Wellhead Protection Plan
Unit Well 29
City of Madison, Wisconsin

Prepared for:
Madison Water Utility
523 East Main Street
Madison, WI 53701

Prepared by:
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910 West Wingra Drive
Madison, WI 53715

December 2003

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REFERENCES

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EXECUTIVE SUMMARY

This report is a Wellhead Protection Plan (WHPP) for the City of Madison Unit Well 29. The purpose of this plan is to establish specific criteria for protection of the Well 29 recharge area. This WHPP was prepared for Unit Well 29 to conform with the requirements of the Wisconsin Administrative Code, Chapter NR 811, Section 16(5), for wellhead protection (WHP) planning.

Unit Well 29 is located at 829 N. Thompson Drive in the eastern part of the City of Madison. Construction of Unit Well 29 has been completed recently. Unit Well 29 is 815 feet deep, open to the lower bedrock (sandstone) aquifer. The well has a design capacity of approximately 2,200 gallons per minute (gpm).

Land use in the vicinity of Unit Well 29 is primarily residential, with some conservancy, commercial and agricultural development. The land surrounding Unit Well 29 is zoned residential (R-1, R-3, and R-4), conservancy (C), commercial (C-1 and C-2), and Temp A. There is also some manufacturing (M1) located 1,600 feet northwest of the well. Township zoning in the area, located southeast of the site, is generally R-1 with a small portion of Commercial.

As part of the Dane County regional hydrologic study, a regional groundwater flow model was prepared for Dane County and was used to delineate time-related (5-, 50-, and 100-year time of travel (TOT)) zones of contribution (ZOCs) for municipal wells (Krohelski et. al., 2000). This model was used to develop the 5-, 50-, and 100-year timed travel for Unit Well 29. ZOCs extend east-northeast of Unit Well 29 in the simulated upgradient groundwater flow direction.

Figure 3-4 shows the wellhead protection area (WHPA) for Unit Well 29. Two zones of protection are within the WHPA. Zone A is defined by the 5-year TOT ZOC. Zone B is defined by a 1,200-foot fixed radius around Unit Well 29. The WHPA will provide a conservative protection zone to account for changes in pumping rates, pumping duration, and interference drawdown from other existing and future wells.

A contaminant source inventory (CSI) was performed for the Unit Well 29 area during the first quarter of 2003. Potential and existing contaminant sources within a half-mile radius of Unit Well 29 include a closed landfill, active and closed underground storage tank (UST) sites, private residential septic systems, road salt use, and pesticide, herbicide and nutrient loading on commercial and residential lawns.

Programs and activities to be used by the City of Madison and others for WHPA management at Unit Well 29 can be found in the Wellhead Protection Plan for Unit Well 28, City of Madison, prepared by EarthTech, Inc., in April of 2002.

The Madison Water Utility has an existing water conservation program and Public Education and Awareness program. The Utility has formulated a contingency plan for providing water in the event that Unit Well 29 or one or more of the City's other water supply wells becomes contaminated or removed from service.

A copy of the City of Madison's WHP ordinance is included in the Appendix to this report. The City of Madison is developing an overlay-zoning district to add the WHPA for Unit Well 29. The WHP ordinance will help ensure that other potential contaminant sources are not located in the Unit Well 29 WHPA.

1.0 INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION

This report is a WHPP for the City of Madison Unit Well 29. The purpose of this plan is to establish specific criteria for protection of the local recharge area in the vicinity of Unit Well 29.

This WHPP was prepared for Unit Well 29 to conform with the requirements of the Wisconsin Administrative Code, Chapter NR 811, Section 16(5), for WHP planning. A copy of this section of the code is in Appendix A. The project scope included the following:

1. Research available information regarding the geology and hydrogeology of the well sites and aquifer parameters.

2. Research well construction and operation of Unit Well 29.

3. Coordinate with Dane County Regional Planning Commission (DCRPC) for previously delineated 5-year TOT capture zones for Unit Well 29.

4. Perform a CSI to identify and characterize existing and potential contamination sources within the 5-year TOT capture zone and within a one-half-mile radius of Unit Well 29.

5. Assist with the determination of a WHPA for Unit Well 29.

1.2 LOCATION AND BACKGROUND

Unit Well 29 is located at 829 N. Thompson Drive in the eastern part of the City of Madison. The site is in the SW¼ of the SE¼, of Section 34, Township 8 North, Range 10 East, Dane County, Wisconsin. Figure 1-1 shows the location of Unit Well 29 and other water system facilities in the City of Madison. A portion of the survey plat showing the well site is in Appendix B. Construction of Unit Well 29 was completed in 2003.

The City water system serves approximately 215,000 people and consists of 24 active wells, 28 booster pumping facilities, 24 ground storage reservoirs, 5 elevated water storage tanks, and approximately 777 miles of water transmission and distribution mains. Because of the varying topography in the Madison area, the water system is divided into 10 separate pressure zones. Unit Well 29 is located in the City's Main Pressure Zone. Unit Well 29 is located approximately 7,200 feet southeast of Unit Well 15.

1.3 UNIT WELL 29

Unit Well 29 is constructed to a depth of 815 feet. The well is cased with a 36-inch outside diameter (OD) steel casing driven to a depth of 40 feet below ground. A 30-inch OD steel casing is grouted in from the surface to a depth of 342 feet below ground. A 29-inch diameter open borehole extends from 342 to 500 feet in depth, and a 24-inch diameter open borehole extends from 500 to 815 feet below the ground surface.

