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December 21, 2012

Ms. Carmen Anderson
Project Manager
Indiana Department of Environmental Management
Voluntary Remediation Program
Office of Land Quality
100 North Senate Avenue
Indianapolis, Indiana 46204

Re: **Response to IDEM's November 1, 2012 Review of Additional Investigation Activities Report, Geophysical Survey Investigation Report, and Request for Revised RWP Approval and Technical Response to General Notice of Potential Liability Review**
Michigan Plaza
3801-3823 West Michigan Street
Indianapolis, Indiana 46222
IDEM VRP #6061202
MUNDELL Project No. M01046

Dear Ms. Anderson:

This response is being submitted to the Indiana Department of Environmental Management (IDEM) by MUNDELL & ASSOCIATES, INC. (MUNDELL), on behalf of AMMH, as a response to the above-referenced IDEM review letter. The key results of the continued Site remediation and monitoring activities conducted since the submittal of MUNDELL's March 16, 2012 *Additional Investigation Activities Summary Report* (*AIASR*) and MUNDELL's March 16, 2012 *Response to IDEM Comments* have been incorporated, where appropriate, into the responses to the IDEM comments that follow. This also includes the activities summarized in each of the quarterly monitoring and remediation progress reports for the 1st, 2nd and 3rd Quarters of 2012 already submitted to IDEM.

Because a number of IDEM's comments and questions concerned the interpretation and impact of the geophysical survey on the development of the area conceptual model completed by MUNDELL as part of the response to IDEM, MUNDELL will first provide

some general comments regarding the purpose and scope of the geophysical work and how we suggest it be interpreted in light of the other soil and groundwater sampling results. Following these comments, MUNDELL will list each specific IDEM comment followed by the corresponding MUNDELL response.

MUNDELL GENERAL COMMENTS – GEOPHYSICAL SURVEY

MUNDELL appreciates the concerns that IDEM has expressed regarding the limitations in applying the results of geophysical surveys to subsurface investigations. In the case of the Michigan Plaza area, where groundwater impacts have been observed over a large area, covering multiple city blocks and areas and collecting boring data every few feet is impractical, MUNDELL added the completion of the seven (7) 2-dimensional resistivity geophysical profile lines supplemented with four (4) selected seismic refraction analysis to the scope of the investigation work activities in order to "*supplement the existing subsurface soil and bedrock stratigraphic information collected during the advancement of previous soil borings with additional high density geophysical data to more accurately map the upper sand and gravel water-bearing unit and top of the upper fine-grained glacial till unit previously identified*." (March 16, 2012 Geophysical Report, p. 2). This purpose, also restated in the March 16, 2012 MUNDELL AIAR (p.1), was clearly to "*aid in the detailed assessment and interpretation of the geologic variability in the vicinity of the Site, specifically the distribution of fine-grained glacial till sequences, the unconsolidated sand and gravel units, the top of the lower till surface, and the top of the bedrock surface*."

In undertaking this additional investigation, MUNDELL explicitly recognized the limitations of performing such surveys in urban environments and the impacts that some anthropogenic features such as overhead power lines and underground utilities can have on the results. Even recognizing these limitations, we concluded that the advantages of using geophysical surveys to supplement traditional subsurface investigation programs utilizing only soil borings were significant. These advantages are no more clearly illustrated than when one compares the Top of Till Map from the Geophysical and Boring Data (**Figure 10A** of the Geophysical Report) with a Top of Till Map from Boring Data Only, attached as **Figure 1**. As seen in a comparison of these two figures, the 'supplemented map' captures not only the main features of the 'boring only' map (*e.g.*, the till surface topographic low both north near Little Eagle Creek and northwest of the intersection of Michigan Street and Holt Road, and the downward sloping till surface toward the east immediately east of Michigan Plaza), but also indicates the additional topographic 'texture' of the till surface that can only come from such high density data collection. In addition, while there may be some measureable

'error' that remains in the top of till estimates between the soil borings (note: at the borings, this error is zero since the boring data are included in the analysis), because of the maximum topographic variation of the till surface over the entire area (likely on the order of 30 to 40 ft from north to south), this error has likely been greatly reduced in comparison to that introduced by simply using linear interpolation between the soil borings without the benefit of the geophysical analysis.

With this said, MUNDELL believes that the geophysical survey results have helped to clearly answer the most fundamental questions pertaining to whether the Michigan Plaza releases from *Source Areas A*, *B* and *C* could have migrated west-southwestward toward the Holt Residential wells. Specifically, the geophysical survey results confirm that the Top of Till surface either is 'flat' between the Michigan Plaza chemical source areas and the residential wells (attached **Figure 1** using Only Borings) or 'sloping upward' (see Figure 10A of the Geophysical Report using both the soil borings and geophysical data). In either case, both of these maps provide support for eliminating any potential for DNAPL migration to the west as an explanation for Michigan Plaza being a source area.

It is important to note that questions related to the geologic variability north of Michigan Street see in the geophysical survey results have no impact on whether Michigan Plaza is a source of vinyl chloride impacts at the Holt Road residents or how the remaining chemical Source Areas A, B and C at the Plaza should continue to be remediated. From all potentiometric maps previously generated, it is clear that the majority of the area north of Michigan Street is upgradient of the Plaza and its chemical source areas (except immediately north of Michigan Street near chemical Source Areas B and C), and the shallow and deep cis-1,2-DCE and vinyl chloride groundwater impacts present throughout the majority of the property (*e.g.*, along the northern property line in MMW-3S, MMW-4D, MMW-5D, MMW-6D, MMW-7S, MW165S, MW165D; and upgradient of the source areas in MW166S, MW166D, MMW-2S, MMW-11S, MMW-11D, MMW-12S, MMW-13D, and MMW-14D) have never been determined to be associated with the Plaza.

Against this backdrop, MUNDELL responds to IDEM's more specific comments regarding the geophysical results on the following pages.

MUNDELL'S SPECIFIC RESPONSES TO IDEM'S SPECIFIC COMMENTS

The following paragraphs provide MUNDELL's additional specific responses to IDEM's specific comments in the November 1, 2012 review letter:

IDEM Comment No.1. **"***According to page six of this report, during the installation of monitoring well MMW-P-11D a private forced sewer line with an associated private lift station was encountered approximately three feet bgs. The report indicates that as-built drawings were provided by the City of Indianapolis, however the location of the line was not depicted on any site maps. Preferential pathway releases are a primary contaminant source for Michigan Plaza. As such, it is imperative that a diagram of this sewer line be provided as well as a depiction of where it discharges. IDEM also requests that the as-built drawings from the City of Indianapolis be submitted for review."*

MUNDELL Response:
Please see the attached **Figure 2**, which provides a map of the sewer line from the Floral Park Cemetery. As indicated on the figure, the sewer line is aligned east-west along the northern edge of the Floral Park parking area exiting the cemetery main building. Once it goes beyond the western edge of the Michigan Plaza property, it heads north until it approaches Michigan Street, and then heads west to tie into the manhole of the Michigan Plaza sewer line just before it crosses Michigan Street to the north. MUNDELL observed the construction of a portion of this sewer during the summer of 2007. As indicated from the map, the invert elevation for the forced main is between El 705 and 710. The boring log for MMW-P-11D shows that the native material at the depth of the forced main is sand and thus there would be no appreciable difference in hydraulic conductivity between any backfill and the native materials. The potentiometric surface maps for this area shown the water table to be at around El 696, or at least 10 ft below the sewer invert. Therefore, there is no preferential pathway caused by the construction of the sewer. Again, this sewer was installed well after early observations of vinyl chloride in MW-170D. The potentiometric surface maps for this shallow groundwater in this area have also consistently shown a south-southeastern direction of groundwater flow, which would not allow for any groundwater pressure to cause redirected flow back to the west.

IDEM Comment No.2. "*One of IDEM's primary concerns is that many of the monitoring wells used for delineation have been blind drilled below the water table. According to the report, downhole geophysical analysis was performed on each of the wells to clarify the geology. While geophysical analysis can provided useful supporting data, it is an*

indirect assessment of the geophysical conditions. Without confirmatory response data from properly logged wells, the stratigraphic interpretation of the downhole geophysical responses cannot be validated. Geophysics alone cannot eliminate the data loss from the blind drilled wells since it is not clear if the deep wells are correctly screened at the top of till. IDEM still maintains that monitoring wells with incomplete logs are useful for screening data but may not be useful for delineation or closure decisions."

MUNDELL Response:
MUNDELL agrees that the geophysical downhole logging is an indirect assessment of the geologic conditions at each location and the only way to directly observe the materials is by sampling. However, since geophysical logging is a 'direct' assessment of the geophysical conditions, downhole logging, augmented by other lines of evidence, can be used with confidence to determine the types of materials present outside the well casing. Downhole logging has been routinely used for years to assess the type of materials and formation that wells are screened in, and typical gamma ray and conductivity ranges for outwash deposits has been well-documented by the Indiana Geologic Survey (Bleuer, N. K., 2004, *Slow Logging Subtle Sequences*, Indiana Geological Survey Special Report 65). In addition, while the lack of continuous soil sampling within the water table of the wells in question does not allow for a direct comparison of the downhole geophysical data in those areas, the abundance of continuous soil sampling data above the water table in those wells within the sand and gravel units does allow for obtaining confirmatory response data. In general, the correlation between the boring logs and the downhole logs is excellent. For example, compare the downhole log to the boring log for monitoring well MMW-13D), yielding correspondingly low conductivity and natural gamma results in documented sand, and correspondingly higher conductivity and natural gamma results in clay layers, resolving clay lenses as thin as 1 to 2 feet in thickness (see MMW-13D and MMW-P-03D).

Based on the well logs where boring logs and geophysical logs have both been completed, there are specific ranges of both conductivity (in ms per cm) and natural gamma (cpm) that correlate with clay and sand. A summary of these is provided in the attached **Table A**, along with a complete listing of the monitoring well geophysical logs of the 'blank drilled' depths in which the wells screens were placed. As one can see, all of the monitoring well screens were placed at depths in which the geophysical logs would indicate that there are sand and gravels present. Therefore, based on these, with site-specific correlations with other logs, and also those provided from other Indiana studies on geophysical logs performed on sand and gravel units *(i.e.*, Bleuer, 2004), our confidence is very high that the wells were screened appropriately in sand and gravel.

More importantly, however, is the correct placement of the bottom of the screen at the top of the till surface. While continuous soil sampling was not conducted on the indicated wells beneath the water table, the contrasting hardness of the till surface underlying the upper sand and gravel was observed many times during drilling. The contrast was sufficient enough for not only the MUNDELL on-site trained scientist to determine the depth of the top of the till surface during the advancement of the drill hole based on the response of the drilling tools, it was also apparent to both the driller and the driller's apprentice to be able to determine the depth of the top of till when the drilling augers and/or geoprobe casing encountered it. This till surface was also readily apparent during the installation of the initial deeper wells at the Site as well as during the advancement of the 110 remedial injection points during treatment of the chemical source areas in the same general areas.

In summary, multiple lines of sound evidence (*i.e*., nearby completely logged borings, geophysical survey results, downhole logging results, observations during the installations of the deep monitoring wells, observations during the advancement of the remedial injection points) all confirm with a high degree of confidence that the deeper wells were screened appropriately at the bottom of the sand and gravel unit resting on top of the till surface.

IDEM Comment No.3a. *"The resistivity and seismic data, included in the Geophysical Survey Investigation Report, was used to infer the subsurface geology in the area of concern. Seven resistivity profile lines were conducted as part of this investigation. Based on these seven profile lines, the report suggests that there are irregular flow paths along the top of the till layer. However these interpretations are not consistent with the data reported on the boring logs and regional bedrock maps. In general, the interpretations are geologically improbable as they often show vertical contacts between bedrock units and between the bedrock and unconsolidated materials. Furthermore, the interpreted top-of-till elevations do not match the resistivity readings or many of the logged borings along the profile lines."*

MUNDELL Response:
See MUNDELL General Comments. We agree that there was not an exact correlation between the boring logs and the geophysical data (see MUNDELL Geophysical Report, **Table 1 – Comparison of Actual and Predicted Top-of-Till Elevations** attached). This is due to interference from what IDEM terms "anthropogenic features" (*i.e*., subsurface utilities, overhead power lines, and paved roads), the fact that existing monitoring wells themselves are "anthropogenic features" that can generate

interference in the data, as well as the fact that due to the areas and alignments available to collect the geophysical data, very few of the site monitoring wells were actually within 20 feet of the geophysical profiles. In addition, because topographic elevations along the geophysical profile lines were 'set' at a constant elevation (determined to be the average elevation along the profile) from elevation data provided by the Indiana Spatial Data Portal Tool (ISDPT), which provides contour data at 5 ft intervals, the elevations of the surface elevation and subsurface stratigraphic contacts along profile lines should be viewed as typically accurate to only within plus or minus 2 to 3 feet. Therefore, an exact correlation should not be expected. However, as indicated in the report, the geophysical information was incorporated along with the boring information to improve the top of till map interpolation between the soil borings, which otherwise would have merely been interpolated. Because actual boring information was used where it was available, the maps shown in the attached **Figures 10A** and **10B** taken from the MUNDELL Geophysical Report are exact in the vicinity of each boring. And, with a maximum difference of the top of till of about 40 ft from northern part of the area near Little Eagle Creek (El 660), to southwest near Holt Road (near El 700), even a difference of predicted top of till elevation of from 4 to 5 ft represents an 'error' of perhaps only 10 to 15 percent. For the purpose of understanding the site conceptual flow model, this impact should not be significant.

As far as the statement that the geophysical data is not consistent with regional bedrock maps, all of the MUNDELL data (with the exception of a few sections along *Profile Line 2*) fall within the 50 ft contour limits of numerous published sources (see for example the *Hydrogeologic Atlas of Aquifers in Indiana*, www.indianamap.org, Indiana Geological Survey) which state that the bedrock elevation on and around the site should be between about 600 and 650 feet above sea level. Additionally, it should be noted that these regional geologic studies are compiled from borings spaced hundreds and thousands of feet apart. A review of the area data on which the regional maps were based indicates that there is not enough 'data density' to show the variability at the microscale that geophysics can provide (*e.g.*, a geologic cross-section with only two borings can often only provide a linear interpolation between the two borings located hundreds of feet apart, whereas a geophysical profile line can show continuously changing contact surfaces). In highly variable geologic conditions, with limited subsurface data, the regional data are not always complete. However, in the case of the geophysical results, MUNDELL believes there was a high degree of correlation between area boring logs and the profile lines, especially in cases when the profile lines were close to the borings.

Furthermore, the reference to the bedrock contacts being vertical calls for additional explanation of the geophysical profiles. The deeper variations of resistivity variations observed within the bedrock do not represent actual vertical bedrock contacts, but likely transitional facies areas in which shale grades into limestone and vice versa due to the sedimentary depositional environment. This is consistent with the published regional geologic observations, which indicated the area contained alternating sequences of shale and limestone. In an environment such as this, the geophysics helps to identify where these facies transitional areas occur.

