DRINKING WATER PROTECTION HANDBOOK

By George W. Johnson

(Back cover)

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- It is up to Little Elk Creek residents to protect our drinking water. As Pogo said, “we have met the enemy and he is us”.
- The manner in which you use your land has a profound impact on groundwater quality and the Little Elk Creek domestic water supply. It would be impossible or prohibitively expensive to rehabilitate or replace our wells if our water supply becomes contaminated.
- While Little Elk Creek drinking water quality is excellent, our three water supply wells are shallow and clustered together making them prone to surface and groundwater pollution.
- This Handbook discusses our drinking water and what you must do to protect it. A Colorado State grant is in place, and herein you will find cost sharing information to assist you in protecting our water supply by inspection and maintenance of your septic system.

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Little Elk Creek Drinking Water Protection Handbook

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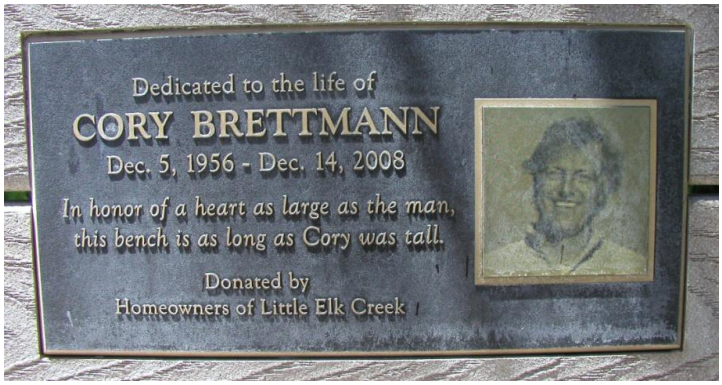
We dedicate this Handbook to Dan Harris. Dan has volunteered many years to providing us with the quantity and quality of drinking water we have all come to expect. We thank you Dan. You are our unsung hero.

We wish to remember Cory Brettman, a loving father and a favorite personality around the ‘hood.



Introduction

We are so fortunate to live in Little Elk Creek Subdivision! As such we need to be stewards of our place of residence. The Little Elk Creek Homeowners Association provides drinking water for its residents. The well water quality is high, but needs protection. The system includes three shallow wells and is underlain by an impervious shale layer. The shale and wells are prone to surface and groundwater pollution. Once contaminated, there is no easy fix.

A recent study identified potential drinking water pollution sources. As Pogo said, “we have met the enemy and he is us”. In other words we present the greatest threat to our own precious drinking water. Subdivision items that could compromise water quality include septic systems, augmentation ponds, residential practices, runoff from roads and fuel storage tanks.

Our drinking water source comes mostly from Little Elk Creek, Capitol Creek and the groundwater arising from the watershed of these Creeks. The existing surface and groundwater quality is high. The watershed is well protected, exhibits steep slopes, is mostly undeveloped and should remain undeveloped. A few large ranches pasture a few horses and cattle. There is a small amount of rural development. Forest management and certain geological features present potential hazards.

Funding for this Handbook and other measures to help protect our drinking water came from a previous grant that developed a Source Water Protection Plan (SWPP) for Little Elk Creek Subdivision. This plan identified the items listed above that could harm our drinking water. A Source Water Protection Implementation Plan grant was awarded. Funding came from the State of Colorado, Little Elk Creek Homeowners Association and the Pitkin County Environmental Health Department. Financial incentives are offered for various septic system and fuel storage tank items.

The Homeowners Board believes the implementation of a drinking water protection plan for Little Elk Creek can help to reduce the risks posed by potential contamination. This source water protection plan was developed to establish protection areas, prioritize source water protection concerns and identify local source water management approaches that can be implemented to protect our drinking water.

On January 5, 2010, the Little Elk Creek HOA Board nominated George Johnson, Dan Harris, Tom Gering, Beth Hoff Blackmer and John Ott to serve on the drinking water protection Steering Committee. George is a former Certified Soil Tester and former Lake Manager dealing with ground and surface water quality and quantity items. Dan has run the HOA water system for many years. Tom is a Master Plumber. Beth is the present HOA President. John has architectural experience and a licensed NAWT certified septic system inspector.

A few others helped in this protection process such as our drinking water expert Scott Leslie, Certified Water Operator for Environmental Process Control, Paul Hempel

Source Water Specialist for the Colorado Rural Water Association, Carla Ostberg, Pitkin County Environmental Health and seven additional Pitkin County Officials. We also thank Keith Edquist, Rett Harper, John and Carol Ott for their editing assistance and the Steering Committee and the Little Elk Creek Board for their help in protecting our most precious resource, namely the water we drink.

The Snowmass-Capitol Creek Caucus is made up of landowners and residents of the Snowmass and Capitol Creek drainage basins. They reviewed our plan and felt it to be educationally beneficial. The caucus makes recommendations to Pitkin County regarding all matters directly affecting the caucus area. The implementation plan adopted many of their goals and objectives.

Environmental Setting

Capitol Creek drains a portion of the Elk Mountains in the south central part of the Roaring Fork Watershed. Capitol Creek sub-watershed contains public land, most of which is designated wilderness, along with rural residential and agricultural land uses. This sub-watershed contains an area known as “Old Snowmass,” primarily a collection of residences that spreads out along the lower Snowmass and Capitol Creek Valleys from State Highway 82. The sub-watershed’s ecoregions include Alpine Zone, Sedimentary Subalpine Forests, Sedimentary Mid-elevation Forests, and Foothill Shrublands.

Capitol Creek has its headwaters at Capitol Lake (11,560 feet). Capitol Creek has 4 small tributaries including Little Elk Creek and flows into Snowmass Creek about a mile upstream of its confluence with the Roaring Fork River.

The Elk Mountains in the upper Capitol Creek drainages are steep, with slopes greater than 30 and 45 percent. Several peaks in these mountains form the divides between the drainages of Snowmass and Capitol Creeks including Snowmass, Hagerman, and Capitol peaks and Snowmass Mountain. Capitol Peak and Snowmass Mountain are both more than 14,000 feet in elevation. All of these peaks are formed by Tertiary intrusive rocks.

The glacial history of this area includes lateral moraines which are often deposited on bedrock surfaces that were sculpted by the glaciers and are very prone to sliding and slumping. The predominant geologic formation in this sub-watershed is the less steep Mancos Shale, which is very susceptible to erosion, leading to mudflows, landslides, and other slope instability problems. Gravels and alluviums in the lowest part of the sub-watershed correspond to the more gently-sloped agricultural lands.

Most of the developed area within the Roaring Fork Watershed including municipalities and private lands receives less than 25 inches of precipitation a year. Colder, north-facing slopes receive more snow and retain that snow well into the summer. Warmer

south-facing slopes receive less snow and that melts off more quickly, leaving snow-free habitat even in winter. The watershed's north-facing Elk Mountains receive 40 to 50 inches of precipitation annually.

Climate data have been collected at the Aspen climate station since the 1890's, establishing normals for temperature and precipitation. In this same time period there has been a 30 percent increase in greenhouse gases in the atmosphere primarily due to the burning of fossil fuels which has a direct effect on the local and regional climate. The future climate of the Roaring Fork Watershed is very likely to be warmer.

There is greater uncertainty about annual precipitation change. It is likely, however, that more of the annual precipitation will fall as rain rather than snow, influencing the timing and amount of spring runoff. This will alter and will impact the Roaring Fork Watershed's ecosystems, agriculture, and the socioeconomic patterns related to outdoor recreation. As regional demand for water increases, it is probable that warming will add additional stress to water availability in the Southern Rockies and the entire Southwest.

