

Flathead County Wastewater Study

INTRODUCTION

The purpose of this report is to provide a broad view of the risks and benefits that present sewage treatment and disposal systems pose to our water resources in Flathead County. We are also facing special challenges with respect to the high rate of growth and anticipated stricter wastewater controls as the Flathead Lake Total Maximum Daily Load plan is finalized and implemented.

HISTORY OF REGULATORY CONTROL

Prior to the Federal Water Pollution Act of 1972 (FWPCA) there was little national regulatory control of sewage treatment and discharge. Limited oversight was provided by the United States Public Health Service (USPHS) and by a few states, but for the most part, it was aimed solely at public health protection rather than addressing environmental concerns. Under the FWPCA, the Federal government created the Environmental Protection Agency (EPA) and assigned that agency the task of protecting air and water quality. Under the program for water quality protection, EPA developed water criteria describing physical and chemical parameters of concern and levels of these required for classified beneficial uses of the water. These criteria were then used to develop effluent limitations for inclusion in wastewater discharge permits issued under the National Pollutant Discharge Elimination System (NPDES) program. Authority to administer this program was subsequently delegated to the Montana Department of Health and Environmental Sciences (MDHES), now the Department of Environmental Quality (MDEQ). Originally, the NPDES program only regulated discharges to navigable interstate surface waters. However, it was determined that the state could exert control over all waters of the state, including groundwater. The wastewater discharge control program title was changed to the Montana Pollutant Discharge Elimination System and expanded to include control of discharges from underground disposal systems.

PERMITS AND LIMITATIONS

To implement the NPDES program, in 1972, the EPA began requiring all industrial and municipal facilities which discharge wastewater to apply for a permit. Limitations in the permits were based upon "Best Practicable Control Technology" (BPCT) for each individual facility, and/or the allowable concentration of toxic or nutrient constituents after dilution in the receiving water body. This continues today as the basis for permit limitations. Even though the individual discharges comply with the permit limitations, it has become clear that cumulative impacts of some discharge parameters, coupled with other sources contributing similar pollutants are becoming a problem. For these reasons, an additional basic criteria program has been developed. This is the Total Maximum Daily Load (TMDL) program. While most permit limitations will continue to be based upon BPCT and allowable receiving water concentration, the nutrient and toxic parameters will also be based upon what the cumulative limit is for a body of surface water (lake, river or drainage basin). The cumulative limit is the total maximum amount of a particular chemical which can be

added to the water body without causing problems with respect to toxicity or eutrophication. Each permit in a particular TMDL area will be assigned a portion of the cumulative limit for the TMDL area. This will assure that the TMDL area does not contain water that exceeds toxic levels or exhibit eutrophication. The State of Montana is a few years away from setting TMDL limits for Flathead Lake and its tributaries. The program is highly controversial, and higher authority guidance is slow in coming. Implementation is going to be a very slow and painful process. It will cost millions of dollars to upgrade each municipal sewage treatment plant in the Flathead Valley to meet the nutrient parameters.

SEWAGE TREATMENT AND DISPOSAL

There are two major categories of sewage treatment and disposal systems in Flathead County. Municipal and on-site systems. Most of the municipal systems employ complex treatment units and discharge directly into a surface water body. Most of the individual on-site systems are simple septic tanks followed by an underground disposal field. The water quality impacts from these two categories differ greatly. The direct discharging municipal systems have significant impact on surface waters while the on-site systems primarily impact groundwater. Therefore, the parameters of primary concern in municipal discharges are related to recreational use and eutrophication of surface waters. On the other hand, most on-site systems discharge to the groundwater and the primary concern is with the health effects of human consumption of water from wells. There exists concern for cumulative impacts of on-site systems on surface waters in areas of high density rural residential development in close proximity to surface waters.

MUNICIPAL SEWAGE TREATMENT FACILITIES AND DISCHARGES

Collection, treatment and discharge of municipal sewage was going on long before the FWPCA or EPA. As stated above, there was the USPHS and a few state agencies which provided control and guidance, but for the most part their help was in the form of recommendations, and aimed at public health measures. With the creation of EPA and the move towards water quality protection measures came changes that included controls, guidance and financial assistance. The EPA Construction Grants Program provided financial assistance to municipalities for planning and construction of wastewater collection and treatment systems. Initially these grants usually provided 85%, and in some cases 100%, of the total cost. Over time, the share percentage has steadily decreased and now is more of a low interest loan program. Municipalities in the Flathead that have received EPA financial assistance include Kalispell, Whitefish, Columbia Falls, Evergreen, Bigfork and Lakeside.

A Typical Municipal Wastewater Treatment Plant

A typical municipal treatment plant includes the following:

- 1 - head or inlet structure
- 2 - primary clarifier
- 3 - secondary treatment unit
- 4 - secondary clarifier

- 5 - sludge digester
- 6 - sludge disposal unit
- 7 - tertiary treatment unit
- 8 - final clarifier
- 9 - disinfection unit
- 10 - discharge structure

The head structure usually includes a bar screen or grinder to remove or grind up the large chunks. Debris removed from the bar screen is usually disposed of by hauling it to a nearby sanitary land fill (dump). From the head structure the sewage flows into the primary clarifier which allows settleable solids to collect in the bottom. These solids are also usually disposed of in a landfill. Overflow from the primary clarifier, goes to a secondary treatment unit.

The secondary treatment process consists of the biological treatment of wastewater by utilizing many different types of microorganisms in a controlled environment. In the biological treatment, a mixed population of microorganisms use the organics found in the effluent from the primary treatment as their food supply. Generally, the biodegradation of the pollutants is allowed to take place in a location where plenty of air can be supplied to the microbes. There are two major types of biological treatment processes: attached growth and suspended growth. The most common type of suspended growth process is the activated sludge system. This consists of two parts, aeration and a settling tank, or secondary clarifier. The aeration tank contains a sludge, which is a mixed microbe culture, containing bacteria, protozoa, fungi, algae, etc. After sufficient aeration time to reach the required level of treatment, the flow goes into the settling tanks or clarifiers. It is important that the culture will flocculate naturally, producing a settling sludge and a reasonably clear upper or supernatant layer. If the sludge does not behave this way, many of the solids will remain in the water leaving the clarifier and the quality of the effluent wastewater will be poor. Sludge is collected at the bottom of the clarifier and retained for a period of time to allow the microbes to become hungry (activated). Then most of them are recycled to the aeration tank to consume more organic material. Excess sludge is routed to the sludge digester and disposal unit. Activated sludge is probably the most versatile of the biological treatment processes capable of producing an effluent with little organic material remaining in the effluent.

In the attached growth system, flow from the primary clarifier is allowed to trickle down over natural (rock) or artificial (plastic forms of fabric) media where attached microbes grab their food (organic material) out of the passing liquid, leaving the water cleaner than it was when introduced to the unit. Normally the flow is cycled back and trickled over the media a number of times to allow multiple chances for the microbes to remove the organics. More passes equals cleaner effluent. Occasionally the layer of microbes gets too thick to hang on to the media and it sloughs to the bottom of the unit and is removed in the secondary clarifier and disposed of as sludge.

Some treatment plants include additional facilities specifically designed to provide for removal of constituents which are not sufficiently removed by the secondary treatment processes. These additional facilities are referred to as tertiary treatment.

