OhioEPA

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Ted Strickland, Governor
Lee Fisher, Lieutenant Governor
Chris Korleski, Director

Re: Statistical Report of Ground Water Quality
Wapakoneta Landfill, Auglaize County

June 16, 2008

Mr. Rex Katterheinrich
Safety Service Director
P. O. Box 269
Wapakoneta, Ohio 45895

Dear Mr. Katterheinrich:

The Ohio Environmental Protection Agency (Ohio EPA) completed a review of the statistical report of ground water quality for the January 2008, sampling event for the Wapakoneta Landfill. The submittal was dated March 7, 2008, and received March 7, 2008. Following are Ohio EPA comments relating to the review.

VIOLATIONS

1. **The City of Wapakoneta is in violation of Ohio Administrative Code (OAC) Rule 3745-27-10 (C)(3) which requires that the permittee establish background ground water quality by analyzing samples from hydraulically upgradient wells. To return to compliance, the owner/operator needs to review the data and determine which well or wells is/are upgradient or install background wells for all the zones and collect a sufficient amount of samples to establish background ground water quality. Comment 1a below is a continuation of a violation.**

   a. In the Statistical Procedures and Methodologies section on page 1 of the memorandum discussing "Statistical Analysis of Detection Monitoring Data Collected During the May 2007 Groundwater Sampling Event at the Wapakoneta Sanitary Landfill; WAP042.100.0010.DOC" dated March 7, 2008, and included in the submittal, the owner/operator states, "Based on the geologic, hydrogeologic, and the geochemical conditions at the facility, statistical evaluations completed for shallow significant saturated zone and uppermost aquifer monitoring wells were generally completed using "intra-well" procedures. However, monitoring well MW-10 was evaluated using "inter-well" procedures upon the request of Ohio EPA." Similar statements were made in the reports for November 2000, May 2001, November 2001, May 2002, November 2002, May 2003, November 2003, May 2004, November 2004, May 2005, November 2005, May 2006, November 2006, and May 2007 sampling events. At those times Ohio EPA responded in similar fashion to the following:

   If the owner/operator indicates that it cannot "determine which wells are upgradient" per OAC Rule 3745-27-10 (C)(4)(a), effective March 1, 1990, it may choose a well that is not upgradient which is "as representative or more representative than that provided by upgradient wells." However, it must first prove that well is not affected by the landfill.

b. At the bottom of the first page of the submittal and continuing on to the second page the owner/operator states, "Based on site re-characterization and Ohio EPA regulations, an inter-well statistical evaluation of groundwater quality is currently being performed to identify statistically significant differences in upgradient and downgradient groundwater quality for both the uppermost aquifer and significant zone of saturation. Statistical evaluations will be performed comparing data collected from the newly installed and identified upgradient wells and also comparing the historic data collected from downgradient monitoring wells to identify potential impacts to groundwater quality downgradient of the landfill. The results of this evaluation will be submitted to Ohio EPA in the near future." The owner/operator, therefore, has yet to determine background wells, let alone collect background data for some of the wells. Background needs to be established and background data needs to be collected.

2. **The City of Wapakoneta continues to be in violation of Ohio Administrative Code (OAC) Rule 3745-27-10 (C)(1) which requires that the sampling and analysis procedures be consistent and protective of human health and the environment and be designed to ensure results which are an accurate representation of ground water quality. To return to compliance, the owner/operator needs to review the data and perform interwell statistical analyses or utilize some other means to prove that the significant zone of saturation wells are not affected, prior to using intrawell methods.**

On page 4 of the submittal, in the section labeled, "Statistical Evaluation" the owner/operator states, "No statistical significance was identified for any monitoring well/parameter combination with the exception of specific conductance in monitoring well SW-7 and specific conductance and total dissolved solids (TDS) in monitoring well MW-10."

The determination that only specific conductance was determined to be a statistical exceedance in SW-7 is likely a function of the intrawell statistical methods which do not detect the exceedances in wells which are already contaminated. SW-7 has been known to be affected for at least the past 12 years. The latest analytical results indicate that vinyl chloride was again detected. This time it was detected at 12.5 □g/L in well SW-7. Monitoring well SW-1, for example, displays high levels of chloride, sodium, total dissolved solids and specific conductance when compared to some other significant saturated zone wells. Below is a table of analytical results in several wells. The table is based on the January 2008, event data and consists of: affected well SW-7, possibly unaffected well SW-13, possibly affected wells SW-1, SW-8 and SW-4. Wells SW-5 and SW-6 are now considered by the owner/operator to be in the uppermost aquifer system.

ANALYTE	SW-1	SW-8	SW-7	SW-4	SW-13
pH	6.92	5.65	7.16	5.58	7.26
Specific Conductance	1330	1580	2830	900	999
TDS mg/L	872	1030	1710	558	482
TOC mg/L	3.5	5.1	5.2	1.4	2.0

ANALYTE	SW-1	SW-8	SW-7	SW-4	SW-13
Sodium mg/L	84.8	78.2	368	28.1	10.3
Calcium mg/L	121	178	162	120	101
Magnesium mg/L	73.9	73	81.7	38	40.4
Potassium mg/L	3.3	4.7	6.2	2.7	1.9
Chloride mg/L	126	165	613	59	37
Sulfate mg/L	131	143	204	53	53
Alkalinity mg/L	495	554	539	392	339
Iron mg/L	0.27	4.43	3.31	<0.05	1.42
Manganese mg/L	0.29	0.10	0.15	0.04	0.13
Nickel mg/L	0.04	<0.01	<0.01	<0.01	<0.01
Ammonia mg/L	0.4	0.22	0.6	0.4	<0.10
COD mg/L	<10	12	19	<10	<10

Significant saturated zone wells SW-1, SW-4, and SW-8 may be affected since concentrations of analytes in each of these wells display exceedances compared to the concentrations in well SW-13. The use of intrawell statistical techniques without first determining if the well is affected by the landfill would not indicate the presence of contaminants in a contaminated well. The use of intrawell statistical methods, on analytical results from a well that was contaminated before the statistical methods are applied, is not protective of human health and the environment and is not designed to provide an accurate representation of ground water quality. It should be noted, however, that the pH in wells SW-4 and SW-8 do display exceedances while using intrawell methods. The low pH values exceed the lower limits on the control charts when a two tailed procedure is assumed.

