4/17/15
715-395-7334
Public Works admin

Superior, Wisconsin

Jeff Goetzman
395-7334

Sewer Service Area Plan

August 23, 1999

Consoer Townsend Envirodyne Engineers, Inc.
2855 Anthony Lane South, Suite 145
Minneapolis, Minnesota 55418
(612) 788-6844

Table of Contents

List of Figures

Figure No.

List of Tables

Table No.

EXECUTIVE SUMMARY

Background

Required by the State of Wisconsin (Wisconsin Administrative Code, NR 121), Areawide Water Quality Management Plans (AWWQMP) oversee, protect, and enhance groundwater and surface water quality. The AWWQMP serves to umbrella subsequent water quality initiatives and activities affecting water quality and uses, including point and nonpoint pollutant sources and related environmental resource considerations. One item found under the umbrella of Areawide Water Quality Management Planning is the Sewer Service Area Plan.

A Sewer Service Area Plan (SSAP) protects water quality by proactively addressing the future needs for wastewater collection and treatment in developing areas. This planning helps protect water resources from adverse impacts associated with development by implementing cost-effective and environmentally sound 20-year sewerage system growth plans. An SSAP identifies existing sewered areas as well as available land suitable for new development. The planning process also identifies areas not amenable for sewerage, including but not limited to environmentally sensitive areas (NR 121.05(1)(g)2.c).

Goals

To establish guidance for service area planning, policies relating to wastewater collection and treatment within the City of Superior were developed in tandem with the Comprehensive Plan. City policies framing service area planning decisions include:

- Providing cost-effective collection and treatment facilities;
- Consideration of current and anticipated development or redevelopment that conforms with the Land Use Element of the Comprehensive Plan;
- Providing collection and treatment infrastructure improvement and upgrades accommodating 7-yr design events, and addressing NPDES permitting and EPA guidelines;
- Providing collection and treatment facilities that comply with state and federal regulations and Special Area Management Plan (SAMP) guidance regarding wetlands;
- Optimizing Main and CSO treatment plant performance and efficiency;
- Emphasize and optimize industrial pretreatment and pollution prevention strategies;
- Emphasize interagency cooperation and public involvement in a professional manner with openness, honesty and integrity.

With input from City Planning, Engineering, and Wastewater Departments, and WDNR personnel (Jeff Prey and Anne Holy), the Superior SSAP effectuates long-term water quality protection by designating as environmentally sensitive all wetlands, shorelands, floodplains, steep slopes, lands with erodible soils, and environmentally limiting areas within the planning area boundary. Additional areas within the City's limits which are guarded from sewered development include parks, the municipal forest and other valuable recreational areas. Limiting growth in those areas mentioned above safeguards public and environmental health, protects diverse aquatic wildlife, and provides continued benefits associated with enjoyed recreational areas.

Scope

The Superior SSAP employs 20-year population projects, local density standards and an inventory of areas discluded from development to evaluate wastewater collection and treatment needs. Numerous past and present planning efforts complement Superior's SSAP, including but not limited to the following:

- 1999 (present) Comprehensive Plan—City of Superior;
- 1999 (present) Surfacewater Management Planning—City of Superior;
- 1996 Special Area Management Plan—City of Superior;
- 1993 Facility Plan for Wastewater Collection and Treatment—City of Superior;
- 1999 Facility Plan Update (Presently being prepared); and
- 1991 (under revision) Lake Superior Basin Water Quality Management Plan.

Superior's SSAP supports economic development and growth, and does so without obligating increased wastewater treatment capacity. The SSAP assesses Superior's existing and anticipated collection system needs.

Planning Area

The City of Superior, located in the St. Louis and Lower Nemadji River Watersheds, provide boundaries for sewer service area planning. Numerous activities related to wastewater collection and treatment in Douglas County are at various stages of implementation, however regional activities outside the boundaries of the City of Superior are not considered for the City's SSAP. A significant portion of the City's 45-square-mile area is undeveloped, including a seven square-mile Municipal forest. The City of Superior is marked with limited topographical relief and wetlands (2 acres or larger) encompass 7130 acres or 25 percent of total city land area. Other environmentally sensitive areas within the City's limits include shorelands, floodways and floodplains, steep slope areas, and highly erodible soils and environmentally limiting areas.

Inventories and Forecasts

CHAPTER B – The Comprehensive Plan has been completed by RLK-Kuusisto and is available at City Hall.

Water Quality Assessment

Planning area "water quality assessment" focuses on point & nonpoint source pollutant inputs to the water environment. Planning area discharge locations associated with Municipal wastewater treatment facilities and industrial process plants are considered point sources. The City of Superior operates four wastewater treatment facilities with average yearly pollutant loadings totaling 213,000, 216,000, and 21,000 pounds of BOD_5, TSS, and phosphorus respectively. Future municipal point source loadings will increase relative to population increases, or roughly 25 percent.

Of several industrial dischargers located within planning boundaries, Murphy Oil USA contributes the greatest estimated pollutant loads of 22,630 lbs/yr BOD_5 and 8212 lbs/yr TSS. Other industries with relatively minor point source discharges include: Burlington Northern Railroad; Lakehead Pipeline; Superior Midwest Energy Resources Company; and Chicago Northwestern Railroad.

Although sediment loads attributed to upstream non-urban land uses (agriculture/forestry) overshadow urban pollutant inputs, the City of Superior receives and contributes nonpoint pollution - including sediments, nutrients, and toxic substances - associated with a variety of land use and levels of management

Observation and analysis of Dry Weather Flow (DWF) screening locations indicate that Superior's storm sewer and surface water systems do not exhibit significant pollutant loadings, and that illicit connections or inappropriate entries are not implicated.

Wet Weather Flow (WWF) monitoring results indicate low pollutant concentrations associated with undeveloped areas. Also, monitoring results implicate snow melt as a significant carrier of chlorides and TS, and developed/commercial possess the highest BOD_5 and fecal Coliform concentrations and perhaps contribute significant pollutant loads to receiving waters.

WDNR's Source Loading and Management Model was employed by WDNR for urban rainfall runoff water quality modeling. Predicted total existing pollutant loads with BMPs considered are: Total Solids, 4139765 lbs/yr; Phosphorus, 2125 lbs/yr; Copper, 168 lbs/yr; Zinc, 2996 lbs/yr; and Lead, 2517 lbs/yr. Predicted total future pollutant load increases due to future land projections are: Total Solids, 2275329 lbs/yr; Phosphorus, 1717 lbs/yr; Copper, 254 lbs/yr; Zinc, 2615 lbs/yr; and Lead, 3108 lbs/yr. SLAMM credence requires adequate calibration with additional WWF monitoring and "ground truthing" basin mapping and characterization efforts. Planning area urban nonpoint source pollution inputs as predicted by SLAMM are approximately 3 - 4 times less the magnitude of nonpoint source pollution contributed by the City of Duluth. Also, non-urban nonpoint source input areas upstream of Superior, such as the Nemadji and St. Louis river watersheds, deliver far greater pollution loadings than does the City of Superior.

Environmentally Sensitive Areas

Numerous areas within the Superior City limits provide environmental, recreational and aesthetic benefits. Given the worthwhile benefits of Superior's environmentally sensitive areas, urban development into the following areas should be discouraged:

- Wetlands as highlighted by the SAMP and delineated by WDNR (wetland inventory);
- Floodways/Floodplains as denoted by he 1977 FIA (now FEMA) Flood study;
- Shorelands as located by the ordinary highwater mark of navigable waters;
- Steep Slopes and Highly Erodible Soils located on slopes equal to or greater than 12 percent; and
- Environmentally Limiting Areas not included with descriptions above but not considered suitable for service area growth are also to be considered.

Wetlands encompass a total of 7130 acres or 25 percent of Superior's total land area and provide function and value. The concept mitigation plan protects 655 wetland acres and 1288 uplands acres while providing 208 acres of constructed wetlands.

Surface water resources in Superior consist primarily of Lake Superior, Lake Superior Bay, Allouez Bay, the St. Louis River and its many inlets and bays, the Nemadji and Pokegama Rivers, and several other smaller continuous and intermittent streams. Low-lying areas of Superior are subject to flooding due to overflow of the various streams and Lake Superior. With predominating and impermeable red clay soils and subsequent high runoff potential, flooding as a result of intense rainfall is not uncommon for the Superior area waterways.

In the City of Superior, Steep slope areas are located along the banks of waterways. Major steep slope areas are located adjacent to Bluff, Bear, and other smaller creeks in the southeastern portion of the City, along the shores of the Nemadji and Pokegama Rivers and along the shores of Faxon Creek. Steep slope areas are also found along the inlets of the St. Louis River in the Western portion of the City, including the Billings Park Municipal Forest areas.

Within the City of Superior, limited relief, vegetative cover, and wetland presence serve to limit soil erosion. Areas within the City susceptible to high erosion rates can be localized to those area with steep slope and also those open areas with limited vegetation cover.

A number of other environmentally limiting areas have been identified. These areas and sources include locations with particularly elevated levels of sediment contaminants, upstream drainage areas of waterways running through or adjacent to the City of Superior.
A variety of polynuclear aromatic hydrocarbons (PAHs) and/or heavy metals have been detected in the following Superior areas: Newton Creek and Hog Island inlet of Superior Bay; and Crawford Creek wetland/ Koppers Co. vicinity.

Water Quality Standards

Wastewater related discharges within the City's limits are regulated by the WDNR's WPDES (Wisconsin Pollutant Discharge Elimination System) permits. The area waters are also addressed by the Bi-National agreement relating to the Great Lakes Basin. The St. Louis River Area of Concern was one of 43 areas identified as having impaired beneficial uses of the water resources due to pollution. In general, the DNR requires collection system design to be based on the 5 year rainfall. However, a 7-yr rain was required by WDNR for recent design activities.

WDNR is finalizing a stormwater management permit addressing water quality standards for Superior stormwater issues. Appendix 6 contains the City's Draft Stormwater Management Plan. Short term efforts are to focus on non-capital measures, and provide a conclusive basis for long term efforts--future decisions relating to capital improvements associated with stormwater management.

At present, Total Maximum Daily Loads (TMDLs) have not been allocated for the Lake Superior Drainage Basin. Waste Load Allocations (WLAs) are those portions of a receiving water's TMDL that are allocated to one of its existing or future pollution sources. Industries and the City of Superior have not been allocated WLAs for their wastewater treatment facilities or nonpoint sources.

Wastewater Collection and Treatment Systems

The largest of Superior's four wastewater treatment facilities, the Main WWTP is a conventional activated sludge process designed for 5 MGD. Adjacent to the Main WWTP, the 50 MG CSO 2 pond treats a daily maximum flow of 75 MG via stabilization. The 6 million gallon CSO 5 facility and can treat 7.5 MGD via physical/chemical processes when overflows cannot be drained to the Main WWTP during drier flow regimes. CSO 6 stores 12 million gallons with operation and treatment similar to those provided by CSO 5. All sludge is treated at the Main WWTP and consists of anaerobic digestion, dewatering and co-disposal at the municipal landfill.

Following construction and implementation of 1993 Facility Plan recommendations, wastewater treatment needs are limited. Assuming flow increases associated with Comprehensive Plan land use projections are balanced with ongoing City efforts to reduce wet weather system input (I/I), the existing main WWTP should satisfactorily handle future flow increases. Needed main WWTP treatment improvements relate more to correct operation of existing systems than capital improvement requirements. As with the Main WWTP, CSO 2 facilities presently require no capital improvements. There may be future needs relating to relocation of the CSO 2 outfall. Operational needs are limited to flow control, and related Main WWTP maximized flow. CSOs 5 and 6 also currently require limited treatment improvements. Disinfection of CSOs 5 and 6 effluent may be required in the future—the City is currently investigating the need for effluent disinfection. Also, required treatment could be reduced by effectively increasing the pond water surface elevation at overflow conditions.

About half of the City's collection system was constructed of mostly non-reinforced concrete generally in the 1890's and included the following:

- thousands of plugged taps for later service connections (wyes);
- brick manholes with "18 hole" manhole covers;. and

- crossings of ravines on timber piles, rock cradles or specially built bridges/walkways.

The late 1930's witnessed WPA program constructed interceptors, with main lift stations and the Main WWTP constructed in 1956. Sewer extensions have accompanied city growth. The DNR limits new connections in the East End. Some septic tank systems exist in outlying areas. Many manholes are located in areas inundated by spring snow-melt or moderately sized rains. Building foundation drains exist throughout the City. Sewer Separation in 1975 provided additional sanitary sewers and retained the old pipes for storm water conveyance. New sanitary pipes have proven too small for a combination of factors:

- inefficient private separation by property owners (roof drains, sump pumps, yard drains);
- missed cross-connections with storm sewers;
- new cross-connections with storm sewers;
- infiltration to new pipes; and/or
- inadequate design values.

Sanitary sewers exhibit tributary flows associated surface drainage. Sewer surcharging is extensive throughout the service area--The City has provided approximately 450 backflow valves on existing service connections to mitigate basement flooding.

The 1993 Facility Plan initiated ongoing collection system definition. Lift stations are generally reliable, with recently completed and anticipated improvements. Ongoing issues and efforts related to Superior's collection system include:

- maximizing flow to WWTP in conjunction with 12 lift stations, landfill leachate pumps, and CSO Facilities;
- additional system documentation (mapping);
- I/I source identification and reduction;
- improved operation and maintenance; and
- detailed sewershed basin analysis relating to surface drainage and stormwater permitting.

Collection system needs are manifold. The City is currently in the midst of major restructuring activities relating to operation and maintenance of collection systems. Not including O&M related activities, existing collection system capital improvement needs total approximately $900,000.

Determination of future collection system needs hinges on future landuse projections and existing system capacity. The iterative process used to finalize landuse planning associated with the Comprehensive Plan is in its middle stages. Capacity analysis and needs assessment pertaining to collection system needs (interceptors and storage) for future growth yields capital improvements totaling approximately $11,000,000.

Industrial wastewater treatment system needs are limited. In comparison to municipal point sources, industries within the city limits contribute only small pollutant loads to receiving waters. At present, there are no known industrial wastewater treatment system needs additional to existing physical and regulatory structures. The greatest need related to industrial wastewater treatment systems is a correct and current understanding of surface water management plans per site. Also, collection facilities for sanitary flows from new industrial areas associated with the future land use plans are necessary. Future industries with major treatment systems are not expected with development, but would be subject to WPDES permit requirements.

Nonpoint Source Control Needs

The draft Surface Water Management Plan (SWMP) developed by the City and WDNR identified needed control measures for nonpoint source pollutants within the planning area boundaries. Short term (1997-2001) SWMP efforts include: public information and education; basin characterization and mapping; industrial inventory and characterization; best management practice (BMP) inventory, development, and optimization; and monitoring and data collection. Long term (2001 and beyond) SWMP efforts include: appropriate capital improvements for stormwater management; on-going public information & education; on-going BMP efforts; and appropriate system monitoring to assess existing conditions and assist planning measures. Available SWMP funding sources may include, but are not limited to: City sewer and wastewater enterprise funds; Coastal Zone management grants; Wisconsin priority watershed grants; the formation of a stormwater utility and/or surface drainage user fees; and construction erosion control permit fees.

Stormwater permitting by the Wisconsin Department of Natural Resources (WDNR) requires delineation and characterization of surface water drainage basins within a municipality's limits. Physical delineation of watershed and sewershed boundaries underlies all ensuing efforts to assess and control surface water quality and quantity concerns. Basin mapping and characterization for a portion of Superior has been completed (Howard Bay, Newton Creek, Faxon Creek and the ongoing South Superior Drainage Areas). The remainder of Superior is to be completed as part of the City's Stormwater Management Plan short term efforts.

Residual Waste Control Needs

The 1993 Facility Plan identified three sludge handling alternatives for further evaluation: co-disposal at the Superior Municipal landfill; land spreading on selected and approved farmland; and composting and marketing of the compost by-product. The WDNR currently allows co-disposal of WWTP sludge at the municipal landfill. Although co-disposal decreases the effective landfill life and wastes a potential resource, area wide water quality concerns are essentially negated since the landfill is lined with impermeable clay and landfill leachate is pumped into the City's sewer collection for eventual treatment. Composting is an attractive alternative for future consideration. Estimated annual costs for composting are slightly higher than similar costs for sludge co-disposal ($267 vs. $223 per dry ton respectively, 1993 Facility Plan). Composting recycles two waste streams, sludge and additive (typically yard waste), for beneficial reuse and removes sludge as a pollutant source for area wide water quality. Composting of municipal WWTP sludge should be implemented if and when co-disposal is not a viable option.

Planning and Regulatory Components

The Federal Water Pollution Control Act Amendments of 1972 required locally developed areawide water quality management plans, or basin plans. Wisconsin Administrative Code (NR 121) specifies that Areawide Water Quality Management Plans include components dealing specifically with sewer service areas and projected needs for 20 years into the future. Only those areas with wastewater collection and treatment systems are subject to service area planning. State, local, and regional authorities contribute throughout the planning process—this integrated focus limits negative impacts on water and land resources locally and regionally. The City of Superior is the local administrative authority for the implementation of the plan. The SSAP provides direction to safeguard fulfillment of SSAP and future landuse goals and objectives. In addition to local support, the actions of the WDNR will greatly impact successful plan implementation.

Existing and anticipated state regulatory programs provide sufficient direction and requirements for continued control and increased understanding of water quality and resource concerns. The non-proliferation policy of the WDNR is designed to restrict the construction of new wastewater treatment facilities in order to preserve and protect the quality of Wisconsin water. WDNR WPDES permits currently exist for municipal and industrial point sources within Superior's city limits. The WPDES permit that regulates municipal point source discharges expires on December 31, 1998. This WPDES permit covers Superior municipal point source discharges. Individual and general permits for point source discharges exist for numerous industrial concerns within the SSAP boundary.

Following significant stormwater management planning efforts, A Fall of 1997 issuance of a WPDES permit for Superior's municipal separate storm sewer system is expected. Numerous industrial sites located within the City's limits have been permitted for stormwater discharges.

At present, solids associated with wastewater treatment processes and street cleaning constitute planning area "residuals" and are co-disposed of in the municipal landfill. Future WWTP solids disposal is primarily subject to WDNR regulatory action and should be addressed with the next WPDES point source permit.

Existing city ordinances provide additional regulatory measures for management of Superior area water quality. Chapter 30 of the City of Superior Code addresses Sewer Usage and associated charges. The Overland Flow Ordinance relates to drainage from newly developed and redeveloped areas. Erosion control BMPs are set forth by the City's Erosion Control Ordinance.

The Clean Water Fund (CWF) is a State of Wisconsin environmental loan program that was established in June, 1990. Projects eligible for funding include new treatment facilities, expansions and modifications to existing treatment plants, interceptors, or new sewers in an unsewered area. Eligible candidates, including Superior, can receive loans ranging from $25,000 to $74,400,000. Only WDNR approved projects receive funding.

Previous funding sources for projects relating to Superior's wastewater and surface water quality improvement include the City's sewer and wastewater enterprise funds and WDNR grants. Additional available funding sources may also include, but are not limited to:

- City sewer and wastewater enterprise funds;
- Coastal Zone management grants;
- Wisconsin priority watershed grants;
- The formation of a stormwater utility and/or surface drainage user fees; and
- Construction erosion control permit fees.

A process to amend service areas and environmentally sensitive areas is essential so that the City of Superior can effectively and efficiently respond to any factor affecting the approved Superior SSAP. Amendments will be classified according to the area of proposed change and whether the change affects environmentally sensitive areas or sewer service areas. Mapping and narrative sufficiently describing proposed changes must be submitted with all proposed amendments.

Environmental and Economic Impacts

Environmental impacts associated with the Superior SSAP include, but are not limited to, the following:

- Appropriate management of area-wide water quality;
- Appropriate understanding of area wide water quality;
- urban point source pollution control;
- urban nonpoint source pollution control;
- protection and mitigation of planning area "valuable" wetlands;
- minimized water, land, and resource degradation in association with balanced development;
- public information and educational programs associated with area-wide water quality issues; and water quality and quantity issues associated with concentrated development.

A. PLANNING AREA BOUNDARIES

The municipal limits for the City of Superior provide boundaries for sewer service area planning. Superior, the County Seat of Douglas County, is located in the St. Louis and Lower Nemadji River Watersheds **(Figure A.1)** on the south shore of Lake Superior, the largest freshwater lake in the world.

Superior is an international port city at the west end of Lake Superior **(Figure A.2).** The population of 27,134 (1990 census) is distributed with major concentration in the northern most area of the City, stretching to the southeast along the Superior Bay Shoreline to Allouez Bay. An additional population center is located in the City's south-central area. Port facilities handle grain, coal, iron ore, and taconite, and includes a 420-slip full-service marina. Industrial and commercial enterprises are also supported by the City. Also, the City is home to a branch campus of the University of Wisconsin and the Wisconsin Indianhead Technical College, and is a recreation and tourism center. A significant portion of the City's 45-square-mile area is undeveloped, including a seven square-mile Municipal forest.

The City of Superior possesses 2.83 miles of public frontage on Lake Superior. In addition to lake frontage, numerous tributary discharges originate within or flow through the boundary of the City of Superior. Tributary discharges include, but are not limited to, Nemadji River, Pokegama River, Newman Creek, Bluff Creek, Bear Creek, and Faxon Creek.

Superior lies in the geographic province classified as the Lake Superior Lowland. The topography of this geographic province consists of a clay plain that is interrupted by morainic hills. The clay plain slopes gently from the Superior Escarpment, or Douglas Copper Range, to the lake. Historically, red clay was deposited during glacial Lake Superior (Duluth) high water periods.

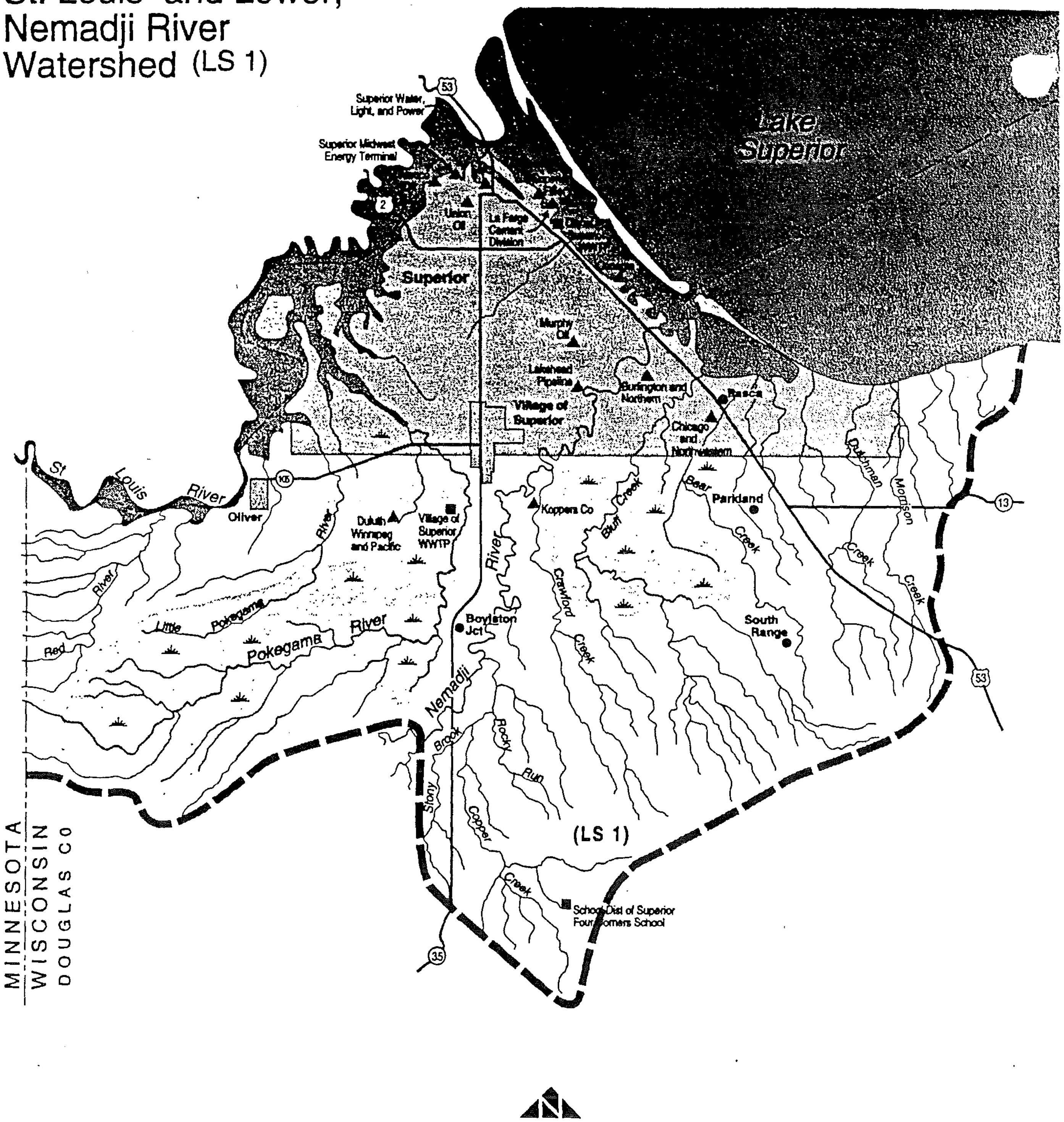
Calcareous, finely textured, and very poorly draining red clay soils predominate within planning area boundaries. Limited topographical relief within Superior's boundary exacerbate poor draining conditions during runoff events.

According to a WDNR 1992 wetlands data, the City of Superior's wetlands (2 acres or larger) encompass 7130 acres or 25 percent of total city land area. Wetlands within planning boundaries provide a variety of functions and values including, but not limited to: Maintenance of dry season stream flows, reception of groundwater discharge, and groundwater recharge; natural treatment systems for sediments, nutrients, or toxic substances; shoreline protection via wave energy dissipation and sediment anchoring; and ecosystem habitats for aquatic organisms.

Other environmentally sensitive areas within the City's limits include shorelands, floodways and floodplains, steep slope areas, and highly erodible soils.

Some parts of Superior are served by separate sanitary and storm sewers, whereas combined sewers service other areas **(Figure A.3).** In some cases, past "separation" projects included installation of new storm sewers which drain a particular catchment only to ultimately discharge to a sanitary or combined sewer further downstream. The City was historically divided into ten sewer districts **(Figure A.4)**, but various stages and degrees of development have blurred some district boundaries. Past construction activity has eliminated combined sewer overflow

St. Louis and Lower, Nemadji River Watershed (LS 1)



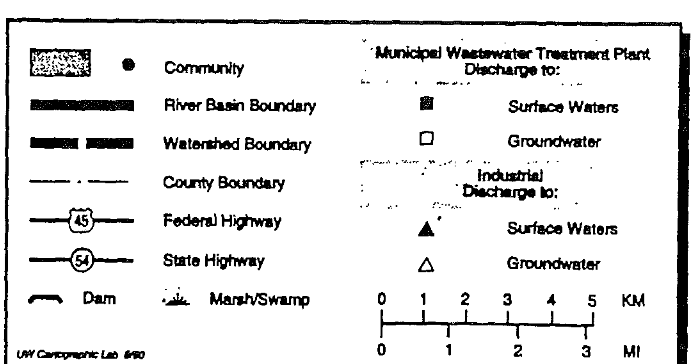


Figure A.1

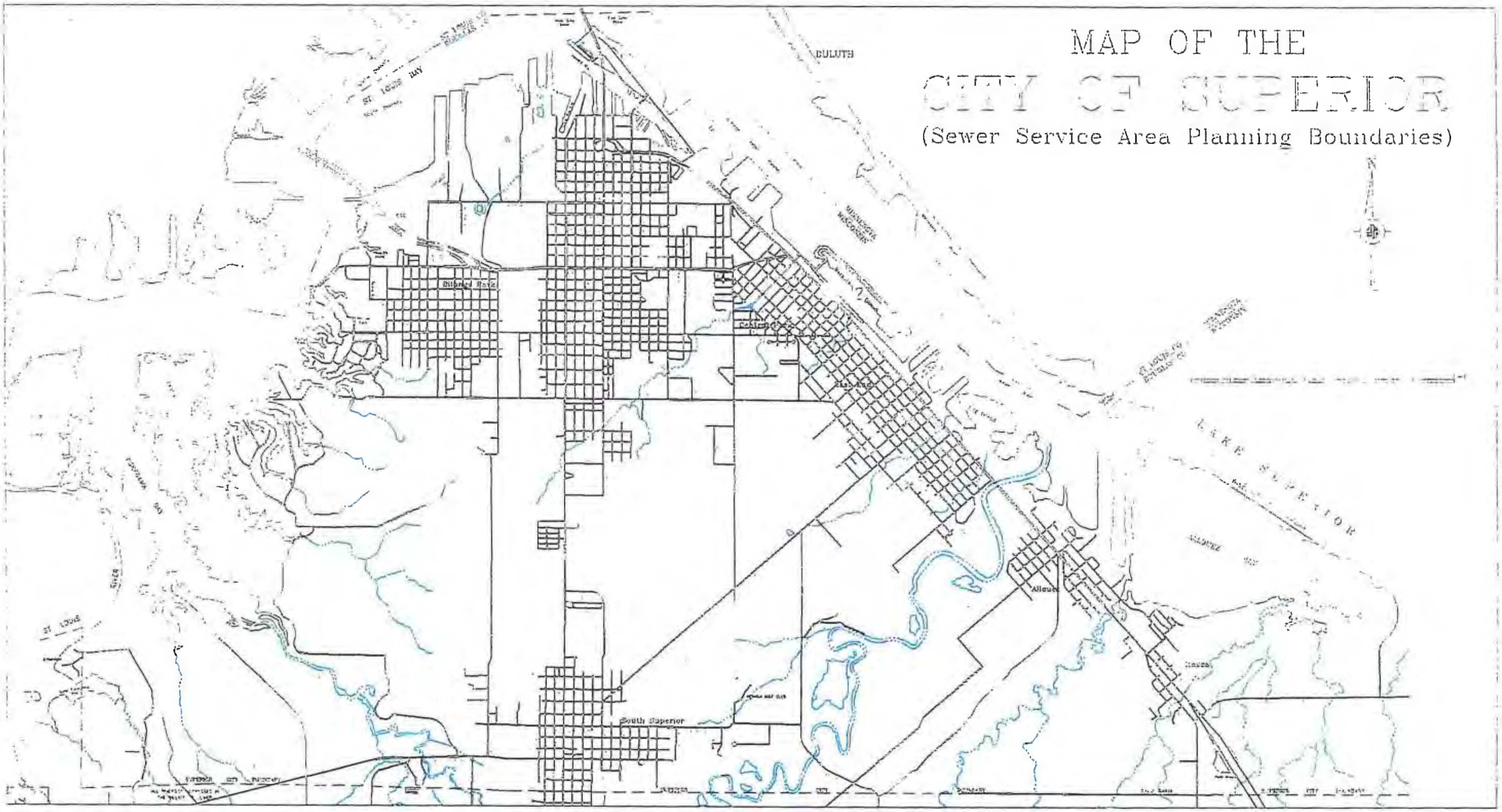

MAP OF THE
CITY OF SUPERIOR
(Sewer Service Area Planning Boundaries)
DULUTH
LAKE SUPERIOR
South Superior
Billings Park
East End
Allouez
N

Figure A.2

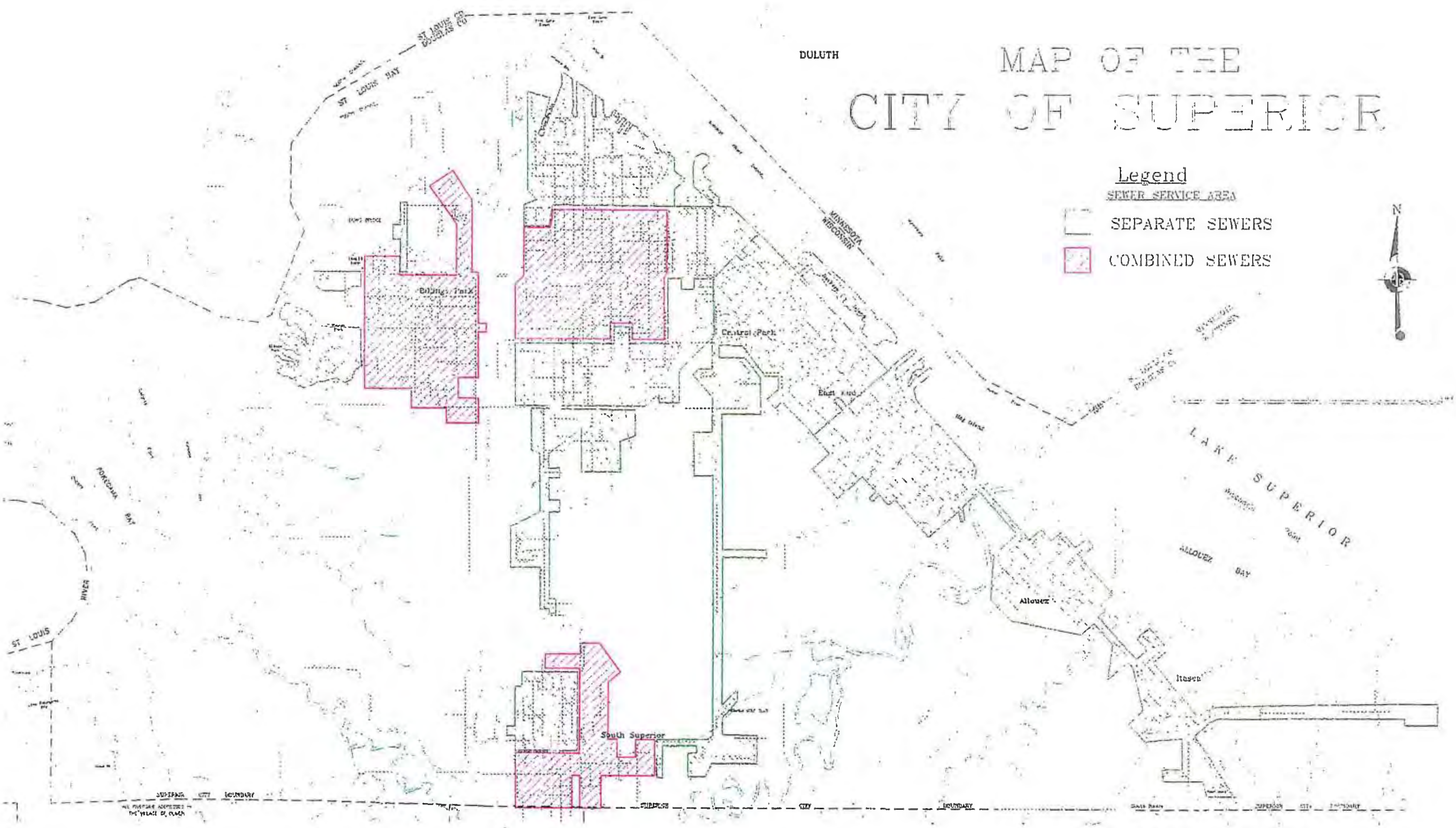

MAP OF THE
CITY OF SUPERIOR
Legend
SEWER SERVICE AREA
SEPARATE SEWERS
COMBINED SEWERS
N
DULUTH
MINNESOTA
WISCONSIN
ST LOUIS CO
DOUGLAS CO
ST LOUIS BAY
LAKE SUPERIOR
ALLOUEZ BAY
Billings Park
Central Park
East End
Allouez
Itasca
South Superior
ST LOUIS RIVER
SUPERIOR CITY BOUNDARY

Figure A.3

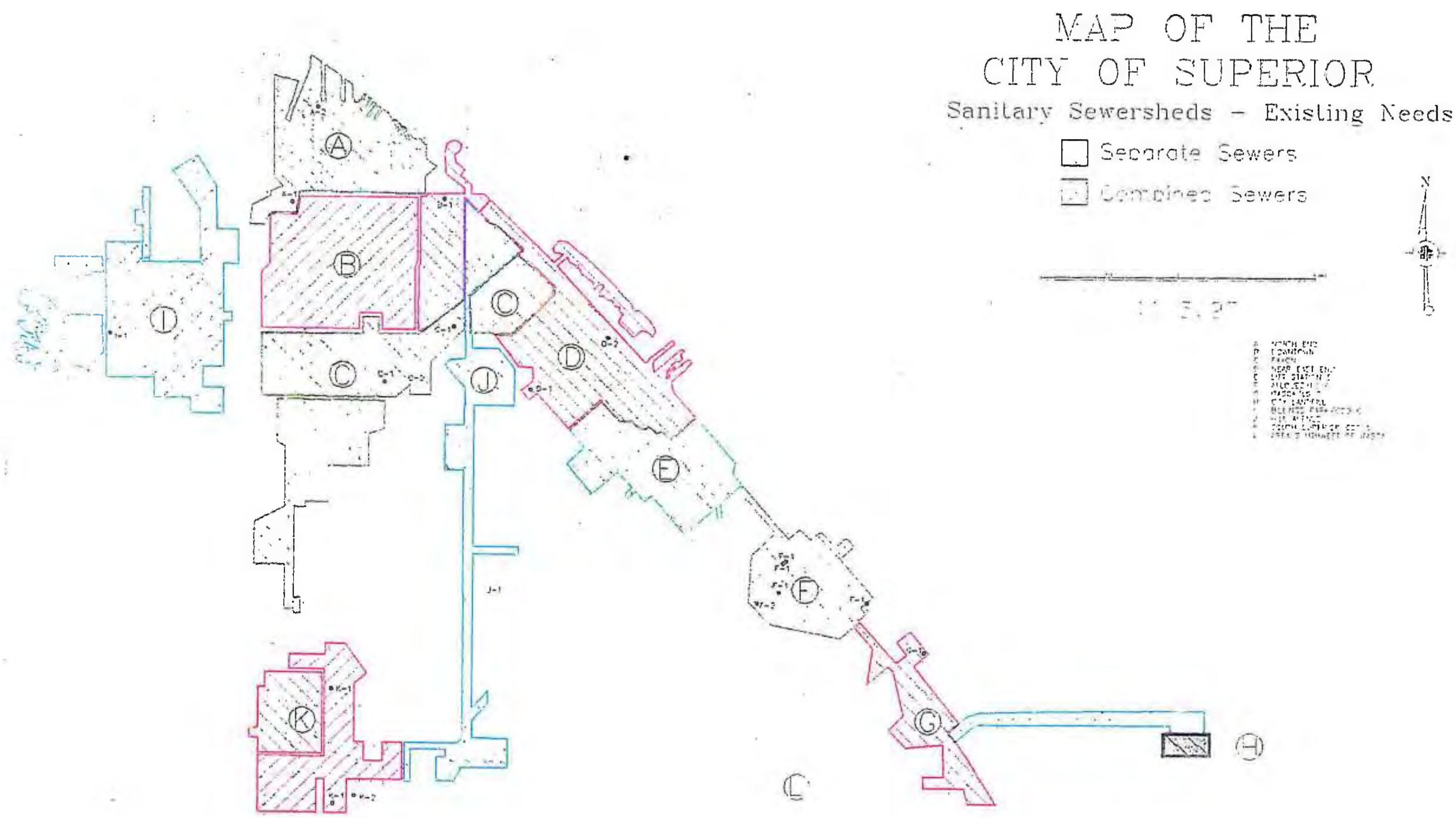
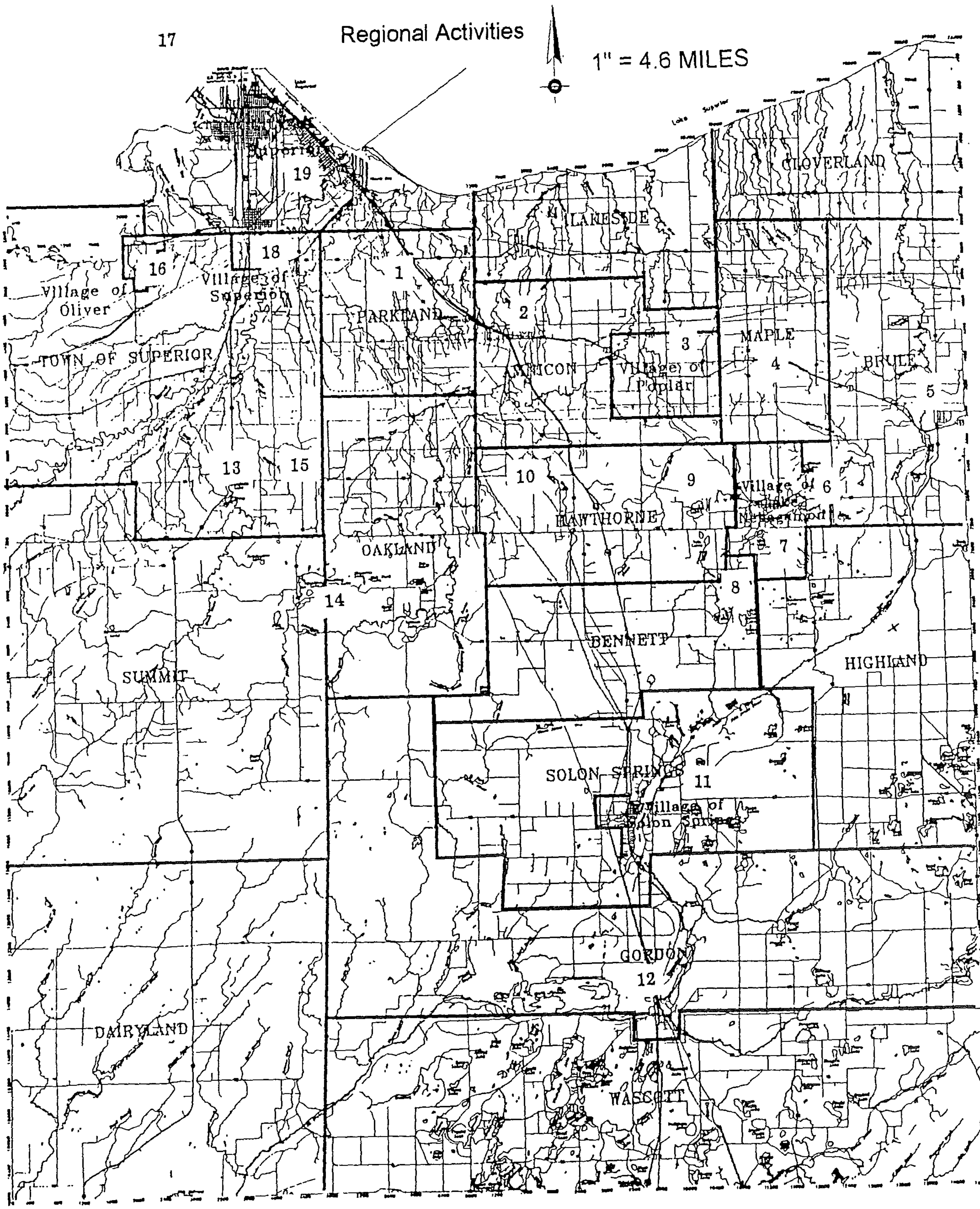

MAP OF THE
CITY OF SUPERIOR
Sanitary Sewersheds - Existing Needs
Separate Sewers
Combined Sewers
N
A
B
C
D
E
F
G
H
I
J
K
L

Figure A.4

DOUGLAS COUNTY, WISCONSIN



FOR DESCRIPTION OF NUMBERS, SEE ATTACHED LIST

Figure A.5

outfalls. However, with substantial rainfall ($\geq 1"$), separate systems exhibit manhole surcharging and in some cases bypassing to the environment. Current construction activities should effectively minimize sanitary sewer overflows during significant wet weather events.

Numerous activities related to wastewater collection and treatment in Douglas County are at various stages of implementation. Existing and potential wastewater facilities in Douglas County are shown in **Figure A.5** and described in **Table A.1.** Regional activities relating to sewer service area planning outside the boundaries of the City of Superior will not be considered.

Table A.1 Regional Activities

Number on Figure A.5	Name and Description
1	Parkland Sanitary District No. 1 - Updating Facility Plan
2	Amnicon Falls State Park - Discussion regarding needs
3	Poplar - Proceeding with design
4	Maple - Discussion regarding needs
5	Brule - Upgrading existing system
6	Village of Nebagamon - Existing system (also see Numbers 6 & 7) Pond to be upgraded
7	Lake Nebagamon - Draft Facility Plan
8	Lake Minnesuing - Request for proposals for preparing Facility Plan
9	Hawthorn - Discussion regarding needs
10	Middle River Health Facility - Existing WWTP
11	Solon Springs - Existing system
12	Gordon - Discussion regarding needs
13	Pattison State Park - Discussion regarding needs
14	Amnicon / Dowling Lakes - Preparing Facility Plan
15	Four Corners School - Existing system
16	Village of Oliver - Tying into WLSSD
17	Village of Superior - Existing system; upgrading lift station. No available capacity per Village.
18	City of Superior - Upgrading existing collection and treatment facilities
19	Douglas County Industrial Park

B. INVENTORIES AND FORECASTS

RLK Associates has developed a preliminary future use plan with associated population projections shown in **Figure B.1** (see RLK's Comprehensive Plan). This is the fourth iteration of the land use planning processes. Population and development data associated with the third land use planning process iteration are shown in **Table B.1** and **Table B.2**. At this point, 2 "staged growth" emphasis will be employed development. Those areas with existing infrastructure able to support increased growth are proposed for earlier stages of development. Staged Growth Areas are shown in **Figure B.2** (see RLK's Comprehensive Plan).

Table B.1

Sewersheds	LA-1	LA-2	LA-3	LA-4	Comm	Industrial	Airport	Inst	Parks	Schools	Env Sens	Total
A			124		38	507		2	8		11	690
B		19	333	78	216	472		32	32	134	36	1352
C	15	295		161	280	259	545	62	50	76		1743
D	10	322	68	42	142	6		13	81	66	162	912
E		361		1	55	360		59	95	6	240	1177
F		509		40	48	777		3	17		448	1842
G	63	137		33	18	53		2	28	18	202	554
H	538	23							36		603	1200
I	712	286		89	93	790		43	35	12	165	2225
J	107	86	116	40	82	760	34	27	240	65	962	2519
K		133	429	8	66	258	13		22	6	544	1479
L	183					3				1	420	607
Totals	1628	2171	1070	492	1038	4245	592	243	644	384	3793	16,300

Superior Land Use Calculations by Sewershed District and Staged Growth Areas

Sewer shed districts	Land Use districts	Total Acres	DU/Acre	Total Dwelling units	exist units	net change	hh size	exist pop	net change	Total Population
Staged Growth Area 1										
A	LA-1	0	1				3.00			
A	LA-2	0	3				2.20			
A	LA-3	124	6	744			2.00			1,488
Total		**124**		**744**	**742**	**2**		**1,574**	**(86)**	**1,488**
A	Comm	38								
A	Ind	507								
A	Institution	2								
A	Parks	8								
A	Env. Sens	11								
B	LA-1		1				3.00			
B	LA-2	19	3	57			2.20			125
B	LA-3	333	6	1,998			2.00			3,998
B	LA-4	78	11	858			1.25			1,073
Total		**430**		**2,967**	**3,685**	**-718**		**7,770**	**(2,576)**	**5,194**
B	Comm	216								
B	Ind	472								
B	Institution	32								
B	Parks	32								
B	School	134								
B	Env. Sens.	36								
I	LA-1	712	1	712			3.00			2,136
I	LA-2	296	3	888			2.20			1,954
I	LA-3	0	6				2.00			
I	LA-4	89	11	979			1.25			1,224
Total		**1,097**		**2,579**	**1,480**	**1,099**		**3972**	**1,341**	**5,313**
I	Comm	93								
I	Ind	790								
I	Institution	43								
I	Parks	35								
I	School	12								
I	Env. Sens.	165								
Grand total Growth Area 1		**1,651**		**6,290**				**13,316**	**(1,321)**	**11,995**

Table B.2

Superior Land Use Calculations by Sewershed District and Staged Growth Areas

Sewer shed districts	Land Use districts	Total Acres	U/Acre	Total Dwelling units	exist units	net change	hh size	exist. Pop	net change	Total Population
Staged Growth Area 2										
C	LA-1	15	1	15			3.00			57
C	LA-2	295	3	885			2.20			1,947
C	LA-3	0					2.00			
C	LA-4	161	11	1,771			1.25			2,214
Total		**471**		**2,671**	**2,195**	**476**		**5,427**	**(1,209)**	**4,218**
C	Comm	280								
C	Ind	259								
C	Airport	545								
C	Institution	62								
C	Parks	50								
C	School	76								
K	LA-1	0	1				3.00			
K	LA-2	133	3	399			2.20			878
K	LA-3	429	6	2,574			2.00			5,148
K	LA-4	8	11	88			1.25			110
Total		**570**		**3,061**	**748**	**2,313**		**1800**	**4,336**	**6,136**
K	Comm	66								
K	Ind.	258								
K	Airport	13								
K	Parks	22								
K	School	6								
K	Env. Sens.	544								
Grand total Growth Area 2		**1,041**		**5,732**				**7,227**	**3,127**	**10,354**

Table B.2

Superior Land Use Calculations by Sewershed District and Staged Growth Areas

Staged Growth Area 3	Land Use districts	Total Acres	U/Acre	Total Dwelling units	exist units	net change	hh size	exist. Pop	net change	Total Population
D	LA-1	10		10						30
D	LA-2	322		966			2.20			2,125
D	LA-3	68		408			2.00			816
D	LA-4	42	11	462			1.25			578
Total		442		1,862	1,153	709		2705	844	3,549
D	Comm	142								
D	Ind	6								
D	institution	13								
D	Parks	81								
D	School	66								
D	Env. Sens.	162								
J	LA-1	107	1	107			3.00			321
J	LA-2	86	3	258			2.20			568
J	LA-3	116	6	696			2.00			1,392
J	LA-4	40	11	440			1.25			550
Total		349		1,501	255	1,246		632	2,199	2,831
J	Comm	82								
J	Ind	760								
J	Airport	34								
J	Institution	27								
J	Parks	240								
J	School	65								
J	Env. Sens.	962								
Total Growth Area 3		791		3,363	1,408			3,337	3,04~~2~~3	6,379

Table B.2

Superior Land Use Calculations by Sewershed District and Staged Growth Areas

Sewer shed districts	Land Use districts	Total Acres	DU/Acre	Total Dwelling units	existing units	net change	hh size	existing pop	net change	Total Population
Staged Growth Area 4										
E	LA-1		1				3.00			0
E	LA-2	361	3	1,083			2.20			2,383
E	LA-3		6				2.00			0
E	LA-4	1	11	11			1.25			14
Total		362		1,094	659	435		1501	895	2,396
E	Comm	55								
E	Parks	95								
E	School	6								
E	Institution	59								
E	Ind	360								
E	Env. Sens.	240								
F	LA-1		1				3.00			0
F	LA-2	509	3	1,527			2.20			3,359
F	LA-3	0	6				2.00			0
F	LA-4	40	11	440			1.25			550
Total		549		2,357	459	1,898		1,091	2,818	3,909
F	Comm	48								
F	Ind	777								
F	Institution	3								
F	Parks	17								
F	Env. Sens.	448								
Grand total Growth Area 4		**911**		**3,451**				**2,592**	**3714**	**6,306**

Sewershed district	Land Use districts	Total Acres	U/Acre	Total Dwelling units	exist units	net change	hh size	exist. Pop	net change	Total Population
Staged Growth Area 5										
G	LA-1	63	1	63			3.00			189
G	LA-2	137	3	411			2.20			904
G	LA-3	0	6				2.00			
G	LA-4	33	11	363			1.25			454
Total		233		837	334	503		651	896	1,547
G	Comm	18								
G	Ind	53								
G	Institution	2								
G	Parks	28								
G	School	18								
G	Env. Sens.	202								
L	LA-1	183	1	183			3.00			549
L	LA-2		3				2.20			
L	LA-3		6				2.00			
Total		183		183	0	0	1.25	-	549	549
L	Comm									
L	Ind.	3								
L	School	1								
L	Env. Sens.	420								

Table B.2

Superior Land Use Calculations by Sewershed District and Staged Growth Areas

Sewershed districts	Land Use districts	Total Acres	U/Acre	Total Dwelling units	exist units	net change	hh size	exist Pop	net change	Total Population
Grand total Growth Area 5		**416**		**1,020**				**651**	**1445**	**2,096**
Staged Growth Area 6										
H	LA-1	538	1	538			3.00			1,614
H	LA-2	23	3	69			2.20			152
H	LA-3	0	6				2.00			
H	LA-4	0	11				1.25			
Total		**561**		**607**	**0**	**0**		**0**	**0**	**1,766**
H	Comm									
H	Ind									
H	Parks	36								
H	Landfill	219								
H	Env Area	603								
Grand Total Growth Area 6		**561**		**607**				**0**	**0**	**1,766**
Grand Totals-the city		***5,371***		***20,463***				***27,123***		***38,896***

Table B.2

C. WATER QUALITY ASSESSMENT

Planning area "water quality assessment" focuses on point & nonpoint source pollutant inputs to the water environment. Point source pollutant loadings can be traced to a pipe or an outfall from a municipal or industrial facility. Conversely, nonpoint source pollution is by nature diffuse and ubiquitous and includes runoff from urban areas, construction sites, industrial sites, and agricultural land. **Figure C.1** shows point source locations and nonpoint source areas of interest.

C. 1. Point Sources

As the name implies, point source pollutants can be attributed to a single discharge location. For the sake of discussion, Planning area discharge locations associated with Municipal wastewater treatment facilities and industrial process plants are considered point sources.

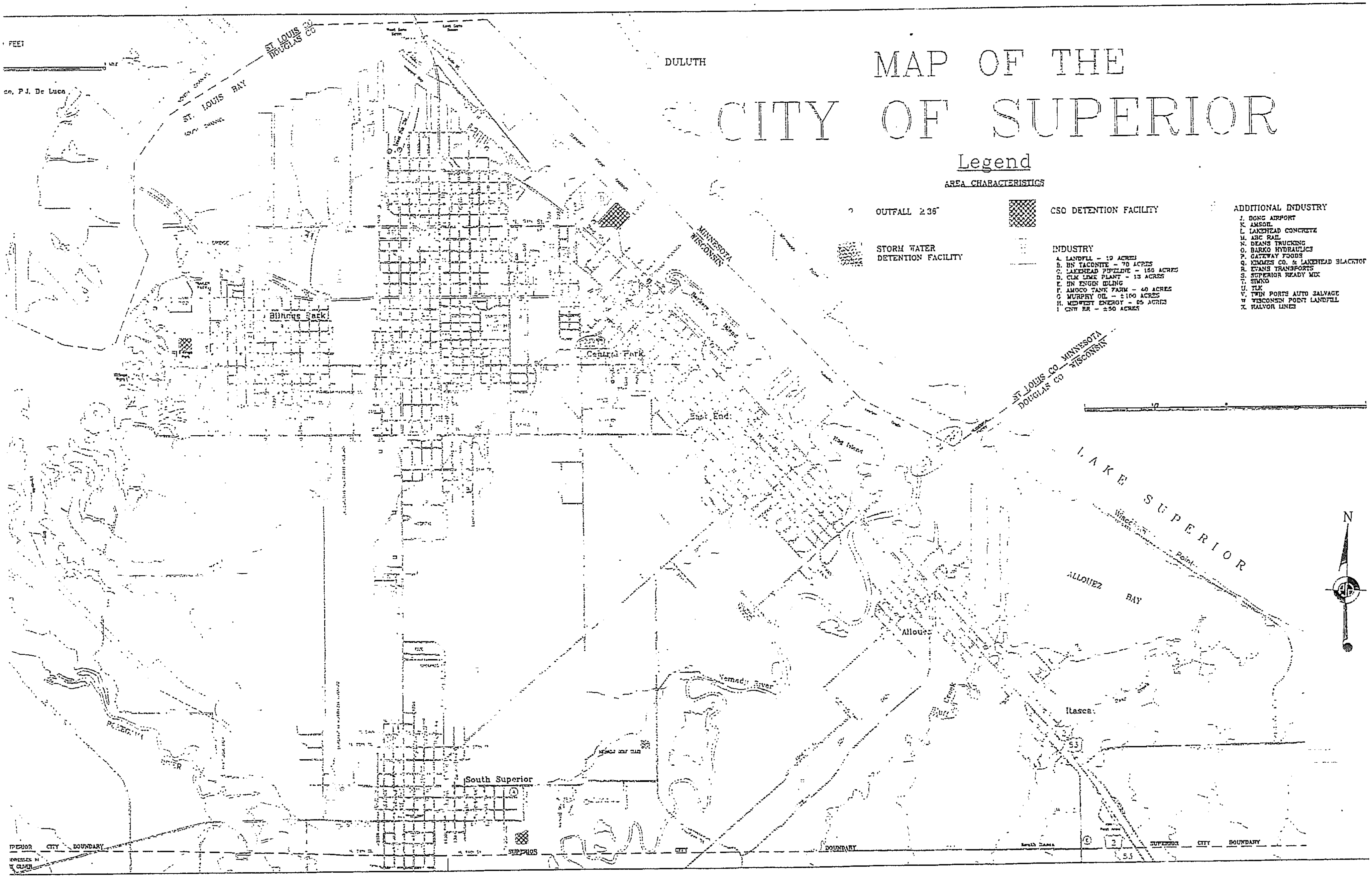
C.1.a Municipal

The City of Superior currently operates four wastewater treatment facilities. Section F.1 provides municipal treatment plant detail. The Superior Main Wastewater Treatment Plant is located at the foot of E Street on Superior Bay. Originally built in 1956, an activated sludge process treats a design flow of 5 MGD, discharging to a point approximately 150 feet from CSO 2's northeast corner. Section F of this report includes further discussion of main plant facilities. Adjacent to the Main WWTP and located on Superior Bay, the 50 MG CSO 2 pond treats a daily maximum flow of 75 MG via settling, biological treatment, and disinfection - ultimately discharging to the base of the slip at the foot of B Street. South Superior is served by CSO 5. Located at 61st Street and Birch Avenue, CSO 5 provides 12 million gallons of storage during wet weather flows and subsequent 7.5 MGD physical/chemical treatment for flows which cannot be drained back into the system feeding the Main WWTP.

