CHAPTER 8
WATER

INTRODUCTION

The City of Helena is located in a semi-arid region and receives an average annual precipitation between 11 and 12 inches. Water is vital to the health, economy, and planning of Helena and its leadership role in the greater area and in sustaining the quality of life for local residents. It is necessary not only for commercial and household uses, fire suppression, and recreational activities but also for the surrounding forest health, wildlife preservation, and maintaining viable agricultural lands.

Main sections of this Chapter:

This chapter addresses water quantity and quality as they relate to future development within the City of Helena and in the surrounding areas. Any future development in Helena and the area hinges on the quantity and quality of this scarce resource.

Prickly Pear Creek

GENERAL OVERVIEW

Various aspects of water are presented within this Growth Policy. Chapter 5 - PUBLIC FACILITIES AND SERVICES provides additional information and details about the facilities that operate the City's water, wastewater, and stormwater networks. Water as a natural resource and its impact on wildlife, forest health, and recreational areas can be found in Chapter 7 - ENVIRONMENT.

WATER QUANTITY

In addition to precipitation, surface and ground water provide an important source of water to the Helena area. Sources of surface water in the Helena area include Prickly Pear and Ten Mile Creeks and their tributaries and the Missouri River, which feeds Canyon Ferry, Hauser, and Holter Lakes. Ground water is present throughout the Helena area at varying depths. The Helena Valley aquifer is the primary source of ground water. High ground water is usually associated with nearby water bodies and underground springs.

HELENA'S WATER SUPPLY

The primary sources of Helena's potable municipal water are the Missouri River, the Upper Ten Mile watershed, and the Eureka well. Water rights for wells in the Helena valley provide an unutilized secondary source. Public and private wells provide untreated water for uses not requiring potable water, such as some manufacturing and irrigation activities. These sources provide a stable supply of water for the community, although the City must remain vigilant in maintaining these resources.

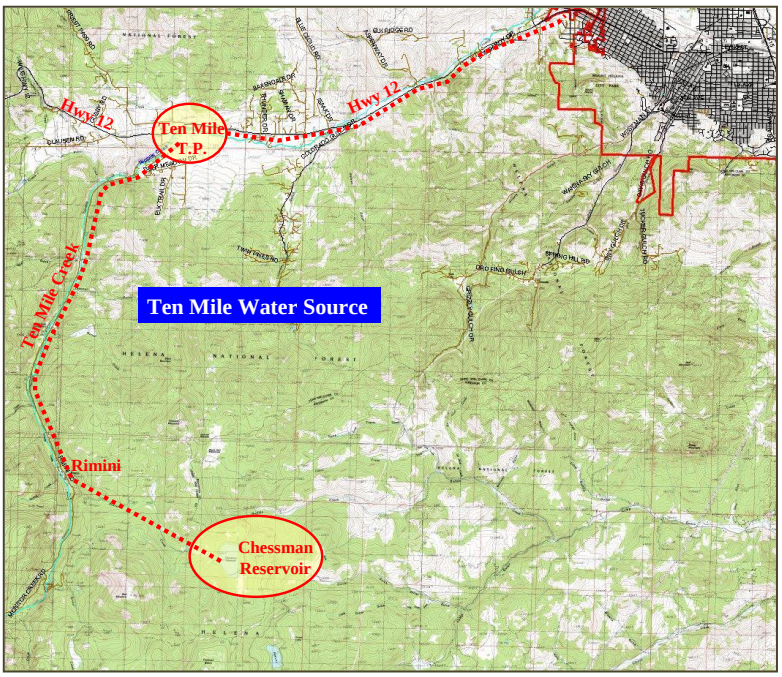
Missouri River

The Army Corp of Engineers regulates the Missouri River, an important waterway for many states, and evaluates multiple demands for this water, including municipal water supplies such as Helena, hydro-electric, agriculture, shipping, and industry uses, to name a few. The Bureau of Reclamation (BOR) regulates the Canyon Ferry Reservoir on the Missouri River.

The City has a 40-year contract with the Bureau of Reclamation, which reserves 11,300 acre-feet per year from the Canyon Ferry Reservoir for the City's use. This contract expires in 2045, but is renewable upon written request and mutually agreeable terms. The City currently utilizes approximately 3,000 acre-feet of water per year from this source.

Water is pumped from the Canyon Ferry Reservoir and channeled to an aboveground holding facility, the Helena Valley Regulating Reservoir, located south of York Road. The water is then piped to the Missouri River Water Treatment Plant (MRWTP), which has a current capacity of 13 million gallons of water a day.

Upper Ten Mile



The City owns the first and second water rights on Ten Mile Creek. Water from this watershed is piped to the Ten Mile Water Treatment Plant. If needed, additional water can be added to this treatment facility from the Chessman and Scott reservoirs located south of the community of Rimini. This network provides the City with approximately 8 million gallons of water per day.

The City depends on the Ten Mile Creek watershed and the Chessman Reservoir for much of its water supply, but the forest health in that vicinity is in decline. Pine beetle infestations and reduced rain fall have weakened and killed many of the trees, heightening the fire risk and endangering City water infrastructure. Sediment and algae growth also can affect the Chessman Reservoir. In 2008, the Ten Mile Watershed Collaborative Committee (TMWCC) was appointed by the City to evaluate issues related to this watershed. The TMWCC developed a number of recommendations to protect this important resource and maintain the water system infrastructure. Some of the action items recommended include removal of vegetation in proximity to structures, modification/replacement of the fire-vulnerable parts of the flume with metal pipe, and explore the development of a pre-sedimentation basin to minimize the effects of sediment on the Ten Mile treatment facility. Protecting and maintaining this water source will include forest thinning to reduce the fire threat and continued maintenance of the reservoirs, including incorporating the latest technology to control algae growth.

In addition to being a source of the City's potable water, the Ten Mile Creek is an important habitat for aquatic species and area wildlife. Maintaining adequate flow helps to sustain this important feature but it can also impact how much water the City can utilize from this watershed. The City, in conjunction with Montana Department of Fish Wildlife and Parks (MFWP), is working to balance the conflicting interests which are reflected in an MOU signed in 2010 between the City and MFWP.

Ground Water

The City utilizes ground water from the Eureka well to serve a relatively small portion of south central Helena's potable water needs. This water requires minimal treatment and is pumped into the Hale water storage tank at less than 400 gallons per minute. Use of well water is also permitted in the City for some manufacturing uses and uses not requiring potable water.

The City of Helena has water rights for ground water wells in the Helena Valley that could be utilized if future expansion dictates need for that source, particularly for irrigation purposes. These water rights could expire if not utilized by 2025. Future utilization of ground water for municipal use may have to take into consideration impacts on that source by other users. Unlike City residents who are connected to the municipal water system, residents living outside of the City typically rely on ground water from wells for their potable water. Ground water is available at varying depths throughout the Helena Valley. This less regulated and relatively easy-to-obtain water promotes growth in the areas surrounding Helena. A number of factors can influence the quantity of ground water in a given area: the number of wells, extended drought conditions, and the functioning of recharge areas. Some areas, such as portions of the north hills and west of Green Meadow Drive, have experienced a lowering of the water table.

