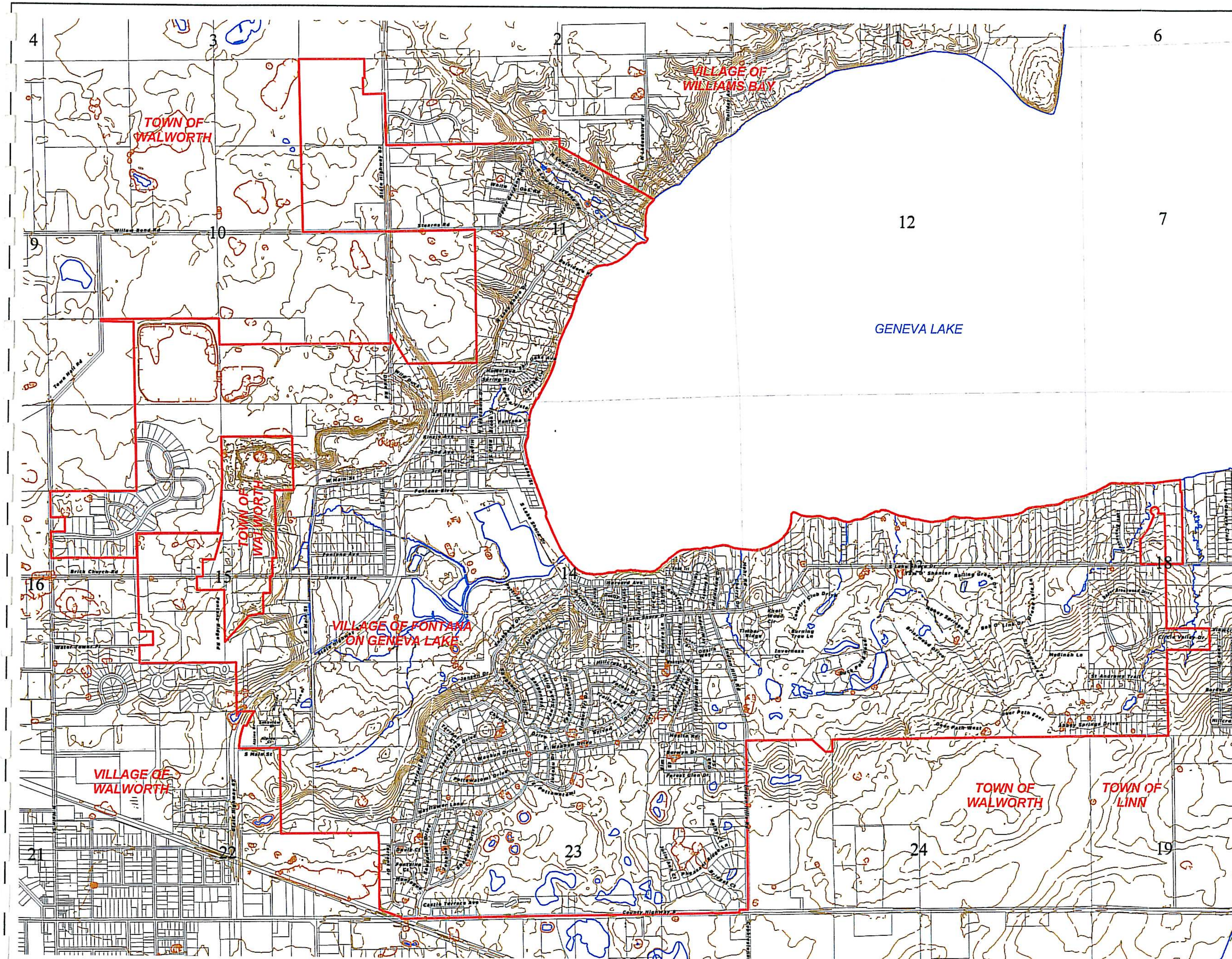

EXHIBIT 2

TOPOGRAPHIC AND CADASTRAL MAP OF THE STORM WATER MANAGEMENT SYSTEM PLANNING AREA

VILLAGE OF FONTANA-ON-GENEVA LAKE WALWORTH COUNTY, WISCONSIN

Legend

Municipal Boundary
10' Contour
10 Contour Depression
Water

0 700 1,400 2,800
Feet

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DATE: SEPTEMBER, 2009

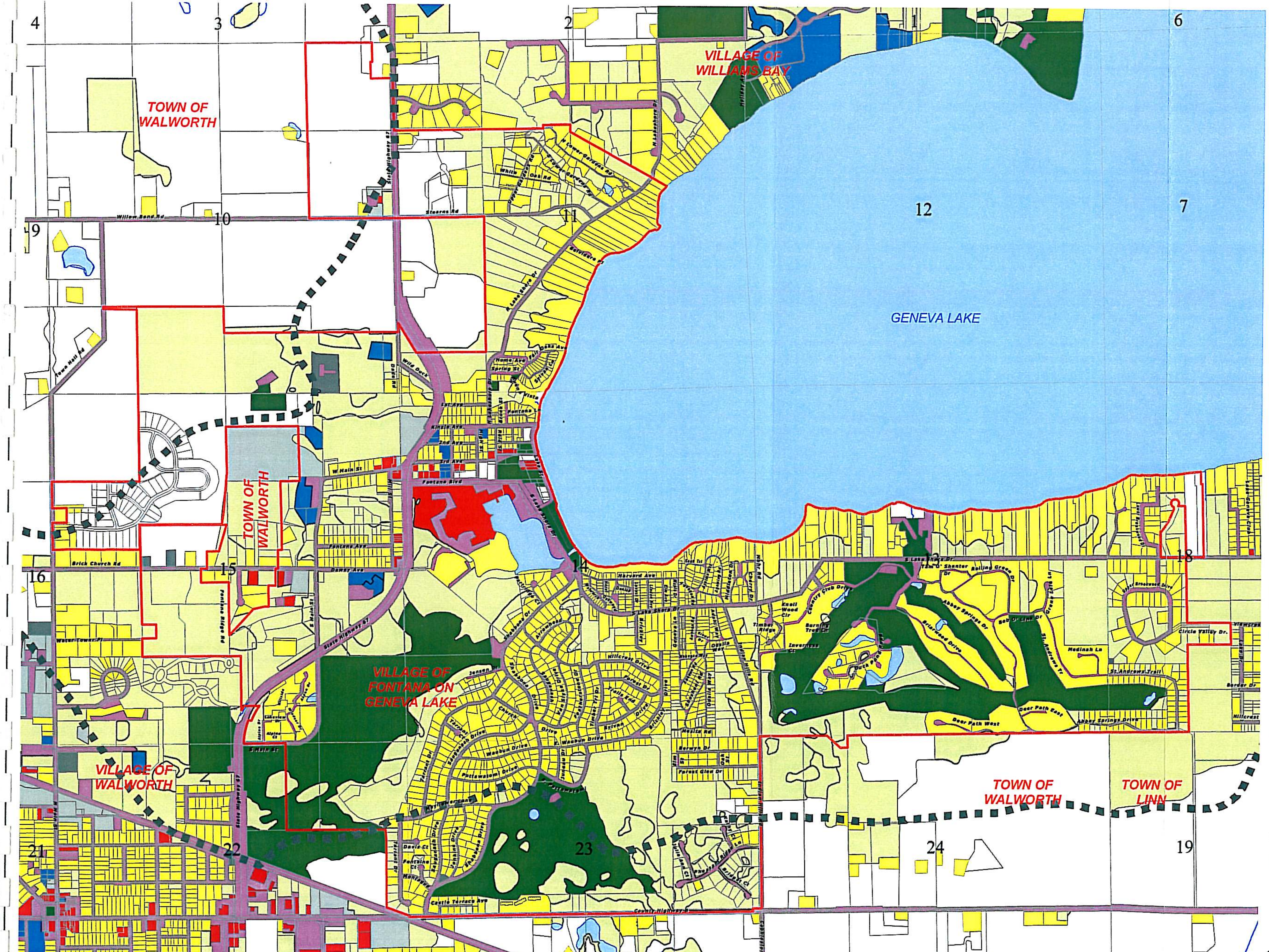

EXHIBIT 3

EXISTING LAND USE CONDITIONS: 2000

VILLAGE OF FONTANA-ON-GENEVA LAKE WALWORTH COUNTY, WISCONSIN

Legend

- Lower Rock River/ Geneva Lake Watershed
- Municipal Boundary
- Residential
- Commercial
- Industrial
- Transportation
- Communications and Utilities
- Governmental and Institutional
- Recreational
- Agricultural
- Open Lands
- Surface Water

0 700 1,400 2,800

Feet

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DATE: SEPTEMBER, 2009

Source: Cadastral-Walworth County, Land Use-SEWRPC

Utilizing data available from the Southeastern Wisconsin Regional Planning Commission, planned land use conditions within the storm water management system planning area were assembled. The data were assembled for the 2035 "build out" land use conditions which may be expected to exist in the planning area beyond the design year. The planned land use conditions under build out conditions are shown on Exhibit 4. The study also considered the Fontana Comprehensive Plan DRAFT August 21, 2009 future land use plan prepared by Vandewalle & Associates, Inc. when analyzing future conditions. A copy of the draft August 21, 2009 future land use plan is shown on Exhibit 5. Urban development was assumed to be excluded from environmental corridors and isolated natural areas, and these environmentally sensitive areas were not considered in the density calculations. As already noted, however, given the requirements of the Village storm water management ordinance, hydrologic analyses for the undeveloped areas of the Village were based upon existing land use conditions. In the developed areas of the Village such analyses were based upon planned year 2035 land use conditions which were assumed to approximate full build out conditions.

