6. Pollutant Sources in the Plum Creek Watershed

The LDC analysis for Plum Creek indicates that both point and nonpoint sources contribute pollutants in the watershed. Identifying sources is a key step in determining and implementing management practices to reduce or eliminate pollution and restore water quality in Plum Creek.

Topical work groups of the Plum Creek Watershed Partnership dedicated significant time to the identification of potential point and nonpoint sources of pollutants in the watershed. Available information and statistics for the Plum Creek Watershed were gathered from stakeholders and independent sources and used to support this process. Based on those discussions, the likely potential sources of pollutants were determined and are presented in Table 6.1.

Table 6.1. Potential pollutant sources in the Plum Creek Watershed.

Potential Sources	Bacteria	Nutrients	Other
Urban			
Urban Runoff	X	X	X
Pets	X	X	
Wastewater			
Septic Systems	X	X	X
Wastewater Treatment Facilities	X	X	X
Agriculture			
Sheep and Goats	X	X	
Horses	X	X	
Cattle	X	X	
Cropland		X	X
Wildlife			
Deer	X	X	
Feral Hogs	X	X	X
Oil and Gas Production			X

Many pollutant sources can contribute both *E. coli* and nutrients. In most cases, identification and management of bacteria sources also will reduce nutrient contributions, particularly when sources include human and animal waste. However, some land use and management practices, such as crop production and lawn and landscape fertilization, only affect nutrient loading and will need to be managed separately from control measures intended to reduce bacteria pollution.

SELECT RESULTS

The Plum Creek Steering Committee and work groups utilized the SELECT approach to evaluate each pollutant source and identify which subwatersheds have the greatest potential to contribute to *E. coli* loads based on both the average bacteria production rate and the concentration of a source within a subwatershed. It is important to note that SELECT evaluates the **potential** for pollution from the possible sources and subwatersheds, resulting in a relative approximation for each area. Sources with high potential are then evaluated to determine if necessary controls are already in place or if action should be taken to reduce pollutant contributions. The following sections of the Watershed Protection Plan present and discuss results of the SELECT analysis for each of the potential sources.

Figure 6.1 presents the total estimated daily *E. coli* load summed for all potential sources in the different subwatersheds in Plum Creek. In this and following figures, red areas indicate a higher potential daily load in that area, and yellow areas indicate a lower potential daily bacteria load, and oranges depicting intermediate levels of potential loads. The northern portion of the Plum Creek Watershed is listed as impaired by *E. coli* and shows a greater potential for bacteria loading than other regions of the watershed. However, high bacteria loads also have been observed in southern reaches of the watershed. Urban runoff, domestic dogs, wastewater, livestock, and wildlife are all key potential nonpoint source pollution contributors in the watershed.

