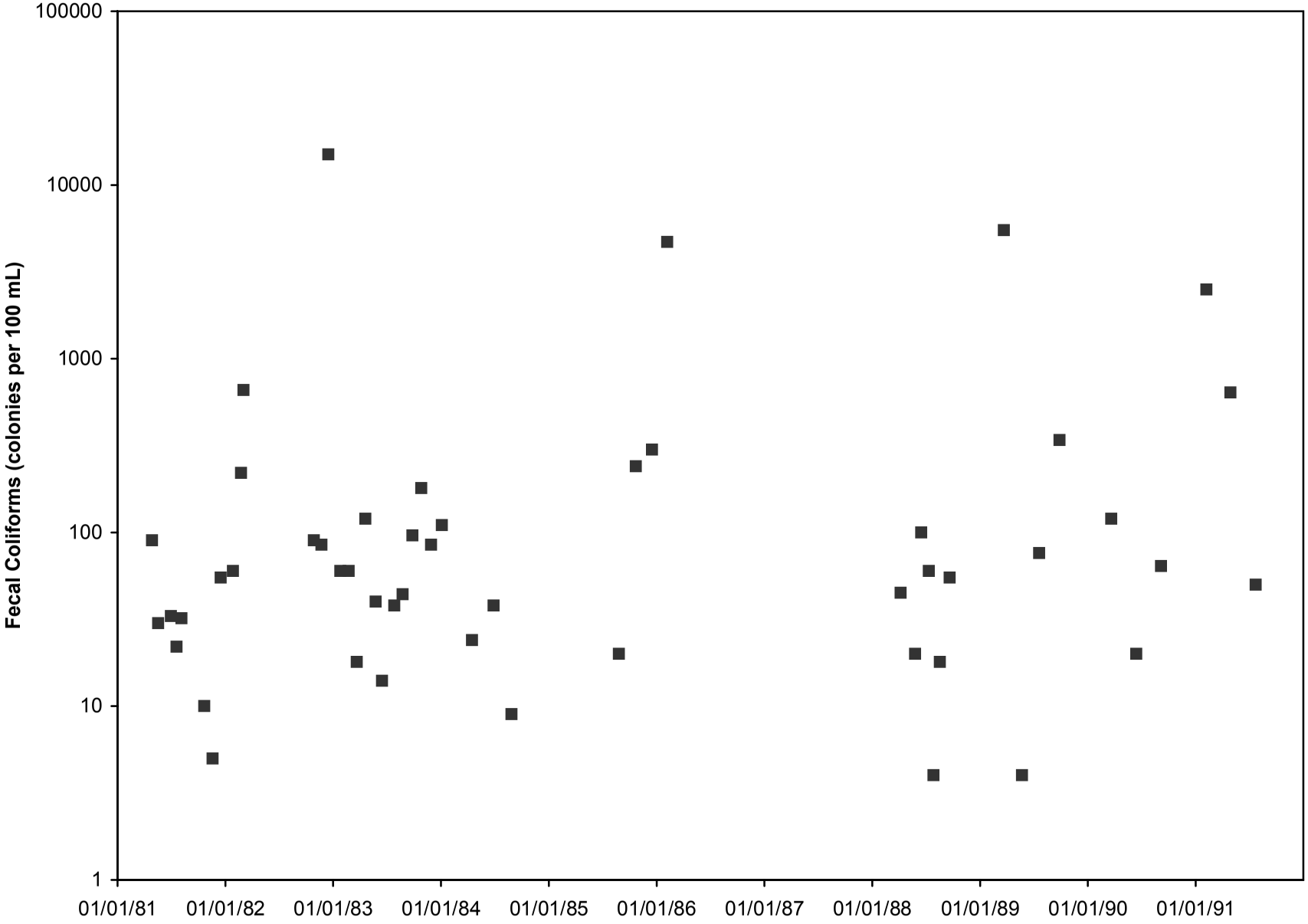


Figure B.3. USGS Fecal Coliform Data for Millaudon Canal near Westwego

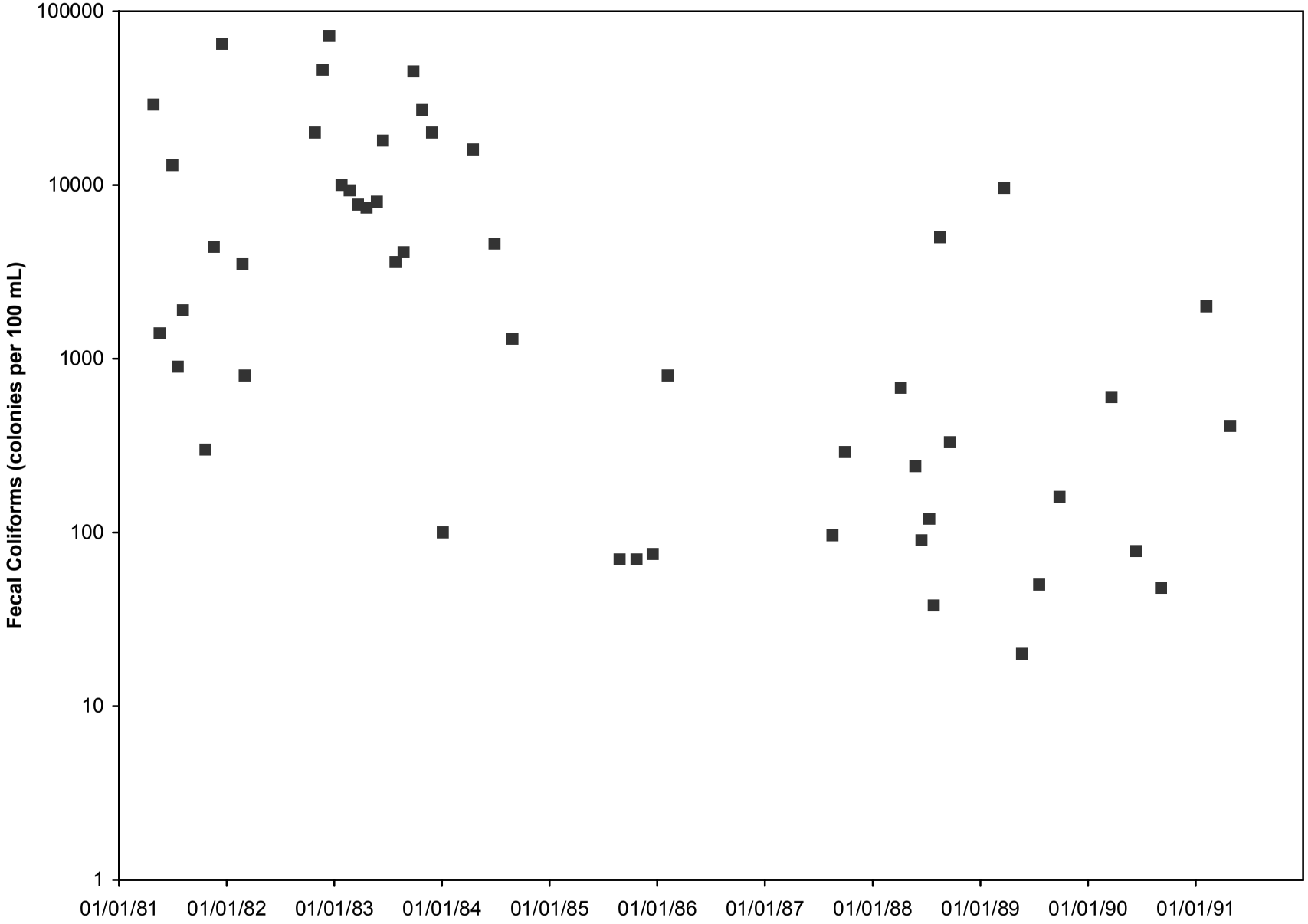


Figure B.4. USGS Fecal Coliform Data for Bayou Segnette 4.6 miles S of Westwego

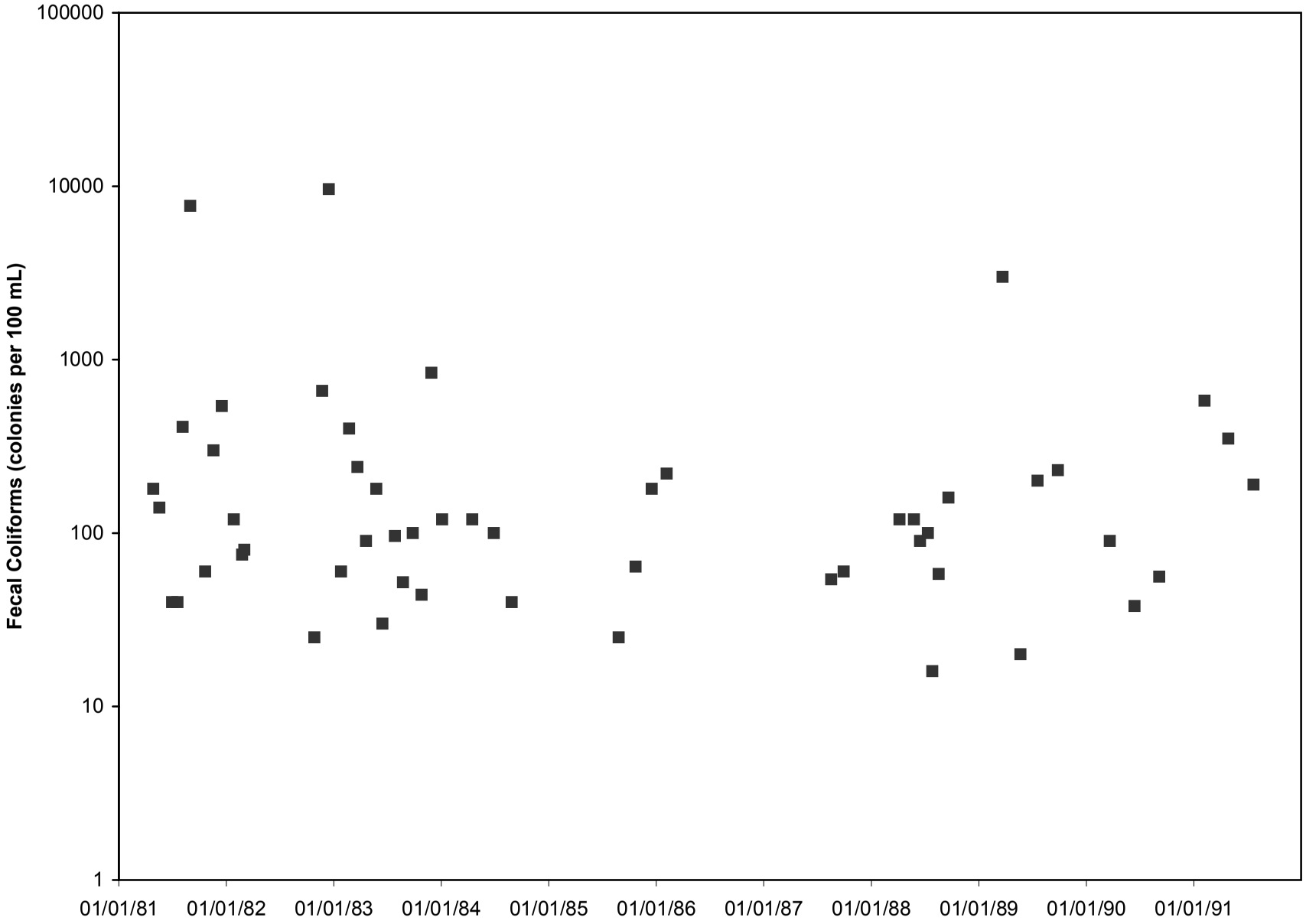


Figure B.5. USGS Fecal Coliform Data for Kenta Canal NW of Crown Point