Topography and Surface Drainage Pattern

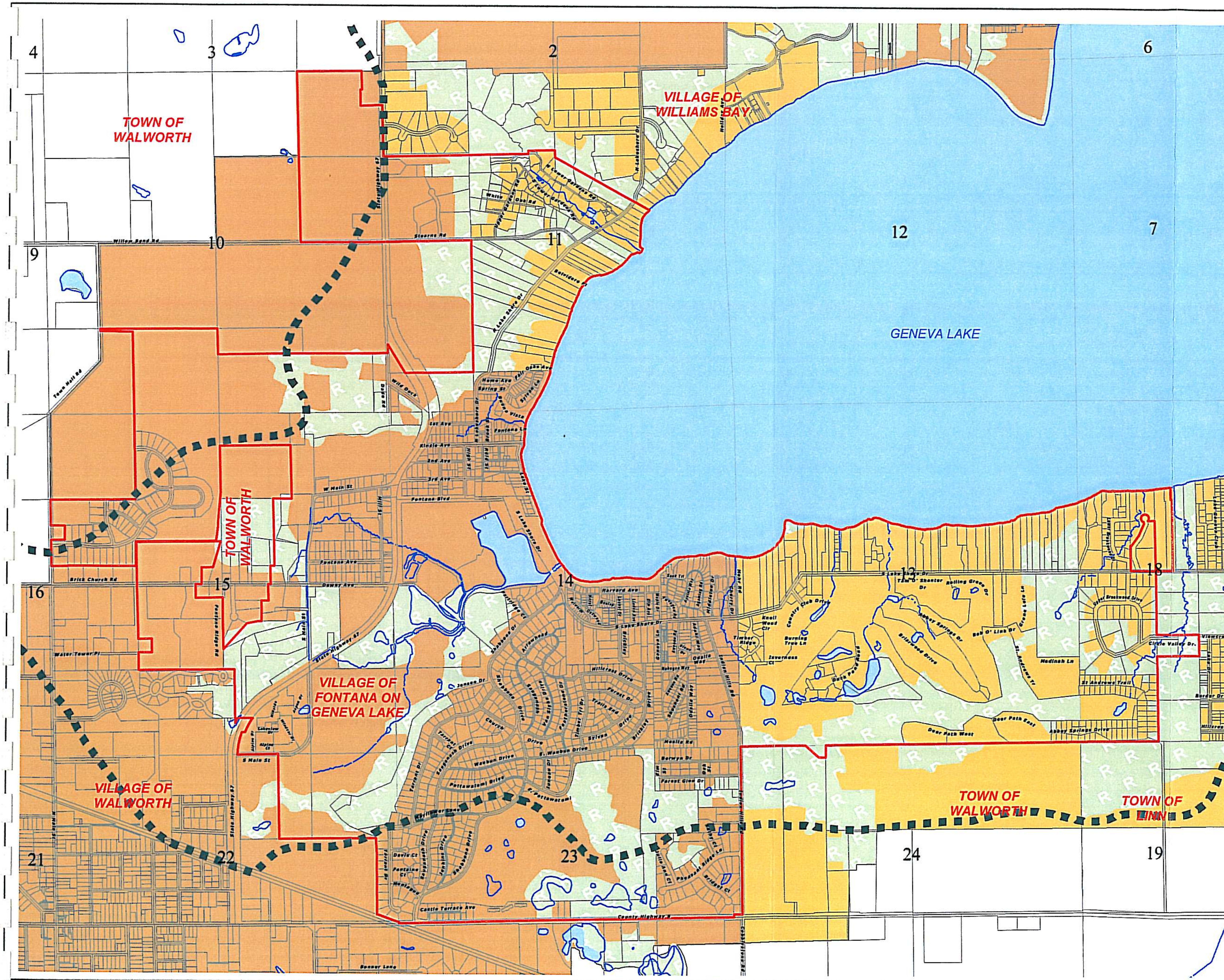
The drainage pattern of an area is a particularly important consideration in any storm water management system planning effort. As already noted, the planning area is traversed by a divide separating the Fox River – Illinois River drainage basin from the Lower Rock River drainage basin. The Lower Rock River drainage basin is the basin that drains to Geneva Lake. The approximate drainage basin line provided by the Geneva Lake Conservancy is shown on Exhibit 1.

Soil Conditions, Geology and Depth to Bedrock

The geologic conditions of an area, including depth to bedrock and depth to the groundwater table, are important considerations in any storm water management system planning effort. The Village of Fontana-on-Geneva Lake storm water management system planning area is located on a rolling ground moraine of glacial origin. The glacial deposits in the planning area are generally relatively shallow, but there are significant areas of deep bedrock within the planning area.

The planning area is located in an area of generally shallow depths to the groundwater table. The groundwater reservoir provided by the glacial till deposits and underlying undifferentiated limestone bedrock formations is the source of supply for many of the municipal and private on-site wells used within the planning area as a source of potable water.

The Village of Fontana-on-Geneva Lake storm water management system planning area contains soils within hydrologic soil group B that generally have moderate suitability for on-site infiltration. The hydrologic soils map for the Village is shown on Exhibit 6.



FONTANA on Geneva Lake

EXHIBIT 4

2035 ULTIMATE BUILD OUT LAND USE CONDITIONS

VILLAGE OF FONTANA-ON-GENEVA LAKE WALWORTH COUNTY, WISCONSIN

Legend

- Lower Rock River/ Geneva Lake Watershed
- Municipal Boundary
- Low Density Urban Area
- Low Density - Public Water and Sewer
- Medium Density - Public Water and Sewer
- Primary Environmental Corridor
- Agricultural-Rural Density
- Water

N W E S

0 700 1,400 2,800
Feet

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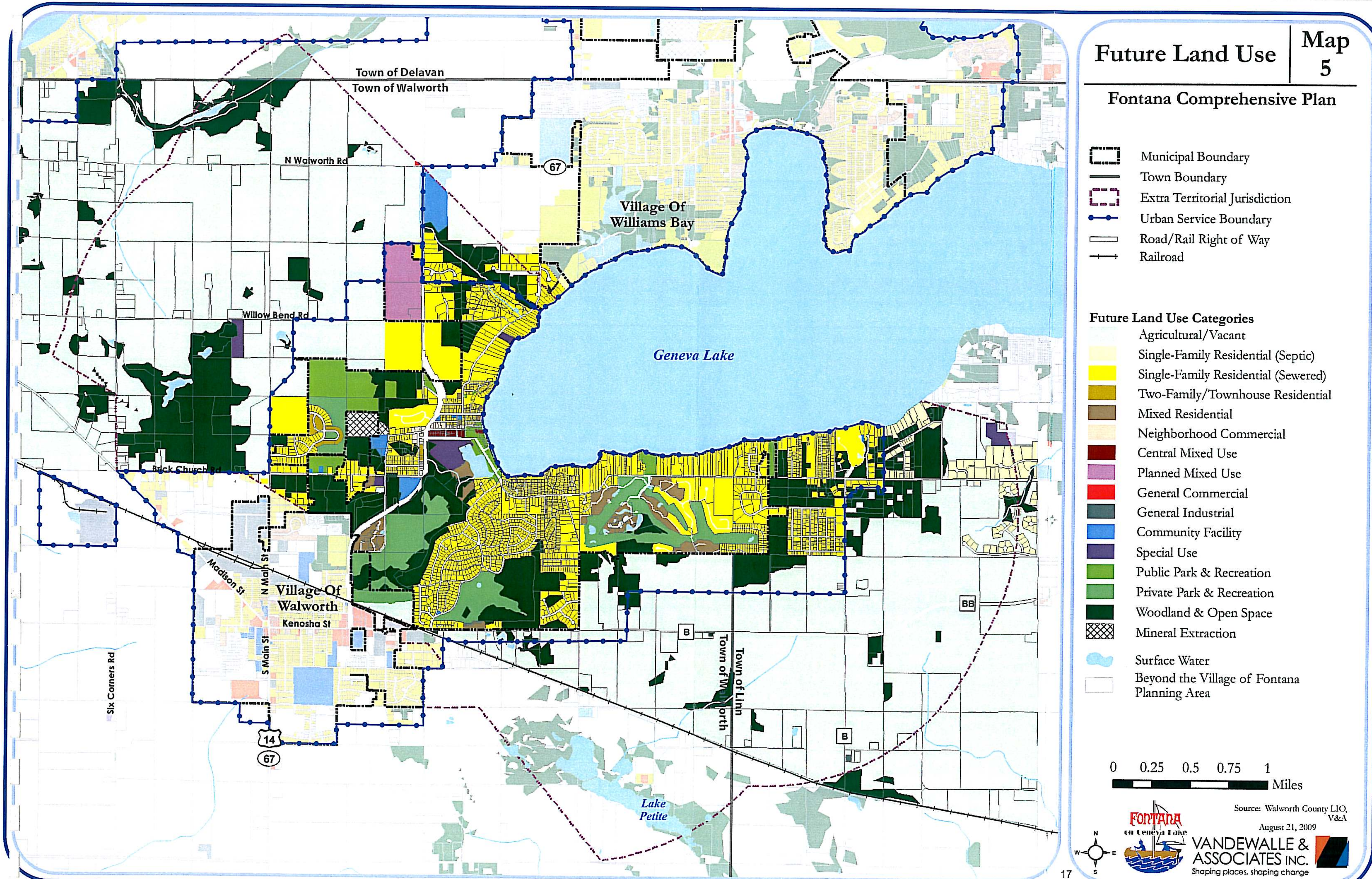
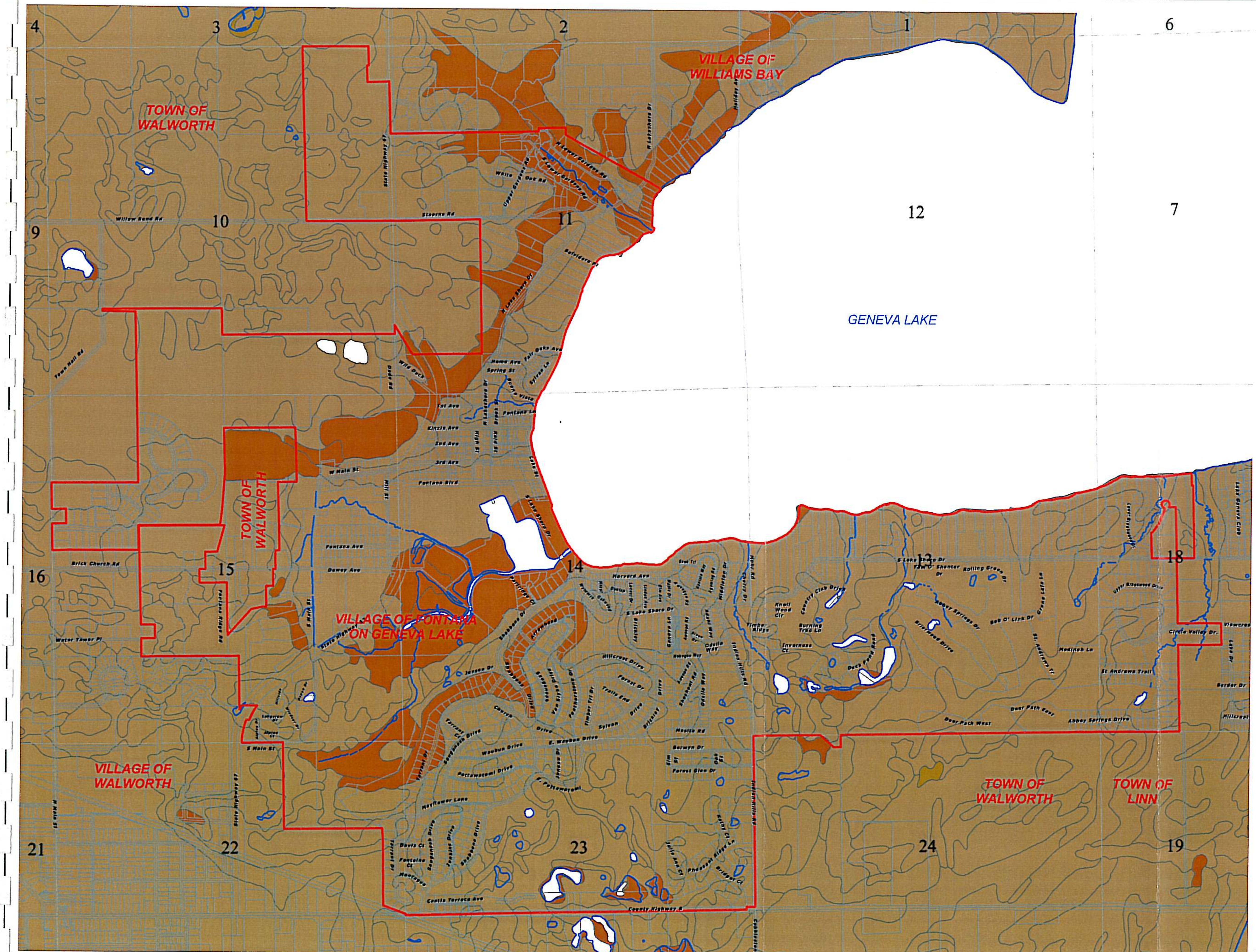
DATE: SEPTEMBER, 2009


