Evaluation of surface water quality impacts and potential threats to drinking water supplies from a piggery in Rochester, MA

by

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Buzzards Bay Project National Estuary Program

Technical Report

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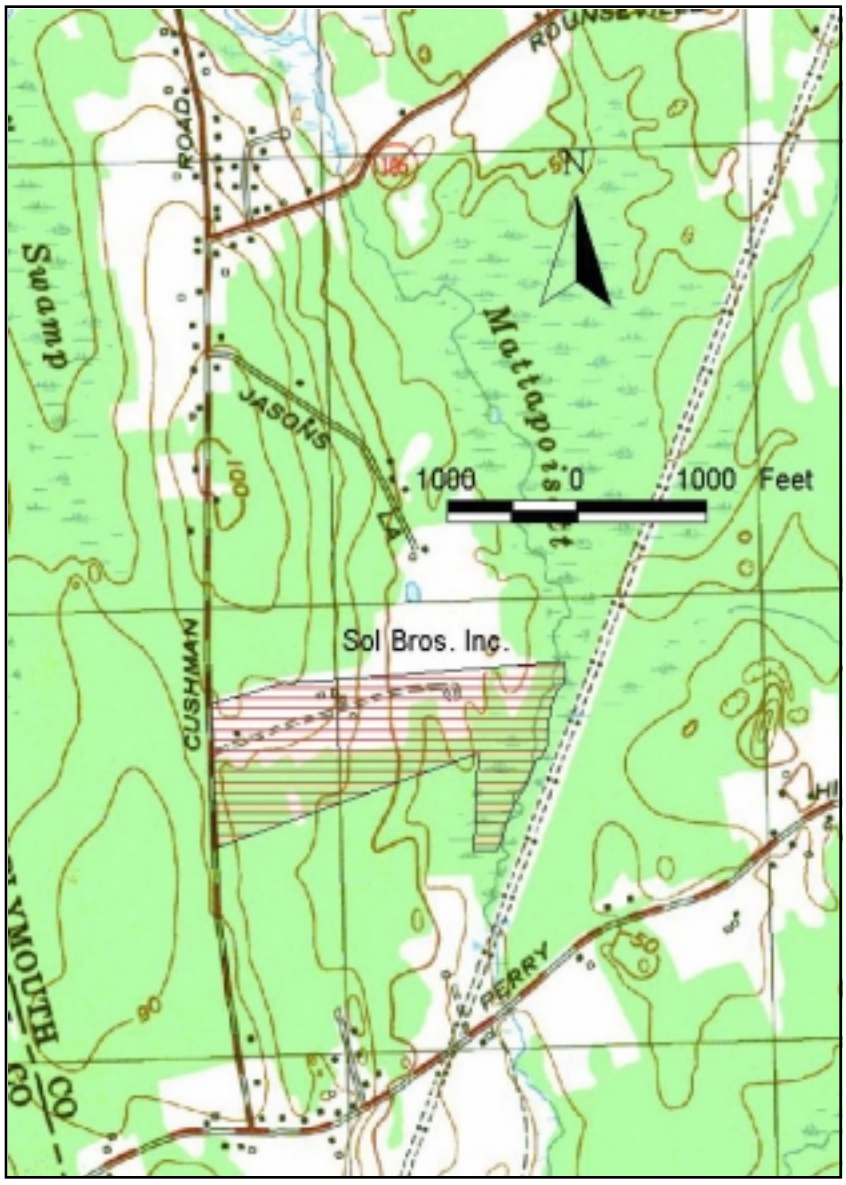
Introduction

At the request of the Rochester Board of Health, the Buzzards Bay Project collected stormwater samples on the Sol Brothers, Inc. pig farm in Rochester, Massachusetts on May 2, 2002 during a day of rain. The site is located at 118 Cushman Road. These data were collected to help evaluate water samples collected earlier from the Mattapoisett River by the Rochester Board of Health. These two earlier Mattapoisett River samplings occurred on March 27, 2002, during a day of rain, and on April 11, 2002 during a dry period to establish baseline conditions. The Buzzards Bay Project evaluated this earlier data in correspondence to the Rochester Board of Health dated April 16, 2002 (attached in Appendix A). The sampling along the Mattapoisett River just above and just below the Sol Brothers, Inc. during the rains of March 3 suggested that farm was an important source of pollution to the river. The May 2 sampling was undertaken in part to document whether stormwater from the property could explain the elevated contaminant levels in the Mattapoisett River.



The Buzzards Bay Project collected samples of stormwater runoff on the Sol Brothers property during the May 2, 2002 site visit, between approximately 2:00 and 3:00 PM. This site visit included municipal officials from the Towns of Rochester and Mattapoisett, attorneys for Rochester and Sol Brothers, Inc., and others. This report summarizes observations from the May 2 site visit, information on existing aerial photographs, and interprets the laboratory results of the May 2 sampling. These findings are compared to the Mattapoisett River samples collected by the Rochester Board of Health on the two earlier dates. The

report also evaluates and interprets these observations, and identifies other environmental concerns related to operations on the property that may be of concern to environmental regulators and managers.

Legal procedural history with the Town of Rochester[1]

In 1992, in response to notices issued by the Rochester Board of Health, Sol Bros. applied for a site assignment for a piggery as required by Massachusetts General Laws (MGL) Chapter 111, section 143. The Board of Health denied that application because Sol Bros. was storing excess fish gurry on the site. Sol Bros. appealed to the Superior Court, which upheld the Board's decision and ordered that Sol Bros. was not to store gurry at the site in excess of the amount needed to feed the pigs. The order allowed Sol Bros. to reapply for the required site assignment. Sol Bros. had failed to do so until ordered by the Court under present litigation.

In July 1996, the Board of Health issued a Cease and Desist Order to Sol Bros., ordering it to cease and desist from operating a piggery and from bringing into, and transporting fish gurry to, the site. Since that time, there has been a series of incidents that suggested to the Board of Health that Sol Bros. Inc. was continuing to bring large amounts of fish gurry to the farm and allegedly landfilling the material on site. During a site visit on December 4, 2001 by members and agents of the Board of Health and other town officials allege they observed evidence of dumping and landfilling of fish and other waste. Water sampling of the Mattapoisett River on Wednesday, March 27, 2002 by the Board of Health indicated highly elevated and abnormal levels of fecal coliform, nitrogen, nitrates, and nitrites immediately downstream of the property.