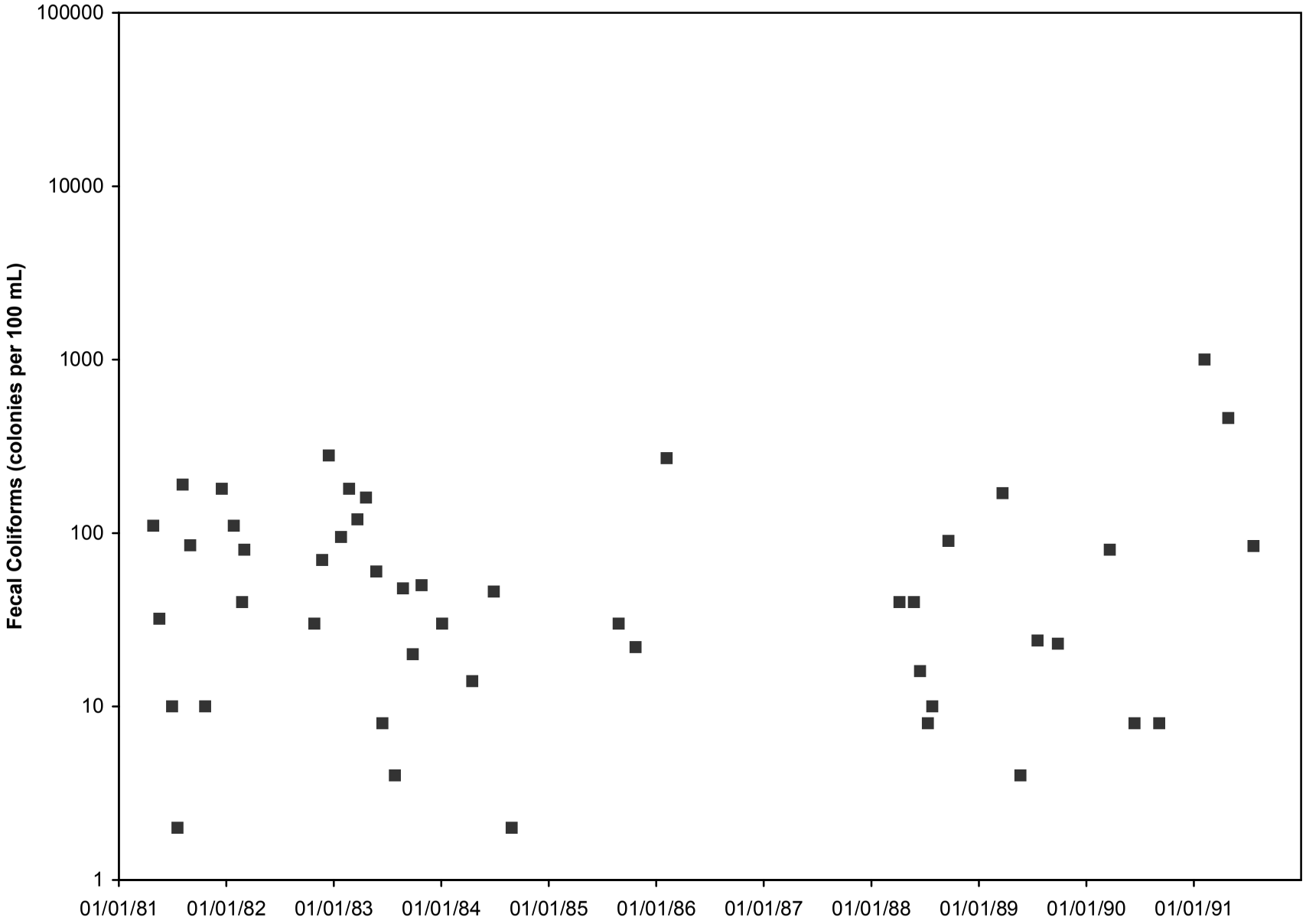


Figure B.6. USGS Fecal Coliform Data for Bayou Segnette near Barataria

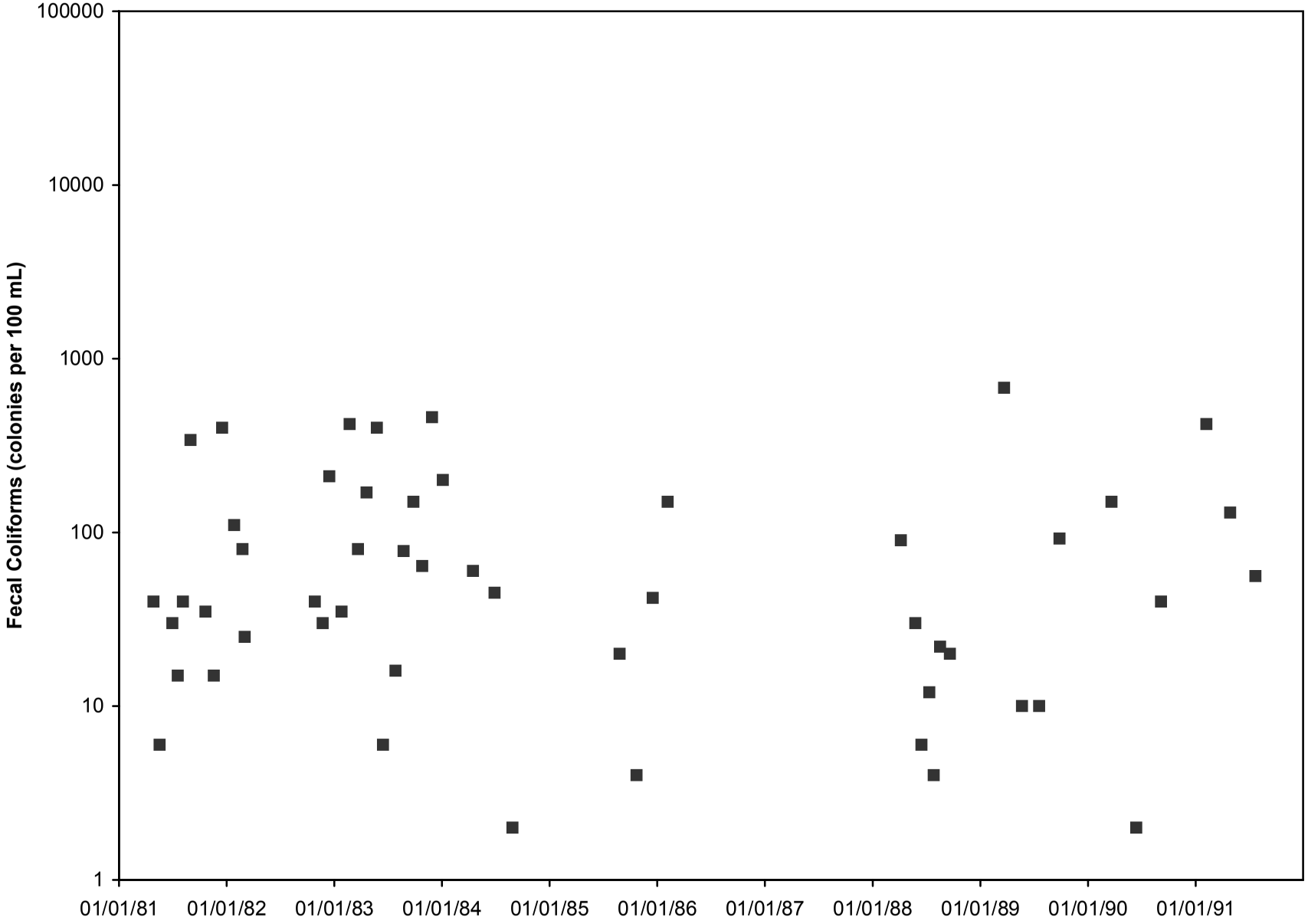


Figure B.7. LDEQ Data for Bayou Segnette near Westwego vs. 3-day Precipitation

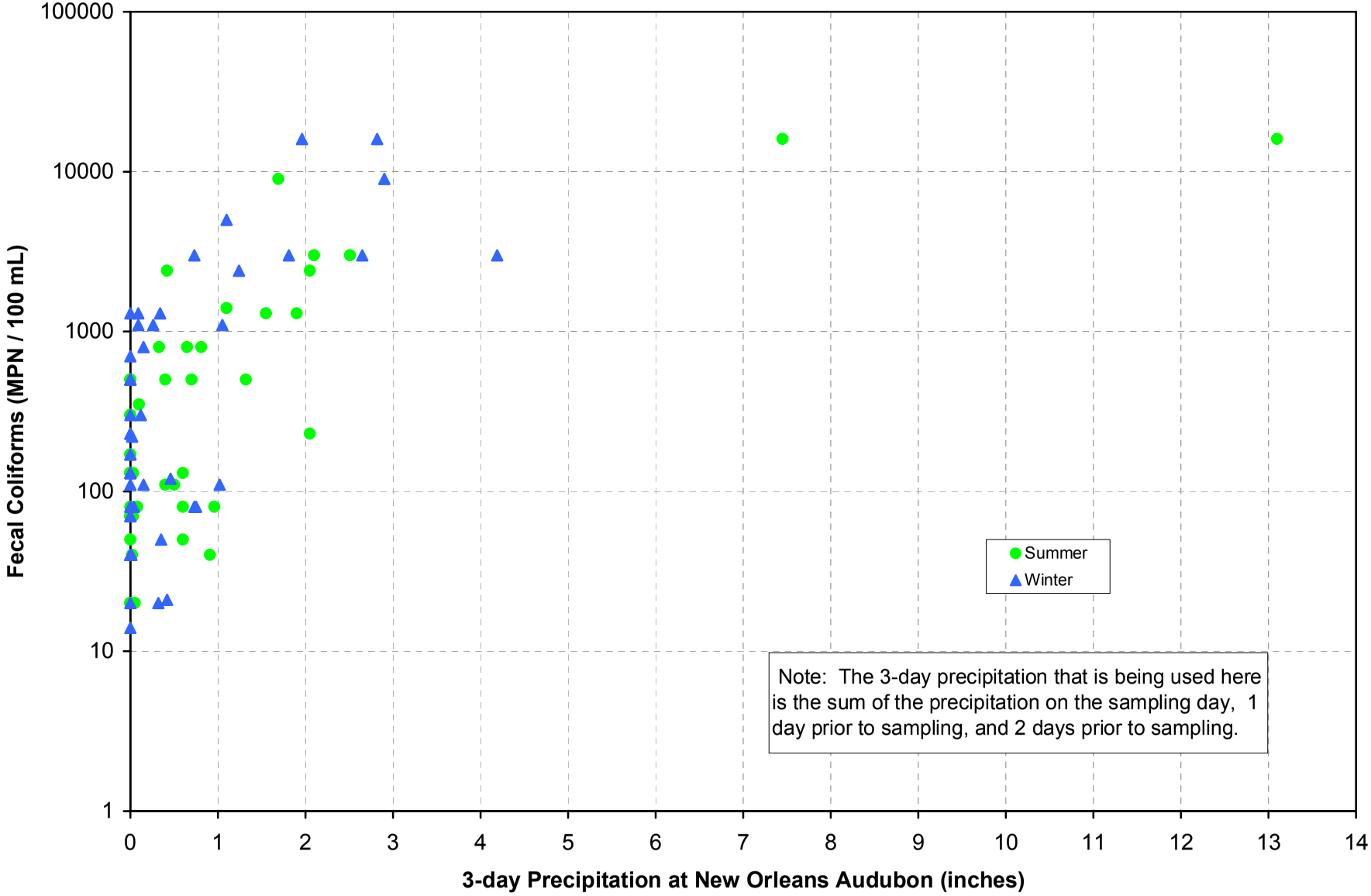


Figure B.8. USGS Data for Bayou Segnette 2.9 miles S of Westwego vs. 3-day Precipitation

