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Eagle Mountain Watershed Management

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Reservoir age, increasing human population, and changing land uses have prompted the development of a watershed protection plan to reduce contaminants in Eagle Mountain Lake and to promote stewardship among the people who work, live, and recreate near the lake.

Lake managers are working with local residents, elected officials, and government agency representatives to develop a comprehensive program to protect the lake. The program has integrated water quality testing, citizen involvement, expert input, and computer models to:

- Analyze the source and amount of pollutants in the lake
- Illustrate past, present, and future lake conditions that result from various management techniques
- Evaluate the economic effects of those techniques to determine the most efficient use of funds to improve water quality in the lake

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The resulting watershed protection strategy is a flexible combination of management practices and educational programs for targeted audiences and issues in the watershed. The lake's water quality will be monitored regularly to gauge the program's success in improving lake conditions.

Eagle Mountain Lake

Eagle Mountain Lake was built in 1932 to control flooding and supply water to residents of north central Texas (Table 1). Most of the lake lies in Tarrant County just north of Fort Worth. The lake provides aesthetic, economic, recreational, water supply, and wildlife value for the region.

Table 1. Eagle Mountain Lake facts

Surface area	8,702 acres
Conservation storage	179,880 acre feet
Shoreline	83.5 miles
Length	11 miles
Maximum depth	50.9 feet
Origin	An impoundment of the West Fork of the Trinity River

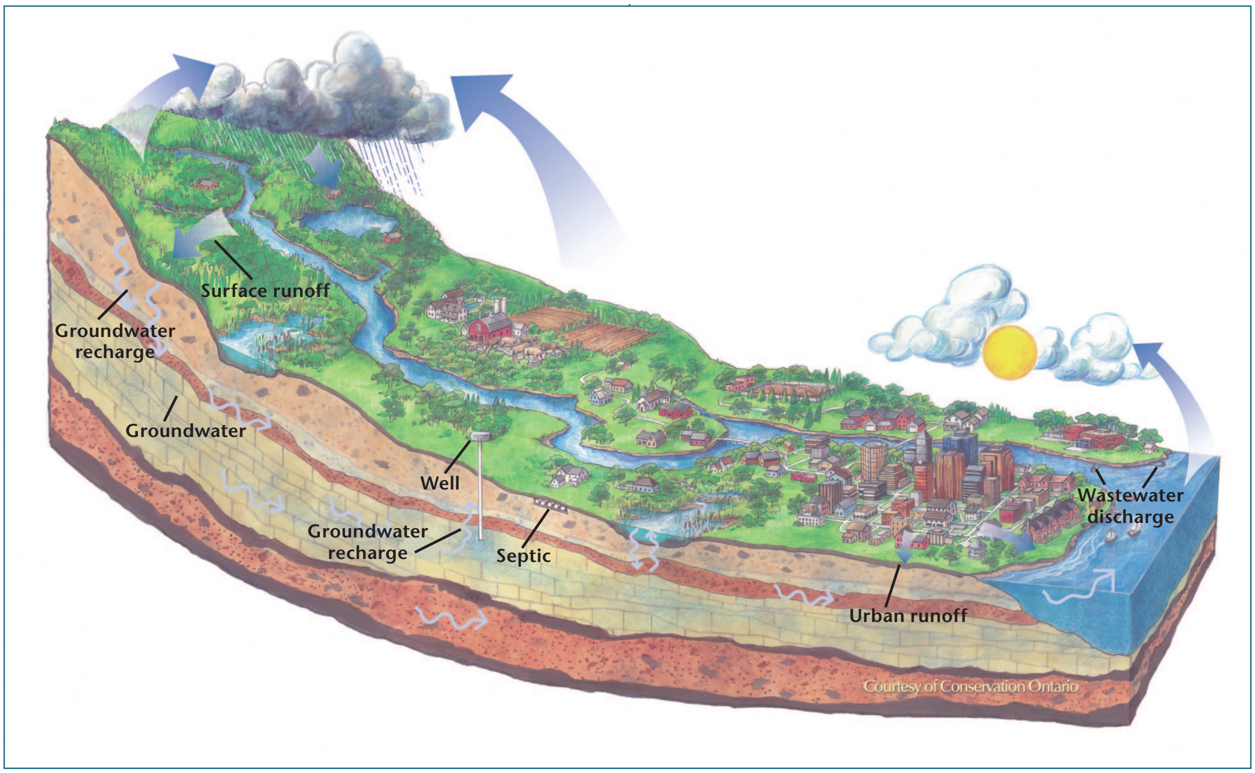

Figure 1. Example of a watershed with multiple land uses. **(Source: Conservation Ontario, 2009)**

Eagle Mountain Watershed

A watershed is an area of land that drains into a common water body such as a river, lake, or ocean (Fig. 1). For the Eagle Mountain Watershed (Fig. 2), the common body of water is Eagle Mountain Lake.