On April 1, 2002, the Town of Rochester filed a complaint in Superior Court seeking an injunction against Sol Bros.' operation of the piggery and against Sol Bros.' landfilling on the property. The Town of Rochester believes and is alleging that Sol Bros. is accepting both fish and other waste for a fee and is using its land to dispose of it. Sol Bros. has not received a site assignment to operate a piggery under MGL Chapter 111, section 143, nor has it received a site assignment to operate or maintain a solid waste facility, required under MGL Chapter 111, section 150A.

On April 24, 2002, the Superior Court continued the action for 30 days until May 28, 2002, during which time Sol Bros. was enjoined from transporting any fish waste not used for stock feeds, Sol Bros. was ordered to apply for the requisite permits, and more samples were to be taken. On Thursday, May 2, 2002, the Board and their representatives made a site visit to the farm to take further sampling.

1 Based on information provided by attorneys for the Town of Rochester.

Site description

The Sol Brothers, Inc. farm is located at 118 Cushman Road, Rochester, MA (see Fig. 1), coinciding with assessors office parcel map 33, lot 40. The parcel covers approximately 54.8 acres[2], but the actively used portion of this parcel constituting the piggery and other animal husbandry (some cows were also evident) occupies approximately 33.7 acres.

The Mattapoisett River bounds the eastern edge of the property. The land is somewhat sloped, dropping more than 40 feet from west to east along the 2200 feet of actively used area. Large areas of the farm have little vegetation, including fenced off fields, an area along the eastern bounds that appears to be excavated for sand or fill, and a central area, which is purported to be a composting area.

Press reports state there have been more than 1000 pigs on the site at any given time. Under a court order, the number of swine on the property has been limited to 1000[3]. These pigs live in small sheds and barns throughout the site. The piggery is divided into 8 to 10 fields, largely devoid of vegetation. Several cows were also observed on the site. The town estimates that 800 pigs are currently found on the site.

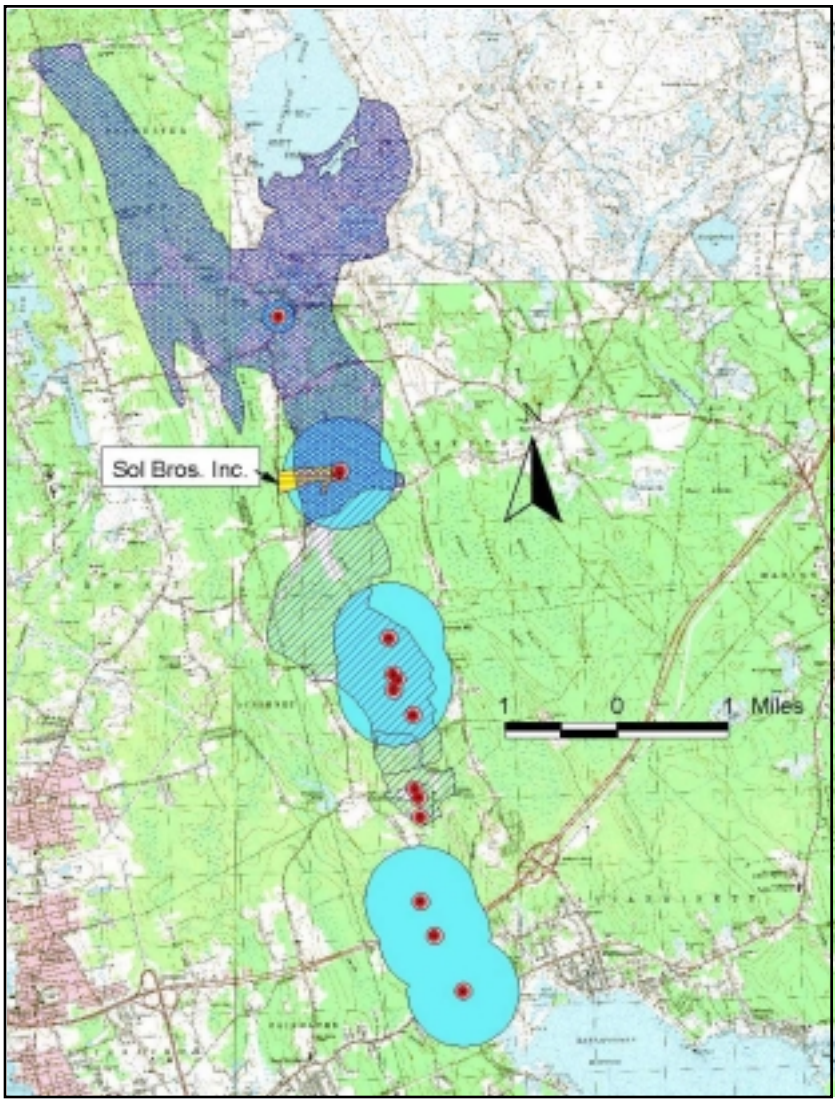


Figure 2. Public wells along the Mattapoisett River Valley (red dots) with Zone IIs (blue crosshatched) and Interim Wellhead Protection Areas (solid light blue) areas shown). The two wells adjacent to the Sol Brothers, Inc. property appear as one point at this scale.

2 Based on Town of Rochester GIS parcel overlay. This area may not be consistent with Board of Assessors records.

3 According to a New Bedford Standard Times newspaper article of 4/24/02 posted at www.s-t.com/daily/04-02/04-24-02/a06lo036.htm.

Nearby Public Wells

The Mattapoisett River Valley contains 14 public drinking water supply wells (Fig. 2). These wells are recharged by river and groundwater in the areas adjoining the wells.

The Sol Brothers, Inc. property is adjacent to two public drinking water supply wells (Fig. 3). One of these wells is known as "Perry Hill North Well on New Bedford Road" (DEP ID #4169000), the other is "Perry Hill South Well on New Bedford Road" (DEP ID #4169000-06G). Both wells are owned by the Town of Marion, but the water supply serves both the Towns of Rochester and Marion. New Bedford Road is also identified as Perry Hill Road on some maps. Together, both wells pump more than 700,000 gallons per day (pers. comm. R. Zora, Town of Marion Public Works).

The east portion of the Sol Brothers, Inc. property, is within the "Zone I" recharge area of these wells; that is, within 400 feet of the wells. However, none of the actively used portions of the parcel area are within the Zone I of this well. Most of the property, including all of the pig operation and purported composting (or alleged landfilling) operation, is located within the Zone II[4] recharge area of the two wells, and the remaining area of the property is within the Zone III[5] of these two wells. Because the approved pumping rate for these wells exceed 100,000 gpd, Zone II regulations and policies apply.