DANE COUNTY

INDEX MAP

N

0' 7000' 14000'

SCALE

LAKEVIEW PRESSURE ZONE (5)

EAST PRESSURE ZONE (1)

Unit Well 29

GLACIER HEIGHTS PRESSURE ZONE (2)

MAIN PRESSURE ZONE (6)

RICHMOND HILLS PRESSURE ZONE (3)

ALLIS HEIGHTS RESERVOIR

SOUTHEAST PRESSURE ZONE (4)

NORTHWEST PRESSURE ZONE (8)

WEST PRESSURE ZONE (10)

SOUTHWEST PRESSURE ZONE (7)

SMITH PRESSURE ZONE (9)

LAKE MENDOTA

LAKE MONONA

LAKE WINGRA

LAKE WAUBESA

UNIVERSITY BAY

MONONA BAY

UPPER MUD LAKE

MUD LAKE

LEGEND

- 20 UNIT WELL NUMBER
- ● WELL
- ■ RESERVOIR
- ▲ ELEVATED STORAGE
- ⊙ BOOSTER PUMP STATION

STRAND ASSOCIATES, INC. ENGINEERS

Base Map Obtained from EARTH TECH

FIGURE 1-1
LOCATION OF UNIT WELL 29 & OTHER WATER SYSTEM FACILITIES
MADISON WATER UTILITY
MADISON, WISCONSIN

APRIL 2002

46945

DGN = X:\stsp01\civil0\work\projects\46945\dgn\FIG1-1.DGN

The well construction log reported encountering the top of sandstone at a depth of 25 feet. The well was terminated in the granite formation at a depth of 815 feet. The specific capacity of Unit Well 29 was approximately 13.8 gallons per minute per foot (gpm/ft) of drawdown. A construction report prepared by the driller is in Appendix C.

2.0 HYDROGEOLOGIC CONDITIONS

2.1 LAND USE, TOPOGRAPHY, AND DRAINAGE

Land use in the area is a mix of residential, conservancy, and commercial development. Current zoning immediately around Unit Well 29 is single-family residential (R1), Conservancy (C), and General Residence (R4). Other zoning in the area is:

Zoning Designation	Description
C1	Limited Commercial District
R3	Single- and Two-Family Residence District
PUD	Planned Unit Development District
C2	General Commercial District
Temp A	Agriculture District

The topography in the area of the well generally slopes from northeast toward the southwest with local elevation ranging from 1,020 feet to the east to 920 feet to the west and south. The surface elevation at Unit Well 29 is approximately 950 feet MSL. Drainage in the area of Unit Well 29 is toward Starkweather Creek. Starkweather Creek discharges to Lake Monona south-southwest of the well site.

2.2 GEOLOGY

The area was glaciated by the Green Bay Lobe during the Wisconsinan Stage. The rocks and unlithified deposits in the area range from Precambrian basement rocks to recent soils. The bedrock from oldest to youngest includes Precambrian crystalline rocks and Cambrian and Ordovician age bedrock consisting of sandstone, dolomite, and shale.

No formation logs were compiled for Unit Well 29 construction. Appendix C shows the construction reports for Unit Well 29 and a test well previously constructed near the site. The stratigraphic sequence expected for the well, based on typical conditions for the region as well as on the well construction reports, is briefly described as follows.

2.2.1 Precambrian Basement Bedrock

Precambrian bedrock was encountered at a depth of 812 feet. A geologic log has not yet been constructed by the Wisconsin Geologic and Natural History Survey (WGNHS) for Unit Well 29, but the well construction report indicates encountering black/red granite at a depth of 812 feet.

2.2.2 Cambrian and Ordovician Bedrock

Cambrian and Ordovician age rocks expected to be identified in Unit Well 29 include in ascending order the Mount Simon Formation, the Eau Claire Formation, Galesville Member, Ironton Member and Franconian Formation. Sandstone was encountered in the Unit Well 29 site between 25 feet and 286 feet below grade. A shale layer between 286 feet and 295 feet precedes sandstone, limestone, and siltstone deposits to a depth of 812 feet. Cambrian and Ordovician rocks are relatively flat-lying in the Madison area in the east-west direction and dip slightly to the south. The thickness of deep rock units appears to

be relatively consistent in the Madison area, although there are textural and compositional changes, laterally.

2.2.3 Unlithified Deposits

A geologic log of the test well constructed at relatively the same location as Unit Well 29 shows that from 0 feet to 28 feet below the surface, the drift consists primarily of pea-sized gravel and gray clay with gravel. The well construction report for Unit Well 29 describes the unlithified deposits to a depth of 25 feet below the surface as top soil and clay with sand.

Soils in the immediate vicinity of Unit Well 29 are classified as the Plano, Dodge, Ringwood, Dresden, and Saint Charles silt loams. These soils have good attenuation potential. The DCRPC assigned a risk classification of low to moderate from surface activities in the Unit Well 29 area on the basis of several factors including soil properties (DCRPC, 1999).

2.3 HYDROGEOLOGY

In the study area, groundwater occurs within the bedrock aquifer and the unlithified (sand and gravel) aquifer. Locally, the sand and gravel aquifer is used for private domestic supplies. Municipal and industrial wells are constructed into the bedrock aquifer. A brief discussion follows about the aquifers.

2.3.1 Bedrock Aquifer

The bedrock aquifer occurs in the Mount Simon Formation and lower part of the Eau Claire Formation. The Precambrian bedrock is the base of the bedrock aquifer. Water occurs within horizontal and vertical fractures, along bedding planes, and between sand grains in the aquifer. Mount Simon Sandstones typically yield the greatest amount of water, while Eau Claire Sandstone yields moderate amounts of water. In general, hydraulic characteristics for an aquifer may be represented by two values – hydraulic transmissibility and storage coefficient. Transmissibility is expressed as the rate of flow of water at the prevailing water temperature, in gallons per day, through a vertical strip of the aquifer 1 foot wide, under a hydraulic gradient of 1 foot per foot. Storage coefficient is defined as the volume of water released from or taken into storage per unit surface area of the aquifer per unit change in the component of head normal to that surface. Previous studies of Dane County groundwater determined that the typical coefficient of transmissibility for Cambrian sandstones is greater than 45,000 gpd per foot, and the typical storage coefficient is approximately 0.0004 (Cline, 1965). Examination of Unit Well 29 data indicates that the coefficient of transmissibility for this region is much lower, at 17,082 gpd per foot. This suggests there may be decreased recharge activity in the bedrock aquifer in this area.

