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as a Metropolitan Landfill Site,
Town of Mendon, Monroe County

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The Suitability of the Pittsford Gravel Corporation Gravel Pit As A Metropolitan Landfill Site, Town of Mendon, Monroe County

by
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Summary:

The gravel pit located adjacent to the southeast section of Mendon Ponds County Park appears to be a poor site for disposal of solid wastes. The proximity of the water table to the bottom of pit, the nature of the sands and gravel underlying the pit, and the extent of leaching of water-soluble materials from such landfills indicate that degradation of the ground water in the vicinity of the pit could occur.

Background:

The Pittsford Gravel Corporation (PGC) gravel pit is a 32 acre, L-shaped pit which abuts Mendon Ponds Park in the areas of the Pittsford-Mendon Center Road and Smith Road (dashed line, accompanying map) (1). Part of the original site consisted of a kame hill (hill of sand and gravel deposited during the recession of the Continental Ice Sheet) at an elevation of 765 feet above sea level. This hill has been removed, and the deepest part of the pit is now at an elevation of 674.7 feet (1). The bottom of the pit at its deepest lies from 60 to 90 feet below the present rim, which is the boundary with the Park (2). Some of the wildest and most rugged terrain of the Park is adjacent to the pit. This terrain consists of glacial features (kames, an esker, and a kettle) which brought recognition to the Park as a National Natural History Landmark. The kettle, known as Woodchuck Hollow, lies immediately adjacent to the pit; the bottom is a marsh, at an elevation of about 670 feet. Since the pit elevation is 674, water may flow from it to Woodchuck Hollow.

The Mendon Gravel Ordinance requires that the finished excavation be restored with stockpiled earth so that slopes do not exceed 40% and that the floor of this particular site be no more than 17.5 feet below the rim (3). Two independent surveys made during the summer of 1970 revealed that the corporation had mined beyond the point where the pit could be restored to meet the requirements of the ordinance with earth stockpiled on the site. The engineer employed by the Town of Mendon reported that 177,000 cubic yards of additional material would have to brought in to bring the pit into compliance with the gravel ordinance. Accordingly, the Town issued a stop-work order, and there has been no further excavation.

The owner of the pit wishes to restore the pit by operating a landfill. The pit is one of nine similar sites considered by the Monroe County Department of Public Works as a site for solid waste disposal. It was also considered for this purpose in the

* The help of Drs. Lawrence W. Lundgren and William A. Diment is gratefully acknowledged.

report on solid waste disposal by the consulting firm of Greeley and Hansen (4). The Mendon Supervisor has indicated an interest in using the pit for disposing of junk cars and tree trunks.

The site of the gravel pit is part of the projected expansion program of the Park (5). The owner has offered an option to the County, but with the provision that the County would not take title until 1977, and that the corporation be allowed to operate a landfill in the meantime (6).

Approach:

The New York State Sanitary Code requires that no refuse be deposited in a way that it or leachings from it could cause or contribute to a condition that does not meet standards of the Public Health Law (7). We have taken a broader view and considered conditions that could lead to general degradation of the ground water in the area. We have attempted to locate the water table relative to the bottom of the pit and have considered the nature of the soil underlying the pit. Studies of leaching from landfills have been considered in terms of conditions which exist in the PGC pit. Our interest goes beyond public health factors to consider possible deleterious effects on the unique ecology of the natural areas in the Park.

Findings:

1. Soil and Water Conditions in the Pit - The water table is defined as the upper surface of the zone of saturation, in which the pores of the soil are entirely filled with water. The soil above the water table is the zone of aeration, where the soil pores are filled with air and water (8). On June 12, 1970, the pit was studied by L. Lundgren of the U. of R. Geology Department. At that time the floor of the deepest part of the pit was wet, and it was concluded that the water table lay at or near the floor (9). We re-examined the pit on August 6, 1970 in the company of the owner. Water was standing in the deep part of the pit to a depth of 18-24 inches. The pool was underlain with about one-half inch of finely divided silt, and it could not be determined whether the pool resulted from ground water or surface run-off. Two trenches were dug in dry areas with a back hoe to a depth up to about eight feet. No water ran into the trenches within 15 to 30 minutes. The material removed from one trench was moist sand of a uniform size such as is used in concrete. The second trench yielded sand and a layer of coarser gravel mixed with sand. Thus, the material underlying the pit is coarse and permeable, and similar to the stratified sand and gravel deposits which have been mined (9). The wet conditions found in the bottom of the pit during the summer indicate that material introduced as fill into this area would decompose under conditions of saturation at least part of the time, where leaching into the ground water would almost certainly occur.