Determining the potential threats of the Sol Brothers, Inc. property to drinking water supplies depends on soil and geologic features around the wells. Previous studies funded by the Town of Marion suggest that the Perry Hill Wells may be of sufficient depth, and hydrologically separated by impervious layers of sediments so that any potential contamination of upper levels of groundwater property do not pose a threat to the wells (Rick Guerzoni, Marion Water Department, pers. communication).

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4 As stated in 310 CMR 22.02, a Zone II is: "That area of an aquifer which contributes water to a well under the most severe pumping and recharge conditions that can be realistically anticipated (180 days of pumping at safe yield, with no recharge from precipitation). It is bounded by the groundwater divides, which result from pumping the well and by the contact of the aquifer with less permeable materials such as till or bedrock. In some cases, streams or lakes may act as recharge boundaries. In all cases, Zone IIs shall extend up gradient to its point of intersection with prevailing hydrogeologic boundaries (a groundwater flow divide, a contact with till or bedrock , or a recharge boundary)."

5 Zone III is the land area beyond the area of Zone II from which surface water and groundwater drain into Zone II. The surface drainage area as determined by topography is commonly coincident with the groundwater drainage area and is used to delineate Zone III. Where surface and groundwater drainage are not coincident, Zone III consists of both the surface drainage and the groundwater drainage areas. Regulatory prohibitions of certain activities apply to both Zone IIs and Zone IIIs.

With the given delineation of the Zone II, the presumption is that the Sol Brothers, Inc. operation has the potential to degrade only the Perry Hill wells, and not other wells to the south. However, a Zone II delineation represents the recharge area of a well during peak pumping and drought or low precipitation conditions. During wet weather high water table conditions, it is also conceivable that any potential ground water plumes from the Sol Brothers property may enter the Zone II of the Town of Marion Wolf Island Road Wells, which begins 2000 feet to the south. By definition, the Perry Hill Road Zone II constitutes the Wolf Island Road Zone III recharge area. Furthermore the situation is complicated by the fact that stormwater runoff entering the Mattapoisett River enters the Zone Is and Zone IIs of other wells down gradient along the Mattapoisett River.

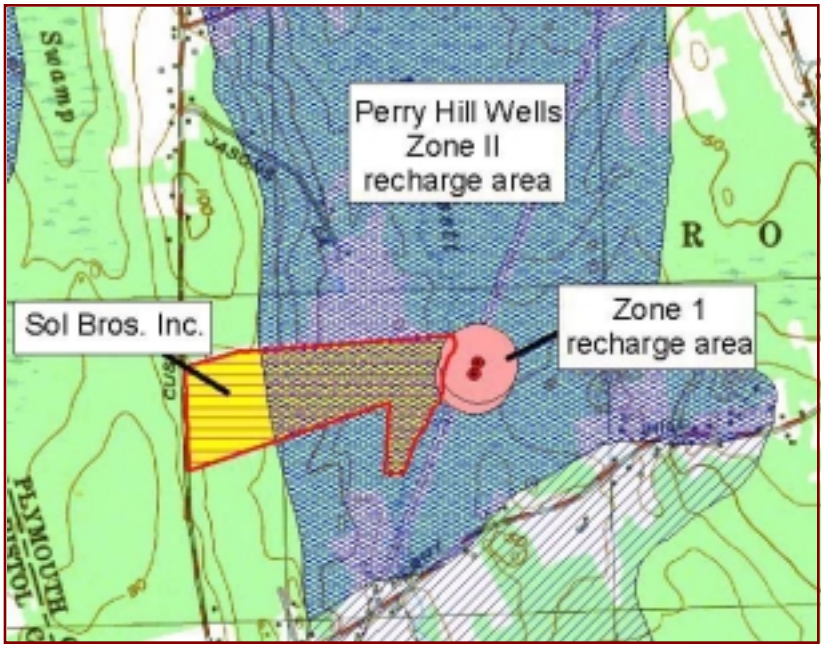

Figure 3. Two public wells and Zone I and Zone II areas adjoining and coincident with the Sol Brothers, Inc. parcel.

The Town of Marion tests their water supply annually for nitrates. In an April 2002 sampling of Marion drinking water from the Perry Hill Road wells, nitrites were found to be 0.45 mg/l and nitrates were 3.1 mg/l (Rick Guerzoni, Marion Water Department, pers. communication). Most public wells have no nitrites, and nitrates well below 1.0 mg/l. The elevated nitrate and nitrite concentrations suggest a source of contamination to the Town of Marion Perry Hill wells. Whether this contamination is from the Sol Brothers, Inc. farm would need further analysis. The observed concentration was below the state drinking water limit of 10 mg/l nitrate for drinking water, and also below the more stringent limits of 5 ppm adopted by regional regulatory agencies like the Cape Cod Commission. If the elevated nitrogen concentrations were related to a contaminant plume, concentrations may be higher during periods of lower water tables or higher water pumping rates. Consequently, the Town of Marion may wish to test the well water more frequently during late summer and early fall when these hydraulic conditions prevail.

Farm Layout

Based on the site visit and preexisting aerial photographs, a general layout of the farm operation is shown in Fig. 4. In general, down the main axis of the property perpendicular to Cushman Road, lay

the farm's dirt road. One thousand feet down this road, on the north side is found the main barn, probable silage areas, and apparent principal operational areas of the farm. In this location were concrete bins that contained food for the pigs. On this date, these bins appeared to contain food remains as might be collected from a restaurant (broccoli, bread, etc. were evident). No large fish parts were observed in this stockpile of food, but fish meal or ground fish products may have been included.

In the central portion of the farm is a fill area purported to be a composting operation. Along the freshly worked area of the fill was a 10-foot tall mound of pig feces and bedding mixture, a mound of dirt, and a small pile of shells. In the disturbed portions of the fill area were shells and fish hard parts by large jaws, fish opercula (gill covers), and vertebrae. The remains of large fish hard parts were also evident in disturbed older areas of the fill. These included large jaws exceeding six inches in length, which were definitely not present in the food storage bins near the main barn.

Further down this road, mostly on the north side of the road, lay the principal fenced in pig areas.

