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VIA EMAIL & OVERNIGHT DELIVERY

April 19, 2013

Mr. Thomas C. Nash
Associate Regional Counsel
EPA - Region 5
Enforcement Services Section 1
(Mail Code: SE-5J)
77 West Jackson Boulevard
Chicago, IL 60604-3590

Re: Technical Response to "Technical Memorandum: Analytical and Hydrogeological Evaluation, West Vermont Street Site, Speedway, Marion County, Indiana" prepared for USEPA by Weston Solutions, Inc., (January 30, 2013)

Dear Mr. Nash:

As we discussed, attached is a Technical Response to the *"Technical Memorandum Analytical Hydrogeological Evaluation, West Vermont Street Site, Speedway, Marion County, Indiana,"* prepared for USEPA by Weston Solutions, Inc., which was prepared for AIMCO Michigan Meadows Holdings, LLC (AMMH) by R C Minning and Associates (RCMA) and MUNDELL & ASSOCIATES, INC. (MUNDELL). Per our conversation yesterday, one hard copy of the Technical Response is being provided to you, and two hard copies are being sent directly to Shelly Lam.

We look forward to receiving EPA's response. In the meantime, if you or others at EPA or Weston have any questions about the analysis, please let me know.

Sincerely,

Scott H. Reisch

Enclosure

cc: Shelly Lam
Nick Billings
Pete Cappel
Bob Minning
John Mundell

TECHNICAL RESPONSE

TO "TECHNICAL MEMORANDUM:
ANALYTICAL AND HYDROGEOLOGICAL EVALUATION,
WEST VERMONT STREET SITE, SPEEDWAY, MARION COUNTY, INDIANA"
PREPARED FOR USEPA BY WESTON SOLUTIONS, INC. (JANUARY 30, 2013)

Prepared for:

AIMCO Michigan Meadows Holdings, LLC
4582 S. Ulster St. Parkway, Suite 1100
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April 18, 2013

Prepared by:

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**Technical Response to "Technical Memorandum:
Analytical and Hydrogeological Evaluation,
West Vermont Street Site, Speedway, Marion County, Indiana"
prepared for USEPA by Weston Solutions, Inc., (January 30, 2013)**

This Technical Response (TR) to the January 30, 2013 United States Environmental Protection Agency (EPA) *"Technical Memorandum Analytical Hydrogeological Evaluation, West Vermont Street Site, Speedway, Marion County, Indiana,"* prepared by Weston Solutions, Inc. (2013 TM) is being submitted by R. C. Minning & Associates, Inc. (RCMA), and MUNDELL & ASSOCIATES, INC. (MUNDELL) on behalf of AIMCO Michigan Meadows Holdings, LLC (AMMH). Its purpose is to evaluate potential concerns that past historic activities or recent remediation efforts at the Michigan Plaza property located at 3801-3823 West Michigan Street in Indianapolis, Indiana (IDEM Incident #0000198, IDEM VRP #6061202) may have been responsible for the Vinyl Chloride (VC) groundwater impacts that have been detected in the West Vermont Street Drinking Water Site (Site)[1] water wells located west of the property on Vermont Street and Cossell Road in Indianapolis, Indiana.

This TR formally assesses the new data presented in the 2013 TM as well as additional data that have become available since the initial Weston Technical Memorandum concerning the Site was issued on March 27, 2011 (2011 TM). In particular, this TR addresses three (3) main topics: (1) potentiometric surface and direction of groundwater flow from Source Areas A, B, and C within the Michigan Plaza/Apartments complex to the east of the Site; (2) influence of CAP-18® injections on the direction of groundwater flow from the Source Areas, if any; and (3) the significance of blind drilled wells and subsurface stratigraphy on our understanding of these issues. While we presented much of the analysis below at our meeting on March 21, 2013, we have included in this TR additional information that addresses questions and comments raised by EPA at that meeting.

I. POTENTIOMETRIC SURFACE AND DIRECTION OF GROUNDWATER FLOW

In assessing the potential for Source Areas A, B and C within the Michigan Plaza/Apartments complex to have been a source of the contamination found in the private wells at the Site, the first and foremost factor to consider is the direction of groundwater flow. That is, the Site must be or must have been downgradient of the Source Areas and groundwater flow lines passing through one or more of the Source Areas also must pass through the Site.

[1] For the purposes of this Technical Response, the boundaries of the "Site" are assumed to be as outlined in Figure 3-1 on EPA's website:
http://www.epa.gov/region5/cleanup/cossellvermont/pdfs/cossellvermont_map_201002.pdf.

When Weston initially assessed the potentiometric surface in the vicinity of the Site in the 2011 TM, it prepared the October 2010 Potentiometric Surface Figures 10a (Upper Water Bearing Zone) and 10b (Intermediate Water Bearing Zone). These figures are attached to this report and presented as **MUNDELL Figures 1 and 2**, respectively.[2] The figures are identical to those included in the 2011 TM except that flow lines have been added to show the direction of groundwater flow. **MUNDELL Figure 3** presents a Site Plan showing the locations of Source Areas A, B and C within the Michigan Plaza/Apartments complex. Transposing those Source Areas onto Figures 1 and 2 shows that no flow lines from Source Areas A, B or C pass through the Site or even come close. Indeed, groundwater flow is primarily to the south through the Source Areas. Accordingly, it is not surprising that the 2011 TM concludes that:

> *The Michigan Plaza Site is cross-gradient from this plume and therefore is a potential but unlikely contributor to PCE contamination in the Residential area.*
>
> *…*
>
> *One large VC plume is present northeast of the Site and appears to originate at the Genuine Auto Parts Site is present south of Michigan Plaza and east into the Site. The Michigan Plaza Site is cross-gradient from this plume. However, Michigan Plaza may be a potential contributor to VC contamination in the Residential Area because following CAP-18 injection at the Michigan Plaza property significant increase in vinyl chloride concentrations have been noticed and injection of several thousand gallons of water may have cause cross-gradient flow towards the residential neighborhood. The isoconcentration maps show that this plume is migrating to the Residential Area, indicating that the Genuine Auto Parts Site is a likely source area for the VC contamination at the Residential Site. Additionally, the VC plume could also have originated from Allison Transmission Site prior to the control of groundwater through the remedial system…* [*See* 2011 TM at 22-23.]

Despite this conclusion, the 2011 TM stated that:

> *The installation of monitoring wells up-gradient, down-gradient, and cross-gradient, relative to the Site, is*

[2] **Figures** prepared by MUNDELL for the purpose of this report are referenced in **bold** and labeled as **MUNDELL Figure __** to distinguish them from figures prepared by MUNDELL or others and included in prior reports.

> *necessary to determine groundwater flow and contaminant source areas.*[3]

As a result, between November 9 – 18, 2011, Weston installed a series of soil borings and monitor well nests: SB-01 thru SB-06; and MW-WES-01 through MW-WES-05. Their locations along with other area monitor wells installed by ENVIRON and MUNDELL following issuance of the 2011 TM are presented in **MUNDELL Figure 3**. Weston took water level measurements in December 2011 in the new wells along with area wide monitor wells. Those data were used to construct new potentiometric surface maps which are presented as Figures 11 (Potentiometric Surface Map for Shallow A2) and 12 (Potentiometric Surface Map for Deep A2) in the 2013 TM, and **Figures 4** and **5**, respectively in this report. Groundwater flow lines have been added to **Figures 4** and **5**. A comparison of the two sets of potentiometric surface maps generated by Weston for conditions in October 2010 and December 2011 shows that the configuration of the equipotential contour lines and the groundwater flow lines are very similar. As a result, based on the Weston October 2010 and December 2011 water level elevations and the configuration of the resulting equipotential contour lines and groundwater flow lines, we conclude that there is no groundwater flow from Michigan Plaza/Apartments Source Areas A, B and C passing through or close to the Site, and that the Michigan Plaza/Apartments Source Areas remain "cross gradient" from the Site as Weston concluded in 2011.

While we believed it was important to assess the Weston figures in the form in which they were provided, we also evaluated the Weston figures to determine if they accurately and objectively represent all of the available data. Our review of the 2013 TM - Figure 11 (**Figure 4**) suggested, and our subsequent conversation with EPA confirmed, that the configuration of the 696 equipotential contour line was "hand-drawn" as opposed to computer generated using the Surfer® routine. While we recognize that in some circumstances hand-drawing of contour lines is appropriate, we wanted to determine how a computer routine, devoid of bias, would draw the 696 equipotential line in this case. Accordingly, the same December 2011 groundwater elevations generated by Weston were input into a Surfer® routine for plotting the potentiometric surface contour lines. This plot is presented as **MUNDELL Figure 6** and groundwater flow lines have been added. Note the configuration of the 696 contour line becomes more east-west using the Surfer® routine with the corresponding groundwater flow direction being more southerly than suggested in Weston Figure 11 (**Figure 4**).

Our further review of Figure 11 (**Figure 4**) and Table 3 from the 2013 TM found that the water level elevations for MMW-P-11S and MMW-P-13S were not included although the

[3] The 2011 TM also hypothesized that the injection of thousands of gallons of water in connection with the CAP 18® injection in connection with the voluntary remediation of the Michigan Plaza/Apartments Site may have caused cross-gradient flow to the wards the Site. 2011 TM at 23. This hypothesis is evaluated in Section II of this report.

elevations are presented in Table 3. These water levels are important in understanding groundwater flow in the area in between the Michigan Plaza/Apartments Source Areas A, B and C and the Site. We understand from our conversation with EPA that these water levels were omitted from Table 3 due to timing considerations and not because of any lack of confidence in the data. We also understand that EPA believed that including these data in Figure 11 would have resulted in a depiction of groundwater flow to the southwest of what was depicted in Figure 11.

Including the water level elevations for MMW-P-11S and MMW-P-13S in another Surfer® plotting routine produces the results shown in **MUNDELL Figure 7**. Contrary to EPA's expectation, including this additional data makes the 696 equipotential contour line even more east-west oriented between MW-WES-02a and MMW-P-02, and the corresponding flow lines are oriented in a more southerly direction. Figure 7 represents a more accurate depiction of groundwater flow conditions in December 2011 than Weston Figure 11 (**Figure 4**) for the Shallow A2 Aquifer.

We also reviewed Weston Figure 12 (**Figure 5**) for the Deep A2 Potentiometric Surface. Using the same groundwater level elevation data as Weston, we generated **MUNDELL Figure 8** and again subjected those data to a Surfer® routine and added groundwater flow lines. The results are depicted in **Figure 8**. The direction of groundwater flow correlates well between **Figures 5** and **8** and again supports the conclusion that groundwater flow in the deep portion of the A2 aquifer that passes through Source Areas A, B or C is in a general southerly direction away from and considerably side gradient to the Site. The direction in the Deep A2 is even more important than in the shallow A2 since the depths of the residential wells in which VC was detected in December 2011 are 59 ft and 75 ft. *See* 2013 TM at 28. From these figures, it is noted that groundwater flow lines passing through the residential wells have their origin far to the north and west of Michigan Plaza.

As a check on our conclusion, we also considered whether the analysis prepared by Genuine Part's consultant, ENVIRON, undermines our conclusions. In a Remedial Progress Report dated January 2012, ENVIRON used the December 6, 2011 water level elevations to prepare its potentiometric surface Figures 8 and 9 (**Figures 9** and **10**) for the shallow and deep monitoring wells, respectively. These water level elevations are purportedly the same as presented in Table 3 of the 2013 TM. Flow lines have been added to **Figures 9** and **10**.

ENVIRON Figure 9 (**Figure 10**) for the Deep Monitor Wells is incorrect in that it utilizes the water level elevation of 697.31 ft for MW-174D which is really the water level elevation for MW-174S. *See* 2013 TM, Table 3. The correct elevation is 696.95 ft. This is an anomalous reading and Weston did not use it in its preparation of its Figure 12 (**Figure 5**). In addition, ENVIRON and Weston did not use the location or water level elevations for MMW-P-12S/D in any of its figures although the elevations are presented

in Table 3 of the 2013 TM. MMW-P-12S/D is an important monitoring location for determining groundwater flow direction in the western portion of Source Area B, including SB-05, which we discussed in our meeting of March 21, 2013. Note that the correct screen settings are 16 ft – 26 ft for MMW-P-12S and 31.5 – 36.5 ft for MMW-P-12D, which properly qualifies them for the shallow and deep portions of the A2 aquifer, respectively. **MUNDELL Figure 8B** has been prepared using a 0.5 ft contour interval (as ENVIRON did), omitting the anomalous water level elevation for MW-174D, and incorporating the location and water level elevation (697.49 ft) for MMW-P-12D. Flow lines have been added. There is good correlation between **MUNDELL Figure 8B** and Weston Figure 12 (**Figure 5**). Note that the direction of groundwater flow through the northwestern portion of Source Area B which incorporates the location of SB-05 is predominantly to the south and clearly cross-gradient with respect to the Site.

Arcadis also developed a Potentiometric Surface – Shallow Sand Unit S2 map based on the October 2010 groundwater elevations which was presented as Figure 12a (**Figure 11**). Flow lines have been added. This figure and inferred groundwater flow directions correlates well with Weston Figure 10a (**Figure 1**) and shows a southerly flow through Source Areas A, B and C.

Finally, to further evaluate groundwater flow direction issues, we prepared **MUNDELL Figure 12**, which presents the hypothetical flow lines needed for groundwater passing through Source Areas A, B, and C to migrate to the residential areas in question. The flow lines are superimposed for reference on the deep zone December 2011 equipotential contour lines (refer to **MUNDELL Figure 8** for base figure). The conflict between the potentiometric surface relative to the hypothetical flow lines needed is clearly illustrated; flow would have to disobey the laws of fluid dynamics and move sub-parallel to parallel along the potentiometric surface of the aquifer for the hypothetical flow lines to be oriented this way. No shallow or deep potentiometric surface maps ever prepared for the Site and Source Areas A, B and C have remotely approached depicting this hypothetical flow line configuration.

Based on the above review, all of the data-based constructions of the potentiometric surface and associated groundwater flow lines for the shallow and deep portions of the A2 aquifer that have been prepared by Weston, ENVIRON, Arcadis and MUNDELL show that Source Areas A, B and C associated with the Michigan Plaza/Apartments Site are side or cross gradient with respect to the Site. No flow lines from Source Areas A, B or C pass through the Site or even come close. This is especially true when all of the valid available data are used and objectively depicted.

II. INFLUENCE OF CAP 18® INJECTIONS

A. Groundwater Flow Direction

This section of our review deals with the Weston hypothesis that injection(s) of CAP 18® resulted in cross gradient flow of contaminants into the Site. The hypothesis put forth on page 19 of the 2011 TM states:

> *The CAP-18 injection at the Michigan Plaza property has shown significant increase in vinyl chloride concentrations. Furthermore, according to information received from U.S. EPA, several thousand gallons of water were injected in the groundwater. This injection of groundwater could have potentially changed the hydraulic conditions at the site and may have caused cross-gradient flow towards the residential neighborhood. As a result of this injection, the wells in the residential neighborhood could have been impacted.*

The same hypothesis is reiterated and expanded upon in page 11 of the 2013 TM:

> *Newell et al also indicates that the ''hydraulic conductivity of the medium is proportional to the density and inversely proportional to the viscosity of the LNAPL [*Light Nonaqueous Phase Liquid]*." The viscosity of soy bean oils ranges from 80 to 800 centipoise (cP) for treated soy bean oils; water has a viscosity of 1.002 cP. Therefore, injection of a high-viscosity fluid, such as CAP 18 ME, would decrease the hydraulic conductivity of the aquifer, also resulting in a decrease in groundwater flow velocity. These conditions generally result in <u>increased hydraulic head</u> and cause <u>a change in the groundwater flow direction</u> because groundwater and associated contamination typically follows the path of least resistance (Newell et al, 1995, page 5). [Emphasis added.]*

The emphasis above has been added to those parameters above which appear to form the basis for the hypothesis. As a preliminary matter, please note that we have reviewed the Newell paper cited by the 2013 TM, and only the quoted language regarding hydraulic conductivity appears in that paper. There is no discussion in the Newell paper of any changes in hydraulic head or flow direction. Moreover, the characterization of CAP 18® ME as a "high-viscosity fluid" is incorrect. Data from the Carus Corporation, manufacturers of the CAP 18® ME shows that it has a viscosity of about 78 centipoise at 62 degrees Fahrenheit, which is the temperature of the

groundwater in the vicinity of Source Areas A, B and C. The Material Safety Data Sheet – Section 9. Chemical and Physical Properties states that the "Appearance" is "Pale yellow, slightly viscous, oily liquid." (Emphasis added.). Accordingly, Newell provides no authority for the proposition that injection of CAP 18® would be expected to alter groundwater flow direction.

Nevertheless, we further evaluated Weston's hypothesis by using available data and analytical tools, and collecting additional data where necessary. To that end, MUNDELL conducted aquifer slug testing during March and April 2013, subsequent to our meeting. MUNDELL performed falling and rising head slug tests in seven monitoring wells (MMW-P-02, MMW-11S, MMW-11DR, MMW-P-13S, MMW-P-13D, MMW-P-14S, MMW-P-14D) located between Michigan Plaza and the drinking water wells at the Site. The results, summarized in **Table 1** with the analysis provided in **Attachment 1**, indicate that the hydraulic conductivity of the upper sand and gravel unit ranged from about 22.1 to 141.1 ft/day, with a representative, mean value of about 70 ft/day. It should be noted from the observed behavior of the falling and rising head tests that groundwater levels that were displaced temporarily within each monitoring well were observed to rapidly return to their pre-displacement levels within a few minutes, indicating the responsiveness of the sand and gravel units.

Based upon the measured mean hydraulic conductivity value of 70 ft/day, we evaluated the expected behavior of groundwater during a typical 10 hour CAP 18® injection in which the maximum discharge (injection) rate would be limited to about 3 gpm. As set forth in **Attachment 1**, our analysis used the pump/injection test software AQTESOLV™ to simulate a constant pumping rate of 3 gpm into a 20 ft thick saturated aquifer with a K value of 70 ft/day, and a storativity (specific yield, S) range of 0.1 to 0.3,[4] and determined that the theoretical maximum response (in this context, water level rise) in the groundwater level at a distance of 1 ft from the injection point is estimated to range between 0.27 and 0.31 ft,, with the rise in groundwater level at a distance of 10 ft away from the injection point to be between 0.12 and 0.16 ft. Mounding effects would be negligible (~0.02 ft or less) at a 50-foot distance from the injection point.. Therefore, mounding effects even within close proximity to the injection point are expected to be minimal. In addition, once injection stops, the AQTESOLV™ analysis predicts that it will take two hours or less for the groundwater levels to return to approximate pre-injection conditions. This theoretical analysis fully supports the conclusion that no significant mounding of groundwater would have occurred during the previous CAP 18® injections.

Finally, and most importantly, we evaluated Weston's hypothesis in light of contemporaneous data collected before, during and after the prior injections, much of which was not previously in Weston's possession. Since the injections took place in August/September of 2007 and February 2009, monitoring data from those periods

[4] Lohman, S. W., 1972, Ground-Water Hydraulics, USGS Professional Paper No. 708, p. 8.

provide insight into whether or not there were increases in hydraulic head and/or associated changes in groundwater flow direction. Had significant, sustained mounding occurred as a result of the CAP 18® injections, water levels in the vicinity of and away from the injections would have been observed to rise several feet above their typical levels and remain there, resulting in a potentiometric surface with contours lines wrapping around the point or area of injection (as if an elevated water level 'hill' is present). This would have resulted in potentiometric contour lines indicating significant radial flow outward from the injection points in all directions. As discussed below, the actual conditions measured during and after the injections did not reflect this behavior.

The injection of CAP 18® is a relatively straight forward process as shown in **MUNDELL Figure 13**. The Geoprobe was driven into the A2 aquifer until the upper till surface was encountered. The leading section of the drill rods was a three (3)-foot "screen." A measured quantity of CAP 18® was injected and the drill rods and screen were pulled back (withdrawn) three (3) feet and the injection process was repeated. A typical injection log is presented as **MUNDELL Figure 14** and shows the amount injected at each interval. **MUNDELL Figures 15A thru 15F** are photos of a typical CAP 18® injection and equipment. **MUNDELL Figures 16 and 17** show the injection sites for the August 2007 and February 2009 events, respectively. **Table 2A** presents the specific injection volumes per depth interval for Source Areas A, B and C for the August 1 – September 4, 2007 event (see **MUNDELL Figure 16**). **Table 2B** presents the injection volumes per depth interval for the February 4 – 12, 2009 event (see **MUNDELL Figure 17**). **Table 2C** is a summary of the CAP 18® injection volumes for both events. Note that the average injection rate ranged from 0.38 to 0.70 gallons per minute.

During the course of the August 2007 injection, groundwater levels and CAP18® product levels were monitored. These measurements are presented in **Table 3 – Groundwater Level and CAP 18® Product Level Monitoring – Post Injection**. A water level meter and an oil/water interface probe were used to measure water level changes and observe the presence of any CAP 18® on the groundwater surface in the vicinity of the injection locations as the injections were occurring. No measureable groundwater mounding effects or the presence of CAP 18® (*i.e.*, no rise in groundwater level of more than 0.01 ft or the presence of a measurable CAP 18® thickness of greater than 0.02 ft) beyond a 10 ft radius from the point of injection was observed in nearby monitoring wells associated with **Source Area A** (MMW-P-02, MMW-P-03S/D, MMW-P-04, MMW-P-05, MMW-P-06), **Source Area B** (MMW-P-01, MMW-P07, MMW-P-08, MMW-P-10S/D, MMW-8S) and **Source Area C** (MMW-1S, MMW-8S, MMW-9S, MMW-10S). Clearly, there was no widespread or thick layer of CAP 18® (as a LNAPL) observed and there was no change in the potentiometric surface or groundwater flow direction.

As part of its normal quarterly monitoring of the site, MUNDELL measured water levels in on-site monitor wells and prepared a series of potentiometric surface maps for dates

prior to and subsequent to both the August 2007 and February 2009 CAP 18® injections. **Figures 18** thru **22** cover the period from June 14, 2007 (prior to the August 2007 injection) to June 2, 2008 (ten months after the injection). A review of those figures shows that the direction of groundwater flow through Source Areas A, B and C was generally to the south throughout the ten (10) months subsequent to the injection, with no groundwater mounding. **Figures 23 thru 29** cover the period from March 17, 2009 (one-month after the February 2009 injection) to July 20, 2010 (seventeen months after the injection). A review of those figures shows that the direction of groundwater flow through Source Areas A, B and C was generally to the south throughout the seventeen (17) months subsequent to the injection, with no groundwater mounding.

Based on the relative magnitudes of water levels observed during the CAP 18® injections (*i.e*., the water level did not raise significantly near injection locations as compared to other water levels taken during the injections in wells further away), and the lack of CAP 18® accumulation in wells beyond a distance of 10 ft from the injection points (*e.g*., note that CAP 18® was detected in MMW-P-04 with a thickness of 3.77" on June 15 (see **Figure 24**) and August 5, 2009 (see **Figure 25**), but not in any other wells), there is no evidence in the field data collected that significant groundwater mounding or CAP 18® transport away from the injection locations occurred as a result of the in-situ bioremediation process.

Based on the foregoing, the Weston hypothesis that the injections of CAP 18® resulted in "increased hydraulic head" and caused "a change in groundwater flow direction" is not supported by the data and further analysis. Instead, the data show that there was no increase in hydraulic head or change in groundwater flow direction due to the CAP 18® injections.

B. Analysis of VC Detections at MW-170D

The 2013 TM attempts to support the CAP 18® hypothesis based on observed impacts of VC at MW-170D. Page 11 of the 2013 TM states that:

> *VC concentrations in monitoring well MW-170D near the Residential Area increased approximately 10 to 17 months after each CAP 18 ME injection. VC concentrations increased in MW-170D from 105 ug/L in February 2007 to 230 ug/L in June 2008, approximately 10 months after the first CAP-18 ME injection. VC increased in MW-170D again in July 2010 to 233 ug/L, approximately 17 months after the second CAP-18 ME injection (**Figure 3**) (Mundell, 2012).*

There are a number of difficulties with attributing variations in VC at MW-170D to the CAP-18® injections. First, VC was detected at MW-170D at a level of 80 ug/L as early

as 2001, almost six (6) years prior to remediation activities at the Michigan Plaza/Apartments properties. Therefore, this VC could not have been caused by remediation activities that were not undertaken until six years later. Second, the 2013 TM's assertions that VC concentrations travelled from Michigan Plaza/Apartments Source Areas in 10 to 17 months (or less, as the available data only show when the additional VC was detected in MW-170D, not when it actually arrived)) implies a groundwater velocity that can be calculated. The distance from NW corner of Michigan Plaza (Source Area B) to MW-170D is approximately 450 ft. The distance from the SW corner of Michigan Plaza (Source Area A) is also approximately 450 feet. Both are cross-gradient to MW-170D. Ten months equals 300 days. The implied rate of VC (groundwater) travel is velocity = distance / time or 450 ft / 300 days = 1.5 feet/day. Accordingly, the actual mound (and therefore hydraulic gradient) needed to achieve an arrival time for VC at MW-170D within 10 months can be calculated using Darcy's Law:

$$v = K\, i / n_e = K\, (dh/dl)/n_e \qquad (1)$$

where:

v = groundwater velocity,
K = aquifer hydraulic conductivity,
n_e = average aquifer effective porosity [5],
i = horizontal hydraulic gradient,
= dh/dl, or the change in head dh that occurs over the distance dl

Rearranging the Darcy equation, we arrive at the sustained mounding needed over 10 months in order to achieve the hydraulic gradient that causes the groundwater velocity needed for VC to arrive at MW-170D:

$$dh = (v\, n_e\, dl)/K = (1.5 \text{ ft/day}) \times (0.26) \times 450 \text{ ft} / (70 \text{ ft/day})$$

$$= 2.51 \text{ ft}$$

That is, a sustained mound height of 2.51 ft is needed to move VC from the southwest corner of the Michigan Plaza to MW-170D in 10 months, and an even larger mound would have been needed for the VC to travel from a Michigan Plaza/Apartments Source Area in less than 10 months. As previously discussed, all available data show that no such sustained mound ever existed.

Having demonstrated that the CAP 18® injection did not alter the groundwater flow direction in the vicinity of the Source Areas so as to push VC to the residential wells at the Site, we took the analysis a step further and considered whether the spikes of VC at MW-170D detected in June 2008 and July 2010 could be attributed to the CAP 18®

[5] Fetter, C. W. 1994. *Applied Hydrogeology*. Upper Saddle River, N. J.; Prentice Hall, page 91.

injections if one were to assume (contrary to the available data) that residential wells were directly downgradient of Source Areas A and B, and then calculate the theoretical travel time between the Source Areas and the residential wells using the actual hydraulic head differential between MW-170D and the Source Areas. It is apparent after reviewing all potentiometric maps that the groundwater elevation at Source Area A is either equal to or lower than that at MW-170D. Therefore, the travel time from Source Area A would be infinite, and VC would never arrive at the residential wells. For Source Area B, the groundwater level is typically on the order of 0.5 to 1.0 ft above that of MW-170D. With a distance from MW-170D of about 450 ft from Source Area B, the time of travel would then be:

time = distance/(Ki/n_e) = (450 ft)/((70 ft/day)(0.5 to 1 ft)/450 ft)/(0.26))

= 752 to 1,504 days

= 2.06 to 4.12 years

Therefore, even if we assumed that monitoring well MW-170D is located directly downgradient of the Source Area B injection area, and we used the actual measured head differential between the two locations, it would take from 2.06 to 4.12 years for VC to arrive at the monitoring well. Accordingly, despite making that (unsupported) assumption, the observed increase in VC in MW-170D ten months after the August 2007 CAP 18® injection and seventeen (17) months after the February 2009 injection cannot be attributed to AMMH's voluntary remediation.

An additional difficulty with relying on the change in VC detections at MW-170D to support the hypothesis that CAP 18® injections caused VC contamination to migrate to the Site is that the same hypothesis would necessarily require that increased VC be detected at monitoring wells closer to the Michigan Plaza/Apartments Source Areas before the VC was detected in MW-170D. **Figures 30A and 30B** present the Historical Chlorinated Solvent Concentration Trends In MW-170D and other monitoring wells associated with the Michigan Plaza/Apartments Site. A review of **Figures 16 and 30B** shows that a number of monitoring wells are directly within (MMW-P-03S, MMW-P-03D and MMW-P-06) or immediately downgradient (MMW-P-01) of the injection areas. As shown in the graphs for the aforementioned monitor wells, there was virtually no increase in VC concentrations within the ten (10) months following the August 2007 injection event. Further examination of the graphs in **Figure 30B** reveals that increases in VC concentrations in the above cited monitoring wells did not occur until well after the second CAP 18® injection event in February 2009.

Finally, since the ultimate question is not whether the CAP 18® injections impacted MW-170D but whether they caused the detections of VC in the residential wells, we considered how long it would take any VC generated as part of AMMH's voluntary

remediation to travel 450 feet in a downgradient direction (*e.g.*, the distance between the closest of the Michigan Plaza/Apartments Source Areas and the nearest impacted residential wells at the Site).

Using the Darcy equation, and a horizontal hydraulic gradient of i = 0.001 ft/ft, which is the measured horizontal hydraulic gradient downgradient and beyond the southern property boundary of Michigan Plaza (between contour lines EL 696 and EL 695.5, and between EL 695.5 and EL 695) from the September 19, 2007 potentiometric surface (**Figure 19**), we obtain:

$v = \text{distance/time} = Ki/n_e = K\,(dh/dl)/n_e$

$\text{time} = \text{distance}/(Ki/n_e) = (450\text{ ft})/((70\text{ ft/day})(0.001\text{ ft/ft})/(0.26))$

$= 1{,}671\text{ days}$

$= 4.58\text{ years}$

Therefore, by this estimate, non-degrading and non-retarding VC impacts might be expected to arrive at a distance of 450 ft downgradient of the injection location after about 4.6 years (*i.e.*, no earlier than February 2012 for the August 2007 injection).[6] This calculated time frame is slightly shorter than the data showing actual VC concentrations generated in downgradient monitoring wells MMW-P-01 (*i.e.*, about a 100 ft VC movement from Source Area B in about 1.5 years, which is equivalent to 450 ft VC movement in 6.75 years) and MMW-P-06 (a 200 ft VC movement in 2.5 years from Source Area B, which is equivalent to a 450 ft VC movement in 5.6 years) as seen in the trends shown on **Figure 30B**. This analysis is significant because it shows that any impacts from the 2007 injection could not possibly have arrived in the residential wells until early last year, even if (contrary to the data) the residential wells were downgradient of the Michigan Plaza/Apartments Source Areas.

Based on this review, the inference by Weston that the increases in VC concentrations in MW-170D were due to the August 2007 and February 2009 CAP 18® injections in Michigan Plaza/Apartments Source Areas A, B and C is <u>not</u> supported by the monitoring data or reasoned analysis.

III. BLIND DRILLED WELLS

During the course of the investigation and remediation activities associated with Source Areas A, B and C of the Michigan Plaza/Apartments properties, a number of monitoring

[6] Given that the CAP 18® injections would not spontaneously generate VC, and the effects of chemical retardation, hydrodynamic dispersion, and sequential dechlorination processes would only serve to lengthen travel time, the actual time between the date of the injection and the arrival of VC 450 feet downgradient of the injection would actually be longer than 4.6 years.

wells or portions thereof were blind drilled, *i.e.*, the composition of the materials encountered during the drilling process was not described or recorded. This condition created an apparent data gap as to the continuity of the basal till and proper screen setting. Efforts to supplement the data gaps were undertaken and included utilizing the data from the CAP 18® injection wells that encountered the upper glacial till surface and natural gamma ray and electrical conductivity geophysical logging of the blind drilled wells. While that information was useful, it was decided that the most definitive way to address the perceived data gap was to drill soil borings adjacent to the blind drilled wells, describe all materials encountered, and verify the depth to the top of the till surface.

Accordingly, in March 2013, based on past discussions with and comments by the Indiana Department of Environmental Management, eleven (11) soil borings were drilled adjacent to the blind drilled wells. The subsurface materials encountered were continuously sampled down to and including the basal till. Those soil borings are listed in **Table 4** along with the adjacent blind drilled well, the initial blank drilled interval, the screen setting and the sand interval per the logged borehole. Their locations are shown in **MUNDELL Figure 3**. **MUNDELL Figures 31 A-P** present the logs for the soil borings and include SB100 – 103 which were drilled to provide additional subsurface information in the vicinity of Source Area C (SB-100 – 102) and Source Area B (SB-103). All data gaps have been resolved with the exception of MMW-P-08 and MMW-P-09, which will both be drilled at the time of the next CAP 18® injection event.

Based on the additional data collected, we prepared a series of geologic cross-sections to show the continuity of the upper glacial till beneath the Michigan Plaza Source Areas and the screen settings for the selected monitoring wells. The lines of cross section are shown in **Figure 32** and cross sections A - A', B - B' and C - C' are presented as **MUNDELL Figures 33, 34 and 35**, respectively. The additional soil boring logs confirm that the screen settings for the blind drilled wells were properly placed, and that the upper glacial till is aerially extensive beneath Source Areas A, B and C**.** Cross section C – C' shown in **MUNDELL Figure 35** is essentially the same as cross section A – A' shown in Figure 5 of the 2013 TM and confirms the continuity of the upper glacial till surface in the vicinity of MMW-P-10S/D that acts as a boundary to the vertical extent of chlorinated solvent impacts near the Source Areas.

A review of the portion of cross section A – A' immediately beneath and east of Holt Road and the portion of cross section B – B' in the northern portion of the Michigan Apartments property on both sides of Little Eagle Creek reveals that the upper intermediate glacial till is not present in those areas. The absence of this glacial till layer allows for chemical movement originating from the north to migrate downward into the deeper sand and gravel layer to depths of greater than 50 ft below the ground surface north and west of Michigan Plaza.

IV. CONCLUSIONS

Based on all of the available groundwater level data, the actual 2007 and 2009 measurements of water levels and CAP 18® accumulation during the remedial injection program, additional 2013 borings drilled in the vicinity of the Michigan Plaza property and 2013 aquifer hydrologic testing, it can be concluded that:

1) Groundwater flow direction through the Michigan Plaza/Apartments Source Areas A, B and C remains south and southeast. As such, these Source Areas are cross-gradient from the residential wells at the Site that have been impacted with VC.

2) Injection of CAP 18® as part of AMMH's voluntary remedial efforts at the Michigan Plaza/Apartments did not cause any significant groundwater mounding, change in groundwater flow directions, or dispersion of CAP-18® within the A2 aquifer to cause the VC generated by the in-situ bioremediation process to move hydraulically cross-gradient into residential wells at the Site.

3) Additional borings completed on the Michigan Plaza property have confirmed the continuous presence and areal extent of the upper glacial till surface that acts as a boundary to the vertical extent of chlorinated solvent impacts near the Source Areas. As such, chemical impacts from the deeper movement of chlorinated solvents into lower aquifer zones has not occurred. However, the absence of this glacial till layer to the north and west of the Michigan Plaza/Apartments property allows for groundwater below this confining layer to be impacted at depths of greater than 50 ft below the ground surface from chemical sources north and west of Michigan Plaza.

We appreciate the opportunity to provide additional interpretation of conditions on and surrounding the Michigan Plaza/Apartments property, with specific regard to the presence of VC in residential wells along Vermont Street and Cossell Road.

Sincerely,

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Attachements: Tables
Figures
Attachment 1 – 2013 Hydrologic Testing and Analysis

TABLES

FIGURES

TABLES

Table 1

Slug Test Data Summary - March-April 2013

Michigan Plaza

3801-3823 West Michigan Street

Indianapolis, Indiana

MUNDELL Project No.: M01046

Field Test Type/ Well I.D.	HYDRAULIC CONDUCTIVITY, ft/day										
	MMW-P-02	MMW-P-11S	MMW-P-11DR	MMW-P-13S	MMW-P-13D	MMW-P-14S	MMW-P-14D	Maximum	Median	Mean	Minimum
Falling Head	33.5	32.9	85.0	57.4	52.0	93.0	67.1	93.0	57.4	60.1	32.9
Rising Head	44.4	38.9	130.3	99.6	22.1	141.1	84.4	141.1	84.4	80.1	22.1
Avg K-Value	**39.0**	**35.9**	**107.6**	**78.5**	**37.0**	**117.0**	**75.8**	**117.0**	**70.9**	**70.1**	**27.5**

Note:

All analyses above utilized the Bower and Rice solution method for unconfined aquifers (Bouwer and Rice, 1976) as contained in the software AQTESOLV™.

Table 2A
CAP18 Injection Data
August 1 - September 4, 2007
Michigan Plaza
3801-3823 West Michigan Street
Indianapolis, IN
Mundell Project # M01046

Injection Point	Date of Injection	Depth of Boring (ft)	Depth of Clay till (ft)	Injection Depth Range (ft)	Total Amt CAP18 Injected (gallons)
Source Area A:					
A1	8/16/07	39	39	17-38	22.0
A2	8/16/07	37	37	15-36	22.0
A3	8/16/07	39	NA	17-38	22.0
A4	8/17/07	42	42	17-41	22.0
A5	8/17/07	43	43	15-42	22.0
A6	8/17/07	42	42	17-41	22.0
A7	8/17/07	44	44	16-43	22.0
A8	8/17/07	44	44	16-43	22.0
A9	8/17/07	40	40	15-39	22.0
A10	8/17/07	39	NA	17-38	22.0
A11	8/17/07	43	43	15-42	22.0
A12	8/20/07	52	52	15-51	22.5
A13	8/20/07	34	34	15-33	22.0
A14	8/20/07	36	36	17-35	22.0
A15	8/20/07	36	36	17-35	22.0
A16	8/20/07	36	36	17-35	22.0
A17	8/21/07	39	39	17-38	66.0
A18	8/21/07	36	36	17-35	66.0
A19	8/21/07	36	36	17-35	66.5
A20	8/21/07	39	39	17-38	66.0
A21	8/21/07	36	36	17-35	66.5
A22	8/22/07	38	38	16-37	66.0
A23	8/22/07	39	39	17-38	66.0
A24	8/22/07	37	37	15-36	66.0
A25	8/22/07	36	36	17-35	66.5
A26	8/22/07	36	36	17-35	66.5
A27	8/23/07	36	36	17-35	66.5
A28	8/23/07	35	35	16-34	66.0
A29	8/23/07	36	36	17-35	66.5
A30	8/23/07	35	35	16-34	66.0
A31	8/23/07	35	35	16-34	66.0
A32	8/24/07	32	30	16-31	66.0
A33	8/24/07	34	34	15-33	66.0
A34	8/24/07	32	32	15-31	22.0
A35	8/24/07	34	34	15-33	22.0
A36	8/24/07	34	34	15-33	66.0
A37	8/24/07	32	32	16-31	66.0
A38	8/24/07	32	32	15-31	22.0
A39	9/4/07	36	NA	17-35	55.0
A40	9/4/07	36	NA	17-35	55.0
A41	9/4/07	36	NA	17-35	55.0

Table 2A
CAP18 Injection Data
August 1 - September 4, 2007
Michigan Plaza
3801-3823 West Michigan Street
Indianapolis, IN
Mundell Project # M01046

Injection Point	Date of Injection	Depth of Boring (ft)	Depth of Clay till (ft)	Injection Depth Range (ft)	Total Amt CAP18 Injected (gallons)
Source Area B:					
B1	8/1/07	46	38	15-45.5	44.6
B2	8/1/07	42	NA	14.5-41.5	47.2
B3	8/2/07	45	39	14-44	44.2
B4	8/2/07	42	40	14-41	44.4
B5	8/2/07	40	39	15-39	44.0
B6	8/2/07	42	40	17-41	45.0
B7	8/3/07	38	38	16-37	66.5
B8	8/3/07	38	38	16-37	66.5
B9	8/3/07	32	31	17-31	22.0
B10	8/3/07	28	24	15-27	65.0
B11	8/6/07	30	30	17-29	22.0
B12	8/6/07	32	31	16-31	67.0
B13	8/6/07	32	31	16-31	22.0
B14	8/6/07	32	31	16-31	67.0
B15	8/6/07	21	21	16-20	22.0
B16	8/6/07	27	27	17-26	64.0
B17	8/7/07	31	31	15-30	22.0
B18	8/7/07	27	27	17-26	66.0
B19	8/7/07	35	33	15-33	22.0
B20	8/7/07	39	38	17-38	65.5
B21	8/8/07	38	38	16-37	66.3
B22	8/8/07	38	38	16-37	66.3
B23	8/8/07	37	37	15-36	66.3
B24	8/8/07	34	34	15-33	66.0
B25	8/8/07	38	38	15-36	88.5
B26	8/9/07	35	35	16-34	66.0
B27	8/9/07	31	31	15-30	66.0
B28	8/9/07	36	35	17-35	89.0
B29	8/9/07	36	35	16-34	66.0
B30	8/9/07	35	35	16-34	66.0
B31	8/10/07	35	35	16-34	22.5
B32	8/10/07	36	36	17-35	66.0
B33	8/10/07	34	34	15-33	66.0
B34	8/10/07	35	35	16-34	22.0
B35	8/10/07	36	34	17-35	66.0
B36	8/13/07	37	37	15-36	22.0
B37	8/13/07	37	37	15-36	22.0
B38	8/13/07	36	36	17-35	22.0
B39	8/13/07	39	39	17-38	22.0
B40	8/13/07	39	39	17-38	22.0
B41	8/13/07	38	38	16-37	22.0
B42	8/13/07	38	38	16-37	22.0
B43	8/13/07	39	39	17-38	22.0
B44	8/13/07	35	35	16-34	66.0
B45	8/14/07	40	40	15-39	66.0
B46	8/14/07	38	38	16-37	66.5
B47	8/14/07	37	37	15-36	66.5
B48	8/14/07	36	36	17-35	22.0
B49	8/15/07	36	NA	17-35	22.0
B50	8/15/07	34	34	15-33	22.0
B51	8/15/07	35	35	16-34	22.0
B52	8/15/07	37	37	15-36	22.0
B53	8/15/07	36	36	17-35	22.0
B54	8/15/07	35	35	16-34	22.0
B55	8/15/07	36	36	17-35	22.0
B56	8/15/07	40	NA	15-39	58.0

Table 2A
CAP18 Injection Data
August 1 - September 4, 2007
Michigan Plaza
3801-3823 West Michigan Street
Indianapolis, IN
Mundell Project # M01046

Injection Point	Date of Injection	Depth of Boring (ft)	Depth of Clay till (ft)	Injection Depth Range (ft)	Total Amt CAP18 Injected (gallons)
B57	8/16/07	37	37	15-36	22.0
B58	8/16/07	36	36	17-35	22.0
B59	8/16/07	37	37	15-36	22.0
B60	8/16/07	35	35	16-34	22.0

Table 2A
CAP18 Injection Data
August 1 - September 4, 2007
Michigan Plaza
3801-3823 West Michigan Street
Indianapolis, IN
Mundell Project # M01046

Injection Point	Date of Injection	Depth of Boring (ft)	Depth of Clay till (ft)	Injection Depth Range (ft)	Total Amt CAP18 Injected (gallons)
Source Area C:					
C1	8/27/07	32	32	16-31	66.0
C2	8/27/07	31	31	15-30	66.0
C3	8/27/07	32	32	16-31	66.0
C4	8/27/07	32	NA	16-31	66.0
C5	8/27/07	34	34	15-33	66.0
C6	8/27/07	32	NA	16-31	66.0
C7	8/27/07	34	34	15-33	52.0
C8	8/28/07	34	34	15-33	52.0
C9	8/28/07	36	NA	17-35	52.0
C10	8/28/07	34	NA	15-33	52.0
C11	8/28/07	36	NA	17-35	52.0
C12	8/28/07	35	NA	16-34	52.0
C13	8/28/07	31	NA	15-30	52.0
C14	8/29/07	32	32	16-31	52.0
C15	8/29/07	35	35	16-34	52.0
C16	8/29/07	32	32	16-31	52.0
C17	8/29/07	32	32	16-31	52.0
C18	8/29/07	32	32	16-31	52.0
C19	8/29/07	34	34	15-33	52.0
C20	8/29/07	34	34	15-33	52.0
C21	8/30/07	30	NA	17-29	17.3
C22	8/30/07	32	32	16-31	17.5
C23	8/30/07	31	NA	15-30	17.3
C24	8/30/07	32	NA	16-31	17.5
C25	8/30/07	32	NA	16-31	17.3
C26	8/30/07	34	NA	15-33	52.0
C27	8/30/07	34	NA	15-33	17.5
C28	8/30/07	34	NA	15-33	17.3
C29	8/30/07	30	30	17-29	52.0
C30	8/31/07	35	35	16-34	17.5
C31	8/31/07	36	NA	17-35	17.3
C32	8/31/07	33	NA	17-32	17.5
C33	8/31/07	31	31	15-30	52.0
C34	8/31/07	31	31	15-30	17.3
C35	8/31/07	31	31	15-30	17.5
C36	8/31/07	35	35	16-34	17.3
C37	8/31/07	32	NA	16-31	17.5
C38	8/31/07	31	31	15-30	52.0
C39	8/31/07	NA	NA	NA	17.3
C40	9/4/07	32	NA	16-31	30.0

Table 2B
CAP18 Injection Data
February 4-12, 2009
Michigan Plaza
3801-3823 West Michigan Street
Indianapolis, IN
Mundell Project # M01046

Injection Point	Date of Injection	Depth of Boring (ft)	Depth of Clay till (ft)	Injection Depth Range (ft)	Total Amt CAP18 Injected (gallons)
Source Area B:					
B-1	2/9/09	38	38	20-38	65.0
B-2	2/9/09	38	38	20-38	65.0
B3	2/9/09	35	35	20-35	65.0
B-4	2/9/09	38	38	20-38	65.0
B-5	2/9/09	38	38	20-38	65.0
B-6	2/10/09	39	39	20-38	65.0
B-7	2/10/09	38	38	20-38	65.0
B-8	2/9/09	38	38	20-38	65.0
B-9	2/10/09	38	38	20-38	65.0
Source Area C:					
C-1	2/11/09	40	40	22-40	65.0
C-2	2/11/09	36	36	15-36	65.0
C-3	2/11/09	36	36	15-36	64.0
C-4	2/11/09	36	36	15-36	65.0
C-5	2/11/09	36	36	15-36	65.0
C-6	2/12/09	36	36	15-36	65.0
C-7	2/12/09	36	36	15-36	65.0
C-8	2/12/09	36	36	15-36	65.0
C-9	2/12/09	36	36	15-36	65.0
C-10	2/12/09	36	36	15-36	65.0
C-11	2/12/09	36	36	15-36	65.0
C-12	2/12/09	36	36	15-36	65.0
C-13	2/12/09	36	36	15-36	65.0
Soil Borings:					
SB-1	2/4/09	32	32	20-32	64.0
SB-2	2/4/09	32	32	20-32	64.0
SB-3	2/5/09	32	32	20-32	67.0
SB-4	2/5/09	32	32	20-32	67.0
SB-5	2/5/09	32	32	20-32	65.0
SB-6	2/5/09	32	32	20-32	65.0
SB-7	2/5/09	32	32	20-32	65.0

TABLE 2C.
SUMMARY OF TOTAL CAP18™ INJECTION VOLUME
FOR 2007 and 2009 EVENTS
Michigan Plaza, Indianapolis, Indiana

2007 TOTAL Injection Quantity = 6,506 gallons

- ***Source Area A**:* 1,962 gallons CAP 18™ over 8 days of field time.
  - ~ 245 gallons per day.
- ***Source Area B**:* 2,815 gallons CAP 18™ over 12 days of field time.
  - ~ 235 gallons per day.
- ***Source Area C**:* 1,729 gallons CAP 18™ over 5 days of field time.
  - ~ 346 gallons per day.

