

3.5 Groundwater Resources

3.5.1 Existing Conditions

In the Town of Carmel, and surrounding areas, there are private community water systems, water districts run by the Town of Carmel and Somers, and individual wells serving residents and businesses. This also applies to the land users that surround the Union Place project site.

Location and Description of Aquifer and Recharge Areas

Groundwater for the supply of potable water in the vicinity of the project site is primarily found in the bedrock. Shallow groundwater located in glacial till material is not a reliable source of groundwater in Carmel due to the relatively thin cover of glacial till in the area. Till material was found to be approximately 30 feet thick to bedrock in the drilled wells, too thin to support a sand and gravel aquifer. For this reason bedrock wells are most common in the Carmel area. Shallow groundwater in this till would be too susceptible to impacts from any potential surface contamination.

Bedrock wells are installed into the metamorphic gneiss rock found locally. These wells are generally dependent upon fractures in the bedrock to provide sufficient water for a reliable water supply. Therefore, depths of wells and well yields can vary considerably depending upon the size and quantity of fractures that are intercepted when a given well is drilled.

Depth to Water Table

Ten (10) six-inch diameter bedrock production wells and one (1) eight-inch diameter bedrock production well were drilled on the Union Place site to provide water for the project. Drilling logs are provided in Appendix F. Static water levels in the eleven (11) bedrock wells were found between zero and 168.3 feet below top of casing (ft btoc). Information about each of the eleven (11) bedrock wells including depth to groundwater is shown in Table 3.5-1. Included in this information is the drillers estimated yields. The driller, P.F. Beal and Sons, Inc., provided a compressed air lift test for 6 hours to test for the estimated water yield of the well.

Well Number	Casing Length (ft)	Casing Diameter (inches)	Total Well Depth (ft)	Drillers Estimated Yield (gpm)	Static Water Level (ft btoc)		
					November 2006	July 2009	August 2009
1	122	6	500	200.0	20.3	NM	16.8
2	125	6	605	8.5	4.3	2.3	NM
3	176	6	900	45.0	45.6	44.7	42.8
4	112	6	605	4.0	19.8	19.5	NM
5	62	6	605	8.0	61.1	65.2	NM
6	62	6	900	120.0	0.0	0.0	0.2
7	62	6	405	100.0	11.9	10.0	9.1
8	82	6	720	175.0	30.0	27.9	26.9
9	121	8	610	150.0	ND	20.7	18.5
10	205	6	740	5.0	ND	168.3	NM
11	250	6	880	10.0	ND	145.5	NM

Notes
gpm - gallons per minute
ft btoc - feet below top of casing
ND - Not drilled (well had not been drilled by date)
NM - Not measured
Wells 3, 6, and 8 were deepened and hydrofracked to gain more water from the wells.
Source: Construction detail from boring logs and water level data supplied by Leggette, Brashears & Graham, Inc.

Fracture Trace Analysis

A fracture trace analysis was completed for the Union Place site in order to assist in the location and development of water supply wells for the project. This report was completed by SSEC and is attached in Appendix F. Fracture trace analysis utilizes high altitude infrared photography and geologic maps to identify surface features which reflect underlying geologic structures such as faults and bedrock fractures. The number and location of bedrock fractures is dependent on the degree of deformation that the bedrock has undergone through its formation. Typically, the larger, more productive fractures tend to produce visible topographic traces. These traces can be found using aerial photography and digital terrain modeling.

Review of the high altitude infrared photography shows that the project area has many fractures located on the western portion of the site as well as some deeper fractures on the eastern and central portions of the site. Fracture traces are shown on the figures included within the fracture trace report, as well as on Figures 3.5-1 and 3.5-2.

Area Contributing to Recharge

The contributing surface water drainage area which provides recharge to the property typically is limited to the area of the subject property (approximately 287.2 acres) and immediately adjacent undeveloped land (approximately 10 acres), which is a total of approximately 297.2 acres (see Figure 3.5-1). Limiting the analysis in this way is very conservative and is based only on surface topography. It does not consider that the project site is underlain by a system of subsurface fractures and minor faults. The faults and fractures that form the valleys surrounding the project site may extend for miles and intercept additional fractures well beyond the boundaries of the property. Precipitation falling anywhere within this area naturally drains

towards the valleys from the higher elevations. The fractures tapped by the Union Place wells will potentially draw water from an area significantly larger than the project site including the areas beneath Lake Baldwin and those underlying NYSDEC Wetlands ML-10 and ML-11. Lands well outside of the recharge area associated with the project site could also contribute water to the aquifer providing water through these fractures thereby increasing the area of recharge significantly. Figure 3.5-2 shows the larger drainage basins that intersect fractures that underlie the property; this larger area is estimated to be approximately 7 square miles. Both Figure 3.5-1 and 3.5-2 show the recharge area as well as the existing well locations on the Union Place property.