Throughout the Capitol Creek drainages, upland plant communities vary with elevation, aspect, and soil type. At Capitol Lake, uplands are characterized by alpine tundra ecosystems. Below the lakes, subalpine plant communities include dense stands of spruce-fir forests interspersed with aspen groves and herbaceous meadows. Montane plant communities begin at approximately 9,000 feet with aspen forests intermixing with spruce-fir forests, sage shrublands, and herbaceous meadows. As the geology becomes dominated by shale at around 7,500 feet, the upland plant community shifts to a mosaic of oak serviceberry and sage shrublands intermixed with pinion-juniper forest and, where soil moisture increases in drainages on north-facing slopes, by aspen groves and patches of Douglas fir forest. The subalpine riparian habitat is mainly dense spruce-fir forest with an understory of willow and alder. In flatter canopy openings, it is made up of sedge meadows and willow carrs. Upper montane riparian ecosystems are characterized by riparian aspen-alder forests intermixed with conifer forests, wet meadows, and willow carrs. Further downstream, in the Montane Life Zone, plant communities transition to narrowleaf cottonwood-blue spruce forests interspersed with wide willow carr communities dominated by thinleaf alder, willow, red-osier dogwood, twinberry honeysuckle, gooseberry, currant, and Wood's rose.

A typical mix of native mammals is found in the undeveloped areas of the sub-watershed. The Stream Health Initiative observed mammals or signs/tracks of species including marmot, pika, mountain lion, pine marten, elk, mule deer, black bear, and beaver. Also documented is the presence of bobcat, mountain lion, pine marten, long-tailed weasel, black bear, and fox, and small mammals such as montane, long-tailed, and Southern red-backed vole.

Bald eagle wintering range includes the lower part of Capitol Creek. The bald eagle is designated at the state level as threatened. The Colorado Division of Wildlife (CDOW) has identified occurrence of the following fish species: Colorado River cutthroat (CRCT), brook, brown, and rainbow trout; and mottled sculpin.

In the higher reaches of the Capitol Creek sub-watershed, upland habitat is designated wilderness (within the Maroon Bells-Snowmass Wilderness Area) that is in fairly pristine condition. However, historic and present grazing activities in wilderness areas have altered native plant communities, enabled the spread of weeds, and changed soil characteristics in portions of the sub-watershed. Trees and shrubs are dominated by mature-aged growth and seedlings and saplings have been reduced by grazing. The herbaceous layer is dominated by low to-the-ground or disturbance-tolerant species such as dandelion, wild strawberry, pussytoes, and clover. Recreational trails are heavily used by hikers and pack horses causing erosion and enabling the spread of weeds in some areas.

A fairly recent study compared wildlife diversity on recreational trails with diversity away from trails for the Hay Park Trail area in the upper Capitol Creek drainage. The results indicated that bird and mammal communities along trails differ from the communities more than 50 meters (165 feet) away from trails, with human tolerant species more prevalent near trails and sensitive species more prevalent away from trails.

Public lands that make up about half of this sub-watershed are federally managed. The upper portion is within the White River National Forest, managed by the U.S. Forest Service (USFS). Several Bureau of Land Management open space parcels lie within and below the Capitol Creek sub-watershed. The lower half of the sub-watershed is predominantly in private ownership.

Predominant land uses in higher elevation reaches include forest, grazing, and recreation. At lower elevations, land uses shift to agriculture including irrigated hay fields and pastures for grazing, and, to a lesser extent, rural residential use.

No developed campgrounds are found in the sub-watershed. Camping occurs intermittently during the summer and elk hunting seasons. USFS trails follow Capitol Creek and the Hay Park Trail traverses to Dinkle Lake. Capitol Lake Trail is a popular hiking/backpacking destination.

Horse riding is popular in the summer on the Hay Park Trail and at the Saint Benedicts Monastery.

Fishing is limited. Colorado River and Pikes Peak Cutthroat trout have been stocked in Capitol Lake.

Population within the Capitol Creek Watershed

Little Elk Creek Subdivision lies within the Capitol Creek watershed (drainage basin). The Subdivision has less than 200 people year-round population. The remainder of the upper Capitol Creek watershed has less than 100 year-round residents. Seasonal residency is very small.

It is estimated that 50% of the land area within the watershed is currently undeveloped and under Federal protection. The remainder of the watershed is currently zoned for some residential and mostly agricultural uses. Some developmental potential exists.

Potential water quality impacts upstream of the Little Elk Creek Subdivision wells:

- The six major land owners and ranch managers of the parcels greater than 500 acres within the Capitol Creek watershed were interviewed in 2011 regarding land use information pertaining to real and potential water quality impacts. They were specifically interviewed regarding point and nonpoint source contaminant sources, land use, animal units (cows and horses), herbicide use and developmental potential. About 10,600 acres were surveyed and represent the majority of the developed watershed contributory to Capitol Creek. None interviewed had any knowledge of point source contamination problems (superfund, hazardous waste, toxic release, wastewater discharge, mines or quarry sites; leaking storage tanks, confined feedlots and so on). They also had no knowledge of dispersed contaminant sources (quarries, failing septic systems, urban developmental issues and so on).

- Approximately 58% of the lands (6200 acres) are in pasture/hay and 42% (4440 acres) in mixed forest. About 1200 acres are irrigated in the summer.

- Four ranches are either fully developed or protected by or in the process of conservation easements. Those with current easements have the right to add three to seven more homes. This represents 58% of the lands (6200 acres). Two parcels are not protected by easement. This represents 42% of the land (4440 acres). It is highly unlikely that these parcels will be subdivided in the near future.

- Approximately 81 horses are present in the warmest three to six month period and nine reside year around. Approximately 937 cattle reside in the warmest three to six month period and 340 reside year around. The maximum density of horses plus cattle pastured occurs in the warmest three to six month period and averages around 5 acres per animal.

- All parcels use a limited amount of herbicides. Those herbicides include 2,4D, Banville, Round Up and Milestone. All of these herbicides are non-restricted, sold over the counter and generally not considered to be harmful to the

environment if used per label instructions. The herbicides are used on a spot treatment basis for noxious weed and brush control.

- Naturally occurring erosion due to the steep watershed occurs. Potential water quality issues can occur if fires remove the vegetation.

Groundwater and Ditches

Groundwater may be locally available in the Quaternary unconsolidated materials, and to a lesser extent, in the Ft. Hayes and Dakota/Burro Canyon bedrock units. Groundwater in the lower Capitol Creek area may be locally available in the Quaternary and Recent unconsolidated materials. The groundwater in these materials is locally and variably sustainable depending on climate processes, slope steepness and aspect, connection to creeks, and anthropogenic land use-- notably irrigation ditches. However, these shallow units are vulnerable depending on natural protective cover or from leaking into the aquifers from irrigation ditches or the creeks. Sufficient information about size, quality and flow patterns of groundwater aquifers is lacking.