3. **The City of Wapakoneta continues to be in violation of OAC Rule 3745-27-10 (C)(3), which requires that the permittee establish background ground water quality by analyzing samples from hydraulically upgradient wells, and OAC Rule 3745-27-10 (C)(8), which requires that the permittee determine if there is a statistically significant increase (or decrease in the case of pH) by comparing the downgradient well data to the background data. In order to return to compliance the owner/operator needs to perform interwell statistical analyses until it can be proven that the downgradient wells are not affected.**

In Appendix C of the submittal the owner/operator presents statistical analyses for significant zone of saturation wells SW-1, SW-4, SW-7, and SW-8 and uppermost aquifer system wells SW-5, SW-6, MW-6R, MW-5, MW-8 and MW-10. All of these wells, except MW-10 utilized intrawell methods. Since the exception in paragraph (C)(4) does not apply, in order to meet the requirements of OAC Rule 3745-27-10 (C)(8) the owner/operator needs to statistically compare the downgradient well results to the background (upgradient) well results.

This was not done for the significant zone of saturation wells, or for the appropriate uppermost aquifer system wells with the exception of MW-10. (Well MW-6R is the designated upgradient well for the uppermost aquifer system and not statistical analyses are required.) The owner/operator should understand that intrawell methods should not be utilized until it can be shown that the wells are not affected by leachate or leachate-derived constituents.

4. **The City of Wapakoneta continues to be in violation of the requirements of OAC Rule 3745-27-10 (C)(7), which requires that the permittee determine if there is a statistically significant increase (or decrease in the case of pH) by comparing the downgradient well data to the background data. The City is in violation of this rule by not performing the appropriate statistical analysis. To return to compliance the owner/operator needs to utilize a two-tailed test for all current statistical analyses for pH and for all those performed in the future.**

   In the statistical analysis section of the submittal the owner/operator provides parametric prediction interval analysis using interwell comparisons for pH for well MW-10. The provided information indicates the prediction interval is 0 to 2.06111 (logged value). This is a one-tailed test. OAC Rule 3745-27-10 (C)(8) indicates that the owner/operator shall determine whether or not there is a statistically significant increase (or decrease in the case of pH). This requires a two-tailed test and a lower prediction limit needs to be determined. In addition, the Shewhart-CUSUM Control Chart analysis for pH in wells SW-1, SW-4, SW-5, SW-6, SW-7, SW-8, MW-5, MW-6R, and MW-8 utilize one-tailed procedures. (Note that well MW-6R, being an upgradient well does not require statistical analyses.)

5. **The City of Wapakoneta continues to be in violation of OAC Rule 3745-27-10 (C)(2) which requires that ground-water elevations be measured in each well immediately prior to purging and sampling. The owner/operator must ensure that ground water elevations are measured immediately prior to purging and sampling for all future events.**

   In the first full paragraph on page 4 of the submittal the owner/operator states, "Groundwater elevation data was collected on January 7, 2008, to evaluate hydrogeologic conditions at the facility." In the first paragraph on the first page of the submittal the owner/operator states, "On behalf of the City of Wapakoneta (City), Hull & Associates, Inc. (Hull) has developed this report to provide Ohio EPA with documentation, statistical analyses, and an evaluation of data collected during the January 8-9 and 17, 2008, groundwater sampling activities at the Wapakoneta Sanitary Landfill (facility) as part of the detection and assessment monitoring programs in accordance with Ohio Administrative Code (OAC) 3745-27-10 (effective March 1, 1990)." The field data sheets corroborate these statements in that some wells were purged on January 7 or 8, 2008 and some wells were purged on January 16, 2008. In addition some of the wells were sampled on January 8 or 9, 2008, and some wells were sampled on January 17, 2008. As stated by the owner/operator ground water levels were measured on January 7, 2008, but some of the wells were not purged until January 16, 2008 and not sampled until January 17, 2008.

6. **The City of Wapakoneta is in violation of OAC Rule 3745-27-10 (D)(4) which requires that after the initial year all monitoring wells be sampled at least semi-annually. The owner/operator needs to ensure that the required sampling events occur at least semiannually.**

The current submittal discusses the sampling event which occurred between January 7, 2008, and January 17, 2008. The previous sampling event occurred May 14 through 16, 2007. The time between the May 2007, event and the January 2008, event is 34 weeks (over 35 weeks for the January 17 portion of the event.). Semiannual events would be expected to occur about every 26 weeks. The January event occurred about two (2) months after the expected semiannual date.

7. **The City of Wapakoneta is in violation of OAC Rule 3745-27-10 (C)(1) which requires that procedures be used to produce data which are representative of the ground water of the site and that the sampling and analysis procedures employed in the ground water monitoring program be documented in a written plan. The owner/operator needs to ensure that representative samples are collected, and that the procedures used for collecting samples are documented in the plan.**

A review of the field data sheets for the wells sampled at the site indicates that ground water field parameter values did not display stable conditions or displayed conditions which were not consistent with purge data. In wells which were not purged dry, there are typically seven (7) readings for field parameters: pH, temperature and corrected conductance. These represent readings labeled: initial, 1, 2, 3, 4, 5, and 6/Final. When properly purged, field data from the wells should display consistent results for the last three readings. When compared to each other the last three readings ideally should be within 0.1 S.U. for pH, within 3% for conductance, and within 0.5°C for temperature. Following is a table which shows the differences in pH and conductivity field results for some of the wells. These differences are not documented in the plan. Excessive readings are shown in italics. The data indicate that the wells were not properly purged and the ground water readings were not stable at the time of sampling.

WELL	pH (as a % difference)	COND (as a % difference)
SW-8	***17.59***	9.4
DAW-1	6.56	***10.9***
DAW-2	8.07	***16.6***
MW-6R	2.65	***10.4***
MW-8	***19.38***	***10.4***
MW-10	6.22	***17.7***
SW-7	7.84	***21***
IAW-1	3.96	***26.7***
IAW-3	4.95	***11***
SW-2	1.96	***34***
SAW-4	0.72	***18***
SAW-5	6.43	***11.7***
SW-13	0.28	***10.4***

The field data sheets, however, indicate that the wells were purged one day and sampled the next. It is possible that the owner/operator recorded stability in samples 3, 4, and 5. The wells were again field sampled the next day represented by sample 6/Final. If this is the case the owner/operator is still in violation of OAC Rule 3745-27-10 (C)(1) because the chemistry clearly changed from one day to the next and the samples sent to the laboratory are not representative of the ground water of the site and the sampling and analysis procedures employed in the ground water monitoring program be documented in a written plan.