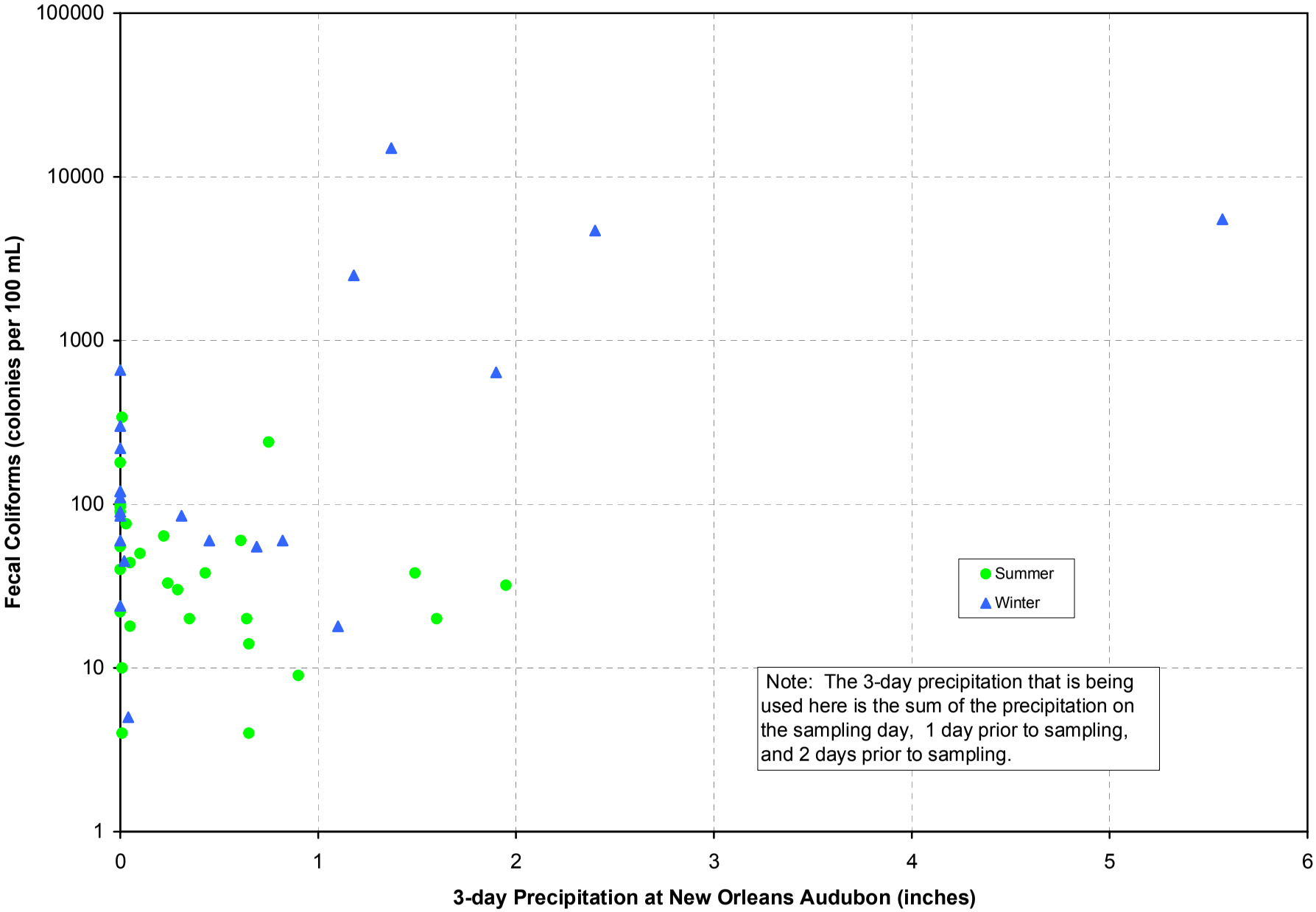


Figure B.9. USGS Data for Millaudon Canal near Westwego vs. 3-day Precipitation

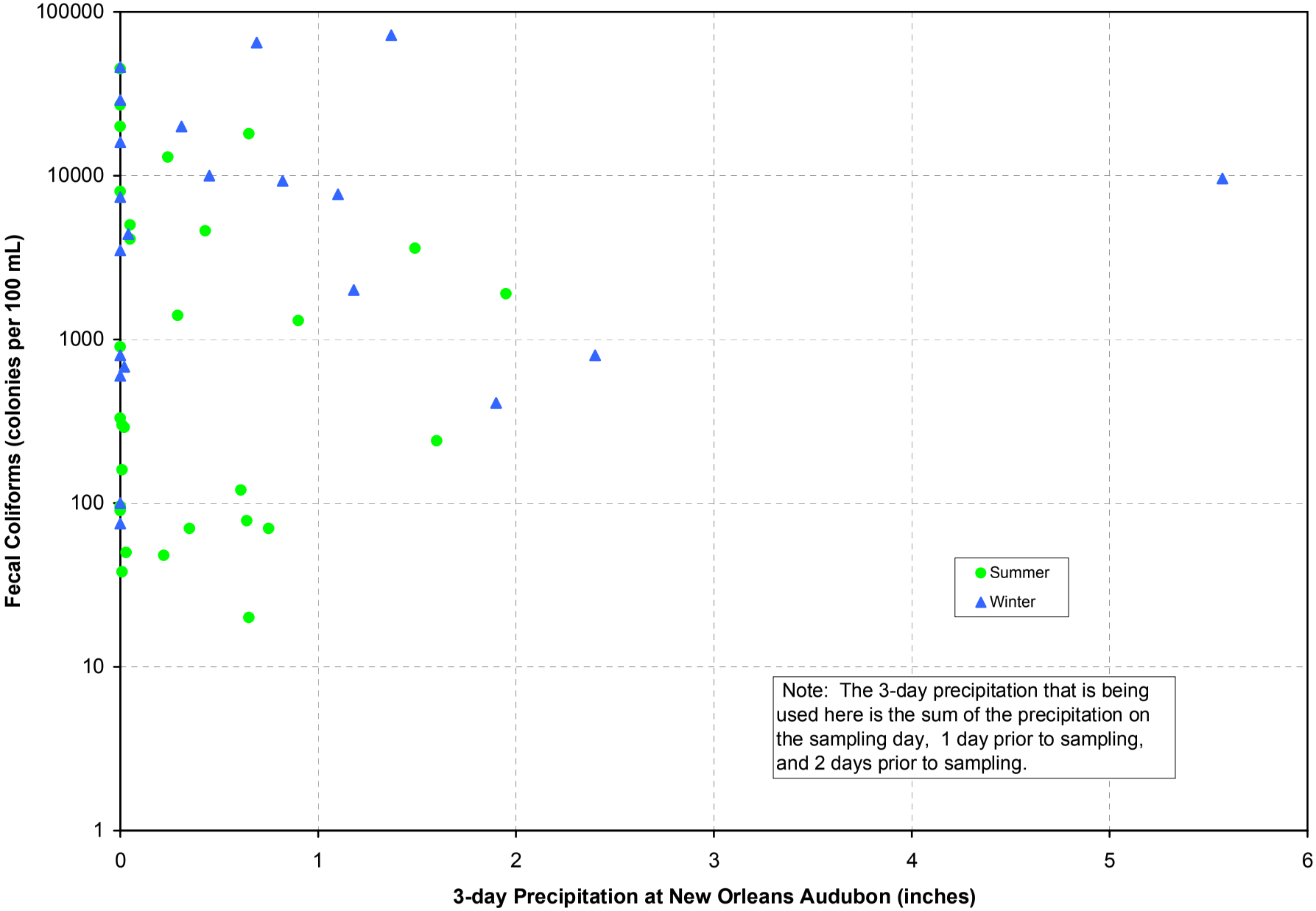


Figure B.10. USGS Data for Bayou Segnette 4.6 miles S of Westwego vs. 3-day Precipitation