History of Recorded Groundwater Contamination and Failed Wells

Properties in the vicinity of the project site are served by individual wells, community water supply wells and municipal Water Districts. Certain local wells are not in service either due to failed yields or water quality issues. These wells are discussed in further detail below.

The area south and east of the Union Place property is part of the Baldwin Place Critical Environmental Area (CEA), shown on Figure 3.5-3. Releases from dry cleaners and gas stations have caused chlorinated solvent and petroleum product contamination of the bedrock aquifer in that area.

Groundwater samples were collected from the two (2) groundwater wells located on the Zipkin Property, which is the southern part of the Union Place property adjacent to Baldwin Place Road, and analyzed for volatile organic compounds (VOCs) plus methyl tertiary-butyl ether (MTBE). These samples were collected by Tim Miller Associates, Inc. (TMA) and analyzed by Accutest Laboratories, to determine if they had been impacted by the Mobil Station petroleum spill (The Mobil Station is located at the corner of Route 6 and Baldwin Road). The laboratory results are provided in Appendix F. Very low levels of MTBE, below the New York State Department of Health (NYSDOH) drinking water standard of 10 micrograms per liter (ug/L), were detected in these two (2) wells. The Mobil Station has had an ongoing investigation since April 30, 1989 and has an open New York State Spill Number (#8812007) for impacting groundwater, determined by reviewing the provided Quarterly Monitoring Report from the current environmental consultant doing work at the Mobile Station. This open spill number indicates that the site is still under clean up regulations with the New York State Department of Environmental Conservation.

Present Uses of Groundwater in the Area

As described above, properties in the vicinity of the Union Place site are served by either private community water supply systems, private wells, or Town Water Districts. The Union Place property currently has eleven (11) bedrock wells that have been recently drilled but are not yet in use. Other wells that are currently in use as potable drinking water supplies include two older bedrock wells that service the existing residences on the Zipkin Property. These wells are pumped at less than 5 gallons per minute (gpm), the typical demand for a single family residences. The Mobil Station, located on the corner of US Route 6 and Baldwin Place Road also has one bedrock potable drinking water well. This well provides less than 5 gpm since it is only used to supply drinking and lavatory water to the Mobil Station.

Community Water Supply Systems

Several community water supply systems are located in the area surrounding the Union Place property. These community water supply systems may not fall entirely within the recharge area of the site. Below is a summary of the three (3) community water supply systems:

- Society Hill - Society Hill Condominiums is located east of the Union Place site and has four (4) bedrock wells located on its property. Only two (2) of the wells are currently in use for the community water supply. One well, located just south of the Union Place Property and shown on Figure 3.5-1, yields approximately 30 gpm while the other in service well is located on the southeastern portion of the Society Hill property and only yields 5 gpm, as a back up to the other well. The other two (2) wells have been taken out of service due to their low yield. According to Roy Barticciotto of CEMCO Water & Wastewater, the operator of the community water system, which supplies water to 100 townhomes and one (1) community building, the average usage of water for the condominiums is 17,300 gallons per day (gpd) and the peak day demand was reported to be 24,100 gpd (information from 2008 data). The one Society Hill well located within the Union Place recharge area yields 30 gpm and provides most of the water needed for the site. Therefore this well pulls approximately 17,300 gpd (as the average daily demand) to 24,100 gpd (as the peak day demand) from the Union Place sites recharge area.
- Chateau Ridge - Chateau Ridge is a residential community of single family homes located to the east of the Union Place site east of US Route 6. This system has three (3) bedrock wells, with only two of the wells in service. One well has been taken out of service due to low yield and water quality issues. There are approximately 150 service connections associated with this community water supply. According to Ken Sabia of VRI, the operator of the community water supply, the average usage of water for the community is 35,200 gpd with a peak day usage of 45,200 gpd (information from 2008 data). The wells associated with this community water supply are not within the recharge area of the site.
- Williamsburg Ridge - Williamsburg Ridge Condominiums are located west of the Union Place site. This community water supply uses four (4) bedrock wells. According to John Muro of Allied Pollution Control, the operator for the community water supply, the average usage of water for the condominiums is 16,600 gpd with a peak usage of 23,600 gpd (information from 2008 data). The wells associated with this community water supply are not within the recharge area of the site.

