



Tacoma - Pierce County  
**Health Department**  
*Healthy People in Healthy Communities*

[www.tpchd.org](http://www.tpchd.org)

**Spring 2016 Summary Report  
Residential Drinking Water Well Sampling  
LRI Landfill**

## **Contents**

1. Summary
2. Table 1 – Spring 2016 Water Quality Results
3. Table 2 – Spring 2016 Water Quality VOC Results
4. Table 3 – Spring 2016 Water Quality Duplicate Results
5. Table 4 – Spring 2016 Water Quality Duplicate VOC Results
6. Water Quality Abbreviations and Notes
7. Appendix A – Sampling for Volatile Organic Compounds

# Summary

## Background

This report is a summary of the water quality sampling event conducted in the Spring of 2016.

All drinking water wells within one-half (1/2) mile of the boundary of the LRI Landfill are eligible for free water quality sampling once each year. The Spring 2016 water sampling is a continuation of a *Residential Drinking Water Well Program (Program)* developed and implemented in 2006, by the Tacoma-Pierce County Health Department, in response to concerns raised during the LRI Landfill's solid waste permit re-issuance process. The Program is a requirement of the LRI Landfill Solid Waste Handling Permit, issued by the Health Department. Substances chosen for testing by the Health Department were selected in order to assess groundwater quality. These tests can provide information about possible groundwater impacts from the landfill.

The Program allows property owners to have their well water sampled in either the Spring ("Spring Participants") or Fall ("Fall Participants") of each year, and may decline participation in the Program or drop out of the Program at any time.

The water samples are tested annually for twenty characteristics and substances, including conductivity, pH, ammonia, nitrate, chloride, iron, manganese, magnesium, and Coliform bacteria. In addition to the annual water quality test, participants will have their water tested once every five years for 'Volatile Organic Compounds' (VOCs). Approximately one fifth of the participating property owners will be selected to have their well water tested for VOCs each year, thereby ensuring all participants will have their water analyzed for VOCs once every five year cycle. However, effective with the spring 2015 sampling event, members of the Woodbrook Homeowners Association are now eligible for annual VOC testing. This change is the result of a legal settlement between the Woodbrook Homeowners Association and LRI over the relocation of Woodbrook Road (317<sup>th</sup> Street East). The legal settlement is facilitating the relocation of Woodbrook Road around the perimeter of the landfill this summer. Woodbrook Road currently bisects the southern portion of the landfill property and is the sole access point for residents of the Woodbrook community.

Although landfills are not regarded as a source of Coliform bacteria in groundwater, the Health Department elected to include Coliform bacteria testing as part of the sampling program. These tests are taken due to the known health effects of bacterial contamination, and because many homeowners in rural areas are unaware of possible bacterial contamination of their well water.

In addition to this Program, the landfill operator is required by the Health Department to maintain an on-site groundwater monitoring program. This on-site monitoring program has been in effect since 1999. For the on-site groundwater monitoring program, nine wells around the perimeter of the landfill property are sampled quarterly (four times a year). All groundwater monitoring data from these wells is available from the Health Department.

## Spring 2016 Sampling Event

The Spring 2016 water samples were collected at 27 properties between May 2-5, 2016. Samples collected by the Health Department were analyzed by independent Washington State certified analytical laboratories. Centric Analytical Labs performed bacteriological analyses, and OnSite Environmental Inc. performed organic and inorganic chemical analyses. 2016 Spring participants

were sent detailed water quality test results in June 2016. No landfill-related impacts to groundwater quality were identified from the water quality test results.

A complete list of water quality test results may be found on **Table 1** of this summary report.

For the Spring 2016 sampling event, water samples from 12 residential wells were tested for VOCs. The analytical results indicated that there were no VOCs detected in the water from any of the wells.

The Spring 2016 water quality test results are consistent with water quality test results from previous sampling events, and show groundwater near the landfill remains typical of groundwater chemistry in Pierce County. Iron and manganese levels were consistently above the secondary standards set by the Washington State Department of Health. Elevated iron and manganese levels are typical of groundwater conditions throughout much of Pierce County due to the underlying geology.