In several areas of the farm, there are large accumulations of rusted metal and abandoned vehicles, including at least 7 dilapidated school busses. The two most prominent clustering of abandoned vehicles and junk metal is shown in Fig. 4. While some of the abandoned vehicles seem farm related, many, including the school buses appear unrelated to farming activity.

At the eastern most extent of the property is a sand pit. It is possible that some of the sand from this mined area is being used in the fill area or it may be used off site.

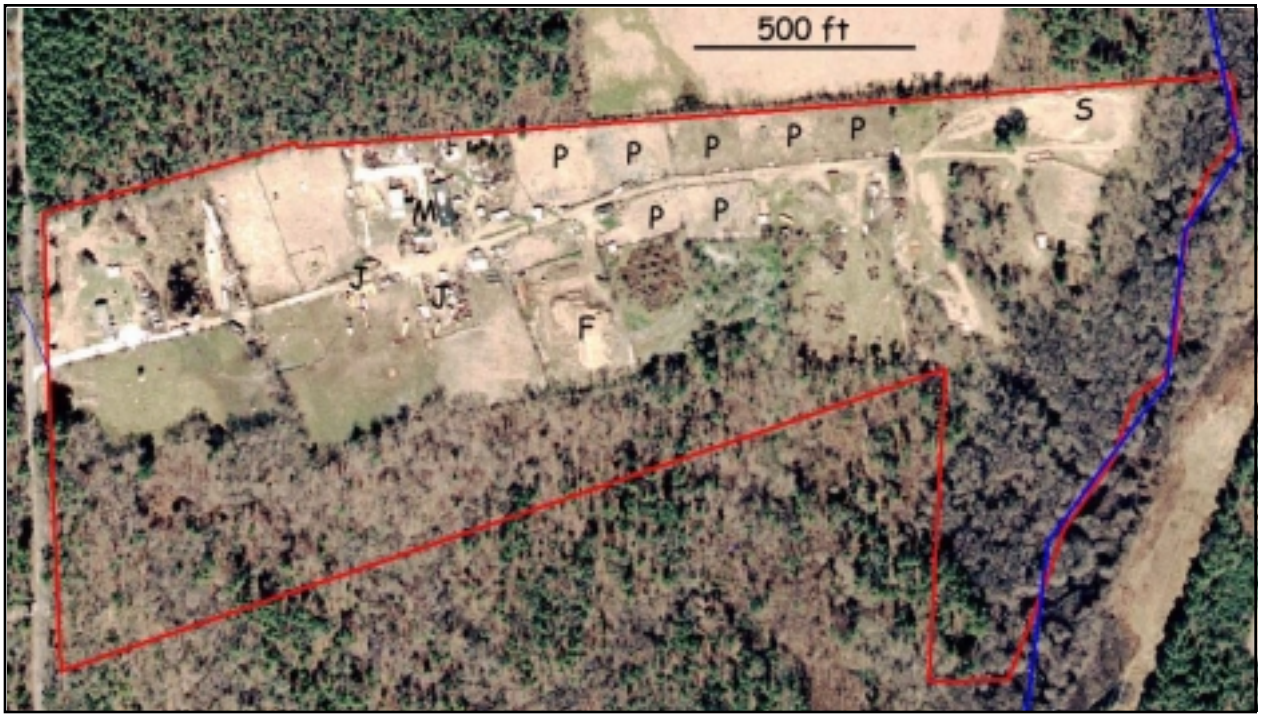

Figure 4. General layout of the Sol Brothers, Inc. farm showing main barn and operations areas (M), fields with pigs (P), area of fill (F), areas of accumulated metal or junk vehicles (J), and an apparent sand mining area (S.). The approximate location of the Mattapoisett River is shown in blue along the property's eastern boundary. Parcel boundary (red) from Town of Rochester.

Stormwater flow

The stormwater from this farm flows through creeks, ditches, and wetlands to the Mattapoisett River. During the May 2 visit, a light to moderate rain had fallen prior to and during the visit. At the Wareham Cranberry experiment station, 0.6 inches of rain was recorded, and 0.2 inches were recorded for the previous day. The National Weather Service recorded for New Bedford, 0.54 inches on May 2, and no rain on May 1[6]. Based on observed rainfall and saturation of soils, we presume that at least 0.3 inches of rain had fallen in the storm by the time of sampling. Stormwater flow patterns were evaluated based on observed actual flows, washout areas on the property from past heavy rainfalls, and contours and vegetation at the site. These stormwater flow patterns are shown in Fig. 5. As shown, stormwater flows through several pathways to the Mattapoisett River.

Stormwater and river water sample collection and analysis

Fourteen water samples were collected at seven stations (ammonia samples required a separate bottle because of acid preservative) on the farm during the May 2 sampling from 2:00 to 3:00 PM. These sampling locations are shown in Figure 6. Because of time deadlines necessary to deliver the samples

6 from "unofficial records" at www.erh.noaa.gov/er/box/dailystns.shtml.