Town of Carmel Water Districts

Several Town of Carmel water districts are located in the vicinity of the Union Place site. Information on these water districts was obtained through phone conversations with Mr. John Karrel, P.E., the Town of Carmel Town Engineer. The information is provided below:

- Town of Carmel Water District No. 4 - Lake Baldwin - This Town water district is located southwest of the Union Place site and supplies single family homes. The water district has seven (7) bedrock wells, four (4) of which are used on a constant basis. The average water demand is 31,800 gpd with a peak demand of 37,000 gpd (information from 2008 data). The wells associated with this Town water district are not within the recharge area of the site.

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- Town of Carmel Water District No. 5 - Maple Terrace - This Town water district is located northwest of the Union Place site and supplies single family homes. The water district has four (4) bedrock wells with one (1) well not in service due to high iron levels. The average water demand for this district is 8,600 gpd with a peak demand of 12,900 gpd (information from 2008 data). The wells associated with this Town water district are not within the recharge area of the site.
- Town of Carmel Water District No. 13 - Rolling Green Subdivision - This Town water district currently has two (2) bedrock wells neither of which are in use. This district currently obtains Town of Carmel Water District No. 8. District No. 8 does not rely on the bedrock aquifer as a water source but rather takes water from Lake Mahopac, a surface water source. It supplies water to 28 homes located in the Rolling Green Development. The remaining ten (approximately) of the homes in the Rolling Green Development use individual bedrock wells located on their respective properties. These ten homes use an estimated 4,000 gpd or 400 gpd per 4-bedroom home.

Water District No. 13 will also supply water to the nine (9) proposed homes in the Baldwin Estates development. No average usage or peak water usage was provided for this water district (the Rolling Green Subdivision or proposed Baldwin Estates Development). The wells associated with this Town water district are not within the recharge area of the site.

Non-Community Water Supplies

The remaining properties in the vicinity of the Union Place site utilize non-community water supplies or individual wells that are located on the respective properties. Commercial private wells near the site include: the Post Office, Lupi Storage Facility, the Putnam Square Shopping Center, the William Koehler Senior Center, the Mahopac Senior Housing, the Mobil Station (mentioned above), Zipkin Property (mentioned above), Pine Grove Day Care, the Baldwin Meadows development, the NYSEG building, and South Putnam Animal Hospital. The water usage for the commercial properties is significantly less than the water usage for the residential communities mentioned below. Typically a commercial property would be required to supply approximately 0.1 to 0.8 gpd per square foot and a single family residence averages 300 to 400 gpd, depending on the number of bedrooms in the residence. These residential communities and their usage are described below.

- Baldwin Meadows - This development includes fifteen (15) newly constructed single family homes and is located to the west of the Union Place site. Each home has its own private well. The total estimated water usage for the 15 lots development is 6,000 gpd using an estimated 400 gpd for each 4-bedroom residence. The wells associated with this non-community water supply are not located within the recharge area of the site.
- Mi-Anna Drive - There are eleven (11) single family homes located along this road (Mi-Anna Drive). These homes are supplied by individual private wells. The estimated groundwater usage for these homes is 4,400 gpd, using an estimated 400 gpd per 4-bedroom house. The wells associated with this non-community water supply are not located within the recharge area of the site.
- Mahopac Senior Housing - This complex is supplied by two (2) bedrock wells. The Putnam County Department of Health (PCDOH) stated that their average daily usage

was 1,800 gpd in 2008. These two (2) wells are not located within the recharge area for the Union Place site.

- William Koehler Senior Center - This building is supplied by one (1) bedrock well located onsite. There was limited information associated with this well but based on the Center's water supply design, the water demand is estimated to be 2,200 gpd. The wells associated with this non-community water supply are not located within the recharge area of the site.

Production Well Testing

At the completion of the Union Place groundwater exploration a 72-hour pump test will be completed. Before commencement of this 72-hour pump test a Pump Test Protocol will be submitted to the Town of Carmel and the PCDOH for review and approval.

