INTRODUCTION [6-1]

Since the 1970's the region has made great progress toward making its air and water cleaner and safer and protecting and restoring its lands. However, today this region is dealing with environmental issues far more complex than those of 20 to 30 years ago. The environmental problems faced today are more difficult to define, and possible solutions are more difficult to identify. Population growth in this region, and the way resources are consumed to sustain this growth, are altering the environment in unprecedented ways. Today more than ever, the Village of Volente, along with the region, recognize the need to look toward the future to anticipate potential threats to human health and the environment, establish clear priorities, and implement strategies to address the threats.

The success of Volente in addressing its own particular environmental issues and concerns depends upon a variety of critical factors:

- First, the Village set reasonable goals for protecting the environment and human health. The Steering Committee collaborated with the community and with environmental professionals to set meaningful goals and to develop the strategies and goals that would achieve the intended environmental results.

- Volente utilized the best available scientific and environmental information to establish priorities and make decisions. Sound science and technology was the primary basis for determining which problems posed important risks to the Village's natural environment, human health, and quality of life.

- The Steering Committee collected the environmental information needed to assess where the community is at and where the community needs to go.

- The Steering Committee explored new and creative ways for Volente to achieve its environmental goals. The community will continue to look for innovation ways to address high-priority environmental problems.

- The success of Volente's plan for environmental quality will depend to a great degree upon the Village's ability to provide environmental leadership and education for the community and its ability to enforce accountability in complying with its environmental regulations.

ENVIRONMENTAL QUALITY GOALS AND STRATEGIES

Through the 2004 Community Survey the Village received feedback from Volente residents on how they viewed Volente now, what they liked and disliked about it and what their vision of Volente in the future was. Based on the results of this survey, the environmental subgroup of the Comprehensive Plan Steering Committee developed this Environmental Quality Plan for the Village.

[6-1] "2003-2008, EPA Strategic Plan, Direction for the Future"; Environmental Protection Agency; www.epa.gov.

Overwhelmingly, the survey results showed that the residents of the Village liked the natural, rural-type surroundings that is Volente now. In addition the survey showed support for retaining that rural quality, and for protecting Lake Travis water quality, the natural habitats of the area, and for preserving the ecological health of the area. To that end the Environmental Quality Plan described herein provides goals and objectives in which the Village has clear direction from its citizens to enact ordinances to protect the environmental quality of the area, and areas in which the Village would like to provide guidance, and suggestions to residents and businesses, both current and future, for means to enhance and protect the natural environment and hence the quality of life for the Village of Volente.

Preserving the Volente way of life and environment is uppermost in these goals, however it is also mandated by the citizens to maintain the Volente Vision of minimal government, regulation and spending. This is always a compromise, and will involve the support of Volente citizens to attain this goal

WATER QUALITY

The Village has a variety of habitats, ranging from critical habitat woodlands, to scrub and lake front. The main feature is, of course, Lake Travis, and many residents draw their water supply from the lake, or from private groundwater wells. These wells are typically completed in the Glen Rose Aquifer, the locally occurring upper formation of the regional Trinity Aquifer. Water quality in the Glen Rose is far from excellent, having the characteristic of high total dissolved solids, and sometimes a sulfur component. However, with filtration the water provides an adequate supply to those individual wells. In recent years, the Glen Rose is thought to be declining, as increased development and well installation stresses the water table, through increased withdrawals and decreased recharge.

One of the goals of the Village is to attempt to protect this declining resource, by enacting ordinances to protect the quantity of local groundwater available to the citizens of Volente, by restricting new wells within the Glen Rose aquifer (upper zone of the Trinity aquifer), and by working with State of Texas groundwater conservation districts to develop a groundwater management plan for the area. By limiting impervious cover by ordinance to 20% for all new single-family residential developments and to 35% for all new multi-family residential and non-residential developments, recharge to the aquifer is protected. Septic systems (existing and future) will continue to be regulated under the Lower Colorado River Authority (LCRA) design, construction and operating standards, however the Village should require additional inspections to ensure that septic systems are operating properly and are being maintained. In addition, the Village should encourage the phasing out of commercial and domestic septic systems if and when a public wastewater system is made available. The Village shall also propose groundwater quality protection measures through restricting and discouraging improper waste disposal practices, such as use of used oil as a dust suppressant, or improper disposal of pesticides and /or herbicides.

The Village seeks to protect the quality of water in Lake Travis to ensure that both human and aquatic organisms can continue to enjoy this valuable resource. A means to achieve this is through restrictions on non-point source discharges. These are commonly known as storm (or rainwater) run-off sources, and can carry pollutants which vary from increased sediments flowing into the lake from a disturbance of the land due to developments, to unwanted chemicals being washed from parking lots and other activities into the lake. These discharges can affect water quality, by causing rapid growths of water plants and algae which in turn can cause fish kills and other upsets. The Village should require, through a Non-Point Source (NPS) Pollution Control Ordinance, specific removal efficiencies for total suspended solids, phosphorus and oil and grease, which will provide protection of the lake water quality. A 20 % limit on impervious cover should be established for all new single-family residential developments, and a 35% limit on impervious cover should be established for all new multi-family and non-residential developments as applicable. Restrictions on developments on critical environmental features, such as steep hill slopes, should be adopted to reduce the erosion potential from such activities. The Village should encourage the use of natural vegetated buffer zones to enhance removals of these pollutants as a means to avoid large, unsightly stormwater ponds. Best Management Practices (BMPs) should be employed to take advantage of new technologies and ideas as much as possible. For example, vegetated ditches are preferred over concrete lined ditches.