2009 TOTAL Injection Quantity = 1,884 gallons

- ***Source Area A**:* 455 gallons CAP 18 ME™ over 2 days of field time.
  - ~ 228 gallons per day.
- ***Source Area B**:* 585 gallons CAP 18 ME™ over 2 days of field time.
  - ~ 293 gallons per day.
- ***Source Area C**:* 844 gallons CAP 18 ME™ over 2 days field time.
  - ~ 422 gallons per day.

Average Injection Rate Range = 0.38 to 0.70 gallons per minute (gpm)*****

*****Based on a 10-hour workdays on each of the injections days; this represents an average rate of more than one order of magnitude less than a small, low-flowing garden hose (3/4 in diameter), which is typically rated at about 10 gpm.

Table 3
Groundwater Level and CAP18 Product Level Monitoring - Post Injection
Michigan Plaza
3801-3823 West Michigan Street
Indianapolis, Indiana
MUNDELL Project No. M01046

Monitoring Well	Top of Casing Elevation (feet MSL)	Total Depth (feet)	Date of Reading	Depth To Water (feet)	Date of Reading	Depth To Water (feet)	Date of Reading	Depth To CAP18 (feet)	Depth To Water (feet)	Date of Reading	Depth To CAP18 (feet)	Depth To Water (feet)	Date of Reading	Depth To CAP18 (feet)	Depth To Water (feet)
On-Site Monitoring Wells (Plaza)															
MMW-P-01	715.79	28	6/14/2007	18.95	--	--	--	--	--	--	--	--	--	--	--
MMW-P-02	716.70	30	6/14/2007	19.96	--	--	--	--	--	--	--	--	8/23/07	20.44	20.45
MMW-P-03S	716.55	28	6/14/2007	19.79	--	--	--	--	--	--	--	--	8/23/07	20.25	20.26
MMW-P-03D	716.45	35	6/14/2007	19.70	--	--	--	--	--	--	--	--	8/23/07	NP	20.15
MMW-P-04	716.27	28	6/14/2007	19.51	--	--	--	--	--	--	--	--	8/23/07	19.91	19.92
MMW-P-05	716.12	28	6/14/2007	19.31	--	--	--	--	--	--	--	--	8/23/07	NP	19.67
MMW-P-06	716.50	28	6/14/2007	19.70	--	--	--	--	--	--	--	--	8/23/07	NP	20.10
MMW-P-07	715.30	28	6/14/2007	18.20	7/30/2007	18.63	8/7/07	NP	18.66	8/16/07	NP	18.84	8/23/07	18.38	18.39
MMW-P-08	715.22	28	6/14/2007	18.09	7/30/2007	18.48	8/7/07	NP	18.50	8/16/07	NP	18.69	8/23/07	18.22	18.23
MMW-P-10S	714.59	28	6/15/2007	17.70	7/30/2007	18.09	8/7/07	NP	18.12	8/16/07	NP	18.30	8/23/07	NP	17.82
MMW-P-10D	714.98	38	6/16/2007	18.09	--	--	--	--	--	--	--	--	8/23/07	NP	18.23
Off-Site Monitoring Wells (Michigan Meadows Apartments)															
MMW-1S	713.66	20	6/14/2007	15.97	--	--	--	--	--	--	--	--	--	--	--
MMW-8S	714.75	24	6/14/2007	16.94	--	--	8/7/07	NP	17.23	8/16/07	NP	17.42	8/23/07	NP	16.94
MMW-9S	714.09	25	6/14/2007	17.01	--	--	--	--	--	--	--	--	--	--	--
MMW-10S	713.23	25	6/14/2007	15.87	--	--	--	--	--	--	--	--	--	--	--

Notes:
NP = No Product observed in well
Shading indicates pre-injection depths to water.

Table 3
Groundwater Level and CAP18 Product Level Monitoring - Post Injection
Michigan Plaza
3801-3823 West Michigan Street
Indianapolis, Indiana
MUNDELL Project No. M01046

Monitoring Well	Top of Casing Elevation (feet MSL)	Total Depth (feet)	Date of Reading	Depth To CAP18 (feet)	Depth To Water (feet)	Date of Reading	Depth To CAP18 (feet)	Depth To Water (feet)	Date of Reading	Depth To CAP18 (feet)	Depth To Water (feet)
On-Site Monitoring Wells (Plaza)											
MMW-P-01	715.79	28	8/28/07	NP	19.33	8/29/07	19.38	19.39	8/30/07	NP	19.42
MMW-P-02	716.70	30	8/28/07	NP	20.58	8/29/07	20.59	20.60	8/30/07	NP	20.63
MMW-P-03S	716.55	28	8/28/07	NP	20.27	8/29/07	20.30	20.31	8/30/07	NP	20.36
MMW-P-03D	716.45	35	8/28/07	NP	20.37	8/29/07	NP	20.41	8/30/07	NP	20.45
MMW-P-04	716.27	28	8/28/07	NP	20.07	8/29/07	20.10	20.11	8/30/07	20.14	20.15
MMW-P-05	716.12	28	8/28/07	NP	19.78	8/29/07	NP	19.82	8/30/07	19.88	19.89
MMW-P-06	716.50	28	8/28/07	NP	20.21	8/29/07	NP	20.25	8/30/07	20.30	20.31
MMW-P-07	715.30	28	8/28/07	NP	18.49	8/29/07	NP	18.54	8/30/07	NP	18.59
MMW-P-08	715.22	28	8/28/07	NP	18.34	8/29/07	NP	18.38	8/30/07	NP	18.43
MMW-P-10S	714.59	28	8/28/07	NP	17.74	8/29/07	NP	18.40	8/30/07	NP	18.45
MMW-P-10D	714.98	38	8/28/07	NP	18.34	8/29/07	NP	18.00	8/30/07	NP	18.04
Off-Site Monitoring Wells (Michigan Meadows Apartments)											
MMW-1S	713.66	20	8/28/07	NP	15.99	8/29/07	16.03	16.04	8/30/07	16.09	16.10
MMW-8S	714.75	24	8/28/07	NP	17.02	8/29/07	NP	17.09	8/30/07	NP	17.13
MMW-9S	714.09	25	8/28/07	NP	17.14	8/29/07	NP	17.16	8/30/07	NP	17.24
MMW-10S	713.23	25	8/28/07	NP	15.85	8/29/07	15.90	15.91	8/30/07	NP	15.96

Notes:
NP = No Product observed in well

Table 3
Groundwater Level and CAP18 Product Level Monitoring - Post Injection
Michigan Plaza
3801-3823 West Michigan Street
Indianapolis, Indiana
MUNDELL Project No. M01046

Monitoring Well	Top of Casing Elevation (feet MSL)	Total Depth (feet)	Date of Reading	Depth To CAP18 (feet)	Depth To Water (feet)	Date of Reading	Depth To CAP18 (feet)	Depth To Water (feet)	Date of Reading	Depth To CAP18 (feet)	Depth To Water (feet)
On-Site Monitoring Wells (Plaza)											
MMW-P-01	715.79	28	8/31/07	NP	19.45	9/4/07	NP	19.55	--	--	--
MMW-P-02	716.70	30	8/31/07	20.66	20.67	9/4/07	NP	20.76	--	--	
MMW-P-03S	716.55	28	8/31/07	NP	20.46	9/4/07	NP	20.58	10/25/07	20.56	20.58
MMW-P-03D	716.45	35	8/31/07	NP	20.48	9/4/07	NP	20.57	10/25/07	NP	20.46
MMW-P-04	716.27	28	8/31/07	NP	20.16	9/4/07	NP	20.27	10/25/07	19.98	19.99
MMW-P-05	716.12	28	8/31/07	NP	19.90	9/4/07	NP	20.01	--		
MMW-P-06	716.50	28	8/31/07	NP	20.33	9/4/07	NP	20.42	10/25/07	20.39	20.40
MMW-P-07	715.30	28	8/31/07	NP	18.61	9/4/07	NP	18.71	10/25/07	18.61	18.62
MMW-P-08	715.22	28	8/31/07	NP	18.46	9/4/07	NP	18.56	10/25/07	18.89	18.90
MMW-P-10S	714.59	28	8/31/07	NP	18.46	9/4/07	NP	18.17	--		
MMW-P-10D	714.98	38	8/31/07	NP	18.06	9/4/07	NP	18.58	--		
Off-Site Monitoring Wells (Michigan Meadows Apartments)											
MMW-1S	713.66	20	8/31/07	NP	16.14	9/4/07	NP	16.25	10/25/07	16.03	16.04
MMW-8S	714.75	24	8/31/07	NP	17.19	9/4/07	NP	17.29	--		
MMW-9S	714.09	25	8/31/07	NP	17.24	9/4/07	17.35	17.36	10/25/07	17.17	17.18
MMW-10S	713.23	25	8/31/07	NP	16.00	9/4/07	NP	16.09	--		

Notes:
NP = No Product observed in well

Table 4. Monitoring Well Screen Comparisons After Confirming Blank Drilling Stratigraphy				
Michigan Street				
Indianapolis, Indiana				
Mundell Project No. 01046				
Well ID	Corresponding Soil Boring ID	Blank Drilling Interval	Screen Interval	Sand Interval (Logged Hole)
MMW-08S	MMW-08S-A	0 -40'	14 - 24'	10.5 - 38'
MMW-09S	MMW-09S-A	0 -40'	15 - 25'	11 - 35'
MMW-10S	MMW-10S-A	0 -40'	15 - 25'	9.5 - 34.5'
MMW-11D	MMW-11D-A	20 -32'	23 - 33'	11 - 32.1'
MMW-13D	MMW-13D-A	24 - 50'	35 - 50'	14 - 37.4' and 39 - 59'
MMW-14D	MMW-14D-A	24 - 50'	40 - 50'	7.5 - 23', 24 - 36', and 37 - 67'
MMW-P-02	MMW-P-02-A	12 - 30'	20 -30'	8 - 32'
MMW-P-03D	MMW-P-03D-A	30 -40'	25 - 35'	4 - 39.5'
MMW-P-04	MMW-P-04-A	20-28'	18-28'	16-21', 22-32'
MMW-P-07	MMW-P-07-A	20 -40'	18 - 28'	6 - 32'
MMW-P-08	MMW-P-08-A	20-40'	18-28'	to be completed spring 2013
MMW-P-09D	MMW-P-09-A	24-45'	35-45'	to be completed spring 2013
MMW-P-10S	MMW-P-10D-A	24 -28'	18 - 28'	6-21', 23-38.5'
MMW-P-10D	MMW-P-10D-A	0 -37.5'	28 - 38'	6-21', 23-38.5'

FIGURES

AOI-42
AOI-44
AOI-43
AOI-13
AOI-26
AOI-27
AOI-19
AOI-25
AOI-28
AOI-51
AOI-31
AOI-32
699
698
697
696
695
694
693
692
GRANGE AVE
HOLT RD
W. MICHIGAN ST.
COSSELL ROAD
ARTHUR AVE

LEGEND

- GM ALLISON TRANSMISSION PLANT BOUNDARY
- GENUINE AUTO PARTS BOUNDARY
- MICHIGAN MEADOW APARTMENTS BOUNDARY
- MICHIGAN PLAZA BOUNDARY
- RESEDENTIAL AREA
- POTENTIOMETRIC SURFACE CONTOUR
- GROUNDWATER FLOW DIRECTION
- AOI-9 AREA OF INTEREST

SOURCE:
ADAPTED FROM FIGURE 3.4.1 OF RCRA FACILITY INVESTIGATION REPORT (ARCADIS, ENVIRON, AND EXPONENT 2009).

N

0 400'
SCALE

MUNDELL Figure 1
(flow lines added)

Prepared for:
U.S. EPA. REGION V
Contract No: EP-S5-06-04
TDD: S05-0001-0910-024
DCN: 816-2A-AHYW

Prepared By:
WESTON SOLUTIONS, INC
750 E. Bunker Court
Suite 500
Vernon Hills, Illinois 60061

Figure 10a
October 2010 Upper Water Bearing Zone Potentiometric Surface Map
West Vermont Street Contamination
Speedway, Marion County, Indiana

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AOI-13
AOI-19
AOI-26
AOI-27
AOI-25
AOI-28
AOI-31
AOI-32
AOI-42
AOI-44
AOI-43
AOI-51
GRANDE AVE
HOLT RD
W. MICHIGAN ST.
ARTHUR AVE.
CONSELL ROAD
695
696
697
MUNDELL Figure 2
(flow lines added)

LEGEND

- GM ALLISON TRANSMISSION PLANT BOUNDARY
- GENUINE AUTO PARTS BOUNDARY
- MICHIGAN MEADOW APARTMENTS BOUNDARY
- MICHIGAN PLAZA BOUNDARY
- RESEDENTIAL AREA
- POTENTIOMETRIC SURFACE CONTOUR
- GROUNDWATER FLOW DIRECTION
- AOI-9 AREA OF INTEREST

SOURCE:
ADAPTED FROM FIGURE 3.4.1 OF RCRA FACILITY INVESTIGATION REPORT (ARCADIS, ENVIRON, AND EXPONENT 2009).

N

0 400'
SCALE

Prepared for:
U.S. EPA. REGION V
Contract No: EP-S5-06-04
TDD: S05-0001-0910-024
DCN: 816-2A-AHYW

Prepared By:
WESTON SOLUTIONS, INC
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Suite 500
Vernon Hills, Illinois 60061

Figure 10b
October 2010 Intermediate Water Bearing Zone Potentiometric Surface Map
West Vermont Street Contamination
Speedway, Marion County, Indiana

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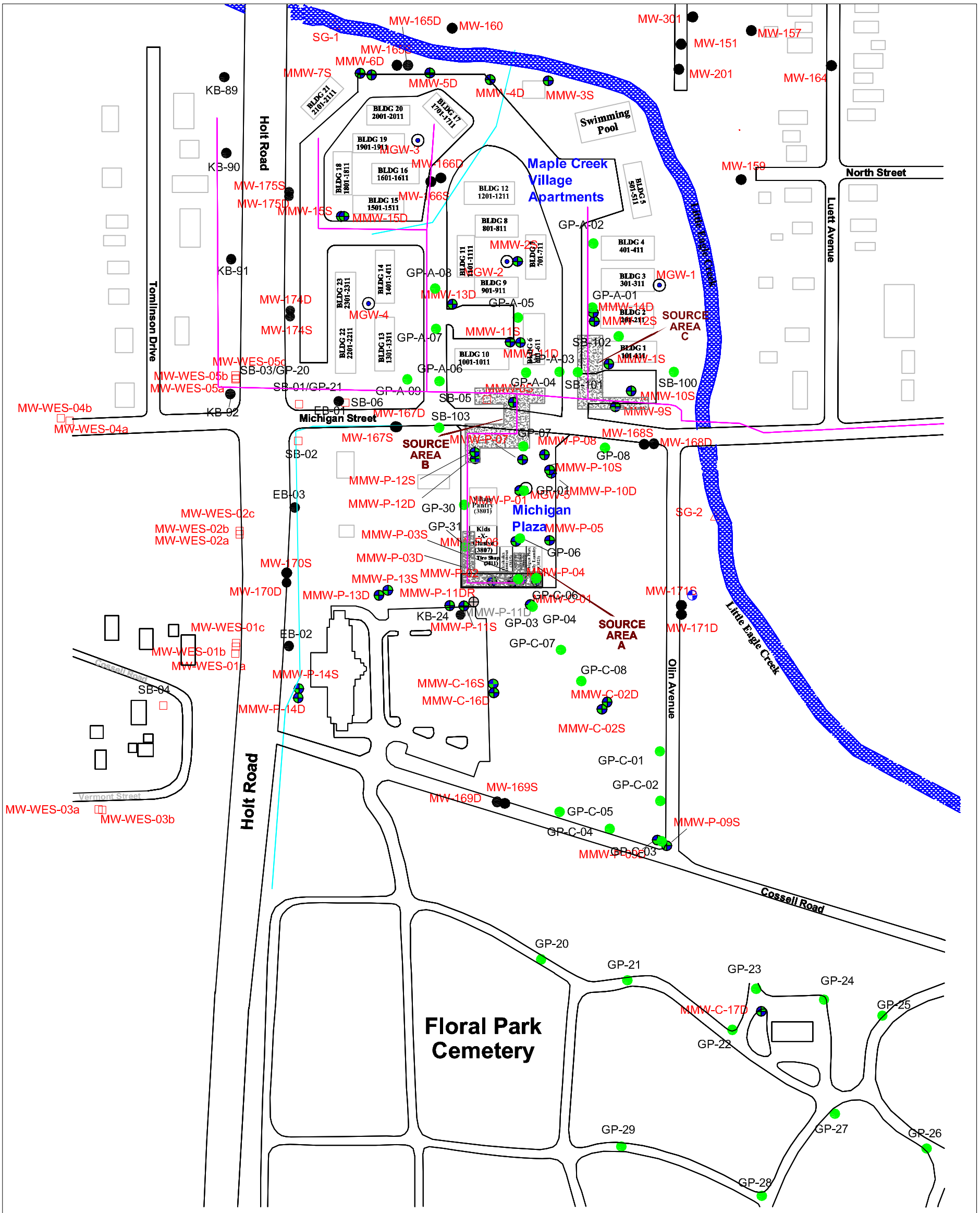

LEGEND

———	Fence
MMW-P-06 ⊕	MUNDELL Monitoring Well
MW-160/ KB-90 ●	ENVIRON Monitoring Well/Soil Boring
MW-WES-O1A/ SB-02 □	U.S. EPA Monitoring Well/Soil Boring
SG-1 △	Stream Gauge Location
MGW-O1 ⊙	MUNDELL Soil Gas Well
GP-29 ●	Soil Boring
———	Sanitary Sewer
———	Storm Sewer

**Note that soil borings were advanced adjacent to monitoring wells MMW-8S, MMW-9S, MMW-10S, MMW-11D, MMW-13D, MMW-14D, MMW-P-02, MMW-P-03D, MMW-P-04, MMW-P-07, and MMW-P-10D, in March of 2013.

N

SCALE 0 200 feet

ENVIRON/Keramida/EPA Monitoring Well Locations Referenced from December, 2011 EPA Survey.

Mundell
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Project Number:	M01046
Drawing File:	1Q13 QMR
Date Prepared:	03-11-13
Scale:	1"=200'

SITE PLAN

Michigan Plaza
3801 - 3823 West Michigan Street
Indianapolis, INDIANA

FIGURE
3

Imagery Source: ESRI Bing Maps

Allison Transmission Div-GMC

Olin Park

AJ Thatcher Golf Course

W North St

W Vermont St

Cossell Rd

N Rybolt Ave

N Lilly One Ave

N Gray Ave

N Vine St

N Illinois St

N Huett Ave

N Livingston Ave

MW-0629-S2 702.28
MW-0202-S2A 694.91
MW-16-S2 701.04
MW-0410-S2 700.29
MW-S2-0601 697.2
MW-S2A-0501 698.82
MW-0632-S2 697.95
MW-0102-S2 697.05
MW-9-9-S2 698.26
MW-0104-S2 702.10
MW-0803-S2 695.08
MW-0709-S2 701.5
MW-0108-S2A 697.70
MW-0421-S2A 697.18
MW-0118-S2 698.47
MW-0107-S2 697.09
MW-0525-S2 697.00
MW-0105-S2 695.25
MW-0624-S2 696.56
MW-33-S2 695.35
MW-34-S2 697.11
MW-0524-S2A 696.30
MW-0622-S2A 696.49
MW-31-S2 695.37
MW-32-S2 694.71
MW-0814-S2 694.82
MW-0815-S2 694.74
MW-0823-S2A 695.77
MW-28-S2 694.89
MW-0625-S2A 695.50
MW-0522-S2A 695.71
MW-0816-S2 694.99
MW-0522-S2B 695.34
MW-0523-S2 694.65
MW-30-S2 694.07
MW-WES-03a 694.72

MW-154 700.68
MW-147AR 700.61
MW-148R 700.49
MW-158 700.81
MW-155 700.58
MW-145 699.33
MW-161 699.05
MW-153 700.04
MW-152 699.54
MW-200 699.72
MW-133R 699.85
MW-160 699.88
MW-135 700.14
MW-162 700.16
MW-150 699.23
MW-163 701.34
MW-156 699.67
MW-164 698.83
MW-201 700.39
MW-146 699.21
MW-159 698.02
MMW-7S 698.52
MW-166S 698.12
MW-165S 698.58
MMW-9S 698.44
MW-175S 697.55
MMW-2S 697.83
MMW-12S 697.65
MMW-11S 697.66
MMW-1S 697.53
MW-WES-05a 697.52
MMW-8S 697.68
MMW-10S 697.07
MW-WES-04a 697.11
MMW-P-07 698.91
MW-167S 697.77
MMW-P-01 698.38
MW-188S 697.29
MMW-9S 697.10
MMW-P-08 697.02
MW-WES-02a 696.01
MMW-P-06 698.24
MMW-P-10S 697.35
MW-170S 695.86
MMW-P-05 698.19
MW-WES-01a 695.71
MW-171S 698.23
MMW-P-04 698.31
MMW-P-02 698.07
MMW-P-03S 696.08
MMW-C-02 695.48
MMW-C-01 698.10
MW-169S 695.38

700
701
702
699
698
697
696
695

Legend

Potentiometric Isocontour

Groundwater Elevation (feet)
- 694-695
- 695-697
- 697-699
- 699-701
- >701

Property Owner
- Allison Transmission Site
- Genuine Parts Site
- Michigan Meadows Apartments
- Michigan Plaza Site
- Residential Area

Shallow- Monitoring wells where the top of the screen is at or above the water table or potentiometric surface to a depth of approximately 10' below the water table

N

0 400 Feet

MUNDELL Figure 4 (flow lines added)

Prepared For:
U.S. EPA REGION V
Contract No.: EP-S5-06-04
TDD: S05-0001-1205-013
DCN: 1856-2A-BBKP

Prepared By:
WESTON SOLUTIONS, INC.
2501 Jolly Road
Suite 100
Okemos, MI 48864

Figure 11
Potentiometric Surface Map for Shallow A2
Monitoring Wells - December 2011
West Vermont Street
Speedway, Marion County, Indiana

FILE: T:\GIS_Projects\START\West_Vermont\mxd\TechMemo_Hydro_Evaluation\Revision_10\Fig_11_Shallow_A2mw_PotSurface.mxd 4:35:08 PM 1/8/2013 stolzs

Imagery Source: ESRI Bing Maps

MW-0409-S2B 695.01
MW-0427-S2B 696.95
MW-S2B-0501 697.04
MW-0202-S2B 697.03
MW-0817-S2B 696.71
MW-1002-S2B 697.74
MW-0406-S2B 696.98
MW-1001-S2B 697.51
MW-165D 698.64
MMW-5D 698.43
MMW-4D 698.24
MMW-6D 698.43
MW-166D 698.18
MW-175D 697.75
MW-WES-05c 697.45
MW-WES-05b 697.49
MMW-13D 697.77
MMW-11D 697.66
MMW-14D 697.69
MW-167D 697.66
MW-WES-04b 696.89
MW-0524-S2B 696.22
MW-168D 697.22
MW-0526-S2B 695.94
MW-WES-02b 695.97
MMW-P-10D 696.78
MW-WES-01b 695.61
MW-171D 695.71
MW-170D 695.87
MMW-P-13D 695.76
MMW-P-03D 696.13
MW-WES-01c 695.85
MW-169D 695.34
MMW-P-09D 695.11
MW-WES-03b 694.73

Allison Transmission Div-GMC
Olin Park
Cossell Rd
W North St
W Walnut St
W Michigan
W Vermont St
Grande Ave
Nyloncraft Ave
Nyloncraft Dr
Olin Ave
Nuvett Ave
Livingston Ave
Anthuriam Ave
Vance St
Fleming St
Alley
Golf Course

698
697
696
695

Deep- Monitoring wells where the top of the screen is greater or equal to 10' below the water table or potentiometric surface.

Legend

Potentiometric Isocontour

Groundwater Elevation (feet)
- 694 - 695
- 695-696
- 696-697
- 697-698
- 698-699

Property Owner
- Allison Transmission Site
- Genuine Parts Site
- Michigan Meadows Apartments
- Michigan Plaza Site
- Residential Area

N

0 400 Feet

MUNDELL Figure 5
(flow lines added)

Prepared For:
U.S. EPA REGION V
Contract No.: EP-S5-06-04
TDD: S05-0001-1205-013
DCN: 1856-2A-BBKP

Prepared By:
WESTON SOLUTIONS, INC.
2501 Jolly Road
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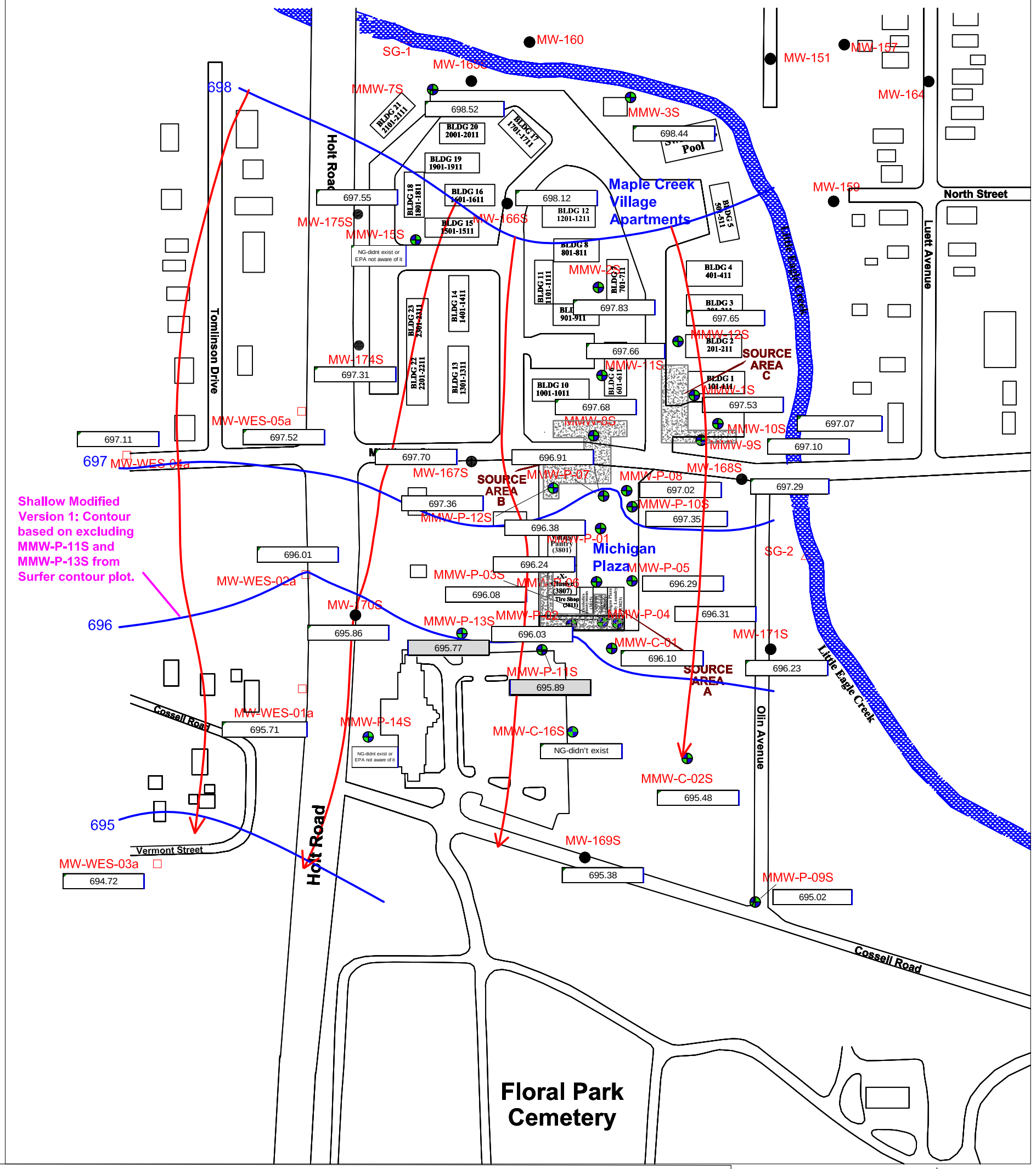
Okemos, MI 48864

Figure 12
Potentiometric Surface Map for Deep A2
Monitoring Wells - December 2011
West Vermont Street
Speedway, Marion County, Indiana

FILE: T:\GIS_Projects\START\West_Vermont\mxd\TechMemo_Hydro_Evaluation\Revision_10\Fig_12_Deep_A2mw_PotSurface.mxd 4:10:35 PM 1/8/2013 stolzs



LEGEND

MMW-P-06	MUNDELL Monitoring Well	NG = Not Gauged
MW-160	ENVIRON Monitoring Well	696.68 — Static water elevation (ft-MSL)
MW-WES-O1A	U.S. EPA Monitoring Well	695.64 — Static water elevation not used to contour potentiometric surface map.
SG-1	Stream Gauge Location	
697	Potentiometric Surface Equipotential Lines Contour Interval = 1.0 feet	Inferred groundwater flow direction

N

0 SCALE 200 feet

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

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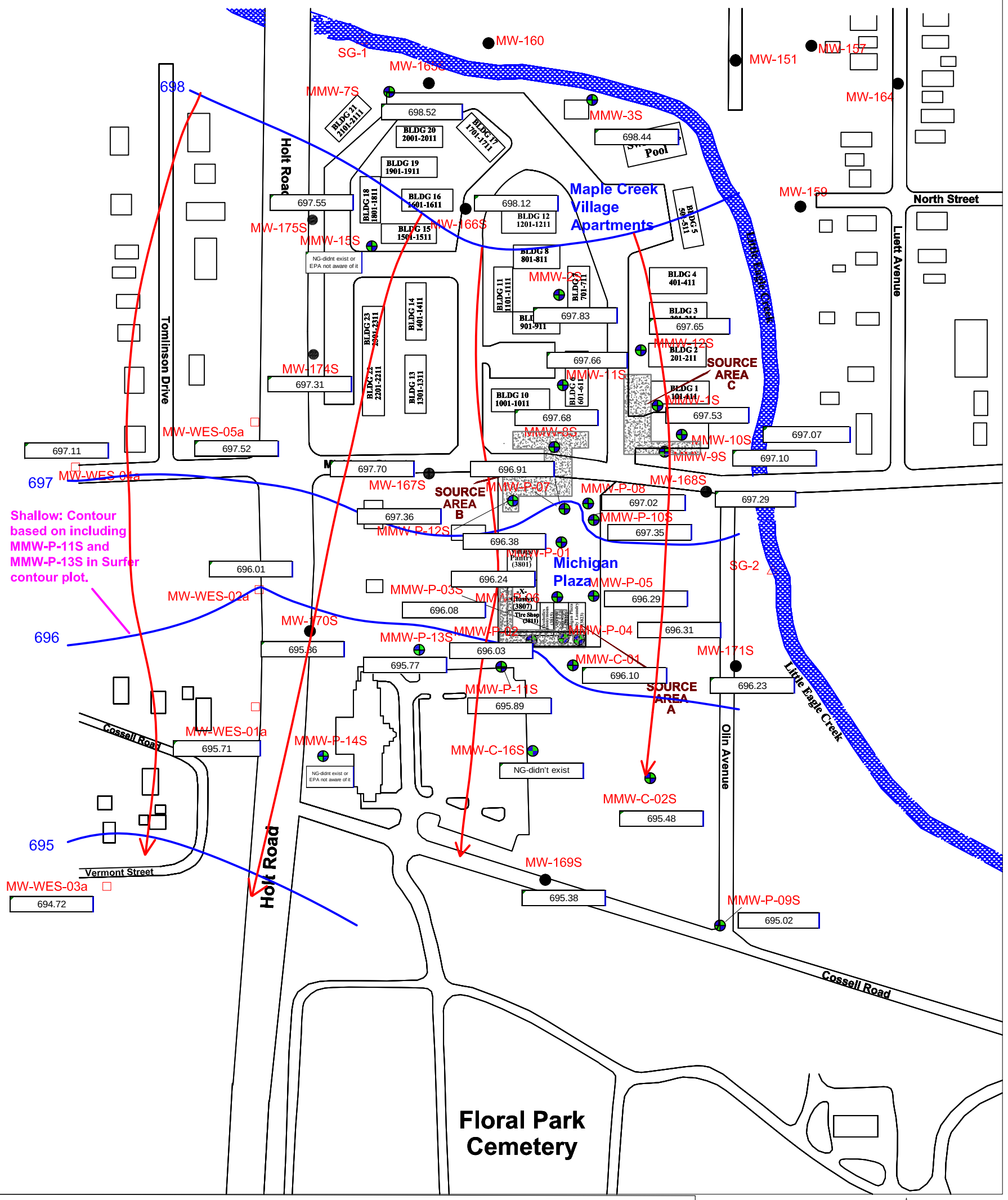
www.MundellAssociates.com

Project Number:	M01046
Drawing File:	Weston Response
Date Prepared:	2-22-13
Scale:	1"=200'

SHALLOW POTENTIOMETRIC SURFACE - WESTON DATA (MODIFIED VERSION 1) - DECEMBER 2011
Michigan Plaza
3801 - 3823 West Michigan Street
Indianapolis, INDIANA

FIGURE 6



LEGEND

MMW-P-06	MUNDELL Monitoring Well
MW-160	ENVIRON Monitoring Well
MW-WES-O1A	U.S. EPA Monitoring Well
SG-1	Stream Gauge Location
697	Potentiometric Surface Equipotential Lines Contour Interval = 1.0 feet

NG = Not Gauged

696.68 — Static water elevation (ft-MSL)

695.64 — Static water elevation not used to contour potentiometric surface map.

Inferred groundwater flow direction

N

0 SCALE 200
feet

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

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Consulting Professionals for the Earth and the Environment

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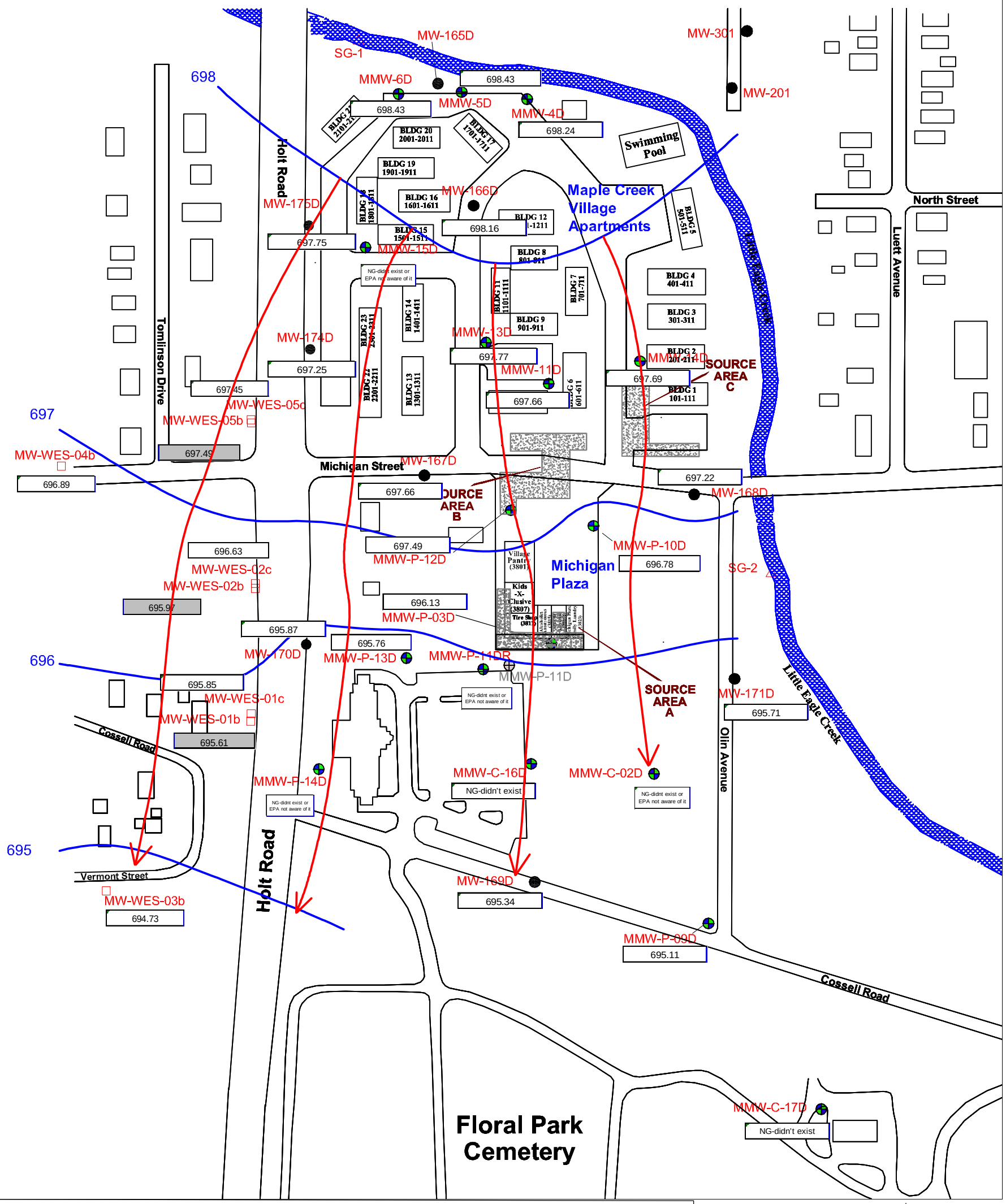
Project Number:	M01046
Drawing File:	Weston Response
Date Prepared:	2-22-13
Scale:	1"=200'

SHALLOW POTENTIOMETRIC SURFACE - WESTON DATA - DECEMBER 2011

Michigan Plaza
3801 - 3823 West Michigan Street
Indianapolis, INDIANA

FIGURE 7



LEGEND

MMW-P-06	MUNDELL Monitoring Well	NG = Not Gauged
MW-160	ENVIRON Monitoring Well	696.68 — Static water elevation (ft-MSL)
MW-WES-O1A	U.S. EPA Monitoring Well	695.64 — Static water elevation not used to contour potentiometric surface map.
SG-1	Stream Gauge Location	
697	Potentiometric Surface Equipotential Lines Contour Interval = 1.0 feet	Inferred groundwater flow direction

N

0 SCALE 200 feet

ENVIRON/Keramida/EPA Monitoring Well Locations Referenced from December 2011, EPA Survey.