Tertiary treatment is the additional removal of dissolved, colloidal and suspended solids by chemical coagulation or filtration for the reduction of nutrients. Nutrient removal refers to the treatment of the wastewater to take out the nitrogen or phosphorus, which can cause growth of algae or weeds in receiving waters. In nitrogen reduction, oxygen is required for nitrification in the primary aeration tanks. An aluminum compound is most commonly used for phosphorus removal and the solids, which are produced, can be settled out with other sludge. There is also a biological process for phosphorus removal, which depends on designing an activated sludge system in such a way as to promote the development of certain types of bacteria, which have the ability to accumulate excess phosphorus with their cells. For treatment plants, which are required to discharge only very low concentrations of total phosphorus, it is common to have a sand filter as a final stage to remove most of the suspended solids, which may contain phosphorus.

Disinfection, usually the final process before discharge, is the destruction of harmful microorganisms, disease-causing bacteria. The most commonly used disinfectant is chlorine, in the form of a liquefied gas or in the form of a solution of sodium hypochlorite, the same as common household chlorine bleach. The other commonly used method of disinfection is ultraviolet light. This is becoming more popular because of the increasing complications associated with the use of chlorine. A more powerful disinfectant is ozone, an unstable form of oxygen. Ozone is consumed very rapidly and leaves no residual as those produced by chlorine.

The discharge structure is where the rubber hits the road. It is the unit where the effluent is delivered into the receiving water. It may be as simple as the end of a pipe or it may be some type of a dispersal unit to provide better mixing with the receiving water.

Municipal Wastewater Treatment Plants in Flathead County

Every community must find ways to treat its wastewater to levels that protect public health and water quality. We will be looking at each (POTW) publicly- owned treatment works and individual on-site wastewater systems.

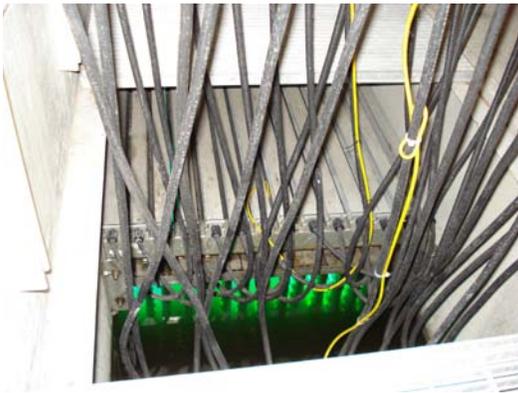
Flathead County has three municipal wastewater treatment plants, Kalispell, Whitefish and Columbia Falls. There are three Wastewater Treatment District facilities, two of which treat their own wastewater, Bigfork and Lakeside/Somers County Water and Sewer. Evergreen County Water and Sewer District is contracted with the City of Kalispell for their treatment.

Municipal Wastewater Treatment Plants

Kalispell's wastewater treatment plant is currently the largest of the three. It is a tertiary treatment plant. It is permitted and capable of processing 3.1 million gallons per day (mgd) and averages 2.79 mgd. (See Appendix on 2007 flows).The

Advanced Wastewater Treatment and Biological Nutrient Removal Facility began operation in 1992 to protect Flathead Lake, Kalispell accounts for 59 percent of the municipal load in the watershed. There are currently seven certified operators, four of whom respond to calls. The plant has received numerous awards for their operation and maintenance. The plant reached eighty percent of that capacity about four years ago. It has an outstanding removal of solids, nutrients and fecal coliform, all without the use of chemicals. The plant uses a biological removal treatment process with suspended growth for the phosphorus removal process. The plant is currently in an expansion phase. The current expansion should be completed by June, 2009, and will be able to process 5.4 (mgd). The improvements will also add a biological odor control system. Plans still exist to expand capacity to 7.2 mgd in the future, according to Joni Emrick, Water Resource Manager.

The sewage treatment plant services approximately 19,000 customers. Flow enters the plant in a 36-inch diameter pipe from the City system off Airport Road. The influent flows through the headwork's plant where a 1-inch bar screen removes rags and other debris. The liquid portion is pumped to the primary clarifiers where grit and solids are removed and settling in the basin. The effluent flows into the bioreactors, which consist of 11 cells in series. In the bioreactor tanks, anaerobic and aerobic zones are created to maximize nutrient removal. The bioreactor effluent flows to two circular secondary clarifiers and then through an upflow sand filter, a continuous backwash design.



The filtered effluent flows through an ultraviolet disinfection system and then is re-aerated before it is discharged to Ashley Creek and to Flathead Lake.

The primary sludge is pumped to two belt filter presses for dewatering. Waste activated sludge is pumped to two dissolved air flotation thickeners. Waste activated sludge flows to the gravity thickener and then returned to the fermenter, then pumped back through the filter presses.



The sludge is then loaded onto a truck (20 yds.) once a day and brought to Glacier Gold Composting Plant in Olney. Here the sludge is mixed with wood chips, composted and sold as gardening soil. If Glacier Gold is unable to take the sludge, the Flathead County Landfill will take some of this sludge during early morning hours before it is open to the public.

Bioreactor addition



Kalispell's \$21 million expansion



Treated effluent discharging into Ashley Creek



Kalispell's bioreactor cells (nutrient removal)

Whitefish is the second largest city in Flathead County. The city's wastewater treatment plant (WWTP) is located south of town along side the Whitefish River. Whitefish is currently trying to obtain their discharge permit from Montana Department of Environmental Quality (MDEQ) which expired in 2006. It was permitted for 1.25 mgd, but averages .850 mgd (see Appendix for 2007 daily flows). The sewage plant serves approximately 6,000 customers. There are currently two full time operators for the three partially mixed aerated lagoons. This facility is built on 40 acres. In 1979, the lagoons were built and designed for a capacity based on 1.25 mgd on an average daily flow. In 1986, Whitefish made improvements to the main lift station and a phosphorous removal process using alum was added after the facility's aerated lagoons. In 2002, the lagoons were upgraded with sludge removal from cell #1 and new aeration diffusers. This summer they will construct a new

building that will house an automated screen pretreatment process and plumbed for bypassing the main lift station. This will remove solids and stringy materials from raw wastewater and will de-water and containerize the materials for disposal. As it is now, the pretreatment is manually operated and cleaned with a rake and 2 inch bar screen. This will allow temporary bypassing for needed inspection, cleaning and maintenance of the wet well. Failure to have redundancy in the primary pumping system could result in a bypass to the Whitefish River. The lift station pumps raw wastewater into the aerated lagoon system. The lagoons are designed to provide secondary treatment of the wastewater prior to the flocculation clarifier that further polishes the wastewater effluent, including the reduction of phosphorus. The expanded project will include construction of another flocculation clarifier, similar to the existing clarifier, where phosphorous removal process will be redundant. In addition, it will allow necessary maintenance and repairs on the existing clarifier. Improvements to the lagoons are needed to address the erosion problem. A proposed replacement of the aerated lagoon system with an activated sludge facility (similar to Columbia Falls facility) would be necessary to allow compliance with the anticipated changes in the discharge permit. The sludge stored in the cells must eventually be removed. An estimated volume of 11 to 13 million gallons of sludge slurry is pumped from cell #1 to a drying bed, constructed on site. The retention time is approximately 25 days. Facilities planning for system improvements are recommended when future effluent standards (TMDL) become available. The treatment facility currently does not provide disinfection of the wastewater effluent. It is likely that more stringent bacterial standards will be imposed in future discharge permits.

