GROUNDWATER RESOURCES

IN

TOWN OF VICTOR NEW YORK

JANUARY 1987

43 Oak St.
Geneseo, NY 14454

January 18, 1987

Mr. Gilbert Holtz
Chairman, Conservation Board
Town of Victor
85 E. Main Street
Victor, NY 14564

Dear Mr. Holtz:

Enclosed please find the completed maps and report on the present status of information available on groundwater resources in the Town of Victor. The report indicates the major sources used in the study. As the report states, the groundwater system cannot presently be characterized as a simple "aquifer" with a single water table surface. The information has been put together in a format that will permit further evaluation and discussion of the best approaches to achieving or setting goals for regulation or planning.

The preliminary information requested in the memos of Mr. Varno and Mrs. Fouquet (May 27 and May 28, 1986) prior to my June 10, 1986 meeting with the board has been considered along with the discussions and ideas presented at the June 10th meeting.

All of the available information has been summarized within the limitations of the data sets. In reviewing the original requests, I believe that the only specific information that cannot be addressed relates to the "cone of depression" and "groundwater flow rates". These kinds of information cannot be derived, of course, without pump tests and multiple well installations, which were outside the goals of this data collection and evaluation exercise.

However, now that a reasonable map of the existing aquifer subdivisions is available, specific goals can be developed, discussed, and implimented within defined geographic limits.

The project involved the equivalent of 13.5 days (@ 7 hours per day) work at $125 per day ($1687.50). One trip of 60 miles ($7.50 @ .25 per mile) to visit the Moravics drill rig was necessary, as well as a 136-mile trip ($34) to the Moravic's offices in Penn Yan. Materials to prepare the report and maps came to $19.00.

Total cost of project to date:

$1687.50 salary
41.50 milage
19.00 materials
$1748.00 Total

I look forward to meeting with the board to go over the report and the maps and to discuss any questions or further requests that may be indicated.

Sincerely,

Richard A. Young

REPORT TO ACCOMPANY MAP OVERLAYS OF SURFICIAL GEOLOGY CONDITIONS FOR THE TOWN OF VICTOR, NY

Prepared by: Richard A. Young, Geologist

Date: January 1987

PURPOSE OF PROJECT

The maps accompanying this report have been prepared in order to characterize and illustrate the available geologic information that could be useful in the understanding and protection of the groundwater resources of the Town of Victor, NY. A variety of general geologic information is available in different formats, but it is in need of updating, coordination, and interpretation. It is also necessary to extract the specific types of information that are the most useful and to focus the study on the limited area of the Town from larger, more general studies. Finally the information needs to be presented in a usable (practical) format that is compatible with existing land use maps at a reasonably large scale (1:12,000).

INFORMATION SOURCES

The following major sources were utilized in the preparation and interpretation of the geologic data.

1) The Groundwater Resources of Ontario County, N.Y.S. Department of Conservation Water Resources Commission Bulletin GW-48 (1962). (Includes condensed information from Soil Survey of Ontario County, 1912)

2) Surficial Geologic Map of New York State: Finger Lakes Sheet, New York State Museum-Geological Survey Map and Chart Series #40 (1986). This map, although recently published, is somewhat generalized and in need of minor revisions. Plate 2 of this report includes my revisions of this recent map.

3. Young, R.A. (1980) Bedrock, Groundwater, and Overburden Maps of Monroe Co., NY (Monroe Co. Environmental Management Council).

4. Well drilling information from employees of Barney Moravic, Inc.

5. Fairchild, H.L. (1909) Glacial Waters in Central NY, NY State Museum Bull. 127 (with maps).

6. USGS topographic maps: Victor, Fairport and adjacent topographic sheets (1:12,000 scale).

7. Limited field reconnaissance.
(Including previous work experience in adjacent areas by R.A. Young)

8. A water well survey of Town residents completed by the Town.

9. Logs from a water well test drilling program carried out in the Town in 1966 (11 wells).

10. Oil and gas well logs from the NYS Geological Survey, NY State Museum Bull. 418A (1972).

GENERAL GEOLOGIC SETTING

The Town of Victor includes a number of significant glacial features that have figured prominently in the study and interpretation of the glacial history of central and western N.Y.