Specific responses to observed variations in the geophysical profiles versus soil boring data are provided below:

IDEM Comment No.3b. (cont.)

"*For example:*

- *Figure 2 – Resistivity Profile Line 1: This figure depicts sand and gravel on the west side of the line from approximately 40 feet to greater than 100 feet below ground surface (bgs). The Arcadis monitoring well MW-1102, which is along this line, contained fine grained materials from 53 to 95 feet deep. Also, along the center of this line silt and clay are depicted from 20 to 100 feet bgs. Arcadis monitoring well MW-1103 shows the upper sand extending to 31 feet deep."*

MUNDELL Response:

Each MUNDELL Profile Line contains an indication of the model's accuracy in resolving the geophysical data that was obtained (shown as the Root Mean Square (RMS) error and the Maximum Misfit Error). The original purpose of the Profile Line 1 location was to supplement existing boring data collected west of Holt Road to assess potential flow pathways from the northwest toward the Allison Plant. Based on MUNDELL measurements, the Arcadis monitoring wells MW-1102 and MW-1103 were located approximately 15 feet off of *Profile Line 1* (see **Figure 2**, Geophysical Report); and as such, would not be expected to represent an exact match of subsurface conditions, especially in an area shown to exhibit rapidly changing geologic conditions. *Profile Line 1* also represents the geophysical line with one of the highest model errors (RMS Error =16.1 %, Maximum Misfit = 85 %) due to the presence of numerous anthropogenic features west of Holt Road. However, it should be noted that the overall geologic trend as shown from the boring logs was captured by the resistivity data.

IDEM Comment No.3c. (cont.)

- *Figure 3 – Resistivity and Seismic Profile Line 2: This line depicts monitoring well MMW-14D extending into the shale bedrock with the top of till located at approximately 25 feet bgs. The log for this well shows the top of till at 36 feet with no bedrock encountered during installation. The profile line also depicts the top of till being 20 feet deep at monitoring well MW-170D. The log for this well shows the top of till at 37 feet deep, not 20 feet deep as suggested on the figure. In addition, the profile line shows the top of till at boring EB-3 to be approximately 20 feet deep, while the boring log shows the top of till at 40 feet. Finally, the top of till line for this profile shows a 'valley' is unsupported by the resistivity data on the figure."*

MUNDELL Response:

IDEM's comment discusses why it believes that the depth to till data from the boring logs for MMW-14D, EB-2, EB-3, and MW-170D) does not correlate well with the geophysical data (see **Figure 3**, Geophysical Report). First, it should be noted that all of the well locations along this profile are stated to be "projections", as the closest of these borings to the resistivity profile was still 15 to 20 feet off the line. Second, as the geophysical profile line was located in the flattest part of the alignment (*i.e*., in a drainage ditch), the wells and borings in this area were located approximately 3 to 6 feet higher in elevation, which makes the correlation closer. Thirdly, the "interpreted top of till from the resistivity and seismic data" is a surface interpreted from the average of both the seismic and resistivity data. While an interpretation from the resistivity data alone would have led to a deeper till surface (approximately 5 to 10 feet deeper), the seismic data suggested a shallower till surface. Finally, the presence of several subsurface utilities in the area may have generated sufficient interference in a couple of areas to affect the resistivity data, introducing ambiguity into the interpretation.

IDEM's also commented that the 'till valley' located between EB-2 and MW-170D is not supported by the resistivity data. We disagree. In general, the 90 ohm-meter contour interval is used to delineate the boundary between sand and silt in the resistivity geologic continuum based on our experience in this part of central Indiana. Figure 3 clearly shows a quasi-continuous zone of resistivity values in that range dipping downward between electrode locations 19 to 21, affecting the silt/clay layer thickness as shown. Because the fine-grained silt/clay layer is shown 'necking down' *(i.e*., is reducing in thickness from a lower resistivity layer extending 'upward' at electrode location 22 to 23), MUNDELL interpreted this variation as an increase in shallow sand and gravel in this same area.

IDEM Comment No.3d. (cont.)

- *Figure 5 – Resistivity Profile Line 4: This line shows a vertical channel of high resistivity directly beneath monitoring well MMW-P-02 which extends down at least 140 feet. This geophysical feature needs further explanation and confirmation."*

MUNDELL Response:

IDEM's comment refers to the area shown beneath monitoring MMW-P-02 on Resistivity Profile Line 4 (**Figure 5**, Geophysical Report). In reality, this channel of high resistivity is the graphical result of the resistivity modeling program's attempt to connect two separate high resistivity geologic strata: a dipping high resistivity upper sand and gravel and a highly resistive section of limestone bedrock in this area. The depth of the sand and gravel appear to be in the range of 60 to 80 ft. The 'white-dashed' line indicates the top of the highly resistive limestone. Also, it should be noted that the location of MMW-P-02 is stated as the "projection" of that well, since the actual well is located <u>greater than 50 feet north</u> of the geophysical profile. As such, depending on the orientation of the 'sand and gravel valley', MMW-P-02 may not be over the top of it. Finally, it should also be noted that this profile line indicates an area where the geophysics and the boring logs from the wells exhibited excellent correlation and provides a high degree of confidence in the geologic model.

IDEM Comment No.3e. (cont.)

- *Figure 6 – Resistivity Profile Line 5: The profile line shows sand and gravel extending almost 20 feet below the bottom of monitoring well MW-167D (roughly 50 feet bgs). The geologic log for this monitoring well indicates that the topf of till was encountered at 33 feet bgs."*

MUNDELL Response:

It is important to understand the location of the geophysical profile line in relationship to the projected borings/wells onto the cross-section. The location of MW-167D is approximately 115 feet south of the geophysical profile line location (see **Figure 1** and **Figure 6**, Geophysical Report), located south of Michigan Street, which is why its location on **Figure 6** was denoted as the "projection" of the well location. Additionally, it should be noted that this well was only shown on **Figure 6** for site reference, and not to make a site model correlation.

IDEM Comment No.3f. (cont.)

- *Figure 7 – Resistivity Profile Line 6: This line shows a very irregular top of till surface with what appears to be channel cuts. Only one monitoring well nest, MW-15S and D, intersects this profile line. According to the boring log for this well nest, the top of till was encountered at 39 feet bgs. According to the figure, the resistivity measurements show sand to at least 60 feet deep in this location."*

MUNDELL Response:
As MUNDELL indicated on the Profile Line, the model error for this profile line was the highest of all lines (RMS Error = 23.86 % and Maximum Misfit = 100 %). IDEM's comment refers to the irregularity of the till surface shown on Resistivity *Profile Line 6* (**Figure 7**, Geophysical Report), and the correlation between MW-15D and the resistivity profile line. While we believe that the channels within the till surface shown on **Figure 7** are indeed present, it is likely that the presence of abundant shallow subsurface utilities and various fill materials along this profile may have affected the accuracy of the resistivity model (see above comment regarding model error), and could have led to a slight exaggeration of these features. Additionally, the comment by IDEM that the resistivity data show sand and gravel in the vicinity of the projection of MMW-15D down to at least 60 ft is not accurate. The data actually show that the projected location of MMW-15D is located on the downward slope of a valley within the till, which terminates at approximately 50 feet, where it likely meets the limestone bedrock, or a thin lens of till on top of the limestone bedrock.

IDEM Comment No.3g. (cont.)
"The interpreted top-of-till surface and suggested contaminant flow paths are unsupported by the boring log data. All of the implied stratigraphic anomalies need to be confirmed with direct geologic observations."

MUNDELL Response:
See General Comments. Since the geophysical survey was meant to supplement an already complete boring program, MUNDELL believes that enough borings have been advanced and monitoring wells installed to understand both the groundwater flow and chemical impacts from the Michigan Plaza Source Areas for the purpose of demonstrating that the Plaza is not a source of groundwater impacts to the west of Holt Road.

IDEM Comment No.4a. *"Geophysical technologies such as resistivity and seismic surveys are investigative tools which aid in the interpretation of subsurface geologic*

conditions. According to page three of the report "The resistivity cross-sections presented in this are 2-dimensional representations of the general distributions of electrical resistivity in the 3-dimensional subsurface. There is no unique direct conversion from resistivity to lithology." By the very nature of resistivity, it is imperative that the geophysical models utilized are adequately calibrated using direct measurements such as boring logs. Furthermore, the potential affects that anthropogenic features such as subsurface utilities, overhead power lines, and paved roads may have on the geophysical profiles should be taken into account. The presence of these features can greatly distort the interpretation of the geologic subsurface. It is not clear whether the potential presence of these features was investigated and how they were taken into account in the geophysical models."

MUNDELL Response:
See General Comments. We completely agree with IDEM's comments. While it is true that electromagnetic interference from "anthropogenic features" does influence resistivity and seismic data, their affect cannot be avoided in an urban environment. The best any geophysicist can do is take their effect into account, and understand that their presence may introduce ambiguity into the site model. However, as previously discussed, the addition of known, observed data from boring logs into a given site model (as was the case in **Figures 10A** and **10B**) greatly helps to reduce that ambiguity.

IDEM Comment No.4b. (cont.)
"For example:

- *Along Resistivity Profile Line 1 there are two significant dips in the till surface between electrodes 21 and 29 and electrodes 66 and 71. Overhead electrical lines are present above or nearby these apparent data anomalies. The report does not discuss the potential interference that these power lines may have had on the resistivity data in this area."*

MUNDELL Response:
IDEM's comment indicates a concern that the presence of the overhead electrical lines relative to Resistivity *Profile Line 1* (see **Figures 1** and **2**, Geophysical Report) may have generated the two significant dips in the till surface between electrodes 21 and 29 and 66 and 71. While it is true that overhead power lines were present in this area (one parallel to the resistivity profile, located approximately 40 feet south, and three that cross over the resistivity profile), and that they can generate small eddie currents in the ground, which can affect electrical resistivity and conductivity measurements, these

electrical interferences are highly localized to the area directly beneath a power line, and the effect of the generated eddie currents (should any be strong enough to affect the data) decays exponentially with distance away from the source (i.e., the power line). With that being said, the parallel line located on the south side of Michigan Street was a uniform distance away from the resistivity profile, so any affect it may have had would have been consistent across the profile line. The power lines that crossed overhead appear to intersect the resistivity profile approximately at electrodes 17, 34, and 87, none of which are located within the portions of Profile Line 1 in question, and as there does not appear to be any irregularity in the profile beneath these electrodes, any effects of intersection overhead power lines appears to be negligible.

IDEM Comment No.4c. (cont.)

- *Resistivity Profile Line 2 appears to be located atop or adjacent to a storm sewer line. The report states that 'the greatest variation between predicted and actual top of till elevations is along north-south profile line 2 near Holt Road." There is no discussion of the potential effect of the anthropogenic features such as the storm sewer on the geophysical interpretations along this line."*

MUNDELL Response:

While it is possible that presence of the storm sewer line may have contributed to the additional variation between the geophysical data and the observed boring data, it is unlikely. As the storm sewer is not an electrical utility, any induced variation or noise would only have been seen in the shallow subsurface where the sewer line was located. In contrast, the shallow subsurface as seen on **Figure 3** of the Geophysical Report appears to be mostly uniform. Additionally, as the storm sewer was likely mostly dry (none of the geophysical data was collected in the rain), it would have appeared as a very high resistivity (greater than 750 ohm-meters) air void. The extremely high resistivity anomalies these air voids generate tend to skew high resistivity values down deeper, which were not seen on **Figure 3**. The more likely reason for the disparity between the geophysical and well data is the lateral and vertical offset of the wells from the resistivity profile, in conjunction with an undulating till and bedrock surface.

IDEM Comment No.4d. (cont.)

- *In the upper unit along Resistivity Profile Line 3 there are features labeled as voids. This profile lines run through a cemetery. The possible effect the nearby graves may have had on the geophysical profile is not discussed. These anthropogenic features may explain the voids that are depicted in the sand and gravel unit."*

MUNDELL Response:
MUNDELL agrees with IDEM that these features do explain the voids that are depicted in the sand and gravel unit. These features are shown as very high resistivity anomalies likely generated from air voids associated with coffins and graves within the Floral Park Cemetery, where Profile Line 3 was collected. Because of their presence above the water table, they had no impact on the interpretation of the deeper geology and issues related to groundwater flow in this area. Therefore, the anomalies were simply denoted as "voids".

IDEM Comment No.4e. (cont.)

- *Along Resistivity Profile Line 4 there is a pronounced dip between electrodes 31 and 35 which is located in a red colored area labeled as sand and gravel. There is also a large red anomaly in this area that appears to extend ground surface to a depth of at least 120 feet. This anomaly is located in the general area of the sanitary sewer line encountered during the installation of monitoring well MMW-P-11D, yet there is no discussion of how this storm sewer may have affected the profile line."*

MUNDELL Response:
In this fourth comment, IDEM raises the question of how the floral park sanitary sewer line trending along Resistivity Profile Line 4 (**Figure 5**, Geophysical Report) from approximately electrode 11 to electrode 47 affected the data. As this line is a 12" PVC line, it was likely mostly empty during the time Profile Line 4 was being collected. Thus, if its presence would affect the resistivity data, it would appear as an air void (high resistivity data anomaly) within the shallow subsurface. In fact, several such zones of very high (greater than 750 ohm-meters) resistivity values are imaged between electrodes 11 and 47, and are possibly related the presence of the sanitary line. However, there is also a high resistivity zone centered at electrode 8, as well as one from electrode 48 to 54, locations where the sewer line is not known to be present. Thus, while the sanitary line may have generated some of the highest resistivity response along this profile line, the rest of the highest response is likely due to naturally-occurring high resistivity, unsaturated sand and gravel. Finally, although air voids can tend to thicken the appearance of high resistivity materials (such as sand and gravel), the parallel alignment of the sewer line from electrodes 11 to 47 and the excellent correlation between the borings located closest to the profile line (e.g., MMW-P-11D, MMW-P-13D, and MMW-P-C1) indicate that any affect the sewer line could have generated would not account for the depression in the till between electrodes 31 and 35.

IDEM Comment No.4f. (cont.)

- *Along Resistivity Profile Line 5 there is a dip between electrodes 28 and 32 which appears to coincide with a known sewer line. This profile line also crosses a paved road however there is no discussion of how this may have effected electrode placement or how the paved surface and sub-base for the roadway were taken into account in the geophysical models."*

MUNDELL Response:
MUNDELL does not believe either the sewer line or pavement significantly impacted the modeled profile results shown, although the data may be slightly noisier (RMS slightly over 10 %) as a result of it. As the sewer line was a non-electrical, non-metallic utility, it likely had little effect on the data. While sewer lines can often generate shallow, high resistivity anomalies where they are present, no such feature can be seen on the profile line, which supports our initial interpretation. In addition, the deeper feature observed beneath the paved area is also shown to occur from electrode location 51 to 57 in an area which had no roadways or utilities. Despite this particular profile line being slightly noisier in general, the features depicted are considered to be accurate portrayals of the subsurface conditions and have not been significantly affected by crossing non-metallic utilities and roadways.