CSO 5 discharges and overflows to the Nemadji River via an outfall through a drainage swale. CSO 6 operation, treatment scheme and capacity are similar to those provided by CSO 5. Located at Texas Avenue and 17th Street, CSO 5 stores 6 million gallons during wet weather events and discharges/overflows to St. Louis Bay. Also, current East End construction efforts to provide storage of sanitary sewer overflows will centralize discharges associated with 7-year design storms. LS 7 storage is located north of E. 2nd Street and South of Bluff Creek and provides 0.9 MG of SSO storage. LS 5 storage stores 0.6 MG of SSOs and is located Northeast of Newton Creek and northwest of Newton Creek. Overflows from storage at LS's 5 and 7 discharge to Newton and Bluff Creeks respectively.

Average yearly pollutant loadings for the main WWTP were generated using 1992 - 1996 data. Yearly BOD_5 loadings for Superior Bay ranged from 98,630 pounds to 247,180 pounds for 1995 and 1996 respectively (**Table C.1**). Between 1992 and 1995, yearly loads of TSS to Superior Bay averaged roughly 80,000 pounds. 1996 data indicate yearly TSS loads of 211,870 pounds. Total yearly phosphorus loads to Superior Bay from the Main WWTP and significantly below discharge permitted limitations of 15,230 pounds. Section C of this report further discusses WPDES limitations for point sources within the City of Superior.

Using data from 1992 - 1996, yearly pollutant loadings are calculated for CSO 2 (**Table C.2**). BOD_5 loadings range from 62,150 pounds to 74,660 pounds for years exhibiting complete effluent quality data sets. Yearly TSS pollutant loads to Superior Bay from CSO 2 range from 87,100 pounds to 108,760 pounds for



MAP OF THE
CITY OF SUPERIOR
Legend
AREA CHARACTERISTICS
OUTFALL ≥ 36"
CSO DETENTION FACILITY
STORM WATER DETENTION FACILITY
INDUSTRY
A. LANDFILL - 19 ACRES
B. BN TACONITE - 70 ACRES
C. LAKEHEAD PIPELINE - 150 ACRES
D. CLM LIME PLANT - 13 ACRES
E. BN ENGIN BLDING
F. AMOCO TANK FARM - 40 ACRES
G. MURPHY OIL - ±100 ACRES
H. MIDWEST ENERGY - 65 ACRES
I. CNW RR - ±50 ACRES
ADDITIONAL INDUSTRY
J. BONG AIRPORT
K. AMSOIL
L. LAKEHEAD CONCRETE
M. ABC RAIL
N. DEANS TRUCKING
O. BARKO HYDRAULICS
P. GATEWAY FOODS
Q. KIMMES CO. & LAKEHEAD BLACKTOP
R. EVANS TRANSPORTS
S. SUPERIOR READY MIX
T. SIMKO
U. TLK
V. TWIN PORTS AUTO SALVAGE
W. WISCONSIN POINT LANDFILL
X. HALVOR LINES
DULUTH
ST. LOUIS BAY
ST LOUIS CO
DOUGLAS CO
MINNESOTA
WISCONSIN
LAKE SUPERIOR
ALLOUEZ BAY
Billings Park
Central Park
East End
Allouez
Itasca
South Superior
Nemadji River
N
FEET
SUPERIOR CITY BOUNDARY

Figure C.1

"complete" data sets. WPDES limits yearly CSO 2 phosphorus concentrations to less than 1.0 mg/l, correlating to maximum yearly phosphorus loads (1992) of 6400 pounds.

Four years of data, 1992 - 1995, were used to estimate pollutant loads associated with CSOs 5 & 6 (**Tables C.3 & C.4**). Maximum yearly pollutant loads between 1992 and 1995 for CSO 5 were: 8300 pounds BOD_5; 15800 pounds TSS; and 256 pounds phosphorus. Maximum yearly pollutant loads for CSO 6 were: 4700 pounds BOD_5; 12550 pounds TSS; and 186 pounds phosphorus. Fecal Coliform densities at CSO 5 and CSO 6 greatly exceed WPDES limitations (400 organisms/100 ml), but are not dissimilar to concentration associated with stormwater. Current City monitoring efforts address disinfection needs at CSOs 5 & 6.

Table C.1
Main Plant - Pollutant Loadings

	Design	1992	1993	1994	1995	1996
Average Flow, MGD	5	3.6	3.4	3.4	3.6	5.8
Peak Daily Flow, MGD	15	4.9	4.7	5.5	5.2	9.0
Effluent BOD_5, #/yr	-	120,550	134,550	113,850	98,630	247,180
Effluent TSS, #/yr	-	76,711	83,000	83,000	76,710	211,870

WPDES Limitations: BOD_5, 456615 #/yr; TSS, 456615 #/yr; Phosphorus, 15230 #/yr

Table C.2
CSO 2 - Pollutant Loadings

	*1992	1993	1994	1995	1996
Peak Event Flow, MGD	30	38	35	28	47
Yearly Flow, MG	381	767	621	746	660
Effluent BOD_5, mg/l	11	10	12	12	12
Effluent BOD_5, #/yr	34,950	63,970	62,150	74,660	66,050
Effluent TSS, mg/l	17	15	21	14	18
Effluent TSS, #/yr	54,020	95,950	108,760	87,100	99,080

* 1992 data is not complete - data for last half of 1992

WPDES Limitations: BOD_5, 30 mg/l; TSS, 60 mg/l; Phosphorus, 1.0 mg/l

Table C.3
CSO 5 - Pollutant Loadings

	1992	1993	1994	1995
Runs/yr	17	14	9	13
Ave. MG/Run	3.9	6.5	5.1	4.4
Mg/Year	65.8	90.4	46.2	56.9
Ave F. Coli (Org/100 ml)	-	26,30	40,40	110,870
Ave BOD_5 #/yr	4400	8300	3850	6640
Ave BOD_5 (mg/l)	*8	11	10	14
Ave TSS #/yr	10400	15800	8862	12812
Ave TSS (mg/l)	19	21	23	27
Ave Phosphorous #/yr	274	218	135	256
Ave Phosphorous (mg/l)	0.50	0.29	0.35	0.54
Pond Overflow (MG)	0	3.3	4.7	0

Table C.4
CSO 6 - Pollutant Loadings

	1992	1993	1994	1995
Runs/yr	11	11	6	10
Ave. MG/Run	4.5	5.7	5.7	4.95
Mg/Year	49.50	62.70	34.00	49.50
Ave F. Coli (org/100 ml)	-	13550	27840	31470
Ave BOD_5 #/yr	2476	4700	3120	4950
Ave BOD_5 (mg/l)	*6	9	11	12
Ave TSS #/yr	8256	12550	5670	8670
Ave TSS (mg/l)	20	24	20	21
Ave Phosphorous #/yr	149	167	100	186
Ave Phosphorous (mg/l)	0.36	0.32	0.35	0.45
Pond Overflow (MG)	0	0	0	0

* Limited Data

WPDES Limitations: BOD_5, 30 mg/l; TSS, 30 mg/l; Phosphorus, 1.0 mg/l; Coliform, 400 org/100ml

C.1.b Industrial

Several industrial dischargers are located within planning boundaries. Murphy Oil USA - Superior Refinery refines petroleum to gasoline, kerosene, diesel fuel, heating oils, heavy fuel oil, liquid petroleum gas, asphalt, and elemental sulfur. Beginning operation in 1981 and occupying a total of 233 acres (tank farm included), the refinery processes approximately 38,000 barrels of crude oil daily. Process wastewater, contaminated runoff, and uncontaminated runoff receive varying degrees of treatment preceding discharge to the headwaters of Newton Creek. Treated process wastewaters discharge at a rate of 0.29 MGD. Murphy Oil pollutant load estimates provided by St. Louis River System Remedial Action Plan include: 22,630 lbs/yr BOD_5 and 8212 lbs/yr TSS.

Burlington Northern Railroad operates a taconite transshipment facility in the Allouez section of Superior. Discharge from this facility is variable but averages approximately 60,000 gpd. Discharge to the Nemadji River stems from taconite pile runoff collected by underdrain systems. WPDES limits pH, BOD_5 , TSS and requires monitoring for copper.

Although not an industrial processing plant, the Lakehead Pipeline terminal intermittently discharges hydrostatic test water and detained surface water runoff from lagoons to the Nemadji River. Effluent limitations from this location include TSS, pH, DO, oil/grease, and ammonia-nitrogen.

Superior Midwest Energy Resources Company uses recycled precipitation for coal pile dust and temperature control. Discharges to Superior Bay, which can occur less frequently than once every decade, are limited by WPDES for SS, pH, iron, and oil/grease. Additional heavy metal monitoring is required. Bear Creek receives variable and precipitation related discharges from Chicago Northwestern Railroad site surface water runoff. The facility employs an oil/water separator to treat collected runoff prior to discharge to a drainage ditch. WPDES limitations include oil/grease and TSS, with flow monitoring required.

Due to their intermittent and infrequent nature, point source pollutant loads from Burlington Northern Railroad, Lakehead Pipeline Terminal, Superior Midwest Energy, and Chicago Northwestern Railroad are insignificant in comparison to other Superior area point source inputs.

C.2. Nonpoint Sources

The City of Superior receives and contributes nonpoint pollution - including sediments, nutrients, and toxic substances - associated with a variety of land use and levels of management. Although sediment loads attributed to upstream non-urban land uses (agriculture/forestry) overshadow urban pollutant inputs, sources of nonpoint sediment loading include construction site runoff, stream bank corrosion, and road sand application. Phosphorus and nitrogen stem from organic matter such as lawn clippings, leaves, fertilizers, and road sand/salt. Sources of trace metals include automobile emissions, atmospheric deposition, galvanizing and chrome plating, and road sand/salt. Nonpoint source organic loading (BOD_5) is linked to pet wastes, street litter, and organic matter. Pet and animal wastes contribute bacterial pollutants. Hydrocarbons result from oil and gas spillage/leakage, and improper disposal of motor oil. Sand/salt mixtures contribute chlorides to the nonpoint source pollutant pool.

Surface water runoff from the City of Superior delivers the above mentioned pollutants to water bodies. Superior's relatively impermeable red clay soil and development induced imperviousness greatly limit percolation to groundwater sources, consequentially delivering runoff, and its associated nonpoint source pollution directly to surface water bodies. The area of Superior's storm sewers are presented in **Figure C.2**.

Monitoring and modeling activities within the planning area boundary have attempted to quantify and predict nonpoint pollution sources. Water quality and quantity constituents have been monitored during dry weather flow (DWF) and wet weather flow (WWF) conditions. Monitoring efforts included four WWF sites and 23 DWF screening locations. Runoff pollutant loadings throughout the planning area were predicted with the Source Loading and Management Model (SLAMM).

C.2.a. DWF Screening

Observation and analysis of DWF screening locations were completed between August 1995 and December 1996 (Appendix 1). Screening locations **(Figures C.3 & C.4)** showed estimated dry weather flows ranging between zero (0) and 150 gpm. Five sites displayed no dry weather flow, two sites exhibited dry weather flows in excess of 75 gpm, and all other observable flows did not exceed 15 gpm. Only three screening locations exhibited non-clear water. Odor was detected at just one screening site (Newton Creek). No screening location exhibited oil presence. Water temperatures ranged from 32° F to 64° F. Measured total chlorine levels were near or below the detection limit of analysis. No free copper, total copper, or phenols were detected for DSFs. Only one screening location yielded a detergent concentration above the analysis detection limit. Measured pH values ranged from 7.4 to 8.6. The highest fecal coliform density, 37,000 organisms/100 mL, was exhibited - subsequent analysis showed fecal coliform densities no greater than 680 organisms per mL.

A number of conclusions relating to planning area water quality are reached following DWF screening and analysis. Superior's storm sewer and surface water systems do not exhibit significant pollutant loadings from dry weather flows. Neither illicit connections nor inappropriate entries are implicated or indicated. Existing and future DWF BMPs appear unnecessary. Without suspected illicit connections or inappropriate entries to the system, no further DWF screening is required.

C.2.b. WWF Monitoring

In addition to DWF screening activities, WDNR established 4 WWF sampling locations within the City of Superior and one representative location in Duluth, MN, with various degrees of analysis occurring for each site during 1995 and 1996 (Appendices 2 & 3). Sampling sites and periods included:

- **undeveloped area** - 76-acre woodland/grassland adjacent to drainage creek behind green No.7 on east/west course of Nemadji Public Golf Course (7/95 - 9/96);
- Unpaved **recreational area** in Petroski Park in South Superior (7/95 - 9/96);
- 11.8 acre drainage basin on north side of Nemadji **golf course** No. 2 fairway or east/west course (7/95 - 9/96);
- West side of **Tower Avenue** intersection with 32nd Street (3/95 - 9/95); and
- **gas station** in Duluth (95 - 96).

Of all sites monitored, the undeveloped area generally exhibited the lowest constituent concentrations - 26 separate runoff events were monitored. Total phosphorus concentrations averaged 0.084 mg/l.

The mean concentrations for Total Kjedahl Nitrogen (TKN), nitrate-nitrogen and ammonia-nitrogen were 1.4, <0.01 (DL) and >0.027 (DL) mg/l respectively. Total Solids (TS) concentrations averaged 203 mg/l, and the mean BOD_5 concentration was 14 mg/l. Heavy metal concentrations were generally low, but sometimes detectable - with total lead, total copper, and total zinc exhibiting concentrations of 0.4, 4.0, and >19 mg/l respectively. Chloride concentration averaged 2.2 mg/l per event. Mean Fecal Coliform densities were 2329 orgs/100 ML.

The golf course site (26 events) showed a higher than expected average concentration for Zinc, 52 mg/l, but a lower than might be expected phosphorus average concentration of 0.276 mg/l. High Zinc concentrations may be associated with putting green fertilizer (1.3% Zn). 0.1 lbs phosphorous per 1000 ft^2 is typically applied two to three times per year at the golf course. Golf Course TKN, nitrate/nitrite-nitrogen, and ammonia-nitrogen concentrations average 3.0, 0.1 and 0.2 mg/l respectively. Mean total lead and total copper concentrations for the golf course were 0.9 and 7.0 mg/l, with chloride averaging 3.8 mg/l. Golf Course TS and BOD_5 concentrations averaged 205 and 22 mg/l respectively. Mean fecal coliform densities of 3300 orgs/100 ML were exhibited.

Less extensive WWF monitoring occurred during 1995 at the Tower Avenue recreational area, and gas station sites. For all sites, gas station runoff monitoring yielded the highest mean concentrations for total lead (35 mg/l), total copper (60 mg/l), total zinc (305 mg/l), and fecal coliform (9400 organisims/100 ML). TKN, nitrate/nitrite-nitrogen, and ammonia-nitrogen mean values for gas station runoff

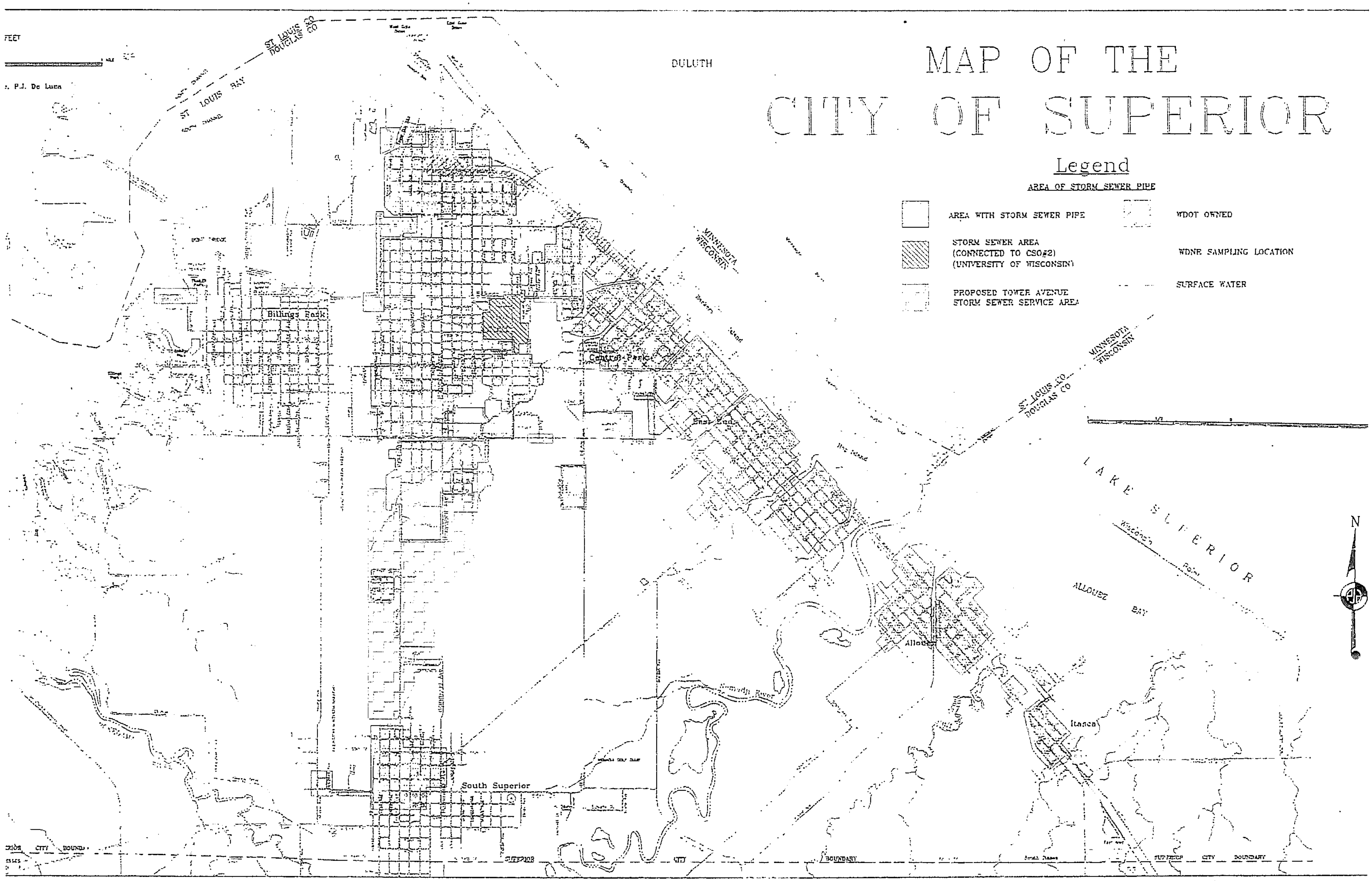

MAP OF THE
CITY OF SUPERIOR
Legend
AREA OF STORM SEWER PIPE
AREA WITH STORM SEWER PIPE
STORM SEWER AREA (CONNECTED TO CSO#2) (UNIVERSITY OF WISCONSIN)
PROPOSED TOWER AVENUE STORM SEWER SERVICE AREA
WDOT OWNED
WDNR SAMPLING LOCATION
SURFACE WATER
FEET
P.J. De Luca
DULUTH
ST LOUIS CO
DOUGLAS CO
ST LOUIS BAY
MINNESOTA
WISCONSIN
Billings Park
Central Park
East End
South Superior
Allouez
Itasca
LAKE SUPERIOR
ALLOUEZ BAY
N
SUPERIOR CITY BOUNDARY

Figure C.2

DWF Screening Locations

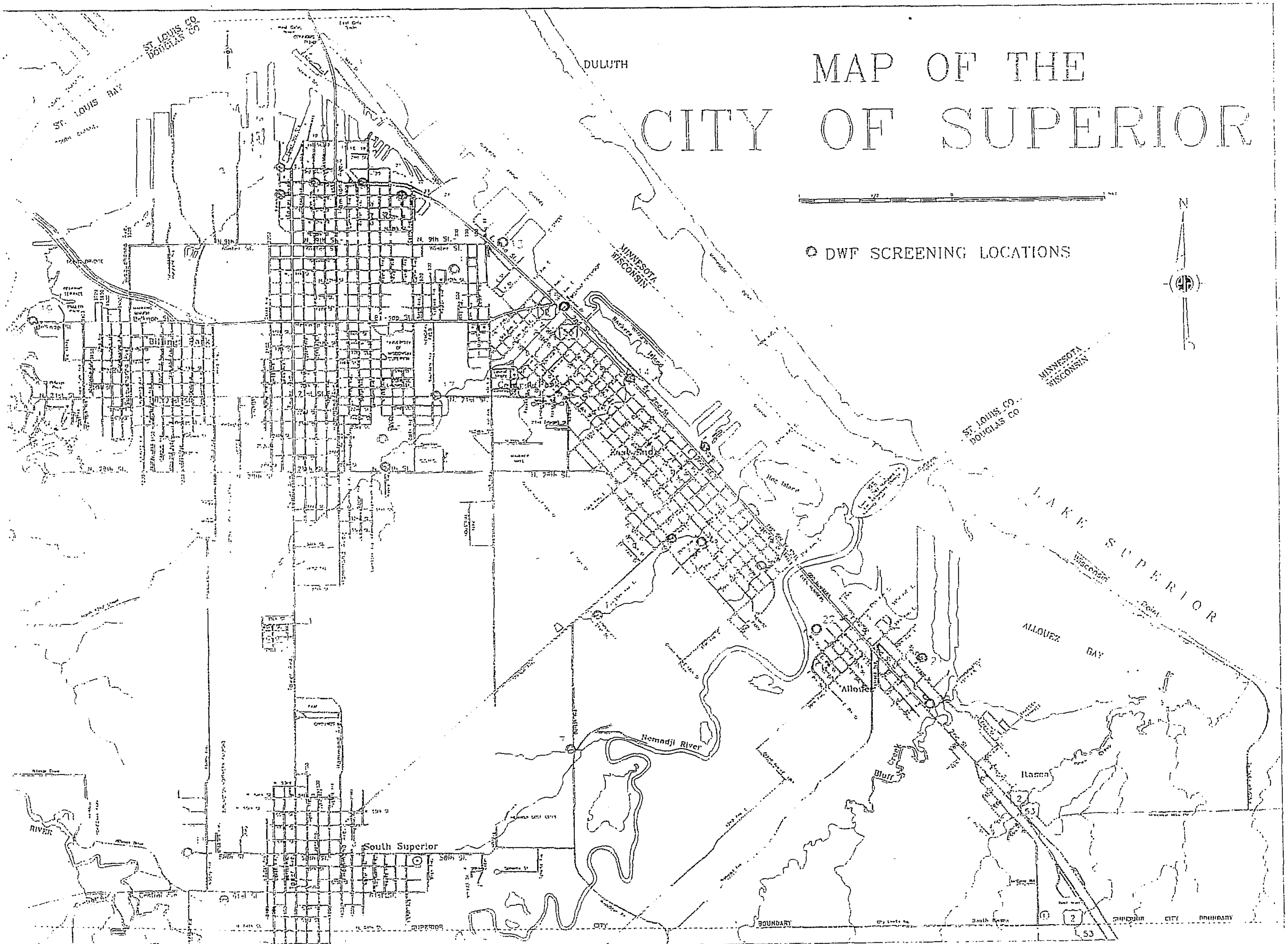


Figure C.3

were 3.3, 0.51, and 0.17 mg/l respectively - the highest among WWF sites. Total phosphorus concentration averaged 0.81 mg/l. Chloride and TS concentrations for gas station runoff averaged 80 ML 750 mg/l respectively.

Recreation area runoff exhibited the highest average total phosphorus concentration (0.96 mg/l) among all WWF sites. Mean recreation area runoff nitrogen concentrations were 1.9 mg/l (TKN), 0.3 (nitrate-nitrite), and 0.1 (ammonia). The recreation area yielded a relatively low average chloride concentration, 8 mg/l, but a high TS concentration of 550 mg/l. A BOD_5 average concentration of 23 mg/l was shown for the recreation area.

1995 WWF monitoring at the Tower Avenue site included 10 rain events and 5 snow melt events (chloride & TS analysis only). Dramatic differences between snow melt and rain event chloride and TS average concentration are shown. Tower Avenue snowmelt exhibited an average chloride concentration of 225 mg/l - the highest among WWF monitoring sites and significantly greater than the average Tower Avenue rain event chloride concentration of 15 mg/l. Tower Avenue average TS concentrations of 652 (snow melt) and 348 (rain event) mg/l were shown. Tower Avenue rainfall runoff yielded the greatest average fecal coliform density (9600 organisms/100 ML) and BOD_5 concentration (49 mg/l) of all WWF monitoring sites. The mean rainfall runoff total phosphorus concentration was, and nitrogen average concentrations of 3.3 (TKN), 0.51 (nitrate-nitrite), and 0.17 (ammonia) mg/l were exhibited.

WWF monitoring results **(Table C.5)** indicate low pollutant concentrations associated with undeveloped areas. Also, monitoring results implicate snow melt as a significant carrier of chlorides and TS, and developed/commercial (Tower Avenue) areas appear to possess the highest BOD_5 and fecal Coliform concentrations and perhaps contribute significant pollutant loads to receiving waters. Gas station site runoff contains the highest heavy metal concentrations, and high phosphorus concentrations but provide centralized locations for nonpoint source input control. All planning decisions based on WWF monitoring and subsequent "source loading" modeling should require a conservative calibration process. **Figure C.5 and C.6** show stormwater discharge quality comparisons.

WDNR developed SLAMM as an urban rainfall runoff water quality model. The model considers runoff coefficients and particulate solid concentrations that are statistically representative of a source area. Source area boundary conditions include:

- storm event data;
- % impervious and pavement characteristics;
- area;
- soil type;
- topographical relief; and
- best management practices.

C.2.c SLAMM

Runoff volume and pollutant loadings are calculated using the above information. For SLAMM application, Superior was divided into twenty-five subbasins (Figure C.7). Further division of those twenty-five subbasins detail area distribution of residential, commercial, industrial, institutional, open spaces, and freeways. Given subbasin divisions and their associated model input parameters, annual pollutant loadings per subbasin were determined by SLAMM. Mean annual cumulative rainfall input to drive SLAMM was 28.74 inches. BMP reduction of nonpoint source pollutant loads relate to street sweeping, CSO removal/detention, and detention ponds. Predicted total pollutant loads with BMPs considered are shown in **Table C.6** and are summarized below:

- Total Solids, 4139765 lbs/yr;
- Phosphorus, 2125 lbs/yr;
- Copper, 168 lbs/yr;
- Zinc, 2996 lbs/yr; and
- Lead, 2517 lbs/yr.

To account for nonpoint source pollution increases associated with future land use planning, a number of assumptions were made. Representative SLAMM subbasin area 1 pollutant loadings rates per land use designation were used. For example, the LA3 land use designation is represented by SLAMM residential pollutant loadings of WISULS12 and WISULS01. The average pollutant loading of representative SLAMM subbasins was employed for calculations of future additional loadings associated with proposed future land use. Predicted total pollutant load increases due to future land projections are presented in **Table C.7** and are summarized:

- Total Solids, 2275329 lbs/yr;
- Phosphorus, 1717 lbs/yr;
- Copper, 254 lbs/yr;
- Zinc, 2615 lbs/yr; and
- Lead, 3108 lbs/yr.

With the predictive nature of the SLAMM Model is worth noting. Adequate calibration requires additional WWF monitoring and "ground truthing" basin mapping and characterization efforts. Planning area urban nonpoint source pollution inputs as predicted by SLAMM are approximately 3 - 4 times less the magnitude of nonpoint source pollution contributed by the City of Duluth. For example, Superior phosphorus loads average 2125 pounds per year, while Duluth contributes a mean yearly phosphorous load of 7378 pounds. Also, non-urban nonpoint source input areas upstream of superior, such as the Nemadji and St. Louis river watersheds, deliver far greater pollution loadings than does Superior.

Fecal Coliform Sampling Locations Upstream of No. 28th St. and Weeks Ave.

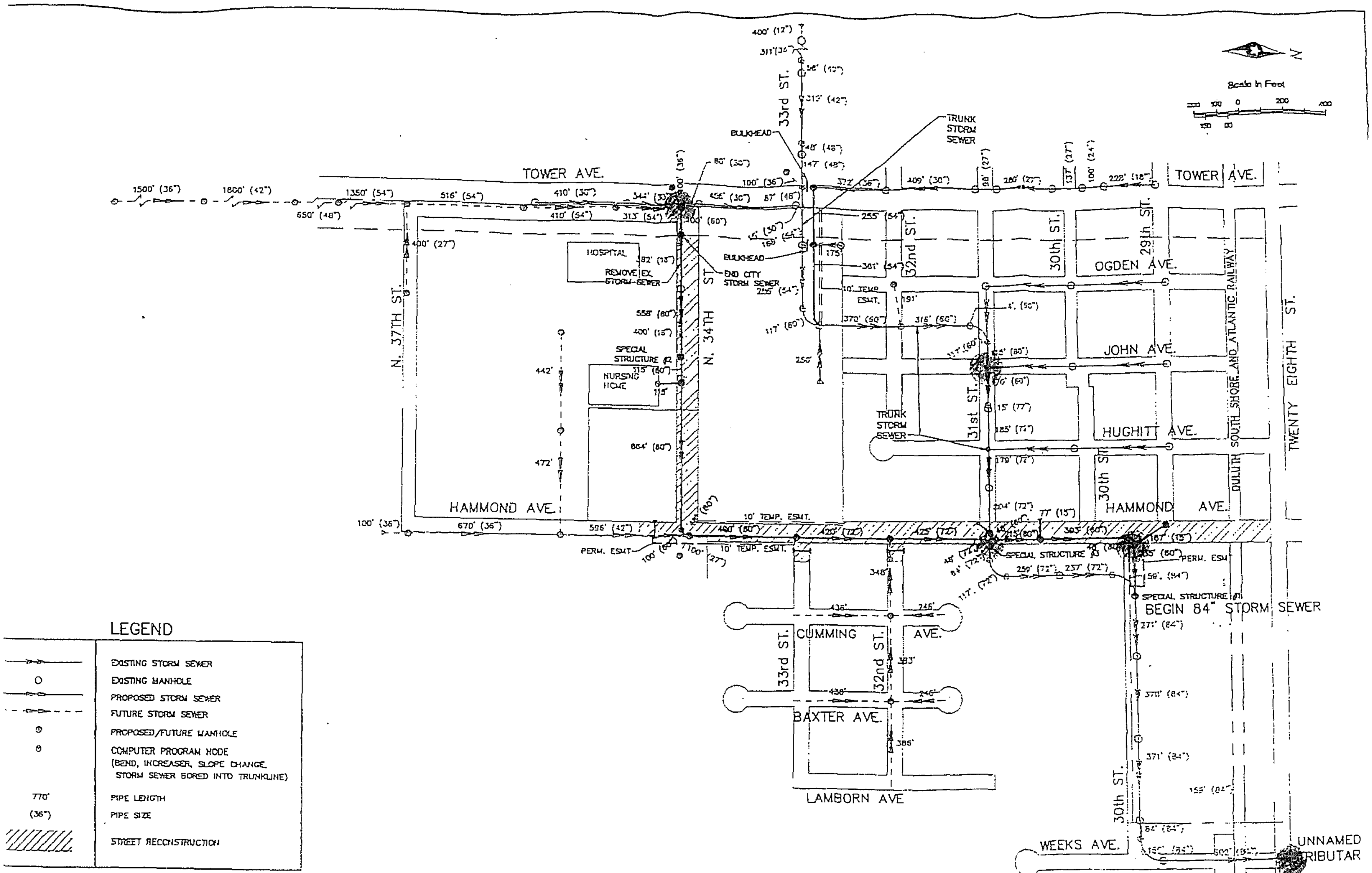


Figure C.4

Table C.5

WWF Monitoring - Mean Concentrations

	Total Phosphorus mg/l	TKN mg/l	Nitrate-Nitrite-N mg/l	Ammonia-N mg/l	BOD_5 mg/l	TS mg/l	Chloride mg/l	Total Lead mg/l	Total Copper mg/l	Total Zinc mg/l	Fecal Coliform orgs/100 ML
Undeveloped Area	0.08	1.4	<0.01	<0.027	14	203	2.2	0.4	4	<19	2329
Golf course	0.28	3.0	0.10	0.199	22	205	3.8	0.9	7	52	3300
Tower Avenue	0.33	0.9	0.36	0.170	49	348 652*	15 225*	35	35	125	9400
Recreation Area	0.96	1.9	0.30	0.100	23	550	8	-	-	-	-
Gas Station	0.81	3.3	0.51	0.170	-	250	80	35	60	305	-

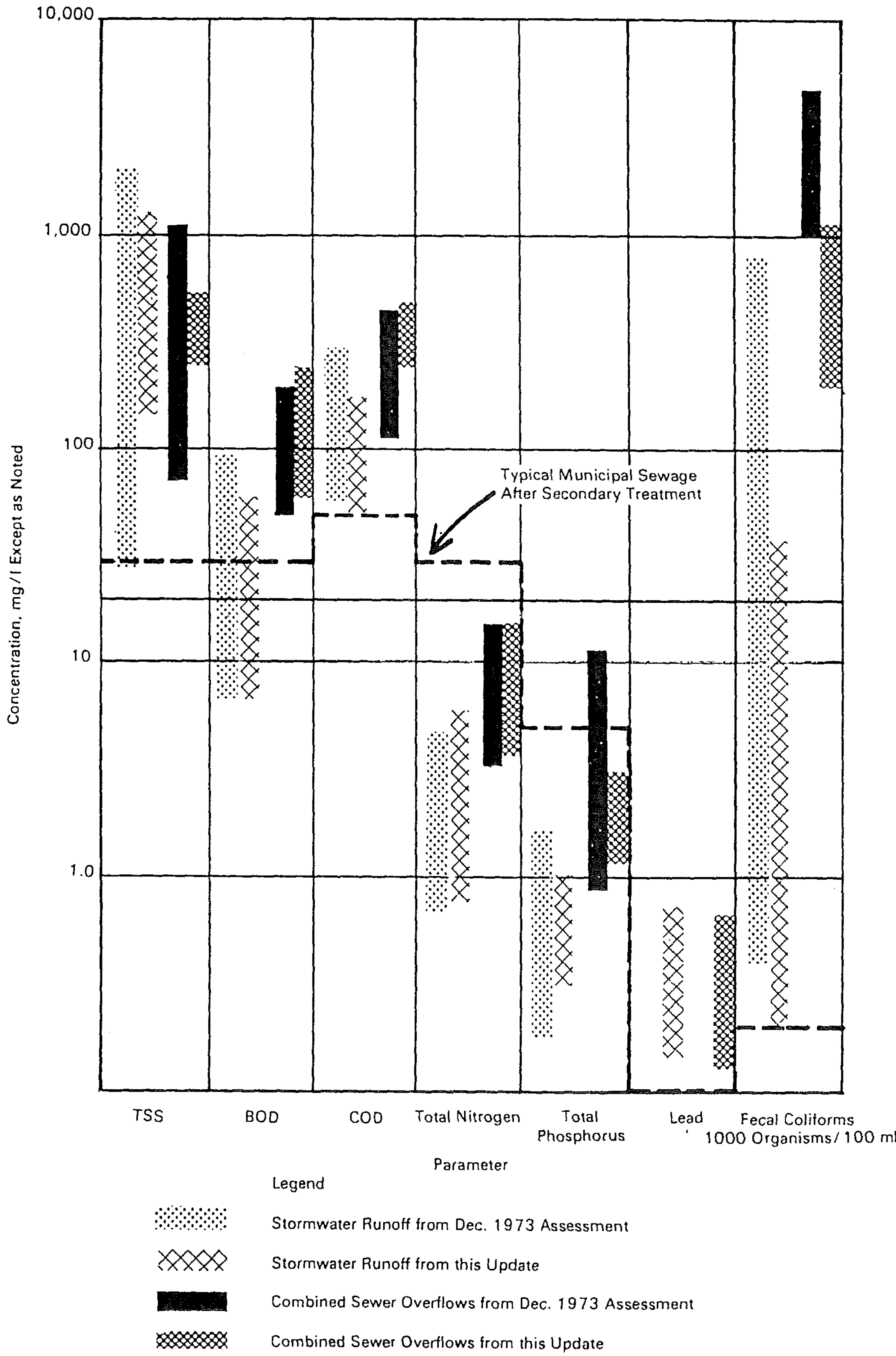


Figure 1. Representative Stormwater Discharge Quality.
Source: Lager, A., W. G. Smith, W. G. Lynard, R. M. Finn, and E. J. Finnemore, *Urban Stormwater Management and Technology: Update and User's Guide*, U.S. EPA Report, EPA 600/8-77-014, p. 10, September 1977.

Figure C.5

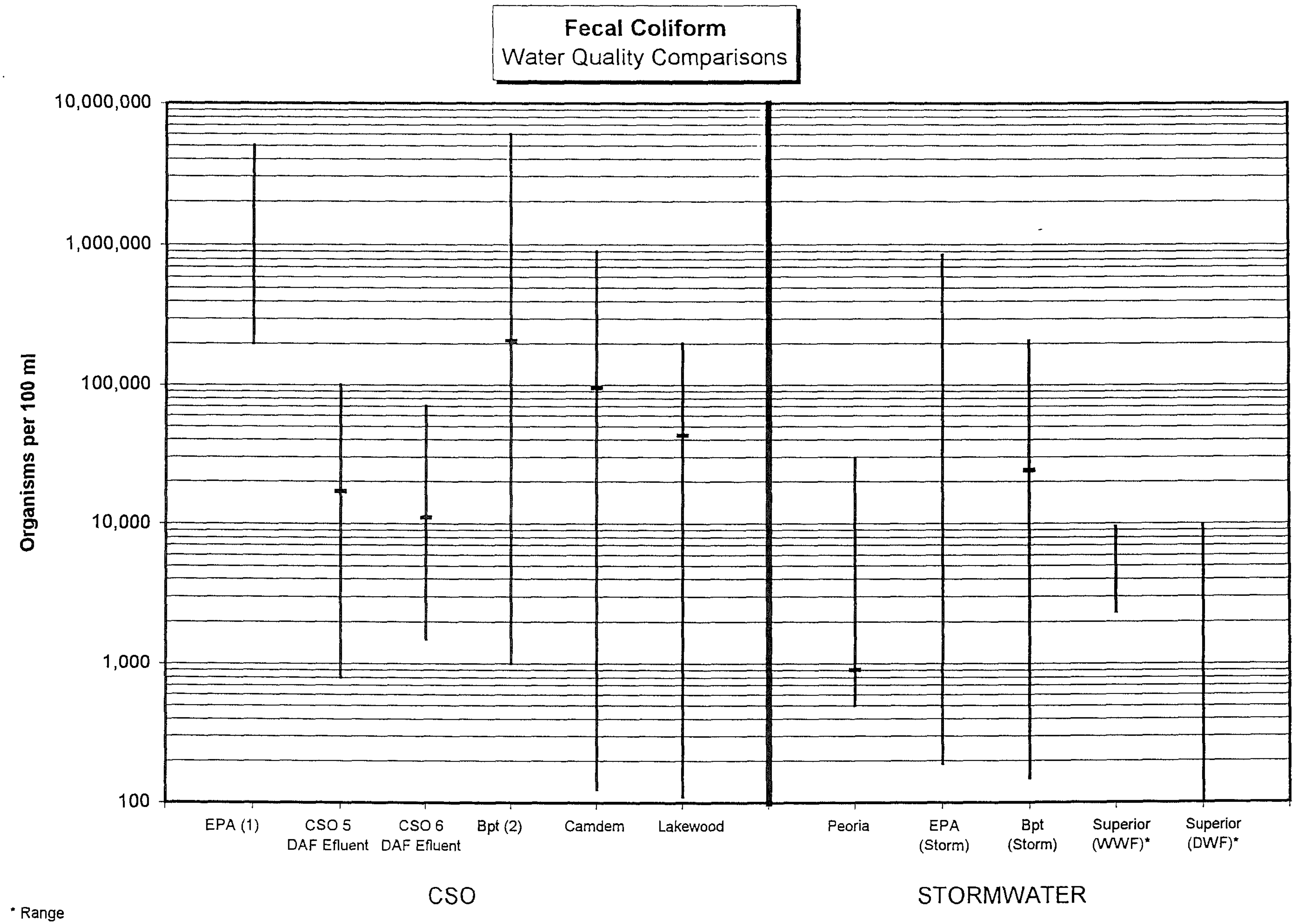

Fecal Coliform
Water Quality Comparisons
Organisms per 100 ml
10,000,000
1,000,000
100,000
10,000
1,000
100
EPA (1)
CSO 5 DAF Efluent
CSO 6 DAF Efluent
Bpt (2)
Camdem
Lakewood
Peoria
EPA (Storm)
Bpt (Storm)
Superior (WWF)*
Superior (DWF)*
CSO
STORMWATER
* Range

Figure C.6

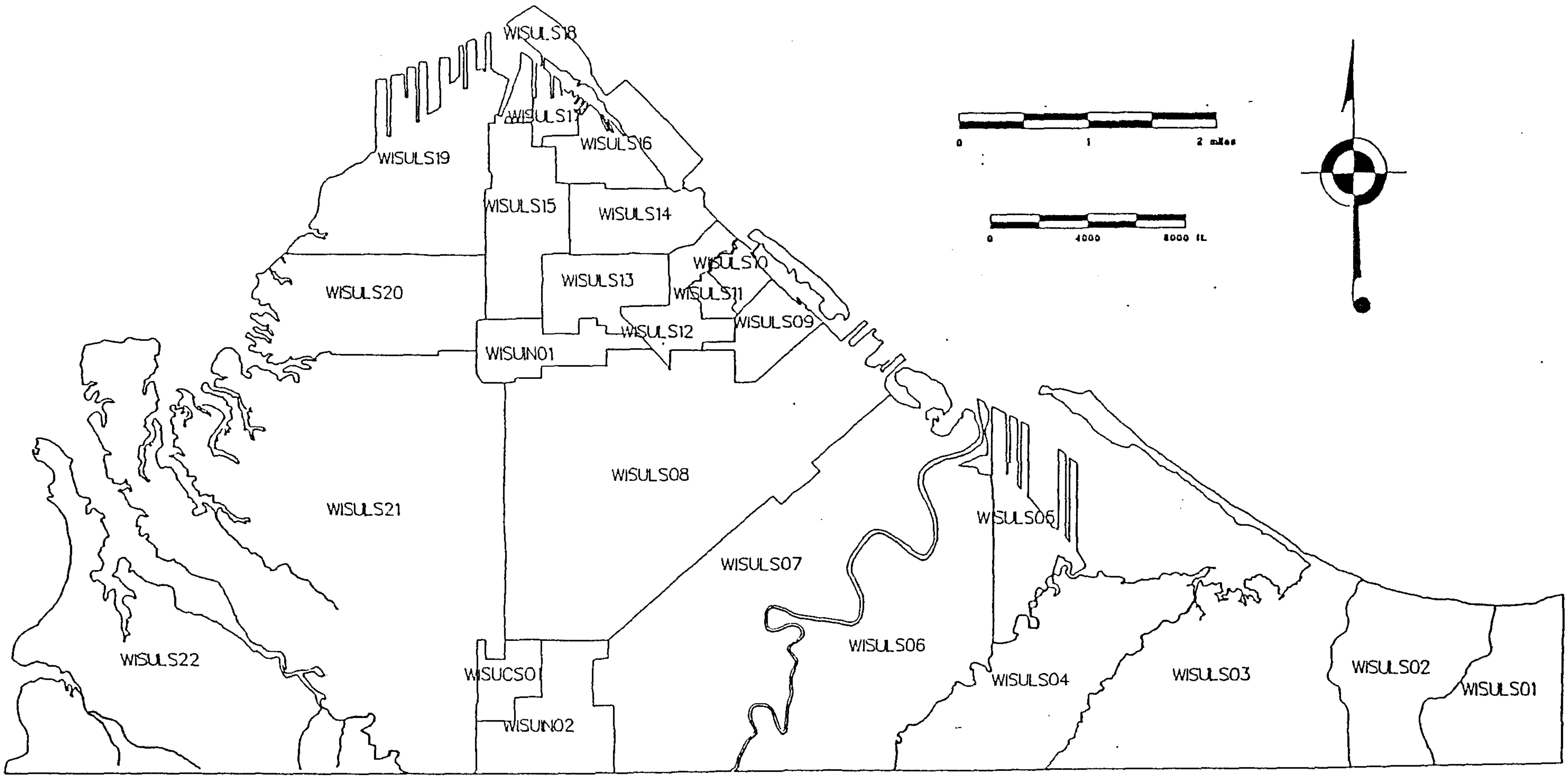

WISULS18
WISULS17
WISULS16
WISULS19
WISULS15
WISULS14
WISULS10
WISULS13
WISULS11
WISULS20
WISULS12
WISULS09
WISUIN01
WISULS08
WISULS21
WISULS05
WISULS07
WISULS06
WISULS22
WISUCS01
WISULS04
WISULS03
WISULS02
WISULS01
WISUIN02
0
1
2 miles
0
4000
8000 ft.

Figure C.7

Superior, WI
Annual Loads, lbs. (WDNR - SLAMM)

Subbasin	Volume (cu. ft.)	Total Solids	Total P	CU	ZN	PB
WISULS01	22,146,638	56,283	0	0	0	0
WISULS02	12,020,132	30,548	0	0	0	0
WISULS03	36,475,208	141,848	55	13	43	114
WISULS04	22,613,286	189,444	86	8	70	169
WISULS05	18,221,263	466,663	242	22	320	202
WISULS06	29,340,327	174,897	82	3	64	101
WISULS07	58,830,581	473,333	189	18	258	194
WISULS08	82,440,944	1,083,969	557	39	589	744
WISULS09	8,320,333	98,732	88	3	63	60
WISULS10	11,304,114	127,342	104	4	78	70
WISULS11	2,383,054	32,790	28	1	23	30
WISULS12	10,348,591	135,885	98	5	86	86
WISULS13	8,574,509	97,922	76	4	50	39
WISULS14	10,058,475	152,318	108	5	91	133
WISULS15	26,357,978	550,658	378	24	343	767
WISULS16	10,302,315	16,546	112	7	116	128
WISULS17	3,683,043	86,950	57	5	73	57
WISULS18	12,121,226	192,681	100	8	138	70
WISULS19	51,520,161	1,009,077	625	54	778	440
WISULS20	34,392,239	282,056	243	7	178	138
WISULS21	115,335,981	871,043	346	21	287	697
WISULS22	37,571,950	95,485	0	0	0	0
WISUIN01	9,341,377	105,922	78	4	60	145
WISUIN02	15,474,017	236,789	108	6	88	225
WISUCS01	5,798,009	44,858	35	1	30	61
Subtotal	654,975,751	6,754,039	3,795	262	3,826	4,670
CSO reduction						
Basins LS13, LS14, LS15, LS20, IN02	94,857,218	1,319,743	913	46	750	1,302
Street sweeping reductions		1,294,531	757	48	80	851
Wet pond reductions accounted for in above subbasin totals		422,885	145	4	197	228
TOTAL	**560,118,533**	**4,139,765**	**2,125**	**168**	**2,996**	**2,517**

Table C.6

landuse	representative SLAMM areas	pollutant loading (lb/acre/yr) total solids	phosphorus	copper	zinc	lead
LA1	WISULS09	381	0.37	0.01	0.25	0.11
LA2	WISULS20	364	0.35	0.01	0.24	0.11
LA3	WISULS12, WISUCSO1	298	0.23	0.01	0.14	0.08
LA4*	WISUCSO1	221	0.12	0.01	0.06	0.04
commercial	WISULS15, WISULS09	2168	1.67	0.13	1.48	3.55
industrial	WISULS15, WISULS17	1406	0.86	0.08	1.21	0.59
government	WISULS12, WISULS20	705	0.33	0.05	18.56	0.11
TCPU	WISULS15, WISULS04	1369	1.29	0.29	1.24	3.68
entertainment	WISULS21, WISULS08	47	0	0	0	0

landuse	"new" acres	"new" loads (lb/yr) total solids	phosphorus	copper	zinc	lead
LA1	834	317754	308.58	8.34	208.5	91.74
LA2	780	283920	273	7.8	187.2	85.8
LA3	-322	-95956	-74.06	-3.22	-45.08	-25.76
LA4*	449	99229	53.88	4.49	26.94	17.96
commercial**	545	1181560	910.15	70.85	806.6	1934.75
industrial**	470	660820	404.2	37.6	568.7	277.3
government**	25	17625	8.25	1.25	464	2.75
TCPU**	916	1254004	1181.64	265.64	1135.84	3370.88
entertainment*	236	11092	0	0	0	0
"new" TOTAL	3933	3730048	3066	393	3353	5755
BMP % reduction		39	44	36	22	46
"new" (w/BMP) TOTAL		2275329	1717	251	2615	3108
Exisitng Load (lb/yr)		4139765	2125	168	2996	2517
TOTAL		**6415094**	**3842**	**419**	**5611**	**5625**
percent increase (from exisitng)		55	81	150	87	123

*LA4 includes 1st Edition LA4 and LA5

** "lost acres" not accounted for

Table C.7

D. ENVIRONMENTALLY SENSITIVE AREAS

Numerous areas within the Superior City limits provide environmental, recreational and aesthetic benefits. Given the worthwhile benefits of Superior's environmentally sensitive areas, urban development into those areas should be discouraged so as to insure continued enjoyment and preserved value of environmentally sensitive areas. WDNR definition of environmentally sensitive areas follows:

> "Major areas unsuitable for the installation of waste treatment systems because of physical or environmental constraints are to be excluded from the service area. Areas to be considered for exclusion from the sewer service area because of the potential for adverse impacts on the quality of the waters of the state from both point and nonpoint sources of pollution include but are not limited to wetlands, shorelands, floodways and flood plains, steep slopes, highly erodible soils and other limiting soil types, groundwater recharge areas, and other such physical constraints." --NR 121.05(1)(g)2.c.

The following areas and associated "buffer" zones are to be avoided with any future sewer service area development:

- Wetlands—the SAMP provides detailed discussion of Superior area wetlands (WDNR wetland inventory basis) and the related mitigation plan. All wetlands recommended for protection by the SAMP process, including an additional 50 feet buffer zone beyond the wetlands edge shall be considered environmentally sensitive areas.
- Floodways/Floodplains—The 1977 FIA (now FEMA) Flood study denotes areas within the City of Superior determined as floodways and flood plains. All lands within the 100-year floodway elevation, plus an additional 100 feet buffer zone from the associated water's edge shall be considered environmentally sensitive areas. When a water way is intermittent or a 100-year floodway elevation has not been determined, the associated environmentally sensitive area shall include a 50 feet buffer zone from the water courses edge (or channel center if intermittent).
- Shorelands—The ordinary highwater mark of navigable waters plus an additional 250 feet buffer zone shall be considered environmentally sensitive areas.
- Steep Slopes and Highly Erodible Soils—Any slope or gradient equal to or greater than 12 percent and any soil type located on a slope equal to or greater than 12 percent shall be considered environmentally sensitive areas.
- Environmentally Limiting Areas—Locales not included with descriptions above but not considered suitable for service area growth are also to be considered.

D.1. Wetlands

Wetlands encompass a total of 7130 acres or 25 percent of Superior's total land area (**Figure D.1**, Map Pocket). According to the Superior SAMP, wetlands in the City of Superior provide function and value. The highest valued wetlands are located adjacent to surface water bodies, or shoreland wetlands. Isolated and smaller wetlands are most lowly ranked. A low ranking does not consider vegetal quality and/or structure. The functional worth of wetlands are manifold.

- Wetlands provide storage and retention for storm and flood waters as well as equalizing potential water level extremes **Figure D.2**). More than 4300 acres in the planning area provide this function - primarily located adjacent to Allouez

Bay, the St. Louis River, Pokegama Bay and River, the Nemadji River, Newton Creek, Faxon Creek, Bluff Creek, Bear Creek, Dutchman Creek, and Morrision Creek.

- Hydrologic functions such as dry season stream flow maintenance, groundwater discharge, recharge, and flow routing are provided by wetlands. Within the City of Superior, only those wetlands immediately adjacent to water bodies provide limited dry season stream flows.
- Wetlands "filter" and store pollutants that would otherwise negatively impact receiving water bodies - provided by greater than 4300 wetland acres in the City of Superior (**Figure D.2**).
- Shorelines are protected by wetlands via wave energy dissipation and sediment anchoring. Some 1130 wetland acres located in Allouez Bay, St. Louis Bay, and the lower reaches of the St. Louis and Pokegama Rivers provide shoreline protection (**Figure D.3**).
- Wetlands provide habitat for aquatic organisms - 3002 acres of wetlands in the City provide this function (**Figure D.4**).

To minimize development delays and safeguard existing planning area wetlands, development of the Superior Special Area Management Plan included a detailed wetland delineation map. Specifically, the SAMP is intended to provide: predictability for potential developers by reducing permit processing time; protection for moderate and high-value wetlands and other natural resources, while allowing for development of less valuable wetlands; and planning for mitigation of wetland loss. The SAMP recommends the following:

- preservation of unique high quality uplands such as the boreal forest;
- protection of uplands contributing surface water drainage to quality wetlands; and
- restoration and creation of additional wetlands.

The SAMP identifies fourteen compensatory mitigation sites within the Municipal Forest, providing developers (permit applications) a means for compensating for wetlands loss due to development. The concept mitigation plan protects 655 wetland acres and 1288 uplands acres while providing 208 acres of constructed wetlands. Over eight acres of mitigation are provided for each acre of development impacted so that a "no net loss goal" is achieved.

D.2. Shorelands

Surface water resources in Superior consist primarily of Lake Superior, Lake Superior Bay, Allouez Bay, the St. Louis River and its many inlets and bays, the Nemadji and Pokegama Rivers, and several other smaller continuous and intermittent streams. Shoreline miles are as follows: Lake Superior, 4.59; Superior Harbor, 12.66; St. Louis River, 41.65; St. Louis Bay, 11.60; Allouez Bay, 12.84; Nemadji River, 13.41 (both sides); and Pokegama River, 6.28.

D.3. Floodways and Floodplains

The most recent analysis of Superior area floodways and floodplains occurred as part of the June 1977 Federal Insurance Agency (FIA) Flood Insurance Study (Appendix 4). Low-lying areas of Superior are subject to flooding due to overflow of the various streams and Lake Superior. With predominating and impermeable red clay soils and subsequent high runoff potential, flooding as a result of intense rainfall is not uncommon for the Superior area waterways. Lake Superior (4.59 shoreline miles) possesses a 100-year open coast floe elevation of 604.5. Although not considered for 100-year flood elevation determination, flooding due to wave run-up influences flood elevations. Also, obstruction such as flooding ice or man-made structures can produce higher than normal water surface profiles. **Figure D.5** presents 100-yr flood boundaries for the City of Superior.

The Nemadji River originates in Minnesota and is the main waterway running through the City of Superior. The Nemadji River drains 438 squire miles to its mouth on Superior Bay. The river's course drops 11.7 feet per mile and is characterized by deeply entrenched ravines. Peak Nemadji River discharges are 6,800 cfs for a 10-year event, 11,000 cfs for a 50-year event, 13,000 cfs for a 100-year event, and 18,500 cfs for a 500-year event.

The Pokegama River has a drainage area if 29.2 square miles. Tributary to the St. Louis River, the Pokegama has and average gradient of 21.6 feet per mile and is subject to significant erosion problems. Peak discharges (CFS) associated with, 5, 50, 100 and 500 year events are 950, 1650, 2000, and 3000 cfs respectively.

Running through Central Park, Faxon Creek (unnamed tributary in FIA 1977 report) has a drainage area of 4.2 square miles (1977). With increased development in the Tower Avenue area, drainage area characteristics have been altered from 1977 analysis boundary conditions. The average gradient for Faxon Creek flows intermittently, and empties to Superior Bay just west of Barker's Island with discharges (1977) of 305 cfs for a 10-year event, 590 cfs for a 50-year event, 720 cfs for a 100-year event, and 1150 cfs for a 500-year event. Near future surface water management planning includes basin mapping and characterization for the Faxon Creek drainage area - accounting for engineered drainage systems.

Bluff and Bear Creeks are small and intermittent drainages feeding Allouez Bay of Lake Superior. Bluff Creek drains 19.6 square miles at an average gradient of 39 square miles of mostly forested and undeveloped land. Bear Creek flows with an average gradient of 29.6 feet per mile, draining 6.9 square miles of mostly forested and undeveloped land to Allouez Bay. Discharges from Bluff Creek are 1200 cfs for a 10-year event., and 1650 cfs for a 500 year event.

The 100-year event is employed to determine floodway and floodway fringe extents. The floodway is the channel of the stream, plus any adjacent floodplain areas that must be free of encroachment to allow for 100-year event flows without substantial increased in flood heights. The floodway fringe is the area between the 100-year flood boundary and the floodway, encompassing the floodplain portion that could be completely obstructed without yielding a 0.1 foot increase of 100-year flood water surface elevation. Complete data and profiles for Superior area floodways and floodplains are offered in Appendix 4 (1977 FIA Study).

D.4. Steep Slope Areas

In the City of Superior, Steep slope areas are located along the banks of waterways (**Figure D.6**, map pocket). Major steep slope areas are located:

- adjacent to Bluff, Bear, and other smaller creeks in the southeastern portion of the City;
- along the shores of the Nemadji River;
- along the shores of Faxon Creek; and
- along the shores of the Pokegama River.

Steep slope areas are also found along the inlets of the St. Louis River in the Western portion of the City, including the Billings Park Municipal Forest areas.

D.5. Highly Erodible Soils

Erodibility of soils is a function of topography, soil type, hydrology, land use, and vegetative cover. A relatively high rate of erosion is to be expected in the geologically young, highly erodible red clay deposit around western Lake Superior. Within the City of Superior, limited relief, vegetative cover, and wetland presence serve to limit soil erosion. Areas within the City susceptible to high erosion rates can be localized to those area with steep slope (see previous discussion, D.3.d) and also those open areas with limited vegetation cover **Figure D.6**, map pocket. As discussed previously in section C.2, rainfall runoff average TS concentrations in the recreation area of 550 mg/l were more than twice the average TS concentrations of 205 and 203 mg/l for the golf course and undeveloped area respectively. This difference is partially explained by the differences in vegetative cover - the recreation area is not covered with vegetation like the golf course or the undeveloped areas.

D.6. Environmentally Limiting Areas

A number of other environmentally limiting areas have been identified. These areas and sources include locations with particularly elevated levels of sediment contaminants, upstream drainage areas of waterways running through or adjacent to the City of Superior, and upwind sources of atmospheric deposition.

