

SECTION II

II. LAND AND WATER RESOURCE INVENTORY

As required in Minnesota Rules Section 8410.0060, this section of the plan provides a general description and summary of the climate, geology, surficial topography, soils, land use, surface and ground water resource data, public utility services, pollutant source locations, water-based recreation areas, fish and wildlife habitat, unique features, and scenic areas within the Pioneer-Sarah Creek Watershed. This section also identifies where detailed information can be obtained for many of these topics. The information in this section is intended to provide guidance to the Commission in managing water resources and is not intended to be used for final design or construction within the Commission.

A. **PRECIPITATION / CLIMATE**

The present climate of the Pioneer-Sarah Creek basin is temperate, characterized by wide variations in temperature, ample rainfall, and moderate snowfall. The average annual temperature is 44 degrees Fahrenheit, (7 degrees Celsius), with the extremes ranging from 112 degrees F. (44 degrees C.) to -37 degrees F. (-38 degrees C.). **Table II-1** shows the average monthly temperature, precipitation, and snowfall data. **Table II-2** shows the rainfall events within the area. **Figure II-1** shows the normal annual precipitation.

TABLE II-1. AVERAGE MONTHLY TEMPERATURE, PRECIPITATION, AND SNOWFALL DATA FOR MINNEAPOLIS/ST. PAUL METROPOLITAN AREA

<u>Month</u>	<u>Average Temp. F°</u>	<u>Precip. inches</u>	<u>Snowfall inches</u>
January	11.8	0.83	9.8
February	17.9	0.85	8.4
March	31	1.60	11.7
April	46.4	2.17	2.8
May	58.5	3.38	0.1
June	68.2	4.17	0
July	73.6	3.55	0
August	70.5	3.40	0
September	60.5	2.89	0
October	48.8	2.01	0.5
November	33.2	1.45	7.9
December	<u>17.9</u>	<u>0.94</u>	<u>9.3</u>
Annual Average: 44.9		Total: 27.24	Total: 50.5