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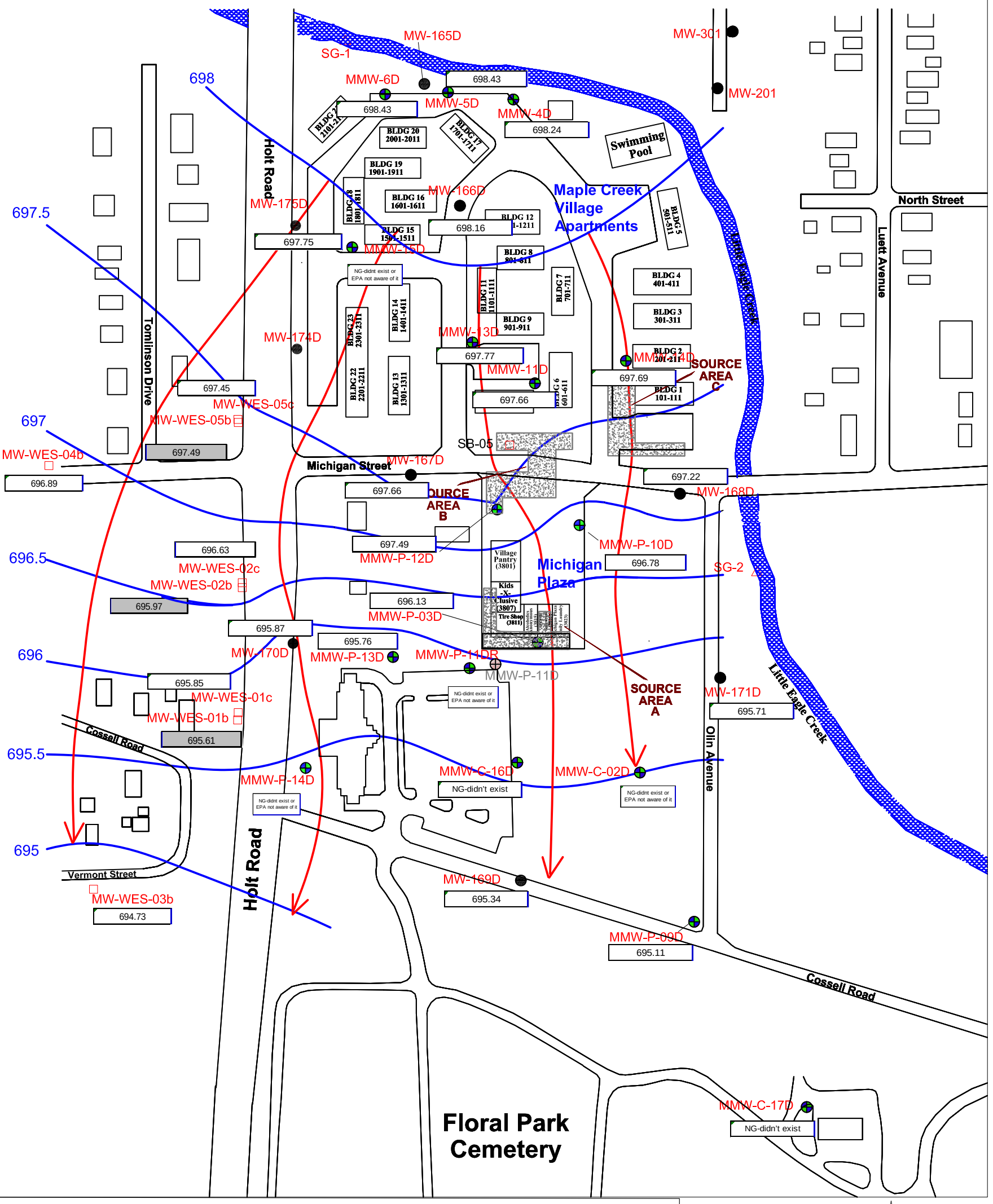
Project Number: M01046
Drawing File: Weston Response
Date Prepared: 2-22-13
Scale: 1"=200'

DEEP POTENTIOMETRIC SURFACE - WESTON DATA - DECEMBER 2011

Michigan Plaza
3801 - 3823 West Michigan Street
Indianapolis, INDIANA

FIGURE 8



LEGEND

MMW-P-06	MUNDELL Monitoring Well	NG = Not Gauged	
MW-160	ENVIRON Monitoring Well	696.68	Static water elevation (ft-MSL)
MW-WES-O1A	U.S. EPA Monitoring Well	695.64	Static water elevation not used to contour potentiometric surface map.
SG-1	Stream Gauge Location		
697	Potentiometric Surface Equipotential Lines Contour Interval = 1.0 feet		Inferred groundwater flow direction

N

0 SCALE 200 feet

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

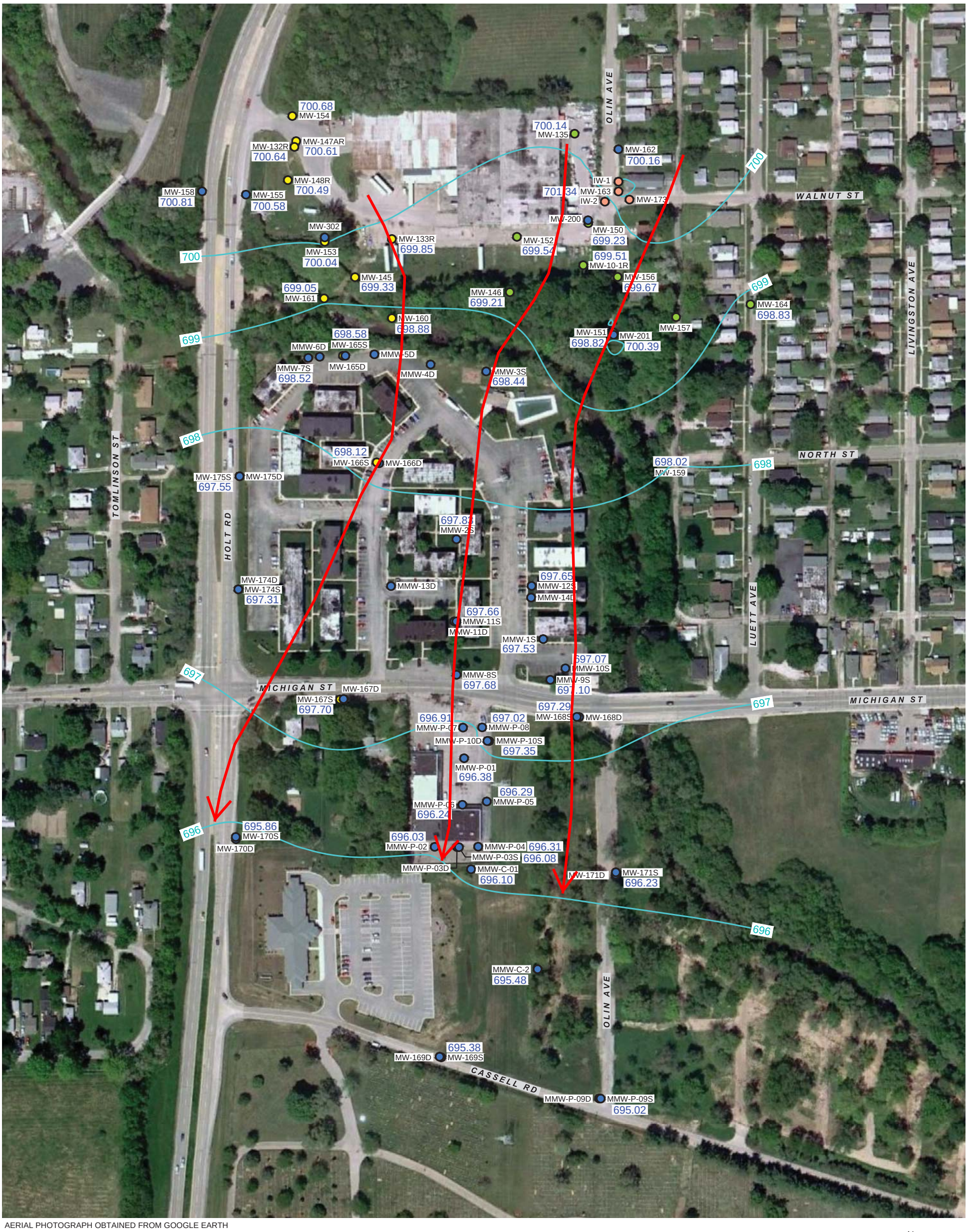
Mundell
Consulting Professionals for the Earth and the Environment

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

Project Number:	M01046
Drawing File:	Weston Response
Date Prepared:	3-26-13
Scale:	1"=200'

DEEP POTENTIOMETRIC SURFACE - WESTON DATA - DECEMBER 2011- MODIFIED VERSION 1 (0.5 FT CONTOUR)
Michigan Plaza
3801 - 3823 West Michigan Street
Indianapolis, INDIANA

FIGURE 8B



AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH

LEGEND

- MONITORING WELL
- 694.76 GROUNDWATER ELEVATION (FT)
- 697 GROUNDWATER CONTOUR (1 FT INTERVAL)

GROUNDWATER MONITORING PLAN
2004 REMEDIATION WORK PLAN

- WESTERN SOURCE AREA
- EASTERN SOURCE AREA
- EAST OFF-SITE BIOREMEDIATION AREA

N W E S

MUNDELL Figure 9 (flow lines added)

APPROX. SCALE (ft.) 0 200

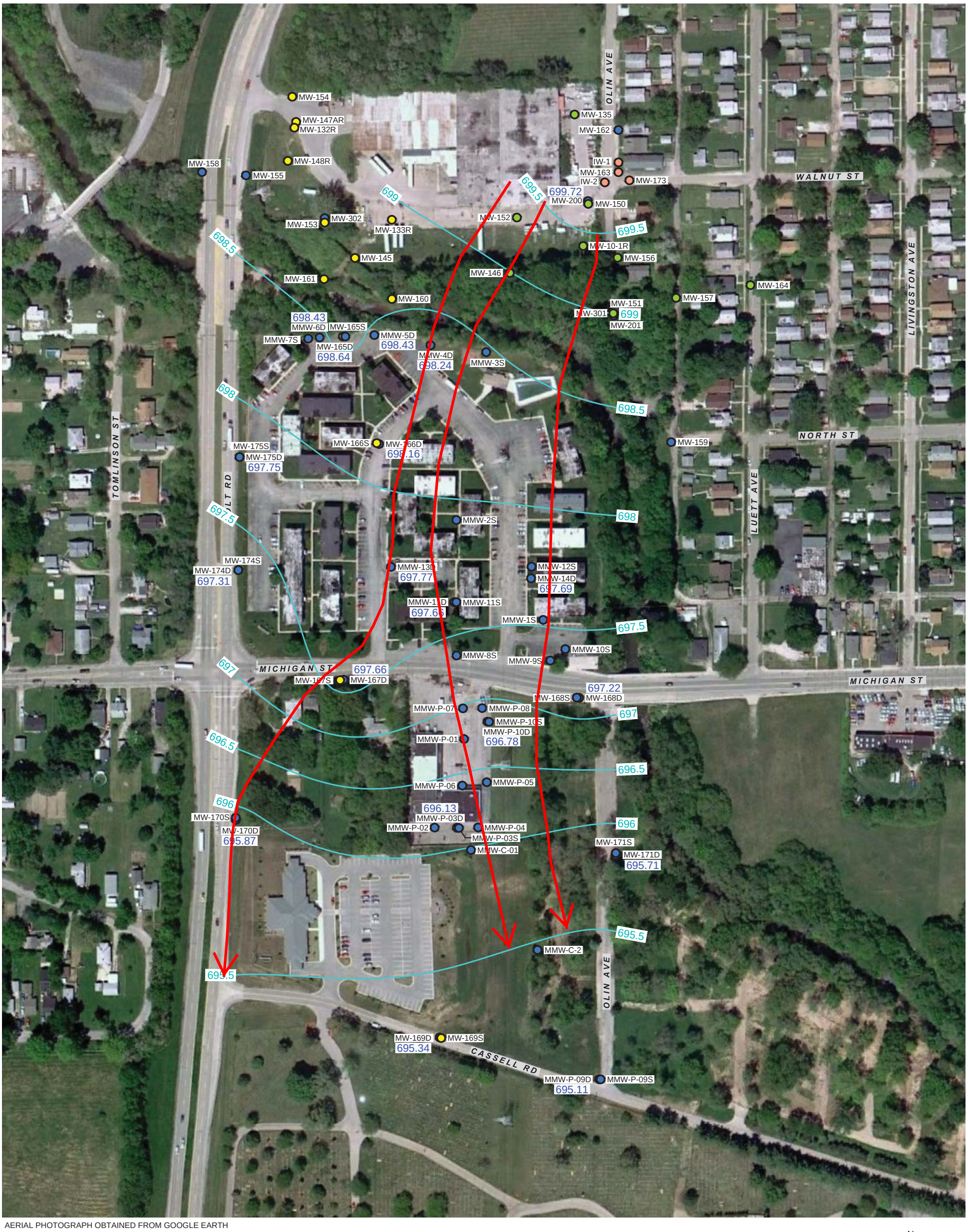
ENVIRON

GROUNDWATER POTENTIOMETRIC SURFACE MAP
SHALLOW MONITORING WELLS - DECEMBER 6, 2011
FORMER ALLISON PLANT 10, 700 NORTH OLIN AVENUE
INDIANAPOLIS, INDIANA

FIGURE 8

DRAFTER: APR/CKN DATE: 1/10/12 CONTRACT NUMBER: 21-25641E APPROVED: REVISED:

L:\Loop Project Files\00_CAD FILES\21\Genuine Parts_Semi-Ann GW Monitor 2125641E\08_GWPS Map - SMWs 120611.dwg



AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH

LEGEND

- MONITORING WELL
- 696.63 GROUNDWATER ELEVATION (FT)
- 697 GROUNDWATER CONTOUR (0.5 FT INTERVAL)

GROUNDWATER MONITORING PLAN
2004 REMEDIATION WORK PLAN

- WESTERN SOURCE AREA
- EASTERN SOURCE AREA
- EAST OFF-SITE BIOREMEDIATION AREA

N W E S

APPROX. SCALE (ft.) 0 200

MUNDELL Figure 10 (flow lines added)

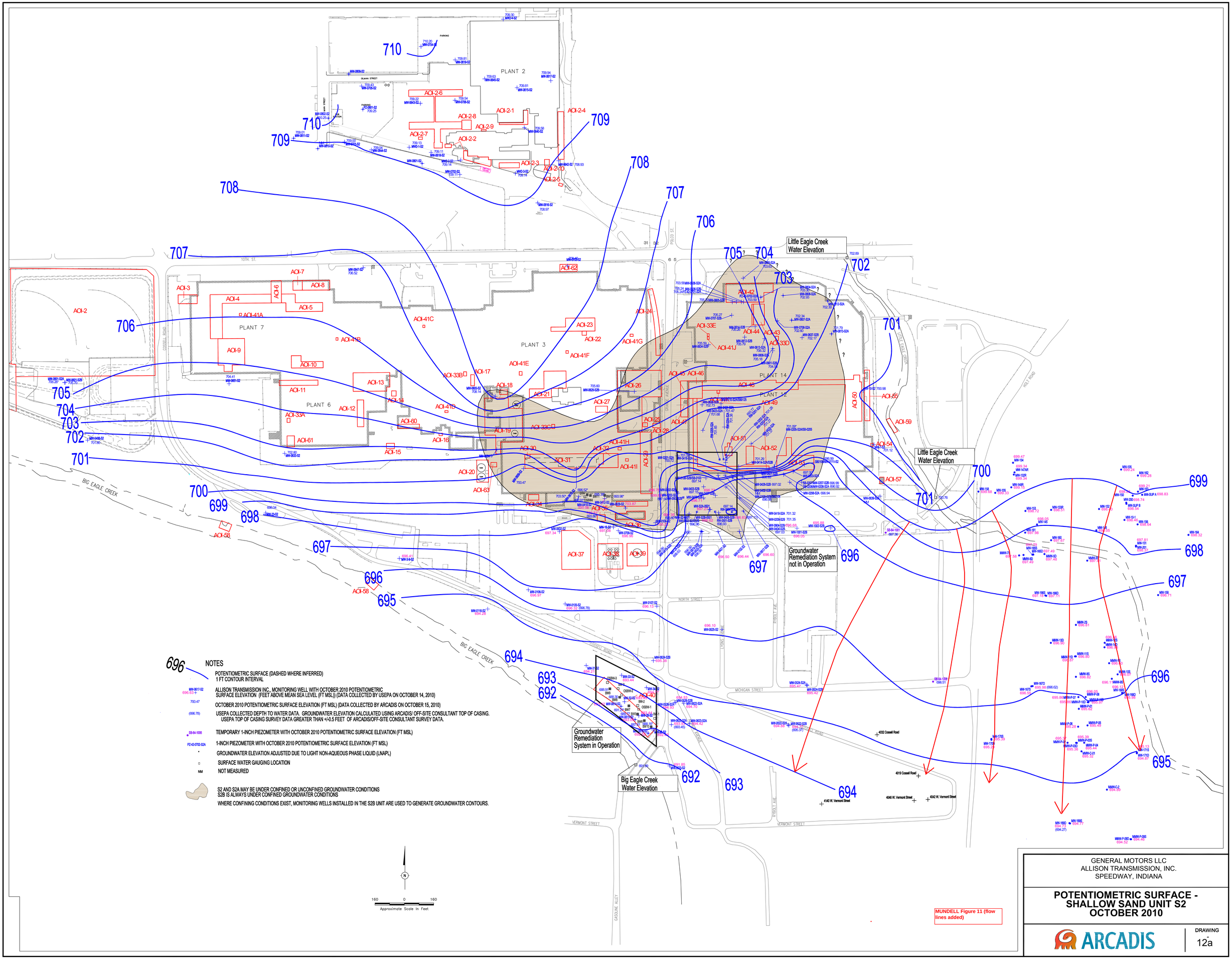
ENVIRON

GROUNDWATER POTENTIOMETRIC SURFACE MAP
DEEP MONITORING WELLS - DECEMBER 6, 2011
FORMER ALLISON PLANT 10, 700 NORTH OLIN AVENUE
INDIANAPOLIS, INDIANA

FIGURE 9

DRAFTER: APR/CKN DATE: 1/9/12 CONTRACT NUMBER: 21-25641E APPROVED: REVISED:

L:\Loop Project Files\00_CAD FILES\21\Genuine Parts_Semi-Ann GW Monitor 21256411E\09_GWPS Map - DMWs 120611.dwg

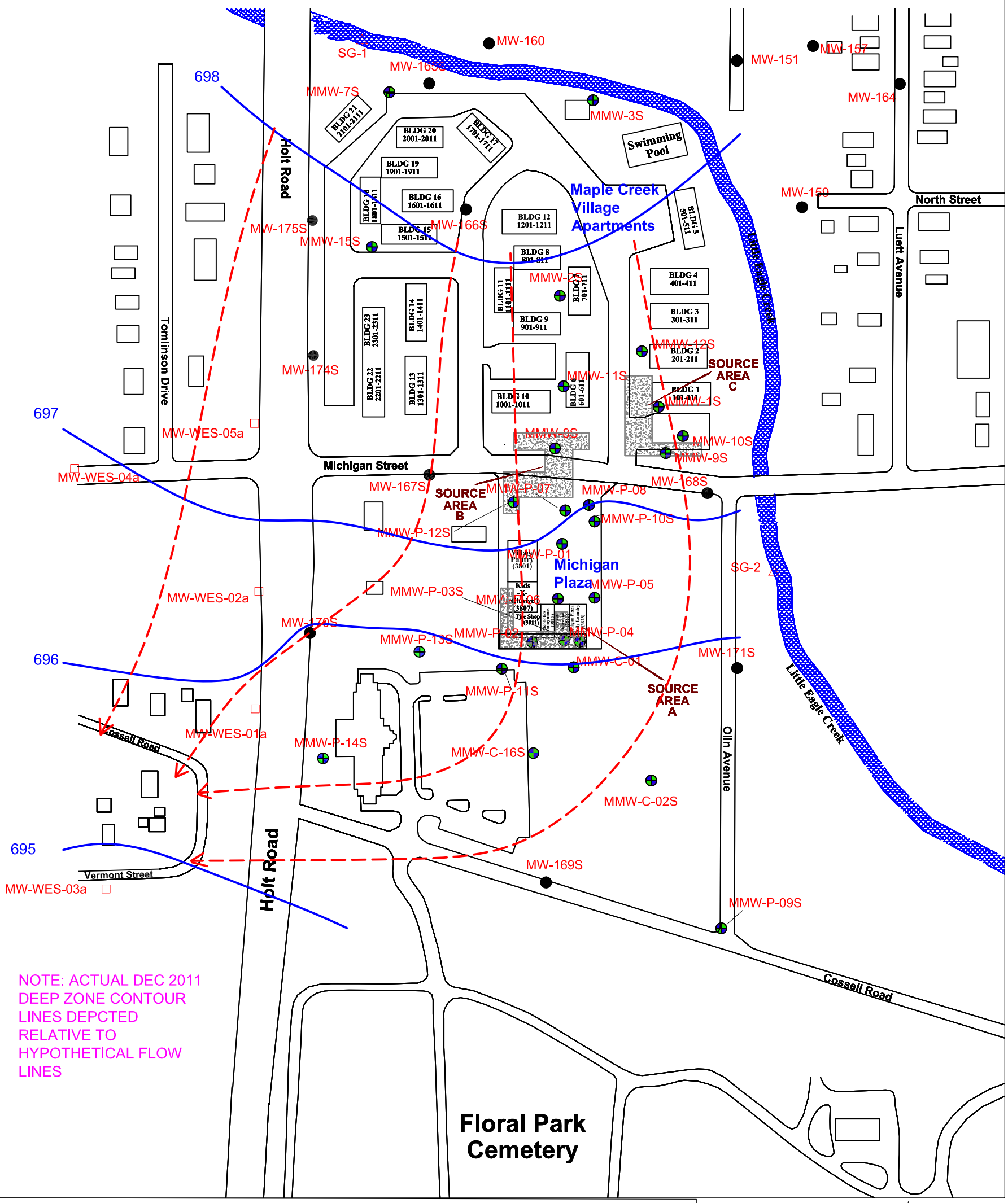


GENERAL MOTORS LLC
ALLISON TRANSMISSION, INC.
SPEEDWAY, INDIANA

POTENTIOMETRIC SURFACE - SHALLOW SAND UNIT S2 OCTOBER 2010

ARCADIS

DRAWING 12a



NOTE: ACTUAL DEC 2011 DEEP ZONE CONTOUR LINES DEPCTED RELATIVE TO HYPOTHETICAL FLOW LINES

LEGEND

MMW-P-06	⊕	MUNDELL Monitoring Well
MW-160	●	ENVIRON Monitoring Well
MW-WES-O1A	□	U.S. EPA Monitoring Well
SG-1	△	Stream Gauge Location
697		Potentiometric Surface Equipotential Lines Contour Interval = 1.0 feet
	⇢	hypothetical groundwater flow direction needed to impact residential area

N

0 SCALE 200 feet

ENVIRON/Keramida/EPA Monitoring Well Locations Referenced from EPA Survey in December, 2011.

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

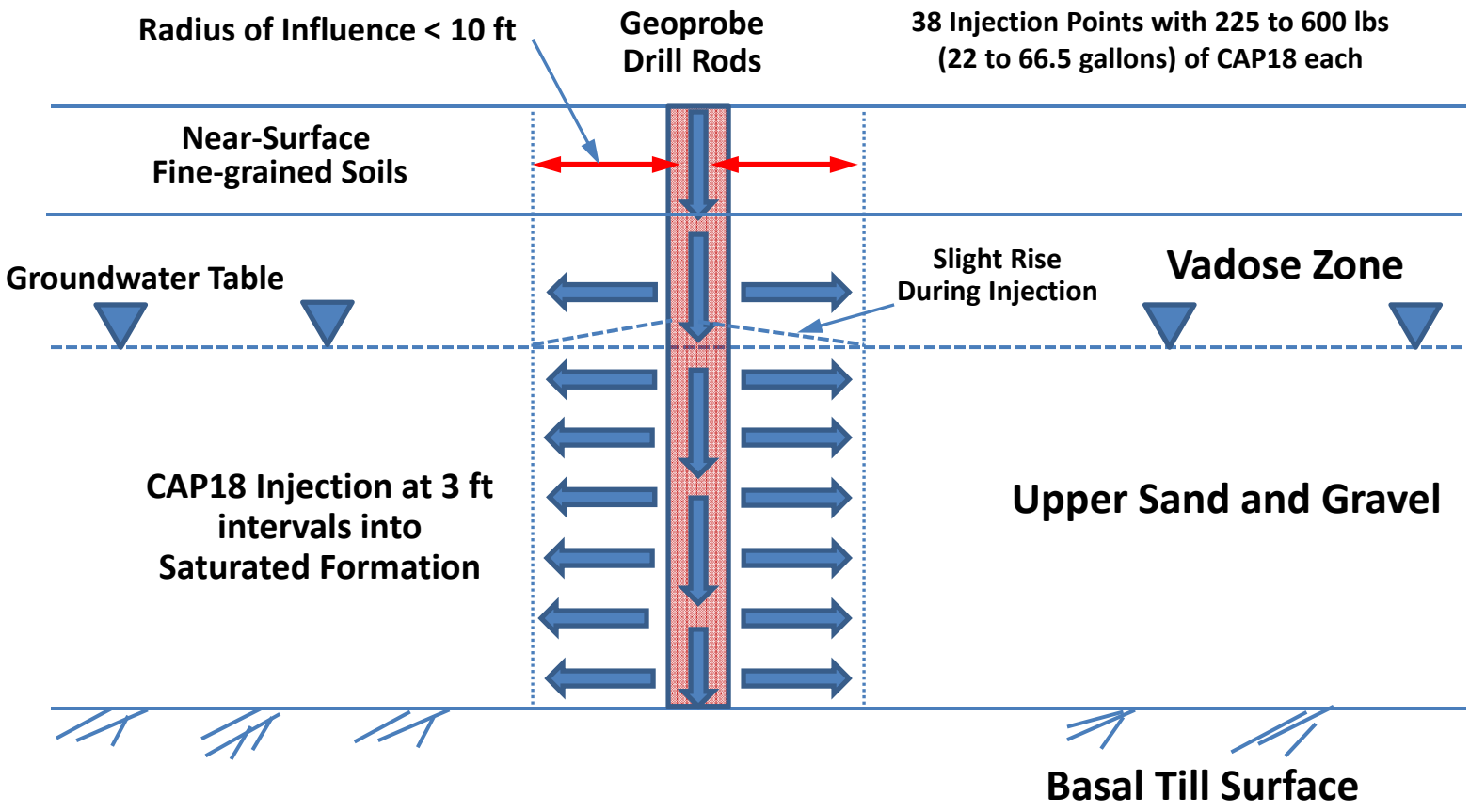
Project Number:	M01046
Drawing File:	Weston Response
Date Prepared:	2-22-13
Scale:	1"=200'

HYPOTHETICAL FLOW LINES NEEDED TO IMPACT THE RESIDENTIAL AREAS

Michigan Plaza
3801 - 3823 West Michigan Street
Indianapolis, INDIANA

FIGURE 12

Figure 13 - Typical Cross-Section CAP18TM Injection
Chemical Source Area A
August 2007



MUNDELL & ASSOCIATES, INC.

FIELD BORING LOG

Injection NO: B-1

CLIENT: AIMCO
PROJECT LOCATION: Indianapolis, Indiana
PROJECT NAME: Michigan Meadows Apartments
PROJECT NO: M01046
DRILLING CONTRACTOR: Midway Services, Inc.
DRILLER: Mark Hicks
BORING LOCATION: Source Area B (Parking Lot of Michigan Plaza)
FIELD SCIENTIST: LL/AD/

DATE BEGAN: 2/9/2009 (10:00AM)
DATE FINISHED: 2/9/2009 (10:33 AM)
DRILLING MEATHOD: Direct Push
DRILL EQUIP: Geoprobe
GW Depth (OBSERVED):
DEPTH OF BORING: 38ft.
SURFACE ELEVATION: N/A
TOP OF CASING ELEVATION: N/A

GEOLOGIC DESCRIPTION	*STRATUM DEPTH, ft*	*DEPTH FT*	*GALLONS INJECTED PER INTERVAL*	*COMMENTS*
Ground surface is Asphalt.		1		
		2		
		3		
		4		
		5		
		6		
		7		
		8		
		9		
		10		
		11		
		12		
		13		
		14		
		15		
		16		
		17		
		18		
		19		
		20	11	
		21		
		22		
		23	11	
		24		
		25		
		26	11	
		27		
		28		
		29	11	
		30		
		31		
		32	11	
		33		
		34		
		35	5	
		36		
		37		
		38	5	Total 65 Gallons
		39		
		40		
		41		
		42		
		43		
		44		
		45		
		46		
		47		
		48		
		49		
		50		

Water Level Observations:
Noted on Rods: _____'
At Completion:

Sampling Methods:
LBS - Large Bore Sampler
MBS - Macro Bore Sample
HSA - Hollow Stem Auger
GEO - Geoprobe

Notes:
TPV - Total Photoionizable Vapors
ND - Not Detected
* - Water Sample(s) Retained for Laboratory Analysis

Figure 15A – Photo of CAP-18 Injection Process
August 2007

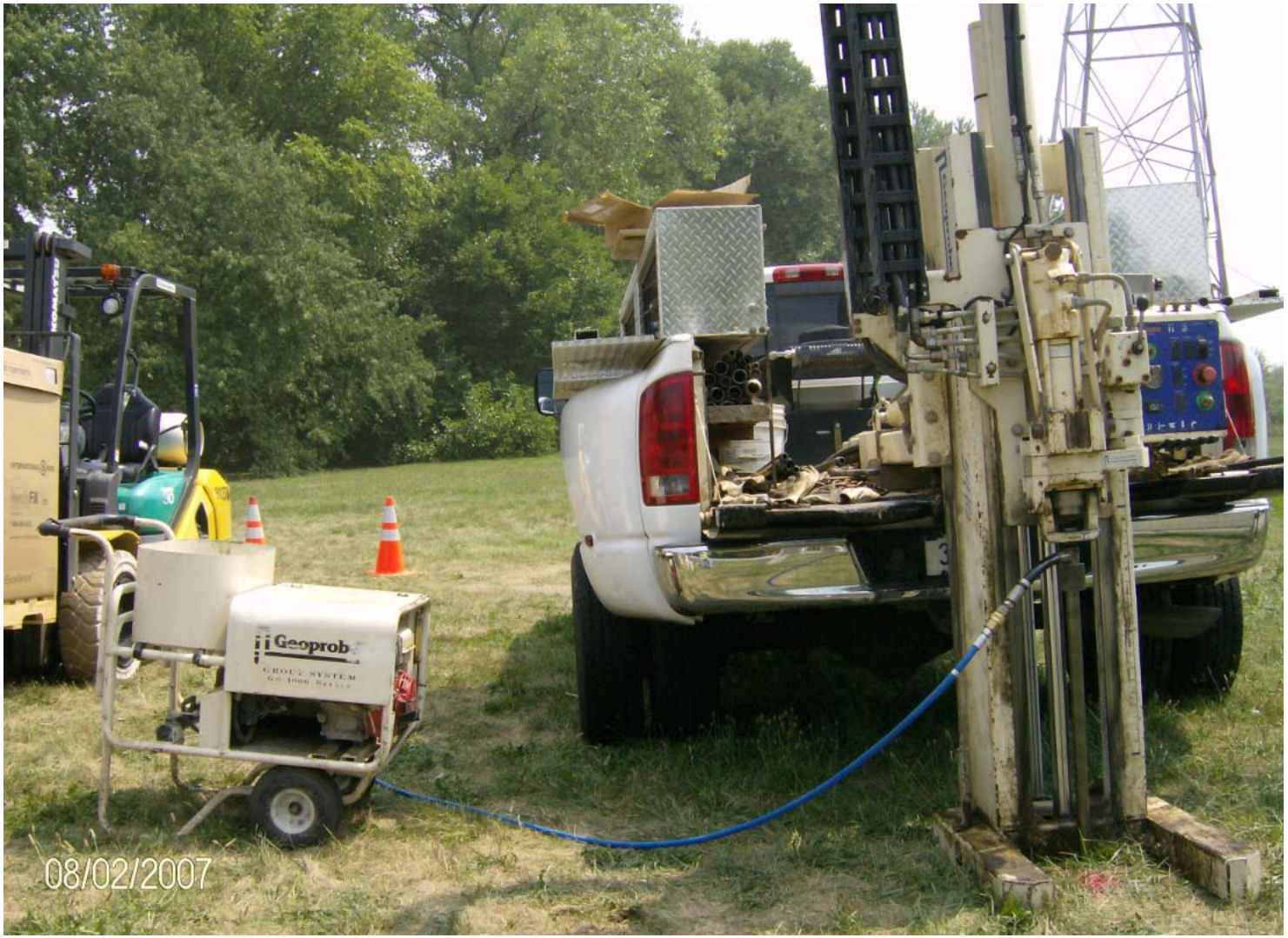
Figure 15B – Photo of CAP-18 Injection Process
August 2007

Figure 15C – Photo of CAP-18 Injection Process
August 2007

Figure 15D – Photo of CAP-18 Injection Process
August 2007

Figure 15E – Photo of CAP-18 Injection Process
August 2007

Figure 15F – Photo of CAP-18 Injection Process
August 2007



Remediation Overview

150 -170 Proposed Chemical Injection Points, dependent on aquifer ability to handle load per foot, utility locations, etc.

CAP18 Injection to occur every 3 feet for the entire saturated zone down to hard till at load listed.

Injection locations subject to change based on field response and IDEM evaluation.

Source Area C: CAP18 Loading
Required Demand: 13,000 lbs
Influencing Via 52 Injection Pts.
- 250 lbs/injection location (originally designed)
- 125 lbs/injection location
- 375 lbs/injection location

Source Area B: CAP18 Loading
Required Demand: 19,000 lbs
Influencing Via 60 Injection Pts.
- 318 lbs/injection location (originally designed)
- 159 lbs/injection location
- 477 lbs/injection location

Source Area A: CAP18 Loading
Required Demand: 15,000 lbs
Influencing Via 52 Injection Pts.
- 395 lbs/injection location (originally designed)
- 198 lbs/injection location
- 592 lbs/injection location

NORTH

SCALE
0 80
feet

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

LEGEND

- Fence
- MW171S — Keramida Monitoring Wells
- MUNDELL Sewer Sampling Locations (September & November 2005)
- GP-07 — MUNDELL Soil Boring Locations (September 2005)
- MMW-P-06 — MUNDELL Monitoring Wells (September 2005)
- MMW-P-07 — MUNDELL Monitoring Wells (January 2007)
- MMW-11S — MUNDELL Monitoring Wells (May-June 2007)
- 36.1 — PCE Concentration in Groundwater, ppb June 14, 2007
- Contour of Total PCE concentration in groundwater (ppb) based on January 2007 - June 2007 Monitoring Well Data
- Design Locations of Geoprobe Injected CAP18 Chemical Stimulant Points (Proposed in April 2007, Re-desiged in August 2007)

MUNDELL & ASSOCIATES, INC.
Consulting Professionals for the Earth & Environment
429 East Vermont Street, Suite 200
Indianapolis, Indiana 46202-3688
317-630-9060, fax 317-630-9065

Project Number:	M01046
Drawing File:	Remediation Opt 3
Date Prepared:	8/2/07
Scale:	1"=80' ±

AUGUST - 07 REMEDIAL DESIGN
Michigan Plaza
3801-3823 West Michigan Street
Indianapolis, Indiana

FIGURE
16

Round 2:Application Overview

Approx. 33-35 Chemical Injection Points, with varying loads dependent on aquifer ability to handle load per foot, utility locations, etc.

CAP-18 Injection to occured every 3 feet for the entire saturated zone down to hard till at load listed. General loading typically injected twice as much CAP18 in upper portion as lower portion of injection point.