The Village should also coordinate with the LCRA on water quality monitoring along the shore line, as a means to alert the Village of potential problems or issues associated with water quality which could affect all its citizens lives in one way or another. The Village should encourage recycling and other sustainable waste management practices, through public education and working with local waste disposal companies who provide service to the Volente area. The Village should also encourage the use of rainwater collection systems on public buildings.

AIR QUALITY

With increasing development and population comes increasing air pollution, in the form of particulates (dust) and other chemicals such as those which increase the formation of ozone, carbon dioxide and NOx. Volatile organic compounds (VOCs) such as solvents, and other petroleum-based chemicals are primary culprits in reducing air quality. The Village should enact ordinances to restrict the use of such chemicals, and to promote the use of low-emission alternatives, such as low-VOC coatings, paints and other items. The 2004 Community Survey showed no support for businesses such as dry cleaners, who are often a large source of these VOCs, and can also be a risk to water quality in the area should they spill or discharge these chemicals into the environment.

The Village should support participation in regional clean air planning groups, and encourage the Pedernales Electric Coop, and other energy providers to provide options for public participation in alternative, clean air electric power energy sources (e.g. hydropower, wind). The Village should attempt to work with Capital Metro to provide increased service to Volente to facilitate the use of rapid transit and park-and-ride features.

OTHER ENVIRONMENTAL CONCERNS

The Village of Volente is fortunate to be surrounded in large part by the Balcones Canyonlands Preserve (BCP). The BCP is the result of a community-based effort to protect more than 30 species while allowing development to occur in western Travis County. It was established through a permit issued by the U.S. Fish and Wildlife Service to the City of Austin and Travis County in 1996. The Preserve will ultimately protect about 30,000 acres of prime habitat in western Travis County. Preserve tracts are owned by public and private entities including the

City of Austin, Travis County, the Lower Colorado River Authority, the Nature Conservancy of Texas, the Travis Audubon Society, as well as private landowners, making it one of the country's largest urban preserves. The managing partners have currently acquired a total of over 26,000 acres.

While the Village does not itself own or operate any BCP lands, it is essential to the ongoing health of these threatened and endangered species that habitat be maintained and enhanced as much as possible. To that end the Village should encourage through public education the sale and use of native plant species and the protection of migratory birds and other species by preserving natural riparian corridors, habitats and buffers, among other features. The Village should establish standards which will ensure the preservation of local trees, including procedures for managing oak wilt, and should establish Village membership and participation in the National Wildlife Refuge System and the Federal Partners for Fish and Wildlife Program as applicable.

Proposed Restricted Businesses

The Steering Committee recommended that the following uses be partially or fully restricted from the Village due to their potential release of environmentally adverse chemicals and compounds:

- Auto-body refinishing shops
- Large auto repair shops
- Gasoline stations
- Dry cleaners
- Confined animal feeding operations
- Meat and poultry processing operations
- Drive-through businesses
- Any business which stores significant amounts of potentially toxic chemicals, above or below ground.
- Used oil, batteries or tire collection facilities.

ENVIRONMENTAL QUALITY STANDARDS

CLEAN WATER

Over the last 30 years since the federal government's enactment of the Clean Water and Safe Drinking Acts, the region's local governments, citizens and the private sector have worked together to make dramatic progress in improving the quality of surface waters and drinking waters.

Thirty years ago, about two-thirds of the nation's surface waters assessed by the states were not attaining basic water quality goals. Some of the nation's waters, including the Colorado River below Austin, were virtual open sewers posing health risks, and many water bodies were so polluted that traditional uses, such as swimming, fishing, and recreation, were impossible or of too great a risk to human health. Today, the number of polluted waters has been dramatically reduced, and many clean waters are even healthier. A massive investment of federal, state and local funds into water quality initiatives has resulted in a new generation of treatment facilities including stormwater runoff treatment. Sustained efforts to implement "best management practices" have helped reduce runoff pollutants from diffuse or "non-point" sources.

EFFECT OF URBANIZATION ON RUNOFF AND RECEIVING WATERS[6-2]

In agricultural and undeveloped land settings there is very little surface runoff. Most of the rainfall soaks into the top soil and is held there by capillary action to be used by vegetation, percolates into the groundwater, or migrates slowly through the soil mantle (as interflow) to the nearest stream, lake or estuary. In Texas, the fraction of the rainfall that turns into runoff varies from less than 5% in the western plains to about 20% in the wetter eastern third of the state. This natural process averages out the intra-storm variations in rainfall intensity over a period of several hours (except for major storms) so that short duration, high intensity rainfall does not have a large impact on peak flow rates in the receiving waters.

But as a watershed develops, the land is covered with impervious surfaces—roads, parking lots, roofs, driveway, sidewalks—preventing rainfall from directly infiltrating into the ground. Even the remaining open ground, or pervious surface, cannot infiltrate rainfall as rapidly as it did before development because, the top soil has been removed or been mixed during construction with the less permeable clay soils. The result is that interflow is essentially halted, and now, 30% (dry climates) to 90% (wet climates) of the rainfall reaches the receiving water in the form of direct runoff, responding in a matter of minutes to the rainfall on the impervious land surface. As a result, stream flow rates respond much more directly to the rainfall intensities, both in time and in magnitude. The result is that the hydrology of the receiving water, especially streams, is drastically changed. A given rainstorm now produces significantly more runoff volume than before, and the flow peaks are increased by a factor of two to ten. The overall effect is that the flow frequency curve for a developed area is significantly higher than that of an undeveloped area.