A large east-west trending valley naturally divides the Town into a northern and southern half. Most recently this valley served as the drainage outlet for proglacial lakes that existed as the continental ice sheets retreated toward the shore of Lake Ontario. However, this valley has a more complex origin related to the relative erosional resistance of the bedrock formations beneath the glacial overburden. The valley lies at the foot of the Onondaga limestone escarpment (see cross section a-b) created by the preglacial erosion of the rock layers.

The normal processes of stream erosion create parallel lines of cliffs in sequences of dipping sedimentary rocks such that limestones and sandstones form resistant ridges between valleys cut in the weaker shales. Glacial scouring by the ice sheets has accentuated the older stream topography by deepening the preglacial valleys. Thus the basic topography seen in the overburden reflects the underlying shape of the general rock surface, with some modification by the final deposition of glacial sediments.

This east-west valley is tributary to a deeper buried valley that curves through the northwest corner of the Town (see bedrock contour map) and continues beneath Irondequoit Bay.

As the last ice sheet (Winconsin stage) retreated from this area about 12,000 to 13,000 years ago, it periodically halted, retreated, or experienced minor readvances (surges). Some of these episodes are recorded by the large glacial ridges (moraines) such as the Pinnacle Hills in Rochester. At least two such ridges pass through Victor and are important to an understanding of the occurrence and quality of groundwater.

The larger of the two moraines occupies the southwestern portion of the Town between Dryer Road and Ionia. Because this large moraine is very sandy, unlike the local bedrock, it can be inferred to represent a substantial ice readvance from a more northerly position. Such a readvance would have picked up sandy glacial outwash and lake sediments deposited in front of the ice and reformed them into a mass of sandy glacial till. Normally the glacial till in any location reflects the predominant type of bedrock immediately north of the location, which is obviously not the case here. Some of the material in a glacial moraine is washed off the ice and sorted in the process or slumps down the steep ice front. Lakes were generally present in this region along the ice front, causing further sorting of the material as it was discharged into the deep water.

An additional factor in the size and shape of this southern moraine is the location of the bedrock ridge beneath the overburden. As can be seen in cross section a-b, the Onondaga scarp not only acted as an impediment to ice movement, but is also partially responsible for the exaggerated relief of the moraine, relative to the lower topography to the north.

The ice sheet subsequently retreated to a position north of the Thruway (KTM on Plate II). A smaller, discontinuous moraine was formed as the ice front remained briefly in this position. During these successive ice recessions the newly exposed terrain to the south was mantled with fine sand, silt, and clay in the lakes adjacent to the ice.

When the ice front finally retreated further to the north, a mass of stagnant ice probably became detached from the main glacier and was partially buried by outwash sediments in the northwest corner of the Town. This accounts for the ice stagnation terrain and kame/esker deposits along the course of Irondequoit Creek. At about this same time the lake levels were dropping in elevation until the discharging meltwater scoured and deposited outwash sediments in the central, east-west valley south of the Thruway (water drained to the east). Kame deltas were deposited at the margins of some of the lower lakes (KD).

As the lake levels were gradually falling during the ice recession, the most prominent lake shoreline stage was near 850-900 feet (glacial Lake Warren). Sands and gravels mark this prominent lake stage on many of the hillsides, and finer lake floor sediments related to the deeper lake cover lower elevations. Other lake stage(s) appear to be represented near 700 feet, but this shoreline zone is less prominent. It is difficult to give a precise figure for the variable thicknesses of sand, silt, and clay mantling the present surface which might be related to these individual lake stages.

In between the more prominent or conspicuous glacial deposits, which have obvious topographic (geomorphic) expression, there are broad areas of ground moraine or glacial till "plains" veneered with small amounts of lake, outwash, and ablation (ice melting) sediments, which are difficult to specifically identify without access to extensive shallow excavations.

The deposits described above only represent the most obvious conditions during the last series of glacial events in the immediate vicinity. Undoubtedly, buried within the deeper overburden, there must be deposits formed when the ice front was further south, or deposits buried by repeated, older ice oscillations. Thus the surface deposits cannot be used as the sole guide to what other glacial sediments exist from intermediate depths down to bedrock.