While roadways and sub-base materials very rarely affect seismic data unless there is excessive passing pedestrians and vehicles along the roadways at the time of data collection, they can sometimes pose a challenge for resistivity data acquisition. In order for an electrical contact to be made with the underlying soils, half-inch holes must be drilled through the pavement and any base coarse materials to allow the electrode to make direct contact with the underlying soils. This was done in this study when crossing roadways, and no problems with contact with underlying soils were experienced.

IDEM Comment No.4g. (cont.)

- *Resistivity Profile Line 6 is located within the Michigan Meadows Apartments Complex. The anthropogenic features related to the apartment complex were not discussed in the report nor is it clear whether they were taken into account when creating this line. For instance, pronounced dips are shown near electrodes 7 and 40 which correspond to areas where sewer lines are known to be present."*

MUNDELL Response:
IDEM's comment indicates concern with the possibility that sewer lines trending orthogonally to the resistivity profile line in the vicinity of electrodes 7 and 40 may have influenced the data. As stated before, sewer lines typically appear in resistivity data as shallow, very high resistivity "air voids". This effect is seen near electrode 7, very close to an extremely low resistivity (close to 0 ohm-meters) feature. This extremely sharp contrast is likely due to the presence of the non-metallic sewer line located next to a metallic utility of some sort. However while this interference generated by "anthropogenic" features is definitely notable near electrode 7, it appears to be very localized. In contrast, the high-resistivity zone centered around electrode 40 is more subdued, irregularly shaped (non-circular as orthogonal utility lines often appear), and deeper that the zone near electrode 7. For these reasons, we do not believe the depression in the till surface near electrode 40 is related to the aforementioned sewer line.

IDEM Comment No.5. *"According to the report, seismic surveys were conducted along Resistivity Profile Lines 2 through 5. The report does not indicate why seismic surveys were only conducted along these profile lines and not Resistivity Profile Lines 1 and 7. It is also not clear how the data obtained from these seismic surveys was utilized in the interpretation of the till surface or to what extent the data was used in relation to the resistivity data. Since the actual seismic data was not included in the report an evaluation of the correlation between the data and the actual depth to till could not be conducted. A discussion of why seismic surveys were only conducted along Resistivity Profile Lines 2-5 should be provided as well as the actual seismic data collected."*

MUNDELL Response:
IDEM's comment focuses on concern with the seismic data. Co-linear seismic data were acquired along Profile Lines 2 through 5. These data were not acquired along Lines 1 or 6 due to budgetary constraints, and because they were well upgradient and side-gradient of the Michigan Plaza chemical source areas. Given the urban environment the site is located in and the potential for electrical interference from "anthropogenic features" to influence the resistivity data, seismic refraction was included on Profile Lines 2 through 5 as a secondary technique to attempt to image the till and bedrock surfaces. Because seismic refraction uses the travel time of induced acoustic waves (essentially sound waves) through consecutive geologic layers to map variations within those layers, the technique is not influenced by any electrical interference from overhead or buried power lines, or metal utilities. However, while seismic refraction is

not susceptible to electric or metallic interference, it is influenced by external sources of induced seismic waves, such as those generated by passing, pedestrians, vehicles, and airplanes. Despite the abundance of seismic interference present on the site, the seismic data processing was able to filter out much of the noise, and the resulting models correlated fairly well with the resistivity results in the majority of areas. The final "interpreted top of the till from the resistivity and seismic" surface shown on Profile Lines 2 through 5 was generated by averaging the depth to the till as interpreted from the resistivity data along with the depth to till as interpreted from the seismic data alone, except that where the difference between the two exceeded 5 ft, the top of the till was taken as that interpreted from the resistivity profile lines, since in most cases, it was more consistently predicted along the profile lines.

The following comparisons between the top-of-till predicted by the seismic data and the 2D resistivity data are provided to IDEM for each profile line in which the two techniques were used:

Profile Line 2: Average Difference: 6.1 ft
Profile Line 3: Average Difference: 3.7 ft
Profile Line 4: Average Difference: 3.4 ft
Profile Line 5: Average Difference: 5.2 ft

If there is any additional analysis and results from these profile lines that IDEM desires, MUNDELL would be happy to provide it. MUNDELL would also be happy to share the raw seismic data downloaded from the StrataView R24, 24-channel digital seismograph. It would be helpful for IDEM to specify the data format it desires so that MUNDELL can respond appropriately.

Response to IDEM's Request for Revised RWP Approval

IDEM Comment No.6a. *"This report included composite plume maps for each compound which depict Michigan Plaza, Genuine Parts, and USEPA sampling locations. The maps appear to compile groundwater results from both grab samples and monitoring wells from various times. IDEM attempted to validate the iso-concentration lines and noted the following inconsistencies:*

MUNDELL Response:
The groundwater concentration data were taken from **Tables 1, 6, 7** and **9** from the March 16, 2012 MUNDELL AIASR, which includes monitoring data from September and October 2011 from all MUNDELL on-site and off-site wells, available Keramida and

ENVIRON wells, and USEPA groundwater sampling that was completed during the late fall of 2011. These data are provided again in the attached **Tables 1, 6, 7** and **9.** In addition, if current analytical data were not available at some locations, MUNDELL also considered earlier 2011 data as well as data collected in early 2012 before the AIASR was submitted. These additional data are shown in the attached **Table B**. The strongest weight has been given to monitoring well data; however, analytical data generated from the available USEPA geoprobe investigation, the MUNDELL Floral Park Cemetery geoprobe study, the ENVIRON geoprobe studies, and groundwater impacts previously detected in the Holt Road residential wells have also been considered.

IDEM Comment No.6b. (cont.)

- *Figures 15 and 16 – Cis-1,2-DCE Distribution in Shallow and Deep Groundwater: The iso-concentration listed on the figures for cis-1,2-DCE are >5, >10, >100 and >500 ug/L. Considering that the MCL for cis-1,2-DCE is 70 ug/L, that concentration should have been used as a baseline value. As listed, the contouring makes the plume look worse than the actual data indicates it is."*

MUNDELL Response:

The purpose of presenting the contour maps was not only to depict those areas that might exceed cleanup goals like the MCL, but also to understand the likely source of chemical impacts that have been detected in the Holt residential properties. Indicating the full extent of the cis-1,2-DCE impacts allows for evaluating what has been the source of VC impacts along and west of Holt Road. Since both cis-1,2-DCE and VC are daughter-products of PCE/TCE that was released on the Genuine Site north of Little Eagle Creek, and since the breakdown of cis-1,2-DCE can be a further source of VC in anaerobic portions of the deeper sand and gravel (where VC has been detected in the residential wells), Figures 15 and 16 indicate the likely contributory areas to VC impacts from the further breakdown of cis-1,2-DCE.

Therefore, MUNDELL believes that the depiction of the contour intervals selected for cis-1,2-DCE provided the most comprehensive information for identifying the full extent of impacts and the likely pathways that could contribute 'detectable' chemicals to the drinking water in the residential wells.

IDEM Comment No.6c. (cont.)

- *Figure 15 – Cis-1,2-DCE Distribution in Shallow Groundwater: The figure depicts monitoring well MW-167S as being located within the >10 ug/L contour. A review*

of the sampling data for this well indicates that for the past two years the well has been below detection limits for cis-1,2-DCE."

MUNDELL Response:

MUNDELL agrees that the concentration in MW-167S has been below detection limits for cis-1,-DCE during the last two years, and the contour map should have reflected this concentration. A *Revised Cis-1,2-DCE in the Shallow Groundwater Map* is provided in the attached **Figure 15R**. As indicated in the figure, the only change from the previous **Figure 15** is a lower cis-1,2-DCE concentration area present north and northwest of the Plaza highlighted in 'white/yellow' which includes monitoring wells MMW-2S, MMW-8S, MW-167S and soil boring SB-05.

IDEM Comment No.6d. (cont.)

- *Figure 18 – Vinyl Chloride Distribution in Deep Groundwater: The figures shows monitoring well MW-167D within the >100 ug/L contour, however the most recent sampling event indicates that this well contained 16 ug/L of vinyl chloride."*

MUNDELL Response:

MUNDELL agrees that the levels of Vinyl Chloride in MW-167D have been detected at concentrations ranging from 14.9 to 21.7 during 2011 and 2012, and the contour map should have reflected this concentration. A *Revised Vinyl Chloride Distribution in the Deep Groundwater Map* is provided in the attached **Figure 18R**.

IDEM Comment No.6e. (cont.)

- *Figure 18- Vinyl Chloride Distribution in Deep Groundwater: The figure shows that the >100 ug/L vinyl chloride plume widening around monitoring well MMW-2S, however there is no data to support this conclusion since MMW-2S does not extend into the deep aquifer.*

MUNDELL Response:

See MUNDELL Response to IDEM Comment No. 6a. The revised >100 ug/L vinyl chloride contoured area is shown on the attached Revised **Figure 18R**, and is based on two key pieces of data: the groundwater analytical data containing vinyl chloride concentrations that exceed 100 ug/L and the deep groundwater potentiometric map.

IDEM Comment No.6f. (cont.)

In summary, the cis-1,2-DCE and vinyl chloride plume maps (Figures 15-18) depict unusual shapes without accessible analytical data to support them. A complete listing

of each groundwater data point used to create composite map should be provided. Furthermore, the maps should be revised to accurately depict the supporting analytical data. Without this data, the interpretation of the plumes nature and extent is unsupported."

MUNDELL Response:
See MUNDELL Response to IDEM Comment 6a. MUNDELL does not believe that the plume maps depict 'unusual shapes' based on the analytical data used, the existing geologic conditions in the area, the concentrations of cis-1,2-DCE and Vinyl Chloride still coming onto the Michigan Meadows Apartment Site from the north, and the potentiometric surfaces of the shallow and deeper sand and gravel (as seen in Figures 16 and 17 in the March 12, 2012 AIASR). In fact, the distribution of cis-1,2-DCE and VC are remarkably consistent with all of this data and the conceptual site groundwater flow model depicted in **Figure 10B**.

IDEM Comment No.7. "*IDEM has requested on several occasions that the residential properties to the west of the Plaza be investigated for vapor intrusion. To date this investigation has not been conducted. The report notes that several attempts have been made to gain access to the property located at 3817 West Michigan however, no additional information was provided. There are additional properties besides 3817 West Michigan to the west of the Plaza that need to be investigated for vapor intrusion, yet there is no mention of attempts to gain access to these properties. Given that Source Area A extends farther than previous suspected it is imperative that vapor intrusion sampling be conducted immediately at the residential properties to the west of the Plaza. In addition, a detailed list of past attempts to gain access to 3817 West Michigan should be provided for IDEM review."*

MUNDELL Response:
By way of background, MUNDELL recently addressed the question of access to residents for a vapor intrusion investigation in the Quarter Monitoring Progress Report, 2nd Quarter 2012, submitted to IDEM on October 22, 2012, MUNDELL summarized in Section 2.4.3 continuing efforts during 2012 to gain access to complete the vapor intrusion evaluation:

"*Due to elevated vinyl chloride concentrations above the 1-year groundwater screening level, IDEM requested a vapor intrusion investigation for residential properties within 100 feet of the groundwater plume as soon as possible (Request for Revised Remediation Work Plan Approval Review and Technical Response to General Notice of*

Potential Liability Review, June 22, 2011). Subsequent to this request, MUNDELL has made several attempts to request property access to conduct vapor intrusion sampling at the residence located at 3817 West Michigan Street, as well as the two residences to the west of this property. To date, the property owners have not granted access to conduct sampling. MUNDELL will continue to periodically contact them for access."

Below, we provide additional details regarding our attempts during 2011 and 2012 to gain access to the three residences that are present to the west between Michigan Plaza and Holt Road:

3817 West Michigan Street - Ms. Aferoncina Cox

8/25/2011
Ms. Sarah Webb and Mr. Andy Dammeyer of MUNDELL visited the residence and knocked on the door, but no one answered. They left a letter in the mailbox at the home (see **Attachment A**). When they left the site for the day, they drove past the house and it appeared the letter had been removed from the mailbox. No response was ever received.

8/31/2011
Ms. Sarah Webb again knocked on the door and attempted to speak to someone. No one answered the door.

9/26/2011
Ms. Sarah Webb prepared a simple postcard to leave at the residence. The card included 'yes' and 'no' checkboxes and was addressed and stamped (see **Attachment A**). Ms. Webb met with Ms. Cox, who was home on this afternoon and explained the general reasoning behind the vapor sampling and that is was in the interest of Ms. Cox's health and safety. Ms. Webb then left her copies of the access agreement and photos of what the summa canisters look like. Ms. Cox indicated she wanted to discuss the situation with her son. Ms. Webb then took down her phone number and indicated she would call her the next week. Several attempts were made to contact through telephone calls without success.

October 2011
Three direct conversations over the last month with the resident and the mailing of a certified letter on October 2011 resulted in no response.

5/30/12

Following a meeting with EPA on May 15, 2012, MUNDELL renewed efforts to contact Ms. Cox. Mr. Mark Breting of MUNDELL spoke to a caregiver for Ms. Cox by telephone to indicate the intention of dropping off an access agreement.

5/31/12

Mr. Breting then visited Ms. Cox residence but no one was home; an access agreement was left at the front door. No response has been received.

3835 West Michigan: Burton and Iva Olmsted

12/21/2011

Direct contact with the Olmsted's was made by Ms. Sarah Webb during a site visit. Ms. Iva Olmstead indicated that she had no interest in allowing indoor air sampling.

5/31/2012

MUNDELL representative Mr. Mark Breting met in person with Ms. Olmstead and provided information regarding the purpose of the testing. No response was received.

3839 West Michigan – Jimmie and Karen Helton

5/31/12

MUNDELL representative Mr. Mark Breting met in person with Mrs. Helton and provided information regarding the purpose of the testing; however, to date no response has been received.

Based on observations made during the quarterly sampling events during 2012, the resident at 3817 West Michigan is elderly with health issues and may not be at the residence at the present time. Discussions with Mrs. Olmsted indicate she is concerned about testing and the impact it could have on their property values. Mrs. Helton was seemingly open to consideration of allowing access, but has not approved it to date. Based on the prior attempts described above, MUNDELL does not believe that further contacts by MUNDELL are likely to be productive and may even be viewed by residents as annoying or harassing.

Because of the lack of success in gaining access and the apparent lack of interest in allowing access, MUNDELL respectfully requests that IDEM help facilitate access with these residents if it believes such efforts could be successful.

SUMMARY

We appreciate the opportunity to provide additional information regarding IDEM's concerns for remedial activities and progress pertaining to the Site. If you have any questions regarding the content presented in this *Response to IDEM's November 1, 2012 Review of Investigation Activities Report, p*lease do not hesitate to contact us at (317) 630-9060 or via email (jmundell@MundellAssociates.com; mbreting@MundellAssociates.com).