[6-2] "Texas Non-Point Source Book"; www.txnpsbook.org

The City of Austin has found that, in smaller watersheds (up to 50 acres), the highest concentrations of pollutants are generally contained in the first part of the runoff from a storm event commonly called the "first flush". Larger watersheds tend not to exhibit this behavior and the highest pollutant concentrations occur with the highest flows. This is important because it directly relates the amount of pollutants with the amount of flow. Therefore, if we know how much pollutant(s) we wish to capture from a watershed's runoff we can then calculate the amount of flow we must capture in a BMP such as a retention pond.

The most commonly observed effects of urbanization on receiving waters is the physical degeneration of the natural waterway, presence of trash and litter along the streamway or shoreline, and the observance of oil sheens in areas where the water pools. Decreases in biodiversity and numbers of aquatic stream biota are also commonly observed; wetlands are destroyed or experience major changes in plant species, and animal populations. In lakes and estuaries increased algae growth and associated problems may be observed due to nitrogen and phosphorus contributed by urban runoff. The stream channel effects are most predominant in the smaller headwater streams of urbanized watersheds; as the watershed becomes larger, and non-urban land use becomes predominant, the effects of urban runoff on the streams are less apparent.

By changing the primary source of water to the urban stream from interflow to direct runoff, several things happen to the storm channel. First, dry weather flows decrease dramatically, because their source of supply-interflow-has been reduced or eliminated (Note however that in dry areas where development includes irrigation as part of the development, base flow can actually increase because excess irrigation water applications return to the stream as interflow). The reduced flows cause stress to the wetlands and stream biota when it rains; the increased flow peaks together with the increased frequency of those high flows, causing the stream to cut a deeper and wider channel, damaging or destroying the in-stream aquatic habitat. The streambed changes from coarse-grained particles to a mixture of fine and coarse-grained particles. The eroded sediments are deposited downstream in slower moving reaches of the stream or at the entrance to lakes or estuaries, destroying aquatic habitat by smothering the benthos, filling wetlands with sediment, etc. Often, smaller urban impoundments will silt up completely over the course of a few years, with resultant loss of flood storage capacity.

The chemical effects that urban runoff has on the receiving water environment are not well documented because they are strongly masked by the effects of high flows and the sediment scoured from the streambed. Table 6.1 shows average chemical concentrations of storm, water from the Lower Colorado River Authority's Non-Point Source Pollution Control Technical Manual[6-3].

[6-3] "Non-Point Source Pollution Control Technical Manual"; Lower Colorado River Authority; Effective July 10, 1998.

Table 6.1 Typical Pollutant Concentrations Found in Urban Runoff in Lake Travis Watershed as Compared to Undeveloped (Background)Conditions		
Pollutant	Concentration	
	Undeveloped	Developed
Total Suspended Solids (TSS)	48mg/l	130mg/l
Total Phosphorus (TP)	0.08mg/l	0.26mg/l
Oil & Grease (O&G)	0mg/l	5.0mg/l

It is generally agreed that nutrient concentrations in urban runoff are similar to those found in secondary wastewater effluents, and accelerate the eutrophication process in lakes and estuaries. It is also well established that urban runoff contains heavy metals-primarily copper, iron, and zinc-in toxic concentrations (Lead which was once found, is not a problem any more due to the switch to unleaded fuels), and recent work by Herricks using Microtox techniques shows some toxicity response by the test organisms. But, in the general case, the metals attach themselves to the suspended solids in the runoff or the stream, and are not available biologically unless they settle out in an area where the bottom sediment is anaerobic (which can happen in a lake or estuary), in which case they enter the dissolved state and become bio-available.

Fecal coliform is another "pollutant" that is found in urban runoff in high concentrations. Values of 10^4 to 10^6 counts/100 ml are commonly found in urban runoff. The source of these organisms is unclear. Many believe that they come from animal activity on the watershed; but others feel, based on their experience, that whenever these high counts are encountered and tracked down, they turned out to be sewage related – cross connections, exfiltration from septic system drain fields and/or poorly maintained sanitary sewers infiltrating into storm sewers, etc.

CONTROLLING URBAN RUNOFF[6-4]

In light of the preceding discussion, the question that naturally arises is "Why does Volente need to include a program for reduction of pollutants in urban storm water"? The principal reason is that it is a federal law, passed by the Congress of the United States, and enforced by the USEPA and through third party suits, notably those brought by the Natural Resources Defense Fund.

But it is not a waste of time and money to implement these controls, because if properly designed, they can also be used in combination with flood control practices to control and treat flow. Moreover, and more pragmatically, by focusing urban storm water management programs on protection and enhancement of the aquatic environment, as well as community health and safety, Volente can have a program that, for the same money, goes far beyond just meeting the EPA regulations.

According to the WEF/ASCE Manual of Practice on Urban Storm Water Quality Management (MOP), controlling the quality of urban runoff is more of an engineering art than a science, and there are few established algorithms for designing a system to remove specific pollutants to a specified level. But the following basic facts extracted from the MOP (pg. 488), constitute basic

[6-4] See footnote 6-2

axioms of urban runoff quality management. Perhaps the most important axiom is the second item.

- Most obnoxious pollutants in urban runoff are settleable, so BMP's designed to remove suspended solids from the runoff will remove most of the other pollutants as well. This rule does not apply to nutrients, which are mostly in a dissolved state and require special treatment.