Source Area C:
CAP-18ME loading
est demand: 9,000 lbs
via 18 injection points
(in pink)

Source Area B:
CAP-18ME loading
est demand: 4,500 lbs
via 9 injection points
(in pink)

Source Area A:
CAP-18ME loading
est demand: 3,000 lbs
via 6 injection points (6 out of the 10 'PBs')
(in pink)

MMW-13D
GP-A-05
BLDG 6
601-611
BLDG 10
1001-1011
MMW-11D
MMW-11S
GP-A-04
MMW-14D
MMW-12S
BLDG 2
201-211
BLDG 1
101-111
MMW-1S
MMW-10S
MMW-8S
MMW-9S
Michigan Street
GP-08
MW168D
MW168S
GP-07
MMW-P-07
MMW-P-08
MMW-P-10S
MMW-P-10D
MMW-P-01
MGW-5
Village Pantry (3801)
Michigan Plaza
Former Public Library (3805)
MMW-P-06
MMW-P-05
Possible Former Dry Cleaning Machine Location
Former Handicap Workshop (3815)
Former Office Space (3817)
Zacatecos (3819)
Michigan Plaza Family Laundry (3823)
MMW-P-04
MMW-P-02
MMW-P-03S
MMW-P-03D
MMW-C-01/
GP-C-06
GP-C-07
Grass
Floral Park Funeral Center (off Map to the west)
GP-C-08
Funeral Center Parking Lot
MMW-C-02/
GP-C-09
Grass Field
Little Eagle Creek
Olin Avenue
MW171S
MW171D
MW169S
MW169D
Floral Park Cemetery
MMW-P-09D
MMW-P-09S

NORTH

SCALE
0 80
feet

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

LEGEND

- Roadway
- MW171S — Keramida Monitoring Wells
- MUNDELL Sewer Sampling Locations (September & November 2005)
- GP-07 — MUNDELL Soil Boring Locations (September 2005)
- MUNDELL Monitoring Wells (September 2005)
- MUNDELL Monitoring Wells (January 2007)
- MMW-P-06 — MUNDELL Monitoring Wells (May-June 2007)
- MMW-P-07
- MMW-11S
- B-4 — Locations of Geoprobe Injected CAP-18 Chemical Stimulant (Round 2) (greater than 400 lbs)
- MMW-C-02/ GP-C-09 — MUNDELL Monitoring Wells (August 2008)
- MUNDELL Test Pit (TP-3) Sampling Location (April 2005)
- Anticipated Dry Cleaning Machine Location
- PMW-12D — MUNDELL Deep Monitoring Wells (September 2008)
- SB-4 — MUNDELL Soil Boring Locations which could be potential CAP-18 injection point

MUNDELL & ASSOCIATES, INC.
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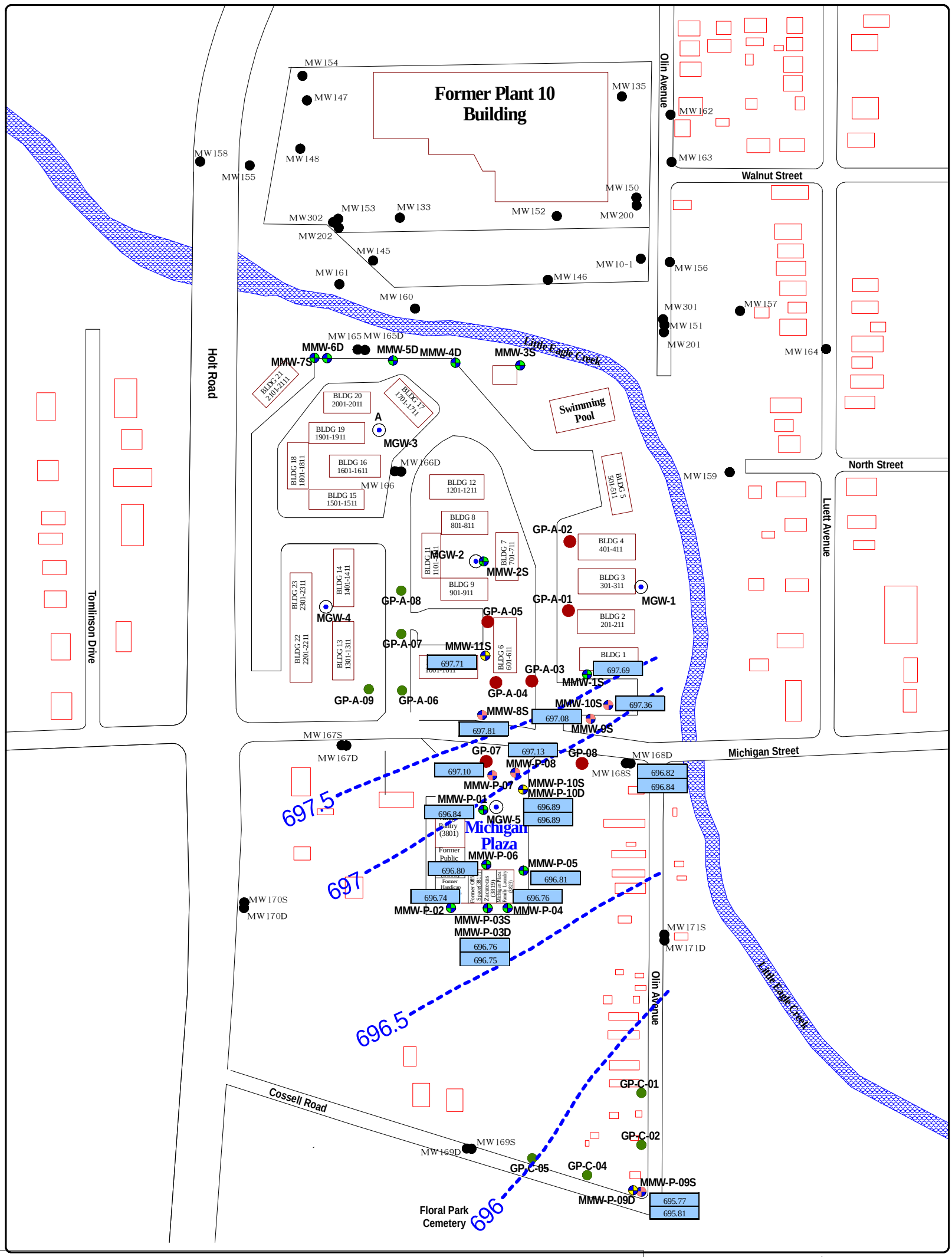
Indianapolis, Indiana 46219
317-630-9060, fax 317-630-9065

Project Number:	M01046
Drawing File:	
Date Prepared:	7/17/09
Scale:	1"=80'

CAP18 INJECTION REMEDIATION
(Round 2 - February 2009)
Michigan Plaza
3801-3823 West Michigan Street
Indianapolis, Indiana

FIGURE
17



LEGEND

- Fence
- MW160 — Keramida Monitoring Wells
- SS-P-01 — MUNDELL Sewer Sampling Locations (September & November 2005)
- GP-07 — MUNDELL Soil Boring Locations (September 2005)
- MMW-P-06 — MUNDELL Monitoring Wells, Michigan Plaza (September 2005)
- GP-C-04 — MUNDELL Soil Boring Locations (January 2007)
- MMW-P-07 — MUNDELL Monitoring Wells (January 2007)
- MMW-11S — MUNDELL Monitoring Wells (May-June 2007)
- 696.80 — Water Level as Measured on June 14, 2007
- 697 — Potentiometric Surface Equal Potential Lines

NORTH

SCALE
0 200
feet

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

MUNDELL & ASSOCIATES, INC.
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317-630-9060, fax 317-630-9065

Project Number: M01046
Drawing File: Base Map.SKF
Date Prepared: 7/3/07
Scale: 1"=200' ±

Potentiometric Surface Map
June 14, 2007
Michigan Plaza
3801-3823 West Michigan Street
Indianapolis, Indiana

FIGURE
18

BLDG 2
201-211

BLDG 6
601-611

BLDG 10
1001-1011

BLDG 1
101-111

MMW-11S
697.26

697.30
MMW-1S

697.06
MMW-10S

MMW-8S
697.34

696.64
MMW-9S

697

Michigan Plaza

696.45
696.45
MW168D

696.46
MMW-P-08
696.61
MW168S

MMW-P-07

MMW-P-10S
MMW-P-10D
696.29
696.29

696.5

MMW-P-01

Village Pantry (3801)

696.10
MGW-5

Former Public Library (3805)

MMW-P-06
695.93

MMW-P-05
695.98

Former Handicap Workshop

Office (3817)

Mexican Restaurante (3819)

Plaza Family Laundry (3823)

695.76

695.80
695.82

MMW-P-04
695.78

696

MMW-P-02

MMW-P-03S
MMW-P-03D

Michigan Street

Little Eagle Creek

Olin Avenue

NORTH

SCALE
0 80
feet

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

MW171S
MW171D

695.5

LEGEND

- Roadway
- MW171S — Keramida Monitoring Wells
- MUNDELL Sewer Sampling Locations (September & November 2005)
- MMW-P-06 — MUNDELL Monitoring Wells (September 2005)
- MMW-P-07 — MUNDELL Monitoring Wells (January 2007)
- MMW-11S — MUNDELL Monitoring Wells (May-June 2007)
- Potentiometric Surface Contours, in feet
- 695.19 — Groundwater Elevation, in feet

MW169S
MW169D

Floral Park Cemetery

MMW-P-09D
694.86

695.19
MMW-P-09S

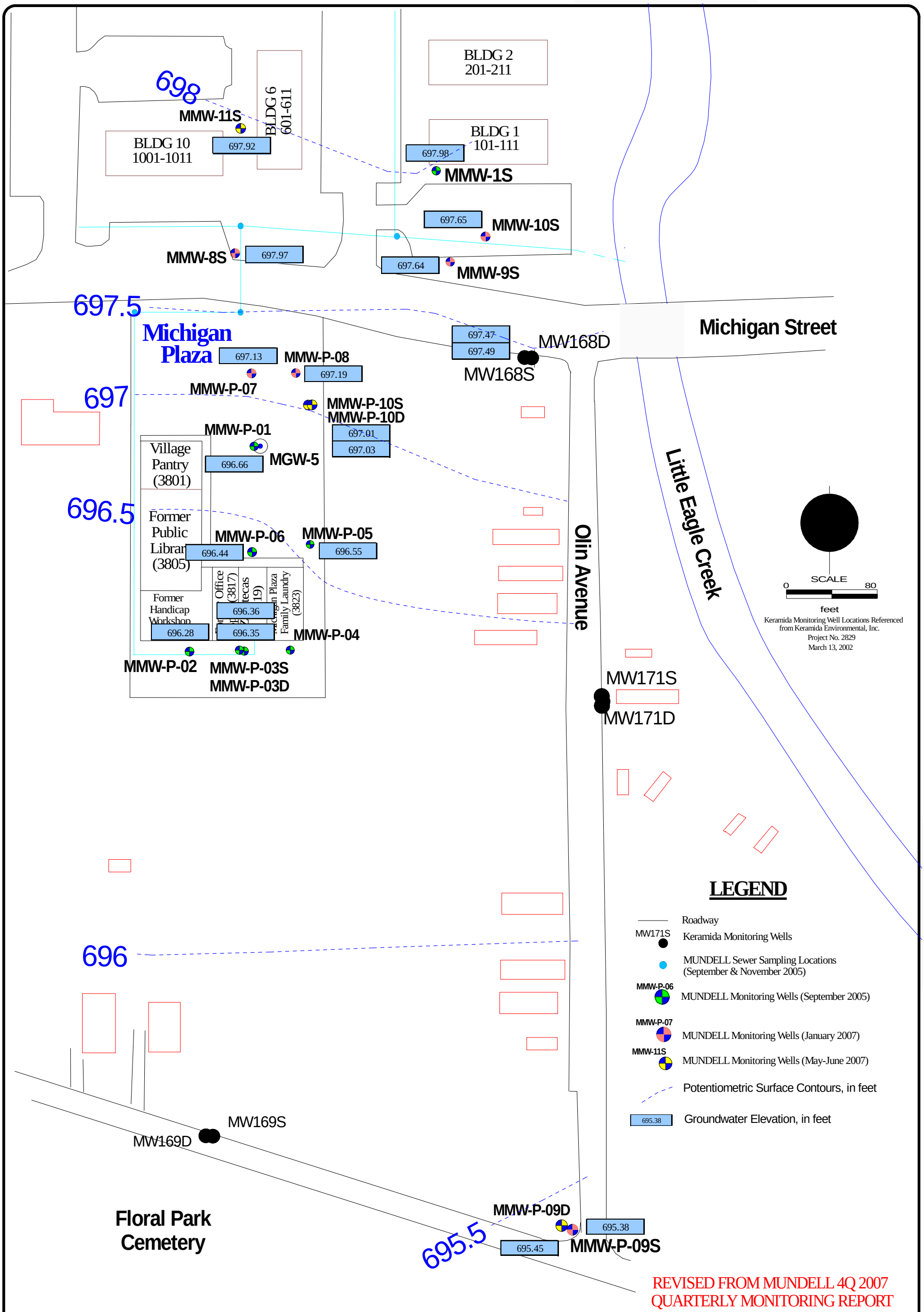
695

MUNDELL & ASSOCIATES, INC.
Consulting Professionals for the Earth & Environment
429 East Vermont Street, Suite 200
Indianapolis, Indiana 46202-3688
317-630-9060, fax 317-630-9065

Project Number:	M01046
Drawing File:	Basemap_rev2
Date Prepared:	11/6/07
Scale:	1"=80' ±

POTENTIOMETRIC SURFACE MAP
September 19, 2007
Michigan Plaza
3801-3823 West Michigan Street
Indianapolis, Indiana

FIGURE
19



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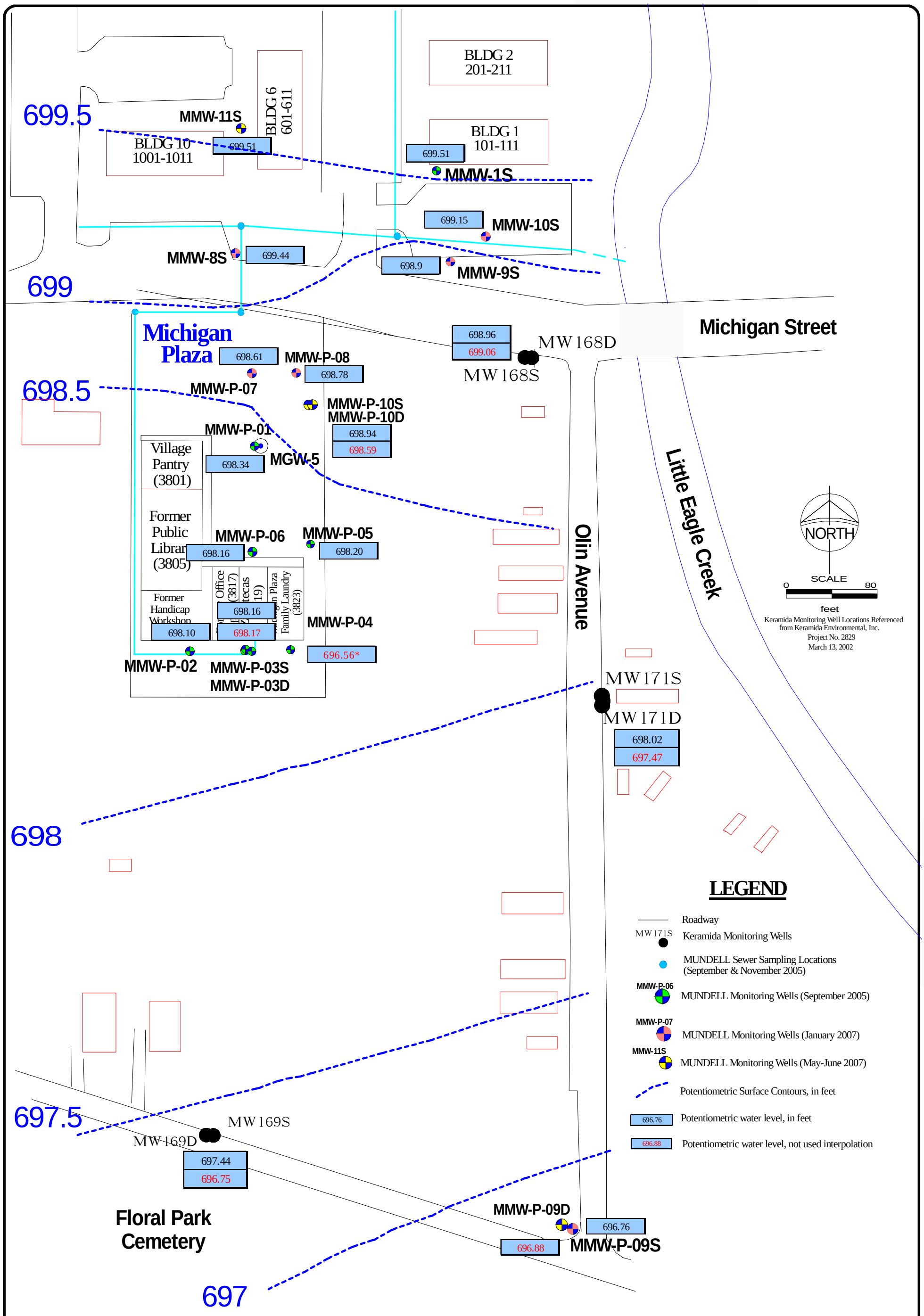
317-630-9060, fax 317-630-9065

Project Number:	M01046
Drawing File:	Basemap_rev2
Date Prepared:	2/4/08
Scale:	1"=80'6

POTENTIOMETRIC SURFACE MAP
December 12-14, 2007
Michigan Plaza
3801-3823 West Michigan Street
Indianapolis, Indiana

FIGURE
20



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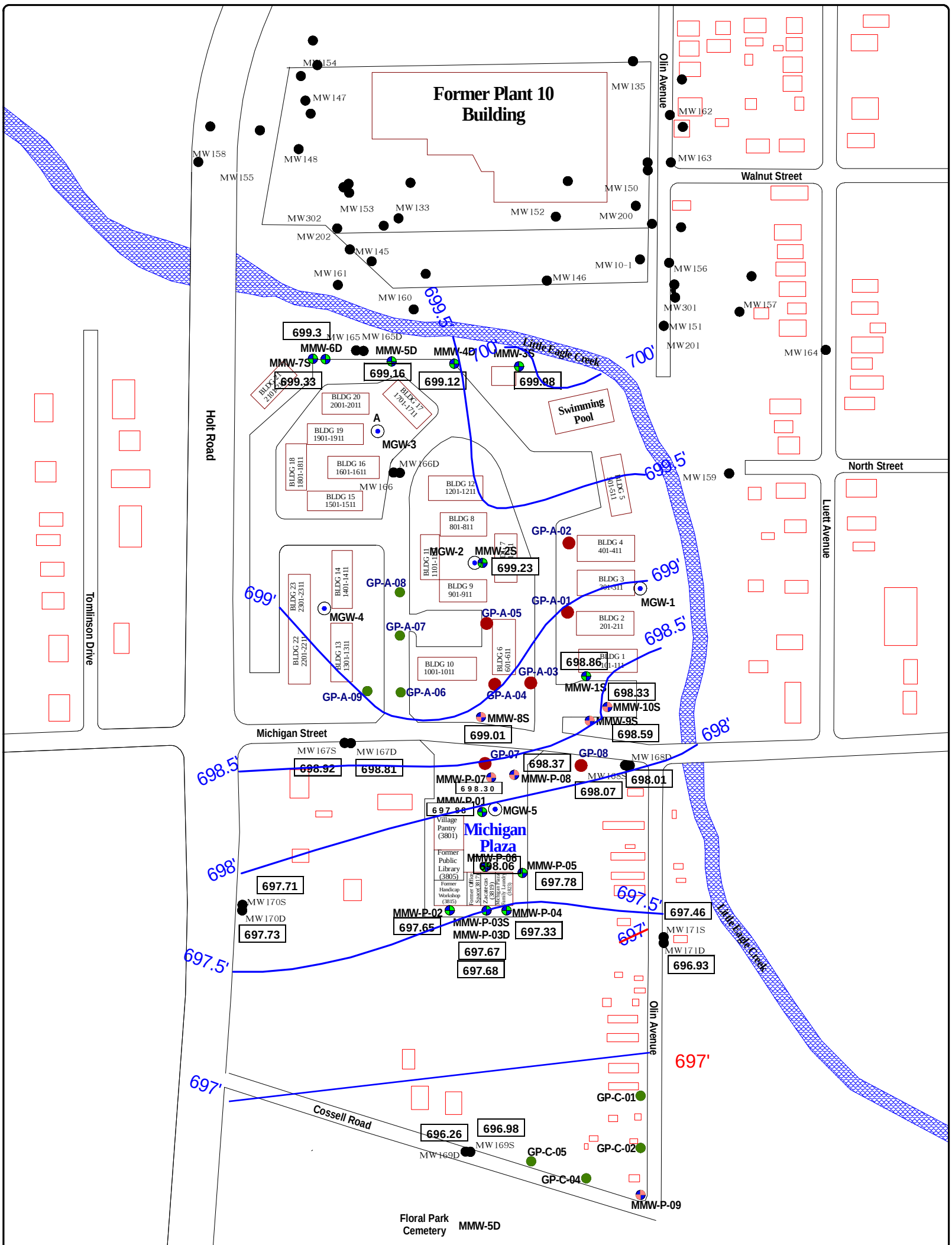
317-630-9060, fax 317-630-9065

Project Number:	M01046
Drawing File:	Basemap_rev2
Date Prepared:	4/16/08
Scale:	1"=80' ±

POTENTIOMETRIC SURFACE MAP
March 21, 2008
Michigan Plaza
3801-3823 West Michigan Street
Indianapolis, Indiana

FIGURE
21



LEGEND

———	Fence
MW160 ●	Keramida Monitoring Wells
SS-P-01 ●	MUNDELL Sewer Sampling Locations (September & November 2005)
GP-07 ●	MUNDELL Soil Boring Locations (September 2005)
MMW-P-06 ◔	MUNDELL Monitoring Wells, Michigan Plaza (September 2005)
GP-C-05 ●	MUNDELL Soil Boring Locations (January 2007)
MMW-P-07 ◔	MUNDELL Monitoring Wells (January 2007)
◔	Water Level as Measured on February 21, 2007
———	Potentiometric Surface Equal Potential Lines

NORTH

SCALE 0 200 feet

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

Revised from MUNDELL 2Q 2009 Quarterly Monitoring Report

MUNDELL & ASSOCIATES, INC.

Consulting Professionals for the Earth & Environment

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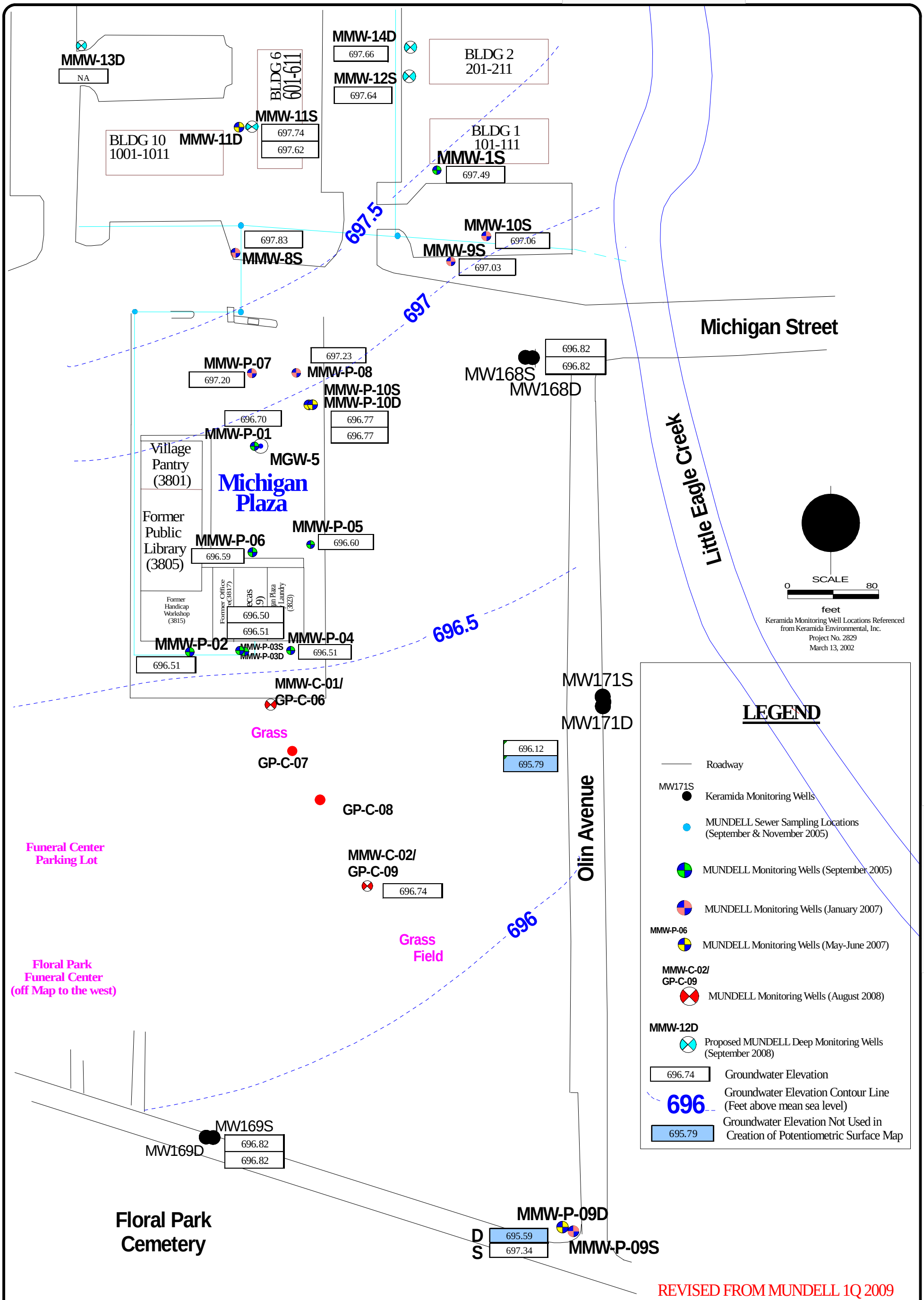
Project Number:	M01046
Drawing File:	Base Map.SKF
Date Prepared:	6/23/08
Scale:	1"=200' ±

Shallow Potentiometric Surface Map
June 2, 2008
Michigan Plaza
3801-3823 West Michigan Street
Indianapolis, Indiana

FIGURE
22



REVISED FROM MUNDELL 1Q 2009
QUARTERLY MONITORING REPORT

MUNDELL & ASSOCIATES, INC.

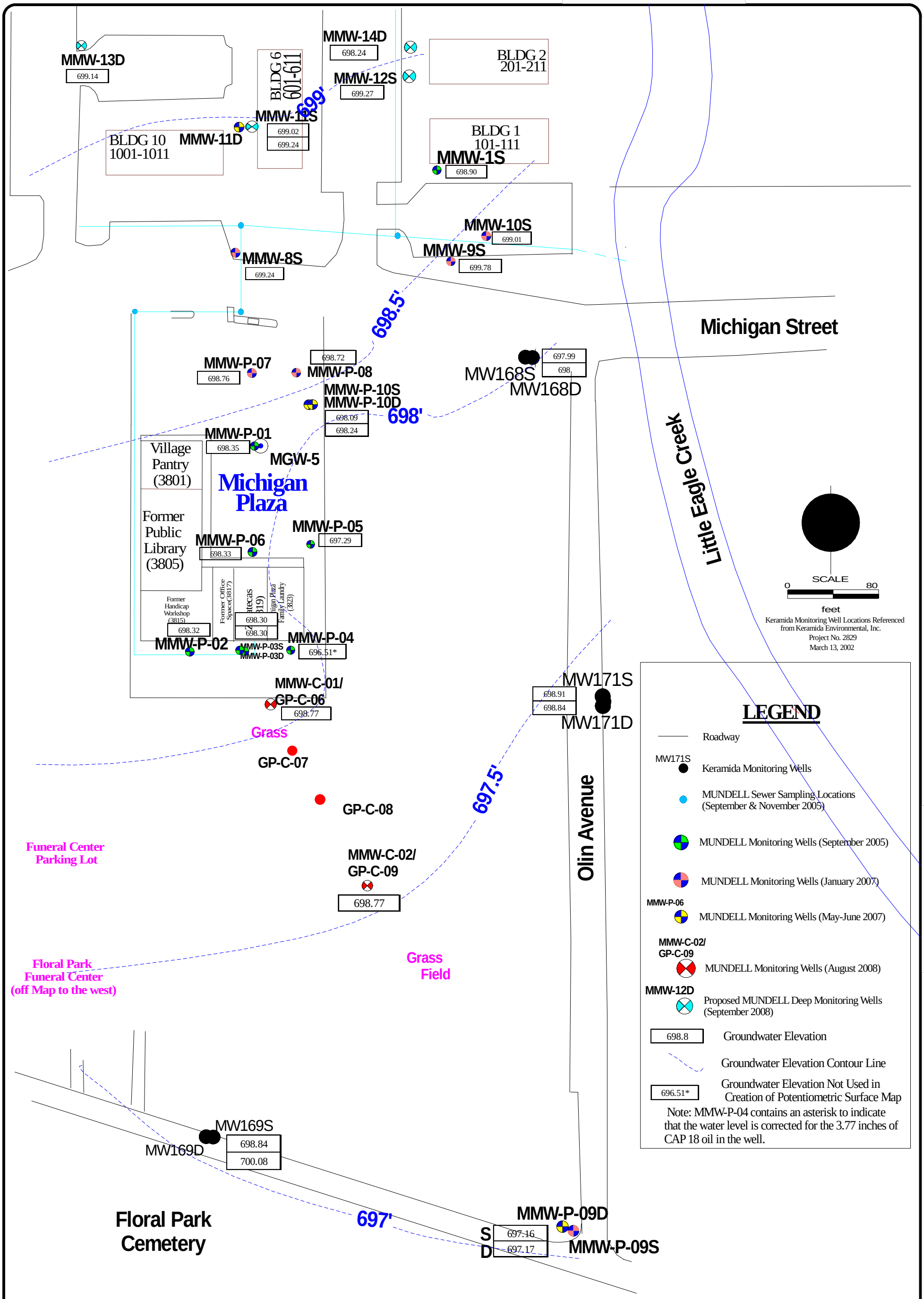
Consulting Professionals for the Earth & Environment

110 South Downey Avenue
Indianapolis, Indiana 46219
317-630-9060, fax 317-630-9065

Project Number:	M01046
Drawing File:	
Date Prepared:	7/27/09
Scale:	1"=80'

Potentiometric Surface Map
March 17, 2009
Michigan Plaza
3801-3823 West Michigan Street
Indianapolis, Indiana

FIGURE
23



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Consulting Professionals for the Earth & Environment

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Project Number:	M01046
Drawing File:	
Date Prepared:	7/27/09
Scale:	1"=80'

Potentiometric Surface Map
June 15, 2009
Michigan Plaza
3801-3823 West Michigan Street
Indianapolis, Indiana

FIGURE
24

MMW-13D
698.03

MMW-14D
697.85

MMW-12S
697.80

BLDG 6
601-611

BLDG 2
201-211

MMW-11S
697.73
698.10

BLDG 10
1001-1011

MMW-11D

BLDG 1
101-111

MMW-1S
697.55

MMW-10S
696.81

MMW-9S
697.27

MMW-8S
697.84

697.5'

Michigan Street

698'

MMW-P-07
697.07

697.11
MMW-P-08

MMW-P-10S
MMW-P-10D
697.29
697.15

698.05
698.02
MW168S
MW168D

MMW-P-01
696.99

MGW-5

Village
Pantry
(3801)

Michigan
Plaza

697'

Former
Public
Library
(3805)

MMW-P-05
696.96

MMW-P-06
695.91

Former
Handicap
Workshop
(3815)
696.84

Former Office
Space(3817)

696.90
696.87

MMW-P-02

MMW-P-03S
MMW-P-03D

MMW-P-04
696.51

MMW-C-01/
GP-C-06
696.08
697.35

Grass

696.5'

697.04
696.66
MW171S
MW171D

GP-C-07

GP-C-08

Olin Avenue

Little Eagle Creek

Funeral Center
Parking Lot

MMW-C-02/
GP-C-09
696.08

Grass
Field

Floral Park
Funeral Center
(off Map to the west)

696'

MW169S
MW169D
696.82
696.08

695.5'

MMW-P-09D
S
D
695.44
695.40
MMW-P-09S

Floral Park
Cemetery

SCALE
0 80
feet

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

LEGEND

- Roadway
- MW171S — Keramida Monitoring Wells
- MUNDELL Sewer Sampling Locations (September & November 2005)
- MUNDELL Monitoring Wells (September 2005)
- MUNDELL Monitoring Wells (January 2007)
- MMW-P-06 — MUNDELL Monitoring Wells (May-June 2007)
- MMW-C-02/ GP-C-09 — MUNDELL Monitoring Wells (August 2008)
- MMW-12D — Proposed MUNDELL Deep Monitoring Wells (September 2008)
- 697.39 — Groundwater Elevation
- Groundwater Elevation Contour Line
- 696.51 — Groundwater Elevation Not Used in Creation of Potentiometric Surface Map

Note: MMW-P-04 contains an asterisk to indicate that the water level is corrected for the 3.77 inches of CAP 18 oil in the well.

Note: MMW-10S third quarter 2009 groundwater elevation is derived from an average of the second quarter and fourth quarter of 2009.

MUNDELL & ASSOCIATES, INC.
Consulting Professionals for the Earth & Environment
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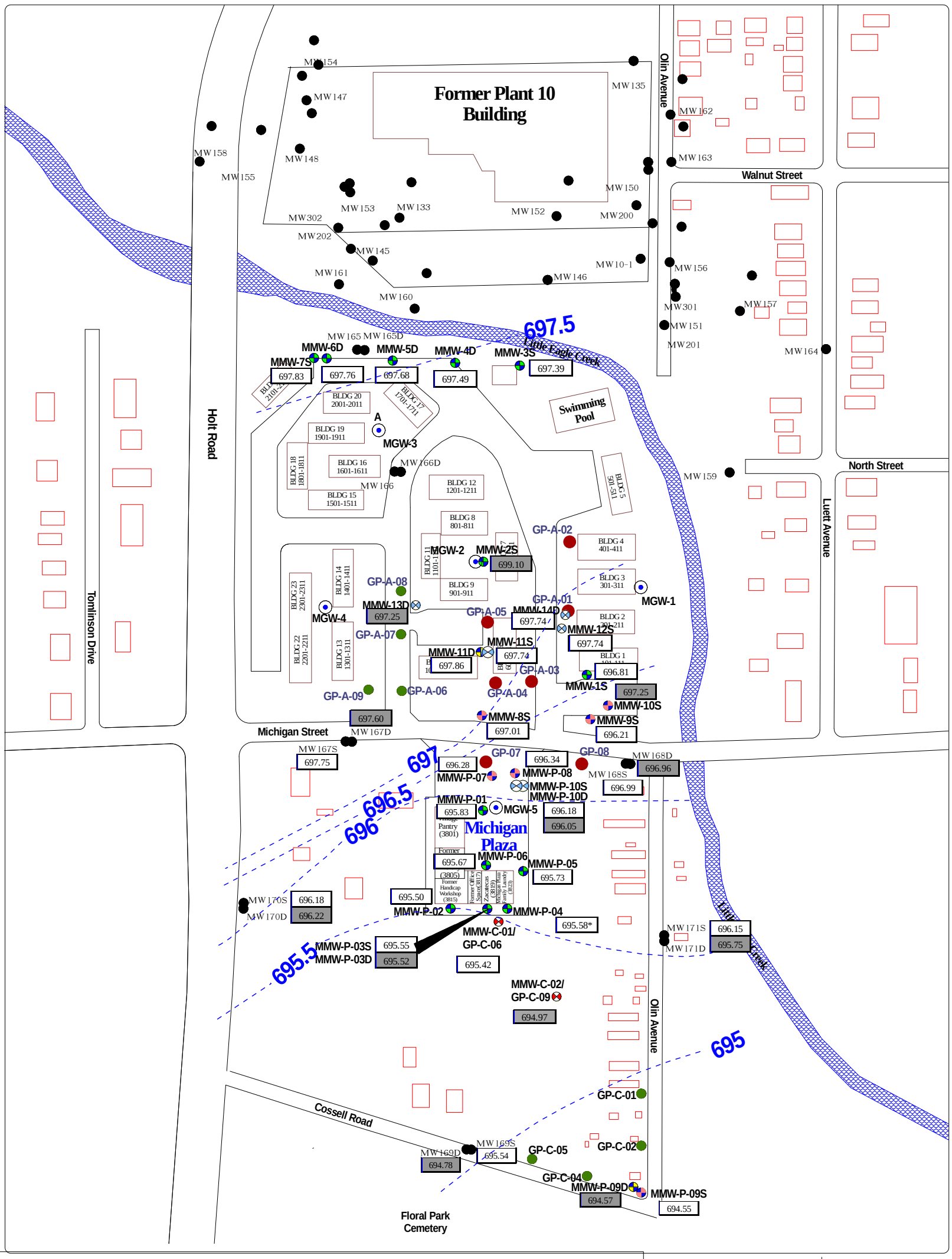
Indianapolis, Indiana 46219
317-630-9060, fax 317-630-9065

Project Number:	M01046
Drawing File:	
Date Prepared:	7/27/09
Scale:	1"=80'

Potentiometric Surface Map
August 5, 2009
Michigan Plaza
3801-3823 West Michigan Street
Indianapolis, Indiana

FIGURE
25



LEGEND

———	Fence
MW160 ●	Keramida Monitoring Wells
SS-P-01 ●	MUNDELL Sewer Sampling Locations (September & November 2005)
GP-07 ●	MUNDELL Soil Boring Locations (September 2005)
MMW-P-06 ◔	MUNDELL Monitoring Wells, Michigan Plaza (September 2005)
GP-C-05 ●	MUNDELL Soil Boring Locations (January 2007)
MMW-P-07 ◔	MUNDELL Monitoring Wells (January 2007)
MMW-P-09D ◔	MUNDELL Monitoring Wells (May-June 2007)
MMW-C-01/ GP-C-06 ⊗	MUNDELL Monitoring Wells (August 2008)
MMW-11S ⊗	MUNDELL Monitoring Wells (September 2008)
697.03	Water Level as Measured on November 2, 2009 (gray boxes indicate groundwater elevation values not used for the creation of the Potentiometric Surface Map)
699	Potentiometric Surface Equal Potential Lines

NORTH

SCALE
0 200
feet

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

REVISED FROM MUNDELL 4Q 2009 QUARTERLY MONITORING REPORT

MUNDELL & ASSOCIATES, INC.

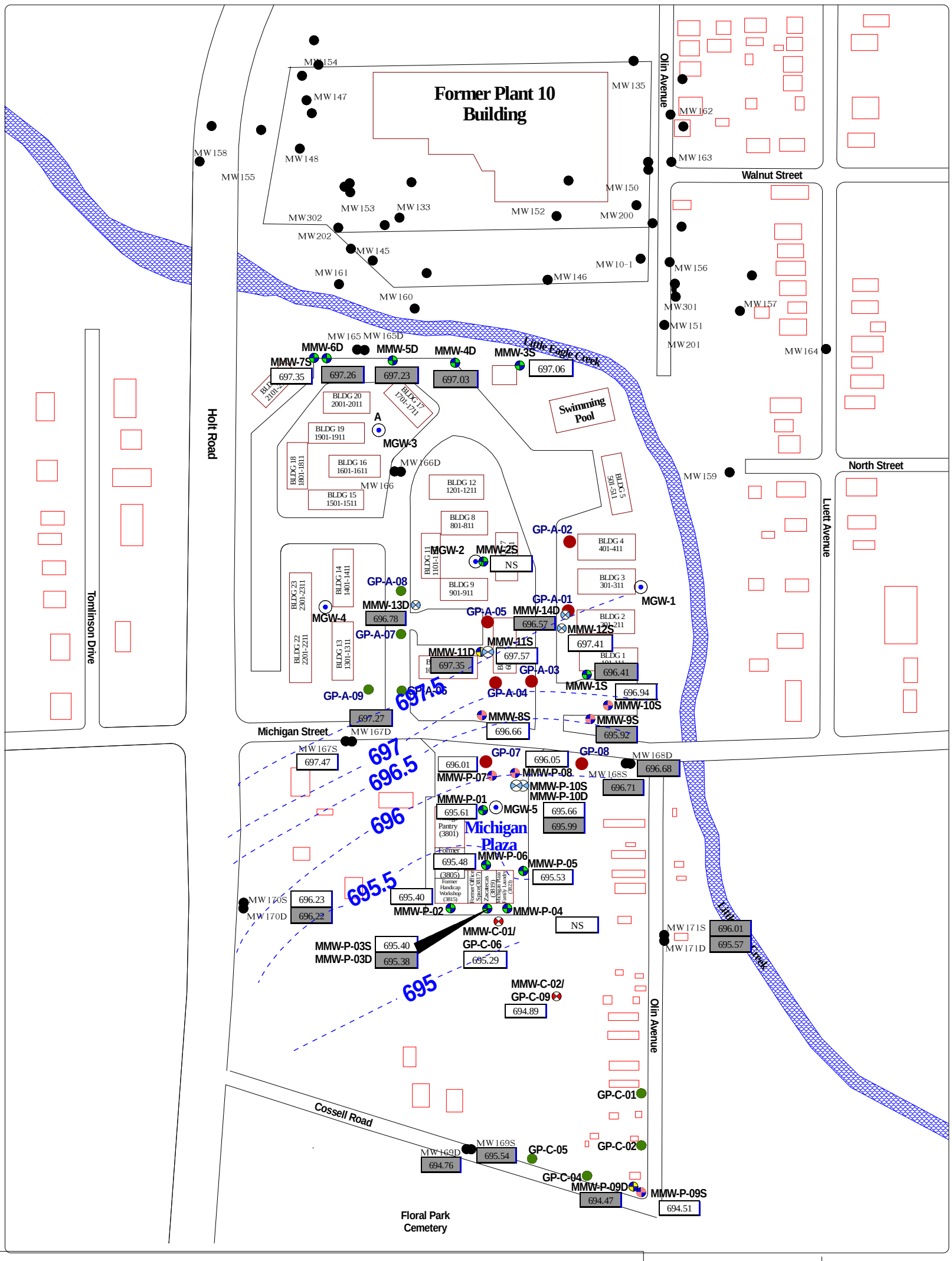
Consulting Professionals for the Earth & Environment

110 South Downey Avenue
Indianapolis, Indiana 46219-6406
317-630-9060, fax 317-630-9065

Project Number:	M01046
Drawing File:	Base Map.SKF
Date Prepared:	12/29/09
Scale:	1"=200' ±

Shallow Potentiometric Surface Map
November 2, 2009
Michigan Plaza
3801-3823 West Michigan Street
Indianapolis, Indiana

FIGURE
26



LEGEND

———	Fence
MW160	Keramida Monitoring Wells
SS-P-01	MUNDELL Sewer Sampling Locations (September & November 2005)
GP-07	MUNDELL Soil Boring Locations (September 2005)
MMW-P-06	MUNDELL Monitoring Wells, Michigan Plaza (September 2005)
GP-C-05	MUNDELL Soil Boring Locations (January 2007)
MMW-P-07	MUNDELL Monitoring Wells (January 2007)
MMW-P-09D	MUNDELL Monitoring Wells (May-June 2007)
MMW-C-01/ GP-C-06 MMW-11S	MUNDELL Monitoring Wells (August 2008) / MUNDELL Monitoring Wells (September 2008)
697.03	Water Level as Measured on February 3, 2010 (gray boxes indicate groundwater elevation values not used for the creation of the Potentiometric Surface Map)
699	Potentiometric Surface Equal Potential Lines

NORTH

SCALE
0 200
feet

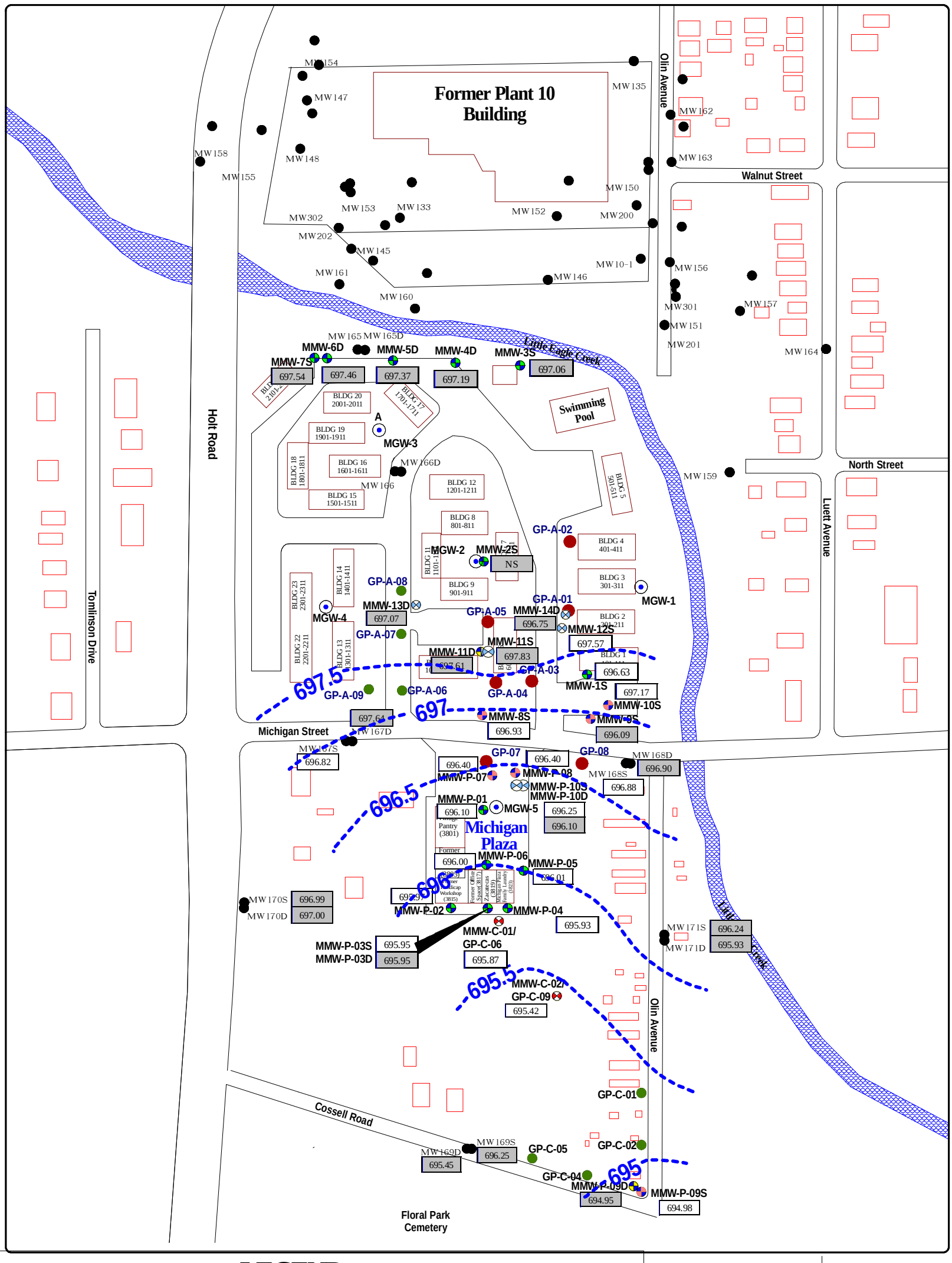
Keramida Monitoring Well Locations Referenced from Keramida Environmental, Inc.
Project No. 2829
March 13, 2002

MUNDELL & ASSOCIATES, INC.
Consulting Professionals for the Earth & Environment
110 South Downey Avenue
Indianapolis, Indiana 46219-6406
317-630-9060, fax 317-630-9065

