Ohio Environmental Protection Agency

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Hydrogeologic Evaluation of 99 Construction & Demolition Debris Facilities in Ohio

Prepared by
Division of Drinking and Ground Waters for
Division of Materials and Waste Management

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Introduction

To understand the potential impacts of Construction and Demolition Debris (C&DD) facilities on ground water (GW) quality, the Division of Materials and Waste Management (DMWM) requested that the Division of Drinking and Ground Waters (DDAGW) evaluate the records of each C&DD facility that is currently or has operated in Ohio during the last decade. The records evaluation included the facility's hydrogeologic setting and construction and engineering structures. This report was originally published on April 18, 2008, and based on updated information, revised on August 30, 2011.

Data Collection and Evaluation Criteria

Number of C&DD Facilities Examined

DDAGW collected geologic and hydrogeologic data from 99 existing, proposed, closed and inactive C&DD facilities across Ohio. Data were gathered from the facility's Site Characterization Report (SCR) and/or public information from either the local health district office or Ohio EPA district office. This was done for 99 C&DD facilities across Ohio. This includes all existing, proposed, closed and inactive C&DD facilities in Ohio. Attachment 1 summarizes all of the data collected.

Complete vs. Incomplete Data Sets

If all or nearly all of the six components listed in Table 1 were documented, the data set from a facility was determined to be substantially complete and was used for more thorough evaluation (as discussed later in this paper). In all, 47 facilities had substantially complete data sets.

Table 1
Components of a "Substantially Complete Data Set"

1. Documented GW monitoring information/data available for the facility.
2. GW monitoring data includes analysis of key constituents over multiple sampling events
3. Information related to construction and engineering of debris placement.
4. Identified or estimated separation distance from the debris liner down to the first continuous significant zone of saturation/Uppermost Aquifer System.
5. Description or estimate of depth from the ground surface to the first continuous significant zone of saturation.
6. Characterization of geologic/hydrogeologic conditions at or near the facility.

Sensitive Hydrogeologic Settings

Hydrogeologic settings in Ohio that are considered sensitive to ground water quality impacts are: thick, glacial sand and gravel deposit areas; known karst areas; shallow, fractured bedrock aquifer areas; and location of a facility in an old quarry (sand and gravel, limestone, sandstone). These include areas designated in Ohio Administrative Code (OAC) 3745-27-07 as 100 gallon/minute aquifer systems; Drinking Water Source Protection areas; known karst areas; U.S. EPA designated Sole Source Aquifers; and areas with less than five feet of clay/glacial till over bedrock.

Figures 1 and 2 show the C&DD facilities state-wide along with the hydrogeologic sensitivity and areas identified for ground water protection.

Indication of Impact on Ground Water Quality

Facilities with substantially complete data sets were evaluated to determine if there was an indication of impacts to ground water quality. Using information from facility operators, ground water analytical data from background monitoring wells were compared to data from downgradient monitoring wells.

Reviewers noted differences between background and downgradient ground water quality and determined whether the difference was significant. Significant differences could be indicated by, but were not restricted to, the presence of volatile organic compounds (VOCs); presence of an increasing trend in a constituent at a downgradient well; elevated concentrations (e.g. order of magnitude) in a downgradient monitoring well; and ammonia concentrations exceeding three milligrams per liter in a downgradient well.

None of the facilities in Ohio are known to have conducted an actual ground water quality assessment to confirm any indication of a potential release to ground water. Therefore, all differences were noted as indications of a release of contaminants and not regarded as confirmed releases. Whether or not there was an *indication* of a release was then evaluated against the following factors to determine if differences were noted which may influence protectiveness to ground water:

- Site geologic and hydrogeologic settings.
- Engineering controls and construction/siting.