Source: State Climatology Office for the Minneapolis/St. Paul Airport

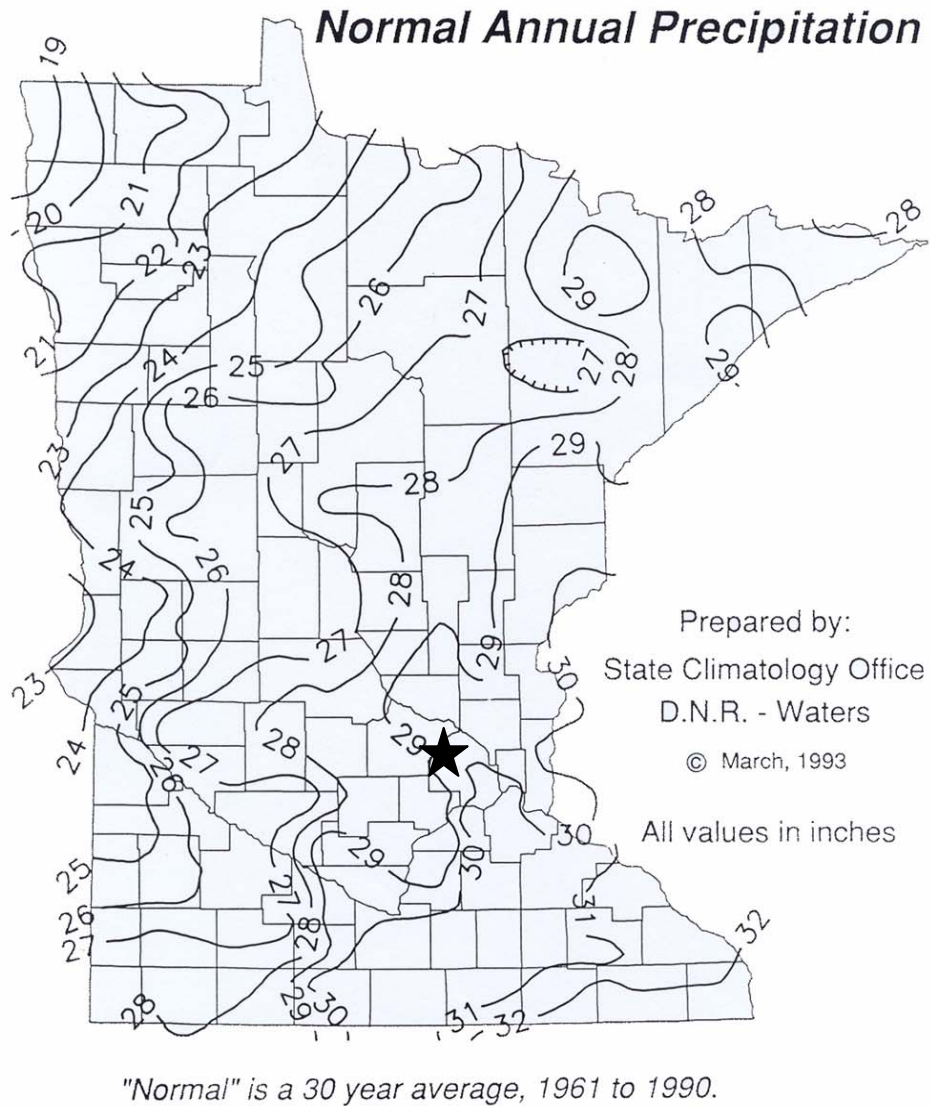


Figure II-1. Annual Normal Precipitation with the State of Minnesota

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TABLE II-2. RAINFALL/RUNOFF EVENTS FOR THE PIONEER-SARAH CREEK WATERSHED

EVENT FREQUENCY	EVENT DURATION	PROBABILITY OF OCCURRENCE IN ANY GIVEN YEAR	RAINFALL AMOUNT (INCHES)
1 - Year	24 - Hour	99%	2.4
2 - Year	24 - Hour	50%	2.8
5 - Year	24 - Hour	20%	3.5
10 - Year	24 - Hour	10%	4.2
25 - Year	24 - Hour	4%	4.7
50 - Year	24 - Hour	2%	5.3
100 - Year	24 - Hour	1%	5.9
25 - Year	10 - Day	4%	8.6
50 - Year	10 - Day	2%	9.8
100 - Year	10 - Day	1%	10.8
100 - Year	10 - Day Runoff	1%	7.2 (Runoff)

Source: Source: 24-hour rainfall values are from USWB TP 40; 10-day rainfall values are from USWB TP49; 10-day runoff values are from SCS TR60, Hydrology Guide for Minnesota

B. GEOLOGY

The present topography of the Pioneer-Sarah Creek watershed is a result of glaciation that ended approximately 10,000 to 12,000 years ago. Topography of the area is dominated by flat-topped hills and flat-bottomed basins separated by relatively short, steep slopes. The highest hills in the area reach approximately 1,070 feet in elevation above mean sea level, and the lowest areas are at about 920 feet elevation. Topography of the watershed area has been influenced by two major glacial events: the Superior Lobe and the Grantsburg Lobe that followed.

Grantsburg ice advanced from Manitoba along what are now the valleys of the Red and Minnesota Rivers. The Grantsburg Lobe advanced toward the southeast, bounded by the Coteau des Prairies on the southwest and the Alexandria-St. Croix moraine complex on the northeast. A broad, lower area in the St. Croix moraine allowed ice to flow northeast, over what is now the Twin Cities metropolitan area. Ice advance ceased in this area when the ice could not rise above increasing elevations to the northeast.

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The Grantsburg Lobe eroded and incorporated limestone fragments from Manitoba and shale particles from the Red River Valley, as well as particles left from previous glaciers. The interpretation of ice flow direction described above is supported by the types of particles and their geometric orientation within the Grantsburg till. The Grantsburg till varies in thickness but is usually more than forty feet thick. Pockets of silt, sand or gravel can be found within the till, and in places clayey, silty, or sandy sediments cover the till.