The grouted casing in Unit Well 29 extends into the Mount Simon Formation. Therefore, water levels measured in Unit Well 29 are believed to be representative of the bedrock aquifer and are unaffected by the sand and gravel aquifer.

2.3.2 Sand and Gravel Aquifer

The sand and gravel aquifer occurs in sand and gravel deposits near the surface. The unlithified materials are thin near Unit Well 29. The construction log for Unit Well 29 indicates that deposits are supplanted by sandstone at a depth of 25 feet below the surface. No water is withdrawn from the sand and gravel aquifer by Unit Well 29, since the well is cased to a depth of 344 feet below ground.

2.3.3 Groundwater Flow System

Average annual precipitation in the City of Madison area is reported to be approximately 30 to 30.5 inches per year (in/yr) (Cline, 1965; Cotter et. al., 1969). Cline (1965) estimated that the amount of recharge to the groundwater reservoir in the Upper Yahara River basin was approximately 6 in/yr. More recently Swanson (1996) estimated that the recharge rate in Dane County ranges from 0.3 to 6.7 in/yr and has an average value of 2.6 in/yr. Precipitation infiltrates through the till layer and recharges the unlithified and shallow bedrock aquifers. In some areas, a small percentage of water moves downward from the upper bedrock aquifer through the Eau Claire confining layer and into the lower bedrock aquifer. Map 7 in Appendix D shows areas of recharge to and discharge from the lower bedrock (Mount Simon) aquifer (Bradbury et. al, 1999; DCRPC 1999). Discharge from the unlithified and shallow bedrock aquifers is to pumping wells and/or to surface waters (lakes, streams and wetlands) in the area. Locally, discharge from the lower bedrock aquifer is primarily to pumping wells.

3.0 WELLHEAD PROTECTION AREA DELINEATION

This chapter describes methodologies used to define the Zone of Influence (ZOI) and Zone of Contribution (ZOC) for Unit Well 29.

3.1 ZOI

The ZOI for Unit Well 29 was estimated in accordance with Wisconsin Department of Natural Resources (DNR) requirements based on 30 days of continuous pumping at the rated pump capacity, assuming no aquifer recharge. The ZOI was determined using the Theis equation, which assumes uniform conditions throughout an aquifer media and no recharge. The estimated ZOI for Unit Well 29 to a radius where there is 1 foot of drawdown is approximately 6.8 miles. Groundwater modeling performed by the DCRPC, as described in detail in Section 3.2 below, estimates the ZOI for Unit Well 29 to have a radius of 8.0 miles. This generally agrees with the calculated value above.

3.2 GROUNDWATER MODEL DEVELOPMENT AND ZOC DELINEATION

As part of the Dane County regional hydrologic study, a regional groundwater flow model was prepared for Dane County and was used to delineate time-related ZOCs for municipal wells (Krohelski et. al., 2000) including Unit Well 29. The Dane County regional hydrologic study was conducted cooperatively by the WGNHS, DCRPC, and the United States Geological Survey (USGS). The USGS modular groundwater modeling code [MODFLOW (McDonald & Harbaugh, 1988)] was used to simulate groundwater flow. After the calibrated groundwater flow model was prepared, PATH3D (Zheng, 1991) was used to determine time-related ZOCs.

The model domain covers an area of 50 by 60 miles and is divided into 144,000 nodes. Each node has regular spacing of 1,312.4 feet (400 meters) on a side. The grid has 200 rows and 240 columns (Krohelski et. al., 2000).

In 2002, the groundwater flow model was converted from a three-layer model to a four-layer model. The sand and gravel aquifer is Layer 1. The upper bedrock aquifer is Layer 2. The Eau Claire Formation is Layer 3. The lower bedrock aquifer is Layer 4. The model was recalibrated and various boundary conditions modified (DCRPC, 2001). Other aquifer parameters input into the model were as previously described in Chapter 2 and in Krohelski et. al., 2000.

Three groundwater flow simulations were performed using the calibrated model and different pumping rates for existing and known future municipal supply wells in Dane County (Bradbury, 1998). Simulation No. 1 was performed using the projected pumping rates from municipal wells for the year 2025. The projected pumping rate for Unit Well 29 is 1.383 million gallons per day (mgd). Pumping at a rate of 1.383 mgd is equivalent to pumping continuously at a rate of approximately 960 gallons per minute (gpm). Simulation No. 2 was performed using the "maximum sustained pumping rate" or "one-half design capacity" (Bradbury, 1998). The maximum sustained pumping rate (one-half design capacity) for Unit Well 29 is 1.584 mgd. Pumping at a rate of 1.584 mgd is equivalent to pumping continuously at a rate of 1,100 gpm, or approximately half the well's nominal capacity. Simulation No. 3 was performed using full design capacity. Full capacity for Unit Well 29 is 3.024 mgd. Pumping at a rate of 3.024 mgd is equivalent to pumping continuously at a rate of 2,100 gpm.

3.3 ZOC

The area that recharges or contributes water to Unit Well 29 is defined as the ZOC. The areal extent of the ZOC (capture zone) depends on the pumping rate, amount of horizontal and vertical recharge, aquifer characteristics, pumping duration, and other stresses such as other pumping wells. It is beneficial to know the well capture zone because contaminants introduced within the zone could reach Unit Well 29.