Aerial view of Whitefish's treatment plant and lagoons





Lagoons in Whitefish

Columbia Falls treatment plant is located along the Flathead River by the Montana State Veterans Home. They are permitted for 0.550 mgd, but average 0.350 mgd. The sewage plant serves approximately 4,000 customers. It is an activated sludge, biological system with tertiary treatment. Both nitrogen and phosphorus can be removed through biological means, typically through the aeration basin for this process. This includes zones of no oxygen (anaerobic) and chemically treated oxygen, as well as aerated (aerobic) zones. The plant currently uses alum, a chemical precipitant in a flocculating clarifier for additional phosphorus removal. The plant was upgraded in 2000, when they added two aerobic digesters, a sludge thickener and sludge de-watering (belt press) to allow for land application or composting. There are currently eight lift stations that are maintained and operated by the City and one that is owned and operated by the Meadow Lake County Sewer District. The Meadow Lake lift station began pumping flow to the city in 1985 under a 40-year agreement in which they are allowed 1/3 of the current plant capacity (0.183 mgd). The station currently averages 0.043 mgd of discharge to the city. (see Appendix for 2007 daily flows).

Disinfection of the effluent is required during the warm months of the year when people may be in contact with the receiving waters. Disinfecting is accomplished by adding gaseous chlorine to the wastewater and allowing time for contact prior to discharge into the Flathead River. It is likely that year-round disinfection will be required in the next permit. Solids are pumped from the Sludge Storage Basin (500,000 gallons) to a belt press for de-watering and then loaded into a manure

spreader and land applied twice a year.



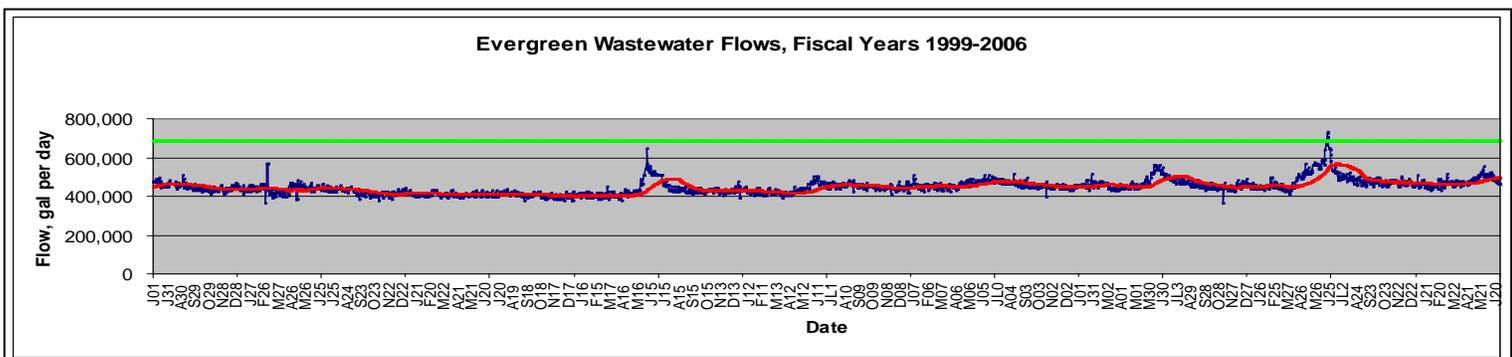
Columbia Falls 550,000 gallon aeration basin for biological treatment



Columbia Falls sludge storage basin. During winter months before belt pressing and land application.

Districts

Evergreen Sewer and Water District contracts with the Kalispell WWTP to treat their wastewater. Their contract limit is 682,000 gallons per day. In 2007 their daily average was 456,134 gpd. Evergreen owns and maintains their own force mains and lift stations. They currently have 25 lift stations; the main station is located behind Snappy Sports Senter. Evergreen is unique as it employs both conventional and STEP collection methods. Generally, residential areas use a Septic Tank – Effluent Pump (STEP) collection method and commercial areas use conventional methods for collecting sewage for treatment. The STEP collection method uses a septic tank for pretreatment and only conveys the sewage effluent for treatment. Septic tanks maintenance is the responsibility of the sewer district. The conventional collection and conveyance portion collects all components of the sewage for eventual treatment at the Kalispell Treatment Works. Evergreen District has been in the planning process to develop a treatment plant for the past several years. Although many options are under consideration, the Evergreen District has obtained an option on some county-owned property along the Stillwater River south of Kalispell as a possible treatment facility site. There are an estimated 8,200 people in the Evergreen District.



The spikes indicate stormwater run off

Bigfork's Sewer and Water District was created in 1984. In 1987, the existing facility was constructed. It serves the unincorporated community on the northeastern shore of Flathead Lake. It services approximately 1300 residential and non-residential connections. Their discharge permit is for 0.50 mgd, but average about 0.215 mgd (see Appendix for 2007 daily flows). The existing facility is a tertiary (advanced) treatment facility utilizing synthetic media trickling filters for secondary treatment and chemical precipitation phosphorus removal, pressure sand filters and ultraviolet disinfection for advanced treatment. With trickling filters, the microorganisms are attached to a fixed surface forming a biological film. The bacteria break down the organic waste and remove pollutants from the wastewater. Since the trickling filter is an aerobic process, no serious odor exists.

Bigfork is currently upgrading their facility with a new headworks building where screening, grit removal and washing, influent flow measured and odor is controlled. The main lift station will also be upgraded with the addition of a third pump and replacing the two existing pumps and controls. Their room for expansion is limited on the 1.37 acres along the Swan River. The facility is well maintained, and consistently meets its discharge standards. From March to November of each year, a sludge truck removes the stored sludge to the off-site sludge storage facility. The sludge that is generated by Bigfork is disposed of by subsurface injection into approximately 20-30 acres/year on 317 farmland acres north and west of the District.



Bigfork's expansion adjacent to a New condominium complex

Lakeside/Somers County Water and Sewer Districts are located on the west shore of Flathead Lake. Lakeside Sewer District currently provides sewer collection service to 1,165 equivalent dwelling units (edu's). Of those about 935 are located in the community of Lakeside and the remaining 240 in the community of Somers. Somers has its own sewer district, although it doesn't have a treatment facility. They pay Lakeside Sewer District to treat their sewage. Lakeside/Somers combined daily average flow is 0.165 million gallons and utilizes a STEP collection method. The Lakeside District owns and operates the treatment facility. Aerated lagoons and land application using spray irrigation treat sewage effluent. They currently are not required to have an MPDES permit because they do not discharge into any surface waters.

The existing treatment facility is located one mile north of Highway 82 and one mile east of Highway 93. The facility consists of two aerated treatment lagoons and two larger ponds for wintertime storage of treated effluent. Detention time is approximately 75 days to move that much flow through the two ponds in series. Disposal of the effluent is accomplished through a slow rate land application (irrigation) system located to the north and west of the ponds. Each treatment lagoon has a capacity of approximately 5.2 million gallons (mg), and is sixteen feet deep.