Other evidence points to the elevation of the water table relative to the floor of the pit. Most of the ponds in the Park are fed by springs and ground water (10). The surface elevation of the pond closest to the pit (Round Pond) is 649 feet. The marsh in Woodchuck Hollow, lying within a distance of 1,000 feet of the pit, is at an elevation of 670 feet. There is a marsh east of the pit off Smith Road at an elevation of 660 feet. Topographical maps made prior to the excavation show springs emerging from the slopes south of the pit at elevations of 665 and 675 feet. These brooks flow southward and empty into Irondequoit Creek.

A Monroe County water well survey gives the location, depth, and water levels in dug and drilled wells existing in the area before excavation of the gravel pit (11). The water level elevations in wells closest to the pit (at Mendon Center and Smith Roads) varied from 653 feet to 702 feet. All these data support the conclusion that the present water table lies close to the 675 foot elevation of the floor of the pit. Filling the pit would predictably cause a rise in the water table in the area.

2. Leaching from Landfills - Studies of leaching from landfills have been carried out in England, Germany, and in Illinois and California (12, 13, 14). The Illinois study is particularly germane to the case at hand because the landfills studied were located in glacial drift similar to that present in Mendon. In nearly all cases where data from existing landfills are available, the landfills contained general rubbish and household refuse such as is collected on a regular basis. Simple extraction of such refuse, which contained no industrial wastes, yielded quantities of water soluble organic materials, ammonia, and chloride (12). The dust separated from such refuse yielded on extraction a water-soluble content of about 2%, one third of which was organic. The chemical oxygen demand, measured as the permanganate value, of a 10% suspension of the dust in water, was about the same as sewage (12).

The degree of leaching from a landfill will depend on whether the refuse is deposited in a wet area and whether surface water can percolate through the fill. The nature of water-soluble products leached from a decomposing landfill (leachate) will depend on whether oxygen is available (aerobic conditions) or absent (anaerobic). Although the decomposition of freshly deposited refuse may occur under aerobic conditions, the dissolved oxygen in the water will soon be consumed and anaerobic decomposition will predominate. Chemical analyses of leachate and ground water from landfills have varied from study to study, but generally, analyses showed the presence of a high level of dissolved organics, measured by chemical and biological oxygen demand, ammonia, organic nitrogen compounds, high hardness, measured as calcium carbonate, sulfate, sulfide, sodium, chloride, and iron. In one study, bacterial counts in a leachate revealed 93,000 B. Coli-aerogenes per ml, 9,300 B. Coli, type 1 fecal per ml, and 230 fecal streptococci per ml (12). Although the composition of the fill material was not specified, the presence of fecal bacteria suggests that septic tank pumpings may have been included. Generally, negligible amounts of dissolved organic acids were found (13). Gaseous products are carbon dioxide, methane (marsh gas), nitrogen, and ammonia. The California study found that an acre of fill containing 5,640 tons of refuse produced 330,800 pounds of carbon dioxide and 14,000 pounds of methane (14). The high levels of carbon dioxide in water produce an acidic condition which aids in dissolving substances such as limestone. This contributes to increased hardness of the leachate and simultaneously reduces the acidity. Similarly, the ammonia produced will be neutralized either by the carbon dioxide or by the soil acids formed during decomposition. pH measurements made on ground water in the vicinity of the Illinois landfills varied from slightly basic to slightly acid (13).

The PGC pit has been considered as a site for disposal of special types of refuse such as incinerator and fly ash and of demolition rubble (4). No studies were found on landfills limited to these wastes alone. The California study, however, measured the leaching from incinerator ash in test bins (14). The leachate from the ash contained a high amount of dissolved solids which increased dramatically when leaching was by an acid solution. This was particularly notable in the case of dissolved calcium.