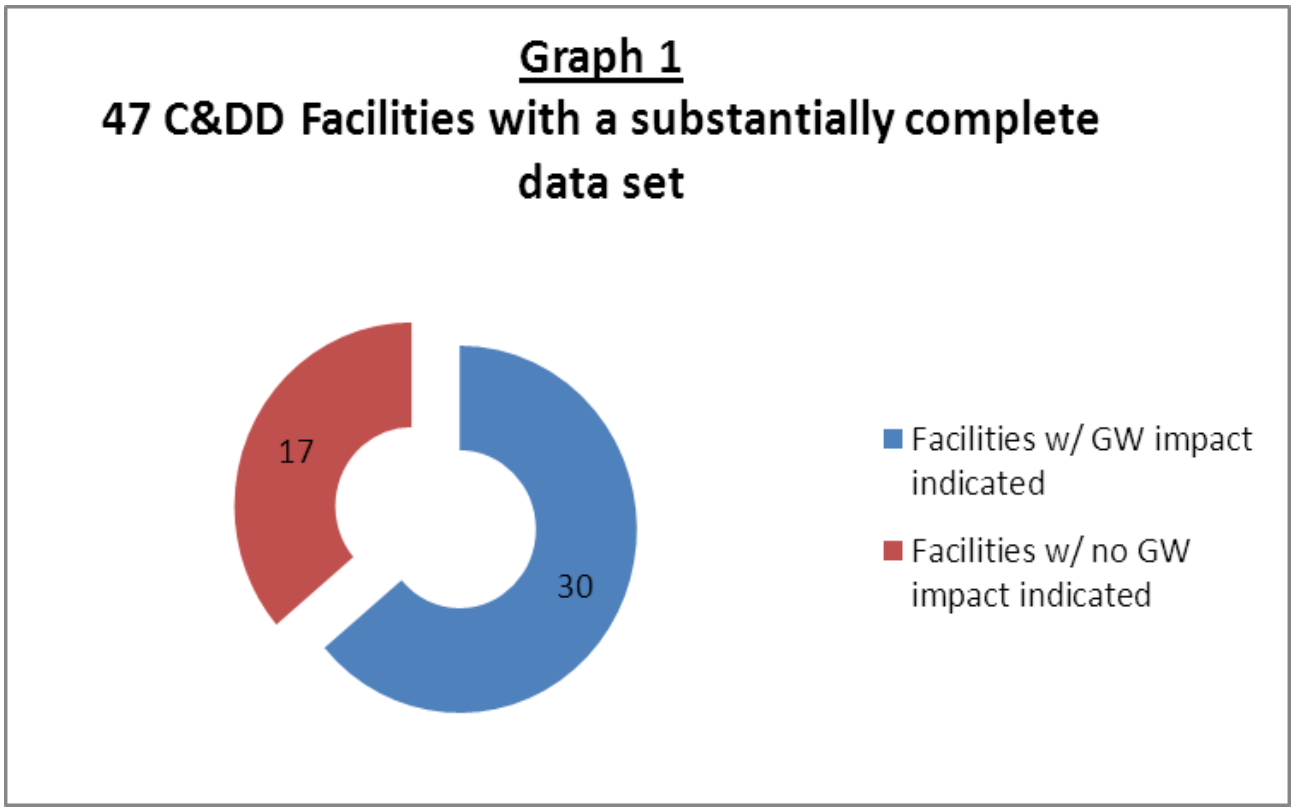
Facilities without substantially complete data sets were evaluated to determine the likelihood of ground water impact based on their geologic/hydrogeologic setting. A comparison of similar geologic/hydrogeologic settings was made between facilities with and without a substantially complete data set.