The "Helena Valley Groundwater Vulnerability Mapping Project" found that, in addition to precipitation, significant sources of recharge in the study area include: infiltration of streamflow, infiltration of irrigation water through the irrigation canal network in the valley, and infiltration of excess applied irrigation water. Agricultural users in the area transport surface water via a network of canals from the Missouri River and local streams through the valley to water their fields. This irrigation network helps to recharge the area's ground water supply. As more of the Helena Valley is converted from agricultural uses to residential and commercial uses, which reduce the amount of water from irrigation, the hydrology of the area could be affected.

Climate change that increases average temperatures in the area may result in less rainfall, increased evaporation and dryness, and reduced stream flow at certain times of the year, which could affect ground water recharge.

Various actions could be taken to help preserve ground water levels. Protecting recharge areas by limiting the amount of impervious surfaces and allowing more water to percolate down could help maintain ground water levels. Annexation of property and connection to the City's municipal water system could help to reduce the number of wells in the area, reducing the amount of ground water being removed. Also, better regulation and protection of ground water rights might help to maintain ground water availability to existing users.

Water Storage

To better serve and distribute water throughout Helena, the City utilizes a number of water reservoirs. There are nine water storage reservoirs within the City of Helena water distribution system: Nob Hill, two Woolston Reservoirs, Malben Reservoir, two Winne Reservoirs, Hale Reservoir, the Upper Hale Reservoir, and the West Side Reservoir. These reservoirs provide operational storage to meet peak-hour water demands; emergency storage to satisfy short-term, emergency supply; and storage for fire protection as required by the Insurance Services Office (ISO) and the City of Helena.

Future Availability

Although the City has adequate water supply at this time, the population of Helena and the surrounding areas is growing. Future need should be evaluated and actions taken to ensure that Helena will always have sufficient and economical water and that other water-dependent uses, such as recreational activities, forest health, wildlife preservation, and maintaining viable agriculture lands, are balanced with urban uses.

One way to promote future availability of an adequate water supply is to make land-use changes and development decisions that promote efficient use of City water infrastructure and resources. A number of other mechanisms can increase future water availability, such as water conservation, reuse, and more efficient use of water resources; drought-resistant landscaping; and means that increase the City's access to water sources. Compact, higher density development also reduces water consumption compared to more spread out or larger lot developments. (Environmental Protection Agency's "Growing Toward More Efficient Water Use: Linking Development, Infrastructure, and Drinking Water Policies" (2006) and "Protecting Water Resources with Higher – Density Development" (2006). Therefore, the City should encourage in-fill and full utilization of properties currently served by, or in close proximity to, City water and wastewater infrastructure.

Promoting activities that reduce the use of water also could help reduce the amount of water the City will need in the future:

- Conducting educational and incentive programs and regulations that promote more efficient water fixtures and appliances, encourage fixing leaks, and encourage effective irrigation practices for residential and commercial uses
- Promoting environmentally-sensitive landscaping and gardening; encouraging the use of landscaping that is drought resistant and appropriate for the Helena climate, including xeriscaping; and encouraging nurseries, landscape architects, and others who develop and implement landscape plans to use vegetation that is both attractive and appropriate for this region.

History of Impacts to Helena Area Water Quality

To a large extent, current water quality in the Lake Helena watershed is a result of man's activities within the watershed over the last 100 to 150 years. In the mid-1800s, mining activity increased following the discovery of gold and other minerals in the mountains around the Helena Valley. At the same time, the earliest miners and homesteaders began diverting water from Prickly Pear, Ten Mile, and Silver Creeks to irrigate land for crops. The watershed's hydrology and water quality experienced a period of rapid change because of these land development activities. Today, several hundred abandoned mines are present in the watershed, and these continue to influence basin hydrology and water quality.

In 1907, the hydrology of the Helena Valley was further altered with the completion of Hauser Dam and Reservoir on the Missouri River north of Helena. As the reservoir filled, the low-lying wetlands of Prickly Pear and Silver Creeks flooded to form Lake Helena. In 1945, an earthen causeway and control structure was built to separate Hauser Reservoir and Lake Helena, allowing the two to be regulated independently.

Between 1940 and 1970, extensive logging occurred in the Lake Helena watershed, primarily in the western portions of the watershed along the Continental Divide where the most valuable timber was located. During this period, equally extensive road networks were built to harvest and transport the timber. Many of the stream impacts observed today are remnants from these earlier activities.

Population growth and the associated infrastructure have also permanently altered the landscape and will continue to play a role in defining water quality in the Lake Helena watershed. Since the 1950s, population growth has averaged approximately 18 percent per decade. In summary, the water quality conditions and problems present today in the Lake Helena watershed are a function of past and present land uses.

Framework Water Quality Restoration Plan and Total Maximum Daily Loads (TMDLs) for the Lake Helena Watershed Planning Area: Volume II – Final Report

- Promoting water reuse, such as grey water utilization and rain barrels that capture rainfall for future irrigation use, which reduces the use of potable water for situations that do not require it, such as landscaping and yard and tree irrigation.

The City must be vigilant in guarding against other threats to the City's water system. Invasive aquatic species such as some varieties of mussels have invaded other municipal systems in the United States. Once established these invasive mussels can clog water intake and delivery pipes restricting flows and requiring costly maintenance. Supporting guidelines to stem the spread of these species into Montana waterways could help protect the City's system from these invasive species. Moreover, continuing to invest in system upgrades and maintenance of the City's municipal water network—including providing adequate water treatment facilities, mains, and reservoirs and maintaining older pipes to reduce the risk of leaks and breaks—could help meet future water needs.

WATER QUALITY

Although water *quantity* is very important, water *quality* also plays an important role in influencing the character of Helena and the surrounding area. In addition to providing a source of municipal water, surface water in the Helena area provides water for industrial uses, agricultural irrigation, animal habitat, fisheries, aquatic habitat, and recreational opportunities. Mitigating the impacts to water quality from municipal wastewater, individual septic systems, and aging community waste water treatment facilities; encroachments on wetlands and waterways; erosion; agricultural, timber and mining uses; and other potential pollutants is a constant challenge.

