

**SEMI-ANNUAL GROUNDWATER MONITORING
BRISTOL MUNICIPAL LANDFILL
BRISTOL, VERMONT**

DEC Project RU95-205

June 17, 2019

Prepared for:
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LEE Project # 14-013



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- A. Site Maps
 - B. Data Summary Tables
 - C. Laboratory Analytical Report
-  Not included, but
are available.



1.0 INTRODUCTION

The Town of Bristol, Vermont (the Town) owns and previously operated a municipal landfill on Pine Street in the Town of Bristol, Vermont (See Site Location Map in Appendix A). The Site is currently a closed, unlined municipal solid waste disposal facility. The facility previously served approximately 3,500 people prior to closure.

The Site is certified for operation by the State of Vermont Department of Environmental Conservation (DEC), Waste Management Division, under Facility Certification RU95-0205. The current certification period is from January 30, 2017 through December 31, 2026.

The Town of Bristol has retained LE Environmental LLC (LEE) to collect groundwater samples in the vicinity of the landfill according to conditions 8 and 10 of the certification. Groundwater samples are collected in May and October from MW-101, 102R, 103, 309, and 335. The certification requires that the groundwater samples be tested for field parameters during collection, and for inorganic analytes and volatile organic compounds (VOCs – in May only) by a certified laboratory.

Semiannual monitoring is conducted to detect changes in groundwater quality which could indicate that landfill leachate is impacting groundwater beneath or adjacent to the Site. In addition to applicable Federal and State waste management statutes and regulations, the Site is regulated under the State of Vermont Groundwater Protection Rule and Strategy, Subchapter 12, effective December 2016 (GWPRS) including Primary and Secondary Vermont Groundwater Enforcement Standards (VGES) contained in GWPRS Tables 1 and 2. The GWPRS requires that regulated activities not cause groundwater quality to exceed the VGES at the compliance boundary, defined as the downgradient property line, or at an alternative compliance boundary if one is established (see Section 12-801 and Appendix 1 of the GWPRS). The Federal regulations for municipal solid waste disposal facilities (40 C.F.R. Part 258) allow downgradient points of compliance to be up to 150 meters from the downgradient edge of the waste mass.

Surficial groundwater beneath the Site flows from northeast to southwest. The configuration of the Site is such that the distance between the southwestern edge of the waste mass and the southwestern property line is approximately 50 feet. In order to meet the requirements contained in the GWPRS with a higher degree of certainty, the Town has acquired groundwater easements from neighboring property owners west, north, and south of the Site. These easements allow the downgradient points of compliance for groundwater quality to be further from the landfill than the downgradient property lines.

The Site's compliance groundwater monitoring network consists of two upgradient monitoring wells (MW-309 and MW-103) and three downgradient monitoring wells



(MW-102R, MW-101, and MW-335). The approximate locations of these wells are depicted on the Site Map in Appendix A.

2.0 METHODOLOGY

On May 29, 2019, LEE obtained depth to groundwater measurements and groundwater samples from the five groundwater monitoring. The water level indicator was cleaned before and between uses. The depth to water was subtracted from the top-of-casing elevation to obtain the relative water table elevation.

Groundwater monitoring wells were purged and sampled using the Town's dedicated pumping system. The pumping system in each well consists of one, dedicated QED PL-1101 polyethylene Micropurge Bladder Pump connected to dedicated, bundled polyethylene tubing. Samples were purged and collected according to LEE's standard protocol for low flow sampling. Each well was purged until stabilization of pH, temperature, and turbidity occurred (typically 1-3 gallon evacuation).

All samples were delivered to Eastern Analytical, Inc of Concord, New Hampshire under proper chain of custody procedures on May 30, 2019.

3.0 RESULTS OF GROUNDWATER MONITORING

3.1 GROUNDWATER ELEVATIONS

Water level measurement data and calculated groundwater elevations are presented in Appendix B. The water table elevations in the Spring of 2019 were 1.1-2.4' higher than those seen in the Fall 2019 sampling event. The estimated groundwater flow direction in May 2019 was toward the southwest, similar to previous results.

3.2 GROUNDWATER QUALITY DATA

The May 2019 field measurement data for groundwater monitoring wells are summarized as follows. A summary of the data is included in Appendix B.

1. Groundwater pH at the time of sampling ranged measurements ranged from 6.61 to 8.14 standard units. Measured pH was within historic range at all monitoring locations.
2. Groundwater temperatures at the time of sampling ranged from 9.4° – 12.2° Celsius and were within historic range at all monitoring locations.
3. Groundwater turbidity measurements ranged from 0.22 – 27.8 NTU and were within historic ranges at all monitoring locations.