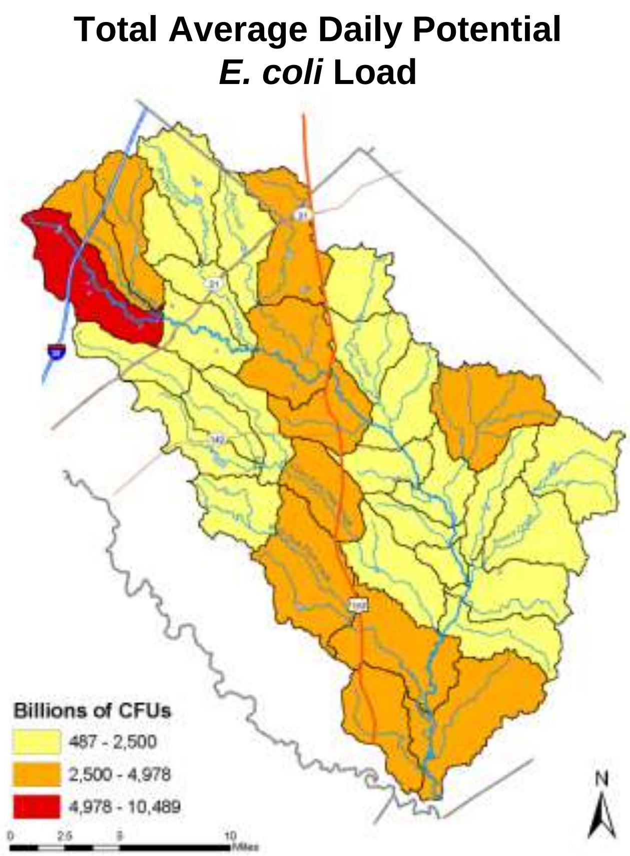

Figure 6.1. Estimate of total potential bacteria contribution by all sources by subwatershed.

URBAN RUNOFF

Because of the range of activities that occur there, runoff from urban areas can contain a variety of pollutants, including both bacteria and nutrients. Increased impervious cover (rooftops, roads, and other hard surfaces) causes more surface runoff and less water infiltration into the soil (Figure 6.2). This greater runoff increases the potential for pollutants from household pets, leaky wastewater pipes, sanitary system overflows, and urban wildlife to eventually reach Plum Creek. Identifying the original source of pollution is extremely difficult, since pollutants in runoff from urban areas may potentially come from any one source or a combination of several sources.

Figure 6.2. Development in Hays County. Impervious cover causes increased runoff, which can carry pollutants.

A study conducted by the City of Austin (1997) showed that bacteria concentrations in urban runoff can be extremely high, particularly in areas with a high degree of impervious surface cover. Similar conditions and potentials for significant bacteria contributions exist for established and growing cities in the Plum Creek Watershed, including Kyle, Lockhart, and Luling. Based on the land use analysis, each of these urban areas contains substantially higher densities of impervious cover than the Plum Creek Watershed as a whole (Table 6.2).

Table 6.2. Approximate city limit area and corresponding impervious cover estimates for cities having a majority of their city area within the Plum Creek Watershed based on 2004 land use classification.

City	City Area (Acres)	Impervious Cover (Percent)
Kyle	5,597	38
Lockhart	7,212	27
Luling	2,123	38
Plum Creek Watershed	288,240 (total)	9

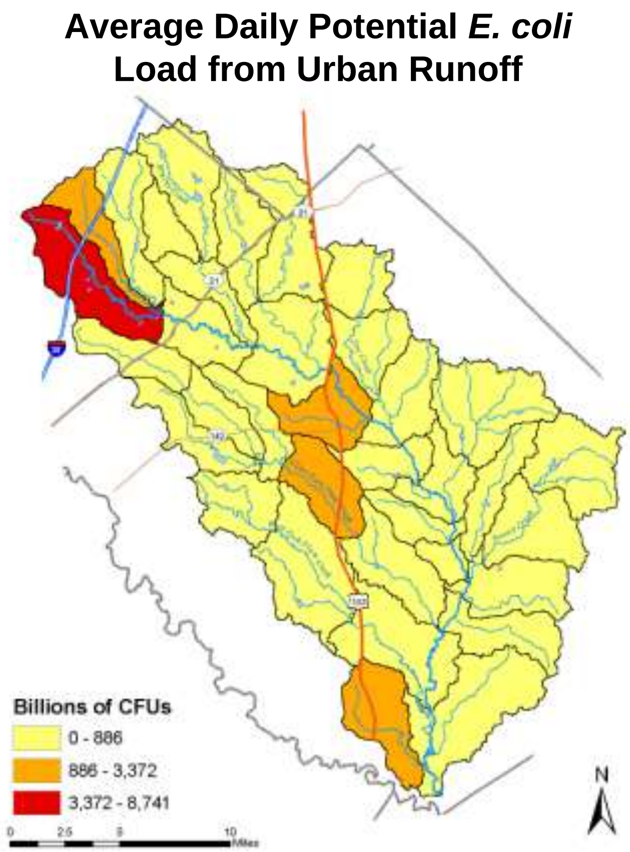

Figure 6.3. Potential bacteria contributions from urban runoff.