An off-site monitoring program will be organized prior to the commencement of a 72-hour pump test. Properties adjacent to the Union Place project site and at a distance agreed upon by the Town of Carmel (typically a 1,000 foot radius from the onsite test well) will be sent letters with the option to have their wells monitored during the 72-hour pump test. This monitoring will provide information regarding influence between the onsite proposed production wells and nearby off-site wells. Once positive confirmation has been received from property owners, off-site locations will be selected to provide the most information regarding pump test influence on off-site locations. These off-site locations will be reviewed by the Town of Carmel and the PCDOH.

Two (2) consecutive 72-hour pump tests will be conducted on the proposed supply wells located on the Union Place property. A 72-hour test will be conducted on the most productive well, followed by a 72-hour simultaneous test on the remaining supply wells. This will help to determine if the combined yield of the supply wells will meet twice the average daily demand of the entire proposed project with the best well out of service.

The project engineer, Insite Engineering, has estimated the preliminary average water demand for the proposed Union Place development to be an average daily demand of 195,270 gpd or 135.6 gpm, also shown below in Table 3.5-2. The NYSDOH requires that the water supply system supply water for the development at a rate/volume equal to or exceeding the design maximum daily demand, which is calculated as twice the average daily demand. Therefore, the system would need to supply 390,540 gpd or 271.2 gpm with the best well out of service.

Facility	Unit Flow Rate	Size	Demand
Large (non-food) Retail Space ¹	0.01 gpd/sf	213,000 sf	2,130
Medium to Small Retail Space ²	0.08 gpd/sf	208,000	16,640
Retail/Service Office ²	0.08 gpd/sf	-----	-----
Specialty Grocer ³	6,000 gpd	1	6,000
Office Space ²	0.08 gpd/sf	475,000	38,000
Hotel ²	96 gpd/room	90	8,640
Restaurants ^{2,4}	2,800 gpd/seat	3	8,400
Residential ^{2,5}	240 gpd	480	115,200
Community Space ³	260 gpd	1	260
Recreation Centers	1,200 gpd	-----	-----
Playhouse ^{2,6}	4 gal/seat	-----	-----
Total	-----	-----	195,270

Notes:

gpd - gallons per day;

sf - square foot;

¹ - Large (non-food) Retail Space usage based on study of actual users.

² - 20% reduction applied to all DEC88 published flows as now permissible by PCDOH Bulletin CS-31. See Table 3.5-3 DEC88 published flows compared to the 20% reduction design flows.

³ - Usage based on past projects.

⁴ - Each restaurant is assumed to have 100 seats at 28 gpd/seat.

⁵ - Residential Unit Flow is based upon 2-bedroom units.

⁶ - Playhouse usage based upon similar use of Sports Stadium (5 gal/seat) as presented in DEC 88.

Use	DEC88 Published Design Flow	Design Flow with 20% Reduction Applied
Medium to Small Retail	0.1 gpd/sf	0.08 gpd/sf
Retail/Service Office	0.1 gpd/sf	0.08 gpd/sf
Office Space	0.1 gpd/sf	0.08 gpd/sf
Hotel	120 gpd/room	96 gpd/room
Restaurant	35 gpd/seat	28 gpd/seat
Residential (2-bedroom unit)	300 gpd/unit	240 gpd/unit
Playhouse (based upon Sports Stadium use)	5 gpd/seat	4 gpd/seat

Source: Insite Engineering, Surveying & Landscape Architecture, P.C., 2010.

As stated above, an off-site monitoring program will be set up. During the 72-hour pump test the water level in off-site and on-site monitoring wells will be monitored to determine possible influence. Piezometers will be placed in nearby wetlands (any wetland or water course within 200 feet of any well) and water levels monitored. These piezometers will also collect water quality data, such as conductivity and temperature for Groundwater Under the Direct Influence of surface water (GWUDI) requirements. At the completion of the 72-hour pump test water samples will be collected in accordance with the New York State Sanitary Code, Part V, Subpart 5-14 from each well that was pumped and a Microscopic Particulate Analysis (MPA)

sample will be collected from any well that is within 200 ft of a surface water body or wetland (in conformance with GWUDI standards).

The information gathered within this 72-hour pump test will be used to determine if water level or yield impacts to the neighboring wells occur due to the use of the Union Place wells and what or if any mitigation measures will need to be put into place.