The Washington State Department of Health considers iron and manganese a “secondary contaminant.” Secondary contaminants pose aesthetic problems rather than health concerns. High levels of iron and manganese can give water a metallic taste, cause odors, and can cause brown or black staining of porcelain fixtures exposed to the water. They are not a health hazard and are not a result of the LRI Landfill.

The water quality sample results are shown on **Tables 1 and 2** of this report. Results that exceed the state water quality standards are shown in bold. For quality control purposes duplicate samples were taken at four locations. Results of the quality control samples are shown on **Tables 3 and 4**.

## **Bacteria**

During this sampling event, only 1 of the 27 wells tested had bacteria present in their well water (bacteria in the water is shown as an “unsatisfactory” test result, and indicated as a “U” on Table 1).

## **CONTACTS**

For questions regarding this report or the sample results please contact representatives of the Health Department’s Drinking Water Program.

Michelle Harris      (253) 798-7683      or      Brad Harp      (253) 798-2851

TABLE 1: LRI Landfill Residential Well Sampling Program – Spring 2016 Water Quality Results  
Chemical or Analyte\*----->

|           |             | General Chemistry |          |                   |                   |         |                        | Dissolved Metals |        |         |        |       |           |           |           |        |          |       | Total Metals |           | Cond/Bact/pH |          |     |
|-----------|-------------|-------------------|----------|-------------------|-------------------|---------|------------------------|------------------|--------|---------|--------|-------|-----------|-----------|-----------|--------|----------|-------|--------------|-----------|--------------|----------|-----|
| Site      | Sample Date | Ammonia           | Chloride | Nitrogen, Nitrate | Nitrogen, Nitrite | Sulfate | Total Dissolved Solids | Arsenic          | Barium | Calcium | Copper | Iron  | Magnesium | Manganese | Potassium | Sodium | Vanadium | Zinc  | Iron         | Manganese | Conductivity | Bacteria | pH  |
| MCL**     |             |                   | 250      | 10.0              | 1.0               | 250     | 500                    | 0.01             | 2.0    |         | 1.3    |       |           |           |           |        |          | 5.0   | 0.3          | 0.05      | 700          |          |     |
| SR0117458 | 5/3/2016    | ND                | 3.6      | ND                | ND                | ND      | 110                    | ND               | ND     | 19      | ND     | ND    | 5.1       | 0.079     | ND        | 17     | ND       | ND    | 0.24         | 0.078     | 139.3        | S        | 8.1 |
| SR0120529 | 5/5/2016    | ND                | 3.8      | 0.14              | ND                | ND      | 100                    | ND               | ND     | 15      | ND     | 0.98  | 6.8       | 0.17      | ND        | 9.5    | ND       | 0.034 | 1.5          | 0.18      | 123.7        | S        | 7.5 |
| SR0120533 | 5/4/2016    | ND                | 5.1      | 1.5               | ND                | ND      | 40                     | ND               | ND     | 12      | 0.016  | ND    | 7.6       | ND        | 1.9       | 7.7    | ND       | ND    | 0.13         | ND        | 107.4        | S        | 6.8 |
| SR0120539 | 5/4/2016    | ND                | 7.1      | 4.7               | ND                | 5.9     | 71                     | ND               | ND     | 17      | 0.021  | ND    | 9.6       | ND        | 2.3       | 9.4    | ND       | ND    | 0.1          | ND        | 153.5        | S        | 6.6 |
| SR0120545 | 5/5/2016    | ND                | 9.7      | 4.2               | ND                | ND      | 45                     | ND               | ND     | 14      | ND     | 0.16  | 11        | ND        | 3.4       | 11     | ND       | ND    | ND           | ND        | 156.7        | S        | 6.6 |
| SR0120547 | 5/5/2016    | ND                | 3.6      | ND                | ND                | ND      | 120                    | ND               | ND     | 17      | ND     | 0.15  | 5.5       | 0.23      | 1.3       | 11     | ND       | ND    | 0.53         | 0.26      | 122.2        | S        | 7.9 |
| SR0120549 | 5/5/2016    | ND                | 3.7      | ND                | ND                | ND      | 24                     | ND               | ND     | 17      | ND     | 0.2   | 7         | 0.16      | 1.3       | 13     | ND       | 0.035 | 0.79         | 0.17      | 139.3        | S        | 7.3 |
| SR0120559 | 5/2/2016    | ND                | 2.9      | ND                | ND                | ND      | 67                     | 0.0039           | ND     | 18      | ND     | ND    | 6.6       | 0.11      | ND        | 15     | ND       | ND    | 0.18         | 0.11      | 132.4        | S        | 7.7 |
| SR0120560 | 5/2/2016    | 0.19              | 5.6      | ND                | ND                | ND      | 180                    | 0.0042           | ND     | 1.6     | ND     | 0.071 | 0.7       | 0.073     | ND        | 70     | ND       | ND    | 0.35         | 0.07      | 200.4        | S        | 7.6 |