The Urban Stormwater and Nonpoint Source work group utilized estimates of impervious surface cover from the land use analysis and bacteria loading estimates from the study conducted by the City of Austin (1997) to complete SELECT analysis for urban runoff. Results confirm a significant potential for urban bacteria and nutrient loading in Plum Creek from the subwatersheds containing the majority of urban development, including Kyle along Interstate 35, Lockhart, and Luling (Figure 6.3).

Considerable variation exists in the level of urbanization among municipalities in the Plum Creek Watershed. The city of Buda, a small area of which falls in the far northern portion of the watershed, is now under municipal separate storm sewer system (MS4) regulations as a part of federal Clean Water Act legislation. These regulations are discussed in more depth later in the document. The city of Kyle most likely will fall under the same regulations following the next census due to its rapid population growth, and the cities of Lockhart and Luling eventually may face similar regulations. Future changes in population and potential for pollutant contributions from these urbanizing areas will need to be considered as plan implementation proceeds.

PETS

According to the American Veterinary Medical Association (AVMA 2002), the average Texas household owns 0.8 dogs. The Urban Stormwater and Nonpoint Source work group recommended using this information to estimate dog numbers in the watershed. Pets are sources of *E. coli*. Especially in urban areas, improper disposal of dog waste can affect water quality. Pollution concerns arise when animals deposit their waste outdoors and it is not collected. Waste and the bacteria it contains are transported to the stream during rainfall events or as a result of over-irrigation, especially when it is deposited directly in drainage ditches or streets and sidewalks. The closer these pets are to a waterway, the greater the likelihood they will be a major source of *E. coli*. The same potential for pollution applies to nutrients in pet waste, if the waste itself or soluble nutrients within it are transported to local streams. Thus, pet waste represents a significant potential source of both bacteria and nutrients in the watershed. Because the majority of cat waste is collected in litter boxes, these animals were not included in the SELECT analysis.