It is often assumed that only glacial till is deposited when an area is under an ice sheet, but is possible that a complex sequence of glacial sediments exists at depth in some places, and that their origins cannot be readily explained from a few randomly scattered water-well borings. However, from the existing information, a schematic outline of the most likely sequence of glacial deposits can generally be constructed. Once this has been completed the gaps in the data base can be filled by new engineering borings or by compiling additional water-well information as it is generated.

THE RELATIONSHIP OF GROUNDWATER TO THE GLACIAL OVERBURDEN

Groundwater in this region occurs both in the overburden and in the bedrock. However, in the Town of Victor the water resources in the overburden appear to be the most significant, and the most vulnerable. A brief discussion of the water in bedrock will be left to a later section.

Typically, groundwater in glacial overburden slowly percolates through the sediments, according to their relative permeability, the finer-grained sediments usually being less permeable. The water tends to accumulate in coarser (sandier) horizons or pockets above more clay-rich beds, such as till. If the overburden section is uniformly permeable, and the underlying rock less so, the water may accumulate in the weathered zone near the top of rock. The rock formations are typically cut by vertical joints and bedding-plane partings which allow the water to move preferentially along the narrow fractures.

However, when glacial sediments are very heterogeneous, as appears to be the situation in much of the Town (based on the limited boring log data), the occurrence of groundwater is more difficult to predict. The water may percolate vertically downward, as well as horizontally, through a multitude of interconnected but individually restricted beds or lenses, saturating several of them. Well drillers have indicated that the water producing zones are variable, with as many as three encountered in some wells. In addition, water production at the top of rock is not especially important, because water is generally encountered in sufficient quantities above this level, at least in the southern portion of the Town.

Under these circumstances it is impossible to construct a simple diagram or map of a single water table in the overburden. On the positive side, it appears that both sandy or gravelly beds and groundwater are sufficiently common throughout much of the Town that locating an adequate water supply for a single family dwelling is not difficult, especially in the region south and west of Route 96.

PLATE I: APPROXIMATE BEDROCK SURFACE CONTOUR MAP.

This is a contour map of the projected surface of bedrock with a contour interval of 25 feet. The map is based on limited data, mostly from water wells with limited geologic descriptions of the overburden. It has been supplemented by the well survey carried out by the Town in 1986 and by discussions with personnel working for Barney Moravic, Inc. who have drilled many wells in the area. Although not all of the well survey information could be scientifically verified, it was used to supplement the published information where there were gaps in the data base, and where the information seemed to be in reasonable agreement with other wells in the vicinity. More confidence was attached to reports by owners who indicated the wells were drilled when they owned the property or to those recently completed (with more detailed information).

The accuracy of this bedrock map in different regions is suggested by the relative density of dots representing data points. The dots represent all wells known to go to bedrock, deep wells not in rock (minimum overburden thicknesses used to supplement rock data), and some published seismic information near Fishers. The completed bedrock map for Monroe County was used to adjust the contours on the west boundary. Much of the data appears in reference Bulletin GW-48.

In addition to the data points, the contours were drawn with attention to the assumed effects of glacial ice erosion on the underlying rock formations.

This map is an approximation of the buried rock surface from existing data (much unverifiable) and should be assumed to have a minimum possible error of plus or minus one contour interval in areas of little or no information. The map should not be considered as an absolutely valid measure of the depth to rock in areas where extrapolations have been made. However, it is believed to represent a reasonably accurate picture of the general shape of the rock surface and the relative elevations of adjacent regions.

In the southeast corner of the map a region of potential fold/fault structures has been indicated. The condition of the rock in this area is uncertain, but anomalous depths to the top of the Onondaga Formation are indicated in oil and gas well information. A major fault zone has been extrapolated to exist to the east, near Canandaigua. Information available to date suggests that this zone of structural disturbance in the rock is wider than previously published. In addition, a fold has been noted in the local rocks in the bed of Mud Creek in the vicinity of East Victor. The significance of such a structural zone lies in its possible influence on the occurrence or movement of groundwater in the bedrock (discussed in a later section).

