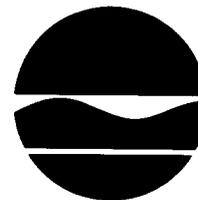


**New York State Department of Environmental Conservation**  
50 Wolf Road, Albany, New York 12233



**Thomas C. Jorling**  
Commissioner

October 23, 1990

MEMORANDUM

TO: Regional Water Engineers, Bureau Directors, Section Chiefs

SUBJECT: Division of Water Technical and Operational Guidance Series (2.1.3.)  
PRIMARY AND PRINCIPAL AQUIFER DETERMINATIONS  
(Originator: Mr. DeGaetano)

PURPOSE

To clarify the meaning of the terms "Primary Water Supply Aquifer" and "Principal Aquifer" as they are set forth in the Upstate New York Groundwater Management Program, and to establish guidance for determining whether an aquifer is considered a Primary Water Supply Aquifer or Principal Aquifer.

DISCUSSION

"Geographic targeting", as set forth in the Upstate New York Groundwater Management Program, is the adoption of special program policies and/or priorities to provide a special (i.e., extra) level of protection in locations where the groundwaters are both highly productive and highly vulnerable. The basic categories of areas which have been identified for use in geographic targeting, in order of priority, are:

- Public Water Supply Wellhead Areas
- Primary Water Supply Aquifer Areas
- Principal Aquifer Areas
- Other Areas

The intention of geographic targeting is not to remove or lessen the basic regulatory protections afforded by existing program such as SPDES, the Solid and Hazardous Waste Programs, the Bulk Storage Program, and others, for any geographic area. Rather, it provides a method for enhancing regulatory protection in critical locations where the groundwater resource is most productive and most vulnerable.

The importance of this concept for responsible and effective management of the state's groundwater resources cannot be overemphasized. To make the concept serve its intended purpose, the meaning of the terms "Primary Water Supply Aquifer" and "Principal Aquifer" must be better understood and guidance must be available on how an aquifer is determined to be a Primary Water Supply Aquifer or a Principal Aquifer.

#### General Intent Of The Terms "Primary Water Supply Aquifer" And "Principal Aquifer"

Highly productive unconsolidated aquifers which provide, or which have the potential to provide water for large populations and which are highly vulnerable to contamination from activities on the land surface directly over the aquifer, underlie only a small portion -- roughly ten percent -- of the state's land area. They are termed:

- Primary Water Supply Aquifers: Highly productive aquifers presently being utilized as sources of water supply by major municipal water supply systems.
- Principal Aquifers: Aquifers known to be highly productive or whose geology suggests abundant potential water supply, but which are not intensively used as sources of water supply by major municipal systems at the present time.

The Primary Water Supply Aquifers were originally identified by the NYSDOH in the "Report on Groundwater Dependence in New York State", 1981. The municipal populations supplied with water from the 18 identified Primary Water Supply Aquifers range in size from 8,100 people (Croton-on-Hudson) to roughly 150,000 people (Schenectady).

The range of populations supplied by the Primary Water Supply Aquifers is an indication of the water resource capability envisioned when the terms "Primary" and "Principal" were originally used in the development of the Upstate Groundwater Management Program. In regard to the ability to yield water to wells, there is intended to be no difference between a Primary Water Supply Aquifer and a Principal Aquifer. The only difference is that one is used intensively now, and the other is not. The Principal Aquifers are, in effect, the potential Primary Water Supply Aquifers of the future.

Where the phrase "potential for development" is used in evaluating an aquifer, it refers only to the capability to supply significant quantities of water. It should not be used to refer to whether or not human development will

ever locate in that particular spot. In protecting the groundwater resource, we cannot presume to know where development may or may not locate at some time in the distant future.

### Productivity, And Natural Water Quality

As used in the definitions of Primary Water Supply Aquifer and Principal Aquifer, the term "highly productive" means aquifers with capability to provide water for public water supply of a quantity and natural background quality which is of regional significance. As discussed above, the range of populations currently served by the Primary Water Supply Aquifers serves to illustrate the intended meaning of this term.