Each lagoon includes six surface aspirators that provide aeration and mixing for treatment of raw wastewater. Much of the treatment occurs naturally, but the use of aeration to add oxygen to the wastewater makes the treatment more efficient, so that less land area is necessary. The two larger storage ponds, one being the “Lakeside Pond” located to the north of the treatment lagoons (cells), has a storage capacity of 47 mg. The “Somers Pond” to the north of the Lakeside pond has a storage capacity of 24.0 mg, each are eighteen feet deep. These ponds are necessary to store the effluent during the winter months when land application cannot be used. The sewage effluent is applied to land utilizing alfalfa, hay or barley as the receiving crops on the 160-acre parcel to assist with the uptake of nutrients. In a 24 hour period, 1.2 million gallons of effluent can be applied to the land. After land application they are required by their DEQ permit to wait 3-days before applying again. The District works closely with the farmer that tends the crops. The District also owns an additional 120 acres of land adjacent to the existing ponds that will be used for future expansion of the facility.



Land application using spray irrigation for Lakeside/Somers District

Lakeside County Sewer District Biosolids (sludge) accumulations at the Lakeside/Somers lagoon ponds were measured in inches last summer. At that time, the sludge accumulation in the bottom of the ponds was six inches. The District has never had to remove the sludge in the twenty years of operation.

GROWTH

If the existing trend continues, Flathead County will have 120,000 residents by 2020, says Rich Moy, Chairman of the Flathead Basin Commission

Kalispell has been annexing or is preparing to annex 2.7 square miles to the north and northwest. These major subdivisions which developers plan to build thousands of homes, townhomes and commercial businesses include the Wolford's Glacier Town Center with various types of business and residential zoning on 485 acres. Silverbrook Estates, 2.0 miles north of Kalispell, is proposing 466 single-family homes, 114 townhouses on 330 acres and 18 acres for commercial development. Valley Ranch, south of Ponderosa Subdivision and to the north of the Town Center annexed 81 acres. The preliminary plans have yet to be reviewed. The Starling Subdivision, a site west of the new Glacier High School, is one-square-mile where 3,000 homes are proposed over the next 20 years. Bluestone Subdivision, 85 acres on section 36, west of the Kidsports Park, is proposing 569 dwelling units. Willow Creek Subdivision, to the southwest off Foy's Lake Road and Meridian, proposes 531 dwelling units that have preliminary plat approval. School Addition, south of Kalispell, has since been serviced by sewer and water and services mainly commercial businesses at this time.

Since Kalispell's growth boom began in 2002, it has added an average of almost 336 new homes a year. "The number of homes counted in a final plat doesn't necessarily mean all of them will be built. All of these projects are not going to be built out right away", says Tom Jentz, City Planning Director. If the proposed developments were to be built out, we are looking at over 5,000 dwelling units, not including the commercial lots.

See map in appendix for Kalispell's planning area showing anticipated areas of expansion

Whitefish City is considered a resort community offering both summer and winter recreation and is experiencing rapid growth. Whitefish is the second largest city in Flathead County and 15th most populated in Montana. There is significant seasonal fluctuations in water demand due to the visiting population, some due to second homes that are not occupied year-round. In the period between 2000 and 2005 the City experienced a 27% growth rate. The city's current population is approximately 6,000. Part of the growth was due to annexation of developed areas. Today the economic growth is from tourism, recreation, retirement, second homes and some people who telecommute from their homes in town and own business interests elsewhere.

See map in appendix for Whitefish's planning area showing anticipated areas of expansion

Columbia Falls grew by 24 percent from 1990-2000. Most new customers are residential consumers of both water and sewer utilities. The City's sewage facility serves a population of close to 4,000. The proposed 132-lot Columbia Range

Subdivision, across Flathead River is being annexed into the City and the Developer would pay for the costs of extending the sewer main across the Highway 2 E bridge.

See map in appendix for Columbia Fall's planning area showing anticipated areas of expansion.

Bigfork is considered a summer resort community and is the fastest growing area Flathead County. The source of this growth has been a combination of the rapid residential seasonal development in the area and District boundary expansion. The estimated number of residential sewer connections in the District has increased by 200 from 2000-2005. Currently, the 320-lot Saddlehorn subdivision has been approved by the District for connection to the sewer system in a number of phases. There are also 547 additional lots that are within the current District boundary and has been approved by the District for connection. This does not account for any additional connections as a result of further subdivision, or service area boundary expansion.

See map in appendix for Bigfork's planning area showing anticipated areas of expansion.

Lakeside's existing community is predominantly residential with the commercial uses concentrated along Highway 93. The planning area includes developable lands between Somers and Lakeside and in the vicinity of the existing wastewater treatment facility. The Eagle Crest development is currently under construction to the south of Lakeside, and includes approximately 1,000 residences at full build. The Bear Meadows development, if constructed, would add approximately 400 residences to the system. The Cooper Farms development is proposing 800 residences adjacent to the facility. This does not account for any additional connections of further subdivision, or service boundary area.

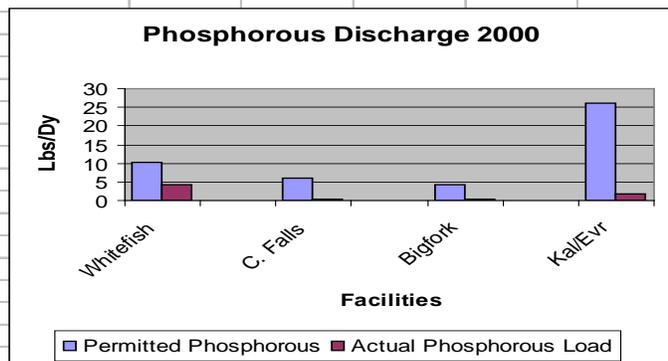
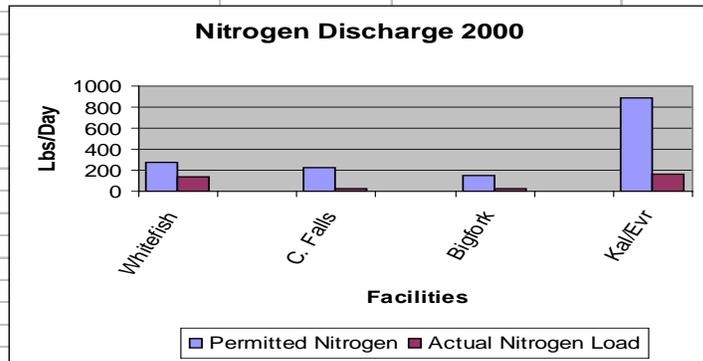
See map in appendix for Lakeside's planning area showing anticipated areas of expansion.

Hungry Horse Villages is proposing to create 132 dwelling units on 74 lots. The developers are proposing a central wastewater treatment system in place of additional individual septic systems. The system will utilize an advanced activated sludge treatment process with membrane filtration, housed in an above ground facility. A groundwater discharge permit is being obtained from MDEQ to introduce up to 0.305 mgd. This system will be designed to accommodate the possible connections of the Hungry Horse Community, if desired. Though the plant is ultimately expandable to accommodate the community, a thorough study would need to be completed.

Bigfork, Evergreen and Lakeside/Somers Sewer and Water Districts are the three main districts that lie in Flathead County that are not categorized as municipal treatment facilities. Other smaller districts serve their own subdivision. Fox Hill Estates, Glacier Horse Ranch, the proposed Hungry Horse Villages, and Cove Creek Ridge Subdivision are examples of these smaller districts.