A principal source of fly ash in the Rochester area is from coal-burning power plants. The Rochester Gas and Electric Corp. disposes of most of its fly ash in landfills through private contractors (15). The company does not permit contractors to dump in wet areas or near active bodies of water or residential areas. Approximately 5% of the sulfur oxides in the RG & E stack emissions are adsorbed in the fly ash. Chemical analysis of the ash shows the presence of 1 to 3% sulfur, 1 to 2% calcium, 1 to 2% magnesium, and sodium, potassium, and iron (15). The large surface area and high carbon content of the ash facilitates adsorption of certain organic and suspended materials and gives the ash some desirable properties as a filter material.

The main components of demolition rubble are wood and asphalt shingles as the principal organic materials, and masonry, concrete, and plaster as the main inorganics. Although data are not available, leachates from such waste should contain dissolved inorganic salts, particularly since the decomposition of the wood should create an acidic leach. Leaching from the mortar in the rubble should increase the hardness of the water (16).

3. Natural Purification of Leachings - Contaminated water from a landfill will move downward through the zone of aeration to the water table and then will move horizontally in the direction of flow of the ground water (8). The rate of flow will depend on the permeability of the underlying soil and will be greatest in sands and gravels and least in clays and silts. The rates are quite slow, however, being measured in terms of several feet per day. Less dilution and dispersion of contaminants takes place in ground water than in surface waters owing to the lack of turbulence (16). The direction of the ground water will be down the slope of the ground water table. Possible points of discharge of contaminated water from the PGC pit are the marsh in Woodchuck Hollow or the ponds in the Park, the marsh off Smith Road, or the springs emptying into Irondequoit Creek.

The filtering action of the sand underlying the pit should remove bacterial pollutants and much of the organic material before it has travelled far. Gravel is considered a poor filter (8). In a California study of the travel of pollution, diluted (10%) raw sewage containing 2.4 million coliform organisms per 100 ml was continuously pumped into a recharge well. No bacterial pollution was detected at any point more than 100 feet from the well (18).

Dissolved salts are not removed from ground water as it passes through soil. The only attenuation is through dilution and dispersion. Passage through some clays may change the nature of the contaminants by ion-exchange, but this does not reduce the total dissolved salt. At Krefeld, Germany, wells at distances up to 4 3/4 miles from a wet landfill were tested over a period of years. Deterioration of the water in the most remote well did not occur until 14 years after dumping was begun. The degradation of the wells consisted of a 270-400% increase in hardness and high levels of sulfate and chloride. No coliform bacteria were found.