HELENA AREA WATER QUALITY STUDIES

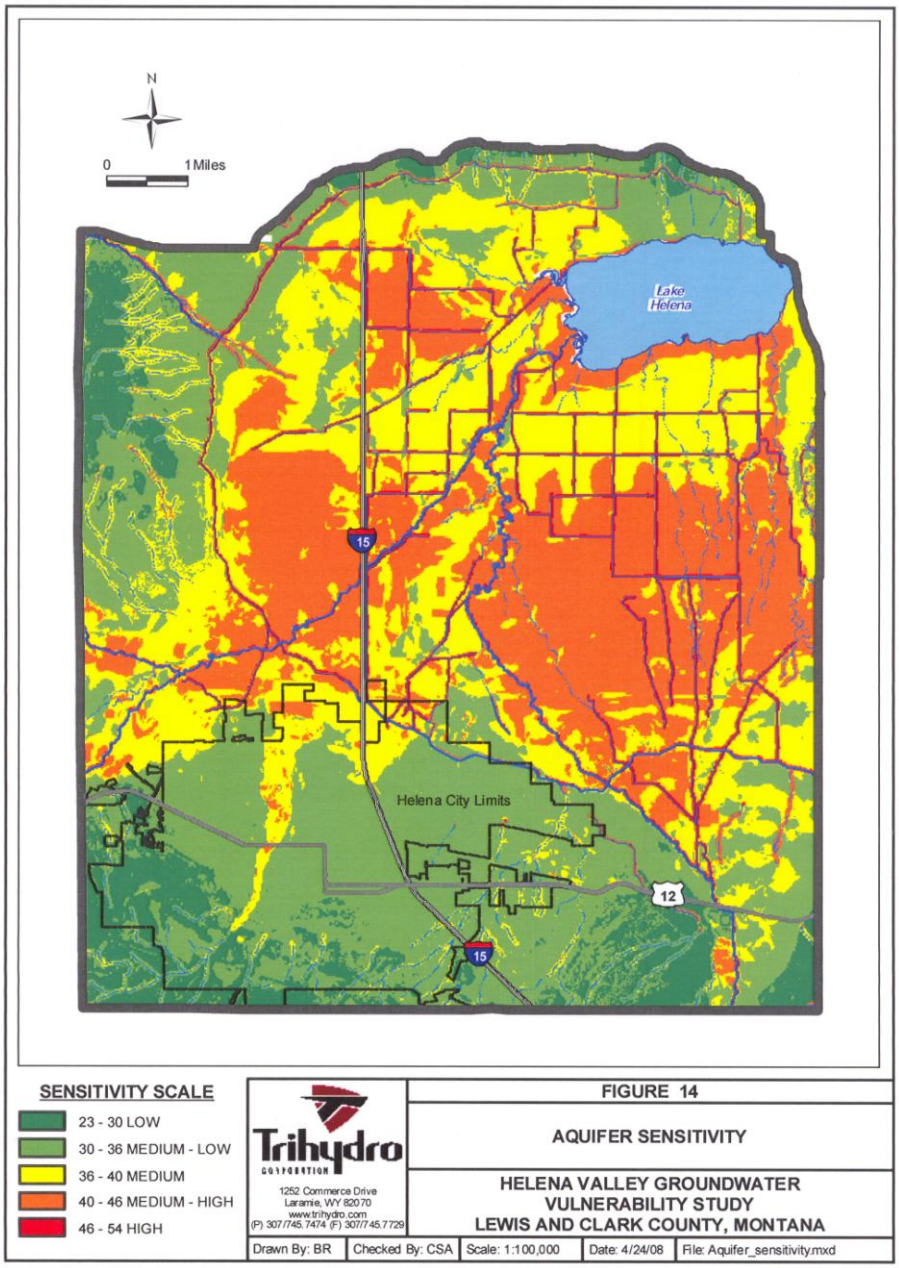
Studies have shown a connection between pollution of ground water and the quality of surface water. Therefore, the quality of surface and ground water is interrelated, and both are important in maintaining the Helena community. Several studies have been conducted in the state and in the Helena area to evaluate various aspects of regional water quality. The following is a summary of some of the more recent studies that pertain just to the Helena area.

In 2008, Lewis and Clark County completed the *Helena Valley Groundwater Vulnerability Mapping Project*, which delineates areas that may be susceptible to impacts from potential septic system discharges. This mapping project also can be used as an effective planning tool for evaluating the impact of potential pollution sources on susceptible areas.

This study noted that precipitation percolating downward through the soil is a relatively insignificant source of recharge on non-irrigated areas in the valley. This is due to the semi-arid environment and the fact that evaporation and water uptake by vegetation is greater than the amount of precipitation. In irrigated areas, the application of irrigation waters during the growing season will result in higher soil moisture contents, and recharge through infiltration of precipitation and irrigation water will be a potential source for contaminant migration.

Additional significant sources of recharge in the study area include infiltration of stream flow, infiltration of irrigation water through the irrigation canal network in the valley, and infiltration of excess applied irrigation water. (See figure 14.)

In 2006, the Montana Department of Environmental Quality completed the *Framework Water Quality Restoration Plan and Total Maximum Daily Loads (TMDLs) for the Lake Helena Watershed Planning Area: Volume II – Final Report*, which identified factors that impair the surface waters in the Helena area.



This study identified some of the pollutants and other factors that affect Lake Helena and the streams and creeks that flow into that lake. Various impairments to the waters in this planning area, such as nutrients, sediment, metals, and temperature are summarized in Table 4-1 of this study. The study identifies nutrients as the single greatest impairment to the lake's water quality. The cumulative effect of nutrients on Lake Helena could cause the MDEQ and USEPA to increase treatment requirements for Helena's wastewater treatment plant at considerable expense to Helena taxpayers when the discharge permit is renewed. The City should continue to encourage Lewis & Clark County to take measures to reduce nutrient sources in the Helena Valley and make the City's treatment plant available when compatible with City goals and objectives and the City's discharge permit.

Table 4-1. Top five pollution sources in the Lake Helena watershed and corresponding watershed stakeholders.