8. **The City of Wapakoneta is in violation of OAC Rule 3745-27-10 (B)(3)(e) which requires that the monitoring wells, piezometers, and other measurement, sampling, and analytical devices be operated and maintained to perform to design specifications. Wells which display siltation and fill-up need to be cleaned, redeveloped or replaced in order to provide representative samples.**

The owner/operator had previously indicated that the wells had been surveyed for location and elevation and that the well total depths were measured. The total depths were recorded on the field data sheets as "Total Depth (from top of casing)". Annually the owner/operator measures the total depth (TD) of each well and records this information on the field data sheet as "Measured Total Depth (From TOC)". A review of the field data sheets indicates that several wells indicate a significant change in total depth. In some cases the well TDs were shallower than the historical value and in other cases the TDs were deeper than the historical value. These changes could be due to fill-up of the well by silt or other damage. Following is a table indicating significant changes in TD values at some of the wells:

WELL	Total Depth Difference (+ is deeper, - is shallower)
SW-5	+0.89'
SW-8	+0.9'
P-1	+1.32'
DAW-1	-0.58'
DAW-2	+0.5'
DAW-3	+0.5'
MW-5	-2.68'
MW-8	+2'
MW-10	+0.97'
IAW-3	+0.47'
IAW-4	-26.7'
SW-2	-0.87'
SAW-5	-0.54 (3' screen)
SW-3R	-0.76' (5' screen)
AW-9	+2.98'
AW-7	-6.79' (5' screen)

9. **The owner/operator is in violation of OAC Rule 3745-27-10 (C)(3), which requires that the owner/operator establish background ground water quality by analyzing samples from upgradient wells unless OAC Rule 3745-27-10 (C)(4) applies; OAC Rule 3745-27-10 (C)(4), which requires that background can be determined from wells that are not upgradient if upgradient positions cannot be determined and if other wells will provide data which is as representative or more representative than that provided by upgradient wells; and OAC Rule 3745-27-10 (C)(7) which requires that the owner/operator determine the presence of statistically significant change from background values. The owner/operator must perform interwell statistical analyses on the uppermost aquifer system well data, including data from the new uppermost aquifer system wells. In addition, the owner/operator must perform interwell statistical analyses on the significant zone of saturation well data to determine the presence of statistically significant change.**

In the last paragraph on page one of the statistical analysis memorandum the owner/operator states, "Based on the geologic, hydrogeologic, and geochemical conditions at the facility, statistical evaluations completed for shallow significant saturated zone and uppermost aquifer monitoring wells were generally completed using "intra-well" procedures. However, monitoring well MW-10 was evaluated using "inter-well" procedures upon the request of Ohio EPA." It has not been shown that wells other than the upgradient well MW-6R will provide data which is as representative or more representative. The exception in OAC Rule 3745-27-10 (C)(4), therefore, does not apply. The owner/operator must determine the presence of statistically significant change utilizing interwell methods using upgradient well MW-6R for all uppermost aquifer system monitoring wells until it can be adequately shown that the exceptions in OAC Rule 3745-27-10 (C)(4) are applicable. In addition, the owner/operator must utilize an appropriate and unaffected upgradient background well to determine the presence of statistically significant change at the significant zone of saturation wells.

10. **The owner/operator is in violation of OAC Rule 3745-27-10 (E)(2)(a), which requires that the assessment plan include provisions for sampling the affected and background wells and analyzing those samples for all leachate or leachate-derived constituents; and OAC Rule 3745-27-10 (E)(3)(d)(iv), which requires that the assessment plan include detailed descriptions of the methods for ground water sample analysis for all leachate or leachate-derived constituents; and OAC Rule 3745-27-10 (E)(4), which requires that the permittee implement the assessment plan. The owner/operator needs to list and analyze for all leachate and leachate-derived parameters.**

In the first full paragraph of page 2 of the submittal the owner/operator states, "Representatives of Hull collected groundwater samples from significant saturated zone detection monitoring wells SW-1, SW-4, and SW-8; uppermost aquifer detection monitoring wells SW-5, SW-6, MW-5, MW-6R, and MW-8; uppermost aquifer detection monitoring wells SW-8, SW-6, MW-5, MW-6R, and MW-8; significant saturated zone assessment monitoring wells SW-2, SW-3R, SAW-4, SAW-5, SAW-9, SW-7, IAW-1, IAW-3, IAW-4, AW-1, AW-7, and AW-9; uppermost aquifer assessment monitoring wells MW-10, DAW-1, DAW-2, and DAW-3; uppermost aquifer piezometer P-1; and investigative wells SW-12 through SW-16." A review of the detection and assessment wells indicates that analyses for most or all of the volatile organic compounds, all of the metals and most of the "general parameters" were not performed for detection and assessment wells SW-2, SW-4, SAW-5, SAW-9, IAW-1, IAW-3, IAW-4, DAW-1, DAW-2, DAW-3.

11. **The City of Wapakoneta continues to be in violation of the requirements of OAC Rule 3745-27-10 (C)(7), which requires that the permittee determine if there is a statistically significant increase (or decrease in the case of pH) by comparing the downgradient well data to the background data. The City is in violation of this rule by not determining the presence of a statistically significant change. The permittee must properly determine the presence of a statistically significant change for all appropriate wells.**

In the last paragraph on page 3 of the statistical memorandum the owner/operator states, "No statistical significance was identified for any monitoring well/parameter combination evaluated for the January 2008 sampling event with the exception of specific conductance in monitoring well SW-7 and specific conductance and TDS in monitoring well MW-10."

Tables C-1 and C-2 provide a summary of statistical evaluations of monitoring wells screened in the significant saturated units and uppermost aquifer system. The tables only note statistical significance for specific conductance in well SW-7 and specific conductance and total dissolved solids in well MW-10. Statistical analyses were performed for pH in other wells, but none were noted as being an exceedance.

A review of the statistical analyses results was performed by Ohio EPA. Wells SW-4, SW-8 and MW-8 all show an apparent significant change exceeding standardized units for pH on Shewhart-CUSUM control charts. The statistical limits on control charts are set at 4.5 and 5.0 units. Additional review and statistical analyses by Ohio EPA indicates that the low pH readings in wells SW-4, SW-8, and MW-8 are, indeed, statistically significant changes. These changes were not determined by the City of Wapakoneta as required by OAC Rule 3745-27-10 (C)(7).

