SECTION 3

District Land and Resource Factors Inventory

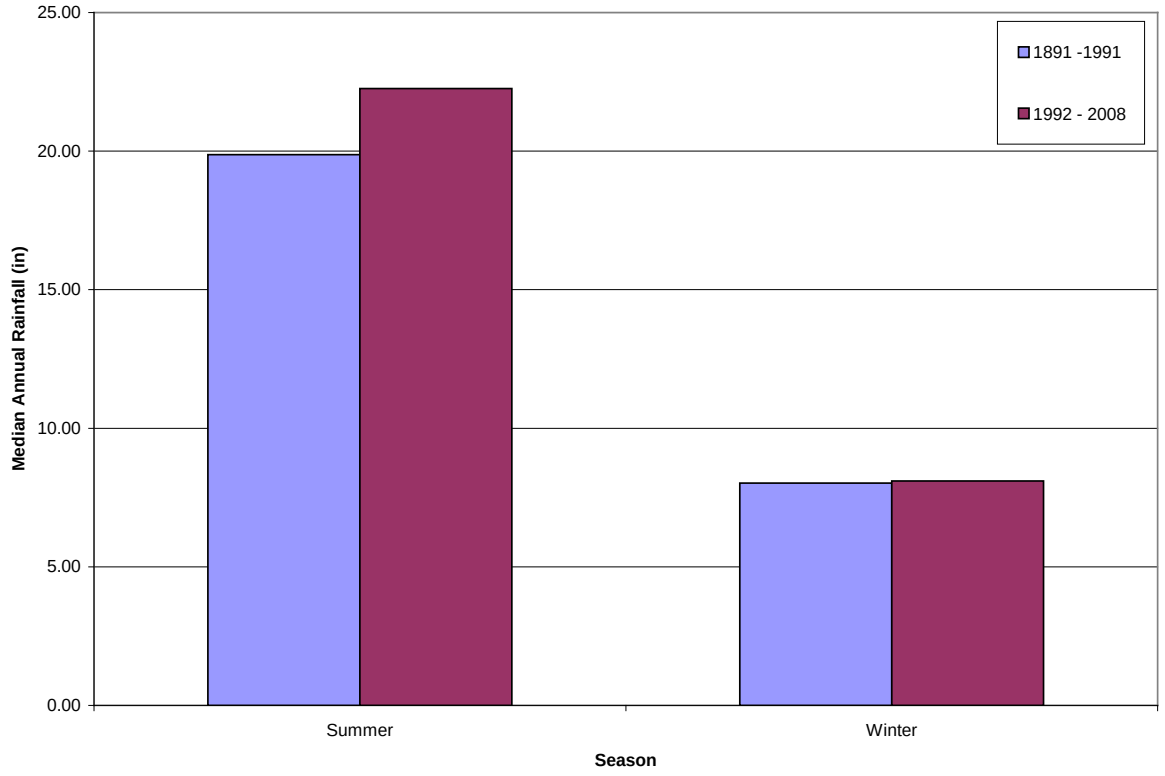
In accordance with the requirements for Watershed Plan content as set forth by Minnesota Rules Chapter 8410, this section is provided as a summary of watershed-wide characteristics. Section 3 describes those land and resource factors that cover the entire watershed including precipitation, geology, topography, groundwater resources, soils, and unique features. Lake and creek specific resource inventories can be found by creek watershed in Section 4 (Riley Creek watershed), Section 5 (Purgatory Creek watershed), and Section 6 (Bluff Creek watershed).

3.1 Precipitation

The precipitation data normally used in the seven-county metropolitan area for hydrologic and hydraulic design are incorporated by reference in this plan or may be included in the local plans of the municipalities within the District. The data are recorded and maintained by the United States Weather Service located at the Minneapolis/St. Paul Metropolitan Airport and published in the U.S. Weather Bureau Technical Papers No. 40 and 49, and updates. The District also uses information recorded by the United States Weather Service at the Minneapolis-St. Paul International Airport and Chanhassen, Flying Cloud Airport, and private observers in Eden Prairie and Chanhassen. The location of monitoring stations is shown in the Annual Report of the District which also publishes the data in that report.