- BMPs are intended to handle small storms (smaller than a one-year storm), drainage facilities are designed for control of the two-year and larger storm. This means that BMPs can be constructed within drainage facilities if proper safeguards are designed to protect them against damage from the major storm events, e.g. 10- and 25- year and larger storms.

- The most effective runoff quality controls reduce both the runoff peak and the volume (these are generally source controls).

- The next most effective controls reduce the runoff peak (these controls generally involve storage and are called treatment controls).

- For small runoff events larger than the BMP design storm, but smaller than the two-year event, the runoff should be retarded by detention and a properly designed multiple outlet structure in order to prevent downstream channel erosion.

Best Management Practice or BMP is a term that was originally coined by the agricultural industry to describe actions to reduce erosion of farmland and improve crop yield. Typical agricultural BMPs include contour plowing, leaving idle fields in stubble to reduce wind erosion, crop rotation, and fertilizer management programs. The term was adapted to the American urban setting in the early 1970s to distinguish actions and practices aimed at reducing flow rates and pollutant concentrations in urban runoff from the more highly engineered municipal wastewater facilities. Urban BMPs were divided into new classes: ***non-structural and structural***. Non-structural controls minimized the opportunity for pollutants to come in contact with rainfall and runoff, while structural controls were constructed facilities for treating runoff. More recently, BMPs have been grouped into the following three categories: ***pollution prevention practices, source controls, and treatment controls***. ***Pollution Prevention Practices*** keep chemicals from coming into contact with rainfall and/or runoff so that they never pose a pollution threat to receiving waters. They include covering chemicals exposed to the elements, cleanup of spill areas, proper chemical waste disposal, etc.

Source Controls regulate the amount and rate of runoff and the amount of pollution in the runoff at or near the source of the runoff. These controls consist primarily of infiltration devices, and minimizing the amount of ***directly connected impervious area***. The tributary area to these devices is generally less that one acre.

Treatment Controls are designed to remove pollutants from the runoff. They are usually applied to drainage areas greater than one acre, and regional facilities serving several hundred acres are not uncommon. These facilities include most commonly extended detention basins, retention basins (also know as wet ponds), and wetlands. Large filtering facilities have been used in some locations in Texas, notably Austin.

None of the BMP categories, nor a BMP within a category will suffice, in and of itself, to meet the ***Maximum Extent Practicable (MEP)*** criteria identified in the EPA, and EPA Region 6 rules and regulations regarding control urban runoff quality. The MEP concept is that of a treatment train of processes that successfully reduce the pollutants in the water passing through the train until the pollution is removed to the "maximum extent practicable".

Pollution Prevention BMPs are the first line of defense against urban runoff pollution; if a chemical never comes into contact with the rainfall or runoff, it will never become a pollutant. Thus, covering chemical storage areas, placing containment barriers around liquid handling areas so that spills are confined, and berming off areas where chemicals that are stored to prevent run-on of storm water generated upstream of the storage area all make sense.

Runoff that does come into contact with pollutants, such as runoff from roof tops, sidewalks, driveways, parking lots, and roadways is most efficiently managed close to its point of origin. So, draining this runoff to pervious vegetated areas, such as lawns, filter (or buffer) strips around parking lots, and shallow swales provides the second line of defense. These source controls provide maximum opportunity for infiltration, which reduces the volume of runoff and eliminates the pollutants contained in that runoff. The vegetated areas also reduce the peak runoff rate, placing less stress on downstream facilities, allowing them to be smaller in size.

The last line of defense is the treatment controls, and for most municipalities they are the **only** planned line of defense, because the drainage regulations, in these cases, require simply that treatment controls be integrated into the drainage system; no credit is given in terms of reducing size of the treatment controls if good housekeeping and/or source controls are included in the drainage plan.

Pollution Prevention Practices: The seven housekeeping categories identified above actually comprise more than 20 separate practices amongst the various categories. Application of these controls should always be an integral part of a municipal storm water management program on both existing development and new development. Many of the practices are already included in the municipalities programs, albeit not necessarily the storm water management program; for example:

- Household hazardous waste collection programs
- Used oil recycling programs
- Spill control and cleanup programs implemented under the municipalities hazardous waste management program
- Illegal dumping controls, usually part of the solid waste program
- Illicit connection prevention and leaking sanitary sewer control

Source Controls: Source Controls regulate the amount and rate of runoff and the pollution in the runoff at or near the source of the runoff. These controls include:

- Minimize Impervious Area: In light of the earlier discussions on the effect of urbanization on the hydrologic cycle, it is fairly obvious that the more one can limit the amount of impervious area on the landscape, the less impact one will have on the hydrology. But what can the Village do? The most obvious thing to do is to restrict the amount of impervious cover that is constructed in the first place. The Village can also encourage infrequently used parking areas to be converted to a permeable medium such as porous and modular pavement. Underdrained graveled parking is good, and economical. For seldomly used (less than once a week) overflow parking areas, simple grassed areas are fine. There are two important general criteria that apply to these techniques. Grassed areas must have sufficient water to keep the grass healthy throughout the growing season. If natural rainfall is insufficient, then the areas must be irrigated. If porous pavement or porous blocks have not been used previously with success, test the technique on a pilot area first to insure that the underlying soils can infiltrate the rain that falls on the pervious surface, and that fine particulate matter does not get into the pores of permeable medium and plug it.