| SR0120561 | 5/2/2016    | 0.43              | 4.6      | ND                | ND                | ND      | 140                    | 0.0032           | ND     | 23      | ND     | 0.1   | 9.2       | 0.53      | 2.3       | 19     | ND       | ND    | 1            | 0.52      | 181.4        | S        | 7.5 |
| SR0120564 | 5/3/2016    | ND                | 8        | 5.4               | ND                | 20      | 140                    | ND               | ND     | 26      | ND     | ND    | 9.4       | ND        | 6.1       | 11     | ND       | ND    | ND           | ND        | 185.4        | S        | 6.8 |
| SR0120566 | 5/5/2016    | ND                | 3.5      | 0.21              | ND                | ND      | ND                     | ND               | ND     | 14      | ND     | 0.24  | 7.7       | 0.19      | 1.5       | 10     | ND       | 0.043 | 0.72         | 0.18      | 114.6        | S        | 7.5 |
| SR0120631 | 5/3/2016    | ND                | 3.5      | 0.2               | ND                | ND      | 130                    | ND               | ND     | 18      | ND     | 0.17  | 8.8       | 0.17      | 2.2       | 20     | ND       | ND    | 1.1          | 0.18      | 169.8        | S        | 7.6 |
| SR0120633 | 5/3/2016    | ND                | 3.3      | ND                | ND                | ND      | 95                     | ND               | ND     | 16      | ND     | ND    | 6.4       | 0.18      | 1.5       | 16     | ND       | ND    | 0.18         | 0.17      | 142          | S        | 7.4 |
| SR0120634 | 5/4/2016    | ND                | 3.5      | ND                | ND                | ND      | 79                     | ND               | ND     | 12      | ND     | 0.097 | 6.8       | ND        | 1.9       | 8.5    | ND       | ND    | 0.31         | ND        | 104.9        | S        | 7.2 |
| SR0120637 | 5/4/2016    | ND                | 9.9      | ND                | ND                | 11      | 55                     | 0.0051           | ND     | 27      | ND     | ND    | 18        | 0.14      | 3.3       | 9.8    | ND       | 0.12  | 0.14         | 0.13      | 227          | S        | 7.6 |
| SR0120640 | 5/2/2016    | 0.55              | 5.6      | ND                | ND                | ND      | 150                    | 0.0063           | ND     | 20      | ND     | 0.083 | 8.8       | 0.78      | 2.8       | 20     | ND       | ND    | 2.2          | 0.8       | 212          | S        | 7.4 |
| SR0120642 | 5/4/2016    | ND                | 7.1      | 0.08              | ND                | ND      | 120                    | ND               | ND     | 13      | ND     | ND    | 9.1       | ND        | 2.4       | 9.2    | ND       | ND    | 0.32         | 0.018     | 121.5        | U        | 7.1 |
| SR0120644 | 5/3/2016    | ND                | 9        | 0.074             | ND                | 11      | 130                    | 0.0059           | ND     | 28      | ND     | ND    | 15        | 0.18      | 4.1       | 9.8    | ND       | ND    | 0.24         | 0.18      | 204.4        | S        | 7.4 |
| SR0120646 | 5/3/2016    | 0.065             | 5        | ND                | ND                | 5.9     | 120                    | 0.0043           | ND     | 19      | ND     | ND    | 7.5       | 0.31      | 2.8       | 14     | ND       | ND    | 0.11         | 0.29      | 150.8        | S        | 7.3 |
| SR0120647 | 5/5/2016    | ND                | 3.4      | 0.059             | ND                | ND      | 56                     | ND               | ND     | 17      | ND     | 0.22  | 7.3       | 0.2       | 1.5       | 13     | ND       | 0.054 | 0.44         | 0.2       | 134.6        | S        | 7.3 |
| SR0120939 | 5/3/2016    | ND                | 3.6      | ND                | ND                | ND      | 110                    | ND               | ND     | 17      | ND     | 0.17  | 6.8       | 0.21      | 1.9       | 11     | ND       | ND    | 0.67         | 0.2       | 118.7        | S        | 7.6 |
| SR0121035 | 5/2/2016    | ND                | 2.4      | 0.17              | ND                | ND      | 36                     | ND               | ND     | 6.9     | 0.026  | ND    | 3.6       | ND        | 1.1       | 8.3    | ND       | ND    | 0.21         | ND        | 69.5         | S        | 7.1 |
| SR0137778 | 5/5/2016    | ND                | 3.5      | 0.34              | ND                | ND      | 29                     | ND               | ND     | 12      | 0.023  | 0.49  | 5.3       | 0.16      | ND        | 8.5    | ND       | 0.39  | 0.93         | 0.17      | 100.5        | S        | 7.1 |
| SR0163421 | 5/2/2016    | ND                | 2.6      | ND                | ND                | ND      | 100                    | 0.0037           | ND     | 17      | ND     | ND    | 7.3       | 0.057     | 2.1       | 12     | ND       | ND    | 0.28         | 0.055     | 128.9        | S        | 7.5 |
| SR0185993 | 5/3/2016    | ND                | 3        | ND                | ND                | ND      | 110                    | ND               | ND     | 19      | ND     | 0.19  | 7.5       | 0.14      | 1.3       | 12     | ND       | ND    | 0.27         | 0.13      | 130.9        | S        | 7.6 |
| SR0198809 | 5/2/2016    | ND                | 3.8      | ND                | ND                | ND      | 140                    | ND               | ND     | 20      | ND     | ND    | 9.7       | 0.14      | ND        | 11     | ND       | ND    | 0.61         | 0.14      | 151.8        | S        | 7.6 |