Additional precipitation gages are operated by the Metropolitan Council. Rain gage #19 has the most complete coverage of the watershed. It has a long term rainfall record from 1891 to present. The long term median annual rainfall from 1891 to 1991 was 27.68 inches. The median annual rainfall from 1992 to 2008 has increased to 30.77 inches. The bulk of this increase has occurred in the summer months (April – September) while the winter months (October – March) have remained relatively constant (see Figure 3-1). Climate change predictions from the U.S. Global Climate Change Research Program predict that this will shift to wetter winters and springs with more intense precipitation throughout the year.

FIGURE 3-1
Seasonal Long Term Precipitation Trends



3.2 Summary of General Geology and Topography

The District is located within the Minnesota River Basin. Its creeks are small tributaries to the Minnesota River. The District is part of the North Central Hardwood Forest Ecoregion. Within this ecoregion the District is part of the region commonly known as "Big Woods", which is characterized by a rolling glacial end-moraine whose rich soils supported native oak woodlands and dense maple-basswood forests.

3.2.1 Topography

The District's topography is divided into three general categories.

The upper portion of the District, north of Trunk Highway 7, is relatively flat with poorly defined drainage patterns. Most of the drainage facilities in this area were agricultural drain systems installed in the 1920s. In 1977, the City of Minnetonka undertook a project that improved the drainage facilities in the Trunk Highway 7 and Trunk Highway 101 area.

The central portion of the District is characterized by gently rolling upland areas with well-defined drainage patterns and floodplain areas. Much of the floodplain through this portion of the District is marsh and wetland. All the major lakes are located within the central portion of the District.

The southern and western portions of the District, are dominated by a part of the northern bluff of the Minnesota River valley. Riley Creek, Purgatory Creek, and Bluff Creek, have eroded deep channels as they flow from the top of the bluff, at elevations ranging from 820 to 950 to the Minnesota River floodplain at an elevation of 700. The United States Geological Survey Topographic Map contains additional detail on elevations in the District.

3.2.2 Geology

The uppermost bedrock formation over most of the District is the Shakopee-Oneota Dolomite. In the lower portion of the District, glacial action had eroded away the Shakopee-Oneota Dolomite, leaving the Jordon Sandstone and the St. Lawrence Formation as the uppermost bedrock formation. The St. Peter Sandstone and other overlying formations which exist in other portions of the Twin Cities areas are not present within the District, having apparently been eroded away by glacial action.

Surficial Geology

See Meyer G.N. and Hobbs. H.C, "Plate 3 of 9: Surficial Geology" in Geologic Atlas Hennepin County, Minnesota, University of Minnesota (1989).

Bedrock Geology

See Olsen, B.M. and Bloomgren, B.A., "Plate 2 of 9: Bedrock Geology" in Geologic Atlas Hennepin County, Minnesota, University of Minnesota (1989).

3.3 Groundwater Resource Data

3.3.1 Aquifers

The groundwater system in the District is comprised of the glacial drift water table and the underlying bedrock aquifers which are partially in an artesian condition. An artesian condition means that water in the bedrock is maintained under pressure by confining upper layers.

The glacial drift aquifer system includes a buried drift aquifer that is hydrologically separated from the water table aquifer in the western part of the District.