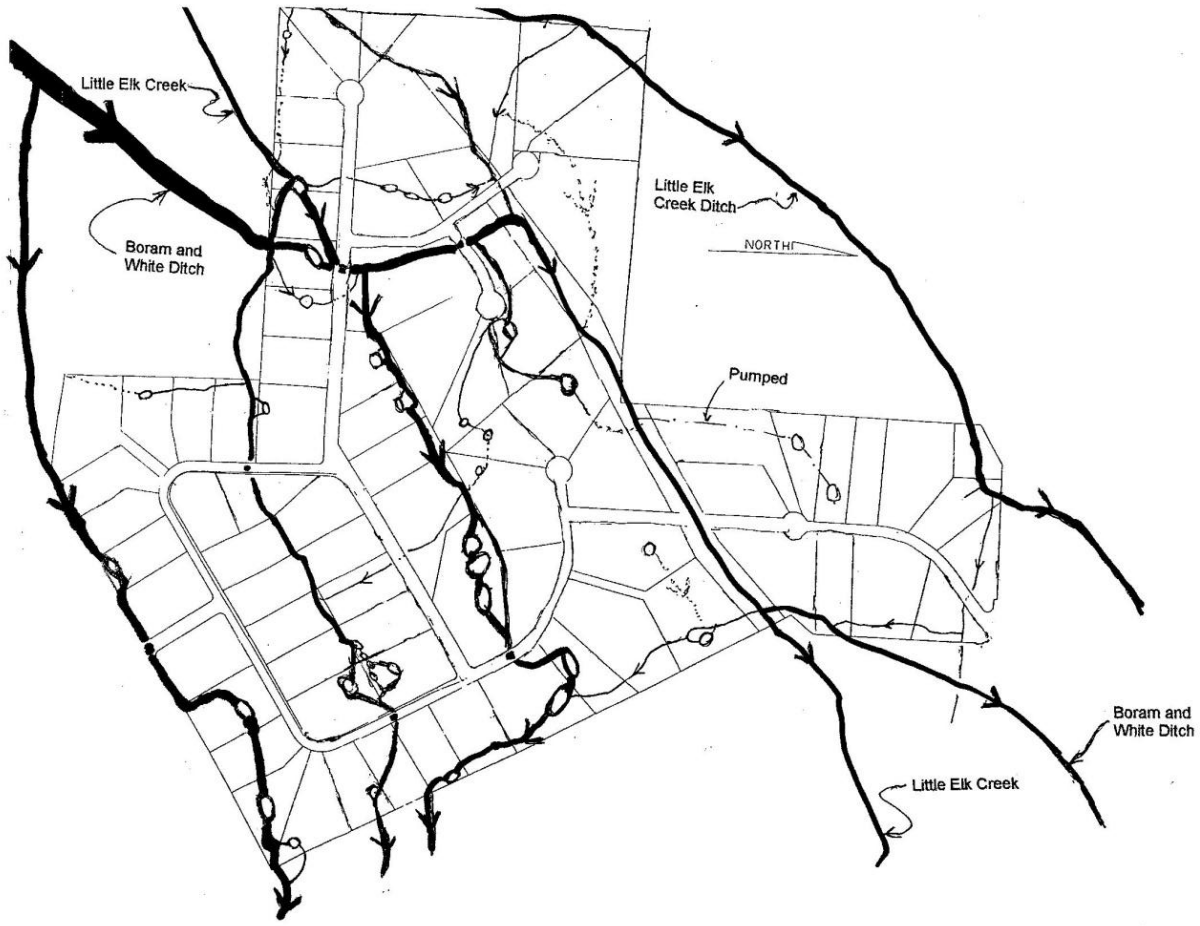
The underlying bedrock may be sustainable for smaller quantities of groundwater. However they are separate from the upper groundwater by a rather impervious layer of Mancos Shale.

Seven irrigation diversions occur off Capitol Creek of 10 or greater cubic feet per second (cfs). Many other diversions under 10 cfs have been adjudicated. Severe flow shortages in the late summer and early fall are rare because of irrigation return flow, springs, and voluntary agreements between water-right holders.

Boram and White Ditch as it enters the Subdivision

Two ditches serve the Little Elk Creek Subdivision. The Little Elk Creek ditch serves about 12 homes on the Subdivision's north side. It can be variable in flow due to others using it for irrigation and the Creek tends to decrease in volume towards the end of the summer. Other water users share this ditch with the Subdivision.

The rest of the Subdivision is served by Boram and White ditch. This ditch conveys much more irrigation water and has higher priority water rights than the Little Elk Creek ditch. Boram and White water mixes with the lower Little Elk Creek. Other water users share this ditch with the Subdivision. The Subdivision shares in the repair and maintenance of both ditches.

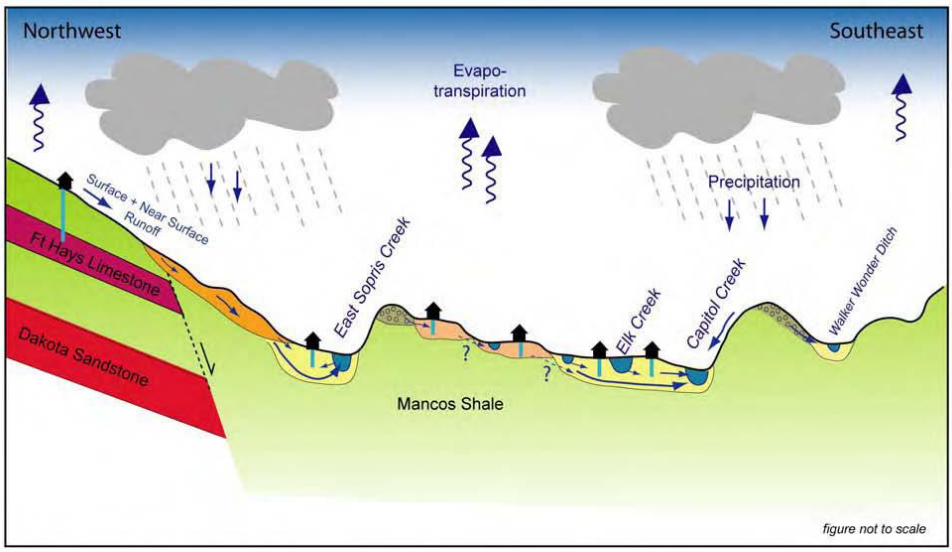


Little Elk Creek Ditch System

Sprinkler system pumps should be protected with a low flow shut off. Pumps can burn out if they run without water. Ditch water supply is variable because others take water out causing sudden and an unexpected volume decrease.

There are numerous ditches in the area. These are mostly unlined. When carrying water, the ditches may leak. The ditch system contains two types of ditches: 1) primary ditches, carrying water during most of the growing season; and 2) secondary ditches, carry water only during an actual irrigation cycle. The water leaking from the ditches may be used by vegetation or it may recharge the groundwater forming a local

groundwater mound. Ditch leakage appears to contribute significantly to the local water balance, increase the water table elevation, and alter groundwater flow directions.



Hydrologic Subsystem 4
Lower Capitol Creek (LCC)

Hydrogeology

Unconsolidated Units

- Qal - alluvium
- Qgf - fans and gravels
- Qm - moraine
- Qls - landslide

Bedrock Units

- Km - Mancos Shale
- Kms - Mancos Upper Sandstone Mbr
- Kml - Mancos Lower Sandstone Mbr
- Kmf - Fort Hays Limestone
- Kdb - Dakota and Burro Canyon
- LB - Lower Bedrock

apitol Creek Subsystem

In the past, because we did not understand how vulnerable groundwater was, we have been careless. Even today gasoline and other harmful liquids leak from underground storage tanks into the groundwater supply. Pollutants soak into groundwater from poorly constructed landfills or septic systems. Groundwater is polluted by runoff from fertilized fields, livestock areas, abandoned mines, salted roads and industrial areas. Few people realize it, but homeowners can contribute to groundwater contamination by dumping household chemicals down the drain or pouring them on the ground. Further, because groundwater moves so slowly, the contamination is likely to remain concentrated and close to the point where the pollution occurred. When contaminated, groundwater quality must be restored before it can be used.

What is poured on the ground today can end up in our drinking water many years later. We all have the responsibility to protect groundwater. Groundwater contaminated with bacteria, chemicals, pesticides, gasoline or oil can result in serious human health problems. Those who drink it or come in contact with it can suffer bacterial diseases, nervous system disorders, liver or kidney failure, or cancer. Feedlots, malfunctioning septic systems, and the overuse of farm chemicals can pollute groundwater with bacteria and nitrates. The health of people and animals drinking contaminated groundwater can be jeopardized.