Figure 3-1 shows the 5-, 50-, and 100-year TOT ZOCs for Unit Well 29 based on the projected 2025 pumping rates (Simulation No. 1). Figure 3-2 shows the 5-, 50-, and 100-year TOT ZOCs for Unit Well 29 based on the one-half design capacity pumping rate (Simulation No. 2). Figure 3-3 shows the 5-, 50-, and 100-year TOT ZOCs for Unit Well 29 based on the full-capacity pumping rate (Simulation No. 3). The capture zones extend east-northeast in the simulated upgradient groundwater flow direction. Table 3-1 summarizes the upgradient and downgradient extent of capture zones for the various pumping simulations. The ZOCs delineated using the Simulation No. 3 pumping rates are more conservative in length and width compared to the ZOCs delineated using Simulation Nos. 1 and 2 pumping rates.

The ZOCs estimated for Simulation Nos. 1, 2, and 3 are representative of anticipated pumping conditions.

Maps 21 and 22 and Figure 2 in Appendix H show regional and local ZOCs for municipal wells in Dane County. Figure 2 in Appendix H shows ultimate ZOCs for municipal wells in Dane County. The ZOCs for Unit Well 29 are located entirely within Dane County.

3.4 WELLHEAD PROTECTION AREA

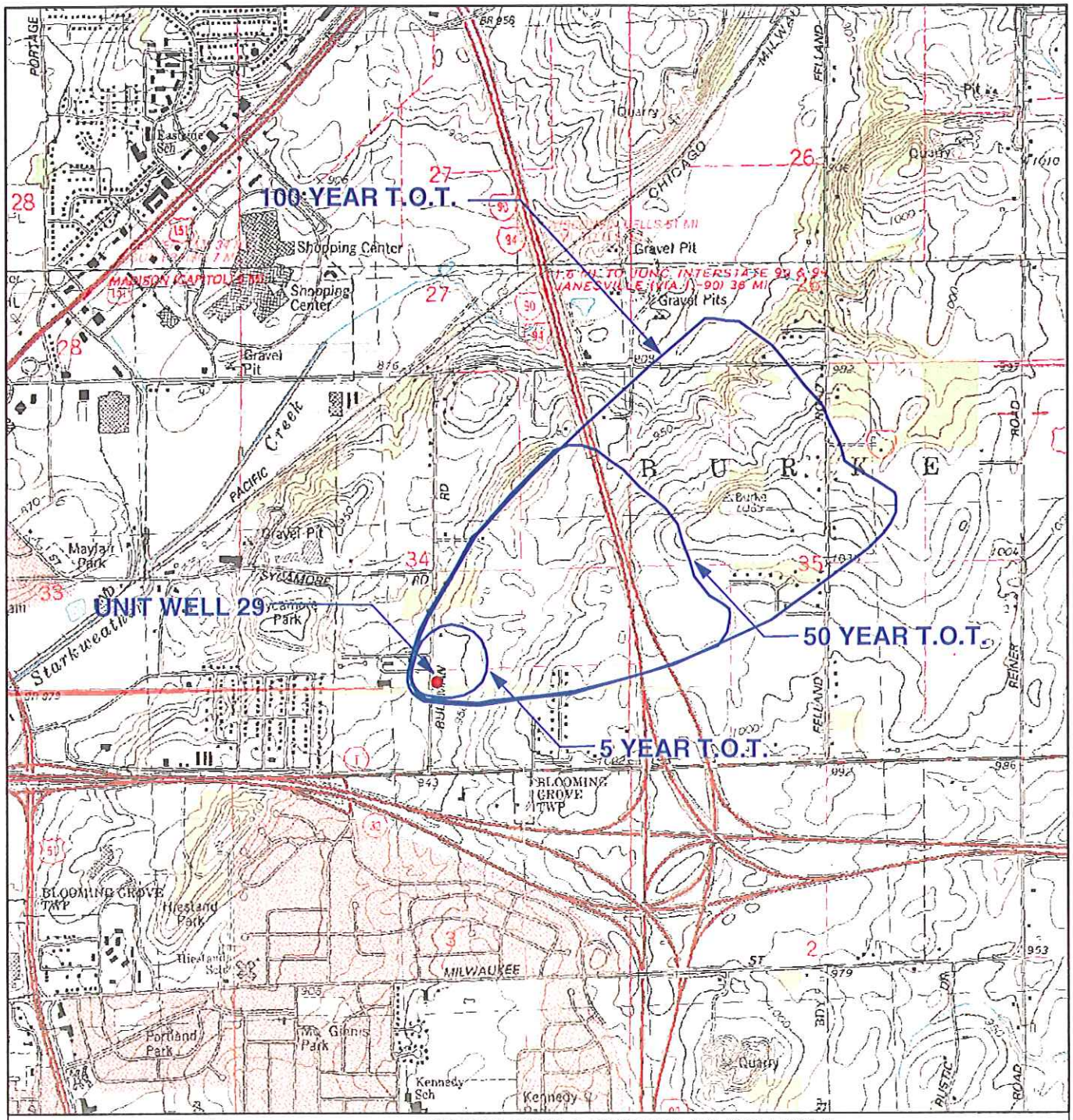
The Wisconsin Administrative Code (Chapter NR811.16(5)(e)) requires that a WHPA for municipal water supply wells "encompass, at a minimum, that portion of the recharge area equivalent to a 5-year time of travel to the well." Any of the three simulations described above could be used to model the 5-year TOT ZOC for Unit Well 29. For the city's Unit Well 28, the half-capacity pumping level (Simulation No. 2) was used to represent the most likely scenario under which water would be withdrawn from the aquifer over the next five years. For Unit Well 29, however, Simulation No. 3 provides a more realistic, albeit conservative, model of actual water withdrawal.