A variety of polynuclear aromatic hydrocarbons (PAHs) and/or heavy metals have been detected in the following Superior areas:

- Newton Creek and Hog Island inlet of Superior Bay; and
- Crawford Creek wetland/ Koppers Co. vicinity.

Stack air emissions in the proximity of Superior constitute potential pollution sources subject to atmospheric deposition. Emission sources include, but are not limited to, wood stoves, automobiles, municipalities, and industries. Current atmospheric monitoring efforts focus on sulfur, particulates VOX, NOX, and CO_2 rather than or persistent, bioaccumulative toxic substances. However, no deposition monitoring or data exists for the City of Superior.

The Nemadji River upstream of the City of Superior contributes sediment loadings which dramatically overshadow urban nonpoint source loadings attributed to the City of Superior. Approximately 2.3×10^5 metric tons/yr of sediment is deposited by Nemadji River drainage. Following large storm events, the Nemadji's sediment plume extends as much as 15 miles from its mouth.

1 Cobble/gravel
2 Sand
3 Mud
4 Organic
5 Vegetated pioneer

W Open water
ø Subclass unknown
1 Cobble/gravel
2 Sand
3 Mud
4 Organic

Hydrologic modifier

L Standing water, Lake
R Flowing water, River
H Standing water, Palustrine
K Wet soil, Palustrine

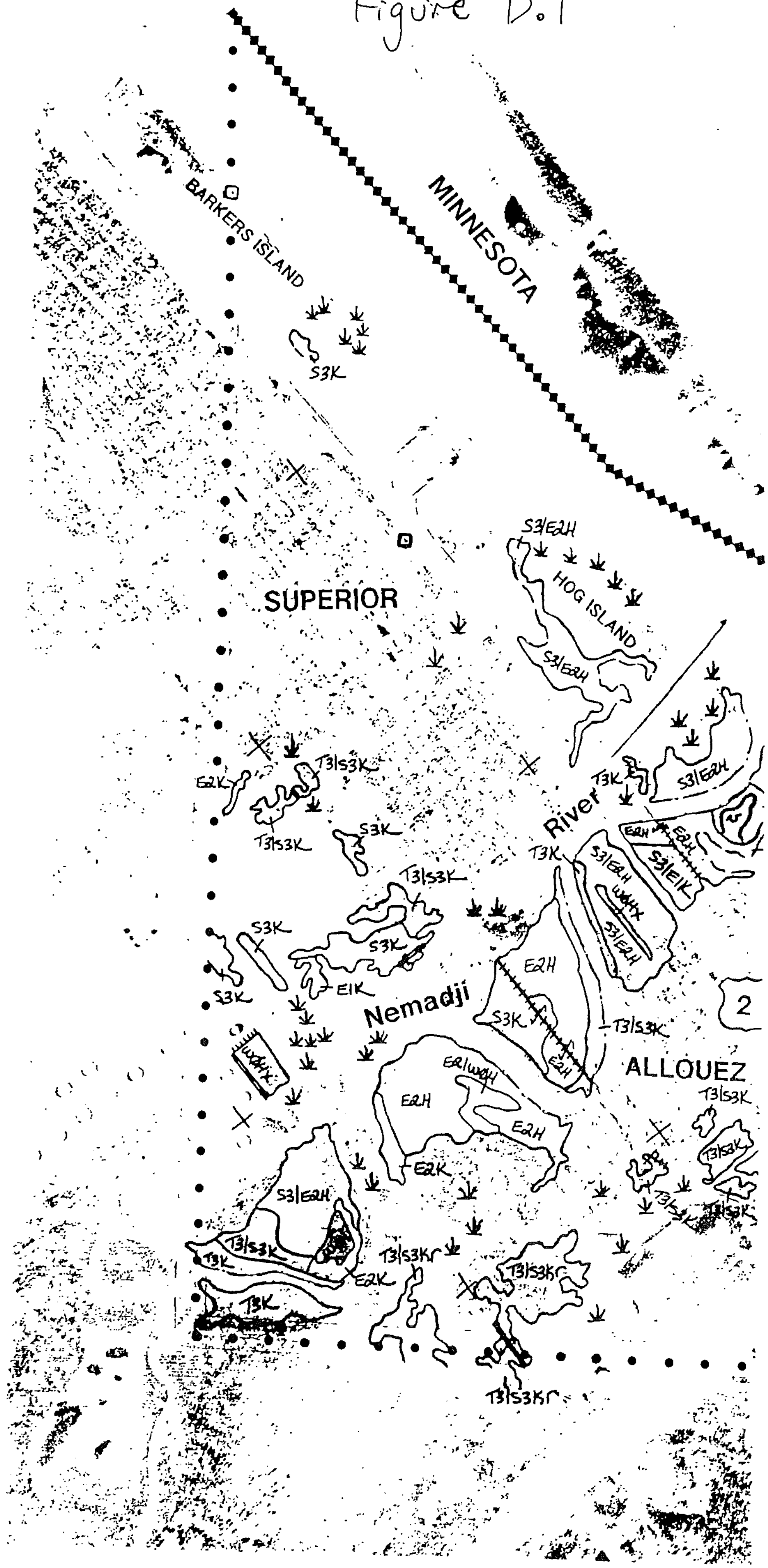
Special modifiers

a Abandoned cropland
c Man-made cranberry bog
e Exposed flats complex
f Farmed in dry years
g Grazed
j Central sands complex
m Floating vegetated mats
s Ridge and swale complex
v Vegetation recently removed
w Floodplain complex
x Excavated
r Red clay complex

Map symbols

Upland surrounded by wetland
Wetland — upland boundary
Wetland — deep water lake
Level ditch
Stream or drainage ditch
Road
Railroad
Dike, levee, abandoned railroa
Same classification on both sides of linear feature
Wetland smaller than 2 acres
Dammed pond smaller than 2 acres
Excavated pond smaller than 2 acres
Man-made dam
Spring within a wetland
Beaver dam
Municipal boundaries
County boundary
Township boundary
Area no longer wetland; field verified

Figure D.1



Northwest Regional Planning Commission

SUPERIOR AREA MANAGEMENT PLAN

WETLANDS PROVIDING WATER QUALITY/ WILDLIFE HABITAT

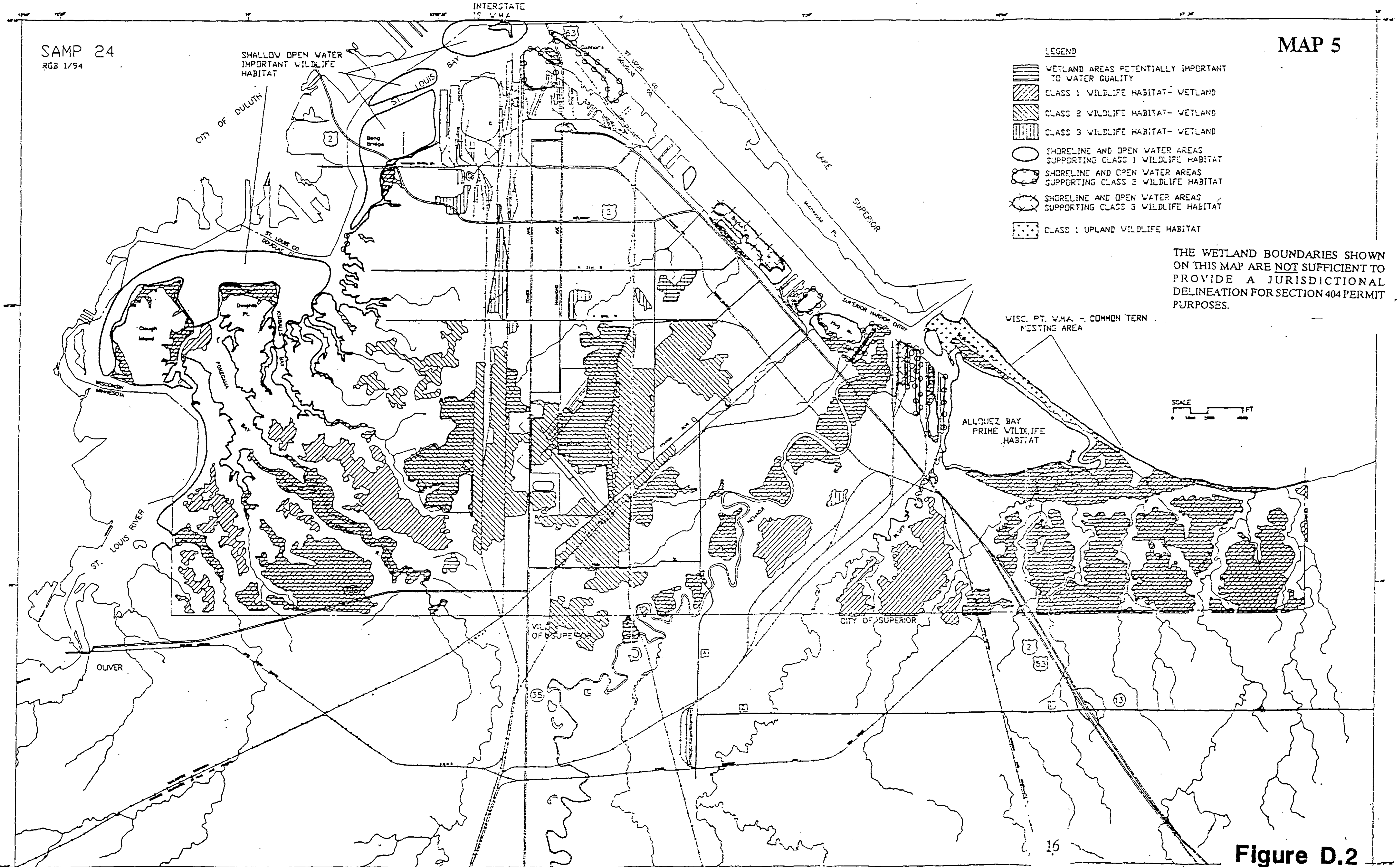


Figure D.2

SUPERIOR AREA MANAGEMENT PLAN

Northwest Regional Planning Commission

WETLANDS PROVIDING SHORELINE PROTECTION

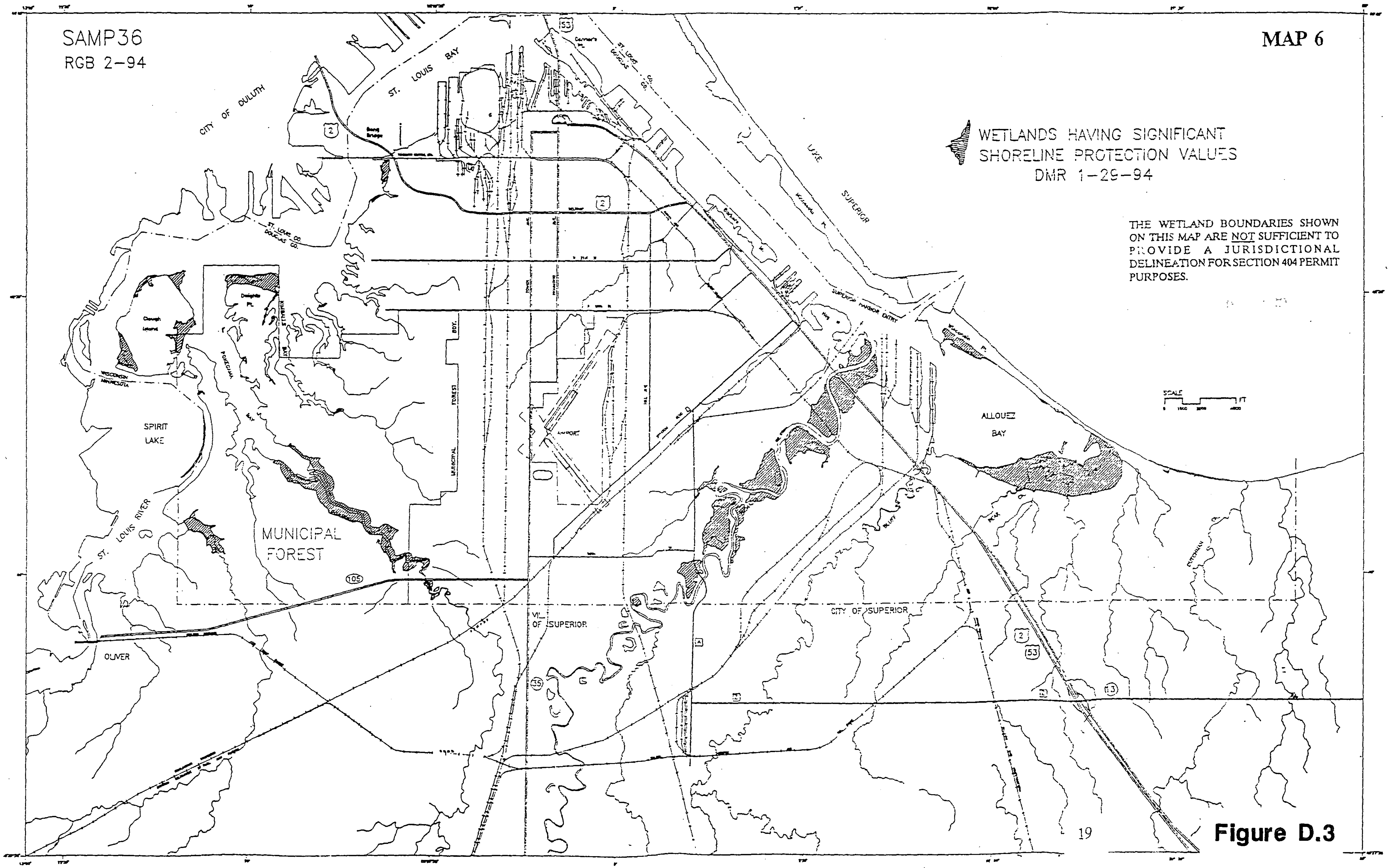


Figure D.3

Northwest Regional Planning Commission

SUPERIOR AREA MANAGEMENT PLAN

WETLANDS PROVIDING SIGNIFIGANT FISHERIES AND OTHER AQUATIC LIFE HABITAT

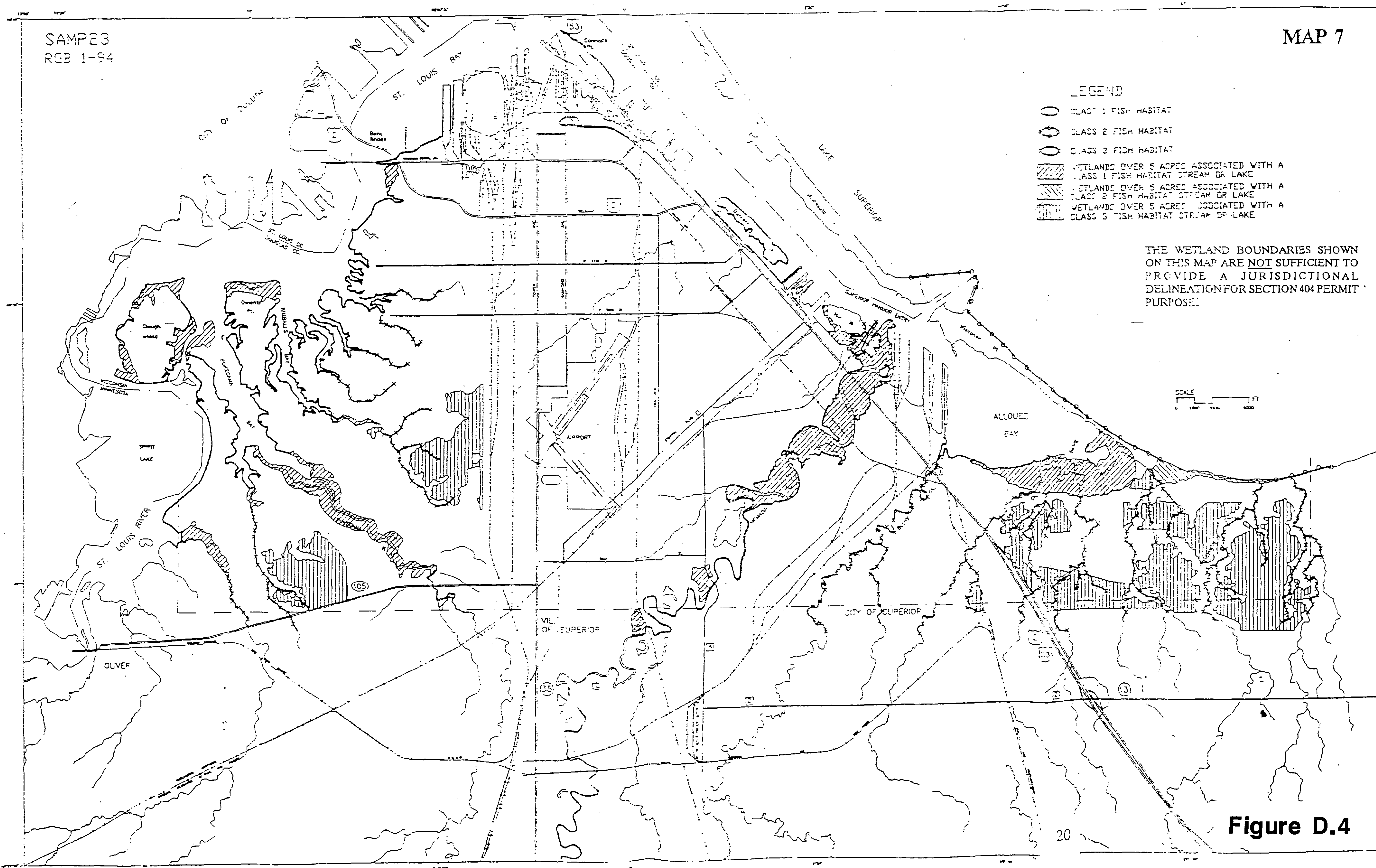


Figure D.4

Northwest REGIONAL Planning COMMISSION

SUPERIOR AREA MANAGEMENT PLAN

FLOODPLAINS

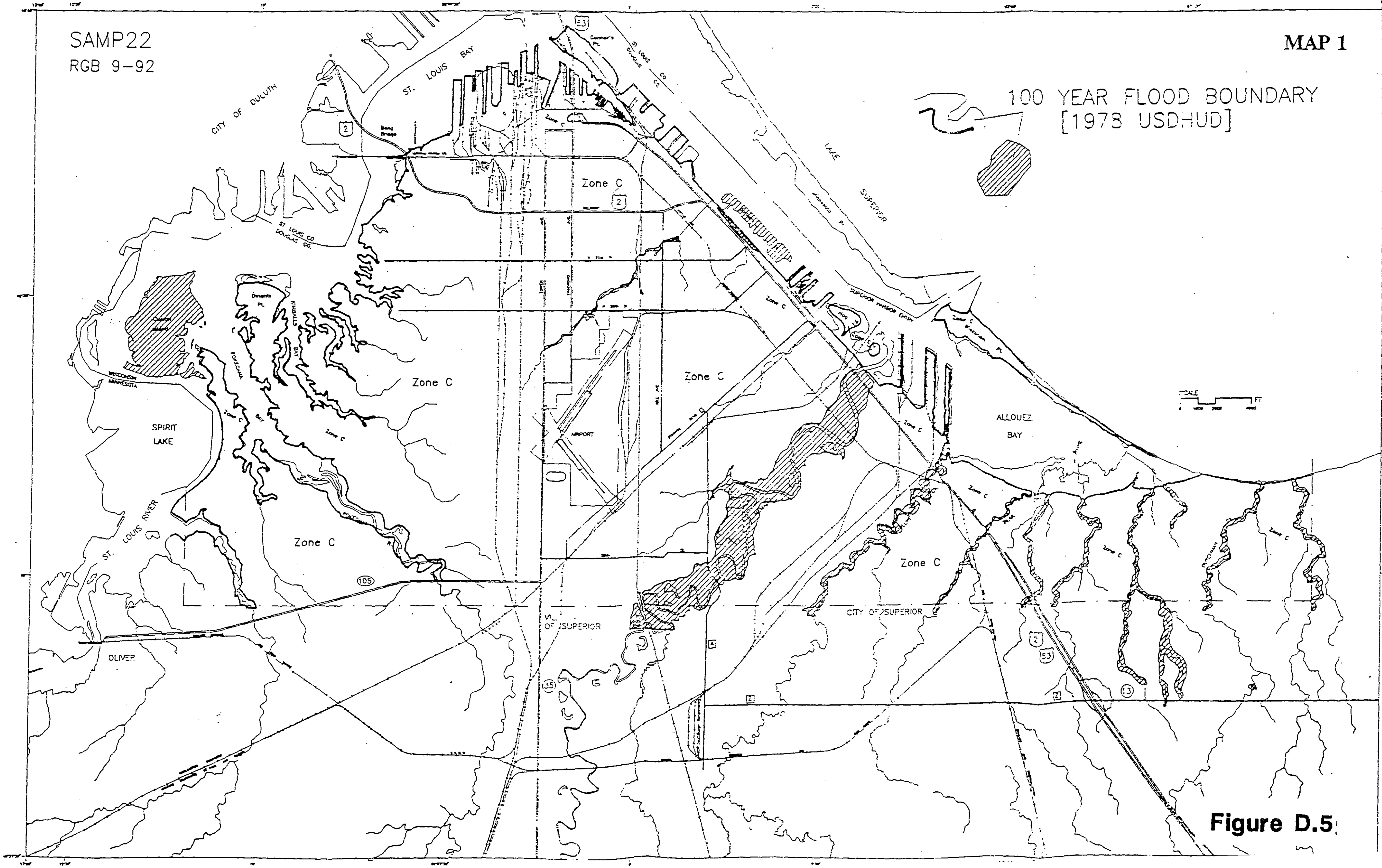
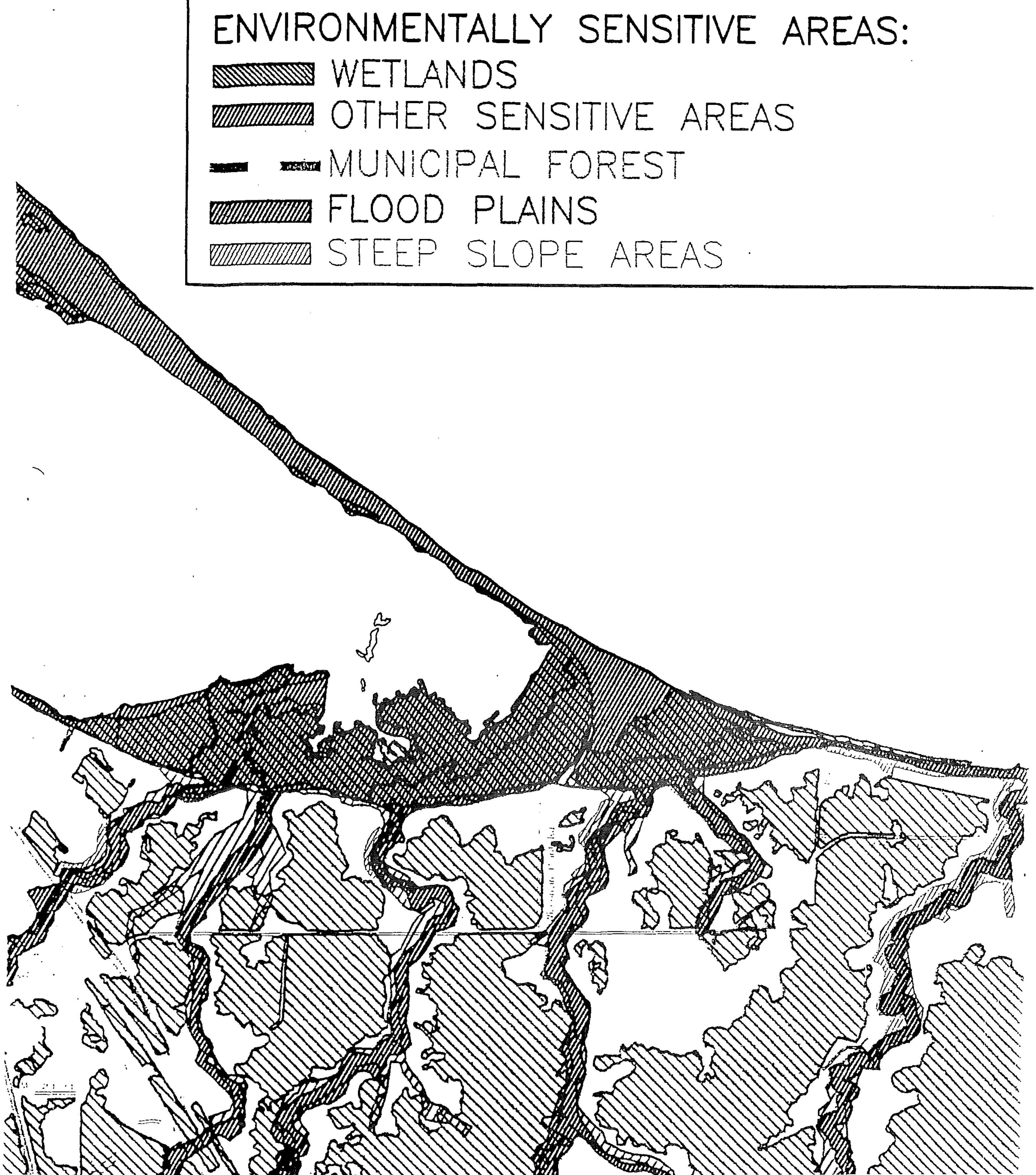


Figure D.5

Figure D-6


ENVIRONMENTALLY SENSITIVE AREAS:
WETLANDS
OTHER SENSITIVE AREAS
MUNICIPAL FOREST
FLOOD PLAINS
STEEP SLOPE AREAS

E. WATER QUALITY STANDARDS

E.1. Wastewater

Wastewater related discharges within the City's limits are regulated by the WDNR's WPDES (Wisconsin Pollutant Discharge Elimination System) permits. The City's existing WPDES Permit is effective January 1, 1994 and expires on December 31, 1998. A summary of the existing Permit requirements are outlined in **Table E.1.** Appendix 5 contains a complete copy of the existing Permit and outlines additional requirements for monitoring, reporting, and sludge management. The four treatment plants discharge to the following receiving waters:

- Main WWTP - Superior Bay of Lake Superior (classified as a "Great Lakes Communities" water under NR 102, and is also a public water supply).
- CSO 2 - Boat slip tributary to Superior Bay.
- CSO 5 - Nemadji River (fish and aquatic life water).
- CSO 6 - St. Louis Bay (fish and aquatic life, "Great Lakes Communities").

The water quality uses, standards, and dilution factors during wet weather are being addressed during the discussions on the proposed Permit. Flow rates in the receiving waters are relatively high when precipitation has been great enough to cause the need for discharge of treated effluent from the CSO treatment facilities (or greater flow from the Main WWTP).

The area waters are also addressed by the Bi-National agreement relating to the Great Lakes Basin. The St. Louis River Area of Concern was one of 43 areas identified as having impaired beneficial uses of the water resources due to pollution. The Minnesota Pollution Control Agency (MPCA) and Wisconsin DNR have an on-going study to identify the problems and solutions. "The St. Louis River System Remedial Action Plan, Stage One", April, 1992 outlines the process as follows.

Table E.1
Existing WPDES Permit Requirements Summary
WPDES Permit No. WI-0025593-5

Effluent Parameter	Effluent Limit			
Outfall No. Location (Outfall No.)	030 ....Main Plant (001)	031 CSO 2 (002)	032 CSO 5 (003)	033 CSO 6 (004)
BOD_5 (monthly avg., mg/l)	30	30	30	30
BOD_5 (weekly avg., mg/l)	45	45	45	45
Suspended Solids (monthly avg., mg/l)	30	60	30	30
Suspended Solids (weekly avg., mg/l)	45	60	45	45
pH (min-max, s.u.)	6-9	6-9	6-9	6-9
Phosphorus (monthly avg., mg/l)	1.0	1.0	1.0	1.0
Residual Chlorine (daily max., mg/l)	37	37	37	37
Fecal Coliforms (monthly avg., #/100 ml)	400	400	400	400
Zinc (weekly avg, ug/L)	-	66.8	-	-
Pentachlorophenol (weekly avg. mg/l)	-	8.23	-	-
274 – Dichlorophenol (weekly avg. mg/l	-	0.30	-	-
Bergllium (monthly avg., mg/l	0.22	0.014	-	-
Chloroform (monthly avg., mg/l)	0.12	0.0009	-	-
Benzo (ghi) perlene (monthly avg., mg/l)	0.058	0.0009	-	-
Benzo (a) pyrene (monthly avg., mg/l	-	0.0009	-	-
Phenanthrene (monthly avg., mg/l)	0.037	0.010	-	-
Total PAH Compounds (monthly avg., mg/l)	0.095	0.011	-	-
YEARLY MASS LIMITS, LBS				
BOD_5	456,615	-	-	-
Suspended Solids	356,615	-	-	-
Phosphorus	15,230	-	-	-
Residual Chlorine	560	-	-	-
Beryllium	3.35	-	-	-
Chloroform	1.83	-	-	-
Benzo (ghi) perylene	0.883	-	-	-
Phenanthrene	0.563	-	-	-
Total PAH Compounds	1.45	-	-	-

Table E.1 (continued)
Existing WPDES Permit Requirements Summary
WPDES Permit No. WI-0025593-5

ADDITIONAL MONITORING REQUIREMENTS				
Benzo (2) anthraeene	✓	✓	-	-
3, 4 – Benzoflnoranthene	✓	✓	-	-
Benzo (k) fluoranthene	✓	✓	-	-
Chrysene	✓	✓	-	-
Dibenzo (a,h) anthacene	✓	✓	-	-
Pyrene	✓	✓	-	-
Indeno (1,2,3-cd) pyrene	✓	✓	-	-
Total Cadmium	✓	-	-	-
Total Chromium	✓	-	-	-
Total Copper	✓	-	-	-
Total Lead	✓	-	-	-
Total Nickel	✓	-	-	-
Total Zinc	✓	-	-	-
Total Cyanide	✓	-	-	-
Total Mercury	✓	-	-	-
Ammonia-nitrogen	✓	✓	✓	✓
Handness	✓	✓	-	-
Design Flow for mass limits				
	5.0			
(M		-	-	-

"St. Louis River Remedial Action Plan

The Remedial Action Plan (RAP) process is a result of the International Joint Commission's (IJC) efforts to halt the degradation of water quality in the Great Lakes. The 1972 Great Lakes Water Quality Agreement between the United States and Canada initially focused on controlling phosphorus inputs to the lakes. The 1978 Agreement expanded the issues of concern to include the effects of toxic substances on the Great Lakes water quality. After the signing of the 1978 agreement, the IFC identified 43 areas in the Great Lakes Basin as having impaired beneficial uses of the water resources due to pollution. The St. Louis River is one of these designated areas.

The St. Louis River Area of Concern is defined as the portion of the St. Louis River from Cloquet, Minnesota down to Lake Superior, including St. Louis Bay and the nearshore waters of the lake. The RAP also looks at sources of problems from throughout the St. Louis and Nemadji River Watersheds. The estuarine portion of the lower St. Louis River exhibits reduced flow velocities in comparison with the free-flowing upstream areas. These flow conditions have encouraged settling of suspended solids, which include numerous pollutants. As a result, a significant accumulation of sediment and pollutants has developed in the lower river and harbor. The greatest water quality concern at present is the elevated levels of heavy metals and synthetic organic chemicals found in both the sediment and fish in the Area of Concern.

The RAP process involves the following three stages:

Stage I:	*Identifying the problems and their sources*
Stage II:	*Recommending actions to remediate the problems*
Stage III:	*Implementing the recommendations*

Stage I of the process is complete and work has begun on Stage II. Staff from the Minnesota Pollution Control Agency and the Wisconsin Department of Natural Resources are working together to define the problems, gather data, and determine the actions necessary to improve the environmental health of the St. Louis River and Estuary. They are assisted in these efforts by over 150 local volunteers who have been active in the development of the Remedial Action Plan through their participation in committees.

A copy of the document is available from the Minnesota Pollution Control Agency (218) 723-4663 or the Wisconsin Department of Natural Resources (715) 635-2101."

For collection and treatment systems subject to substantial I/I (as in the "separated" and combined sewer areas in Superior), the selection of the design rain is a very significant item. Various rainfall intensities, duration, directions of travel, time since last rain, etc. produce substantially different flow rates and volumes. In general, the DNR requires no system bypasses for the 5 year rainfall. However, for recent collection system storage improvements (Contract 3), a 7-yr rain was required by WDNR for design. Information from the U.S. Weather Bureau Technical Paper NO. 40 (1961), Rainfall Frequency Atlas for the United States (by D.M. Hershfield) includes the following data for the five-year rainfall events at Superior:

Table E.2

5-year Rainfall Durations and Associated Amounts

Rainfall Duration hours	5-Year Rainfall Event inches
0.5	1.25
1.0	1.55
3.0	2.05
6.0	2.40
12.0	2.77
24.0	3.25

E.2. Stormwater WDNR is finalizing a stormwater management permit addressing water quality standards for Superior stormwater issues. Appendix 6 contains the City's Draft Stormwater Management Plan.

- Information and Education Program relating to public awareness of stormwater issues and BMPs. These efforts to commence in 1997 and continue through the SWMP duration.
- Basin Mapping and Characterization of the following City area; Howard Bay (1996); Newton Creek (1996) Faxon Creek (1997); South Superior (1998); Allouez-Itasca (1998); Billings Park (1998); and all other areas (1998).
- Industrial Inventory and Characterization with emphasis on collection of relevant information (surface drainage maps, storm sewers, industry category, 2nd site specific management plans).
- BMP Inventory, Development, and Optimization will follow the same schedule as proposed for basin mapping and characterization. Investigating the need and effectiveness for BMPs will be completed by 1999.
- Monitoring and Data Collection of stormwater flows will be completed where appropriate and when necessary. Monitoring will be conducted as part of Snow Disposal BMP project. All additional WWF & DWF monitoring efforts will follow WDNR consultation.
- Fiscal Analysis of available funding sources will be conducted and will consider city enterprise funds, government agency grants, utility formation, user fees, and stormwater - related activity fees.

Depending upon conclusions and results of short-term efforts, long term efforts will commence in 2001 and include:

- appropriate capital improvements for stormwater quality and quantity management;
- continued information and education efforts;
- BMP development and implementation; and
- necessary monitoring and data collection.

Appendix 7 contains WDNRs draft Stormwater Management Permit. Key elements of the permit include:

- applicability of authorized discharges relating to the permitted area; other municipality owned stormsewers within permit area; responsibilities; authorized discharges; water quality standards; discharge limitations; and compliance with water quality standards and discharge limitations.
- Required legal authority with respect to pollutant contributions from industrial activity; illicit discharges to the storm sewer system; non-stormwater contributions to stormsewer system; in the municipal agreements; compliance of ordinances, permits, contracts, etc; and system-wide inspection, surveillance and monitoring.
- Stormwater Management Programming, including: limiting pollutant discharges to the maximum extent practicable; consistency; cooperation; municipal area expansion;

resources; source area and BMP controls; illicit discharges; industrial high risk run-off; geographic priorities; and revisions.

- Monitoring requirements, including: characterization data of representative outfalls; program assignment; sampling procedures; alternative data sources; sampling exemptions; a proposed monitoring program.
- Stormwater Pollutant Loading calculations, including: stormwater discharges; pollutant data sources; and procedures.
- Assessment of Controls, including as annual review of their stormwater management program – including structural and non-structural practices.
- Publication of Annual report detailing the status and past year's tasks of the stormwater management plan, and submission to appropriate WDNR offices.

E.3. Total Maximum Daily Loads

Total Maximum Daily Loads (TMDLs) are set by regulators to allocate the maximum amount of pollutant that may be introduced into a water body while still attaining and maintaining water quality standards. At present, TMDLs have not been allocated for the Lake Superior Drainage Basin. Preliminary discussions addressing TMDLs have occurred at the regulatory level.

E.4. Waste Load Allocations

Waste Load Allocations (WLAs) are those portions of a receiving water's TMDL that are allocated to one of its existing or future pollution sources. WLAs constitute a type of water-quality-based effluent limitation. Industries and the City of Superior have not been allocated WLAs for their wastewater treatment facilities or nonpoint sources since there are currently no TMDLs established for the Lake Superior Basin.

F. WASTEWATER TREATMENT AND COLLECTION SYSTEMS

F.1.a Municipal Treatment Systems—Existing Systems

The City of Superior currently operates four wastewater treatment facilities. The Superior Main Wastewater Treatment Plant is located at the foot of E Street on Superior Bay. Originally built in 1956, an activated sludge process treats a design flow of 5 MGD, discharging to a point approximately 150 feet from CSO 2's northeast corner. Adjacent to the Main WWTP and located or Superior Bay, the 50 MG CSO 2 pond treats a daily maximum flow of 75 MG via settling, biological treatment, and disinfection - ultimately discharging to the base of the slip at the foot of B Street. South Superior is served by CSO 5. Located at 61st Street and Birch Avenue, CSO 5 provides 6 million gallons of storage during wet weather flows and a subsequent 7.5 MGD physical/chemical treatment for flows which cannot be drained back into the system feeding the Main WWTP. CSO 5 discharges and overflows to the Nemadji River via an outfall through a drainage swale. CSO 6 operation, treatment scheme and capacity are similar to those provided by CSO 5.

Located at Texas Avenue and 17th Street, CSO 6 stores 12 million gallons during wet weather events and discharges/overflows to St. Louis Bay. Also, current construction efforts to provide storage of sanitary sewer overflows will centralize discharges associated with 7-year design storms. LS 7 storage is located north of E. 2nd Street and south of Bluff Creek and provides 0.9 MG of SSO storage. LS 5 storage stores 0.6 MG of SSOs and is located northeast of Newton Creek. Overflows from storage at LSs 5 and 7 discharge to Newton and Bluff Creeks respectively. **Figure F.1** presents the wastewater collection and treatment system.

The Main WWTP was originally constructed as a primary treatment plant in 1956-58. In 1975, the plant was upgraded to secondary treatment and included phosphorus removal. Subsequent modifications included dechlorination in 1989, the belt press for digested sludge dewatering in 1993, preliminary treatment improvements in 1995, and aeration tank improvements (fine bubble diffusers) in 1997. The Main WWTP process schematic is shown on **Figure F.2.**, and design criteria (Bonestroo, 1975) is summarized in **Table F.1.**

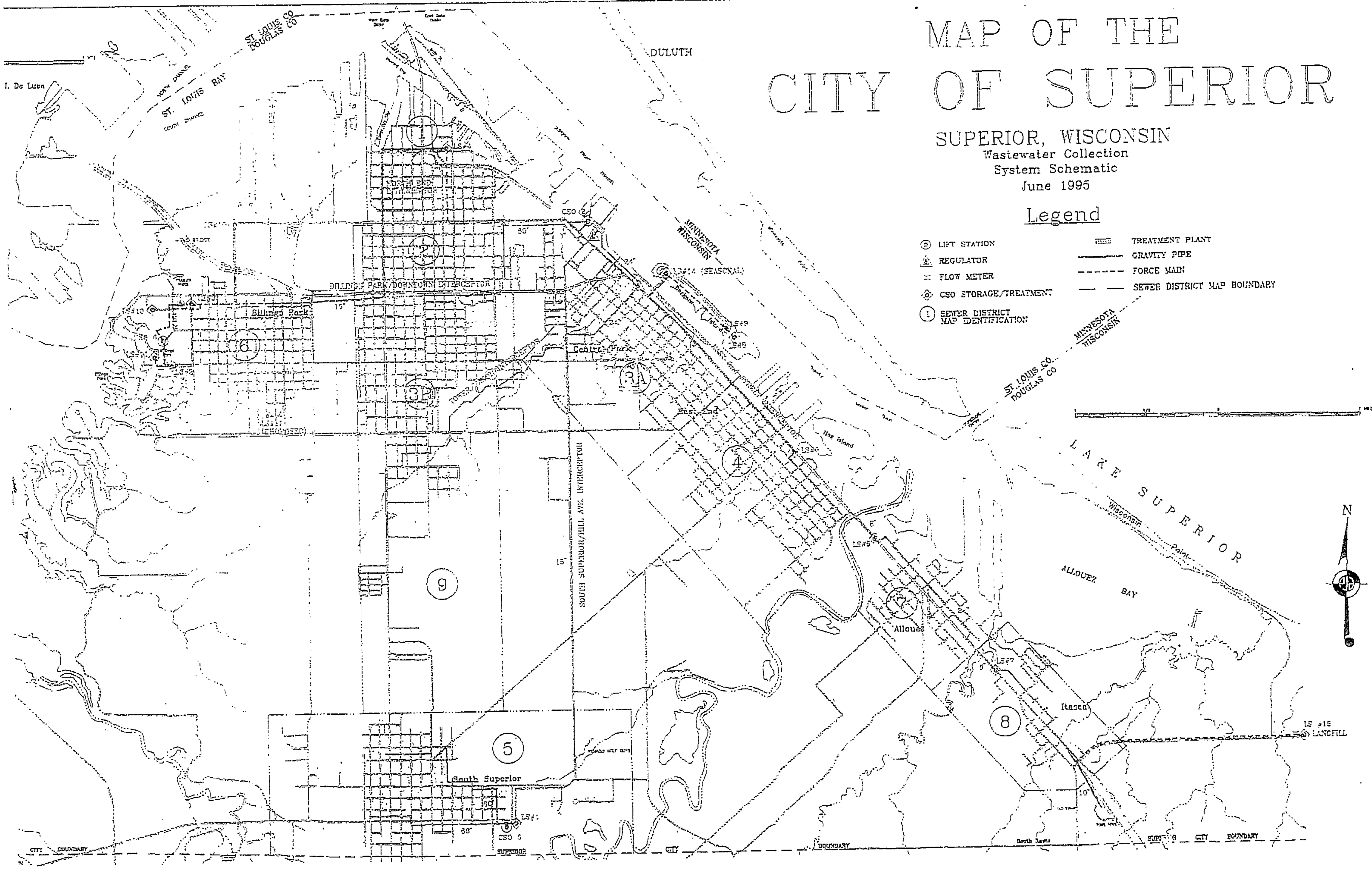

MAP OF THE
CITY OF SUPERIOR
SUPERIOR, WISCONSIN
Wastewater Collection
System Schematic
June 1995
Legend
LIFT STATION
REGULATOR
FLOW METER
CSO STORAGE/TREATMENT
SEWER DISTRICT MAP IDENTIFICATION
TREATMENT PLANT
GRAVITY PIPE
FORCE MAIN
SEWER DISTRICT MAP BOUNDARY
DULUTH
MINNESOTA
WISCONSIN
ST. LOUIS CO.
DOUGLAS CO
ST. LOUIS BAY
LAKE SUPERIOR
ALLOUEZ BAY
Wisconsin Point
N
I. De Luca
Billings Park
Central Park
South Superior
Allouez
Itasca
BILLINGS PARK/DOWNTOWN INTERCEPTOR
SOUTH SUPERIOR/HILL AVE. INTERCEPTOR
LS#14 (SEASONAL)
LS #15 LANDFILL
CSO 5
1
2
3A
3B
4
5
6
7
8
9
CITY BOUNDARY

Figure F.1

City of Superior Wastewater Treatement Plant
1993 Facility Plan

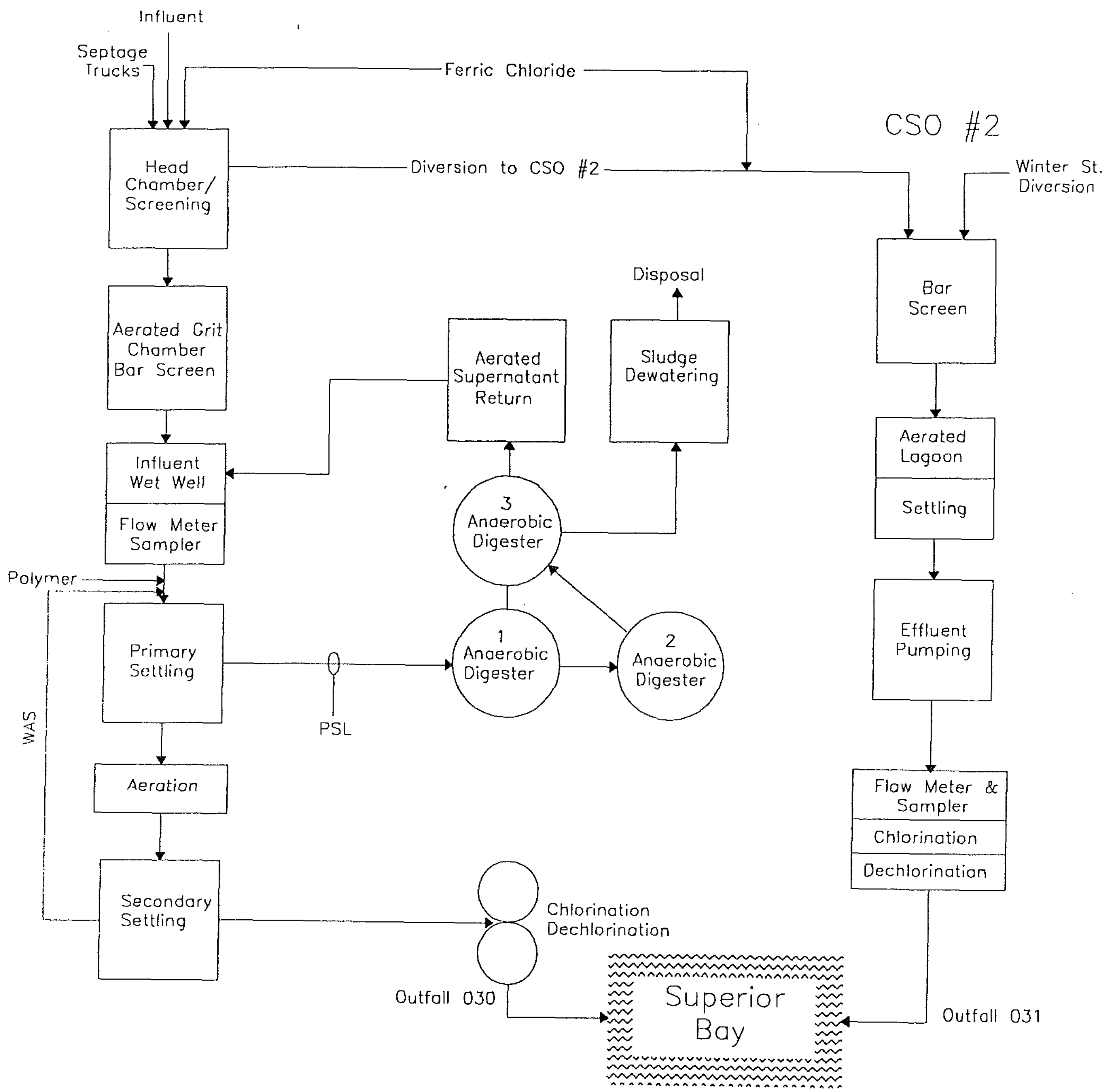


Figure F.2

Table F.1
Main WWTP
Design Criteria for 1975 Upgrade (Bonestroo)

Influent Characteristics	Design Value
Flow (average MGD)	5.0
Flow (peak MGD)	15.0
BOD_5 (average lbs/day)	7,500
BOD_5 (average mg/l)	180
SS (average lbs/day)	8,500
SS (average mg/l)	200
Phosphorus (mg/l)	10
Population Equivalent (P.E.)	44,000
Effluent Concentrations	**Design Value**
BOD_5 (mg/l)	20
SS (mg/l)	20
Fecal Coliform (No./100ml)	200
Phosphorus (mg/l)	1

Main WWTP Process Components follow:

- **Head Chamber (Overflow Bypass Structure)** – Receives flow from the two interceptors and haulers. Sluice gate, $FeCl_3$ addition for phosphorus removal , screening (Rotomat ®), and piping to Aerated Grit Basin. Excess flow is diverted through a coarse bar rack to the CSO 2 pond. This excess flow diversion occurs frequently when flow to the Main WWTP is excessive (presently greater than 5 MGD, historically up to 7.5 MGD, when solids carryover occurs in the Final Sedimentation Tanks).
- **Aerated Grit Basin** - Aeration and removal of settled grit by pumps, cyclone separator and classifier.
- **Bar Screen** - Mechanical bar rack for removal of rags. Antiquated and very poor for O&M.
- **Raw Sewage Pumping Station** - Wet Well and 4 variable speed pumps to lift wastewater to the Primary Sedimentation Basins. Includes Venturi flow measurement. Wet well also receives digester supernatant and belt press drainings.
- **Primary Sedimentation Tanks** - Settling of coarse solids. Receives WAS from Final Sedimentation Tanks. Settled sludge pumped to Anaerobic Digesters.
- **Aeration Tanks** - Aerated tanks containing suspended biological growth (floc) for reduction of organics. Polymer addition to Chemical Mixing Chamber at end of Aeration Tanks.
- **Final Sedimentation Tanks** - Settling of biological floc (converted in 1975 from original primary settling tanks constructed in 1956), return sludge (RAS) pumped to Aeration Tanks, waste sludge (WAS) pumped to Primary Sedimentation Tanks.
- **Sludge Thickener** - Unused tank adjacent to the Aeration Tanks; can be used to thicken WAS prior to being pumped to Anaerobic Digester.
- **Chlorine Contact Tanks** - Chlorination detention tanks to allow time to kill bacteria.
- **Dechlorination** - Quick mix to allow Sulfur Dioxide to reduce chlorine residual.

- **Effluent Pipe** - Sixty inch pipe to Superior Bay to the Northeast (under the CSO 2 Pond dike).
- **Anaerobic Digesters** - Heated tanks (95°F) to allow bacteria to reduce volatile solids and produce digester gas (about 60% methane). Digester gas to boilers and excess to waste gas burner. Supernatant to Supernatant Aeration Basin and then to Wet Well. Settled digested sludge to Belt Press.
- **Belt Press** - Dewatering of digested sludge, increasing solids from 3% to 20%. Drain to Supernatant Aeration Basin. Sludge cake to hopper and trucked to off site disposal.
- **Elutriation Tank** - Unused tank; formerly for conditioning solids prior to vacuum filters which have been removed.

The CSO treatment plants store/treat excessive combined sewage resulting from precipitation or snow melt. Available information on the design bases for the existing CSO treatment facilities is shown in **Table F.2.**

The CSO 2 treatment facilities were constructed in 1975 to treat excessive wet weather flows mainly from District 2 via the sewer regulator on Winter Street. As described above, it also receives flow (unmetered and directly to the aerated pond) from the Main WWTP Head Chamber when the influent flow to the Main WWTP is excessive. The basic unit processes and sequence of operation are as follows:

- **Chemical Addition** - $FeCl_3$ addition to influent pipe.
- **Influent Meter** - Hybrid meter (depth and velocity in elliptical pipe (72" x 113")) for influent flow measurement. System flooded out soon after start-up and has not been operable. Design flow basis was 230 MGD influent.
- **Mechanical Screens** - Removal of rags.
- **Aerated Pond** - Fifty MG pond for normal operating depth with Floculation Zone, Aeration Zone and Settling Zone. Tapered aeration through system via tube aerators (system repaired in 1992). Design Operating level 602' to 607' elevation for 16.8 MG design storage requirements. Normally operate at about 601' level now. Overflow for 100 year storm via depression (elevation 606.5) in pond dike.
- **Blowers** - 3, 75 HP, 903 CFM blowers for pond aeration.
- **Effluent Pumps** - 3, 100 HP, 25 MGD pumps.
- **Effluent Meter** - Parshall Flume.
- **Chlorine Contact Tank** - Chlorination detention tank. Provided with traveling bridge sludge collector which has been inoperable since freezing problems the first year after start-up. Settled solids (minimal accumulation) are pumped to the Aerated Grit Basin at the Main WWTP.
- **Dechlorination** - Quick mix with SO_2 at end of the Chlorine Contact Tank for removal of residual chlorine.
- **Effluent Pipe** - Seventy-two inch pipe to the slip to the Northwest.

The CSO 5 Treatment Facility (**Figure F.3**) was also constructed in 1975. It receives excess flow (flow in excess of LS 1 or Hill Avenue Interceptor capacity) from the South Superior service area (District 5). Information available on the design aspects indicates it was to serve 260 combined sewer acres and contain/treat the 10 year storm event. Total sewered area is about 500 acres. The basic facilities at CSO 5 are as follows:

- **Regulating Chamber** - 60" influent pipe, 18" dry weather outlet (DWO) pipe to LS 1, overflow weir and 60" outlet pipe (SWO) to the Holding Pond.
- **Holding Pond** - Six MG, bituminous lined, 12' maximum depth, open pond. Operating depth is 11 feet.
- **Inlet Structure** - This structure has three components:
- **Submersible pump** (one 200 gpm) to empty the pond contents to the wet well at the CSO Treatment Plant. (Field measurement of pump capacity was 300 gpm.)
- **Screw pumps** (two 3.25 MGD) to lift pond contents to the CSO Treatment Plant
- **Overflow weir** (elevation 653) to allow extreme flows to discharge after pond

Table F.2
CSO's 2, 5, & 6
Design Information* for 1975 Facilities

	CSO 2	CSO 5	CSO 6
Design Rain Frequency			
Hydraulic (Years)	10	10	10
Biological (Years)	2		
Tributary Area of Combined Sewers (acres)	700	260**	433
Runoff Coefficient (decimal percentage)	0.6	0.4	0.4
Influent Characteristics			
Flow (Peak MGD)	230		
Flow (MG/year)			
BOD_5 (mg/l)	45	45	45
SS (mg/l)	200	100	100
Phosphorus (mg/l)	3.0	3.0	3.0
Pond Volume (MG)	50	6	12
Flow Through Treatment Capability (MGD)	90	6.5	6.5
Effluent Concentrations			
BOD_5 (mg/l)	20	23	23
SS (mg/l)	20	30	30
Phosphorus (mg/l)	1.2	1.2	1.2
Volume Treated (DAF for CSO 5 & 6) (MG/year)	352	161	161
(Times/year)	50	55	55
(Hours/year)	249	360	590
Overflow (Hours/year)		325	325

* Information gathered from various City and Bonestroo documents, 1970's.
** Remaining combined acres (of 460 total) after "partial separation"

DISTRICT 5 C.S.O. TREATMENT PLANT SITE

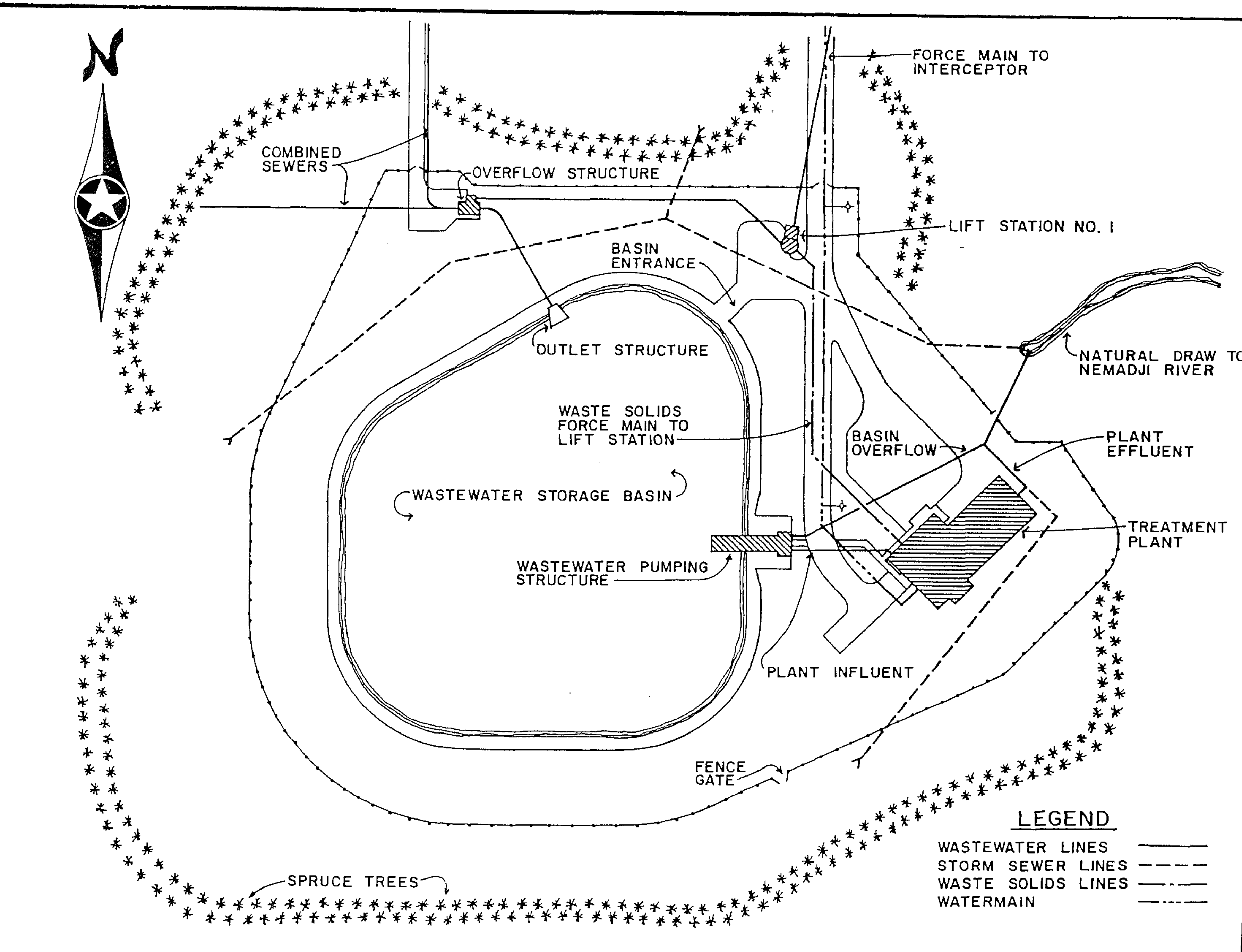


Figure F.3

settling to the receiving waters.