- Minimizing Directly Connected Impervious Area: The next best way to control urban runoff is by directing roof, driveway, and sidewalks runoff over grassed areas where the runoff has an opportunity to infiltrate, or sheet flow through the grass, slowing the rate of runoff and allowing pollutants to settle/filter out within the grassed medium. The point to be made here is that traditional drainage practice is to slope everything "toward" the impervious surface – notice that lawns and medians are nearly always crowned to direct flow toward the pavement. This is because traditional design is directed at "drainage" for large storms, not for the small storms that are critical in managing for environmental purposes. Maintenance costs for this control are also small since the control is primarily landscaping and mostly on private property.

- Filter Strips and Swales: Swales and filter strips have widespread application in areas where vegetation can be maintained on them naturally or with irrigation. Swales also have value without vegetation if the soil is highly permeable. The basic principals of these devises are to slow the flow of the storm water runoff for small, frequent storms, and give the water a chance to be filtered by the vegetation and/or infiltrate into the ground. Filter strips are gently sloped land surfaces over which runoff from an impervious area sheet flows before entering a drainage channel. They must be vegetated for three reasons. First the vegetation holds the soil in place, especially for larger storms. Secondly, the vegetation maintains the permeability of the top 18 inches of soil, providing for some infiltration of the runoff as it passes over the filter strip. Thirdly, the vegetation slows the water allowing for greater infiltration, and filtering solid particles out of the runoff from small storms as the water moves through the vegetation matrix. Swales as water quality control facilities should be designed with small longitudinal slopes, and wide bottoms to avoid soil erosion and allow for maximum contact of the runoff with the channel bottom where it can infiltrate and be filtered through the vegetation. Often the swales have berms or small check dams integrated into the design to slow the velocity in the channel and enhance the opportunity for infiltration. For swales without maintained vegetation, the soils must be very permeable and able to infiltrate a significant portion of the water quality design storm. To function appropriately, the inflow to the swale should be sheet flow (or nearly so) either from a filter strip, or impervious surface. Their use at the end of a pipe draining a large area is inappropriate. Where curb is used, runoff can be delivered to the swale through curb cuts, or by small drainpipes spaced incrementally along the gutter. In these cases, the designer should take precautions to ensure that flows channeled through curb cuts, or delivered by the drain pipes do not cause erosion of the swale side slope or bottom. Avoid swales in areas subject to frequent roadside parking; integrate swales into roadside green way landscaping plan where possible. With respect to maintenance, filter strips are usually grassed and maintained by the owner of the impervious area which generates the runoff. Swales may or may not be on private property. The swales can be grassed, and regularly mowed, or planted in a vegetation that requires mowing only once or twice a year. Routine inspection is required to check for erosion and insure the integrity of the vegetative cover

- Infiltration Devices: The controls discussed here are designed specifically to infiltrate all or a specific fraction of the water quality design storm. These include infiltration basins and percolation trenches/wells. The good thing about these controls is that small storms infiltrate the soils as they did in the predevelopment land condition, reducing the negative impact on interflow; as discussed this makes them very attractive. The negative aspect is that unless the soil on which the devices are placed is very permeable soil, and unless fine sediments are removed from the runoff before being introduced to the devices, they will soon clog. Moreover, the percolation devices, being underground and out of sight, show no visible signs of failure. At least with surface infiltration basins, standing water will signal failure. The two most important design considerations for these devices are: 1) do not design the facility for storm volumes that cannot be infiltrated/percolated in less than 12 hours; and, 2) do not allow the facility to come on line until construction of the site that drains to it is completed, including landscaping, so that the facility is not subjected to high sediment loading.

  Maintenance of surface infiltration basins is straightforward. If they are maintained with a healthy vegetative cover, the ecological activity in the root zone will maintain the porosity of the surface soil, and they should perform well under loading from typical runoff. And if they plug, due to excessive sediment loads generated by upstream activity (such as excessive swale erosion, or unregulated construction site runoff), they can be reconditioned by disking the basin and replanting it, With percolation trenches/wells, it is a different story. If these facilities plug, the entire trench/well will need to be replaced; an expensive procedure. The chances are slim that individual property owners will rehabilitate their own percolation wells. The odds are not much better that municipal facilities will be rehabilitated in a timely fashion.

- Other Controls: Included in this category are devices intended to separate oil from the runoff. While these are technically treatment controls, their application must be at the source of the runoff for them to be effective. This includes oil-water separators, oil absorbent pads, surface booms, water quality inlets, etc. In general these devices do not work well on storm water flows, because the larger storms overwhelm the devices and wash out whatever oils were accumulated in the smaller storms. It is better to use these devices to capture accidental spills that occur during dry weather and keep them from entering the storm water management system.

- Treatment Controls: Treatment controls capture collected urban runoff from a number of upstream areas or sites, and provide a degree of treatment to, or removal of pollutants from, the runoff. These controls, which include extended detention basins, retention ponds, and wetlands, are most often used as the single runoff quality control, but they can and should be used in series with the source controls. A problem that one often faces is how to apply the treatment train concept to runoff quality control, or a drainage ordinance that gives no credit for using source controls by reducing the size requirements of the downstream facilities. These controls usually serve residential catchments of 5 to 50 acres, but, extended detention is regularly applied on small commercial developments of ¼ acre (i.e. the corner gasoline station or convenience store). Extended detention removes primarily settleable materials, and the pollutants that sorb on the surface of these materials. Retention ponds and wetlands remove these pollutants plus dissolved nutrients and biodegradable organic pollutants. The following paragraphs provide an overview of how they work.