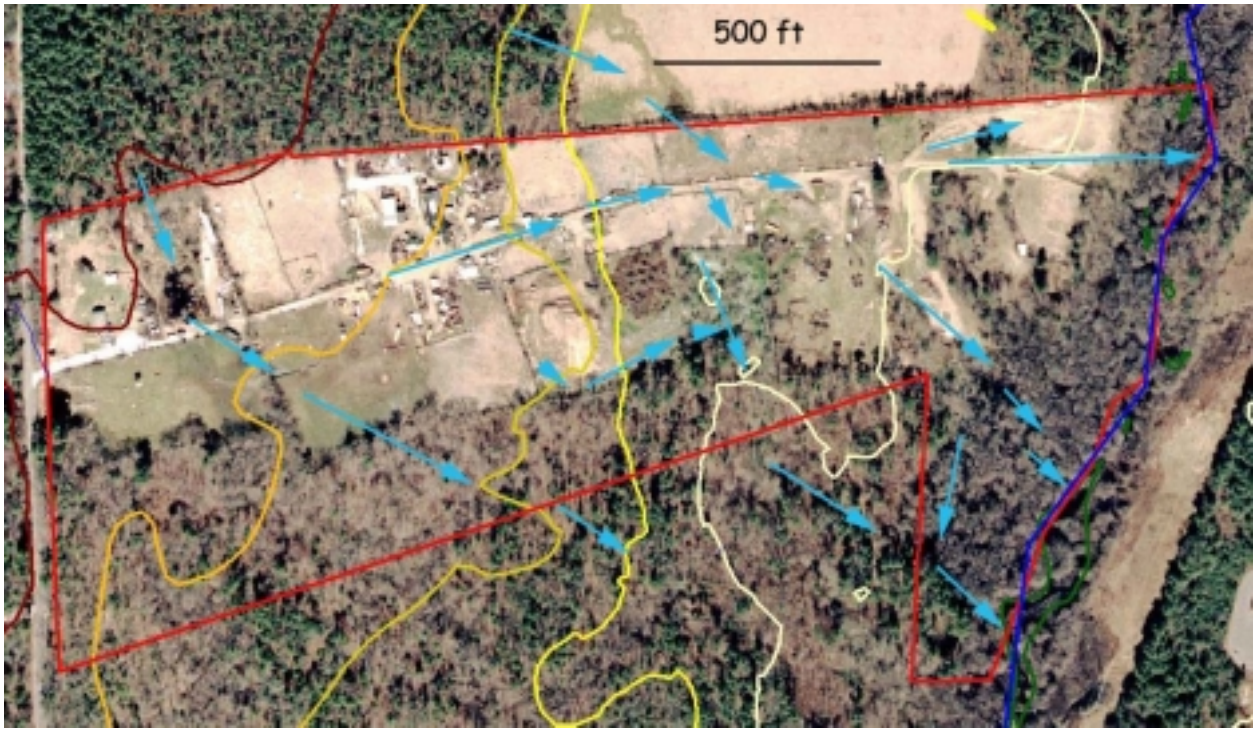

Figure 5. Surface flow of stormwater based on direct observations, contours, and aerial imagery. Colored lines are 10-foot contours (red, shades of yellow, to white is 78 ft, 68 ft, 58 ft, 48 ft and 38 ft respectively, data from Mass GIS).

to the laboratory, no sample of leachate was collected at the base of the fill area at station 4, which represented pooled water atop the fill. Analytical results of this sampling are shown in Table 1 and the original lab report is included in Appendix A. Samples of solids from the feed bins at station 1 and a white foul smelling substance from the fill area (described below) were collected and stored frozen for future analysis. The samples have not yet been analyzed.

As shown in Table 1, stormwater traveling across the Sol Brothers, Inc. farm is remarkably high in the bacterial indicators used for assessing threats to human health and safety of shellfish. Concentrations of bacteria often exceed hundreds of thousands or even millions of bacteria per 100 milliliters of sample. Many of the strains of bacteria measured, including the *E. coli*, and Enterocci, are themselves considered harmful. They are also indicators that more harmful pathogens are also present. Since 1989, the Buzzards Bay Project has collected or evaluated stormwater contaminant data from hundreds of sites around Buzzards Bay and in the watershed, and rarely have samples been documented this high. If stormwater in suburban and urban areas contains more than 1,000 bacteria per 100 milliliters (ml) of any of these bacteria, those samples are considered very high and an indicator of a significant pollution source. In the case of fecal bacteria, counts of 50 to 300 is more typical of "contaminated " stormwater in areas where pet waste, wildlife, and human contamination contribute to the accumulative non-point sources of contamination.

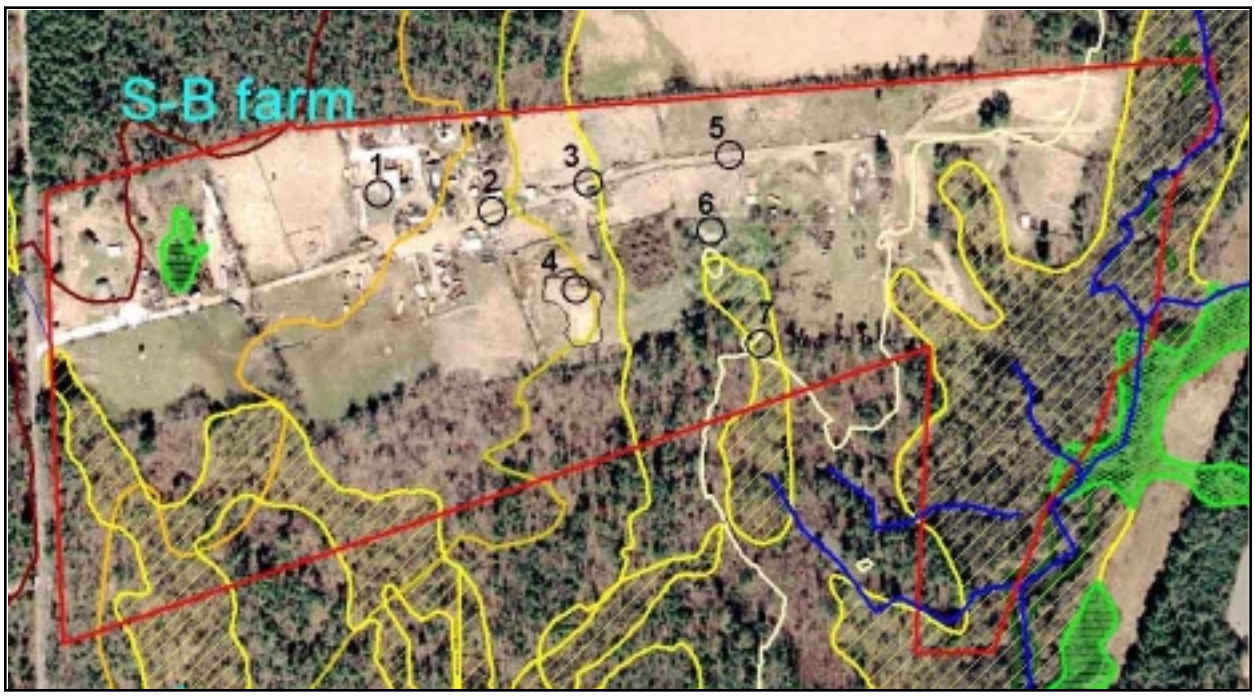

Figure 6. Locations of May 2, 2002 sampling. Observed stormwater flow was from the road opposite station 1 to 2, 3,5, 6, then to 7. Sample 4 represents a pool of water on the top of the fill, but stormwater and leachate from the base of the fill area flows NE for a short distance toward a point between station 6 and 7, eventually flowing into station 7. Yellow and green crosshatched areas are the minimum extent of wetlands estimated by MassGIS. Tributaries and rivulets (shown in blue) were approximated based on aerial photograph features.

Table 1. Results of May 2, 2002 sampling.