3.5.2 Potential Impacts

Loss of Recharge Area

The project will result in the conversion of 81.4 acres of the 287.2 acre site to impervious surface in the form of either roads, building areas, or parking areas. Therefore, the amount of area in which rainfall can directly fall on pervious (unpaved) surfaces and potentially recharge the aquifer will be reduced by approximately 28 percent. It should be noted that most if not all stormwater from impervious surfaces will be directed to stormwater treatment facilities, such as vegetated swales and detention basins, thereby allowing much of the precipitation falling on impervious surface to potentially contribute to aquifer recharge.

Effects on Neighboring Wells

As stated in Section 3.5.1 above, off-site wells will be monitored for effects of water level drawdown and yield during the 72-hour on-site pump test. Information from this test will be provided once it is completed.

Construction Impacts

Soil compaction will occur as a result of construction on-site. It is expected that soil compaction will occur in areas where buildings and roads are proposed, which includes the 81.4 acres of proposed impervious surface. Soil compaction reduces the groundwater recharge rate due to the reduction in soil pore space in the soil through which water flows. The project has been designed and engineered to collect and distribute stormwater from areas of impervious surface (compacted soil) into stormwater basins to be recharged into the groundwater aquifer below the site.

Baldwin Place Critical Environmental Area

It is not likely that the Union Place property or its drinking water supply will be affected by the groundwater problems associated with the CEA based on the sampling conducted in 2006 and 2009, explained above. The CEA is downgradient of the Union Place proposed supply wells further minimizing the likelihood of impact. Additional information will be collected during the 72-hour pump test, including water quality data and water level measurements from off-site wells. This data will be used to determine if groundwater from the CEA is moving towards the Union Place property as a result of the pumping.

Other Potential Impacts

No other potential impacts to groundwater associated with the current proposed development of the Union Place site have been identified.

3.5.3 Mitigation Measures

Present water supply systems in this part of the Town of Carmel rely on groundwater for water supply, and the proposed Union Place development is also expected to rely on groundwater as a water source. As described above, the applicant proposes a 72-hour pump test to determine the potential groundwater impacts from the project.

Potential Well Pumping Impacts

Private off-site wells will be monitored during the proposed pump test to determine any impacts to off-site wells. If any off-site wells are impacted by the project, the applicant will provide mitigation. These mitigation measures could include replacing wells that show impact from the proposed 72-hour pump test, deepening any impacted well, hydrofracking the impacted well to boost its performance, or extending water districts from the Union Place property to include the impacted water supply.

Surface Water as a Drinking Water Supply

The closest surface water body that could be used as potable drinking water source is Lake Mahopac, located north of the Union Place property. As documented above in Section 3.5.1, Lake Mahopac is used by the Town of Carmel Water District No. 8. This water district does supply water to Town of Carmel Water District No. 13, which is located adjacent to and north of the property. The total capacity of Water District No. 8 is currently 375,000 gpd; the district supplied or filtered 147,000 gpd in 2009, 151,000 gpd in 2008 and 194,000 gpd in 2007, an annual average of 164,000 gpd of usage. As stated above, the peak water supply for this project must have the capacity to supply 390,540 gpd or 271.2 gpm. The excess capacity from Water District No. 8, 211,000 gpd cannot supply this entire amount, however the groundwater wells already developed on the property can be used to supplement the water supply. Permission from the Town of Carmel would need to be supplied for this water district to supply water to the Union Place project.

If the Town of Carmel Water District No. 8 filter system is not capable of supplying water to the Union Place project, there is the potential to use Lake Mahopac surface water as the source for a newly developed private or supplemental filter system. There is infrastructure in place just north and adjacent to the Union Place property, this infrastructure includes 8 inch pipe, which carries water from Water District No. 8 to the Rolling Green subdivision. While this infrastructure would enable Water District No. 8 to supply water to the Union Place Property from Lake Mahopac, upgrades may be required to this system. These could include expanding the filter system and/or supplying more storage capacity to the Town water district. Permission would be required from the Town of Carmel and NYSDEC to use water from Lake Mahopac for this water supply option.