The best use of this type of map is as a general guide to the approximate thickness of the overburden materials and the locations of major buried valley features. To estimate overburden thickness in a region, the overlay should be used on top of the 1:12,000 scale topographic maps available for the Town. The rock surface elevation would be subtracted from the elevation on the topographic map to calculate the approximate overburden thickness.

The bedrock map would also be a valuable tool for gradually improving and updating the existing data base. This can be achieved by supplying appropriate engineering firms and well drillers with copies of the maps, which they could update as further work is completed on wells or engineering projects. Alternatively, someone in the Town could be assigned the task of periodically checking with such firms and recording new data on the maps.

The implications of the shape of the bedrock surface relative to larger production wells will be discussed in a later section.

PLATE 2: GENERALIZED SURFICIAL GEOMORPHIC-GLACIAL OVERBURDEN MAP.

This map portrays in a general way the major surficial glacial features created during the retreat of the last ice sheet. Many details are omitted and the boundaries are approximate. The map is intended to be illustrative of the general types of glacial materials to be expected in broad regions near the surface. Actual conditions generalized on the map may be different from those encountered in exact locations due to the nature of the existing information base, the reconnaissance nature of this study, and the extreme variability of glacial materials and environments. An appreciation of how variable some of these features might be can be obtained from rereading the introductory section on the glacial history, or by referring to textbook discussions of how individual glacial features form (a comprehensive text by R.F. Flint, Glacial and Quaternary Geology, contains comprehensive descriptions).

The main value of this map is as an indication of the approximate texture and permeability of the major overburden units. Combined with a basic knowledge of glacial processes and the depth to bedrock (Plate 1) this map was used as a guide to the construction of Plate 3, Groundwater Regions. In the hands of an experienced geologist, the overburden map can be valuable as a general guide to many engineering projects which need to consider soil textures, permeabilities, and construction planning.

The overburden map (Plate 2) should also be considered as complimenting the more commonly available USDA County Soils Maps. It is more simplified, but at the same time can be more useful in extrapolating overburden characteristics to greater depths. It may occasionally be useful to use the overburden map in conjunction with the available County Soils Maps (which generally are only accurate for the upper 2 to 3 feet of the soil profile).

Two cross sections have been constructed as shown by the dashed lines (a-b, c-d) on Plate 2. These cross sections were constructed to pass through and take advantage of the most detailed well log information for the overburden geology. They were also constructed to give as broad a view of the geology as possible from both a north-south and an east-west perspective. As can be seen on these cross sections, the subsurface geology does not always bear a one-to-one relationship to the surficial geology generalized on Plate 2. However, the agreement, from a geological standpoint is not unreasonable. These profiles, and others, can be improved if better information is collected from engineering and drilling projects in the future.

AVAILABILITY OF ADDITIONAL SUBSURFACE DATA

The well-drilling firm of Barney Moravic, Inc. (Penn Yan) has a great deal of additional information on wells drilled in the Victor area over many years. This information is in the process of being computerized by the firm. The Moravics were most cooperative and supplied information to fill in some of the gaps in the present data base during this study. However, at the present time the data is located in boxes according to year and client name. Thus without the name of an individual and the year that a well was drilled it is too time consuming to search for the information. This is especially true since much of the data requires confirmation by the driller to explain what some of the notations mean (depth to rock, etc.). This source of information could become very useful in the future when it has been computerized by location and street name so that it can be easily recalled.

I recommend that an update of this report be considered as soon as the Moravics are able to provide the information.

PLATE 3: MAP OF GROUNDWATER REGIONS - OVERBURDEN

Plate 3 is based on the compilation of information represented by Plates 1 and 2, plus a geologic analysis of the regional geology and the author's experience.

Plate 3 is an attempt to specify, in a general way, the subregions within the Town that have relatively coherent groundwater-overburden characteristics. The map delineates those regions in which the surface geology appears coherent, and by inference, where the conditions extrapolated to intermediate depths are likely to be coherent as well. Such an exercise is not 100% accurate, given the nature of the data base. However, the general divisions are thought to represent as rational an approach to such "groundwater zones" as can reasonably be deduced from our understanding of glacial processes and the known geology of the region.