The boundaries of a watershed are defined by the lay of the land—they are the outermost areas that divert rainfall and streams into a specific collection point. Watersheds include human populations, land uses, wildlife, and biological and ecological processes.

On a larger scale, watersheds fit into river basin systems. Eagle Mountain Lake is located in the Trinity River Basin (Fig. 3).

Figure 2. Eagle Mountain Watershed.(Source: Texas A&M Spatial Sciences Laboratory, 2007)

Water quality

In the late 1980s, the Tarrant Regional Water District implemented a long-range study of chemical water-quality parameters within its reservoirs, including Eagle Mountain Lake. Over a study period of 19 years, the tests found increasing amounts of chlorophyll-*a*, the major

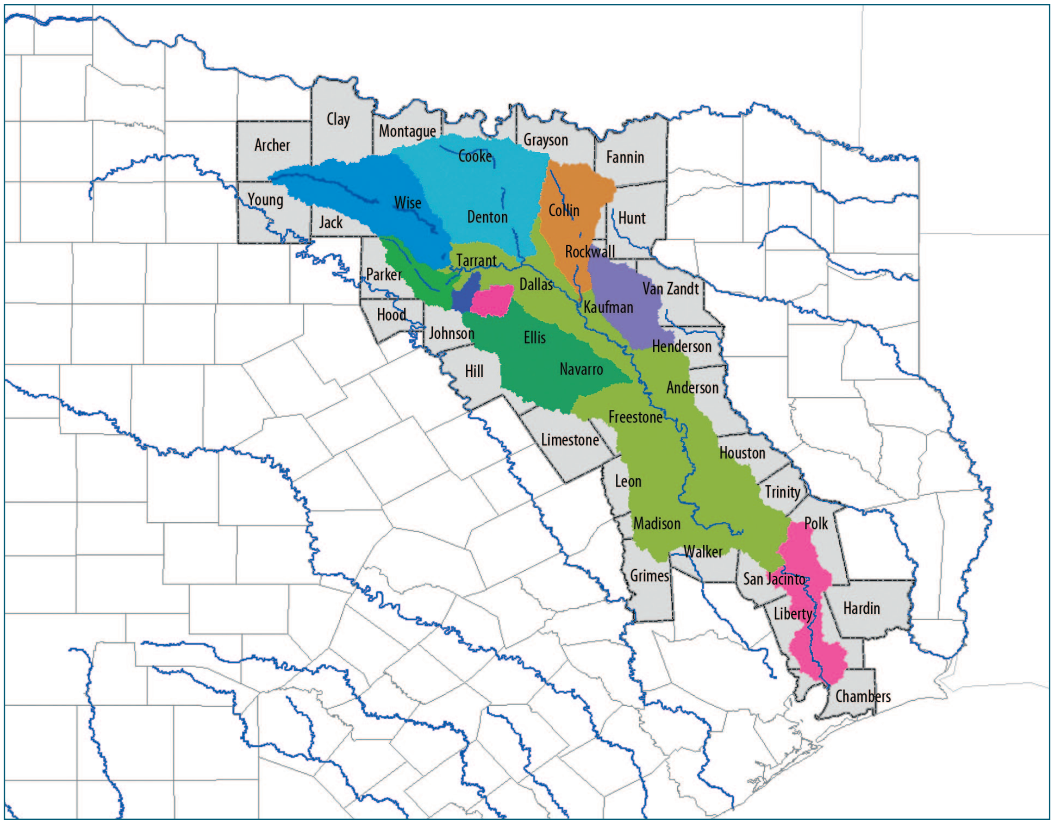

Figure 3. Greater Trinity River Basin with surrounding counties. **(Source: Texas Water Development Board)**

type of chlorophyll in green algae. Scientists use the amount of chlorophyll-*a* in water to indicate the amount of algae in a water body. The tests found that during the study period, the levels of chlorophyll-*a* increased at an annual percentage rate of 3.53 percent.