MORE INFORMATION NEEDED TO DETERMINE COMPLIANCE

12. **Compliance with OAC Rule 3745-27-10 (C)(1), which requires the collection of representative samples, and (C)(1)(d), which requires that the sampling and analysis plan include a detailed description of the equipment, procedures, and techniques to be used for performance of field analysis, cannot be determined at this time. Actual stabilization of the field parameters might not be occurring in the monitoring wells during purging. The City of Wapakoneta should do one of the following:**

- **revise the Groundwater Detection Monitoring Sampling and Analysis Plan to document the new field parameter stabilization criteria noted below, followed by field implementation;**

  OR

- **demonstrate to Ohio EPA how the current field parameter stabilization criteria in the Groundwater Detection Monitoring Sampling and Analysis Plan meet the requirements of OAC Rule 3745-27-10(C)(1).**

According to the owner/operator's Revised Groundwater Detection Monitoring Sampling and Analysis Plan (July 2002) page 14, "After groundwater elevations are measured in all monitoring wells and prior to sample collection, all monitoring wells will be purged to remove any stagnant water in the casing and to ensure that a representative groundwater sample is being collected. Purging will be performed using a Teflon bailer or Keck pump. Purge water will be disposed of away from the well head. Hulls SOP No. 3007 included in Appendix C outlines the proper purging procedures and documentation utilized. Note that in all cases, the monitoring well will be purged until the temperature, conductivity, and pH values of the purge water have stabilized." Hull's SOP 3007 could not be found in the plan, however, Hull's SOP 3008(2002rev) provided in Appendix C of the plan states in part, "The temperature, pH, and conductivity will be measured initially, as well as after each well volume is purged. The last two values obtained must be within 10 percent of one another."

Based on review of current technical literature, Ohio EPA now considers the criteria for stabilization of these field parameters to be 0.1 S.U. for pH, 3% for conductivity, 0.5°C for temperature and 10% for turbidity (when turbidity is >10 NTU). Also, a parameter can be considered stable when at least three consecutive readings have stabilized.

13. **Compliance with OAC Rule 3745-27-10(C)(1), which requires that representative samples be collected, cannot be determined at this time. Stagnant samples may have been collected from some wells. The City of Wapakoneta should provide documentation when the wells recharged sufficiently to collect a sample. Wells should be sampled as soon as enough water is available in the well to sample. In addition the owner/operator should not use excessive purge rates. A similar comment was made regarding the 2006 and 2007 sampling events.**

a. Based on review of current technical literature, Ohio EPA considers the criteria for stabilization of these field parameters to be 0.1 S.U. for pH, 3% for conductivity, 0.5°C for temperature and 10% for turbidity (when turbidity is >10 NTU). Also, a parameter can be considered stable when at least three consecutive readings have stabilized.

A review of the field data sheets indicates that all wells were purged and field parameters were determined and recorded by Mike Charchol on either January 7, 2008, January 8, 2008, or January 16, 2008, but were sampled by Mike Charchol the next day (January 8, 2008 January 9, 2008, or January 17, 2008, respectively), whether they could produce enough water immediately following purging or not. It is understood that several wells may recharge slowly and it might take several hours before enough water is available for sampling. However, many of the wells cannot be purged dry even when using the Keck pump operating at 1 gallon per minute, and enough water is available for sampling immediately following purging. OAC Rule 3745-27-10 (C)(1) requires that procedures be used which will produce representative samples. This usually means that samples are collected as soon as enough water is available for sampling. Waiting 18 to 23 hours to sample a well which had recharged immediately following purging, could result in samples of "stagnant" water and would not result in representative samples. Also, as discussed in comment 8 above, the last field sample collected often displayed a significant difference relative to field parameters from the previous two or three samples, which could also be indicative of unrepresentative samples.

b. A review of the field data sheets indicates that wells P-1, SW-3R, SW-15, SW-16, and DAW-3 were purged dry. All, but well SW-16 were purged with a Keck pump at a rate of 1 gallon per minute. The wells were then sampled the next day. OAC Rule 3745-27-10 (C)(1) requires that procedures be used which will produce representative samples. This usually means that samples are collected as soon as enough water is available for sampling. Waiting 18 to 23 hours to sample a well which had recharged shortly after going dry could result in samples of "stagnant" water and would not result in representative samples. There is no information provided by the owner/operator which clearly indicates when these wells recharged with enough water to sample. It can be determined from the data provided that several of the wells which were purged dry were recharging at a rapid rate. Well P-1 was purged of 1.2 volumes at 1 gallon per minute. Well DAW-3 was purged of 1.44 volumes at 1 gallon per minute. Well SW-3R was purged of 1.27 volumes at 1 gallon per minute. Well SW-15 was purged of 1.04 volumes at 1 gallon per minute. Even well SW-16, which was purged with a bailer, was purged of 2.22 volumes. This means that the well potentially recharged as much as 1.22 volumes during purging. Even though these wells were recharging they were sampled the next day. The samples may have been of stagnant water. Several of these wells displayed significant differences in field parameters between the last and final field readings.

In addition, it is clear that the purge rates were excessive in that a slower rate would have produced the full purge volume and the wells would not have purged dry. Excessive purge rates could result in non-representative samples.

14. **Compliance with OAC Rule 3745-27-10(C)(1), which requires that representative samples be collected, cannot be determined at this time. Non-representative samples may have been collected from some wells. The City of Wapakoneta should provide documentation that the procedure utilized for purging and sampling is providing representative samples with low turbidity. Alternatively, the owner/operator may modify their procedure in such a manner as to produce representative samples. This may include purging at a slower rate.**

A review of the field data sheets indicates that wells SW-3R, SW-6, SW-15, MW-5, MW-6R, MW-8, MW-10, P-1, DAW-3, AW-1, AW-9, and AW-7 were purged with a "Keck Pump" at the rate of 1.0 gallon per minute. Other wells were bailed. Pumped wells P-1, DAW-3, SW-3R, and bailed wells SW-15, and SW-16 were purged dry. Sampling occurred on these wells 18 to 23 hours after purging. While some of the bailed wells recorded modest field turbidity values at least one recorded an excessive turbidity reading (100 NTUs at well SW-16). Even after letting the well set for over 20 hours, these wells still produced turbid water. OAC Rule 3745-27-10 (C)(1) requires that procedures be used which will produce representative samples. With these high turbidity readings, it is clear that the procedures utilized may not be producing representative samples. It appears that purging and/or sampling methods are causing an increase in intergranular velocities resulting in the movement of clay and fine silt size fraction materials. Also, while dissolved metals are analyzed from filtered samples, other parameters can be affected by the presence of high turbidity.