Sincerely,

MUNDELL & ASSOCIATES, INC.

Mark E. Breting

Mark E. Breting, L.P.G.
Senior Project Geologist

John A. Mundell, P.E., L.P.G.
President/Senior Environmental Consultant

cc: Mr. Peter Cappel, AMMH
Mr. Nick Billings, AMMH

TABLES

Table A. Summary of Downhole Geophysical Log Property Ranges in Site Monitoring Wells.

Table B. Additional Groundwater Analytical Results Considered

Table 1. Comparison of Actual and Predicted Top-of-Till Elevations (2012 Geophysical Report)

Table 1. Baseline Groundwater Analytical Data September 9, 2011 (2012 AIASR)

Table 6. Soil Boring Groundwater Analytical Data December 2011 (2012 AIASR)

Table 7. Groundwater Analytical Data October 2011 (2012 AIASR)

Table 9. U.S. EPA Soil Boring Groundwater Analytical Data – November 2011 (2012 AIASR)

TABLE A.
SUMMARY OF DOWNHOLE GEOPHYSICAL LOG PROPERTY RANGES IN SITE MONITORING WELLS
MICHIGAN PLAZA SITE

WELL I.D	Natural Gamma Range (cps)		Conductivity Range (mS/m)	
	Sand	Clay	Sand	Clay
MMW-P-02	60-78	72-118	02-16	16-48
MMW-P-03D	28-70	80-118	04-28	20-68
MMW-P-07	28-52	NA	4-32	NA
MMW-P-09D	32-48	82-112	08-32	20-36
MMW-P-10S	24-52	86-120	2-28	40-46
MMW-11D	23-52	110-139	08-22	25-32
MMW-13D	28-70	70-150	20-32	35-68
MMW-14D	44-65	54-86	15-24	24-38
Overall Range	**23-78**	**54-150**	**2-32**	**16-68**

Blank Drilled Wells - Geophysical Data from Screened Interval Only

WELL I.D	Natural Gamma Range (cps)		Conductivity Range (mS/m)	
	Sand	Clay	Sand	Clay
MMW-P-03D	34-42		28-32	
MMW-P-07	28-52		18-28	
MMW-P-09D	30-44		22-32	
MMW-P-10D	32-46		18-22	
MMW-8S	32-60		15-25	
MMW-9S	20-56		10-34	
MMW-10S	28-56		8-34	
MMW-11D	29-45		16-22	
MMW-13D	34-52		18-28	
MMW-14D	32-52		18-20	
Overall Range	**20-60**		**8-34**	

Table B.
Additional Groundwater Analytical Results Considered
2011 Results
Michigan Plaza
3801-3823 West Michigan Street
Indianapolis, Indiana
MUNDELL Project No.: M01046

Well ID	Sample Date	PCE	TCE	cis-1,2-DCE	trans-1,2-DCE	Chloroform	Vinyl chloride
		ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
Monitoring Wells/Geoprobe (Apts, Floral Park)							
MMW-2S	4/30/2011	<5.0	<5.0	<5.0	<5.0	<5.0	<2.0
MMW-3S	5/4/2011	<5.0	**12.4**	12.4	<5.0	<5.0	**4.4**
MMW-4D	4/29/2011	<5.0	<5.0	**1,050**	<5.0	<5.0	164
MMW-5D	4/29/2011	<5.0	<5.0	**659**	<5.0	<5.0	**166**
MMW-7S	5/4/2011	<5.0	<5.0	<5.0	<5.0	<5.0	<2.0
MMW-P-14S	2/16/2012	<5.0	<5.0	<5.0	<5.0	<5.0	<2.0
MMW-P-14D	2/16/2012	<5.0	<5.0	<5.0	<5.0	<5.0	**49.6**
MMW-15S	2/15/2012	<5.0	<5.0	<5.0	<5.0	<5.0	<2.0
MMW-15D	2/15/2012	<5.0	<5.0	7.3	<5.0	<5.0	<2.0
MMW-C-02D	2/15/2012	<5.0	<5.0	<5.0	<5.0	<5.0	**30.7**
Keramida Wells and Geoprobe Borings (Apartments, Plaza, Floral Park)							
MW-165S	9/16/2011	<5.0	<5.0	<5.0	<5.0	<5.0	<0.2
MW-165D	9/16/2011	<5.0	<5.0	**89.6**	<5.0	<5.0	**221**
MW-166S	9/16/2011	<5.0	<5.0	**150**	5.0	<5.0	<0.2
MW-166D	9/16/2011	<5.0	<5.0	**763**	<5.0	<5.0	**269**
MW-167S	2/16/2011	<5.0	<5.0	**150**	5.0	<5.0	<0.2
MW-167D	4/29/2011	<5.0	<5.0	**377**	16.9	<5.0	**21.7**
MW-168S	4/21/2010	**14**	**7.0**	21.9	<5.0	<5.0	<2.0
MW-168D	10/24/2011	<5.0	<5.0	8.9	<5.0	<5.0	137.0
MW-169S	4/29/2011	<5.0	<5.0	<5.0	<5.0	<5.0	<2.0
MW-169D	4/29/2011	<5.0	<5.0	<5.0	<5.0	<5.0	**9.1**
MW-170S	4/29/2011	<5.0	<5.0	<5.0	<5.0	<5.0	<2.0
MW-170D	4/29/2011	<5.0	<5.0	<5.0	<5.0	<5.0	**100**
MW-171S	4/29/2011	<5.0	<5.0	<5.0	<5.0	<5.0	<2.0
MW-171D	4/29/2011	<5.0	<5.0	<5.0	<5.0	<5.0	<2.0
MW-174S	9/13/2011	<5.0	<5.0	<5.0	5.0	<5.0	<0.2
MW-174D	9/13/2011	<5.0	<5.0	**8**	<5.0	<5.0	<5.0
EB-1 (30-35 ft)	May 2011	<5.0	<5.0	**218**	<5.0	<5.0	**21.4**
EB-2 (31-36 ft)	May 2011	<5.0	<5.0	<5.0	<5.0	<5.0	**44.0**
EB-3 (35-40 ft)	May 2011	<5.0	<5.0	<5.0	<5.0	<5.0	**68.3**
USEPA Borings							
SB-01	11/10/2011	<5.0	<5.0	<5.0	<5.0	<5.0	<2.0
SB-03	11/10/2011	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
SB-06	11/10/2011	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
IDEM RISC Default Industrial Cleanup Level		**55**	**31**	**1,000**	**2,000**	**1,000**	**4**
IDEM RISC Default Residential Cleanup Level		**5**	**5**	**70**	**100**	**80**	**2**

Note:
All Values Over IDEM RISC Industrial Default Cleanup Level in **RED**
All Values Over IDEM RISC Residential Default Cleanup Level in **BLUE**
PCE = Tetrachloroethene; TCE = Trichloroethene; cis-1,2-DCE = cis-1,2-Dichloroethene; trans-1,2-DCE = trans-1,2-Dichloroethene
ug/L = micrograms per liter
NS = Not Sampled
All analytical results presented in micrograms per liter (ug/L)

Table 1
Baseline Groundwater Analytical Data
September 9, 2011
Michigan Plaza
3801-3823 West Michigan Street
Indianapolis, Indiana
MUNDELL Project No.: M01046

Well ID	Sample Date	PCE	TCE	cis-1,2-DCE	trans-1,2-DCE	Chloroform	Vinyl chloride
		ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
MMW-P-11S	9/9/2011	**76.1**	<5.0	5.9	<5.0	<5.0	**9.1**
MMW-P-11D*	9/9/2011	<5.0	<5.0	7.3	<5.0	<5.0	**84.0**
MMW-P-12S	9/9/2011	<5.0	<5.0	**741**	14.1	<5.0	**50.8**
MMW-P-12D	9/9/2011	<5.0	<5.0	**678**	15.9	<5.0	**63.0**
MMW-P-13S	9/9/2011	<5.0	<5.0	<5.0	<5.0	<5.0	**8.3**
MMW-P-13D	9/9/2011	<5.0	<5.0	<5.0	<5.0	<5.0	**139**
IDEM RISC Default Industrial Cleanup Level		**55**	**31**	**1,000**	**2,000**	**1,000**	**4**
IDEM RISC Default Residential Cleanup Level		**5**	**5**	**70**	**100**	**80**	**2**

Note:
All Values Over IDEM RISC Industrial Default Cleanup Level in **RED**
All Values Over IDEM RISC Residential Default Cleanup Level in **BLUE**
PCE = Tetrachloroethene; TCE = Trichloroethene; cis-1,2-DCE = cis-1,2-Dichloroethene; trans-1,2-DCE = trans-1,2-Dichloroethene
ug/L = micrograms per liter
NS = Not Sampled
* = During installation activities a forced sewer line was penetrated. Following baseline sampling activities, this monitoring well location was abandoned.
All analytical results presented in micrograms per liter (ug/L).

Table 1. Comparison of Actual and Predicted Top-of-Till Elevations			
Michigan Street			
Indianapolis, Indiana			
Mundell Project No. 01046			
Well ID	Depth to Till from Resistivity Profiles (ft)	Depth to till from Boring Logs (ft)	Depth to Till From Figure 10A
MMW-P-14D	25.1	36.0	35.0
MMW-170D	13.3	37.0	37.0
EB-2	21.2	35.5	36.0
EB-3	30.7	39.6	36.0
MMW-169D	35.9	37.0	36.0
MMW-P-09D	39.3	45.0	45.0
MMW-P-13D	29.7	33.0	34.0
MMW-P-11D	35.4	36.0	38.0
MMW-P-02	52.0	Till Not Encountered	37.0
MMW-P-03D	33.3	Till Not Encountered	34.5
MMW-P-04D	33.5	Till Not Encountered	38.0
EB-1	24.7	34.5	35.0
MW-167D	50.8	34.0	34.0
MMW-P-08S	26.7	Till Not Encountered	26.0
MMW-15D	37.7	39.0	36.0
MW-7S	48.8	Till Not Encountered	46.0
MW-6D	42.0	48.0	38.0
MW-5D	40.5	45.5	42.0
MW-4D	54.1	63.0	54.0
MW-3S	26.4	29.0	26.0
MMW-165D	53.1	47.0	48.0
MW-1102	Not Interpreted	41	40.5
MW-1103	Not Interpreted	36	36.0
MW-1104	Not Interpreted	35	35.0

Table 6
Soil Boring Groundwater Analytical Data
December 2011
Michigan Plaza
3801-3823 West Michigan Street
Indianapolis, Indiana
MUNDELL Project No.: M01046

Sample ID (Depth)	Date Sampled	PCE	TCE	cis-1,2-DCE	trans-1,2-DCE	Acetone	Vinyl chloride
		ug/L					
GP-20 (30.0')	12/7/2011	<5.0	<5.0	<5.0	<5.0	<5.0	<2.0
GP-20 (39.0')	12/7/2011	<5.0	<5.0	<5.0	<5.0	<5.0	<2.0
GP-21 (28.0')	12/7/2011	<5.0	<5.0	<5.0	<5.0	<5.0	**4.9**
GP-21 (38.0')	12/7/2011	<5.0	<5.0	<5.0	<5.0	<5.0	**2.8**
GP-22 (24.0')	12/8/2011	<5.0	<5.0	<5.0	<5.0	<5.0	<2.0
GP-22 (34.0')	12/8/2011	<5.0	<5.0	<5.0	<5.0	<5.0	<2.0
GP-23 (27.0')	12/8/2011	<5.0	<5.0	<5.0	<5.0	<5.0	<2.0
GP-23 (37.0')	12/8/2011	<5.0	<5.0	<5.0	<5.0	<5.0	**7.2**
GP-24 (28.0')	12/12/2011	<5.0	<5.0	<5.0	<5.0	<5.0	**2.9**
GP-24 (38.0')	12/12/2011	<5.0	<5.0	<5.0	<5.0	<5.0	**4.8**
GP-24 (48.0')	12/12/2011	<5.0	<5.0	<5.0	<5.0	<5.0	<2.0
GP-25 (28.0')	12/9/2011	<5.0	<5.0	<5.0	<5.0	<5.0	<2.0
GP-25 (38.0')	12/9/2011	<5.0	<5.0	<5.0	<5.0	<5.0	<2.0
GP-26 (25.0')	12/9/2011	<5.0	<5.0	<5.0	<5.0	<5.0	<2.0
GP-26 (32.0')	12/9/2011	<5.0	<5.0	<5.0	<5.0	<5.0	<2.0
GP-27 (26.0')	12/9/2011	<5.0	<5.0	<5.0	<5.0	<5.0	<2.0
GP-27 (36.0')	12/9/2011	<5.0	<5.0	<5.0	<5.0	<5.0	<2.0
GP-28 (28.0')	12/9/2011	<5.0	<5.0	<5.0	<5.0	<5.0	<2.0
GP-28 (38.5')	12/9/2011	<5.0	<5.0	<5.0	<5.0	<5.0	<2.0
GP-29 (30.0')	12/14/2011	<5.0	<5.0	<5.0	<5.0	<5.0	<2.0
GP-29 (40.0')	12/14/2011	<5.0	<5.0	<5.0	<5.0	<5.0	<2.0
GP-30 (25.0')	12/13/2011	<5.0	<5.0	57.5	<5.0	<5.0	**59.7**
GP-30 (35.0')	12/13/2011	<5.0	<5.0	42.4	<5.0	<5.0	**25.5**
GP-31 (26.0')	12/13/2011	**9.3**	**9.5**	69.9	<5.0	<5.0	**20.6**
GP-31 (36.0')	12/13/2011	<5.0	<5.0	37.2	<5.0	<5.0	**74.3**
MMW-15D (28.5')	12/14/2011	<5.0	<5.0	6.5	<5.0	<5.0	<2.0
MMW-15D (38.5')	12/14/2011	<5.0	<5.0	6.2	<5.0	<5.0	<2.0
MMW-C-02D (22.0')	12/6/2011	<5.0	<5.0	<5.0	<5.0	<5.0	<2.0
MMW-C-02D (32.0')	12/6/2011	<5.0	<5.0	<5.0	<5.0	<5.0	<2.0
MMW-C-02D (42.0')	12/6/2011	<5.0	<5.0	<5.0	<5.0	<5.0	<2.0
MMW-P-14D (24.0')	12/6/2011	<5.0	<5.0	<5.0	<5.0	<5.0	<2.0
MMW-P-14D (34.0')	12/6/2011	<5.0	<5.0	<5.0	<5.0	<5.0	**5.1**
IDEM RISC 2009 Default Industrial Cleanup Level	-	**55**	**31**	**1,000**	**2,000**	**92,000**	**4**
IDEM RISC 2009 Default Residential Cleanup Level	-	**5**	**5**	**70**	**100**	**6,900**	**2**

Table 7
Groundwater Analytical Data
October 2011
Michigan Plaza
3801-3823 West Michigan Street
Indianapolis, Indiana
MUNDELL Project No.: M01046