Extended Detention Basins: This facility removes pollutants simply by settling out solids in the runoff, and taking with it those other pollutants that are sorbed on the settled solids. This control is the most frequently applied BMP for urban runoff quality management, because it is the easiest to design, construct and get permitted, relatively easy to maintain, and it takes up the least amount of land space of the "treatment controls". Detention ponds are familiar to most engineers who have had to use them to control peak runoff rates for drainage purposes. The difference between the two types of facilities is that the drainage facility is designed to control the peak flow rate of a larger design storm(s), while the extended detention basin is designed to "capture and release" a smaller design storm over a specified period of time, typically 12 to 40 hours.

The slow release of a small storm means that the outlet control, especially for small catchment areas, will be a small V-notch weir, or an orifice. Because the opening is so small, special precautions are taken in the design to prevent them from plugging with debris.

The most common problems with extended detention basins are clogging of the outlet and accumulation of a solids around the outlet, creating a ugly wet mudhole. Both of these conditions are usually accompanied by a mosquito problem. The mudhole problem usually results from there being uncontrolled runoff from construction upstream, or incomplete emptying/drying of the basin between storms. This can be remedied by designing the basin with a small wetland, planted with native wetland species, or a permanent pool, with native wetland vegetation around the perimeter. The water or wetland covers the sediment, and the wetland plants provide habitat for critters that feed on mosquitoes and their larvae. If this pond or wetland dries up during the dry season, no harm is done if native wetland species are planted, because, they have learned to cope with local dry periods. Another method of handling the problem is to design a sediment fore bay into the upstream end of the basin.

Other features that enhance the community value of the basin are integration of these facilities with green space planning and with drainage and flood control facilities.

Maintenance requirements depend primarily on landscaping. If planted with low growing ground cover, and shrubbery, semi annual inspection and repair of eroded areas is sufficient. Inspection of inlet areas and outlet works for debris and erosion should be performed semi-annually and after large storms. Inspect sediment pool accumulation annually; removal of the accumulated sediment is required every 7 to 10 years. With rare exceptions, the concentration of hazardous chemicals in the sediments should well below the threshold for classification of the sediment as a hazardous waste, so the sediment usually are disposed in a landfill, or used for fill.

Retention Ponds: Retention ponds are designed to be artificial lakes with an open water area, and a wetland bench. Their purpose is to remove dissolved biochemically oxidizable pollutants and nutrients from urban runoff. They do this through a combination of physical, biochemical processes. Sedimentation of solids occurs in the open water and wetland bench; nutrients are removed in the open water by photosynthesis and by bacteria attached to the stems of the wetland plants; and biochemically oxidizable pollutants are removed by bacteria in the open water and in attached biofilms on the wetland plants.

Retention ponds are usually developed as water features in a community, increasing the value of adjacent property. In the literature, retention ponds are also commonly referred to as wet ponds, but different authors have assigned different types of treatment control under this heading. Basically there are two wet pond types. The first is an extended detention basin with a permanent pool, and sizing criteria is based on the removal of suspended solids from the runoff. The second is a retention basin designed as a wetland. An advantage of retention ponds is that the permanent pool can be excavated; this allows retention ponds to be constructed on fairly flat land, and still function properly.

The permanent pool is sized so that the runoff's the residence time during the wettest month of the year is about 14 days. The pool bottom is designed with a 10 to 16 ft. wide bench around the perimeter that is less than 3 feet deep and planted in emergent aquatic vegetation. The vegetation deters children from wading out to the deeper area of the pond, and provides habitat for a variety of aquatic plants and animals. Among other things the animals include small fish and insects that prey on mosquitoes and their larvae. It is important to design the open water portion of the pool over 6 ft deep, otherwise submerged aquatic vegetation will begin to grow, creating a displeasing aesthetics situation that requires vegetation harvesting, or use of herbicides to control, A retention pond should also have a sufficient supply of water during the dry months of the year so that the aquatic vegetation does not die. Flood control detention storage can be added above the permanent pool, with the sides of the detention pond landscaped appropriately.

Maintenance of retention ponds is significant during the first year during which time the aquatic plantings should be inspected quarterly to detect and remove nuisance aquatic plants. If the inlets and outlets are properly designed against erosion and plugging, the only further maintenance required --other than landscape maintenance-- is annual inspection of the outlets, and checking and repairing shoreline erosion. Some designers recommend harvesting of vegetation every 3 to 5 years. Unless there is uncontrolled construction runoff to the retention pond, sediment removal is usually required every 7 to10 years, and with rare exception, can be disposed as non-hazardous fill material. Where sediment is a problem, the design of a sedimentation forebay will make maintenance much easier.

Wetlands (or Vegetated Storm Water Treatment Facilities): In their simplest description, wetlands are retention ponds with more emergent aquatic vegetation and a smaller open water area (less than 25% of the water surface area). Wetlands remove the same pollutants as retention ponds, with about the same efficiency. The permanent pool size requirement varies, depending upon the designer, but 14 days retention time during the wettest month of the year is generally considered adequate. As with retention ponds, wetlands can be integrated into developments as part of the water features of the community, and they can be excavated below the dry land surface. Flood storage can also be added above the treatment wetland where terrain permits. It is essential that a wetlands ecologist be consulted about planting so that the proper plants are selected for pollutant removal, and they can withstand the dry periods that naturally occur in the local area. In areas where significant soil erosion is anticipated upstream of the facility, a settling pond forebay should be incorporated into the design.