15. **Compliance with OAC Rule 3745-27-10(C)(1), which requires that consistent sampling and analysis procedures which provide that representative samples be collected, cannot be determined at this time. The field turbidity results in some cases are significantly different from the laboratory field turbidity results. The City of Wapakoneta should provide documentation that the procedures utilized for purging, sampling, and field and laboratory analyses are consistent and providing representative results. If both sets of results are accurate then it should be determined what is causing the variance between field and laboratory results.**

A review of the field sheets and laboratory analysis indicates that, for those wells where field turbidity and laboratory turbidity were recorded, some turbidity readings differed substantially from the laboratory-derived turbidity results. Following is a table indicating the well, the field turbidity result and the laboratory turbidity result. Only those wells, with both field and laboratory results, are listed.

WELL	FIELD TURBITITY	LABORATORY TURBIDITY
SW-1	1	15.4
SW-4	1	1820
SW-5	10	1440
SW-6	1	13.1
MW-5	74	15
MW-8	3	59
SW-7	24	39.9
SW-12	67	199
SW-14	1	142

WELL	FIELD TURBITITY	LABORATORY TURBIDITY
SW-15	4	269
SW-16	1000	2400

16. **Compliance with OAC Rule 3745-27-10(C)(1), which requires that representative samples be collected, and compliance with OAC Rule 3745-27-10 (C)(5), which requires that the statistical method ensure protection of human health and the environment and compliance with the performance standards stated in the rules, cannot be determined at this time. Comments had been provided by Ohio EPA regarding updating with trends and variations in population, but no reply has been received. The current submittal has made positive changes, but also has provided a lack of clarity. The City of Wapakoneta should perform the trend tests on the appropriate representative population, after outliers have been removed, prior to any updating activities.**

In Ohio EPA comments to the ground water report for the May 2006, sampling event, the agency stated the following for which no owner/operator response has been received regarding this agency comment:

"On page 2 of the statistical memorandum the owner/operator states, 'However, Ohio EPA has requested that prior to updating the background data set, the data be evaluated for small increasing trends that would not be evident when individual data point comparisons are completed'."

In the Ohio EPA comments to the June 2003, sampling event the following comment was made:

A review of the control charts for several analyte-well combinations was performed by Ohio EPA. The background data bases for these combinations appear to have been updated by the owner/operator. The review indicates that updating of these data bases may be inappropriate. Following is a table indicating some of the well-analyte combinations and reasons for not updating and also associated comments. Decreasing trends are based on Mann-Kendall trend analysis and variation in population is based on rank sum.

Well/Analyte	***Reason for not Updating***	***Comments***
SW-1/Total Organic Carbon (TOC)	*Decreasing Trend and Variation in Population*	*Difference in population between first 8 data points and subsequent data.*
SW-4/TOC	*Decreasing Trend and Variation in Population*	*Difference in population between first 16 data points and subsequent data.*
SW-6/TOC	*Decreasing Trend and Variation in Population*	*Difference in population between last 4 data points and prior data.*
SW-7/TOC	*Decreasing Trend and Variation in Population*	*Difference in population between earlier data and subsequent data.*
SW-8/TOC	*Decreasing Trend and Variation in Population*	*Difference in population between first 14 and last 9 data points.*

Well/Analyte	***Reason for not Updating***	***Comments***
MW-5/TOC	*Decreasing Trend*	*Decreasing trend continues until 9 greatest values removed which are 9 earliest values.*
MW-5/pH	*Decreasing Trend and Variation in Population*	*Difference in population between first 12 data points and subsequent data.*
MW-6R/TOC	*Decreasing Trend and Variation in Population*	*Difference in population between first 8 data points and subsequent data.*

In order to continue to meet the requirements of OAC Rule 3745-27-10 (C)(1) and (C)(5) the owner/operator needs to again determine the presence of trends, including downward trends and variations in population. Any anomalies need to result in the data bases not being updated until there are no significant trends and no population differences. The owner/operator may also show that these data bases had been appropriately updated.

For each sampling event, at least since June 2003, the owner/operator appears to have updated background data sets even though decreasing trends and/or variations in population are indicated. In the case of TOC, these decreasing trends are associated with decreasing turbidity values. The early data no longer appear to be representative of the ground water of the site.

The updating of these data bases with data that no longer appear to be representative of the ground water of the site is not protective of human health and the environment. One way to comply would be for the owner/operator to review the background data bases and incrementally test the data bases for statistical change beginning with the first eight values compared to the next four values. If there is no upward or downward trend, or no significant variation in population the background data may be updated. Where trends or variation in population do occur additional justification would need to be provided before the data could be used.

In addition, the owner/operator's statement as quoted above indicates the background data for several wells may have been updated; however, it is not clear which wells were updated and which data was involved in the updating. For the November 2005, sampling event data, at least for the well/parameter combination for MW-6R (total organic carbon) the data appears to have been updated even though no documentation was presented demonstrating no differences in the population were observed over time. This comment was previously expressed to the owner/operator regarding other updating periods without owner/operator reply. Again, the owner/operator needs to provide information as to which wells were updated, when they were updated, and what data were involved.

Without a response this situation is becoming more confused. In the May, 2007 submittal the owner/operator performed Dixon's and/or Rosner's test for outliers as appropriate. Outliers were removed as indicated. Ohio EPA appreciates this action; however, the owner/operator included in the submittal a series of Mann-Kendall trend analyses which appear to include the outliers. It is unclear if the owner/operator intended to retain the outliers or not. Some of the trend tests showed downward trends which appeared to be caused by the outliers.

17. **Compliance with OAC Rule 3745-27-10(C)(1), which requires that representative samples be collected, cannot be determined at this time. Non-representative data is being provided on a field data sheet. The City of Wapakoneta should provide an explanation regarding the discrepancy discussed below or make necessary corrections.**

Relative to the ground water report for the May 2006, sampling event Ohio EPA made the following comment for which no owner/operator response has been received regarding this agency comment:

The field data sheet indicates a 5 foot screen was installed in well DAW-3. This is consistent with table 1 in the sampling and analysis plans. The boring log, however, indicates that a 10 foot screen was installed. The boring log is considered to be a primary source of information in this instance since the field geologist indicated what size screen was installed at the time of well construction. The owner/operator needs to provide consistent data regarding the wells at the site. If the boring log is in error it needs to be corrected and documentation of why the boring log is in error needs to be provided. This documentation could include copies of original field notes, photos, etc.