The landscape in the Pioneer-Sarah Creek watershed is believed to have formed from a downwasting, stagnant ice field. Some believe a thick bed of till lay on the ice surface in the late stages of the glacial advances; and as the ice melted, the highly saturated drift slumped and slid into lows, filling holes in the melting ice. The melting of the ice walls left the till deposited above what had been the former highs, the ice blocks melted and formed the lows which are now marshes and potholes.

Marshes and swamps in the Pioneer-Sarah Creek Watershed meander in elongated flowages through the hollows and are interconnected with shallow lakes and watercourses. Some are set off from the main drainage system in closed basins or are linked to the main system by lateral ditches. Water, rather than draining off the land, tends to collect in the network of marshes, ponds and lakes, resulting in low runoff and sedimentation. Only a small amount of water can be expected to move downward through this land to deep bedrock aquifers unless fractures in the glacial drift are present. The reason water moves downward into these soils slowly, at best, is because of its dense, tightly-packed clayey mass.

Additional information about the geology of the area can be obtained from the Minnesota Geologic Atlas for Hennepin County (1989) in the Water Resource Library. The atlas contains the following plates:

- Data Base Map
- Bedrock Geology
- Surficial Geology
- Depth to Bedrock and Bedrock Topography
- Quaternary Hydrogeology
- Sensitivity of Groundwater Systems to Pollution
- Geology and Well Construction
- Geologic Resources

Within the watershed there are several areas that are mapped as high to very highly sensitive to ground water pollution of the water table. One extensive area of very high sensitivity is located along the Crow River in its border of Greenfield and Independence. Some smaller scattered areas of high to very high sensitivity are located surrounding several of the lakes and wetland complexes. The majority of the watershed is mapped as having low sensitivity to ground water pollution as it may affect the Prairie du Chien-Jordan aquifer, the primary source of groundwater in Hennepin County.

C. SOILS

Soil information was obtained from the Hennepin County Soil Survey. Using this information, the hydrologic soil classification map was developed and is shown on **Figure II-2**. Additional information about individual soil types can be obtained in the Soil Survey. The soils within the Commission have been classified into four hydrologic soil groups, which are defined as follows:

Group A – These soils have high infiltration rates even when thoroughly wetted. The minimum infiltration rates range from 0.3 to 0.45 inches per hour. The maximum permeability rate ranges from 6 to 20 inches per hour. These soils consist chiefly of deep, well drained to excessively drained sands and gravel. These soils have a high rate of water transmission, therefore resulting in a low runoff potential.

Group B - These soils have moderate minimum infiltration rates ranging from 0.15 to 0.30 inches per hour when thoroughly wetted. The maximum permeability rate ranges from 2 to 6 inches per hour. These soils consist of deep moderately- well to well-drained soils with moderately fine to moderately coarse textures.

Group C – These soils have slow minimum infiltration rates ranging from 0.05 to 0.15 inches per hour when thoroughly wetted. The maximum permeability rate ranges from 0.2 to 2 inches per hour.

Group D - These soils have very slow minimum infiltration rates ranging from 0 to 0.05 inches per hour when thoroughly wetted. The maximum permeability rate ranges from 0.06 to 2 inches per hour. These soils are typically clay soils with high swelling potential, soils with a high permanent water table, soils with a clay layer at or near the surface, or shallow soils over nearly impervious material.

D. LAND USE

Land use within the Pioneer-Sarah Creek Watershed has been influenced by agricultural activities and rural residential development. There is very little high-density development in the watershed with some commercial development, townhomes, and apartments in the Cities of Loretto and Maple Plain. Existing and projected land uses for areas within the Commission's boundaries are described in the member Cities' Comprehensive Plans, which are available from these Cities. The Cities have land use plans that include residential, commercial, and industrial development; designated park and open space areas; and public recreational areas. Land use mapping information is available from each City. The MUSA boundary directly impacts development in the watershed. The MUSA boundary within the Pioneer-Sarah Creek Watershed is shown on **Figure II-3**.