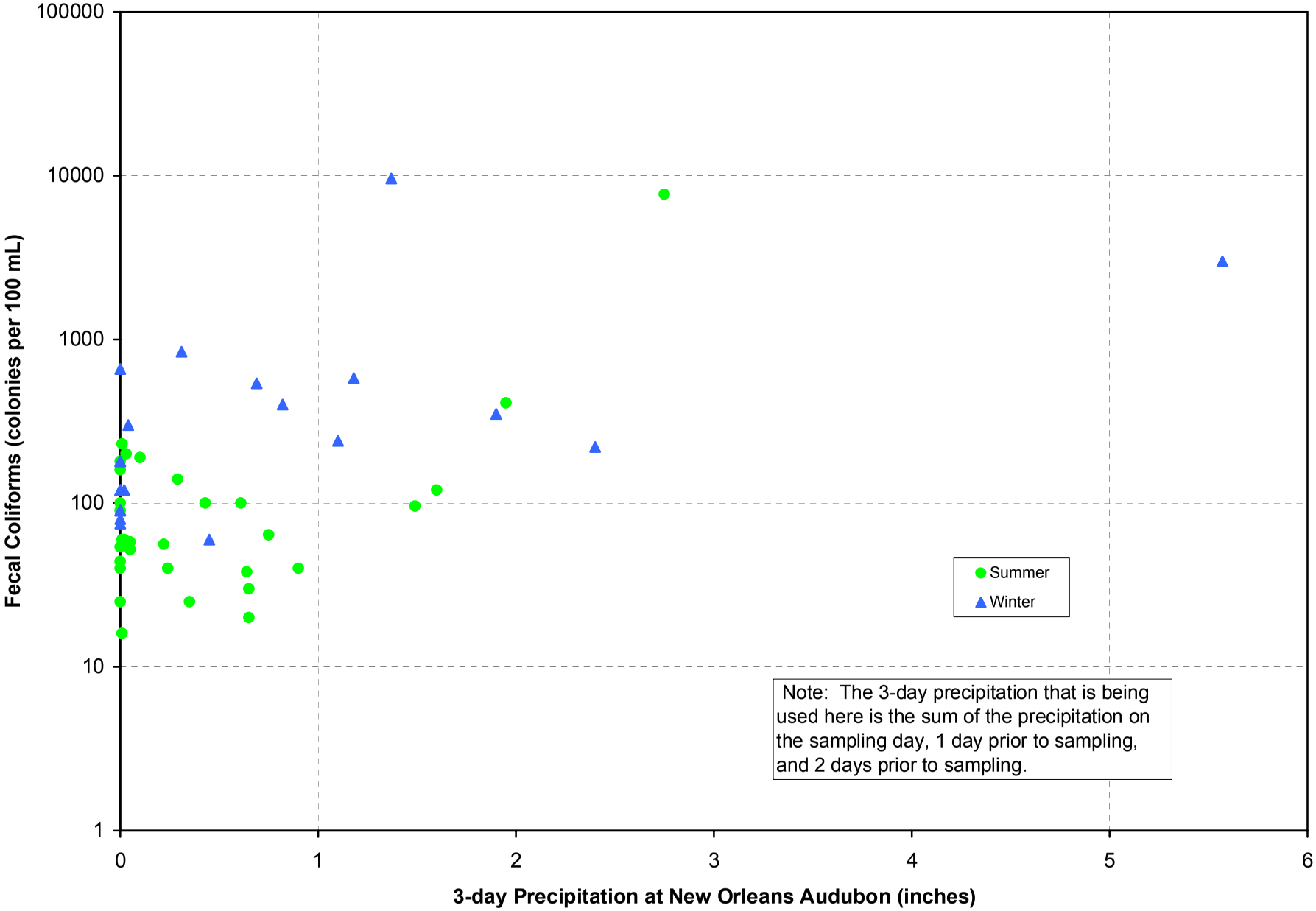


Figure B.11. USGS Data for Kenta Canal NW of Crown Point vs. 3-day Precipitation

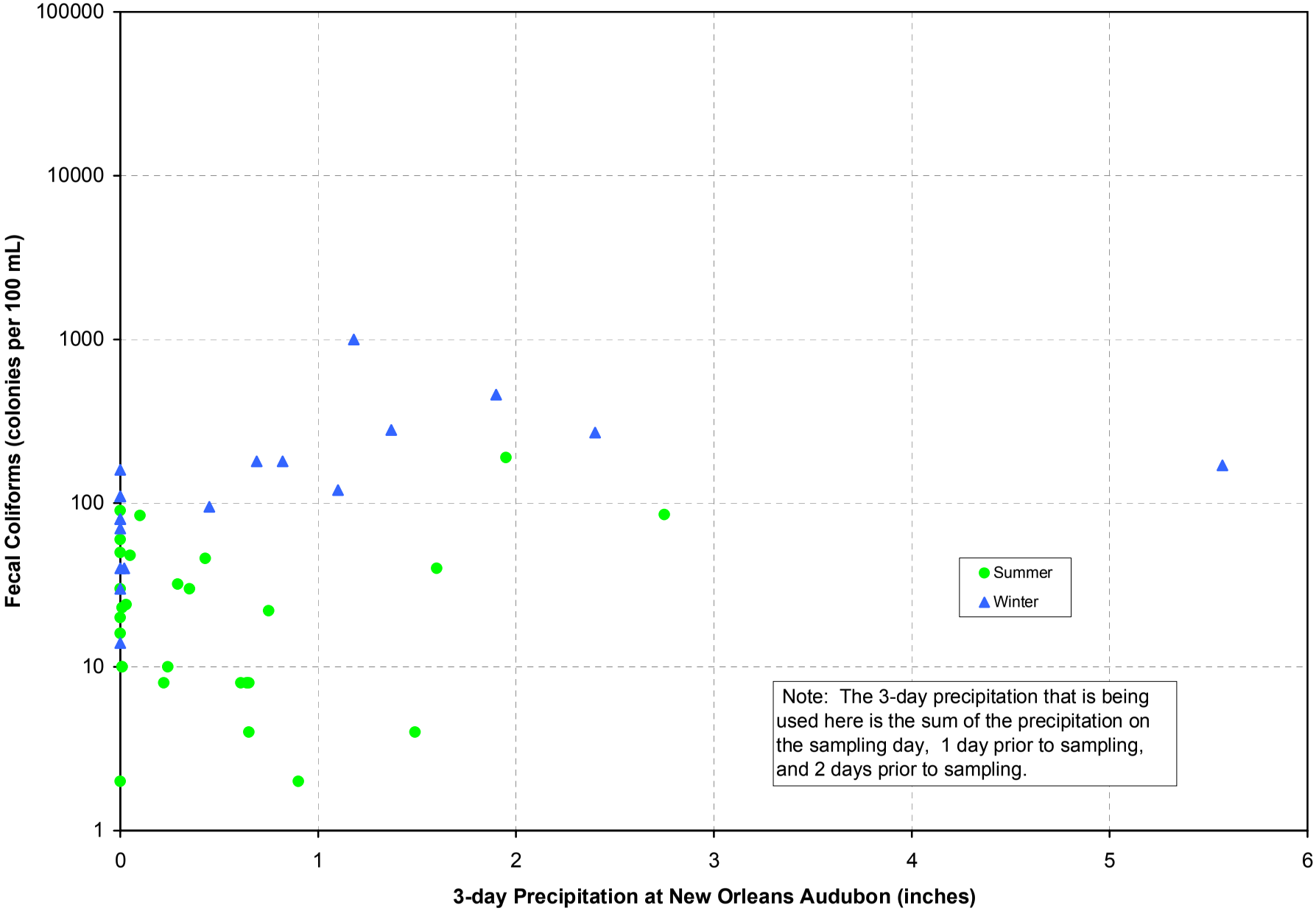


Figure B.12. USGS Data for Bayou Segnette near Barataria vs. 3-day Precipitation

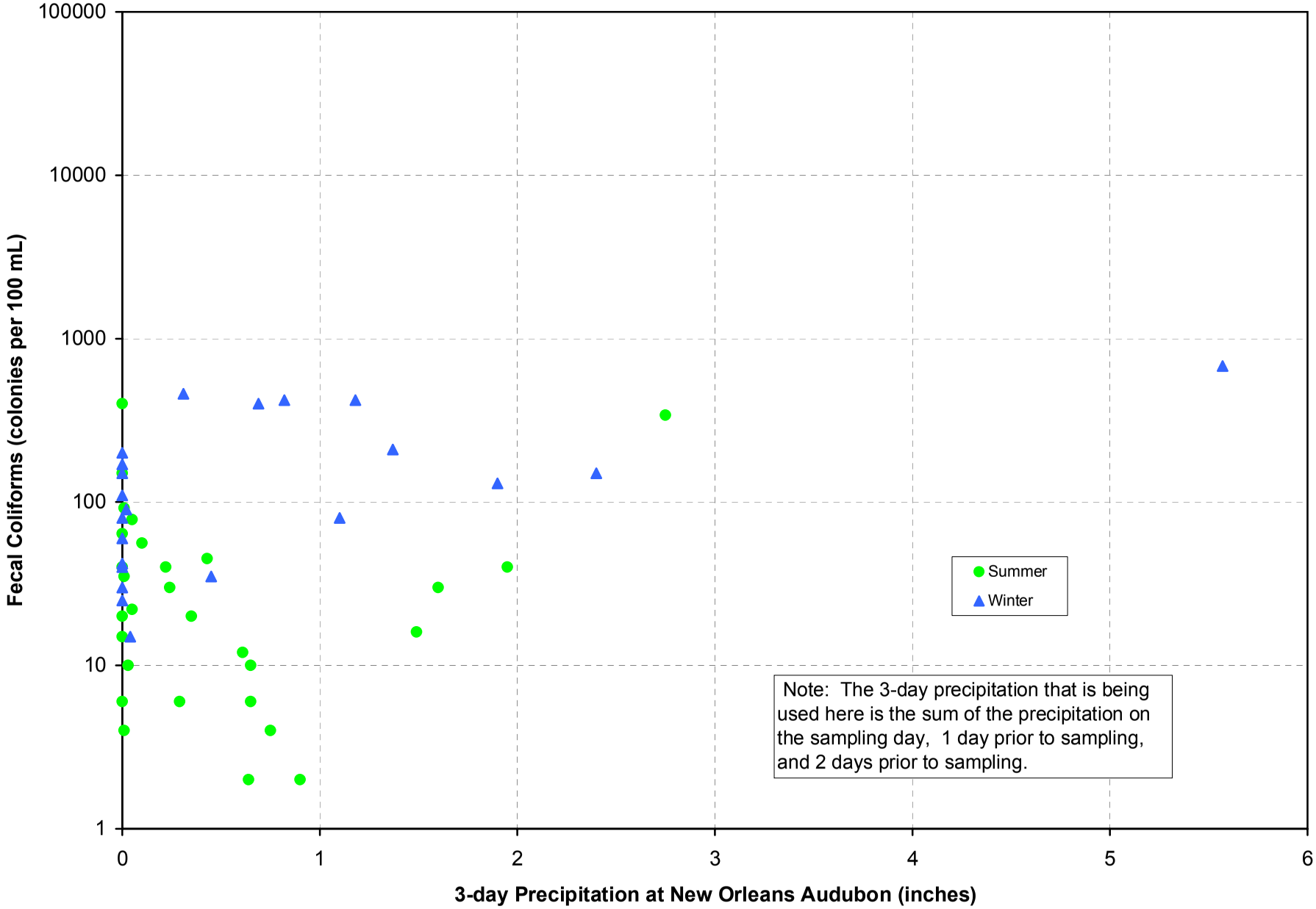


Figure B.13. Seasonal Plot of LDEQ Data for Bayou Segnette near Westwego