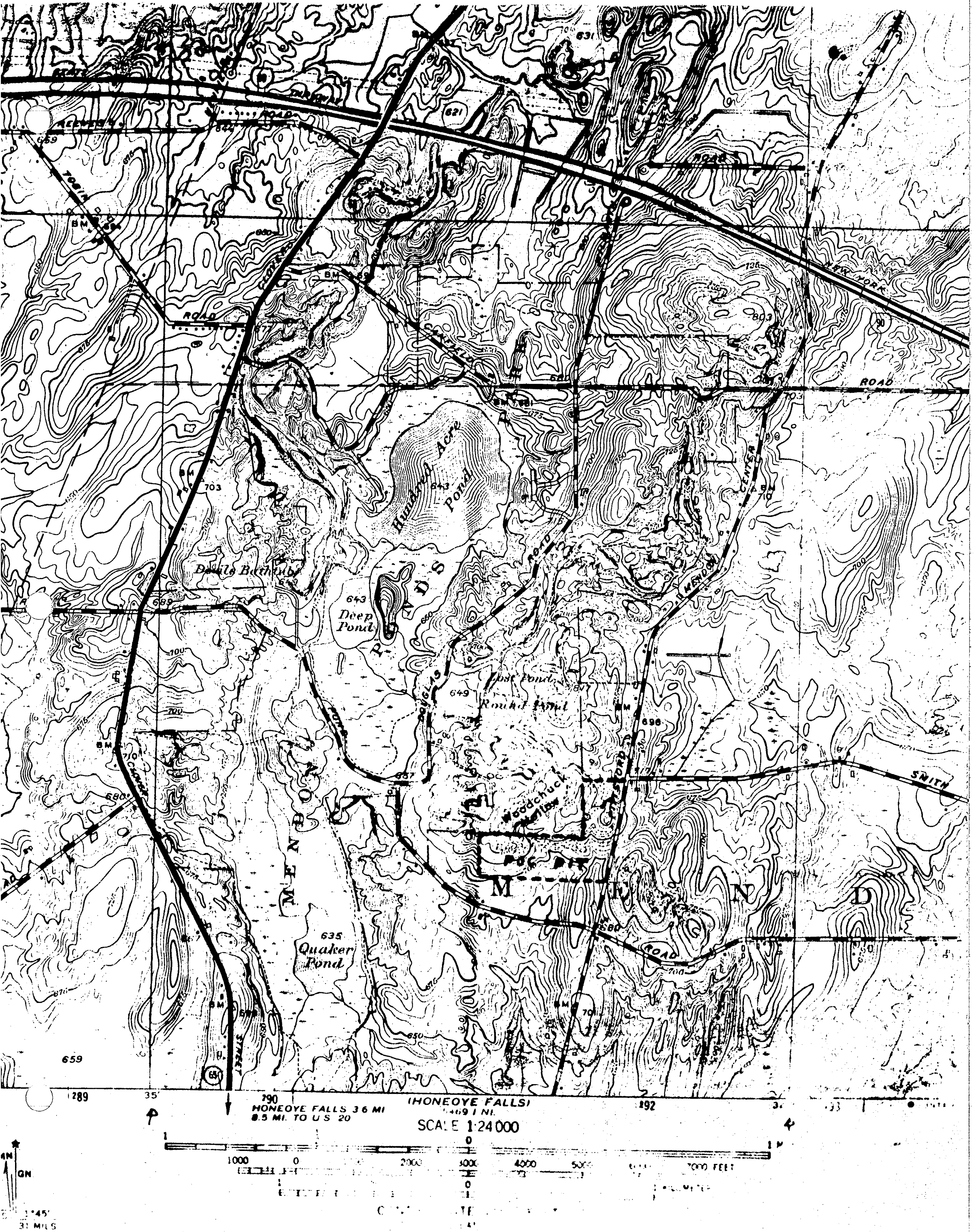
No studies of landfills known to contain junk cars were found. The major source of pollution from cars would be from iron and from oil and petroleum products remaining in the carcasses. These contaminants are not removed from the ground water by natural purification processes. A gasoline spill of unknown origin contaminated the ground water under Rockaway Beach, Long Island, and it was concluded that the fluid must have been spilled many years earlier at some distant point and floated along the water table (19).

4. Suitability of the PGC Gravel Pit as a Landfill Site - Gravel pits and burial sites underlain by sand and gravel are generally regarded as unsuitable landfill sites (8, 17, 20). The Illinois Department of Public Health prohibits refuse disposal in standing water and has adopted the convention that there be at least 30 feet, and preferably 50 feet, of relatively impermeable material between the base of the landfill and the water table. In addition, the topography of the landfill area should be such that surface runoff will not flow into or through the fill (16, 17, 20). The PGC pit does not meet any of these criteria. The consulting firm of Greeley and Hansen considered this pit specifically among five similar pits and concluded that "use of these sites for all types of ordinary solid wastes would require sealing to prevent the possible contamination of ground water" (4). In sealing, the base and sides of the disposal site are lined with a 1 to 2 foot layer of compacted clay (17). Clay liners, however, have been found to leak (17).

The proximity of the PGC pit to the Mendon Ponds Park creates an additional consideration of ground water contamination that may not exist in other areas. The park is primarily a nature-oriented park and is registered with the Department of the Interior as a National Landmark because of its unique glacial features and ecological systems. The preservation of the Park, however, is a County function. The existence of certain of the bog plants found in the Park depends on the ground water remaining in its present natural state, particularly with regard to acidity. Contamination of the ground water by increased amounts of dissolved salts could have an unfavorable effect on some plant life.

Conclusions:

Considerable leaching from all types of solid refuse can occur in landfills. The contaminants that can reach and degrade the ground water are mainly water-soluble inorganic salts. Bacterial pollutants are removed over short distances. The type of soil underlying the PGC gravel pit and the proximity of the water table to the floor of the pit make the pit a poor site for a landfill from the standpoint of ground water contamination.


Hundred Acre Pond
643
Deep Pond
Devils Bathtub
Lost Pond
Round Pond
Woodchuck
Quaker Pond
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NEW YORK
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