Well ID	Sample Date	PCE	TCE	cis-1,2-DCE	trans-1,2-DCE	Chloroform	Vinyl chloride
		ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
Monitoring Wells (Apts)							
MMW-1S	10/19/2011	**136**	**66.0**	**75.3**	<5.0	<5.0	**14.3**
MMW-8S	10/24/2011	**7.9**	<5.0	9.9	<5.0	<5.0	**200**
MMW-9S	10/24/2011	<5.0	<5.0	**2,330**	92.8	<5.0	**694**
MMW-10S	10/19/2011	**5.2**	<5.0	**134**	<5.0	<5.0	**198**
MMW-11S	10/21/2011	<5.0	<5.0	33.9	<5.0	<5.0	<2.0
MMW-11D	10/21/2011	<5.0	<5.0	**751**	22.7	<5.0	**11.8**
MMW-12S	10/18/2011	<5.0	<5.0	39.4	<5.0	<5.0	<2.0
MMW-13D	10/18/2011	<5.0	<5.0	**771**	5.2	<5.0	**140**
MMW-14D	10/19/2011	<5.0	<5.0	**898**	11.1	<5.0	**92.6**
Monitoring Wells (Plaza)							
MMW-P-01	10/24/2011	**23.4**	**10.0**	**839**	9.1	<5.0	**1,410**
MMW-P-02	10/19/2011	**9.1**	<5.0	36.9	<5.0	<5.0	**304**
MMW-P-03S	10/19/2011	<5.0	<5.0	33.5	6.6	<5.0	**446**
MMW-P-03D	10/18/2011	<5.0	<5.0	<5.0	<5.0	<5.0	**61.5**
MMW-P-04	10/24/2011	<5.0	<5.0	14.8	<5.0	<5.0	**68.7**
MMW-P-05	10/19/2011	<5.0	<5.0	8.3	<5.0	<5.0	**48.3**
MMW-P-06	10/24/2011	<50.0	<50.0	**10,100**	<50.0	<50.0	**11,300**
MMW-P-07	10/24/2011	<5.0	<5.0	37.3	<5.0	<5.0	**388**
MMW-P-08	10/24/2011	<5.0	<5.0	32.5	<5.0	<5.0	**136**
MMW-P-09S	10/18/2011	<5.0	<5.0	<5.0	<5.0	<5.0	<2.0
MMW-P-09D	10/21/2011	<5.0	<5.0	<5.0	<5.0	<5.0	**71.9**
MMW-P-10S	10/21/2011	<5.0	<5.0	<5.0	<5.0	<5.0	<2.0
MMW-P-10D	10/21/2011	<5.0	<5.0	<5.0	<5.0	<5.0	**444**
Keramida/Environ Monitoring Wells (Off-Site)							
MW-168D	10/24/2011	<5.0	<5.0	8.9	<5.0	<5.0	**137**
Floral Park Monitoring Wells (Off-site)							
MMW-C-01	10/21/2011	**18.7**	<5.0	20.6	<5.0	<5.0	**58.8**
MMW-C-02	10/18/2011	<5.0	<5.0	<5.0	<5.0	<5.0	<2.0
MMW-P-11S	10/24/2011	**592**	<5.0	<5.0	<5.0	<5.0	**2.5**
MMW-P-12S	10/24/2011	<5.0	<5.0	**642**	19.2	<5.0	**60.7**
MMW-P-12D	10/24/2011	<5.0	<5.0	**644**	14.2	<5.0	**71.3**
MMW-P-13S	10/24/2011	<5.0	<5.0	<5.0	<5.0	<5.0	**19.8**
MMW-P-13D	10/24/2011	<5.0	<5.0	<5.0	<5.0	<5.0	**116**
IDEM RISC Default Industrial Cleanup Level		**55**	**31**	**1,000**	**2,000**	**1,000**	**4**
IDEM RISC Default Residential Cleanup Level		**5**	**5**	**70**	**100**	**80**	**2**

Note:
All Values Over IDEM RISC Industrial Default Cleanup Level in **RED**
All Values Over IDEM RISC Residential Default Cleanup Level in **BLUE**
PCE = Tetrachloroethene; TCE = Trichloroethene; cis-1,2-DCE = cis-1,2-Dichloroethene; trans-1,2-DCE = trans-1,2-Dichloroethene
ug/L = micrograms per liter
NS = Not Sampled
All analytical results presented in micrograms per liter (ug/L).

Table 9
U.S. EPA Soil Boring Groundwater Analytical Data - November 2011
Michigan Plaza
Indianapolis, Indiana
MUNDELL job No.: M01046

Sample ID	Sample Date	PCE	TCE	cis-1,2-DCE	trans-1,2-DCE	Chloroform	Vinyl chloride
		ug/L					
VAS03 (30-35')	11/14/2011	<0.5	<0.5	<0.5	<0.5	<0.5	**6.3**
VAS03 (40-45')	11/14/2011	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2
VAS01 (25-30')	11/9/2011	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2
VAS01 (32.5-37.5')	11/9/2011	<0.5	<0.5	<0.5	<0.5	<0.5	**60.1**
VAS01 (41-46')	11/10/2011	<0.5	<0.5	<0.5	<0.5	<0.5	**40.9**
VAS01 (50-55')	11/10/2011	<0.5	<0.5	<0.5	<0.5	<0.5	**32.4**
VAS02 (24-30')	11/11/2011	<0.5	<0.5	6.7	<0.5	<0.5	<0.2
VAS02 (35-40')	11/11/2011	<0.5	<0.5	<0.5	<0.5	<0.5	**23.0**
VAS02 (45-50')	11/11/2011	<0.5	<0.5	<0.5	<0.5	<0.5	**5.5**
SB-05-GW	11/11/2011	**9.7**	<0.5	5.8	<0.5	<0.5	<0.2
VAS04 (25-30')	11/16/2011	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2
VAS04 (39-44')	11/16/2011	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2
VAS05 (20-25')	11/16/2011	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2
VAS05 (32.5-37.5')	11/16/2011	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2
VAS05 (45-50')	11/16/2011	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2
VAS05 (63-68')	11/17/2011	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2
IDEM RISC Default Industrial Cleanup Level		**55**	**31**	**1,000**	**2,000**	**1,000**	**4**
IDEM RISC Default Residential Cleanup Level		**5**	**5**	**70**	**100**	**80**	**2**

Note: All Values over IDEM RISC Default Industrial Cleanup Level in **RED**

All Values over IDEM RISC Default Residential Cleanup Level in **BLUE**

FIGURES

Figure 1. Top-of-Till Map from Boring Data Only

Figure 2. Sewer Line from Floral Park Cemetery

Figure 10A. Top-of-Till Map from Combined Geophysical Survey and Boring Data (2012 MUNDELL Geophysical Report)

Figure 10B. Conceptual Site Flow Model Deep Upper Sand and Gravel (2012 MUNDELL Geophysical Report)

Figure 16. Shallow Potentiometric Surface Map January 18, 2012 (2012 MUNDELL AIASR)

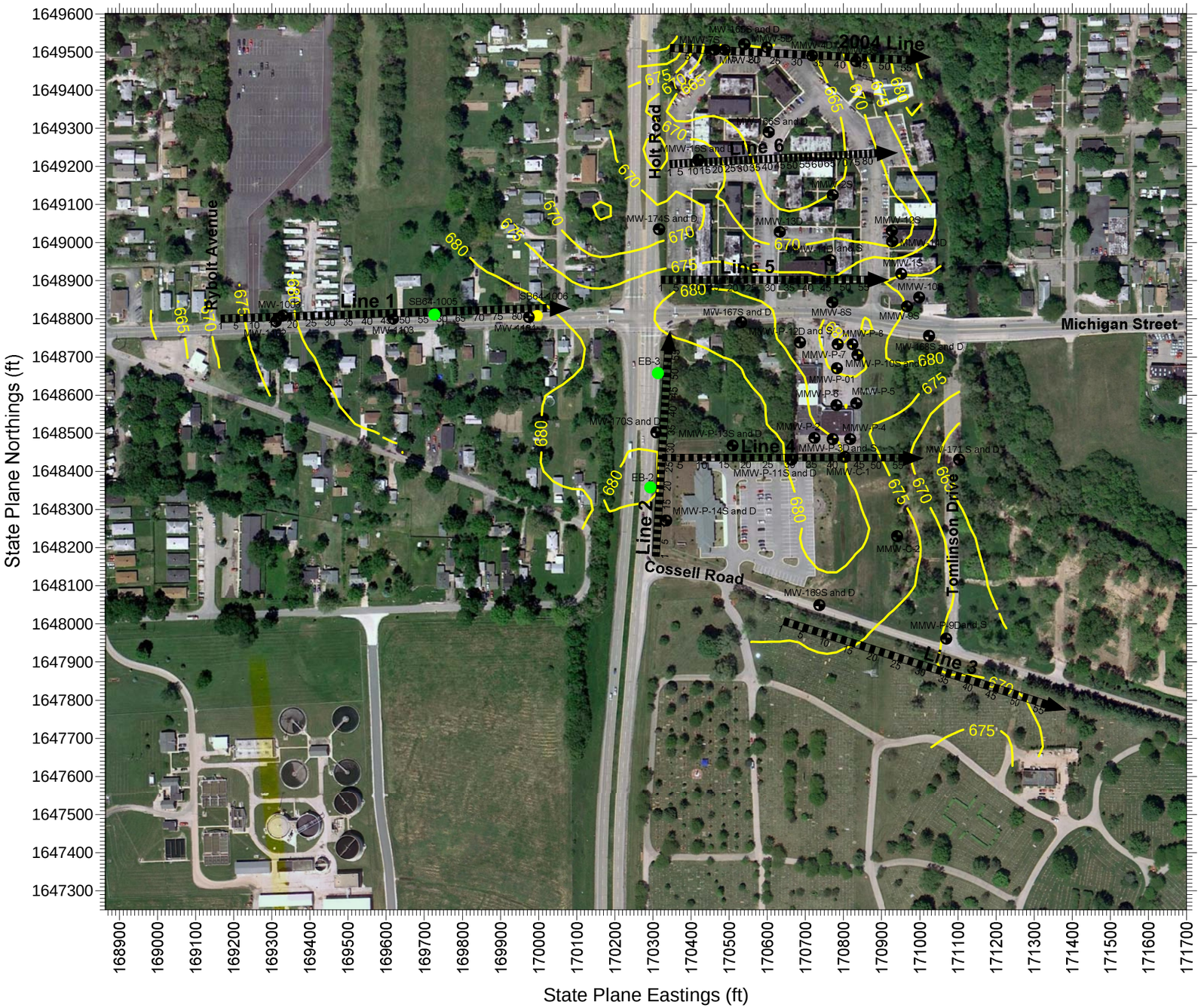
Figure 17. Deep Potentiometric Surface Map January 18, 2012 (2012 MUNDELL AIASR)

Figure 15. Cis-1,2-DCE Distribution in Shallow Groundwater (October 2011)

Figure 15R. REVISED Cis-1,2-DCE Distribution in Shallow Groundwater (October 2011)

Figure 18. Vinyl Chloride Distribution in Deep Groundwater (October 2011)

Figure 18R. REVISED Vinyl Chloride Distribution in Deep Groundwater (October 2011)



Resistivity Line Location

Top of Till Elevation (ft. above mean sea level)

Monitoring Well Location

N

Scale in Feet

0 100 200 300 400 500

1" = 300'

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REV.	DATE	DESCRIPTION	BY	APPR.

PROJECT NO.:	M01046	FILE NO.:	2011 Resistivity.srf
DRAWING:		PLOT SIZE:	11"x17"
DRAFTED BY:	GJH	DATE:	12/05/11
CHECKED BY:	GJH	DATE:	12/05/11
APPROVED BY:	JAM	DATE:	12/13/11

Top of Till Map from the Injection and Boring Data
Michigan Street
Indianapolis, Indiana
MUNDELL Project No. M01046