- **CSO Treatment Plant** - This building contains the following unit processes, designed to treat 6.5 MGD: mechanical screen - removal of coarse solids; parshall flume - flow metering; drum screen - removal of fine solids; $FeCl_3$ and polymer addition; flocculating tank; DAF (Dissolved Air Flotation); chlorinator (later removed when disinfection was removed from the Permit requirements); wet well - with three (100, 100, and 400 gpm) pumps to return solids (or pond contents via the submersible pump) to the forcemain downstream from LS 1 and thus to the Main WWTP. (Field measurement of Pump # 2 capacity was 650 gpm.); and monitoring, control, and telemetry system.

The CSO 6 treatment facility (**Figure F.4**) receives excess wet weather flow from the Billings Park area (District 6). Flows in excess of LS 3 capacity (2 pumps each 1.7 MGD) overflows to the CSO 6 pond via a 84" pipe. The pond also receives excess flow from LS 2 via a 30" pipe. The CSO 6 treatment system is identical to the CSO 5 system except the pond is 12 MG. The design was intended to store/treat the 5 year storm from a 433 acre combined sewer service area. Total sewer service area is about 600 acres. Return flows (pond contents or DAF sludge) are returned to LS 3 discharge forcemain via a 2400 foot long 6" forcemain.

Sludge treatment consists of anaerobic digestion, dewatering and co-disposal at the municipal landfill. Processing equipment for the original primary plant (constructed in 1956) consisted of two digestion tanks, one elutriation tank, and two vacuum filters. In 1975, the plant was upgraded to a secondary treatment facility with the addition of an activated sludge process. Sludge process additions included a gas holding digester, gravity thickener and an aerated supernatant basin for digester recycle. The latest addition to the sludge process stream is a belt filter press which was constructed in the spring of 1993.
Primary sludge is pumped directly to the primary digesters. Waste activated sludge is returned to the primary settling tank and is co-settled with the primary sludge. The waste activated sludge can also be thickened in the thickener and then pumped to the digesters. Sludge from CS0 Nos. 5 and 6 DAF treatment, which is a very minor load, is returned to the main wastewater treatment plant via the collection system.

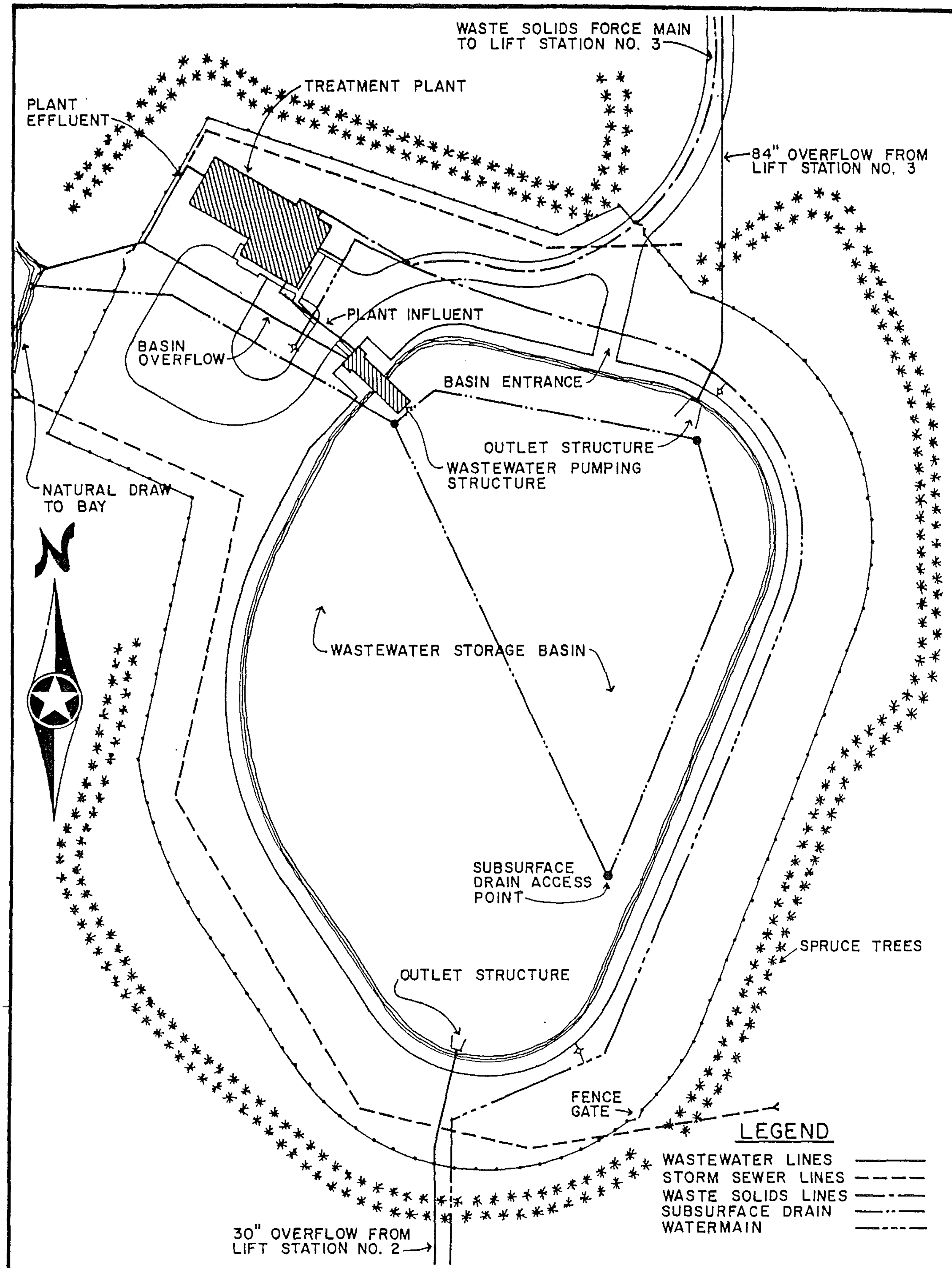
Anaerobic digestion is a biological process in which anaerobic and facultative microorganisms stabilize organic materials (volatile solids) contained in the sludge. The process converts approximately 30 to 40 percent of the volatile solids to water, carbon dioxide and methane gas. This process reduces the quantity of solids contained in the sludge and allows it to be disposed of with reduced public health hazards and nuisance potential. The anaerobic digestion system in use at Superior is a two stage process consisting of two primary digesters, a secondary digestion tank, heating equipment, a gas system and appurtenant pumps. Two of the digesters have gas-tight floating covers and the third digester has a gas holding and floating cover. The gas recirculation system provides for mixing the digester contents.

F.1.b. Treatment System Needs

Following construction and implementation of 1993 Facility Plan recommendations, wastewater treatment needs are limited. According to efforts conducted by RMA engineering (30APR97 memo), the main plant can handle influent flows and loadings described below.

- **Flow**: 5.75 MGD average day at current influent concentrations of approximately 150 mg/l BOD_5 and 175 mg/l suspended solids) 8.0 MGD peak day (due to hydraulic loadings on clarifiers);
- **BOD_5**: 7,500 pounds per day average;
- **Suspended Solids**: 8,500 pounds per day average.

Needed main WWTP treatment improvements relate more to correct operation of existing systems than capital improvement requirements. Main WWTP operational recommendations include:



DISTRICT 6 C.S.O. TREATMENT PLANT SITE

Figure F.4

- peak flow limits of 8 MGD (daily) and 9.2 MGD (hourly); and
- maximized division up to 8 MGD peak daily flow, 7500 ponds per day BOD_5, and 8,500 pounds per day suspended solids.

Assuming flow increases associated with Comprehensive Plan land use projections are balanced with ongoing City efforts to reduce wet weather system input (I/I), the existing main WWTP should satisfactorily handle future flow increases.

As with the Main WWTP, CSO 2 facilities presently require no capital improvements. There may be future needs relating to relocation of the CSO 2 outfall. Operational needs are limited to flow control, and related Main WWTP maximized flow. With years of average or less rainfall, total yearly flow to CSO 2 should be limited to 700 million gallons. CSOs 5 and 6 also currently require limited treatment improvements. Disinfection of CSOs 5 and 6 effluent may be required in the future—the City is currently investigating the need for effluent disinfection. Required treatment could be reduced by effectively increasing the pond water surface elevation at overflow conditions.

The City of Superior has compiled a listing of existing project needs for the Main WWTP and the CSO Facilities (WWTP staff, 19DEC96). Treatment facilities needs and estimated costs are presented in table form in Appendix 6.

F.2.a Municipal Collection System--Existing Facilities

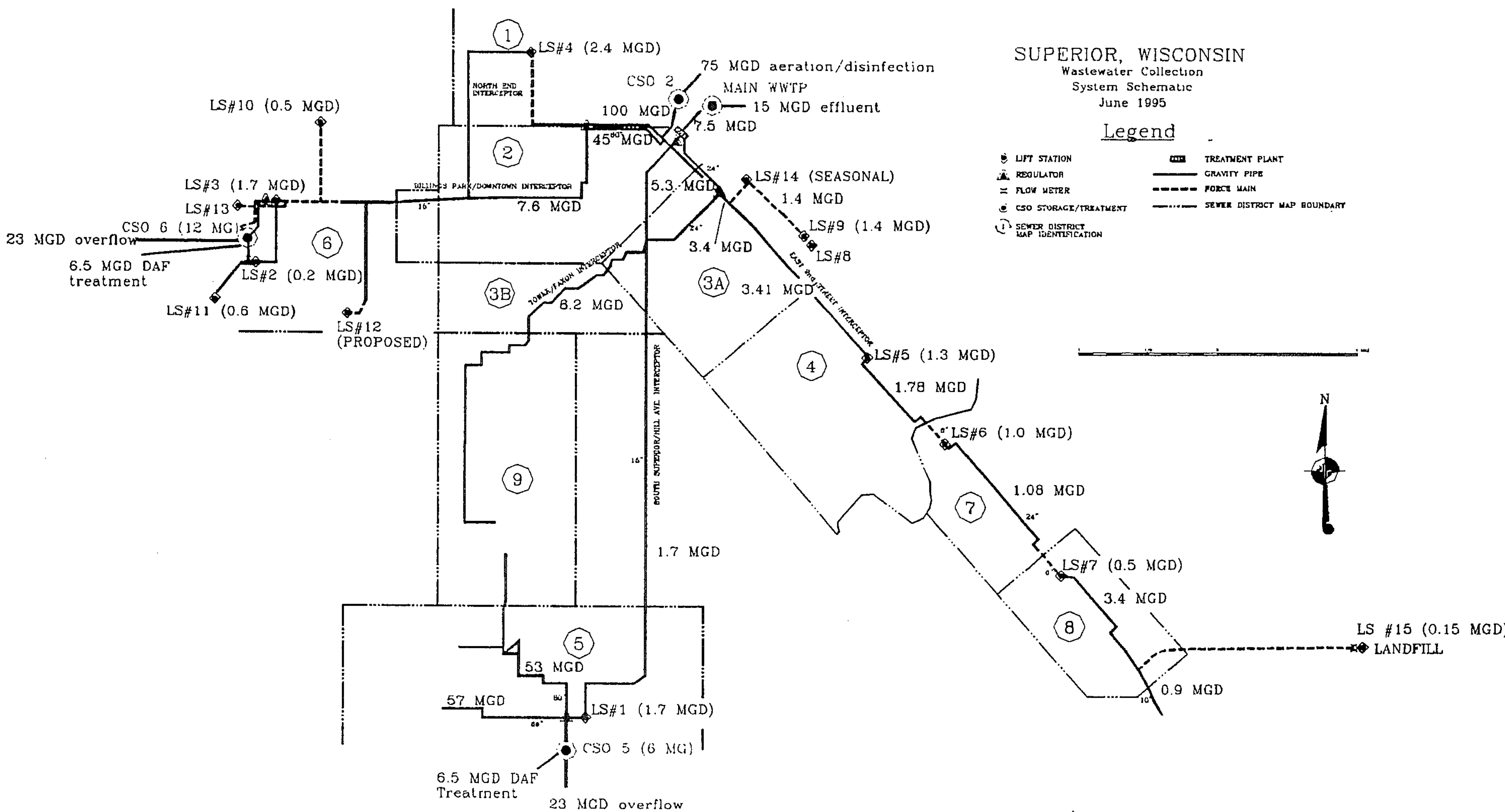
Figure F.5 shows a schematic highlighting Superior's collection system. About half of the City's sewers were constructed in the 1890's. The sewers are generally non-reinforced concrete (some tile for small pipes and some brick for large pipes) and were constructed with thousands of plugged taps for later service connections (wyes). Manholes were generally constructed of brick with "18 hole" manhole covers. Crossings of ravines were on timber piles, rock cradles or specially built bridges/walkways.

In the late 1930's, interceptors were constructed under the WPA program. These pipes are generally concrete. When the main lift stations and the Main WWTP were constructed in 1956, 23 overflow locations remained in the sewer system. Industries along the waterfront generally have their own forcemains to the City's gravity sewers. Sewer extensions have progressed with City growth. Due to some bypassing along East 2nd Street, however, the DNR has limited new connections in Districts 4, 7 and 8 since early 1992. Some septic tank systems exist in outlying areas.

Many manholes are located in areas that are inundated during spring snow-melt or following moderately sized rains. Building foundation drains exist throughout the City. At times, they can be a major source of I/I but it is expensive to redirect the flow.

The sewer separation project in 1975 provided additional sanitary sewers and retained the old pipes for storm water conveyance. Separate and combined sewer areas are shown in **Figure F.6**. These new sanitary pipes have proven to be too small; possibly due to a combination of factors: inefficient private separation by **Figure F.5.** property owners (roof drains, sump pumps, yard drains), missed cross-connections with storm sewers, new cross-connections with storm sewers, infiltration to new pipes, or inadequate design values. A rain in the spring of 1977 caused severe basement flooding and three overflow locations were reopened. The last overflow location (near Lincoln School) was sealed following the SSES/Rehab projects of 1982. Some new storm sewers were also constructed for the separation project in the eastern portion of District 2 and the Northwest portion of District 5. Stormwater from the Northwest portion of District 5 is sent to a 4.1 MG pond (Butler Pond) constructed in 1975 and designed for the 100 year storm.

Sewer surcharging is extensive throughout the service area. Basement flooding and some bypassing on East 2nd St. has occurred. The City has provided approximately 450 backflow valves on existing service connections at a cost of almost $1/2 million (Years



SUPERIOR, WISCONSIN
Wastewater Collection
System Schematic
June 1995
Legend
LIFT STATION
REGULATOR
FLOW METER
CSO STORAGE/TREATMENT
SEWER DISTRICT MAP IDENTIFICATION
TREATMENT PLANT
GRAVITY PIPE
FORCE MAIN
SEWER DISTRICT MAP BOUNDARY
N
LS#4 (2.4 MGD)
NORTH END INTERCEPTOR
LS#10 (0.5 MGD)
CSO 2
75 MGD aeration/disinfection
MAIN WWTP
15 MGD effluent
100 MGD
7.5 MGD
45 MGD
LS#3 (1.7 MGD)
LS#13
CSO 6 (12 MG)
23 MGD overflow
6.5 MGD DAF treatment
LS#2 (0.2 MGD)
LS#11 (0.6 MGD)
LS#12 (PROPOSED)
BILLINGS PARK/DOWNTOWN INTERCEPTOR
7.6 MGD
5.3 MGD
LS#14 (SEASONAL)
1.4 MGD
LS#9 (1.4 MGD)
LS#8
3.4 MGD
3.41 MGD
TOWER/FAXON INTERCEPTOR
8.2 MGD
EAST SIDE INTERCEPTOR
LS#5 (1.3 MGD)
1.78 MGD
LS#6 (1.0 MGD)
1.08 MGD
LS#7 (0.5 MGD)
3.4 MGD
LS #15 (0.15 MGD)
LANDFILL
0.9 MGD
SOUTH SUPERIOR/HILL AVE. INTERCEPTOR
1.7 MGD
53 MGD
57 MGD
LS#1 (1.7 MGD)
CSO 5 (6 MG)
6.5 MGD DAF Treatment
23 MGD overflow
1
2
3A
3B
4
5
6
7
8
9

Figure F.5

1979-92) (see **Figure F.7**).

As part of the 1993 Facility Plan the following work tasks were initiated in order to define the existing sewer system (sanitary and combined):

- Find, copy, and distribute all available sewer drawings.
- Prepare sewer schematics (1" = 200') with key information (sewer size, length, slope, materials of construction, year of construction and reference drawing; manhole numbers and invert elevations).
- Field verify missing or conflicting information (SSES recommendations, Rehab, "restrictors" placed in sewers, support frames left in manholes, elevations, industrial force mains, sewer crew notes, on-going projects and extensions). (Applies to lift stations and treatment plants as well).
- Assign manhole numbers for those manholes without numbers or new manholes "found."
- Prepare AutoCAD maps and FMS database.

This "definition of sewer system" is a monumental task because drawings could not be easily located, as-built data was questionable or not available, manholes were paved over, etc. The AutoCAD maps and FMS data base are now available for use, but subject to additional updates. The system is resident on the City-County computer system located in the Douglas County Clerk's Office in the Court House. System capabilities and use is documented at the AutoCAD station in the Court House.

Approximately 50 AutoCAD maps were prepared and are contained in Volume 2, "Sanitary Sewer Maps," an oversized addendum of the 1993 Facility Plan. An example of a portion of a typical AutoCAD map (1/2 Section at 1" = 200') is shown in **Figure F.8.**

An example for the FMS data is shown in **Table F.3.** The data base allows for additional fields of data (i.e. manhole condition) and future coordination with a Geographic Information System (GIS). **Figure A.3** and **Table F.3** outline the City-wide sewer system service areas.

Table F.3
Estimated Service Acres
Per District Map

Figure A.3 "letter"	District	Separate	Combined	Excess Surface	Total
A	1	340			340
B	2	100	740		840
D	3A	550			550
C	3B	300			300
E	4	525			525
K	5	150	310	170*	630
I	6	47	600		647
F	7	373			373
G	8	86			86
C	9	195			195
	Total	2666	1650	170	4486

*Some acreage has already been eliminated.

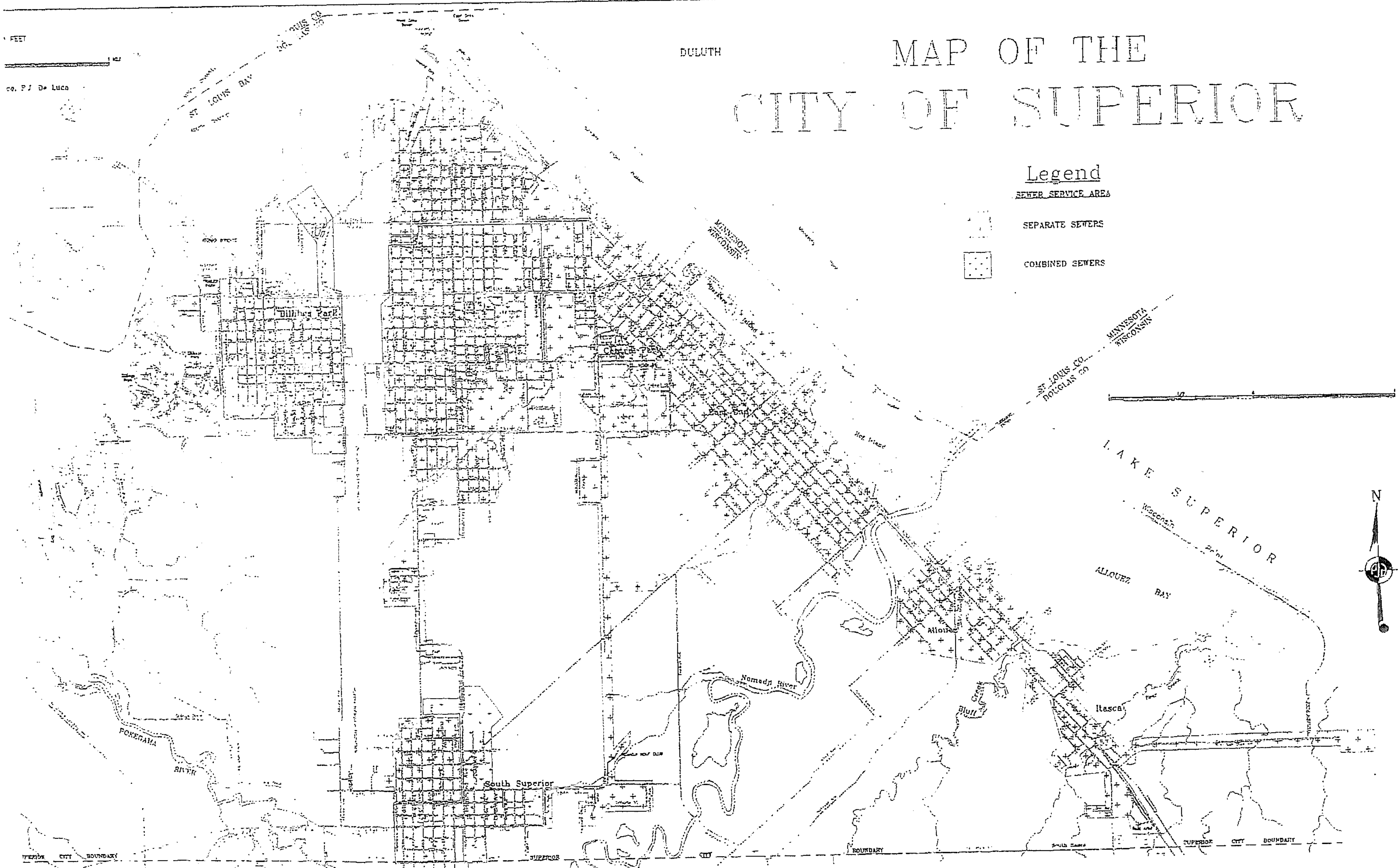

MAP OF THE
CITY OF SUPERIOR
Legend
SEWER SERVICE AREA
SEPARATE SEWERS
COMBINED SEWERS
DULUTH
ST LOUIS BAY
MINNESOTA
WISCONSIN
ST LOUIS CO
DOUGLAS CO
LAKE SUPERIOR
ALLOUEZ BAY
Billings Park
South Superior
Allouez
Itasca
Nemadji River
POKEGAMA RIVER
Bluff Creek
SUPERIOR CITY BOUNDARY
N
FEET
P J De Luca

Figure F.6

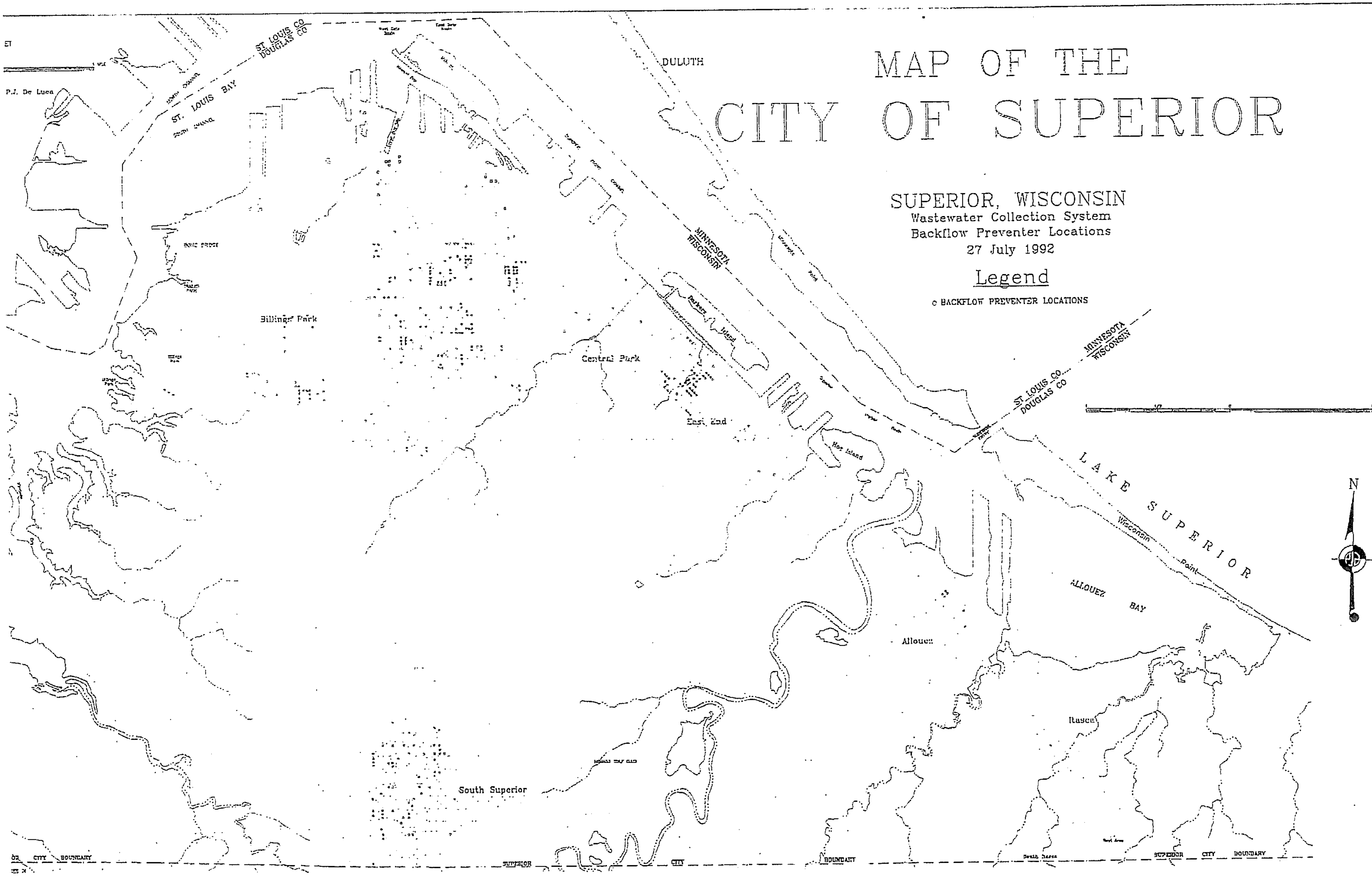

MAP OF THE
CITY OF SUPERIOR
SUPERIOR, WISCONSIN
Wastewater Collection System
Backflow Preventer Locations
27 July 1992
Legend
○ BACKFLOW PREVENTER LOCATIONS
DULUTH
MINNESOTA
WISCONSIN
ST LOUIS CO
DOUGLAS CO
ST. LOUIS BAY
LAKE SUPERIOR
Wisconsin Point
ALLOUEZ BAY
Allouez
Billings Park
Central Park
East End
South Superior
Barkers Island
Hog Island
P.J. De Luca
N
SUPERIOR CITY BOUNDARY

Figure F.7

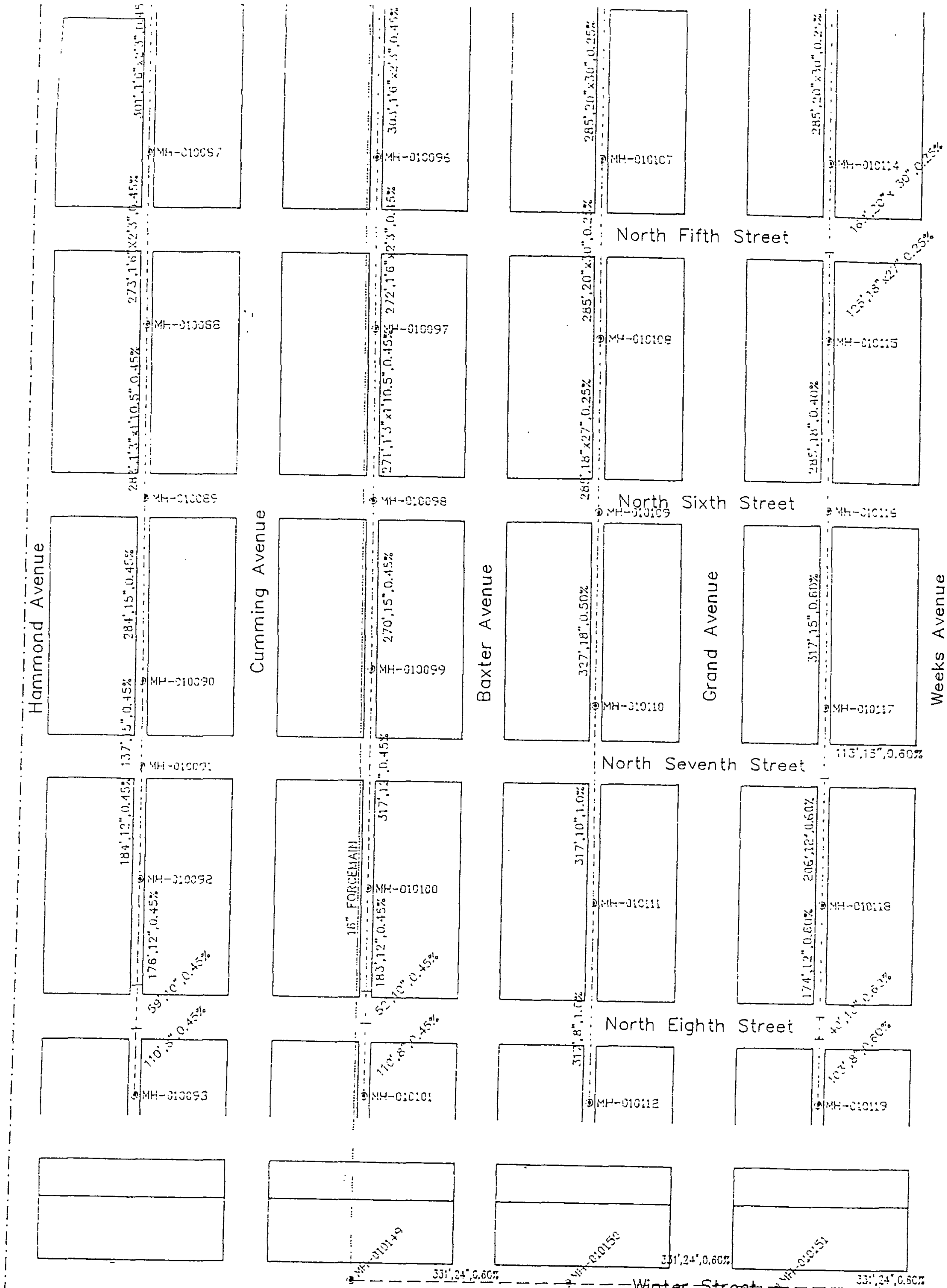

North Fifth Street
North Sixth Street
North Seventh Street
North Eighth Street
Winter Street
Hammond Avenue
Cumming Avenue
Baxter Avenue
Grand Avenue
Weeks Avenue
MH-010097
MH-010096
MH-010107
MH-010114
MH-010088
MH-010097
MH-010108
MH-010115
MH-010089
MH-010098
MH-010109
MH-010116
MH-010090
MH-010099
MH-010110
MH-010117
MH-010091
MH-010092
MH-010100
MH-010111
MH-010118
MH-010093
MH-010101
MH-010112
MH-010119
MH-010149
MH-010150
MH-010151
16" FORCEMAIN
331',24",0.60%

Figure F.8

Table F.3 also shows the area with combined sewers and the estimated surface area tributary to the sanitary sewers. Due to the flat topography, standing water has often been directed to drainage holes in manholes, resulting in substantial surface drainage being tributary to the sanitary sewers. The excess surface areas along Hill Avenue have been removed and the excess surface areas along 58th street are being addressed.

Most of the lift stations were constructed in the late 1950's in conjunction with construction of the Main WWTP. Modifications were made during the sewer separation and treatment plant construction projects in 1975, and also in 1997.
In general, the lift stations are reliable.

Lift stations 7, 6, and 5 serve the East End in series. In the past maximum throughput has caused downstream surcharging and basement flooding. However, lower throughput during wet weather has caused bypassing at the lift stations or at a low upstream manhole. Construction of Contract 3, LS 5 & 7 Improvements and Storage, minimizes WWF concerns. **Figure F.9** shows bypassing vs. rainfall data and **Figures F.10 and F.11** represent "before and after" conditions with Contract 3 implementation.

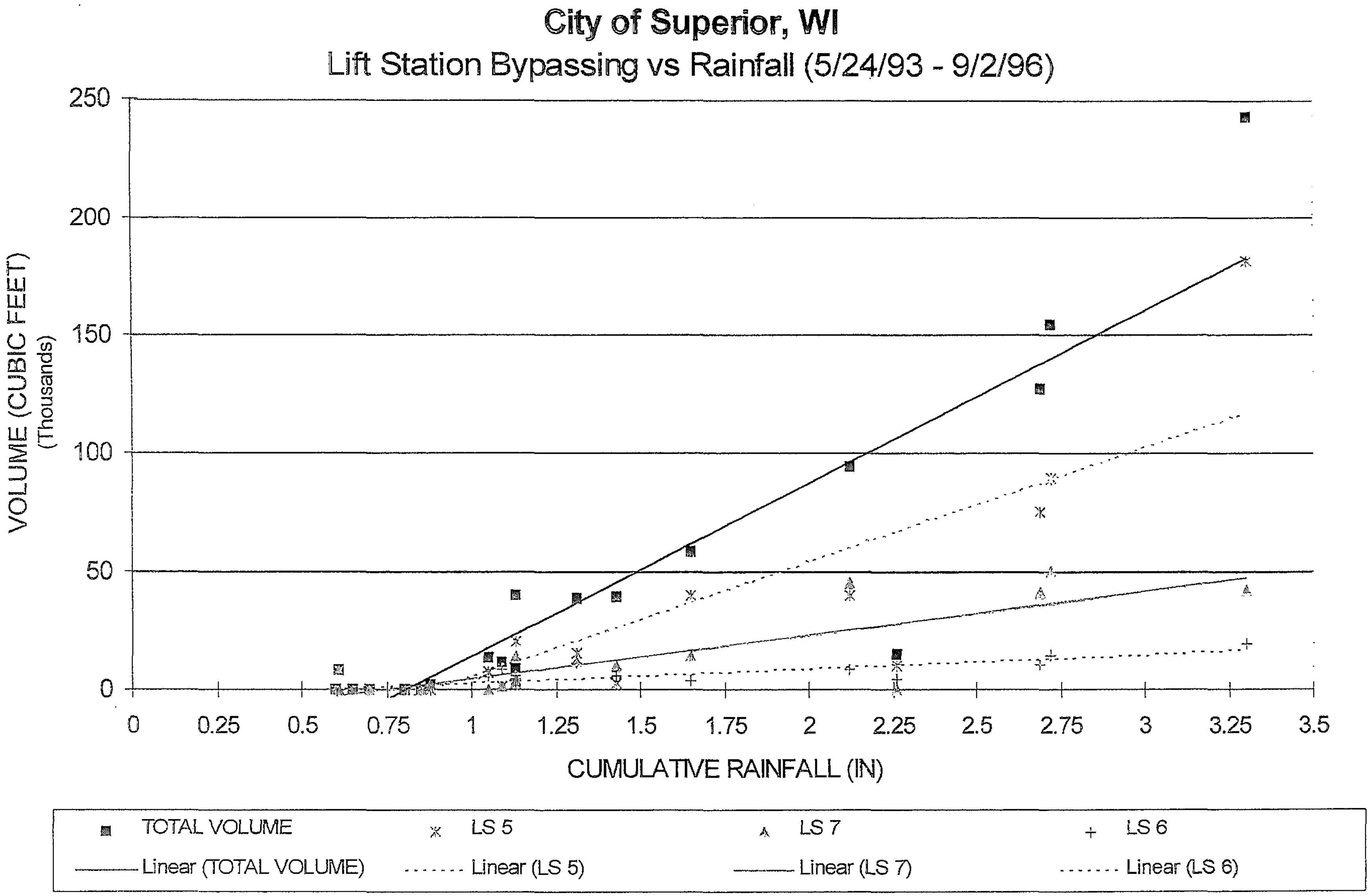
Ongoing issues and efforts related to Superior's collection system include:
- maximizing flow to WWTP in conjunction with 12 lift stations, landfill leachate pumps, and CSO Facilities;
- additional system documentation (mapping);
- I/I source identification and reduction;
- improved operation and maintenance; and

detailed sewershed basin analysis relating to surface drainage and stormwater permitting.

F.2.b. System Needs

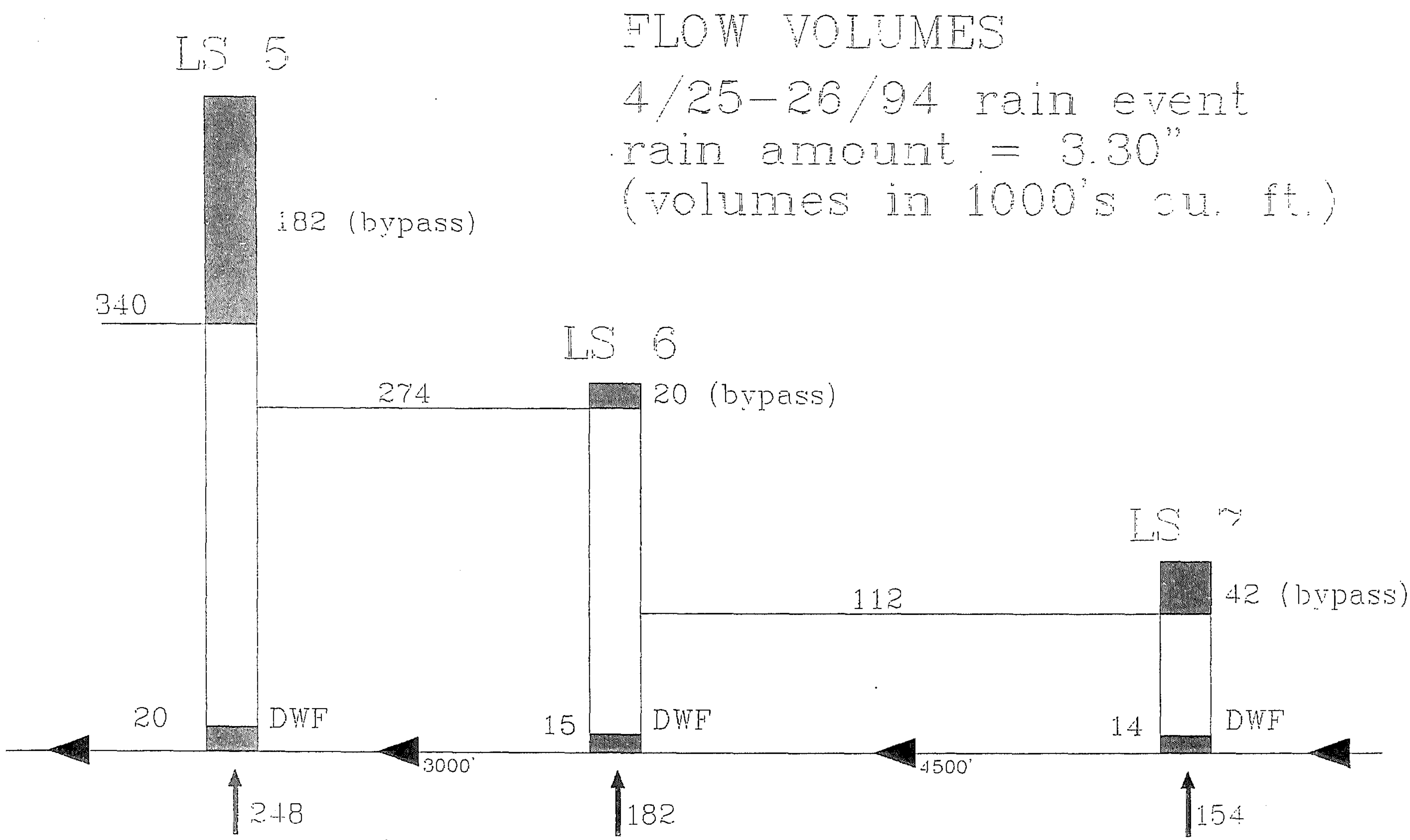
Collection system needs are manifold. The City's understanding of collection system needs are presented in Appendix 6. The City is currently in the midst of Contract 7 activities - a major restructuring and maintenance of the collection systems. Appendix 7 contains the cover for a packet that details Contract 7 activities. Existing Collection System Needs are summarized in **Table F.4** below.

Determination of future collection system needs hinges on future landuse projections and existing system capacity. Existing collection system capacities and problems are described by a letter to RLK Associates (Appendix 10). The iterative process used to finalize landuse planning associated with the Comprehensive Plan is its middle stages. Consequently, any detailed capacity analysis and needs assessment for future planning area development analysis and needs assessment as it pertains to future growth has been completed using the June 1997 Land Use Plan as a base and presented in **Table F.6** and **Figure F.12**.



City of Superior, WI
Lift Station Bypassing vs Rainfall (5/24/93 - 9/2/96)
VOLUME (CUBIC FEET)
(Thousands)
250
200
150
100
50
0
0
0.25
0.5
0.75
1
1.25
1.5
1.75
2
2.25
2.5
2.75
3
3.25
3.5
CUMULATIVE RAINFALL (IN)
TOTAL VOLUME
LS 5
LS 7
LS 6
Linear (TOTAL VOLUME)
Linear (LS 5)
Linear (LS 7)
Linear (LS 6)

Figure F.9



FLOW VOLUMES
4/25-26/94 rain event
rain amount = 3.30"
(volumes in 1000's cu. ft.)
LS 5
182 (bypass)
340
274
LS 6
20 (bypass)
LS 7
42 (bypass)
112
20
DWF
15
DWF
14
DWF
3000'
4500'
248
182
154

Figure F.10

FLOW VOLUMES WITH:

1. 10% reduction of WWF (I/I removal)
2. Increased throughput 25% @ LS 5
   29% @ LS 6
   11% @ LS 7
3. 120,000 cu. ft. storage @ LS 7
4. 60,000 cu. ft. storage @ LS 5

4/25-26/94 rain event
rain amount = 3.30"
(volumes in 1000's cu. ft.)

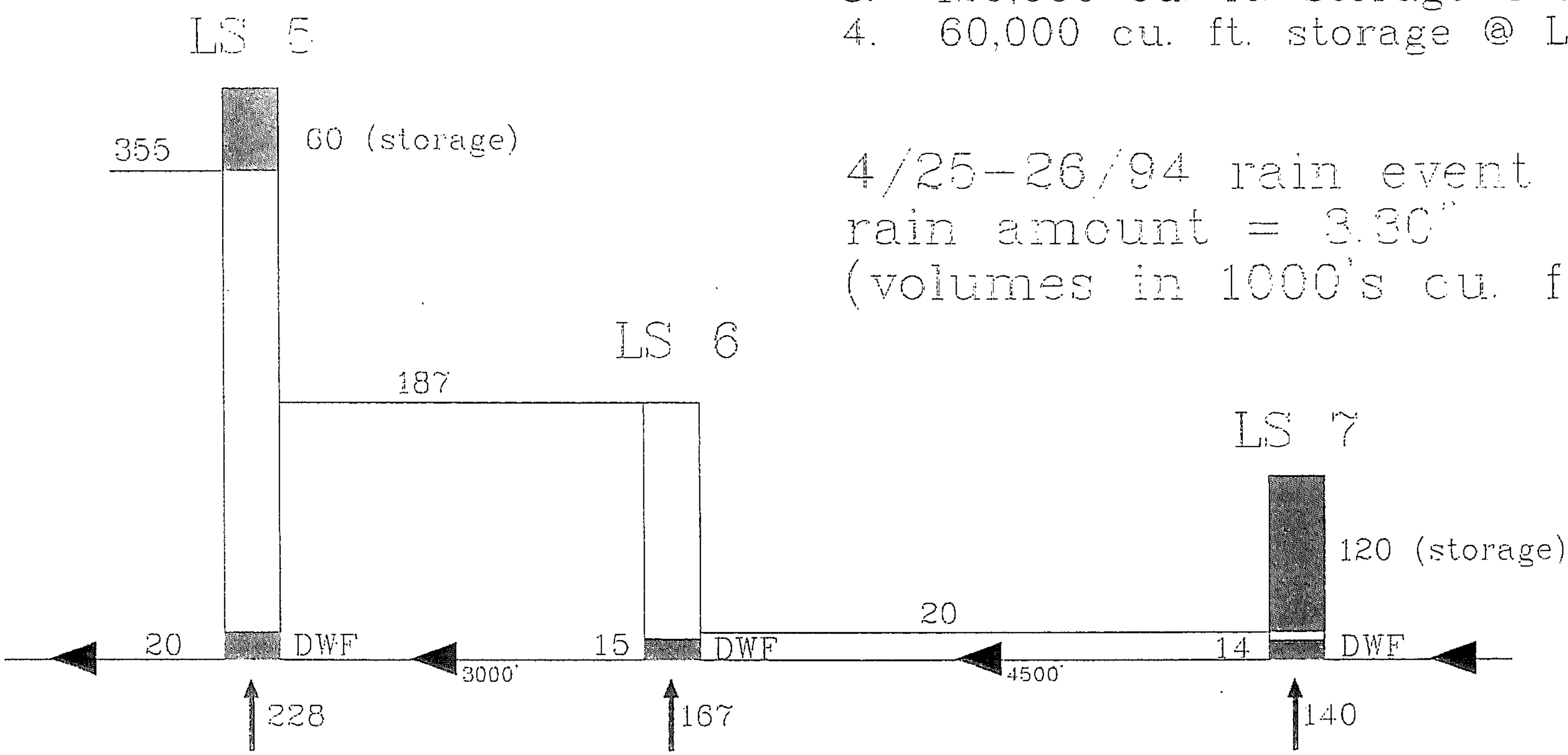


Figure F.11

Table F.4.* Existing Collection System Needs.

SEWERSHEDS	EXISTING NEEDS	Estimated Cost
A-1	Plug cross connection between separate sewershed A and combined sewershed B at 9 1/2 and Tower	$1,000
A-2	Winslow Power Station - verify existence of possible inflow source and separate	$5,000
B-1	Automatic control for MH7 gate	$10,000
C-1	Fix holes in ground above Faxon Interceptor at locations shown on map	$5,000
C-2	Faxon Interceptor WWF presently exceed capacity based on 7 yr design. Needs repair	$200,000
D-1	Divert Orphanage roof leader discharge from sanitary sewer (presently restricted not diverted)	$2,000
D-2	East 2nd St Interceptor presently exceeds capacity based on 7 yr design. Needs upgrade and/or repair	$300,000
F-1	All lampholes noted on map should be plugged	$10,000
F-2	Hole in sewer noted on map should be repaired	$10,000
G-1	Needs pending results of flow monitoring to be performed in 1997 (est.)	$20,000
I-1	Upgrade LS 3 (new submersible pumps) and increase CSO 6 volume	$270,000
J-1	Needs for Hill Ave Interceptor pending results of TVing to be done in 1998 (est.)	$50,000
K-1	Divert excess surface drainage away from combined sewer per map	$10,000
K-2	Increase CSO 5 Volume (raise pond effluent weir 2 feet, provide additional asphalt to top of basin-extra 2 MG)	$20,000
	Total	$913,000

*Significant non-routine maintenance needs

Existing sanitary sewer collection system needs total costs are estimated at almost one million dollars ($913,000) and relate to significant non-routine maintenance and capital needs. Major existing needed capital improvements include:

- Faxon Interceptor repair to handle 7 year WWFs;
- East End Interceptor repair to handle 7 year WWFs; and
- LS 3 upgrade in conjunction with CSO 6 volume increase.

Existing sanitary sewer needs pale in comparison to needs required for development according to the June 1997 draft Land Use Plan developed for the City of Superior by RLK-Kuusisto. Future interceptor sewer system needs have been determined per sewersheds and include capital costs estimated at nearly eight million dollars. See **Figure F.12** and **Table F.5** for supporting detail and location of future sewer system needs.

Sewershed A future system needs include additional storage totaling 1.40 million gallons.

Sewershed B future needs include a new sewer for development on Connor's Point.

Sewershed C future needs include additional capacity for the Faxon Creek Interceptor.

Sewershed D future system needs include storage totaling 1,200,000 gallons.

Sewershed E future needs include rehabilitation and additional storage.

Sewershed F future system needs include new sewers and additional storage to accommodate future development along the southern shore of the Nemadji River.

Sewershed G future system needs includes an additional 300,000 gallons of storage.

Sewers, storage, and lift station (s) are identified needs associated with future development in Sewershed H.

Three separate areas of Sewershed I are targeted for future development and each require new sewers and lift stations.

Interceptor improvements are future needs associated with development in Sewershed J.

Substantial future development of the area represented by Sewershed K is projected and requires additional needs including storage, sewers, and lift stations.

Finally, additional sewers and system storage are required for the collection system needs associated with future development in Sewershed L.

Table F.5.* Future Sanitary Sewer Needs

Updated 5/5/99

Sewershed	FUTURE NEEDS	Estimated Costs
FA-1	Provide 700,000 gallons of additional storage	$500,000
FA-2	Provide 700,000 gallons of additional storage	$500,000
FB-1	New sewer for Conner's Point	$50,000
FC-1	Additional Faxon Interceptor capacity	$200,000
FD-1	Provide 1,200,000 gallons of additional storage	$800,000
FE-1	Rehab 24" Newton Trunk from E. 3rd St. to E. 8th St.	$80,000
FE-2	Rehab 10" Sewer along 30th Ave E. from E. 3rd St. to E. 9 1/2 St.	$80,000
FE-3	Provide 1,700,000 gallons of storage	$1,200,000
FF-1	Provide 2,300,000 gallons additional storage	$1,400,000
FF-2	Provide sewers along Nemadji River per RLK Land Use Map	$650,000
FG-1	Provide 550,000 gallons additional storage	$400,000
FH-1	Provide 700,000 gallons additional storage	$500,000
FH-2	Provide new sewers	$1,400,000
FH-3	Provide new lift station(s)	$400,000
FI-1	Future industrial area south of N. 28th St. is presently unsewered - would need sewers & lift station	$100,000
FI-2	Future industrial area north of Belknap St. is presently unsewered - would need sewers & lift station	$100,000
FI-3	Future TCPU area north of Winter St. is presently unsewered - would need sewers & lift station	$100,000
FI-4	Future LA1 area southwest of N. 28th St. is presently unsewered - would need sewers & lift station	$90,000
FJ-1	Rehab Hill Ave. Interceptor	$80,000
FK-1	Provide 2,000,000 gallons additional storage	$1,300,000
FK-2	Provide sewers for west LA2 area (Butler Park)	$100,000
FK-3	Provide new lift station to serve west LA2 area (0.17 cfs)	$200,000
FK-4	Provide sewers for presently unsewered LA3	$50,000
FK-5	Provide new lift station to serve LA3 area near river (0.12 cfs)	$100,000
FL-1	Provide new sewers to presently unsewered area	$350,000
FL-2	Provide 200,000 gallons additional storage	$250,000
	Total	$10,880,000

*Based on April 1999 Draft Landuse Plan

F.3. Industrial Waste Treatment Systems

Industrial wastewater treatment system needs are limited. Murphy Oil discharges the greatest amount of treated process effluent. All other industries within the city limits contribute only small amounts of low pollutant load water to receiving waters. The greatest need related to industrial wastewater treatment systems is a correct and current understanding of surface water management plans per site. This understanding will come when site specific stormwater permits are collected and compiled. Also, collection facilities for sanitary flows from new industrial areas associated with the future land use plans are necessary. Future industries with major treatment systems are not expected with development, but would be subject to WPDES permit requirements.

Forty commercial and industrial concerns were identified as part of Superior's Industrial Pretreatment Program (Appendix 11). Using WDNR Administrative Code Chapter NR 211.03 (19m), four significant industrial users were shown to contribute wastewater flows to the City of Superior's Main WWTP:

- Barko Hydraulics;
- Koppers Industries;
- Lake Superior Laundry; and
- Superwood Corp.

The industrial pretreatment program concluded that a likelihood of Main WWTP operation upset due to industrial flows is limited.

WDNR WPDES industrial point source permitting activities provide additional information regarding industrial wastewater treatment systems autonomous of the City's wastewater treatment facilities. Planning area Industries with WDNR WPDES point source permits include:

- Murphy Oil USA—Superior Refinery;

- Burlington Northern Railroad;
- Lakehead Pipeline Terminal;
- Superior Midwest Energy Resources Co.; and
- Chicago Northwestern Railroad.

Upon consideration of discharge frequency and magnitude, Murphy Oil remains the only WDNR WPDES permitted industry with significant flows. Treated process wastewaters from Murphy Oil discharge at rate of 0.29 MGD to the headwaters of Newton Creek. Although presently in compliance with permit requirements, Murphy Oil signed a memorandum of understanding (April 1996) with the WDNR regarding remediation of Newton Creek System sediments. Appendix 12 contains the entirety of the this agreement. At present, there are no known industrial wastewater treatment needs additional to existing physical and regulatory structures.

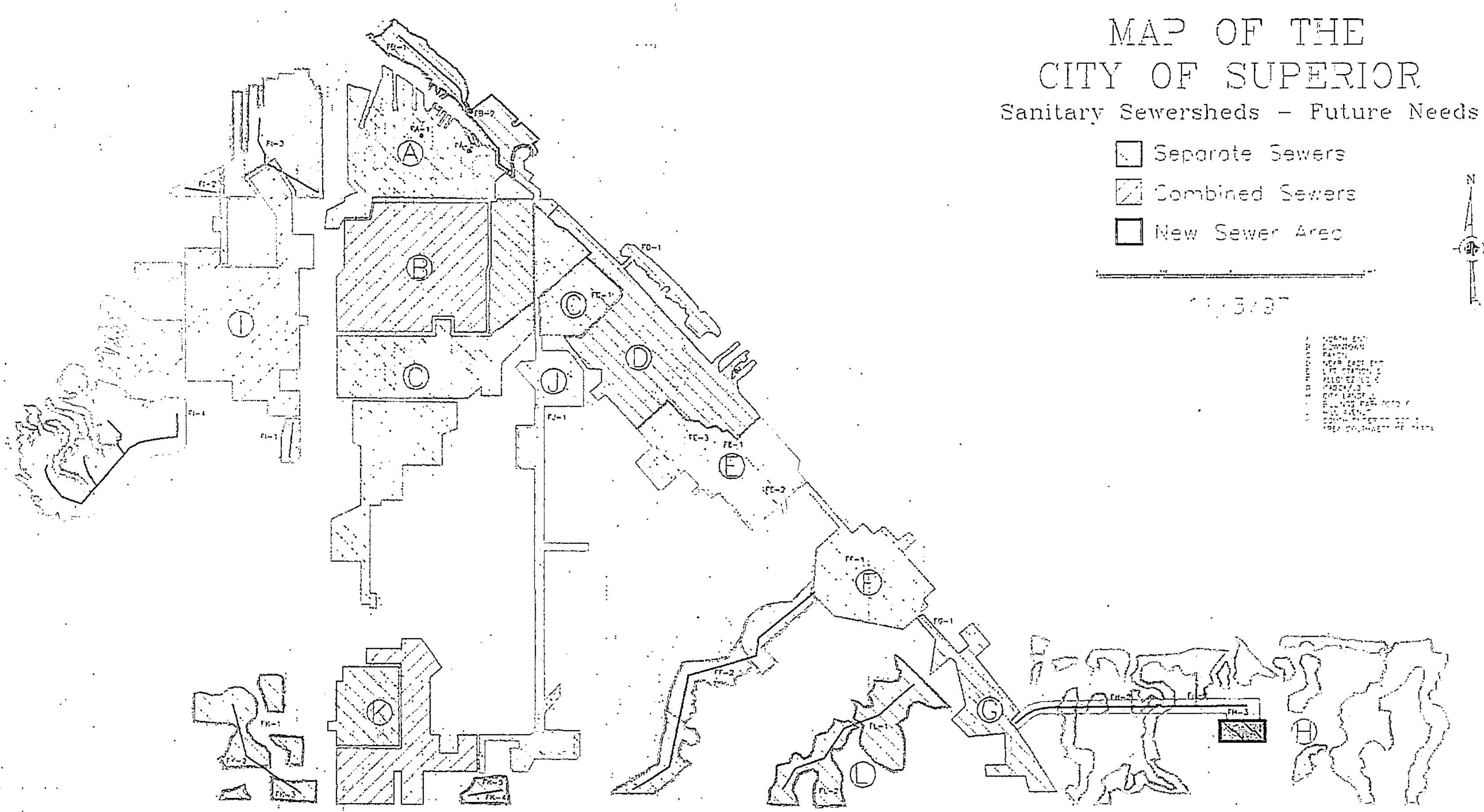

MAP OF THE
CITY OF SUPERIOR
Sanitary Sewersheds - Future Needs
Separate Sewers
Combined Sewers
New Sewer Area
N
A
B
C
D
E
F
G
H
I
J
K
L

Figure F.12

Number of Records: 30

Facility I.D. Number	Street Seg. ID Number	Pipe Size	File Number	Block Name	Material Type	Top Elevation	Invert Elev.(A)	Invert Elev.(B)	Last Rep.	Last Insp.	Inst. Year	Repair Category
-		10.0		PIPE		0.0	14.6	1.1	0	0	18	
-020002		0.0		PIPE		0.0	0.0	1.2	0	0	19	
-020021		20.0		PIPE		0.0	15.0	4.3	0	0	19	
-020034		0.0		PIPE		0.0	0.0	0.0	0	0	0	
-020040		0.0		PIPE		0.0	0.0	14.6	0	0	0	
-020052		15.0		PIPE		0.0	30.2	15.8	0	0	19	
020002-020001		0.0		PIPE		0.0	0.0	0.6	0	0	19	
020020-020001		0.0		PIPE		0.0	0.0	0.6	0	0	0	
020021-020020		0.0		PIPE		0.0	11.0	0.0	0	0	0	
020023-020021		24.0		PIPE		0.0	15.0	3.0	0	0	19	
020024-020023		0.0		PIPE		0.0	20.2	3.0	0	0	0	
020025-020024		15.0		PIPE		0.0	22.5	8.2	0	0	19	
020026-020025		15.0		PIPE		0.0	23.9	10.0	0	0	19	
020027-020026		15.0		PIPE		0.0	28.6	11.8	0	0	19	
020028-020019		24.0		PIPE		0.0	14.8	599.6	0	0	19	
020029-020028		24.0		PIPE		0.0	14.8	10.0	0	0	19	
020030-020029		24.0		PIPE		0.0	16.5	0.2	0	0	19	
020031-020030		24.0		PIPE		0.0	19.2	0.7	0	0	19	
020032-020031		24.0		PIPE		0.0	21.8	1.1	0	0	19	
020033-020020		0.0		PIPE		0.0	0.0	0.0	0	0	0	
020034-020033		0.0		PIPE		0.0	0.0	0.0	0	0	0	
020035-020020		0.0		PIPE		0.0	0.0	0.0	0	0	0	
020037-		20.0		PIPE		0.0	18.0	5.8	0	0	19	
020038-020037		18.0		PIPE		0.0	18.7	7.2	0	0	19	
020040-020038		12.0		PIPE		0.0	24.6	8.7	0	0	19	
020041-020040		10.0		PIPE		0.0	24.6	14.6	0	0	19	
020042-020040		12.0		PIPE		0.0	25.5	14.6	0	0	19	
020043-020042		10.0		PIPE		0.0	28.0	16.7	0	0	19	
LH-020043		8.0		PIPE		0.0	0.0	18.9	0	0	19	
LH-020052		6.0		PIPE		0.0	28.5	21.0	0	0	19	

Table F.6

Table F.6 (continued)

Number of Records: 30

Facility I.D. Number	Auxiliary Factor A	Auxiliary Factor B	Auxiliary Factor C	Facility Name	Pipe Length	Symbol Angle	Easting Coordinate	Northing Coordinate	Handle
-					340.8	46	110533.97	107896.56	920824.20014432
-020002	C-11	370'@4'0"X5'6"			225.7	-44	110954.80	107838.16	920824.20151123
-020021	2B-81	369'			359.3	316	110901.01	106871.47	920824.20464247
-020034					375.0	316	111663.01	106629.05	920824.20262467
-020040					174.6	46	111375.50	106042.06	920824.20504750
-020052	A-1	409'			183.9	92	110514.08	105359.09	920824.20571395
020002-020001	C-11	350'@4'0"X5'6"			325.6	-44	111134.35	107665.94	920824.20174491
020020-020001					419.4	47	111140.22	107382.42	920824.20214927
020021-020020					353.7	46	110894.18	107123.49	920824.20134186
020023-020021	2B-81	330'			180.6	46	110708.92	106930.99	920824.20112241
020024-020023					241.0	46	110562.72	106779.08	920824.20110027
020025-020024	A-1	400'			417.3	92	110484.62	106483.67	920824.21032217
020026-020025	A-1	400'			412.1	92	110495.48	106069.13	920824.21024746
020027-020026	A-1	398'			393.3	92	110506.03	105666.57	920824.21015633
020028-020019	D-1	352'			337.8	316	111406.52	107403.44	920824.20202073
020029-020028	D-1	142'			187.0	54	111473.82	107210.30	920824.20223574
020030-020029	D-1	367'			353.8	315	111545.58	107010.27	920824.20245651
020031-020030	D-1	366'			372.9	315	111804.70	106755.58	920824.20255550
020032-020031	D-2	366'			356.8	315	112064.90	106499.84	920824.20263988
020033-020020					342.0	316	111140.03	107132.35	920824.20240197
020034-020033					367.3	316	111395.58	106886.41	920824.20253463
020035-020020	NO_INFO._AVAIL				508.0	-44	110833.81	107427.05	920824.20095052
020037-	2B-81	342'			369.4	316	111163.56	106618.83	920824.20425563
020038-020037	2B-81	360'			355.9	46	111173.40	106362.38	920824.20522686
020040-020038	2B-81	362'			367.5	316	111182.56	106106.57	920824.20510271
020041-020040	2B-81	309'			314.6	316	111428.28	105870.09	920824.20501641
020042-020040	2B-83	356'			347.7	46	111194.42	105853.91	920824.20554338
020043-020042	2B-83	356'			362.6	46	110948.18	105598.04	920824.20545351
LH-020043	2B-83	76'			113.6	-44	110781.55	105506.80	920824.20542418
LH-020052	2B-70	133'			141.8	316	110562.76	105401.83	920824.21002454

G. NONPOINT SOURCE CONTROL NEEDS

G.1. Identification and Evaluation of BMPs Needed for Basic Control

The draft Surface Water Management Plan (SWMP) developed by the City and WDNR identified needed control measures for nonpoint source pollutants within the planning area boundaries. Superior's SWMP has been divided into "short term" efforts and "long term" efforts. Short term efforts are to be completed between 1997 and 2001, whereas long term efforts will be commenced in 2001. Short term SWMP efforts include: public information and education; basin characteristics and mapping; industrial inventory and characterization; best management practice (BMP) inventory, development, and optimization; and Monitoring and data collection. Long term SWMP efforts include: appropriate capital improvements for stormwater management; on-going public information & education; on-going BMP efforts; and appropriate system monitoring to assess existing conditions and assist planning measures.