Units of measurement = Parts Per Million (mg/L), except for bacteria, conductivity, and pH  
ND = Not detected at the specified laboratory detection limit  
U = Unsatisfactory (bacteria are present in the sample)  
S = Satisfactory  
\*\*MCL = Maximum Contamination Level  
1 = Sites with a “T” indicate a water treatment system was present.

\*Please refer to the “Water Quality and Abbreviation and Notes” page for information about the terms used on this table.

TABLE 2: LRI Landfill Residential Well Sampling Program – Spring 2016 Water Quality VOC Results

|                             | MCL  | SR0120533 | SR0120539 | SR0120634 | SR0120637 | SR0120642 | SR0120529 | SR0120545 | SR0120547 | SR0120549 | SR0120566 | SR0120647 | SR0137778 |
|-----------------------------|------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 1,1,1,2-Tetrachloroethane   | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| 1,1,1-Trichloroethane       | 0.20 | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| 1,1,2,2-Tetrachloroethane   | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| 1,1,2-Trichloroethane       | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| 1,1-Dichloroethane          | 1.0  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| 1,1-Dichloroethene          | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| 1,1-Dichloropropene         | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| 1,2,3-Trichlorobenzene      | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| 1,2,3-Trichloropropane      | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| 1,2,4-Trichlorobenzene      | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| 1,2,4-Trimethylbenzene      | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| 1,2-Dibromo-3-chloropropane | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| 1,2-Dichlorobenzene         | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| 1,2-Dichloroethane          | 0.5  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| 1,2-Dichloropropane         | 0.6  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| 1,3,5-Trimethylbenzene      | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| 1,3-Dichlorobenzene         | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| 1,3-Dichloropropane         | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| 1,4-Dichlorobenzene         | 4.0  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| 2,2-Dichloropropane         | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| 2-Butanone                  | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| 2-Chloroethylvinylether     | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| 2-Chlorotoluene             | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| 2-Hexanone                  | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| 4-Chlorotoluene             | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| Acetone                     | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| Benzene                     | 1.0  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| Bromobenzene                | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| Bromochloromethane          | 0.3  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| Bromoform                   | 5.0  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| Bromomethane                | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| Carbon Disulfide            | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| Carbon Tetrachloride        | 0.3  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| CFC-11                      | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| CFC-12                      | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| Chlorobenzene               | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| Chloroethane                | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| Chloroform                  | 7.0  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| Chloromethane               | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| Cis-1,2-Dichloroethene      | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| Cis-1,3-Dichloropropene     | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| Dibromochloromethane        | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| Dibromomethane              | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| Dichlorobromomethane        | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| Ethylbenzene                | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| Ethylene dibromide          | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| Hexachlorobutadiene         | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| Isopropylbenzene            | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| m, p-Xylene                 | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| Methyl Iodide               | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| Methyl Isobutyl Ketone      | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| Methyl t-Butyl Ether        | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| Methylene Chloride          | 5.0  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| Naphthalene                 | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| n-Butylbenzene              | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| n-Propylbenzene             | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| o-Xylene                    | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| p-Isopropyltoluene          | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| sec-Butylbenzene            | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| Styrene                     | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| tert-Butylbenzene           | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| Tetrachloroethene           | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| Toluene                     | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| Trans-1,2-Dichloroethene    | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| Trans-1,3-Dichloropropene   | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| Trichloroethene             | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| Vinyl Acetate               | ---  | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |
| Vinyl Chloride              | 0.02 | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        | ND        |

Units of measurement = Parts per Billion (ug/L)

ND = Not detected at the specified laboratory detection limit  
MCL = Maximum Contamination Level

TABLE 3: LRI Landfill Residential Well Sampling Program – Spring 2015 Water Quality Duplicate Results

| Chemical or Analyte*-----> |             |                   |          |         |         |         |     |                  |        |         |        |      |           |           |           |        |          |       |              |           |              |                 |     |
|----------------------------|-------------|-------------------|----------|---------|---------|---------|-----|------------------|--------|---------|--------|------|-----------|-----------|-----------|--------|----------|-------|--------------|-----------|--------------|-----------------|-----|
|                            |             | General Chemistry |          |         |         |         |     | Dissolved Metals |        |         |        |      |           |           |           |        |          |       | Total Metals |           | Cond/Bact/pH |                 |     |
| Site                       | Sample Date | Ammonia           | Chloride | Nitrate | Nitrite | Sulfate | TDS | Arsenic          | Barium | Calcium | Copper | Iron | Magnesium | Manganese | Potassium | Sodium | Vanadium | Zinc  | Iron         | Manganese | Conductivity | Bacteriological | pH  |
| MCL**                      |             |                   | 250      | 10.0    | 1.0     | 250     | 500 | 0.01             | 2.0    |         | 1.3    |      |           |           |           |        |          | 5.0   | 0.3          | 0.05      | 750          |                 |     |
| SR0120529                  | 5/5/2016    | ND                | 3.8      | 0.14    | ND      | ND      | 100 | ND               | ND     | 15      | ND     | 0.98 | 6.8       | 0.17      | ND        | 9.5    | ND       | 0.034 | 1.5          | 0.18      | 123.7        | S               | 7.5 |
| SR0120529D                 | 5/5/2016    | ND                | 3.6      | 0.1     | ND      | ND      | 110 | ND               | ND     | 15      | ND     | 0.75 | 6.7       | 0.16      | 1.3       | 9.5    | ND       | 0.047 | 1.3          | 0.19      |              |                 |     |
| SR0120539                  | 5/4/2016    | ND                | 7.1      | 4.7     | ND      | 5.9     | 71  | ND               | ND     | 17      | 0.021  | ND   | 9.6       | ND        | 2.3       | 9.4    | ND       | ND    | 0.1          | ND        | 153.5        | S               | 6.6 |
| SR0120539D                 | 5/4/2016    | ND                | 6.3      | 4.3     | ND      | 5.9     | 65  | ND               | ND     | 17      | 0.022  | ND   | 9.7       | ND        | 2.3       | 9.4    | ND       | ND    | 0.13         | ND        |              |                 |     |
| SR0120561                  | 5/2/2016    | 0.43              | 4.6      | ND      | ND      | ND      | 140 | 0.0032           | ND     | 23      | ND     | 0.1  | 9.2       | 0.53      | 2.3       | 19     | ND       | ND    | 1            | 0.52      | 181.4        | S               | 7.5 |
| SR0120561D                 | 5/2/2016    | 0.43              | 4.4      | ND      | ND      | ND      | 140 | 0.0033           | ND     | 25      | ND     | 0.14 | 9.2       | 0.52      | 2.2       | 18     | ND       | ND    | 1            | 0.54      |              |                 |     |
| SR0120633                  | 5/3/2016    | ND                | 3.3      | ND      | ND      | ND      | 95  | ND               | ND     | 16      | ND     | ND   | 6.4       | 0.18      | 1.5       | 16     | ND       | ND    | 0.18         | 0.17      | 142          | S               | 7.4 |
| SR0120633D                 | 5/3/2016    | ND                | 2.7      | ND      | ND      | ND      | 85  | ND               | ND     | 19      | ND     | ND   | 6.4       | 0.17      | 1.4       | 15     | ND       | ND    | 0.22         | 0.17      |              |                 |     |