Permitted nutrient loads from the WWTP and actual loads in pounds/day

Facility Name	Permitted Load *		Actual Load *	
	Total Nitrogen (N) lbs	Total Phosphorous (P)	N	P
Whitefish	280	10.4	137	4.1
C. Falls	220	6	26	0.47
Bigfork	152	4.2	26	0.3
Kal/Evr	890	26	167	1.8



Phosphorus loading into Flathead Lake before and after the ban on phosphates in the Flathead

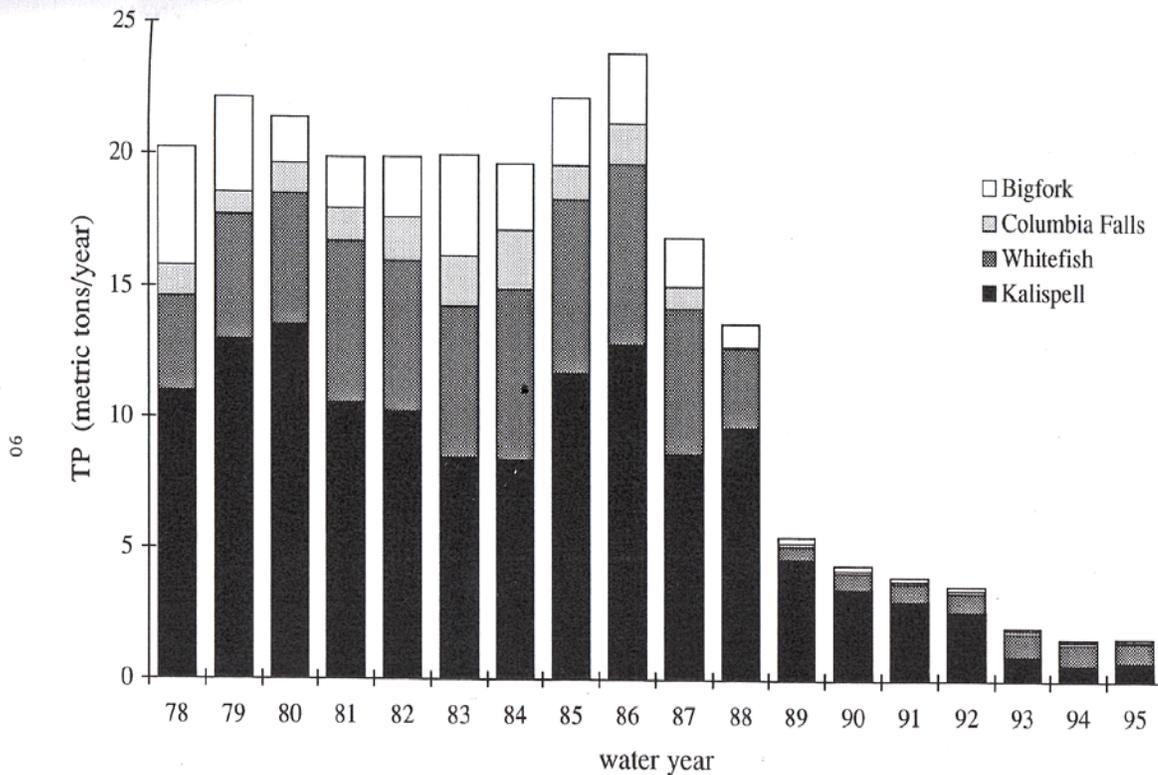
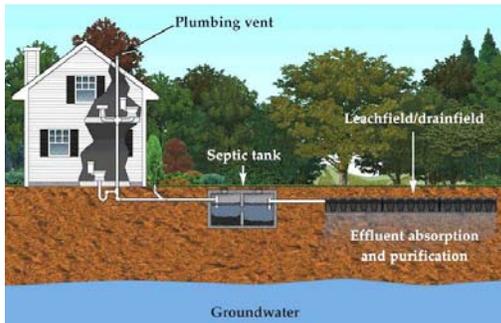


Figure 23. Mass of bioavailable phosphorus (metric tons per year) from the urban wastewater treatment facilities discharged into Flathead Lake or its tributaries. The significant change in the pattern is associated with initiation of new treatment operations emphasizing P removal (see text).

State of On-Site Wastewater Treatment and disposal.

On-site wastewater systems constructed to treat/dispose of wastewater where public services are not available have evolved over the years. The cesspool was the standard for many years. At some point, cesspools were not allowed as new regulations regarding new wastewater systems were developed and permitting requirements were enacted. Currently, there are 21,276 permits in our computer database, dating from the late nineteen sixties to the present. Approximately 18,000 of these contain sufficient information to be geographically located. The others, typically those issued in the earlier years, do not.

The earliest regulations this office has on file were effective July 1, 1969, and were only 6 pages long. The emphasis in the early years was disposal. Through the years, regulations have been revised again in 1972, 1975, 1980, 1983, 1988, 2002 and 2005. Each revision has represented a tightening of regulations and improvements in construction standards and technology with emphasis on treatment, rather than disposal. Until 2005, most systems consisted of a septic tank and gravity flow drainfield. Currently, all on-site systems utilize uniform pressure distribution in the drainfields, which require the use of a pump or siphon to pressurize the system. Flathead and Lake County are the only two counties in the state that require uniform pressure distribution.



In the last 10 years, there were 6,481 septic systems inspected. Approximately 90% of those were for new construction. The rest were for replacements or alterations. Of those, 2,070 have been installed since the uniform pressure distribution requirement was adopted in 2005. (See Appendix on Permits issued)

Since 2002, prior to the issuance of any permit, an analysis of the impacts on water from nitrate and phosphorous has been done. These are required by the non-degradation rules under the state Water Quality Act. The estimated level of nitrates cannot exceed 5 mg/l in groundwater after construction using conventional systems. A level of 7.5 mg/l is allowed if Level 2 treatment is used. Level 2 treatment is defined in the Flathead County Sewage Treatment System Regulations as follows: "Level 2 treatment" means a subsurface wastewater treatment system that:

- (a) removes at least 60% of total nitrogen as measured from the raw sewage load to the system; or
- (b) discharges a total nitrogen effluent concentration of 24 mg/l or less.

The term does not include treatment systems for industrial waste.

To protect public health, it is important to limit the amount of nitrates in groundwater. The EPA maximum concentration standard for nitrates for public drinking water supplies is 10 mg/l. Infants under 6 months of age are particularly

susceptible to methemoglobinemia (blue baby syndrome) caused by nitrates ingested in drinking water. The current EPA standard for drinking water is specifically designed to protect infants.

Level 2 treatment systems are becoming more common in order to comply with non-degradation rules or to fit a drainfield within a limited area. In addition to treating water to a higher standard than a conventional system, the drainfield for a system using Level 2 can be reduced in size by 50%. This makes it possible to locate drainfields where it may have been impossible using conventional sizing standards. There are approximately 60 systems currently utilizing Level 2 technology, although many more parcels, including entire major subdivisions that have not yet been developed, are required to use it.