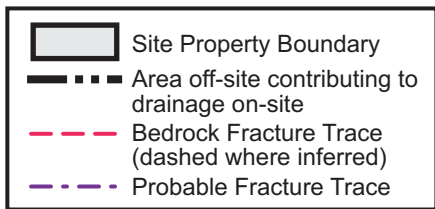
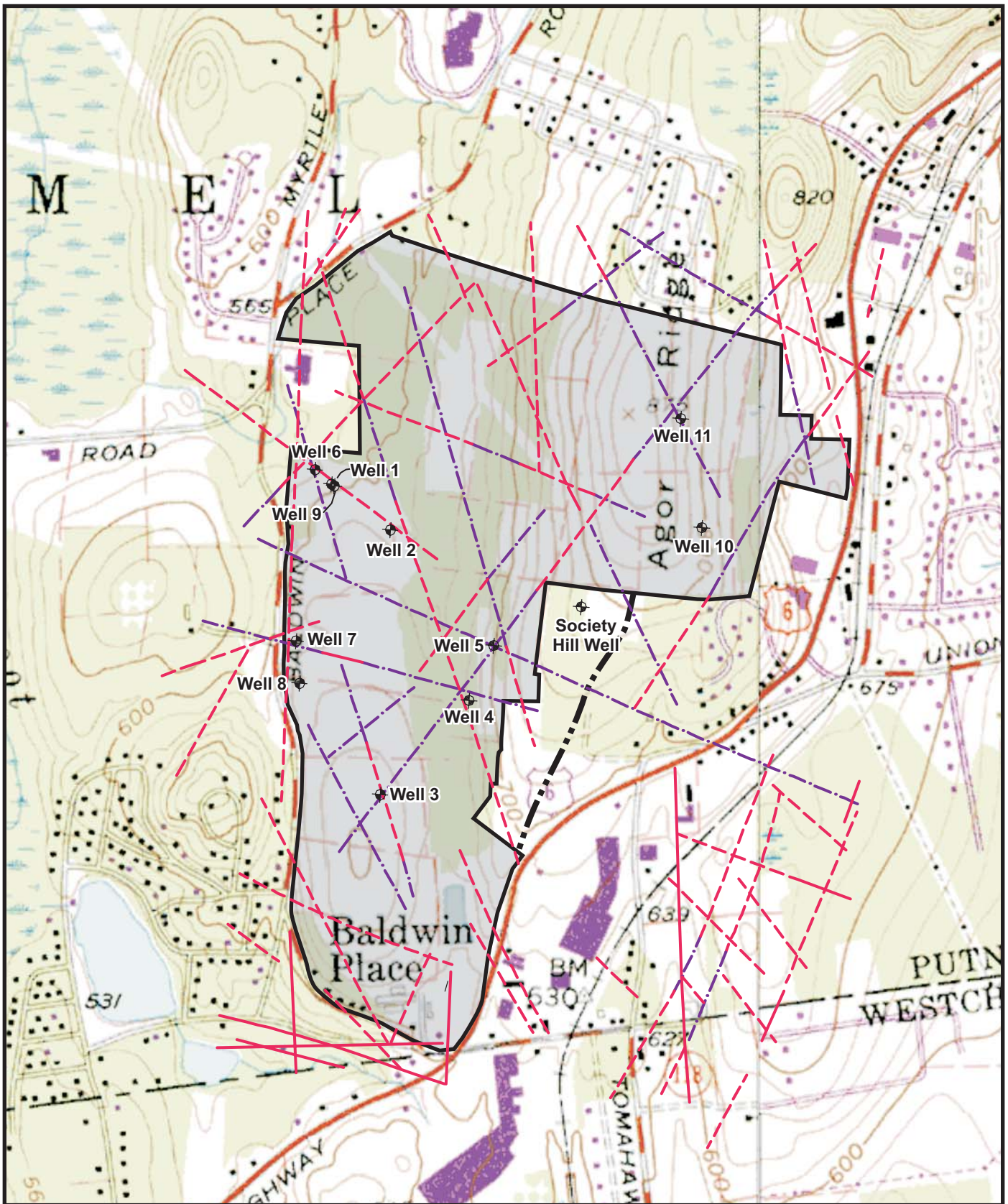


Figure 3.5-1: On-Site Surface Water Drainage Map
 Union Place
 Town of Carmel, Putnam County, New York
 Base Map: USGS 7.5-minute Topographic Map, Mohegan Lake Quad
 Scale: 1" = 2,000'