Since groundwater flows from high pressure area to a low pressure area, the relative magnitude of the groundwater contour determines the direction of the flow between the aquifers. For example, in the Duck Lake area of Eden Prairie, the glacial drift water table is at an elevation of approximately 870 and the Jordon pressure is at approximately elevation 840. This indicates that, in the absence of a confining layer, a groundwater flow from the glacial drift to the Jordon Sandstone exists. This situation is reversed along the southern boundary of the District. In the area of Flying Cloud Drive and Riley Creek, the glacial drift water table is at an elevation of approximately 700 and the pressure in the lower reaches of the glacial drift is at an elevation of 700. This indicates that a flow of water exists from the Jordan aquifer to the glacial drift in this area. In many places along the southern boundary of the District, the Jordon Formation is a source of water to Riley, Purgatory and Bluff Creeks.

Quaternary Hydrogeology

See Kanivetsky, R., "Plate 5 of 9: Quaternary Hydrogeology" in Geologic Atlas Hennepin County, Minnesota, University of Minnesota (1989).

Bedrock Hydrogeology

See Kanivetsky, R., "Plate 6 of 9: Bedrock Hydrogeology" in Geologic Atlas Hennepin County, Minnesota, University of Minnesota (1989).

3.3.2 Groundwater/Surface Water Connections

Water flowing through the Shakopee-Oneota Dolomite and Jordon Sandstone formations is recharged by precipitation and resulting vertical seepage over the upland areas. These aquifers discharge to the Minnesota River in the form of springs along the riverbanks and seepage into small streams such as Purgatory Creek, Riley Creek, and Bluff Creek.

Sensitive Geologic Areas

See Piagat, J., "Sensitivity of Ground-water Systems to Pollution" in Geologic Atlas Hennepin County, Minnesota, University of Minnesota (1989).

Surface water must be managed with a concern for the groundwater resource. There is an inter-relationship between surface and groundwater resources.

3.3.3 County Groundwater Planning

Carver County

Carver County's groundwater plan was approved in August 1992. The plan identified the following as immediate planning and implementation issues: integration of groundwater planning into comprehensive plans; adoption of groundwater sensitivity maps; feedlot and septic system impacts; agricultural and urban chemical and fertilizer use; water quality monitoring; data collection and maintenance; abandoned wells; and land-spreading. In 2001, the county prepared the Carver County Water Management Plan, a comprehensive water plan dealing with both surface and groundwater issues. A copy can be found online at the following location:

http://www.co.carver.mn.us/departments/lws/water/2001Water/2001WaterWeb.htm

Hennepin County

Hennepin County prepared and BWSR approved a county groundwater plan in 1994. The county groundwater plan includes information on groundwater surface water connections and information on aquifers and the geology of the region. To this date, Hennepin County had yet to adopt the approved plan. Although the county has not formally adopted the plan, the county is proceeding with implementation of many aspects of the plan. Plan goals for cities will include management according to geographic location and hazard potential, delineation of wellhead protection areas around public supply wells, applying existing zoning authority to protect groundwater, ranking and management of hazardous land use activities according to risk, using a GIS system to manage groundwater information, location of abandoned wells, and adoption of contingency plans for groundwater.

The District will cooperate with Hennepin County as it implements different parts of its plan and use it to guide watershed management with respect to impact upon groundwater.

The Hennepin County Groundwater Plan requires that the District has a responsibility to coordinate preparation of standards and to implement programs that are uniform throughout each city, except where hydrologic conditions require variations. The District agrees to cooperate in fulfilling the following tasks:

- Within one year of Hennepin County adoption, amend the watershed plan for consistency with requirements of the county plan.
- Encourage cooperation by cities within the jurisdiction to fulfill the purposes of the county plan.
- Forward copies of local water management plans or planned amendments to Hennepin County and Hennepin Conservation District for comment.
- Within 2 years of Hennepin County adoption, attempt to identify District property that does not meet the requirements of applicable state and federal standards intended to prevent groundwater contamination.

3.4 Soil Data

The distribution of soil types in the District is the direct result of glacial action. The soils of the area are till materials deposited by the latest glacial advance. This advance, known as the Grantsburg Sublobe of the Des Moines Lobe, deposited grey drift over the area approximately 10,000 years ago. Near the surface, this material appears brown because of the oxidation; however, in deeper reaches it has a distinctive grey coloring. The moraine areas are typified by rolling hills and depressions usually filled lakes and marshes.