Ohio EPA has commented on this error since December 13, 2002. There has been no owner/operator response. Again it is noted that the field data sheets for the January 2008, sampling event show the same discrepancy (5' screen on field data sheet).

18. **Compliance with OAC Rule 3745-27-10(C)(5), which requires that the statistical method ensure protection of human health and the environment and compliance with the performance standards stated in the rules, cannot be determined at this time. Comments had been provided by Ohio EPA regarding the background population. The City of Wapakoneta should provide the current background data base and provide the background data bases for previous sampling events where the specific background data sets were not provided.**

Relative to the ground water report for the May 2006, sampling event Ohio EPA made the following comment for which no owner/operator response has been received regarding this agency comment. It is still very difficult to determine the background populations. This information is again requested.

Currently and in the past the owner/operator has supplied some statistical information in the submittals. This is, in part, consistent with OAC Rule 3745-27-10 (D)(7); however, from the data provided, it is difficult to determine the population of the utilized background data base. Compliance with OAC Rule 3745-27-10 (C)(5) cannot be determined since a listing of background was not provided. In accordance with OAC Rule 3745-27-10(D)(7) the owner/operator needs to provide a list of the current background data base for each well/analyte combination in order for Ohio EPA to determine compliance with OAC Rule 3745-27-10 (C)(5).

19. **Compliance with OAC Rule 3745-27-10(B)(3)(e), which requires that the wells be maintained to perform to design specifications, cannot be determined at this time. Wells DAW-3 and P-1 do not appear to be as productive as could be expected. The City of Wapakoneta should respond to the comment as discussed below.**

From the current submittal it can be stated that well DAW-3 was purged of 1.43 volumes (4.5 gallons), using an electric pump, before it went dry and well P-1 was purged of 1.2 (6 gallons) volumes before it went dry. Relative to the ground water report for the May 2006 sampling event Ohio EPA made the following comment.

Well DAW-3 is installed with a ten foot screen in a zone containing a total of three feet of sand based on the boring log. When purged by a bailer, the well went dry in 1.4 volumes during the May 2004 sampling event and went dry at less than 1 volume in November 2001. This well went dry at 1.07 volumes in November 2004 using an electric pump and at 1.41 volumes in May 2005, 1.23 volumes in November 2005, 1.04 volumes in May 2006, and 1.01 volumes in May 2007. With three feet of saturated sand exposed to the screen it would be expected that this well would be more productive.

In addition, in November 2004, well P-1 went dry at 1.3 volumes (4.6 gallons), in May 2005 P-1 went dry at 1.58 volumes (7.5 gallons) using an electric pump, in November 2005 this well went dry at 1.76 volumes (7.5 gallons), in May 2006 this well went dry at 1.48 volumes (4.81 gallons), and in May 2007 it went dry in 1.46 volumes using an electric pump. In 2001 this well went dry at 8.5 gallons. Well P-1 is constructed with a 10 foot screen with a 16 foot sand pack across a continuous saturated sand zone. Well P-1 also would be expected to produce more water than this volume before being bailed dry.

These wells might require redevelopment or the wells might need to be replaced. It is also possible a slower pump rate may be required. The stated rate for both wells, 1.0 to 1.5 gallons per minute, may be excessive for these wells. Purging wells dry may result in stripping of volatile organic compounds, increasing turbidity, trapping air resulting in lingering effects on dissolved gas levels and redox states and producing affects on sample chemistry. In order to determine compliance with OAC Rule 3745-27-10 (B)(3)(e) the owner/operator needs to provide data indicating that these wells are performing to design specifications and that the sampling method is producing representative samples. Otherwise the wells should be redeveloped or replaced. The owner/operator also needs to provide information demonstrating that the samples were collected as soon as the wells recovered. Even though this comment or similar comments were sent to the owner/operator for the past several years (since at least 2006), the owner/operator has not responded to this comment.

20. **Compliance with OAC Rule 3745-27-10 (B)(1)(a) and (b), which requires that the monitoring system consist of an appropriate number of properly positioned wells to provide representative samples of the ground water of the site, cannot be determined at this time. Ohio EPA had previously commented on maps produced without the benefit of all of the well data. The City of Wapakoneta should respond to the comment as discussed below.**

Relative to the ground water report for the May 2006 and November 2006 sampling events, and continuing in this submittal, Ohio EPA made the following comment and no owner/operator response has been received: *A review of Figure 2, Potentiometric Surface Map for the Uppermost Aquifer System (5/08/06) and Figure 6, Potentiometric Surface Map for the MW-10 Area, indicates, for well P-1, "Value not used in the construction of the potentiometric surface map." Data collected needs to be representative. If the data is representative, it should be used in the map. The owner/operator does not indicate why the value was not used.*

Since these data were not utilized a complete understanding of the ground water flow regime cannot be determined and; therefore, it cannot be determined if the requirements of OAC Rule 3745-27-10 (B)(1)(a) and (b) are being met. It should be noted that Figure 2, Potentiometric Surface map for the Uppermost Aquifer System (5/08/06), indicated ground water flow to be in a general westerly direction, toward wells P-1, MW-10, DAW-1, DAW-2 and DAW-3. Figure 6, Potentiometric Surface Map for the MW-10 Area (5/8/06), said to be constructed using MW-10, DAW-1, DAW-2 and DAW-3, displays a general south southwest flow direction. If all the data is used from all wells, the flow on the east is generally toward the west impinging on well P-1 and the flow on the west side of the site, in the MW-10 area, is generally toward the southeast, which is generally toward well P-1. Well P-1 displays the lowest ground water elevation of the wells in this zone. A map using all of the data might show a ground water low area under the southwest portion of the facility.