Nutrients		Sediment		Metals		Temperature	
Sources	**Stakeholders**	**Sources**	**Stakeholders**	**Sources**	**Stakeholders**	**Sources**	**Stakeholders**
Municipal Wastewater Treatment Facilities	City of Helena, City of East Helena, MDEQ Wastewater Permitting Program, MDEQ State Revolving Fund Program	Unpaved Roads	Helena National Forest, Lewis and Clark and Jefferson County Governments, MDEQ Subdivision Review Program, Private Landowners	Abandoned Mines	EPA Superfund Program, MDEQ Abandoned Mine Program	Degraded Riparian Vegetation (i.e., lack of shade)	Private Landowners, Conservation Districts, LCWQPD
Septic Systems	MDEQ Subdivision Review Program, Lewis & Clark and Jefferson County Boards and Commissions, City of Helena, City of East Helena, LCWQPD, Private Landowners	Agriculture	Conservation Districts, NRCS, Helena Valley Irrigation District, Bureau of Reclamation, Private Landowners	Agriculture	Conservation Districts, Natural Resource Conservation Service, Helena Valley Irrigation District, Bureau of Reclamation, Private Landowners	Dewatering	Helena Valley Irrigation District, Bureau of Reclamation, Conservation Districts, NRCS, EPA Superfund Program, City of Helena, Private Landowners
Helena Valley Irrigation District	Helena Valley Irrigation District, Bureau of Reclamation, Conservation Districts, NRCS, EPA Superfund Program, City of Helena, Private Landowners	Timber Harvest	Helena National Forest, Department of Natural Resources and Conservation, Bureau of Land Management, Private Landowners	Unpaved Roads	Helena National Forest, Lewis and Clark and Jefferson County Governments, MDEQ Subdivision Section, Private Landowners	NA	
Agriculture	Conservation Districts, Natural Resource Conservation Service, Helena Valley Irrigation District, Bureau of Reclamation, Private Landowners	Streambank Erosion	Private Landowners, Conservation Districts, LCWQPD	Streambank Erosion	Private Landowners, Conservation Districts, LCWQPD	NA	
Urban Areas	MDEQ Stormwater Permitting Program, MDEQ Subdivision Review Program, Lewis & Clark and Jefferson County Boards and Commissions, City of Helena, City of East Helena, LCWQPD, Private Landowners	Abandoned Mines	EPA Superfund Program, MDEQ Abandoned Mine Program, Lewis and Clark Water Quality Protection District	Timber Harvest	Helena National Forest, Department of Natural Resources and Conservation, Bureau of Land Management, Private Landowners	NA	

Framework Water Quality Restoration Plan and Total Maximum Daily Loads (TMDLs) for the Lake Helena Watershed Planning Area: Volume II – Final Report

In addition to the stakeholders identified in this table, the Montana Department of Fish Wildlife and Parks and the Environmental Protection Agency are active players in maintaining the quality of this watershed.

Conclusions from the Montana Department of Agriculture's 2006 study, *Groundwater Monitoring for Pesticides and Nitrate in Shallow Aquifers of the Helena Valley, Montana*, state that pesticides were detected in eleven of thirteen groundwater samples and from six of the seven sampling locations. All of the pesticides detected were herbicides. The most commonly detected herbicide was atrazine and one of its metabolites, deethyl atrazine, which accounted for eleven of the 22 detections. All herbicide concentrations were very low.

None of the pesticide concentrations exceeded or approached the Montana drinking water standards. Nitrate was detected in six of the thirteen groundwater samples and at three of the seven sampling sites. Nitrite was not detected in any of the groundwater samples.

The Montana Department of Environmental Quality study, *Helena Valley Ground Water: Pharmaceuticals, Personal Care Products, Endocrine Disruptors (PPCPs) and Microbial Indicators of Fecal Contamination*, noted that the valley surrounding the City of Helena, is experiencing rapid growth into areas that rely on septic tanks and drainfields for

onsite wastewater treatment and disposal. Findings regarding levels of PPCPs in drinking water derived from wells is consistent with the findings of other similar studies of these compounds in ground-water and septic systems. Sulfamethoxazole and atrazine, the two most frequently detected compounds, were found at frequencies of 80% and 40% of samples, respectively. Atrazine demonstrates a strong correlation with chloride and total dissolved solids (TDS), two typical inorganic indicators of ground-water degradation from domestic wastewater. Further sampling and analysis of septic tank effluent should be conducted to verify whether atrazine is occurring in domestic wastewater.

These studies indicate that there are varying levels of pollutants from a number of sources present in both ground and surface waters. Addressing the sources and various methods of mitigation can be important for future growth in the Helena area.

SOURCES OF WATER DEGRADATION

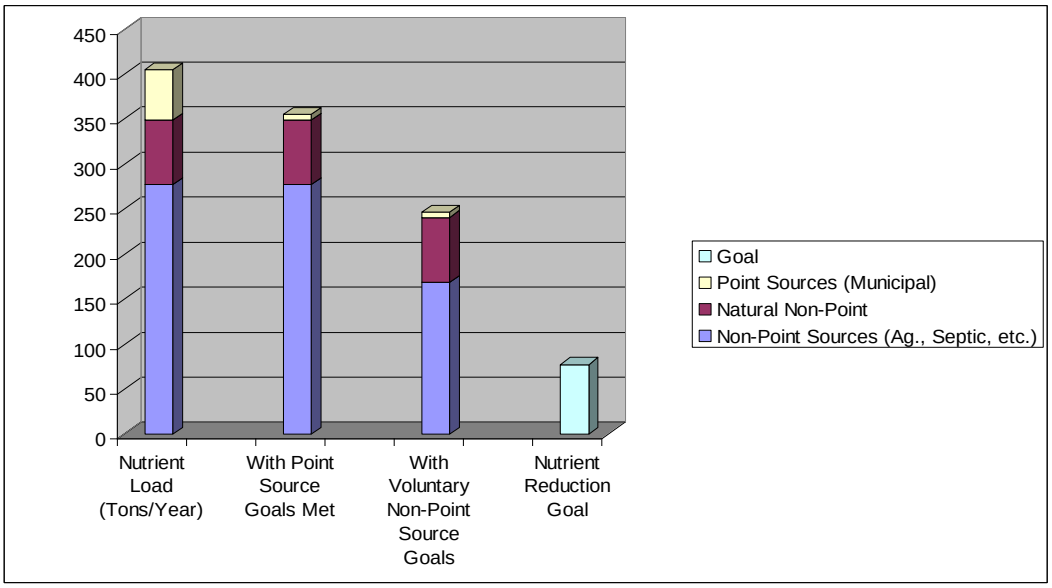
The Helena area watershed is impacted by a number of pollutants two of the more significant ones are Nitrogen and Phosphorus. The following is a breakdown of sources for the Lake Helena Watershed total nutrient loading of Nitrogen and Phosphorus based on information from Framework Water Quality Restoration Plan and Maximum Daily Loads (TMDLs) for the Lake Helena Watershed Planning Area," Volume II, 2006

- Agriculture** 108 Tons/yr (27%)
- On-Site Septic 102 Tons/yr (25%)
- Municipal 53 Tons/yr (13%)

* ** Includes Helena Valley Irrigation District

Goals have been established to reduce these nutrient loads as illustrated by the following graph.

Lake Helena Watershed Nutrient Loading Goals



Total Nutrient Reduction Goals for Lake Helena from the "Framework Water Quality Restoration Plan and TMDL's for the Lake Helena Watershed Planning Area" MDEQ 2006

This graph illustrates that even with the City of Helena meeting their nutrient reduction goals, there would still be significant nutrient pollution from non-point sources such as agricultural uses, septic systems, and naturally occurring sources.

Wastewater

One source of water degradation is wastewater associated with urban and rural density development.

Helena's Wastewater Treatment

A very important component in maintaining the area's water quality is the City's Wastewater Treatment Facility, which includes the Wastewater Treatment Plant and the Industrial Pretreatment Program. The Wastewater Treatment Plant's average daily flow is about 3.2 million gallons per day, in which the solids and other pollutants are removed in accordance with regulations and the City's permit. The Industrial Pretreatment Program protects the environment and the community from adverse effects caused by industrial waste discharges and reduces heavy metal loading in the effluent discharge and bio-solids.