The Minnesota Land Cover Classification System (MLCCS) is also available from the DNR and incorporated by reference. The MLCCS is a vegetation oriented classification system designed to identify natural and cultural land cover types using standardized methodology. This method identifies land based on true land cover. This tool can be used for greenway identification, open space planning, natural resource inventories, and land use planning. Available MLCCS data can be obtained from the DNR.

E. SURFACE WATER RESOURCES

The information collected in this section outlines how surface water runoff is collected, managed, and discharged from the watershed.

1. Hydrologic System

The Pioneer-Sarah Creek Watershed contains several large depressions and drainageways. Water is generally directed to the Crow River. Major drainageways include Pioneer Creek, Sarah Creek, Deer Creek, Robina Creek, Spurzem Creek, and Timber Creek. Water is eventually discharged from the Crow River to the Mississippi River.

Figure II-4 outlines the major subwatershed boundaries tributary to lakes and streams within the Pioneer-Sarah Creek Watershed. A flood study was completed for Pioneer Creek and its major tributaries (see Section II.K and **Appendix E**).

2. Wetland Inventory

The Hennepin Conservation District has completed wetland inventories for much of the watershed. These wetland inventories identify existing wetlands by the following categories:

- Wetlands – unaltered hydrology
- Wetlands – altered hydrology
- Wetlands that no longer exist
- Wetlands – potentially restorable

This inventory is shown on **Figure II-5** and is intended for information purposes only. Additional information is available from the member communities and the Water Resource Library. **Figure II-6a** shows the locations of DNR Public Waters and Wetlands and **Figure II-6b** shows the location of the public ditches.

3. Water Quality

Water quality data for the Commission has been obtained from the STORET water quality database, which is available through the Minnesota Pollution Control Agency (MPCA). The MPCA storage and retrieval database is utilized by participating agencies to compile water quality testing data. This database is almost entirely used for the storage of water quality parameters. The Commission and Three Rivers Park District have undertaken water quality monitoring for selected waterbodies and streams. **Appendix D** contains lake summaries completed by HCD.

Figure II-7 shows the location of monitoring sites within the Commission that have been used in the past or are currently being used to collect water quality or quantity data. Additional information on water quality is available in the following reports:

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- Pioneer-Sarah Creek Watershed Management Commission Annual Reports
- Water Quality Management Plan (Hennepin Parks, 1999)
- Lake Sarah Project Diagnostic-Feasibility Study and Implementation Plan
- Diagnostic Study of Lake Independence
- Metropolitan Council Regional Report on Water Quality of Metro Area Lakes (CAMP information)
- Minnesota Pollution Control Agency Citizen Lake Monitoring Program reports.

Water quality information obtained from the MPCA (STORET), the HCD, and Three Rivers Park District can be found in the Water Resource Library.

F. GROUND WATER RESOURCES

Three major aquifers are located within the Commission's boundaries: the Prairie Du Chien-Jordan Aquifer, the Franconia-Ironton-Galesville Aquifer, and the Mt. Simon-Hinckley Aquifer. The lowest of the three aquifers is the Mt. Simon-Hinckley. The average elevation of the Mt. Simon-Hinckley Aquifer in the Pioneer-Sarah watershed is 850 feet above sea level and this aquifer is characterized by Mt. Simon and Hinckley Sandstones. The Eau Claire Formation confines this aquifer from above. Above this, the Franconia-Ironton-Galesville Aquifer is at approximately elevation 900 feet above sea level. It is composed of the Franconia Formation and Ironton & Galesville Sandstones. The St. Lawrence Formation confines this aquifer in most areas. The upper most aquifer, the Prairie Du Chien-Jordan, is at approximately elevation from 900 feet above sea level in this area. It is composed of Jordan Sandstone and the Prairie Du Chien Group. The Prairie Du Chien-Jordan aquifer is located in a small southeast portion of the Pioneer-Sarah Creek Watershed.