Existing contamination which is the result of man's activities is not part of "natural background". On the other hand, some aquifers have the physical capability to supply significant quantities of water, but the natural background quality of the water makes it unsuitable for drinking. Aquifers with naturally unpotable water will not be considered Principal Aquifers. Consistent with 6 NYCRR Part 703, this means water with a natural chloride concentration of more than 250 mg/liter or a natural total dissolved solids concentration of more than 1,000 mg/liter.

### Vulnerability, Confined vs. Unconfined Aquifers, And Unconsolidated vs. Bedrock Aquifers

As used in defining "Primary Water Supply Aquifer" and "Principal Aquifer", the term "highly vulnerable" refers to aquifers which are highly susceptible to contamination from human activities at the land surface over the identified aquifer. Additionally, so that the special policies designed to protect them can be applied fairly and equitably, such aquifers must be generally identifiable based on available mapping if they are to be considered Primary Water Supply Aquifers or Principal Aquifers.

Unconfined (water table) aquifers consisting of unconsolidated geologic deposits (a) are the most common type of high-yielding aquifer system in upstate New York, (b) are generally mapped, so that regulated entities and the general public can be provided with at least reasonably accurate comprehensive mapping showing where they exist, and (c) are vulnerable to contamination from the land surface over the aquifer. These aquifers, where they are sufficiently productive, fall within the meaning of "Primary Water Supply Aquifer" and "Principal Aquifer".

Where a highly productive aquifer is overlain by thick, continuous impermeable deposits and the predominant recharge to the aquifer is from land areas outside of the aquifer area, the aquifer does not fall within the meaning of the terms "Primary" and "Principal". Special protective policies applied to the land area over the aquifer will provide little if any additional protection for it. Where the major sources of recharge for confined aquifers can be iden-

tified, those areas should receive appropriate special consideration through the operation of ongoing regulatory programs and procedures. However, such areas cannot be comprehensively identified and mapped across the entire state at the present time. Therefore, it is neither reasonable nor feasible to include them within the meaning of "Primary" and "Principal".

Some high yielding aquifer areas are underlain by patterns of geologic deposits which include unconfined permeable deposits in some portions of the area, and less permeable confining layers over the highly permeable deposits in other portions. Often, however, the confining layers are not well defined and they are not so extensive, thick, and continuous as to assure that there are not pathways for contaminants to reach the aquifer from the overlying land surface. Where a high-yielding aquifer system exhibits this type of condition and it cannot be shown that major potential contamination pathways from the land surface do not exist, the Division of Water will treat the system as being an unconfined system (i.e., it falls within the meaning of "Primary" and "Principal").

Where it can be identified that a high-yielding bedrock aquifer is potentially vulnerable to contamination from a proposed activity at the land surface over the aquifer, protection of that aquifer should receive special emphasis through the normal operation of regulatory programs (e.g., through the application of Part 360 procedures for landfills). However, it is not currently feasible to comprehensively map the specific land areas across the state where bedrock aquifers are vulnerable to contamination from the overlying land surface. Therefore, it is not appropriate to include bedrock aquifers within the meaning of "Primary Water Supply Aquifer" and "Principal Aquifer" at the present time.

#### Sole Source Aquifers

Sole Source Aquifers are those which are designated by the USEPA as the sole or principal source of drinking water for a community, under provisions of the Federal Safe Drinking Water Act. The designations are made in response to a petition from the locality, and after public hearing. New York State has little influence over such designations, other than through testimony and comments during the review process.

At the present time, the programmatic implications of Sole Source designation are limited. The principal benefit is symbolic, in drawing attention to the aquifer. In New York State, we believe that all of the Primary Water Supply Aquifers would qualify for such designation and that the localities relying on them should petition. However, there is no evidence that the Federal designation process utilizes considerations of groundwater resource potential and vulnerability in the same way they are used with regard to identification of Primary Water Supply Aquifers and Principal Aquifers. Therefore, there is no direct technical relationship between the designation of "Sole Source" aquifers and the subject of this TOGS memo.