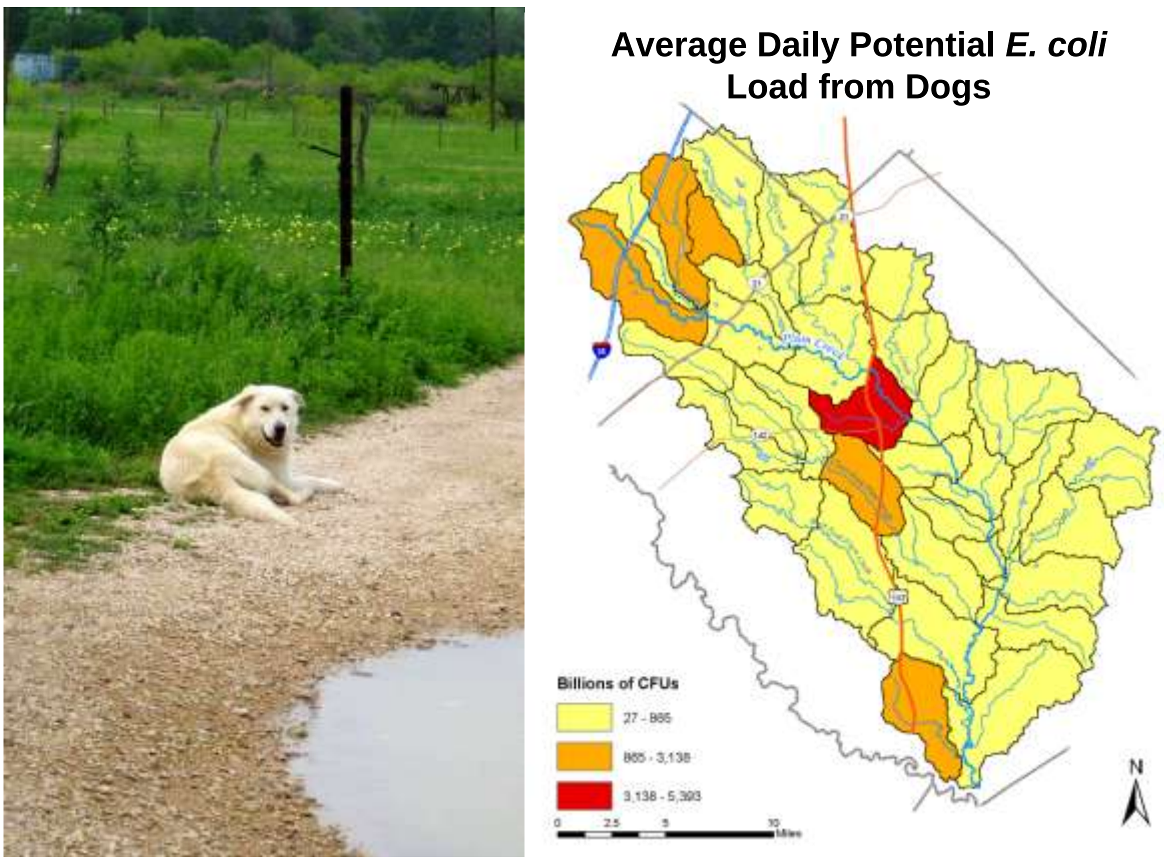

Figure 6.4. Dog in the Plum Creek Watershed. Animal densities and potential bacteria loads are highest in urban areas.

According to 2000 US Census population data for the watershed, there are an estimated 9,000 dogs in the watershed. These animals are concentrated in urban areas, particularly near Lockhart, Kyle, and Luling, which have more households and a greater human population. There has been a significant influx of residents since 2000, and this number will rise as development continues in the watershed. Based on this information, the SELECT analysis indicates the greatest potential for pollutant loads from pets occurs in these urbanized subwatersheds (Figure 6.4).

Septic Systems

Rural areas across Texas rely on on-site sewage facilities (also referred to as OSSFs), or septic systems, for disposal of household wastewater. Thousands of new systems are installed statewide each year when homes and businesses are constructed outside city limits or where centralized municipal sewer service is unavailable. While municipal wastewater facilities must be operated by trained personnel, septic systems are the responsibility of the homeowner. If regular and essential maintenance are not conducted, major problems can occur. Lack of septic system training has been a major issue in some areas and has been acknowledged by homeowners themselves.

When septic systems fail, wastewater does not receive adequate treatment. This sewage can be a source of bacteria, other pathogens, and nutrients. While inadequate septic system maintenance is a factor in system failure, other concerns are system design, inappropriate soils, and age. Pre-regulatory systems installed before requirements issued in 1989 are often not as efficient as new systems and are more prone to failure. Degradation of construction materials can lead to a drop in performance and eventual failure. Alteration or compaction of the drainfield can also dramatically affect septic system function and may completely eliminate treatment in worst-case scenarios. Some soils also limit system function, because they inhibit leaching and increase the likelihood of surfacing. Selection of a system should be determined by soil type, a practice which has not always been followed. Additionally, a lack of enforcement of septic system regulations can contribute to system failure. In some cases, governing bodies do not have adequate resources to inspect and regulate septic systems throughout their jurisdictions. This allows potential problem systems to go undetected and unaddressed. A combination of these factors makes septic systems a potential major contributor of both bacteria and nutrients to Plum Creek.

As with most types of nonpoint source pollution, failing septic systems are found across the landscape. Those located nearest streams or drainage areas are most likely to impact water quality in Plum Creek. A study funded by the Texas On-Site Wastewater Treatment Research Council (Reed, Stowe, & Yanke 2001) determined that in the counties within and around the Plum Creek Watershed, approximately 12% of reported septic systems are chronically malfunctioning. However, older unregulated systems have been shown to fail at a much higher rate. Because records of the location, age, and failure rate for septic systems in the watershed are not available, the Wastewater and Industry work group recommended utilization of a conservative failure rate for unregulated septic systems of 50% for the SELECT analysis. Based on the location of current centralized sewer utilities in Plum Creek, the highest potential densities of septic systems are located in Hays County in the northern portion of the watershed (Figure 6.5).