Maintenance requirements for wetlands are similar to those of retention ponds. During the first two years, it is extremely important that the facilities be inspected quarterly for nuisance vegetation and that these be removed; this will insure a healthy and aesthetically pleasing facility. Subsequent maintenance comprises annual inspection for erosion and outlet blockage, in addition to inspection of the integrity of the facility after major storms. Every 7 to 10 years, the vegetation should be removed and replanted, and sediment accumulations removed.

Other Treatment Controls: There are two other treatment controls that are often referenced in storm water treatment handbooks. These are *media filtration*, and *alum injection*. Media filtration generally comprises a settling basin followed by a filter. These facilities have been widely applied in Austin and San Antonio, Texas. Various media have been used in the filters; sand is the most popular, but peat and compost have also been tried. Field research indicates the sand filter has the same effectiveness in removing suspended solids as extended detention or retention facilities. Reported removal efficiencies for other types of media have varied widely. Plugging of the filter media is common with these facilities and a significant maintenance program is required to insure their proper operation.

Alum injection has been used with good success in Orlando Florida as a retrofit treatment process where storm water inflows to local lakes in developed areas have become eutrophied. Alum is injected into the storm drains a short distance from the outlet; the resulting floc coagulates the suspended sediments, metals and phosphorus out of the water column and settles it to the bottom. Maintenance requirements are minimal, requiring only servicing of the alum injection units. The long term effects of the alum of the bottom benthos are not known, but facilities in operation for more than ten years indicate a healthy and diverse biological community, significantly better than the community that was there at the time the process was initiated.

IMPERVIOUS COVER LIMITATIONS

As mentioned above, the most effective source control for regulating the amount and rate of runoff and the pollution in the runoff at or near the source of runoff is to minimize the amount of impervious cover.

Single-Family Residential Use: The BMP design criteria in the LCRA Technical Manual [6-3] indicates that for low density single family residential uses (i.e. with minimum lot sizes of one acre), the use of vegetative buffer areas for treating runoff should be solely adequate for impervious covers up to about 20%. However, for single family residential development with impervious cover in excess of 20% additional treatment trains of structural BMPs (e.g. ponds) are necessary. As discussed above, structural BMPs require much more maintenance than vegetative buffer areas; therefore, for this reason and because of the overwhelming response to the 2004 Community Survey to maintain green space at no less than 80%, the Steering Committee recommends that no more than 20% impervious cover be allowed for low density, single family residential development.

Non-Residential and Multi-Family Residential Use: Multi-family residential and non-residential uses commonly have a more dense use than single family residential use and commonly have greater financial resources to maintain structural BMPs for treating stormwater runoff from areas with impervious cover exceeding 20%. The citizens of Volente indicated through the 2004 Community Survey that they were willing to allow a higher percentage of impervious cover (i.e. lower percentage of green space) within multi-family residential and non-residential developments if the total amounts of multi-family residential and non-residential uses were restricted within the Village (see the Future Land Use element of the Comprehensive Plan). The Steering Committee recommended that the denser multi-family residential and non-residential uses be allowed up to 35% impervious cover, roughly 50% more allowable impervious cover than allowed for single-family residential use.

POLLUTANT TREATMENT RATES

The LCRA's Lake Travis "Nonpoint-Source Pollution Control Ordinance" prescribes the minimum pollutant removal rates for total suspended solids, total phosphorus and oil and grease for all development within Volente (see Table 2.4 of the Baseline Analysis element of the Comprehensive Plan). The citizen's response to the 2004 Community Survey indicated that they desired the pollutant removed rates for single-family residential development be the same as required by the LCRA Lake Travis ordinance. However, the citizens of Volente indicated that they desired higher pollutant removal rates for multi-family residential and non-residential developments. As a result of citizen input, the Steering Committee recommended the following pollutant removal rates:

- Single-Family Residential Use: The same pollutant removal rates required in the LCRA Lake Travis ordinance;

- Multi-Family Residential and Non-Residential Uses: 95% pollutant removal rate for all pollutant categories (note: 100% removal rate was considered unrealistic).

VILLAGE-WIDE VEGETATIVE BUFFER

By removing less than 100% of the pollutants generated by development on the sites of developments, up to 30% of the pollutants created by single-family residential uses and up to 5% of the pollutants created by multi-family residential and by non-residential uses will be released off the sites of development, to flow downstream toward and into Lake Travis. Based upon input from the community, the Steering Committee recommended that additional treatment of pollutants be effected through the preservation of natural greenbelts along Volente's upland waterways. The City of Austin's environmental ordinances in effect prior to the Village's incorporation required the preservation of such greenbelts as Water Quality Buffer Zones. The preservation of 100-feet wide buffer zone along either bank of the upland waterways will result in additional treatment of the total pollutants released off the sites of development. Plate 6-1 maps the recommended WQBZs along the Village's upland waterways.

RESTRICTIONS ON DISTURBING STEEP NATURAL GRADES

Steep natural slopes (i.e. natural grades of 25% or steeper) are highly sensitive to degradation caused by land disturbing activities of urban developments, resulting in loss of top soil and wildlife habitat, and resulting in accelerated amounts of pollutants (primarily suspended solids) being deposited along the upland waterways and within Lake Travis. Such steep areas are commonly defined with other environmentally sensitive areas (such as springs, bluffs, recharge features, wetlands, critical habitat) as Critical Environmental Features (CEF). Within such CEF zones all land disturbing activities are restricted. Plate 6-1 maps the locations within Volente with natural slopes of 25% and steeper.

CLEAN AIR STANDARDS[6-5]

Over the last thirty years air quality in the nation has steadily improved, even as the nation's economy and population has greatly expanded. However, the federal state government and regional local governments continue to look for progressive solutions to remaining indoor and outdoor air pollution problems, which can cause breathing difficulties, long-term damage to respiratory and reproductive systems, cancer, and premature death.