The Wastewater Treatment Plant also accepts hauled waste, including waste from maintenance of septic systems located outside Helena. Based on plant utilization between 2004 and 2009, this program treats approximately 1.6 million septic gallons a year which is more concentrated than city wastewater. These septic gallons are much more concentrated than city wastewater flows; thus, the impact on plant operation is a magnitude greater than the same volume of city wastewater. This City facility not only reduces the environmental impact of city waste but also reduces the impact from County residents who use this treatment option for their septic systems.

The 1996 Helena Area Wastewater Treatment Study reviewed and evaluated a number of treatment options and promoted comprehensive and cooperative wastewater management between Lewis and Clark County and the City of Helena. When upgrades to the Helena Wastewater Treatment Facility were installed, capacity was included to accommodate a regional approach to wastewater treatment. As a result, the City's Wastewater Treatment Facility has a permit capacity of treating 5.6 million gallons of wastewater daily and is currently at about 57% capacity. Although there is excess capacity at the treatment plant, portions of the collection system, such as lift stations—that are at capacity now—and undersized mains, may require upgrading to accommodate growth in some areas adjacent to City infrastructure.

The Wastewater Treatment Facility discharges treated water into Prickly Pear Creek. The facility is regulated and must meet current water quality standards. This facility, as well as other sources, has been identified as increasing total nitrogen and phosphorus loading in the Lake Helena sub-watershed. Reducing the output of phosphates would improve water quality in this watershed. One mechanism would be to reduce the amount of phosphorus entering the facility by reducing the use of phosphorus–containing household cleaning products. The recent "Phosphorus Ban Act," MCA 75-7-4, would authorize banning the sale of these products in counties where one or more

surface water bodies exceed the numerical algal biomass or total phosphorus standards. Numerical standards for Lewis and Clark County are currently being studied. If phosphorus content or algal biomass in surface waters exceeds the standards, the County may be subject to this ban, which could significantly reduce the amount of phosphorus discharge from the treatment plant. Educational programs promoting the use of phosphorus-free or reduced-phosphate household and commercial cleaning products to decrease the amount of phosphates released into ground and surface waters could also help water quality.

Several things can be done to reduce the impact of wastewater on surface and ground water quality in the Helena area. The City can continue to reline old sewer pipes to extend their life and reduce leaking into the ground; extend and upgrade main size and lift stations as needed to assure the extension of City wastewater treatment, particularly into environmentally sensitive areas; investigate utilization of gray water for landscape and yard irrigation, which could reduce the amount of wastewater needing treatment; maintain the City treatment plant, incorporating the latest technology; and maintain compliance with permit requirements and all other regulations such as the Clean Water Act (CWA).

Community Wastewater Treatment

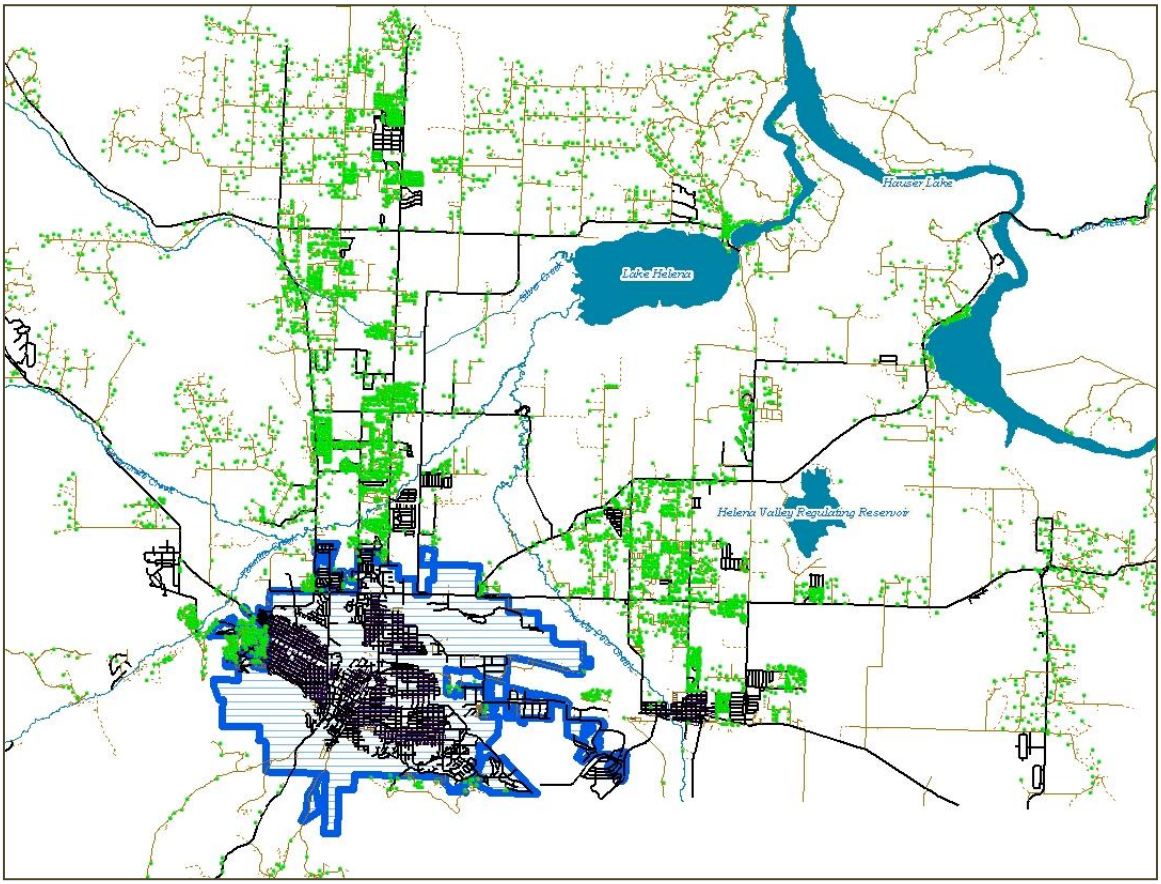
Some developments outside the City use community wastewater treatment facilities that serve an entire subdivision. These treatment facilities often use lagoons in the process of treating their waste. Over time, these lagoons can break down and leak contaminants into ground and surface waters. Several developments in the Helena area such as Ten Mile, Pleasant Valley, and Leisure Village are experiencing failures of their lagoons. These failures result in contaminants being leaked into the ground resulting in both ground and surface water degradation. They must be upgraded or replaced, or another system must be incorporated—such as connection to the City's treatment facility. The construction of regional lift stations could expand municipal wastewater treatment to areas where lagoons are failing or in danger of failing. One option for providing coordinated infrastructure to serve a greater geographical area would be to cooperatively plan for a regional wastewater treatment system, designed to City standards.