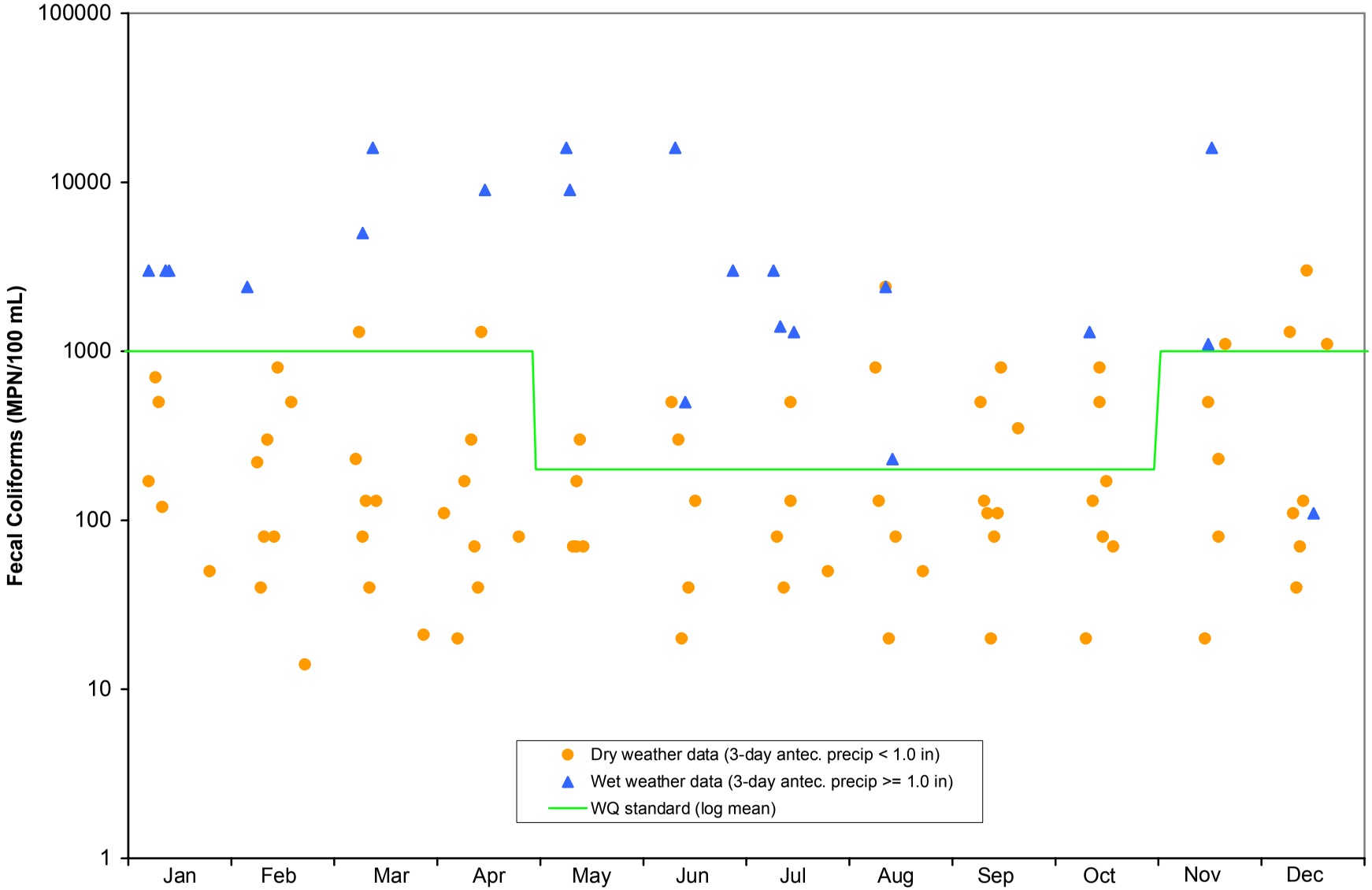


Figure B.14. Seasonal Plot of USGS Data for Bayou Segnette 2.9 miles S of Westwego

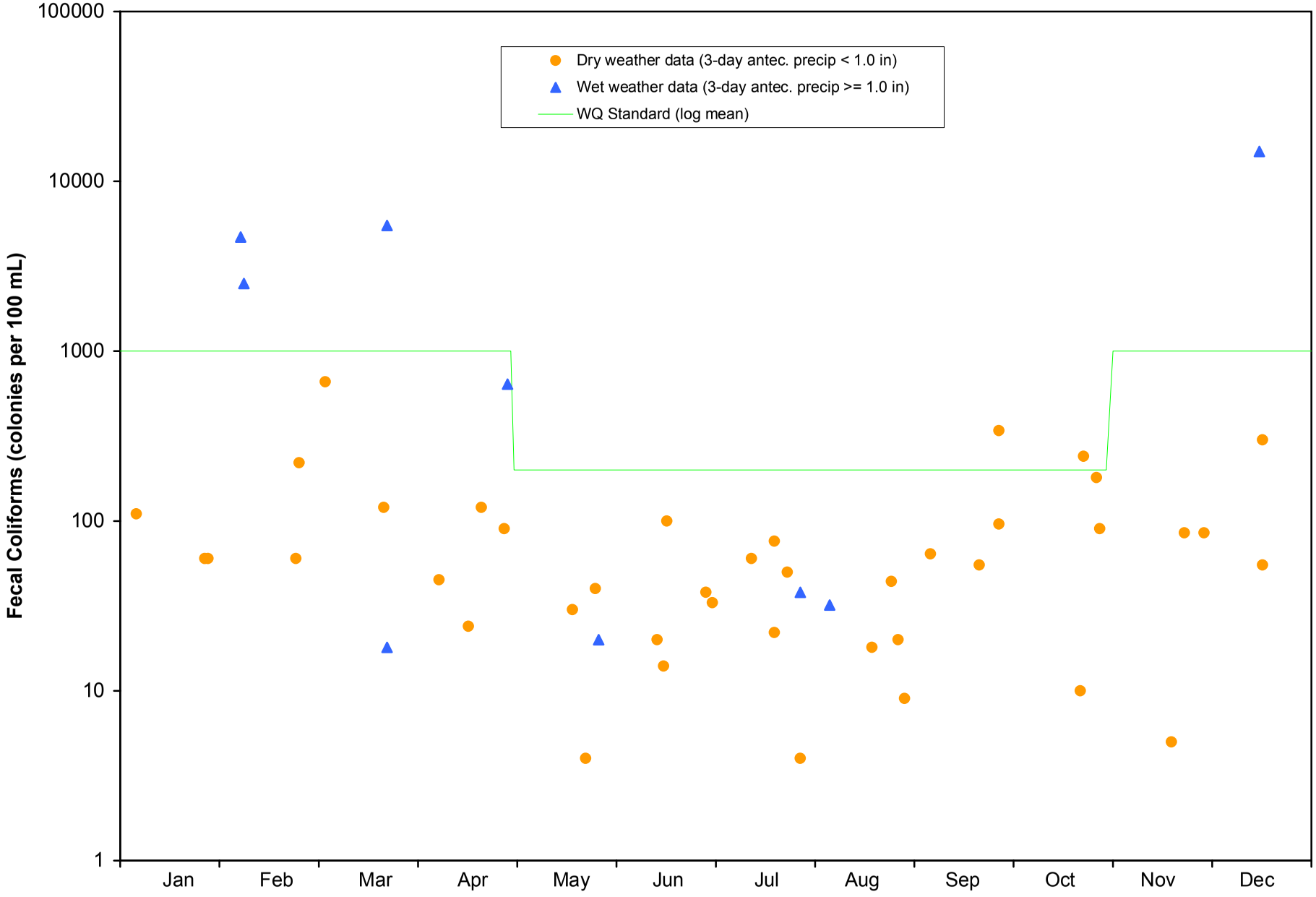


Figure B.15. Seasonal Plot of USGS Data for Millaudon near Westwego

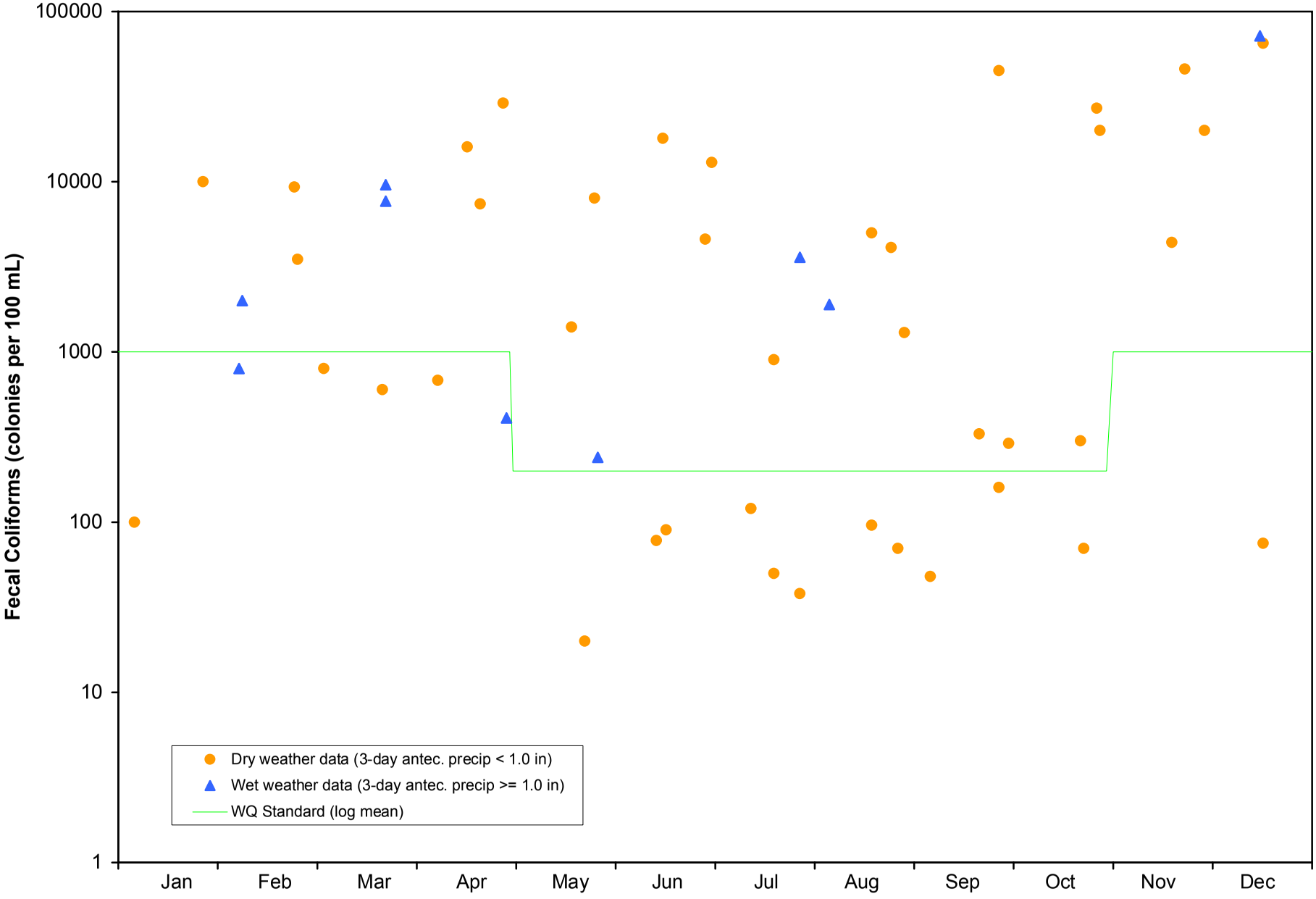


Figure B.16. Seasonal Plot of USGS Data for Bayou Segnette 4.6 miles S of Westwego