Air pollution also can affect the environment by reducing visibility, damaging crops, forests, and buildings, acidifying lakes and streams; and stimulating the growth of algae in estuaries and the build-up, or bioaccumulation, of toxics in fish. Bioaccumulation poses particular risks to those who subsist on plants, fish and game. Certain chemicals emitted into the air diminish the protective ozone layer in the upper atmosphere.

The Village desires to best address clean air problems by restricting uses that are known air polluters and by providing leadership and education for its citizens in employing clean air techniques.

WILDLIFE HABITAT CONSERVATION[6-6]

This Environmental Quality element of the Strategic Plan, includes a plan for tackling the challenges of wildlife habitat conservation. Volente citizen's input through public hearings and the 2004 Community Survey indicate that the community recognizes the critical importance of protecting and conserving the Village's natural resources.

Conservation and protection of natural resources is about more than water, earth and species - it is about Volente's quality of life. Fish and wildlife in the region represent tremendous environmental, recreational, cultural, special, historical, and economic assets for the region, especially for the Village. The citizens of Volente have clearly expressed a strong commitment

[6-5] See footnote 6-1
[6-6] "Strategic Plan, Fish and Wildlife Service, 2000-2005"; www.usfws.gov.

to fish and wildlife resources; they enjoy watching and pursuing fish and wildlife, and hunting and fishing remain strong components of the community's rural culture.

Natural resource protection and conservation has been underway in the region for many years; however, in the last twenty years, the region's citizens and local governments have committed themselves to understanding and protecting not only fish and wildlife but also the ecosystems that support them. There has been a growing realization that sustained economic growth and quality of life are dependent on maintaining the balance of a healthy environment with the full diversity of the creatures that live there. Today, in Volente, there is an awareness and greater appreciation of its relationship with the environment and how its actions can affect the ecosystems within which its citizens live. The challenge to Volente extends further than simply controlling the numbers of animals harvested or fish caught; the Village faces the complex issues of diversity and sustainability of biological resources literally in its own back yard.

Human activity within Volente will continue to create significant stress on its natural resources. Population dynamics and geographic demographics play a significant role in the use and demands made upon the Village's natural resources and natural settings. Volente's rapid population growth will place even greater demands and stresses on its environment and use of its natural resources than ever before. Further, the implications of this unprecedented era of growth in the Village of prosperity and progress in technology will continue to have a profound affect on the management of its natural resources.

Accelerated land use activities within Volente will dramatically affect the composition and configuration of diverse wildlife habitats and populations sustainability. This significant increase in urban growth will likely have significant impacts on wildlife population, especially from the continued loss of habitat. Though it is difficult to directly measure the economic benefits of fish and wildlife conservation to the community, the citizens of Volente have expressed that they gain value simply from knowing that wild places and unique species still exist in the Village. While many species of wildlife are abundant and are exhibiting stable or increasing population trends, the number of threatened or endangered species is also increasing. Today, there are over 39 species of animals and plants listed as threatened or endangered of extinction within Travis County (see the Baseline Analysis element of the Comprehensive Plan). The Volente area itself is considered prime habitat for the endangered Golden-Cheeked Warbler and for endangered Edwards limestone cave-dwelling species. The BCP land adjacent to Volente attests to not only the region's commitment to the preservation of its endangered and threatened species but also attests to the quality of the wildlife habitat within and around Volente.

Plate 6-2 maps the current delineations of the confirmed and unconfirmed habitats of the Golden-Cheeked Warbler and of the cave species within the Village. Table 6.2 summarizes the pertinent land areas encompassed by the critical habitats.

Table 6.2 Summary of Critical Habitat for Threatened and Endangered Species within Volente	
Golden-Cheeked Warbler Confirmed Habitat	754 acres
Golden-Cheeked Warbler Unconfirmed Habitat	264 acres
Endangered Cave Species Habitat	151 acres[1]
(1) The area of the endangered cave species habitat is encompassed by the area of the golden-cheeked warbler confirmed habitat.	

WILDLIFE HABITAT CONSERVATION MEASURES

The enforcement of the federal Endangered Species Act falls under the jurisdiction of the U.S. Fish and Wildlife Service (USFWS), primarily through the "10a" permitting process. The enforcement of the federal Clean Water Act falls under the jurisdictions of the U.S. Army Corps of Engineers through the "Section 404" permitting process with respect to the conservation of critical habitats. Though not responsible for enforcement of federal statutes and laws, the Village should require all persons desiring to develop lands within Volente to provide proof of compliance with the federal statutes and laws, such as providing copies of the federal permits. Volente should also undergo informal consultation with state and federal resource agencies to receive guidance and training on appropriate conservation measures.

A direct conservation measure that the Village can take is to set aside as much open space as reasonably possible. The water quality element of this Environmental Quality Plan discusses the dedications of Water Quality Buffer Zone along the upland waterways. The Parks and Open Space element of the Comprehensive Plan discusses setting aside up to 20% of the future development lands for useable open space. In all cases, the open spaces and buffer zones should be preserved in their natural states with only minimal land disturbing activities allowable (e.g. construction of hike and bike trails).

Another direct conservation measure the Village can take is to utilize dedicated funds to purchase pristine critical habitat through a "funds in lieu of a park" payment program. Even with limited financial resources, Volente can take the leadership role in educating its citizens in implementing conservation measures.