In order to determine compliance with OAC Rule 3745-27-10 (B)(1)(a) and (b) the owner/operator needs to show why the data was not used and show if it is representative. If the data is representative it should be utilized in the maps and new maps should be drawn which include this data point. The new maps should be submitted to Ohio EPA. A similar comment was made by Ohio EPA regarding maps in the May 2004 sampling event submittal, the November 2004 sampling event submittal the May 2005 sampling event submittal, and the November 2005 sampling event submittal. While not listed on Figure 2, the ground water elevation data for wells DAW-1, DAW-2 and DAW-3, which are located in the MW-10/P-1 area, are not noted as anomalous, but were not utilized in the map on Figure 2. All of the data should be utilized and properly honored. Since all of the data are not being utilized, the maps may provide an erroneous picture of ground water flow.

In the current submittal the uppermost aquifer system potentiometric surface map (1/7/08) does not note that the wells were not used. It only indicates that wells DAW-1 and DAW-3 will be decommissioned. There is no reason given for decommissioning these wells. It is inappropriate to decommission a well because the ground water elevation data does not meet a preconceived interpretation of the ground water flow regime. The owner/operator should utilize all data in the maps unless a clear reason can be documented why it should not be used. Also, if there is no clear reason, the wells should not be decommissioned. In addition, if these wells are decommissioned due to damage or another appropriate reason, they should be replaced since they are affected by leachate or leachate-derived constituents.

21. **Compliance with OAC Rule 3745-27-10(C)(1), which requires procedures that provide representative data be utilized, cannot be determined at this time. Non-representative data is being provided on a field data sheet. The City of Wapakoneta should respond to the comment as discussed below.**

Relative to the ground water report for the May 2006, and November 2006, sampling events and not corrected in this submittal, Ohio EPA made the following comment for which no owner/operator response has been received:

A review of the field data sheet for well SW-5 indicates that the difference between the top of casing elevation and the ground level (a.k.a. stickup) is 2.34 feet. The difference between the total depth measured from the top of casing and the total depth measured from ground level is 1.28 feet. These values should be the same. One or more of the four values involved are in error and need to be corrected.

In order to determine compliance with OAC Rule 3745-27-10 (C)(1) the owner/operator needs to review the data, determine the source of the error and make necessary changes. This information should be reported to Ohio EPA.

22. **Compliance with OAC Rule 3745-27-10 (C)(1) cannot be determined at this time. The owner/operator is not providing proper information relating to the trends in some well/parameter combinations. The City of Wapakoneta should respond to the comment as discussed below.**

In response to the owner/operator's submittal of the ground water report for the May 2006, sampling event, Ohio EPA made the following comment for which no response has been received by the agency:

A review of the statistical reports indicates that Mann-Kendall Trend Analyses were performed on several well/analyte combinations. Typically the reports contain a statement ending in the phrase, "...indicating no evidence of an upward trend." These statements are made even for analyses which result in a Z score which is negative. While the statement may be true, the negative Z score is indicative of a downward trend. The analyses presented by the owner/operator do not determine if that downward trend is statistically significant. Following is a table of well/parameter combinations and their negative Z scores:

Well	*Parameter*	*Z Score*
SW-1	*TDS*	*-3.8942*
SW-4	*TOC*	*-4.69269*
SW-5	*pH*	*-2.07877*
SW-5	*TOC*	*-2.26184*
SW-6	*TDS*	*-2.55853*
SW-7	*pH*	*-0.405874*
SW-7	*TOC*	*-4.46934*
SW-8	*TOC*	*-2.90762*
MW-5	*pH*	*-2.55092*
MW-5	*TDS*	*-1.91229*
MW-5	*TOC*	*-4.18564*
MW-6R	*TDS*	*-1.46436*
MW-6R	*TOC*	*-4.76174*
MW-8	*CONDUCTANCE*	*-0.944215*
MW-8	*TDS*	*-2.33233*

It is important to determine if a trend, upward or downward is statistically significant. Downward trends in pH are important since the updating of this data may mask a statistically significant change in pH toward low pH. A downward trend for other parameters may be indicative of early data which is no longer representative of ground water in the well.

A trend analysis of a few of the parameter/well combinations indicates that pH in well MW-5 displays a statistically significant decreasing trend (Mann-Kendall Statistic -126, Critical Value -106, n = 29 and Mann-Kendal Statistic -128, Critical Value -101, n = 28). Also, total organic carbon in well MW-5 displays a statistical significant decreasing trend (Mann-Kendall Statistic -190, Critical Value -85, n = 25 and Mann-Kendall Statistic -169, Critical Value -81, n = 24).

In order to determine compliance the owner/operator needs to determine if the downward trends are statistically significant. Any statistically significant downward trends, especially for pH, should be reported to Ohio EPA. These downward trends should be taken into account when updating background. If there are/were downward trends for pH, the data should not be updated. If the data was updated, the updated values should be removed from the background data base.

The owner/operator should address all historical issues relative to apparent negative Z Scores.

23. **Compliance with OAC Rule 3745-27-10 (C)(1) cannot be determined at this time. Significant differences exist for several parameters between the two values recorded in the duplicate data sample set. The owner/operator should demonstrate how the use of procedures which produce results with large RPD values meet the requirements of this rule. In addition, the owner/operator needs to ensure that sampling and analytical procedures are used which do not produce large RPD values in field duplicate sample sets.**

The laboratory analytical reports for the two samples in the duplicate sample set collected from well SW-3R in January 2008, indicated a series of excessive relative percent differences (RPD) for several parameters. Following is a table of these RPD values:

PARAMETER	RELATIVE PERCENT DIFFERENCE
Selenium	RPD equals 59.22%
Phenols	Difference in values (105 mg/L) exceeds PQL (50 mg/L)
Total Suspended Solids	RPD equals 39.08%

Excessive RPD values may be indicative of the use of procedures which will produce results which are not representative of the ground water of the site.

24. **Compliance with OAC Rule 3745-27-10 (C)(6)(a), which requires that the statistical method be appropriate for the distribution of the parameters, cannot be determined at this time. The owner/operator may be inappropriately determining normality. The City of Wapakoneta should provide details relating to how the W statistic was determined. This information should include the list of coefficients a_{n-i+1} which were utilized in the Shapiro-Wilks Normality calculation. A similar comment was made by Ohio EPA regarding the owner/operator's submittal regarding the May and November 2006, sampling events.**

A review of the owner/operator-provided Shapiro-Wilks Test of Normality for field conductance at upgradient background well MW-6R indicates that the data is normally distributed at both 5% and 1% with a W statistic of 1.08995. Few details relative to how the W statistic was calculated were provided by the owner/operator.