An information and education program to make all City of Superior residents and businesses aware of factors affecting stormwater quality and quantity will be the most significant component of the SWMP. In conjunction with Douglas County and UW-Superior, the City will attempt to inform and educate Superior residents and businesses. The City of Duluth will be invited to join the City with this SWMP information and education program. Information and education material presented to Superior residents will include:

- proper disposal of vehicle, motor, and appliance fluids and parts;
- appropriate lawn care practices;
- appropriate vehicle washing practices;
- proper placement of raingutter downspouts;
- proper pet waste disposal;
- proper household hazardous waste disposal;
- effective soil erosion control;
- a general description of surface drainage and storm sewer systems;
- appropriate litter control; and
- a summary of City's illicit connection ordinance.

Information and education materials presented to Superior businesses will include:

- highlighting Douglas County's business waste redemption program;
- proper disposal of vehicle, motor and appliance fluids and parts;
- appropriate waste management practices;
- summary of the City's illicit connection ordinance.

Information and education efforts will commence in 1997 and continue through the SWMP duration. In addition to information and education material addressing public and corporate ownership with minimizing human impacts upon stormwater quality and quantity, citizens will be made aware of present City measures toward appropriate and effective stormwater management, including:

- stormwater mapping and cataloging;
- wet weather flow (WWF) monitoring;
- dry weather flow (DWF) screening;
- basin mapping and characterization; and
- snow disposal BMP demonstration project.

At present, the City has completed basin mapping and characterization for the northern area of Superior, with boundaries roughly defined by the Sanitary District 1 area. Basins also mapped and characterized are those areas draining to Newton Creek along with some regions north of 2nd draining to the Nemadji River (Appendix 13). Future anticipated basin mapping and characterization efforts will include:

- Faxon Creek Drainage (1997);
- South Superior Area (1998);
- Allouez - Itasca Area (1998);
- Billings Park Area (1998); and
- All other areas (1998).

Basin mapping and characterization includes: sewershed and watershed boundary determination, BMP identification; and correlation of basins with topography, aerial photographs, land use, flooding zones, wetlands, zoning, and industries. The City has conducted only preliminary work regarding inventorying and characterizing industries which may impact Superior's stormwater system. WDNR is presently in the process of permitting industrial stormwater within the City. To integrate present municipal SWMP efforts, all relevant information (surface drainage maps, storm sewers, industry category, and site specific management plans) should be made available to the City. Focus areas should include:

- The Winter Street area (Amoco Tank Farm, ABC Rail, BN Engine idling, Simko, Midwest Energy, Lakehead Concrete, and TLK);
- The Shoreline area draining to Howard Bay (Frazer Shipyards and Harvest States);
- Burlington Northern RR (between 42nd Ave. E and Railroad Ave.)
- Newton Creek Area (Murphy Oil and Lakehead Pipeline).

Integration of industrial stormwater management plans with city-wide efforts will be commenced once relevant information is made available to the City. The integration schedule will follow that shown for basin mapping and characterization.

On-going stormwater management efforts by the city include identification of existing BMPs. Therefore, cataloging in-place BMPs will follow the same schedule proposed for basin mapping and characterization. Optimization and development of existing BMPs depends on the existing conditions and expected system needs. Investigating the effectiveness and need for the following BMPs will be completed between 1997 and 1999:

- street sweeping;
- catchbasin cleaning;
- snow management (icing, sanding, and disposal);
- pesticide and fertilizer application policies;
- existing leaf removal practices;
- hazardous household waste and used oil collection;
- soil erosion control (BMPs and existing ordinance); and
- RAP recommendations.

The following city-operated industrial facilities will be considered for non-structural and structural BMPs:

- main Wastewater Treatment Facility;
- CSOs 5 and 6;
- landfill; and
- municipal services building/public works garage.

Monitoring of stormwater system flows will be completed where appropriate and when necessary. Completed DWF screening indicates that illicit discharges and inappropriate sources are not entering the City's storm sewer system. The need for further DWF screening does not currently exist. WWF flow monitoring has been considerable, covering areas including: Tower Ave.; gas stations; and open areas. Monitoring of various BMPs for snow disposal and treatment is slated for the

Spring of 1998. The City does not plan to conduct additional storm sewer system WWF monitoring, but does support any appropriate efforts conducted by WDNR. If the need for additional monitoring arises, the City will consult WDNR for a strategic and appropriate monitoring plan.

During the course of SWMP short-term efforts, a fiscal analysis will be conducted. Current and past SWMP efforts have been funded by the City's sewer and wastewater enterprise funds and WDNR grants. Available funding sources may include, but are not limited to:

- City sewer and wastewater enterprise funds;
- Coastal Zone management grants;
- Wisconsin priority watershed grants;
- The formation of a stormwater utility and/or surface drainage user fees; and
- Construction erosion control permit fees.

Once short-term efforts have been sufficiently completed, the following efforts are proposed by the City:

- appropriate capital improvements for stormwater quality and quantity management;
- continuation of information and education efforts;
- implementation and development of BMPs (in conjunction with capital improvements); and
- necessary monitoring and data collection.

Long-term SWMP efforts depend upon conclusions and results of short-term efforts. Therefore, long-term efforts will commence in 2001.

G.2. Watershed Identification and Associated Water Quality Evaluation

Stormwater permitting by the Wisconsin Department of Natural Resources (WDNR) requires delineation and characterization of surface water drainage basins within a municipality's limits. An appropriate and effective surface water management plan for the City of Superior must include accurate surface water drainage basin documentation. Surface water drainage basins include both natural surface watersheds and engineered storm sewer systems. Delineation of surface water drainage basins rests upon location of topographical surface boundaries and storm water conveyances. Physical delineation of watershed and sewershed boundaries underlies all ensuing efforts to assess and control surface water quality and quantity concerns.

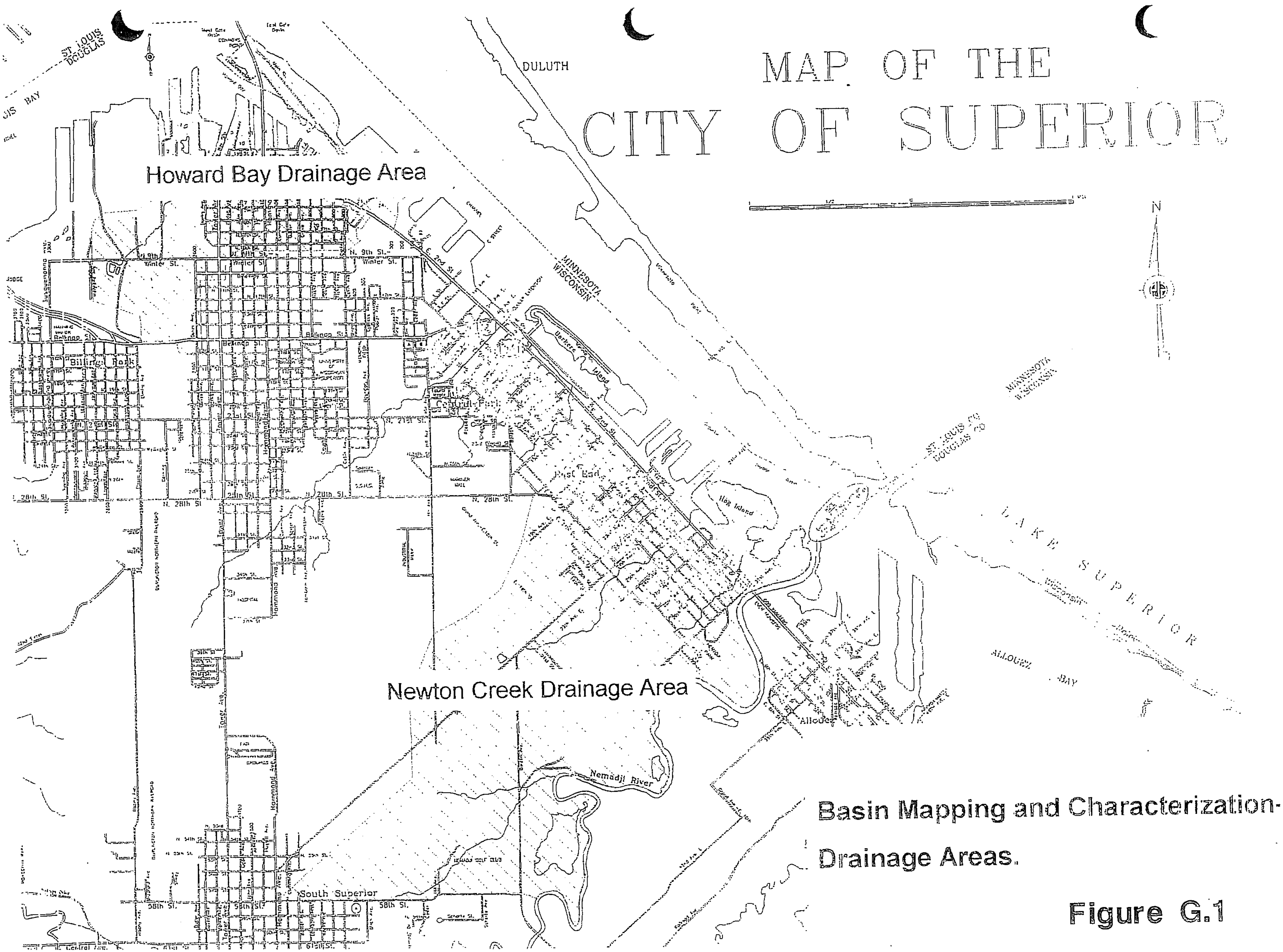
The City has detailed storm sewer pipe networks. Detailing storm sewer pipe networks includes the mapping and cataloging of: pipe age, size, type, and slope; manhole and catchment rim and invert elevations, and the size and type of outfall per network. Information also collected to support stormwater planning includes maps showing Superior's topography, land use, industries, aerial photographs, and wetland location and characterization. Basin mapping and characterization efforts have been completed for the Howard Bay and Newton Creek drainage areas (Appendix 13). Basin mapping and characterization for the remainder of Superior is to be completed as part of the City's Stormwater Management Plan.

Two areas of Superior were selected to be part of a pilot study that delineates surface water drainage basin boundaries and character. The first area chosen for assessment is commonly called "sewer service area district 1." District 1 is in the northern portion of the City and is described later in greater detail. To compliment those attributes exhibited in district 1, the area designated by WDNR as WISUL07 (basin 7) for SLAMM water quality modeling application was addressed as a second area. Basin 7 is in the location generally draining to Newton Creek and is further described later. These pilot areas were chosen as "starting points" for surface water drainage basin determination. During the course of basin mapping and characterization, the "District 1" area was more appropriately termed Howard Bay

Drainage Area and "Basin 7" was more aptly described with Newton Creek Drainage Area (see **Figure G.1**).

A logical step-wise survey was accomplished to appropriately and effectively determine surface water drainage within the City of Superior. In general, sewersheds were determined first, watersheds were determined next, and general field information within and between drainage basins was collected during the entire survey.

Sewershed boundaries were determined by locating areas of storm sewer on existing network maps; verifying sewershed boundaries via "windshield surveys"; and if necessary, walking the perimeter of area known to be underlain by storm sewer pipe. At the perimeter, the boundary of drainage was determined according to natural and engineered topographical features. Once sewershed boundaries were determined, watershed boundaries were estimated with USGS topographical maps and field verified. Field verification included boundary confirmation and collection of any relevant field information. Basins were given names according to those water bodies receiving their drainage. The attached flowchart (**Figure G.2**) shows the methodology for drainage basin determination.



Basin Mapping and Characterization-

Drainage Areas.

Figure G.1

SURFACE WATER DRAINAGE -
BASIN CHARACTERIZATION & MAPPING FLOWCHART

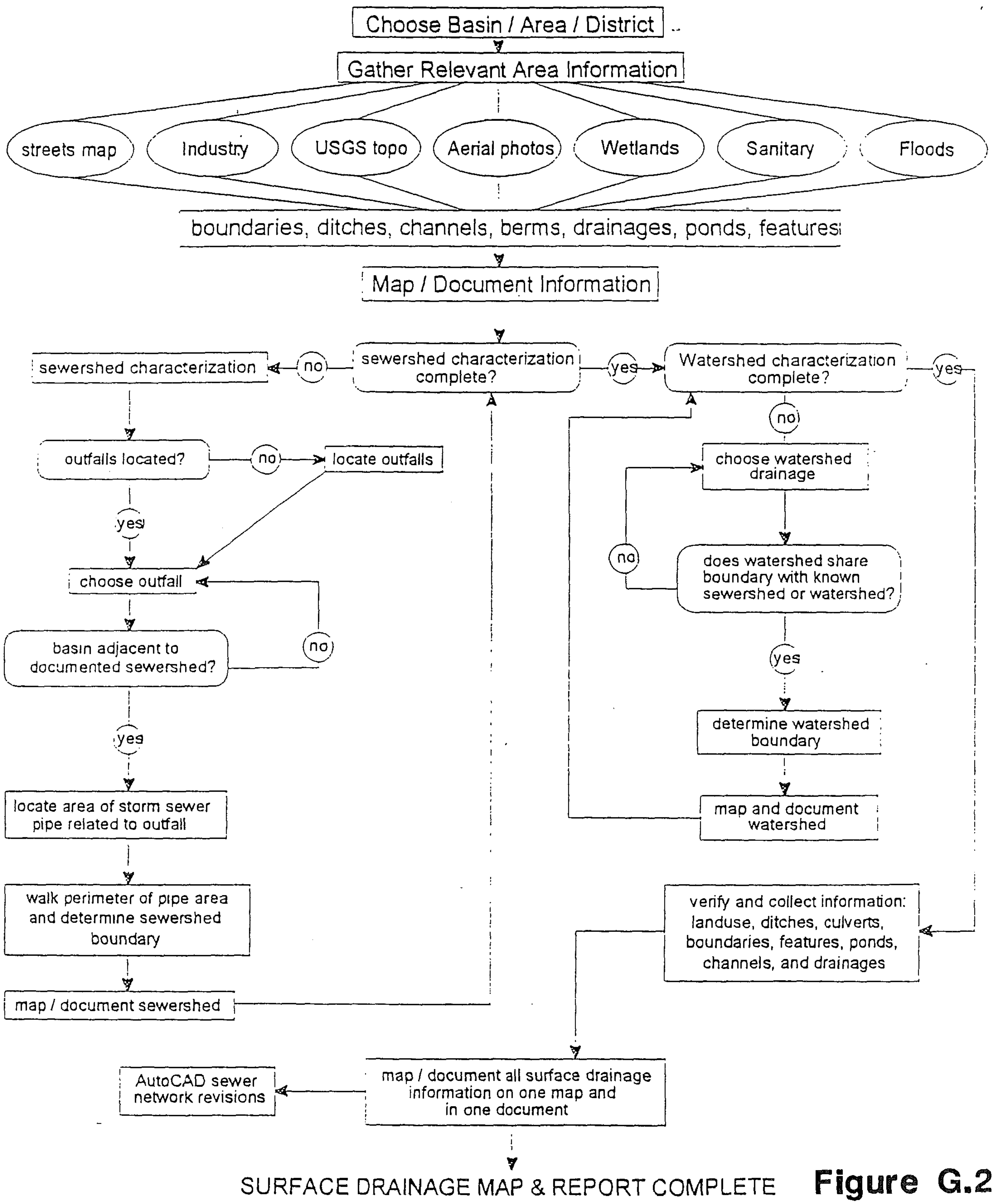


Figure G.2

H. RESIDUAL WASTE CONTROL NEEDS

The 1993 Facility Plan identified three sludge handling alternatives for further evaluation:

- **Co-disposal** of the dewatered sludge with solid waste at the Superior Municipal landfill;
- **Land Spreading** of the dewatered sludge on selected and approved farmland; and
- **Composting** of the dewatered sludge and marketing of the compost by-product.

The City of Superior currently operates a solid waste landfill on Douglas County owned land. According to the City Engineer, the landfill should have a useful capacity for approximately 15 years. Digested, dewatered sludge sums to nearly 4500 cubic yards per year and constitutes roughly 10% of landfilled material. The WDNR currently allows co-disposal of WWTP sludge at the municipal landfill. Although co-disposal decreases the effective landfill life and wastes a potential resource, area wide water quality concerns and essentially negated since the landfill is lined with impermeable clay and landfill leachate is pumped into the City's sewer collection for eventual treatment.

From 1977 through 1992, the City landspreaded liquid sludge on fourteen selected municipal sites. To compensate for poor soil conditions at eight of the spreading sites, a sludge storage lagoon was constructed on a site located adjacent to Albany Avenue in the Southwest section of the City. The City must provide sufficient storage facilities and be able to stabilize sludge to a minimum class B pathogen control with vector affection reduction as well as plan for significant capital improvements to existing digesters to justify land spreading. Since 1992, digested sludge has been dewatered and co-disposed at the municipal landfill. Future land disposal of Superior's solids/biosolids product appears unlikely with the advantages supporting a composting alternative if and when co-disposal is no longer an option. If land disposal becomes a need, those formerly used sites can be revisited for application.

Composting is an attractive alternative for future consideration. Estimated annual costs for composing are slightly higher than similar costs for sludge co-disposal ($267 vs. $223 per dry ton respectively, 1993 Facility Plan). Composting recycles two waste streams, sludge and additive (typically yard waste), for beneficial reuse and removes sludge as a pollutant source for area wide water quality. Composting of municipal WWTP sludge should be implemented if and when co-disposal is not a viable option.

I. AREA-WIDE WATER QUALITY MANAGEMENT—PLANNING AND REGULATORY COMPONENTS

In the Federal Water Pollution Control Act Amendments of 1972 (PL92-500), federal law created a process to establish locally developed areawide water quality management plans, or basin plans. Areawide water quality management planning was codified at the state level through the development of NR 121, Wisconsin Administrative Code. NR 121 specifies that Areawide Water Quality Management Plans include components dealing specifically with sewer service areas and projected needs for 20 years into the future. Sewer Service Area Plans and related water quality plans can be referred to as "Section 208" plans due to the original stipulation in the Clean Water Act for Areawide Water Quality Management Plans.

While the federal and state law provided conceptual framing, logistical details of sewer service planning have evolved to satisfy resource and stakeholder needs. SSAPs are in some cases developed and in all cases reviewed through public involvement activities prior to WDNR approval or denial. WDNR typically funds required local technical work and retains ultimate responsibility for preparation and implementation of the SSAP. Only those areas with wastewater collection and treatment systems are subject to service area planning. State, local, and regional authorities contribute throughout the planning process. This integrated focus limits negative impacts on water and land resources locally and regionally.

Numerous City and State regulatory measures exist to insure SSAP compliance. An amendment process is proposed for any revisions to the WDNR approved Superior SSAP. The City of Superior is the local administrative authority for the implementation of the plan. The SSAP provides direction to safeguard fulfillment of future landuse goals and objectives. In addition to local support, the actions of the WDNR will greatly impact successful plan implementation.

I.1. Point Sources

Existing and anticipated state regulatory programs provide sufficient direction and requirements for continued control and increased understanding of water quality and resource concerns. The non-proliferation policy of the WDNR is designed to restrict the construction of new wastewater treatment facilities in order to preserve and protect the quality of Wisconsin water. According to this policy, the WDNR can deny approval for a new wastewater treatment facility unless it satisfies certain criteria. Basically, any new treatment facility must be in accordance with any approved areawide water quality management plan and any additional criteria necessary to address regional and local considerations.

WDNR WPDES permits currently exist for municipal and industrial point sources within Superior's city limits. The WPDES permit that regulates municipal point source discharges expires on December 31, 1998. This WPDES permit covers discharges associated with the Main WWTP and the three CSOs (1, 5, and 6). A 01Jan99 issuance of a new permit is anticipated and should effect a five year period. Further permit detail is provided in Chapter E (Water Quality Standards).

Additional to the City's WPDES permit, individual permits for point source discharges exist for the following entities:

- Burlington Northern Taconite Facility;
- Lakehead Pipeline;
- Midwest Energy Resources;

- Murphy Oil; and

General permits for point source discharges have been granted to the following enterprises:

- Superwood/Georgia Pacific;
- Union Pacific—Itasca Yard;
- Amoco Petroleum; and
- Murphy Oil.

I.2. Nonpoint Sources

Following significant stormwater management planning efforts, A Fall of 1997 issuance of a WPDES permit for Superior's municipal separate storm sewer system is expected. The permit duration is five years and should extend through the Fall of 2002. Further permit detail is provided in Chapter E (Water Quality Standards).

Numerous industrial sites located within the City's limits have been permitted for stormwater discharges. Permitted industries submitted stormwater management plans in June of 1996 and monitoring results in June of 1997. Industries with WPDES stormwater discharge permits are listed below.

At present, solids associated with wastewater treatment processes and street cleaning constitute planning area "residuals" and are disposed of in the municipal landfill. Co-disposal of WWTP solids in the municipal landfill is a temporary measure. Future WWTP solids disposal is primarily subject to WDNR regulatory action and should be addressed with the next WPDES point source permit. Continued landfilling of street sweepings is expected.

Existing city ordinances provide additional regulatory measures for management of Superior area water quality. Chapter 30 of the City of Superior Code addresses Sewer Usage and associated charges. The Overland Flow Ordinance relates to drainage from newly developed and redeveloped areas. Erosion control BMPs are set forth by the City's Erosion Control Ordinance.

As implied by the name, the Sewer Usage Ordinance addresses numerous issues relating to sewer usage in the City of Superior. The Ordinance speaks to unlawful and unregulated discharges of sanitary sewage, industrial wastes, or other polluted waters mandated utilization of municipal sanitary sewer collection systems. In the case where no municipal sanitary sewer is available, the acceptability and operation of privately owned sewage disposal system is discussed by the Ordinance. Industrial and commercial entities with pretreatment requirements. User charges are dealt with in Division 2 of the Sewer Ordinance.

The Overland Flow Ordinance attempts to control surface water runoff from areas of new development or redevelopment. The rate of flow, course of flow and the relationship with upstream/downstream flow patterns are addressed by the Overland Flow Ordinance. The Faxon Creek watershed is treated specially, runoff in excess of 0.2 cfs/acre must be stayed. Also, stormwater detention facilities must be designed on the largest net difference of the total storm rainfall and maximum total permissible run-off of a 100-year storm of the appropriate duration.

All land development and land disturbing activities within the City of Superior are subject to the Erosion Control Ordinance. This ordinance requires BMPS that will reduce the amount if sediment and other pollutants carried by runoff or discharged from construction sites. All BMPs shall meet the design criteria, standards and specifications set forth by the City's BMP Handbook. BMP requirements relate to:

site dewatering; waste and material disposal; tracking; drain inlet protection; sediment cleanup; and site erosion control.

I.3. Financial Assistance

The Clean Water Fund (CWF) is a State of Wisconsin environmental loan program that was established in June, 1990. The Purpose of the fund is to provide low interest loans and grants for municipal wastewater projects. The WDNR is the primary administrator of the CWF program, and the Department of Administration id the financial manager for the CWF program. Projects eligible for funding include new treatment facilities, expansions and modifications to existing treatment plants, interceptors, or new sewers in an unsewered area. Eligible candidates, including Superior, can receive loans ranging from $25,000 to $74,400,000. Only WDNR approved projects receive funding. Additional to WDNR project approval, a municipality must have a "fair and equitable" user charge system, a replacement or depreciation fund, and be able to afford the loan payments.

Previous funding sources for projects relating to Superior's wastewater and surface water quality improvement include the City's sewer and wastewater enterprise funds and WDNR grants. Additional available funding sources may also include, but are not limited to:

- City sewer and wastewater enterprise funds;
- Coastal Zone management grants;
- Wisconsin priority watershed grants;
- The formation of a stormwater utility and/or surface drainage user fees; and

Construction erosion control permit fees.

I.4. Amendments

A process to amend service areas and environmentally sensitive areas is essential so that the City of Superior can effectively and efficiently respond to:

- unanticipated city growth;
- additional technical data;
- changing trends; and
- public input.

An amendment process requires the sponsor to submit information describing the burdens, benefits and details of the proposed change(s) to the Superior SSAP. With sufficiently documented amendments, the City and WDNR would jointly review the information. Following a joint review, the City would request additional information, issue a recommendation, submit the amendment request with City staff recommendation to the City of Superior Council and (for Major or Environmentally Sensitive Area Changes) submit to WDNR for formal review and approval.

Amendments will be classified under one of the four following categories:

- Minor Sewer Service Area Changes—involves any area deletion or addition encompassing less than five total acres. These additions must be located adjacent to a current sewer service area.
- Major Sewer Service Area Changes—involves any area deletion or addition not defined as a Minor Sewer Service Area Change.
- Environmentally Sensitive Areas—involves any area deletion or addition of environmentally sensitive areas.

Information submitted with all amendments must include the following:

- a map sufficiently showing the area of requested change including details relating to change boundaries, existing sewer service areas and environmentally sensitive areas, landuse designations, north arrow, scale, and other detail which defines the proposed change.
- a narrative sufficiently describing and justifying the proposed change.

J. ENVIRONMENTAL, SOCIAL, AND ECONOMIC IMPACTS .

The Comprehensive Plan has been completed by RLK-Kuusisto Inc. and addresses the environmental, social and economic impacts of the SSAP. The Comprehensive Plan is available and can be referenced at City Hall

Environmental impacts associated with the Superior SSAP include, but are not limited to, the following:

- appropriate management of area-wide water quality;
- appropriate understanding of area wide water quality;
- urban point source pollution control;
- urban nonpoint source pollution control;
- protection and mitigation of planning area "valuable" wetlands;
- minimized water, land, and resource degradation in association with balanced development;
- public information and educational programs associated with area-wide water quality issues; and
- water quality and quantity issues associated with concentrated development.

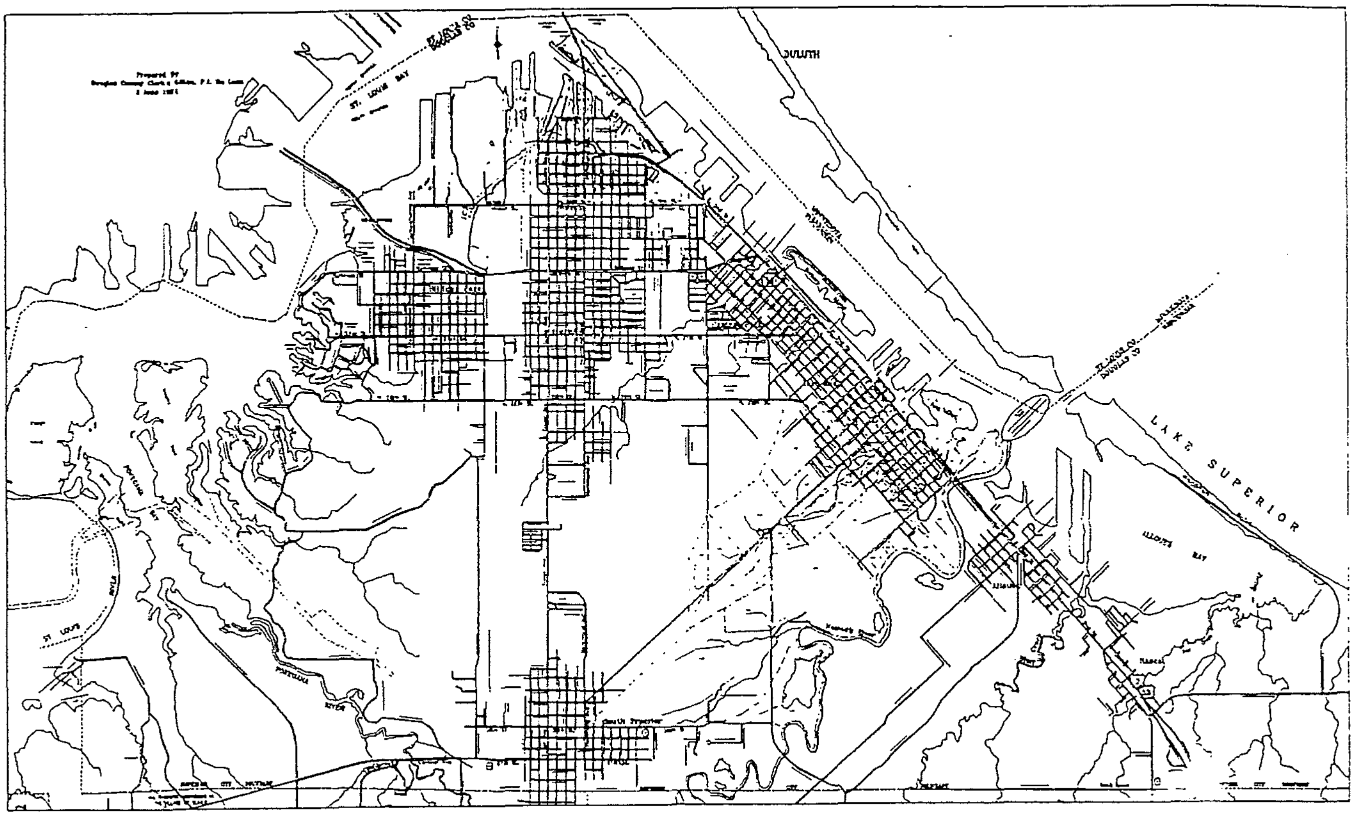
Superior, WI SSAP Report
List of Appendices

Appendix 1	DWF Screening
Appendix 2	WDNR 1995 Data
Appendix 3	WDNR 1996 Data
Appendix 4	FIA/FEMA Report
Appendix 5	WPDES Municipal Point Source Permit
Appendix 6	City's Draft Stormwater Management Plan
Appendix 7	WDNR's Draft Stormwater Management Permit
Appendix 8	Needs-Treatment
Appendix 9	Needs-Collection
Appendix 10	Collection System Capacities
Appendix 11	Industrial Pretreatment-40 concerns
Appendix 12	WDNR/Murphy Oil Agreement
Appendix 13	Basin Mapping
Appendix 14	Sewer Ordinance
Appendix 15	Overland Flow Ordinance
Appendix 16	Erosion Control Ordinance

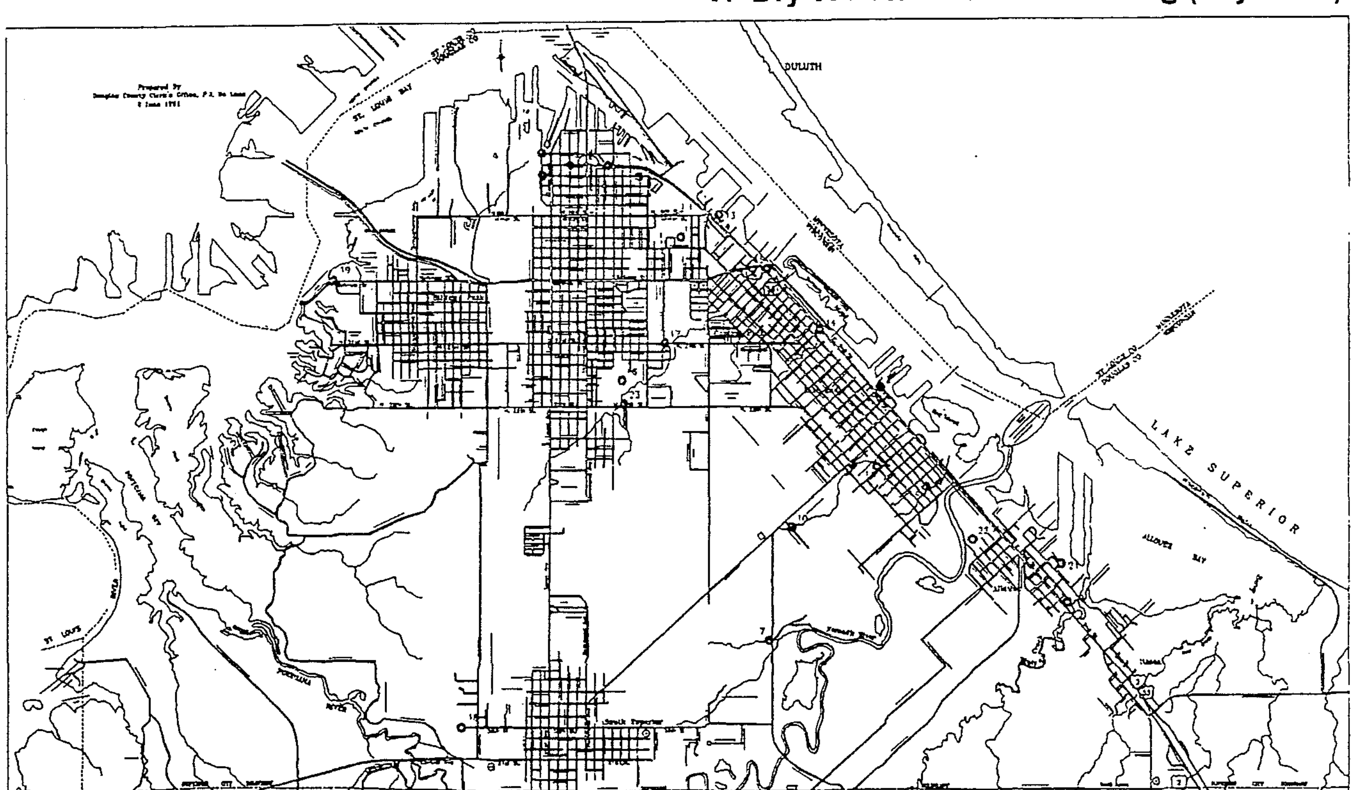
Appendix 1

DWF Screening

IV. Basin Mapping and Characterization (Howard Bay and Newton Creek Drainage Areas)



V. Dry Weather Flow Screening (city-wide)



Superior, Wisconsin Surface Water Management Plan

March 1997

CTE Engineers

Sampling Locations

A total of 23 locations were identified for potential screening (Figure 5.2). For each screening location, the first upstream site without static head was located. Of the 23 identified screening locations, six (6) did not show any dry weather flow, and seventeen (17) exhibited sufficient flow for sampling and analysis. Table 5.4 lists all locations identified for screening, the associated number shown on Figure 2, and whether flow was sufficient for sampling.

TABLE 5.4 DWF Screening Locations

Location Number	Location	Flow?
1	N. 5th St. and Fischer Ave.	y
2	N. 4th St. and John Ave.	y
3	N. 3rd St. and Banks Ave.	y
4	N. 5th St. and Banks Ave.	n
5	N. 4th St. between Baxter and Grand Avenues	n
6	24th Ave. E. and E. 10th St.	y
7	Nemadji Golf Course Creek at Bardon Ave.	y
8	30th Ave E. and E. 6th St.	y
9	21st Ave. E. and E. 1st St.	y
10	Newton Creek at 21st Ave.	y
11	26th Ave. E. and E. 8th St.	n
12	Conan Ave. and Spruce Ave.	y
13	On Bay: between E St. and Hill Ave.	y
14	Outfall to Superior Bay near 14th Ave. E.	y
15	Faxon Creek outfall near 5th Ave.	y
16	Faxon Creek outfall near Clough Ave. & 25th St.	y
17	Grand Ave. and N. 21st St.	y
18	58th St. and Harper Ave.	y
19	Near Belknap St. and Arrowhead fishing pier	n
20	E. 1st/2nd St. and 45th Ave. E.	n
21	St. Croix St. and 42nd Ave. E.	n
22	E. 5th St. and 36th Ave. E.	y
23	Weeks Ave. and 28th St.	y

Figure 5.2. DWF Screening Locations

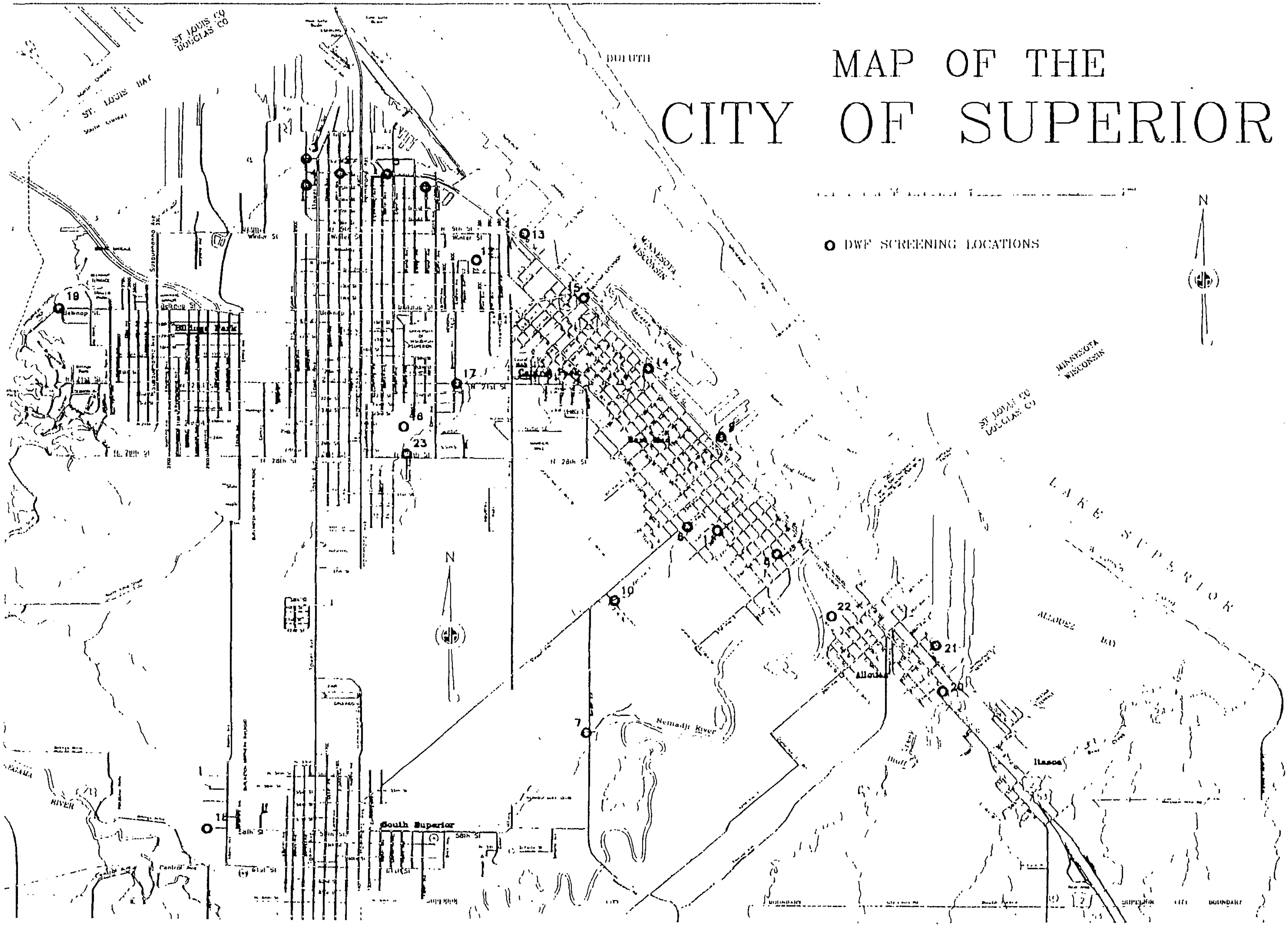
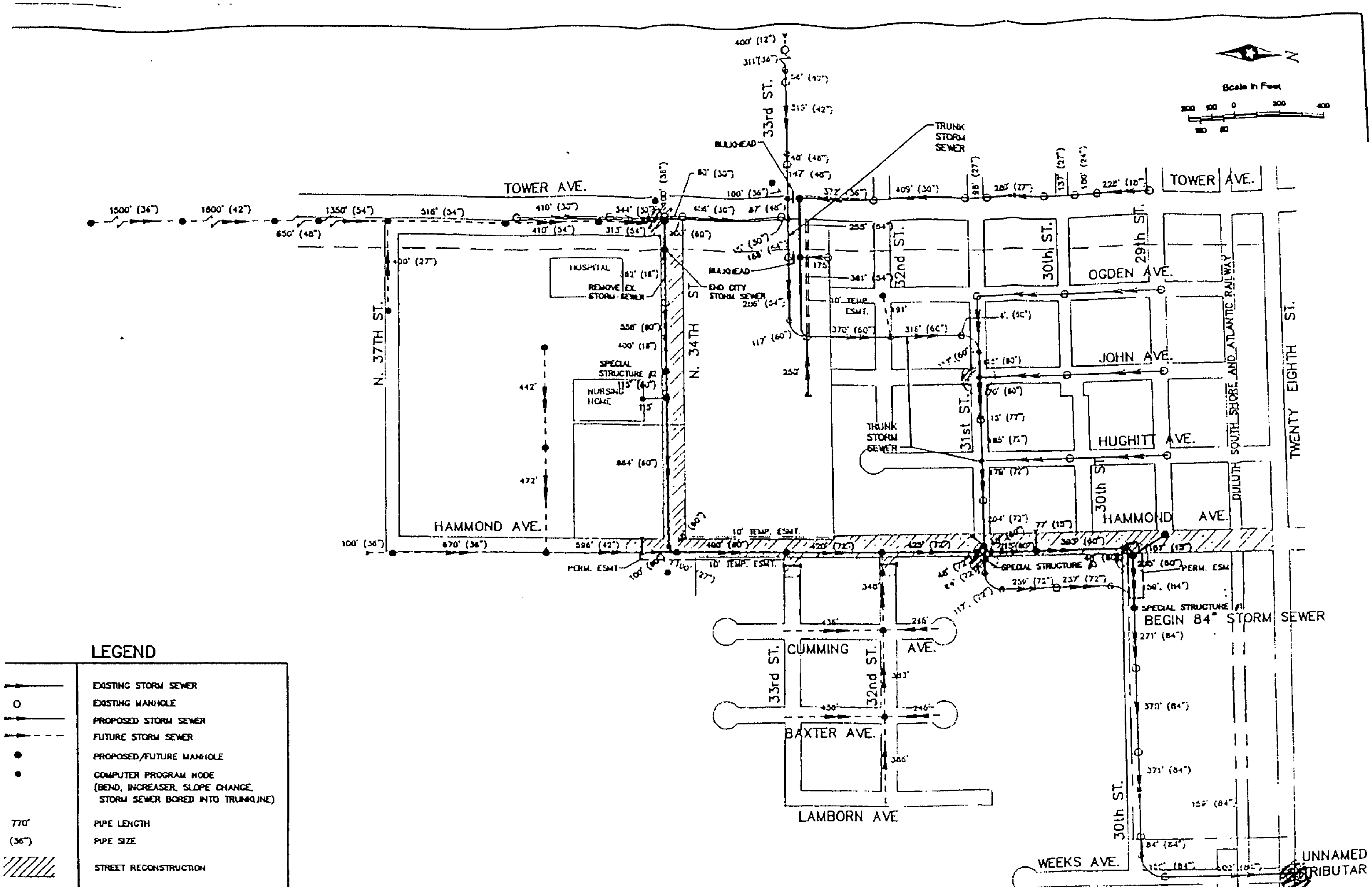


Figure 5.3. Fecal Coliform Sampling Locations Upstream of No. 28th St. and Weeks Ave.



CONCLUSIONS

Results of Dry Weather Flow screening and analysis yields the following conclusions:

- Superior's storm sewer and surface water systems do not exhibit significant pollutant loadings from dry weather flows;
- the quantity of dry weather flow in Superior's storm sewer system is estimated to be no greater than 15 gpm. Five of the 23 screening locations exhibited no DWF;
- neither illicit connections nor inappropriate entries are implicated or indicated;
- present and future BMPs do not appear necessary for dry weather flows;
- additional fecal coliform analysis may be warranted at and upstream of the N. 28th and Weeks Ave. screening location; and
- Future dry weather flow observation and screening is not required unless there is suspicion of illicit connections or inappropriate entries to the system.

Sampling Results

Observation and analysis of screening locations were completed between August of 1995 and December of 1996 (Table 5.5). Highlights for each recorded observation and completed analysis follow.

Flow Rate:

Screening locations showed estimated dry weather flows ranging between zero (0) to 150 gpm. Five sites displayed no dry weather flow. Two sites exhibited dry weather flows greater than or equal to 75 gpm; one associated with Newton Creek (150 gpm) and the other carrying Faxon Creek drainage (75 gpm). All other observable flows did not exceed 15 gpm.

Color:

In all but three screening locations there was no discernible color. The term "light brown" was is to describe those sites with non-clear water. The three sites exhibiting color are associated with Faxon and Newton Creeks, and an outfall to Superior Harbor located between E. St. and Hill Ave.

Odor:

Only one of the 23 sites was odorous. Observations of a portion of Newton Creek gated near 21st Ave. E. possessed the odor of oil. Much of Newton Creek's flow at this location originates from Murphy Oil surface water runoff and treated wastewater effluent discharge.

Oil/Sheen:

Screening locations showed neither oil nor a sheen attributed to oil.

Temperatures:

Water temperatures ranged from 32° F (Nemadji Golf Course Creek, 11/13/95) to 64° F (outfall near Conan and Spruce Avenues). Water temperature was not recorded for three screening locations.

Total Chlorine:

Measured total chlorine levels for samples taken from screening locations were typically below the detection limit of the analysis. Three locations exhibited total chlorine concentrations ranging from 0.1 mg/L (N. 3rd St. and Banks Ave. site and the site near Grand Ave. and N. 21st St.). to 0.4 mg/L (N. 4th St. and John Ave. site).

Copper:

Screening location dry weather flows exhibited free and total copper concentrations below the detection limit.

Table 5.5 DWF [illegible]ng Results

Site	Site #	Time	Date	Duration since last rain (days)	Flow (gpm)	Color	Odor	Oil/Sheen	Temperature (degrees F)	Total Chlorine (mg/L)	Free Copper (mg/L)	Total Copper (mg/L)	Detergents (ppm)	pH	pH (D I water)	Phenols (mg/L)	Fecal Coliform (# org/100 mL)	Notes
N. 5th St and Fischer Ave	1	7.00 AM	9/12/95	5	3	none	none	none	N/A	<dl	<dl	<dl	0 01	8 5	N/A	<dl	30	
		4 00 PM	9/12/95	5	3	none	none	none	N/A	0 1	<dl	<dl	<dl	8 3	N/A	<dl	80	
N 4th St and John Ave	2	8 00 AM	9/12/95	5	4	none	none	none	N/A	0 4	<dl	<dl	<dl	8 5	N/A	<dl	250	
		4 35 PM	9/12/95	5	4	none	none	none	N/A	<dl	<dl	<dl	<dl	8 2	N/A	<dl	3600	
N 3rd St and Banks Ave	3	11 30 AM	8/23/95	>3	15	none	none	none	N/A	<dl	<dl	<dl	<dl	8 2	N/A	<dl	300	
		3 30 AM	8/23/95	>3	15	none	none	none	N/A	<dl	<dl	<dl	<dl	8 2	N/A	<dl	500	
		9 30 AM	9/12/95	5	12	none	none	none	N/A	<dl	<dl	<dl	<dl	8 3	8 3	<dl	1000	
		5:15 PM	9/12/95	5	12	none	none	none	N/A	<dl	<dl	<dl	<dl	8 4	8 3	<dl	<100*	*interfering organisms
N 5th St and Banks Ave	4			>3														No flow
				>3														No flow
N 4th St between Baxter/Grand Ave	5			>3														No flow
				>3														No flow
24th Ave E and E 10th St	6	9 35 AM	11/13/95	5	5	clear	none	none	36	<dl	<dl	<dl	<dl	7 6	N/A	<dl	5,000	Samples taken to trailer (too cold)
		2 05 PM	11/13/95	5	5	clear	none	none	35	<dl	<dl	<dl	<dl	7 9	N/A	<dl	3,000	Samples taken to trailer (too cold)
Nemadji Golf Course Creek at Bardon Ave	7	9 30 AM	11/13/95	5	5	clear	none	none	32	<dl	<dl	<dl	<dl	7 4	N/A	<dl	1,200	Samples taken to trailer (too cold)
		2 00 PM	11/13/95	5	5	clear	none	none	32	<dl	<dl	<dl	<dl	7 7	N/A	<dl	3,000	Samples taken to trailer (too cold)
30th Ave. E. and E 6th St	8	9 30 AM	10/31/95	3 5	3	clear	none	none	44	<dl	<dl	<dl	<dl	8 4	N/A	<dl	<10*	*interfering organisms
		2 00 PM	10/31/95	3 5	3	clear	none	none	46	<dl	<dl	<dl	<dl	8 4	N/A	<dl	<10*	*interfering organisms
21st Ave E. and E. 1st St	9	8:15 AM	10/31/95	3 5	15	clear	none	none	46	<dl	<dl	<dl	<dl	8 6	N/A	<dl	40	
		1:15 PM	10/31/95	3 5	15	clear	none	none	49	<dl	<dl	<dl	<dl	8 4	N/A	<dl	300	
Newton Creek at 21st Ave E	10	10 15 AM	10/31/95	3 5	150	clear	oil	none	41	<dl	<dl	<dl	<dl	8 4	N/A	<dl	<10	
		2 45 PM	10/31/95	3 5	150	clear	oil	none	41	<dl	<dl	<dl	<dl	8 3	N/A	<dl	200	
26th Ave E. and E 8th St	11																	No flow
																		No flow
Conan Ave and Spruce Ave	12	8:30 AM	8/2/96	3	2	clear	none	none	58	<dl	<dl	<dl	<dl	7 8	N/A	<dl	10	
		3 00 PM	8/2/96	3 5	2	clear	none	none	64	<dl	<dl	<dl	<dl	7 6	N/A	<dl	340	
Broadway St and Hill Ave	13	7 30 AM	8/2/96	3	3	lite brn	none	none	56	<dl	<dl	<dl	<dl	7 7	7 2	<dl	<10	
		2 00 PM	8/2/96	3 5	3	lite brn	none	none	60	<dl	<dl	<dl	<dl	7 8	7 2	<dl	600	
Outfall to Superior Bay near 14th Ave E	14	9 00 AM	11/4/96	3	15	lite brn	none	none	40	<dl	<dl	<dl	<dl	7 6	7 2	<dl	<10	
		1:30 PM	11/4/96	3	15	lite brn	none	none	44	<dl	<dl	<dl	<dl	7.7	7 3	<dl	20	
Faxon Creek outfall near 5th Ave E	15	7 30 AM	5/28/96	6	75	lite brn	none	none	36	<dl	<dl	<dl	<dl	7 7	7 5	<dl	310	
		2 15 PM	5/28/96	6	75	lite brn	none	none	45	<dl	<dl	<dl	<dl	7 8	7 5	<dl	200	
Faxon Creek outfall near Clough Ave and N. 25th St	16	8 00 AM	8/26/96	5	5	clear	none	none	54	<dl	<dl	<dl	<dl	7 6	7.3	<dl	500	
		12 30 PM	8/26/96	5	5	clear	none	none	57	<dl	<dl	<dl	<dl	7 8	7 4	<dl	400	
Grand Ave and N 21st St	17	8 20 AM	5/28/96	6	5	clear	none	none	44	<dl	<dl	<dl	<dl	7 7	7 5	<dl	10	
		3 00 PM	5/28/96	6	5	clear	none	none	45	0 1	<dl	<dl	<dl	7.7	7 5	<dl	<10	
58th St. and Harper Ave	18	8 20 AM	6/11/96	5	5	clear	none	none	44	<dl	<dl	<dl	<dl	7 6	7.1	<dl	120	
		2 00 PM	6/11/96	5	5	clear	none	none	46	<dl	<dl	<dl	<dl	7 5	7 1	<dl	120	
Near Belknap St and Arrowhead Fishing Pier	19			>3														No flow
				>3														No flow
E. 1st/2nd St and 45th Ave E	20			>3														No flow
				>3														No flow
St Croix St and 42nd Ave E	21			>3														No flow
				>3														No flow
E 5th St and 36th Ave E	22	8 00 AM	11/4/96	3	15	clear	none	none	41	<dl	<dl	<dl	<dl	7 5	7 3	<dl	510	
		12.30 PM	11/4/96	3	15	clear	none	none	44	<dl	<dl	<dl	<dl	7 6	7 3	<dl	460	
Weeks Ave and N 28th St	23	9 00 AM	8/26/96	5	8	clear	none	none	56	<dl	<dl	<dl	<dl	7 7	7 4	<dl	37000	
		1 30 PM	8/26/96	5	8	clear	none	none	58	<dl	<dl	<dl	<dl	7 8	7 4	<dl	22000	
		9 00 AM	11/19/96	>3													680	
		1 00 PM	11/19/96	>3													650	

Detergents:
Only one screening location yielded a detergent concentration above the detection limit of the analysis. A detergent concentration of 0.01 ppm was found for the 5th St. and Fischer Ave. screening location.

pH:
measured pH values ranged from 7.4 to 8.6. During analysis, the same pH meter measured deionized water pH values to be slightly below those measured for screening location dry weather flows.

Phenols:
Analysis yielded phenol concentrations below the detection limit of the analysis for all screened locations.

Fecal Coliform:
Fecal coliform densities were below the detection limit for at least one sample from five sites (see Table 5.6). The highest fecal coliform density, 37,000 organisms/100 mL, was exhibited at the Faxon Creek outfall at N. 28th St. and Weeks Ave. This screening location was sampled again and produced fecal coliform densities of 680 organisms per 100 ml. Also, samples were collected at upstream locations. Upstream samples exhibited densities between 350 and 3800 organisms per 100 ml. Table 5.6 shows results of fecal coliform analysis for locations (Figure 5.3) in the storm sewers upstream of the N. 28th St. and Weeks Ave. screening site.

Table 5.6. Fecal Coliform Densities in Storm Sewer at and upstream of N. 28th St. and Weeks Ave on 11/19/96.