Future Land Use
Map 5
Fontana Comprehensive Plan
Municipal Boundary
Town Boundary
Extra Territorial Jurisdiction
Urban Service Boundary
Road/Rail Right of Way
Railroad
Future Land Use Categories
Agricultural/Vacant
Single-Family Residential (Septic)
Single-Family Residential (Sewered)
Two-Family/Townhouse Residential
Mixed Residential
Neighborhood Commercial
Central Mixed Use
Planned Mixed Use
General Commercial
General Industrial
Community Facility
Special Use
Public Park & Recreation
Private Park & Recreation
Woodland & Open Space
Mineral Extraction
Surface Water
Beyond the Village of Fontana Planning Area
0 0.25 0.5 0.75 1 Miles
Source: Walworth County LIO, V&A
August 21, 2009
Fontana on Geneva Lake
VANDEWALLE & ASSOCIATES INC.
Shaping places, shaping change
Town of Delavan
Town of Walworth
N Walworth Rd
67
Village Of Williams Bay
Geneva Lake
Willow Bend Rd
Brick Church Rd
Madison St
N Main St
Village Of Walworth
Kenosha St
S Main St
Six Corners Rd
14
67
B
BB
Town of Walworth
Town of Linn
Lake Petite



FONTANA on Geneva Lake

EXHIBIT 6

HYDROLOGIC SOILS MAP OF THE STORM WATER MANAGEMENT SYSTEM PLANNING AREA

VILLAGE OF FONTANA-ON-GENEVA LAKE WALWORTH COUNTY, WISCONSIN

Legend

Municipal Boundary

Water

Hydrologic Soils

A; A/D

B; B/D

C; C/D

D

N
W E
S

0 700 1,400 2,800

Feet

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DATE: SEPTEMBER, 2009

Source: Cadastral-Walworth County. Soils - SSURGO

Climate and Weather

Climate and weather are particularly important considerations in storm water management system planning because they directly affect the performance, configuration, and design of storm water runoff collection, conveyance, storage and treatment facilities. Temperatures affect treatment processes and determine frost depths. Precipitation directly determines the rate and amount of storm water runoff and the selection of hydraulic design loading factors and facility sizes.

The Village of Fontana-on-Geneva Lake storm water management system planning area has a continental climate which spans four seasons, one season succeeding the other through varying time periods of unsteady transition. The cold winters generally span the months of December, January and February, but may in some years include parts of November and March.

Based upon weather records from 1971 through 2000, average daily minimum temperatures range from a low of 12.2 degrees Fahrenheit for the month of January, to a high of 63.1 degrees for the month of July. Average daily maximum temperatures range from a low of 27.9 degrees in January to a high of 85.6 degrees for the month of July. Extreme winter temperatures of as low as -27 degrees below zero Fahrenheit have been recorded; and extreme summer temperatures of 106 degrees have been recorded. The growing season averages about 155 days with the last freeze in the spring generally occurring in the first two weeks of May, and with the first freeze in autumn generally occurring in mid-October. Recorded frost depths have exceeded 48 inches in Walworth County. The frost depths are recorded for landscaped areas in cemeteries, and may be deeper under areas without sod and snow cover such as under roadway pavements.

Precipitation occurs in the form of rain, sleet, hail and snow and ranges from gentle showers to intense destructive thunderstorms. The more pronounced weather events can cause overland flooding resulting in major property damage, inundation of poorly drained areas, and flooding of streams and watercourses.

Based upon weather records from 1971 through 2000, the total annual precipitation averages slightly more than 37 inches expressed as water equivalent. The annual precipitation has ranged from a low of about 21.17 inches to a high of about 49.97 inches. Monthly average precipitation ranges from a low of 1.64 inches in February to a high of 4.07 inches in August. A maximum monthly precipitation of over 12 inches has been recorded. Snowfall and sleet average about 49 inches annually, with January receiving the heaviest snowfall, averaging 14.4 inches. Maximum 24 hour rainfalls of almost 3.88 inches and maximum 24 hour snowfalls of over 13.2 inches have also been recorded.

Prevailing winds in the planning area are northwesterly in the late autumn and winter; northeasterly in the spring; and southwesterly in the summer and early autumn. Wind velocities are less than five miles per hour for about 15 percent of the year; between 5 and 15 miles per hour for about 60 percent of the year; and more than 15 miles per hour for about 25 percent of the year.

Severe windstorms as well as severe precipitation events--particularly freezing rain--may cause electric power supply system failures for extended periods of time, with attendant failure of building foundation drain sump pumps, excessive clear water inflow into sanitary sewers through basement floor drains, surcharging of sanitary sewers, and the backup of sewage into basements of buildings.

The Southeastern Wisconsin Regional Planning Commission has developed rainfall intensity-duration-frequency relationships which are fundamental to the design of storm water management systems. These relationships are based upon over 108 years of precipitation record. The rainfall intensity-duration-frequency relationships are intended primarily for use in the design of storm water management systems, but are also useful in some analyses relating to sanitary sewerage system performance and the need for sewage flow relief and bypassing.

Water Supply

Water supply within the Village of Fontana-on-Geneva Lake storm water management system planning area is provided by a municipal utility. This municipal utility has a total of four wells. Three of these wells are approximately 150 feet deep with the fourth well being around 1600 feet deep. Two of the four wells are located on the West side of the Village just north of Dewey Avenue. The two remaining wells are positioned on the southeast corner of Tarrant Dr. and Mayflower Lane in Country Club Estates.

Natural Resource Base

The natural resource base of an area is an important consideration in any storm water management planning effort. The natural resource base has great recreational and aesthetic value, and it is that base which makes an area pleasant in which to live and work, and attractive as a setting for high value residential, commercial, and industrial development. In order to preserve and protect the important community assets concerned, development--including storm water management system development--must be carefully adjusted to the ability of the natural resource base to support various types, densities and intensities of urban and rural development without deterioration or destruction of that base. Accordingly, careful consideration was given in the storm water management system planning effort for the Village of Fontana-on-Geneva Lake to the preservation and protection of the natural resource base of the planning area.

The natural resource base of the planning area consists of seven elements: soils, streams and watercourses, groundwater, floodlands, wetlands, woodlands and wildlife habitat. The location, extent and characteristics of these seven elements have been inventoried, mapped and intensively studied by the Southeastern Wisconsin Regional Planning Commission. The Commission studies indicated that the best remaining elements of the natural resource base of the area - the organic soils, the streams and watercourses, the areas of groundwater recharge and discharge, the floodlands, the major wetlands, the high quality woodlands, and the best wildlife habitat areas - occur in elongated areas in the landscape that are termed environmental corridors.

The preservation of these corridors in essentially natural, open uses is considered essential to both the maintenance of the overall quality of the environment and to the avoidance of the creation of serious and costly developmental problems. The preservation of the corridors in essentially natural, open uses can assist in the attenuation of flood flows; the abatement of surface and groundwater pollution; glare reduction; favorable climate modification; reduction of air pollution and maintenance of atmospheric oxygen supplies; maintenance of biological diversity; and the maintenance of groundwater aquifers and stream flows. The intrusion of urban development into such corridors may result in the creation of costly problems, such as failing foundations for pavements and structures; wet basements; excessive operation of building foundation sump pumps; excessive clear water infiltration and inflow into sanitary sewerage systems; and poor surface drainage. To help achieve preservation of these environmental corridors, State regulations, as well as good planning and engineering practice, preclude the extension of sanitary sewer service into the environmental corridors.

The environmental corridors of the Village of Fontana-on-Geneva Lake storm water management system planning area have been delineated by the Southeastern Wisconsin Regional Planning Commission together with some remnant, isolated natural resource areas. The environmental corridors and remnant isolated natural areas within the Village of Fontana-on-Geneva Lake storm water management system planning area are shown on Exhibit 7.

The Village of Fontana-on-Geneva Lake has an area of about 4 square miles, and includes about 0.8 square miles of environmental corridor, and no isolated natural resource areas. The need to protect and preserve these environmentally sensitive areas was carefully considered in the storm water management planning.

Existing Storm Water Management System

The existing storm water management system within the Village of Fontana-on-Geneva Lake consists of a network of public and private pipes, inlets, catch basins, detention ponds, culverts, drainage ditches and associated overland flow paths. The location and configuration of the public system is shown on Exhibit 8. The system consists of approximately 7 miles of concrete, plastic and corrugated metal gravity flow storm sewers and culverts ranging in size from 6 inches to 72 inches in diameter.

The techniques and criteria used to design storm water drainage systems have evolved over time. Therefore, the needed capacity of a particular storm water drainage facility as determined by the techniques and criteria in common use at an earlier time in history, may be quite different from the needed capacity of that same facility as determined by techniques and criteria in common use at a later time in history. The year of the design and construction thus becomes an important consideration in any attempt to understand and explain the performance of an existing facility.

The year of the construction is also an important consideration in assessing the condition of a facility and the need for, and scheduling of, the rehabilitation or reconstruction of the facility and of related facilities in a particular service area.