Results

Facilities with Substantially Complete Data Sets

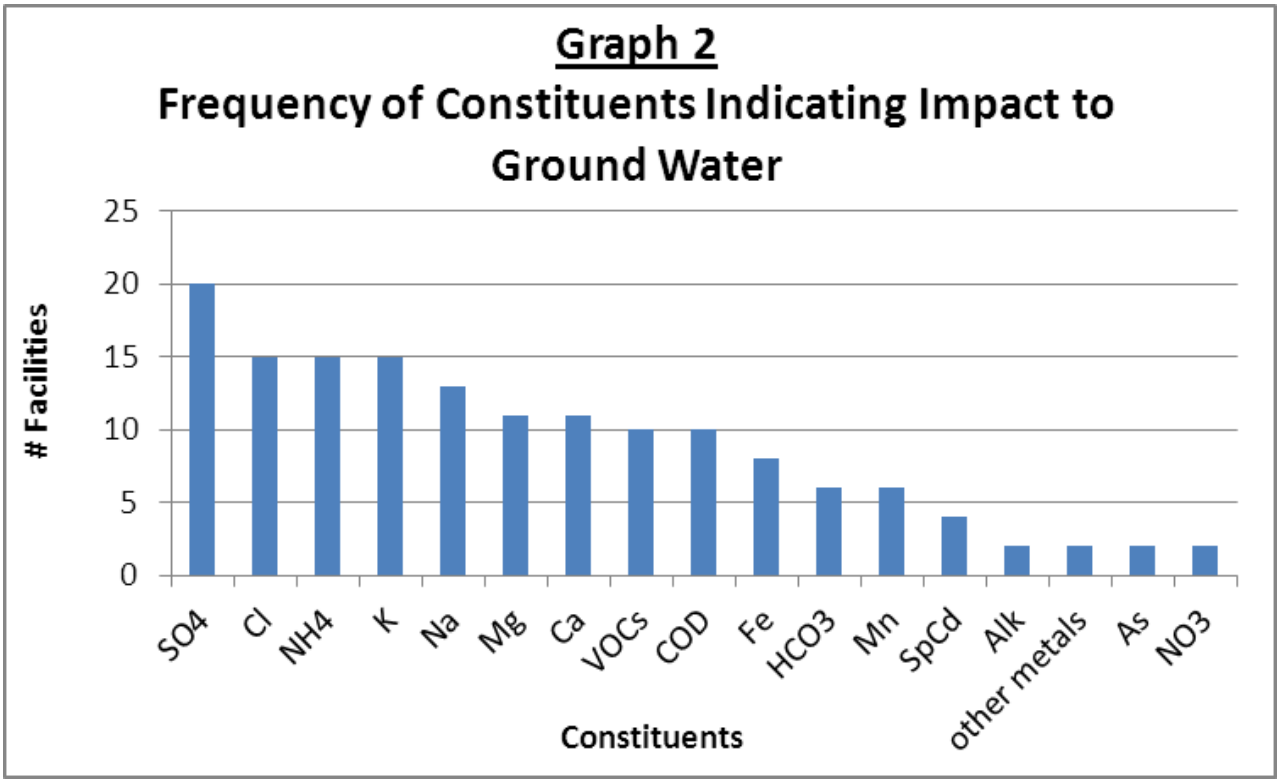
The following sections summarize the analysis results for the 47 facilities that had substantially complete data sets as defined at the beginning of this report.

Overall Indication of Ground Water Impacts: Of the 47 facilities with substantially complete data sets, 30 (64 percent) have an indication of an impact to ground water quality (Graph 1).