The 5-year TOT ZOC is irregular in shape and extends up to 1,150 feet on the upgradient side of the well. Downgradient, the 5-year TOT ZOC extends between 400 feet and 900 feet from the well, depending upon direction.

The 100-year TOT ZOC extends up to 7,400 feet upgradient from Unit Well 29. However, protecting the entire 100-year TOT ZOC from Unit Well 29 to the upgradient boundary at the same level of protection as the area within the 5-year TOT ZOC is likely too severe.

Figure 3-4 shows the WHPA for Unit Well 29. Two zones of protection are within the WHPA. Zone A is the area around Unit Well 29 that is defined by the 5-year TOT ZOC delineated for Simulation No. 3 (full design capacity pumping rate). Zone B is the area that is defined by a 1,200-foot fixed radius around Unit Well 29. This radius is selected because the Wisconsin Administrative Code Chapter NR811.16(4) requires a 1,200-foot minimum separation distance between a municipal water supply well and certain contamination sources.

The boundary of Zone B is larger than the 5-year TOT ZOC delineated for Unit Well 29 on the downgradient side of the well but is slightly smaller on the upgradient side. The WHPA will provide a



DANE COUNTY

INDEX MAP

SOURCE: USGS 7.5 MINUTE QUADRANGLE,
MIDDLETON, WISCONSIN, 1982

T.O.T. = TIME OF TRAVEL
Z.O.C.s = POTENTIAL CONTAMINANT SOURCE OR ROUTE

SCALE 1 : 24,000

2,000 1,000 0 2,000 4,000 6,000 Feet

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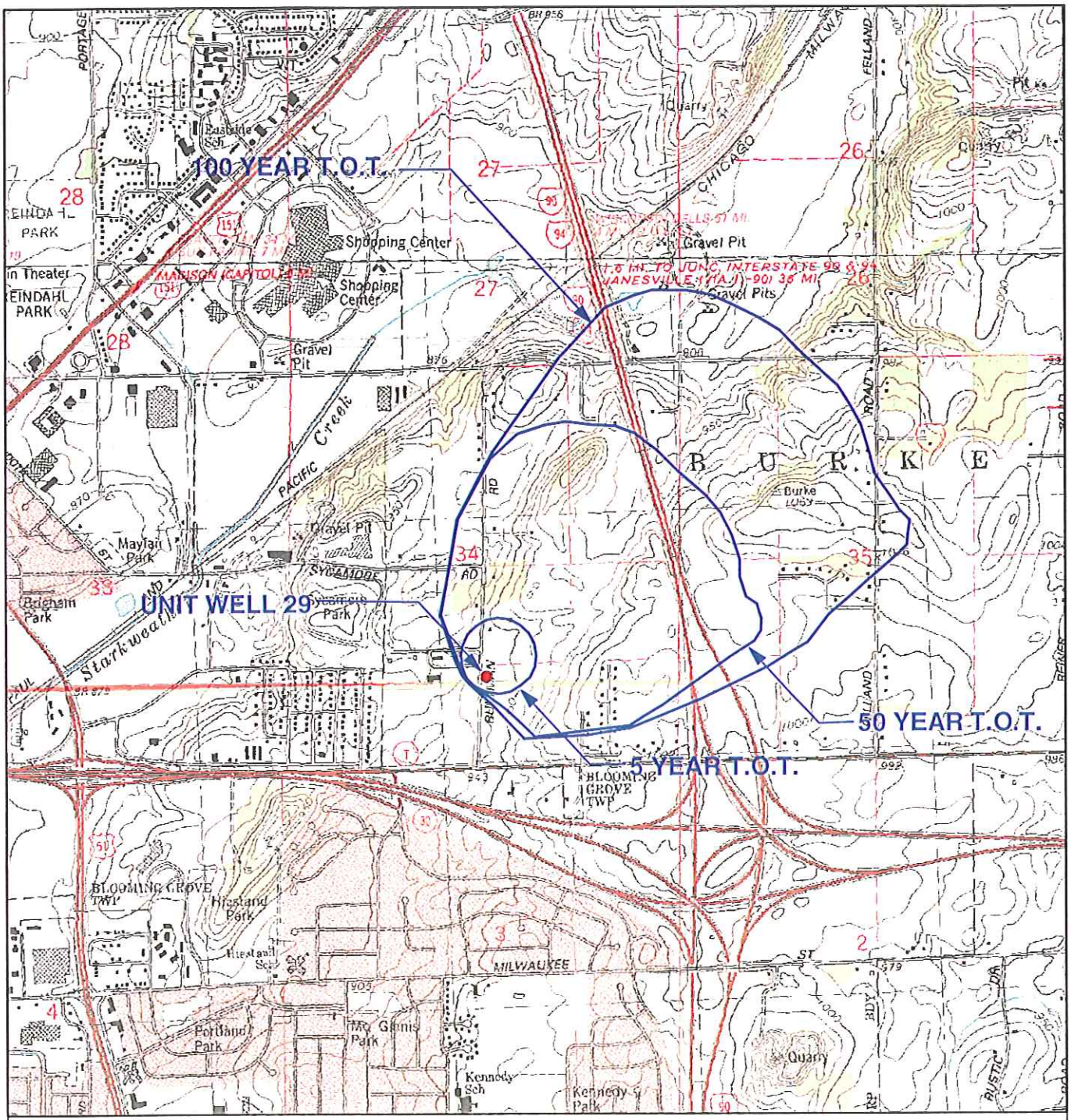
FIGURE 3-1