Location	time	Fecal Coliform Count
N. 28th St. and Weeks Ave.	9:00 a.m.	680
N. 28th St. and Weeks Ave.	1:30 p.m.	650
N. 30th St. and Hammond Ave.	9:15 a.m.	3,800
N. 30th St. and Hammond Ave.	2:45 p.m.	960
N. 31st St. and Hammond Ave.	9:30 a.m.	1,400
N. 31st St. and Hammond Ave.	2:00 p.m.	350
N. 31st St. and John Ave.	9:45 a.m.	2,000
N. 31st St. and John Ave.	2:15 p.m.	1,800
N. 34th St. and Tower Ave.	10:00 a.m.	530
N. 34th St. and Tower Ave.	2:30 p.m.	570

Appendix 2

WDNR 1995 Data

Appendix 3

WDNR 1996 Data

3657 -- 14.3.2

United States Department of the Interior

U.S. GEOLOGICAL SURVEY
Water Resources Division
6417 Normandy Lane
Madison, Wisconsin 53719-1133
608 274-3535 (Fax 608 276-3817)

January 31, 1997

Mr. Jeffrey Prey
Mr. Roger Bannerman
Bureau of Water Resources Management, WR/2
Wisconsin Department of Natural Resources
P.O. Box 7921
Madison, Wisconsin 53707

Re: Superior, Wisconsin, 1996 water-quality and water-quantity data summary

This communication summarizes collection site descriptions, sample collection protocol and data analysis for the urban basins in Superior, Wisconsin. The attached tables detail constituent concentrations and quality-assurance samples collected in water year 1996 for the undeveloped urban and golf course sites in Superior, Wisconsin. In addition, discharge, precipitation and loading data are included. The majority of the enclosed data will be published in the Wisconsin District 1996 annual data report.

1. Urban Basin Sites--Superior, Wisconsin

A. Study area and sampling site descriptions

Undeveloped Urban (USGS site 040244533): The station was installed on an ephemeral creek adjacent to the No. 7 green on the east/west course of the Nemadji Public Golf Course (lat 46°40'45"N., long 92°04'24"W.) and was in operation from June 1995 through September 1996. The creek drained a 76-acre woodland/grassland area located between the Nemadji Golf Course and a bermed oil refinery tank farm.

This site utilized a Parshall flume with a CR-10 controlled double bubbler unit to measure stage in the flume throat and downstream of the flume. Discharge at 5-minute increments was calculated using the following equation:

$$Q = 1.142 \times Ha^{1.58}$$

Where: Q = flow (cfs)
Ha = flume stage (ft)

On two occasions, the flume and wing walls were overtopped. Under these conditions discharge was calculated using the monitored approach stage to the downstream 2-foot-diameter culvert. The 1996 peak discharge was 4.1 cubic feet per second on August 7, 1996. Table 1 details individual storm statistics.

Additional site equipment consisted of a non-refrigerated model 3700 ISCO sampler with four 10-liter glass jars, a 3/8-inch teflon-lined sampler suction line, a datalogger programmed to activate the automatic sampler and store data, a modem for remote data retrieval, and a tipping-bucket rain gage.

Golf Course (USGS site 040244534): The site is located on the north side of No. 2 fairway on the east/west course of the Nemadji Public Golf Course (lat 46°40'41"N., long 92°04'21"W.) and was operated from June 1995 through September 1996. The 11.8-acre basin contains a drain tile system and lies entirely within the golf course property. Station equipment consists of a Parshall flume, a non-refrigerated model 3700 ISCO sampler with four 1-gallon glass bottles, a 3/8-inch teflon-lined sampler suction line, and a datalogger programmed to activate the automatic sampler and store data. A stilling well, equipped with float and potentiometer provided 15-minute stage data from the flume throat. The CR-10 datalogger computed discharge using the equation detailed in the undeveloped urban site section.

On several occasions, the flume and wing walls were overtopped, resulting in estimated discharge using a broad-crested weir calculation. The estimated 1996 peak discharge, 4.8 cubic feet per second, occurred on August 7, 1996. Table 2 details individual storm runoff statistics. Site equipment was removed on September 23, 1996.

B. Sample collection methods and protocol

At both sites, water-quality samples were collected on a flow composite basis with one-liter subsamples. Samples were composited using a teflon-lined churn splitter, filtered, preserved, put on ice and sent to the Wisconsin State Laboratory of Hygiene (WSLOH) for analyses. Glass collection bottles were cleaned after each use by washing with a non-phosphate detergent, rinsing with tap water, 10% hydrochloric acid, methanol, and Milli-Q water. Gelman 0.45 micron capsule filters pretreated with 500 milliliters of 5% HCl and 1000 milliliters of Milli-Q water were used for the dissolved constituents. The teflon-lined churn splitter was cleaned between sample splits with the same procedure.

C. Data

From May to September 1996, 13 precipitation events at the undeveloped urban and golf course sites were sampled. Tables 1 and 2 and figure 1 provide precipitation, flow and sampling statistics for the undeveloped urban and golf course sites. Storm-runoff volumes were calculated by summing the 5- or 15-minute interval flume discharges over the event duration.

Table 3 details event mean concentrations (EMC) as measured at the respective flumes to arrive at individual constituent loads detailed in table 4.

During two events at the undeveloped urban site (6/26/96, 7/11/96) and three events at the golf course site (6/26/96, 7/11/96, 7/22/96), the four ISCO sample bottles filled prior to runoff termination. In all instances, the samplers were serviced and the latter portion of the hydrograph was sampled. Table 3 indicates that for these events (UND16/UND17, UND23/UND24, GLF11/GLF12, GLF13/GLF14, and GLF18/GLF19) total suspended solids concentrations decreased on the latter portion of the hydrograph. This was not true for all constituents.

In 1996, an increased number of samples were analyzed for metals. The undeveloped urban site had low but sometimes detectable concentrations of lead and copper (median values of <0.8 μg/L and 4 μg/L, respectively) with all zinc analyses reported less than detection. The golf course site had similar lead and copper concentrations (<0.8 μg/L and 7 μg/L respectively). Zinc concentrations, however, were often above 50 μg/L (median value of 54 μg/L), resulting in loadings of 10 to 60 grams per event. The zinc may be a result of "Scott's Step" fertilizer (1.3% zinc) which was applied to putting greens for minor soil deficiencies.

The golf course fertilizer application rate was 1.0 lbs nitrogen/1000 ft^2 and 0.1 lbs phosphorus/1000 ft^2 two to three times per year. For phosphorus and nitrite + nitrate, the golf course loading/acre was greater than the undeveloped site but lower than the commercial Tower Avenue site (table 4, figure 5(b) - letter dated 3/19/96).

These project data will be used in the Source Loading and Management Model (SLAMM); in that light figure 2 presents nutrient and metals concentrations generated from the five Superior and Duluth sites monitored in 1995 and 1996. The arithmetic means contain error bars representing one standard deviation. The letter dated March 19, 1996, details the Tower Avenue, recreational park and gas station site drainage basins. Gas stations generated the highest metals concentrations while the highest nutrient concentrations did not originate from a consistent source. Winter samples collected from Tower Avenue showed significantly elevated chloride concentrations although the suspended solids concentrations did not greatly increase.

D. Quality assurance and quality control

To examine sample integrity, two field equipment and processing blanks were collected at each site (table 5) in 1996. In all instances, the equipment blank results were less than laboratory detection limits or less than the minimum sample concentration (except chloride).

Duplicate splitter samples, double sets of laboratory bottles filled from the splitter, were processed to determine splitter, preservation, transportation, and laboratory analyses variability (table 6). Duplicate sample coefficients of variation were less than 20% with the exception of dissolved cadmium, lead, phosphorus, and total Kjeldahl -N.

Do not hesitate to call me if you need further assistance.

Sincerely,

Jeffrey Steuer
Hydrologist

cc: John Thomas, MPCA, Duluth, MN

Table 1. … eloped urban site storm statistics.

NDEVELOPED URBAN - 1996

rainage Basin = 76.2 acres

ample Threshold = .10 feet

haded areas are runoff events that overlapped

Bold italicized peaks were overtopping conditions

Sample No.	Rain Start Date/Time	Rain End Date/Time	Rain Duration HH:MM	Total Rain (inches)	Rainfall Intensity (in/hr)	Total Rain Volume (ft^3)	Time First Sample Taken Date/Time	Time Last Sample Taken Date/Time	Sampling Duration HH:MM	Total Runoff Vol. (ft.^3)	Percent Runoff	Peak Discharge (ft.^3/sec)
UND-10	05/15/96 13:40	05/15/96 14:45	01:05	0.11	0.10	30,427	05/15/96 21:01	05/16/96 11:13	14:12	2,151	7%	0.01
UND-11	05/18/96 23:15	05/19/96 03:55	04:40	0.60	0.13	165,964	05/19/96 02:58	05/19/96 05:54	02:56	65,940	33%	***2.2***
	05/21/96 20:30	05/22/96 01:05	04:35	0.12	0.03	33,193						
	06/01/96 08:00	06/01/96 12:05	04:05	0.10	0.02	27,661				No Runoff	0%	
	06/02/96 14:00	06/02/96 15:35	01:35	0.10	0.06	27,661				No Runoff	0%	
UND-12	06/03/96 06:00	06/03/96 10:30	04:30	0.21	0.05	58,087	06/03/96 12:32	06/04/96 01:04	12:32	847	1%	0.01
UND-13	06/05/96 15:45	06/06/96 01:30	09:45	0.58	0.06	160,431	06/06/96 00:21	06/08/96 19:03	66:42	28,581	18%	0.92
	06/12/96 16:00	06/12/96 18:45	02:45	0.12	0.04	33,193				No Runoff	0%	
	06/15/96 13:45	06/16/96 01:10	11:25	0.54	0.05	149,367				4,821	3%	0.04
ND-14,14D	06/21/96 09:50		56:10	0.94	0.02	260,010	06/21/96 12:15	06/22/96 18:42	30:27	42,863	16%	0.36
UND-15		06/23/96 18:00					06/23/96 12:49	06/25/96 09:18	44:29			
UND-16	06/25/96 21:35		14:45	1.06	0.07	293,202	06/26/96 03:20	06/26/96 11:19	07:59	Lost CR-10 power at end of event		
UND-17		06/26/96 12:20					06/26/96 20:36	06/28/96 02:09	29:33	Lost CR-10 power at end of event		
UND-18	No Data						07/11/96 09:17	07/12/96 01:36	16:19	Lost CR-10 power		
UND-19	07/14/96 16:20	07/14/96 16:50	00:30	0.09	0.18	24,895	07/12/96 11:20	07/15/96 00:29	61;09	Combined with 7/11 event;; lost power		
	07/15/96 13:45	07/15/96 15:35	01:50	0.22	0.12	60,853			Combined with previous event			
UND-20	07/18/96 01:20	07/18/96 18:20	17:00	0.39	0.02	107,876	07/18/96 04:48	07/20/96 00:45	43:57	33,083	31%	0.51
UND-21	07/21/96 21:45	07/21/96 22:25	00:40	0.73	1.10	201,922	07/21/96 22:11	07/25/96 16:40	90:29	104,138	35%	***3.3***
	07/23/96 12:50	07/24/96 22:05	33:15	0.34	0.01	94,046						
	07/27/96 12:40	07/27/96 20:15	07:35	0.10	0.01	27,661				3,879	11%	0.02
	07/29/96 05:00	07/29/96 21:35	16:35	0.03	0.00	8,298						
UND-22	08/04/96 16:00	08/05/96 13:25	21:25	0.65	0.03	179,794	08/05/96 09:33	08/06/96 03:43	18:10	6,143	3%	0.10
	08/07/96 00:25	08/07/96 02:30	02:05	0.86	0.41	237,881				96,751	41%	***4.1***
	08/13/96 08:45	08/13/96 10:35	01:50	0.02	0.01	5,532				No Runoff	0%	
	08/19/96 09:05	08/19/96 21:20	12:15	0.10	0.01	27,661				No Runoff	0%	
	08/21/96 23:50	08/22/96 01:30	01:40	0.05	0.03	13,830				No Runoff	0%	
UND-23	09/02/96 09:40	09/02/96 20:15	10:35	1.78	0.17	492,359	09/02/96 17:43	09/03/96 10:06	16:23	57,828	9%	1.1
UND-24	09/03/96 20:20	09/03/96 23:30	03:10	0.47	0.15	130,005	09/03/96 21:53	09/05/96 11:16	37:23			
	09/07/96 17:45	09/07/96 20:10	02:25	0.06	0.02	16,596				No Runoff	0%	
	09/10/96 10:05	09/10/96 11:30	01:25	0.17	0.12	47,023				657	0%	0.01
	09/21/96 15:25	09/22/96 17:00	25:35	0.29	0.18	80,216				No Runoff	0%	
Medians			04:30	0.22	0.05	59,470			29:33	2,151	3%	**0.36**

Table 2. ' urse site storm statistics.

OLF COURSE - 1996
rainage Basin = 11.8 acres
ample Threshold = .10 feet
haded areas are runoff events that overlapped

Bold italicized peaks were overtopping conditions

Sample No.	Rain Start Date/Time	Rain End Date/Time	Rain Duration HH:MM	Total Rain (inches)	Rainfall Intensity (in/hr)	Total Rain Volume (ft^3)	Time First Sample Taken Date/Time	Time Last Sample Taken Date/Time	Sampling Duration HH:MM	Total Runoff Vol. (ft.^3)	Percent Runoff	Peak Discharge (ft.^3/sec)
	06/01/96 08:00	06/01/96 12:05	04:05	0.10	0.02	4,283				No Runoff	0%	
	06/02/96 14:00	06/02/96 15:35	01:35	0.10	0.06	4,283				No Runoff	0%	
	06/03/96 06:00	06/03/96 10:30	04:30	0.21	0.05	8,995				No Runoff	0%	
GLF-8	06/05/96 15:00	06/06/96 17:35	26:35	0.58	0.02	24,844	06/05/96 23:51	06/06/96 06:37	06:46	7,422	30%	0.91
	06/12/96 16:00	06/12/96 18:45	02:45	0.12	0.04	5,140				No Runoff	0%	
	06/15/96 13:45	06/16/96 00:10	10:25	0.54	0.05	23,130				1,503	6%	0.08
GLF-9,9D	06/21/96 09:50	06/21/96 15:40	05:50	0.58	0.10	24,844	06/21/96 11:24	06/21/96 22:03	10:39	6,817	27%	0.61
GLF-10	06/23/96 10:00	06/23/96 18:00	08:00	0.36	0.05	15,420	06/23/96 13:42	06/24/96 07:04	17:22	6,653	43%	0.22
GLF-11	06/25/96 21:35	06/26/96 12:20	14:45	1.07	0.07	45,832	06/26/96 03:15	06/26/96 09:49	06:34	40,660	89%	***1.5***
GLF-12							06/26/96 16:51	06/27/96 09:34	16:43			
GLF-13	Undeveloped Lost Power - Missing Precipitation Data						07/11/96 08:31	07/11/96 15:49	07:18	13,288		1.2
GLF-14	Undeveloped Lost Power - Missing Precipitation Data						07/12/96 12:02	07/13/96 00:57	12:55	36,072		***3.1***
GLF-15	07/14/96 16:20	07/14/96 16:50	00:30	0.09	0.18	3,855	07/14/96 18:26	One Subsample		12,787	96%	1.11
GLF-16	07/15/96 13:45	07/15/96 15:35	01:50	0.22	0.12	9,423	07/15/96 14:28	07/16/96 07:39	17:11			
GLF-17	07/18/96 01:20	07/18/96 18:20	17:00	0.39	0.02	16,705	07/18/96 03:06	07/18/96 11:50	08:44	13,582	81%	0.94
GLF-18	07/21/96 21:45	07/21/96 22:25	00:40	0.73	1.10	31,269	07/21/96 22:10	07/22/96 04:15	06:05	27,199	87%	***3.7***
GLF-19							07/22/96 09:14	07/22/96 13:21	04:07			
GLF-20	07/23/96 12:50	07/24/96 22:05	33:15	0.34	0.01	14,564	07/23/96 22:04	One Subsample		6,696	46%	0.12
GLF-21							07/24/96 15:43	07/25/96 07:02	15:19			
	07/27/96 12:40	07/27/96 20:15	07:35	0.10	0.01	4,283				No Runoff	0%	
	07/29/96 05:00	07/29/96 21:35	16:35	0.03	0.00	1,285				No Runoff	0%	
GLF-22	08/04/96 16:00	08/05/96 13:25	21:25	0.65	0.03	27,842	08/05/96 11:02	08/05/96 18:03	07:01	4,337	16%	0.44
	08/07/96 00:25	08/07/96 02:30	02:05	0.86	0.41	36,837				32,460	88%	***4.8***
	08/13/96 08:45	08/13/96 10:35	01:50	0.02	0.01	857				No Runoff	0%	
	08/19/96 09:05	08/19/96 21:20	12:15	0.10	0.01	4,283				No Runoff	0%	
	08/21/96 23:50	08/22/96 01:30	01:40	0.05	0.03	2,142				No Runoff	0%	
GLF-23	09/02/96 09:40	09/02/96 20:15	10:35	1.78	0.17	76,245	09/02/96 10:24	09/03/96 08:55	22:31	26,991	35%	***3.5***
GLF-24	09/03/96 20:20	09/03/96 23:30	03:10	0.47	0.15	20,132	09/03/96 21:45	09/04/96 09:52	12:07	11,966	59%	***1.5***
	09/07/96 17:45	09/07/96 20:10	02:25	0.06	0.02	2,570				No Runoff	0%	
	09/10/96 10:05	09/10/96 11:30	01:25	0.17	0.12	7,282				No Runoff	0%	
	09/21/96 15:25	09/22/96 17:30	26:05	0.29	0.14	12,422				2,454	20%	0.08
Medians			5:10	0.26	0.05	10,923			10:39	4,337	16%	**1.03**

Table ´ ıdeveloped urban site constituent concentrations.

Bold Italics signifies samples from same runoff event	DATE	TIME	CONDUCTIVITY UMHOS/CM	pH lab standards	COD LOW LEVEL MG/L	DISSOLVED COD COLORIMETRIC MG/L	5 DAY BOD MG/L	DISSOLVED 5 DAY BOD MG/L	FECAL COLIFORM COLS./100ML	TOTAL RECOVERABLE HARDNESS MG/L	DISSOLVED HARDNESS MG/L	TOTAL CALCIUM MG/L	DISSOLVED CALCIUM MG/L	CHLORIDE DISSOLVED MG/L
Watstore Codes			00095	00403	00335	99901	310	99900	31625	99908	99907	916	915	940
UNDEVELOPED														
URBAN														
UND-1	07/04/95	00:45	187	7.87	45	55				100		23		0.9
UND-2	07/05/95	11:26	167	7.96	66	69			470					1.7
UND-3	07/10/95	03:50	182	8.15	80	67	25	24	680	98		23		1.2
UND-4	07/13/95	07:35	199	8.25	70	62	16	>20	2,100	100		25		0.8
UND-5	08/06/95	13:00	297	7.59	100	91	37	>19	2,500					9
UND-6	08/09/95	03:29	235	7.99	240	190	>52	>19	4,200	120	120	30	29	2.6
UND-7	08/12/95	20:35	199	8.2	58	58	14	14	5,900	100	110	25	26	2.8
UND-8	08/13/95	23:43	223	8.22	64	52	24	20	450	110	110	28	27	2.1
UND-8D	08/13/95	23:44			66	55	12	14		110		27		
UND-10	05/15/96	21:01												
UND-11	05/19/96	02:58												
UND-12	06/03/96	12:32												
UND -13	06/06/96	00:21	156	7.95	45		<3.0			87	86	20	20	1.3
UND-14	06/21/96	12:15	182	7.91	43	40	<3.0	<3.0		100	99	23	23	1.5
UND-14D	06/21/96	12:16	183	7.87	46	43	<3.0	<3.0		100	99	23	23	1.6
UND-15	06/23/96	12:49	167	7.96	40	55	<3.0	<3.0		94		22		1.6
UND-15D	06/23/96	12:50	166	8.1	45	61	<3.0	<3.0		93		21		1.6
UND-16	***06/26/96***	***03:20***	112	7.65	63	54	3.7	<3.0		67	61	15	14	2.4
UND-17	***06/26/96***	***20:36***	126	7.63	58	56				72	69	16	16	1.9
UND-18	***07/11/96***	***09:17***												
UND-19	***07/12/96***	***11:20***												
UND-20	07/18/96	04:48												
UND-21	07/27/96	22:11												
UND-22	08/05/96	09:33												
UND-23	09/02/96	17:43	130	7.59	42	51	3.5	2						2.6
UND-24	09/05/96	21:53												
1996														
MEAN			**153**	**7.8**	**48**	**51**				**88**	**83**	**20**	**19**	**1.8**
MEDIAN			**161**	**7.9**	**45**	**54**	**<3.0**	**<3.0**		**93**	**86**	**21**	**20**	**1.6**
STD. DEVIATION			**26.9**	**0.2**	**8.2**	**7.5**				**13.2**	**17.3**	**3.3**	**4.1**	**0.5**
1995-1996														
MEAN			182	7.9	69	66			2,329	97	94	23	22	2.2
MEDIAN			182	8.0	58	56	12	14	2,100	100	99	23	23	1.7
STD. DEVIATION			45.0	0.2	46.9	35.0			2,083	14.0	20.8	4.2	5.3	1.9

Table : developed urban site constituent concentrations.

Bold Italics signifies sampl	DATE	TOTAL RECOVERABLE MAGNESIUM	DISSOLVED MAGNESIUM	ALKALINITY	SULFATE	TOTAL SOLIDS	SUSPENDED SOLIDS	NITRATE PLUS NITRITE-N	AMMONIA-N	TOTAL KJELDAHL NITROGEN	DISSOLVED KJELDAHL NITROGEN	TOTAL PHOSPHORUS	DISSOLVED PHOSPHORUS	ARSENIC
		MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L AS P	MG/L AS P	UG/L
Watstore Codes		921	925	417	946	530	500	631	608	625	623	665	671	99910
UNDEVELOPED														
URBAN														
UND-1	07/04/95	10		86	12	200	27	0.038	<0.027	1.2	0.9	0.085		<0.6
UND-2	07/05/95			78	12	210	9	<0.010	<0.027	1.1	1	0.087		
UND-3	07/10/95	10		90	10	194	15	<0.010	<0.027	1	0.8	0.05	0.007	
UND-4	07/13/95	10		101	7	202	16	<0.010	<0.027	1	0.9	0.053	0.007	
UND-5	08/06/95			122	26	548		0.117	0.041	2.7	1.1	0.391	0.093	
UND-6	08/09/95	12	11	112	10	204	12	0.027	<0.027	1.2	0.8	0.101	0.026	
UND-7	08/12/95	10	10	97	8			<0.010	<0.027	1.1	0.8	0.084	0.01	
UND-8	08/13/95	11	11	111	8			<0.010	0.03	3.8	0.8	0.124	0.01	
UND-8D	08/13/95	11						0.025	<0.027	1	0.9	0.064	0.012	
UND-10	05/15/96					148	<4.88					0.022		
UND-11	05/19/96					268	48					0.148	0.008	
UND-12	06/03/96					174	8					0.032	0.003	
UND -13	06/06/96	9.2	8.5	79	10	156	16	0.028	<0.027			0.026	0.005	
UND-14	06/21/96	10	9.8	92	8	180	15	<0.01	0.009	0.9	0.7	0.053	0.004	
UND-14D	06/21/96	10	9.9	92	8	174	14	<0.01	0.01	0.9	0.7	0.057	0.011	
UND-15	06/23/96	9.7		85	9	188	12	<0.01	<0.027	1	1.2	0.056	0.008	
UND-15D	06/23/96	9.6		85	9	182	10	<0.01	<0.027	1	1.1	0.053	0.007	
UND-16	***06/26/96***	7.3	6	55	12	222	49	<0.01	<0.027	1.4	1.4	0.119	0.011	
UND-17	***06/26/96***	7.5	6.9	62	11	196	12	<0.01	0.037	1.3	1.3	0.07	0.008	
UND-18	***07/11/96***					168	28						0.002	
UND-19	***07/12/96***					164	<4.88						0.004	
UND-20	07/18/96					182	9					0.036	0.003	
UND-21	07/27/96					156	24					0.068	0.001	
UND-22	08/05/96					196	7					0.049	0.007	
UND-23	09/02/96			45	18	184		0.058	<0.027	1.13	0.95	0.105	0.019	
UND-24	09/05/96					172	18					0.081	0.009	
1996														
MEAN		9	8	74	11	183	18			1.1	1.1	0.065	0.007	
MEDIAN		10	9	82	10	180	14	<0.010	<0.027	1.0	1.1	0.056	0.007	
STD. DEVIATION		1.2	1.7	18.0	3.3	28.1	13.7			0.2	0.3	0.036	0.004	
1995-1996														
MEAN		10	9	87	11	203	18			1.4	1.0	0.084	0.012	
MEDIAN		10	10	88	10	184	15	<0.010	<0.027	1.1	0.9	0.066	0.008	
STD. DEVIATION		1.2	1.9	20.6	4.8	79.4	12.2			0.8	0.2	0.073	0.019	

Table 3 developed urban site constituent concentrations.

		TOTAL RECOVERABLE CADMIUM	DISSOLVED CADMIUM	TOTAL RECOVERABLE COPPER	DISSOLVED COPPER	TOTAL RECOVERABLE LEAD	DISSOLVED LEAD	TOTAL RECOVERABLE SILVER	TOTAL RECOVERABLE ZINC	DISSOLVED ZINC
Bold italics signifies sampl	DATE	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
Watstore Codes		1113	1025	1119	1040	1114	1049	1079	1094	1090
UNDEVELOPED										
URBAN										
UND-1	07/04/95	<0.04		5		1.3		<0.2	<19	
UND-2	07/05/95									
UND-3	07/10/95									
UND-4	07/13/95									
UND-5	08/06/95									
UND-6	08/09/95									
UND-7	08/12/95									
UND-8	08/13/95									
UND-8D	08/13/95									
UND-10	05/15/96									
UND-11	05/19/96									
UND-12	06/03/96									
UND -13	06/06/96	<0.04	<0.02	4	4	1.6	0.4		<19	<8
UND-14	06/21/96			3	2.8	<0.8	<0.4		<19	<8
UND-14D	06/21/96			3	2.9	<0.8	<0.4		<19	<8
UND-15	06/23/96			4		<0.8			<19	
UND-15D	06/23/96			4		1.1			<19	
UND-16	***06/26/96***			6	3.2	1.3	1.3		<19	<8
UND-17	***06/26/96***			5	3.3	<0.8	1		<19	<8
UND-18	***07/11/96***									
UND-19	***07/12/96***									
UND-20	07/18/96									
UND-21	07/27/96									
UND-22	08/05/96									
UND-23	09/02/96									
UND-24	09/05/96									
1996										
MEAN				4	3					
MEDIAN				4	3	<0.8	0.4		<19	<8
STD. DEVIATION				1.1	0.5					
1995-1996										
MEAN				4	3					
MEDIAN				4	3	0.9	0.4		<19	<8
STD. DEVIATION				1.0	0.5					

Table 3' [illegible]f course site constituent concentrations.

Bold italics signifies samples from same runoff event	DATE	TIME	CONDUCTIVITY UMHOS/CM	pH lab standards	COD LOW LEVEL MG/L	DISSOLVED COD COLORIMETRIC MG/L	5 DAY BOD MG/L	DISSOLVED 5 DAY BOD MG/L	FECAL COLIFORM COLS./100ML	TOTAL RECOVERABLE HARDNESS MG/L	DISSOLVED HARDNESS MG/L	TOTAL CALCIUM MG/L	DISSOLVED CALCIUM MG/L	CHLORIDE DISSOLVED MG/L
Natstore Codes			00095	00403	00335	99901	310	99900	31625	99908	99907	916	915	940
GOLF														
COURSE														
GLF-1	07/03/95	22:46	164	7.57	50	52				80		18		3.9
GLF-2	07/05/95	13:05	195	7.85	78	81								3.8
GLF-3	07/13/95	07:06	136	7.62	130	110	50	>19		66		16		3.1
GLF-4	08/06/95	11:13	206	7.16	240	170	>82	>19	10,000					4.2
GLF-5	08/09/95	02:38	136	7.24	92	100	33	26	2,400	62	47	14	11	3.6
GLF-6	08/12/95	20:06	173	7.61	74	80	25	23	660	81	80	17	17	3.5
GLF-7	08/13/95	21:22			130	130	22	19	140	110	110	26	26	
GLF-8	06/06/96	23:51	141	7.56	64	46	12.4	5.4		60	57	14	14	4.7
GLF-9	6/21/96	11:24	172	7.24	82	63	10.8	4.6		82	78	20	20	4
GLF-9D	6/21/96	11:25	171	7.42	110	60	11.7	3.2		82	80	20	20	3.9
GLF-10	6/23/96	13:41	190	7.46	95	88	8.2	4.5		96	95	23	23	4.4
GLF-10D	6/23/96	13:42	189	7.62	96	92	8.7	4.9		97		24		4.5
GLF-11	***6/26/96***	***3:15***	127	7.72	83	70	10.5	5.6		67	63	16	16	3.8
GLF-12	***6/26/96***	***16:51***	212	7.97	65	61	4.7	4		110	110	26	26	3.6
GLF-13	***7/11/96***	***8:31***												
GLF-14	***7/13/96***	***12:02***												
GLF-15	7/14/96	18:26												
GLF-16	7/15/96	14:28												
GLF-17	7/18/96	3:06												
GLF-18	***7/21/96***	***22:00***												
GLF-19	***7/22/96***	***9:14***												
GLF-20	7/23/96	22:04												
GLF-21	7/24/96	15:43												
GLF-22	8/5/96	11:02												
GLF-23	9/2/96	10:24	168	7.65	50	35	5.3	2.5		77	77	19	19	2
GLF-24	9/3/96	21:45												
1996														
MEAN			171	7.6	81	64	9	4		84	80	20	20	3.9
MEDIAN			172	7.6	83	62	10	5		82	78	20	20	4.0
STD. DEVIATION			27.3	0.2	19.9	19.2	2.9	1.1		16.5	18.1	4.0	4.0	0.8
1995-1996														
MEAN			170	7.5	96	83	22	11	3,300	82	80	19	19	3.8
MEDIAN			172	7.6	83	80	12	5	1,530	81	79	19	20	3.9
STD. DEVIATION			27.0	0.2	46.8	35.0	22.2	8.8	4,570	16.8	20.9	4.2	4.9	0.7

Table : .lf course site constituent concentrations.

		TOTAL						NITRATE		TOTAL	DISSOLVED			
Bold italics signifies sampl		RECOVERABLE	DISSOLVED			TOTAL	SUSPENDED	PLUS		KJELDAHL	KJELDAHL	TOTAL	DISSOLVED	
	.	MAGNESIUM	MAGNESIUM	ALKALINITY	SULFATE	SOLIDS	SOLIDS	NITRITE-N	AMMONIA-N	NITROGEN	NITROGEN	PHOSPHORUS	PHOSPHORUS	ARSENIC
	DATE	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L AS P	MG/L AS P	UG/L
Watstore Codes		921	925	417	946	530	500	631	608	625	623	665	671	99910
GOLF														
COURSE														
GLF-1	07/03/95	9		69	8	216	54	0.186	0.327	2.9	2.3	0.313		1.5
GLF-2	07/05/95			88	10	194	19.5	0.035	0.038	1.9	1.5	0.118		
GLF-3	07/13/95	6		54	11	248	76	0.233	0.144	3.4	2.2	0.326	0.038	
GLF-4	08/06/95			84	17			0.127	0.243	6.6	2.3	0.787	0.089	
GLF-5	08/09/95	7	4.7	53	11	168	48	0.121	0.054	2.4	1.4	0.267	0.003	
GLF-6	08/12/95	9	9.1	71	12			0.06	0.041	1.9	1.3	0.231	0.058	
GLF-7	08/13/95	11	11					<.010	0.074	3.8	3.1	0.196	0.023	
GLF-8	06/06/96	5.8	5.1	55	11	190	55	0.178	1.27	4.9	6.85	0.584	0.57	
GLF-9	6/21/96	7.9	7.1	69	13	212	54	0.111	0.28	3	2.1	0.382	0.101	
GLF-9D	6/21/96	7.9	7.3	69	14	224	70	0.091	0.27	3.3	2.1	0.405	0.102	
GLF-10	6/23/96	9.3	9	83	13	224	28	0.037	0.04	2.6	2.4	0.205	0.026	
GLF-10D	6/23/96	9.4		83	14	222	23	0.037	0.037	3.2	2.6	0.202	0.009	
GLF-11	***6/26/96***	6.2	5.6	54	11	186	33	0.033	0.081	2.6	2.6	0.194	0.024	
GLF-12	***6/26/96***	11	11	99	12	216	15	0.021	0.032	1.9	2	0.117	0.021	
GLF-13	***7/11/96***					156	23						0.002	
GLF-14	***7/13/96***					206	7						0.016	
GLF-15	7/14/96					276	15						0.02	
GLF-16	7/15/96					214	35						0.049	
GLF-17	7/18/96					184	16					0.209	0.058	
GLF-18	***7/21/96***					148	40					0.264	0.008	
GLF-19	***7/22/96***					194	11					0.109	0.004	
GLF-20	7/23/96					230	11							
GLF-21	7/24/96					260	13					0.189	0.024	
GLF-22	8/5/96					184	16					0.364	0.158	
GLF-23	9/2/96	7.3	7	71	12	NA	NA	0.161	0.093	1.68	1.21	0.183	0.071	
GLF-24	9/3/96					158	12.5	0.066	0.164	2.13	1.93	0.16	0.049	
1996														
MEAN		8.1	7.4	72.9	12.5	205	26	0.082	0.252	2.8	2.6	0.255	0.073	
MEDIAN		7.9	7.1	70.0	12.5	209	20	0.066	0.093	2.6	2.1	0.204	0.025	
STD. DEVIATION		1.7	2.0	15.1	1.2	33.8	18.0	0.058	0.394	1.0	1.6	0.133	0.131	
1995-1996														
MEAN		8.2	7.7	71.6	12.1	205	31	0.094	0.199	3.0	2.4	0.276	0.066	
MEDIAN		7.9	7.2	70.0	12.0	209	23	0.079	0.087	2.8	2.2	0.209	0.026	
STD. DEVIATION		1.7	2.3	14.4	2.1	33.0	20.5	0.068	0.303	1.3	1.3	0.163	0.117	

Table ? lf course site constituent concentrations.

		TOTAL RECOVERABLE CADMIUM	DISSOLVED CADMIUM	TOTAL RECOVERABLE COPPER	DISSOLVED COPPER	TOTAL RECOVERABLE LEAD	DISSOLVED LEAD	TOTAL RECOVERABLE SILVER	TOTAL RECOVERABLE ZINC	DISSOLVED ZINC
Bold italics signifies sampl	DATE	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
Watstore Codes		1113	1025	1119	1040	1114	1049	1079	1094	1090
GOLF COURSE										
GLF-1	07/03/95	0.05		6		2.8		<0.2	33	
GLF-2	07/05/95									
GLF-3	07/13/95									
GLF-4	08/06/95									
GLF-5	08/09/95									
GLF-6	08/12/95									
GLF-7	08/13/95									
GLF-8	06/06/96			8	4.9	2.1	0.6		51	29
GLF-9	6/21/96			7	5.8	0.9	<0.4		72	36
GLF-9D	6/21/96			8	5.9	1.3	0.8		80	38
GLF-10	6/23/96			5	4.4	<0.8	0.8		52	35
GLF-10D	6/23/96			6		<0.8			56	
GLF-11	***6/26/96***			6	4	<0.8	<0.4		45	18
GLF-12	***6/26/96***			7	5.4	<0.8	0.6		62	45
GLF-13	***7/11/96***									
GLF-14	***7/13/96***									
GLF-15	7/14/96									
GLF-16	7/15/96									
GLF-17	7/18/96									
GLF-18	***7/21/96***									
GLF-19	***7/22/96***									
GLF-20	7/23/96									
GLF-21	7/24/96									
GLF-22	8/5/96									
GLF-23	9/2/96			6	3.6	2.2	<0.4		21	15
GLF-24	9/3/96									
1996										
MEAN				7	5				55	31
MEDIAN				7	5	<.8	0.7		54	35
STD. DEVIATION				1.1	0.9				17.9	10.9
1995-1996										
MEAN				7	5				52	31
MEDIAN				6	5	0.9	0.7		52	35
STD. DEVIATION				1.0	0.9				18.3	10.9

Table 4ɐ 'ɘveloped urban site constituent loadings.

LOADS	DATE	COD LOW LEVEL	DISSOLVED COD COLORIMETRIC	5 DAY BOD	DISSOLVED 5 DAY BOD	TOTAL CALCIUM	DISSOLVED CALCIUM	DISSOLVED CHLORIDE	TOTAL RECOVERABLE MAGNESIUM	DISSOLVED MAGNESIUM	SULFATE	TOTAL SOLIDS	SUSPENDED SOLIDS	NITRATE PLUS NITRITE-N
		KG	KG	KG	KG	KG	KG	KG	KG	KG	KG	KG	KG	KG
Watstore Codes		00335	99901	00310	99900	916	915	940	921	925	946	530	500	631
UNDEVELOPED														
URBAN														
UND-1	07/04/95	14.0	17.1			7.1		0.3	3.1		3.7	62	8	0.012
UND-2	07/05/95	55.3	57.9					1.4			10.1	176	6	
UND-3	07/10/95	24.6	20.6	7.7	7.4	7.1		0.4	3.1		3.1	60	5	
UND-4	07/13/95	19.5	17.3	4.5		7.0		0.2	2.8		1.9	56	4	
UND-5	08/06/95													
UND-6	08/09/95	20.4	16.2			2.6	2.5	0.2	1.0	0.9	0.9	17	1	0.002
UND-7	08/12/95	7.7	7.7	1.9	1.9	3.3	3.5	0.4	1.3	1.3	1.1			
UND-8	08/13/95	7.5	6.1	2.8	2.3	3.3	3.2	0.2	1.3	1.3	0.9			
UND-8D	08/13/95	7.7	6.4	1.4	1.6	3.2			1.3					0.003
UND-10	05/15/96											9		
UND-11	05/19/96											491	88	
UND-12	06/03/96											4		
UND -13	06/06/96	36.4		<2.4		16.2	16.2	1.1	7.4	6.9	8.1	126	13	0.023
UND-14	06/21/96	18.9	17.6	<1.3	<1.3	10.1	10.1	0.7	4.4	4.3	3.5	79	7	<.004
UND-14D	06/21/96	20.2	18.9	<1.3	<1.3	10.1	10.1	0.7	4.4	4.4	3.5	76	6	<.004
UND-15	06/23/96	30.9	42.5	<2.3	<2.3	17.0		1.2	7.5		7.0	145	9	<.008
UND-15D	06/23/96	34.8	47.2	<2.3	<2.3	16.2		1.2	7.4		7.0	141	8	<.008
UND-16	06/26/96	79.2	67.9	4.6	<3.8	18.8	17.6	3.0	9.2	7.5	15.1	279	62	<.013
UND-17	06/26/96	57.9	55.9			16.0	16.0	1.9	7.5	6.9	11.0	196	12	<.010
UND-18	07/11/96													
UND-19	07/12/96											242	<7.2	
UND-20	07/18/96											170	8	
UND-21	07/27/96											460	71	
UND-22	08/05/96											34	1	
UND-23	09/02/96	23.3	28.2	1.9	1.1			1.4			10.0	102		0.032
UND-24	09/05/96											186	19	
1996														
MEAN		38	40			14.9	14.0	1.4	6.8	6.0	8.1	171	24	
MEDIAN		33	43	<2.3	<2.3	16.2	16.0	1.2	7.4	6.9	7.5	143	9	<.009
STD. DEVIATION		20.9	19.0			3.4	3.6	0.8	1.8	1.5	3.9	142	29	
1995-1996 MEAN		29.2	28.5			9.9	9.9	1.0	4.4	4.2	5.8	148	19	
MEDIAN		21.8	18.9	<2.3	<2.3	8.6	10.1	0.7	3.8	4.3	3.7	126	8	<.008
STD. DEVIATION		20.2	20.4			5.9	6.3	0.8	2.9	2.7	4.3	133	26	

Table 4 Undeveloped urban site constituent loadings.

LOADS			TOTAL	DISSOLVED			TOTAL		TOTAL		TOTAL	
			KJELDAHL	KJELDAHL	TOTAL	DISSOLVED	RECOVERABLE	DISSOLVED	RECOVERABLE	DISSOLVED	RECOVERABLE	DISSOLVED
		AMMONIA-N	NITROGEN	NITROGEN	PHOSPHORUS	PHOSPHORUS	COPPER	COPPER	LEAD	LEAD	ZINC	ZINC
	DATE	KG	KG	KG	KG	KG	Grams	Grams	Grams	Grams	Grams	Grams
Watstore Codes		608	625	623	665	671	1119	1040	1114	1049	1094	1090
UNDEVELOPED												
URBAN												
UND-1	07/04/95		0.373	0.280	0.026		1.6		0.4		<5.9	
UND-2	07/05/95		0.922	0.838	0.073							
UND-3	07/10/95		0.307	0.246	0.015	0.002						
UND-4	07/13/95		0.278	0.250	0.015	0.002						
UND-5	08/06/95											
UND-6	08/09/95		0.102	0.068	0.009	0.002						
UND-7	08/12/95		0.147	0.107	0.011	0.001						
UND-8	08/13/95	0.004	0.445	0.094	0.015	0.001						
UND-6D	08/13/95		0.117	0.105	0.007	0.001						
UND-10	05/15/96				0.001							
UND-11	05/19/96				0.271	0.015						
UND-12	06/03/96				0.001	0.0001						
UND -13	06/06/96	<.022			0.021	0.004	3.2	3.2	1.3	0.3	<15.4	<6.5
UND-14	06/21/96	0.004	0.396	0.308	0.023	0.002	1.3	1.2	<.4	<.2	<8.4	<3.5
UND-14D	06/21/96	0.004	0.396	0.308	0.025	0.005	1.3	1.3	<.4	<.2	<8.4	<3.5
UND-15	06/23/96	<.021	0.773	0.928	0.043	0.006	3.1		<.6		<14.7	
UND-15D	06/23/96	<.021	0.773	0.851	0.041	0.005	3.1		0.9		<14.7	
UND-16	06/26/96	<.034	1.759	1.759	0.150	0.014	7.5	4.0	1.6	1.6	<23.9	<10.1
UND-17	06/26/96	0.037	1.297	1.297	0.070	0.008	5.0	3.3	<.8	1.0	<19.0	<8.0
UND-18	07/11/96											
UND-19	07/12/96					0.006						
UND-20	07/18/96				0.034	0.003						
UND-21	07/27/96				0.200	0.003						
UND-22	08/05/96				0.009	0.001						
UND-23	09/02/96	<.015	0.626	0.526	0.058	0.011						
UND-24	09/05/96				0.088	0.010						
1996												
MEAN			0.860	0.854	0.069	0.006	3.5	2.6				
MEDIAN		<.021	0.773	0.851	0.041	0.005	3.1	3.2	<.8	0.3	<14.7	<6.5
STD. DEVIATION			0.500	0.536	0.079	0.004	2.2	1.3				
1995-1996 MEAN			0.581	0.531	0.052	0.005	3.3	2.6				
MEDIAN		<.021	0.396	0.308	0.025	0.003	3.1	3.2	0.4	0.3	<14.7	<6.5
STD. DEVIATION			0.465	0.503	0.068	0.004	2.1	1.3				

Table 4 [illegible] f course site constituent loadings.

LOADS	DATE	COD LOW LEVEL	DISSOLVED COD COLORIMETRIC	5 DAY BOD	DISSOLVED 5 DAY BOD	TOTAL CALCIUM	DISSOLVED CALCIUM	DISSOLVED CHLORIDE	TOTAL RECOVERABLE MAGNESIUM	DISSOLVED MAGNESIUM	SULFATE	TOTAL SOLIDS	SUSPENDED SOLIDS	NITRATE PLUS NITRITE-N
		KG	KG	KG	KG	KG	KG	KG	KG	KG	KG	KG	KG	KG
Watstore Codes		00335	99901	00310	99900	916	915	940	921	925	946	530	500	631
Golf Course														
GLF-1	07/03/95	26.4	27.5			9.5		2.1	4.8		4.2	114	29	0.098
GLF-2	07/05/95	18.7	19.4					0.9			2.4	47	5	0.008
GLF-3	07/13/95	18.9	16.0	7.3	>2.8	2.3		0.4	0.9		1.6	36	11	0.034
GLF-4	08/06/95	19.4	13.8	>6.6	>1.5			0.3			1.4			0.010
GLF-5	08/09/95	30.9	33.6	11.1	8.7	4.7	3.7	1.2	2.4	1.6	3.7	56	16	0.041
GLF-6	08/12/95	12.8	13.8	4.3	4.0	2.9	2.9	0.6	1.6	1.6	2.1			0.010
GLF-7	08/13/95	17.1	17.1	2.9	2.5	3.4	3.4		1.4	1.4				<.001
GLF-8	06/06/96	13.4	9.7	2.6	1.1	2.9	2.9	1.0	1.2	1.1	2.3	40	12	0.037
GLF-9	6/21/98	15.8	12.2	2.1	0.9	3.9	3.9	0.8	1.5	1.4	2.5	41	10	0.021
GLF-9D	6/21/96	21.2	11.6	2.3	0.6	3.9	3.9	0.8	1.5	1.4	2.7	43	14	0.018
GLF-10	6/23/96	17.9	16.6	1.5	0.8	4.3	4.3	0.8	1.8	1.7	2.4	42	5	0.007
GLF-10D	6/23/96	18.1	17.3	1.6	0.9	4.5		0.8	1.8		2.6	42	4	0.007
GLF11,12 event load	6/26/96	87.7	76.6	9.6	5.8	22.7	22.7	4.3	9.2	8.8	13.1	227	30	0.033
GLF13,14 event load	7/11/96											247	23	
GLF-15	7/14/96											14	1	
GLF-16	7/15/96											67	11	
GLF-17	7/18/96											71	6	
GLF-18	7/21/96											93	25	
GLF-19	7/22/96											27	2	
GLF-20	7/23/96											1	0.1	
GLF-21	7/24/96											48	2	
GLF-22	8/5/96											23	2	
GLF-23	9/2/96	38.2	26.7	4.0	1.9	14.5	14.5	1.5	5.6	5.3	9.2			0.123
GLF-24	9/3/96											54	4	0.022
1996														
MEAN		**33.1**	**26.8**	**3.8**	**1.8**	**9.0**	**9.9**	**1.5**	**3.6**	**3.7**	**5.4**	**69**	**9**	**0.033**
MEDIAN		**19.6**	**16.9**	**2.2**	**0.9**	**4.4**	**4.3**	**0.8**	**1.8**	**1.7**	**2.7**	**43**	**5**	**0.021**
STD. DEVIATION		**27.9**	**25.0**	**3.1**	**2.0**	**7.9**	**8.5**	**1.4**	**3.2**	**3.3**	**4.6**	**72**	**10**	**0.041**
1995-1996 MEAN		**25.5**	**22.3**	**4.7**	**2.6**	**6.6**	**6.9**	**1.2**	**2.8**	**2.7**	**3.9**	**67**	**11**	**0.032**
MEDIAN		**18.8**	**16.8**	**3.5**	**1.7**	**4.1**	**3.9**	**0.8**	**1.7**	**1.6**	**2.5**	**45**	**8**	**0.021**
STD. DEVIATION		**19.2**	**17.1**	**3.2**	**2.4**	**6.1**	**7.0**	**1.0**	**2.5**	**2.6**	**3.4**	**64**	**9**	**0.034**

Table ʻ 'f course site constituent loadings.

LOADS			TOTAL	DISSOLVED			TOTAL		TOTAL		TOTAL	
			KJELDAHL	KJELDAHL	TOTAL	DISSOLVED	RECOVERABLE	DISSOLVED	RECOVERABLE	DISSOLVED	RECOVERABLE	DISSOLVED
		AMMONIA-N	NITROGEN	NITROGEN	PHOSPHORUS	PHOSPHORUS	COPPER	COPPER	LEAD	LEAD	ZINC	ZINC
	DATE	KG	KG	KG	KG	KG	Grams	Grams	Grams	Grams	Grams	Grams
Watstore Codes		608	625	623	665	671	1119	1040	1114	1049	1094	1090
Golf Course												
GLF-1	07/03/95	0.173	1.5	1.2	0.165		3.2		1.5	-	17.4	
GLF-2	07/05/95	0.009	0.5	0.4	0.028							
GLF-3	07/13/95	0.021	0.5	0.3	0.047	0.006						
GLF-4	08/06/95	0.020	0.5	0.2	0.064	0.007						
GLF-5	08/09/95	0.018	0.8	0.5	0.090	0.001						
GLF-6	08/12/95	0.007	0.3	0.2	0.040	0.010						
GLF-7	08/13/95	0.010	0.5	0.4	0.026	0.003						
GLF-8	06/06/96	0.267	1.0	1.4	0.123	0.120	1.7	1.0	0.4	0.1	10.7	6.1
GLF-9	6/21/96	0.054	0.6	0.4	0.074	0.019	1.4	1.1	0.2	<.1	13.9	6.9
GLF-9D	6/21/96	0.052	0.6	0.4	0.078	0.020	1.5	1.1	0.3	0.2	15.4	7.3
GLF-10	6/23/96	0.008	0.5	0.5	0.039	0.005	0.9	0.8	<.2	0.2	9.8	6.6
GLF-10D	6/23/96	0.007	0.6	0.5	0.038	0.002	1.1		<.2		10.5	
GLF11,12 event load	6/26/96	0.072	2.7	2.7	0.190	0.026	7.3	5.2	<.3	<.1	59.2	32.4
GLF13,14 event load	7/11/96					0.011						
GLF-15	7/14/96					0.001						
GLF-16	7/15/96					0.015						
GLF-17	7/18/96					0.022						
GLF-18	7/21/96					0.005						
GLF-19	7/22/96					0.001						
GLF-20	7/23/96											
GLF-21	7/24/96					0.004						
GLF-22	8/5/96					0.019						
GLF-23	9/2/96	0.071	1.3	0.9	0.140	0.054	4.6	2.7	1.7	<.3	16.0	11.5
GLF-24	9/3/96	0.056	0.7	0.7	0.054	0.017						
1996												
MEAN		0.046	1.0	0.9	0.087	0.015	2.8	2.2			20.8	12.9
MEDIAN		0.054	0.6	0.5	0.074	0.015	1.4	1.1	0.2	0.2	14.7	7.3
STD. DEVIATION		0.027	0.8	0.8	0.057	0.014	2.6	1.8			19.0	11.1
1995-1996 MEAN		0.056	0.8	0.7	0.080	0.018	2.7	2.0			19.1	11.8
MEDIAN		0.021	0.6	0.5	0.064	0.010	1.6	1.1	0.3	0.15	14.7	7.1
STD. DEVIATION		0.073	0.6	0.7	0.052	0.026	2.2	1.7			16.4	10.3

Table f :ate samples for Superior, WI. sites.

	DATE	TIME	CONDUCTIVITY UMHOS/CM	pH lab standards	COD LOW LEVEL MG/L	DISSOLVED COD COLORIMETRIC MG/L	5 DAY BOD MG/L	DISSOLVED 5 DAY BOD MG/L	FECAL COLIFORM COLS./100ML	TOTAL RECOVERABLE HARDNESS MG/L	DISSOLVED HARDNESS MG/L	TOTAL CALCIUM MG/L AS CA	DISSOLVED CALCIUM MG/L AS CA	CHLORIDE DISSOLVED MG/L as Cl	TOTAL RECOVERABLE MAGNESIUM MG/L AS MG	DISSOLVED MAGNESIUM MG/L AS MG	ALKALINITY MG/L	SULFATE MG/L	TOTAL SOLIDS MG/L
Watstore Codes			00095	00403	00335	99901	00310	99900	31625	99906	99907	00916	00915	00940	00921	00925	00417	00946	00530
RECREATIONAL																			
PARK																			
PRK-7	09/06/95	03:55	355	8 39	49	42	6.0	3 6	27,000	270	170	65	45	6 7	25.0	15	213	12	430
PRK-7D	09/06/95	03:58	354	8.46	46	46	6.5	3.7	24,000	270	180	65	45	7.0	25.0	15	245	–	–
UNDEVELOPED URBAN																			
UND-8*	08/13/95	23:43	223	8.22	64	52	24.0	20 0	450	110	110	28	27	2.1	11.0	11	111	8 0	–
UND-8D	08/13/95	23:44	N/A	N/A	66	55	12 0	14 0	–	110	–	27	–	–	11.0	–	–	–	–
UND-14	06/21/96	12:15	182	7.91	43	40	<3	<3	–	100	99	23	23	1.5	10.0	9 8	92	8	180
UND-14D	06/21/96	12:16	183	7.87	46	43	<3	<3	–	100	99	23	23	1.6	10.0	9.9	92	8	174
UND-15	06/23/96	12:49	167	7.96	40	55	<3.0	<3 0	–	94	–	22	–	1.6	9.7	–	85	9	188
UND-15D	06/23/96	12:50	166	8.10	45	61	<3.0	<3 0	–	93	–	21	–	1.6	9 6	–	85	9	182
Golf Site																			
GLF-9	06/21/96	11:24	172	7.24	82	63	10.8	4 6	–	82	78	20	20	4.0	7.9	7	69	13	212
GLF-9D	06/21/96	11:25	171	7.42	110	60	11.7	3.2	–	82	80	20	20	3.9	7.9	7	69	14	224
GLF-10	06/23/96	13:41	190	7.46	95	88	8.2	4.5	–	96	95	23	23	4.4	9.3	9	83	13	224
GLF-10D	06/23/96	13:42	189	7.62	96	92	8.7	4.9	–	97		24		4.5	9.4		83	14	222
Tower Avenue																			
SU-32	08/13/95	19:44	181	7.67	87	63	54 0	53 0	7,400	62	49	19	15	17.4	4 0	2 5	54	7.0	N/A
SU-32D	08/13/95	19:45	183	7.66	88	54	40.0	39.0	10,000	62	48	19	15	17.4	4 0	2 5	54	9 0	N/A
average (variance/mean^2)			*0 0000*	*0.0000*	*0.008*	*0.004*	*0.039*	*0 025*	*0.028*	*0.000*	*0.001*	*0.000*	*0.000*	*0 001*	*0.000*	*0.000*	*0 002*	*0.007*	*0.001*
average coefficient of variation			0.6%	0.4%	8.8%	6.3%	19.8%	15.9%	16.1%	0.4%	2.3%	1.9%	0.0%	2.5%	0.4%	1.0%	4.0%	8.6%	2.6%

	SUSPENDED SOLIDS MG/L	NITRATE PLUS NITRITE-N MG/L	AMMONIA-N MG/L	TOTAL KJELDAHL NITROGEN MG/L	DISSOLVED KJELDAHL NITROGEN MG/L	TOTAL PHOSPHORUS MG/L AS P	DISSOLVED PHOSPHORUS MG/L AS P	ARSENIC UG/L	TOTAL RECOVERABLE CADMIUM UG/L	DISSOLVED CADMIUM UG/L	TOTAL RECOVERABLE COPPER UG/L	DISSOLVED COPPER UG/L	TOTAL RECOVERABLE LEAD UG/L	DISSOLVED LEAD UG/L	TOTAL RECOVERABLE SILVER UG/L	TOTAL RECOVERABLE ZINC UG/L	DISSOLVED ZINC UG/L	CARBON MG/L
Watstore Codes	00500	00631	00608	00625	00623	00665	00671	99910	01113	01025	01118	01040	01114	01049	01079	01094	01090	00680
RECREATIONAL																		
PARK																		
PRK-7	160	0.572	0.129	2.0	1.4	0.587	0.067	–	–	–	–	–	–	–	–	–	–	35
PRK-7D	–	0 540	0.154	1 8	1.4	0.558	0.061	–	–	–	–	–	–	–	–	–	–	39
UNDEVELOPED																		
UND-8*	–	<0.010	0 030	3.8	0.8	0.124	0.010	–	–	–	–	–	–	–	–	–	–	–
UND-8D	–	0.025	<0.027	1.0	0.9	0.064	0.012	–	–	–	–	–	–	–	–	–	–	–
UND-14	15	<0.01	0.009	0.9	0.7	0.053	0.004	–	–	–	3.0	2.8	<0.8	<0.4	–	<19	<8	–
UND-14D	14	<0.01	0.01	0.9	0.7	0.057	0.011	–	–	–	3 0	2 9	<0 8	<0.4	–	<19	<8	–
UND-15	12	<0 01	<0 027	1 0	1.2	0.056	0.008	–	–	–	4 0	–	<.8	–	–	<19 0	–	–
UND-15D	10	<0.01	<0 027	1 0	1.1	0 053	0 007	–	–	–	4 0	–	1.1	–	–	<19.0	–	–
Golf Site																		
GLF-9	54	0.111	0.280	3.0	2.1	0.382	0.101	–	–	–	7.0	5.8	0.9	<.4	–	72	36	–
GLF-9D	70	0.091	0.270	3.3	2.1	0.405	0.102	–	–	–	8.0	5 9	1.3	0.8	–	80	36	–
GLF-10	26	0 037	0 040	2.6	2.4	0 205	0.026	–	–	–	5.0	4.4	<0 8	0.8	–	52	35	–
GLF-10D	23	0.037	0.037	3.2	2.6	0.202	0.009	–	–	–	6 0	–	<0 8	–	–	56	–	–
Tower Avenue																		
SU-32	N/A	0.470	0.115	0 6	0.3	0.160	0.026	3.8	0.25	0.1	17.0	4.2	20.0	<0.40	<0 2	61	<8 0	–
SU-32D	N/A	0.341	0.116	0 7	0.3	0.162	0 028	3 4	0.30	0.0	17.0	4.1	21.0	<0.40	<0 2	60	<8 0	–
average (variance	*0 015*	*0.012*	*0.004*	*0.103*	*0 002*	*0 0301*	*0.134*	*0.0062*	*0.0165*	*0.1250*	*0.0051*	*0.0004*	*0.0234*	*0.1111*		*0.0017*	*0 0005*	
average coeffi	12.2%	10.9%	6.4%	32.2%	4.5%	17.4%	36.6%	7.9%	12.9%	35.4%	7.1%	1.9%	15.3%	33.3%		4.1%	2.2%	

Table 995 and 1996 Equipment Blank Data, Superior, WI and Duluth,

Equipment Blanks	DATE	TIME	CONDUCTIVITY UMHOS/CM	pH lab standards	COD LOW LEVEL MG/L	DISSOLVED COD COLORIMETRIC MG/L	5 DAY BOD MG/L	DISSOLVED 5 DAY BOD MG/L	FECAL COLIFORM COLS./100ML	TOTAL RECOVERABLE HARDNESS MG/L	DISSOLVED HARDNESS MG/L	TOTAL CALCIUM MG/L
Watstore Codes			00095	00403	00335	99901	00310	99900	31625	99908	99907	00916
REC. PARK	6/13/95	12:30	5	6.5	28	31	2.8	5	<10	<6	N/A	0.51
UNDEV. URBAN	6/13/95	13:00	10	7.1	38	42	4.5	N/A	<10	<6	N/A	0.99
GOLF COURSE	6/13/95	13:30	3	5.9	17	17	5.2	N/A	<10	N/A	N/A	N/A
GAS STATION	5/13/95	11:30	11	7.7	<5.0	<5.0	2.5	N/A	<10	<6.0	<6.0	0.16
TOWER AVE.	6/13/95	11:30	3	6	11	8	<1.0	<1.0	N/A	<6.0	<6.0	0.09
Golf -Q1	5/13/96	10:30	N/A	4.14	<5	<5	<3	<3	N/A	N/A	N/A	N/A
Und-Q1	5/13/96	10:00	24	4.3	<5	<5	<3	3	N/A	0.3	<.1	0.1
Q-GLF.2	9/24/96	10:30	2.87	5.8	<5	N/A	<3	<3	N/A	<.2	<.1	0.04
Q-UND.2	9/24/96	10:15	6	5.27	<5	<5	0.4	0.12	N/A	N/A	N/A	N/A

	DISSOLVED CALCIUM MG/L	CHLORIDE DISSOLVED MG/L	TOTAL RECOVERABLE MAGNESIUM MG/L	DISSOLVED MAGNESIUM MG/L	ALKALINITY MG/L	SULFATE MG/L	TOTAL SOLIDS MG/L	SUSPENDED SOLIDS MG/L	NITRATE PLUS NITRITE-N MG/L	AMMONIA-N MG/L	TOTAL KJELDAHL NITROGEN MG/L	DISSOLVED KJELDAHL NITROGEN MG/L	TOTAL PHOSPHORUS MG/L
Watstore Codes	00915	00940	00921	00925	00417	00946	00530	00500	00631	00608	00625	00623	00665
REC. PARK	N/A	0.3	0	N/A	3	4	8	<4.88	<0.01	<0.027	<0.21	0.09	0.012
UNDEV. URBAN	N/A	0.3	0.41	N/A	6	2	8	<4.88	<0.01	<0.027	<0.21	0.18	<0.008
GOLF COURSE	N/A	<0.1	N/A	N/A	3	2	<7	<4.88	<0.01	<0.027	<0.21	0.17	0.008
GAS STATION	0.03	0.6	0.07	<0.02	6	<1.21	12	<4.88	<0.01	<0.027	<0.21	<0.21	<0.008
TOWER AVE.	0.03	0.3	<0.03	<0.02	3	1	<7.01	<4.88	<0.01	<0.027	<0.21	0.07	<0.008
Golf -Q1	N/A	2	N/A	N/A	N/A	2	<7.01	<4.88	<0.01	<0.027	0.08	<0.21	0.004
Und-Q1	<.02	2.4	<0.03	<0.02	N/A	<1.21	<7.01	<4.88	<0.01	<0.027	<0.21	0.05	0.007
Q-GLF.2	<.02	<.1	<0.03	<0.02	2.82	<1.21	<7.01	<4.88	<0.01	<0.027	<0.21	<0.21	<0.008
Q-UND.2	N/A	0.6	N/A	N/A	2.36	<1.21	<7.01	N/A	<0.01	<0.027	<0.21	<0.21	<0.008

	DISSOLVED PHOSPHORUS MG/L	ARSENIC UG/L	TOTAL RECOVERABLE CADMIUM UG/L	DISSOLVED CADMIUM UG/L	TOTAL RECOVERABLE COPPER UG/L	DISSOLVED COPPER UG/L	TOTAL RECOVERABLE LEAD UG/L	DISSOLVED LEAD UG/L	TOTAL RECOVERABLE SILVER UG/L	TOTAL RECOVERABLE ZINC UG/L	DISSOLVED ZINC UG/L	TOTAL ORGANIC CARBON MG/L
Watstore Codes	00671	99910	01113	01025	01119	01040	01114	01049	01079	01094	01090	00680
REC. PARK	<0.002	<0.8	0.12	–	<1	–	<0.8	–	<0.2	<19	–	–
UNDEV. URBAN	<0.002	<0.8	0.07	–	<1	–	<0.8	–	<0.2	<19	–	–
GOLF COURSE	<0.002	--	--	–	–	–	–	–	–	–	–	–
GAS STATION	0.001	<0.8	0.06	<0.02	1	2.4	<0.8	<0.4	0.2	<19	<8	1.2
TOWER AVE.	<0.002	<0.8	<0.04	0.07	<1.0	2	<0.8	0.4	<0.2	<19	<8	–
Golf -Q1	0.003	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Und-Q1	0.005	N/A	N/A	N/A	2	<.7	<.8	<.4	N/A	<19	<8	
Q-GLF.2	N/A	N/A	N/A	N/A	2	1.2	<.8	<.4	N/A	<19	<8	
Q-UND.2	<0.002	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

Figure 2(a). Nutrient concentrations at Superior and Duluth sites.