Units of measurement = Parts Per Million (mg/L)

ND = Not detected at the specified laboratory detection limit

\*\*MCL = Maximum Contamination Level

MCL exceedences for Iron and Manganese do not pose a health risk.

\*Please refer to the “Water Quality and Abbreviation and Notes” page for information about the terms used on this table.

TABLE 4: LRI Landfill Residential Well Sampling Program – Spring 2016 Water Quality VOC Duplicate Results

|                             | MCL  | SR0120539 | SR0120539D | SR0120529 | SR0120529D |
|-----------------------------|------|-----------|------------|-----------|------------|
| 1,1,1,2-Tetrachloroethane   | ---  | ND        | ND         | ND        | ND         |
| 1,1,1-Trichloroethane       | 0.20 | ND        | ND         | ND        | ND         |
| 1,1,2,2-Tetrachloroethane   | ---  | ND        | ND         | ND        | ND         |
| 1,1,2-Trichloroethane       | ---  | ND        | ND         | ND        | ND         |
| 1,1-Dichloroethane          | 1.0  | ND        | ND         | ND        | ND         |
| 1,1-Dichloroethene          | ---  | ND        | ND         | ND        | ND         |
| 1,1-Dichloropropene         | ---  | ND        | ND         | ND        | ND         |
| 1,2,3-Trichlorobenzene      | ---  | ND        | ND         | ND        | ND         |
| 1,2,3-Trichloropropane      | ---  | ND        | ND         | ND        | ND         |
| 1,2,4-Trichlorobenzene      | ---  | ND        | ND         | ND        | ND         |
| 1,2,4-Trimethylbenzene      | ---  | ND        | ND         | ND        | ND         |
| 1,2-Dibromo-3-chloropropane | ---  | ND        | ND         | ND        | ND         |
| 1,2-Dichlorobenzene         | ---  | ND        | ND         | ND        | ND         |
| 1,2-Dichloroethane          | 0.5  | ND        | ND         | ND        | ND         |
| 1,2-Dichloropropane         | 0.6  | ND        | ND         | ND        | ND         |
| 1,3,5-Trimethylbenzene      | ---  | ND        | ND         | ND        | ND         |
| 1,3-Dichlorobenzene         | ---  | ND        | ND         | ND        | ND         |
| 1,3-Dichloropropane         | ---  | ND        | ND         | ND        | ND         |
| 1,4-Dichlorobenzene         | 4.0  | ND        | ND         | ND        | ND         |
| 2,2-Dichloropropane         | ---  | ND        | ND         | ND        | ND         |
| 2-Butanone                  | ---  | ND        | ND         | ND        | ND         |
| 2-Chloroethylvinylether     | ---  | ND        | ND         | ND        | ND         |
| 2-Chlorotoluene             | ---  | ND        | ND         | ND        | ND         |
| 2-Hexanone                  | ---  | ND        | ND         | ND        | ND         |
| 4-Chlorotoluene             | ---  | ND        | ND         | ND        | ND         |
| Acetone                     | ---  | ND        | ND         | ND        | ND         |
| Benzene                     | 1.0  | ND        | ND         | ND        | ND         |
| Bromobenzene                | ---  | ND        | ND         | ND        | ND         |
| Bromochloromethane          | 0.3  | ND        | ND         | ND        | ND         |
| Bromoform                   | 5.0  | ND        | ND         | ND        | ND         |
| Bromomethane                | ---  | ND        | ND         | ND        | ND         |