Septic Systems

Subsurface wastewater treatment systems (SWTS), more commonly referred to as septic systems, consist of a septic tank, a distribution system, and drain field. A properly working system can remove or greatly reduce bacteria, viruses, and environmental pollutants such as phosphorus, but is not as effective at removing nitrogen from wastewater. In areas sensitive to nitrogen loading, different levels of treatment may be required. Septic systems can have a significant impact on ground-water quality and are identified in the Lake Helena study as increasing the nitrogen loading not only in the Prickly Pear Creek and Ten Mile sub-watershed, but also in Lake Helena.

Groundwater is the sole source of drinking water for most of the people in the vicinity who live outside the City of Helena including more than 27,000 people in the surrounding areas. The Helena Valley aquifer provides water through approximately 5,700 domestic wells and 71 public water supplies based on a 2010 analysis of well and septic permits. In addition, the Environmental Health Services for Lewis and Clark County has indicated there are about 6,000 septic permits in the Helena Valley and surrounding area. Pollutants from septic systems migrate into the ground water, contaminating wells needed for potable water. It is important that wells for potable water be monitored and tested regularly to assure the quality of that water. Septic systems should also be adequately maintained. Lewis and Clark County is moving towards establishing a County septic maintenance program. This program will allow for the regular maintenance and inspection of septic systems to better assure proper functioning systems.

Septic permits in the Helena area as indicated by green dots per Lewis and Clark County Environmental Health data base



Connecting properties in close proximity to municipal services could reduce the impact of septic systems and failing lagoons on the water quality in the Helena area. Working with the County on joint development (City/County) standards could promote future connection to city services.

Stormwater

Development creates impervious surfaces, may change natural drainage patterns, and could affect vegetation. These factors can affect where precipitation drains, how fast precipitation flows, and the precipitation's contamination content when it enters local waterways. Property owners with more than 5,000 square feet of impervious surface (roof tops, patios, decks and driveways) must address stormwater drainage on their property. Development may not allow more than the historic amount of stormwater to run off of the property, and it must be at a controlled rate. Stormwater drainage may be accommodated in onsite detention ponds or may use the City's storm drainage system.

Polluted runoff occurs when contaminants, such as metals, salts, grease, and oil from roads and parking lots; sediments from disturbed soils; lawn and garden products; toxic materials; and herbicides, pesticides, and fertilizers from agricultural uses, are picked up by rainwater, snowmelt, or landscape irrigation and carried off to lakes, rivers, and streams. This runoff can affect water quality with negative consequences for the environment and human health. Excess nutrients can lead to algae blooms, which damage aquatic ecosystems. Polluted runoff can introduce toxic materials, bacteria, viruses, and other pathogens into local water bodies. As areas develop, these pollutants can increase water degradation, not only in the Helena area, but also downstream, affecting the entire watershed.

Stormwater management is an important function of the City. The Storm Drain Master Plan was developed and updated in 2003 to facilitate this planning by providing information on stormwater locations and identifying discharges, impacts, and needed projects for mitigation to reduce water pollution. In 2009, the City passed a stormwater ordinance resulting in the *HELENA STORMWATER CONTROL CHAPTER* of the City Codes. This chapter establishes methods for controlling the introduction of pollutants into the municipal separate storm sewer system (MS4) in order to comply with requirements of the Montana pollutant discharge elimination system (MPDES) permit process. The objectives of this chapter are:

A. To regulate the contribution of pollutants to the municipal separate storm sewer system from stormwater discharges by any user.

B. To prohibit illegal connections to and discharges into the municipal separate storm sewer system.

C. To establish legal authority to carry out all inspection, surveillance, and monitoring procedures necessary to ensure compliance with this chapter.

D. To establish legal authority to develop, implement, and enforce a program to address stormwater runoff from new development and redevelopment projects.

In addition, the stormwater ordinance provides guidance and regulations for providing adequate stormwater facilities that not only reduce runoff but requires best management practices to reduce pollutants from entering the watershed. In suitable locations and utilizing certain design features some stormwater detention basins can function as wetlands which help to filter out sediments and some contaminants.

In addition, utilization of Federal Emergency Management Agency (FEMA) flood plain maps and adhering to floodplain regulations in development of areas susceptible to flooding are important to protect flood-prone areas and downstream development.

The Department of Environmental Quality (DEQ) has established best management practices in designing stormwater systems so that they filter out sediments and reduce pollutants entering into ground and surface waters. Incorporating these design guidelines could reduce the impact of stormwater on the quality of ground and surface waters.

Reducing impervious surfaces could increase infiltration through the soil and help regenerate groundwater and remove pollutants. The removal of topsoil and compaction of soil by heavy equipment during construction reduces the land's ability to absorb water, thus increasing runoff. Saving and replacing topsoil or adding organic materials such as compost can increase absorption and reduce the impact. Minimizing overall land disturbances and impervious surface associated with development and continuing sediment control at construction sites could also reduce development's impact to stormwater water quality.

Rapid storm runoff can cause erosion and cutting into stream banks, which results in soil and vegetation being washed away. This can have a significant negative impact on riparian areas, reducing their ability to remove contaminants from stormwater. Incorporating channel protection strategies that retain soils and protect riparian vegetation near streams could reduce these impacts.

Trees intercept and slow the fall of rainwater, helping the soil to absorb more water for gradual release into water sources. This cycle reduces flooding, allows for filtering out toxins and impurities from the water, releases water into the atmosphere, and reduces the amount of stormwater entering the system. Xeriscape or natural landscaping, which is adapted to the local climate, soil, and environment, requires little maintenance and water and fewer pesticides and fertilizers. Lawn grass is less likely than trees, grasses, and shrubs to filter water and mitigate runoff. Grass is generally more compacted during installation and during continual mowing than vegetation that has deeper root systems and that is adaptable to the area's climate. Encouraging planting and maintaining trees and vegetation suited to this climate and reducing the use of lawn grass in landscaping may improve the quality and reduce the amount of stormwater in an area.

Nonpoint Source Water Contamination

The 2006 *Integrated Water Quality Report* concluded that nonpoint source pollution, such as agriculture, commercial/industrial sites, septic systems, transportation, etc., is the leading cause of surface-water impairment in Montana and accounts for approximately 90% of the degradation problems in streams and 70% of the lake problems. The City Wastewater Treatment Facility and stormwater system are classified as point sources and must follow strict regulatory guidelines for discharge into surface waters—unlike most nonpoint sources.