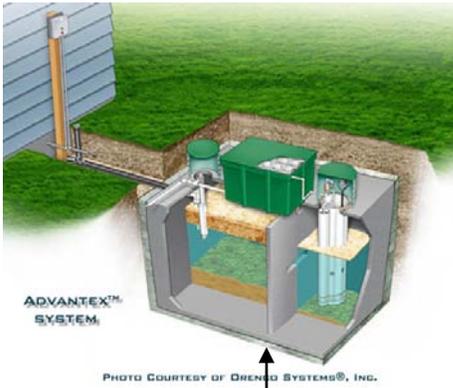


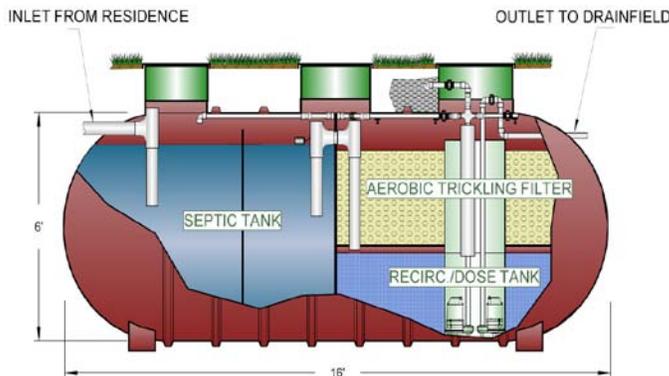
PHOTO COURTESY OF ORENCO SYSTEMS®, INC.

There are only two types of technology accepted by the Montana Department of Environmental Quality for reducing nitrates enough to be classified as Level 2 treatment technology. These systems must be maintained annually by a certified technician requiring the owner to enter into a maintenance agreement for the life of the system.

Advantex System

Individual Level 2 treatment systems

Eliminite



The primary reason for limiting phosphorous discharge to groundwater is its impact on the quality of surface water. A phosphorous prohibition was adopted in Flathead County by the County Commissioners in 1986 limiting the amount of phosphorous in

most cleaning materials to elemental levels, which is defined as no more than 0.5% by weight. There were some exemptions to this ban. That reduced the amount of phosphorous in wastewater and, therefore, surface water or groundwater that would directly affect surface water. Every septic permit application requires a phosphorous breakthrough analysis to be done. It's effect is measured in time of travel to the nearest surface water. A breakthrough of at least 50 years is required. Unlike nitrates, there is no reasonable treatment technology available for treating phosphorous in a small on-site system. The only siting criteria that can be used is distance from the surface water body. This distance must be sufficient to insure the effluent will not reach the surface water body in less than 50 years, even though that distance may be greater than the minimum setback of 100 feet.

Wastewater systems permitted by FCCHD Environmental Services department fall into four (4) categories based on size or number of connections. They are defined in the Flathead County Sewage Treatment System Regulations as follows:

1. "Individual Sewage Treatment System" shall mean a system designed to serve one single family dwelling or a structure used for a single commercial use which employs and/or serves less than 25 people per day or a single commercial use which employs and/or serves 25 or more people per day less than 60 days per year.
2. "Shared Sewage Treatment System" means a sewage treatment system which receives wastewater from 2 living or commercial units with a total service population of less than 25 people per day, or more than 25 people per day for less than 60 days per year.
3. "Multi-user Sewage Treatment System" shall mean all systems that serve 3 - 14 families or service connections, but not over 24 people.
4. "Public Sewage System" means a system which serves 15 or more families, or 25 or more persons for a period of at least 60 days out of the calendar year. There are many public systems that are regulated by our local regulations. These include rural schools, churches, motels, restaurants, bars, campgrounds, a variety of other commercial businesses and residential subdivisions. Due to the age of many of these systems, there are no permits of record for some of them. Therefore, an exact number of systems within this category cannot be given.



A community Level 2 advanced treatment system- using 45 - AX 100 Oreco's AdvanTex pods.

Individual systems

The majority of all permits issued are for individual systems. Most of these are for single family dwellings, with a small percentage serving light commercial businesses or private shops. Effective with the 2005 regulation change, residential permits have a minimum size of three (3) bedrooms. Finishing out a basement or building an addition often results in additional bedrooms. Until recent years, three (3) bedrooms was the most common application. However, houses are now more likely to have 4-5 bedrooms. In the past, those dwellings with systems sized for fewer than three (3) bedrooms often were marketed as having at least three (3) bedrooms. Although this office does not police these types of transactions, lending institutions can deny loans when the home involved has more bedrooms than what has been permitted. Systems may be upgraded or completely replaced. In the 5 years from 1998 through 2002, 45% of the single family residence permits were for 4-5 bedrooms. In the 5 years from 2003 through 2007, 65% of the permits were issued for 4-5 bedrooms, even with the three (3) bedroom minimum requirement in force. All but a few permits issued for systems using Level 2 treatment have been for single family dwellings. See appendix on septic permits issued in the last 10 years.

Shared systems and Multi-user

Systems within these categories are far fewer in number than the individual systems. Under current regulations, the required non-degradation analysis can result in the denial of some of these proposals. It may be necessary for an owner to build multiple smaller systems than one larger one. Systems within these categories, especially the multi-user systems, can be quite large. However, unlike the even larger public systems, these systems do not require any type of certified operator. These often become the responsibility of the owners of the system, such as a homeowners association. All systems within these categories that are serving different properties require a user agreement and easements.

Public Systems

Residential-

Currently there are 8 public residential systems for a total of 273 connections. The technologies for these systems vary. There are only 2 using conventional septic tank/drainfield technology totaling 31 lots. Two use intermittent sand filters between the tanks and drainfield serving 23 connections. Two use lagoon and spray irrigation technology serving 177 connections. One uses elevated sand mounds serving 32 connections. One uses a type of package plant. The technology used in this system includes a sand filter and tertiary treatment, which is an advanced treatment process, removing nutrients such as phosphorus and nitrogen and practically all suspended and organic matter from wastewater. This system serves 15 lots. These public systems are as follows:

<u>Name</u>	<u>Connections</u>
North Blaine Estates	15
Valley Ridge Estates	13
Lion Mountain Ph. 6	18
Sunrise Bay/Fireman's Island	13 (8/5)
Tr. 10LA (Garber)	10
Buffalo Mountain	77
McGregor Lake Highlands	
Phases 1-3	32
Forest Acres Trailer Court	100

Campgrounds/RV parks*

There are 62 trailer courts, campgrounds and RV parks served by on-site wastewater systems, 14 of these facilities which are large enough to be classified as "Public Systems, these are:

<u>Name</u>	<u>Spaces</u>
Canyon RV Park	66
Glacier Campground	162
Glacier Meadows RV Park	41
Glacier Mountain Shadow Resort	45
Glacier Peaks RV Park	72
Glacier View Golf Club	10
LaSalle RV Park	53
Mountain Meadows RV Park	65
North American RV Park	109
Rocky Mountain Hi Campground	106
Sans Suz Ed	88
Sundown Campground	31
West Glacier KOA	117
Whitefish KOA	85

Commercial

Most on-site public systems serve a single commercial operation either employing or serving more than 25 people a day. Many of these are food service related establishments, including restaurants, bars and food manufacturing. Food service operations will typically generate wastewater that is higher in strength than residential strength wastewater. Large amounts of greases, oils and food scraps allowed to enter the system can lead to premature failure. New systems must be designed to address these constituents in the wastewater. Although most existing systems are still conventional septic tank/drainfield systems, the replacement of failing systems will require additional treatment technology to improve the wastewater quality. Although most of these types of systems are permitted, there are many of these systems built prior to permitting requirements and are still in operation today. Therefore, there are no records of these systems.

Systems other than those related to food include, among other things, offices, athletic clubs, water parks, horse arenas, work camps and manufacturing facilities. There are dozens of single connection systems throughout the county, generating varying amounts of wastewater. There are also large facilities served by more than one wastewater system, such as Glacier International Airport, Semitool and Plum Creek.