Inorganic analytes were reported above detection limits in each of the samples



collected from the monitoring wells. A database summary of accumulated water quality data for the Site is included in Appendix B. The laboratory analytical reports are included in Appendix C.

MW-101:

The laboratory analytical report indicates that chloride, sodium, dissolved and total manganese were reported above laboratory reporting limits. None exceeded applicable primary or secondary VGES except for dissolved manganese, which exceeded the site-specific secondary VGES.

MW-102R:

The laboratory analytical report indicates that chloride, sodium, dissolved and total manganese were reported above laboratory reporting limits. None exceeded applicable primary or secondary VGES.

MW-103:

The laboratory analytical report indicates that sodium and chloride were reported above laboratory reporting limits. None exceeded applicable primary or secondary VGES.

MW-309:

The laboratory analytical report indicates that chloride, sodium, dissolved and total manganese were reported above laboratory reporting limits. None exceeded applicable primary or secondary VGES except for dissolved manganese, which exceeded the site-specific secondary VGES.

MW-335:

The laboratory analytical report indicates that sodium, chloride, total iron, and total manganese were reported above laboratory reporting limits. None exceeded applicable primary or secondary VGES.

The site-specific secondary VGES for dissolved manganese was calculated using the methodology set forth in Section 12-502 (1)(a)(ii) of the GWPRS because background water quality exceeds published secondary standards. The mean dissolved manganese concentration in 55 samples collected from background well MW-309 is 0.12 ppm.

Data analysis indicates the following observations.

1. Reported concentrations of sodium, chloride, and manganese at downgradient monitoring well MW-101 have depicted a fluctuating trend. All concentrations were within historic ranges.
2. Sampling data at monitoring well MW-102R indicates sodium, chloride, dissolved manganese and conductivity have exhibited a fluctuating trend.
3. In upgradient monitoring well MW-103, all concentrations are within historic



ranges with no discernable chloride or sodium trends. Concentrations of dissolved manganese have depicted a long term decline.

4. In upgradient monitoring well MW-309, all concentrations are within historic ranges with no discernable trends.
5. In downgradient monitoring well MW-335, all concentrations remained within historic ranges. The dissolved manganese concentrations have fluctuated over time. Concentrations of chloride and sodium have depicted a long term decline.

4.0 QUALITY ASSURANCE AND QUALITY CONTROL SUMMARY

A duplicate sample was obtained from monitoring well MW-309 during the Spring 2019 sampling event for quality assurance and control (QAQC) purposes. The duplicate sample was analyzed for all test parameters. The results of the laboratory analysis of the duplicate sample were analyzed using a relative percent difference (RPD) analysis. For the Spring 2019 monitoring event, the absolute RPD values ranged from 0.0-0.9%, which is within the 30% range specified by United States Environmental Protection Agency (EPA) Region 1.

5.0 CONCLUSIONS

LEE makes the following conclusions for the May 2019 monitoring event at the Bristol landfill.

1. Based on the estimated groundwater flow direction and previous sampling events, monitoring wells MW-101, MW-102R, and MW-335 are downgradient of the landfill, while MW-103 and MW-309 are upgradient of the landfill. Monitoring well MW-309 is also downgradient of several residences and businesses. The estimated flow direction is similar to previous estimates.
2. Compliance sampling of upgradient and downgradient groundwater monitoring wells indicated that the site specific secondary VGES for dissolved manganese was exceeded at MW-101 and MW-309.
3. No sensitive receptors appear to be impacted. The Town holds groundwater easements on adjacent properties, which limit uses of groundwater in these zones.