5, 50 & 100 YEAR T.O.T. Z.O.C.s ASSUMING
PROJECTED 2025 PUMPING RATE
MADISON, WISCONSIN

APRIL 2003



DANE COUNTY

INDEX MAP

SOURCE: USGS 7.5 MINUTE QUADRANGLE,
MIDDLETON, WISCONSIN, 1982

T.O.T. = TIME OF TRAVEL
Z.O.C.s = POTENTIAL CONTAMINANT SOURCE OR ROUTE

SCALE 1 : 24,000

2,000 1,000 0 2,000 4,000 6,000 Feet

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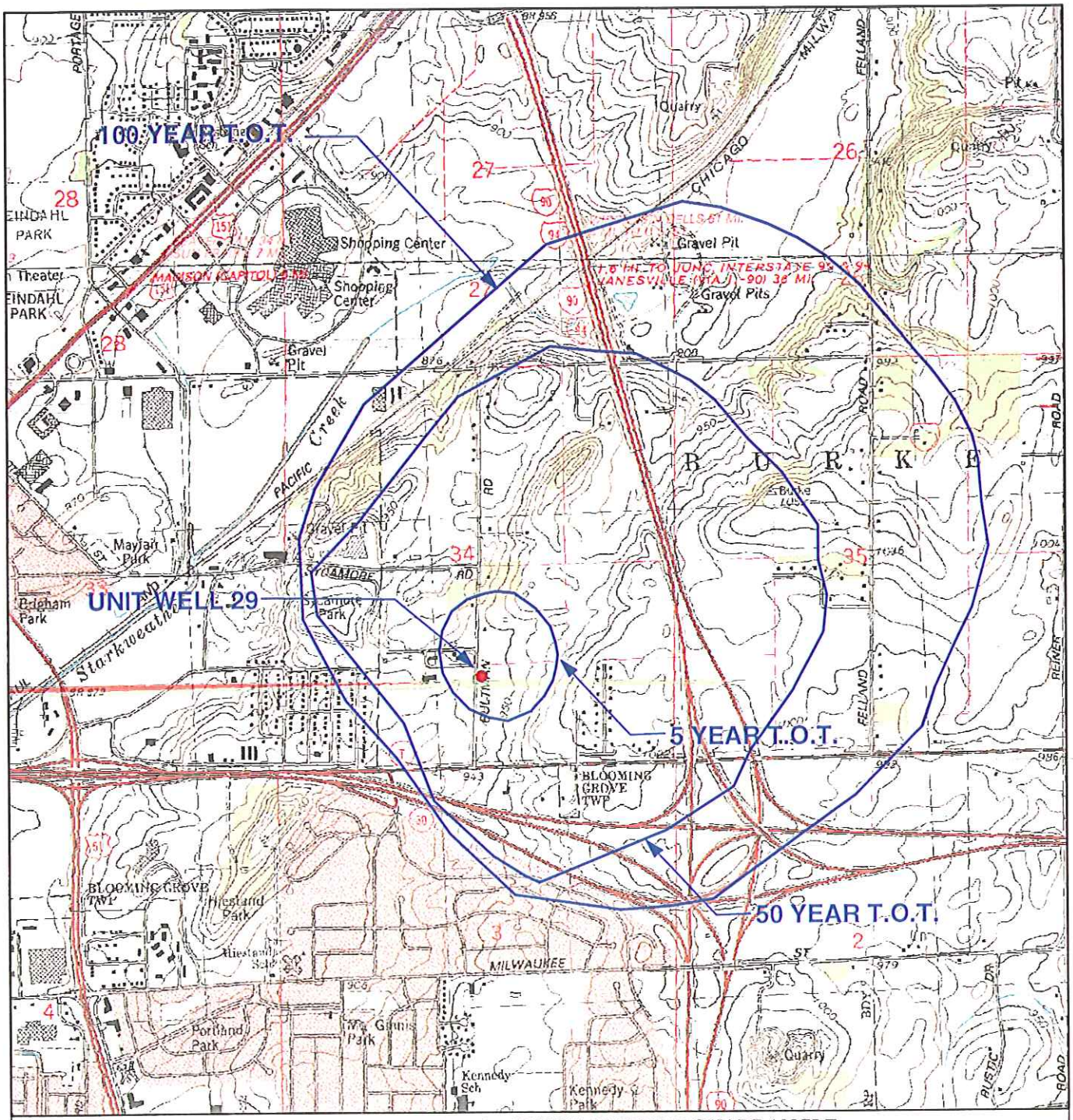
FIGURE 3-2

5, 50 & 100 YEAR T.O.T. Z.O.C.s
ASSUMING 50 PERCENT CAPACITY PUMPING RATE

MADISON, WISCONSIN

APRIL 2003



DANE COUNTY

INDEX MAP

SOURCE: USGS 7.5 MINUTE QUADRANGLE,
MIDDLETON, WISCONSIN, 1982

T.O.T. = TIME OF TRAVEL
Z.O.C.s = POTENTIAL CONTAMINANT SOURCE OR ROUTE

SCALE 1 : 24,000

2,000 1,000 0 2,000 4,000 6,000 Feet

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ENGINEERS

FIGURE 3-3

5, 50 & 100 YEAR T.O.T. Z.O.C.s ASSUMING PUMPING AT 100 PERCENT CAPACITY (3MGD)

MADISON, WISCONSIN

APRIL 2003

TABLE 3-1
SUMMARY OF EXTENT OF ZOCs (CAPTURE ZONE)
WELLHEAD PROTECTION UNIT WELL 29
MADISON, WISCONSIN

Item	Simulation No. 1 (projected 2025 pumping rates)	Simulation No. 2 (one-half design capacity pumping rates)	Simulation No. 3 (continuous pumping at maximum capacity)
Simulated Pumping Rate (MGD)	1.383	1.584	3.024
Upgradient Extent of ZOC (feet)			
5-year TOT	800	800	1,150
50-year TOT	3,850	3,800	4,950
100-year TOT	6,600	6,100	7,400
Downgradient Extent of ZOC (feet)			
5-year TOT	300	200	1,500