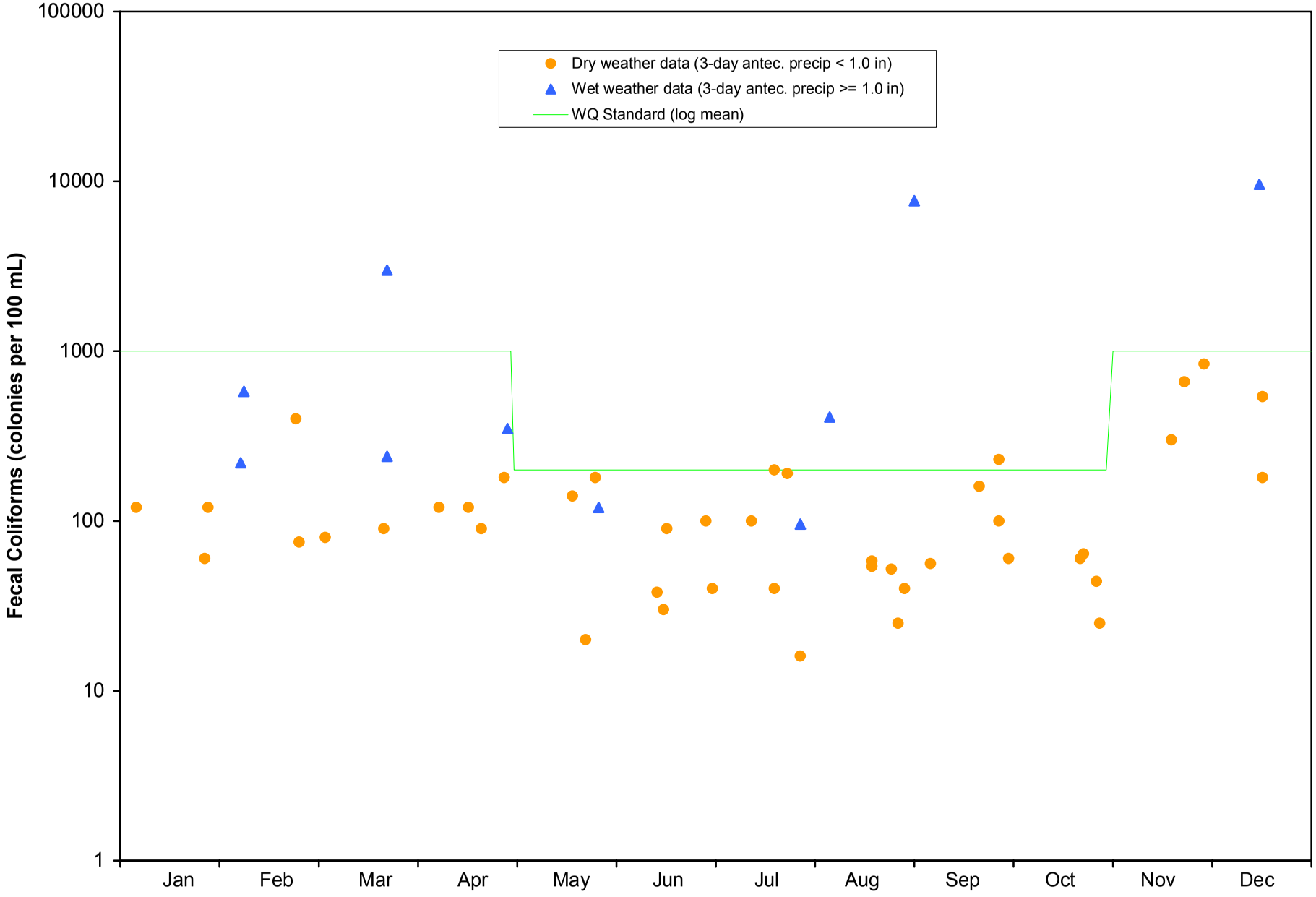


Figure B.17. Seasonal Plot of USGS Data for Kenta Canal NW of Crown Point

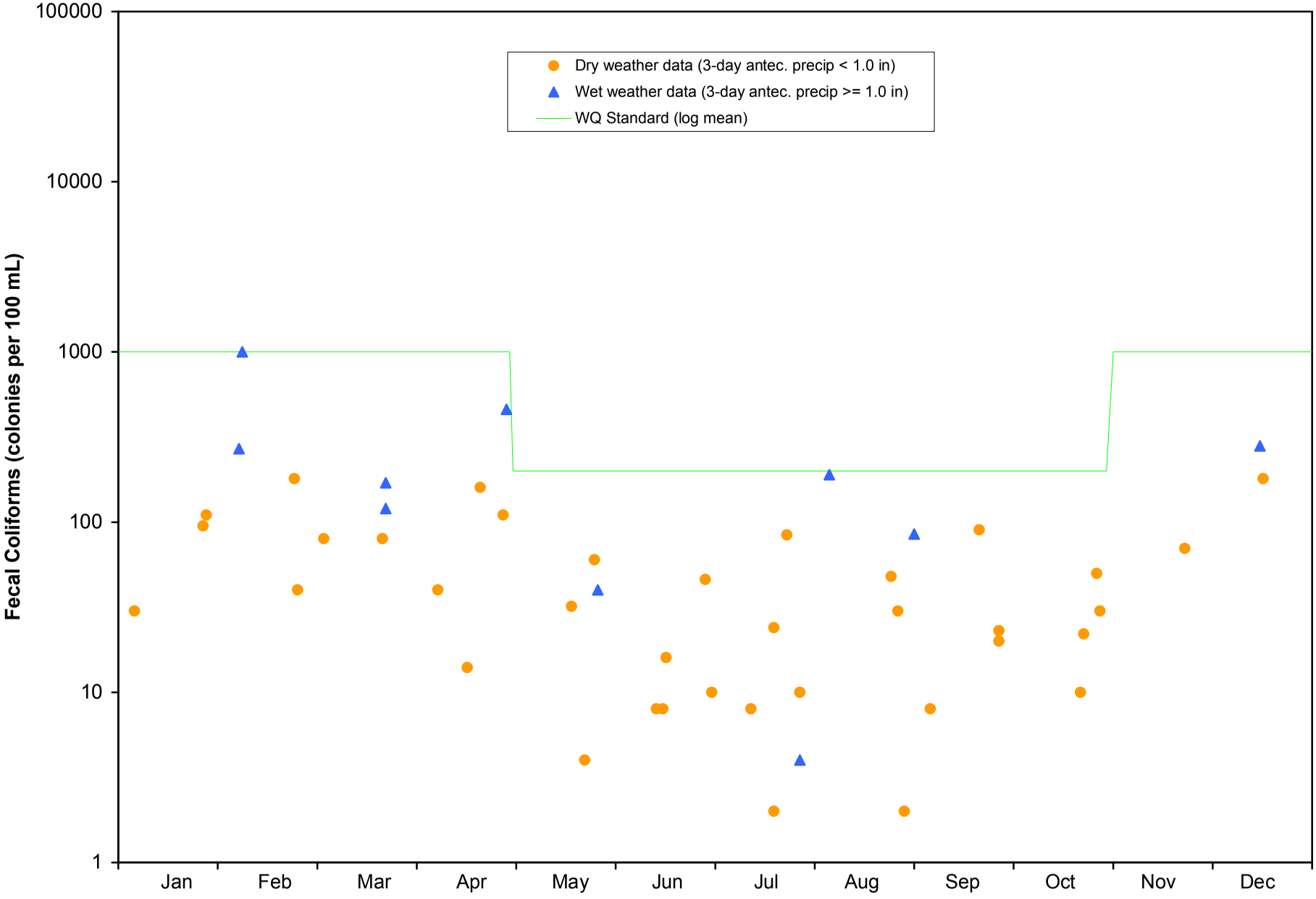
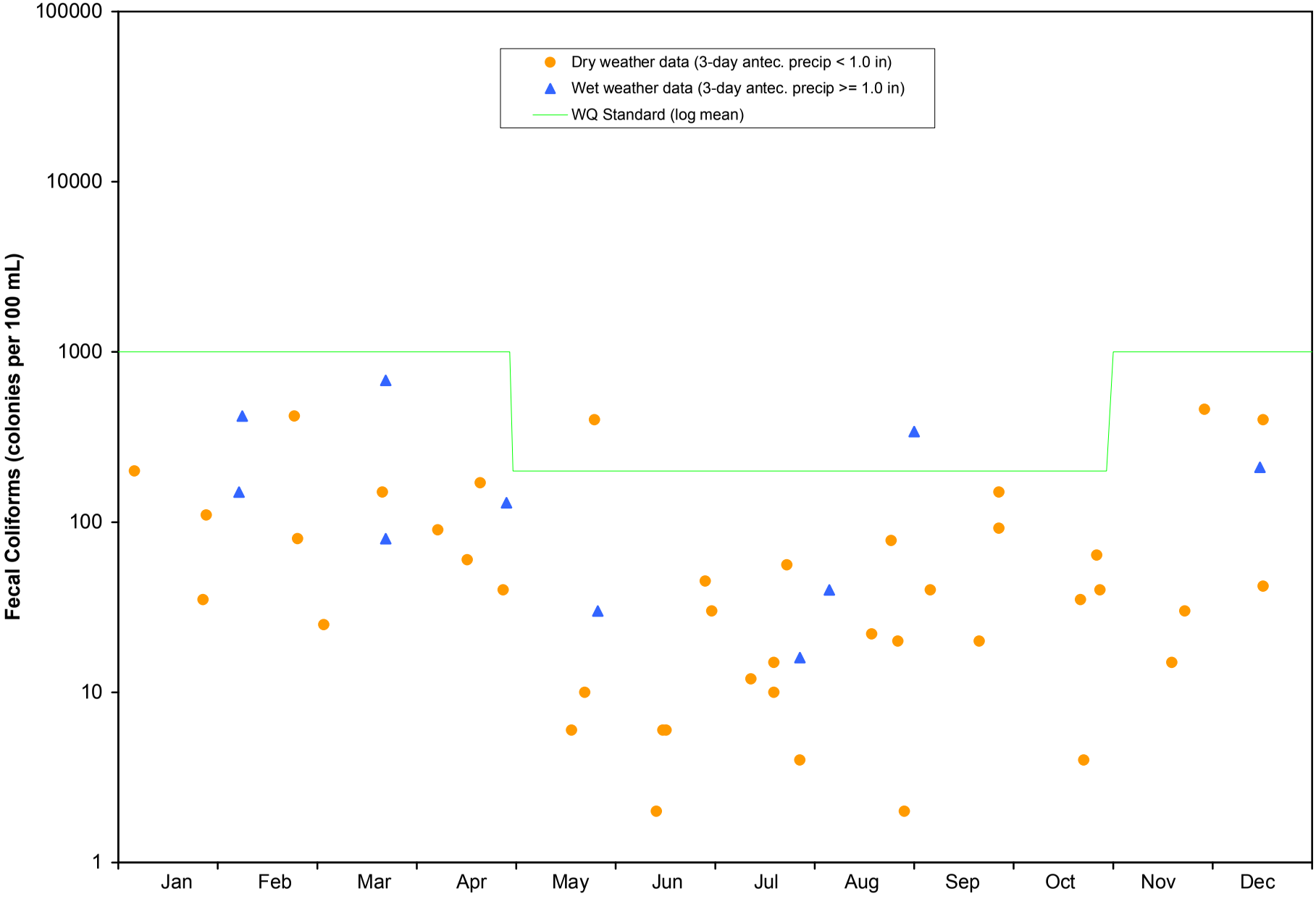


Figure B.18. Seasonal Plot of USGS Data for Bayou Segnette near Barataria



APPENDIX C

Bacterial Indicator Tool Spreadsheet

Summary worksheet for Bayou Segnette fecal coliform contributions

Source	Area Load (#/ac/day)	Hourly Load (count/hr)	Daily Load (count/day)	Seasonal Loads Summer (185 days)	Seasonal Loads Winter (181 days)	Percentage for each source Summer	Percentage for each source Winter
Built-up	9.29E+06		1.12E+11	2.08E+13	2.03E+13	77.32%	77.32%
Septics		3.31E+08	7.95E+09	7.35E+11	7.19E+11	2.74%	2.74%
Wildlife and wate	1.37E+06		2.88E+10	5.33E+12	5.22E+12	19.84%	19.84%
Point sources *			1.51E+08	2.80E+10	2.74E+10	0.10%	0.10%
Total			1.49E+11	2.69E+13	2.63E+13		

*Point Sources

number of pt sources =		4		
permitted flow =	2500 GPD =		9.46E+06	mL/day
summer fecal /100mL =		400		
winter fecal /100mL =		400		

THIS SPREADSHEET ESTIMATES THE FECAL COLIFORM BACTERIA CONTRIBUTION FROM MULTIPLE SOURCES.