Ground water quality can be affected by a variety of land use types. The identification of areas susceptible to ground water contamination is difficult due to the character (permeability and thickness) of the surficial material, depth to the piezometric surface, precipitation amount and duration, and other components of aquifer recharge. However, the Geologic Atlas for Hennepin County indicates that the potential for groundwater contamination within the watershed is relatively low with scattered areas of high and very high susceptibility near wetlands, lakes, streams, and the Crow River. The Hennepin Geologic Atlas is incorporated by reference into this plan.

A combination of municipal wells and individual wells serve the water supply needs for the member Cities. **Figure II-8** shows the location of the DNR Water Appropriations Permit sites. The MDNR water appropriation list is available in the Water Resource Library.

G. POLLUTANT SOURCE LOCATIONS

Pollutant sources identified by the MPCA are incorporated in this document by reference. A complete list is included in the Water Resource Library. **Figure II-9** shows the locations of pollutant source sites within the Commission.

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Pollutant source sites identified by the MPCA include leaksites (MPCA Leaking Underground Storage Tanks), information from the MPCA Master Entity System, Hazardous Waste Generators, and a list of registered storage tanks. The Master Entity List combines fourteen state and federal pollutant lists and systems. Four of the 14 primary inventory lists are as follows:

- **National Priorities List (NPL).** A listing of hazardous waste sites which represent a significant threat to public health or the environment and are priorities for remedial action.
- **Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS).** The USEPA database of potential or actual hazardous wastes nationwide.
- **Permanent List of Priorities (PLP).** A state listing of verified hazardous waste sites.
- **Brownfield.** MPCA Site Assessment sites where real or perceived contamination stops further development.

The leaksite list contains active and inactive leaksites.

H. WATER-BASED RECREATION AREAS

There are several park facility areas, public accesses, lakes, and adjacent areas in Pioneer-Sarah Creek Watershed that offer passive and active recreation.

Figure II-10 shows the locations of these resources, which include Lake Rebecca Park Reserve, Lake Sarah, Hafften Lake, Lake Independence, Baker Park Reserve, Long Lake, and Whaletail Lake. The Crow River is a state designated canoe and boating route. Other than the Crow River, none of the other creeks within the watershed are considered navigable. Lakes Independence, Sarah, Whaletail, and Little Long are popular fishing lakes.

I. FISH AND WILDLIFE HABITAT

There are many areas that provide fish and wildlife habitat within the Pioneer-Sarah Creek Watershed. Fisheries surveys for a variety of lakes are available through the Department of Natural Resources. Little Long Lake is unique in that its water quality and depth can support a cold-water fishery and the DNR stocks the lake with trout.

The County Biological Survey has been completed by the DNR and this information is incorporated by reference. The Hennepin Conservation District has completed a wetland inventory for the Commission. This information is shown on **Figure II-5**.

J. UNIQUE FEATURES AND SCENIC AREAS

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The Pioneer-Sarah Creek Watershed has many natural areas, water resources, and local parks. Some of these areas contain rare and endangered species and special habitats. Natural communities identified by the Minnesota Biological Survey within the Pioneer-Sarah watershed include maple-basswood forest, wet-meadow, tamarack swamp, willow swamp, and cattail marsh. Rare species identified by the Minnesota Biological Survey within the Pioneer-Sarah watershed include federally or state-listed plants and animals, as well as previously state-listed plants and animals. The natural communities and rare species identified are mainly concentrated within both Lake Rebecca and Baker Park Reserves, and around Little Long Lake and Lake Independence.