Hydrology and Water Quality Monitoring

Our drinking water comes from Capitol Creek, Little Elk Creek and the groundwater. Little Elk Creek is a tributary to, and runs though the Subdivision and joins Capitol Creek below the Subdivision. Both these Creeks flow year around. Little Elk Creek has less pitch and is not as flashy or turbid as Capitol Creek.

Most of the Little Elk Creek annual flow comes from groundwater arising from irrigation practices and some of its warm weather flow comes from ditches above the Subdivision. No direct water quality data is available for Little Elk Creek. Its water quality entering the Subdivision should be similar to or better than Capitol Creek being that most of it is groundwater. However, it is from a more human impacted watershed. It is tributary to and its water quality is included as a small contributor to the Capitol Creek water quality.

Capitol Creek is about 12 miles long and has a few small tributaries. It is flashy and turbid for about two months in the spring because of its steep watershed and natural source erosion.

Capitol Creek has high water quality, no major pollution sources but has only marginal riparian habitat. Nutrient data is too limited to provide a detailed characterization of seasonal or spatial trends. Most of the nutrient samples exhibit generally low levels.

Capitol Creek exhibits very hard water. This hardness is indicative of the geology of the area where Capitol Creek is underlain by Mancos Shale.

Our Drinking Water Quality and Supply

The Subdivision only has a few lots yet to be developed. Outside the Subdivision, three homes use the Subdivision drinking water and one of those homes has another water tap that can be developed. As such, only about 10 more taps may be required.

A Consumer Confidence Report is issued annually for Little Elk Creek Subdivision's drinking water quality as required by the Colorado Department of Public Health and Environment. The wells are considered as groundwater under the influence of surface water. The water is tested for bacteria, organics, inorganics, turbidity, lead, copper, radionuclides, synthetic and volatile organic compounds and sodium.

The existing drinking water quality is high with no recent exceedances. Worthy of note is that the sodium, nitrate and nitrite forms are very low. Sodium is consistently less than 6/1000 than of the maximum contaminant level and the nitrogen forms is consistently less than 0.5 ppm, about 1/20

of the maximum contaminant level. This indicates that fertilizer runoff, erosion and septic system leaching is not a concern at this time. Sodium and the nitrogen forms tend not to be removed as they to move through the soil and into the groundwater. Also, selenium range is around 7 ppm, about 1/7 the maximum contaminant level. This indicates the watershed that is higher in selenium is not reaching the drinking water to any appreciable extent. The system has been granted an exemption for Glyphosate ("Round Up" brand herbicide), nitrite, cyanide and asbestos monitoring because they are not found in our water or because of very low values. As such, drinking water protection is warranted.

The Little Elk Creek Village HOA water system is operated by Little Elk owner Dan Harris. Environmental Process Control (EPC) monitors our well water quality in compliance with State regulations. Their office is located in Carbondale, CO.

Raw water is pumped from the three wells and is sent to the water treatment plant building where it is filtered through four 1-micron bag filters. It is then treated with chlorine per State regulations before it is again pumped up to a 100,000 gallon storage tank on the hill. From there it is distributed to the drinking water system's customers.

The Subdivision uses about 12,000 gallons per day as the base level for winter use. The wells can produce 15,000 to 20,000 gallons per day during a normal winter. Standard use in the summer is harder to estimate since use varies greatly. The wells can produce about 100,000 gallons per day in the summer. Usually water use peaks in late May and early June before the owners get their sprinkler systems on to the ditch water. Use in this period without leaks, can be as much as 40,000 gallons per day or more. Once mid-June hits, use drops slightly and levels off. In a good year, we might be in the mid 30,000 gallon range for most of the summer. However, we have had summers with consistent use in the 40,000 range. This higher use may be attributed to a leak or random sprinkler use. Higher usage usually starts to drop in late September.

Subdivision well head

The water system currently has the capacity of meeting it maximum daily demand of 151,000 gallons per day. Current estimates indicate that the average daily demand by the water system's customers is approximately 25,309 gallons per day, and that the average peak daily demand is approximately 37,466 gallons per day.

Using these estimates, the water system has a surplus average daily demand capacity of 125,891 gallons per day and a surplus average peak daily demand capacity of 113,734 per day.

Drinking water treatment building. Note the warning light and telemetry antenna on the building and the third augmentation pond in the background.

Using the surplus estimates above, Little Elk Creek Village HOA has evaluated its ability to meet the average daily demand and the average peak daily demand of its customers in the event the water supply from one or more of its water sources becomes disabled for an extended period of time due to potential contamination. The evaluation indicated that Little Elk Creek Village HOA may not be able to meet the average daily demand of its customers if as few as two of the water sources became disabled for an extended period of time. The evaluation also indicated that Little Elk Creek Village HOA may not be able to meet the average peak daily demand of its customers if as few as one of the water sources became disabled for an extended period of time or if leaks in the system occur. The ability of Little Elk Creek Village HOA to meet either of these demands for an extended period of time is also affected by the amount of treated water the water system has in storage at the time a water source becomes disabled. In the event of well failure, water could be hauled and put in the wet well.

Little Elk Creek Village HOA recognizes that contamination of its groundwater sources could potentially result in having to treat the groundwater and/or abandon the water source if treatment proves to be ineffective or too costly.

To understand the potential financial costs associated with such an accident, Little Elk Creek Village HOA evaluated what it might cost to replace one of its water sources if this occurs. The evaluation did not attempt to estimate treatment costs, which can be variable depending on the type of contaminant(s) that need(s) to be treated. The evaluation indicated that it could cost $18-25,000 in today's dollars to replace one of its

water sources. Imagine the cost and inconvenience if all three wells went down at one time.

The Subdivision has a water storage capacity of 105,000 gallons. This includes the water mains and a 100,000 gallon tank. The Subdivision has about 8,400 linear feet of water main. This does not include the line from the Subdivision to the storage tank. This line is relatively new (1991 or so) and the ductile iron pipe should not present a replacement issue in the foreseeable future. The lines within the subdivision have been installed at different times and are of different sizes. They are plastic but so far no repairs have been made on the lines. The HOA Board has established a capital reserve to fund water system replacement or repairs.

The water supply consists of four groundwater wells, one of which is capped as a reserve and used as a water level monitoring well. These wells are shallow, around 60 feet deep and are in close proximity to each other. They are drilled down to the top of the underlying and impervious shale layer. The wells are located in close proximity to three augmentation ponds, which help to stabilize the water table during the winter when the water table is the lowest. Two of the three pond surfaces are above the wellheads. These ponds are of concern because they probably are in direct contact with the water table. Surface or groundwater contamination in this area presents a real threat to drinking water.

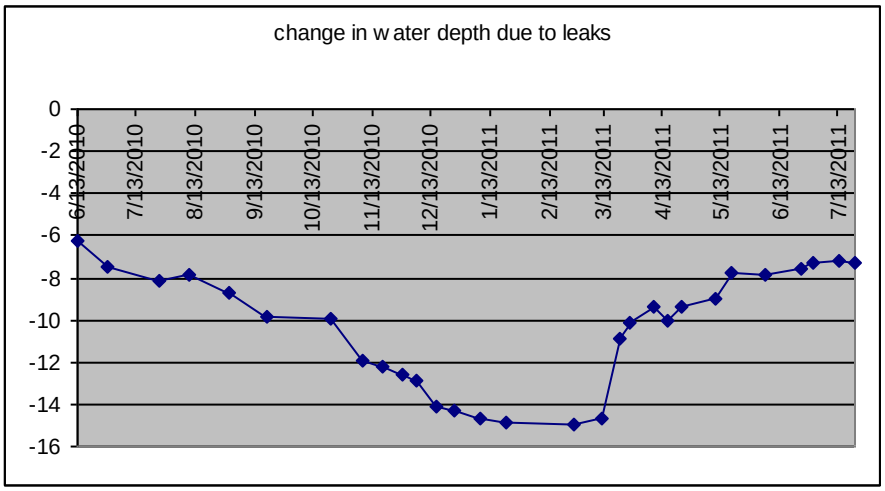
These ponds are fed by Capitol Creek via the Boram and White Ditch and Little Elk Creek itself. Capitol Creek via the Boram and White Ditch provides about 2/3 of that flow for the warmer five to six months. All the flow to the pond for the remaining six to seven months comes from Little Elk Creek, most of it being groundwater. We estimate that Little Elk Creek provides about 72% flow on an annual basis.