Project Number:	M01046
Drawing File:	Base Map.SKF
Date Prepared:	2/12/10
Scale:	1"=200' ±

Shallow Potentiometric Surface Map
February 3rd, 2010
Michigan Plaza
3801-3823 West Michigan Street
Indianapolis, Indiana

FIGURE
27



LEGEND

———	Fence
MW160 ●	Keramida Monitoring Wells
SS-P-01 ●	MUNDELL Sewer Sampling Locations (September & November 2005)
GP-07 ●	MUNDELL Soil Boring Locations (September 2005)
MMW-P-06 ◔	MUNDELL Monitoring Wells, Michigan Plaza (September 2005)
GP-C-05 ●	MUNDELL Soil Boring Locations (January 2007)
MMW-P-07 ◔	MUNDELL Monitoring Wells (January 2007)
MMW-P-09D ◔	MUNDELL Monitoring Wells (May-June 2007)
MMW-C-01/ GP-C-06 MMW-11S ⊗	MUNDELL Monitoring Wells (August 2008) / MUNDELL Monitoring Wells (September 2008)
697.03	Water Level as Measured on February 3, 2010 (gray boxes indicate groundwater elevation values not used for the creation of the Potentiometric Surface Map)
699	Potentiometric Surface Equal Potential Lines

NORTH

SCALE
0 200
feet

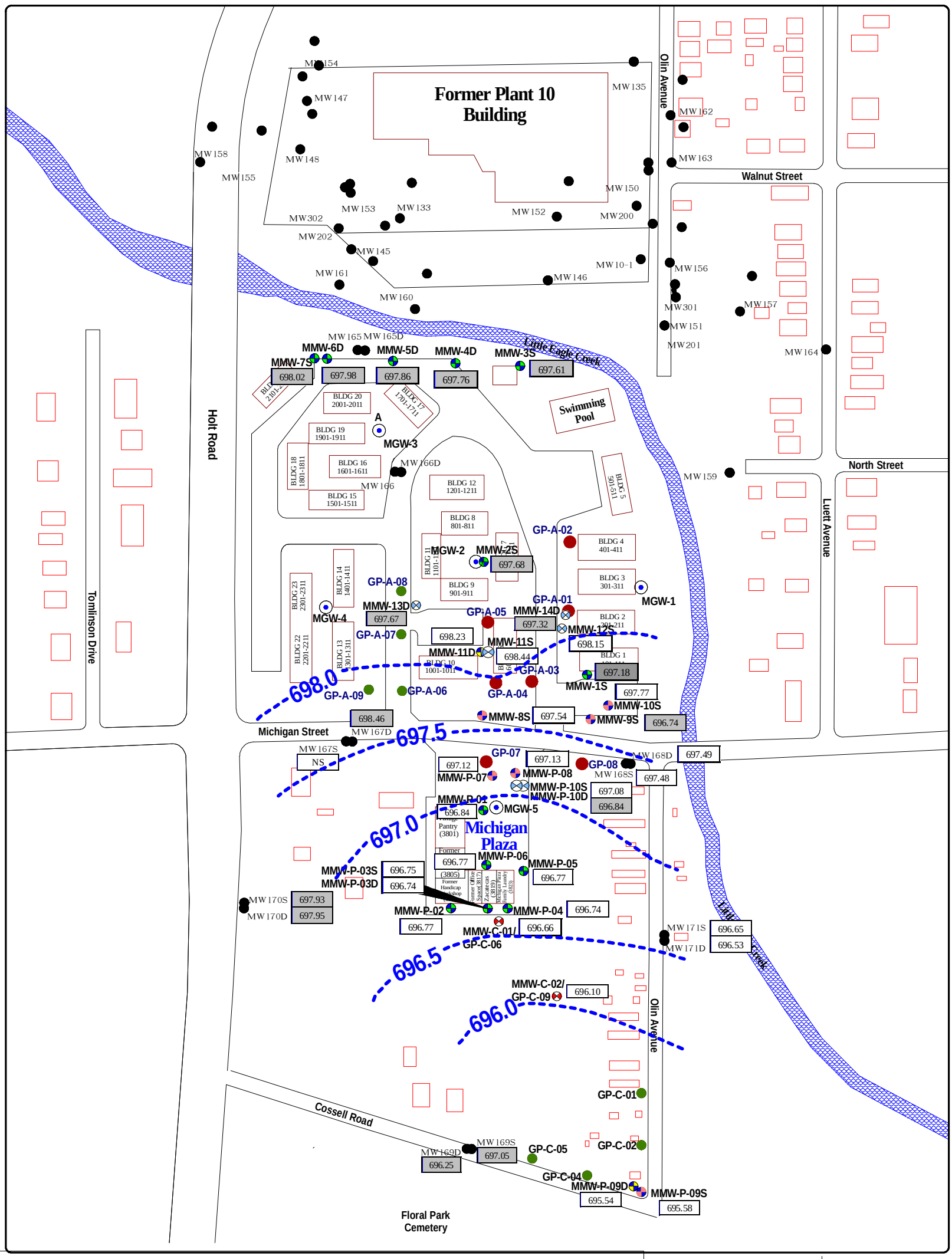
Keramida Monitoring Well Locations Referenced from Keramida Environmental, Inc.
Project No. 2829
March 13, 2002

MUNDELL & ASSOCIATES, INC.
Consulting Professionals for the Earth & Environment
110 South Downey Avenue
Indianapolis, Indiana 46219-6406
317-630-9060, fax 317-630-9065

Project Number:	M01046
Drawing File:	Base Map.SKF
Date Prepared:	5/3/10
Scale:	1"=200' ±

Shallow Potentiometric Surface Map
April 20, 2010
Michigan Plaza
3801-3823 West Michigan Street
Indianapolis, Indiana

FIGURE
28



LEGEND

———	Fence
MW160 ●	Environ Monitoring Wells
SS-P-01 ●	MUNDELL Sewer Sampling Locations (September & November 2005)
GP-07 ●	MUNDELL Soil Boring Locations (September 2005)
MMW-P-06 ◔	MUNDELL Monitoring Wells, Michigan Plaza (September 2005)
GP-C-05 ●	MUNDELL Soil Boring Locations (January 2007)
MMW-P-07 ◔	MUNDELL Monitoring Wells (January 2007)
MMW-P-09D ◔	MUNDELL Monitoring Wells (May-June 2007)
MMW-C-01/ GP-C-06 ⊗	MUNDELL Monitoring Wells (August 2008)
MMW-11S ⊗	MUNDELL Monitoring Wells (September 2008)
697.03	Water Level as Measured on July 20, 2010 (gray boxes indicate groundwater elevation values not used for the creation of the Potentiometric Surface Map)
699	Potentiometric Surface Equal Potential Lines

NORTH

SCALE
0 200
feet

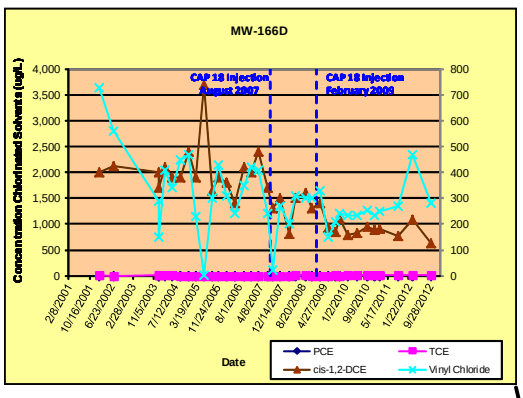
Keramida Monitoring Well Locations Referenced from Keramida Environmental, Inc.
Project No. 2829
March 13, 2002

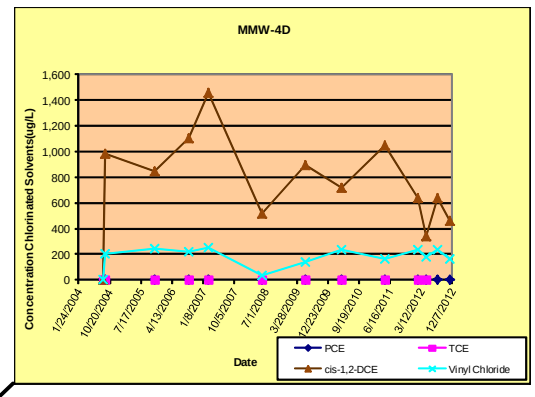
MUNDELL & ASSOCIATES, INC.
Consulting Professionals for the Earth & Environment
110 South Downey Avenue
Indianapolis, Indiana 46219-6406
317-630-9060, fax 317-630-9065

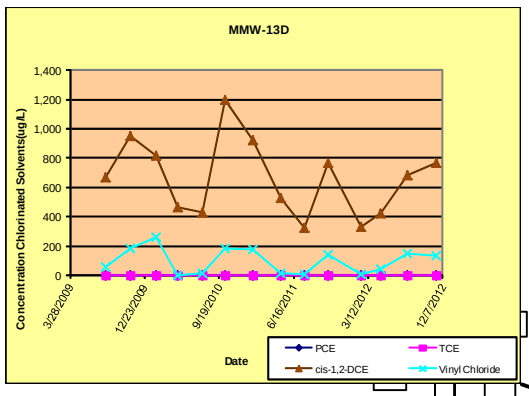
Project Number:	M01046
Drawing File:	Base Map.SKF
Date Prepared:	9/21/10
Scale:	1"=200' ±

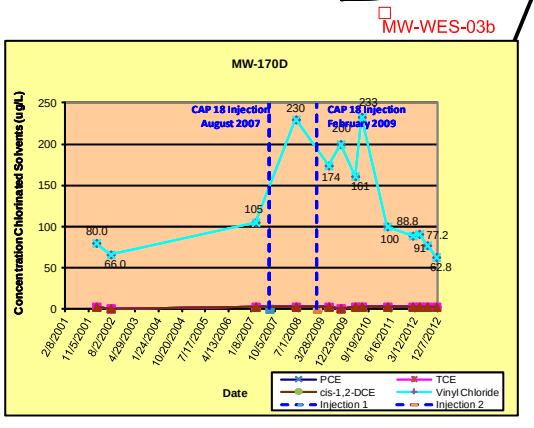
Shallow Potentiometric Surface Map
July 20, 2010
Michigan Plaza
3801-3823 West Michigan Street
Indianapolis, Indiana

FIGURE
29









LEGEND

MMW-P-09D	MUNDELL Monitoring Well
MW-169D	ENVIRON Monitoring Well
MW-WES-05C	U.S. EPA Monitoring Well

N

SCALE 0 200 feet

Mundell
Consulting Professionals for the Earth and the Environment
110 South Downey Avenue
Indianapolis, Indiana 46219
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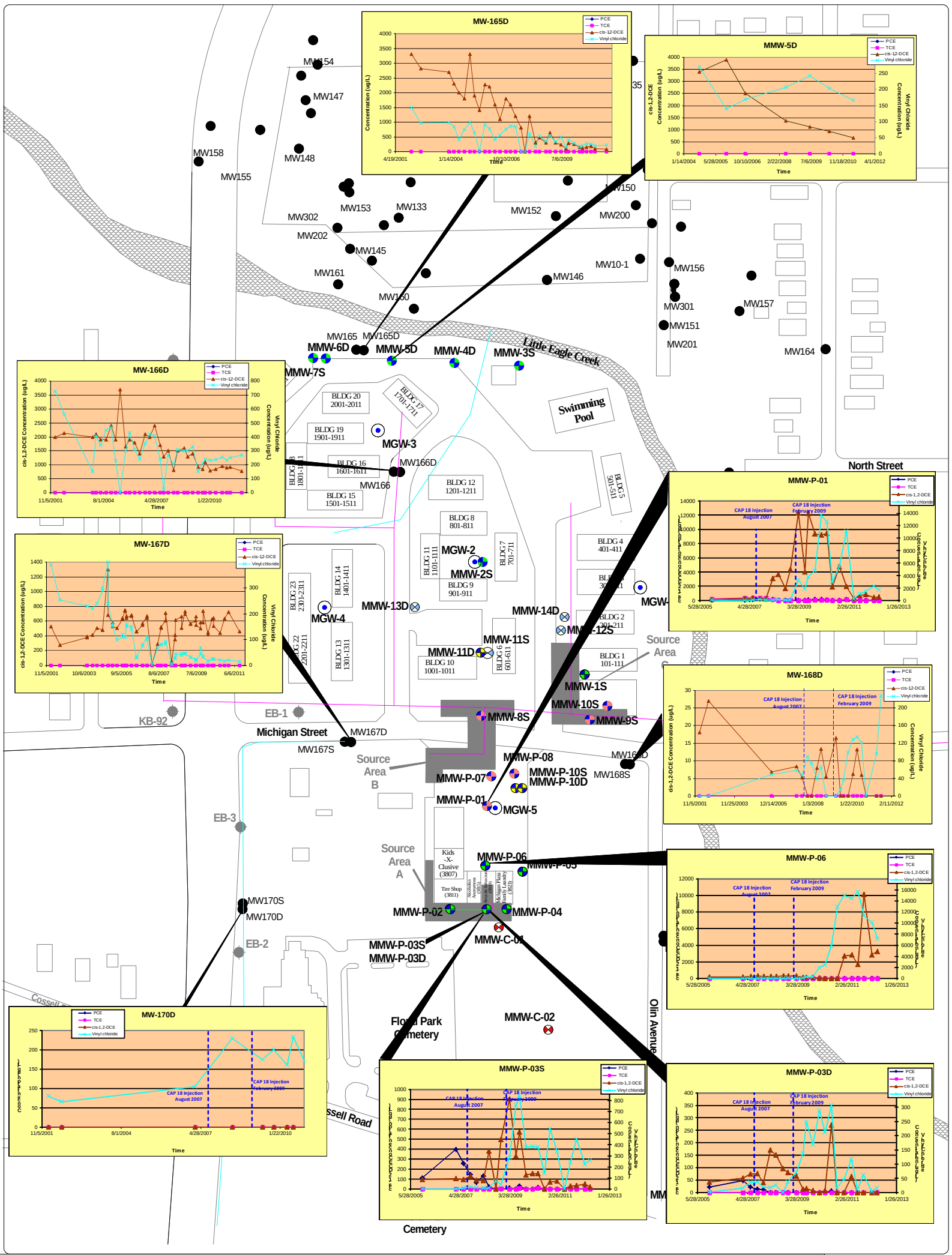
www.MundellAssociates.com

Project Number:	M01046
Drawing File:	4Q12 QMR
Date Prepared:	1-11-13
Scale:	1"=200'

HISTORICAL CHLORINATED SOLVENT CONCENTRATION TREND IN MW-170D

Michigan Plaza
3801 - 3823 West Michigan Street
Indianapolis, INDIANA

FIGURE 30A



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)
MGW-1	MUNDELL Soil Gas Well
	Environ Soil Borings
	Sanitary Sewer
	Storm Sewer

NORTH

SCALE 0 200

feet

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

Mundell
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110 South Downey Avenue
Indianapolis, Indiana 46219-6406
317-630-9060, fax 317-630-9065

Project Number: M01046

Drawing File: Fig_4 IndicatorTrends .skf

Date Prepared: 2/17/2011

Historical Chlorinated Solvent Concentration Trends

Michigan Plaza
3801 - 3823 West Michigan Street
Indianapolis, Indiana

FIGURE
30B

Boring/Well ID: MMW-08S-A

CLIENT: AMMH	FIELD SCIENTIST: Mark Breting
PROJECT LOCATION: Indianapolis, Indiana	DATE BEGAN: 3/5/2013
PROJECT NAME: Michigan Plaza	DATE FINISHED: 3/5/2013
PROJECT NUMBER: M01046	DRILLING METHOD: Geoprobe
DRILLING CONTRACTOR: SCS Environmental	DRILLING EQUIPMENT: 6620 DT
DRILLER: Andy Hermes	GW DEPTH (OBSERVED): 17.0 ft
BORING LOCATION: 3' NW of MMW-8S	SURFACE ELEVATION: NS

Depth BGS (ft)	USCS Symbol	Lithologic Description	Stratum Depth (ft)	TPV (ppm)	Recovery %	Sample Location	Comments
0		Soil	0.5				
1–2	CL	SILTY CLAY, dark gray (10YR 4/2), slightly moist, stiff, slightly plastic, with some fine granules			100		H.A. to 4'
3	SC	CLAYEY SAND with some gravel, grayish brown (10 YR 5/2), loose, slightly moist	3.0				
4–5	CL	SILTY CLAY, dark gray (10 YR 4/1), stiff, slightly moist, slightly plastic	4.5				TPV not recorded 0 to 20'
6					47.5		
7–10					67.5		
10	SM	SILTY fine to medium SAND, with some fine granules, brown (10 YR 5/3), moist, loose	10.3				
11–12							
13		Coarse granules below 13.0'			52.5		
14–15							
16		Minimal silt below 16.0'					
17		Wet below 17.0'					
18					75		
19–20		Gray-black discoloration below 18.6'					
21				0.45			
22		Fine to coarse GRANULES with SAND, gray (10YR 5/1), wet, loose, granules subrounded to rounded	21.5		77.5		
23				0.15			
24							

MMW-08S-A

2" Dia. Borehole

REMARKS:
BGS = Below Ground Surface
USCS = Unified Soil Classification System
TPV = Total Photoionizable Vapors
NS = Not Surveyed
H.A. = Hand Auger

Boring/Well ID: MMW-08S-A

CLIENT: AMMH	FIELD SCIENTIST: Mark Breting
PROJECT LOCATION: Indianapolis, Indiana	DATE BEGAN: 3/5/2013
PROJECT NAME: Michigan Plaza	DATE FINISHED: 3/5/2013
PROJECT NUMBER: M01046	DRILLING METHOD: Geoprobe
DRILLING CONTRACTOR: SCS Environmental	DRILLING EQUIPMENT: 6620 DT
DRILLER: Andy Hermes	GW DEPTH (OBSERVED): 17.0 ft
BORING LOCATION: 3' NW of MMW-8S	SURFACE ELEVATION: NS

Depth BGS (ft)	USCS Symbol	USCS Graphic	Lithologic Description	Stratum Depth (ft)	TPV (ppm)	Recovery %	Sample Location	Comments	MMW-08S-A
24									
25					0.05				
26						75			
27					0.0				
28									
29					1.3				
30						62.5			
31					0.0				
32									2" Dia. Borehole
33					0.0				
34						55			
35					0.3				
36									
37					0.25				
38				38.0		70			
39	CL		SILTY CLAY, dark gray (10 YR 4/1), stiff, slightly moist, non-plastic		0.0				
40			End of boring at 40.0'						
41									
42									
43									
44									
45									
46									
47									
48									

REMARKS:
BGS = Below Ground Surface
USCS = Unified Soil Classification System
TPV = Total Photoionizable Vapors
NS = Not Surveyed
H.A. = Hand Auger

Boring/Well ID: MMW-09S-A

CLIENT: AMMH	FIELD SCIENTIST: Gabriel Hebert
PROJECT LOCATION: Indianapolis, Indiana	DATE BEGAN: 3/6/2013
PROJECT NAME: Michigan Plaza	DATE FINISHED: 3/6/2013
PROJECT NUMBER: M01046	DRILLING METHOD: Geoprobe
DRILLING CONTRACTOR: SCS Environmental	DRILLING EQUIPMENT: 6620 DT Geoprobe
DRILLER: Andy Hermes	GW DEPTH (OBSERVED): 19 ft
BORING LOCATION:	SURFACE ELEVATION: NS

Depth BGS (ft)	USCS Symbol	USCS Graphic	Lithologic Description	Stratum Depth (ft)	TPV (ppm)	Recovery %	Sample Location	Comments
0–4	AR		FILL: Brick, asphalt, gravel		0.25 0.15	25		
5–11	CL		SILTY CLAY, dark brown (10YR 3/3), slightly moist, stiff	5.0	0.05 0.15 0.1 0.2	60 60		
11–19	SW		fine to coarse SAND, pale brown (10YR 6/3), slightly moist, with trace fine granules	11.0	2.1 2.5 4.2 2.85	60 60	S	16-18'
19–24			fine to medium SAND and fine to coarse GRANULES, gray (10YR 6/1), wet, loose	19.0	0.6 0.6	60		

MMW-09S-A

2" Dia. Borehole

REMARKS:
BGS = Below Ground Surface
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TPV = Total Photoionizable Vapors
NS = Not Surveyed

Boring/Well ID: MMW-09S-A

CLIENT: AMMH	FIELD SCIENTIST: Gabriel Hebert
PROJECT LOCATION: Indianapolis, Indiana	DATE BEGAN: 3/6/2013
PROJECT NAME: Michigan Plaza	DATE FINISHED: 3/6/2013
PROJECT NUMBER: M01046	DRILLING METHOD: Geoprobe
DRILLING CONTRACTOR: SCS Environmental	DRILLING EQUIPMENT: 6620 DT Geoprobe
DRILLER: Andy Hermes	GW DEPTH (OBSERVED): 19 ft
BORING LOCATION:	SURFACE ELEVATION: NS

Depth BGS (ft)	USCS Symbol	USCS Graphic	Lithologic Description	Stratum Depth (ft)	TPV (ppm)	Recovery %	Sample Location	Comments
24								
25					0.1			
26						60		
27					0.1			
28								
29					0.1			
30						100		
31					0.15			
32								
33					0.2		S	32-34'
34						60		
35			SILTY CLAY, gray (10YR 5/1), moist, stiff	35.0	0.2			
36								
37	CL				0.2			
38						100		
39					0.2			
40			End of boring at 40 ft	40.0				
41								
42								
43								
44								
45								
46								
47								
48								

MMW-09S-A

2" Dia. Borehole

REMARKS:
BGS = Below Ground Surface
USCS = Unified Soil Classification System
TPV = Total Photoionizable Vapors
NS = Not Surveyed

Boring/Well ID: MMW-10S-A

CLIENT: AMMH	FIELD SCIENTIST: Mark Breting
PROJECT LOCATION: Indianapolis, Indiana	DATE BEGAN: 3/6/2013
PROJECT NAME: Michigan Plaza	DATE FINISHED: 3/6/2013
PROJECT NUMBER: M01046	DRILLING METHOD: Geoprobe
DRILLING CONTRACTOR: SCS Environmental	DRILLING EQUIPMENT: 6620 DT
DRILLER: Andy Hermes	GW DEPTH (OBSERVED): 16 ft
BORING LOCATION:	SURFACE ELEVATION: NS

Depth BGS (ft)	USCS Symbol	Lithologic Description	Stratum Depth (ft)	TPV (ppm)	Recovery %	Sample Location	Comments
0–4	AR	Fill brick, clay, rock	4.0	1.1			H.A. to 3.5'
				NS			
4–9.5	CL	SILTY CLAY, dark gray (10YR 4/1), slightly moist, with trace fine granules	9.5	0.1	87.5		
				0.0			
9.5–16.9	SW-GW	fine to coarse SAND with GRANULES, gray (10YR 5/1), slightly moist, loose		0.05	45	S	10-12'
				0.15			
				NR	0		
				NR			
		wet below 16 ft					
16.9–17.8	ML	CLAYEY SILT, gray (10YR 6/1), very moist, soft, slightly plastic	16.9	0.0	50		
17.8–24	SW	Fine to coarse SAND, grayish brown (10YR 5/2), wet, loose, non-plastic	17.8	NR			
				0.0	65		
				0.0			

MMW-10S-A

2" Dia. Borehole

REMARKS:
BGS = Below Ground Surface
USCS = Unified Soil Classification System
TPV = Total Photoionizable Vapors
NS = Not Surveyed
NR = Not Recorded
H.A. = Hand Auger

Boring/Well ID: MMW-10S-A

CLIENT: AMMH	FIELD SCIENTIST: Mark Breting
PROJECT LOCATION: Indianapolis, Indiana	DATE BEGAN: 3/6/2013
PROJECT NAME: Michigan Plaza	DATE FINISHED: 3/6/2013
PROJECT NUMBER: M01046	DRILLING METHOD: Geoprobe
DRILLING CONTRACTOR: SCS Environmental	DRILLING EQUIPMENT: 6620 DT
DRILLER: Andy Hermes	GW DEPTH (OBSERVED): 16 ft
BORING LOCATION:	SURFACE ELEVATION: NS

Depth BGS (ft)	USCS Symbol	USCS Graphic	Lithologic Description	Stratum Depth (ft)	TPV (ppm)	Recovery %	Sample Location	Comments
24	SW				0.0	88		
25								
26					0.0			
27								
28					0.0	100		
29								
30					0.1			
31								
32				32.4	0.0	100	S	34-36'
33			GRANULES with SAND, grayish brown (10YR 5/2), wet, loose, non-plastic					
34				34.6	0.0			
35	CL		SILTY CLAY, gray (10YR 6/1), slightly moist, stiff, with trace coarse sand and fine granules, slightly plastic			100		
36					0.0			
37								
38					0.0			
39								
40			End of Boring at 40 ft	40.0				
41								
42								
43								
44								
45								
46								
47								
48								

MMW-10S-A

2" Dia. Borehole

REMARKS:
BGS = Below Ground Surface
USCS = Unified Soil Classification System
TPV = Total Photoionizable Vapors
NS = Not Surveyed
NR = Not Recorded
H.A. = Hand Auger

Boring/Well ID: MMW-11D-A

CLIENT: AMMH	FIELD SCIENTIST: Mark Breting
PROJECT LOCATION: Indianapolis, Indiana	DATE BEGAN: 3/5/2013
PROJECT NAME: Michigan Plaza	DATE FINISHED: 3/5/2013
PROJECT NUMBER: M01046	DRILLING METHOD: Geoprobe
DRILLING CONTRACTOR: SCS Environmental	DRILLING EQUIPMENT: 6620 DT Geoprobe
DRILLER: Andy Hermes	GW DEPTH (OBSERVED): 16 ft
BORING LOCATION: 4' south of 11S/11D	SURFACE ELEVATION: NS

Depth BGS (ft)	USCS Symbol	USCS Graphic	Lithologic Description	Stratum Depth (ft)	TPV (ppm)	Recovery %	Sample Location	Comments
0			Soil	0.5				
1			Confirmed lithology to 4.0' with original soil boring log					
2					NS	100		H.A. to 4'
3								
4			Blank drill 4.0'-16.0'	4.0				
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16				16.0				
17	SM		SILTY SAND, brown (10YR 5/2), wet, dense, non-plastic, fine to medium grained		0.0			
18			Gray (10 YR 5/1) below 17.0'			82.5		
19					0.0			
20								
21				21.2	0.0			
22	SW		Fine to coarse grained SAND, brown (10YR 5/2), wet, dense, non-plastic			100		
23					0.0			
24								

MMW-11D-A

2" Dia. Borehole

REMARKS:
BGS = Below Ground Surface
USCS = Unified Soil Classification System
TPV = Total Photoionizable Vapors
NS = Not Surveyed
H.A. = Hand Auger

Boring/Well ID: MMW-11D-A

CLIENT: AMMH	FIELD SCIENTIST: Mark Breting
PROJECT LOCATION: Indianapolis, Indiana	DATE BEGAN: 3/5/2013
PROJECT NAME: Michigan Plaza	DATE FINISHED: 3/5/2013
PROJECT NUMBER: M01046	DRILLING METHOD: Geoprobe
DRILLING CONTRACTOR: SCS Environmental	DRILLING EQUIPMENT: 6620 DT Geoprobe
DRILLER: Andy Hermes	GW DEPTH (OBSERVED): 16 ft
BORING LOCATION: 4' south of 11S/11D	SURFACE ELEVATION: NS

Depth BGS (ft)	USCS Symbol	Lithologic Description	Stratum Depth (ft)	TPV (ppm)	Recovery %	Sample Location	Comments
24–27		GRANULES with some SAND, gray (10YR 5/1), wet, loose, non-plastic		0.0 1.0	75		
27–28	SW	Fine to medium grained SAND, gray (10YR 5/1), wet, dense, non-plastic	27.1				
28–30	SP	Fine SAND, gray (10YR 6/1), wet, dense, non-plastic	28.0	2.9	100		
30–32	SM	Fine to coarse grained SILTY SAND, gray (10YR 5/1), wet, loose, non-plastic	30.3	1.6			
32–34	CL	SILTY CLAY, gray (10YR 5/1), slightly moist, stiff, slightly plastic	32.1	0.0	100		
34		End of boring at 34.0'	34.0				

MMW-11D-A

2" Dia. Borehole

REMARKS:
BGS = Below Ground Surface
USCS = Unified Soil Classification System
TPV = Total Photoionizable Vapors
NS = Not Surveyed
H.A. = Hand Auger

Boring/Well ID: MMW-13D-A

CLIENT: AMMH	FIELD SCIENTIST: Mark Breting
PROJECT LOCATION: Indianapolis, Indiana	DATE BEGAN: 3/5/2013
PROJECT NAME: Michigan Plaza	DATE FINISHED: 3/11/2013
PROJECT NUMBER: M01046	DRILLING METHOD: Geoprobe
DRILLING CONTRACTOR: SCS Environmental	DRILLING EQUIPMENT: 6620 DT
DRILLER: Andy Hermes	GW DEPTH (OBSERVED): 20 ft
BORING LOCATION: 3' NW of MMW-8S	SURFACE ELEVATION: NS

Depth BGS (ft)	USCS Symbol	USCS Graphic	Lithologic Description	Stratum Depth (ft)	TPV (ppm)	Recovery %	Sample Location	Comments
0	CL		SILTY CLAY, yellowish brown, slightly moIst (confirming lithology to original boring)	4.0				
4			Blank Drill 4 ft to 20 ft					
20								

MMW-13D-A

2" Dia. Borehole

REMARKS:
BGS = Below Ground Surface
USCS = Unified Soil Classification System
TPV = Total Photoionizable Vapors
NS = Not Surveyed

Boring/Well ID: MMW-13D-A

CLIENT: AMMH	FIELD SCIENTIST: Mark Breting
PROJECT LOCATION: Indianapolis, Indiana	DATE BEGAN: 3/5/2013
PROJECT NAME: Michigan Plaza	DATE FINISHED: 3/11/2013
PROJECT NUMBER: M01046	DRILLING METHOD: Geoprobe
DRILLING CONTRACTOR: SCS Environmental	DRILLING EQUIPMENT: 6620 DT
DRILLER: Andy Hermes	GW DEPTH (OBSERVED): 20 ft
BORING LOCATION: 3' NW of MMW-8S	SURFACE ELEVATION: NS

Depth BGS (ft)	USCS Symbol	Lithologic Description	Stratum Depth (ft)	TPV (ppm)	Recovery %	Sample Location	Comments
20	SP	fine SAND, gray (10 YR 6/1), loose, wet, non-plastic, with trace granules					
21			21.0				
22	SW	fine to coarse SAND, gray (10 YR 6/1), loose, wet, non-plastic			80		
23							
24			24.0				
25	SP	fine SAND, gray (10 YR 6/1), loose, wet, non-plastic, with trace granules		0.0			
26			25.6		78		
27	SW-GW	fine to coarse SAND and fine to coarse GRANULES, brown (10 YR 5/4), loose, wet, non-plastic, granules subangluar to rounded		0.0			
28							
29				NR			
30					0		
31				NR			
32							
33				0.2			
34					100		
35				0.1			
36							
37				0.0			
38	CL	SILTY CLAY, dark gray (10 YR 4/1), medium stiff, slightly moist, slightly plastic, with some subangular granules	37.4		100		
39	SW	fine to medium SAND, gray (10 YR 6/1), dense, wet, non-plastic	39.0	1.9			
40							

MMW-13D-A

2" Dia. Borehole

REMARKS:
BGS = Below Ground Surface
USCS = Unified Soil Classification System
TPV = Total Photoionizable Vapors
NS = Not Surveyed

Boring/Well ID: MMW-13D-A

CLIENT: AMMH	FIELD SCIENTIST: Mark Breting
PROJECT LOCATION: Indianapolis, Indiana	DATE BEGAN: 3/5/2013
PROJECT NAME: Michigan Plaza	DATE FINISHED: 3/11/2013
PROJECT NUMBER: M01046	DRILLING METHOD: Geoprobe
DRILLING CONTRACTOR: SCS Environmental	DRILLING EQUIPMENT: 6620 DT
DRILLER: Andy Hermes	GW DEPTH (OBSERVED): 20 ft
BORING LOCATION: 3' NW of MMW-8S	SURFACE ELEVATION: NS

Depth BGS (ft)	USCS Symbol	Lithologic Description	Stratum Depth (ft)	TPV (ppm)	Recovery %	Sample Location	Comments	MMW-13D-A
40								
41	SP	fine SAND, gray (10 YR 6/1), dense, wet, non-plastic		0.0				
42					100			
43			43.1	0.0				
44	SW-F42	CLAYEY SAND and fine to coarse GRANULES, gray (10 YR 6/1), loose, very moist to wet, non-plastic, with small piece of clay mixed in at 43.2 ft						
45				0.05				
46					50			
47				NR				
48			48.0					
49	SW-GW	SAND and fine to coarse GRANULES, gray (10 YR 6/1), loose, very moist to wet, non-plastic		0.0				
50					100			2" Dia. Borehole
51			51.0	2.0				
52	SW	fine to medium SAND, gray (10 YR 6/1), loose, wet, non-plastic thin (0.01 ft) fragment of shale at 52 ft						
53				0.05				
54					100			
55				1.65				
56								
57				1.35		S	56-58' (DUP-2)	
58					78			
59	SW-GW		58.5					
	CL	fine to coarse SAND and fine to coarse GRANULES, gray (10YR 6/1), wet, loose, non-plastic	59.0	0.6		S	58-60'	
60		SANDY SILTY CLAY, very dark gray (10YR 3/1), slightly moist, medium stiff, slightly plastic						

REMARKS:
BGS = Below Ground Surface
USCS = Unified Soil Classification System
TPV = Total Photoionizable Vapors
NS = Not Surveyed

Boring/Well ID: MMW-13D-A

CLIENT: AMMH	FIELD SCIENTIST: Mark Breting
PROJECT LOCATION: Indianapolis, Indiana	DATE BEGAN: 3/5/2013
PROJECT NAME: Michigan Plaza	DATE FINISHED: 3/11/2013
PROJECT NUMBER: M01046	DRILLING METHOD: Geoprobe
DRILLING CONTRACTOR: SCS Environmental	DRILLING EQUIPMENT: 6620 DT
DRILLER: Andy Hermes	GW DEPTH (OBSERVED): 20 ft
BORING LOCATION: 3' NW of MMW-8S	SURFACE ELEVATION: NS

Depth BGS (ft)	USCS Symbol	USCS Graphic	Lithologic Description	Stratum Depth (ft)	TPV (ppm)	Recovery %	Sample Location	Comments	MMW-13D-A
60	CL			61.0	0.3	80			2" Dia. Borehole
61			End of boring at 61 ft						
62									
63									
64									
65									
66									
67									
68									
69									
70									
71									
72									
73									
74									
75									
76									
77									
78									
79									
80									

REMARKS:
BGS = Below Ground Surface
USCS = Unified Soil Classification System
TPV = Total Photoionizable Vapors
NS = Not Surveyed

Boring/Well ID: MMW-14D-A

CLIENT: AMMH	FIELD SCIENTIST: Gabriel Hebert/Mark Breting
PROJECT LOCATION: Indianapolis, Indiana	DATE BEGAN: 3/6/2013
PROJECT NAME: Michigan Plaza	DATE FINISHED: 3/11/2013
PROJECT NUMBER: M01046	DRILLING METHOD: Geoprobe
DRILLING CONTRACTOR: SCS Environmental	DRILLING EQUIPMENT: 6620 DT Geoprobe
DRILLER: Andy Hermes	GW DEPTH (OBSERVED): 20 ft
BORING LOCATION:	SURFACE ELEVATION: NS

Depth BGS (ft)	USCS Symbol	USCS Graphic	Lithologic Description	Stratum Depth (ft)	TPV (ppm)	Recovery %	Sample Location	Comments
0–4	CL		SILTY CLAY, dark brown, slightly moist (confirmed lithology to original soil boring)					H.A. to 4 ft
4–20			Blank drill 4 ft to 20 ft					

MMW-14D-A

2" Dia. Borehole

REMARKS:
BGS = Below Ground Surface
USCS = Unified Soil Classification System
TPV = Total Photoionizable Vapors
NS = Not Surveyed
H.A. = Hand Auger

Boring/Well ID: MMW-14D-A

CLIENT: AMMH	FIELD SCIENTIST: Gabriel Hebert/Mark Breting
PROJECT LOCATION: Indianapolis, Indiana	DATE BEGAN: 3/6/2013
PROJECT NAME: Michigan Plaza	DATE FINISHED: 3/11/2013
PROJECT NUMBER: M01046	DRILLING METHOD: Geoprobe
DRILLING CONTRACTOR: SCS Environmental	DRILLING EQUIPMENT: 6620 DT Geoprobe
DRILLER: Andy Hermes	GW DEPTH (OBSERVED): 20 ft
BORING LOCATION:	SURFACE ELEVATION: NS

Depth BGS (ft)	USCS Symbol	Lithologic Description	Stratum Depth (ft)	TPV (ppm)	Recovery %	Sample Location	Comments
20			20.0				
21	SW	fine to coarse SAND, pale brown (10YR 6/3), wet, non-plastic		0.1			
22					100		
23	CL	SILTY CLAY, gray (10YR 6/1), slightly moist, stiff	23.0	0.2			
24			24.0				
25	SW	fine to coarse SAND, pale brown (10YR 6/3), wet, non-plastic		0.55			
26					75		
27				0.65			
28							
29				1.3			
30		GRANULES with SAND, pale brown (10YR 6/3), wet, non-plastic	30.0		90		
31				1.05			
32							
33				3.9			
34					75		
35				3.25			
36	CL	SILTY CLAY, gray (10YR 6/1), moist, stiff	36.0				
37		SAND and GRANULES, light grayish brown (10YR 6/2), wet, non-plastic	37.0	2.2			
38					100		
39				5.4			
40							

MMW-14D-A

2" Dia. Borehole

REMARKS:
BGS = Below Ground Surface
USCS = Unified Soil Classification System
TPV = Total Photoionizable Vapors
NS = Not Surveyed
H.A. = Hand Auger

Boring/Well ID: MMW-14D-A

CLIENT: AMMH	FIELD SCIENTIST: Gabriel Hebert/Mark Breting
PROJECT LOCATION: Indianapolis, Indiana	DATE BEGAN: 3/6/2013
PROJECT NAME: Michigan Plaza	DATE FINISHED: 3/11/2013
PROJECT NUMBER: M01046	DRILLING METHOD: Geoprobe
DRILLING CONTRACTOR: SCS Environmental	DRILLING EQUIPMENT: 6620 DT Geoprobe
DRILLER: Andy Hermes	GW DEPTH (OBSERVED): 20 ft
BORING LOCATION:	SURFACE ELEVATION: NS

Depth BGS (ft)	USCS Symbol	Lithologic Description	Stratum Depth (ft)	TPV (ppm)	Recovery %	Sample Location	Comments	MMW-14D-A
40								
41				15.3				
42		fine to coarse GRANULES with some fine to coarse SAND, gray (10YR 6/1), wet, non-plastic	42.0		75			
43				9.95				
44		fine to coarse SAND, gray (10YR 6/1), wet, with some fine to coarse granules, non-plastic	44.0					
45				18.4		S	44-46'	
46					100			
47				9.25				
48	SW							
49				5.5				
50					100			2" Dia. Borehole
51				6.2		S	50-52'	
52								
53	CL	SILTY CLAY, gray (10YR 5/1), slightly moist, stiff	52.4	2.4				
54	SW-GW	fine to coarse SAND and fine to coarse GRANULES, gray (10YR 6/1), wet, loose, non-plastic	53.2		80			
55	SP	fine SAND, light gray (10YR 7/1), wet, dense, non-plastic	55.1	1.85				
56	SW	fine to medium SAND, gray (10YR 6/1), wet, medium dense, non-plastic	56.0					
57		fine to coarse SAND and fine to coarse GRANULES, gray (10YR 6/1), wet, loose	56.5	0.2				
58					58			
59				0.65				
60								

REMARKS:
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NS = Not Surveyed
H.A. = Hand Auger

Boring/Well ID: MMW-14D-A

CLIENT: AMMH	FIELD SCIENTIST: Gabriel Hebert/Mark Breting
PROJECT LOCATION: Indianapolis, Indiana	DATE BEGAN: 3/6/2013
PROJECT NAME: Michigan Plaza	DATE FINISHED: 3/11/2013
PROJECT NUMBER: M01046	DRILLING METHOD: Geoprobe
DRILLING CONTRACTOR: SCS Environmental	DRILLING EQUIPMENT: 6620 DT Geoprobe
DRILLER: Andy Hermes	GW DEPTH (OBSERVED): 20 ft
BORING LOCATION:	SURFACE ELEVATION: NS

Depth BGS (ft)	USCS Symbol	USCS Graphic	Lithologic Description	Stratum Depth (ft)	TPV (ppm)	Recovery %	Sample Location	Comments
60								
61					1.05			
62						100		
63					0.75			
64			fine SAND, gray (10YR 6/1), wet, very dense, non-plastic	64.0				
65	SP				0.6	100		
66								
67			Refusal at 67 ft (driller notes refusal occured within sand)	67.0	0.45			
68								
69								
70								
71								
72								
73								
74								
75								
76								
77								
78								
79								
80								

MMW-14D-A

2" Dia. Borehole

REMARKS:
BGS = Below Ground Surface
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NS = Not Surveyed
H.A. = Hand Auger

Boring/Well ID: MMW-P-02-A

CLIENT: AMMH	FIELD SCIENTIST: Mark Breting
PROJECT LOCATION: Indianapolis, Indiana	DATE BEGAN: 3/7/2013
PROJECT NAME: Michigan Plaza	DATE FINISHED: 3/7/2013
PROJECT NUMBER: M01046	DRILLING METHOD: Geoprobe
DRILLING CONTRACTOR: SCS Environmental	DRILLING EQUIPMENT: 6620 DT
DRILLER: Andy Hermes	GW DEPTH (OBSERVED): 20 ft
BORING LOCATION:	SURFACE ELEVATION: NS

Depth BGS (ft)	USCS Symbol	USCS Graphic	Lithologic Description	Stratum Depth (ft)	TPV (ppm)	Recovery %	Sample Location	Comments
0			Asphalt	0.5				
1			Confirm lithology to 4.0'					
2								
3								
4			Blank drill 4.0 to 8.0 ft					
5								
6								
7								
8				8.0				
9			Fine to medium grained SAND, light yellowish brown (10YR 6/4), slightly moist, medium dense, non-plastic		0.7			
10	SW					60		
11					0.1			
12				12.0				
13			Fine to coarse grained SAND with some fine to coarse GRANULES, yellowish brown (10YR 5/4), slightly moist, trace clay content, medium dense		1.35		S	12-14'
14						52.5		
15					0.55			
16								
17					0.3			
18	SW					62.5		
19					6.15			
20			Wet below 20.0'					
21					13.9		S	20-22' (DUP-1)
22						77.5		
23					0.95			
24								