An area thought to have been an historic Native American crossing is located across Pioneer Creek east of County Road 90 in the City of Independence. Additional information regarding the DNR Natural Heritage Database can be obtained from the MDNR. A map of the Minnesota County Biological Survey is available in the Water Resource Library. A list of the rare animal and plant species within one mile of the Pioneer-Sarah Creek Watershed is outlined below:

Table II-3. Rare animal and plant species within one-mile of the Pioneer-Sarah Creek Watershed			
Common Name	Scientific Name	State Status	Habitat
<i>Birds</i>			
Bald eagle	<i>Haliaeetus leucocephalus</i>	Special concern	Tall trees, lakes, and wetlands
Trumpeter swan	<u><i>Cygnus buccinator</i></u>	Threatened	Emergent marsh, small ponds, and lakes
<i>Plants</i>			
American ginseng	<u><i>Panax quinquefolius</i></u>	Special concern	Deciduous forests

K. FLOOD PROBLEM AREAS

Flood problem areas have been identified within the watershed and are discussed in **Section IV**. The following reports/summaries are available within the Water Resource Library and address some of the problem areas in greater detail:

- Physical and Ecological Classification of Pioneer and Sarah Creeks and Their Tributaries (HCD)
- A Study of High Water Conditions on Lake Independence during the 1990's (DeMars)
- Flood Hazard Study – Pioneer Creek, Spurzem Creek, and Lake Robina Tributary
- Sarah Creek Flood Study

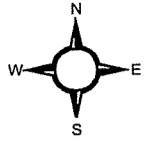
L. EXISTING FLOOD INSURANCE STUDIES

A Federal Emergency Management Agency (FEMA) Flood Insurance Study (FIS) has been completed for the participating cities in the Commission. The cities of the watershed are participating members in FEMA. These reports identified the

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boundaries of the floodway and floodplain. Copies of these flood insurance studies are available from the member Cities.