There are a few commercial on-site public systems serving multiple businesses. Below is a list of those systems and the number of connections approved.

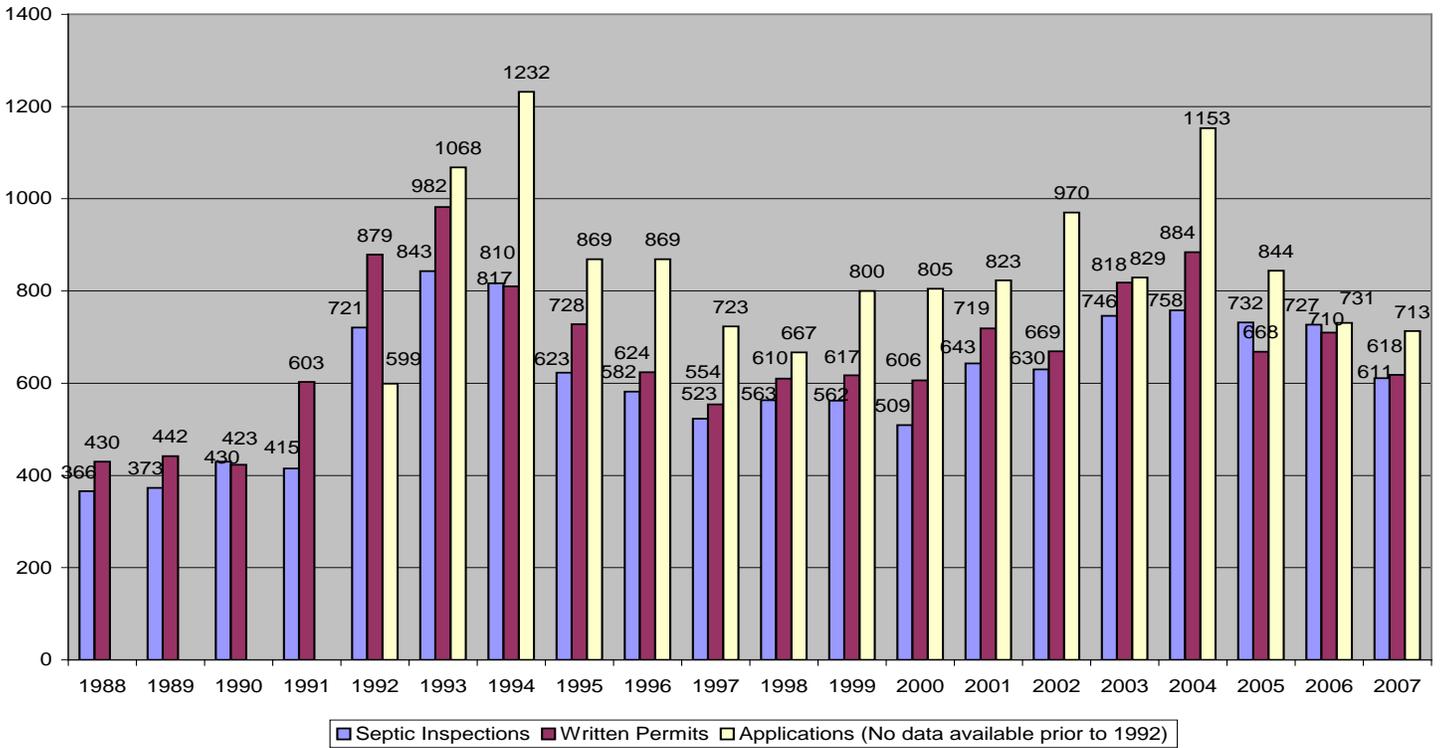
Pioneer Business Park	15
North Country Unit #2	20
Glacier Business Center	7
North Forty Resort	40

Schools*	Churches – 20
Public – 11	Church camps – 5*
Private – 8	

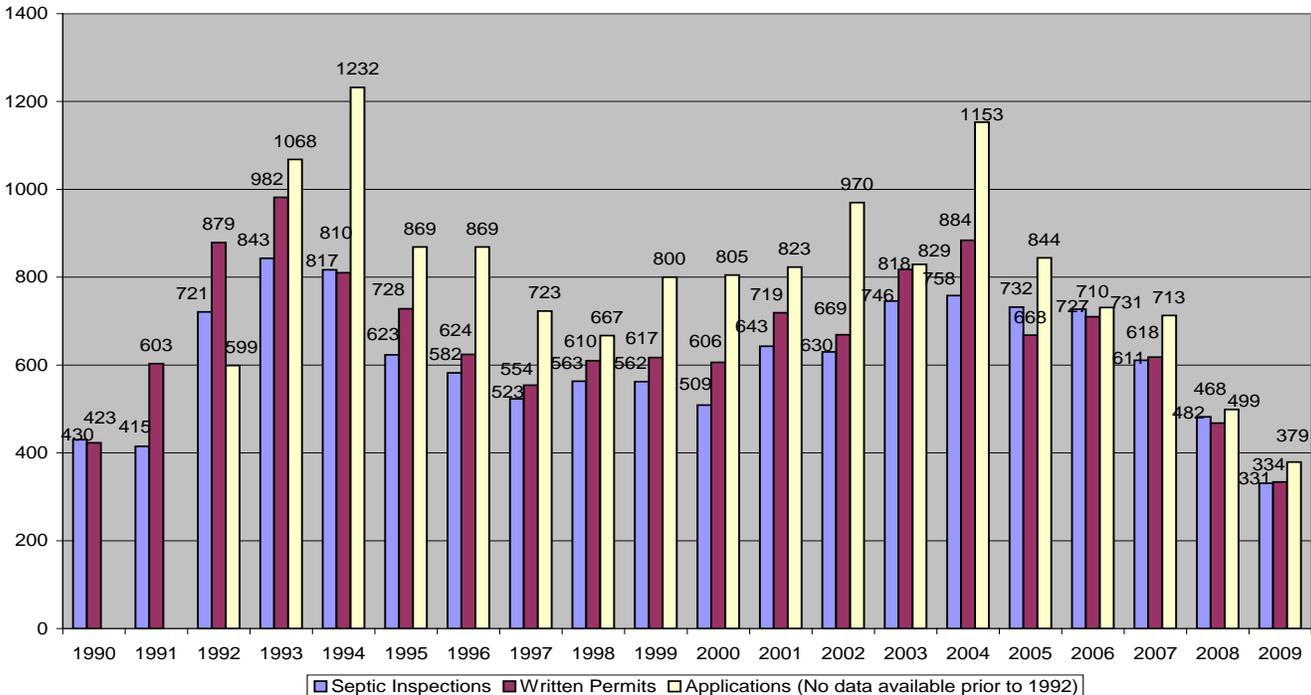
*Some of these facilities are served by more than one individual on-site system. When there are multiple systems, they still meet the definition of a public system.