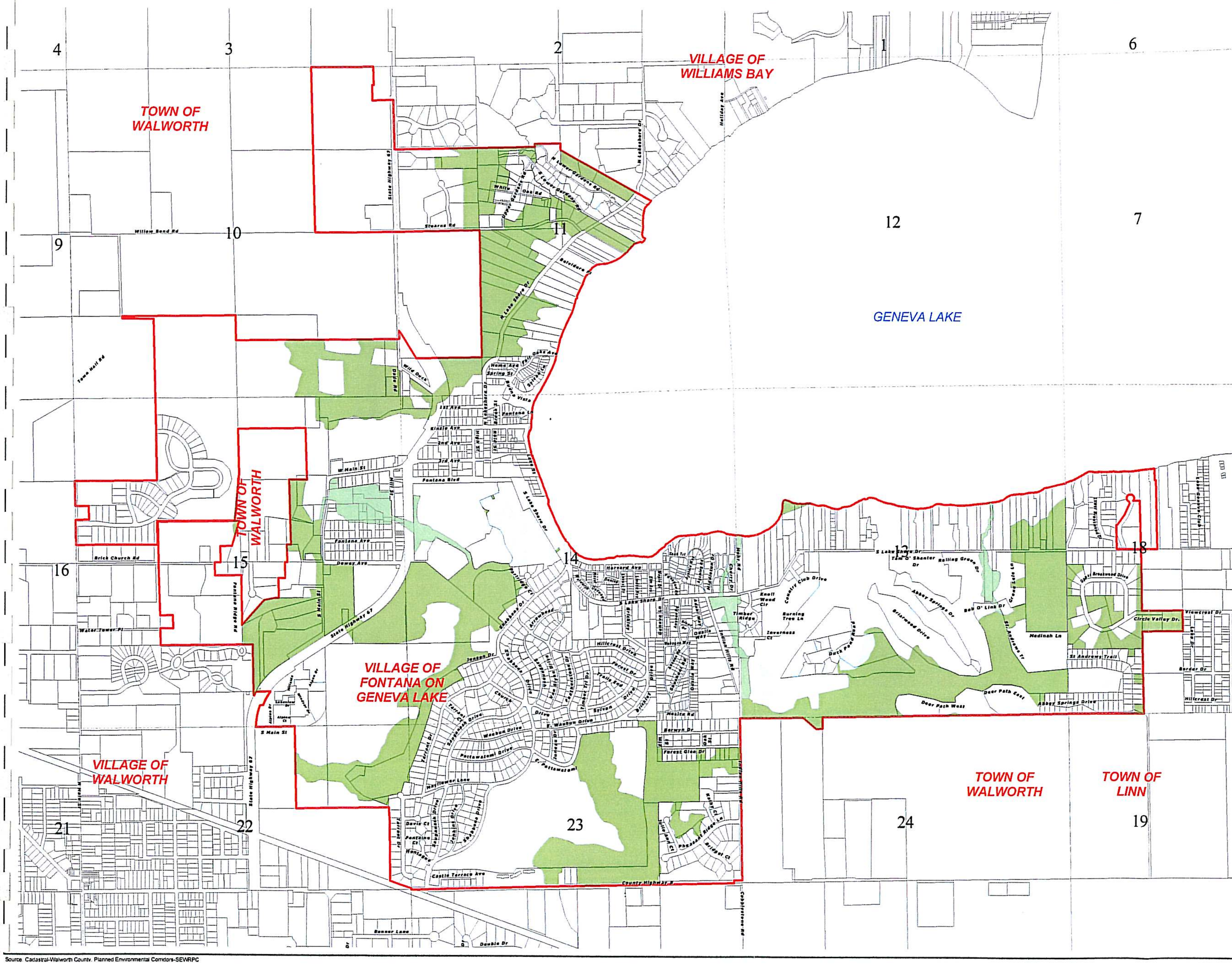

EXHIBIT 7

ENVIRONMENTALLY SENSITIVE AREAS

VILLAGE OF FONTANA-ON-GENEVA LAKE WALWORTH COUNTY, WISCONSIN

Legend

- Planned Primary
- Planned Secondary
- Planned Isolated Natural Areas
- Surface Water
- Municipal Boundary

N S E W

0 700 1,400 2,800 Feet

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DATE: SEPTEMBER, 2009

Source: Cadastral-Walworth County. Planned Environmental Corridors-SEWRPC

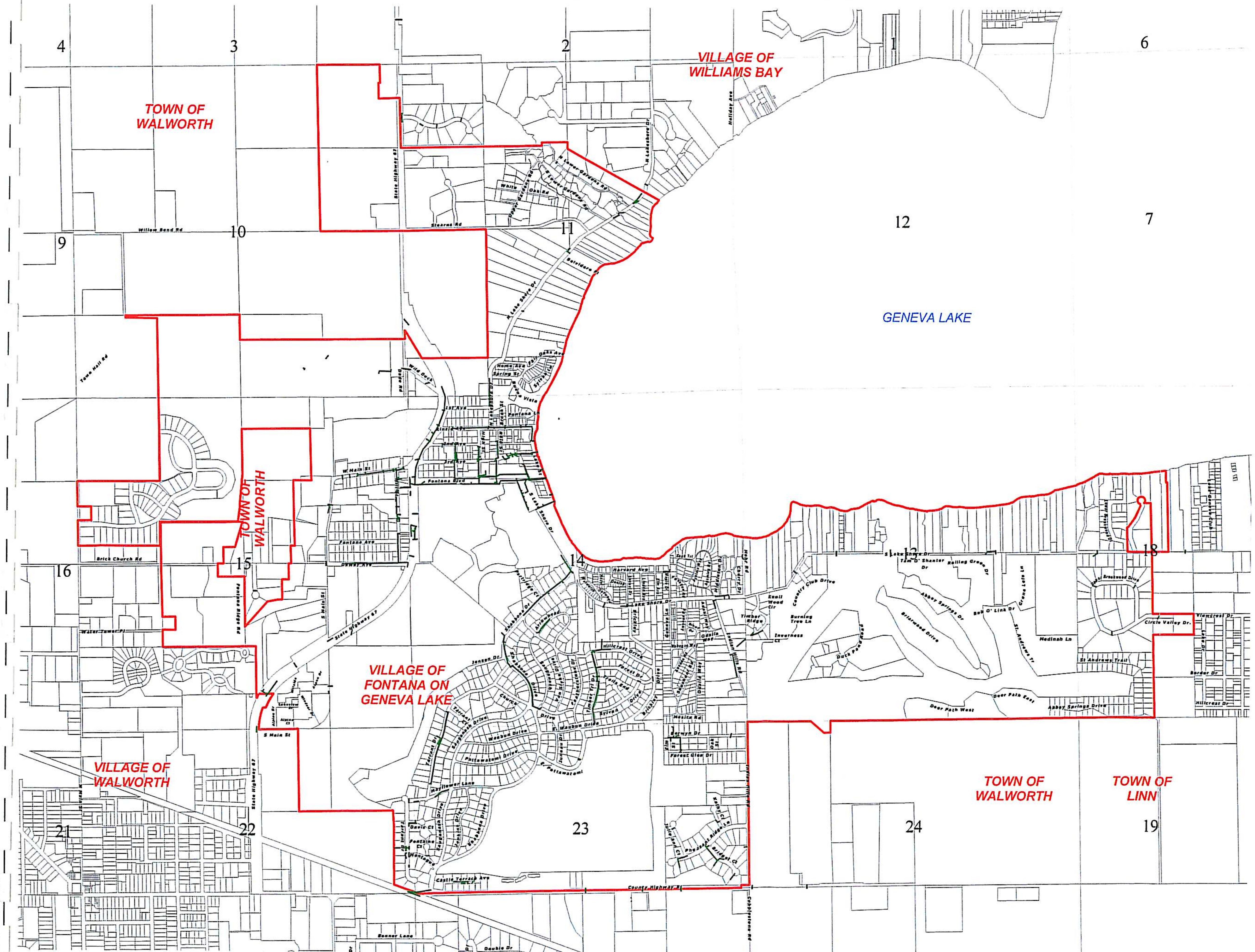

EXHIBIT 8

EXISTING STORM WATER MANAGEMENT SYSTEM

VILLAGE OF FONTANA-ON-GENEVA LAKE WALWORTH COUNTY, WISCONSIN

Legend

Storm Sewer/Culvert

Municipal Boundary

N W E S

0 700 1,400 2,800

Feet

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DATE: SEPTEMBER, 2009

Source: Cadastral-Walworth County, Storm Water System - Village of Fontana-on-Geneva Lake

Public Works Management Information System

Detailed information about the storm water management system of the Village is currently being assembled in computer manipulatable format under the public works management information system being created for the Village. With respect to the storm water management system, the public works management system will consist of an automated base map showing all real property boundary lines, including street right-of-way lines; together with pertinent planimetric details such as roadway pavement lines. The existing storm water management facilities, consisting of inlets and catch basins, manholes, sewers, retention and detention basins, and appurtenances are also shown on the map. The ownership parcels and facilities are assigned identification numbers which are used to link digital attribute data to the mapped features. This linking of geographic location and attribute data provides an organized body of information that can be readily used in the design, construction, operation and maintenance of cost-effective public works facilities and services including storm water management facilities.

Existing Water Quality Best Management Practices

The Village of Fontana-on-Geneva Lake is acutely aware of the need to protect the valuable natural resource base located throughout the planning area. To reach this goal, the Village is actively involved in numerous best management practices designed at protecting water quality. The current activities include street sweeping, leaf collection (beginning in October and extending until pickup is complete), public education through newsletters, hazardous material recycling, illicit discharge detection, catch basin cleaning, a deicer management program and administration of a storm water and erosion control ordinance.

System Performance

In order to assist in evaluating the performance of the existing storm water management system and in the identification of existing problems related to that performance, structured personal interviews were conducted with key Village staff. The interviews elicited information on drainage and flooding over the last approximately five years. The following Village Staff were interviewed:

1. Mr. Craig Workman, P.E. – Director of Public Works
2. Mr. Ron Adams – Department of Public Works Staff

As the storm water management system design process proceeded, the findings of the personal interviews and questionnaire survey were verified, and the probable causes of the problems experienced identified by mathematical simulation of the storm water management system performance and related analyses of the configuration and capacity of that system.

Findings of Staff Interviews

The observations of the Village Staff interviewed indicated that each rainfall or combination rainfall and snowmelt event impacts somewhat differently on the performance of the storm water management system, depending upon the track, intensity and duration of the event and upon antecedent soil moisture conditions, groundwater levels and frost conditions. Thus, two different storms with similar total rainfall amounts may have widely different effects on the performance of the storm water management system of the Village. High groundwater elevations, natural springs and surface flooding also have a major effect on clear water infiltration and inflow into sanitary sewer pipes and manholes, building service connections, and basement floor drains.

The same weather conditions will have different effects in areas developed at higher urban densities with urban street cross sections, having curb and gutter, inlets and piped storm sewers for drainage; than in areas developed at lower urban densities with rural street cross sections having road ditches and surface swales and watercourses for drainage. Piped storm water drainage systems remove excess storm water relatively quickly in one to two days, while ditch systems may take two to six days. Therefore, particularly during a very wet spring, groundwater table elevations may be expected to rise higher and be maintained longer around building foundation drains, building service connections and sanitary sewer pipes and manholes in areas developed with rural street cross sections than in areas developed with urban street cross sections and piped storm sewer systems. This increases clear water infiltration and inflow and may contribute to sewer surcharging during even a moderate rainfall event.

Summary of Existing System Performance Evaluation

The findings of the Staff interviews indicated that basement and roadway flooding in most of the Village can be attributed to inadequate storm water management both on private property and over public rights-of-way. The abatement of such flooding will require significant storm water drainage improvements. The storm water management system should be comprised of a minor system designed to accommodate rainfall events up to and including the 10-year recurrence interval event (10% chance of occurring every year); and a major system designed to accommodate rainfall events up to and including the 100-year recurrence event (1% chance of occurring every year). The former would consist of culverts, ditches and piped storm sewers and inlets; the latter of easements, street rights-of-ways and interconnected surface drainage ways. The reduction of surface flooding will lessen basement flooding due to clear water infiltration and inflow. This will in turn abate excessive clear water infiltration and inflow into the sanitary sewer system, substantially improving the performance of that system.

CHAPTER FOUR
DESIGN CRITERIA

Introduction

The design of a storm water management system plan is a complex engineering task. The design requires the conversion of rainfall into storm water runoff, and the conversion of such runoff into peak rates, volumes of flow and pollutant loadings in the facilities comprising the system. The frequencies and durations as well as the magnitudes of the flows must be determined, a difficult task since the flows are the result of random meteorological occurrences, antecedent soil moisture conditions, and site specific topographic and land use conditions.

The design of a storm water management system plan thus involves the application of the sciences of hydrology and hydraulics. Hydrology may be defined as the study of the physical behavior of the water cycle from its occurrence as precipitation, to its entry into streams, lakes, and the groundwater reservoir and its return to the atmosphere by evaporation and evapotranspiration. The application of hydrology to storm water management system planning focuses specifically on such factors as rainfall, soil conditions, ground cover, land uses, and on the volume and timing of surface runoff which reaches receiving surface water bodies. The location, extent and type of urban development greatly affects the variables concerned due to the changes in imperviousness, reduction in infiltration capacity, changes in natural storage changes in flow paths and reduced flow times which accompany the conversion of land from rural to urban uses.