(CFU= "colony forming unit" and is considered to be equal to the presence of 1 viable bacterium.)

Station ID	Nitrates mg/l	Ammonia mg/l	*E. coli* CFU/100ml	Enterococci CFU/100ml	Fecal Coliform CFU/100ml
1	0.9	112	90,000	18,000,000	120,000
2	<0.1	22	660,000	960,000	910,000
3	<0.1	20	570,000	870,000	1,020,000
4	53	72	110,000	16,100	230,000
5	<0.1	22	600,000	770,000	1,110,000
6	<0.1	32	390,000	420,000	780,000
7	1.1	52	53.000	14.000	56.000

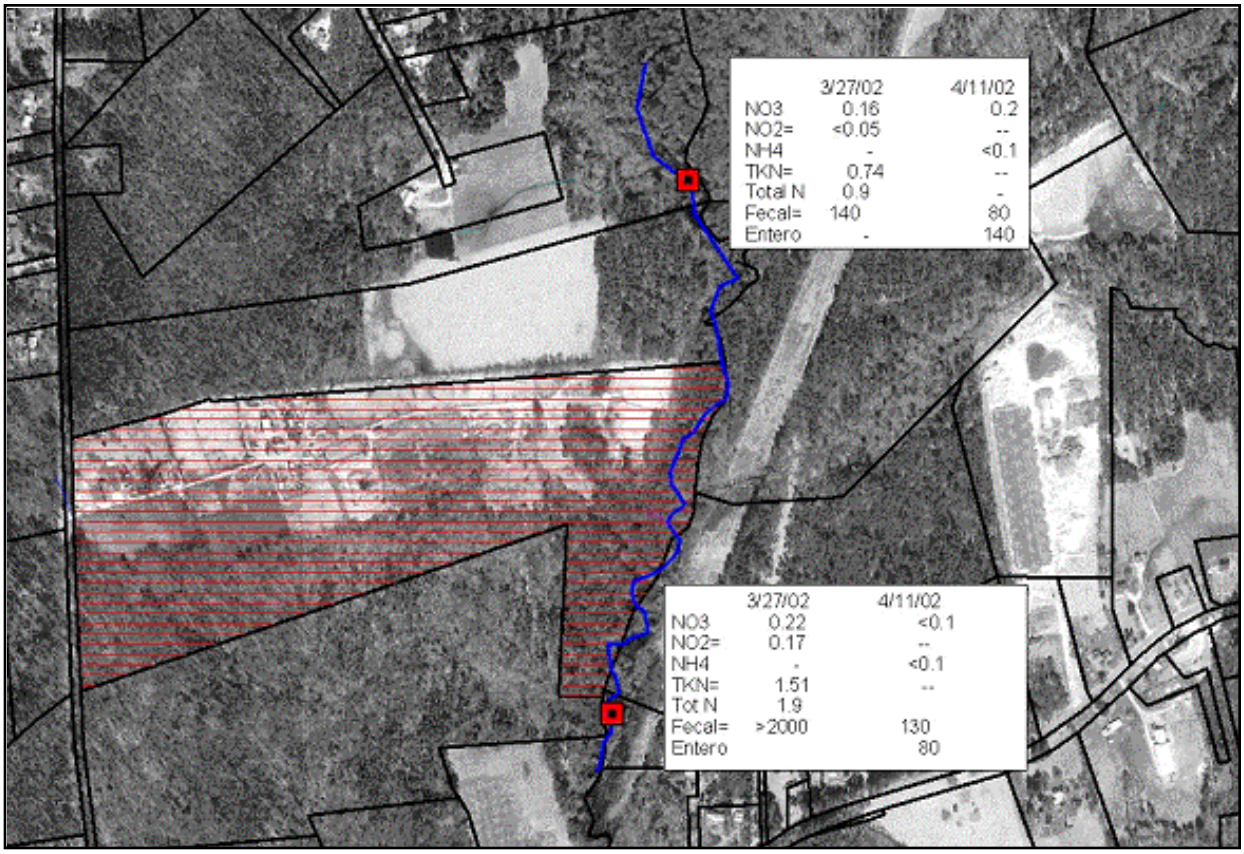

Figure 7. Monitoring results (nutrients and bacteria) of samples taken from the Mattapoisett River during a day of rain on March 27, and during a dry period on April 11, 2002. Sol Brothers, Inc. property is crosshatched area.

In the stormwater samples collected at the Sol Brothers, Inc. property, bacterial counts mostly exceed 100,000 bacteria per 100 ml. In fact, *E. coli* were only below 100,000 at the standing water by the food bins (90,000 per 100 ml) and at station 7 (53,000 per 100 ml). These values, in and of themselves, are not surprising in the sense that pig feces are recognized as having very high concentrations of Enterococci and fecal bacteria per unit weight. However, the results of station 7 areespecially significant because they represent diluted stormwater runoff leaving the property and entering rivulets discharging into the Mattapoisett River. The bacteria concentrations observed here are *E. coli*= 53,000, Enterococcus= 14,000, and fecal coliform=56,000 per 100 ml sample, respectively. To better put these values in perspective, the safe swimming standard for freshwater is that no single sample exceed 235 *E. coli* per 100 ml or 61 Enterococci per 100 ml.

Previously, the Buzzards Bay Project reviewed two sets of water samples collected by the Rochester Board of Health. The first test results were from a March 27, 2002 sampling taken by the Rochester Board of Health (and tested by Analytical Balance Corporation) during a rainy period. The other sampling date was on April 11, 2002 at the same locations during a dry period. The

Barnstable County Department of Health and the Environment Laboratory analyzed these latter samples. The purpose of this data set was to evaluate background contaminant levels in the Mattapoisett River when overland runoff of pollutants from the farm was less significant. The interpretation of these earlier two data sets is attached in Appendix A.

The May 2 stormwater data supports the conclusion that stormwater runoff from the Sol Brothers, Inc. farm is the source of the at least 14-fold increase in fecal coliforms observed in the River on March 3. Because the March 3 river water sample was insufficiently diluted by the laboratory, the actual fecal coliform concentration is unknown from that date, and may have been considerably greater than the ">2000" reported. Additional sampling down gradient of the farm is warranted after periods of rain to fully document the magnitude of pollutant loadings, but based on the May 2, 2002 stormwater and March 3 river water fecal coliform bacterial concentrations, it is clear than runoff from the farm is a major pollution source to the Mattapoisett River.