Frequency of Occurrence for Constituents Indicating an Impact to Ground Water

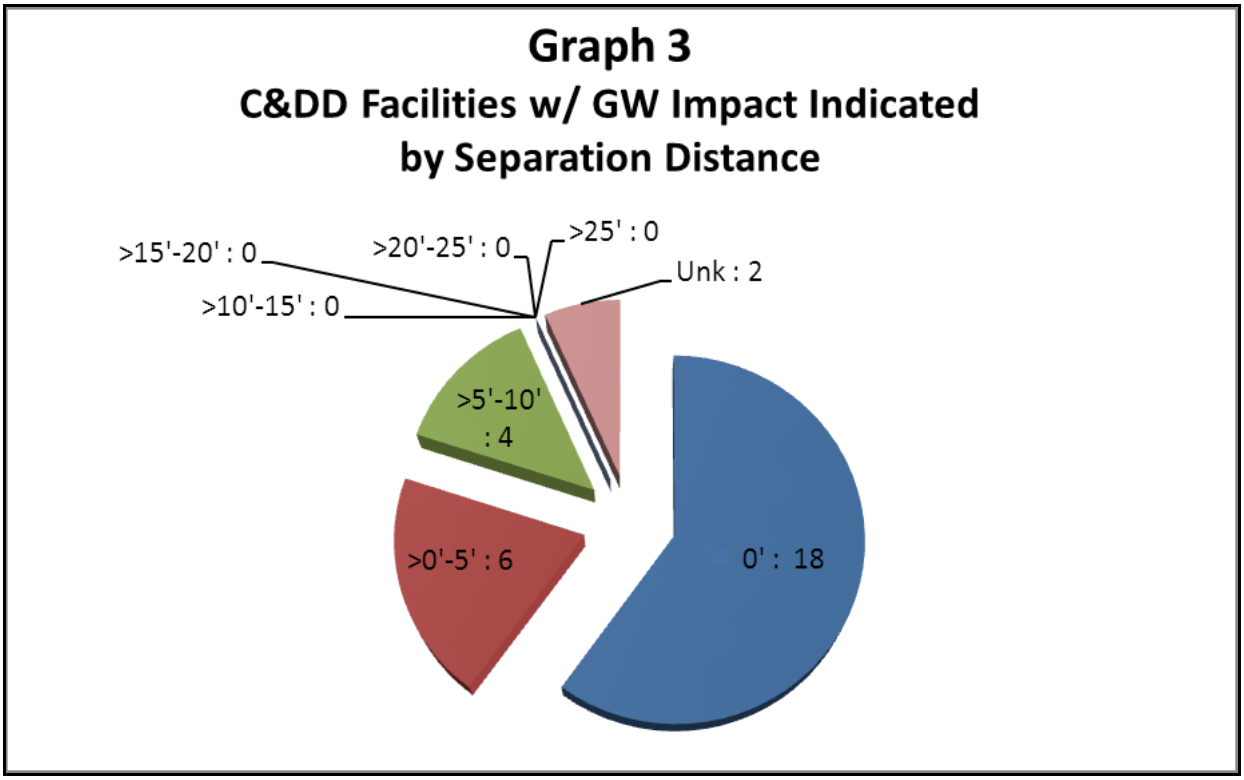
Graph 2 shows constituents that were elevated above background and thus indicate an impact to ground water quality at C&DD facilities. The graph also shows the number of facilities that each particular constituent was listed as part of an indication of impact to ground water quality.



Indication of Ground Water Quality Impacts at Facilities based on Vertical Separation Distance

Graph 3 and Table 2 show the number of facilities indicating an impact to ground water that fall within a given range of separation distances between the bottom of the debris or liner, if present, and the top of the first continuous zone of saturation (CZS).

Indications of an impact to ground water were identified at 24 of 28 facilities (86 percent) with between zero and five feet of separation. Four of eight facilities (50 percent) with between five and ten feet of separation had an indication of an impact to ground water. However, zero of seven facilities (0 percent) with greater than fifteen feet of separation have an indication of an impact to ground water quality (note that four facilities did not have adequate separation distance data).



The results for 15 facilities with no indication of impact were: seven facilities (47 percent) had greater than fifteen feet of separation; four facilities (26.5 percent) had five to fifteen feet of separation; and four facilities (26.5 percent) had less than five feet of separation.

Table 2 Comparison of Separation Distance and GW impact

Separation Distance	With indication of GW impact	Without indication of GW impact	Percent with indication of impact
0 feet	18	3	86%
>0 to 5 feet	6	1	86%
>5 to 10 feet	4	4	50%
>10 to 15 feet	0	0	n/a
>15 to 20 feet	0	2	0%
>20 to 25 feet	0	2	0%
>25 feet	0	3	0%
Unknown	2	2	50%

Indication of Ground Water Impacts Relative to Engineering Controls

Of the 30 facilities with substantially complete data sets and an indication of an impact to ground water, 23 (77 percent) do not have any kind of engineering protection in the form of a partial or full liner or leachate collection system (LCS).