The increase of chlorophyll-*a* in Eagle Mountain Lake could increase populations of algae and reduce the amount of dissolved oxygen in the lake. These changes can damage the lake's water supply, wildlife habitat, and recreational uses.

Sources and causes of pollution

The increasing levels of chlorophyll-*a* in the lake are caused by excessive concentrations of nutrients and sediment that run off from the surrounding watershed. Sediments carry nutrients, which feed algae. These nutrients and sediments are referred to as the *pollutant load.* The *total pollutant load* in a watershed is the amount of pollutants from both point sources and nonpoint sources:

- **Point source pollution** comes from a specific discharge point; examples are industries, stormwater collection systems, and municipal wastewater treatment plants.
- **Nonpoint source pollution** comes from sources that are spread out across the landscape, making the polluted water more difficult to collect and treat. Examples are city streets, farm fields, home lawns, and onsite septic systems.

Point source pollution in the watershed

The primary point sources of pollution in the Eagle Mountain Watershed are wastewater treatment plants. As the population has increased in the watershed, so has the number of wastewater treatment plants that discharge

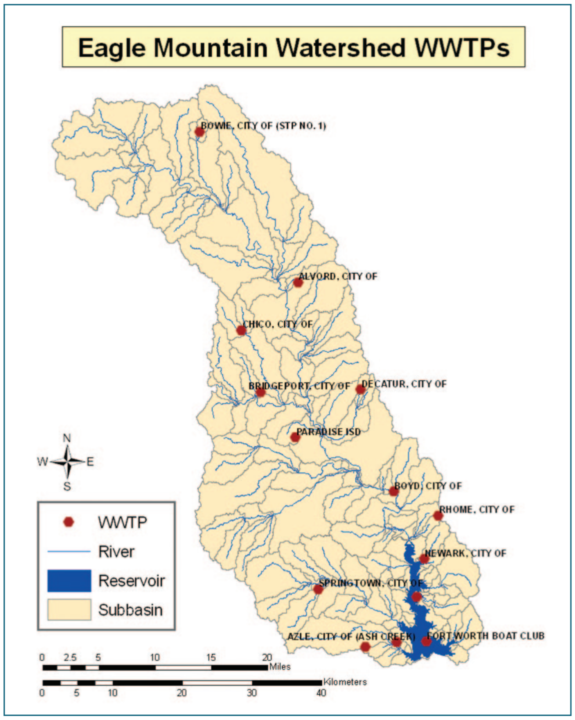

Figure 4. Wastewater treatment facilities in the Eagle Mountain Watershed. **(Texas A&M University Spatial Sciences Laboratory, 2009)**

into area streams and directly into the lake. When the watershed protection strategy was developed, there were 14 wastewater treatment plants in the Eagle Mountain Watershed (Fig. 4). The treatment plants use a variety of methods to comply with current state standards.

Nonpoint source pollution in the watershed

Nonpoint sources in the Eagle Mountain Watershed derive from urban and agricultural land uses. Urban areas, such as Tarrant, Wise, and Parker Counties, have grown significantly in recent years. Agriculture also continues to be a predominant land use in the watershed. According to Geographic Information Systems (GIS) modeling, over 58 percent of the land area in the watershed is grassland or pasture; 4.7 percent is cropland; and over 9.5 percent is urban area.

Fertilizers can be a significant source of nonpoint source pollution. In the past, the overuse or misuse of fertilizer on crops has sent nitrogen and phosphorus over land into streams during heavy rains. Excess phosphorus from lawn fertilizers also can filter into rivers and lakes.

Solving the problem: Watershed protection planning

A watershed protection planning process was established in 2008 to determine the extent of the pollution in Eagle Mountain Lake and to develop a structured course of action to improve water quality. A multi-year implementation phase has been proposed to:

- Limit the rise in chlorophyll-*a* through the use of best management practices (BMPs)
- Educate residents on how to reduce the flow of phosphorus and sediment into the lake

The planning efforts are being guided by a stakeholder-approved goal of reducing phosphorus in the watershed by 30 percent. The phosphorus-reduction practices are expected to also reduce the amount of sediment and nitrogen in the water.