MMW-P-02-A

2" Dia. Borehole

REMARKS:
BGS = Below Ground Surface
USCS = Unified Soil Classification System
TPV = Total Photoionizable Vapors
NS = Not Surveyed
NR = Not Recorded

Boring/Well ID: MMW-P-02-A

CLIENT: AMMH	FIELD SCIENTIST: Mark Breting
PROJECT LOCATION: Indianapolis, Indiana	DATE BEGAN: 3/7/2013
PROJECT NAME: Michigan Plaza	DATE FINISHED: 3/7/2013
PROJECT NUMBER: M01046	DRILLING METHOD: Geoprobe
DRILLING CONTRACTOR: SCS Environmental	DRILLING EQUIPMENT: 6620 DT
DRILLER: Andy Hermes	GW DEPTH (OBSERVED): 20 ft
BORING LOCATION:	SURFACE ELEVATION: NS

Depth BGS (ft)	USCS Symbol	USCS Graphic	Lithologic Description	Stratum Depth (ft)	TPV (ppm)	Recovery %	Sample Location	Comments	MMW-P-02-A
24				24					
25	SW-GW		Fine to coarse grained SAND and fine to coarse GRANULES, gray (10YR 5/1), granules angular to subrounded, wet, loose, non-plastic		1.95	97.5			2" Dia. Borehole
26									
27			Fine grained SAND below 26.7 ft		1.2				
28									
29					0.8	87.5			
30									
31	SP		Fine grained SAND with trace granules, dark grayish brown (10YR 4/2), wet, medium dense	30.5	0.7				
32			Fine to medium grained sand below 31.1 ft						
33			End of boring at 32.0'						
34									
35									
36									
37									
38									
39									
40									
41									
42									
43									
44									
45									
46									
47									
48									

REMARKS:
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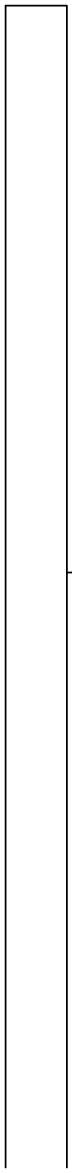
NS = Not Surveyed
NR = Not Recorded

Boring/Well ID: MMW-P-03D-A

CLIENT: AMMH	FIELD SCIENTIST: Mark Breting
PROJECT LOCATION: Indianapolis, Indiana	DATE BEGAN: 3/7/2013
PROJECT NAME: Michigan Plaza	DATE FINISHED: 3/7/2013
PROJECT NUMBER: M01046	DRILLING METHOD: Geoprobe
DRILLING CONTRACTOR: SCS Environmental	DRILLING EQUIPMENT: 6620 DT
DRILLER: Andy Hermes	GW DEPTH (OBSERVED): 28 ft
BORING LOCATION:	SURFACE ELEVATION: NS

Depth BGS (ft)	USCS Symbol	USCS Graphic	Lithologic Description	Stratum Depth (ft)	TPV (ppm)	Recovery %	Sample Location	Comments
0	FB		Asphalt					
1	CL		SILTY CLAY, dark gray, slightly moist (confirmed lithology to original soil boring)					
2								
3								
4			Blank Drill 4 ft to 28 ft	4.0				
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								

MMW-P-03D-A



REMARKS:
BGS = Below Ground Surface
USCS = Unified Soil Classification System
TPV = Total Photoionizable Vapors
NS = Not Surveyed
NR = Not Recorded

Boring/Well ID: MMW-P-03D-A

CLIENT: AMMH	FIELD SCIENTIST: Mark Breting
PROJECT LOCATION: Indianapolis, Indiana	DATE BEGAN: 3/7/2013
PROJECT NAME: Michigan Plaza	DATE FINISHED: 3/7/2013
PROJECT NUMBER: M01046	DRILLING METHOD: Geoprobe
DRILLING CONTRACTOR: SCS Environmental	DRILLING EQUIPMENT: 6620 DT
DRILLER: Andy Hermes	GW DEPTH (OBSERVED): 28 ft
BORING LOCATION:	SURFACE ELEVATION: NS

Depth BGS (ft)	USCS Symbol	USCS Graphic	Lithologic Description	Stratum Depth (ft)	TPV (ppm)	Recovery %	Sample Location	Comments
28	SW		fine to medium SAND, gray (10YR 5/1), wet, medium dense	28.0	0.45	88		
30					0.4			
32			fine to coarse SAND and fine to coarse GRANULES, gray (10YR 5/1), wet, loose, non-plastic, with trace cobbles	32.0	0.6	100		
34					0.65			
36	SW		fine to coarse SAND, gray (10YR 5/1), wet, loose, non-plastic		0.85	100		
38			with coarse granules below 38.5 ft					
39					0.5		S	38-40'
40	CL		SILTY CLAY, gray (10YR 5/1), dry-slightly moist, hard, slightly plastic	39.5 40.0				
41			End of boring at 40 ft					

MMW-P-03D-A

2" Dia. Borehole

REMARKS:

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NS = Not Surveyed
NR = Not Recorded

Boring/Well ID: MMW-P-04-A

CLIENT: AMMH	FIELD SCIENTIST: Gabriel Hebert
PROJECT LOCATION: Indianapolis, Indiana	DATE BEGAN: 3/8/2013
PROJECT NAME: Michigan Plaza	DATE FINISHED: 3/8/2013
PROJECT NUMBER: M01046	DRILLING METHOD: Geoprobe
DRILLING CONTRACTOR: SCS Environmental	DRILLING EQUIPMENT: 6620 DT
DRILLER: Andy Hermes	GW DEPTH (OBSERVED): NA
BORING LOCATION:	SURFACE ELEVATION: NS

Depth BGS (ft)	USCS Symbol	USCS Graphic	Lithologic Description	Stratum Depth (ft)	TPV (ppm)	Recovery %	Sample Location	Comments	MMW-P-04-A
0	FB		Asphalt						
1	CL		CLAY	1.0					
2									
3				3.5					
4	SW		SAND	4.0					
5			Blank Drill 4 ft to 16 ft						
6									
7									
8									
9									
10									
11									
12									2" Dia. Borehole
13									
14									
15									
16				16.0					
17	SW		fine to medium SAND, very pale brown (10YR 7/4), with trace fine granules, slightly moist		1.6		S	16-18'	
18						60			
19					1.1				
20			wet below 20 ft						
21	CL		SANDY CLAY, gray (10YR 6/1), slightly moist, soft	21.0	0.8				
22				22.0		75			
23	SW		fine to coarse SAND, gray (10YR 5/1),wet, loose, with some granules		0.2				
24									

REMARKS:
BGS = Below Ground Surface
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TPV = Total Photoionizable Vapors
NS = Not Surveyed
NR = Not Recorded

Boring/Well ID: MMW-P-04-A

CLIENT: AMMH	FIELD SCIENTIST: Gabriel Hebert
PROJECT LOCATION: Indianapolis, Indiana	DATE BEGAN: 3/8/2013
PROJECT NAME: Michigan Plaza	DATE FINISHED: 3/8/2013
PROJECT NUMBER: M01046	DRILLING METHOD: Geoprobe
DRILLING CONTRACTOR: SCS Environmental	DRILLING EQUIPMENT: 6620 DT
DRILLER: Andy Hermes	GW DEPTH (OBSERVED): NA
BORING LOCATION:	SURFACE ELEVATION: NS

Depth BGS (ft)	USCS Symbol	USCS Graphic	Lithologic Description	Stratum Depth (ft)	TPV (ppm)	Recovery %	Sample Location	Comments
24–25	SW				0.3	100		
25–26								
26–27					0.5			
27–28								
28–29					0.15	100		
29–30								
30–31					0.25			
31–32				32.0				
32			End of Boring at 32 ft					

MMW-P-04-A: 2" Dia. Borehole

REMARKS:
BGS = Below Ground Surface
USCS = Unified Soil Classification System
TPV = Total Photoionizable Vapors
NS = Not Surveyed
NR = Not Recorded

Boring/Well ID: MMW-P-07-A

CLIENT: AMMH	FIELD SCIENTIST: Gabriel Hebert
PROJECT LOCATION: Indianapolis, Indiana	DATE BEGAN: 3/8/2013
PROJECT NAME: Michigan Plaza	DATE FINISHED: 3/8/2013
PROJECT NUMBER: M01046	DRILLING METHOD: Geoprobe
DRILLING CONTRACTOR: SCS Environmental	DRILLING EQUIPMENT: 6620 DT
DRILLER: Andy Hermes	GW DEPTH (OBSERVED): 19 ft
BORING LOCATION:	SURFACE ELEVATION: NS

Depth BGS (ft)	USCS Symbol	USCS Graphic	Lithologic Description	Stratum Depth (ft)	TPV (ppm)	Recovery %	Sample Location	Comments
0	FB		FILL					
1	SW		SAND	1.0				
2								
3	CL		SILTY CLAY	3.0				
4			Blank Drill 4 ft to 16 ft	4.0				
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16			fine to medium SAND, pale brown (10YR 6/3), moist	16.0	0.9	75		
17								
18					4.9			
19	SW		wet below 19 ft					
20					7.6		S	20-22'
21								
22			fine to coarse SAND and fine to coarse GRANULES, gray (10YR 5/1), wet, loose	22.0	0.6	75		
23								
24								

MMW-P-07A

2" Dia. Borehole

REMARKS:
BGS = Below Ground Surface
USCS = Unified Soil Classification System
TPV = Total Photoionizable Vapors
NS = Not Surveyed
NR = Not Recorded

Boring/Well ID: MMW-P-07-A

CLIENT: AMMH	FIELD SCIENTIST: Gabriel Hebert
PROJECT LOCATION: Indianapolis, Indiana	DATE BEGAN: 3/8/2013
PROJECT NAME: Michigan Plaza	DATE FINISHED: 3/8/2013
PROJECT NUMBER: M01046	DRILLING METHOD: Geoprobe
DRILLING CONTRACTOR: SCS Environmental	DRILLING EQUIPMENT: 6620 DT
DRILLER: Andy Hermes	GW DEPTH (OBSERVED): 19 ft
BORING LOCATION:	SURFACE ELEVATION: NS

Depth BGS (ft)	USCS Symbol	USCS Graphic	Lithologic Description	Stratum Depth (ft)	TPV (ppm)	Recovery %	Sample Location	Comments	MMW-P-07A
24									
25					0.4				
26						75			
27					0.55				
28									2" Dia. Borehole
29					0.85				
30			less granules between 30 and 32 ft			75			
31					0.8				
32				32.0					
33			End of Boring 32 ft						
34									
35									
36									
37									
38									
39									
40									
41									
42									
43									
44									
45									
46									
47									
48									

REMARKS:
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TPV = Total Photoionizable Vapors
NS = Not Surveyed
NR = Not Recorded

Boring/Well ID: MMW-P-10D-A

CLIENT: AMMH	FIELD SCIENTIST: Gabriel Hebert
PROJECT LOCATION: Indianapolis, Indiana	DATE BEGAN: 3/8/2013
PROJECT NAME: Michigan Plaza	DATE FINISHED: 3/8/2013
PROJECT NUMBER: M01046	DRILLING METHOD: Geoprobe
DRILLING CONTRACTOR: SCS Environmental	DRILLING EQUIPMENT: 6620 DT
DRILLER: Andy Hermes	GW DEPTH (OBSERVED): NA
BORING LOCATION:	SURFACE ELEVATION: NS

Depth BGS (ft)	USCS Symbol	USCS Graphic	Lithologic Description	Stratum Depth (ft)	TPV (ppm)	Recovery %	Sample Location	Comments
0	FB		FILL					
1	SW		SAND	1.0				
2	CL		SILTY CLAY	2.0				
3								
4			Blank Drill 4 ft to 20 ft	4.0				
5								
6								
7					0.0			
8								
9					0.05	45		
10								
11					0.15			
12								
13					NR			
14						0		
15					NR			
16								
17					0.0			
18						50		
19					NR			
20	SW		fine to medium SAND, yellowish brown (10YR 6/6), wet					
21				21.0	0.7			
22	CL		SILTY CLAY, gray (10YR 5/1), slightly moist, stiff, slightly plastic			75		
23				23.0	1.7		S	22-24'
24	SW		Fine to medium SAND, grayish brown (10YR 5/2), wet, non-plastic					

MMW-P-10D

2" Dia. Borehole

REMARKS:

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TPV = Total Photoionizable Vapors
NS = Not Surveyed
NR = Not Recorded

Boring/Well ID: MMW-P-10D-A

CLIENT: AMMH	FIELD SCIENTIST: Gabriel Hebert
PROJECT LOCATION: Indianapolis, Indiana	DATE BEGAN: 3/8/2013
PROJECT NAME: Michigan Plaza	DATE FINISHED: 3/8/2013
PROJECT NUMBER: M01046	DRILLING METHOD: Geoprobe
DRILLING CONTRACTOR: SCS Environmental	DRILLING EQUIPMENT: 6620 DT
DRILLER: Andy Hermes	GW DEPTH (OBSERVED): NA
BORING LOCATION:	SURFACE ELEVATION: NS

Depth BGS (ft)	USCS Symbol	USCS Graphic	Lithologic Description	Stratum Depth (ft)	TPV (ppm)	Recovery %	Sample Location	Comments	MMW-P-10D
24–25	SW				0.45	75			
25–26									
26–27					0.4				
27–28			fine to coarse SAND and fine to coarse GRANULES, gray (10YR 5/1), wet	27.0	2.0	75			
28–29									
29–30					3.05				
30–31					6.4	100	S	32-34'	2" Dia. Borehole
31–32									
32–33					3.8				
33–34					0.25	100	S	36-38'	
34–35									
35–36									
36–37									
37–38									
38–39	CL		SILTY CLAY, gray (10YR 5/1), slightly moist, stiff	38.5	0.3				
39–40			End of Boring 40 ft	40.0					
40–41									
41–42									
42–43									
43–44									
44–45									
45–46									
46–47									
47–48									

REMARKS:
BGS = Below Ground Surface
USCS = Unified Soil Classification System
TPV = Total Photoionizable Vapors
NS = Not Surveyed
NR = Not Recorded

Boring/Well ID: SB-100

CLIENT: AMMH	FIELD SCIENTIST: Mark Breting
PROJECT LOCATION: Indianapolis, Indiana	DATE BEGAN: 3/6/2013
PROJECT NAME: Michigan Plaza	DATE FINISHED: 3/6/2013
PROJECT NUMBER: M01046	DRILLING METHOD: Geoprobe
DRILLING CONTRACTOR: SCS Environmental	DRILLING EQUIPMENT: 6620 DT
DRILLER: Andy Hermes	GW DEPTH (OBSERVED): 16 ft
BORING LOCATION:	SURFACE ELEVATION: NS

Depth BGS (ft)	USCS Symbol	USCS Graphic	Lithologic Description	Stratum Depth (ft)	TPV (ppm)	Recovery %	Sample Location	Comments
0	AR		Fill brick, clay, rock		0.0			
1								
2								
3				3.0	0.0			H.A. to 4'
4	SC		CLAYEY SILT, brown (10YR 5/3), soft, moist, slightly plastic					
5					0.0			
6						87.5		
7					0.2			
8	SW		Fine to medium grained SAND with trace coarse gravels, yellowish brown (10YR 5/4), moist, dense	8.0				
9					0.25		S	8-10'
10						50		
11					NR			
12								
13					0.10			
14						50		
15					NR			
16			Wet below 16.0'					
17	SC		CLAYEY SILT, gray (10YR 6/1), dense, soft, wet	17.1	0.15			
18						85		
19					0.15			
20	SW		Fine to coarse grained SAND, well graded, wet, dark gray (10YR 4/1) loose, trace gravel	20.0				
21				21.3	0.05			
22	SP		Fine SAND, poorly graded, moist, dense, dark gray (10YR 4/1), loose			100		
23					0.25			
24								

SB-100

2" Dia. Borehole

REMARKS:
BGS = Below Ground Surface
USCS = Unified Soil Classification System
TPV = Total Photoionizable Vapors
NS = Not Surveyed
NR = Not Recorded

Boring/Well ID: SB-100

CLIENT: AMMH	FIELD SCIENTIST: Mark Breting
PROJECT LOCATION: Indianapolis, Indiana	DATE BEGAN: 3/6/2013
PROJECT NAME: Michigan Plaza	DATE FINISHED: 3/6/2013
PROJECT NUMBER: M01046	DRILLING METHOD: Geoprobe
DRILLING CONTRACTOR: SCS Environmental	DRILLING EQUIPMENT: 6620 DT
DRILLER: Andy Hermes	GW DEPTH (OBSERVED): 16 ft
BORING LOCATION:	SURFACE ELEVATION: NS

Depth BGS (ft)	USCS Symbol	USCS Graphic	Lithologic Description	Stratum Depth (ft)	TPV (ppm)	Recovery %	Sample Location	Comments
24–25	SP				0.2			
25–26				25.6				
26–27	SW		Fine to coarse grained SAND, well graded, gray (10YR 6/1), wet, loose		0.2	87.5		
27–28								
28–29					0.3			
29–30								
30–31	SW		SAND with fine to coarse grained granules and trace cobbles, gray (10YR 5/1), loose, wet	30.1	0.5	100		
31–32								
32–33	CL		CLAY, very stiff, gray (10YR 5/1) slightly moist	32.9	0.2		S	32-34'
33–34						100		
34–35					0.2			
35–36								
36–37			End of boring at 36.0'					
37–38								
38–39								
39–40								
40–41								
41–42								
42–43								
43–44								
44–45								
45–46								
46–47								
47–48								

SB-100

2" Dia. Borehole

REMARKS:
BGS = Below Ground Surface
USCS = Unified Soil Classification System
TPV = Total Photoionizable Vapors
NS = Not Surveyed
NR = Not Recorded

03-12-2013 T:\2001\M01046 Michigan Meadows Apts\Data\Boring Logs\Miscellaneous Files\SB-100.bor

Boring/Well ID: SB-101

CLIENT: AMMH	FIELD SCIENTIST: Mark Breting
PROJECT LOCATION: Indianapolis, Indiana	DATE BEGAN: 3/6/2013
PROJECT NAME: Michigan Plaza	DATE FINISHED: 3/6/2013
PROJECT NUMBER: M01046	DRILLING METHOD: Geoprobe
DRILLING CONTRACTOR: SCS Environmental	DRILLING EQUIPMENT: 6620 DT
DRILLER: Andy Hermes	GW DEPTH (OBSERVED): 16.7
BORING LOCATION:	SURFACE ELEVATION: NS

Depth BGS (ft)	USCS Symbol	USCS Graphic	Lithologic Description	Stratum Depth (ft)	TPV (ppm)	Recovery %	Sample Location	Comments
0–4	AR		Fill: brick, clay, rock		NS	100		H.A. to 4'
4–9	CL		SILTY CLAY, very dark gray, (10YR 3/1), very stiff, slightly moist	4.0	0.7	87.5		
					0.0			
			Color change to brown below 8'					
9–14	SW		Fine to medium grained SAND with some fine granules, brown (10YR 5/3), moist, dense	9.0	0.65	50		
					0.05			
					0.9			
14–16	SM		SANDY SILT, pale brown (10YR 6/2), very moist, very dense	13.9	0.9	50	S	14-16'
16–23	SW		Fine to coarse grained SAND, grayish brown (10YR 5/2), wet, dense, non-plastic	16.7	0.05	85		
					0.0			
					0.15	100		
					0.25			
23–24	SW-GW		fine to coarse SAND and GRANULES, gray (10YR 6/1), wet, loose, non-plastic	23.5				

SB-101

2" Dia. Borehole

REMARKS:
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TPV = Total Photoionizable Vapors
NS = Not Surveyed
NR = Not Recorded
H.A. = Hand Auger

Boring/Well ID: SB-101

CLIENT: AMMH	FIELD SCIENTIST: Mark Breting
PROJECT LOCATION: Indianapolis, Indiana	DATE BEGAN: 3/6/2013
PROJECT NAME: Michigan Plaza	DATE FINISHED: 3/6/2013
PROJECT NUMBER: M01046	DRILLING METHOD: Geoprobe
DRILLING CONTRACTOR: SCS Environmental	DRILLING EQUIPMENT: 6620 DT
DRILLER: Andy Hermes	GW DEPTH (OBSERVED): 16.7
BORING LOCATION:	SURFACE ELEVATION: NS

Depth BGS (ft)	USCS Symbol	USCS Graphic	Lithologic Description	Stratum Depth (ft)	TPV (ppm)	Recovery %	Sample Location	Comments
24								
25	SW-GW				0.0			
26			Fine to medium grained SAND, gray (10YR 5/1) wet, medium dense	25.8		87.5		
27	SW				0.95		S	26-28'
28			CLAYEY SAND and GRANULES, gray (10YR 5/1), wet	28.0				
29					0.1			
30	SC-GW					100		
31					NR			
32								
33			SILTY CLAY, gray (10YR 5/1), very stiff, slightly moist	32.7	0.25			
34	CL					100		
35				35.1	0.5			
36	SW		Fine to medium grained SAND, wet, grayish brown (10YR 5/2), loose, non-plastic	36.0				
37			fine to coarse SAND and GRANULES, fine to coarse grained, wet, grayish brown (10YR 5/2)		0.9			
38						100		
39					1.6			
40	SW-GW		Less gravel below 40 ft					
41					3.0			
42						100		
43					2.3			
44			End of boring at 44.0'	44.0				
45								
46								
47								
48								

SB-101

2" Dia. Borehole

REMARKS:
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TPV = Total Photoionizable Vapors
NS = Not Surveyed
NR = Not Recorded
H.A. = Hand Auger

Boring/Well ID: SB-102

CLIENT: AMMH	FIELD SCIENTIST: Mark Breting
PROJECT LOCATION: Indianapolis, Indiana	DATE BEGAN: 3/7/2013
PROJECT NAME: Michigan Plaza	DATE FINISHED: 3/7/2013
PROJECT NUMBER: M01046	DRILLING METHOD: Geoprobe
DRILLING CONTRACTOR: SCS Environmental	DRILLING EQUIPMENT: 6620 DT
DRILLER: Andy Hermes	GW DEPTH (OBSERVED): 16 ft
BORING LOCATION:	SURFACE ELEVATION: NS

Depth BGS (ft)	USCS Symbol	Lithologic Description	Stratum Depth (ft)	TPV (ppm)	Recovery %	Sample Location	Comments
0		Soil	0.5				
1	CL	SANDY CLAY, yellowish brown (10YR 5/6), moist, soft, plastic		0.15	100		H.A. to 4 ft
2							
3							
4		Dark grayish brown below 4.0'	4.7	0.25			
5	SP	Fine SAND, yellowish brown (10YR 5/6), slightly moist, loose, non-plastic			42.5		
6							
7				NR			
8	SC	CLAYEY SAND with fine to coarse grained GRANULES, brownish yellow (10YR 6/6), slightly moist, medium dense, non-plastic	8.0	0.1			
9							
10					35		
11				NR			
12	ML	CLAYEY SILT, grayish brown (10YR 5/2), moist, soft, plastic	12.0 12.4				
13	SP	Fine grained SAND, light gray (10YR 7/1), slightly moist, medium dense, non-plastic		0.25		S	12-14'
14					60		
15		Fine to medium grains below 13.0'		0.2			
16			16.0				
17	SW	Fine to coarse grained SAND with some fine to coarse GRANULES, grayish brown (10YR 5/2), wet, medium dense, non-plastic		0.2			
18					67.5		
19		Fine to medium grained sand with trace granules		0.3			
20							
21				0.8			
22					100		
23				1.05			
24							

SB-102

2" Dia. Borehole

REMARKS:
BGS = Below Ground Surface
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TPV = Total Photoionizable Vapors
NS = Not Surveyed
NR = Not Recorded
H.A. = Hand Auger

Boring/Well ID: SB-102

CLIENT: AMMH	FIELD SCIENTIST: Mark Breting
PROJECT LOCATION: Indianapolis, Indiana	DATE BEGAN: 3/7/2013
PROJECT NAME: Michigan Plaza	DATE FINISHED: 3/7/2013
PROJECT NUMBER: M01046	DRILLING METHOD: Geoprobe
DRILLING CONTRACTOR: SCS Environmental	DRILLING EQUIPMENT: 6620 DT
DRILLER: Andy Hermes	GW DEPTH (OBSERVED): 16 ft
BORING LOCATION:	SURFACE ELEVATION: NS

Depth BGS (ft)	USCS Symbol	USCS Graphic	Lithologic Description	Stratum Depth (ft)	TPV (ppm)	Recovery %	Sample Location	Comments
24	SW		Fine to coarse grained SAND with fine to coarse GRANULES, gray (10YR 6/1), wet, loose, non-plastic	24.2	0.65	57.5		
25								
26	SW							
27					0.55			
28			End of boring at 28.0'					
29								
30								
31								
32								
33								
34								
35								
36								
37								
38								
39								
40								
41								
42								
43								
44								
45								
46								
47								
48								

SB-102

2" Dia. Borehole

REMARKS:
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TPV = Total Photoionizable Vapors
NS = Not Surveyed
NR = Not Recorded
H.A. = Hand Auger

Boring/Well ID: SB-103

CLIENT: AMMH	FIELD SCIENTIST: Gabriel Hebert
PROJECT LOCATION: Indianapolis, Indiana	DATE BEGAN: 3/8/2013
PROJECT NAME: Michigan Plaza	DATE FINISHED: 3/8/2013
PROJECT NUMBER: M01046	DRILLING METHOD: Geoprobe
DRILLING CONTRACTOR: SCS Environmental	DRILLING EQUIPMENT: 6620 DT
DRILLER: Andy Hermes	GW DEPTH (OBSERVED): 18 ft
BORING LOCATION:	SURFACE ELEVATION: NS

Depth BGS (ft)	USCS Symbol	Lithologic Description	Stratum Depth (ft)	TPV (ppm)	Recovery %	Sample Location	Comments
0	FB	ASPHALT/SUBBASE	0.3				
1		FILL: fine to medium SAND, dark yellowish brown (10YR 4/4), with fine to coarse granules, dry		2.8			
2					100		H.A. to 4'
3	SW			2.5			
4							
5		fine to coarse SAND, light yellowish brown (10YR 6/4), dry, loose	5.0	4.1		S	4-6'
6					75		
7				0.15			
8							
9				0.9			
10					50		
11	SW			0.5			
12							
13				0.4			
14					50		
15				0.4			
16	CL	SANDY CLAY, grayish brown (10YR 5/2), moist, soft	16.0				
17		fine to coarse SAND, yellowish brown (10YR 5/4), slightly moist, with some fine to coarse granules	16.5	0.4		S	16-18'
18					50		
19		wet below 18 ft		0.2			
20	SW						
21		color change to gray (10YR 5/1) below 21 ft		0.25			
22					100		
23				0.25			
24							

SB-103

2" Dia. Borehole

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NS = Not Surveyed
NR = Not Recorded
H.A. = Hand Auger

Boring/Well ID: SB-103

CLIENT: AMMH	FIELD SCIENTIST: Gabriel Hebert
PROJECT LOCATION: Indianapolis, Indiana	DATE BEGAN: 3/8/2013
PROJECT NAME: Michigan Plaza	DATE FINISHED: 3/8/2013
PROJECT NUMBER: M01046	DRILLING METHOD: Geoprobe
DRILLING CONTRACTOR: SCS Environmental	DRILLING EQUIPMENT: 6620 DT
DRILLER: Andy Hermes	GW DEPTH (OBSERVED): 18 ft
BORING LOCATION:	SURFACE ELEVATION: NS

Depth BGS (ft)	USCS Symbol	USCS Graphic	Lithologic Description	Stratum Depth (ft)	TPV (ppm)	Recovery %	Sample Location	Comments
24–25	SW		fine to coarse GRANULES with SAND, gray (10YR 6/1), wet, loose	25.0	1.3	100		
25–26								
26–27					1.7			
27–28								
28–29					0.65	100		
29–30								
30–31					2.0			
31–32								
32–33					1.85	100		
33–34								
34–35					2.1		S	34-36'
35–36			increased silt content below 35.5 ft					
36–37	CL		SILTY CLAY, gray (10YR 6/1), moist, stiff	36.0	0.55	100		
37–38								
38–39					0.5			
39–40				40.0				
40			End of Boring at 40 ft					
41–48								

SB-103

2" Dia. Borehole

REMARKS:
BGS = Below Ground Surface
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TPV = Total Photoionizable Vapors
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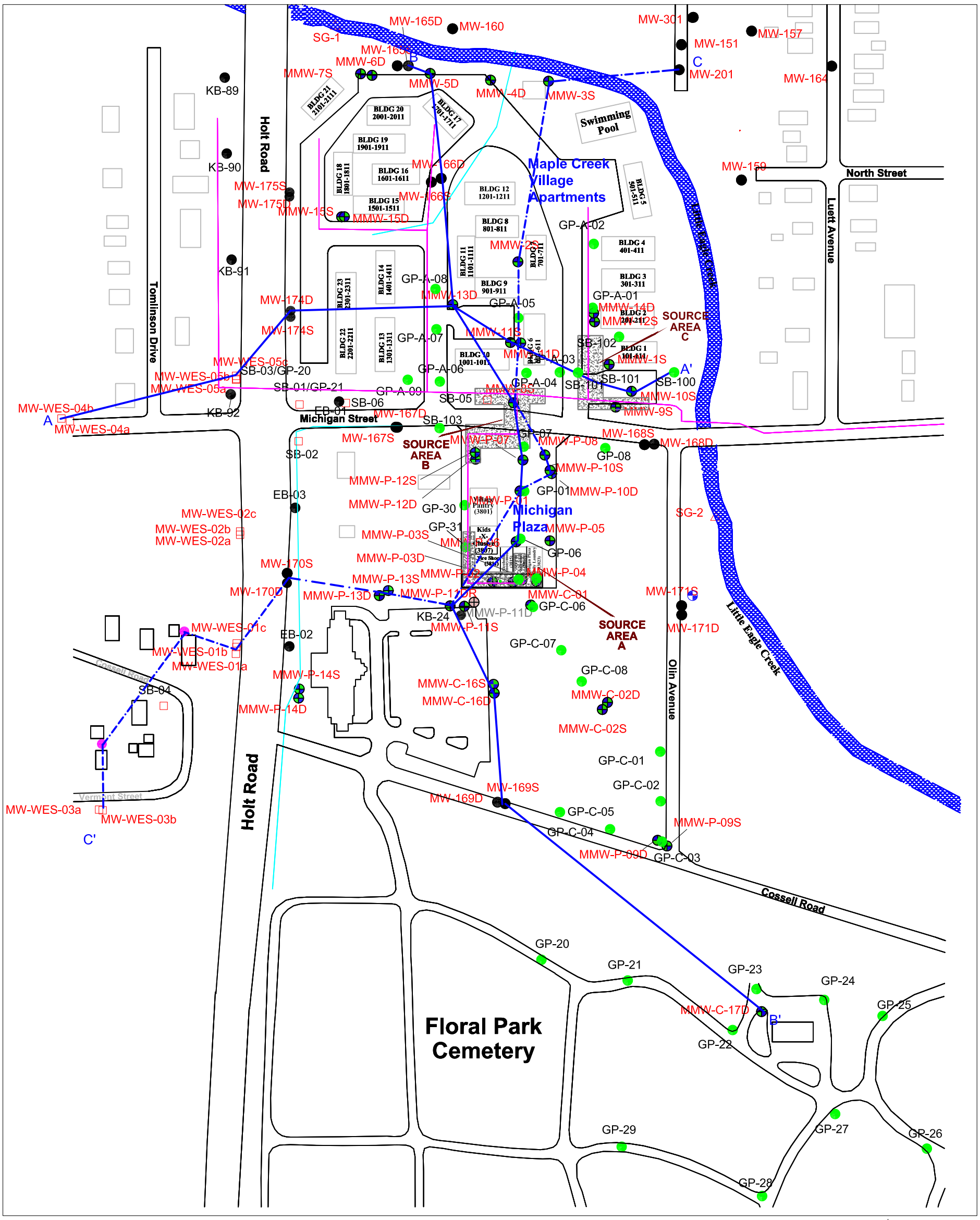
NR = Not Recorded
H.A. = Hand Auger



LEGEND

	Fence	GP-29 ●	Soil Boring
MMW-P-06 ⊕	MUNDELL Monitoring Well		Sanitary Sewer
			Storm Sewer
MW-160/ KB-90 ●	ENVIRON Monitoring Well/Soil Boring		RDCL or IDCL Exceedance (Vadose and Saturated Soil)
MW-WES-O1A/ SB-02 □	U.S. EPA Monitoring Well/Soil Boring		
SG-1 △	Stream Gauge Location		RDCL or IDCL Exceedance (Vadose Soil)
MGW-O1 ⊙	MUNDELL Soil Gas Well	●	New Soil Boring - March 2013

N

SCALE 0 200 feet

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

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Indianapolis, Indiana 46219
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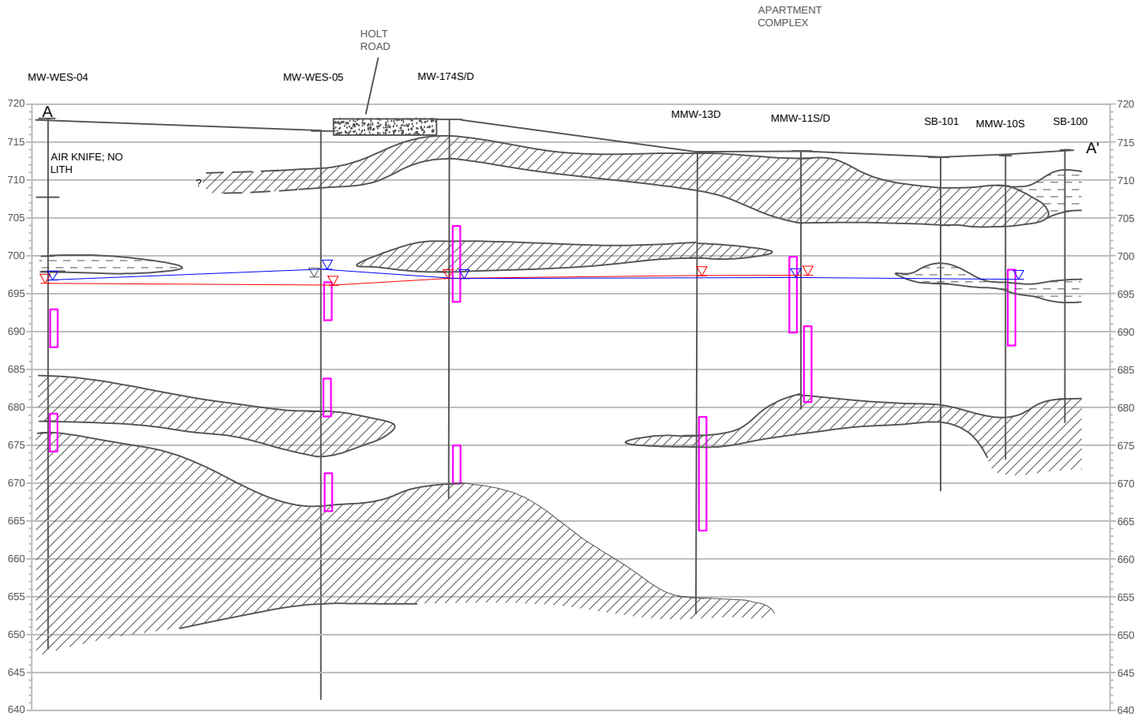
317-630-9065
www.MundellAssociates.com

Project Number:	M01046
Drawing File:	1Q13 QMR
Date Prepared:	3-11-2013
Scale:	1"=200'

CROSS-SECTION LINES

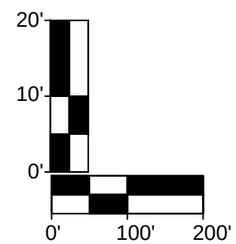
Michigan Plaza
3801 - 3823 West Michigan Street
Indianapolis, INDIANA

FIGURE
32



LEGEND

- Sand
- Clay
- Silt
- Shale (Bedrock)
- Monitoring Well Screen Interval
- Static Water Level 11/12/2012 (Shallow)
- Static Water Level 11/12/2012 (intermediate EPA well if present)
- Static Water Level 11/12/2012 (Deep)



Vertical Exaggeration = 10X

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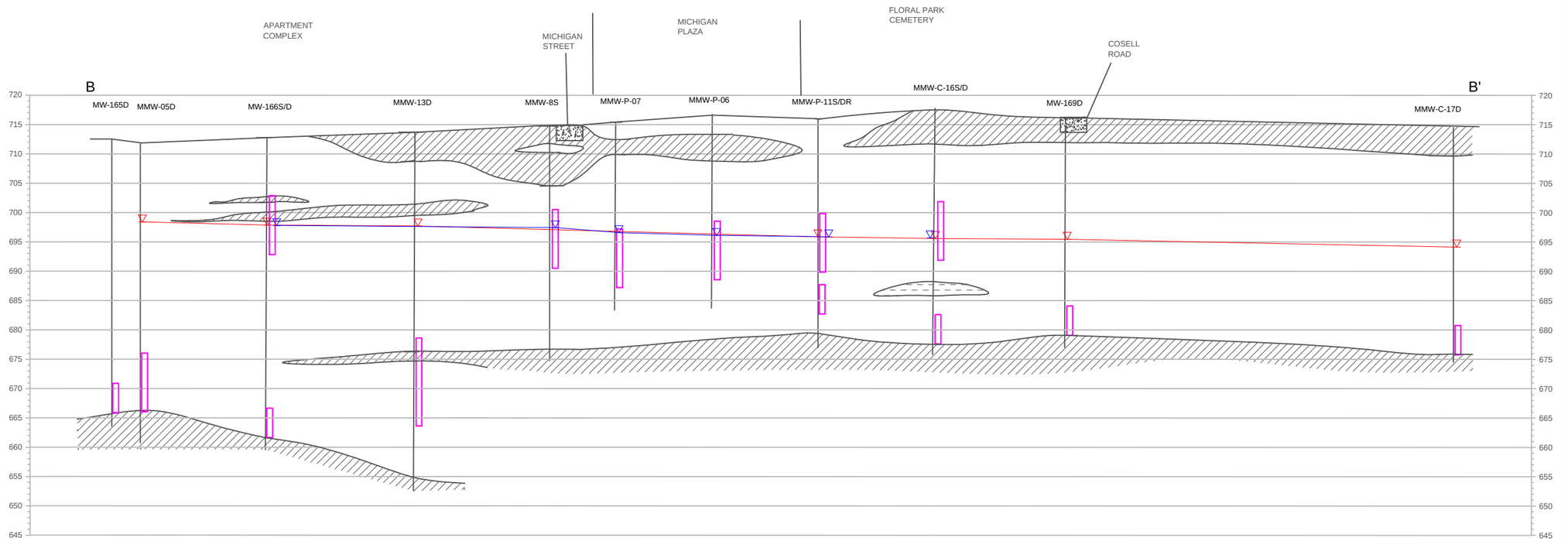
REV.	DATE	DESCRIPTION	BY	APPR

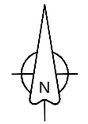
PROJECT NO.:	M01046	FILE NO.:	Cross-Sections.dwg
DRAWING:	FIG XX	PLOT SIZE:	11"X17"
DRAFTED BY:	MB	DATE:	03/11/2013
CHECKED BY:	MB	DATE:	03/12/2013
APPROVED BY:	JAM	DATE:	03/12/2013

GEOLOGIC CROSS-SECTION A - A'

MICHIGAN PLAZA
3801 - 3823 MICHIGAN STREET
INDIANAPOLIS, INDIANA

FIGURE
33





LEGEND

Sand

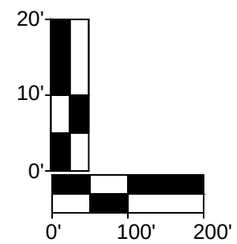
Clay

Silt

Monitoring Well Screen Interval

Static Water Level 11/12/2012 (Shallow)

Static Water Level 11/12/2012 (Deep)



Vertical Exaggeration = 10X

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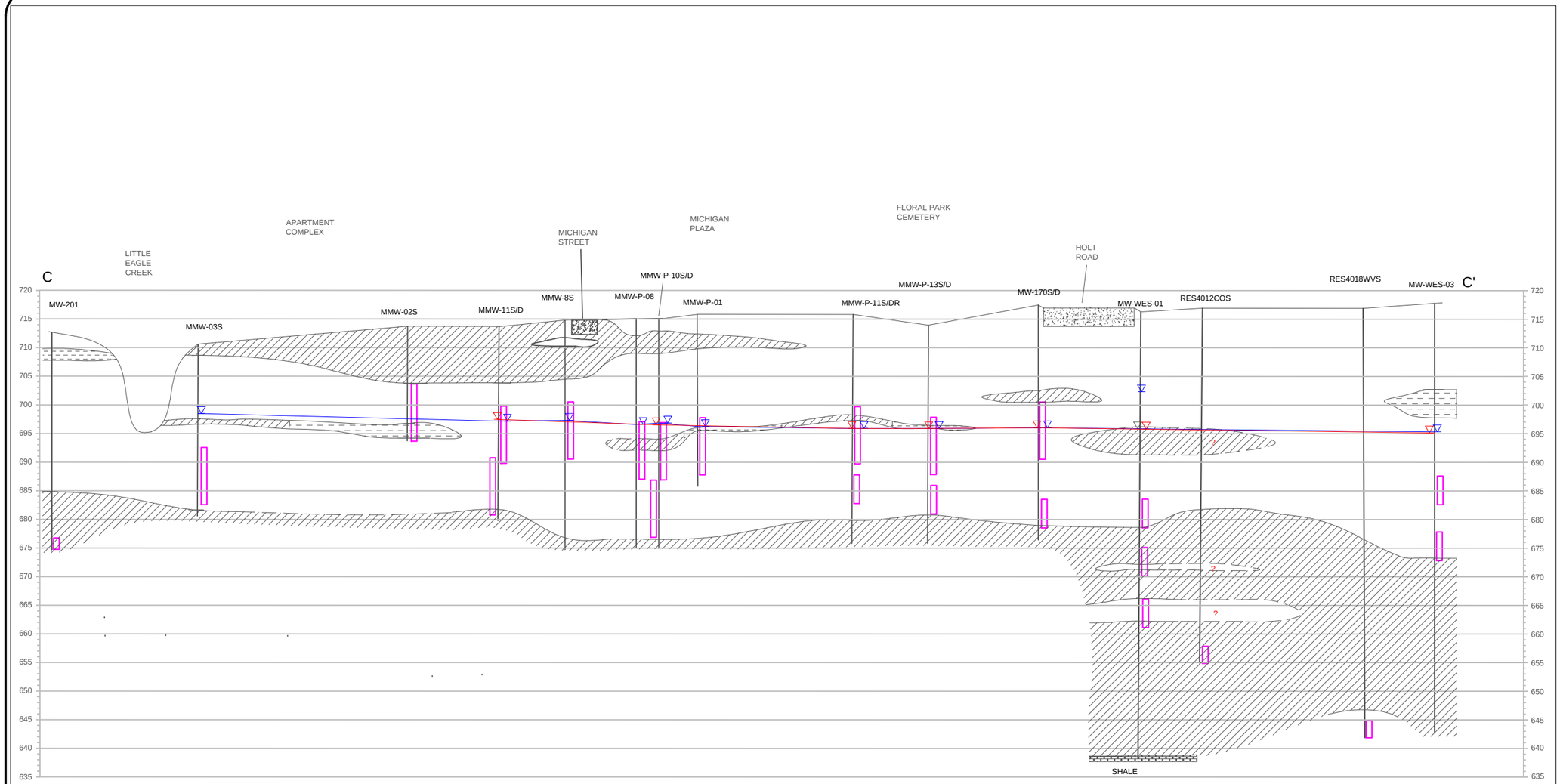
REV.	DATE	DESCRIPTION	BY	APPR

PROJECT NO.:	M01046	FILE NO.:	Cross-Sections.dwg
DRAWING:	FIG XX	PLOT SIZE:	11"X17"
DRAFTED BY:	MB	DATE:	03/11/2013
CHECKED BY:	MB	DATE:	03/12/2013
APPROVED BY:	JAM	DATE:	03/12/2013

GEOLOGIC CROSS-SECTION B - B'

MICHIGAN PLAZA
3801 - 3823 MICHIGAN STREET
INDIANAPOLIS, INDIANA

FIGURE
34



Notes:

1) Drilling notes for RES4018WVS were not utilized to define top of clay unit at that location (inferred between RES4012COS and MW-WES-03).