FIGURE
1

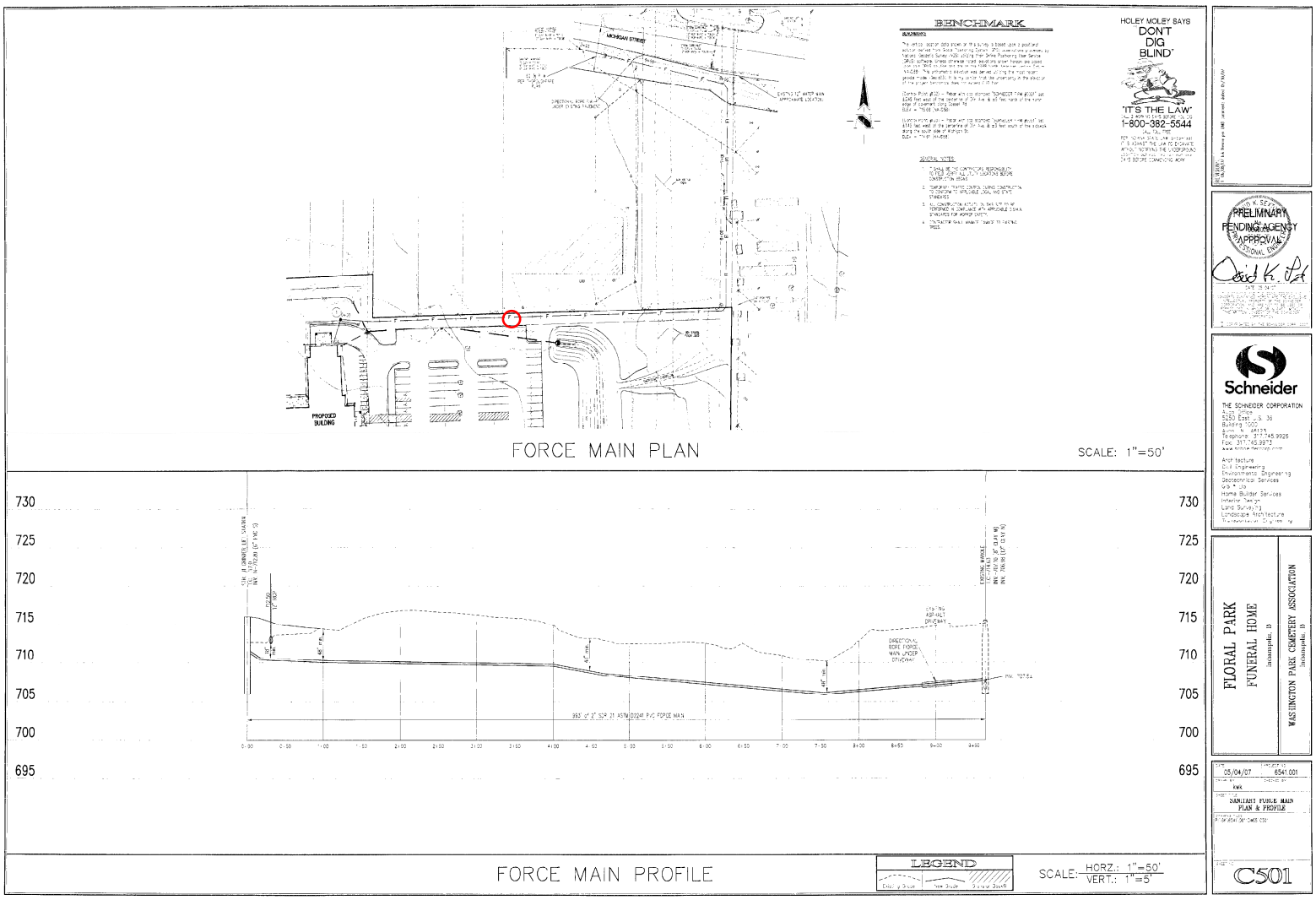
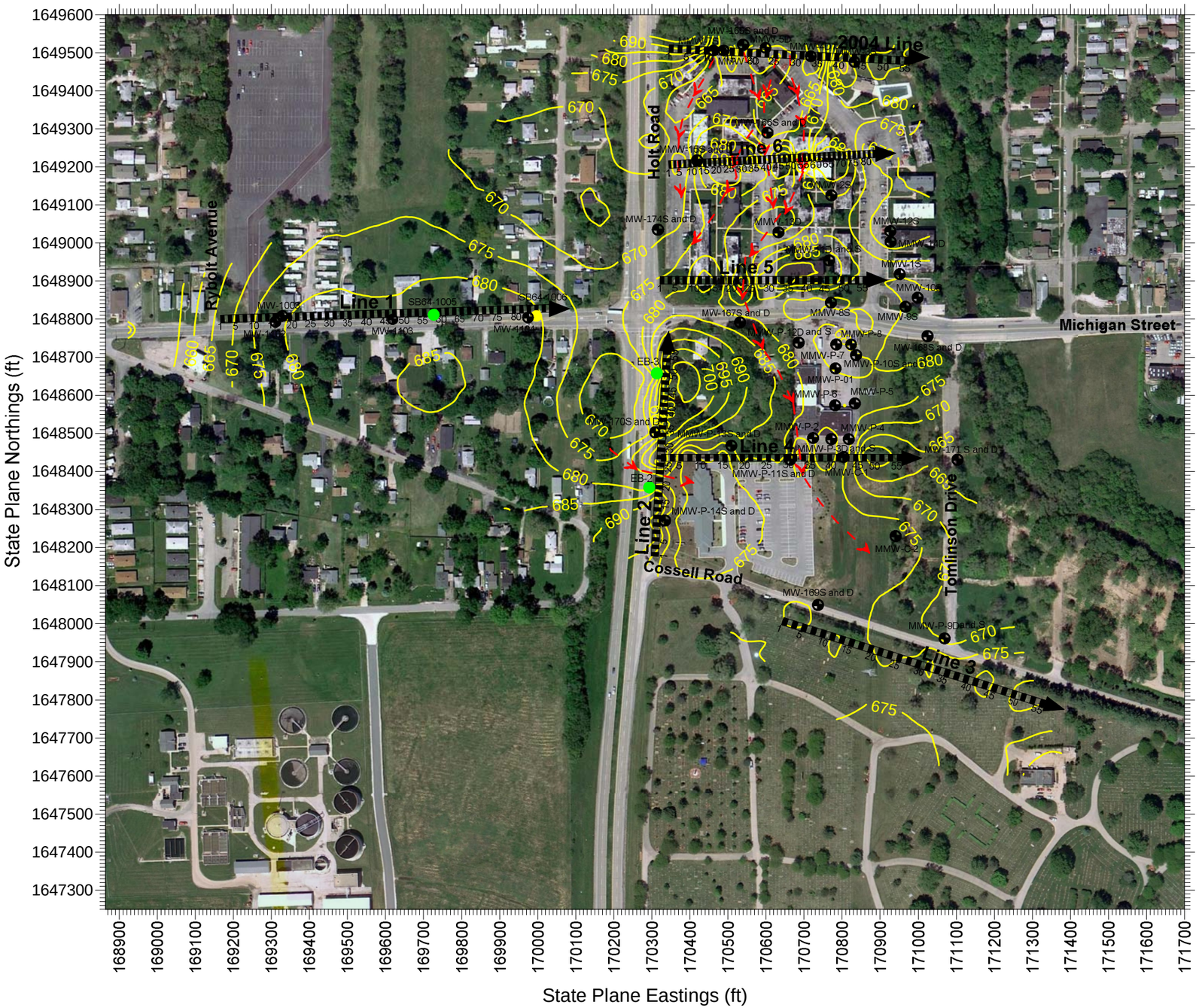


Figure 2. Sewer Line for Floral Park Cemetery



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REV.	DATE	DESCRIPTION	BY	APPR.

PROJECT NO.: M01046	FILE NO.: 2011 Resistivity.srf
DRAWING:	PLOT SIZE: 11"x17"
DRAFTED BY: GJH	DATE: 12/05/11
CHECKED BY: GJH	DATE: 12/05/11
APPROVED BY: JAM	DATE: 12/13/11

Top of Till Map from the Geophysical and Boring Data
Michigan Street
Indianapolis, Indiana
MUNDELL Project No. M01046

FIGURE
10A

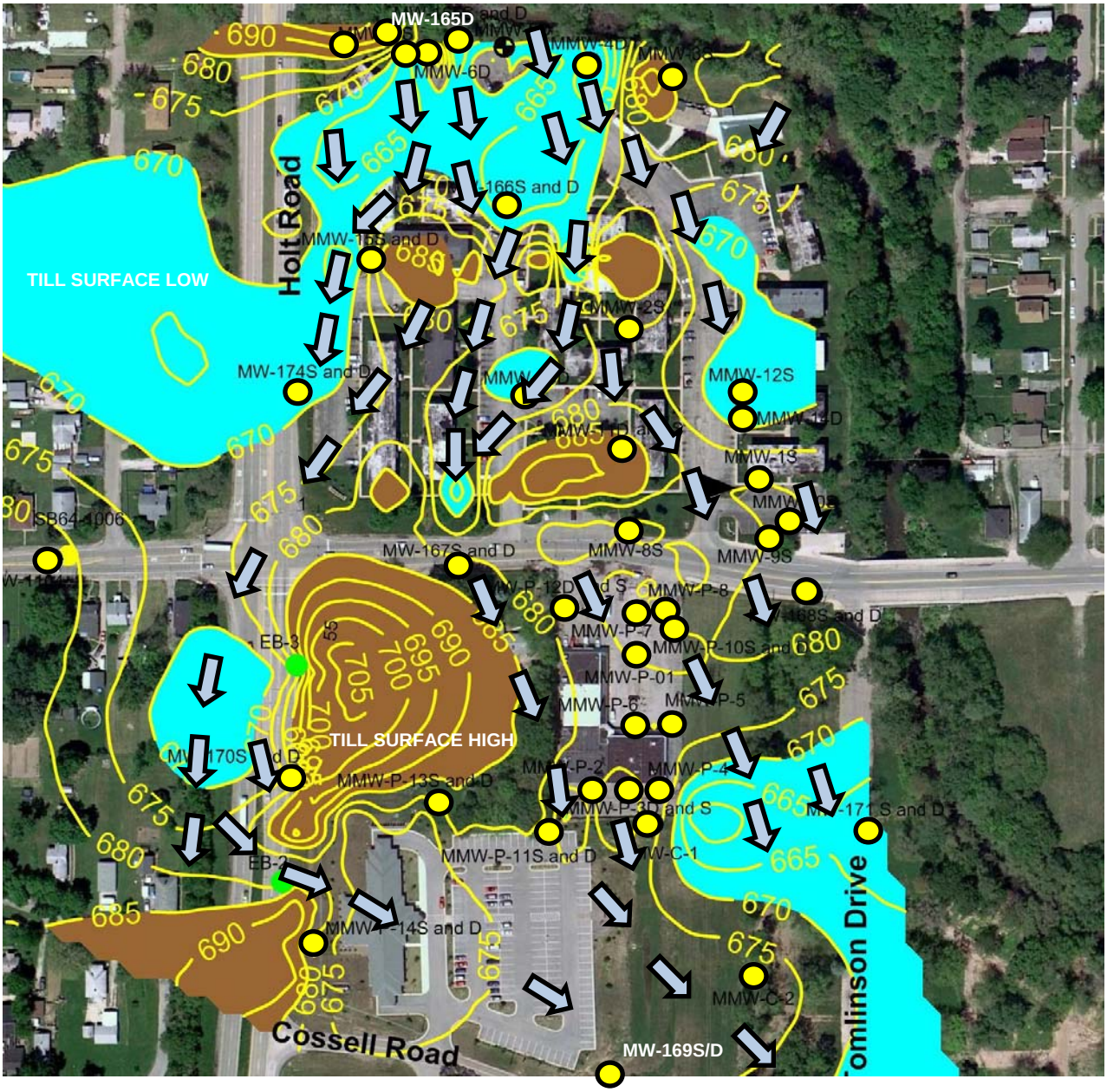
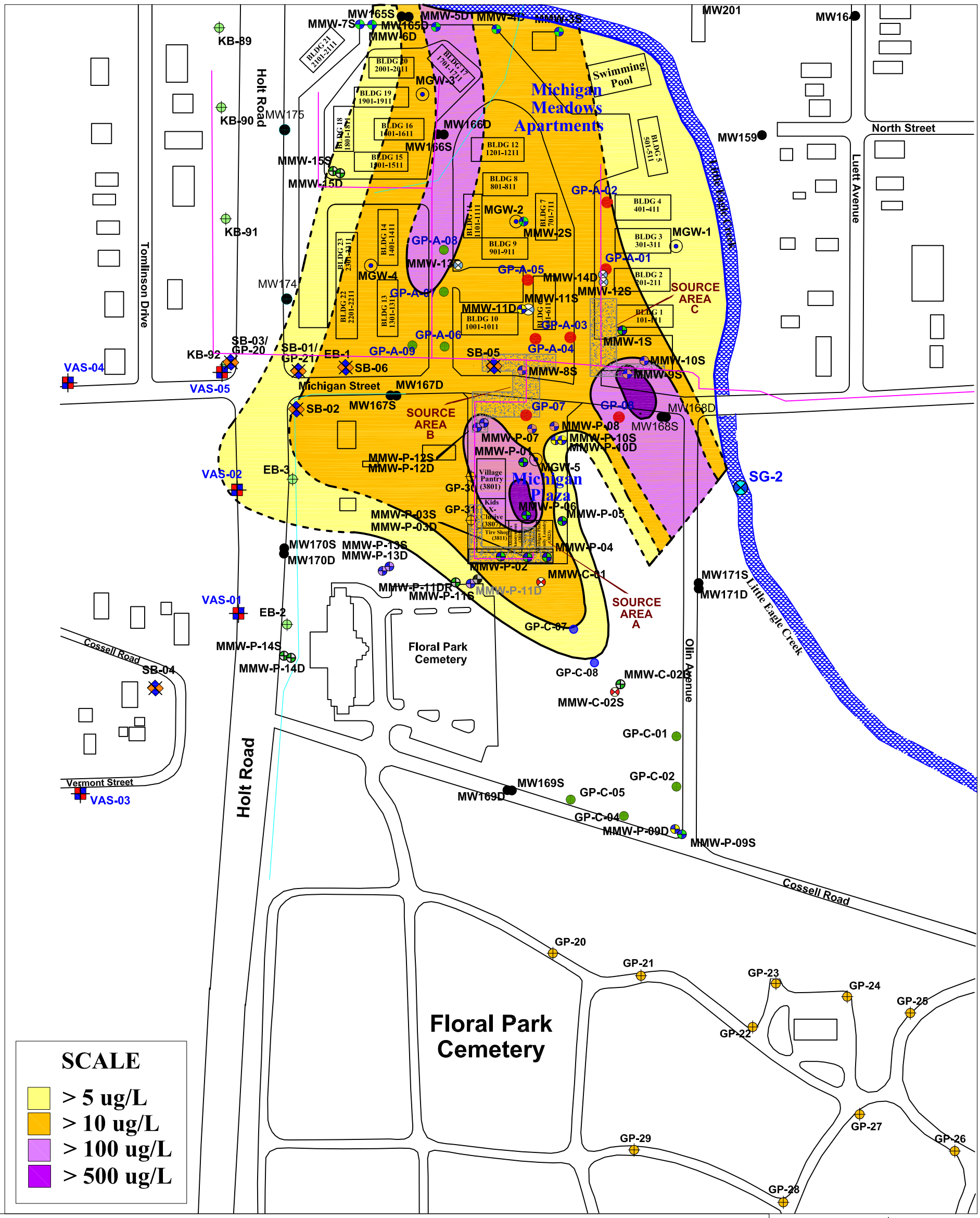


FIGURE 10B.
MICHIGAN PLAZA AND MEADOWS APARTMENTS
CONCEPTUAL SITE FLOW MODEL DEEP UPPER SAND AND GRAVEL



LEGEND

	Fence
MW160	Keramida/Environ Monitoring Wells
MMW-P-06	MUNDELL Monitoring Wells, Michigan Plaza (September 2005)
MMW-P-07	MUNDELL Monitoring Wells (January 2007)
MMW-P-09D	MUNDELL Monitoring Wells (May-June 2007)
MMW-C-01	MUNDELL Monitoring Wells (July/August 2008)
MMW-11S	MUNDELL Monitoring Wells (November/December 2008)
GP-C-05	MUNDELL Soil Boring Locations (January 2007)
GP-07	MUNDELL Soil Boring Locations (September 2005)
GP-C-08	MUNDELL Soil Boring Locations (August 2008)
MMW-P-11D	MUNDELL Monitoring Wells (September 2011)
MGW-1	MUNDELL Soil Gas Well
GP-29	MUNDELL Soil Boring Location (December 2011)
MMW-P-11D	MUNDELL Monitoring Wells (December 2011)
VAS-01	EPA Vertical Aquifer Sampling Well Locations (November 2011)
SB-03	EPA Soil Borings
MMW-P-11D	Abandoned Monitoring Well Location
EB-2	Environ Soil Borings
	Sanitary Sewer
	Storm Sewer

N

SCALE 200 feet

Keramida Monitoring Well Locations Referenced from Keramida Environmental, Inc. Project No. 2829 March 13, 2002