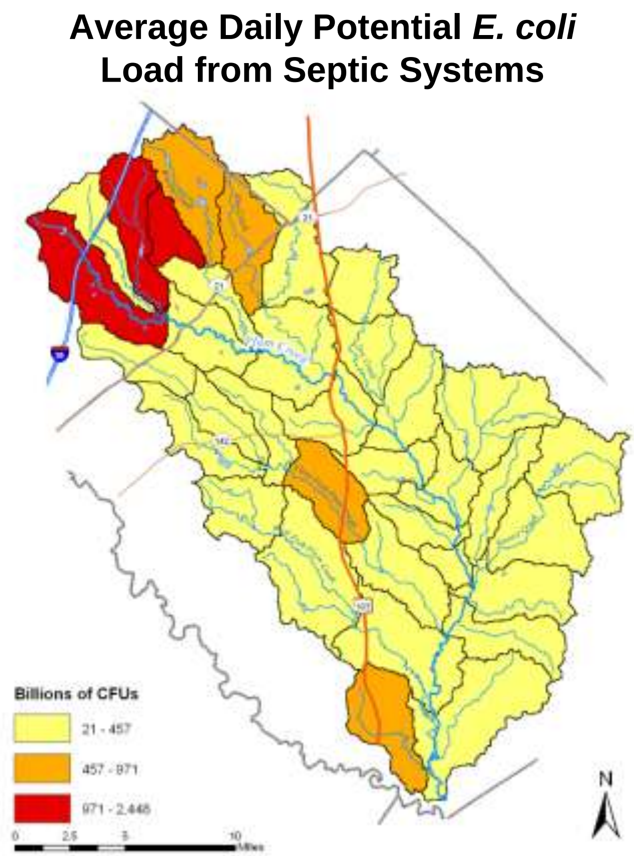

Figure 6.5. Distribution of potential *E. coli* loads from failing septic systems by subwatershed.

WASTEWATER TREATMENT FACILITIES

Permitted point sources in the Plum Creek Watershed are comprised of 12 wastewater treatment facilities (WWTFs), 2 water treatment facilities, and one industrial facility (Figure 6.7). With the exception of the industrial operation, which has no discharge, daily permitted flow in the watershed totals over 12 million gallons per day (MGD). While current discharge rates are well below this level, discharge rates will continue to increase toward the permitted total as existing facilities increase capacity. Further urban development and expansion of WWTF coverage area will also increase total effluent discharge in the watershed. Several additional permits exist for future facilities in conjunction with planned residential and commercial development, particularly in Hays County and western Caldwell County. Many of these facilities will become operational in the near future.