2) Static water elevation for MW-WES-01a not utilized to depict potentiometric contour surface; suspect reading.

LEGEND

- Sand
- Clay
- Silt
- Shale (Bedrock)
- Monitoring Well Screen Interval
- Static Water Level 11/12/2012 (Shallow)
- Static Water Level 11/12/2012 (intermediate EPA well if present)
- Static Water Level 11/12/2012 (Deep)

20'
10'
0'
0' 100' 200'

Vertical Exaggeration = 10X

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REV.	DATE	DESCRIPTION	BY	APPR

PROJECT NO.:	M01046	FILE NO.:	Cross-Sections.dwg
DRAWING:	FIG XX	PLOT SIZE:	11"X17"
DRAFTED BY:	MB	DATE:	03/11/2013
CHECKED BY:	MB	DATE:	03/12/2013
APPROVED BY:	JAM	DATE:	03/12/2013

GEOLOGIC CROSS-SECTION C - C'

MICHIGAN PLAZA
3801 - 3823 MICHIGAN STREET
INDIANAPOLIS, INDIANA

FIGURE
35

ATTACHMENT 1

2013 HYDROLOGIC TESTING AND ANALYSIS

Michigan Plaza Slug Testing Results
March-April 2013

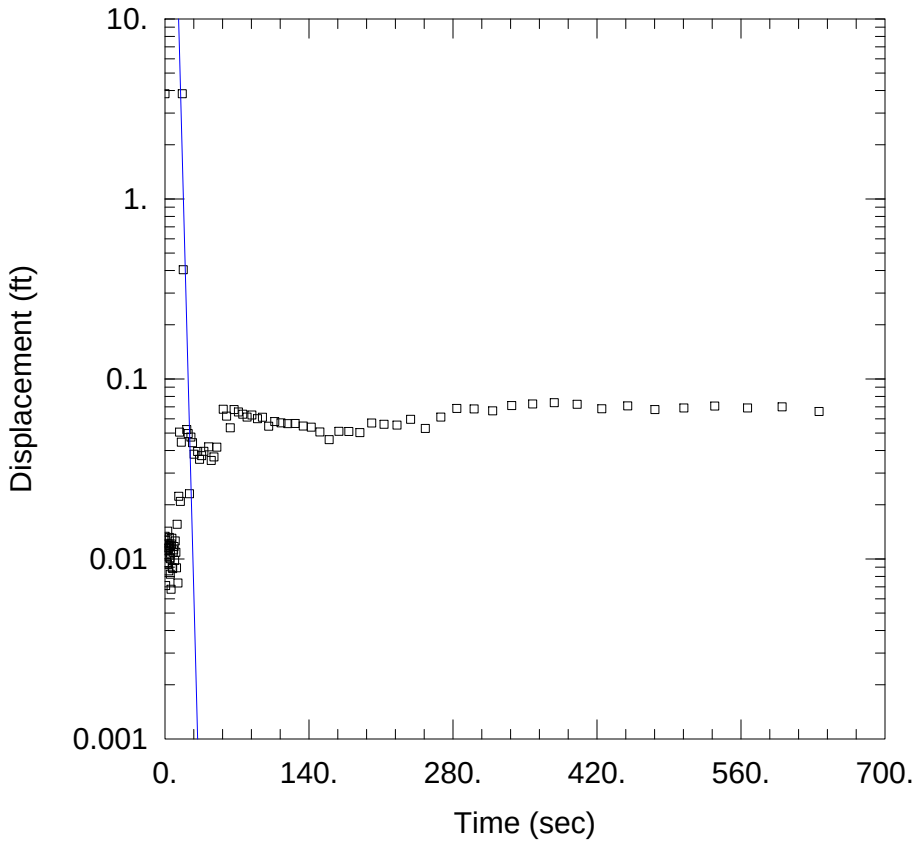
Methodology

On March 29 and April 1, 2013, MUNDELL personnel performed aquifer characterization studies by conducting a series of slug tests at selected wells located between Michigan Plaza and the Cossell Road residences. Monitoring well MMW-P-02 along with shallow/deep well pairs MMW-P-11S/DR, MMW-P-13S/D, and MMW-P-14S/D were evaluated. At each well, the well was opened and allowed to equilibrate for a period of 20 minutes. An In-Situ Inc. Level TROLL® 700 pressure transducer that records elapsed time and water level elevation was then placed into the well and the water level was then allowed to re-equilibrate. The TROLL® was connected to a hand-held In-Situ Inc. RuggedReader® Handheld PC device that controls test initiation and allowed monitoring of water level response data. Slug tests were set up to record response of water level displacement on a logarithmic time scale at intervals of about 3 readings per second at the start of the test, with progressively longer intervals based on a logarithmically decaying schedule as the test progresses. To begin each test, an inert solid PVC slug with dimensions of approximately 3 feet long by 1.25 inches in diameter (for an equivalent displacement volume of about 0.0255 ft^3) was rapidly lowered into the well to displace the water column. Measurements of the falling water level over time (falling head test) were recorded until approximately 95% recovery was attained. The test was stopped and a new test was begun when water levels returned to the approximate original static position. The test was repeated by removing the slug and recording “rising head” data over time. Between each monitoring well slug test, the Level TROLL® and water level meter were properly decontaminated.

Analyses of Field Data

Hydraulic conductivity values were calculated for each test by processing rising and falling water level data using the AQTESOLV™ software, created by HydroSOLVE, Inc. The Bouwer and Rice Method (1976) curve matching solution for partially penetrating wells was utilized. Based on the tests, K-values range between 22.1 and 141.1 ft/day, with an overall average K-value of 70.1 ft/day.

A summary of the testing results is provided in **Table 1** of the main report, with the slug test results included within this attachment.



WELL TEST ANALYSIS

Data Set: T:\...\MMW-P-02 IN (B-R 1976).aqt
Date: 04/10/13 Time: 16:32:12

PROJECT INFORMATION

Company: Mundell & Associates Inc.
Client: AIMCO
Project: M01046
Test Well: MMW-P-02
Test Date: 3-29-2013

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 33.49 ft/day
y0 = 7335.5 ft

AQUIFER DATA

Saturated Thickness: 20.13 ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MMW-P-02)

Initial Displacement: 3.84 ft
Total Well Penetration Depth: 10.63 ft
Casing Radius: 0.083 ft

Static Water Column Height: 20.13 ft
Screen Length: 10. ft
Well Radius: 0.33 ft

Data Set: T:\2001\M01046 Michigan Meadows Apts\Data\Slug Test Files\Bouwer-Rice 1976\MMW-P-02 IN (B-R 1976).aqt
Date: 04/10/13
Time: 16:32:28

PROJECT INFORMATION

Company: Mundell & Associates Inc.
Client: AIMCO
Project: M01046
Test Date: 3-29-2013
Test Well: MMW-P-02

AQUIFER DATA

Saturated Thickness: 20.13 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: MMW-P-02

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 3.84 ft
Static Water Column Height: 20.13 ft
Casing Radius: 0.083 ft
Well Radius: 0.33 ft
Well Skin Radius: 0.33 ft
Screen Length: 10. ft
Total Well Penetration Depth: 10.63 ft

No. of Observations: 105

Observation Data

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
0.25	0.01337	11.94	0.01559	90.	0.06011
0.5	0.01158	12.66	0.007344	94.8	0.06131
0.75	0.007117	13.44	0.0223	100.8	0.05458
1.	0.01265	14.22	0.05062	106.8	0.05795
1.25	0.01121	15.06	0.02085	112.8	0.05698
1.5	0.01108	15.96	0.04448	119.4	0.05638
1.75	0.01168	16.92	3.84	126.6	0.05651
2.	0.00955	17.88	0.4042	134.4	0.0547
2.25	0.01108	18.96	-0.1717	142.2	0.05396
2.5	0.009312	20.1	-0.07645	150.6	0.05073
2.75	0.01426	21.3	0.05232	159.6	0.04602
3.	0.0122	22.56	0.04968	169.2	0.0512
3.25	0.01136	23.88	0.02303	178.8	0.05108

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
3.5	0.01197	25.32	0.0475	189.6	0.05035
3.75	0.008592	26.82	0.04421	201.	0.05687
4.	0.01149	28.38	0.03816	213.	0.05602
4.25	0.01318	30.06	-0.02969	225.6	0.05542
4.5	0.01183	31.86	0.0395	238.8	0.05965
4.75	0.01016	33.72	0.03577	253.2	0.05312
5.	0.01002	35.76	0.03745	268.2	0.06143
5.251	0.008222	37.86	0.03962	283.8	0.06856
5.501	0.01076	40.08	-0.008469	300.6	0.06807
5.751	0.01183	42.48	0.04192	318.6	0.0665
6.001	0.006787	45.	0.03528	337.2	0.07116
6.36	0.0121	47.64	0.03685	357.6	0.07261
6.72	0.01304	50.46	0.04179	378.6	0.07382
7.14	0.008945	53.46	-0.01353	400.8	0.07224
7.56	0.008834	56.64	0.06782	424.8	0.0682
7.98	0.01088	60.	0.06217	450.	0.0708
8.46	0.01123	63.6	0.0535	476.4	0.06755
9.	0.01172	67.2	0.06761	504.6	0.069
9.48	0.009799	71.4	0.06553	534.6	0.07069
10.08	0.01258	75.6	0.06372	566.4	0.06894
10.68	0.01088	79.8	0.06143	600.	0.06991
11.28	0.00892	84.6	0.063	636.	0.06594

SOLUTION

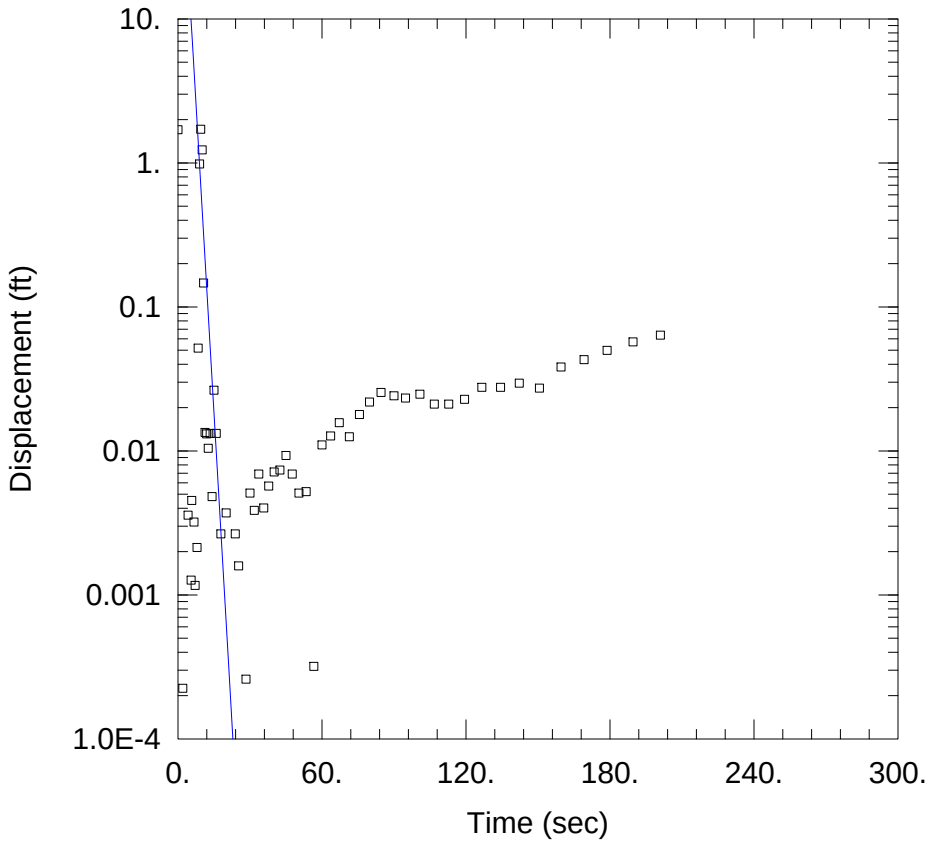
Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 2.262

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	33.49	ft/day
y0	7335.5	ft

K = 0.01182 cm/sec
T = K*b = 674.2 ft²/day (7.25 sq. cm/sec)



WELL TEST ANALYSIS

Data Set: T:\...\MMW-P-02 OUT (B-R 1976).aqt
Date: 04/10/13 Time: 16:31:49

PROJECT INFORMATION

Company: Mundell & Associates Inc.
Client: AIMCO
Project: M01046
Test Well: MMW-P-02
Test Date: 3-29-2013

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 44.42 ft/day
y0 = 363.2 ft

AQUIFER DATA

Saturated Thickness: 20.13 ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MMW-P-02)

Initial Displacement: 1.7 ft
Total Well Penetration Depth: 10.63 ft
Casing Radius: 0.083 ft

Static Water Column Height: 20.13 ft
Screen Length: 10. ft
Well Radius: 0.33 ft

Data Set: T:\2001\M01046 Michigan Meadows Apts\Data\Slug Test Files\Bouwer-Rice 1976\MMW-P-02 OUT (B-R 1976).aqt
Date: 04/10/13
Time: 16:31:07

PROJECT INFORMATION

Company: Mundell & Associates Inc.
Client: AIMCO
Project: M01046
Test Date: 3-29-2013
Test Well: MMW-P-02

AQUIFER DATA

Saturated Thickness: 20.13 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: MMW-P-02

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 1.7 ft
Static Water Column Height: 20.13 ft
Casing Radius: 0.083 ft
Well Radius: 0.33 ft
Well Skin Radius: 0.33 ft
Screen Length: 10. ft
Total Well Penetration Depth: 10.63 ft

No. of Observations: 85

Observation Data

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
0.25	-0.003103	8.46	0.05177	45.	0.009301
0.5	-0.007002	9.	0.9833	47.64	0.006901
0.75	-0.005798	9.48	1.714	50.46	0.005091
1.	-0.005666	10.08	1.233	53.46	0.005212
1.25	-0.004948	10.68	0.1468	56.64	0.000319
1.5	-0.00375	11.28	0.01345	60.	0.011
1.75	-0.008705	11.94	0.01313	63.6	0.01269
2.	0.000225	12.66	0.01044	67.2	0.01572
2.25	-0.008119	13.44	0.01325	71.4	0.01255
2.5	-0.005338	14.22	0.004814	75.6	0.01789
2.75	-0.002539	15.06	0.02638	79.8	0.02187
3.	-0.006428	15.96	0.01325	84.6	0.02548
3.25	-0.001491	16.92	-0.002299	90.	0.02415

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
3.5	-0.001856	17.88	0.002651	94.8	0.0233
3.75	-0.00401	18.96	-0.000374	100.8	0.02475
4.	-0.002686	20.1	0.00371	106.8	0.02114
4.25	0.003576	21.3	-0.001323	112.8	0.02114
4.5	-0.000771	22.56	-0.001568	119.4	0.02283
4.75	-0.003307	23.88	0.002651	126.6	0.02764
5.	-0.004133	25.32	0.00159	134.4	0.02764
5.251	-0.001491	26.82	-0.000374	142.2	0.02957
5.501	0.001268	28.38	0.00026	150.6	0.02728
5.751	0.00453	30.06	0.005091	159.6	0.03824
6.001	-0.000282	31.86	0.003865	169.2	0.04307
6.361	-0.000165	33.72	0.006901	178.8	0.04993
6.721	0.003206	35.76	0.004016	189.6	0.05715
7.141	0.001165	37.86	0.005701	201.	0.06365
7.56	-0.002334	40.08	0.007139		
7.98	0.002134	42.48	0.007375		

SOLUTION

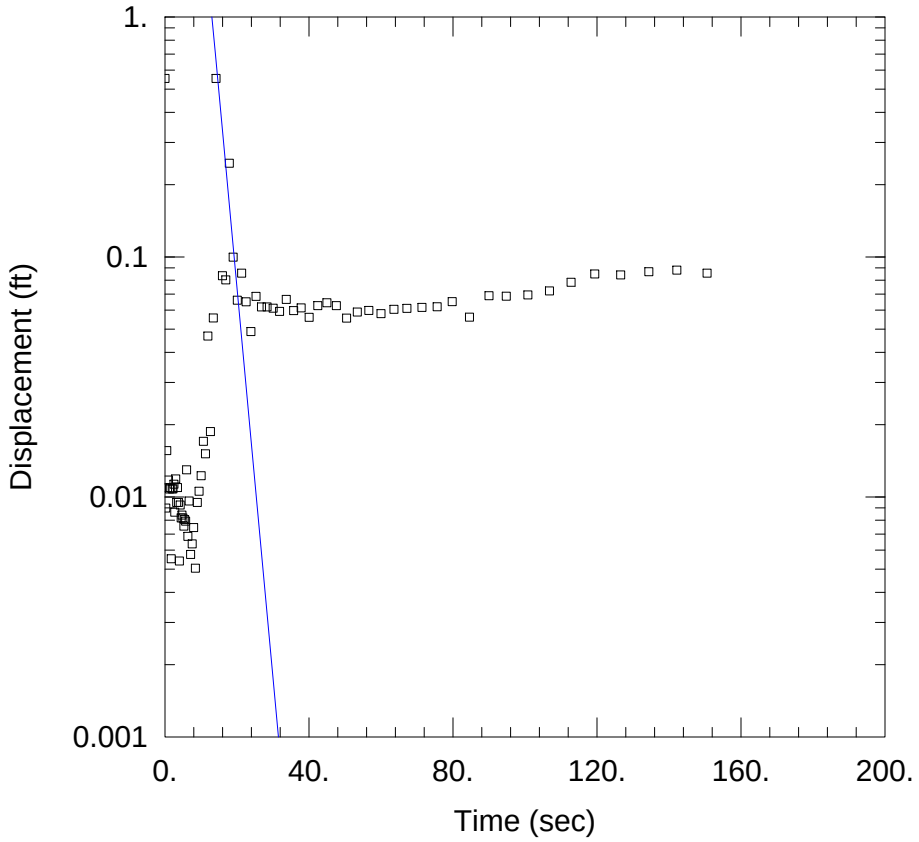
Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 2.262

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	44.42	ft/day
y0	363.2	ft

K = 0.01567 cm/sec
T = K*b = 894.2 ft²/day (9.615 sq. cm/sec)



WELL TEST ANALYSIS

Data Set: T:\...\MMW-P-11S IN (RUN 3) (B-R 1976).aqt
Date: 04/10/13 Time: 16:37:34

PROJECT INFORMATION

Company: Mundell & Associates Inc.
Client: AIMCO
Project: M01046
Test Well: MMW-P-11S
Test Date: 3-29-2013

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 32.9 ft/day
y0 = 132.4 ft

AQUIFER DATA

Saturated Thickness: 16.17 ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MMW-P-11S)

Initial Displacement: 0.5545 ft
Total Well Penetration Depth: 6.17 ft
Casing Radius: 0.083 ft

Static Water Column Height: 16.17 ft
Screen Length: 6.17 ft
Well Radius: 0.33 ft

Data Set: T:\2001\M01046 Michigan Meadows Apts\Data\Slug Test Files\Bouwer-Rice 1976\MMW-P-11S IN (RUN 3) (B-R 1976).aqt
Date: 04/10/13
Time: 16:37:19

PROJECT INFORMATION

Company: Mundell & Associates Inc.
Client: AIMCO
Project: M01046
Test Date: 3-29-2013
Test Well: MMW-P-11S

AQUIFER DATA

Saturated Thickness: 16.17 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: MMW-P-11S

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 0.5545 ft
Static Water Column Height: 16.17 ft
Casing Radius: 0.083 ft
Well Radius: 0.33 ft
Well Skin Radius: 0.33 ft
Screen Length: 6.17 ft
Total Well Penetration Depth: 6.17 ft

No. of Observations: 80

Observation Data

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
0.251	0.008993	7.561	0.00637	35.76	0.05973
0.501	0.01561	7.981	0.007456	37.86	0.06129
0.751	0.01092	8.461	0.005047	40.08	0.05602
1.001	0.01176	9.001	0.00948	42.48	0.06264
1.251	0.01079	9.481	0.01056	45.	0.06444
1.501	0.01092	10.08	0.01225	47.64	0.06264
1.751	0.005527	10.68	0.01705	50.46	0.05555
2.001	0.01081	11.28	0.01512	53.46	0.0589
2.251	0.01081	11.94	0.0468	56.64	0.05985
2.501	0.01129	12.66	0.01874	60.	0.05805
2.751	0.008638	13.44	0.05568	63.6	0.06046
3.001	0.01188	14.22	0.5545	67.2	0.06105
3.251	0.00948	15.06	-0.2492	71.4	0.06164

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
3.501	0.01094	15.96	0.08352	75.6	0.062
3.751	0.00948	16.92	0.08017	79.8	0.06512
4.001	0.005408	17.88	0.2455	84.6	0.05613
4.251	0.009253	18.96	0.09971	90.	0.06896
4.501	0.008174	20.1	0.06598	94.8	0.06859
4.751	0.008401	21.3	0.08556	100.8	0.06945
5.001	0.008174	22.56	0.06504	106.8	0.07221
5.251	0.007562	23.88	0.04885	112.8	0.07843
5.501	0.008044	25.32	0.06851	119.4	0.08493
5.751	0.007927	26.82	0.06191	126.6	0.08417
6.001	0.01297	28.38	0.0619	134.4	0.08682
6.361	0.006848	30.06	0.06118	142.2	0.08814
6.721	0.00961	31.86	0.05926	150.6	0.08561
7.141	0.00576	33.72	0.06649		

SOLUTION

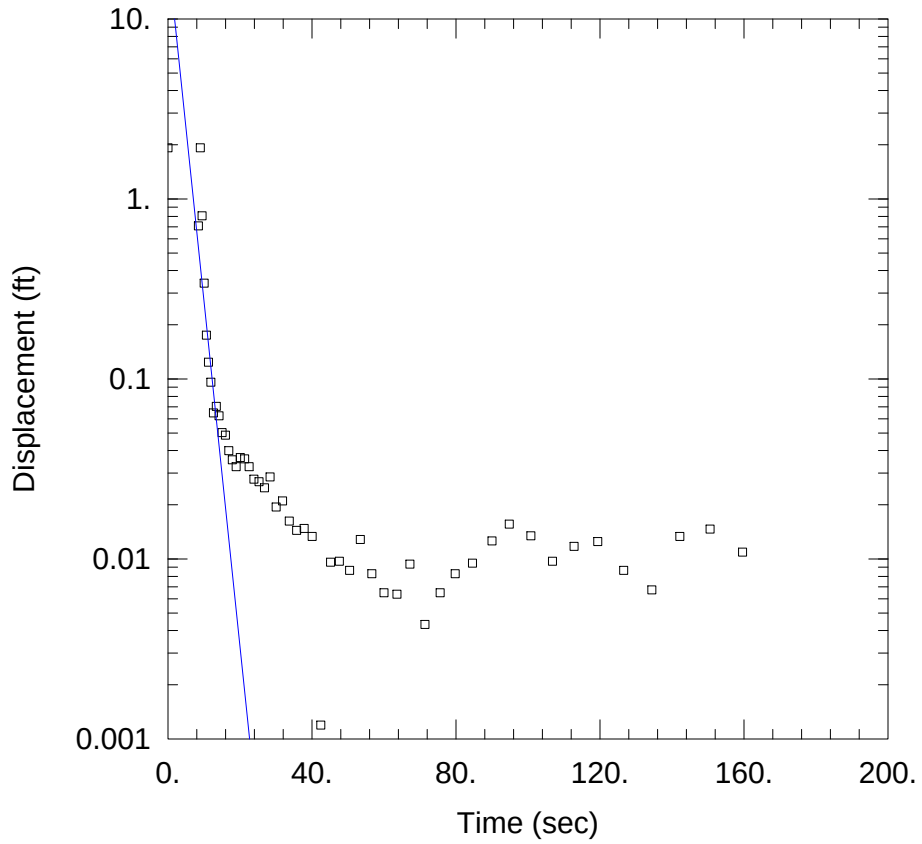
Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 1.823

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	32.9	ft/day
y0	132.4	ft

K = 0.01161 cm/sec
T = K*b = 532. ft²/day (5.721 sq. cm/sec)



WELL TEST ANALYSIS

Data Set: T:\...\MMW-P-11S OUT (RUN 2) (B-R 1976).aqt
Date: 04/10/13 Time: 16:41:23

PROJECT INFORMATION

Company: Mundell & Associates Inc.
Client: AIMCO
Project: M01046
Test Well: MMW-P-11S
Test Date: 3-29-2013

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 38.88 ft/day
y0 = 22.55 ft

AQUIFER DATA

Saturated Thickness: 16.17 ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MMW-P-11S)

Initial Displacement: 1.923 ft
Total Well Penetration Depth: 6.17 ft
Casing Radius: 0.083 ft

Static Water Column Height: 16.17 ft
Screen Length: 6.17 ft
Well Radius: 0.33 ft

Data Set: T:\2001\M01046 Michigan Meadows Apts\Data\Slug Test Files\Bouwer-Rice 1976\MMW-P-11S OUT (RUN 2) (B-R 1976).aqt
Date: 04/10/13
Time: 16:41:39

PROJECT INFORMATION

Company: Mundell & Associates Inc.
Client: AIMCO
Project: M01046
Test Date: 3-29-2013
Test Well: MMW-P-11S

AQUIFER DATA

Saturated Thickness: 16.17 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: MMW-P-11S

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 1.923 ft
Static Water Column Height: 16.17 ft
Casing Radius: 0.083 ft
Well Radius: 0.33 ft
Well Skin Radius: 0.33 ft
Screen Length: 6.17 ft
Total Well Penetration Depth: 6.17 ft

No. of Observations: 81

Observation Data

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
0.25	-0.01164	7.561	-0.01356	35.76	0.01441
0.5	-0.01307	7.98	-0.01403	37.86	0.01478
0.75	-0.01247	8.461	0.7083	40.08	0.01334
1.	-0.0085	9.	1.923	42.48	0.001193
1.25	-0.01511	9.48	0.8051	45.17	0.009592
1.5	-0.01093	10.08	0.3407	47.64	0.009715
1.75	-0.01285	10.68	0.1751	50.46	0.008645
2.	-0.0126	11.28	0.1237	53.46	0.01283
2.25	-0.01248	11.94	0.09599	56.64	0.008275
2.5	-0.01381	12.66	0.06467	60.	0.00648
2.75	-0.01163	13.44	0.07033	63.6	0.006368
3.	-0.0126	14.22	0.0624	67.2	0.009352
3.25	-0.009962	15.06	0.05027	71.4	0.004325

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
3.5	-0.01427	15.96	0.04872	75.6	0.00648
3.75	-0.01237	16.92	0.03995	79.8	0.008275
4.	-0.01104	17.88	0.03552	84.6	0.00948
4.25	-0.01151	18.96	0.03252	90.	0.0126
4.5	-0.01525	20.1	0.0366	94.8	0.01559
4.75	-0.01166	21.3	0.03599	100.8	0.01344
5.	-0.01346	22.56	0.03252	106.8	0.009706
5.251	-0.007694	23.88	0.02771	112.8	0.01175
5.501	-0.01321	25.32	0.02687	119.4	0.01248
5.751	-0.01273	26.82	0.02485	126.6	0.008645
6.001	-0.01032	28.38	0.02856	134.4	0.006734
6.361	-0.01094	30.06	0.01944	142.2	0.01334
6.721	-0.01058	31.86	0.021	150.6	0.01464
7.141	-0.01081	33.72	0.01622	159.6	0.01091

SOLUTION

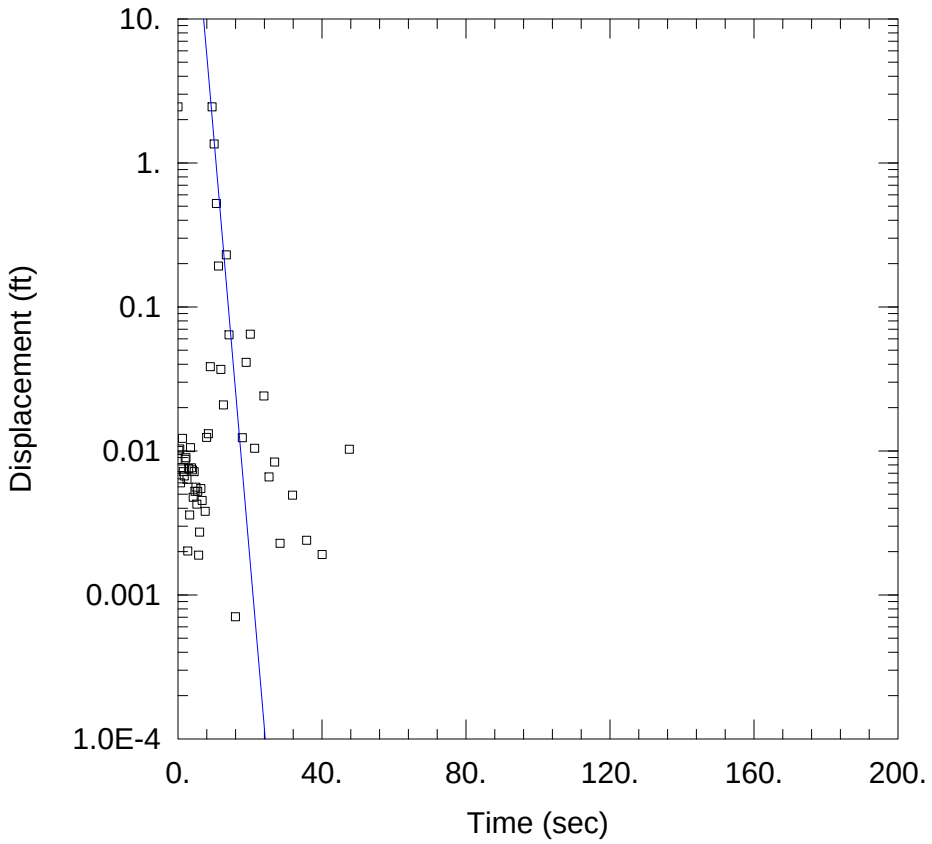
Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 1.823

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	38.88	ft/day
y0	22.55	ft

K = 0.01371 cm/sec
T = K*b = 628.6 ft²/day (6.759 sq. cm/sec)



WELL TEST ANALYSIS

Data Set: T:\...\MMW-P-11DR IN (B-R 1976).aqt
Date: 04/10/13 Time: 16:40:24

PROJECT INFORMATION

Company: Mundell & Associates Inc.
Client: AIMCO
Project: M01046
Test Well: MMW-P-11DR
Test Date: 3-29-2013

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 84.96 ft/day
y0 = 1219.1 ft

AQUIFER DATA

Saturated Thickness: 16.97 ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MMW-P-11DR)

Initial Displacement: 2.452 ft
Total Well Penetration Depth: 13.97 ft
Casing Radius: 0.083 ft

Static Water Column Height: 16.97 ft
Screen Length: 5. ft
Well Radius: 0.33 ft

Data Set: T:\2001\M01046 Michigan Meadows Apts\Data\Slug Test Files\Bouwer-Rice 1976\MMW-P-11DR IN (B-R 1976).aqt
Date: 04/10/13
Time: 16:40:05

PROJECT INFORMATION

Company: Mundell & Associates Inc.
Client: AIMCO
Project: M01046
Test Date: 3-29-2013
Test Well: MMW-P-11DR

AQUIFER DATA

Saturated Thickness: 16.97 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: MMW-P-11DR

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 2.452 ft
Static Water Column Height: 16.97 ft
Casing Radius: 0.083 ft
Well Radius: 0.33 ft
Well Skin Radius: 0.33 ft
Screen Length: 5. ft
Total Well Penetration Depth: 13.97 ft

No. of Observations: 73

Observation Data

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
0.251	0.01008	6.721	0.004525	28.38	0.002283
0.501	0.01032	7.141	-0.000123	30.06	-0.001674
0.751	0.006003	7.561	0.003803	31.86	0.004924
1.001	0.007665	7.981	0.01243	33.72	-0.000964
1.251	0.01222	8.461	0.01317	35.76	0.002394
1.501	0.007183	9.001	0.03848	37.86	-0.003805
1.751	0.006701	9.481	2.452	40.08	0.001907
2.001	0.008735	10.08	1.355	42.48	-0.002874
2.251	0.008967	10.68	0.5223	45.	-0.004052
2.501	0.006344	11.28	0.1922	47.64	0.01028
2.751	0.002017	11.94	0.0368	50.46	-0.002394
3.001	0.007533	12.66	0.02084	53.46	-0.003204
3.251	0.003585	13.44	0.2302	56.64	-0.007419

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
3.501	0.01053	14.22	0.064	60.	-0.008845
3.751	0.007643	15.06	-0.03358	63.6	-0.005261
4.001	0.007386	15.96	0.000705	67.2	-0.01399
4.251	0.004772	16.92	-0.006727	71.4	-0.01652
4.501	0.007179	17.88	0.01235	75.6	-0.01482
4.751	0.005241	18.96	0.04125	79.8	-0.01423
5.001	0.005604	20.1	0.06473	84.6	-0.01521
5.251	0.004276	21.3	0.01044	90.	-0.01999
5.501	0.005241	22.56	-0.01221	94.8	-0.02118
5.751	0.001887	23.88	0.0241	100.8	-0.02766
6.001	0.002733	25.32	0.006591		
6.361	0.005479	26.85	0.008368		

SOLUTION

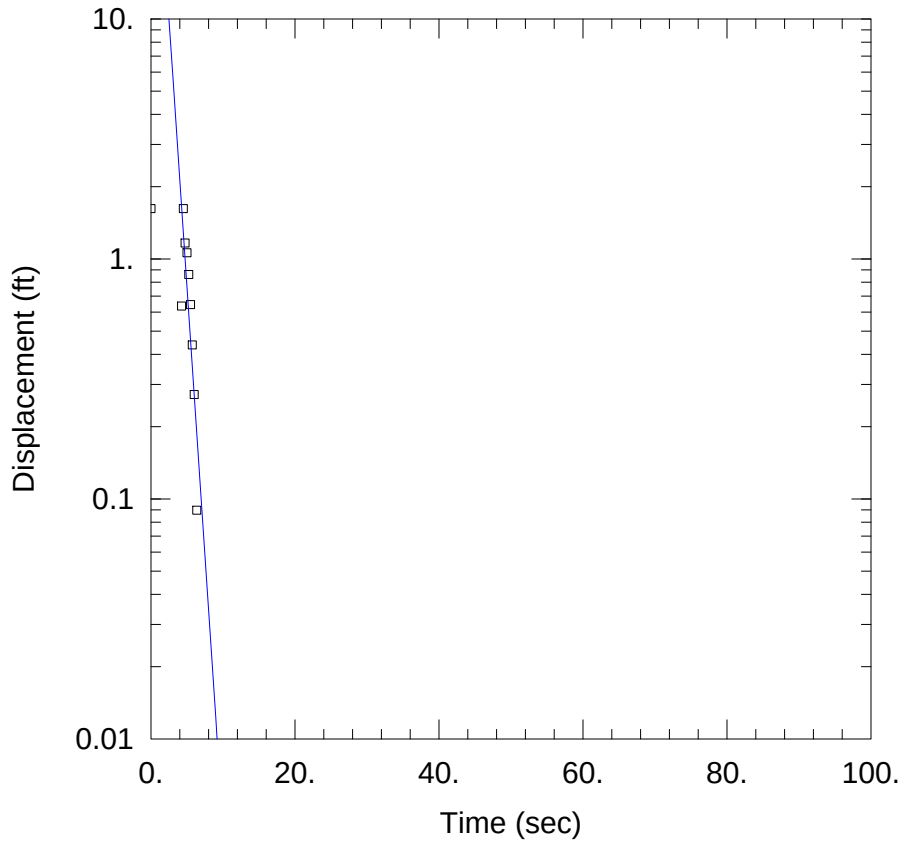
Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 0.

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	84.96	ft/day
y0	1219.1	ft

K = 0.02997 cm/sec
T = K*b = 1441.7 ft²/day (15.5 sq. cm/sec)



WELL TEST ANALYSIS

Data Set: T:\...\MMW-P-11DR OUT (B-R 1976).aqt
Date: 04/10/13 Time: 16:38:54

PROJECT INFORMATION

Company: Mundell & Associates Inc.
Client: AIMCO
Project: M01046
Test Well: MMW-P-11DR
Test Date: 3-29-2013

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 130.3 ft/day
y0 = 132.7 ft

AQUIFER DATA

Saturated Thickness: 16.97 ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MMW-P-11DR)

Initial Displacement: 1.621 ft
Total Well Penetration Depth: 13.97 ft
Casing Radius: 0.083 ft

Static Water Column Height: 16.97 ft
Screen Length: 5. ft
Well Radius: 0.33 ft

Data Set: T:\2001\M01046 Michigan Meadows Apts\Data\Slug Test Files\Bouwer-Rice 1976\MMW-P-11DR OUT (B-R 1976).aqt
Date: 04/10/13
Time: 16:38:38

PROJECT INFORMATION

Company: Mundell & Associates Inc.
Client: AIMCO
Project: M01046
Test Date: 3-29-2013
Test Well: MMW-P-11DR

AQUIFER DATA

Saturated Thickness: 16.97 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: MMW-P-11DR

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 1.621 ft
Static Water Column Height: 16.97 ft
Casing Radius: 0.083 ft
Well Radius: 0.33 ft
Well Skin Radius: 0.33 ft
Screen Length: 5. ft
Total Well Penetration Depth: 13.97 ft

No. of Observations: 72

Observation Data

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
0.25	-0.1126	6.36	0.08968	25.32	-0.1171
0.5	-0.1113	6.72	-0.03156	26.82	-0.1193
0.75	-0.113	7.14	-0.104	28.38	-0.1194
1.228	-0.1177	7.56	-0.1364	30.06	-0.118
1.449	-0.1212	7.98	-0.1402	31.86	-0.119
1.67	-0.1107	8.461	-0.136	33.72	-0.121
2.043	-0.1189	9.	-0.1248	35.76	-0.1206
2.264	-0.1098	9.48	-0.1164	37.86	-0.1205
2.485	-0.1121	10.08	-0.1135	40.08	-0.1156
2.705	-0.113	10.68	-0.1129	42.48	-0.1193
2.926	-0.1124	11.28	-0.1154	45.15	-0.1251
3.146	-0.1081	11.94	-0.1111	47.64	-0.1298
3.366	-0.09571	12.66	-0.1183	50.46	-0.1191

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
3.586	-0.1118	13.44	-0.116	53.46	-0.1215
3.806	-0.117	14.22	-0.116	56.64	-0.1144
4.026	-0.03699	15.06	-0.1179	60.	-0.1191
4.246	0.6362	15.96	-0.1203	63.6	-0.1167
4.5	1.621	16.92	-0.1158	67.2	-0.1121
4.75	1.165	17.88	-0.1141	71.4	-0.1215
5.	1.061	18.96	-0.1189	75.6	-0.1163
5.25	0.8605	20.1	-0.1164	79.8	-0.1187
5.5	0.645	21.3	-0.1165	84.6	-0.1212
5.75	0.4382	22.56	-0.1168	90.	-0.1245
6.	0.2723	23.88	-0.1178	94.8	-0.1219

SOLUTION

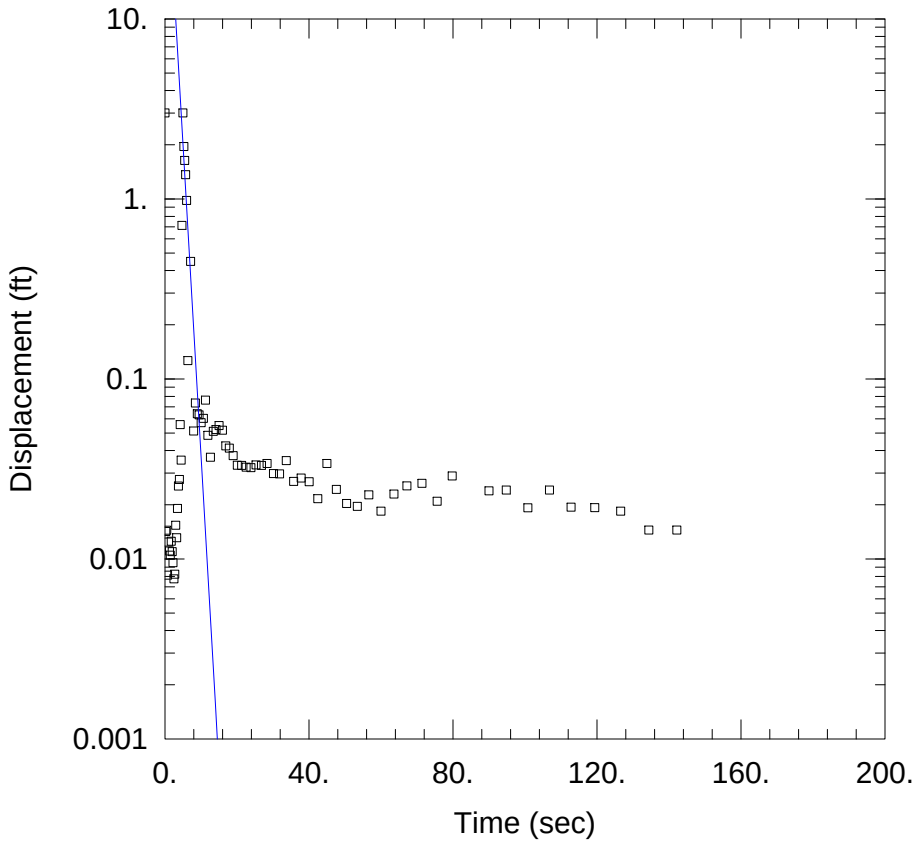
Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 0.