The water mains have not experienced any leaks. However, leaks have occurred in the household water service lines beyond the main. Remember, the homeowner is responsible for all their service line, including the area from the water main to the home.

Dan Harris (our hero) has recorded 34 leaks that have been repaired since 1994. Three homes have had multiple repairs. These are older houses with older piping. The range of leaks has been from lows of about 5,000 gallons per day to as much as 40,000 gallons per day. The smaller leaks are usually found by alert homeowners. The larger leaks are usually found in the winter when water surfaces. People have had leaks as large as 33,000 gallons per day and have not noticed a change in their water delivery. Mind you that this amount of water loss is almost three times the Subdivision's daily winter use!

For example, two homeowner water leaks occurred in the winter of 2010/2011. The leaks resulted in a situation where the water wells ran continuously and ultimately could not keep up with demand. Graph 1 shows the seasonal drop in the water table from June 2010 to April 2011. It exhibits a dramatic water table drop.

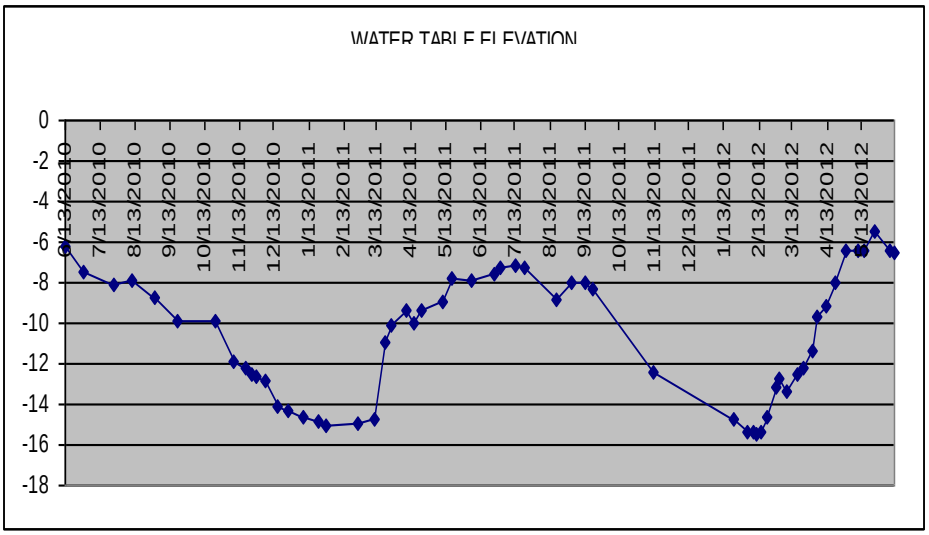
This drop corresponds to the period of the leaks and the water table recovery once the leaks were fixed. We do not know when the leaks started but the two leaks were estimated to be 19,000 gallons per day.



Water Table Elevation Change due to Leaks. Source: George Johnson

The leaks required that different sections of the water distribution system be shut down and monitored in order to find the errant section. Once identified, the individual homes are assessed. Not all homes have curb stops which when turned off, easily help detect an individual home service line leak. As such, it is imperative that our curb stops are properly operating.

The water table drops in the well head area during the winter. This causes the well production to drop which puts a tremendous stress on the pumps. Additional water flow to the augmentation ponds during the cooler months may help increase the water table around the wells.



Annual variation in Water Table Elevation. Source: George Johnson

The water table drops about 10 feet in the winter from the higher summer level. This indicates that the winter water supply is more from groundwater than influenced by the ponds. However, it is wise and prudent to consider protection of both surface and groundwater well sources.

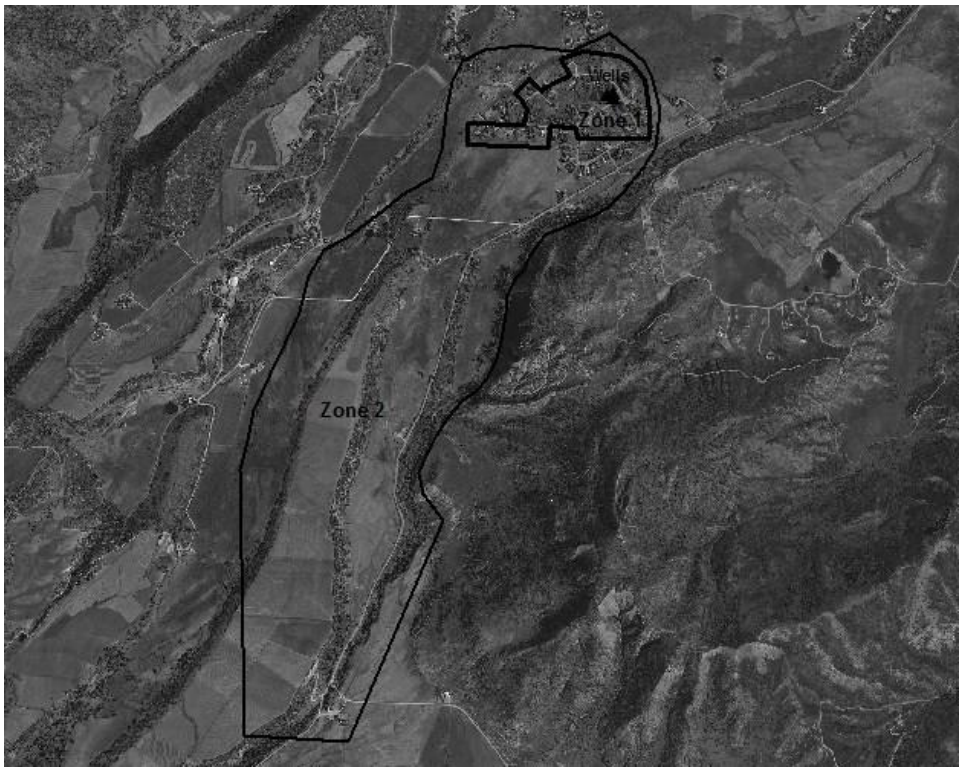
The 2012 dredging of the upper two ponds has been successful in raising the groundwater level about two feet. This should help reduce stress on the pumps and does speak of the connection of the surface water augmentation ponds to the groundwater.

It is anticipated that the HOA will continue funding the water system repair fund, install or find the missing curb stops, access the integrity of the water line segments, monitor individual well volumes and repair or replace poorly producing wells, investigate the possibility of augmenting the wells by treating and using surface water from the third pond in an emergency situation, install protective fencing around the wellheads and sample incoming water quality.

The Drinking Water Supply Protection Areas

The Steering Committee defined the drinking water supply protection area based on the geomorphology of the land, immediacy of the potential contamination sources to the source water, existing and proposed land uses, soils, water table and the type of potential contaminants.

Zone 1 Developed Lots of Greater Importance encompasses an area of approximately 60 acres and has 20 lots within the Subdivision. This area is of critical concern because of its proximity to the wells, high groundwater and poor soils for septic system applications. This includes within 1000 feet of Subdivision wells and augmentation ponds. Most of Zone 1 is currently developed with low density residential and is zoned for residential use. This zone contains a number of possible dispersed contaminant sources, but it is the septic tanks, roads, lawns, other residential uses and ponds that are of the most concern to the quality of Little Elk's water system and supply. The Steering Committee decided that Zone 1 septic systems, augmentation ponds, residential practices, water conservation, roads and underground storage tanks were the primary issues to be addressed by the Source Water Protection Plan.