The map is an attempt to break out those areas in which the characteristics controlling the recharge and location of groundwater are likely to be relatively uniform. This is not to say that water will be found at a common elevation or in uniformly distributed "aquifers" throughout each subregion. Discussions with drillers have made it clear that good water occurs in multiple horizons throughout much of the overburden, and the overburden is very heterogeneous. Thickness of the overburden has been taken into account in defining the regions, as well as the postulated glacial history. For example, outwash channels (OW) often, but not always, are surfaced by well-sorted sands and gravels, sometimes beneath a thin veneer of lake sediments.

The map also arranges the regions into groupings of relative surface permeability and thickness. Those regions characterized by thick, permeable sediments are obviously the places where groundwater production should be higher in quantity.

Groundwater generally is of reasonable quality and quantity in the overburden throughout much of the Town (especially by comparison with much of the surrounding area). A general statement can also be made that the best groundwater production can be expected in the portion of the Town west and south of Route 96. This does not mean that good wells cannot be developed north of this line, or that no places exist to the south which might have poor or limited water.

A general statement can also be made that south of the NYS Thruway the bedrock consists predominantly of more permeable limestones, which produce water generally higher in quality and quantity than the shales and evaporitic rocks to the north. This is the reason for the distinction between regions VIA and VIB. Although both regions are covered by glacial till and some surficial, fine-grained sediments, region VIA is located over the limestone bedrock aquifer zone. Thus if a well is unsuccessful in the overburden, a deeper, rock well is a feasible alternative.

USE OF PLATE 3 (IN CONJUNCTION WITH OTHER OVERLAYS)

This overlay can serve as an approximate guide to delineate those areas where water production or potential surface infiltration characteristics may be relatively similar, as a function of the inferred geology. Utilization of the information for specific engineering projects or similar land use planning should include additional subsurface investigations as appropriate. The overlay (Plate 3) could also be supplemented with the USDA County Soils Map.

The areas where water is encountered at relatively shallower depths in overburden or rock (such as regions I and III) may require more stringent enforcement of protective regulations than areas where water is protected by deeper or more clay-rich sediment (till, region VI).

Areas I through III appear to be the most permeable and best overburden groundwater production regions. Regions IV through VI would appear more difficult to characterize, but overall are likely to be less productive. Alternatively, VIA is located over a productive bedrock aquifer.

Regardless of the presumed differences in overburden materials shown on these maps, groundwater contamination could occur in any portion of the town if unwanted substances were to be accidently introduced at the surface. Any community dependent upon relatively shallow groundwater resources (as these are) should anticipate becoming more involved in long-term public education efforts and ongoing enforcement of practical measures to reduce the potential threat to the resource.

Such efforts probably should include attention to the unregulated use of herbicides, pesticides, and common household chemicals known to be persistent in the environment. A gradual increase in individual septic systems can eventually become a problem, and usually the individual homeowner is likely to jeopardize his or her own water supply before any other part of the system. Thus it is in everyone's interest to preserve the natural system.

Although these map overlays have discrete boundaries, the regions should be considered as generalizations of geologic conditions, and in the absence of actual subsurface data, caution should be used when regulations are invisioned that are based on these boundaries. While useful as a general concept, flexibility is recommended when devising regulatory measures.

GROUNDWATER IN BEDROCK FORMATIONS

The occurrence of groundwater in the bedrock formations has been adequately addressed in Department of Conservation Bulletin GW-48 (1962) by Mack and Digman. The quality and quantity of water in the older rocks that occur generally from the Thruway to the north (north of the "limestone aquifer") are not as good as in the rocks to the south. The water occurs mainly in fractures and partings in the upper 50 to 100 feet of rock and it is often mineralized. Most of the bedrock north of the Thruway is Camillus Shale.
Where weathered shales are overlain by relatively impermeable glacial till, water production is often greatest in the upper few feet of rock below the till layer.