Source: Metropolitan Council



Hydrologic Soil Group

- A
- B
- C
- D
- WATER

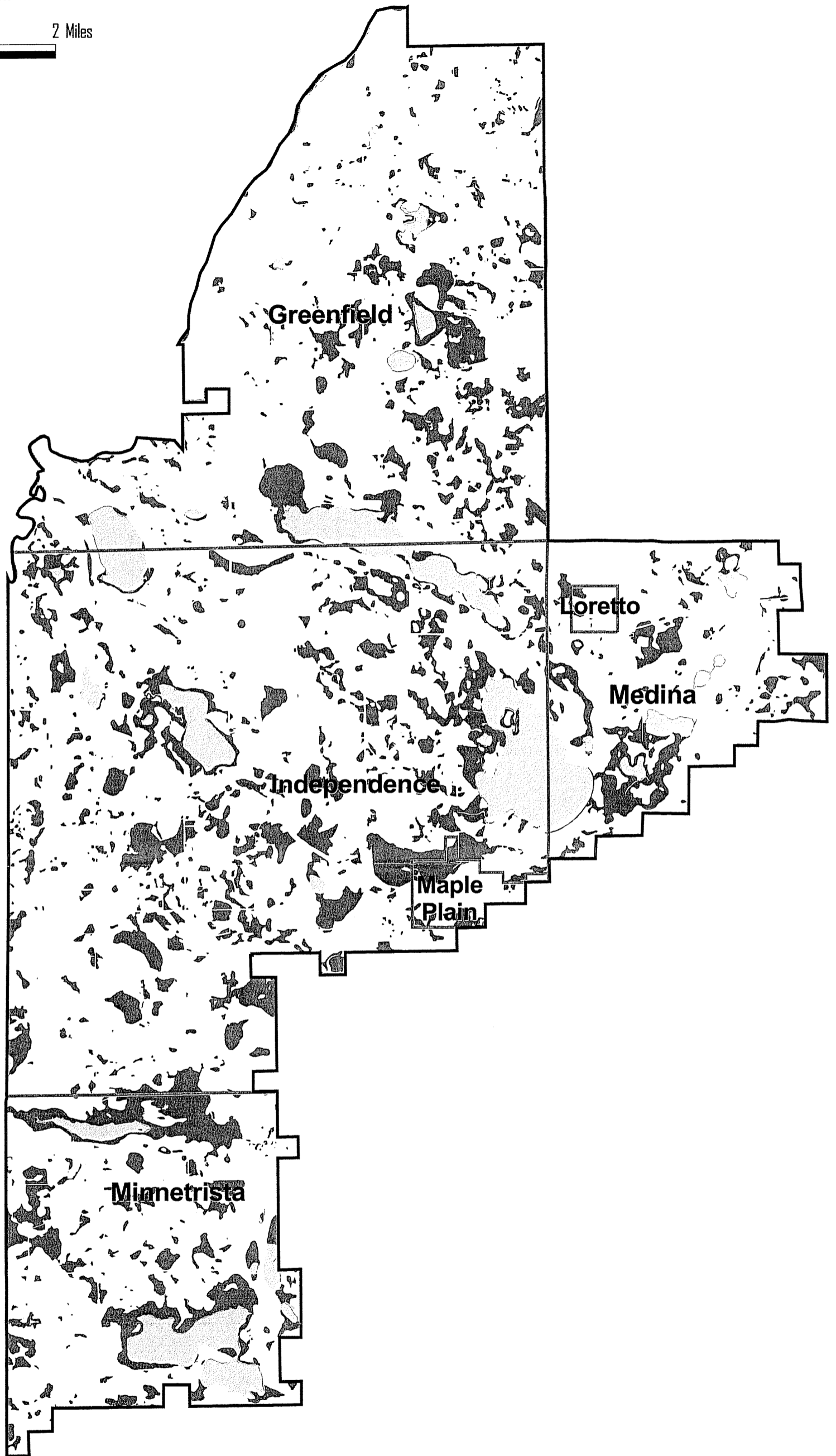
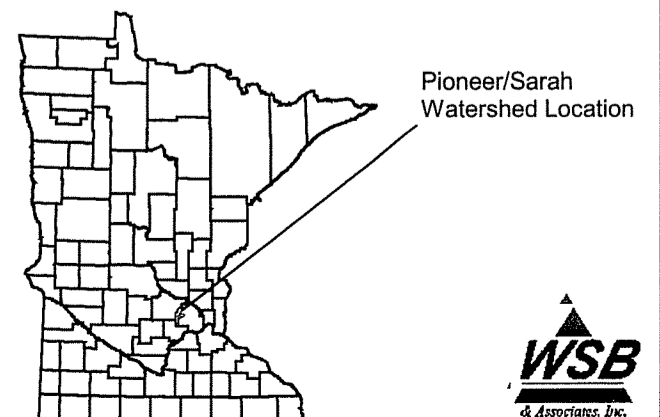
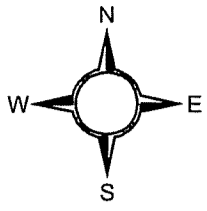