Septic Systems

As previously described, septic systems contribute a significant amount of nutrient loading to the area watershed. Lewis and Clark County has found individual septic systems have a higher rate of failure than anticipated due to lack of maintenance. Failure rates decrease when systems are regularly inspected and periodically pumped, therefore the County is proposing instituting a septic maintenance program. This program would promote maintenance of individual wastewater treatment systems to assure they function properly as well as extend the life of many of these systems. If properly executed, this program could protect public health, and preserve valuable water resources,

Agriculture

Agricultural uses have been identified as the major source of water degradation in the state and as a major contributor to reduced water quality in the Helena area. This use contributes to nutrient loading, metals, and sediments in area surface waters.

Commercial/Industrial

Contamination from commercial and industrial uses also leaches pollutants into the ground water. Arsenic and selenium from the Asarco lead smelter in East Helena have been found spreading in the groundwater north/northwest from the smelter. These plumes have the potential of contaminating wells in their path. Groundwater under or near other industrial areas in Helena is being tested for contaminants.

Two of the best methods of preserving water quality are to eliminate the source of contamination or to reduce the output of pollutants. For example, connecting homes with failed septic systems or failed lagoons to the city wastewater treatment system would improve the quality of water in that area. However, such a solution is not always feasible. In situations where elimination is not possible, mitigation should be explored.

RIPARIAN AREAS

Riparian areas, vegetative buffers, and wetlands play an integral part in improving and maintaining water quality. Streams can be affected by pollutants from activities such as wastewater discharge, septic systems, animal waste, construction, road maintenance, agricultural uses, old mines, and lawn care, as well as by unnatural stream bank erosion, which can significantly reduce water quality. Protecting riparian areas also protects habitat for fish and wildlife.

Riparian areas are vegetative buffers of land that border creeks, rivers, or other bodies of water and provide safeguards for water quality. The roots of trees, shrubs, and native grasses hold soil in place along banks of rivers and streams, reducing the potential for bank erosion and deposition of sediment in streams and rivers. Native vegetation along the banks of rivers and streams and within floodplains slows the movement of flood waters and helps disperse the flood waters, giving water time to percolate into the soil and recharge underlying ground water.

Trees and shrubs adjacent to rivers and streams provide shade, reducing and moderating water temperatures. Extreme fluctuations and high water temperatures harm fish and other aquatic life. Riparian vegetation in floodplains and along rivers and streams acts as a natural filter to remove sediment and other contaminants from stormwater runoff, which can adversely affect water quality.

For example, nitrate/nitrite levels in shallow groundwater can be reduced before reaching surface water through uptake by the roots of plants in vegetated buffers and by bacteria that live in water-saturated soils, which convert nitrates/nitrites to harmless nitrogen gas (a process called denitrification). Stream vegetated buffers are typically effective at short-term control of phosphorus that is bound to sediment particles.

Montana's Nonpoint Source Management Plan identifies locally-adopted water body setbacks as important "Best Management Practices" to protect and improve water quality from nonpoint source pollution. Nonpoint sources of pollution in urban areas include parking lots, streets, and roads where stormwater picks up oils, grease, metals, dirt, salts, and other toxic materials. In areas where crops are grown or in areas with landscaping (including grassy areas of residential lawns and city parks), irrigation and rainfall can carry soil, pesticides, fertilizers, herbicides, and insecticides to surface water (rivers, lakes, steams, etc.) and groundwater.

Establishing and protecting water body setbacks and riparian areas can help maintain and improve area water quality. Various studies indicate that vegetative buffers can filter out the ammonia, fecal coli form, nitrates, nitrogen, pesticides, phosphorus, and sediment. The effectiveness of the buffer as a vegetative filter depends on its width.

Although vegetated buffers with woody plant species (trees and shrubs) and native grasses are both effective at trapping pollutants, those with woody plants provide the most effective water quality protection for several reasons.

First, by providing a canopy, trees and shrubs reduce the velocity of raindrops and lessen runoff and soil erosion. Trees and shrubs also have longer, more complex root systems, which increase their ability to absorb nutrients and curtail erosion.

Native grasses also have complex root systems—especially compared to the root systems of lawn grass—but they are not as deep-rooted as trees and shrubs.

Lawns should not be considered part of the vegetated buffer. With their shallow roots, lawns are not particularly effective at absorbing and retaining water, especially during heavy rains. Consequently, they do not significantly filter out water pollutants.

The criteria for determining riparian buffer width include the value of the resource, the site and watershed traits, slope, intensity of adjacent land uses, soils, and desired buffer functions. From a water quality perspective, the most effective buffers are flat. When slopes are steeper, the width of buffers should be increased to allow more opportunity for the buffer to capture pollutants.

Stream Buffer Purpose and Recommended Width

Type of Water Pollution	Average Stream Buffer Width	Number of Studies Used in Calculating Desired Buffer Width
Erosion control	100-year floodplain, but at least 100 feet	Review article conclusion (Wenger 1999)
Flood control, includes channel migration ability	100-year floodplain	Review article conclusion (Castelle et al 1994)
Nutrient	100 feet (range 33–600 feet)	12
Ammonia reduction (78% reduction)	164 feet	1
Fecal coliform	129 feet (range 100–600 feet)	4
Nitrates in surface runoff	113 feet (range 33–279 feet)	5
Nitrates in shallow groundwater	168 feet (range 3–721 feet)	31
Nitrogen	87 feet (range 5–164 feet)	4
Pesticides	182 feet (range 164–200 feet)	2
Phosphorus	106 feet (range 53–200 feet)	6
Sediment	103 feet (range 30–300 feet)	19

Ellis, J.H. 2008. Scientific Recommendations on the Size of Stream Vegetated Buffers Needed to Protect Water Quality, Part One, The Need for Stream Vegetated Buffers: What Does the Science Say? Report to Montana Department of Environmental Quality, EPA/DEQ Wetland Development Grant. Montana Audubon, Helena, MT. June 2008.

Although vegetated buffers with woody plant species (trees and shrubs) and native grasses are both effective at trapping pollutants, those with woody plants provide the most effective water quality protection.

Lewis and Clark County has adopted waterbody setbacks and guidelines for vegetative buffers in their subdivision regulations to protect water quality and other natural resources. The development of these regulations relied on "A Planning Guide for protecting Montanan's Wetlands and Riparian Areas" July 2003 by Janet H. Ellis and Jim Richard for guidance. These County setbacks range from 50 feet to 250 feet and buffers ranging from 30 feet to 100 feet depending on the type of waterbody or wetlands. These regulations are one mechanism to reduce the impact development might have on critical water resources.

WETLANDS

Example of wetlands in the Helena area

A number of wetland areas might be affected by development in the Helena area. Wetlands are locations where the combination of soils, water, and vegetation produce swamps, bogs, and similar areas. Wetlands can improve water quality in a number of ways. Wetlands support vegetation that acts as a flood buffer and reduces erosion during floods. Wetlands store water during flooding and then slowly release the water, reducing peak flood flows and downstream flood damage. This water then infiltrates into the ground, providing recharge to aquifers. This ground water recharge can be slowly released back to adjacent surface waters such as streams, providing water during low flow periods. Wetlands improve water quality by trapping sediments and toxins, filtering polluted runoff, and absorbing excess nutrients. They use excess nutrients present in runoff and break down man-made water-borne contaminants, such as those from sewer systems and stormwater runoff.