Appendix

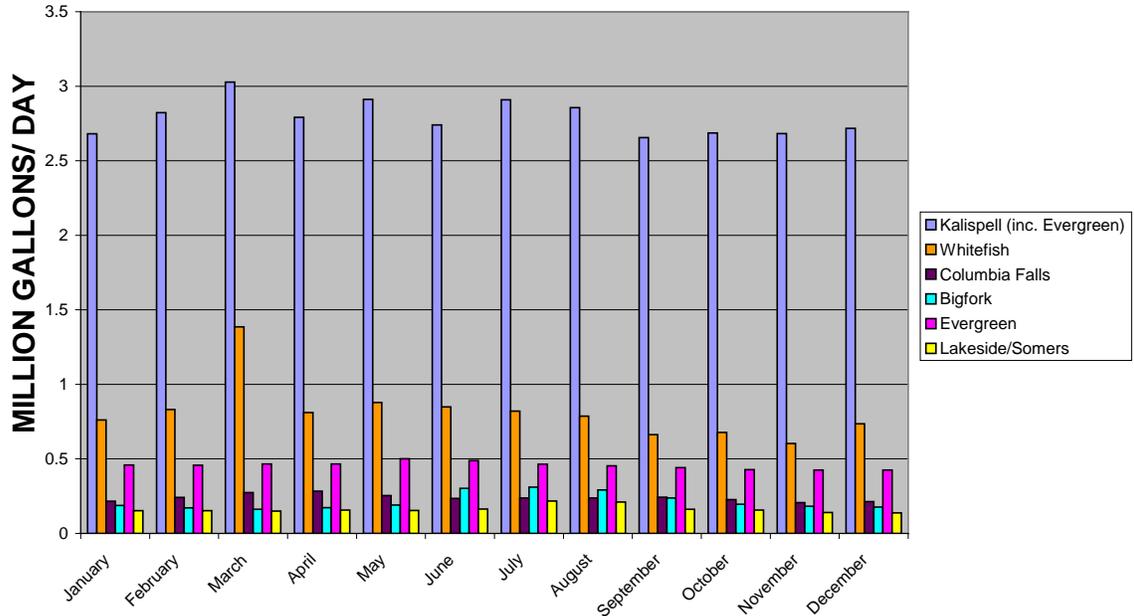
Septic Applications, Permits Written & Final Inspections 1988 - 2007



Septic Applications, Permits Written & Final Inspections (1990 -2009)

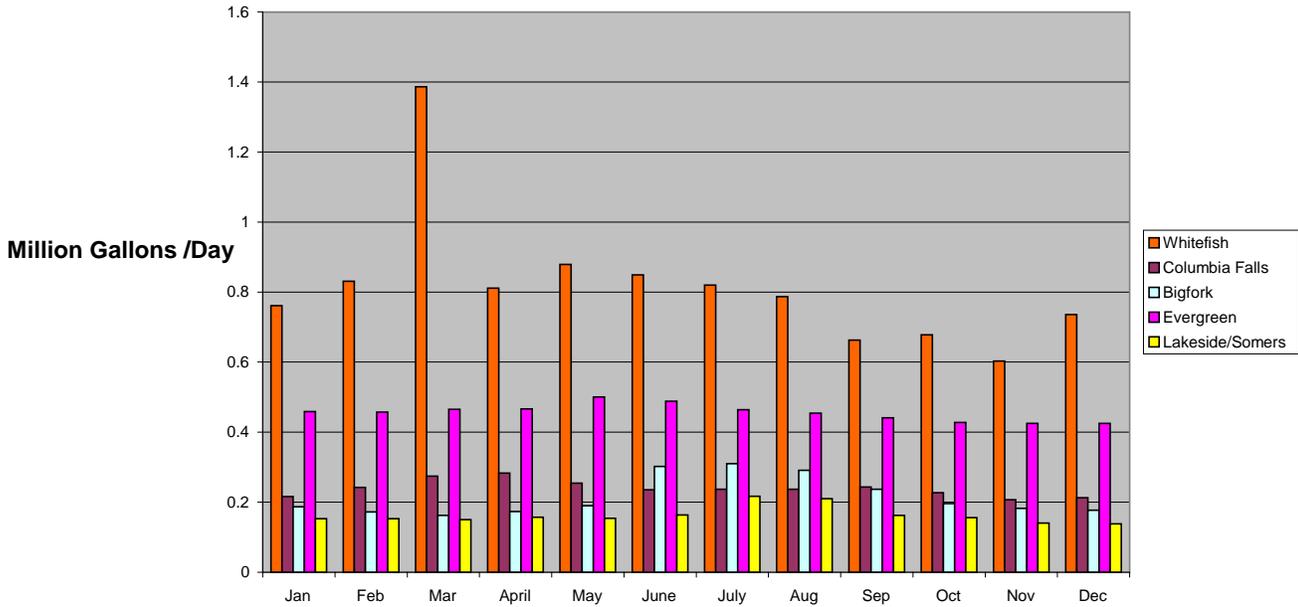


WWTP IN FLATHEAD COUNTY



2007 AVERAGE DAILY FLOWS

Wastewater Flows



2007 Average Daily Flows

Addendum 2008-2009

Kalispell- In 2008-2009 Kalispell had a large addition to their facility. A new head works plant that utilized the existing building. In addition a new lift station, another secondary clarifier to the existing two clarifiers and two - 500,000 gallon bioreactors. A new building housing five new blowers, a new fermenter, an odor control system using a sand bed, and a new U.V. light channel (widened). They were capable of handling up to 3.1 million gallons per day (mgd), with the expansion the plant is now capable of treating up to 5.4 mgd. Their current flows average around 2.34 mgd. There is more room for further expansion.

Evergreen- Evergreens flow contribution to the plant has stayed unchanged . They average about .45 mgd. A new lift station was added for the Trumble Creek Crossing subdivision off of East Reserve Street.

Whitefish- A 2009 addition saw an improvement of the head works plant. The automated 5mm bar screen replaced the 2" bar screen that was cleaned manually. A second clarifier was also added. At this time only the new clarifier is on line while maintenance is being done on the other. In 2012 the State will mandate disinfection before the effluent enters the Whitefish River. Their flows remain about the same, .85mgd with higher flows during the summer and winter months.

Columbia Falls- Phase I of the treatment plant was completed in 2009. This improvement automated the head works plant with 5mm screening and grit removal. A 3.3 million dollar Phase II is under construction and should be completed in the fall of 2010. This plant will be similar to the Kalispell's biological nutrient removal facility. This will include two 67,500 gallon anaerobic digestion tanks. Flow will then enter one of two anoxic basins, each approximately 148,000 gallons. Lastly, the flow will enter one large aeration basin approximately 589,125 gallons. U.V. disinfection will replace the existing chlorination system before discharging into Flathead River. Their current daily discharge has not changed and averages .35 mgd.

Bigfork- Bigfork finished Phase I of their addition in October 2008. The plant has a new head works building with automated screening and grit removal capabilities. They averaged .23mgd in 2008-2009. Phase II will include a membrane bioreactor (MBR) that will be able to treat .84 mgd. Planning is still in the process and construction will take 12 to 18 months to complete. They expect to break ground in 2010-2011. Bigfork will be the first membrane bioreactor (MBR) tertiary treatment plant in Montana.

Lakeside/Somers County Sewer Districts- There has been little change in the Lakeside/Somers Sewer District. Two gravity mains were added to their existing system. One of which is for Eagle Crest Phase 3 south of Lakeside. Forty three lots will connect to this main. To date, only one home was built and connected. The other gravity main is to the north where it crosses under the highway by Deer Creek Rd. To date no one has connected. Their flows remain about the same as previous years, .139 mgd.

Onsite Septic - Due to the recession, there is a slow down in construction of new homes; and we saw a decrease of septic installations. See enclosed graphs.

Treating Wastewater in the Flathead



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