| Carbon Disulfide            | ---  | ND        | ND         | ND        | ND         |
| Carbon Tetrachloride        | 0.3  | ND        | ND         | ND        | ND         |
| CFC-11                      | ---  | ND        | ND         | ND        | ND         |
| CFC-12                      | ---  | ND        | ND         | ND        | ND         |
| Chlorobenzene               | ---  | ND        | ND         | ND        | ND         |
| Chloroethane                | ---  | ND        | ND         | ND        | ND         |
| Chloroform                  | 7.0  | ND        | ND         | ND        | ND         |
| Chloromethane               | ---  | ND        | ND         | ND        | ND         |
| Cis-1,2-Dichloroethene      | ---  | ND        | ND         | ND        | ND         |
| Cis-1,3-Dichloropropene     | ---  | ND        | ND         | ND        | ND         |
| Dibromochloromethane        | ---  | ND        | ND         | ND        | ND         |
| Dibromomethane              | ---  | ND        | ND         | ND        | ND         |
| Dichlorobromomethane        | ---  | ND        | ND         | ND        | ND         |
| Ethylbenzene                | ---  | ND        | ND         | ND        | ND         |
| Ethylene dibromide          | ---  | ND        | ND         | ND        | ND         |
| Hexachlorobutadiene         | ---  | ND        | ND         | ND        | ND         |
| Isopropylbenzene            | ---  | ND        | ND         | ND        | ND         |
| m, p-Xylene                 | ---  | ND        | ND         | ND        | ND         |
| Methyl Iodide               | ---  | ND        | ND         | ND        | ND         |
| Methyl Isobutyl Ketone      | ---  | ND        | ND         | ND        | ND         |
| Methyl t-Butyl Ether        | ---  | ND        | ND         | ND        | ND         |
| Methylene Chloride          | 5.0  | ND        | ND         | ND        | ND         |
| Naphthalene                 | ---  | ND        | ND         | ND        | ND         |
| n-Butylbenzene              | ---  | ND        | ND         | ND        | ND         |
| n-Propylbenzene             | ---  | ND        | ND         | ND        | ND         |
| o-Xylene                    | ---  | ND        | ND         | ND        | ND         |
| p-Isopropyltoluene          | ---  | ND        | ND         | ND        | ND         |
| sec-Butylbenzene            | ---  | ND        | ND         | ND        | ND         |
| Styrene                     | ---  | ND        | ND         | ND        | ND         |
| tert-Butylbenzene           | ---  | ND        | ND         | ND        | ND         |
| Tetrachloroethene           | ---  | ND        | ND         | ND        | ND         |
| Toluene                     | ---  | ND        | ND         | ND        | ND         |
| Trans-1,2-Dichloroethene    | ---  | ND        | ND         | ND        | ND         |
| Trans-1,3-Dichloropropene   | ---  | ND        | ND         | ND        | ND         |
| Trichloroethene             | ---  | ND        | ND         | ND        | ND         |
| Vinyl Acetate               | ---  | ND        | ND         | ND        | ND         |
| Vinyl Chloride              | 0.02 | ND        | ND         | ND        | ND         |

Units of measurement = Parts per Billion (ug/L)