Hydraulics may be defined as the study of the physical behavior of water as it flows within natural stream channels, and associated floodlands; under and over bridges, culverts and dams; through lakes and impoundments; and through conduits such as artificial channels and sewers. The application of hydraulics to storm water management system planning focuses specifically on such factors as the length, slope and flow resistance of overland flow paths and receiving streams and watercourses, and on the configuration and capacity of natural and artificial storm water storage and conveyance facilities.

Basic Concepts

The basic concepts underlying current urban storm water management planning practice have evolved from older practice which sought to remove excess surface water during and after a rainfall as quickly as possible by the provision of an efficient conveyance system generally consisting of urban street cross sections with curbs and gutters, catch basins or inlets, enclosed conduits, and sometimes hydraulically improved channels. The current practice emphasizes treatment, infiltration and storage as well as conveyance of runoff while integrating constructed drainage facilities with the existing natural drainage system. The objectives of the current practice include reducing the peak rate of runoff; reducing the transport of sediment and other water pollutants to downstream surface waters and wetlands; mitigating the adverse impacts of increased runoff and flow frequency on upstream, downstream and riparian flora and fauna; and protecting against increased downstream flooding.

Generally, urban storm water management systems are designed to fulfill four basic objectives:

1. To prevent significant damage to real and personal property;
2. To maintain reasonably convenient access to and egress from various land uses;
3. To protect the public health and safety;
4. To abate non-point source water pollution and assist in achieving recommended water use objectives and water quality standards.

The systems should be cost effective, meeting the objectives at the lowest practicable cost. The systems should also be flexible and readily adaptable to changing needs.

Storm Water Management System Facility Characteristics

The components of a storm water management system are comprised of four basic types of facilities: overland flow, collection, conveyance and storage.

Overland Flow

When precipitation and snowmelt occur in amounts that exceed the interception capacity of vegetation, and the infiltration capacity of the ground surface, the storm water accumulates on the ground surface, filling depression storage, and then begins to flow downslope. In an area served by a traditional urban storm water management system, this overland flow carries the storm water runoff to a collection facility. Thus, overland flow serves to concentrate storm water from its initially more diffuse form. In an urban area, the pattern of overland flow is determined by the siting of buildings and the grading of the surrounding sites, so that such siting and grading becomes an important part of the design of the storm water management system. Proper siting and grading of buildings is important in order to provide proper drainage, to provide access to and from buildings during and after foreseeable rainstorm and snowmelt events and to minimize the effects of urbanization on water quality and infiltration.

Because overland flow has a broad impact on the overall system objectives, it was considered as an important and essential component of the storm water management system for the Village of Fontana-on-Geneva Lake. Specific arrangements for overland flow, however, cannot be addressed at the systems level of planning. The design of such arrangements must be done on a site-specific basis as urban development or redevelopment takes place, and especially during land subdivision process attendant to urbanization. Overland flow was, therefore, considered in the design of the alternative storm water management systems under this planning effort by identifying cost effective means specific to the study area which promote overland flow to be used in subsequent site planning, development and redevelopment efforts with the attendant desirable impacts on the rate, volume and quality of storm water runoff reaching the collection facilities.

Collection

Storm water collection is the process of further concentrating storm water flowing overland and transmitting it to conveyance facilities. Storm water collection facilities may include drainage swales, roadside swales, roadway gutters, storm water inlets, and inlet leads in which storm water is collected and then transmitted to surface or subsurface conveyance systems.

The storm water collection system may also provide some conveyance and storage in the storm water management system. Under minor precipitation events, drainage swales, roadside swales, and roadway gutters collect and transmit storm water to the storm water conveyance facilities. Subsurface conveyance facilities--storm sewers--are designed to accommodate minor runoff events only. During major runoff events, the storm water collected will, by design, exceed the capacity of the subsurface conveyance facilities, with the excess storm water being temporarily stored on, and conveyed over, collector and land access roadways, and interconnected surface drainageways which comprise the major conveyance system.

Conveyance

Conveyance facilities are normally the most costly component of the storm water management system. The conveyance components of a storm water management system may include both open channels and subsurface conduits--storm sewers--designed to receive and transport storm water runoff from or through urban areas to a receiving stream or watercourse. Storm water conveyance facilities may also be used to transport nonpolluted wastewaters, such as spent industrial cooling waters, roof drainage and residential sump pump discharges.

In most urban settings, it is not possible to maintain the natural storm water conveyance system because of the increase in the volume and rate of storm water runoff attendant to the conversion of land from rural to urban use. In addition, landfilling and drainageway excavation are frequently required to facilitate the use of land and roadways unencumbered by storm water. Therefore, as land is converted from rural to urban use, significant modifications are usually made to the natural drainage system to meet the increased storm water conveyance and vertical separation requirements.

Storage

Storm water storage can be defined as both the temporary detention and the long-term retention of storm water within the system. The primary purpose of storm water storage is to reduce the peak storm water drainage rates and the pollutant loadings both within the storm water management system itself and in the receiving waterways. Storm water storage reduces flow velocity and thus the potential for stream erosion; enhances the removal of sediment and other particulates suspended in storm water; and usually reduce the cost of downstream storm water conveyance and flood control facilities. Storm water storage facilities combined with infiltration facilities may also reduce the volume of storm water runoff.

Storm water storage may be either natural or man-made. In an undisturbed setting, natural storm water storage areas normally exist. Storm water is stored in natural surface depressions, in wetlands, on floodplains, and in soils. These natural storage areas dispersed throughout a drainage area serve to significantly reduce the volume and rate of storm water runoff, and may increase the removal of storm water from the surface water system by evaporation, transpiration, and infiltration.

There are a wide variety of passive storm water detention measures that can be used in an urban setting. These measures consist of grassed storm water collection swales designed to flow at low velocities, thereby providing in line storage; and storm water conveyance swales designed to include check dams and berms to reduce flow velocities, thereby providing storage. Storm water storage can also be provided on parking lots, and in specially designed and constructed storm water storage facilities. These storage measures generally detain storm water for short periods of time, in some cases allowing increased infiltration, evaporation, and transpiration, and can significantly reduce downstream peak storm water discharges.

The storm water management planning effort included consideration of storm water storage for both quantity and quality control. The evaluation of potential sites was based on site topography and specific storage volume-outlet discharge relationships.

Non-Point Source Pollution Control Measures

Non-point source water pollution control may be defined as the management of urban and rural land uses to reduce the loadings of pollutants discharged to surface waters. For the purposes of this report, such control measures will be considered only with respect to urban non-point sources of pollution. Various non-point source pollution control measures are described in detail in the Wisconsin Department of Natural Resources' Storm Water Management Technical Standards (Conservation Practice Standards).

There are two major categories of urban non-point sources of pollution. The first category is the erosion of soil from disturbed land areas, especially construction sites. The primary pollutants transported in this manner are suspended sediments and sediment-attached pollutants such as phosphorus. Residential, commercial, industrial, highway, and public utility construction sites all have the potential to produce large amounts of sediment which will reach receiving streams if not controlled. Because of the transitory nature of construction projects, measures to control construction site erosion and runoff are inherently of a short-term nature. Such control measures include mulching and seeding or polymer application of disturbed areas, construction of filter fabric and straw bale fences to intercept eroding soil prior to discharge to a receiving stream, channel stabilization, construction of sediment traps, temporary diversions, stone check dams and wet detention basins, stabilization of stream banks through the provision of sod, geosynthetics, natural armoring or riprap, protection of storm water inlets and proper construction scheduling.

It is feasible and desirable to deal with construction site erosion and sedimentation problems on a site-by-site basis through regulations. The proper control of erosion can be readily achieved under the provision of ordinances which govern construction practices, allowable soil loss, and the application of certain erosion control measures. Construction erosion control must be achieved on a site by site basis, and cannot be addressed in the system planning phase, other than to recommend that appropriate ordinances be developed and implemented to sufficiently regulate construction activities to provide the attendant erosion control measures.

The second major category of urban non-point sources of pollution is the storm water runoff and associated pollutants contributed from developed urban areas. As land is converted from rural to urban uses, the impervious area is increased, different types of pollutants accumulate on and are washed off of the land surface, and the overall amount of water pollutants contained in the storm water runoff is increased. The control of urban non-point source pollution requires long-term solutions which effectively reduce the loadings of those pollutants that are causing water quality problems, and which are flexible enough to be adapted to planned development patterns and densities.

Owing to restrictions on available land and the constraints imposed by land use patterns in developed urban areas, the range of non-point source pollution control measures that are applicable in developed urban areas is more limited than in developing areas, where the necessary non-point control measures can be anticipated and planned for. The control of non-point sources of pollution in developed urban areas requires the preparation on a basin-by-basin basis of detailed storm water management plans. Thus, the control of urban storm water runoff and associated pollutants is an important element of this storm water management plan.

Non-point source pollution control measures appropriate for developed urban areas can be classified either as source area controls or as outfall controls. Source area controls are best management practices carried out in upland areas near the pollution source. Outfall controls are applied at or near the storm water outlet prior to discharge to the receiving stream. Source area controls may include infiltration devices, pervious pavement, biofiltration cells, decentralized storage facilities or constructed wetlands, vegetated filter strips, street cleaning, increased leaf and clippings collection and disposal, and reduced use of road deicing salt. Outfall controls may include centralized storage facilities or constructed wetlands, proprietary separation devices and physical or chemical treatment processes.

Infiltration systems can achieve a high level of loading reduction in both dissolved and particulate pollutants from the drainage area served, with the pollutant loading reductions being proportional to the resulting reduction in storm water volume. Some systems, including infiltration basins and trenches, constructed wetlands, vegetated filter strips, porous pavements, grass swales and waterways, and perforated drainage systems also filter additional pollutants from the remaining runoff. Vegetation-lined infiltration basins, biofiltration areas and gravel-filled infiltration trenches often collect the storm water runoff from frequent storm events from small impervious areas such as parking lots or roofs. Vegetated filter strips, which are generally placed between the pollution source and the collector system, remove pollutants in overland flow through both filtering and infiltration. Porous pavements are generally the most applicable in parking areas which do not handle heavy traffic loads. Such pavements may consist of specially constructed concrete or paving-block grids with openings for the establishment of grass cover. Grass waterways and perforated drainage systems can be effectively incorporated into the conveyance system for transport of runoff to receiving waters. Grass swales, usually placed along roadways, may also reduce pollutant loadings through both filtering and infiltration.

While properly located and sized infiltration devices can substantially reduce the loadings of pollutants from non-point sources to receiving waters, care must be taken to avoid contamination of the groundwater. Studies have shown that particulates are effectively filtered out in the top layers of soil surrounding infiltration devices. However, dissolved pollutants may reach the groundwater when infiltration devices are improperly located in areas with unsuitable topography and soils, or with a shallow depth to bedrock or to the groundwater table. Other potential adverse impacts of infiltration devices include wet basements, sump pump overloading, groundwater mounding, building and foundation failures, and excessive infiltration of clear water into sanitary sewers. Because of these potential problems, infiltration devices should be avoided in areas with a high potential for groundwater contamination, and limited in areas of intensive urban development. These measures are best used in areas of low-density development where problems with basements, foundations, and excessive sewer infiltration can be avoided. It should also be noted that long term maintenance problems may be attendant to the use of infiltration devices. Such maintenance may be required to remove and dispose of resulting contaminated soils thereby restricting the effectiveness of the devices.