### Factors Used In Principal Aquifer Determinations

During the development of the draft Upstate New York Groundwater Management Program it was recognized that criteria would likely be necessary to determine whether a specific geographic location is considered to be within a Principal Aquifer area. For that criteria the draft report suggested a minimum sustained well yield of ten (10) gallons per minute, to be obtainable generally for locations throughout the aquifer and not just from one isolated spot.

There has now been considerable experience in making Principal Aquifer determinations. Experience suggests that the single criterion of 10 gpm sustained well yield does not fully reflect the intent of the phrase "aquifers known to be highly productive or whose geology suggests abundant potential water supply".

The actual boundary of an aquifer area is determined by the pattern of geologic deposits, not by an arbitrary well yield number. However, the value of 10 gpm sustained well yield tends to occur near the edge of an aquifer area, where the thickness of saturated permeable deposits is quite small. Maps illustrating the locations of unconsolidated aquifers often use 10 gpm (somewhat arbitrarily) as the lower end of the range of well yields associated with highly productive aquifers.

Further inside of the boundaries of major aquifers there are ordinarily very substantial areas where the sustained yield to wells is considerably in excess of 10 gpm. Thus, a continuous area of locations which can sustain 10 gpm may help to define the boundary of an aquifer area but does not establish whether the aquifer is sizable enough to be considered a "Principal Aquifer". The term "Principal Aquifer" is intended to reflect the overall capability of the aquifer to supply water, rather than just the capability at the boundary of the aquifer area.

The attached Table 1 provides relevant data for the upstate Primary Water Supply Aquifers and several aquifers considered to be "Principal Aquifers". The data are from the "Atlas of Eleven Selected Aquifers in New York", U.S. Geological Survey, 1982, plus other hydrological reports and data available in DEC files.

On the Table, the columns showing existing population served and the existing average daily pumpage indicate the range of public water supply usage associated with identified "Primary Water Supply Aquifers". The area of the aquifer, thickness of saturated deposits (both average and maximum), and maximum obtainable well yields (actual or estimated) are types of data which are available or obtainable for most unconsolidated aquifers. When considered collectively, they are indicative of the overall capability of an aquifer to supply water. They can serve as a common basis of comparison for considering whether an aquifer is a Principal Aquifer.

To qualify as a Principal Aquifer, overall yields should be comparable to those of the smaller Primary Water Supply Aquifers. Roughly, this means the ability to supply a population of 5,000-10,000 people, or a yield of 500,000 to

Table 1.  
TYPICAL HYDROGEOLOGIC CHARACTERISTICS OF PRIMARY WATER SUPPLY AQUIFERS AND SELECTED PRINCIPAL AQUIFERS\*

	Present Population Dependence	Area Sq. Mi.	Thickness		Maximum Well Yield (gpm)	Present Average	
			Average (Feet)	Maximum (Feet)		Daily Pumpage (mgd)	Est. Aquifer Yield (gpm/ft)
<u>Primary Water Supply Aquifers</u>							
Endicott - Johnson City	110000	21	30±	60+	2000	16.3	
Ramapo - Mahwah	82000	6	40±	150	100	9.6	9.6+
Irondogensee	47500	52	130	200	700	4.0	725-30
Jamestown	52000	34	40-50	100+	1000	8.6	10±
Elmira - Horseheads - Big Flats	50000	43	30-40	100+	1000	18.4	18±
Cortland - Homer - Preble	39000	20	48-80	200+	1000	6.5	
Corning	29000	28	40	100±	1000	16.5	
Sprout Creek - Fishkill	24500	30	30-40	100+	660	3.0	
Fulton	22000	50	20-30	60	1000	4.1	
South Fallsburg - Woodbourne	19000	20	50+	100	400	2.8	
Schenectady	142500	25	50-100	200+	3500	24.6	30-100
Cohocton River	20000	64	20-40	100+	1000	2.5	
Tonawanda Creek	12360	23	30	60	1000	1.9	
Seneca River	15000	10±	20-30	100±	350±	1.6	
Clifton Park	22000	25-30	20	100±	500+		
Olean - Salalanca			MAPPING INCOMPLETE				
Croton - on - Hudson			MAPPING INCOMPLETE				
Owego - Waverly			MAPPING INCOMPLETE				
<u>Principal Aquifers</u>							
Smyrna - Chenango County	260	7	40-60	140	1550	0.064	12.8
Glens Falls Deposits		90	25-50	109	400		
West Milton - Saratoga County	Unknown			80	800	3	
Sandburg Creek Valley - Ulster Co.		7	25-100	186	1000	1	18
Lower Neversink River and Basher Kill Valleys - Orange Co.		12	100	150	330	.5	100
Pine Bush - Albany County		40	40	150	200		
Almond - Alfred (Allegany County)	7556	2.4	40-60	155	703	0.745	12