ND = Not detected at the specified laboratory detection limit

MCL = Maximum Contamination Level

## Water Quality Abbreviations and Notes:

**Analyte:** The chemical or metal tested for in the water sample.

**Result:** The level of the chemical or mineral detected by the laboratory in this water sample.

**ND:** Non-Detect, the chemical or metal was not detected in this water sample.

**Unit:** The unit of measure reported by the laboratory.

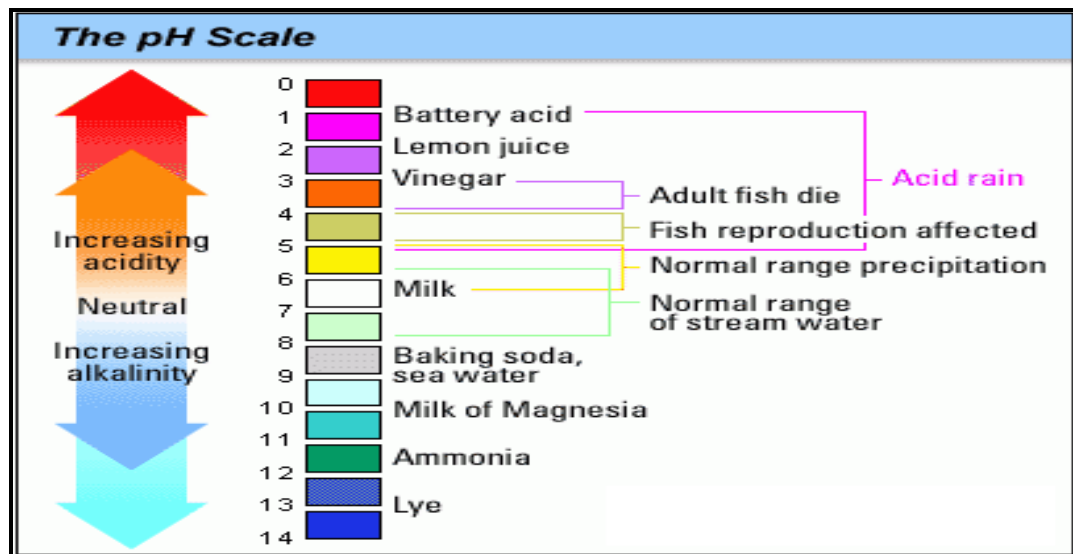
**mg/l:** milligrams per liter, or 1 part per million.

**MCL:** "Maximum Contaminant Level". The water quality standard established by state or federal regulation.

**#/100ml:** The number of bacteria colonies detected in 100 milliliters of water.  
Note: An MCL of "0.00" means that there should be no bacteria detected in the water sample.

**uS/cm:** microSiemens per centimeter, a measurement of the ability of the water to conduct an electrical charge (sometimes reported as microMhos). Used to help determine the presence of some chemical ions.

**pH:** A numerical measure of the level of acidity or alkalinity of the water. See the table below.



**ppb:** Parts per billion often expressed as micrograms per liter (ug/L)

**Unit:** The unit of measure reported by the laboratory.

**#/100ml:** Unit of measure for *Bacteria* test, the number of bacteria colonies detected in 100 milliliters of water. Note: An MCL of "0/100" means that there should be zero bacteria detected in the 100 milliliter water sample.

**(---):** The Environmental Protection Agency and/or the Centers for Disease Control and Prevention have not established a health-risk based maximum contaminant level (MCL) for this chemical, metal, or property.

## APPENDIX A

# Sampling for Volatile Organic Compounds

## LRI Drinking Water Well Sampling Program

In 2007, several program participants and members of the Graham Land Use Advisory Commission asked why 'volatile organic compounds' (VOC) had not been included in the original LRI Landfill residential drinking water sampling program. They asked to have the sampling program modified to include testing for these volatile organic compounds. Because of the request and inquiries, the sampling program was modified to include a limited suite of approximately 68 VOCs for analysis.

The program modification included a provision to test each participating well once every five-year period for VOCs. This modification began during the Fall 2007 sampling event with the testing of nine residential wells for VOCs. Twelve residential wells were sampled and tested for VOCs during the Spring 2016 sampling event. To date, 37 Spring Participant wells have been sampled for VOC's and 49 Fall Participant wells, for a total of 86 wells tested for VOCs.

### **Where do VOCs come from?**

Common artificial sources of VOCs are many and varied, but can include paint thinners, dry cleaning solvents, and some constituents of petroleum-based fuels (e.g., gasoline and natural gas). Landfills, through the anaerobic digestion of waste generate methane gas, which is also considered a VOC.