Average Daily Potential *E. coli* Load from Wastewater Treatment Facilities

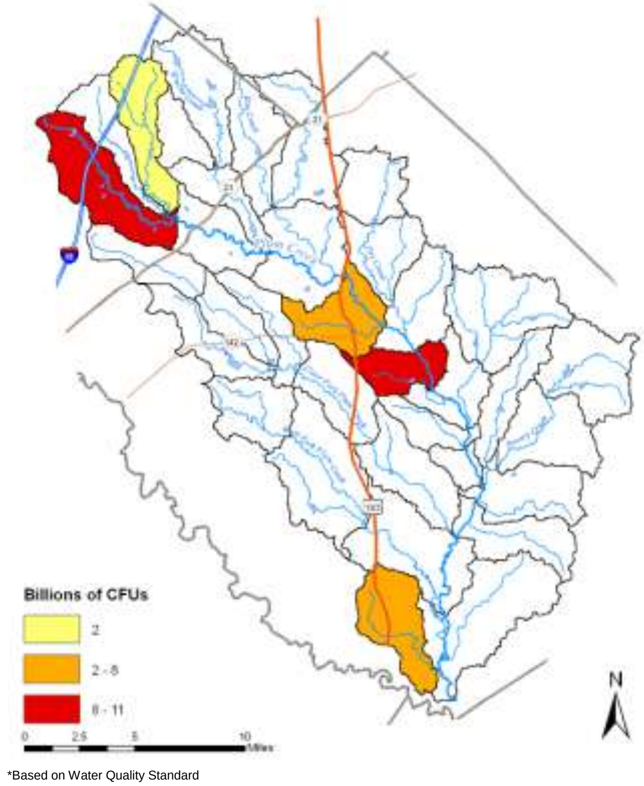

Figure 6.6. Potential *E. coli* contributions from wastewater treatment facilities are concentrated in areas with actively discharging permits in developed areas of the Plum Creek Watershed.

Because exact locations and permitted discharge volumes exist for WWTFs (though precise water quality data do not), these pollutant sources were addressed by the Wastewater and Industry work group somewhat differently in the SELECT analysis. Rather than being contributed from nonpoint sources across the landscape, these point sources of pollutants are introduced at the point where they are discharged to Plum Creek (Figure 6.6). A discussion of the methodology is provided in Appendix F.