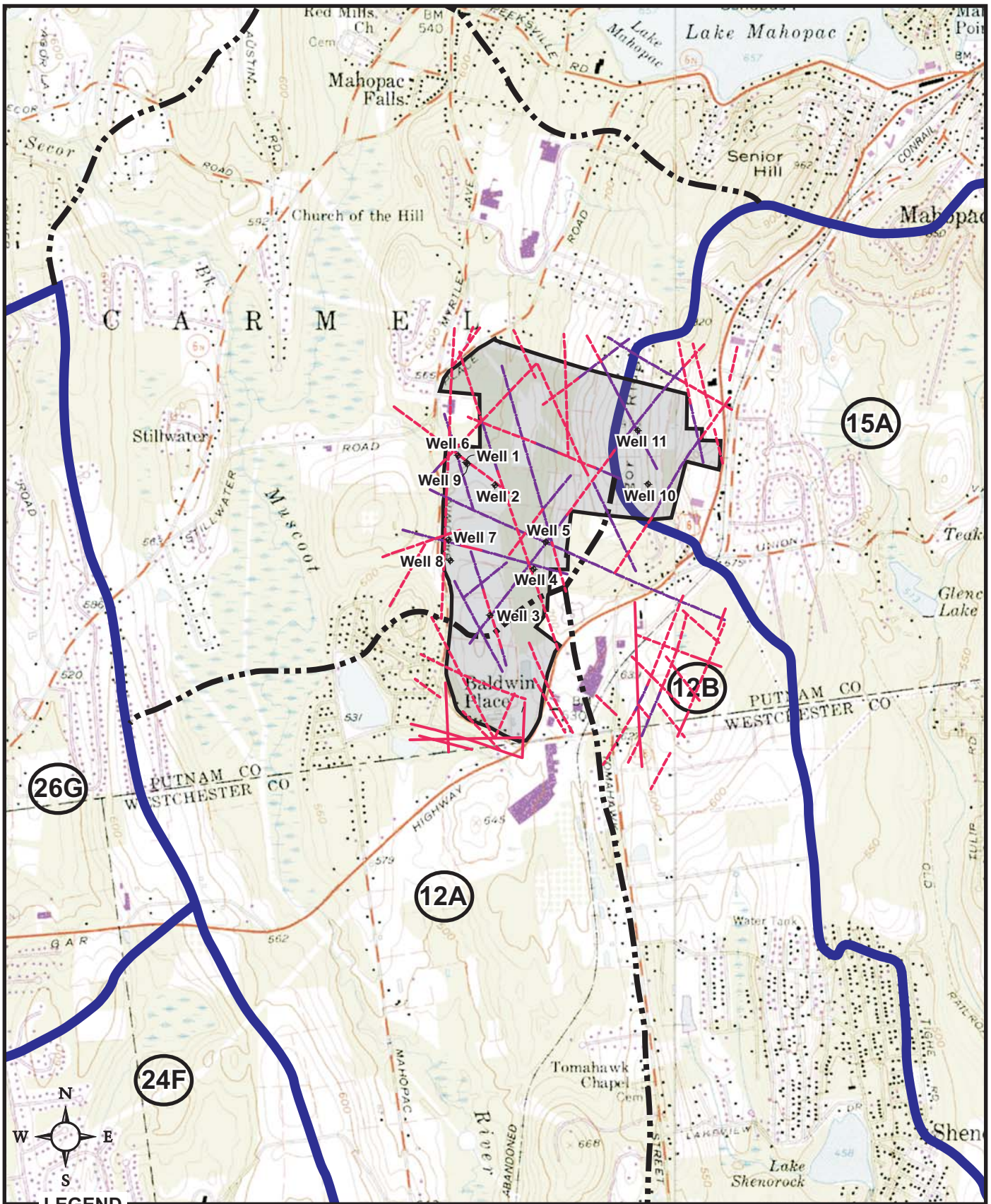


Figure 3.5-2: Regional Surface Water Drainage Map
Union Place

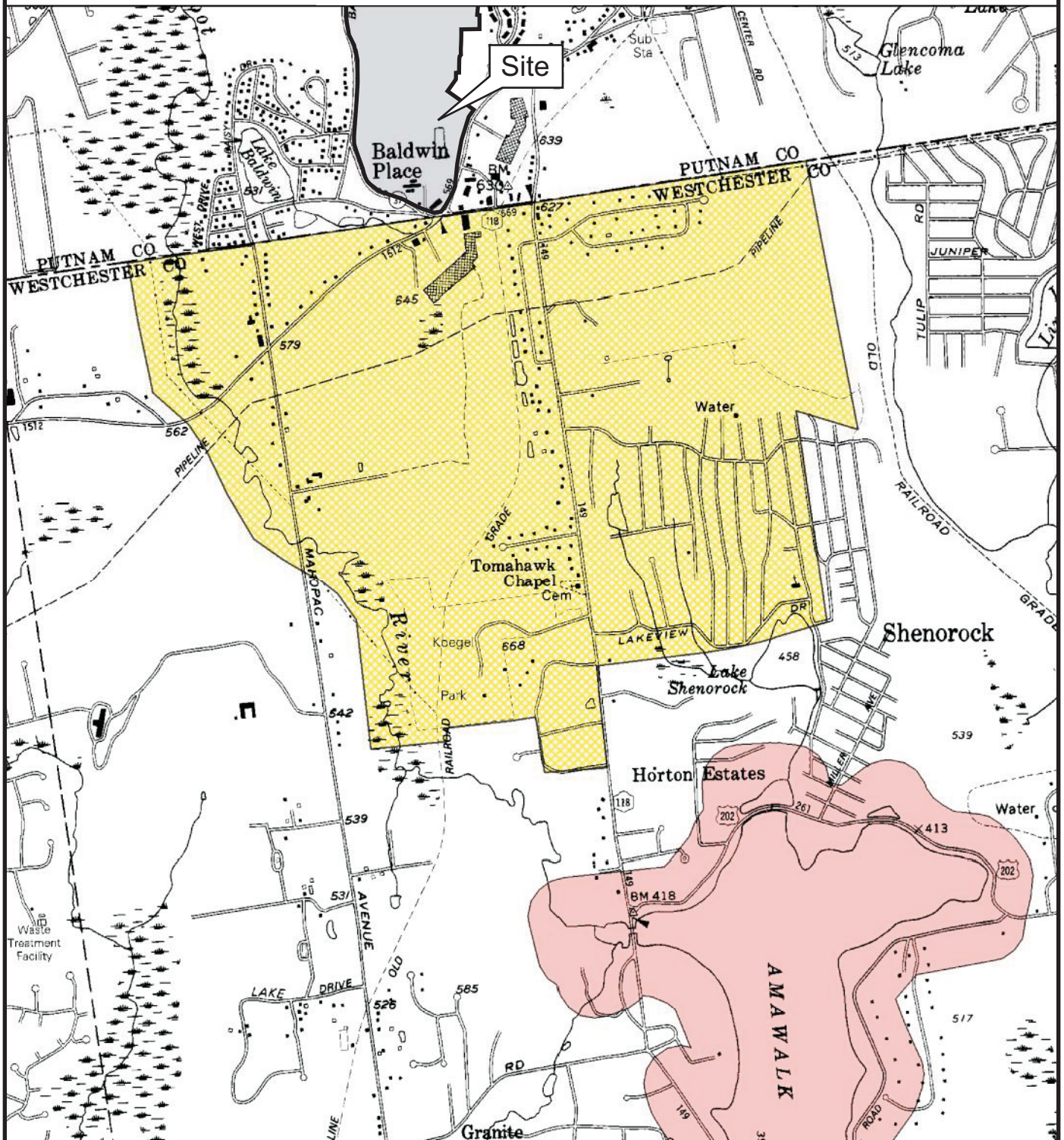
Town of Carmel, Putnam County, New York

Source: Computation of Bedrock-Aquifer Recharge in Northern
Westchester County, US Geological Survey, 1995

Base Map: USGS 7.5-minute Topographic Map, Mohegan Lake Quad
Scale: 1" = 2,000'

LEGEND

- Site Property Boundary
- Major Surface Water Drainage Divide
- Minor Surface Water Drainage Divide
- Bedrock Fracture Trace (dashed where inferred)
- Probable Fracture Trace



Disclaimer: This map was prepared by the New York State Department of Environmental Conservation using the most current data available. It is deemed accurate but is not guaranteed. NYS DEC is not responsible for any inaccuracies in the data. Please contact the designating authority for additional information regarding legal boundary descriptions.

Legend

- Adjacent CEA
- Baldwin Place Area CEA

Base Map: DOT 1:24,000 Planimetric Images

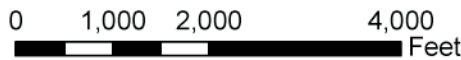


Figure 3.5-3: Baldwin Place Critical Environmental Area
Union Place

Town of Carmel, Putnam County, New York
Source: Leggette, Brashears & Graham, Inc., 11/19/09
Scale: 1" = 2,000'