Ohio EPA using the same apparent 28 background values, but could not calculate the same sample standard deviation or the same mean. The W statistic calculated by Ohio EPA was (0.9292) for non-transformed data using Sanitas® statistical software and hand calculation using the 1992 U.S. EPA guidance assuming a 95% level of significance. The Ohio EPA calculations indicate that the non-transformed data is normally distributed, but the difference between the W statistic and the critical value (Tabulated) is smaller than that indicated by the owner/operator. It is unclear if the method used by the owner/operator is properly determining the normality of the data.

25. **Compliance with OAC Rule 3745-27-10 (C)(6)(a), which requires that the statistical method be appropriate for the distribution of the parameters, cannot be determined at this time. The owner/operator may be inappropriately transforming the data. The City of Wapakoneta should provide details relating to how the W statistic was determined. The owner/operator should show how the use of natural log transformation is more appropriate than raw data when performing Shewhart-CUSUM Control Charts. Typically the need for transformation should be based on the best "W". The default method should be the use of untransformed data.**

A review of the control chart for specific conductance at well MW-5 indicates that the data was transformed using a natural logarithm transformation. Ohio EPA determined the "W" coefficient for both the normality of the raw data and the log transformed data. The best "W" was for the raw data (0.9577) rather than the log transformed data (0.9379). The owner/operator should use the raw data.

26. **Compliance with OAC Rule 3745-27-10 (C)(1), which requires the use of procedures which will result in the collection of representative samples, cannot be determined at this time. The owner/operator did not use the ground water elevation determined for well SW-16 because of "gas pressure", but the data suggest gas pressure did not impact the ground water elevation. The City of Wapakoneta needs to explain how much pressure was in the well and explain how this pressure affected the ground water elevation. Otherwise, the city should use this data in a properly constructed potentiometric surface map.**

The field data sheet for well SW-16 indicates the well was bailed dry, and that prior to purging the well contained a little less than 3 feet of water covering part of its 5 foot screen. On Figure 1, Potentiometric Surface Map for the Significant Saturated Zone (1/07/08), well SW-16 contains a note which states, "Piezometer not used to develop potentiometric surface map due to impacts from gas pressure." Actual gas pressure was not provided by the City. It is unclear what "impacts" the gas pressure had on the ground water level in the well since the gas was open to the well in the over 2 feet of open screen above water level. It is also unclear how those impacts were caused.

A review of the cross sections provided in the sampling and analysis plan and a review of the ground water elevations in this area of the facility indicates that the ground water elevation in well SW-16 is more similar to the levels in the uppermost aquifer system wells than the several significant zones of saturation. This sand unit may be in communication with the uppermost aquifer system.

STATEMENTS

27. **Wells MW-10, P-1, DAW-1, DAW-2 and DAW-3 are affected by operations at the landfill.** On page 3 of the memorandum on the statistical analysis located in Appendix C it is stated, "Therefore, the calculated statistical significances identified in monitoring well MW-10 are considered to be the result of the statistical method used in the evaluation of the data (inter-well procedure). None-the-less, these statistical significances are currently under investigation as outlined in the facility's AMSAP."

    Although errors in the statistical method may sometimes result in the calculation of statistical significances that do not exist, the inappropriate use of a statistical method may show no statistical significance where one exists. A review of the conductivity and TDS results for the uppermost aquifer system wells indicates that the results from MW-10 are significantly greater than those for the upgradient well, MW-6R, and even other downgradient wells. The use of interwell statistical analysis was appropriate and correctly determined that well MW-10 is an affected well. Since this well is affected, the use of intrawell methods would be inappropriate. In addition, interwell statistical procedures indicate that uppermost aquifer system wells P-1, DAW-1, DAW-2, DAW-3, SW-5. SW-6, MW-8 are affected by operations at the landfill.

28. **Phenolics, benzene, and acetone have been observed in the ground water and are considered to be present in the ground water of well SW-3R.** A review of the analytical results for the samples (duplicate sample set) collected from well SW-3R indicates that benzene (1.6 µg/L) was reported from both samples in the duplicate set. Based on the presence of benzene reported since May 25, 2005, this volatile organic compound must be considered to be present in this well. In addition, acetone has been detected three times since May 10, 2006, and four times since May 25, 2005. Phenolics have been observed sporadically since March 2003. The latest concentrations of 172 µg/L and 67 µg/L are significant increases compared to prior events. These organic compounds are considered to be present in the samples and, therefore, in the ground water of the well.

29. **In addition to well MW-10, wells P-1, DAW-1, DAW-2, and DAW-3 display exceedances for field conductance and total dissolved solids when comparing the data to the non-parametric prediction limit for these parameters.** Similar comparisons also indicate that well DAW-1 also displays exceedances for pH and total organic carbon (TOC) and DAW-2 displays an exceedance for pH.

30. **There may be complete radial flow from SW-14 in all directions around this well resulting in the presence of leachate or leachate-derived constituents in the significant zones of saturation west of the landfill as wells as in other directions.** Figure 1, Potentiometric Surface Map for the Significant Saturated Zone (5/14/07), shows that ground water flows from well SW-14 in a partial radial manner in generally northerly, easterly and southerly directions. There are no wells in the significant zones of saturation within at least 500 feet in any direction of this well.

31. **The owner/operator may be inappropriately transforming the data. Typically the need for transformation should be based on the best "W". The default method should be the use of untransformed data.** A review of the control chart for specific conductance at well MW-5 indicates that the data was transformed using a natural logarithm transformation. Ohio EPA determined the "W" coefficient for both the normality of the raw data and the log transformed data. The best "W" was for the raw

The owner/operator is cautioned to use the raw data as the default especially when the raw data provides the best "W". However, as indicated above, the owner/operator cannot use intrawell methods until it can be shown that the well is not affected by the landfill.

If you have any questions, please feel free to contact Randy Skrzyniecki at the Ohio EPA Northwest District Office (419) 373-3149. Any written correspondence should be sent to the attention of Mike Reiser, Division of Solid and Infectious Waste Management, Ohio EPA Northwest District Office, 347 North Dunbridge Road, Bowling Green, Ohio 43402.

Sincerely,

Michael A. Reiser

Michael A. Reiser, R.S.
Environmental Supervisor
Division of Solid and Infectious Waste Management

/llr

pc: Bill Petruzzi, Hull & Associates, Inc.
Jack Leow, DDAGW, NWDO
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(File: Auglaize County, Wapakoneta Landfill, Ground Water
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