It is based on a modeling study of 10 subwatersheds, composed of four landuses (Cropland, Forest, Built-up, and Pastureland).

BLUE text found throughout the spreadsheet presents valuable information and assumptions.

RED text designates values which should be specified by the user.

BLACK text generally presents information which is calculated by the spreadsheet or that should not be changed.

Bayou Segnette subsegment was not divided into subwatersheds.

The modeled landuses are derived from the original landuses by reassigning the original categories to the corresponding model categories.

Drainage areas for pump stations discharging into Bayou Segnette subsegment are included as built-up land use area.

Wetlands are added to forest so wildlife inputs to the large wetland area of the subsegment can be included (there are 270 acres of upland forest in the subsegment).

Modeled landuses

Areas are listed in acres.

SUBWATERSHED	BUILT-UP	CROPLAND	PASTURELAND	FOREST&WETLAND	TOTAL
P1	12080	488	0	21076	33645
P2	0	0	0	0	0
P3	0	0	0	0	0
P4	0	0	0	0	0
P5	0	0	0	0	0
P6	0	0	0	0	0
P7	0	0	0	0	0
P8	0	0	0	0	0
P9	0	0	0	0	0
P10	0	0	0	0	0
TOTAL	12080	488	0	21076	33645

The estimated total number of animals in the Bayou Segnette subsegment is shown below.

Fecal contributions from these animals are used to derive loading estimates for all landuses except for Built-up.
Only manure from cattle, swine, and poultry is assumed to be collected and applied to cropland.
Cattle manure is also assumed to be applied to pastureland. Horse manure is assumed to be collected and applied to pastureland only.
Manure from cattle, horses, sheep and "other" is assumed to be contributed to pastureland in proportion to time spent grazing.
Wildlife densities are provided for all land uses except Built-up and are assumed to be the same in all subwatersheds.

Agricultural Animals

SUBWATERSHED	BEEF CATTLE	SWINE (HOGS)	DAIRY CATTLE	CHICKENS	HORSES	SHEEP	OTHER
P1	0	0	0	0	0	0	0
P2	0	0	0	0	0	0	0
P3	0	0	0	0	0	0	0
P4	0	0	0	0	0	0	0
P5	0	0	0	0	0	0	0
P6	0	0	0	0	0	0	0
P7	0	0	0	0	0	0	0
P8	0	0	0	0	0	0	0
P9	0	0	0	0	0	0	0
P10	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0

Wildlife

	CROPLAND Animals/sq mile	CROPLAND Density/acre	PASTURELAND Density/sq mile	PASTURELAND Density/acre	FOREST/WETLAND Density/sq mile	FOREST/WETLAND Density/acre
Ducks	0	0	0	0	10	0.015625
Geese	0	0	0	0	10	0.015625
Deer	0	0	0	0	1	0.0015625
Beaver	0	0	0	0	1	0.0015625
Raccoons	0	0	0	0	1	0.0015625
Other	0	0	0	0	0	0

The data from the following references are accessed in the remaining worksheets.

Animal Fecal Coliform Production Rates

Values from ASAE (1998) are used as default values when available.

	Default Value	*From ASAE, 1998*	*From NCSU, 1994*	*From Metcalf & Eddy, 1991*	*From LIRPB, 1978*	*est Professional Judgeme*	*Mean*	*Min*	*Max*
Animal	**FC (count/animal/day)**	**FC (count/animal/day)**	**FC (count/animal/day)**	**FC (count/animal/day)**	**FC (count/animal/day)**	**FC (count/animal/day)**	**FC (count/animal/day**	**FC (count/animal/day**	**FC (count/animal/day)**
Dairy cow	1.01E+11	1.01E+11	1.04E+11	5.40E+09	3.75E+09	--	5.36E+10	3.75E+09	1.04E+11
Beef cow	1.04E+11	1.04E+11	1.06E+11	5.40E+09	3.75E+09	--	5.49E+10	3.75E+09	1.06E+11
Hog	1.08E+10	1.08E+10	1.24E+10	8.90E+09	8.91E+09	--	1.02E+10	8.90E+09	1.24E+10
Sheep	1.20E+10	1.20E+10	1.22E+10	1.80E+10	--	--	1.41E+10	1.20E+10	1.80E+10
Horse	4.20E+08	4.20E+08	4.18E+08	--	--	--	4.19E+08	4.18E+08	4.20E+08
Chicken	1.36E+08	1.36E+08	1.38E+08	2.40E+08	2.37E+08	--	1.88E+08	1.36E+08	2.40E+08
Turkey	9.30E+07	9.30E+07	8.93E+07	1.30E+08	--	--	1.04E+08	8.93E+07	1.30E+08
Duck	2.43E+09	2.43E+09	2.43E+09	1.10E+10	1.10E+10	--	6.71E+09	2.43E+09	1.10E+10
Goose	4.90E+10	--	--	--	4.90E+10	--	4.90E+10	4.90E+10	4.90E+10
Deer	5.00E+08	--	--	--	--	5.00E+08	5.00E+08	5.00E+08	5.00E+08
Beaver	2.50E+08	--	--	--	--	2.50E+08	2.50E+08	2.50E+08	2.50E+08
Raccoon	1.25E+08	--	--	--	--	1.25E+08	1.25E+08	1.25E+08	1.25E+08
Dog	4.09E+09	--	--	--	4.09E+09	--	4.09E+09	4.09E+09	4.09E+09
Other Ag Animal	0.00E+00	--	--	--	--	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Other Wildlife	0.00E+00	--	--	--	--	0.00E+00	0.00E+00	0.00E+00	0.00E+00

From ASAE, 1998	**Total Manure prod**	**Typical Animal Mass**	**Manure prod per animal**	**Fecal Coliform**	**Fecal Coliform**	**Manure prod**	**Fecal Coliform**
Animal	**(lb/day per 1,000 lb anima**	**(lb)**	**(lb/day)**	**(count/day E10 per 1,000 lb anima**	**(count/day)**	**(lb/yr)**	**(count/yr)**
Dairy cow	86	1400	120	7.2	1.01E+11	43946	3.68E+13
Beef cow	58	800	46	13	1.04E+11	16936	3.80E+13
Hog	84	135	11	8	1.08E+10	4139	3.94E+12
Sheep	40	60	2	20	1.20E+10	876	4.38E+12
Horse	51	1000	51	0.042	4.20E+08	18615	1.53E+11
Chicken (Layer)	64	4	0	3.4	1.36E+08	93	4.96E+10
Turkey	47	15	1	0.62	9.30E+07	257	3.39E+10
Duck	110	3	0	81	2.43E+09	120	8.87E+11

From LIRPB, 1978	**Waste produced**	**FC content**	**FC produced**
Animal	**(g waste/animal/day)**	**(count/g waste)**	**(count/animal/day)**
Dog	227	1.80E+07	4.09E+09
Duck	336	3.27E+07	1.10E+10
Cattle	16,300	2.30E+05	3.75E+09
Chicken	182	1.30E+06	2.37E+08
Swine	2,700	3.30E+06	8.91E+09

Built-Up Fecal Coliform Accumulation Rates

	From: Horner, 1992	
Land Use	**median count/ha/yr**	**median count/acre/day**
Road	1.80E+08	2.00E+05
Commercial	5.60E+09	6.21E+06
Single family low density	9.30E+09	1.03E+07
Single family high density	1.50E+10	1.66E+07
Multifamily residential	2.10E+10	2.33E+07

This sheet calculates the total fecal coliform bacteria produced by wildlife each day per acre of cropland, pastureland and forest.

Wildlife

	CROPLAND animals/acre	CROPLAND FC/acre/day	PASTURELAND animals/acre	PASTURELAND FC/acre/day	FOREST/WETLAND animals/acre	FOREST/WETLAND FC/acre/day
Ducks	0.000	0.00E+00	0.000	0.00E+00	0.016	3.80E+07
Geese	0.000	0.00E+00	0.000	0.00E+00	0.016	7.66E+08
Deer	0.000	0.00E+00	0.000	0.00E+00	0.002	7.81E+05
Beaver	0.000	0.00E+00	0.000	0.00E+00	0.002	3.91E+05
Raccoons	0.000	0.00E+00	0.000	0.00E+00	0.002	1.95E+05
Other	0.000	0.00E+00	0.000	0.00E+00	0.000	0.00E+00
Total	0.000	0.00E+00	0.00	0.00E+00	0.005	1.37E+06

Due to lack of animal counts, etc. for Built-up land, literature values are used.
The breakout of Built-up land into Commercial and Services, Mixed Urban or Built-Up, Residential, and Transportation, Communications and Utilities is specified by the user below.
A single, weighted Built-up loading value is quantified for each subwatershed based on individual built-up landuses present and their corresponding loading rates.
Loading rates are calculated for each Built-up land use category using the values found in Horner (1992) as follows:
- Commercial and Services: Commercial
- Mxd Urban or Built-up: Average FC accumulation rates for Road, Commercial, Single family low density, Single family high density, and Multifamily residential
- Residential: Average FC accumulation rates for Single family low density, Single family high density, and Multifamily residential
- Trans, Comm, Util: Road

URBAN LAND

Built-Up land use breakout by subwatershed (fraction of built-up land that is used for commercial and services, mixed urban, residentital, and transportation, communication and utilities)