Figure II-2
Hydrologic Soil Group

Pioneer/Sarah Creek
Watershed Management Commission





 1998 MUSA Boundary
(No 1998 MUSA exists within
commision's boundaries.)

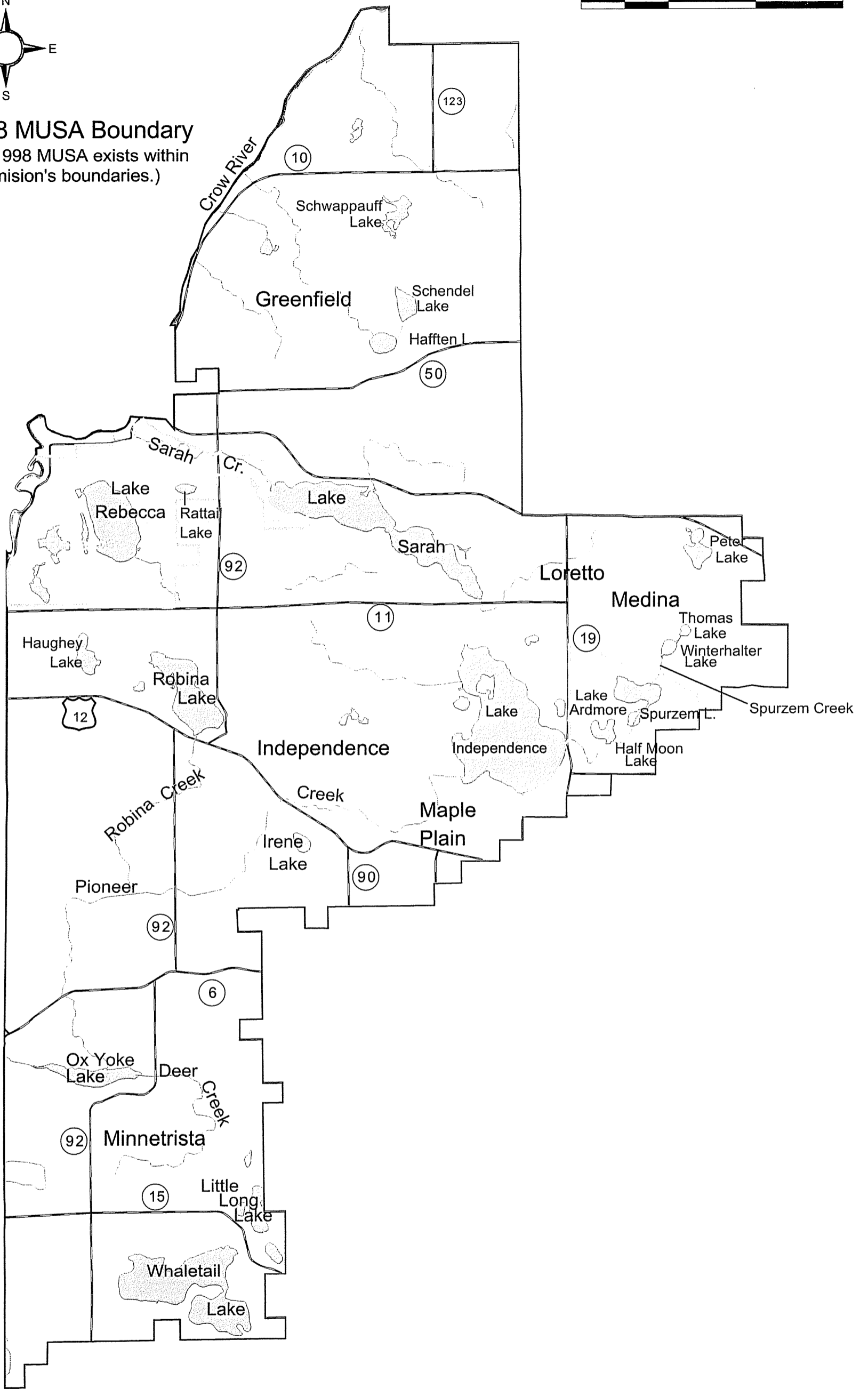


Figure II-3
1998 MUSA Boundary

Pioneer/Sarah Creek
Watershed Management Commission

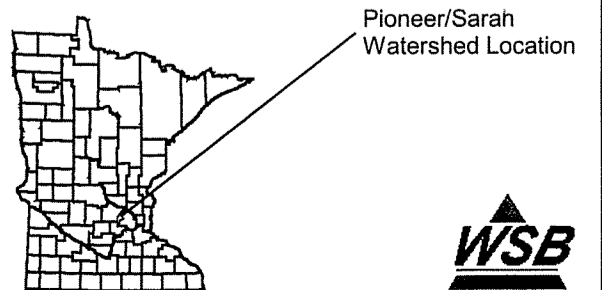


Figure II-6b
Public ditches – to be provided by HCD