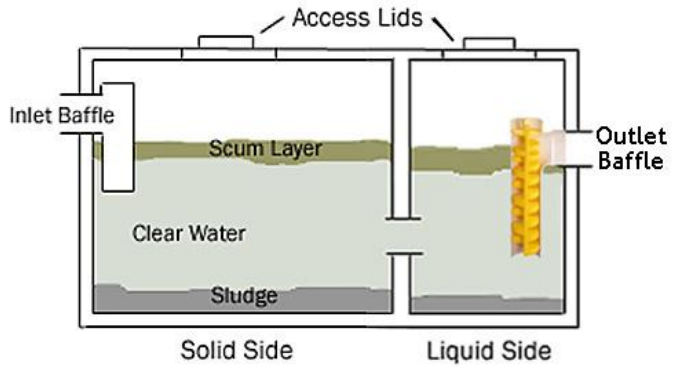


Zone 2 encompasses an area of about 800 acres. This area encircles Zone 1 and includes Part of the Subdivision and the area between Capitol Creek and Little Elk Creek just upstream of Little Elk Creek Village HOA subdivision. Zone 2 contains Subdivision development and several working ranches that graze cattle and horses. Some of these ranches also use their land to make hay. Some of the ranches have above ground fuel storage tanks which could possibly leak into the surface and/or groundwater if not properly maintained. It is the Subdivision development, fuel storage tanks, the roads, septic systems, pasture/livestock, residential development, roads and forest fire hazards and land use practices that are of most concern to Zone 2. They are a prevalent threat to our drinking water and deem attention. Other parts of the Implementation Grant will deal with the potential threats outside of the Subdivision.

Septic Systems

Approximately 22 million households, about 1/3 of the U.S. population use a septic system to treat their domestic wastewater. When a septic system is properly located, designed, installed and maintained, it serves as a simple, effective and economical domestic wastewater treatment system. Maintenance is the homeowner's responsibility and is the key to a long lasting wastewater treatment system.

The standard conventional septic system consists of a septic tank followed by a drainfield, also called a leachfield or soil absorption field. Wastewater flows out of the house and into the septic tank through the building sewer pipe. Once in the septic tank, most solids settle to the bottom of the tank to form a sludge layer. Grease and fats float and form a scum layer on top of the wastewater.



Septic Tank with an effluent filter

The primary function of the septic tank is to trap and store solids, most of which will be broken down by anaerobic bacteria (bacteria that live without oxygen). In a properly functioning septic tank, up to 80% of the solids will be broken down into gases and liquids. The liquid leaving the septic tank is usually cloudy and contains pollutants and disease-causing microbes. The liquid flows into the drainfield. The drainfield may be a network of perforated plastic pipes surrounded by crushed stone. The drainfield allows the wastewater to percolate through the underlying soil. Treatment occurs as it flows through the unsaturated soil before it reaches the groundwater.

The Subdivision septic systems vary in age from greater than 30 years old to installations and repairs that have occurred last year. There are various types of systems in the Subdivision determined by site constraints. Different types of systems are more appropriate than others for constraints such as high groundwater or close proximity to the Creek or ditch. The major system types in Little Elk Creek Subdivision include pipe and gravel, lined evaporation/transpiration beds, chamber systems and mound systems.

The systems serving older homes may be nearing or have exceeded their expected life. It is unknown how well the Subdivision systems are functioning. Failures are usually only discovered when effluent surfaces in the yard or backs up into the house. These failures may be in the form of leaking tanks or saturated soil conditions in the absorption area. Systems may be malfunctioning or not properly treating the wastewater if there is not 4 feet of suitable soil between the absorption area and groundwater.

In general, the water table flows in a similar direction as the land surface and toward open water courses. Most of the Subdivision lies above the wells, so failing systems or improperly treated wastewater could impact our drinking water quality. However, the lots along Alexander Avenue may be downstream of the well water supply aquifer and improperly treated wastewater would be intercepted by Little Elk Creek below the wells. There is a potential for improper treatment of wastewater because of the age of the existing systems, high seasonal groundwater, proximity of some systems to the Creek and ditches and existing subsoil conditions. In general, the water table is “perched” on a more impermeable shale layer below.

The parent subsoil is an outwash plain above an impervious layer of Mancos Shale. It contains a considerable amount of rock and rubble that makes it rather porous and reduces soil contact or purification time as the septic waste moves from drainfield to the

groundwater. Little or no purification occurs once deleterious materials reach the groundwater; only dilution occurs. If managed improperly, these residential septic systems can contribute excessive nutrients, bacteria, pathogenic organisms and chemicals to the groundwater.

One of the biggest enemies of properly sited septic systems is infrequent septic tank pumping. Pumping "as needed" will assure people that don't normally get their tanks pumped are attending to that need and those that pump frequently may save some money. Tanks should be pumped when the sludge and scum layer total greater than 20-25% of the tank capacity. The Subdivision has a piece of equipment available to measure the sludge and scum. Contact George Johnson (927-6535, George@trixieelting.com or 0159 Little Elk Creek Avenue) for this free service.

Pumping is not cheap but it is better to have the tank pumped when needed than to replace a failed drainage field. Replacing the field can be in excess of $30,000 in some cases. Tank pumping is in the $350-$450 range. The septic tank pumpers are listed in the yellow pages. One pumper, Excavation Services, is the only pumper that offers full septic system service, repair and replacement.

The septic systems located on lots bordering the ditches and the augmentation ponds are of particular concern (Zone 1, Developed Lots of Greater Importance). If these septic systems were to malfunction, unprocessed waste could contaminate one of the augmentation ponds or pass through the groundwater and contaminate the drinking water. These important systems should be checked every other year.

The more expensive replacement systems would be typical in Zone 1 being that homes have high groundwater and soils that are not great for treating septic wastes. These systems are more expensive to install and maintain. The newer systems are more complicated because they require an additional chamber to pump the effluent into the field, a drainfield that is expensive to install, installed at or near the ground surface that degrades curb appeal, require annual maintenance and inspections and additional electricity to pump effluent.

The Implementation Grant will pay Little Elk Creek owners $50 per septic tank pumping in any Zone 1 property. Submit the paid pumping bill to George Johnson and the HOA Board via Treasurer Bruce Anderson will make the reimbursement.

Septic system inspections should occur more frequently than tank pumping to assure system components are in place and working properly. A regular inspection process will assure all systems are working properly and any minor or major repair needs can be addressed.

The Implementation Grant will pay Little Elk Creek owners $50 towards an inspection. Submit the paid inspection bill to George Johnson to request reimbursement. A list of Inspectors can be found on the Pitkin County Environmental Health website. Subdivision resident John Ott (925-7444) is a certified Inspector.

Homeowners should consider installing effluent filters on the outlet of their septic tanks. They catch small floating particles and lightweight solids, such as hair, before they can make it out to the disposal area and cause trouble. Some models are also designed to capture suspended grease. This is relatively inexpensive and helps prolong field replacement. The Implementation Grant will reimburse Little Elk Creek owners $50 towards a paid bill submitted to George Johnson.

Please email George Johnson at George@trixieelting.com if you have your system pumped or inspected, add an effluent filter or make any other changes. We are data basing this information. Pitkin County Environmental Health is working closely with us on the Subdivision septic system program.

The three things that can kill a septic system are not pumping when needed, adding too much water and the introduction of harmful chemicals.