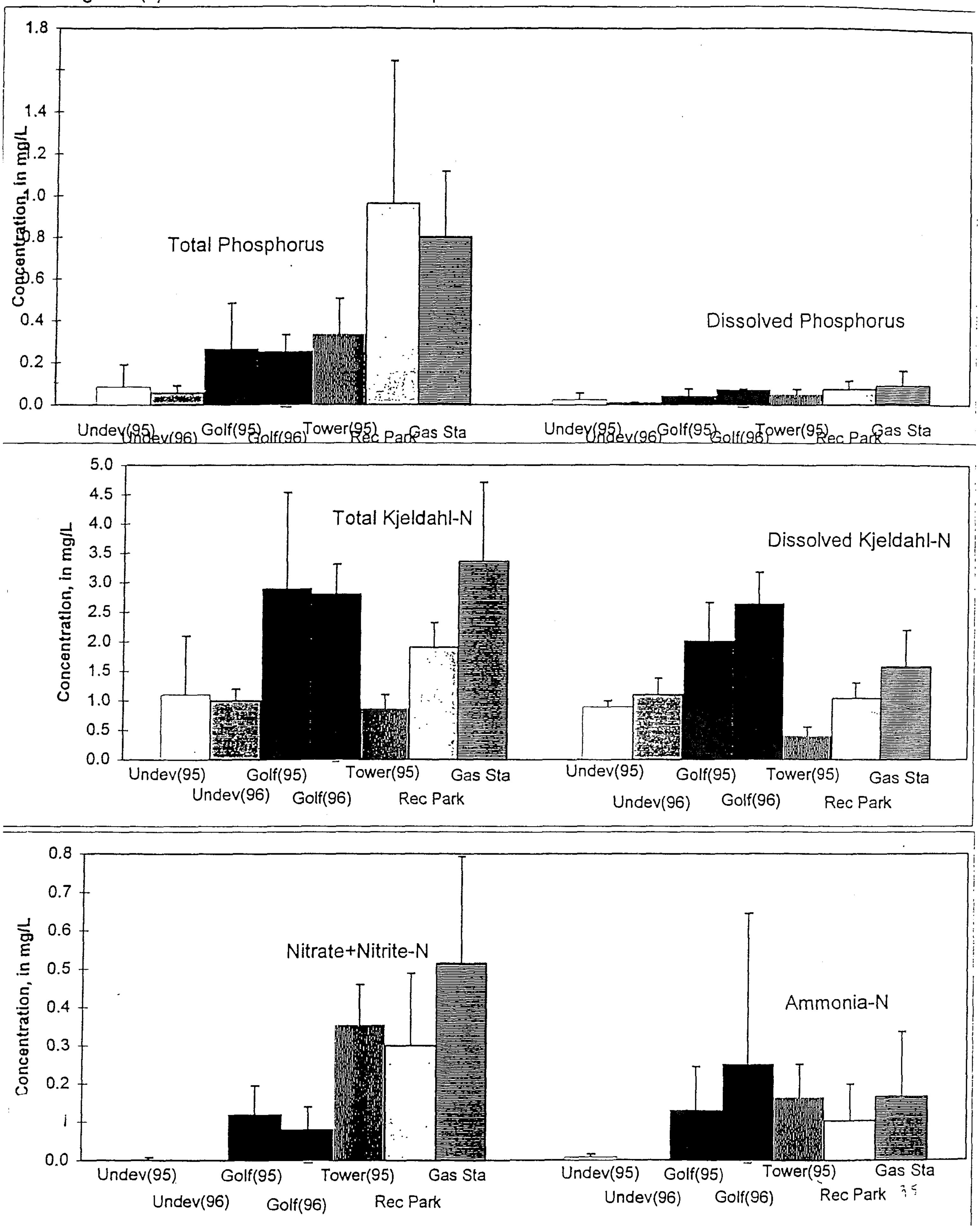
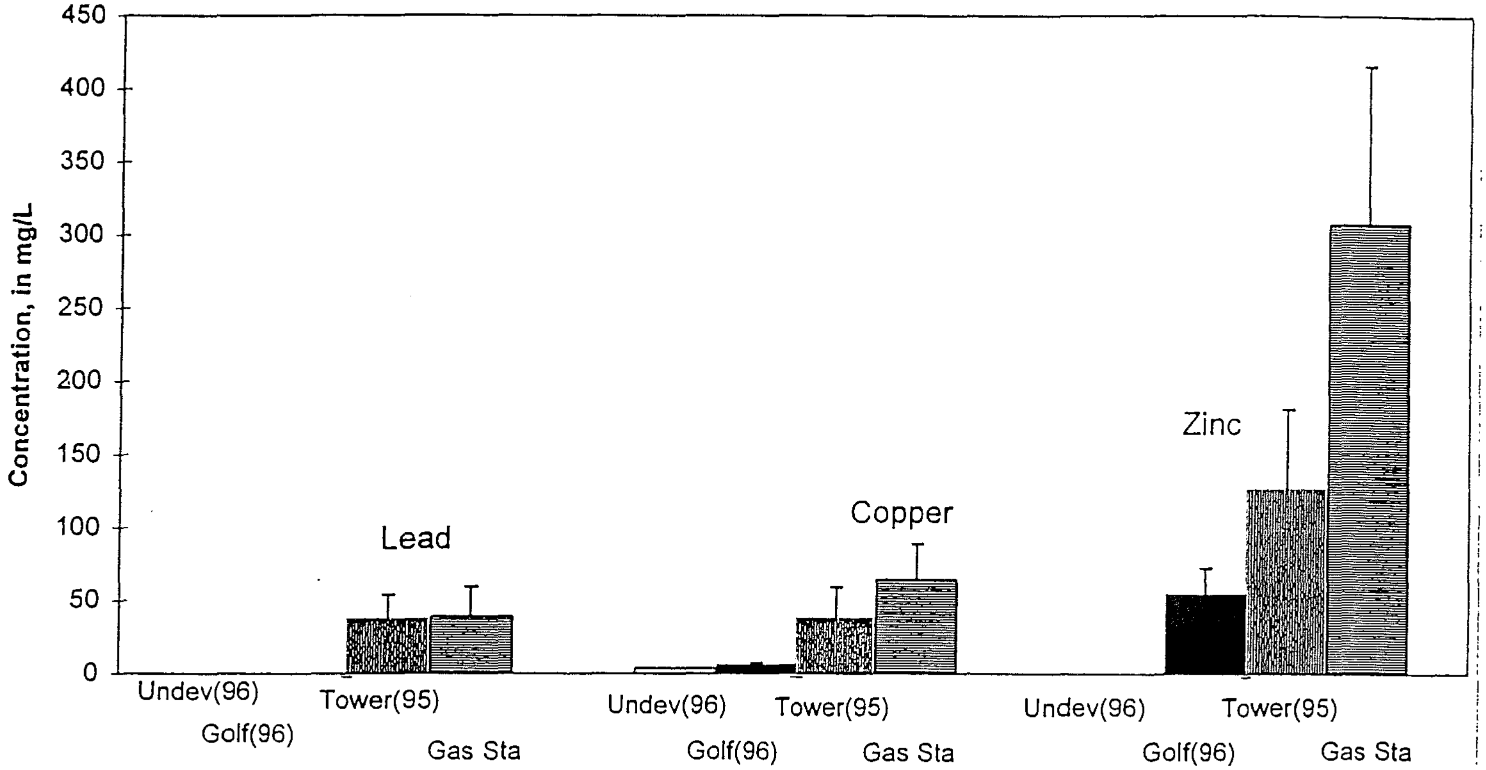
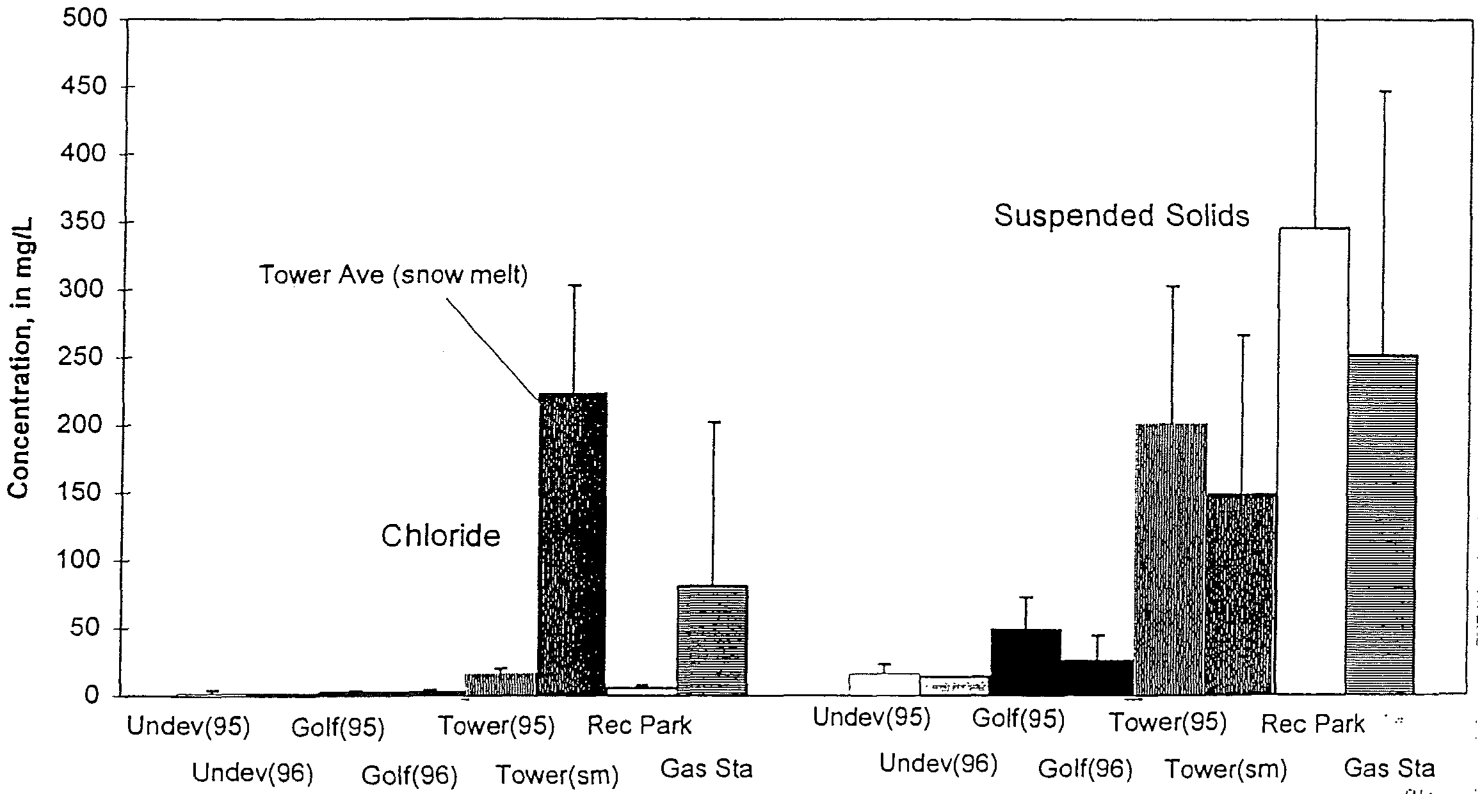


Figure 2(b). Metals and solids concentrations at Superior and Duluth sites.

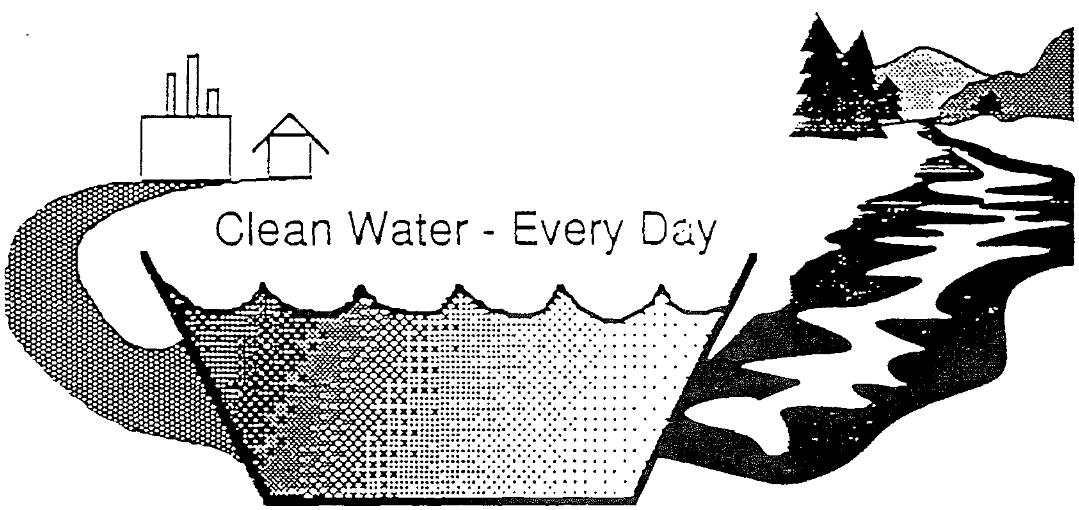


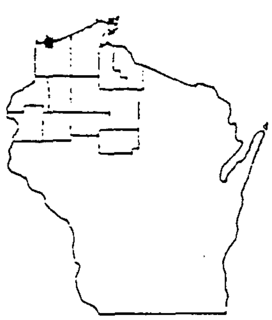


Appendix 5

WPDES Municipal Point Source Permit

The WPDES Clean Water Permit for the City of Superior Wastewater Treatment Plant





Our
Shared
Responsibility

WISCONSIN DEPARTMENT OF NATURAL RESOURCES

WISCONSIN
DEPT. OF NATURAL RESOURCES

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCE

NORTHWEST DISTRICT HEADQUARTE
P.O. Box 3
STH 70 West & First Stre
Spooner, Wisconsin 548
TELEPHONE 715-635-21
TELEFAX 715-635-41

December 17, 1993

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

IN REPLY REFER TO: 3420

Mr. Jeff Vito
City of Superior
1407 Hammond Ave.
Superior, WI 54880

SUBJECT: Final WPDES Permit No. WI-0025593-5

Dear Mr. Vito:

Your application for reissuance of a Wisconsin Pollutant Discharge Elimination System (WPDES) permit has been processed by this Department. The conditions of the attached permit number WI-0025593-5, were determined using the permit application, information from your WPDES permit file, comments received during the public notice period, and Wisconsin Administrative Codes NR 102, NR 105, NR 106, NR 200, NR 203, NR 204, NR 205, NR 208, NR 210, and NR 211.

The attached WPDES permit covers the discharges from the facilities listed below into their respective receiving waters in Douglas County:

Facility	Location	Receiving Water
MAIN PLANT:	At the foot of Avenue E	Superior Bay of Lake Superior
CSO 2:	At the foot of Avenue E	A slip emptying into Superior Bay
CSO 5:	61st Street and Birch Avenue	The Nemadji River
CSO 6:	Texas Avenue and 17th St.	St. Louis Bay of Lake Superior

All discharges from these facilities and actions or reports relating thereto shall be in accordance with the terms and conditions of this permit.

The effective date of the permit is January 1, 1994, and the expiration date is December 31, 1998.

In accordance with this permit, discharge monitoring report forms are required to be submitted by City to the Department on a periodic basis. Blank copies of these report forms and instructions for completing them will be mailed to Mark Drake of your staff under separate cover.

PERMIT TO DISCHARGE UNDER THE WISCONSIN POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of Chapter 147, Wisconsin Statutes,

THE CITY OF SUPERIOR

is permitted to discharge from four wastewater treatment facilities (located as follows):

MAIN PLANT AND CSO 2: at the foot of Avenue E
CSO 5: 61st Street and Birch Avenue
CSO 6: Texas Avenue and 17th St.

to the following receiving streams in Douglas County:

MAIN PLANT: Superior Bay of Lake Superior
CSO 2: a slip emptying into Superior Bay
CSO 5: the Nemadji River
CSO 6: St. Louis Bay of Lake Superior

in accordance with the effluent limitations, monitoring requirements and other conditions set forth in this permit.

This permit shall become effective on January 1, 1994.

This permit to discharge shall expire at midnight, December 31, 1998.

The permittee shall not discharge after the date of expiration. If the City wishes to continue to discharge after this expiration date an application shall be filed for reissuance of this permit in accordance with the requirements of Chapter NR 200, Wis. Adm. Code, at least 180 days prior to this expiration date.

State of Wisconsin Department of Natural Resources
For the Secretary

By Bill Smith /acc

William H. Smith
District Director

Dated 12/17/93

The attached permit contains water quality based effluent limitations which are necessary to ensure that the water quality standards for Lake Superior are met. You may apply for a variance from the water quality standard used to derive the limitations pursuant to s. 147.05, Wisconsin Statutes, by submitting an application to: George E. Meyer, Secretary, Department of Natural Resources, P.O. Box 7921, Madison, Wisconsin 53707 within 30 days after the date of reissuance of this permit. Within 30 days of receipt of your application for variance, the Department will notify you of the specific information you must provide to complete your application. Once your application is complete, the Department will issue a public notice of receipt of your application for variance, which will include a 30 day comment period. A tentative decision on your application for variance will be issued within 120 days after receipt of the complete application. A final decision on your application will be issued within 90 days of the expiration of the 30 day comment period provided in the notice of the tentative decision.

The final decision of the Department may be to approve your request for a variance, in whole or in part, or to deny the request. In order to obtain a variance, you must demonstrate by the greater weight of the credible evidence, at least one of the following:

1. Naturally occurring pollutant concentrations prevent the attainment of the standard.

2. Natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the standard, unless these conditions may be compensated for by the discharge of sufficient volume of effluent without violating water conservation requirements.

3. Human caused conditions or sources of pollution prevent the attainment of the standard and cannot be remedied or would cause more environmental damage to correct than to leave in place.

4. Dams, diversions or other types of hydrologic modifications preclude the attainment of the standard, and it is not feasible to restore the water body to its original condition or to operate such modification in a way that would result in the attainment of the standard.

5. Physical conditions related to the natural features of the water body, such as the lack of proper substrate, cover, flow, depth, pools, riffles, and the like, unrelated to water quality, preclude attainment of aquatic life protection uses.

6. The standard, as applied to the permittee, will cause substantial and widespread adverse social and economic impacts in the area where the permittee is located.

The WPDES permit program has been approved by the Administrator of the U.S. Environmental Protection Agency pursuant to Section 402(b) of the Federal Water Pollution Control Act Amendments of 1972 (33 U.S.C. Section 1342 (b)). The terms and conditions of this permit are accordingly subject to enforcement under Sections 147.21 and 147.29, Wis. Stats., and Section 309 of the Federal Act (33 U.S.C. Section 1319).

The Department has the authority under Chapters 147 and 160, Wisconsin Statutes to establish effluent limitations, monitoring requirements, and other permit conditions for discharges to groundwater and surface waters of the State. The Department also has the authority to issue, reissue, modify, suspend or revoke WPDES permits under Chapter 147, Wisconsin Statutes and has adopted Wis. Adm. Code Chapters NR 102, NR 105, NR 106, NR 200, NR 203, NR 204, NR 205, NR 208, NR 210, and NR 211 under this authority.

To challenge the reasonableness of or necessity for any term or condition of the attached permit, Section 147.20, Wis. Stats., and Chapter NR 203, Wis. Adm. Code require that you file a verified petition for review with the Secretary of the Department of Natural Resources within 60 days of the date of this letter. This notice is provided pursuant to Section 227.48, Wis. Stats., as renumbered by 1985 Wisconsin Act 182.

The City staff, and especially Mark Drake, deserve commendation for reviewing and commenting on both public-noticed versions of the permit, and for being helpful and cooperative throughout the entire process.

Sincerely,

Bill Smith

William Smith
District Director

Dated: 12/17/93

Enclosures

cc: Permits Unit - WW/2
Sreedevi Yedavalli, U.S. Environmental Protection Agency
Mark Drake - City of Superior
U.S. Fish and Wildlife Service
Gerry Novotony - WW/2
Chuck Olson - Brule Area Office
District File
Mary Ryan - WW/2
Jim Hansen - Park Falls Area

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

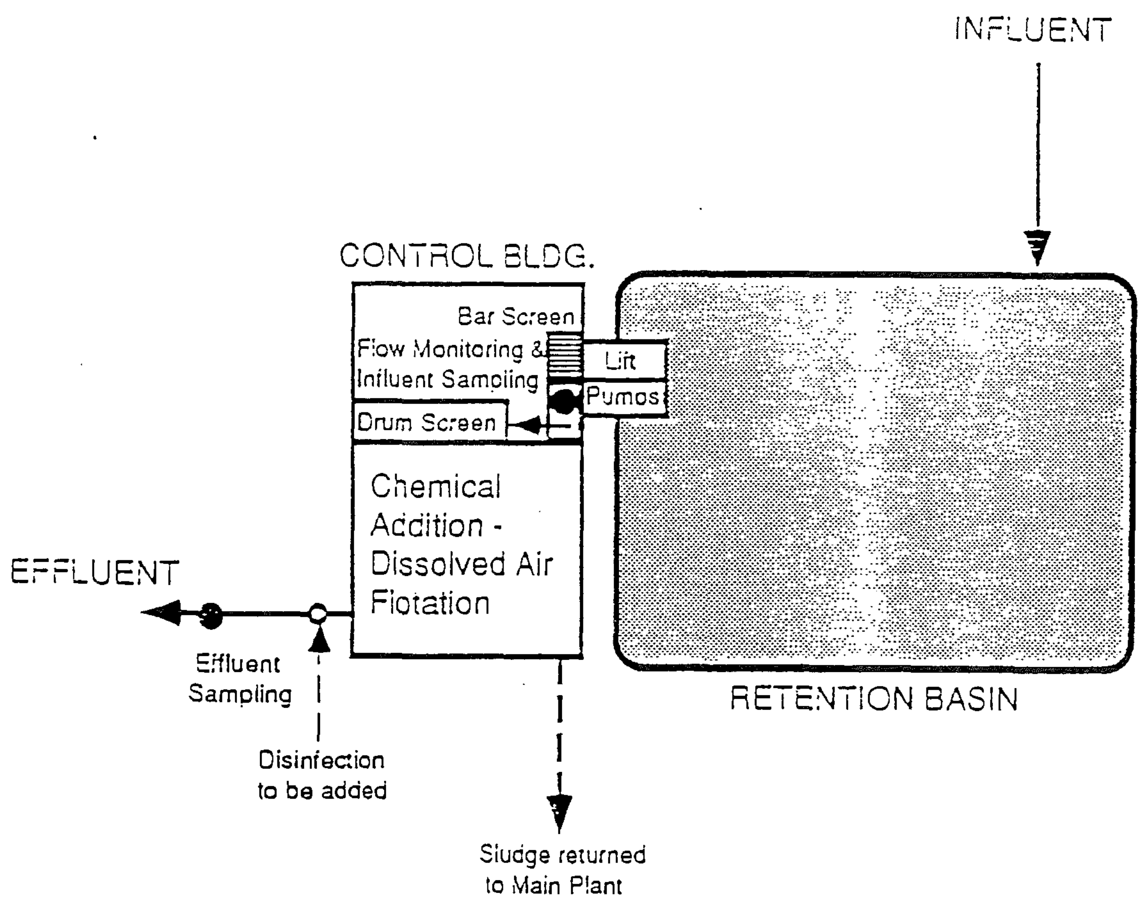
*These deadline dates were set by Douglas County Circuit Court, Case Number 92CV 142, on April 8, 1992 (and are open to modification only through further court action).

City of Superior

WASTEWATER TREATMENT FACILITY DESCRIPTIONS AND FLOW DIAGRAMS

The City of Superior operates four wastewater treatment facilities. The Main Plant (diagram shown on next page) is an activ sludge facility with phosphorus removal and year-round chlorination and dechlorination processes. Effluent is discharged to Superior Bay of Lake Superior. Sludge is treated in anaerobic digestors and landspread as a liquid or belt-pressed cake on Department-approved fields. Upgrading of the system is being required, along with improvements in the sludge recycling operation.

The other plants are retention and treatment facilities for sanitary wastewater and stormwater collected in the City's combin sewers. They are referred to as "Combined Sewer Overflow" (CSO) plants. CSO 2 (diagram on page 7) is an aerated lagoon loca near the Main Plant, and discharging to an adjacent slip which empties into Superior Bay. CSO plants 5 and 6 consist of larg asphalt-lined detention ponds with dissolved air flotation tanks for treatment. They are operated after heavy precipitation events. Otherwise, low volumes of wastewater collected in the ponds can be pumped back to the Main Plant for treatment. CSO is located on 61st Street and Birch Avenue, and discharges to the Nemadji River; CSO 6 is located on Texas Avenue and 17th S and discharges to St. Louis Bay of Lake Superior.



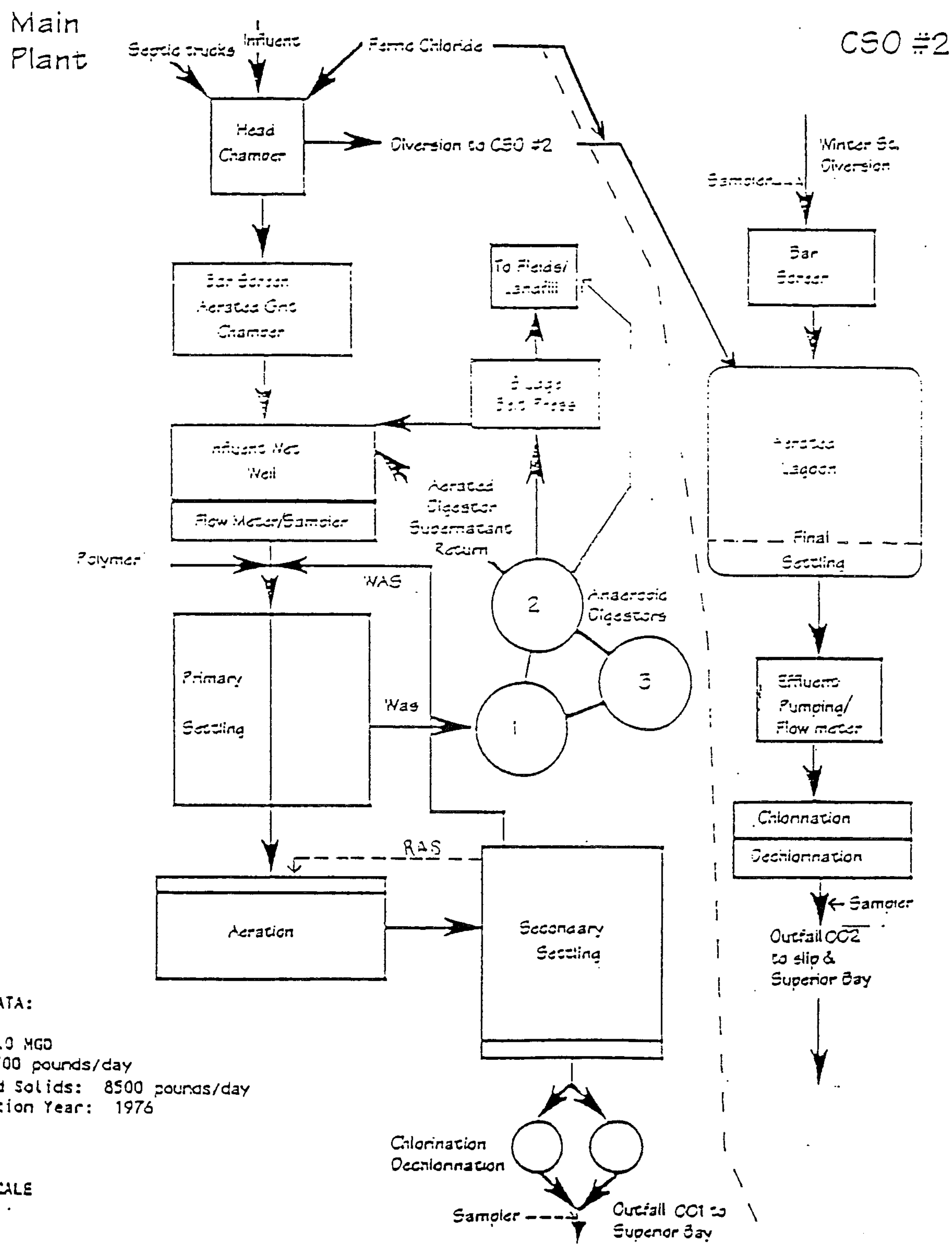
CSO 5 and 6

NOT TO SCALE

Both plants have similar proce

City of Superior

MAIN PLANT AND CSO 2 - FLOW SCHEMATIC



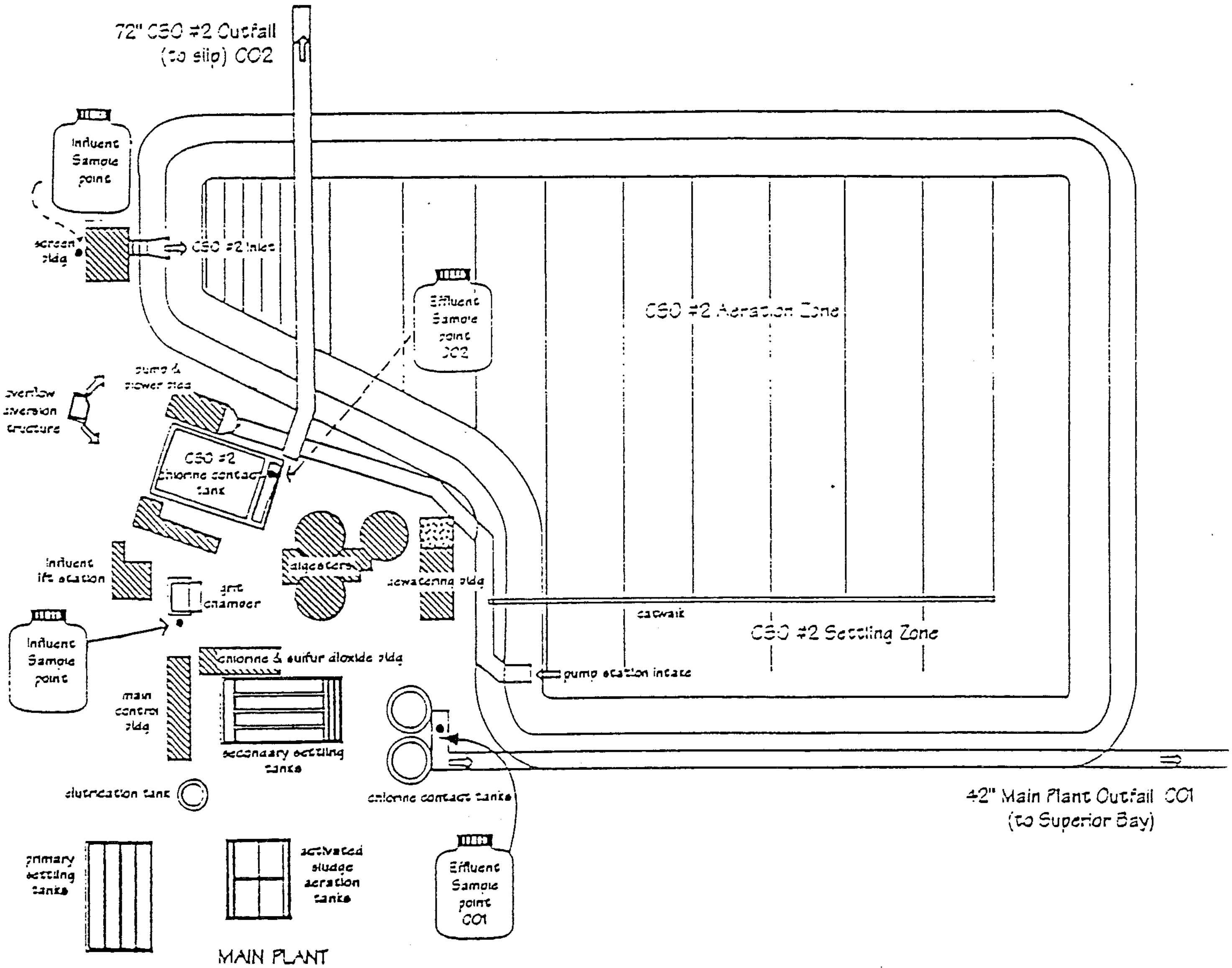
DESIGN DATA:

Flow: 5.0 MGD
BOD_5: 7500 pounds/day
Suspended Solids: 8500 pounds/day
Construction Year: 1976

NOT TO SCALE

City of Superior

MAIN PLANT AND CSO 2 - PLAT DIAGRAM



NOT TO SCALE

PART I: MONITORING REQUIREMENTS AND LIMITATIONS

A. INFLUENT MONITORING REQUIREMENTS - MAIN PLANT

Effective term: Influent monitoring is required from the effective date of this permit until December 31, 1998.

Sampling point: Samples shall be taken immediately following the aerated grit chamber and ahead of the bar screen at the Main Plant.

PARAMETERS	UNITS	MONITORING REQUIREMENTS Sample Frequency	Sample Type
Flow[1]	MGD	Continuous	
BOD_5	mg/l	Daily	24-hour Composite[2]
Suspended Solids	mg/l	Daily	24-hour Composite[2]
Phosphorus	mg/l	Daily	24-hour Composite[2]
Cadmium, Total[3]	µg/l	Monthly	24-hour Composite[2]
Chromium,Total[3]	µg/l	Monthly	24-hour Composite[2]
Copper, Total[3]	µg/l	Monthly	24-hour Composite[2]
Lead, Total[3]	µg/l	Monthly	24-hour Composite[2]
Nickel, Total[3]	µg/l	Monthly	24-hour Composite[2]
Zinc, Total[3]	µg/l	Monthly	24-hour Composite[2]
Cyanide, Total[3]	µg/l	Monthly	Grab
Mercury, Total[3]	µg/l	Monthly	Grab
Beryllium[3]	µg/l	Monthly	24-hour Composite[2]
Chloroform[3]	µg/l	Monthly	24-hour Composite[2]
Total PAH Compounds:[3,4]	µg/l	Monthly	24-hour Composite[2]
Benzo(ghi)perylene[3,4]	µg/l	Monthly	24-hour Composite[2]
Phenanthrene[3,4]	µg/l	Monthly	24-hour Composite[2]
Benzo(a)anthracene[3,4]	µg/l	Monthly	24-hour Composite[2]
3,4-Benzofluoranthene[3,4]	µg/l	Monthly	24-hour Composite[2]
Benzo(k)fluoranthene[3,4]	µg/l	Monthly	24-hour Composite[2]
Chrysene[3,4]	µg/l	Monthly	24-hour Composite[2]
Dibenzo(a,h)anthracene[3,4]	µg/l	Monthly	24-hour Composite[2]
Pyrene[3,4]	µg/l	Monthly	24-hour Composite[2]
Indeno(1,2,3-cd)pyrene[3,4]	µg/l	Monthly	24-hour Composite[2]

[1] The wastewater volume received at the treatment plant, shall be monitored continuously.

[2] Samples shall be composited at or below 4°C. Whenever possible, composite samples shall be taken on a flow-proportional basis.

[3] This sampling is required under the industrial pretreatment program for calculation of percent removal for each parameter. Sampling for all parameters shall be done during days when industrial discharges are occurring at normal to maximum levels. For parameters where grab sampling is required, sampling for the influent and effluent shall be coordinated to approximate the travel time through the plant. See footnote 7 on page 12 and footnote 11 on page 14 for the recommended analysis methods for these parameters.

[4] "Total PAH Compounds" shall be reported as the sum of the concentrations of these 9 substances.

PART I: MONITORING REQUIREMENTS AND LIMITATIONS

B. INFLUENT MONITORING REQUIREMENTS - CSO 2, CSO 5, and CSO 6

Effective term: Influent monitoring is required from the effective date of this permit until December 31, 1998.

Sampling points: CSO 2: Samples shall be taken upstream of the automatic bar screens.

CSO 5 & 6: Samples shall be taken just upstream from the Parshall flume in the drum screen room.

		MONITORING REQUIREMENTS	
PARAMETERS	UNITS	Sample Frequency	Sample Type
Flow[1]	MGD	Continuous	
BOD_5	mg/l	Daily	24-hour Composite[2]
Suspended Solids	mg/l	Daily	24-hour Composite[2]

[1] The wastewater volume received at the treatment plant shall be monitored continuously. At CSO 2, effluent flow may be measured rather than influent flow.

[2] Whenever possible, samples shall be composited at or below 4°C on a flow-proportional basis. A minimum of one 24-hour composite sample shall be taken for each 24 hours of continuous discharge. For discharges lasting less than 24 hours, one composite sample must be taken during the hours of discharge.

PART I: MONITORING REQUIREMENTS AND LIMITATIONS

C. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS - MAIN PLANT

Outfall 001: The City of Superior is authorized to discharge from the Main Plant to Superior Bay via Outfall 001.

Effective term: Monitoring is required and limitations apply from the effective date of this permit until December 31, 1998.

Sampling point: Samples shall be taken following disinfection and prior to discharge to Superior Bay. *Sampling for all parameters shall be done during days when industrial discharges are occurring at normal to maximum levels.*

Disinfection: Disinfection must be provided year-round, because Lake Superior is classified as a Public Water Supply.

	EFFLUENT LIMITATIONS				MONITORING REQUIREMENTS	
EFFLUENT PARAMETERS	Monthly Average	Weekly Average	Daily Minimum	Daily Maximum	Sample Frequency	Sample Type
BOD_5[1,2]	30 mg/l	45 mg/l	-	-	Daily	24-hour Composite[3]
Suspended Solids[1,2]	30 mg/l	45 mg/l	-	-	Daily	24-hour Composite[3]
pH	-	-	6.0 s.u.	9.0 s.u.	Daily	Grab
Phosphorus[2]	1.0 mg/l	-	-	-	Daily	24-hour Composite[3]
Fecal Coliform[4]	400/100 ml	-	-	-	2x Weekly	Grab
Residual Chlorine[2,5,8]	-	-	-	37 µg/l	Daily	Grab
Beryllium[2,5,7,8,9]	0.22 µg/l	-	-	-	Monthly	24-hour Composite[3]
Chloroform[2,5,7,8,9]	0.12 µg/l	-	-	-	Monthly	Grab
Total PAH Compounds:[2,5,7,8,9,10]	0.095 µg/l	-	-	-	Monthly	24-hour Composite[3]
Benzo(ghi)perylene[2,5,7,8,9,10]	0.058 µg/l	-	-	-	Monthly	24-hour Composite[3]
Phenanthrene[2,5,7,8,9,10]	0.037 µg/l	-	-	-	Monthly	24-hour Composite[3]
Benzo(a)anthracene[6,7,8,9,10]	-	-	-	µg/l	Monthly	24-hour Composite[3]
3,4-Benzofluoranthene[6,7,8,9,10]	-	-	-	µg/l	Monthly	24-hour Composite[3]
Benzo(k)fluoranthene[6,7,8,9,10]	-	-	-	µg/l	Monthly	24-hour Composite[3]
Chrysene[6,7,8,9,10]	-	-	-	µg/l	Monthly	24-hour Composite[3]
Dibenzo(a,h)anthracene[6,7,8,9,10]	-	-	-	µg/l	Monthly	24-hour Composite[3]
Pyrene[6,7,8,9,10]	-	-	-	µg/l	Monthly	24-hour Composite[3]
Indeno(1,2,3-cd)pyrene[6,7,8,9,10]	-	-	-	µg/l	Monthly	24-hour Composite[3]
Cadmium, Total[11]	-	-	-	µg/l	Monthly	24-hour Composite[3]
Chromium, Total[11]	-	-	-	µg/l	Monthly	24-hour Composite[3]
Copper, Total[11]	-	-	-	µg/l	Monthly	24-hour Composite[3]
Lead, Total[11]	-	-	-	µg/l	Monthly	24-hour Composite[3]
Nickel, Total[11]	-	-	-	µg/l	Monthly	24-hour Composite[3]
Zinc, Total[11]	-	-	-	µg/l	Monthly	24-hour Composite[3]
Cyanide, Total[11]	-	-	-	µg/l	Monthly	Grab
Mercury, Total[11]	-	-	-	µg/l	Monthly	Grab
Ammonia-nitrogen[12]	-	-	-	mg/l	Monthly	24-hour Composite[3]
Hardness	-	-	-	mg/l	Monthly	24-hour Composite[3]

1 The discharge of visible or floating solids is prohibited in other than trace amounts. Also, removal of 85% of the influent BOD_5 and suspended solids levels is required on a 30-day average basis.

2 Total annual mass limitations for the Main Plant discharge are listed below. Limits for parameters marked by an asterisk (*) will not take effect until September 30, 1997.

PART I: MONITORING REQUIREMENTS AND LIMITATIONS

Parameter	Limitation
BOD_5	456,615 pounds/year (Total annual)
Suspended Solids	456,615 pounds/year (Total annual)
Phosphorus	15,230 pounds/year (Total annual)
Residual Chlorine	560 pounds/year (Total annual)
Beryllium*	3.35 pounds/year (Total annual)
Chloroform*	1.83 pounds/year (Total annual)
Benzo(ghi)perylene*	0.883 pounds/year (Total annual)
Phenanthrene*	0.563 pounds/year (Total annual)
Total PAH Compounds*	1.45 pounds/year (Total annual)

Total annual mass limitations were calculated using either a monthly average or daily maximum concentration limit, multiplied by the design flow of 5.0 MGD, 8.34 pounds per gallon, and 365.25 days per year.

To determine compliance with each total annual mass effluent limitation, the annual mass discharge shall be calculated at the end of each calendar year by calculating a total mass discharge value for each month using the monthly average effluent concentration multiplied by the total monthly flow, and an appropriate conversion factor [8.345 when the average effluent concentration and the total monthly flow are expressed in milligrams per liter (mg/l) and million gallons (MG), respectively], and summing the monthly mass discharge values for the 12 months.

Mass limit report required: Compliance with the annual mass limits must be documented annually on (or as an attachment to) each December's Discharge Monitoring Report (DMR), beginning with the December, 1994 report (which is due on January 15, 1995).

[3] Samples shall be composited at or below 4°C on a flow proportional basis.

[4] Fecal coliform monthly averages must be calculated as geometric means.

[5] Approved chlorine residual test methods which are acceptable are the iodometric back titration (EPA method 330.2) using amperometric endpoint detection, the DPD spectrophotometric method (EPA Method 330.5), and the specific ion electrode method (Orion Research Instruction Manual, Electrode Model 97-70, 1977).

[6] These substances have a cumulative human cancer risk that must be considered when establishing limitations. If additional substances with human cancer criteria are detected in the effluent, the limitation for each substance must be adjusted so that the cumulative cancer risk is less that one [as defined in Wisconsin Administrative Code NR 106.06(5)].

PART I: MONITORING REQUIREMENTS AND LIMITATIONS

7 Monitoring for these substances is required starting on the effective date of this permit. Compliance with the effluent limitations is required by September 30, 1997 in accordance with the compliance schedule in Part III, page 49. After that date, the City shall comply with all limits for each parameter regardless of the monitoring frequency. Monthly or weekly average limits must be met even with monthly monitoring. The City may monitor more frequently than specified, however, all results shall be reported and are subject to the limitations. This monitoring is also required under the industrial pretreatment program, and the conditions of footnote 11 on page 14 also apply. Recommended test methods for these substances are as follows:

Parameter	EPA Method
Beryllium (total)	210.2
Chloroform	624 and 601
Benzo(ghi)perylene	610 HPLC
Phenanthrene	610 HPLC
Total PAH Compounds	610 HPLC
Benzo(a)anthracene	610 HPLC
3,4-Benzofluoranthene	610 HPLC
Benzo(k)fluoranthene	610 HPLC
Chrysene	610 HPLC
Dibenzo(a,h)anthracene	610 HPLC
Pyrene	610 HPLC
Indeno(1,2,3-cd)pyrene	610 HPLC

8 The City shall use the following conventions when reporting effluent monitoring results:

a. Effluent concentrations less than the level of detection shall be reported as < (less than) the value of the level of detection. For example, if a substance is not detected at a detection level of 0.1 µg/l, report the effluent concentration as <0.1 µg/l.

b. Effluent concentrations equal to or greater than the level of detection, but less than the level of quantitation, shall be reported as observed and the level of quantitation shall be specified.

c. For the purposes of calculating an average or a mass discharge value, the City may substitute a "0" (zero) for any effluent concentration that is less than the level of detection.

d. Level of detection report required: The City shall report the methods used to calculate the levels of detection and quantitation as an attachment to the March, 1994 Discharge Monitoring Report (which is due on April 15, 1994).

e. In performing any analysis required under this permit, the City may, at its option, utilize the following quality assurance/quality control procedures to verify analytical results and assist in the evaluation of false positives, whether due to laboratory analytical error or cross contamination of samples. If an analytical result is initially reported by the laboratory as equal to or greater than the level of detection, the result may be deemed to be a "no-detect" if:

1). reanalysis of two aliquots of the original sample extract or analysis of two aliquots of archived replicate samples, all of

PART I: MONITORING REQUIREMENTS AND LIMITATIONS

which comply with the allowable holding times and other quality assurance/quality control requirements, do not confirm the original results; or

2). analysis of field, laboratory or trip blanks demonstrate potential contamination of the sample.

The results may be reported on the Discharge Monitoring Report forms (DMRs) as either the original result or as a "no-detect"; in either case, they shall be designated with an asterisk (*). All data and quality assurance/quality control information, including the original result (if not listed on the DMR) shall be reported as a separate attachment (or follow-up report) to the DMR.

If the above evaluation results in a determination of no-detect for substances with effluent limitations, and upon written Department confirmation, the requirements of footnote 9 on page 13 related to increased sampling frequency, do not apply. If the above evaluation results in the parameter being reported as detected between the limits of detection and quantitation, then the requirements of footnote 9 below (on page 13) do apply.

To determine compliance with the effluent limitation, the Department will apply the following procedures from s. NR 106.07(5), Wis. Adm. Code.

- If the water quality based effluent limitation is less than the level of detection, effluent concentrations less than the level of detection are in compliance with the effluent limitation.

- If the water quality based effluent limitation is less than the level of detection, effluent concentrations greater than the level of detection, but less than the level of quantitation are in compliance with the effluent limitation except when confirmed by a sufficient number of analyses of multiple samples and use of appropriate statistical techniques.

- If the water quality based effluent limitation is greater than the level of detection, but less than the level of quantitation, effluent concentrations less than the level of detection or less than the level of quantitation are in compliance with the effluent limitation.

[9] Effective September 30, 1997, if the level of detection is greater than the effluent limitation, and a sample result or the average of a set of sample results falls between the levels of detection and quantitation, the City shall increase the sample frequency according to the following conditions:

a. Sample frequency shall be twice weekly for three months and then return to monthly.

b. All appropriate QA/QC data shall be submitted with the results.

PART I: MONITORING REQUIREMENTS AND LIMITATIONS

c. Subsequent detects during the accelerated sampling period do not alter the sample frequency further, but the accelerated sampling schedule must be repeated if a detect occurs any time after the conclusion of an accelerated sampling period.

d. The Department may allow the City to return to the original sampling frequency prior to completion of the accelerated sampling period.

[10] Under Wisconsin Administrative Code NR 105, Total Polynuclear Aromatic Hydrocarbons (PAHs) consists of the sum of the individual concentrations of the following compounds: Benzo(ghi)perylene, Phenanthrene, Benzo(a)anthracene, 3,4-Benzofluoranthene, Benzo(k)fluoranthene, Chrysene, Dibenzo(a,h)anthracene, Pyrene, and Indeno(1,2,3-cd)pyrene. Concentrations of each of these parameters must be added together to determine compliance with the Total PAH limit.

[11] This sampling is required under the industrial pretreatment program for calculation of percent removal for each parameter. Sampling for all parameters shall be done during days when industrial discharges are occurring at normal to maximum levels. For parameters where grab sampling is required, sampling for the influent and effluent shall be coordinated to approximate the travel time through the plant. Recommended test methods for substances not included in footnote 7 above are as follows:

Parameter	EPA Method
Cadmium, Total	213.2
Chromium, Total	218.2
Copper, Total	220.2
Lead, Total	239.2
Nickel, Total	249.2 or 200.7
Zinc, Total	289.2 or 289.1 or 200.7
Cyanide, Total	335.1
Mercury, Total	245.1 or 245.2

[12] This permit may be modified or reissued to included additional monitoring or limitations if the results of ammonia testing document the potential for toxicity.

PART I: MONITORING REQUIREMENTS AND LIMITATIONS

D. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS - CSO 2

Outfall 002: The City of Superior is authorized to discharge from Combined Sewer Overflow Facility - District No. 2 (CSO 2) to a slip emptying into Superior Bay via Outfall 002.

Effective term: Monitoring is required and limitations apply from the effective date of this permit until December 31, 1998.

Sampling point: Samples shall be taken in the effluent channel downstream from the chlorine contact tank discharge weir. *Sampling for all parameters shall be done during days when industrial discharges are occurring at normal to maximum levels.*

Disinfection: Disinfection must be provided year-round, because Lake Superior is classified as a Public Water Supply.

	EFFLUENT LIMITATIONS				MONITORING REQUIREMENTS	
EFFLUENT PARAMETERS	Monthly Average	Weekly Average	Daily Minimum	Daily Maximum	Sample Frequency	Sample Type
Flow[1]	MGD	-	-	-	Continuous	
BOD_5[2,3]	30 mg/l	45 mg/l	-	-	Daily	24-hour Composite[4]
Suspended Solids[2,3,5]	60 mg/l	60 mg/l	-	-	Daily	24-hour Composite[4]
pH	-	-	6.0 s.u.	9.0 s.u.	Daily	Grab
Phosphorus[3]	1.0 mg/l	-	-	-	Daily	24-hour Composite[4]
Fecal Coliform[3]	400/100 ml	-	-	-	2x Weekly	Grab
Residual Chlorine[3,7,10]	-	7.06 µg/l	-	37 µg/l	Daily	Grab
Zinc[3,9,10]	-	66.3 µg/l	-	-	Monthly	24-hour Composite[4]
Pentachlorophenol[3,9,10]	-	8.23 µg/l	-	-	Monthly	24-Hour Composite[4]
2,4-Dichlorophenol[3,9,10]	0.30 µg/l	-	-	-	Monthly	24-Hour Composite[4]
Beryllium[3,8,9,10]	0.014 µg/l	-	-	-	Monthly	24-hour Composite[4]
Chloroform[3,8,9,10]	0.0009 µg/l	-	-	-	Monthly	Grab
Benzo(a)pyrene[3,8,9,10]	0.0009 µg/l	-	-	-	Monthly	24-hour Composite[4]
Total PAH Compounds:[3,8,9,10,11]	0.011 µg/l	-	-	-	Monthly	24-hour Composite[4]
Benzo(ghi)perylene[3,8,9,10,11]	0.0009 µg/l	-	-	-	Monthly	24-hour Composite[4]
Phenanthrene[3,8,9,10,11]	0.010 µg/l	-	-	-	Monthly	24-hour Composite[4]
Benzo(a)anthracene[3,9,10,11]	-	-	-	µg/l	Monthly	24-hour Composite[4]
3,4-Benzofluoranthene[3,9,10,11]	-	-	-	µg/l	Monthly	24-hour Composite[4]
Benzo(k)fluoranthene[3,9,10,11]	-	-	-	µg/l	Monthly	24-hour Composite[4]
Chrysene[3,9,10,11]	-	-	-	µg/l	Monthly	24-hour Composite[4]
Dibenzo(a,h)anthracene[3,9,10,11]	-	-	-	µg/l	Monthly	24-hour Composite[4]
Pyrene[3,9,10,11]	-	-	-	µg/l	Monthly	24-hour Composite[4]
Indeno(1,2,3-cd)pyrene[3,9,10,11]	-	-	-	µg/l	Monthly	24-hour Composite[4]
Ammonia-nitrogen[12]	-	-	-	mg/l	Monthly	24-hour Composite[4]
Hardness	-	-	-	mg/l	Monthly	24-hour Composite[4]

1 The wastewater volume discharged from the treatment plant shall be monitored continuously.

2 The discharge of visible or floating solids is prohibited in other than trace amounts.

Appendix 4

FIA/FEMA Report

Appendix 5

WPDES Municipal Point Source Permit

Appendix 6

City's Draft Stormwater Management Plan

Appendix 7

WDNR's Draft Stormwater Management Permit

Appendix 8

Needs-Treatment

Appendix 9

Needs-Collection

City of Superior

Wastewater Division

Collection System

Projects and Priorities

for Contract 7

5/18/99

Appendix 10

Collection System Capacities

Appendix 11

Industrial Pretreatment-40 concerns

Appendix 12

WDNR/Murphy Oil Agreement

Appendix 13

Basin Mapping

IV. Basin Mapping and Characterization

SCOPE

Stormwater permitting by the Wisconsin Department of Natural Resources (WDNR) requires delineation and characterization of surface water drainage basins within a municipality's limits. An appropriate and effective surface water management plan for the City of Superior must include accurate surface water drainage basin documentation. Surface water drainage basins include both natural surface watersheds and engineered storm sewer systems. Delineation of surface water drainage basins rests upon location of topographical surface boundaries and storm water conveyances. Physical delineation of watershed and sewershed boundaries underlies all ensuing efforts to assess and control surface water quality and quantity concerns.