Management measures

Computer modeling along with local experts on the watershed have identified and ranked the areas that may produce the most phosphorus, nitrogen, and sediment within the watershed. Watershed planners have also evaluated a variety of nutrient-reducing practices to determine those that can reduce the most pollution per dollar allocated. Funding to implement the BMPs will be allocated to the areas where pollution can be reduced the most.

Practices: Watershed planners have determined that the most cost-effective practices are filter strips, grade stabilization, grassed waterways, herbicide applications, terracing, and the subsidized conversion of croplands into pasture.

Locations: Using the Soil and Water Assessment Tool, a computer model, the planners have determined the priority areas in the watershed where the management practices will be implemented.

Education: An informational program will be directed to multiple audiences with the goals of improving watershed literacy and stewardship.

Below are descriptions of the various potential management practices that have been identified as economical options for protecting Eagle Mountain Lake.

Proposed practice: Filter strips

Filter strips are vegetated areas situated between surface water bodies (such as streams and lakes) and cropland, grazing land, forestland, or land that has been disturbed by clearing or new construction. They are generally located where runoff water leaves a field. Also known as buffer strips and vegetative filter strips, these areas trap and filter sediment, organic material, nutrients, and chemicals from the runoff water (Fig. 5).

Proposed practice: Grade stabilization

Grade stabilization structures reinforce lakesides, gullies, and stream banks (Fig. 6).

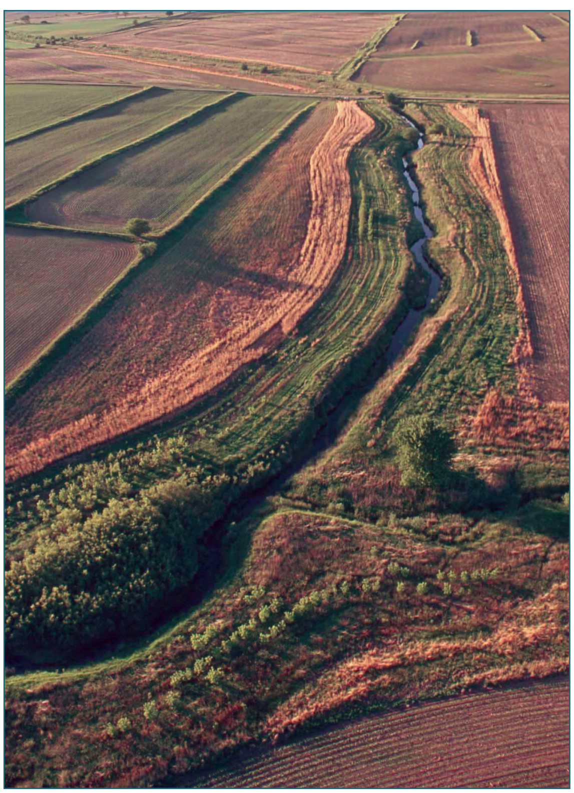

Figure 5. Filter strip. (Source: U.S. Department of Agriculture–Natural Resources Conservation Service)

Figure 6. Grade stabilization structure. (Source: USDA–NRCS)

They reduce erosion and sedimentation from steep embankments that are likely to lose soil during storms. To be most effective, the structures must be located properly.

Proposed practice: Grassed waterways

Grassed waterways are natural or constructed channels that use plants to concentrate and slow water flow (Fig. 7). Established properly, grassed waterways can safely transport large amounts of runoff down slopes.

This conservation practice can reduce the amount of sediment and pollutants that flow into nearby water bodies. The vegetation minimizes erosion, improves soil aeration, and removes nutrients from the water.

Figure 7. Grassed waterway. (Source: USDA–NRCS)

Figure 8. Terracing. (Source: USDA–NRCS)

Proposed practice: Terracing

A terrace is a series of earthen embankments constructed across a field at vertical and/or horizontal intervals based on land slope, crop rotation, and soil conditions (Fig. 8). Terracing is recommended for land with a grade of 2 percent or higher. Because the construction, operation, and maintenance of terraces are significant, they will be located in the Eagle Mountain Watershed only in selected areas of highest priority for the reduction of nutrients and sediment.