During the period when the glacier receded, there were numerous areas where blocks of ice were left in place while adjacent ice melted or was carried away. In these areas, the presence of ice blocks prevented the deposition of tills and outwash soils. Later, after the deposition of materials had ended, the ice blocks melted, leaving depressions in the landscape. These depressions filled with water, resulting in the lakes and potholes which prevail throughout the District.

Soil boring information in the area indicates that the subsurface soils are intermixed and do not exhibit areal continuity. Many soil borings indicate layers of the sand beneath the grey till which indicates the area had been subjected to outwash conditions prior to the last deposition of till over the surface.

Updated soils information for the District may be found at the following web site:

http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx

Soil types are an important factor in a watershed's physical landscape. For example, sandy soils will absorb water quickly versus hard, clay soils which will have less infiltrative capacity. Both types have implications for runoff and erosion, key factors in water quality.

3.4.1 Types

See Lueth, R.A., "Soil Survey of Hennepin County, Minnesota," United States Department of Agriculture (1974).

See Edwards, R.J., "Soil Survey of Carver County, Minnesota," United States Department of Agriculture (1968).

3.4.2 Development Limitations

See Lueth, R.A., "Soil Survey of Hennepin County, Minnesota," United States Department of Agriculture (1974).

See Edwards, R.J., "Soil Survey of Carver County, Minnesota," United States Department of Agriculture (1968).

3.5 Unique Features and Scenic Areas

DNR records that identify unique features and scenic area information including state designated natural and scientific areas containing county, state, and federal rare and endangered species as well as other features, such as waterfalls, springs, historic mills, and heritage elements identified by the DNR Heritage Program are incorporated by reference.

Just outside of District borders in Chanhassen is a calcareous seepage fen known as Seminary Fen. Located near the southwest border of the District (south of Bluff Creek Drive), Seminary Fen is a rare wetland type created by groundwater that comes to the surface along the limestone bluffs of the Minnesota River. Many rare plants and valuable wildlife habitat are found in and around fens. This type of fen is protected under the Wetlands Conservation Act and is regarded as an outstanding resource value water pursuant to the rules of the Minnesota Pollution Control Agency. Even though this fen is not located within the District, any project that has the potential to impact this sensitive and natural resource must address impacts through the preparation of a Fen Management Plan.

Under the Minnesota Wetlands Conservation Act (WCA), impacts to calcareous seepage fens are regulated by the Department of Natural Resources. According to the WCA, calcareous fens may not be filled, drained, or otherwise degraded, wholly or partially, by any activity, unless the commissioner of natural resources, under an approved management plan, decides some alteration is necessary (Minn. Statutes 103G.223).

The DNR purchased over 100 acres of the 600-acre Seminary Fen wetlands complex in 2008 and is developing a stewardship plan for long-term management and preservation of the fen. The Lower Minnesota River Watershed District is also forming a volunteer program to help preserve the Seminary Fen. Potential detrimental impacts may include such actions as upslope development that alters the qualities of surface water entering the fen and groundwater appropriations that would affect the hydrology of the fen including its recharge area. The District will cooperate with the Lower Minnesota River Watershed District in the development of a special protection plan for this fen, should that District determine one to be necessary.

There are three known, unique cranberry bogs within the District. The District, in conjunction with the DNR and the United States Army Corps of Engineers, developed a monitoring program to assess, avoid and mitigate impacts upon these bogs.

3.6 Pollutant Sources

The records of the Minnesota Pollution Control Agency which list known closed and open sanitary landfills, closed and operating dumps and hazardous waste sites as well as feedlots abandoned wells, registered underground and aboveground storage tank sites, and permitted wastewater discharges are incorporated by reference. To the extent that this information is included in a county groundwater plan, that information is incorporated by references and supplements and complements the provided information.