\* Based on available information, some of which has not been field verified.

1,000,000 gallons of water per day. Based on the data in Table 1, the general guidelines for aquifer area, thickness, and well yields contained in the guidance below are consistent with these aquifer yields and are appropriate for determining whether an aquifer should be considered a Principal Aquifer.

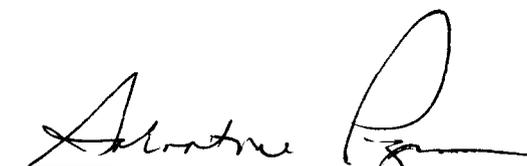
The guidelines below relating to aquifer productivity are general guidelines. They should not be applied rigidly, and there may be instances where all three need not be met simultaneously. For example, there may be situations where the thickness of highly permeable deposits and the ability to produce high well yields (e.g., through interconnection with a major surface stream) lead to the conclusion that a particular aquifer is a Principal Aquifer, even though its areal extent is smaller than the suggested minimum range. In all cases, however, the general level of water resource capability suggested by these three guidelines should be met.

#### GUIDANCE

1. The general factors outlined in the discussion above, regarding the role of groundwater productivity, natural water quality, aquifer vulnerability, confined vs. unconfined aquifers, and unconsolidated vs. bedrock aquifers, will be utilized by the Division of Water in determining whether an aquifer is a Primary Water Supply Aquifer or Principal Aquifer.
2. In addition, the Division of Water will use the following guidelines relating specifically to the question of aquifer productivity:
  - Area of the Aquifer: Five (5) to ten (10) square miles of contiguous area at a minimum;
  - Thickness of Saturated Deposits: Saturated deposits of highly permeable materials should average at least twenty (20) feet through much of the area, with some locations at least fifty (50) feet thick;
  - Obtainable Well Yields: Sustained yields to individual wells should be 50 gpm (gallons per minute) or more from sizable areas (two square miles or greater) throughout the aquifer.
3. The aquifer maps and reports as available now and as periodically updated by new or improved mapping will continue to be the basis for preliminary identification of Primary Water Supply Aquifer Areas and Principal Aquifer Areas.

These include, in descending order of detail, Primary Water Supply Aquifer maps; regional and/or basinwide aquifer maps; and Kantrowitz and Snavely's "Availability of Water from Aquifers in Upstate New York" (USGS, Open File Report 82-437). In using these maps, the map which provides the highest level of detail and coverage of the area in question should in most cases, be one used in decision making.

4. Where an applicant believes that more detailed hydrogeologic information will change the identification of a particular location as being within/outside a Primary Water Supply Aquifer Area or Principal Aquifer Area, the pertinent information should be submitted to the Department with a request for a determination. The information should be submitted through the regulatory program having jurisdiction in the particular situation (e.g., for a landfill site, the Division of Solid and Hazardous Wastes). It is not appropriate to establish specific, detailed guidelines for the types of information and the methods of field investigation which may be required, because conditions in specific locations are too variable. However, hydrogeologic staff of the Division of Water will be available to consult with other regulatory program staff and with applicants as needed on the information required in specific instances.
  
5. The Division of Water is ultimately responsible for making the formal determination as to whether a location is within a Primary Water Supply Aquifer Area or a Principal Aquifer Area. Requests for determinations by the Division of Water will be referred to the DOW by the appropriate regulatory program offices as per Item #4 above.



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