Proposed practice: Pasture and range planting (conversion of cropland to pasture)

Native or introduced vegetation can be planted in pastures and croplands to retain some of the rainwater, reducing runoff. The plants also absorb nutrients from the water and prevent them from reaching waterways.

Figure 9. Pasture planting. (Source: USDA NRCS)

Grasses, shrubs, trees, and other plants are used to restore the plant communities to historically natural conditions while meeting the nutritional needs of livestock and wildlife (Fig. 9).

Land-use-specific BMPs: Pasture and rangeland

Most of the land in the Eagle Mountain Creek Watershed is used for rangelands and pastures. Although pastures produce much less runoff pollution than do urban and cropland areas, BMPs are still needed in overgrazed and heavily fertilized areas. If overgrazed, pastures and rangeland do have enough vegetation to capture and absorb polluted runoff.

Proposed practice: Prescribed grazing

Prescribed (rotational) grazing is a management practice in which livestock are rotated to different pastures at regular intervals (Fig. 10).

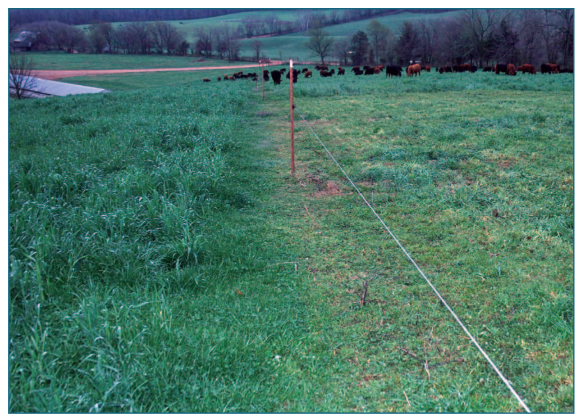

Figure 10. Prescribed grazing. (Source: USDA–NRCS)

The rotation keeps the grass healthy and allows it to establish a dense stand, which reduces soil erosion and retains soil nutrients.

In addition to reducing the runoff of pollutants, these proposed management measures can also benefit the landowner directly. Reducing nutrient runoff keeps the nutrients on the property, which reduces the need for additional fertilizers. The practices also keep soil on a property, which is critical for maintaining healthy plants and animals on the land.

Voluntary urban nutrient management

Urban areas account for 9.57 percent of the total land area in the Eagle Mountain Watershed. Runoff from streets, roofs, and other hard surfaces can carry pollutants into Eagle Mountain Lake. This runoff, made worse during major rains, is referred to as stormwater.

A proposed way to manage stormwater and reduce nutrient pollution is through voluntary changes in lawn care practices by urban residents. This strategy will require that the public be educated on how to reduce fertilizer use through soil testing, proper landscaping, and lawn management.

Education and outreach

To succeed, the Eagle Mountain Watershed Protection Plan must do more than implement structural water-management practices. It must also educate people on how to improve their stewardship of watershed resources. To begin this education process, a campaign has been developed to inform people living in the watershed that their actions affect lake water quality. The program aims to help reverse the trend of increasing pollutants entering Eagle Mountain Lake.

The educational program will:

- Encourage the use of best management practices on multiple levels
- Target specific audiences such as youths, homeowners, agricultural producers, and recreationists
- Explain why structural practices need to be adopted and maintained
- Publicize the current and future conditions of the lake and watershed to increase the public's general water literacy

Summary

The Eagle Mountain Watershed Protection strategy is a comprehensive, scientifically based plan for addressing the water quality problems in Eagle Mountain Lake. It emphasizes that every person living, working, or playing in the watershed contributes to the water quality of the lake.

Planners have identified and prioritized major sources of pollutants in Eagle Mountain Lake, and they have selected structural and non-structural best management practices to reduce lake contamination. A targeted educational program will work to raise awareness and motivate citizens to each do their part to protect this valuable water resource.

About the North Central Texas Water Quality Project

The North Central Texas Water Quality Project is a collaborative effort of the Texas Water Resources Institute, Texas AgriLife Research, Texas AgriLife Extension Service, Texas Commission on Environmental Quality, Texas State Soil and Water Conservation Board, and Tarrant Regional Water District. Funding for the project comes from the Environmental Protection Agency and the U.S. Department of Agriculture–Natural Resources Conservation Service.

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