Proprietary storm water treatment devices are designed to remove sediment and hydrocarbon loadings from runoff before they are conveyed to the storm drain network or to an infiltration device. The effectiveness of such devices in removing pollutants has not been adequately monitored in the field. Because of the relatively small storage volumes and resultant brief retention times involved, such devices are not expected to provide a high degree of pollutant removal. The devices typically require cleaning at least twice a year. Such devices also require careful siting and permitting to meet the attendant regulatory issues.

Street cleaning can be an effective method of urban non-point source pollution control under certain circumstances. Approximately 5 to 30 percent reductions in pollutant loadings from industrial, commercial, institutional, governmental and high density residential areas can be achieved if parking and storage areas are included in the cleaning operation. Street cleaning is the most effective early in spring, when the streets are laden with winter residue, and in the fall, following leaf fall. Wisconsin Department of Natural Resources does not allow credit for street cleaning for new or redevelopment projects, only for managing existing developed areas. Street cleaning may also be an important maintenance consideration for porous or permeable pavement.

Man-made detention storage facilities and wetlands can be utilized to reduce storm water runoff rates and volumes. Such storage facilities and areas can also produce significant reductions in non-point source pollutant loadings.

Along with infiltration basins which are designed to completely store all tributary runoff, the wet detention basin is highly effective in reducing pollutant loadings. In wet detention basins, pollutants are removed through both sedimentation of particulates and biological assimilation of dissolved nutrients. Wet detention basins require considerable maintenance in order to function properly as non-point source control measures. Maintenance requirements for wet basins include weed and algae control, inspection, litter removal, and periodic dredging of accumulated sediments. The cost of periodic dredging is the largest maintenance cost. That cost can be reduced by confining the accumulation of most of the inflowing sediment to a settlement forebay located at the inlet of a wet detention basin. Means of disposal of dredged sediment vary, depending on the level of contamination of the sediment. Sediments with high concentrations of toxic chemicals or metals must be disposed of in specially designed containment areas or landfills. Sediment to be dredged should be tested to determine the appropriate means of disposal.

Dry detention basins, which drain completely between flood events, are not effective in reducing non-point source pollutant loadings. While some sediment accumulation will occur, much of it will be scoured from the bottom of the basin and discharged downstream by subsequent storm events. Dry detention basins can reduce downstream bank erosion by reducing flood flows and velocities.

Wetlands can serve to remove pollutants from storm water runoff by sedimentation, biological assimilation, and filtration. The long flow-through times and low flow velocities in wetlands allow suspended sediments and particulate pollutants to settle. Nutrients are assimilated by wetland plants, and metals and hydrocarbons are deposited in wetland sediments. While wetlands may be effective in controlling non-point source pollutant loadings to downstream waters under certain conditions, the accumulation of pollutants may be harmful to the wetland ecosystem. The effects of certain non-point pollutants on wetlands are known. An abundance of nutrients in a wetland can lead to dominance of less desirable, non-native plant species. Pesticides are taken up by certain plant species and are then released to the water column following plant decay. Due to the relatively long water retention times in wetlands, road de-icing salt concentrations may exceed acceptable levels, leading to density stratification, in the lower layers of the wetland water column. Depending on the hydrologic and hydraulic characteristics of a particular wetland, accumulated pollutants may be flushed to downstream waters during large storm events. The capacities of wetlands to remove pollutants and the long-term effects of such removal on wetlands have not been definitively established. In some cases, it may be desirable to provide facilities to reduce non-point source pollutant loadings prior to discharge to wetlands.

Therefore, water quality treatment is required to occur prior to entering any existing wetland. However constructed wetland complexes may be introduced to assist in the water quality treatment. In addition, small isolated wetlands that have been disturbed or farmed or are comprised of non-native species may be candidates for wetland restoration.

Storm water treatment methods often involve high costs. Less costly urban non-point source control measures have typically been a more attractive alternative in many cases. For this reason, and because there have been few motivating legal requirements regarding the quality of storm water discharged to the surface water system, municipalities have not normally pursued this component of the storm water management system. However, with the impending regulations of the Federal Clean Water Act, the Wisconsin Pollutant Discharge Elimination System, Chapters NR 151 and 216 of the Wisconsin Administrative Code and the increasing priority of water quality with the Village's citizens, non-point water quality improvements will become increasingly more important. Because of this, non-point source pollution control is a significant focus within this study.

Analytical Procedures And Engineering Design Criteria

Certain engineering criteria and procedures were used in designing alternative storm water management plan elements, and in making the economic evaluations of those alternatives. While these criteria and procedures are widely accepted and firmly based in current engineering practice, it is, nevertheless, useful to briefly document them here. The criteria and procedures provide the means for quantitatively sizing and analyzing the performance of both the minor and major components of the total storm water management system components considered in this storm water management plan. In addition, these criteria and procedures can serve as a basis for the more detailed design of storm water management system components comprising the overall storm water management system. These criteria and procedures thus constitute a reference for use in facility design, and as such are intended to be applied uniformly and consistently in all phases of the implementation of the recommended storm water management plan.

Rainfall Intensity-Duration-Frequency Data

Fundamental data for storm water management planning and design are the rainfall intensity-duration-frequency relationships representative of the area. Such relationships facilitate determination of the average rainfall intensity--normally expressed in inches per hour--which may be expected to be reached or exceeded for a particular duration at a given recurrence interval. Under its comprehensive water resources planning program, the Southeastern Wisconsin Regional Planning Commission has developed a set of rainfall intensity-duration-frequency relationships using both a graphic procedure and a mathematical curve fitting method. The Commission recommended design rainfall depths are derived from the 108-year rainfall record from 1891 through 1998 collected by the National Weather Service at General Mitchell Field National Weather Service station in Milwaukee. Analyses conducted by the Commission staff indicate that these data are valid for use not only within the Milwaukee area, but anywhere in Southeastern Wisconsin.

Design Rainfall Frequency

To ensure that the storm water system is able to effectively control the storm water runoff in a cost-effective manner, storm events of specified recurrence intervals must be selected as a basis for the design and evaluation of both the minor and major drainage systems. The selection of these design storm events should be dictated by careful consideration of the frequency of inundation which can be accepted versus the cost of protection. This involves value judgments which should be made by the responsible local officials involved and applied consistently in both the public and private sectors. For example, a 100-year, 24-hour storm recurrence interval can be thought of as a storm producing the amount of rain in 24 hours that has a 1% chance of occurring in any given year. A single large storm event does not change the statistical chance of another large storm event the following day, month or year that explains the reason why some communities have experienced multiple "100-year storms" in a short period of time.

The average frequency of rainfall used for design purposes determines the degree of protection afforded by the storm water management system. This protection should be consistent with the damage to be prevented. In practice, however, the calculation of benefit-cost ratios is not deemed warranted for ordinary urban drainage facilities, and a design rainfall recurrence interval is selected on the basis of experienced engineering judgment and experience with the performance of storm water management facilities in similar areas.

The Village uses a standard 10-year, 24-hour recurrence interval rainfall event for use in the evaluation of the minor drainage facilities such as local storm sewers and culverts. Major facilities, such as overland flow routes and detention ponds, are sized for larger events such as the 25 and 100-year recurrence interval rainfall event. This design practice is consistent with the design in other communities throughout the region.

Analytical Techniques Used

Rational Method

The existing and proposed piped storm sewer system within the Village was analyzed using the Rational Method to calculate rates of storm water runoff. This formula was first introduced to the United States in 1889 and is currently used by numerous municipalities and other governmental agencies in the analysis and design of storm sewer systems serving urban drainage areas less than about one square mile in size. The formula used in the rational method recognizes that a direct relationship exists between rainfall, land use and runoff.

The drainage areas tributary to the points of consideration within the storm water management system were determined utilizing the available large scale topographic maps. The coefficient of runoff was determined through an analysis of the land uses, soil types and land slopes within each of the contributing drainage areas.

National Resources Conservation Service TR-55 Method

Existing and proposed culverts and detention facilities within the Village were analyzed using the National Resources Conservation Service (NRCS), formerly the United States Soil Conservation Service (SCS), TR-55 Curve Number Method to compute rates of storm water runoff. This method was first introduced in January of 1975 and is currently widely used to calculate quantities and rates of storm water runoff in both rural and urban areas.

Economic Evaluation

It is customary to evaluate plans for water resource development projects on the basis of benefits and costs. This is particularly appropriate if the prospective development represents opportunities for investments to provide economic return to the public and if a comparison of alternative investments is desirable. In the case of storm water management systems, however, it is assumed that such systems must be provided to fulfill a fundamental need of the community, and consequently, they do not compete with alternatives of investment in other economic sectors. Accordingly, it is assumed that the least costly alternative system that meets the storm water management objectives set forth in this chapter will be the most desirable alternative economically.

The economic evaluations conducted under this storm water management planning program include capital cost estimates and annual operation and maintenance cost estimates. Capital costs include construction contract costs plus engineering, inspection and contract administration costs and were estimated on the basis of experience within the greater Southeastern Wisconsin area. The costs are expressed in 2008 actual dollars.

CHAPTER FIVE
AREAS OF CONCERN

Introduction

As a result of extreme rainfall events that occurred within the Village of Fontana-on-Geneva Lake in May of 2007 and again in the spring of 2008 as well as through interviews with Village Staff, it became apparent that particular areas of the Village are more prone to storm water flooding. In addition, it was found that while there are many depressed areas on private properties that detain storm water runoff, some of these areas collect runoff from Village owned land or public right-of ways. These areas are of particular concern to the Village, and as a result were studied in detail. Village officials also recognized the need for continued protection and improvement of water quality within the area's watercourses.

The Village, with the assistance of the Storm Water Advisory Committee, has identified five individual locations to be used as the primary focus for this Storm Water Management Plan. These locations are labeled as Hot Spots 1 – 5, although the numbering is used for reference only and does not represent the priority or severity of the storm water issues. The Hot Spot locations include Sauganash Drive near Davis Court, the Indian Hills and Brickley Drive area, Sauganash Drive and Tarrant Drive near Waubun Drive, Abbey Hills Condominiums along STH 67, and Shabbona Drive. In addition to the five Hot Spot areas, four additional recurring Problem Areas were identified. The recurring Problem Areas were deemed less critical to the overall Village drainage system considered, therefore only a quick analysis was conducted for those areas. The recurring Problem Areas included two areas along Lake Shore Drive, one at the Duck Pond Recreation Area and one within the Potawatomi Creek watershed. All of the areas identified are located within public lands or right-of-way, or are at least partially affected by runoff from public lands. This chapter will describe the evaluation and results of the study for each of these areas of concern. Exhibit 9 shows the locations of the storm water management plan Hot Spots and recurring drainage Problem Areas.

Hot Spot 1 – Sauganash Drive Near Davis Court

Residential yard, swimming pool and building flooding was the primary reason for the evaluation of Hot Spot 1. Storm water ponding occurs in a low point in the rear yard of the properties located at 1003 and 1004 Davis Court. The storm water runoff that is being trapped within this low point is generated in part by the Sauganash Drive right-of-way as well as upland land areas to the East that drains toward the low point. There is currently no ditch or storm water conveyance system along Sauganash Drive to collect and convey the runoff from the public road. The home elevations adjacent to this Hot Spot do not allow for an overland flow path that would alleviate the ponding. In addition, the downstream ditch and storm sewer system in Tarrant Drive cannot fully contain the anticipated flows during large storm events. Runoff from this drainage basin is eventually piped to the west into an existing farm field within the Town of Walworth.