One caution is in order when using the bedrock map depicting the bedrock formations in Department of Conservation Water Resources Commission Bulletin GW-48. The shape and location of the bedrock patterns in Plate 2 of that publication does not reflect the topography of the deep bedrock valley in the northwest portion of the Town. Thus the precise location of rock formations has not been accurately depicted. In addition, glacial erosion tended to strip the softer rocks off the top of the Onondaga "ridge". Thus the Onondaga Formation may be the uppermost rock formation further to the south than shown on the map in Bulletin GW-48. For this reason only the lower contact of the Onondaga Formation is shown on the overlays accompanying this report. Some wells logs report Onondaga limestone as the uppermost formation along the southern edge of the Town.

Most of the comments in this report so far relate to the production of water for individual homes (single dwelling wells). Some discussion is appropriate regarding the potential for the development of higher volume well fields for public water supplies.

HIGH-VOLUME WATER PRODUCTION FOR PUBLIC WATER SUPPLIES

The greatest potential for the production of high-volume supplies in the overburden would appear to be in the deep, buried valley in the northwest corner of the Town. Unfortunately, this is also an area of moderate development, and borders areas already commercially developed. The entire section of overburden in this region is not likely to be as permeable as the near-surface materials, so a program of test wells would be needed to explore the potential yields and quality.

A second region that could be explored for increased production is the apparent fold-fault zone in the southeast corner of the Town. If fracturing of the Onondaga Limestone has occurred as a result of structural deformation, the production of groundwater could be enhanced in the rock. A program of test well installation would also be needed to test this hypothesis.

The only other two zones that would appear to be promising for public water (higher volume) production from the overburden would seem to be zones II and III, the large sandy moraine and the shallow outwash channel. However, region III lies in a corridor of transportation routes and older development. Production of high-volume supplies in the southwest (region II) would be largely a matter of intersecting random zones of high permeability, which do not appear to be especially predictable from the existing data base.

POTENTIAL FOR THE DEGRADATION OF GROUNDWATER SUPPLIES IN THE TOWN.

The same characteristics that enhance the occurrence and production of groundwater supplies in the different regions are also directly proportional to the potential for surface contamination to enter the system. A shallow water table and permeable sediments are the worst combination for potential groundwater pollution. In this regard, zones III and I are probably the most pollution prone, from a geologic and a land-use viewpoint.

However, the heterogeneous nature of most of the water producing zones in the Town, combined with the generally sandy nature of much of the overburden, combine to make pollution a relatively important concern. Because many of the individual water-bearing zones are restricted in extent and dependent upon relatively direct surface recharge, the impact of small "spills" or accidents could be relatively direct. By the same token, because the individual aquifers beds are probably somewhat isolated in many cases, any pollutants might be temporarily restricted.

Generally, cleansing localized aquifers of the type common to the overburden sediments would be difficult and expensive where long-term conditions might have degraded the groundwater system.

WATER LEVEL MAP

Although the development of a "water level map" was considered as a possibility for this project, a close examination of the data base and the mode of groundwater occurrence in the different regions of Plate 3 indicated that such a map is not currently feasible. The complex nature of the aquifer system does not permit a simple reconstruction of a single water table, especially in regions II through VI. It might be possible to reconsider such a project as a refinement of the current maps when the data of Barney Moravic, Inc. become available in a computerized format. At the present time, any attempt to simplify the complex groundwater system into a single aquifer would be more misleading than useful. This is particularly true where several water-producing zones are intercepted by a single well, and the resulting water level is a reflection of complex conditions, including local artesian effects.

BRIEF SUMMARY

Groundwater in the Town of Victor is relatively abundant at numerous horizons within the variable, but generally thick glacial overburden, especially in regions I, II, and III (Plate 3). South of the Thruway, if water is not present in the overburden in desired amounts, the Onondaga or related limestones provide a second opportunity for well development (see Bulletin GW-48 for details). Groundwater in other parts of the Town is more difficult to predict and of somewhat lower quality in rock. Good sources can be located, but require either a greater degree of luck or the services of a driller who is very familiar with the local conditions (and even this cannot guarantee consistent results).

If further development of public water supplies is desirable, it would be advisable to begin a systematic test drilling program of exploration before land use patterns have eliminated large parcels from consideration.

Prepared by:
Richard A. Young
Richard A. Young, Geologist