Protecting wetlands is essential to protecting water quality. Increased development affects riparian areas and wetland, but establishing setbacks that limit development within a certain distance of a water body, riparian areas, or wetland can help protect these sensitive areas. For areas where it is not feasible to retain wetlands, relocating them could continue their beneficial effect on water quality. To preserve and maintain riparian areas and wetlands, these areas — including setbacks—could count toward a residential subdivision's parkland dedication.

Other mechanisms that could preserve wetlands and riparian areas include conservation easements to protect recharge areas and larger features and drainages; overlay zoning for sensitive areas; and an inventory of sensitive areas such as water bodies, riparian areas, wetlands, and watersheds so that they can be better protected. Preserving these sensitive areas can also help to protect wildlife and aquatic habitat dependant on the area watershed and preserve critical ecological areas.

AGENCIES AND ORGANIZATIONS

In the Helena area, several groups are involved in protecting and improving water quality:

U.S. Army Corps of Engineers regulates waters of the U.S., including some wetland areas. They also provide a wetlands delineation manual, which describes technical guidelines and methods to identify and delineate wetlands for purposes of Section 404 of the Clean Water Act. The U.S. Army Corps of Engineers does not have jurisdiction

over isolated, intrastate, non-navigable waters, so some wetlands in the Helena area do not fall within their jurisdiction.

The Montana Department of Environmental Quality (DEQ) is the lead state agency responsible for water quality and developing a wetland program for Montana. DEQ has chosen a collaborative approach involving the **Montana Wetland Council**, to develop and help implement the state wetland plan. The Montana Water Quality Act requires DEQ to develop Total Maximum Daily Loads (TMDLs) for streams and lakes that do not meet, or are not expected to meet, Montana Water Quality Standards.

The Montana Wetland Council works cooperatively to conserve and restore Montana's wetland and riparian ecosystems by implementing Montana's Strategic Framework. DEQ provides staff and leadership for this organization. The Council developed *Priceless Resources: Strategic Framework for Wetland and Riparian Area Conservation and Restoration in Montana 2008-2012*, which guides the Council and all involved in wetland conservation activities.

The Lewis and Clark County Water Quality Protection District (WQPD) was created to preserve, protect, and improve water quality within District boundaries. The WQPD is a the fee-assessed area that includes the areas that recharge the Helena Valley alluvial aquifer, including Helena, East Helena, and the surrounding drainages within County borders.

Lake Helena Watershed Group protects, improves, and maintains the watershed and promotes voluntary and cooperative resource management of the Lake Helena watershed.

The Upper Ten Mile Watershed Steering Committee works to improve water quantity and quality, fills gaps in the watershed water-quality database, and educates the public about the role of the watershed. The basin is home to nine of the state's top fifty problematic abandoned mine sites.

The Environmental Protection Agency (EPA) is responsible for clean and safe surface water and ground water. Their goals include assuring that the region's waters are safe for all people to drink and use for recreation, and that the quality of the Region's waters support the life that is expected to be in them. To achieve these goals the EPA works with states on TMDLs, oversees public drinking water programs, and requires compliance with federal standards through their permitting system.

Montana Department of Fish, Wildlife, and Parks (MFWP) is responsible for the management of the fish, wildlife, state parks, and other outdoor recreational resources of the state. Maintaining quality habitats including waterways, wetlands and riparian areas, are key to this management in Montana.

National Forest Service is working with the City to protect the Ten Mile watershed.

The City should continue to move toward maintaining and improving the area's water quality together with these and other groups.

The City, through its many functions, can influence the water quality in the Helena area. Reviewing and updating City regulations and design requirements to ensure that the latest information and technology is used will help the City comply with water quality standards. Reviewing its land use regulations, and revising them if necessary, to address development in areas with challenging physical and environmental characteristics, such as steep slopes, watercourses, drainage ways, and wetlands, and requiring mitigation of adverse impacts can also help maintain and improve water quality. The City could investigate conservation easements, water-body setbacks, overlay buffers, and incentives for maintaining and improving riparian areas and wetlands to protect sensitive waterways, recharge areas, and drainages. In addition, the City should develop policies and regulations establishing environmental standards and enforce those standards or allow an acceptable alternative approved by the City Commission.

WATER GOALS AND OBJECTIVES

Goals:

A. Provide an adequate and stable supply of safe and economical water to the Helena community.

B. Protect groundwater and surface water quality in the Helena area watershed for all users.

C. Reduce the per capita demand for water.

D. Reduce the water and wastewater treatment needs.

Objectives:

1. Maintain current sources of water and increase the City's access to new water resources to support current and projected growth and development.

2. Promote sustainable water availability for multiple uses of area waters, such as for recreational activities, forest health, wildlife preservation, and maintaining viable agricultural lands.

3. Encourage land-use change and development proposals that promote efficient use of City water infrastructure and resources.

4. Promote the efficient use and reuse of potable water.

5. Continue to invest in system upgrades and maintenance of the City's municipal water and wastewater network.

6. Coordinate the development of new, or expansion of existing, water and wastewater treatment capacity with Lewis and Clark County as necessary to meet the needs of a

growing population.

7. Protect and maintain the Ten Mile watershed and water reservoirs.

8. Protect ground water and surface water quality in the Helena area watersheds.

9. Encourage in-fill and full utilization of properties currently served by, or in close proximity to, City water and wastewater infrastructure.

10. Review ways to reduce nutrient discharges from the wastewater treatment plant and the stormwater system, including enforcement of the Stormwater Ordinance and erosion control requirements.

11. Promote reducing impervious surfaces, thus increasing infiltration through the soil, which helps regenerate groundwater and remove pollutants.

12. Work with the County on joint development (City/County) standards that promote future connection to City services.

13. Continue to authorize connection of County residents with failing septic systems or lagoons to City treatment facilities when compatible with this Growth Policy and the City discharge permit.

14. Establish and maintain an inventory of sensitive areas such as water bodies, riparian areas, wetlands, and watersheds.

15. Protect sensitive wildlife and aquatic habitat dependant on the area watershed and preserve critical ecological areas, such as wetlands, floodplains, and riparian corridors.

16. Minimize the effect of development in areas with watercourses, drainage ways and wetlands and require mitigation of adverse impacts.

17. Encourage the use of xeriscape landscaping, grey water, rain barrels, and other mechanisms to reduce demand on potable water and the amount of effluent.

18. Establish nutrient reduction programs to reduce wastewater treatment requirements for City treatment facilities.

19. Continue to promote water conservation techniques.

20. Monitor the increase of invasive species and promote programs that reduce their spread in waterbodies.