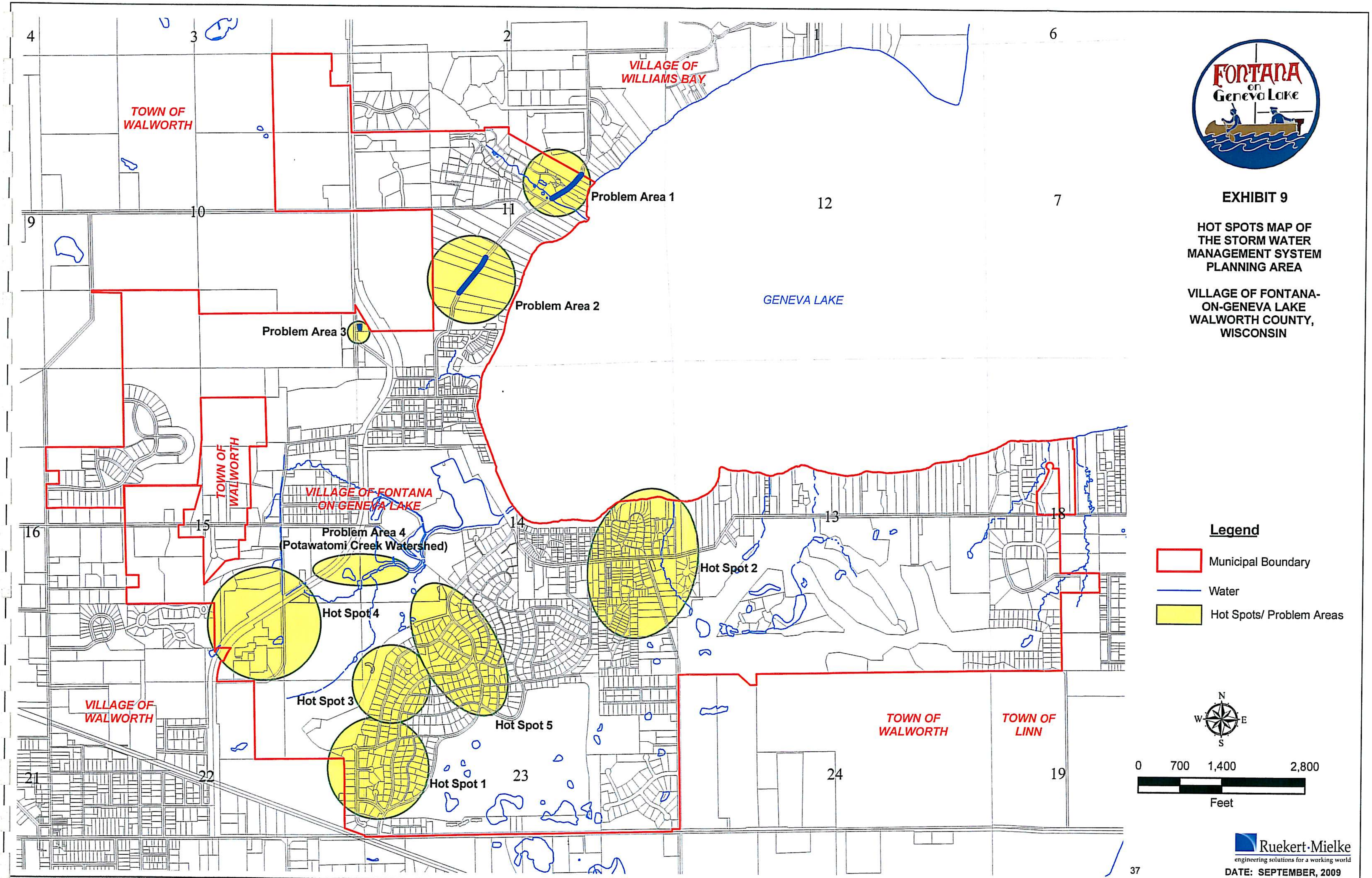


EXHIBIT 9
HOT SPOTS MAP OF THE STORM WATER MANAGEMENT SYSTEM PLANNING AREA
VILLAGE OF FONTANA-ON-GENEVA LAKE WALWORTH COUNTY, WISCONSIN
Fontana on Geneva Lake
TOWN OF WALWORTH
VILLAGE OF WILLIAMS BAY
VILLAGE OF FONTANA ON GENEVA LAKE
VILLAGE OF WALWORTH
TOWN OF LINN
GENEVA LAKE
Problem Area 1
Problem Area 2
Problem Area 3
Problem Area 4 (Potawatomi Creek Watershed)
Hot Spot 1
Hot Spot 2
Hot Spot 3
Hot Spot 4
Hot Spot 5
Legend
Municipal Boundary
Water
Hot Spots/ Problem Areas
N S E W
0 700 1,400 2,800
Feet
Ruekert·Mielke
engineering solutions for a working world
DATE: SEPTEMBER, 2009
Source: Cadastral-Walworth County

Hot Spot 2 – Indian Hills Road and Brickley Drive

Hot Spot 2 is located within the drainage basin tributary to the waterway flowing into Geneva Lake at Mohr Road. It includes several drainage issues including drainage conveyance problems along Mohr Road, and flooding within the Indian Hills Subdivision.

First, there is an inadequate ditch line on the East side of Mohr Road. This condition allows runoff and debris to be washed down the ditch to the inlet at the east end of Mohr Road, ultimately, causing a maintenance issue as well as flooding when the inlet grate becomes blocked. This grate is undersized to handle the amount of debris washed down the ditch during a large storm event. Deposition in the ditch over time has also resulted in runoff crossing Mohr Road towards the Village lift station causing dangerous ice conditions in the winter.

Secondly, the existing 15-inch culvert crossing Indian Hills Road at South Lake Shore Drive and the culvert crossing Indian Hills Road approximately 900' south of South Lake Shore Drive are undersized, resulting in runoff from large rain events to spill over Indian Hills Road. The overtopping of the road creates dangerous driving conditions and is causing erosion of the road shoulder and pavement.

In addition, there has been flooding problems as well as complaints of large volumes of storm water runoff flowing down and through the Indian Hills Subdivision from upstream locations. This includes runoff from the area west of Brickley Drive, where there is no current storm water collection or conveyance system. The interior roads within the Indian Hills Subdivision are private and small, leaving limited options for improving the conveyance system within the subdivision.

Hot Spot 3 – Sauganash Drive & Tarrant Drive at Waubun Drive

Hot Spot 3 is located in the area between Sauganash Drive and Tarrant Drive at Waubun Drive and includes the existing storm water outfall to the west of Tarrant Drive. Currently, storm water from portions of Mayflower Lane, Pottawatomi Drive, Waubun Drive and Sauganash Drive is directed to a low point on Sauganash Drive without a dedicated storm water system to handle the runoff. Storm water runoff then flows out of the Sauganash right-of-way onto private properties towards Tarrant Drive causing chronic wetness, erosion and flooding concerns for property owners. Runoff is then directed to an existing storm water outfall pipe between 896 and 906 Tarrant Drive towards the Big Foot Country Club.

Hot Spot 4 – Abbey Hill Condominiums at STH 67

Drainage problems have been an issue for the condominiums at Abbey Hills for some time, but residents have indicated that they have appeared to increase with the addition of new residential development within the Village of Walworth and road improvements to STH 67 that were constructed by the Wisconsin Department of Transportation (WisDOT). Runoff from the Hawks Ridge development within the Village of Walworth enters a storm water detention facility along the west side of STH 67, then flows through a culvert under STH 67 to the east side. There is also another culvert approximately 700 feet further north of the above-mentioned cross-culvert that also flows from the north side of STH 67 to the south. At this location the runoff leaves the STH 67 ditch-line cutting a path through the woods to the southeast between two condominium complexes. This runoff is eroding the ground around the condominium complexes and is undermining the asphalt and gravel shoulder of South Main Street.

Although there is an existing culvert at South Main Street and STH 67 on the north side of STH 67, there is no culvert under South Main Street on the south side of STH 67. Therefore, even if runoff could remain in the STH 67 ditch line and be directed beyond the existing swale leading between the two Condominium complexes, it could not cross South Main Street. This would result in the runoff being directed south into the existing Abbey Hills storm water detention facility. An analysis of the Abbey Hills storm water detention facility shows that it can handle all of the runoff from the Abbey Hills property but not additional storm water runoff from the STH 67 right-of-way and other tributary lands. Storm water has been reported to overtop South Main Street in the area of the Abbey Hills Condominiums storm water detention facility during large storm events.

Hot Spot 5 – Shabbona Drive Between Big Foot Country Club and Pottawatomi Drive

Hot Spot Area 5 has three areas of concern. First, the existing storm sewer system in Shabbona Drive is undersized. This creates a situation where even small storm events surcharge the system forcing it to flow overland down the paved surface of Shabbona Drive. The upstream portion of this storm sewer system between Tarrant Drive and Church Drive is also constructed of flexible 8-inch plastic pipe that is difficult to maintain and has limited capacity. Secondly, the location of the outfall discharge from the existing storm sewer system is located at the top of a steep embankment on the northeast side of the Big Foot Country Club parking lot. The resulting storm water discharge erodes the embankment carrying soil and debris toward adjacent wetlands and Potawatomi Creek. Finally, the storm sewer system does not extend far enough up Shabbona Drive to collect storm water between Church Drive and Pottawatomi Drive. There are several depressed parcels of developed and undeveloped land between Pottawatomi Drive and Waubun Drive that retain storm water runoff with no means to convey the runoff downstream.

Recurring Problem Areas 1 – 4

In addition to the above-defined Hot Spot areas, there are four additional recurring storm water Problem Areas in the Village identified during this study. Two areas are located along North Lake Shore Drive. Both of these areas have undersized or nonexistent collection and conveyance systems to handle the runoff during rainfall events. The third Problem Area is located within the Duck Pond Recreation Area. Problem Area 4 is a general water quality issue resulting in sediment deposition within Potawatomi Creek.

Problem Area 1 is in an area with a steep roadway without curb and gutter. During large rain events storm water runoff flows south along North Lake Shore Drive, crosses the road and flows out of the right-of-way towards private residences just north of North Lower Garden Road.

Problem Area 2 consists of a large drainage area that flows down a steep slope from west to east towards the lake. Once the storm water runoff reaches North Lake Shore Drive it flows north towards a drainage swale, but because there is not an adequate conveyance system most of the runoff flows east out of the right-of-way and onto private property.

Problem Area 3 is located within the Duck Pond Recreation Area. Runoff from storm events flows south along Dade Avenue towards Wild Duck Road. The runoff is undermining both sides of Dade Avenue, because there is an inadequate drainage facility to capture and convey the runoff. Much of the runoff originates from farm fields located outside of the Village limits. The runoff is also washing out portions of the recently restored native restoration area along the east side of Dade Avenue.

Problem Area 4 consists if deposition of sediments and pollutants in Potawatomi Creek. Potawatomi Creek is a high quality stream and is designated by the Wisconsin Department of Natural Resources as an outstanding and exceptional resource as well as a trout stream. Many of the tributaries to Potawatomi Creek commence or flow through the Big Foot Country Club golf course grounds. Bank erosion along the drainageways within the golf course is evident and large areas of the golf course are mowed and maintained right up to the edge of the creek. In addition large stretches of STH 67 drain into these tributaries washing sediment and pollutants into the Potawatomi Creek. There are also large areas of residential development runoff flowing through the golf course and into the Creek.