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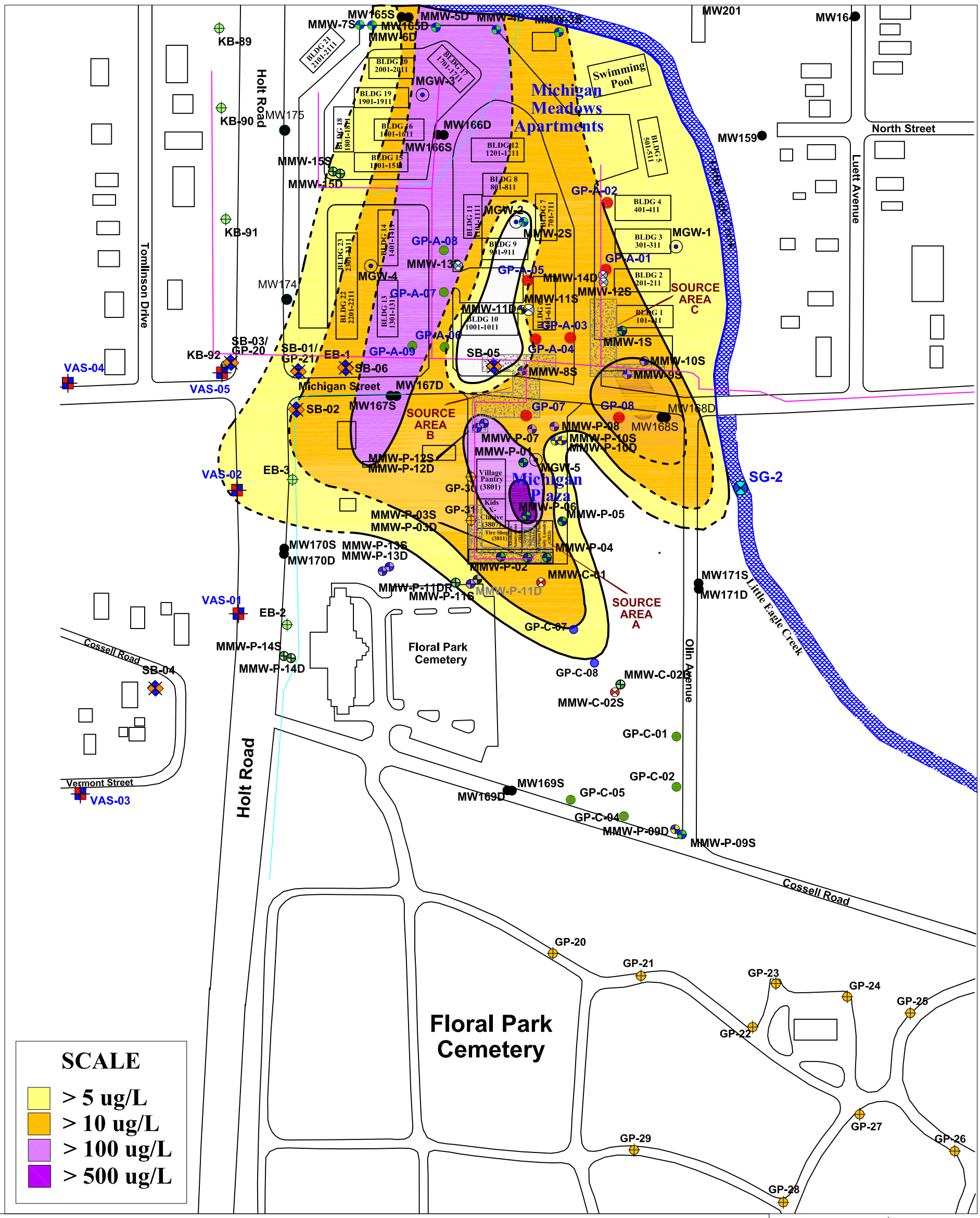
Project Number: M01046
Drawing File: Basemap 2012
Date Prepared: 3/13/2012
Scale: 1"=200'

Cis-1,2-DCE DISTRIBUTION IN SHALLOW GROUNDWATER (OCTOBER 2011)

Michigan Plaza
3801 - 3823 West Michigan Street
Indianapolis, INDIANA

FIGURE 15



LEGEND

	Fence
MW160	Keramida/Environ Monitoring Wells
MMW-P-06	MUNDELL Monitoring Wells, Michigan Plaza (September 2005)
MMW-P-07	MUNDELL Monitoring Wells (January 2007)
MMW-P-09D	MUNDELL Monitoring Wells (May-June 2007)
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GP-C-05	MUNDELL Soil Boring Locations (January 2007)
GP-07	MUNDELL Soil Boring Locations (September 2005)
GP-C-08	MUNDELL Soil Boring Locations (August 2008)
MMW-P-11D	MUNDELL Monitoring Wells (September 2011)
MGW-1	MUNDELL Soil Gas Well
GP-29	MUNDELL Soil Boring Location (December 2011)
MMW-P-11D	MUNDELL Monitoring Wells (December 2011)
VAS-01	EPA Vertical Aquifer Sampling Well Locations (November 2011)
SB-03	EPA Soil Borings
MMW-P-11D	Abandoned Monitoring Well Location
EB-2	Environ Soil Borings
	Sanitary Sewer
	Storm Sewer

N

SCALE 200 feet

Keramida Monitoring Well Locations Referenced from Keramida Environmental, Inc. Project No. 2829 March 13, 2002

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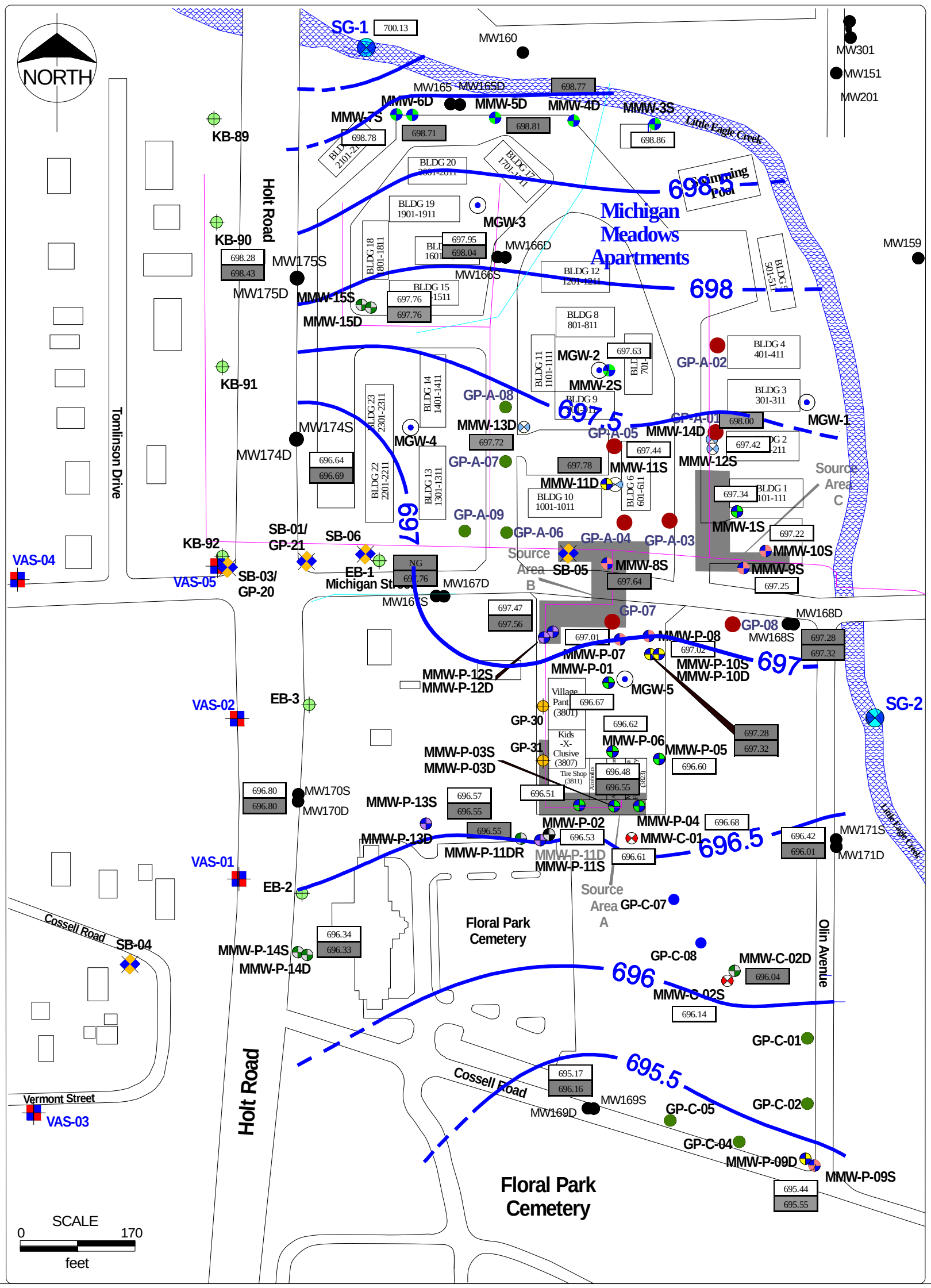
Project Number: M01046
Drawing File: Basemap 2011
Date Prepared: 12/7/2012
Scale: 1"=200'

REVISED Cis-1,2-DCE DISTRIBUTION IN SHALLOW GROUNDWATER (COMPOSITE 2011-2012)

Michigan Plaza
3801 - 3823 West Michigan Street
Indianapolis, INDIANA

FIGURE 15R



LEGEND

	Fence
MW160	Keramida/Environ Monitoring Wells
MMW-P-06	MUNDELL Monitoring Wells, Michigan Plaza (September 2005)
MMW-P-07	MUNDELL Monitoring Wells (January 2007)
MMW-P-09D	MUNDELL Monitoring Wells (May-June 2007)
MMW-C-01	MUNDELL Monitoring Wells (July/August 2008)
MMW-11S	MUNDELL Monitoring Wells (November/December 2008)
GP-C-05	MUNDELL Soil Boring Locations (January 2007)
GP-07	MUNDELL Soil Boring Locations (September 2005)
GP-C-08	MUNDELL Soil Boring Locations (August 2008)
MMW-P-11D	MUNDELL Monitoring Wells (September 2011)
MGW-1	MUNDELL Soil Gas Well
GP-21	MUNDELL Soil Boring Locations (December 2011)
MMW-P-11D	MUNDELL Monitoring Wells (December 2011)
VAS-01	EPA Vertical Aquifer Sampling Well Locations (November 2011)
SB-01	EPA Soil Boring Locations (November 2011)
698	Potentiometric Surface Equipotential Lines Contour Interval = 0.5 feet
MMW-P-11D	Abandoned Monitoring Well Location
EB-2	Environ Soil Borings
	Sanitary Sewer
	Storm Sewer

Water Level as Measured on January 18, 2012 (gray boxes indicate groundwater elevation values not used for the creation of the Shallow Potentiometric Surface Map)

NG - Not Gauged

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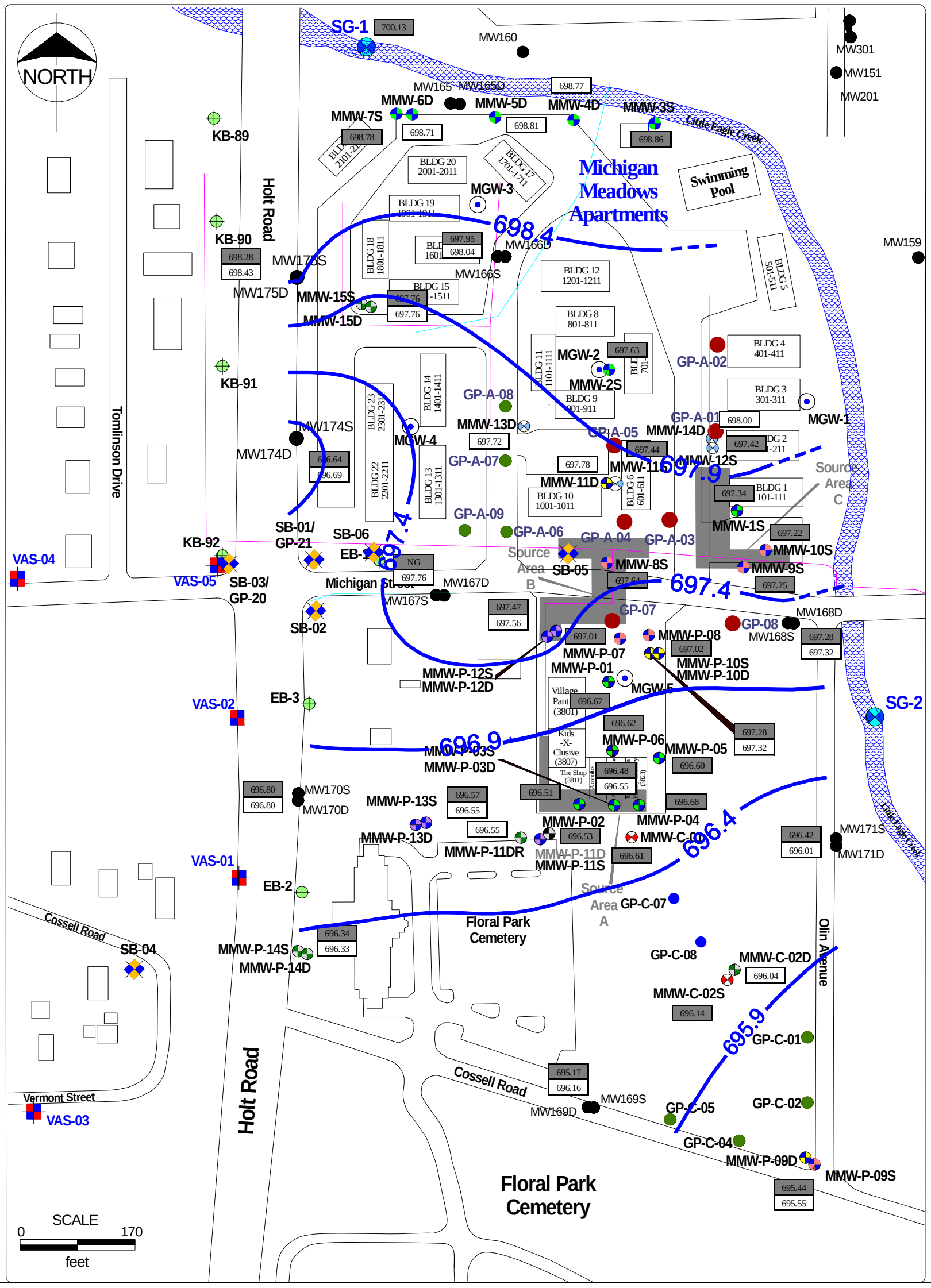
Project Number: M01046
Drawing File: GWE_1Q2012
Date Prepared: 2/18/2012
Scale: 1"=170'