Conclusions and Recommendations

1) Drinking Water Supply Zone II and Zone III issues

Separate from surface water quality issues, there are several activities that are occurring at this site that appear inconsistent with state regulations and policies regarding activities within Zone IIs and Zone IIIs of public drinking water supplies. Table 2 lists selected relevant activities that are now prohibited to be sited within Zone IIs and Zone IIIs and public wells. No new wells may be brought on line or existing wells upgraded if these activities are present. For existing wells, with preexisting land uses, DEP policies are to speed the phasing out of permitted activities that are inconsistent with water supply protection. However, if activities occur within a Zone II or III which require a permit, but for which no permit has been obtained, then such activities are potential subjects of enforcement action. Of course, certain activities may also receive variances from DEP if certain performance standards are met.

It is worth noting that pig farming and other normal farming practices are not prohibited by the public drinking water regulations. However, certain activities on the Sol Brothers property do not appear to be normal farming practices, and do not appear consistent with the goals or requirements for safe drinking water. The Rochester Board of Health should contact DEP to determine if there are any potential Zone II regulation violations associated with the site. Areas that should be specifically examined:

a) Central area appears to be a landfill not a composting area

The fill area at sampling Station 4 (within the Zone II of the Perry Hill wells) does not appear to be a typical "composting area", and instead has the appearance of a landfill of manure, shells, and fish products. Composting operations turn and aerate soil and organic mixtures to prevent putrification. The aerobic decomposition of the material produces compost that can be used on agriculture fields or gardens. There was no evidence of this practice. A core of sediment showed than less than one foot below the surface of portion of the fill was an unrecognizable foul smelling white chalky substance. Other areas within the fill had high organic, black, anaerobic (lacking oxygen) putrefied soils approximately six inches below the surface. In many respects, the site appeared to look like a landfill of fish parts and pig manure.

Table 2. Drinking water supply regulations (310 CMR 22.21(2) (b) excerpts) that may have applicability to this site:

Wellhead protection zoning and nonzoning controls submitted to the Department in accordance with 310 CMR 22.21(1), shall collectively prohibit the siting of the following land uses within the Zone II, or Zone III if the criteria of 310 CMR 22.21(1)(f) have been met, of the proposed well or wellfield, whichever is applicable, unless designed in accordance with the specified performance standards:

1. storage of sludge and septage, as defined in 310 CMR 32.05, unless such storage is in compliance with 310 CMR 32.30 and 310 CMR 32.31;

3. storage of commercial fertilizers; as defined in MGL. c 128 § 64 unless such storage is within a structure designed to prevent the generation and escape of contaminated runoff or leachate

4. storage of animal manures, unless such storage is covered or contained in accordance with the specifications of the Natural Resource Conservation Service

5. storage of liquid hazardous materials, as defined in MGL. c. 21E, and/or liquid petroleum products unless such storage is: a. above ground level, and b. on an impervious surface, and c. either….

6. the removal of soil, loam, sand, gravel or any other mineral substances within four feet of the historical high groundwater table elevation (as determined from monitoring wells and historical water table fluctuation data compiled by the United States Geological Survey), unless the substances removed are redeposited within 45 days of removal on site to achieve a final grading greater than four feet above the historical high water mark, and except for excavations for the construction of building foundations or the installation of utility works.

7.land uses that result in the rendering impervious of more than 15% or 2500 square feet of any lot, whichever is

A three foot tall pile of shells was observed at the edge of the fill area, but it was evident from the edge of the fill area that quantities of shells and large fish parts been previously mixed and buried at the site. Shells and the large fish hard parts (large jaws and vertebrate) were not observed in the pig feed bins and appear unrelated to the feeding operation.

Based on surface stormwater samples and known nitrogen concentrations of swine manure and fish products, the material landfilled at this site will leach into groundwater. This type of disposal will result in elevated ammonia and nitrogen concentrations in groundwater, and may possibly result in elevated bacteria and virus concentrations depending upon soils, bedrock placement, and other subsurface features. Because this fill is in the Zone II and Zone III of several wells, it represents a potential threat to those drinking water supplies.

Aerial photographs of the site between 1990 and 2001 show a progressive filling of the site (Fig 8), which appears to be at least 10 feet above grade at the southernmost end. In the 1990 photograph,

Figure 8. Area of apparent fill activity center-lower rectangular area as observed in 1990, 1997, and 2001 aerial photographs. The 1990 photograph shows a relatively flat field with a small structure in the center. The 1997 photo appears to have pooled water in a depression.

the area appears to be just another pig field. In the 1997 photograph, the site is highly altered, showing standing water most likely in a hole, as well as mounds of fill. Such a depression could have been created by sand mining, for example, but stereoscopic views of the aerials would need to be examined or the fill area could be cored to determine the depth of natural soils and whether the area was mined before fill was added. In the 2001 image, the apparent depression appears filled, and the fill more extensive. In the 2001 photograph, the fill covers 0.35 acres. If the average thickness of the filled area is 7 feet (as an approximation of original grade), then there is nearly 4000 cubic yards of fill at the location. If the site was mined for sand prior to filling, then more fill is located there. A machine powered coring device is needed to determine the extent of fill at the site.

b) Vehicle junkyards may threaten drinking water supplies

The siting of automobile graveyards and junkyards are prohibited in Zone IIs and IIIs of drinking water supply wells because leaching metals and leaking oils pose a threat of groundwater contamination. At the site, at least 7 derelict school buses were observed during the site visit of May 2 as well as many other vehicle parts, trailers, and truck cabs. A visible sheen on the surface of the stormwater was observed at stations 3 and 5, down gradient of the vehicle graveyard areas. If the buses do not serve a farm function, it may be desirable to have them removed to protect drinking water supplies. If they are used for any farm storage function, at a minimum, it would be desirable to have the engine blocks, gas tanks, and transmissions removed to minimize the threats to groundwater, surface waters, and drinking water supplies.

c) Sand mining is prohibited in Zone IIs

The apparent sand mining operation on the northeast corner of the parcel adjoins a wetland area is in the Zone II, and is in fact very close to the Zone 1 area of the two Perry Hill wells. Based on washed out areas, some stormwater may be leaching into groundwater in this area. At the May 2 site visit, this area appeared excavated between 4 feet and 8 feet below grade. Removal of soils within four feet of historic groundwater levels is prohibited within Zone IIs and Zone IIIs, and it should be determined whether this sand and gravel mining area complies with drinking water protection regulations. If soil was mined to the water table in the fill area in the center of the property (also within the Zone II), this too could be in violation of drinking water supply regulations.

d) Manure storage in Zone IIs is a concern

There are prohibitions on the storage of uncovered manure piles in Zone IIs. The large mounds of manure at the fill site, and the apparent landfilling of these manures appear inconsistent with well water protection goals, not to mention the apparent land filling of the manure. Stormwater at the site contains elevated nitrogen, mostly in the form of ammonia, typically exceeding 20 mg/l. In the puddle in the fill area, nitrates were 53 mg/l and ammonia was 73 mg/l. Based on landfill studies, it is certain there is a plume of elevated ammonia and nitrate contamination in the groundwater under the fill area. This leaching into groundwater is creating a contaminant plume. It is possible that this plume may be related to the elevated nitrate concentrations observed in the Perry Hill Road wells 1700 feet to the east, but further groundwater studies may be required.