CHAPTER SIX
ALTERNATIVE PLANS

Introduction

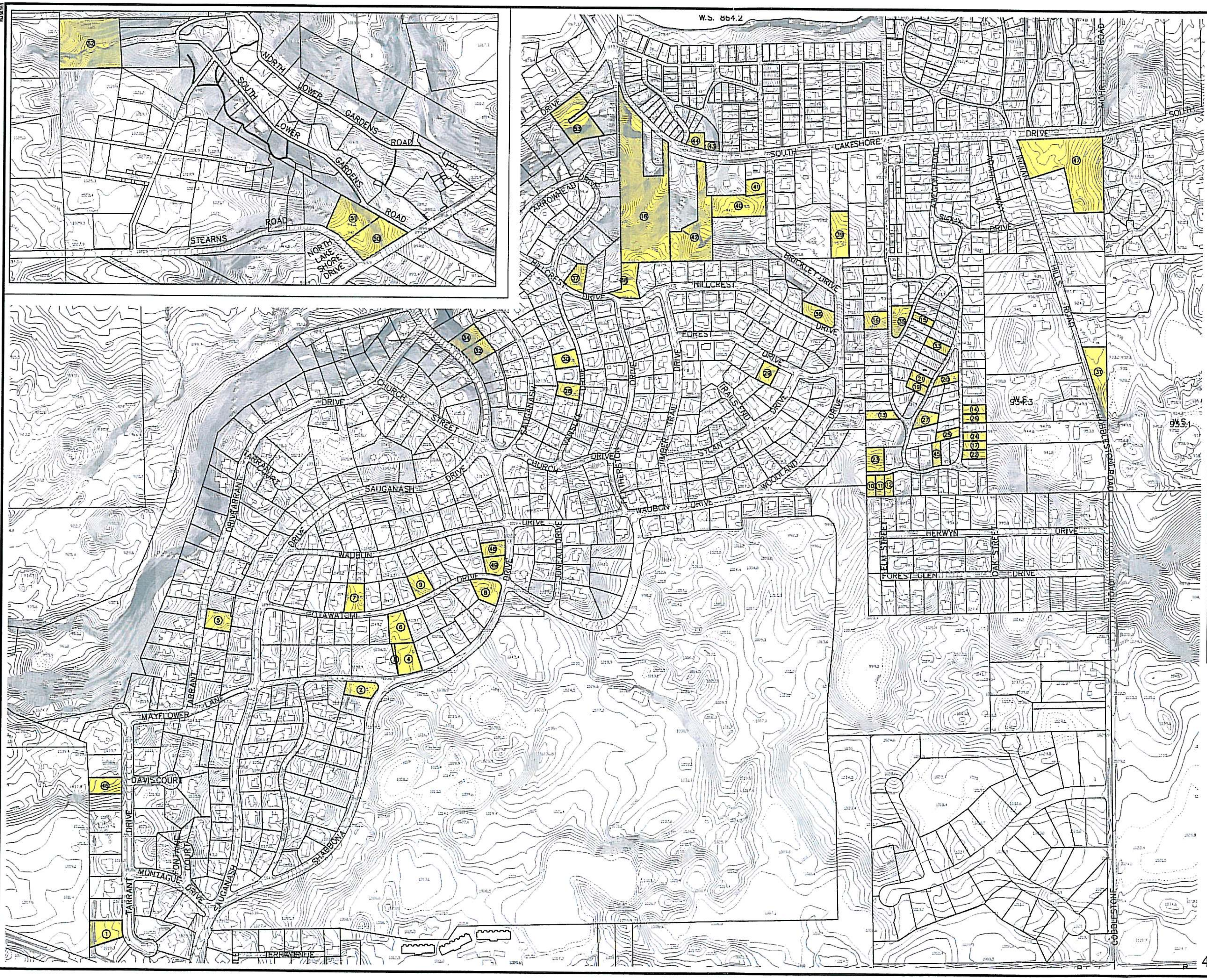
The preparation of a technically sound storm water management plan requires the comparative evaluation of the costs and effectiveness of alternative means of meeting the identified drainage and flood control system needs of the planning area. The primary basic alternative correction measures used for identified storm water management problems were considered as follows: reinforcement of the gravity flow capacity of the existing storm sewerage system, addition of new storm water sewerage system, redirection of the storm runoff to existing systems with excess capacity, reduction of peak flow rates and water quality improvements through the construction of storm water detention facilities, and removal of structures prone to flooding. Constructability and environmental concerns for the selected alternatives were also considered. In addition, to aid in locating potential storm water storage or treatment facilities, the Village asked Ruekert/Mielke to identify undeveloped lots from aerial photographs that could be evaluated for storm water facility locations, which is shown on Exhibit 10. Undeveloped or available parcels should be reviewed for possible Village storm water management activities for future storm water projects.

The alternatives were designed to provide an integrated storm water management system that would function without hazardous roadway or property flooding under rainfall events up to a 100-year recurrence interval. The alternatives considered were then comparatively evaluated on the basis of costs and effectiveness, and a recommended system plan developed by combining the most effective elements of each alternative considered. A summary of the comparative alternative corrective measures is included in Table 1. Exhibit 9 shows the location of these areas.

Hot Spot 1 – Sauganash Drive Near Davis Court

Several storm sewer system and storage options were analyzed for Hot Spot 1 and are shown on Exhibit 11.

Hot Spot 1, Option 1 - This option replaces 950 feet of Sauganash Drive with a super elevated section with Carlson screed asphalt ditch and will direct runoff from the low point in Sauganash Drive via a new storm sewer south to the north ditch-line of Montague Drive. The Davis Court storm sewer is also extended east to the low spot on private property. Additional capacity improvements are needed to the culvert and ditch system in Davis Court, Tarrant Drive and Montague Drive.



FONTANA on Geneva Lake

EXHIBIT 10

POTENTIAL UNDEVELOPED/ VACANT LOTS

VACANT LOT ID #	TAXKEY #	VACANT LOT ID #	TAXKEY #
①	SCTL 00006	㉗	SIHF 00047A
②	SCO2 00072	㉘	SCO3 00062
③	SCO2 00066	㉙	SCTF 00024
④	SCO2 00067	㉚	SCO3 00060
⑤	SCTJ 00008	㉛	STFV 00132
⑥	SCO2 00052	㉜	SCO3 00047
⑦	SCO2 00039	㉝	SIHF 00039
⑧	SCO2 00047	㉞	SCO3 00048
⑨	SCO2 00043	㉟	SIHF 00024
⑩	SIHF 00060	㊱	SCTD 00015
⑪	SIHF 00061	㊲	SCO3 00018
⑫	SIHF 00062	㊳	STFV 00166B
⑬	SIHF 00015	㊴	SA103400002
⑭	SIHF 00079A	㊵	SSV 00004
⑮	SIHF 00027	㊶	STFV 00143
⑯	SIHF 00007	㊷	SA305900002
⑰	SIHF 00082	㊸	SGS 00058
⑱	STFV 00144	㊹	SGS 00059
⑲	SIHF 00035	㊺	SIHF 00052
⑳	SIHF 00044A	㊻	SCTK 00021A
㉑	SIHF 00036	㊼	SA295000002
㉒	SIHF 00083	㊽	SCO2 00021
㉓	SIHF 00017A	㊾	SCO2 00046
㉔	SIHF 00081	㊿	SA 30600001
㉕	SIHF 00054	(51)	SA 30600002
㉖	SIHF 00079B	(52)	STFV 00057
		(53)	SCO1 00018

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DATE: MARCH, 2009

Table 1

Summary of Comparative Alternative Corrective Measures

Village of Fontana-on-Geneva Lake, Walworth County, Wisconsin: 2009

Areas of Concern	Project and Component Description	Village Capital Cost	Exhibit #
Hot Spot #1 (Davis Ct, Sauganash Dr)	Opt 1 - 1350' of 8"-30" storm sewer in Sauganash Dr to Davis Ct	$321,000	11
	Opt 2 - 1700' of 8"-30" storm sewer in Sauganash Dr to Montague	$325,000	
	Opt 3 - 2.9 acre-ft storm water facility (2)	$215,000	
Hot Spot #2 (Indian Hills Subdivision, Mohr Rd & Brickley Dr)	Opt 1 - Mohr Rd ditching & relay 50' of 18" storm sewer	$39,000	12
	Opt 2 - Relay 350' of 24"-36" storm sewer	$78,000	
	Opt 3 - 0.6 acre-ft bioretention facility (2)	$131,000	
	Opt 4 - Relay 350' of 24" storm sewer	$67,000	
	Opt 5 - 1350' of 12"-24" storm sewer & 2.7 acre-ft storm water facility (2)	$512,000	
	Opt 6 - 1.0 acre-ft storm water facility	$129,000	
	Opt 7 - Aweogon Road storm water facilities	$134,000	
Hot Spot #3 (Tarrant Dr, Sauganash Dr)	Opt 1 - 450' of 12"-30" storm sewer (directionally drilled in lots)	$214,000	13
	Opt 2 - 790' of 12"-30" storm sewer	$267,000	
	Opt 3A - Relocate storm outfall with option 1 (2)	$46,000	
	Opt 3B - Relocate storm outfall with option 2 (2)	($27,000)	
	Opt 4 - 1730' of 12"-18" storm sewer extension	$414,000	
	Opt 5 - 1.5 acre-ft storm water facility (2)	$143,000	
Hot Spot #4 (STH 67 & S. Main St)	Opt 1 - Install berm along south side of STH 67 R.O.W.	$34,000	14
	Opt 2 - 750' of 18" storm sewer	$101,000	
	Opt 2A - 100' of 18" storm sewer & ditching	$46,000	
	Opt 3 - 3.1 acre-ft storm water or bioretention facility	$229,000	
	Opt 4 - Install 260'-18" storm under STH 67 to direct water to North side	$66,000	
	Opt 5 - Abandon STH 67 crossing culverts & ditch water on North side	$52,000	
Hot Spot #5 (Shabbona Dr)	Opt 1 - Shabbona Dr storm sewer relay/extension	$682,000	15
	Opt 1A - Shabbona Dr storm sewer extension (Tarrant Dr south)	$285,000	
	Opt 2 - 0.5 acre-ft storm water facility (2,3)	$101,000	
	Opt 3 - Mechanical storm water quality separator	$102,000	
	Opt 4 - Relay 490' of 30" storm sewer outlet (2)	$110,000	
	Opt 5 - 990' of 30" storm sewer & 1.4 acre-ft storm water facility (2)	$306,000	
Problem Area #1 (Lakeshore Dr @ N Lower Gardens Rd)	Curb & gutter, storm sewer	$300,000	9
Problem Area #2 (Lakeshore Dr @ Belvidere Pl)	Curb & gutter, storm sewer	$136,000	9
Problem Area #3 (Duck Pond Recreation Area)	Raingarden to intercept runoff from Dade Ave north of trail underpass	$100,000	9
Problem Area #4 (Potawatomi Cr)	Streambank stabilization, native plant waterway buffers, pond dredging (3)	$0	9
	Potawatomi Creek Phase 1 Initial Assessment	$25,000	
Village Wide	Land acquistion and easements	$500,000	

1) Costs reflect January 2009 dollars and include 30% for contingency, legal, engineering and administration.
2) Cost for land acquisition/easements for storm water facilities not included
3) Potential Private Landowner Cost
4) Storm sewer alternatives include pipe, structures, erosion control, trench patching or asphalt overlay