Shallow Potentiometric Surface Map
January 18, 2012

Michigan Plaza
3801 - 3823 West Michigan Street
Indianapolis, Indiana

FIGURE
16



LEGEND

———	Fence
MW160	Keramida/Environ Monitoring Wells
MMW-P-06	MUNDELL Monitoring Wells, Michigan Plaza (September 2005)
MMW-P-07	MUNDELL Monitoring Wells (January 2007)
MMW-P-09D	MUNDELL Monitoring Wells (May-June 2007)
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MGW-1	MUNDELL Soil Gas Well
GP-21	MUNDELL Soil Boring Locations (December 2011)
MMW-P-11D	MUNDELL Monitoring Wells (December 2011)
VAS-01	EPA Vertical Aquifer Sampling Well Locations (November 2011)
SB-04	EPA Soil Boring Locations (November 2011)
698	Potentiometric Surface Equipotential Lines Contour Interval = 0.5 feet
MMW-P-11D	Abandoned Monitoring Well Location
EB-2	Environ Soil Borings
	Sanitary Sewer
	Storm Sewer

Water Level as Measured on January 18, 2012 (gray boxes indicate groundwater elevation values not used for the creation of the Shallow Potentiometric Surface Map)

NG - Not Gauged

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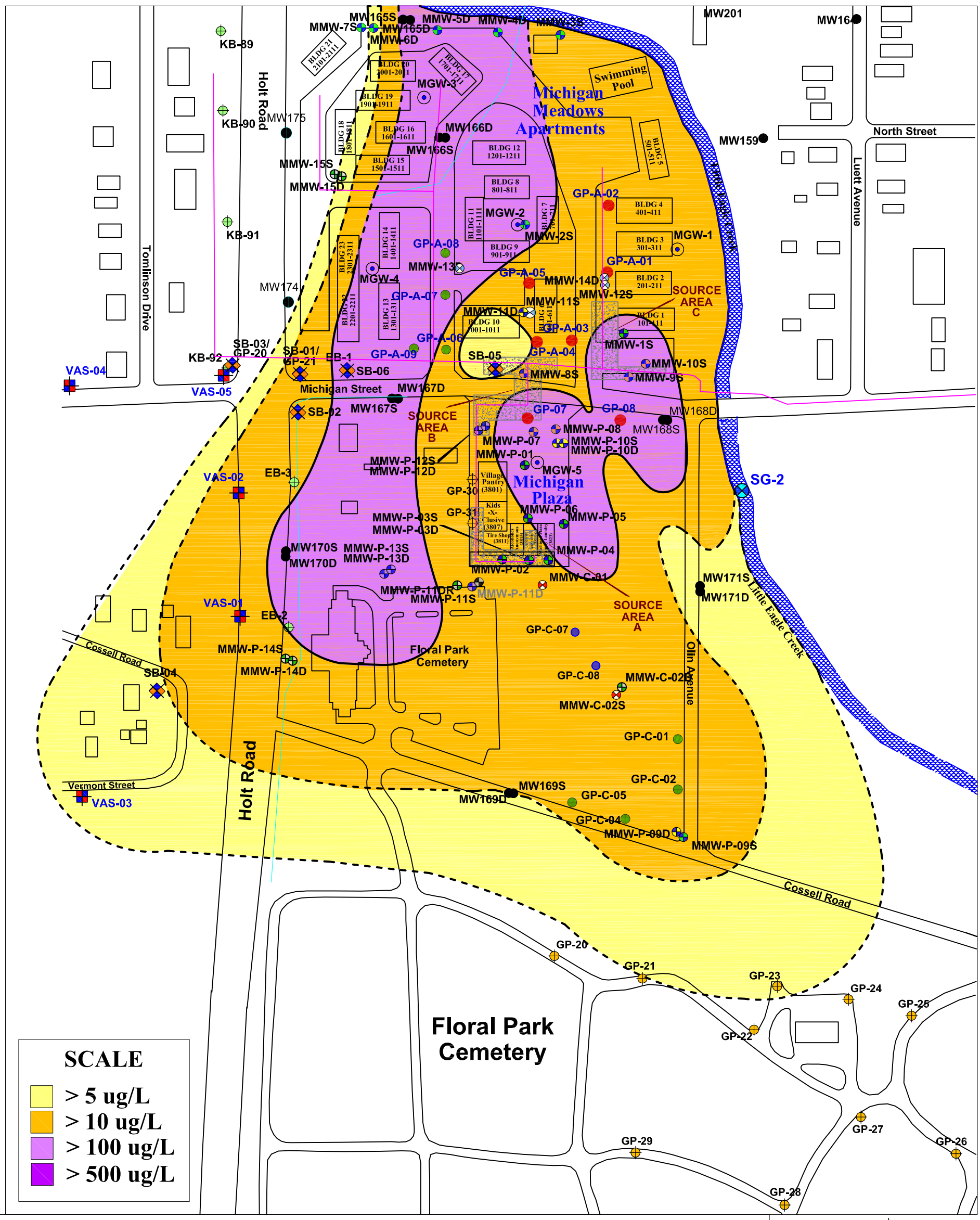
Project Number: M01046
Drawing File: GWE_1Q2012_DEEP
Date Prepared: 2/24/2012
Scale: 1"=170'

Deep Potentiometric Surface Map January 18, 2012

Michigan Plaza
3801 - 3823 West Michigan Street
Indianapolis, Indiana

FIGURE
17



LEGEND

	Fence
MW160	Keramida/Environ Monitoring Wells
MMW-P-06	MUNDELL Monitoring Wells, Michigan Plaza (September 2005)
MMW-P-07	MUNDELL Monitoring Wells (January 2007)
MMW-P-09D	MUNDELL Monitoring Wells (May-June 2007)
MMW-C-01	MUNDELL Monitoring Wells (July/August 2008)
MMW-11S	MUNDELL Monitoring Wells (November/December 2008)
GP-C-05	MUNDELL Soil Boring Locations (January 2007)
GP-07	MUNDELL Soil Boring Locations (September 2005)
GP-C-08	MUNDELL Soil Boring Locations (August 2008)
MMW-P-11D	MUNDELL Monitoring Wells (September 2011)
MGW-1	MUNDELL Soil Gas Well
GP-29	MUNDELL Soil Boring Location (December 2011)
MMW-P-11D	MUNDELL Monitoring Wells (December 2011)
VAS-01	EPA Vertical Aquifer Sampling Well Locations (November 2011)
SB-03	EPA Soil Borings
MMW-P-11D	Abandoned Monitoring Well Location
EB-2	Environ Soil Borings
	Sanitary Sewer
	Storm Sewer

N

SCALE 200 feet

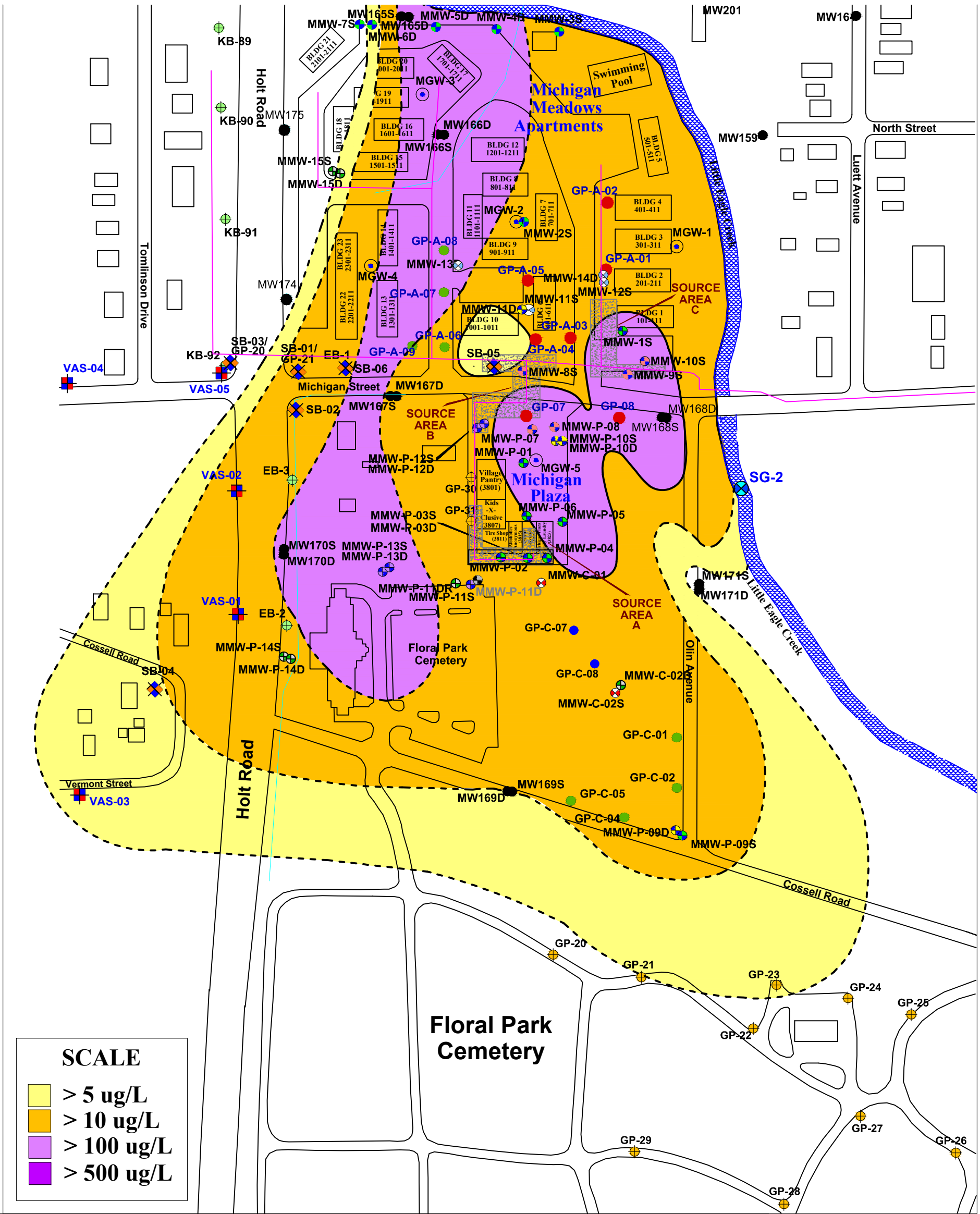
Keramida Monitoring Well Locations Referenced from Keramida Environmental, Inc. Project No. 2829 March 13, 2002

Mundell Consulting Professionals for the Earth and the Environment
110 South Downey Avenue
Indianapolis, Indiana 46219
317-630-9060, fax 317-630-9065
www.MundellAssociates.com

Project Number: M01046
Drawing File: Basemap 2012
Date Prepared: 3/13/12
Scale: 1"=200'

VINYL CHLORIDE DISTRIBUTION IN DEEP GROUNDWATER (OCTOBER 2011)
Michigan Plaza
3801 - 3823 West Michigan Street
Indianapolis, INDIANA

FIGURE 18



LEGEND

	Fence
MW160	Keramida/Environ Monitoring Wells
MMW-P-06	MUNDELL Monitoring Wells, Michigan Plaza (September 2005)
MMW-P-07	MUNDELL Monitoring Wells (January 2007)
MMW-P-09D	MUNDELL Monitoring Wells (May-June 2007)
MMW-C-01	MUNDELL Monitoring Wells (July/August 2008)
MMW-11S	MUNDELL Monitoring Wells (November/December 2008)
GP-C-05	MUNDELL Soil Boring Locations (January 2007)
GP-07	MUNDELL Soil Boring Locations (September 2005)
GP-C-08	MUNDELL Soil Boring Locations (August 2008)
MMW-P-11D	MUNDELL Monitoring Wells (September 2011)
MGW-1	MUNDELL Soil Gas Well
GP-29	MUNDELL Soil Boring Location (December 2011)
MMW-P-11D	MUNDELL Monitoring Wells (December 2011)
VAS-01	EPA Vertical Aquifer Sampling Well Locations (November 2011)
SB-03	EPA Soil Borings
MMW-P-11D	Abandoned Monitoring Well Location
EB-2	Environ Soil Borings
	Sanitary Sewer
	Storm Sewer

N

SCALE 200 feet

Keramida Monitoring Well Locations Referenced from Keramida Environmental, Inc. Project No. 2829 March 13, 2002

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Project Number: M01046
Drawing File: Basemap 2011
Date Prepared: 12/7/2012
Scale: 1"=200'

REVISED VINYL CHLORIDE DISTRIBUTION IN DEEP GROUNDWATER
(Composite 2011-2012)
Michigan Plaza
3801 - 3823 West Michigan Street
Indianapolis, INDIANA

FIGURE 18R

ATTACHMENT A

RESIDENTIAL CONTACT DOCUMENTATION

ACCESS AGREEMENT

This Access Agreement ("Agreement") is entered into by and between Aimco Michigan Meadows Holdings, LLC ("Aimco") and Aferocina Cox ("Landowner")

Recitals

1. Aimco is conducting an environmental investigation at property located at 3801-3823 W. Michigan Street, Indianapolis, Indiana (the "Michigan Plaza Property:");

2. Landowner owns property located at 3817 W. Michigan Street, Indianapolis, Indiana (Landowner's Property);

3. Aimco would like permission for its designated consultant to obtain indoor and ambient air samples (the "Air Sampling") from Landowner's Property in connection with its investigation of the Michigan Plaza Property;

4. Landowner is willing to allow Aimco access to the Landowner's Property to permit the Air Sampling subject to the terms and conditions contained in this Agreement.

Agreement

THE parties agree as follows:

1. Landowner hereby grants Aimco, and its consultant, Mundell & Associates, Inc., permission to enter Landowner's Property for the purpose of conducting the Air Sampling.

2. The terms of this Agreement will be effective until Aimco completes the Air Sampling.

3. Aimco, through its designated consultant, shall take reasonable precautions to minimize any damage that might occur to Landowner's Property from the Air Sampling, and shall restore Landowner's Property to as close to the original condition as reasonably possible. Aimco shall indemnify Landowner from and against all losses, damages, injuries and/or liability arising from the Air Sampling.

Aimco	**Aferocina Cox**
By: _____	_____
Date: 8/18/11	Date: _____

1964856

Mundell
Consulting Professionals
for the Earth and the Environment

110 South Downey Avenue, Indianapolis, Indiana 46219-6406
Telephone 317-630-9060, Facsimile 317-630-9065
www.MundellAssociates.com

September 19, 2011

3817 West Michigan Street
Indianapolis, Indiana

We would like to conduct air quality testing in your home. This testing is related to the ongoing environmental investigation activities at the Michigan Plaza property located to the east of your residence. This sampling will be conducted at NO COST to you and will be scheduled to accommodate your scheduling needs.

Please complete the enclosed self-addressed, stamped postcard and return it via mail. Should you have any questions, please do not hesitate to contact me.

Sincerely,

Sarah E. Webb, L.P.G.
Project Manager
317-630-9060

MUNDELL & ASSOCIATES, INC.

Mundell
Consulting Professionals
110 South Downey Ave
Indianapolis IN, 46219

CURRENT RESIDENT
3817 West Michigan Street
Indianapolis IN, 46222

Mundell
Consulting Professionals

☐ **YES**, I am interested in participating in the indoor air quality survey.

Name: _____
Address: _____
Phone Number: _____

☐ **NO**, I am not interested at this time.