What one can do

- Pump the septic tank and have the system regularly inspected
- Add an effluent filter
- Do conserve water to avoid overloading the system
- Do not use your toilet as a trash can or poison your septic system and the groundwater by pouring harmful chemicals and cleansers down the drain. Harsh chemicals can kill the beneficial bacteria that treat your wastewater
- Do not use septic tank additives, commercial septic tank cleansers, yeast, sugar, etc. These products are not necessary and some may be harmful to your system
- Do not plant trees with tap roots on or near the drain field or add irrigation water to the drain field area
- Do not allow horses or vehicles to compact the soils on the drain field
- Do not use a garbage disposal. Their use leads to buildups of grease from meat scraps and bones, and insoluble vegetable solids such as cellulose. Install a septic tank outlet filter in your tank.
- Do learn the location of your septic tank and drain field. Keep a sketch of it handy with your maintenance records.
- Do keep your septic tank cover accessible for inspections and pumping. Install risers if necessary
- Do divert other sources of water, like roof drains, house footing drains, and sump pumps, away from the septic system. Excessive water keeps the soil in the drain field from naturally cleansing the wastewater
- Do not enter a septic tank. Toxic gases are produced by the natural treatment processes in septic tanks and can kill you in minutes.
- Do not dig in your drain field or build anything over it, and don't cover the drain field with a hard surface such as concrete or asphalt.
- Do not put water softener backwash in your system
- Report septic pumping or improvement activities to George Johnson

Augmentation Ponds

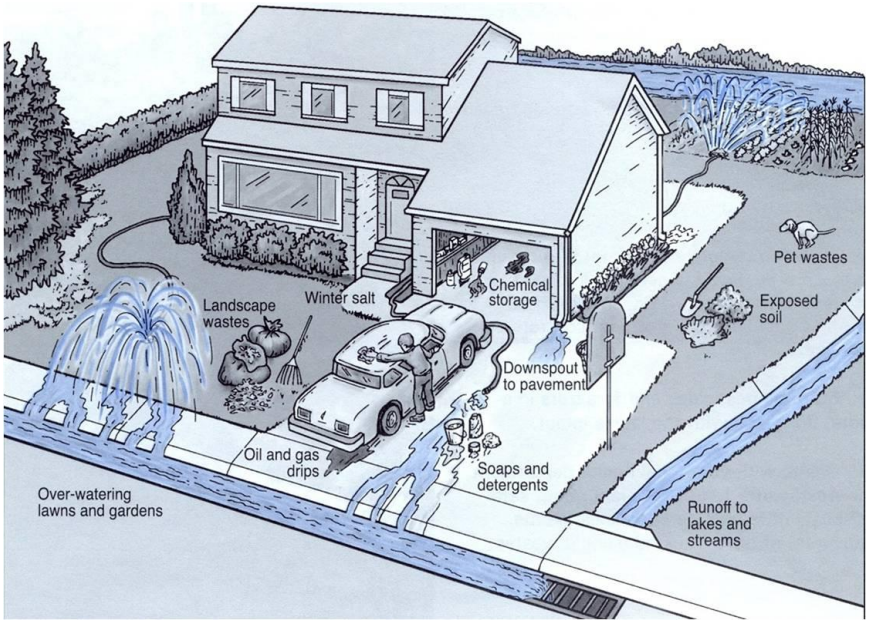
Three augmentation ponds are very close to the Little Elk Creek Village wells. One well in particular is less than 20 feet from the augmentation pond. These ponds help to stabilize the groundwater table. If these ponds were to become contaminated by poor land use practices, the effects could be catastrophic to the drinking water quality.

Center augmentation pond

The Zone 1 Developed Lots of Greater Importance land use activities located on lots bordering the ditches and the augmentation ponds are of particular concern. If the septic systems were to malfunction, unprocessed waste could contaminate the augmentation ponds, pass through the water table and contaminate the drinking water supply. If these areas are used by horses or treated with pesticides, herbicides or fertilizers, chemicals could run off into the ponds and contaminate our drinking water or groundwater. The landowners that own properties bordering the ponds should not use, or minimally use, these chemicals, add exclusionary horse fencing and create a “buffer zone” or small wetland along these ponds and ditches. Wetlands can naturally filter water and further protect the water supply. See the next section for tips on preserving augmentation pond water quality.

Residential Practices

What one does around the home can affect our drinking water quality. The figure to the right shows a few things that one should not do. Note that hard surfaces are direct conduits to the ditches or Little Elk Creek without any mitigation. Those things that are done on the grass areas at least have a chance for the soil and subsoil to mitigate these harmful items. Make water walk, not run, when runoff can occur. The slower water drains the greater the chance that purification can occur as it percolates through the unsaturated soil.



What one can do

- Never pour on the ground, down the drain, or toilet: cleaning supplies, paints, solvents, lawn and garden chemicals, gasoline, motor oil, antifreeze, or other waste chemicals. Participate in household hazardous waste collection events
- Keep fertilizers and pesticides off sidewalks and driveways
- Use alternative pest control measures first. If a pesticide is needed, apply it at the correct time and rate
- Store all pesticides and fertilizers in a safe, dry place with the labels intact. Apply according to label instructions and avoid runoff. Do not exceed recommended application rates
- Use only the amount of fertilizer that is recommended—more is not better and use only as a last resort
- Use slow-release forms of fertilizer
- Calibrate spray equipment for accurate delivery, and follow all label instructions
- Safely dispose of pesticide containers, rinse water and leftover pesticides without dumping them down a house drain or on the street
- Buy only enough chemical for the immediate job
- Store leftover products in their original containers
- Hire a licensed, professional service to apply chemicals
- Keep a record of pest problems and what worked to control them

- Instead of hazardous household products and pesticides, choose natural alternatives or Green Products. Read product labels carefully before purchasing to determine what substances they contain
- Properly dispose of drugs or medications into a sealable plastic bag and add kitty litter, sawdust, or coffee grounds. Seal the bag and dispose in the trash along with unused personal care products
- Clean up and dispose of pet waste by flushing down the toilet, seal it in a plastic bag and put into the garbage, or bury under 8 inches of soil. Pick up your pet waste when walking your dog
- Report spills from vehicles on the roadways in the protection area by calling "911" so that local emergency response teams effectively contain, remediate the spill and prevent it from entering the waterways
- Use planting beds or ground covers to reduce the amount of area in high-maintenance turf and concrete surfaces. Mulched planting beds and ground cover can be maintained with fewer pesticides and less water than high-maintenance turf
- Select native and Xeriscape plants that are well adapted to our climate and soils and that have minimal chemical and water requirements. • Compost leaves and other yard wastes
- Replace turf grass in inappropriate areas, such as dense shade, steep slopes or hard-to-water places. Instead, plant hardy groundcovers or ornamental grasses
- Establish a groundcover or mulch on all bare soil areas
- Install water-efficient sprinkler systems, which are directed away from paved surfaces
- Establish a chemical-free buffer strip of dense vegetation next to any ditch or creek that borders your property
- Use organic mulches, such as wood chips, in flowerbeds to reduce weeds and conserve water
- Water the lawn when it is dry rather than on a calendar schedule
- Reset the sprinkler clock after rain or cool weather
- Redirect down spouts from paved areas to vegetated areas and away from foundations
- Mow your grass up to 3 inches high and do so regularly to keep you lawn healthy. A healthy lawn requires fewer chemicals. Leave grass clippings on your lawn to recycle nutrients that reduce or eliminate the need for lawn fertilizer
- Apply only enough irrigation water to satisfy plant needs. Never over-water after pesticide or fertilizer applications
- Adjust sprinklers to avoid watering paved areas
- Begin with a "no mow" or "no graze" zone along your ditch or creek banks. Make your buffer as wide as possible
- Plant trees and shrubs in your buffer zone. They provide many long-lasting benefits and can be quite inexpensive to establish and maintain
- Using shrubs will give your buffer a quick start; many reach full size in just a few years
- Cover piles of soil with tarps to protect them from rain

- Keep grazing and other farm animals out of and away from the ditches or Little Elk Creek
- Compost yard waste. Don't bag lawn trimmings or throw them into the ditch or creek; leave them in place for effective recycling of nutrients
- Store firewood, trash and other materials well away from the ditch or Creek
- Fence horses away from the Creek and ditches. This is especially important in Zone 1
- Keep animals and their waste out of the ditches or Creek
- Store manure away from ditches or Little Elk Creek and manage grazing to maintain plant cover

Erosion and Sediment Control

Understanding the erosion process is essential to the development and implementation of effective erosion control plans. The key to erosion control is preventing the detachment of soil particles and reducing the volume of runoff. This is achieved through the use of practices such as minimizing land disturbing activities and maintaining vegetative covers or substituting for lack of growing vegetation by mulching or applying a compost blanket or erosion control mat.