	COMMERCIAL AND SERVICES	MXD URBAN OR BUILT-UP	RESIDENTIAL	TRANS, COMM, UTIL	TOTAL
P1	0.5	0.25	0.2	0.05	1
P2	0.25	0.25	0.25	0.25	1
P3	0.25	0.25	0.25	0.25	1
P4	0.25	0.25	0.25	0.25	1
P5	0.25	0.25	0.25	0.25	1
P6	0.25	0.25	0.25	0.25	1
P7	0.25	0.25	0.25	0.25	1
P8	0.25	0.25	0.25	0.25	1
P9	0.25	0.25	0.25	0.25	1
P10	0.25	0.25	0.25	0.25	1

All Months	COMMERCIAL AND SERVICES Area (acres)	FC accum (count/acre/day)	MXD URBAN OR BUILT-UP Area (acres)	FC accum (count/acre/day)	RESIDENTIAL Area (acres)	FC accum (count/acre/day)	TRANS, COMM, UTIL Area (acres)	FC accum (count/acre/day)	TOTAL FC accum (count/acre/day)
P1	6040	6.21E+06	3020	1.13E+07	2416	1.67E+07	604	2.00E+05	9.29E+06
P2	0	0.00E+00	0	0.00E+00	0	0.00E+00	0	0.00E+00	0.00E+00
P3	0	0.00E+00	0	0.00E+00	0	0.00E+00	0	0.00E+00	0.00E+00
P4	0	0.00E+00	0	0.00E+00	0	0.00E+00	0	0.00E+00	0.00E+00
P5	0	0.00E+00	0	0.00E+00	0	0.00E+00	0	0.00E+00	0.00E+00
P6	0	0.00E+00	0	0.00E+00	0	0.00E+00	0	0.00E+00	0.00E+00
P7	0	0.00E+00	0	0.00E+00	0	0.00E+00	0	0.00E+00	0.00E+00
P8	0	0.00E+00	0	0.00E+00	0	0.00E+00	0	0.00E+00	0.00E+00
P9	0	0.00E+00	0	0.00E+00	0	0.00E+00	0	0.00E+00	0.00E+00
P10	0	0.00E+00	0	0.00E+00	0	0.00E+00	0	0.00E+00	0.00E+00

This sheet contains information related to the contribution of failing septic systems to streams.

The direct contribution of fecal coliform from septics to a stream can be represented as a point source in the model. Required input for point sources in NPSM are loading rate (#/hr) and flow (c

The following assumptions are made for septic contributions.

Estimated # septics:	150	
Estimated # people served by septics:	300	
Avg # people served per septic:	2	people/septic
Assume a failure rate for septics in the watershed:	100	%
Therefore the number of failing septics in the watershed is:	150	
Assume failing septics are distributed evenly across watershed based on land area. Therefore, density of failing septics is	0.004458	failing septic systems/acre
Assume the average FC concentration reaching the stream (from septic overcharge) is:	1.00E+04	count/100 ml **(Horsely & Whitten, 1996)**
Assume a typical septic overcharge flow rate of:	70	gal/day/person **(Horsely & Whitten, 1996)**

SEPTICS AS A POINT SOURCE

Subwatershed	Total area (acres)	# failing septics	Tot. # people served	Septic flow (gal/day)	Septic flow (mL/hr)	FC rate (count/hr)	Septic flow (cfs)
P1	33,645	150.0	300.0	21000	3,311,875	3.31E+08	3.26E-02
P2	0	0.0	0.0	0	0	0.00E+00	0.00E+00
P3	0	0.0	0.0	0	0	0.00E+00	0.00E+00
P4	0	0.0	0.0	0	0	0.00E+00	0.00E+00
P5	0	0.0	0.0	0	0	0.00E+00	0.00E+00
P6	0	0.0	0.0	0	0	0.00E+00	0.00E+00
P7	0	0.0	0.0	0	0	0.00E+00	0.00E+00
P8	0	0.0	0.0	0	0	0.00E+00	0.00E+00
P9	0	0.0	0.0	0	0	0.00E+00	0.00E+00
P10	0	0.0	0.0	0	0	0.00E+00	0.00E+00
Total:	33,645						

APPENDIX D

Percent Reduction Calculations

Summer (May-Oct) Percent Reductions for Fecal Coliform Data
for Bayou Segnette near Westwego (LDEQ station 0296)

Minimum fecal coliform count for NPS reductions = 200

Date	Time	Season		Observed FC Data (MPN per 100 mL)	NPS Reduction Factor*	FC Data After NPS Reduction (MPN per 100 mL)
5/14/91	0807	summer		300	65%	105
6/11/91	0756	summer	>	16000	65%	5600
7/16/91	0930	summer		1300	65%	455
8/13/91	0909	summer		20	65%	20
9/10/91	0912	summer		130	65%	130
10/15/91	0852	summer		80	65%	80
5/12/92	0911	summer		170	65%	170
6/16/92	0855	summer		130	65%	130
7/14/92	0939	summer		500	65%	175
8/11/92	0928	summer		2400	65%	840
9/14/92	1007	summer		800	65%	280
10/13/92	0943	summer		500	65%	175
5/11/93	0845	summer		9000	65%	3150
6/15/93	1305	summer		40	65%	40
7/13/93	0923	summer		40	65%	40
8/10/93	1029	summer		130	65%	130
9/14/93	0905	summer		110	65%	110
10/12/93	0901	summer		130	65%	130
5/10/94	1014	summer		16000	65%	5600
6/14/94	1032	summer		500	65%	175
7/12/94	0958	summer		1400	65%	490
8/9/94	1046	summer		800	65%	280
9/13/94	1003	summer		80	65%	80
10/11/94	1008	summer		1300	65%	455
6/13/95	0951	summer	<	20	65%	20
7/11/95	0950	summer		80	65%	80
8/15/95	1015	summer		80	65%	80
9/12/95	0928	summer	<	20	65%	20
10/10/95	0942	summer		20	65%	20
5/14/96	0910	summer		70	65%	70
6/11/96	0928	summer		300	65%	105
7/9/96	1026	summer		3000	65%	1050
8/13/96	0954	summer		230	65%	81
9/10/96	0942	summer		110	65%	110
10/15/96	0931	summer		170	65%	170
5/13/97	1002	summer		70	65%	70
6/10/97	0950	summer		500	65%	175
7/15/97	0919	summer		130	65%	130
8/12/97	1041	summer		2400	65%	840
9/9/97	1030	summer		500	65%	175
10/14/97	0953	summer		800	65%	280
5/12/98	1141	summer		70	65%	70

Date	Time	Season	Observed FC Data (MPN per 100 mL)	NPS Reduction Factor*	FC Data After NPS Reduction (MPN per 100 mL)
6/27/00	1024	summer	3000	65%	1050
7/25/00	1008	summer	50	65%	50
8/22/00	1045	summer	50	65%	50
9/19/00	0936	summer	350	65%	123
10/17/00	0942	summer	70	65%	70

Existing summer log mean =	259	
Summer WQ standard for log mean (primary contact recr.) =		200
Explicit margin of safety (20%) =		40
Target value for summer log mean =		160
Summer log mean after NPS reductions =		158

Existing summer 75th percentile =	800	
Summer WQ standard for 75th %tile (primary contact recr.) =		400
Explicit margin of safety (20%) =		80
Target value for summer 75th percentile =		320
Summer 75th percentile after NPS reductions =		280

* Note: NPS reduction was applied only to observed data that were greater than 200 (the log mean WQ standard) because it was not considered feasible to reduce fecal coliform counts that were already below the WQ standard.

FILE: R:\PROJECTS\2110-610\FC_DATA_0296.XLS

Winter (Nov-Apr) Percent Reductions for Fecal Coliform Data
for Bayou Segnette near Westwego (LDEQ station 0296)

Minimum fecal coliform count for NPS reductions = 1000

Date	Time	Season		Observed FC Data (MPN per 100 mL)	NPS Reduction Factor*	FC Data After NPS Reduction (MPN per 100 mL)
1/15/91	0908	winter			0%	
2/5/91	0906	winter		2400	0%	2400
3/12/91	0833	winter		130	0%	130
4/16/91	0815	winter		9000	0%	9000
12/10/91	1041	winter		110	0%	110
1/7/92	1025	winter		170	0%	170
2/11/92	0955	winter		300	0%	300
3/10/92	0833	winter		5000	0%	5000
4/7/92	0925	winter		20	0%	20
11/17/92	0926	winter		230	0%	230
12/15/92	1108	winter		110	0%	110
1/12/93	1128	winter		3000	0%	3000
2/9/93	0915	winter		40	0%	40
3/9/93	0904	winter		230	0%	230
4/13/93	0906	winter		70	0%	70
11/16/93	0910	winter	>	16000	0%	16000
12/14/93	1008	winter		3000	0%	3000
1/11/94	0940	winter		120	0%	120
2/8/94	1003	winter		220	0%	220
3/15/94	1022	winter		130	0%	130
4/12/94	1020	winter		300	0%	300
11/15/94	1051	winter		500	0%	500
12/13/94	1004	winter		130	0%	130
1/10/95	1017	winter		500	0%	500
2/14/95	0832	winter		800	0%	800
3/14/95	0937	winter	>	16000	0%	16000
4/4/95	0905	winter		110	0%	110
11/14/95	0910	winter	<	20	0%	20
12/12/95	0908	winter		70	0%	70
1/9/96	0937	winter		700	0%	700
2/13/96	1027	winter		80	0%	80
3/12/96	0912	winter		40	0%	40
4/9/96	0931	winter		170	0%	170
11/19/96	1005	winter		1100	0%	1100
12/10/96	0935	winter		40	0%	40
1/7/97	1039	winter		3000	0%	3000
2/18/97	1120	winter		500	0%	500
3/11/97	0908	winter		80	0%	80
4/15/97	0907	winter		1300	0%	1300
11/18/97	1042	winter		80	0%	80
12/9/97	1021	winter		1300	0%	1300
1/13/98	1024	winter		3000	0%	3000

Date	Time	Season	Observed FC Data (MPN per 100 mL)	NPS Reduction Factor*	FC Data After NPS Reduction (MPN per 100 mL)
2/10/98	0941	winter	80	0%	80
3/10/98	1102	winter	1300	0%	1300
4/14/98	1117	winter	40	0%	40
1/25/00	1042	winter	50	0%	50
2/22/00	1022	winter	14	0%	14
3/28/00	1009	winter	21	0%	21
4/25/00	1001	winter	80	0%	80
11/14/00	1005	winter	1100	0%	1100
12/19/00	0922	winter	1100	0%	1100

Existing winter log mean =	289	
Winter WQ standard for log mean (secondary contact recr.) =		1000
Explicit margin of safety (20%) =		200
Target value for winter log mean =		800
Winter log mean after NPS reductions =		289
Existing winter 75th percentile =	1100	
Winter WQ standard for 75th %tile (secondary contact recr.) =		2000
Explicit margin of safety (20%) =		400
Target value for winter 75th percentile =		1600
Winter 75th percentile after NPS reductions =		1100

* Note: NPS reduction was applied only to observed data that were greater than 1000 (the log mean WQ standard) because it was not considered feasible to reduce fecal coliform counts that were already below the WQ standard.

FILE: R:\PROJECTS\2110-610\FC_DATA_0296.XLS