Notes:

mgd = million gallons per day
ZOC = zone of contribution
TOT = time of travel

N

0 300 600
Feet

ZONE B
ZONE A
WELLHEAD PROTECTION AREA

SYCAMORE AVE

THOMPSON DR

UNIT WELL 29

ZONE A

THOMPSON DR

ZONE B

MESTA LN

WINTERGREEN

I-90/I-94

100 YEAR TIME OF TRAVEL CAPTURE ZONE

50 YEAR TIME OF TRAVEL CAPTURE ZONE

5 YEAR TIME OF TRAVEL CAPTURE ZONE

1200' RADIUS

HWY 30

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FIGURE 3-4
MAP OF WELLHEAD DISTRICT NO. 29
MADISON, WISCONSIN
APRIL 2002

4.0 POTENTIAL CONTAMINANT SOURCES

4.1 CONTAMINANT SOURCE INVENTORY

A CSI was performed for Unit Well 29 area during the first quarter of 2003. The CSI consisted of a search of government records, interviews, review of aerial photographs, and a reconnaissance survey completed March 24, 2003, of the area within a one-half-mile radius of Unit Well 29. A copy of the CSI is in Appendix H.

Figures 4-1 and 4-2 show the location of potential and existing contaminant sources in the WHPA and within a one-half-mile radius of Unit Well 29. Figure 4-1 shows the topography of the area, and Figure 4-2 shows the land subdivisions. Table 4-1 summarizes potential contaminant sources that were identified and/or reported to be within the WHPA and review area.

Potential and existing contaminant sources within a half-mile radius of Unit Well 29 include active and closed UST sites, a closed municipal landfill, agricultural farming, fertilizer spreading, closed and active private sewage disposal systems, road salt use, and pesticide, herbicide, and nutrient loading on commercial and residential lawns.

On the basis of available information, following are descriptions of known existing or potential contaminant sources in the WHPA and/or within a 1/2-mile radius of Unit Well 29:

The nearest private sewage disposal system is located outside the WHPA.

The nearest private water supply well is located approximately 1,400 feet east of Unit Well 29.

There are two stormwater detention basins: one is 1,100 feet southeast of the site and the other is 1,300 feet northeast of Unit Well 29.

The nearest sanitary sewer main not constructed of water main materials is located within 200 feet of the well, and existing storm sewer mains are located a little more than 50 feet from Unit Well 29.

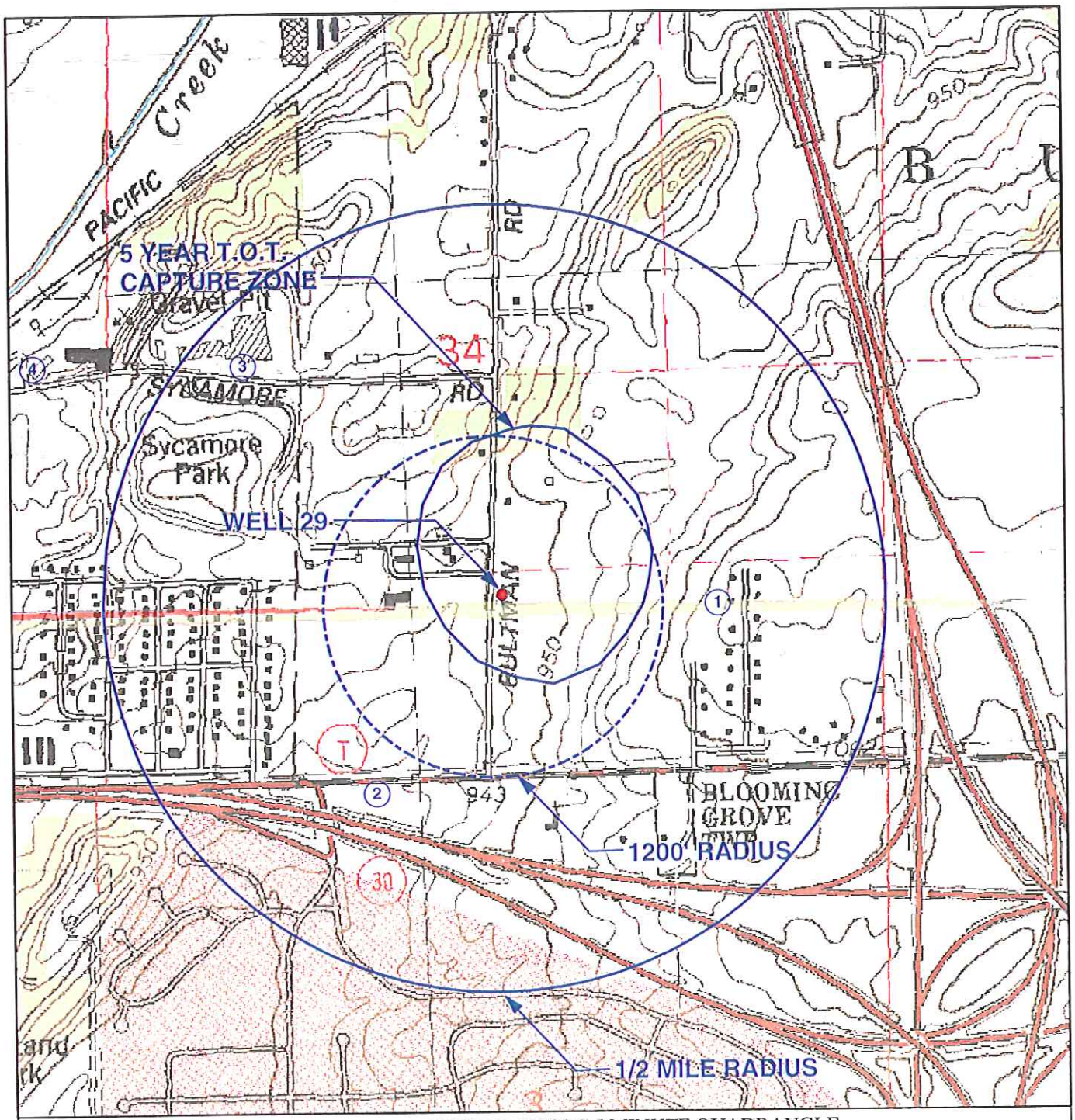
On the basis of the site reconnaissance and a review of the Wisconsin registered storage tank list, the nearest USTs are reported to be located at the convenience store and adjacent oil change facility located 1,400 feet south of Unit Well 29. The nearest reported leaking underground storage tank was identified as being located at the City of Madison East Side Public Works facility approximately one-half mile west of Unit Well 29. DNR records indicate the tank's status is closed since 1998.