Sediment control is trapping detached soil particles that are being transported and ensuring they are deposited on site to prevent damage to other properties or receiving waters. This is achieved by such practices as silt fence installation, compost berms or filter socks, and sediment control basins.

Construction site erosion and sediment control

- Implement an effective combination of erosion and sediment control on all soil disturbed areas
- Conduct site inspections prior to anticipated storm events, every 24 hours during extended storm events, and after actual storm events

- Perform repair and maintenance of best management practices as soon as possible after storm events depending upon worker safety
- Protect the construction site to prevent sediment-laden water from entering the ditch or creek
- Limit access to and from the site. Stabilize construction entrances/exits to minimize the track out of dirt and mud onto adjacent streets
- Protect stockpiles and construction materials from winds and rain by storing them under a roof, secured impermeable tarp or plastic sheeting
- Avoid storing or stockpiling materials near a ditch or Creek
- Phase grading operations to limit disturbed areas and duration of exposure
- Perform major maintenance and repairs of vehicles and equipment offsite
- Wash out concrete mixers only in designated washout areas at the construction site
- Set-up and operate small concrete mixers on tarps or heavy plastic drop cloths
- Keep construction sites clean by removing trash, debris, wastes, etc. on a regular basis and remove existing vegetation only as needed
- Schedule excavation, grading, and paving operations for dry weather periods, if possible
- Designate a specific area of the construction site, well away from ditch or creek for material storage and equipment maintenance
- Develop and implement an effective combination of erosion and sediment controls for the construction site
- Practice source reduction by ordering only the amount of materials that are needed to finish the project

Properly Installed Silt Fence

- Educate your employees and subcontractors about storm water management requirements and their pollution prevention responsibilities
- Control the amount of surface runoff at the construction site by impeding internally generated flows and using berms or drainage ditches to direct incoming offsite flows to go around the site

Water Conservation

Home water use varies considerably, depending upon the number of people in a household, plumbing fixtures, appliances, and other factors. The largest water users in the home are toilets, clothes washers, faucets, and showers. Remember too much water kills your septic system and overuse taxes our water supply system. Using the drinking water for lawn watering is against the Subdivision regulations.

Bathroom Water Efficiency

Toilets made before 1993 use 3.5 to 8 gallons per flush (gpf). High efficiency toilets manufactured after 1993 use 1.6 gpf or less. The date of manufacture of most toilets is on the underside of the tank lid. A family of four can save 14,000 to 25,000 gal/yr by switching from conventional toilets to the newer, more efficient ones. Additional water savings can occur by making sure your toilet is not leaking and that the flapper is working properly.

What one can do

- Install vacuum assisted, low-volume toilets
- Consider not flushing the toilet unless absolutely necessary
- Regularly check for toilet leaks by placing food coloring in your toilet tank Repairing leaking toilets can save more than 600 gallons of water per month
- Make sure your toilet flapper does not remain open after flushing
- Avoid using toilet bowl cleaners such as toilet tank tablets. These products affect the pH of water in your toilet tank and can cause leaks by damaging the rubber and plastic parts of your toilet and may harm the septic system

Showering Efficiency

Showerheads currently manufactured in the U.S. have a flow-rate of 2.5 gallons per minute (gpm) or less.

What one can do

- Install a low-flow showerhead if you do not already have one
- Keep your showers brief. A shower that lasts for five minutes using a low-flow showerhead uses 12 gallons of water. If possible, use a watch to time yourself while you are in the shower

- Turn off the water while you lather up with soap and shampoo
- Irrigate your indoor plants by placing a bucket in the shower to collect the water while waiting for it to warm up
- Check the flow rate of your showerhead by using a 5-gallon bucket and a clock. Turn the shower

on full and place a 5-gallon bucket under the shower for two minutes. A 2.5 gpm showerhead will fill the bucket up in that two-minute time frame

- Check and repair leaks in the tub diverter valve

Faucet Efficiency

- Install low-flow faucet aerators on all your household faucets. Some aerators can restrict flow to less than 1.0 gpm
- Do not run the faucet continuously while washing dishes and hands, shaving, or brushing your teeth
- Checking and repairing faucet leaks can save up to 140 gallons of water per week

Clothes Washing Efficiency

Conventional washing machines use between 35 to 50 gallons per load (gpl). The newer front-loading machines are more efficient and use between 18 to 20 gpl.

What one can do

- Run the washing machine only when you have a full load of clothes
- For lightly soiled laundry loads, use the shortest wash cycle.
- To avoid redundant washing, pre-treat stains on your clothes
- Select the minimum water volume per load if your washer has a variable water volume setting
- Regularly check washing machine hoses for leaks.

Dishwasher Efficiency

What one can do

- Install a high efficiency dishwasher machine
- Running the dishwasher only when it's full can save 1,000 gallons of water per month
- Running a full dishwasher usually uses less water than washing the same number of dishes by hand
- Because the drying cycle of most dishwashing machines uses 1,500 watts per cycle, air or hand drying the dishes is more efficient and less expensive

Check with CORE (www.aspencore.org) rebates for energy and water efficient toilets, washing machines and dishwashers.

Roads

Little Elk Creek Village HOA's drinking water supply protection area is served by a small network of paved surface roads. The Pitkin County Road and Bridge Department maintains the local road systems and the HOA maintains the Subdivision roads. During the winter season the county applies a salt-sand mix to de-ice the roads but the HOA does not apply these substances. De-icing compounds can contaminate both surface water and groundwater. Storm water runoff from paved and unpaved roads can deliver contaminants from the road surface into the nearby surface waters. Additionally, many spills occur on the highways and local roads. Chemicals from accidental spills are often diluted with water, potentially washing the chemicals into the soil and increasing the potential for drinking water contamination.

What one can do

- Repair or wash your vehicle at business that will provide the service in an environmentally friendly manner
- Walk, bicycle or car share
- Dispose of used motor oil, anti-freeze/coolant, tires, and old batteries properly. Many repair facilities accept these items. Or call the county government for recycling sites. Never dump used oil or anti-freeze on the ground
- Do not use de-icing chemicals
- Prevent road materials from entering the creek or ditches
- Call 911 to report a spill and contact the Manager, Keith Edquist

Little Elk Creek Roads

Underground Storage Tanks

There is one known underground fuel oil tank, but most if not all homes in Little Elk Creek Village possesses above or underground propane fuel storage tanks. A voluntary tank survey will be conducted of fuel tanks will be taken within the Subdivision including service address, type of material stored, above or below ground, cathodic protection, actively used and age.

Propane tank with cathodic protection

Propane presents only a minor water quality threat. Underground storage tanks are required to have cathodic protection. A free cathodic test will be done by contacting Ferrelgas at 866 289-9495 or Amerigas at 963-3113. A zinc or magnesium rod is installed outside of the tank and is sacrificed instead of the metal tank. The implementation Grant will pay Little Elk Creek owners $50 towards cathodic rod installation. Submit the paid bill to George Johnson for reimbursement.