Of the 17 facilities with substantially complete data sets and no indication of an impact to ground water, 11 (65 percent) have at least some engineering protection in the form of a partial or full liner or LCS.

Indication of Ground Water Quality Impacts at Facilities Located in a Sensitive Hydrogeological Setting

Of the 47 facilities with a substantially complete data set, 31 are located in a sensitive hydrogeologic setting. Twenty-five of the 31 facilities (81 percent) in a sensitive hydrogeologic setting have an indication of impact to ground water. Among these 25 indicating impact in a sensitive hydrogeological setting:

- All 25 (100 percent) have less than 15 feet of separation between the debris and the CZS.
- Twenty-two facilities (88 percent) have less than five feet of separation between the debris and the CZS beneath the facility per the standard found in OAC 3745-400-09(B).
- Eighteen facilities (72 percent) have less than five feet of separation from the CZS and also do not have any kind of engineering protection in the form of a partial or full liner and/or LCS.

Of the 17 facilities with no indication of ground water quality impact (but substantially complete data), six (35 percent) are located in a sensitive hydrogeological setting.

Facilities without Substantially Complete Data Sets

Because of lack of data available for this evaluation, the facilities without substantially complete data sets could only be evaluated based largely on their locational data. Of the 52 facilities without a substantially complete data set, 13 are located in a sensitive hydrogeological setting, 29 are not located in a sensitive hydrogeological setting and four facilities did not submit sufficient data to determine if they are within a sensitive hydrogeological setting. Six facilities on the list have not yet been constructed.

Discussion

Hydrogeologic setting appears to be a good predictor of whether a C&DD facility will impact the ground water quality. Of the 31 facilities located in a sensitive hydrogeologic setting (with substantially complete data), 25 (81 percent) have an indication of impact to ground water.

When siting/construction and engineering data are added to sensitive hydrogeologic setting, the correlation with indication of impact to ground water strengthens:

- Of the 25 facilities located in a sensitive hydrogeologic setting with less than five feet of separation between debris and the CZS, 22 (88 percent) have an indication of impact to ground water.
- Of the 19 facilities located in a sensitive hydrogeologic setting with less than five feet of separation between debris and the CZS and without any kind of engineering protection in the form of a partial or full liner and/or LCS, 18 (95 percent) have an indication of impact to ground water.
- Of the 16 facilities not located in a sensitive hydrogeological setting, only four (25 percent) had indications of impact to ground water.
- Of the 10 facilities not located in a sensitive hydrogeological setting and with greater than five feet of separation between debris and the CZS, none (0 percent) have an indication of impact to ground water. It should be noted that two facilities with indication of impact to ground water had unknown separation distance. If it is assumed that these two had greater than five feet of separation that would still only be two of twelve (17 percent) indicating impact.

These results are consistent with the 1999 DDAGW report *Correlating Geologic Setting, Engineering and Ground Water Quality at Hazardous and Non-Hazardous Waste Storage, Treatment and Disposal Sites in Ohio* which analyzed hydrogeologic data from solid waste, hazardous waste and other waste facilities in Ohio and also found strong correlations between impact to ground water and separation distance between waste and the underlying aquifer.

Conclusion

The data in this study indicates that the probability of impact to ground water from a C&DD facility increases significantly when a facility is located in a sensitive hydrogeologic setting; is constructed or sited with little or no separation between the debris and ground water; or no engineering controls (liner and LCS) are utilized. Alternately, the data indicate siting a

C&DD facility in a non-sensitive hydrogeologic setting with significant separation between the debris and ground water and use of engineering controls significantly reduces the probability of impact to ground water.

These results support the siting, liner and LCS requirements found in the current OAC chapter 3745-400 as well as those proposed in the 2011 draft OAC chapter 3745-520 rules.

ATTACHMENT 1

C&DD STATEWIDE GEOLOGIC and HYDROGEOLOGIC DATA SUMMARY