6.0 RECOMMENDATIONS

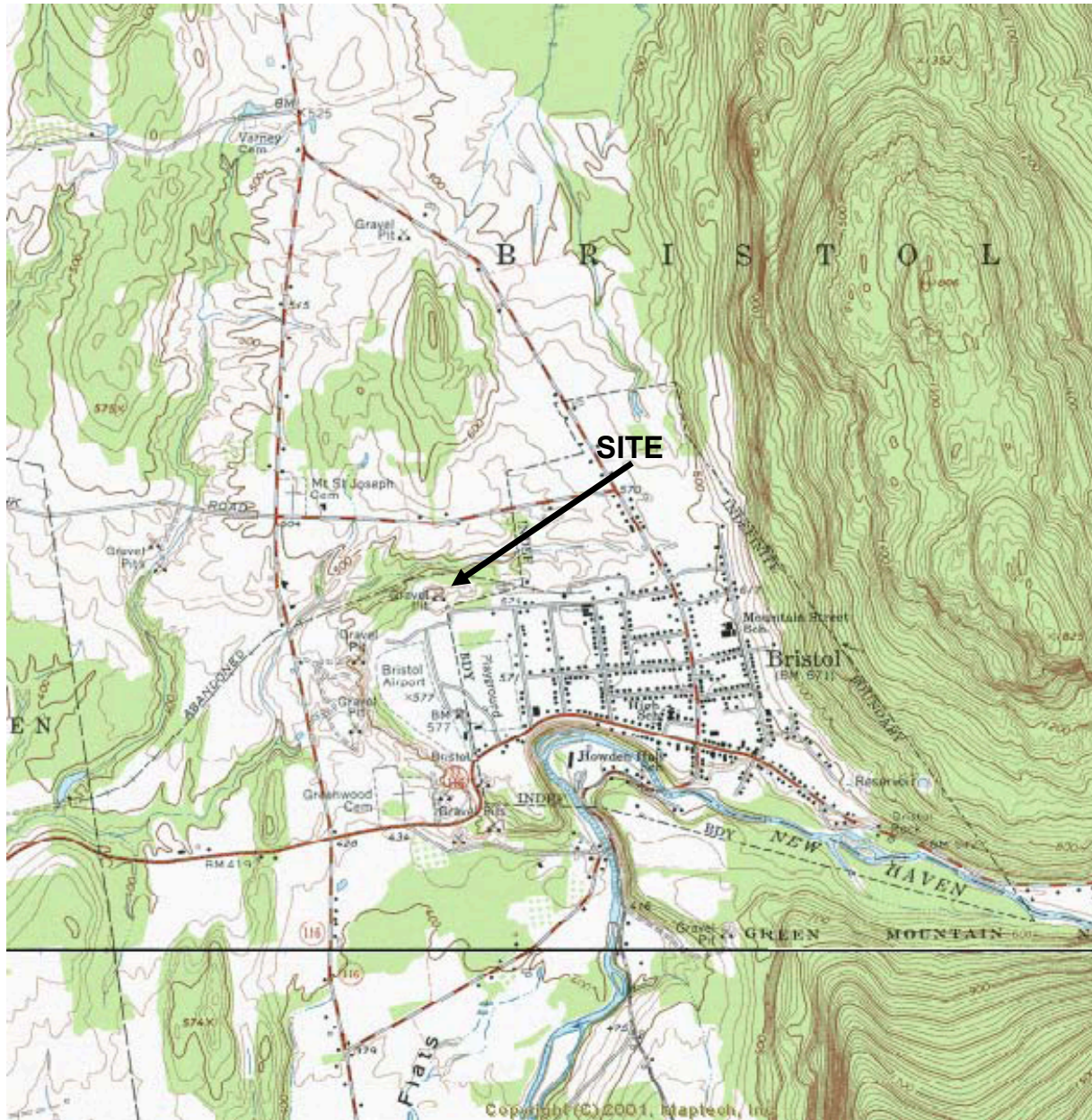
The next semiannual sampling event will take place at the Bristol municipal landfill in October 2019 per the requirements of the landfill certification.



May 2019 Semi-Annual Groundwater Monitoring
Bristol Landfill, Bristol, Vermont

APPENDIX A

SITE MAPS



Bristol Landfill
Bristol, Vermont

USGS Mapping



LE-Environmental

LE #: 14-013

Date: November 3, 2014

Source: msrmaps.com



LEGEND

Town Boundary

NOTES

Map created using ANR's Natural Resources Atlas

122.0 0 61.00 122.0 Meters

WGS_1984_Web_Mercator_Auxiliary_Sphere 1" = 200 Ft. 1cm = 24 Meters
© Vermont Agency of Natural Resources THIS MAP IS NOT TO BE USED FOR NAVIGATION

DISCLAIMER: This map is for general reference only. Data layers that appear on this map may or may not be accurate, current, or otherwise reliable. ANR and the State of Vermont make no representations of any kind, including but not limited to, the warranties of merchantability, or fitness for a particular use, nor are any such warranties to be implied with respect to the data on this map.

1: 2,394
November 4, 2014

SITE PLAN
Bristol Landfill

VT ANR Natural Resources Atlas



LE:Environmental

LE #: 14-013
Date: November 3, 2014
Source: VTANR Mapper