On the basis of site reconnaissance and a review of the Wisconsin registered storage tank list, no above-ground storage tanks could be located within the WHPA.

No dry-cleaning business is located in the vicinity of the Unit Well 29 WHPA.

There are no golf courses located within the Unit Well 29 WHPA.

A former sanitary landfill is located on the site of Sycamore Park, approximately 1,500 feet northwest of Unit Well 29.



DANE COUNTY

INDEX MAP

SOURCE: USGS 7.5 MINUTE QUADRANGLE,
MIDDLETON, WISCONSIN, 1982

T.O.T. = TIME OF TRAVEL

(3) POTENTIAL CONTAMINANT SOURCE OR ROUTE

SCALE 1 : 12,000

0 500 1,000 2,000 3,000 4,000 Feet

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FIGURE 4-1
CONTAMINANT SOURCE INVENTORY
UNIT WELL 29

MADISON, WISCONSIN

APRIL 2003

N

0 300 600

Feet

③ POTENTIAL CONTAMINANT SOURCE OR ROUTE

T.O.T. = TIME OF TRAVEL

SYCAMORE ROAD

THOMPSON DR

5 YEAR T.O.T. CAPTURE ZONE

WELL 29

THOMPSON DR

MESTA LN

WINTERGREEN AVE

HWY 30

1200' RADIUS

1/2 MILE RADIUS

I-90/I-94

STRAND ASSOCIATES, INC. ENGINEERS

FIGURE 4-2
CONTAMINANT SOURCE INVENTORY
UNIT WELL 29
MADISON, WISCONSIN
APRIL 2002

TABLE 4-1
CONTAMINANT SOURCE INVENTORY SUMMARY
WELLHEAD PROTECTION UNIT WELL 29
MADISON, WISCONSIN
NOVEMBER 2003

Map Site No.	Owner/Location	Database or Reference Source	Existing, Potential, or Former Contaminant Sources	Reported Status	Approximate Distance to Unit Well 20	Location within Capture Zone	Estimated Threat to Supply Wells
1	Mark Kuhn 4801 Vernon Road Madison, WI	Wisconsin Department of Commerce Storage Tank Database	Underground storage tank	Closed			Low
2	Francois Oil-Citgo Quik-Mart 4905 Commercial Ave. Madison, WI	Windshield Survey	Underground storage tank	Active			Low
3	City of Madison 4602 Sycamore Ave. Madison, WI	Wisconsin BRRTS database	Underground storage tank aboveground storage tank leaking underground storage tank closed municipal landfill	Closed			Low
4	Samuels Recycling 4400 Sycamore Ave. Madison, WI	Windshield Survey	Used vehicle and equipment storage	Active			Low

TABLE 4-2
MINIMUM SEPARATION REQUIREMENTS
BETWEEN PUBLIC WELLS AND
POTENTIAL CONTAMINANT SOURCES
WELLHEAD PROTECTION PLAN, UNIT WELL 29
MADISON, WISCONSIN

Potential Contamination Source	Minimum Separation Distance
Storm Sewer	50 feet
Sanitary Sewer	200 feet [1]
Sanitary Lift Station	200 feet
Single-Family Residential Fuel Oil Tank	200 feet
Septic Tank Receiving Less than 8,000 gpd	400 feet
Cemetery	400 feet
Stormwater Drainage Pond	400 feet
Gasoline or Fuel Oil Tank Approved by Comm 10.10	600 feet
Land Application of Municipal, Commercial, or Industrial Waste	1,000 feet
Commercial or Municipal Wastewater Lagoons or Storage Structures	1,000 feet
Manure Stacks or Storage Structures	1,000 feet
Septic Tanks or Soil Absorptive Units Receiving Greater than 8,000 gpd	1,000 feet
Solid Waste Storage, Transportation, Transfer, Incineration, Air Curtain Destructor, Processing, Wood Burning, or One-Time Disposal or Small Demolition Facility	1,200 feet
Sanitary Landfill	1,200 feet
Coal Storage Area	1,200 feet
Salt or Deicing Material Storage	1,200 feet
Gasoline or Fuel Oil Storage Tanks not Approved by Comm 10.10	1,200 feet
Bulk Fuel Storage Facilities	1,200 feet
Pesticide or Fertilizer Handling or Storage Facilities	1,200 feet

Reference: Wisconsin Administrative Code, NR 811, November 2002

Footnote:

[1] Lesser separation for sanitary sewer may be allowed if the sewer is constructed of water main materials and pressure tested. Less than 50 feet separation is not allowed.

5.0 MANAGEMENT STRATEGIES

A full discussion of wellhead protection management strategies may be found in the Wellhead Protection Plan for Unit Well 28, including alternative management strategies, water conservation programs, contingency plan, and management plan.