In terms of farm management practices, the USDA Natural Resource Conservation Service can provide free technical assistance on composting procedures and the development of farm management plans. It would be desirable for the operator of the farm to participate in this program.

Figure 9. Apparent vehicle graveyard and storage area, including school buses and trailers. School buses are yellow-orange in the color photo dated 2001. There was an apparent increase in the number of school buses on the site between 1997 and 2001.

2) Stormwater contamination is causing surface water impairments and degradation

The samples of May 2 demonstrate that stormwater runoff from the Sol Brothers, Inc. property is an important source of pathogen contamination to the Mattapoisett River. Both the Mattapoisett River, and Mattapoisett Harbor at the mouth of the River, are impaired by high fecal bacteria levels. These surface waters are on the state's "303d list" of impaired waters not attaining water quality goals, specifically because of pathogens[7]. The marine waters near the mouth of the Mattapoisett River have been closed for many years due to high fecal bacteria in the water. At the mouth of the Mattapoisett River, 21 acres of shellfish beds are permanently closed because of contamination, and 9 additional acres are closed whenever rainfalls exceed 0.2 inches. These shellfish resource areas are closed to shellfishing because fecal coliform concentrations persist above safe shellfish consumption standard of 14 fecal coliform per 100 ml in overlying surface waters. Contaminated stormwater leaving the Sol Brothers, Inc. property and entering the Mattapoisett River likely makes the 5.3 mile journey to Buzzards Bay and these shellfish resource areas in 12 hours or less, assuming a stream flow rate of one half mile per hour.

The Mattapoisett River monitoring results from the rainfall of March 27, and the dry weather sampling from April 11, 2002 (Fig. 7) are consistent with the super elevated concentrations of stormwater leaving the property. The bacteriological data, and the earlier river monitoring demonstrate that this farming operation is a major pollution source to the Mattapoisett River. For example, the 2000 fecal coliform per 100 ml observed on March 3 in the River at the southern edge of

7 FINAL MASSACHUSETTS SECTION 303(d) LIST of WATERS. 1998 Commonwealth of Massachusetts Executive Office of Environmental Affairs Department of Environmental Protection Division of Watershed Management 627 Main Street, Second Floor Worcester, MA 01608 February, 1999. Mattapoisett Harbor (95917), MA95-35; Mattapoisett River (9559425), MA95-36

the property during a day of rain is consistent with the 56,000 fecals per 100 ml in stormwater entering the rivulets near the edge of the Sol Brothers property. The greater volume of the Mattapoisett River would dilute the super elevated fecal concentrations in the rivulets. Thus, it can be stated with considerable certainty that any appreciable rainfall (i.e. greater than 0.2 inches when runoff is expected) will result in very high bacterial contamination to the Mattapoisett River from this property. Higher rainfalls will likely result in runoff at the eastern boundary of the property also, as suggested by debris washout there.

3) Concentrated Animal Feeding Operation (CAFO) stormwater permit may be required

Under US EPA guidelines, the Sol Brothers, Inc. Operation may constitute a "Concentrated Animal Feeding Operation" or CAFO. If that is the case, then an NPDES permit may need to be obtained from the US EPA. Normally 1000 "animal units" must be present to be defined as a CAFO, which equals 2500 swine weighing 55 lbs. However, if "pollutants are discharged directly into waters of the U.S." then only 301 animal units (=752 swine of 55 lb weight) meet the regulatory criteria. The Mattapoisett River meets the regulatory definition of "waters of the US". A fewer number of swine would meet the criteria for a CAFO if their average weight exceeded 55 pounds. As noted earlier, under court order, the number of swine on the property has been limited to 1000. There are purportedly approximately 800 swine on the property. The Rochester Board of Health could contact the US EPA Region I to determine if the CAFO regulations apply to this site.

4) More frequent monitoring of nitrites and nitrates is warranted in the Perry Hill wells.

The April 2002 sampling of Marion drinking water from the Perry Hill Road wells, showing nitrites at 0.45 mg/l (=ppm) nitrates at 3.1 mg/l suggest that the wells may be partially intercepting a plume of elevated nitrogen. Most public wells have no nitrites, and nitrates are usually well below 1.0 mg/l. The elevated nitrate and nitrite concentrations suggest a source of contamination to the Town of Marion Perry Hill wells. Whether this contamination is from the Sol Brothers, Inc. farm requires further study, but it is certainly a near field source. The presence of nitrite in groundwater usually suggests close proximity of a wastewater, manure, or fertilizer source. The observed concentration (3.55 mg/l combined nitrite plus nitrate) is below the state drinking water limit of 10 mg/l nitrate for drinking water, and below the more stringent limits of 5 ppm adopted by regional regulatory agencies like the Cape Cod Commission. The Town of Marion should consider testing the well water more frequently nitrites and nitrates, especially during late summer and early fall when different groundwater flow patterns may occur.

Appendix A: Attachments

1. Additional Photographs
2. Original data reports from Barnstable County Health of May 2 sampling
3. Fold-out 11x17 color aerial photo orthographic map of the site; April 2001 imagery from MassGIS.
4. Correspondence from Buzzards Bay Project dated April 16 interpreting previous Mattapoisett River monitoring

Appendix A1. Additional Photographs

Fig. A1-1. Food bin, puddle is Station 1.

Fig. A1-3. Fill area near Station 4.

Fig. A1-5. Looking down slope to stations 3 and 5 (drainage across road).

Fig. A1-2. Drainage ditch (Station 2), down slope of main barn area.

Fig. A1-4. Solids sample from fill, near Station 4.