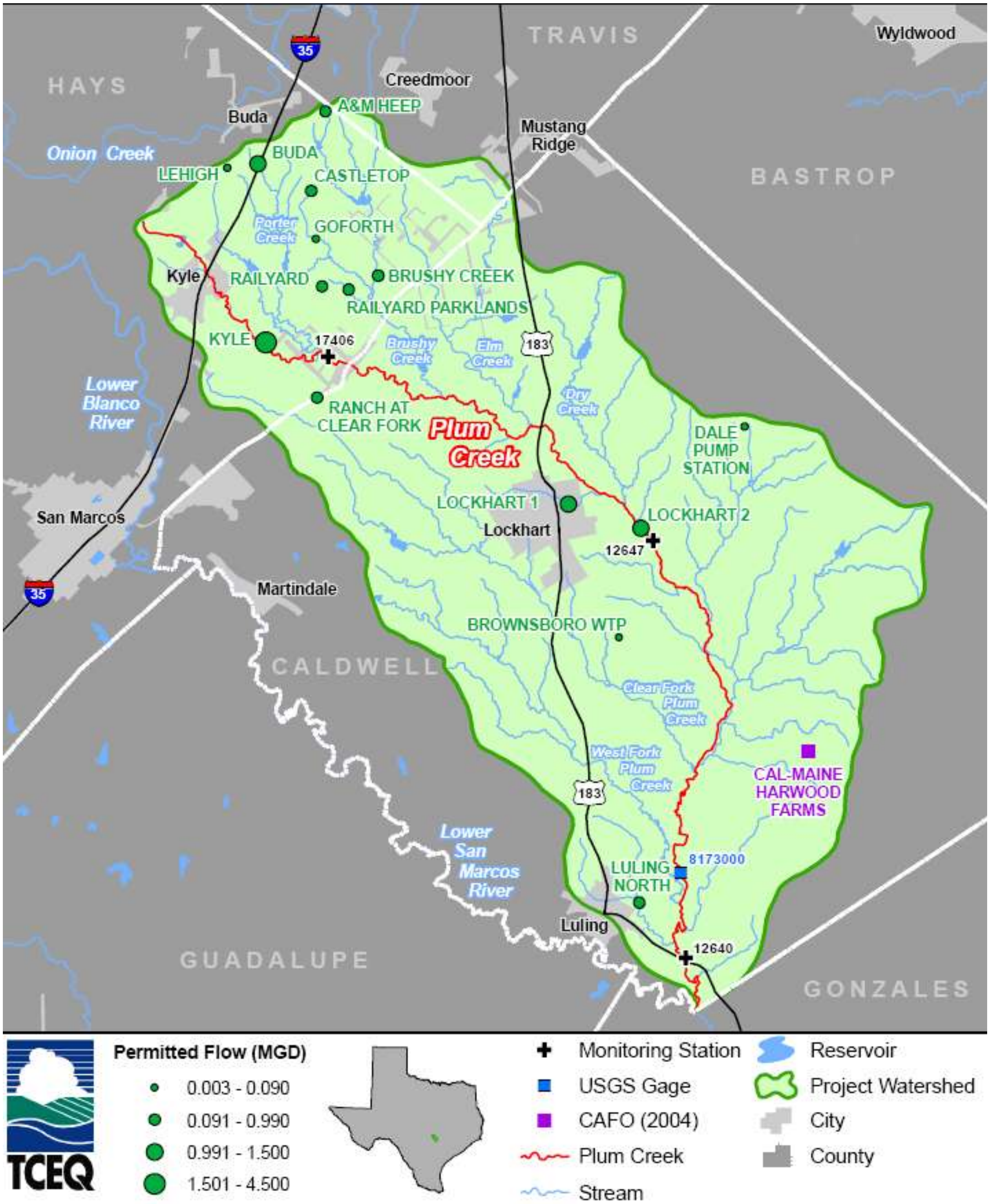

Figure 6.7. Location of wastewater permits and relative discharge volumes in the watershed. Source: TCEQ.

With some exceptions, most permits are written with requirements of 10/15/2 or 10/15/3 (see Appendix G Plum Creek facility permits). This refers to monthly average levels of 10 mg/L biochemical oxygen demand (BOD), 15 mg/L total suspended solids (TSS), and ammonia levels of 2 or 3 mg/L, respectively. Some of the newer permits contain more stringent effluent requirements, maintaining lower concentrations of both BOD (5 mg/L) and TSS (5 mg/L). Certain existing permits transition to include more rigorous limits as facilities expand and increase discharge flows in the future.

Currently, no WWTFs in the Plum Creek Watershed have effluent *E. coli* limits and only two (Lockhart No. 2 and Railyards-Parklands) have fecal coliform bacteria limits in place (not to exceed 200 cfu/100 mL). These two facilities utilize ultraviolet (UV) light to treat bacteria and other pathogens in the effluent. The other facilities use chlorine treatment and are only required to monitor chlorine residuals. While neither process provides complete eradication, both reduce the concentrations of pathogenic viruses and bacteria in effluent to levels which are considered safe for discharge under normal operating conditions (Figure 6.8).

Figure 6.8. City of Lockhart Wastewater Facility No. 2 is managed by the Guadalupe-Blanco River Authority and utilizes UV sterilization to treat bacteria in wastewater.

In dry periods, flow in portions of Plum Creek is dominated by wastewater effluent (Figure 6.9). Particularly in areas where the stream was historically intermittent, increases in wastewater discharge have resulted in a greater percentage of the streamflow coming from these facilities. Some northern sections of Plum Creek that generally had flow only during and shortly after rainfall events now flow perennially due to the addition of effluent from WWTFs.

There have been a number of documented WWTF malfunctions in the Plum Creek Watershed. Violation reports from the TCEQ indicate effluent quality requirements were not met on at least one occasion at several permitted facilities, and some locations had recurring effluent violations. While major failures are rare, there have been a number of treatment bypasses at WWTFs that have resulted in untreated waste being transported to Plum Creek. A major spill on the Porter Creek tributary in 2000-2001 was attributed to the Buda WWTF. Sewage bypass occurred as a result of excessive sludge buildup, which was eventually released to the stream causing extremely high bacteria concentrations directly downstream of the discharge point. A massive cleanup operation was undertaken to remove much of the waste and improve stream health in response to this incident.

Figure 6.9. Parts of the watershed are dominated by effluent during periods of low flow. Photo courtesy of Nikki Dictson, Texas AgriLife Extension Service.