The City has detailed storm sewer pipe networks. Detailing storm sewer pipe networks includes the mapping and cataloging of: pipe age, size, type, and slope; manhole and catchment rim and invert elevations, and the size and type of outfall per network. Information also collected to support stormwater planning includes maps showing Superior's topography, land use, industries, aerial photographs, and wetland location and characterization.

METHODOLOGY

Two areas of Superior were selected to be part of a pilot study that delineates surface water drainage basin boundaries and character. The first area chosen for assessment is commonly called "sewer service area district 1." District 1 is in the northern portion of the City and is described later in greater detail. To compliment those attributes exhibited in district 1, the area designated by WDNR as WISUL07 (basin 7) for SLAMM water quality modeling application was addressed as a second area. Basin 7 is in the location generally draining to Newton Creek and is further described later. These pilot areas were chosen as "starting points" for surface water drainage basin determination. During the course of basin mapping and characterization, the "District 1" area was more appropriately termed Howard Bay Drainage Area and "Basin 7" was more aptly described with Newton Creek Drainage Area (see Figure 4.1).

A logical step-wise survey was accomplished to appropriately and effectively determine surface water drainage within the City of Superior. In general, sewersheds were determined first, watersheds were determined next, and general field information within and between drainage basins was collected during the entire survey.

Sewershed boundaries were determined by locating areas of storm sewer on existing network maps; verifying sewershed boundaries via "windshield surveys"; and, if necessary, walking the perimeter of area known to be underlain by storm sewer pipe. At the perimeter, the boundary of drainage was determined according to natural and engineered topographical features. Once sewershed boundaries were determined, watershed boundaries were estimated with USGS topographical maps and field verified. Field verification included boundary confirmation and collection of any relevant field information. Basins were given names according to those water bodies receiving their drainage. The attached flowchart (Figure 4.2) shows the methodology and progression of drainage basin determination.

DISCUSSION

Howard Bay Drainage Area

Location

The Howard Bay Drainage is located at the northern most tip of the City of Superior and is generally framed by Banks Avenue (west), Winter St. (South), Howard Bay (north and east), and Superior Bay (north). An area to the southwest and outside of those general boundaries described above is also included as part of the Howard Bay Drainage Area.

Drainage

Twenty-six basins were mapped within the Howard Bay Drainage Area (Figure 4.3). Of the twenty-six basins, seven can be described as sewersheds and the remaining nineteen are best described as watersheds. Outfall information for the storm sewer networks is discussed in Chapter 5 (DWF Screening). Storm sewer networks are shown on Figure 4.4 (located in map pocket). Receiving waters were determined by considering those water bodies first taking surface drainage. Surface waters from the twenty-six basins drain to the following receiving waters:

- Tower Slip;
- St. Louis Bay;
- Howard Bay;
- Hughitt Slip;
- Cumming Slip; and
- Superior Bay.

Mapped and characterized watershed and sewersheds exhibit area ranges of 3 - 359 acres and 1 - 30 acres respectively. Table 4.1 details basin type (sewershed vs. watershed), basin area, and basin drainage receiving waters. The largest mapped

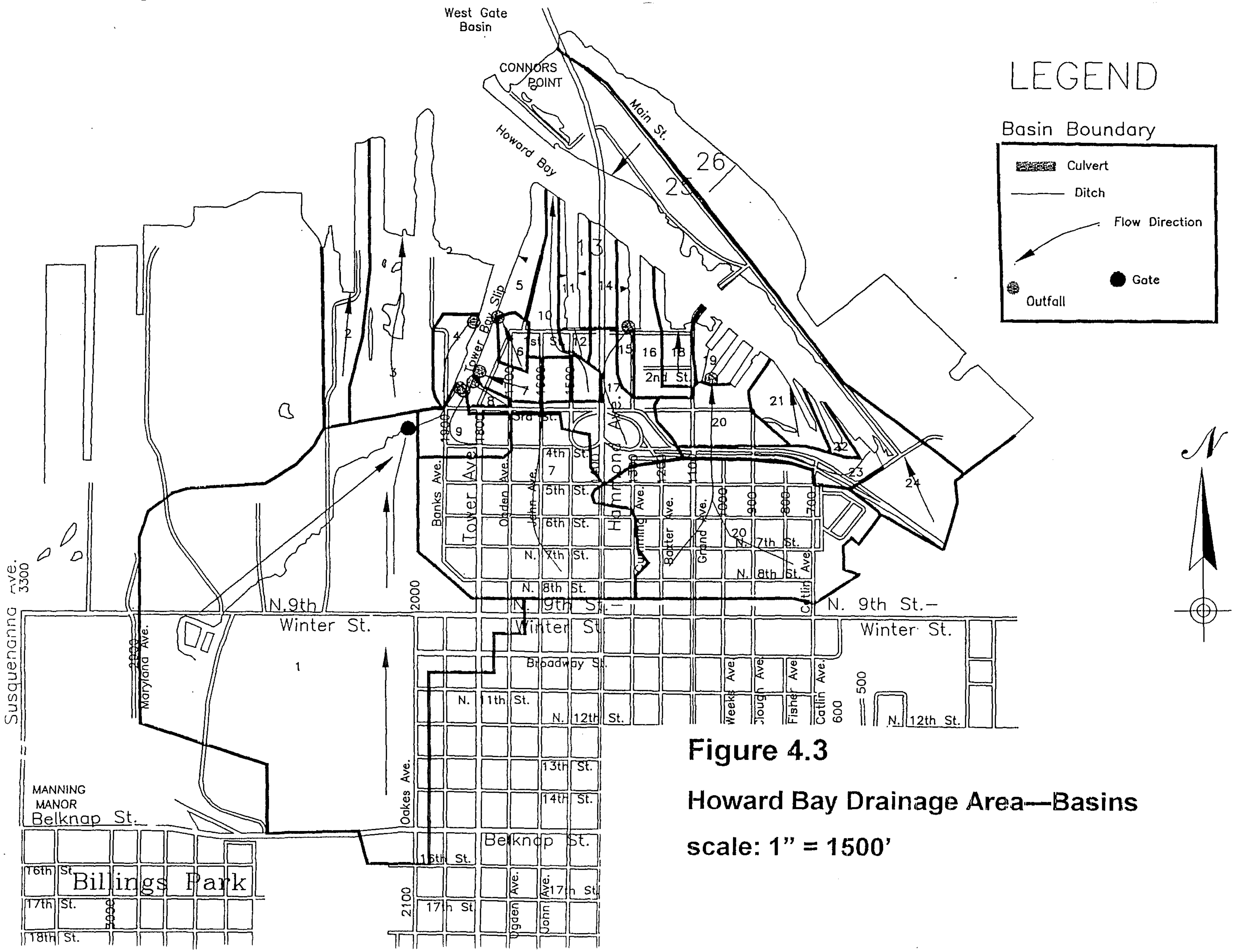


Figure 4.3

Howard Bay Drainage Area—Basins

scale: 1" = 1500'

Table 4.1. Howard Bay Drainage Area Basins

number	name	area, acres
1	Tower Slip 1*	359
2	St. Louis Bay 1	35
3	Howard Bay 1	68
4	Tower Slip 2**	9
5	Tower Slip 3	10
6	Tower Slip 4**	5
7	Tower Slip 5**	9
8	Tower Slip 6**	1
9	Tower Slip 7**	17
10	Howard Bay 2	17
11	Hughitt Slip 1	3
12	Hughitt Slip 2	3
13	Hughitt Slip 3	4
14	Howard Bay 3	9
15	Cumming Slip 1	7
16	Cumming Slip 2	12
17	Cumming Slip 3**	30
18	Howard's Bay 4	9
19	Howard Bay 5	8
20	Howard Bay 6**	22
21	Howard Bay 7	13
22	Howard Bay 8	3
23	Howard Bay 9	15
24	Howard Bay 10	89
25	Howard Bay 11	70
26	Superior Bay 1	119

*considered a watershed, but does contain some sewered areas

**sewershed

basin, *Tower Slip 1*, contains a number of noteworthy features. *Tower Slip 1* comprises an area estimated to be approximately 359 acres. Primarily unsewered, much of this drainage is industrial and includes: ABC Rail; BN Railroad; Amsoil; TLK; SIMKO; and Super One Grocery Store. The sewered component of *Tower Slip 1* encompasses an approximate 5 block area to the southeast of the intersection of Oakes Avenue and Winter Street as well as roof/parking lot drainage from the Super One Grocery Store Area. *Tower Slip 1* drainage culminates in a stream that flows toward the southeast corner of Banks Avenue and 3rd St. A 72" slide gate regulates flow to the Bay. A more detailed discussion of BMPs ensues later.

Most of those basins delineated in the northern area of the Howard Bay Drainage Area are not sewered and exhibit no engineered surface water conveyance systems. This northern area of the Howard Bay Drainage Area primarily serves industry. Connor's Point is mostly undeveloped and does not have any engineered conveyance or storm sewer system. The *Howard Bay 6* and *Tower Slip 5* basins are sewered for stormwater from primarily residential and commercial area.

BMPs

BMPs employed in the Howard Bay Drainage Area are limited. The most significant BMP in the area is the 72" slide gate apparently used to control the *Tower Slip 1* stream (Figure 4.5). The necessity and extent of present gate usage to control stormwater quality or quantity has not been fully investigated. However, according to City personnel, the original purpose of the Gate was to guard against accidental petroleum spills within *Tower Slip 1*. Non-engineered systems within the Howard Bay Drainage Area, such as wetlands, may also serve to minimize the negative impacts of surface water runoff—discussion of wetlands follows.

Wetlands

Previously delineated wetlands are located in a number of Howard Bay Drainage Area basins. Types, areas, and locations of wetlands are shown in Figure 4.6 and listed in Table 4.2.

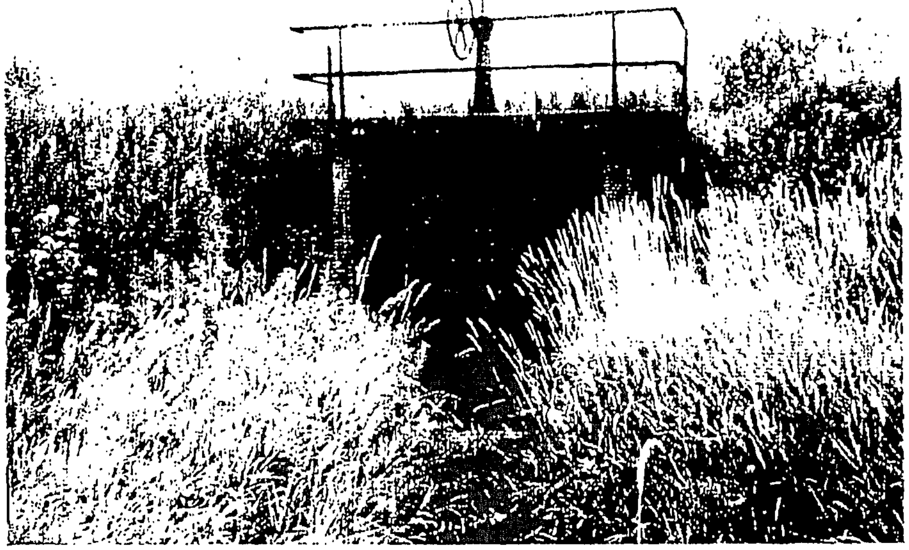
Table 4.2. Howard Bay Drainage Area Wetlands.

BASIN	CODE	TYPE/DESCRIPTION (class;sub-class;hydrologic modifier)	area (acres)
Tower Slip 1	E2K	Emergent/WetMeadow;Narrow-leaved persistent; wet soil/Palustrine	4.2
	S3K	Scrub/Shrub;broad-leaved deciduous; wet soil/Palustrine	1.1
	E2/S3K	see descriptions above	5.0
	T3K	Forrested;broad-leaveddeciduous;wet-soil/Palustrine	0.9+
	W0H	Open water;subclassunknown;standing waterPalustrine	4.2
Tower Slip 2	S3K	see description above	0.5
Tower Slip 3	E2K	see description above	1.9
	W0H	see description above	2.9
	T3K	see description above	0.7
Tower Slip 16/18	S3/E1K	Scrub/Shrub;broad-leaved deciduous; & Emergent/Wet Meadow;persistent; wet soil/Palustrine	1.4
Tower Slip 24	T3/S3K	see description above	3.0
Tower Slip 25	T3/S3K	see description above	4.0
Tower Slip 26	T3/S3Kr	see description above (r denotes red clay complex)	3.0

Topography/Landform

As is seen in the U.S.G.S. map (Figure 4.7) and the aerial photgraph (Figure 4.8), topographical relief in the Harbor Bay Drainage Area is limited. Also, the area is underlain by relatively impermeable red clay. Therefore, surface water infiltration to groundwater is negligible. With limited topographical relief and relatively impermeable

Sluice Gate Structure (from West)



Panoramic view of Tower Slip Basin 1(from East)

Figure 4.5. Howard Bay Drainage Area—*Tower Slip 1* 72" gate.

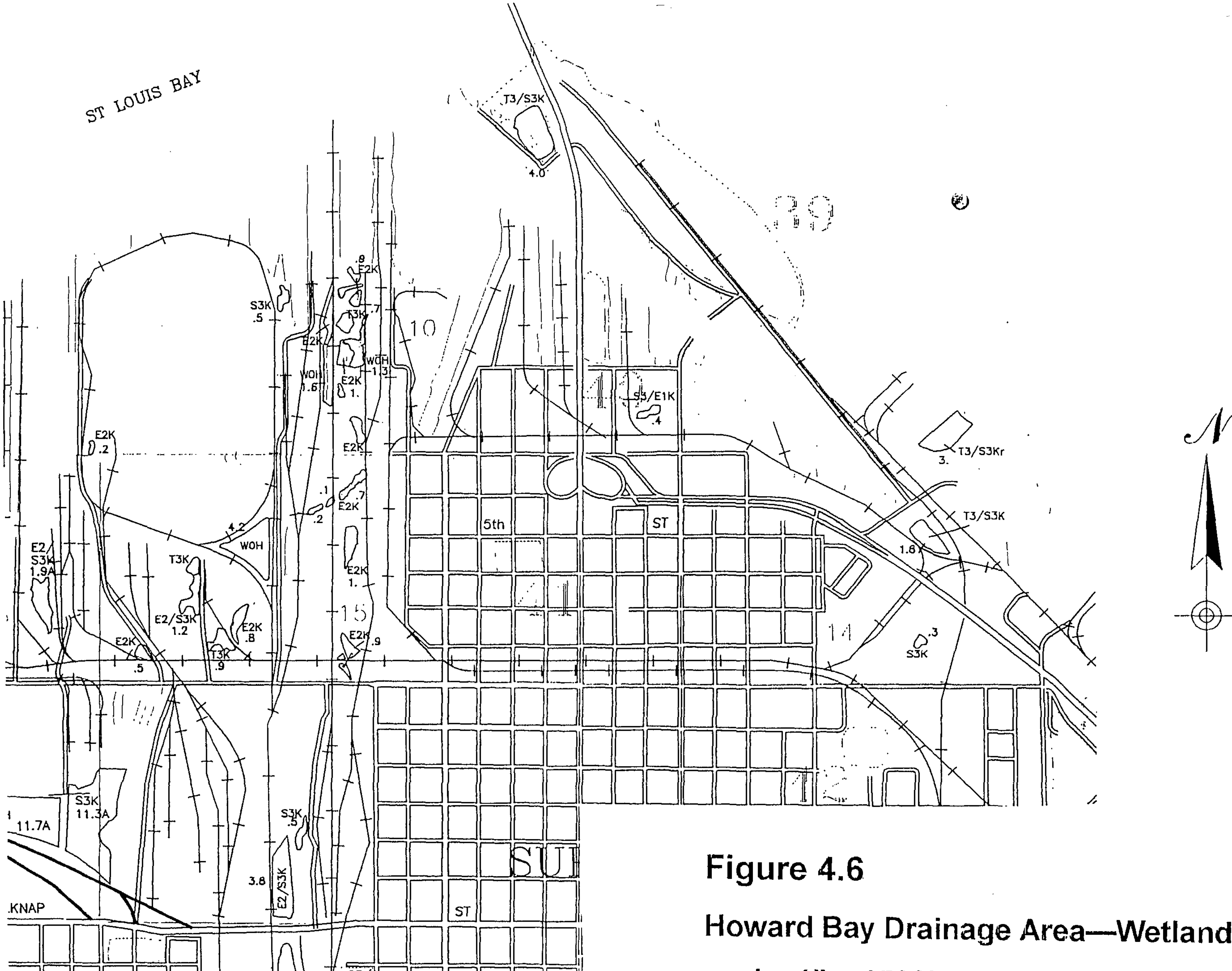


Figure 4.6

Howard Bay Drainage Area—Wetlands

scale: 1" = 1500'

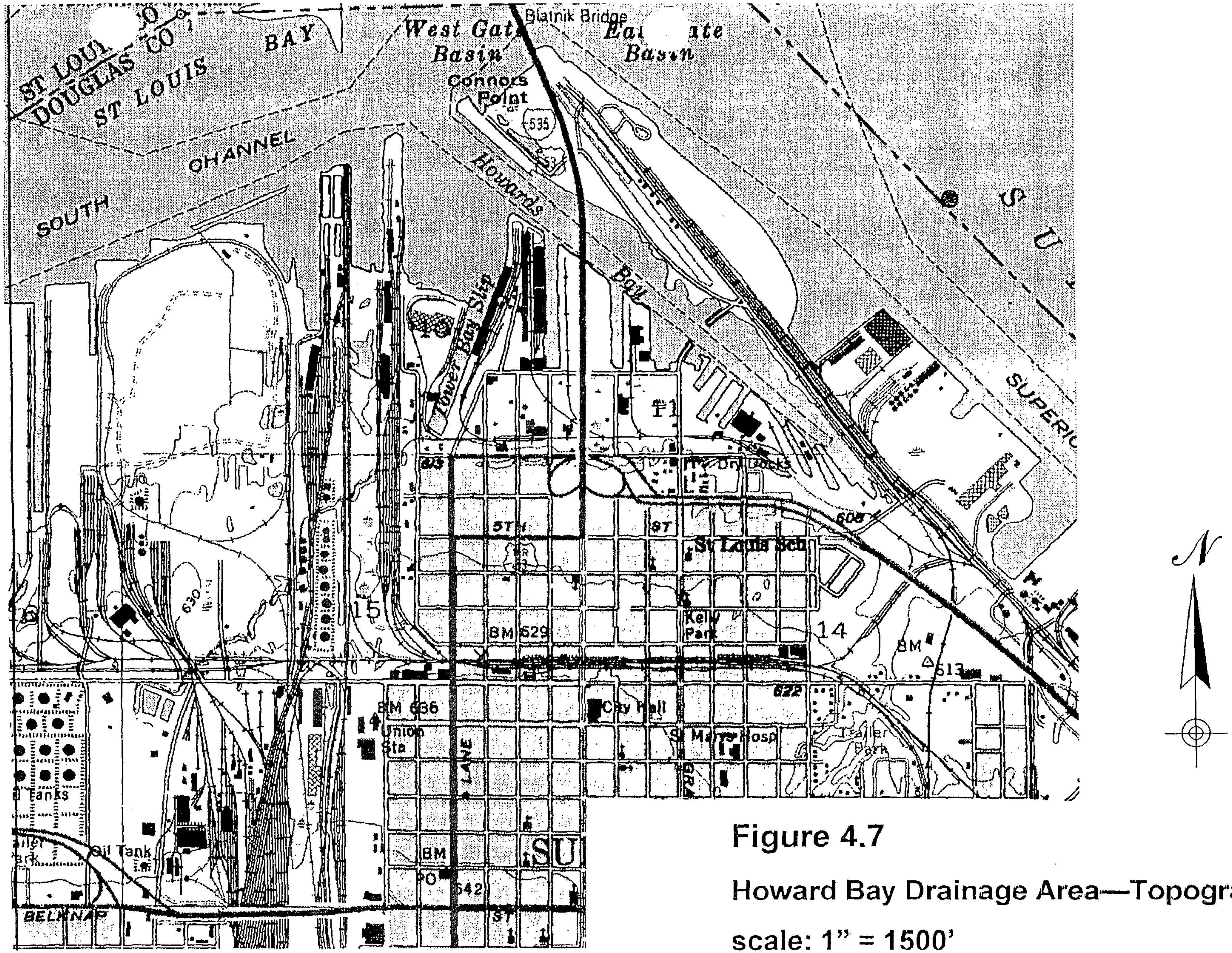
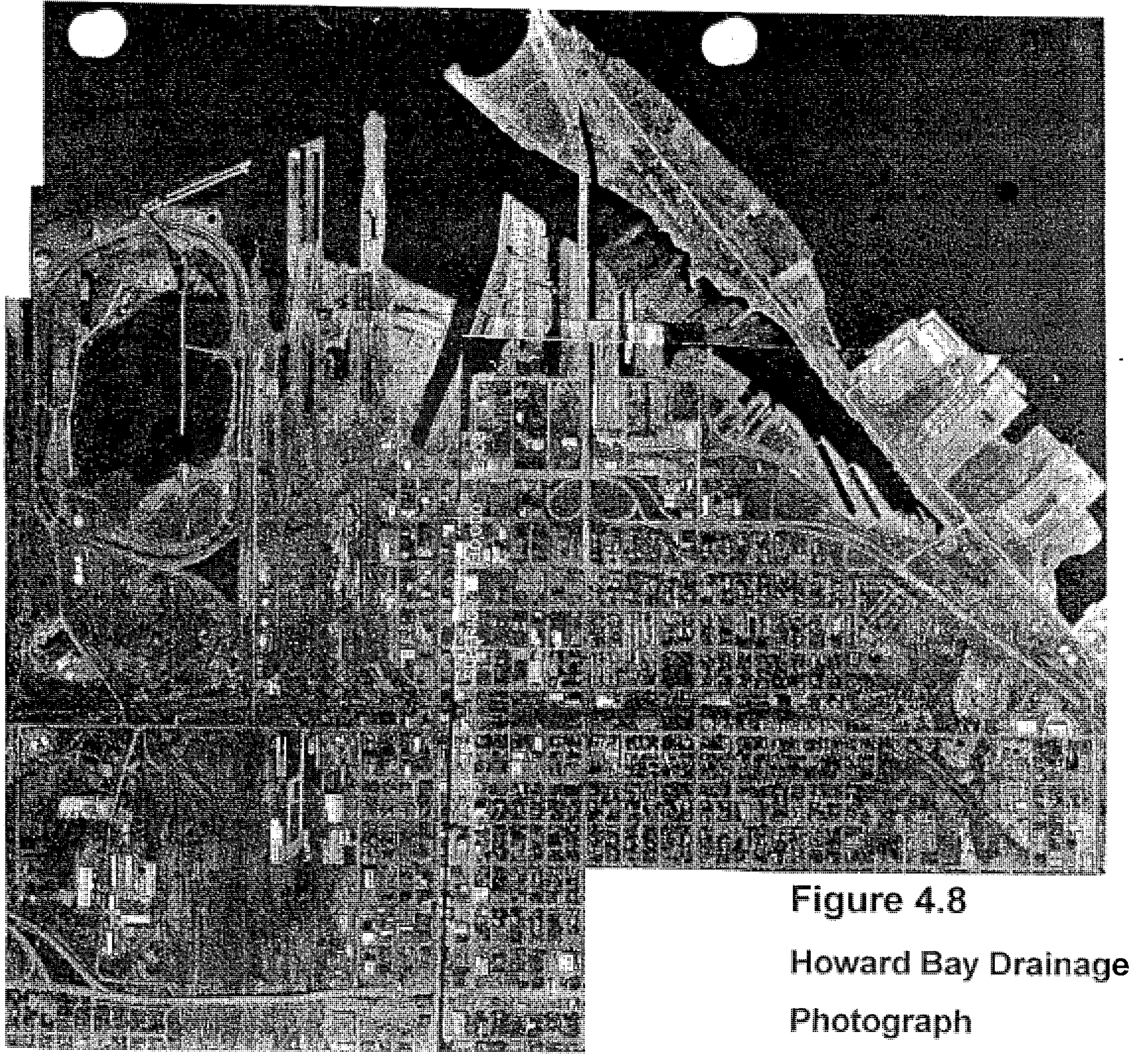


Figure 4.7

Howard Bay Drainage Area—Topography

scale: 1" = 1500'



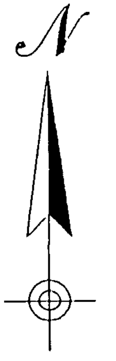


Figure 4.8

Howard Bay Drainage Area—Aerial Photograph

scale: 1" = 1500'

soil, rainfall and snowmelt travel slowly through engineered systems (sewers and ditches), natural systems (surface streams and wetlands), or via overland flow.

Imperviousness is also increased with development. Imperviousness due to development within the Howard Bay Drainage is most prevalent in the northern/shoreline industrial area as well as the southern/southwestern residential/commercial area.

Landuse

Landuse (Figure 4.9) varies considerably within the Howard Bay Drainage Area—virtually all landuse designations are exhibited. Predominate landuses include:

- manufacturing (Tower Slip 1 and other shoreline basins);
- commercial;
- residential; and
- transportation/communications/utility.

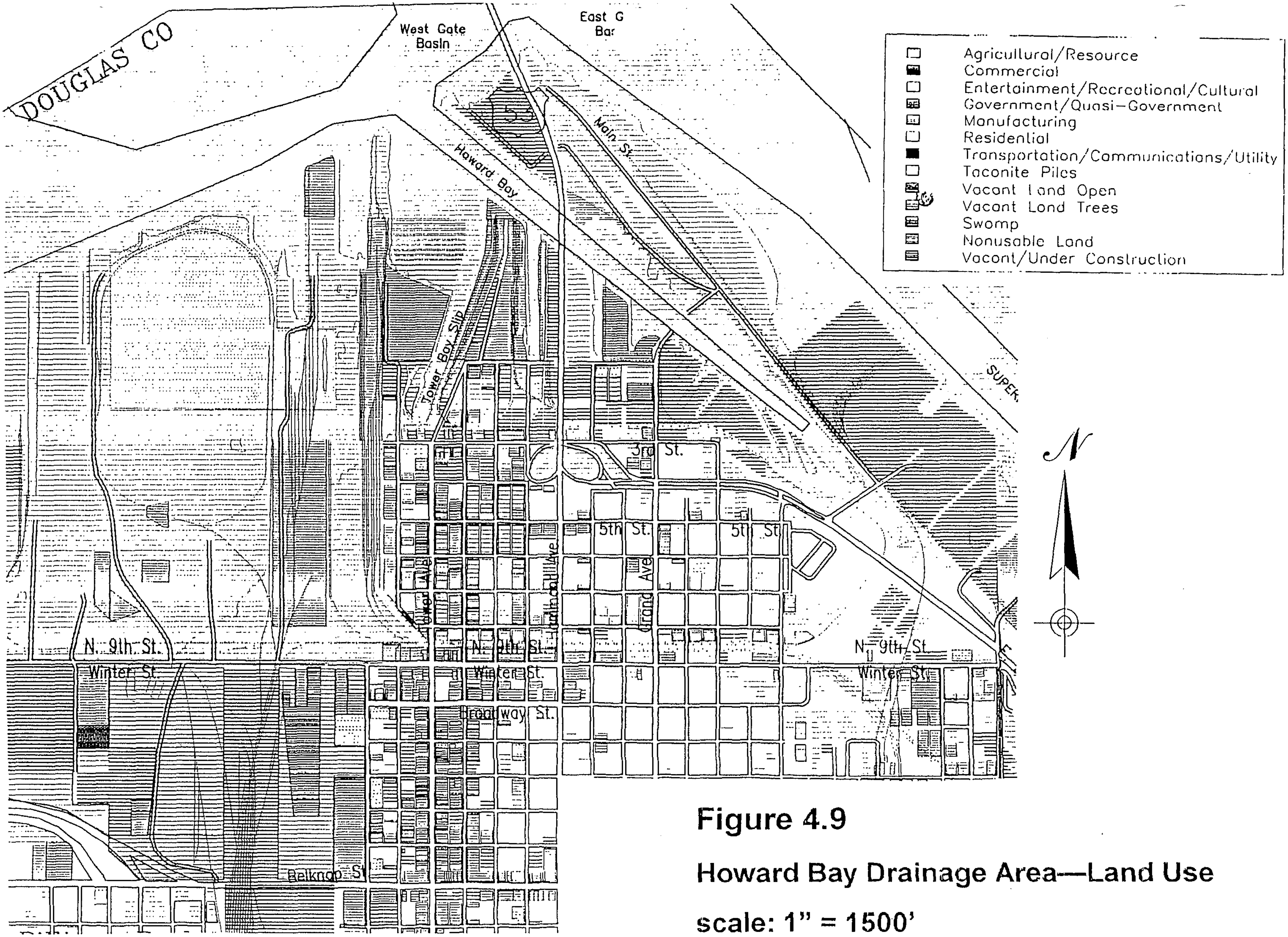


Figure 4.9

Howard Bay Drainage Area—Land Use

scale: 1" = 1500'

Newton Creek Drainage Area

Location

The Newton Creek Drainage is located northwest of the Nemadji River; north of 58th St.; southwest of Superior Harbor (Hog Island area) and southwest of a line running approximately ½ mile north of Stinson Ave. (Figure 4.1). The northeast portion of the Newton Creek Drainage is residential with limited commercial practices located in the vicinity of E. 2nd St. Industries located within the Newton Creek Drainage area include Lakehead Pipeline and Murphy Oil. The southwest portion of the Newton Creek Drainage area is the northeast part of South Superior, which is primarily residential. Although termed the Newton Creek Drainage Area, much of the surface runoff flows to the Nemadji river with some runoff draining to the unnamed creek running in the vicinity and in the direction of what would be 30th Ave. E. Some Newton Creek Drainage area basins drain directly to Superior Harbor.

Drainage

35 basins have been located within the Newton Creek Drainage area. (Figure 4.10). Eight of the 35 basins are serviced by storm sewers. Storm sewer outfall information is discussed in Chapter 5 (DWF Screening) and storm sewer maps within the drainage area are shown on Figure 4.11 (map pocket). Surface water within the Newton Creek Drainage area ultimately flows to the following receiving waters:

- Newton Creek;
- Nemadji River;
- Superior Harbor; and
- 30th Ave. Creek.

As previously mentioned, receiving waters were determined by considering those water bodies first taking surface drainage. Of the 34 Newton Creek Area basins, 16 drain to Newton Creek; 8 drain to the Nemadji River; 6 drain to Superior Harbor; and 4 drain to the unnamed creek in the vicinity of 30th Ave. Table 4.3 details Newton Creek Drainage

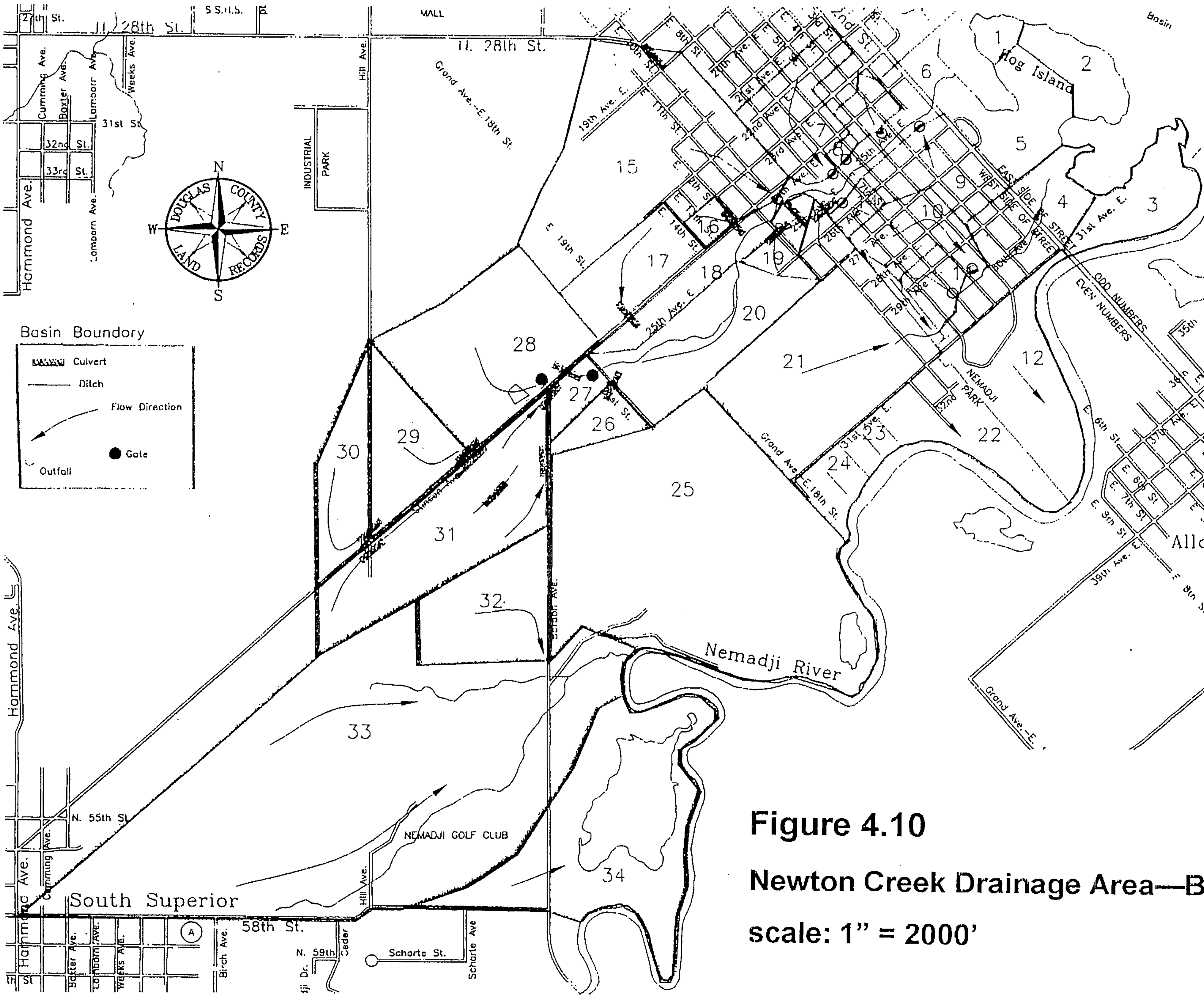


Figure 4.10

Newton Creek Drainage Area—Basins

scale: 1" = 2000'

Table 4.3. Newton Creek Drainage Area Basins

number	name	area, acres
1	Superior Harbor 1	8
2	Superior Harbor 2	28
3	Superior Harbor 3	43
4	Superior Harbor 4	61
5	Superior Harbor 5	58
6	Superior Harbor 6	31
7	Newton Creek 1*	49
8	Newton Creek 2*	3
9	Newton Creek 3*	42
10	30th Ave. Creek 1*	35
11	30th Ave. Creek 2*	15
12	Nemadji River 1	76
13	30th Ave. Creek 3	6
14	Newton Creek 4*	8
15	Newton Creek 5*	184
16	Newton Creek 6	7
17	Newton Creek 7	45
18	Newton Creek 8	31
19	Newton Creek 9	7
20	Newton Creek 10	70
21	30th Ave. Creek 4	134
22	Nemadji River 2	55
23	Nemadji River 3	10
24	Nemadji River 4	17
25	Nemadji River 5	352
26	Newton Creek 11	17
27	Newton Creek 12	15
28	Newton Creek 13	119
29	Newton Creek 14	51
30	Newton Creek 15	46
31	Newton Creek 16	119
32	Nemadji River 6	67
33	Nemadji River 7	533
34	Nemadji River 8	177
35	Newton Creek 17*	20

* sewershed

area basin receiving waters, areas, and locations.

Ditches run along both sides of the length of Stinson Ave. from Hill Ave. to E 11th St., where transported water empties into Newton Creek. Both sides of the railroad tracks in *Newton Creek 6* basin are also ditched—ultimately emptying into ditches alongside Stinson Ave. Also, *Newton Creek 5* basin exhibits street-side ditching that carries surface water to the storm sewer system. Much of the *Superior Harbor 4* basin is ditched to transport water to the unnamed creek running along what would be 30th Ave. E.

Estimated watershed areas range from 6 to 533 acres, and sewersheds have estimated areas ranging from 3 to 49 acres. Much of the Nemadji Public Golf Course constitutes the largest basin (*Nemadji River 7*, approximately 533 acres) within the Newton Creek Drainage area. The smallest basin (*Newton Creek* 2, approximately 3 acres) is bound by 24th and 25th Avenues E. and E. 6th and 7th Streets.

BMPs

Engineered BMPs within the Newton Creek Drainage area and not associated with industry are limited. Both Murphy Oil and Lakehead Pipeline have bermed their sites and provide some degree of surface water pond detention. A weir gate located on E. 21st St. and to the southeast of Stinson Ave. provides control of drainage from Murphy Oil surface water (and wastewater discharge) and those areas directly adjacent to Stinson Avenue south of E. 21st St. The operability and control status of this gate is not known. A marshy area is upstream of the weir gate and has been delineated as one (1) acre of W0H wetlands (open water; subclass unknown; standing water; Palustrine). The degree of surface water runoff quality and quantity benefits derived from natural wetland systems is not known. Discussion of wetland location, area, and classification follows. A gate located north of the Stinson Ave. and Bardon Ave. intersection also controls the discharge rate of Murphy Oil surface water runoff and wastewater discharge. A series of ponds located on the Nemadji Golf Course detain surface runoff to provide management of area flows.

Wetlands

Wetland locations, areas, and classifications as delineated by the February 1997 SAMP are listed in Table 4.4 and shown in Figure 4.12.

Table 4.4. Newton Creek Drainage Area Wetlands.

BASIN	CODE	TYPE/DESCRIPTION (class;sub-class;hydrologic modifier)	area (acres)
Superior Harbor 1	T3K	Forrested;broad-leaved deciduous;wet-soil/Palustrine	0.7+
Superior Harbor 2	T3K	see description above	0.3
Superior Harbor 3	T3K	see description above	1.5
	S3/E2H	Scrub/Shrub;broad-leaved deciduous; Emergent/wet meadow;narrow-leaved persistent; standing water / Palustrine	20.3
	E2H	Emergent/wet meadow;narrow-leaved persistent; standing water / Palustrine	0.9
Superior Harbor 4	S3K	Scrub/Shrub;broad-leaved deciduous;wet soil / Palustrine	0.5
	E2K	Emergent/Wet Meadow;Narrow-leaved persistent; wet soil / Palustrine	0.3
Superior Harbor 5	E1/S3K	Emergent/wet meadow;persistent; Scrub/Shrub;broad-leaved deciduous;wet soil / Palustrine	1.1
	S3/E2H	see description above	18
	E2K	see description above	0.4
Nemadji River 1	E2K	see description above	0.7
	E2H	see description above	36.5
	S3K	see description above	~7
Nemadji River 2	S3K	see description above	~9
Nemadji River 5	E2K	see description above	2.8
	E2H	see description above	5.4
	T3K	see description above	9.5
	T3/S3K	see description above	15.4
	S3/E2H	see description above	30.4
	W0H	Open water;subclass unknown;standing water / Palustrine (engineered)	~15
Nemadji River 6	T3/S3Kr	Forrested;broad-leaved deciduous;wet-soil / Palustrine Scrub/Shrub;broad-leaved deciduous;wet soil / Palustrine (red clay complex)	~20
Nemadji River 7	S3Kr	Scrub/Shrub;broad-leaved deciduous;wet soil / Palustrine (red clay complex)	18.8
	T3/S3Kr	see description above	~50
	S3K	see description above	11.2
Nemadji River 8	S6/E2Hm	Scrub/Shrub;broad-leaved evergreen; Emergent/wet meadow; narrow-leaved persistent; standing water / Palustrine; floating vegetated mats	61.6
	S3K	see description above	12.8
Newton Creek 5	S3/E2Kr	see description above	~10
	T3/S3Kr	see description above	~40
Newton Creek 7	S3/E2Kr	see description above	~25
	S3/E2H	see description above	3
Newton Creek 10	E1K	Emergent/wet meadow;persistent;wet soil / Palustrine	0.5
Newton Creek 12	W0H	see description above	1.0
Newton Creek 13	E1K	see description above	0.5
Newton Creek 15	S3/E2Kr	see description above	~10
	S3Kr	see description above	~20
Newton Creek 16	E2K	see description above	1.8
	S3Kr	see description above	~10
	T3/S3Kr	see description above	~15

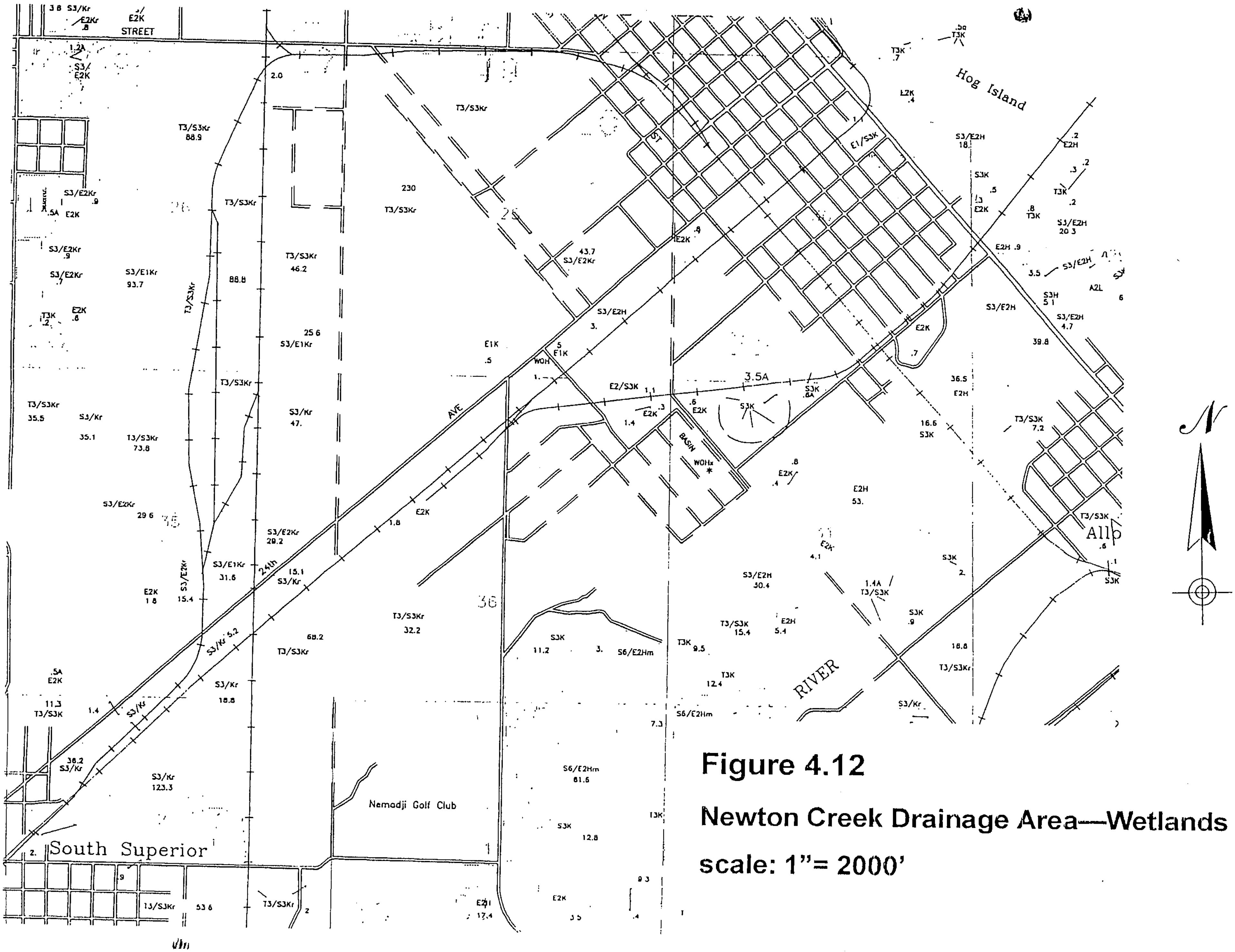


Figure 4.12
Newton Creek Drainage Area—Wetlands
scale: 1"= 2000'

Topography/Landform

The U.S.G.S topographical map and aerial photograph show limited relief in much of the Newton Creek Drainage area (Figures 4.13 and 4.14 respectively). The most significant relief is confined to shoreline areas of the Nemadji River and its tributary streams. Other areas of topographical relief are located along the shorelines of Newton Creek and the unnamed creek along 30th Ave. E. At distances away from shorelines (greater than ~500'), the drainage area is essentially flat.

Red clay underlies all of the City of Superior. Therefore, very little surface runoff infiltrates to groundwater through the relatively impermeable soil.

Landuse

The following landuse designations are found in the Newton Creek Drainage area:

- Entertainment/Recreational/Cultural;
- Vacant Land Trees;
- Vacant Land Open;
- Transportation/Communications/Utility;
- Government/Quasi-Government;
- Swamp;
- Residential; and
- Commercial.

Figure 4.15 shows the locations of these various landuse designations.

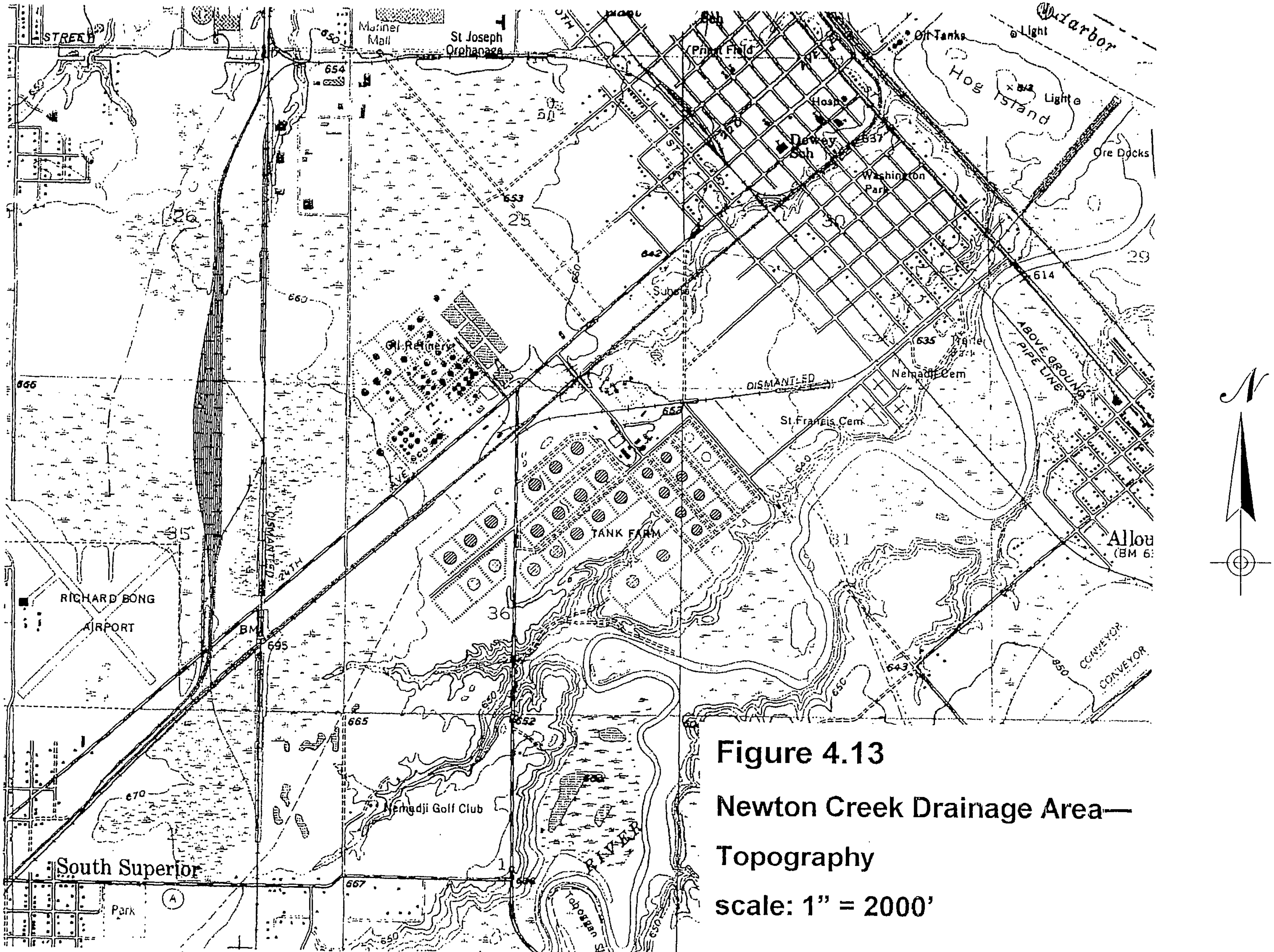
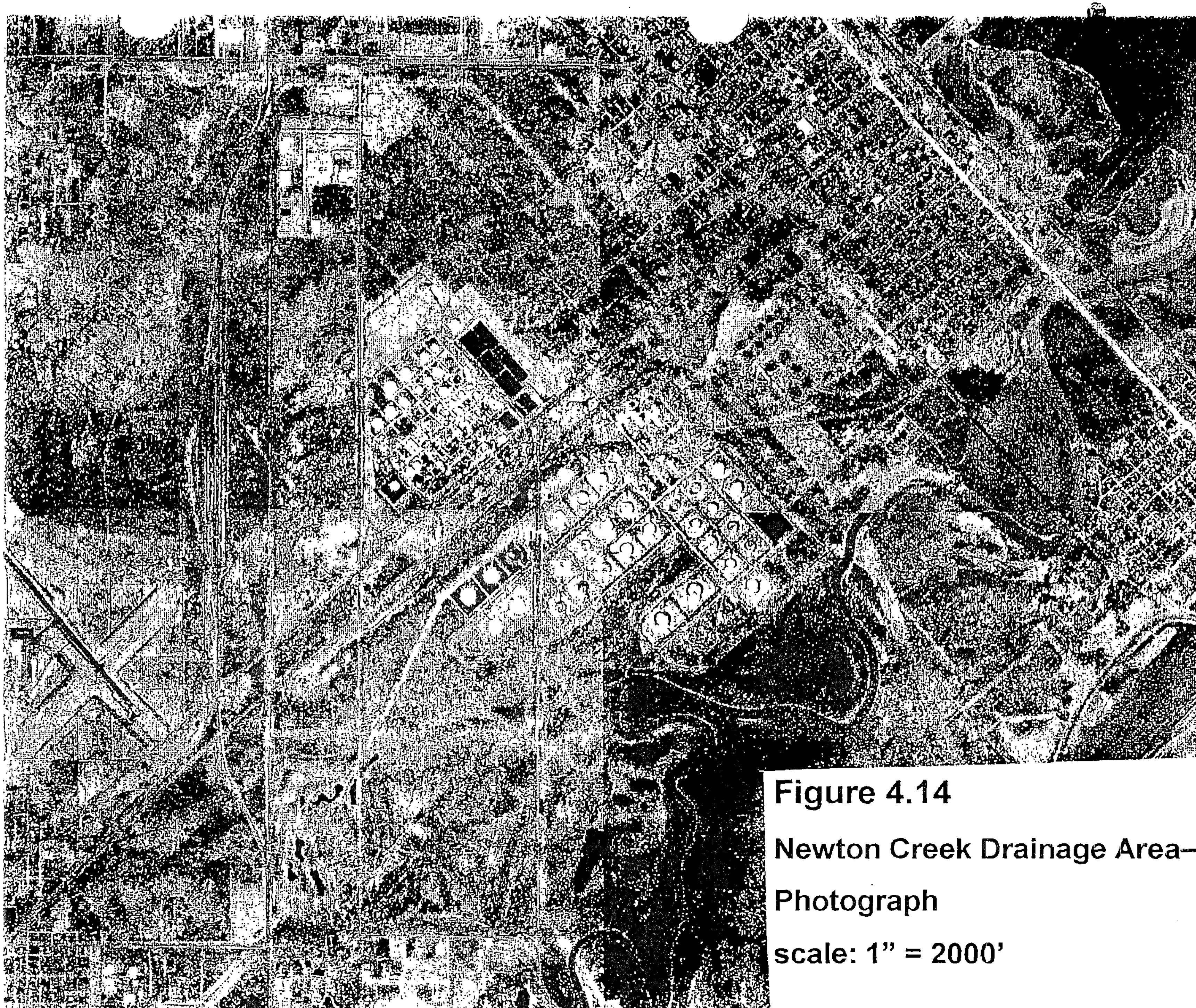


Figure 4.13

Newton Creek Drainage Area—Topography

scale: 1" = 2000'



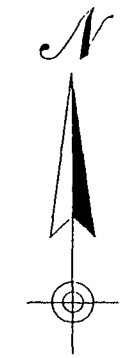


Figure 4.14

Newton Creek Drainage Area—Aerial Photograph

scale: 1" = 2000'

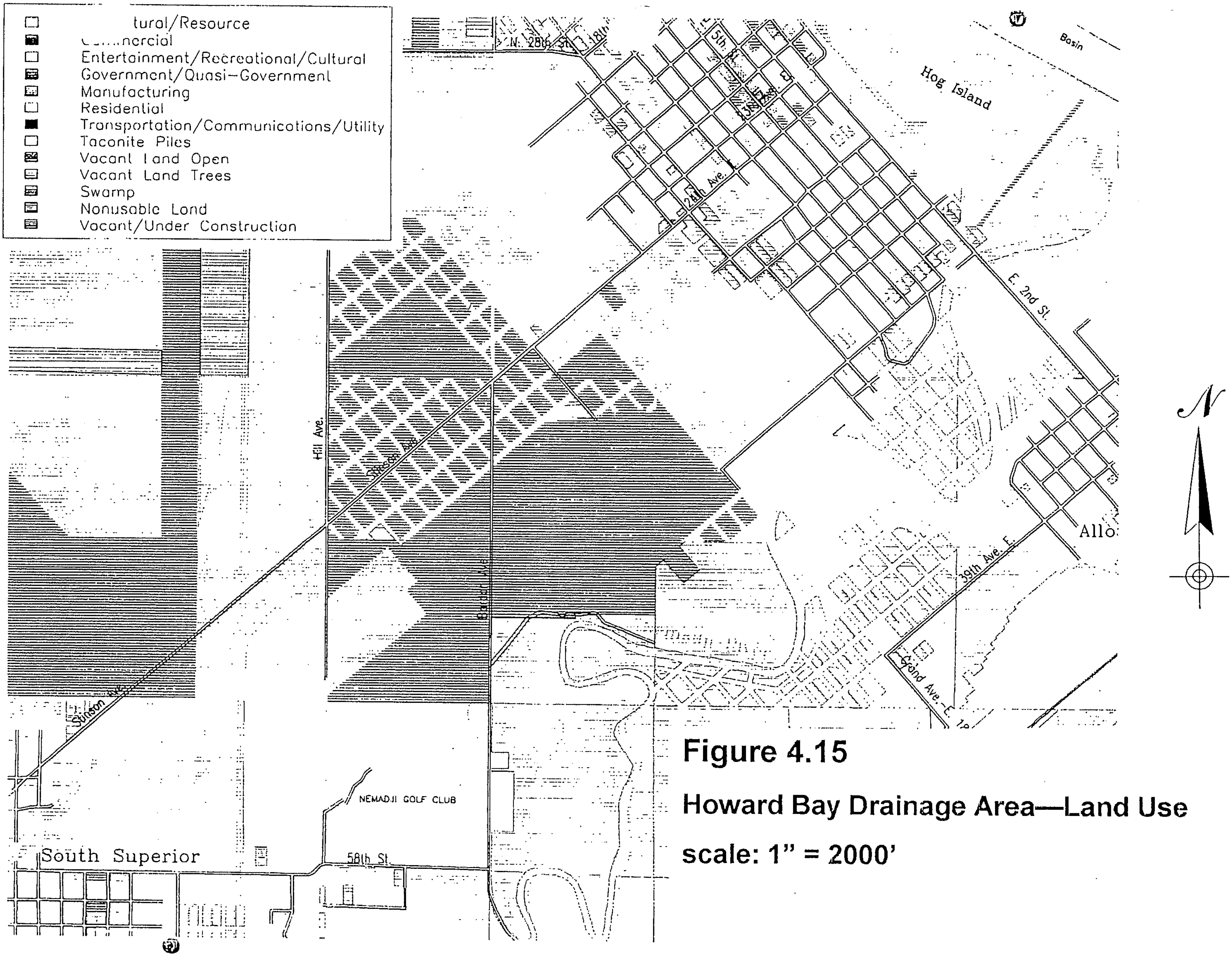


Figure 4.15

Howard Bay Drainage Area—Land Use

scale: 1" = 2000'

Figure 4.4
Howard Bay Drainage
Storm Sewer Network

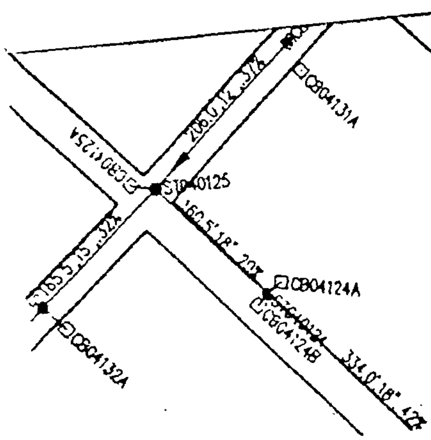


Figure 4.11a
Newton Creek Drainage Area—
Storm Sewer Network (north of Newton C

Figure 4.11b
Newton Creek Drainage Area—
Storm Sewer Network (south of Newton Cr

Appendix 14

Sewer Ordinance

Appendix 15

Overland Flow Ordinance

Appendix 16

Erosion Control Ordinance