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	130.3	ft/day
y0	132.7	ft

K = 0.04598 cm/sec
T = K*b = 2211.7 ft²/day (23.78 sq. cm/sec)



WELL TEST ANALYSIS

Data Set: T:\...\MMW-P-13S IN (B-R 1976).aqt
Date: 04/10/13 Time: 16:50:37

PROJECT INFORMATION

Company: Mundell & Associates Inc.
Client: AIMCO
Project: M01046
Test Well: MMW-P-13S
Test Date: 3-29-2013

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 57.4 ft/day
y0 = 106.6 ft

AQUIFER DATA

Saturated Thickness: 15.86 ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MMW-P-13S)

Initial Displacement: 3.002 ft
Total Well Penetration Depth: 8.86 ft
Casing Radius: 0.083 ft

Static Water Column Height: 15.86 ft
Screen Length: 8.86 ft
Well Radius: 0.33 ft

Data Set: T:\2001\M01046 Michigan Meadows Apts\Data\Slug Test Files\Bouwer-Rice 1976\MMW-P-13S IN (B-R 1976).aqt
Date: 04/10/13
Time: 16:51:01

PROJECT INFORMATION

Company: Mundell & Associates Inc.
Client: AIMCO
Project: M01046
Test Date: 3-29-2013
Test Well: MMW-P-13S

AQUIFER DATA

Saturated Thickness: 15.86 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: MMW-P-13S

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 3.002 ft
Static Water Column Height: 15.86 ft
Casing Radius: 0.083 ft
Well Radius: 0.33 ft
Well Skin Radius: 0.33 ft
Screen Length: 8.86 ft
Total Well Penetration Depth: 8.86 ft

No. of Observations: 79

Observation Data

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
0.251	0.01421	7.561	-0.1045	35.76	0.02697
0.501	0.01444	7.981	0.05142	37.86	0.02817
0.751	0.00813	8.461	0.07351	40.08	0.02685
1.001	0.01241	9.001	0.06409	42.48	0.02162
1.251	0.01107	9.481	0.06313	45.	0.0339
1.501	0.0105	10.08	0.05717	47.64	0.02436
1.751	0.01254	10.68	0.06038	50.46	0.02031
2.001	0.01097	11.28	0.07624	53.46	0.01958
2.251	0.00953	11.94	0.04857	56.64	0.02271
2.501	0.007747	12.66	0.03675	60.	0.01841
2.751	0.008224	13.44	0.05119	63.6	0.02294
3.001	0.01539	14.22	0.05237	67.2	0.02544
3.251	0.01312	15.06	0.05512	71.4	0.02629

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
3.501	0.01907	15.96	0.05188	75.6	0.02092
3.751	0.02542	16.92	0.04249	79.8	0.0289
4.001	0.02765	17.88	0.04128	84.6	-0.0129
4.251	0.05571	18.96	0.03747	90.	0.02389
4.501	0.03542	20.1	0.03317	94.8	0.02414
4.751	0.7127	21.3	0.03306	100.8	0.01923
5.001	3.002	22.56	0.03235	106.8	0.02416
5.251	1.953	23.88	0.03213	112.8	0.01938
5.501	1.635	25.32	0.0333	119.4	0.01926
5.751	1.364	26.82	0.03306	126.6	0.01841
6.001	0.9806	28.38	0.0339	134.4	0.01447
6.361	0.1264	30.15	0.02982	142.2	0.01448
6.721	-0.1229	31.86	0.02971		
7.141	0.4501	33.72	0.03518		

SOLUTION

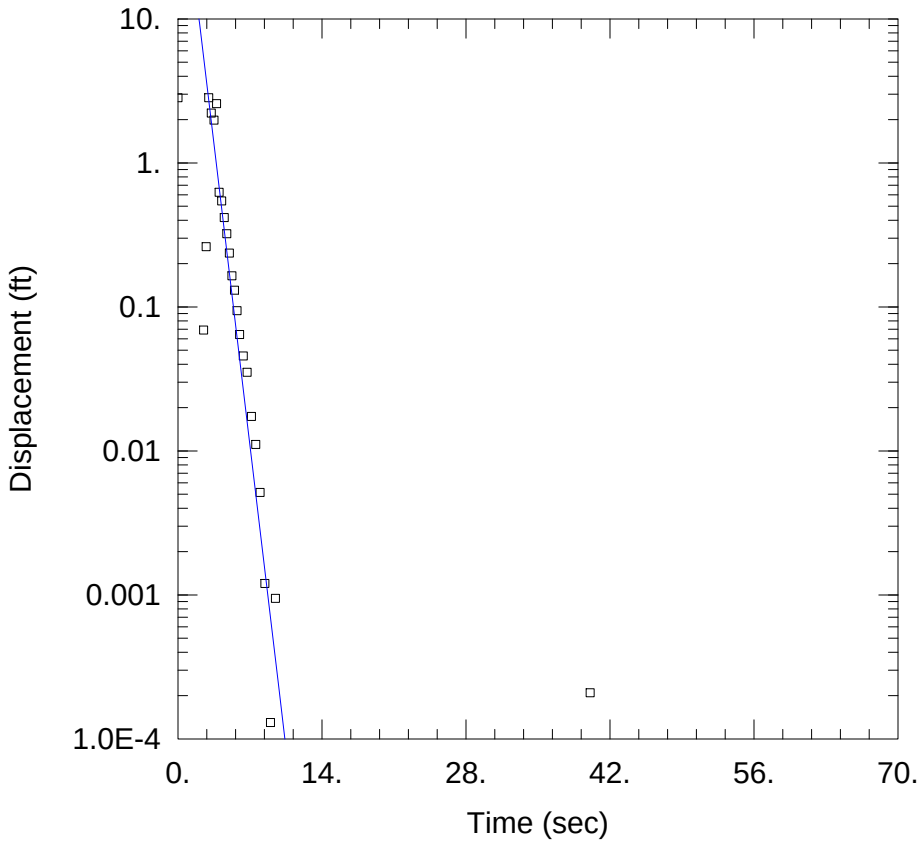
Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 2.151

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	57.4	ft/day
y0	106.6	ft

K = 0.02025 cm/sec
T = K*b = 910.3 ft²/day (9.788 sq. cm/sec)



WELL TEST ANALYSIS

Data Set: T:\...\MMW-P-13S OUT (B-R 1976).aqt
Date: 04/10/13 Time: 16:51:51

PROJECT INFORMATION

Company: Mundell & Associates Inc
Client: AIMCO
Project: M01046
Test Well: MMW-P-13S
Test Date: 3-29-2013

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 99.58 ft/day
y0 = 168.2 ft

AQUIFER DATA

Saturated Thickness: 15.86 ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MMW-P-13S)

Initial Displacement: 2.835 ft
Total Well Penetration Depth: 8.86 ft
Casing Radius: 0.083 ft

Static Water Column Height: 15.86 ft
Screen Length: 8.86 ft
Well Radius: 0.33 ft

Data Set: T:\2001\M01046 Michigan Meadows Apts\Data\Slug Test Files\Bouwer-Rice 1976\MMW-P-13S OUT (B-R 1976).aqt
Date: 04/10/13
Time: 16:52:08

PROJECT INFORMATION

Company: Mundell & Associates Inc
Client: AIMCO
Project: M01046
Test Date: 3-29-2013
Test Well: MMW-P-13S

AQUIFER DATA

Saturated Thickness: 15.86 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: MMW-P-13S

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 2.835 ft
Static Water Column Height: 15.86 ft
Casing Radius: 0.083 ft
Well Radius: 0.33 ft
Well Skin Radius: 0.33 ft
Screen Length: 8.86 ft
Total Well Penetration Depth: 8.86 ft

No. of Observations: 66

Observation Data

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
0.251	-0.01421	5.751	0.0942	20.1	-0.006091
0.501	-0.01469	6.001	0.06438	21.3	-0.01398
0.751	-0.01446	6.361	0.04561	22.56	-0.00693
1.001	-0.01313	6.721	0.0352	23.88	-0.01119
1.251	-0.005877	7.141	0.01734	25.32	-0.005276
1.501	-0.01265	7.561	0.0111	26.82	-0.004197
1.751	-0.0123	7.981	0.00515	28.38	-0.01299
2.001	-0.0111	8.461	0.0012	30.06	-0.01071
2.251	-0.01134	9.001	0.00013	31.86	-0.007493
2.501	0.06911	9.481	0.000947	33.72	-0.002418
2.751	0.2622	10.08	-0.001663	35.76	-0.00087
3.001	2.835	10.68	-0.003444	37.86	-0.00397
3.251	2.218	11.28	-0.002493	40.08	0.000209

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
3.501	1.983	11.94	-0.005137	42.48	-0.005523
3.751	2.578	12.66	-0.007643	45.	-0.004571
4.001	0.6254	13.44	-0.004644	47.64	-0.00565
4.251	0.5441	14.22	-0.001929	50.46	-0.002308
4.501	0.4169	15.06	-0.002512	53.46	-0.007198
4.751	0.3226	15.96	-0.002982	56.64	-0.008738
5.001	0.2363	16.92	-0.003349	60.	-0.005873
5.251	0.1643	17.88	-0.005877	63.65	-0.0123
5.501	0.1308	18.96	-0.004794	67.2	-0.008614

SOLUTION

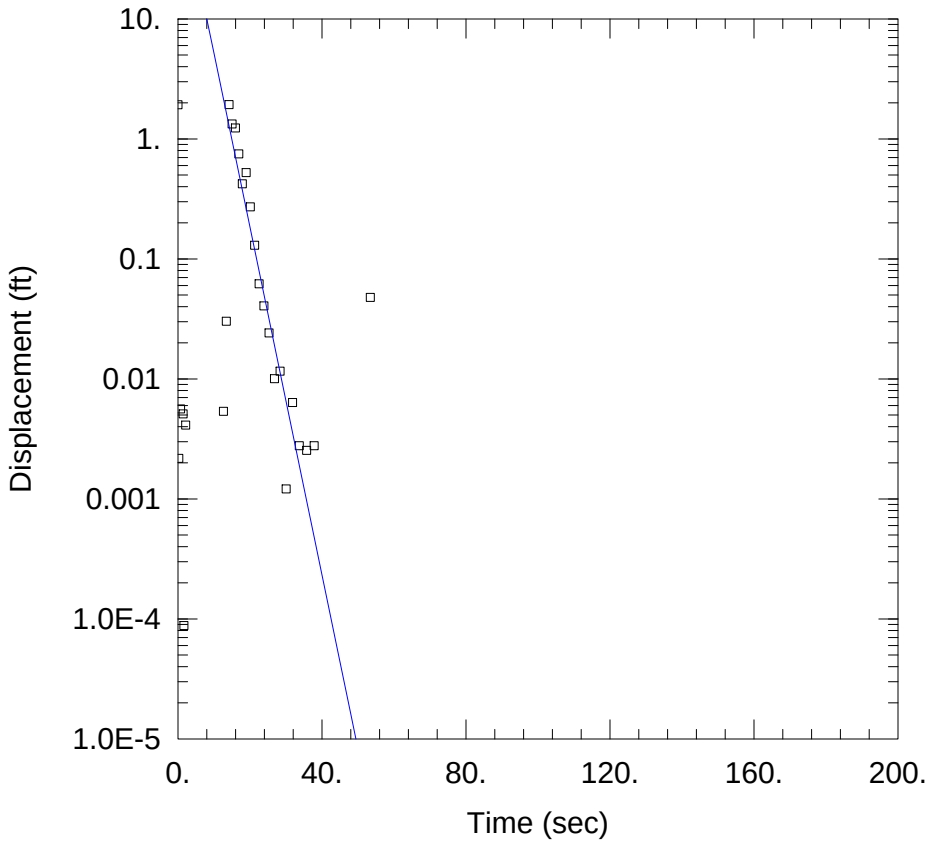
Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 2.151

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	99.58	ft/day
y0	168.2	ft

K = 0.03513 cm/sec
T = K*b = 1579.3 ft²/day (16.98 sq. cm/sec)



WELL TEST ANALYSIS

Data Set: T:\...\MMW-P-13D IN (B-R 1976).aqt
Date: 04/10/13 Time: 16:47:13

PROJECT INFORMATION

Company: Mundell & Associates Inc.
Client: AIMCO
Project: M01046
Test Well: MMW-P-13D
Test Date: 3-29-2013

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 51.97 ft/day
y0 = 145.9 ft

AQUIFER DATA

Saturated Thickness: 16.1 ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MMW-P-13D)

Initial Displacement: 1.929 ft
Total Well Penetration Depth: 16.1 ft
Casing Radius: 0.083 ft

Static Water Column Height: 16.1 ft
Screen Length: 5. ft
Well Radius: 0.33 ft

Data Set: T:\2001\M01046 Michigan Meadows Apts\Data\Slug Test Files\Bouwer-Rice 1976\MMW-P-13D IN (B-R 1976).aqt
Date: 04/10/13
Time: 16:47:40

PROJECT INFORMATION

Company: Mundell & Associates Inc.
Client: AIMCO
Project: M01046
Test Date: 3-29-2013
Test Well: MMW-P-13D

AQUIFER DATA

Saturated Thickness: 16.1 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: MMW-P-13D

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 1.929 ft
Static Water Column Height: 16.1 ft
Casing Radius: 0.083 ft
Well Radius: 0.33 ft
Well Skin Radius: 0.33 ft
Screen Length: 5. ft
Total Well Penetration Depth: 16.1 ft

No. of Observations: 74

Observation Data

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
0.251	0.00218	6.721	-0.007077	28.38	0.01162
0.501	-0.000709	7.141	-0.005754	30.06	0.001213
0.751	0.00562	7.561	-0.007907	31.86	0.006362
1.23	-0.000751	7.981	-0.01244	33.72	0.002779
1.451	0.005111	8.461	-0.01052	35.76	0.002541
1.671	8.8E-5	9.001	-0.01244	37.86	0.002779
2.166	0.004127	9.481	-0.01221	40.08	-0.00569
2.387	-5.3E-5	10.08	-0.009325	42.48	-0.01048
2.607	-0.002904	10.68	-0.004195	45.	-0.0082
2.889	-0.007201	11.28	-0.01029	47.64	-0.002605
3.109	-0.006337	11.94	-0.01016	50.46	-0.009869
3.329	-0.007295	12.66	0.005371	53.46	0.04782
3.549	-0.007529	13.44	0.03024	56.64	-0.005241

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
3.769	-0.01029	14.22	1.929	60.	-0.01213
3.989	-0.004331	15.06	1.334	63.6	-0.01358
4.209	-0.007201	15.96	1.235	67.2	-0.0113
4.43	-0.008017	16.92	0.7503	71.4	-0.01441
4.65	-0.005173	17.88	0.4228	75.6	-0.01405
4.872	-0.006588	18.96	0.5238	79.8	-0.0206
5.092	-0.005754	20.1	0.2713	84.6	-0.01573
5.312	-0.006236	21.3	0.1302	90.	-0.01504
5.532	-0.009365	22.56	0.06195	94.8	-0.01933
5.753	-0.003862	23.88	0.04065	100.8	-0.0204
6.001	-0.007198	25.32	0.02418	106.8	-0.02194
6.361	-0.007577	26.82	0.01006		

SOLUTION

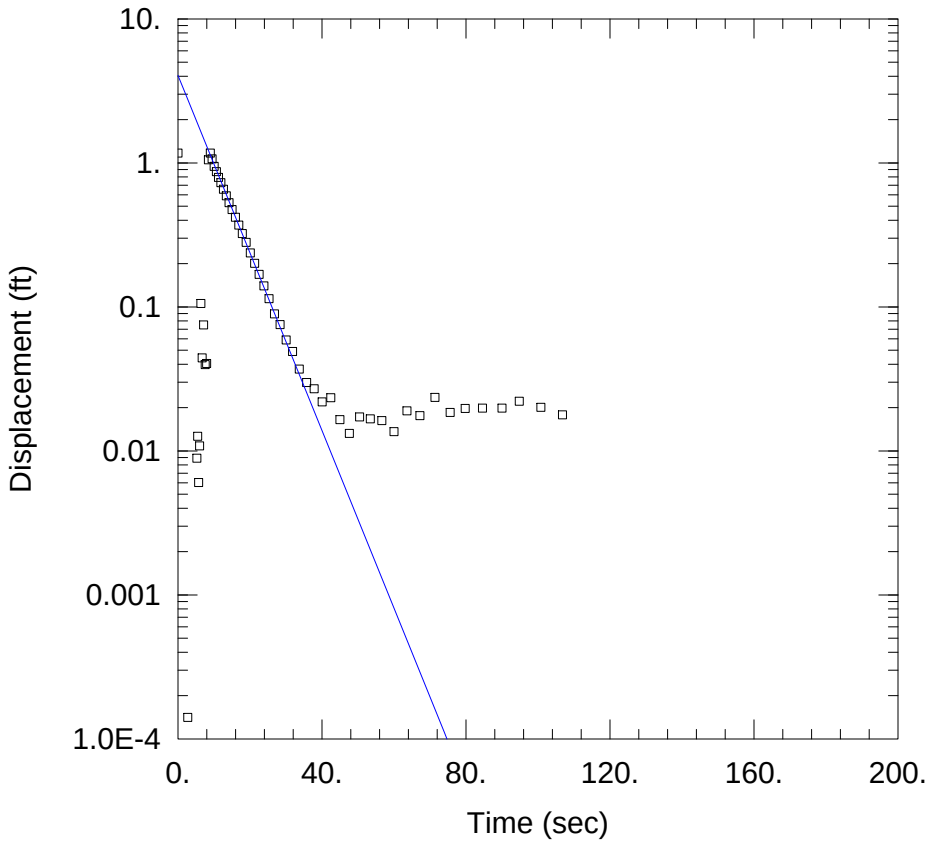
Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 2.616

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	51.97	ft/day
y0	145.9	ft

K = 0.01833 cm/sec
T = K*b = 836.8 ft²/day (8.997 sq. cm/sec)



WELL TEST ANALYSIS

Data Set: T:\...\MMW-P-13D OUT (B-R 1976).aqt
Date: 04/10/13 Time: 16:49:18

PROJECT INFORMATION

Company: Mundell & Associates Inc.
Client: AIMCO
Project: M01046
Test Well: MMW-P-13D
Test Date: 3-29-2013

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 22.11 ft/day
y0 = 4.053 ft

AQUIFER DATA

Saturated Thickness: 16.1 ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MMW-P-13D)

Initial Displacement: 1.17 ft
Total Well Penetration Depth: 16.1 ft
Casing Radius: 0.083 ft

Static Water Column Height: 16.1 ft
Screen Length: 5. ft
Well Radius: 0.33 ft

Data Set: T:\2001\M01046 Michigan Meadows Apts\Data\Slug Test Files\Bouwer-Rice 1976\MMW-P-13D OUT (B-R 1976).aqt
Date: 04/10/13
Time: 16:49:35

PROJECT INFORMATION

Company: Mundell & Associates Inc.
Client: AIMCO
Project: M01046
Test Date: 3-29-2013
Test Well: MMW-P-13D

AQUIFER DATA

Saturated Thickness: 16.1 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: MMW-P-13D

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 1.17 ft
Static Water Column Height: 16.1 ft
Casing Radius: 0.083 ft
Well Radius: 0.33 ft
Well Skin Radius: 0.33 ft
Screen Length: 5. ft
Total Well Penetration Depth: 16.1 ft

No. of Observations: 74

Observation Data

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
0.251	-0.005615	6.721	0.04432	28.38	0.07543
0.501	-0.005245	7.141	0.07505	30.06	0.05893
0.751	-0.008139	7.561	0.03976	31.86	0.049
1.001	-0.008821	7.981	0.04047	33.72	0.03705
1.251	-0.00739	8.461	1.052	35.76	0.02987
1.501	-0.007973	9.001	1.17	37.86	0.02701
1.751	-0.008335	9.481	1.068	40.08	0.02188
2.001	-0.003191	10.08	0.947	42.48	0.02339
2.251	-0.00129	10.68	0.869	45.	0.01649
2.501	-0.005485	11.28	0.7928	47.64	0.01322
2.751	0.000141	11.94	0.7288	50.46	0.01721
3.001	-0.005941	12.66	0.6572	53.46	0.01672
3.251	-0.005602	13.44	0.5912	56.64	0.01625

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
3.501	-0.006078	14.22	0.5295	60.	0.01363
3.751	-0.004393	15.06	0.4745	63.6	0.019
4.001	-0.009136	15.96	0.4201	67.2	0.01757
4.251	-0.00748	16.92	0.3698	71.4	0.02352
4.501	-0.004842	17.88	0.3228	75.6	0.01851
4.751	-0.005212	18.96	0.2806	79.8	0.01972
5.001	-0.001731	20.1	0.2369	84.6	0.01984
5.251	0.008912	21.3	0.2011	90.	0.01984
5.501	0.01263	22.56	0.1684	94.8	0.02211
5.751	0.006036	23.88	0.1399	100.8	0.02009
6.001	0.01083	25.32	0.1142	106.8	0.01782
6.36	0.1058	26.82	0.08953		

SOLUTION

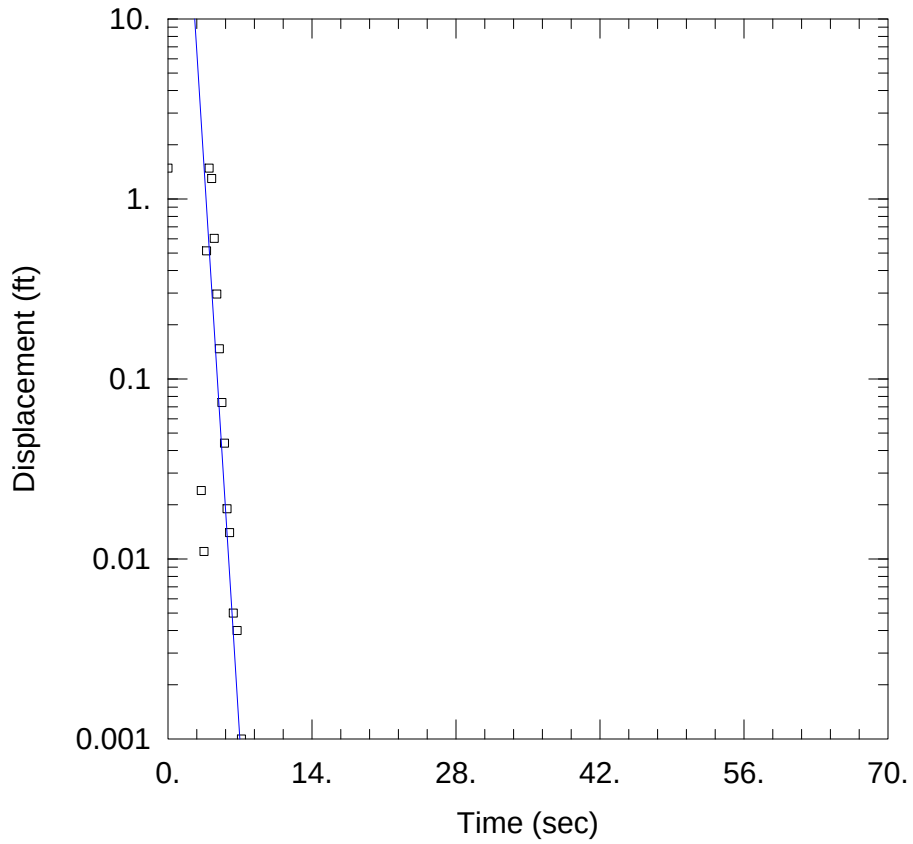
Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 2.616

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	22.11	ft/day
y0	4.053	ft

K = 0.0078 cm/sec
T = K*b = 356. ft²/day (3.828 sq. cm/sec)



WELL TEST ANALYSIS

Data Set: T:\...\MMW-P-14S OUT (B-R 1976).aqt
Date: 04/10/13 Time: 16:56:33

PROJECT INFORMATION

Company: Mundell & Associates Inc.
Client: AIMCO
Project: M01046
Test Well: MMW-P-14S
Test Date: 4-1-2013

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 141.1 ft/day
y0 = 2352.1 ft

AQUIFER DATA

Saturated Thickness: 17.89 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MMW-P-14S)

Initial Displacement: 1.482 ft
Total Well Penetration Depth: 9.89 ft
Casing Radius: 0.083 ft
Static Water Column Height: 17.89 ft
Screen Length: 9.89 ft
Well Radius: 0.33 ft

Data Set: T:\2001\M01046 Michigan Meadows Apts\Data\Slug Test Files\Bouwer-Rice 1976\MMW-P-14S OUT (B-R 1976).aqt
Date: 04/10/13
Time: 16:56:53

PROJECT INFORMATION

Company: Mundell & Associates Inc.
Client: AIMCO
Project: M01046
Test Date: 4-1-2013
Test Well: MMW-P-14S

AQUIFER DATA

Saturated Thickness: 17.89 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: MMW-P-14S

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 1.482 ft
Static Water Column Height: 17.89 ft
Casing Radius: 0.083 ft
Well Radius: 0.33 ft
Well Skin Radius: 0.33 ft
Screen Length: 9.89 ft
Total Well Penetration Depth: 9.89 ft

No. of Observations: 66

Observation Data

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
0.251	-0.014	5.751	0.019	20.1	-0.015
0.501	-0.009	6.001	0.014	21.3	-0.023
0.751	-0.015	6.361	0.005	22.6	-0.021
1.001	-0.011	6.721	0.004	23.88	-0.025
1.251	-0.016	7.141	0.001	25.32	-0.026
1.501	-0.012	7.561	-0.007	26.82	-0.024
1.751	-0.013	7.981	-0.002	28.38	-0.022
2.001	-0.011	8.461	-0.01	30.06	-0.025
2.251	-0.008	9.001	-0.011	31.86	-0.021
2.501	-0.011	9.481	-0.012	33.72	-0.025
2.751	-0.01	10.08	-0.013	35.76	-0.023
3.001	-0.011	10.68	-0.012	37.86	-0.025
3.251	0.024	11.28	-0.013	40.08	-0.025

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
3.501	0.011	11.94	-0.015	42.48	-0.024
3.751	0.515	12.66	-0.019	45.	-0.028
4.001	1.482	13.44	-0.018	47.64	-0.021
4.251	1.299	14.22	-0.017	50.46	-0.021
4.501	0.604	15.06	-0.033	53.46	-0.024
4.751	0.296	15.96	-0.034	56.64	-0.023
5.001	0.147	16.92	-0.031	60.	-0.028
5.251	0.074	17.88	-0.005	63.6	-0.024
5.501	0.044	18.96	-0.021	67.2	-0.025

SOLUTION

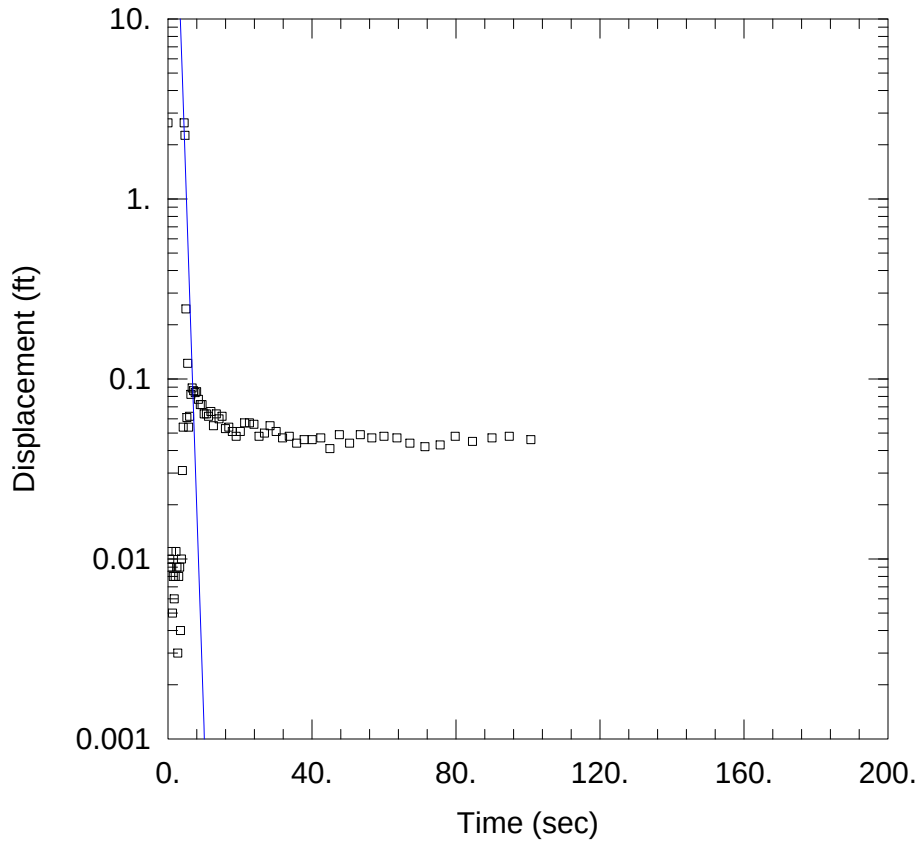
Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 2.236

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	141.1	ft/day
y0	2352.1	ft

K = 0.04979 cm/sec
T = K*b = 2524.9 ft²/day (27.15 sq. cm/sec)



WELL TEST ANALYSIS

Data Set: T:\...\MMW-P-14S-2 IN (B-R 1976).aqt
Date: 04/10/13 Time: 16:57:45

PROJECT INFORMATION

Company: Mundell & Associates Inc.
Client: AIMCO
Project: M01046
Test Well: MMW-P-14S
Test Date: 4-1-2013

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 92.96 ft/day
y0 = 1186. ft

AQUIFER DATA

Saturated Thickness: 17.89 ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MMW-P-14S)

Initial Displacement: 2.647 ft
Total Well Penetration Depth: 9.89 ft
Casing Radius: 0.083 ft

Static Water Column Height: 17.89 ft
Screen Length: 9.89 ft
Well Radius: 0.33 ft

Data Set: T:\2001\M01046 Michigan Meadows Apts\Data\Slug Test Files\Bouwer-Rice 1976\MMW-P-14S-2 IN (B-R 1976).aqt
Date: 04/10/13
Time: 16:58:09

PROJECT INFORMATION

Company: Mundell & Associates Inc.
Client: AIMCO
Project: M01046
Test Date: 4-1-2013
Test Well: MMW-P-14S

AQUIFER DATA

Saturated Thickness: 17.89 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: MMW-P-14S

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 2.647 ft
Static Water Column Height: 17.89 ft
Casing Radius: 0.083 ft
Well Radius: 0.33 ft
Well Skin Radius: 0.33 ft
Screen Length: 9.89 ft
Total Well Penetration Depth: 9.89 ft

No. of Observations: 73

Observation Data

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
0.251	0.009	6.721	0.089	28.38	0.055
0.501	0.01	7.141	0.086	30.06	0.051
0.751	0.009	7.561	0.084	31.86	0.047
1.001	0.011	7.981	0.085	33.72	0.048
1.251	0.005	8.461	0.077	35.76	0.044
1.501	0.008	9.	0.072	37.86	0.046
1.751	0.006	9.48	0.072	40.08	0.046
2.001	0.008	10.08	0.064	42.48	0.047
2.251	0.011	10.69	0.064	45.	0.041
2.501	0.009	11.28	0.062	47.64	0.049
2.751	0.003	11.94	0.066	50.46	0.044
3.001	0.008	12.66	0.055	53.46	0.049
3.251	0.009	13.44	0.064	56.64	0.047

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
3.501	0.004	14.22	0.06	60.	0.048
3.751	0.01	15.06	0.062	63.6	0.047
4.001	0.031	15.96	0.053	67.2	0.044
4.251	0.054	16.92	0.054	71.4	0.042
4.501	2.647	17.88	0.051	75.6	0.043
4.751	2.255	18.96	0.048	79.8	0.048
5.001	0.245	20.1	0.051	84.6	0.045
5.251	0.061	21.3	0.057	90.	0.047
5.501	0.122	22.65	0.057	94.8	0.048
5.751	0.054	23.88	0.056	100.8	0.046
6.001	0.062	25.32	0.048		
6.361	0.082	26.82	0.05		

SOLUTION

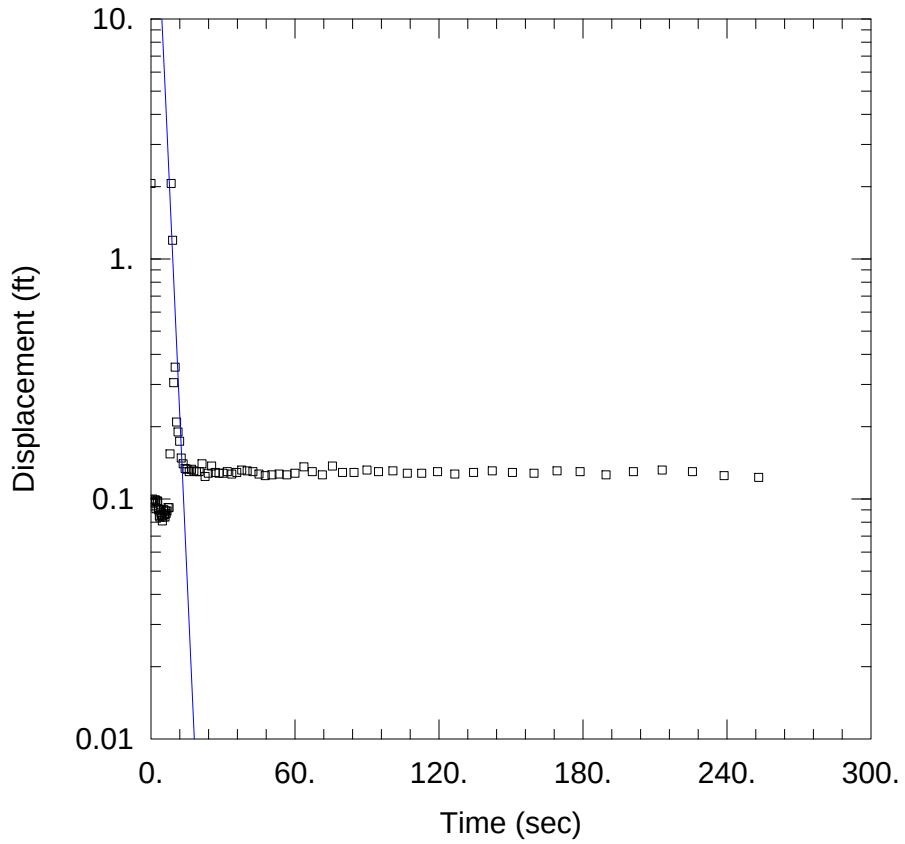
Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 2.236

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	92.96	ft/day
y0	1186.	ft

K = 0.03279 cm/sec
T = K*b = 1663.1 ft²/day (17.88 sq. cm/sec)



WELL TEST ANALYSIS

Data Set: T:\...\MMW-P-14D IN (B-R 1976).aqt
Date: 04/10/13 Time: 16:53:52

PROJECT INFORMATION

Company: Mundell & Associates Inc.
Client: AIMCO
Project: M01046
Test Well: MMW-P-14D
Test Date: 4-1-2013

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 67.13 ft/day
y0 = 104.9 ft

AQUIFER DATA

Saturated Thickness: 17.61 ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MMW-P-14D)

Initial Displacement: 2.061 ft
Total Well Penetration Depth: 15.61 ft
Casing Radius: 0.083 ft

Static Water Column Height: 17.61 ft
Screen Length: 5. ft
Well Radius: 0.33 ft

Data Set: T:\2001\M01046 Michigan Meadows Apts\Data\Slug Test Files\Bouwer-Rice 1976\MMW-P-14D IN (B-R 1976).aqt
Date: 04/10/13
Time: 16:54:11

PROJECT INFORMATION

Company: Mundell & Associates Inc.
Client: AIMCO
Project: M01046
Test Date: 4-1-2013
Test Well: MMW-P-14D

AQUIFER DATA

Saturated Thickness: 17.61 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: MMW-P-14D

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 2.061 ft
Static Water Column Height: 17.61 ft
Casing Radius: 0.083 ft
Well Radius: 0.33 ft
Well Skin Radius: 0.33 ft
Screen Length: 5. ft
Total Well Penetration Depth: 15.61 ft

No. of Observations: 89

Observation Data

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
0.251	0.098	9.001	1.195	50.46	0.126
0.729	0.1	9.481	0.305	53.46	0.127
0.95	0.097	10.08	0.354	56.64	0.126
1.171	0.096	10.68	0.209	60.	0.128
1.662	0.099	11.28	0.19	63.74	0.136
1.883	0.099	11.94	0.174	67.2	0.13
2.106	0.091	12.66	0.148	71.4	0.126
2.591	0.098	13.44	0.14	75.6	0.137
2.812	0.098	14.22	0.134	79.8	0.129
3.032	0.091	15.06	0.133	84.6	0.129
3.255	0.09	15.96	0.13	90.	0.132
3.475	0.085	16.92	0.133	94.8	0.13
3.696	0.084	17.88	0.131	100.8	0.131

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
3.917	0.09	18.96	0.13	106.8	0.128
4.137	0.088	20.1	0.13	112.8	0.128
4.358	0.086	21.32	0.14	119.4	0.13
4.578	0.085	22.56	0.124	126.6	0.127
4.798	0.081	23.88	0.128	134.4	0.129
5.02	0.084	25.32	0.137	142.2	0.131
5.24	0.09	26.82	0.129	150.6	0.129
5.46	0.09	28.38	0.128	159.6	0.128
5.681	0.086	30.06	0.128	169.2	0.131
5.902	0.084	31.86	0.13	178.8	0.13
6.122	0.089	33.72	0.127	189.6	0.126
6.36	0.087	35.76	0.129	201.	0.13
6.721	0.089	37.86	0.132	213.	0.132
7.14	0.092	40.08	0.131	225.6	0.13
7.56	0.092	42.48	0.13	238.8	0.125
7.98	0.154	45.	0.127	253.2	0.123
8.461	2.061	47.64	0.125		

SOLUTION

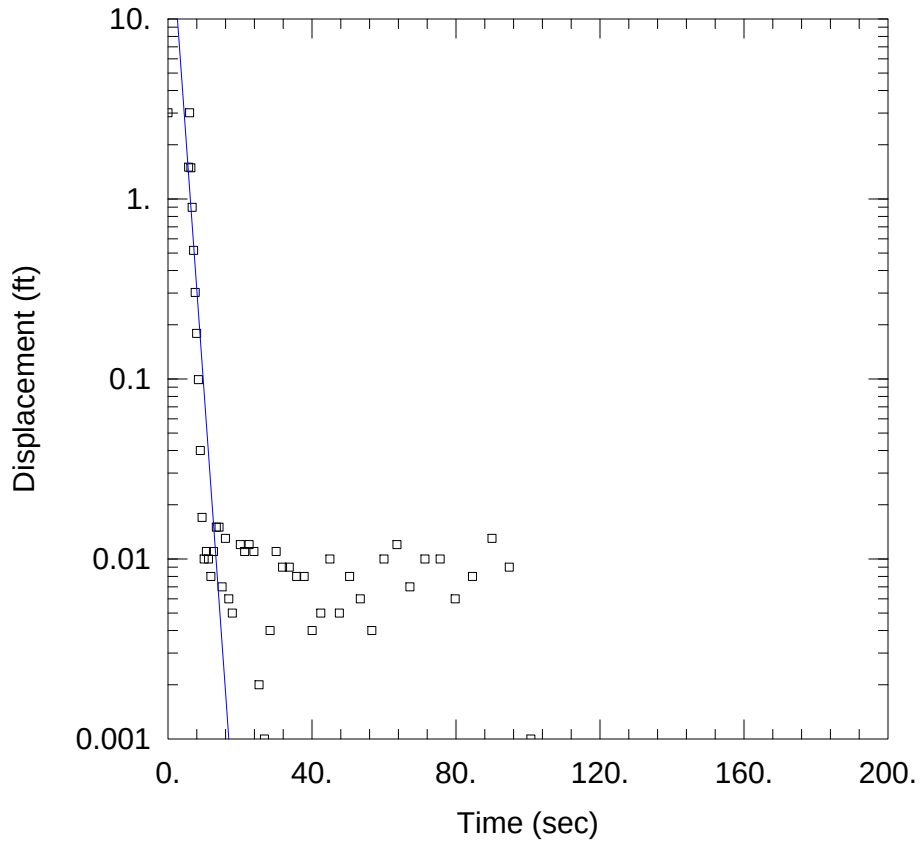
Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 2.199

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	67.13	ft/day
y0	104.9	ft

K = 0.02368 cm/sec
T = K*b = 1182.2 ft²/day (12.71 sq. cm/sec)



WELL TEST ANALYSIS

Data Set: T:\...\MMW-P-14D OUT (B-R 1976).aqt
Date: 04/10/13 Time: 16:55:19

PROJECT INFORMATION

Company: Mundell & Associates Inc.
Client: AIMCO
Project: M01046
Test Well: MMW-P-14D
Test Date: 4-1-2013

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 84.4 ft/day
y0 = 54.51 ft

AQUIFER DATA

Saturated Thickness: 17.61 ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MMW-P-14D)

Initial Displacement: 3.008 ft
Total Well Penetration Depth: 15.61 ft
Casing Radius: 0.083 ft

Static Water Column Height: 17.61 ft
Screen Length: 5. ft
Well Radius: 0.33 ft

Data Set: T:\2001\M01046 Michigan Meadows Apts\Data\Slug Test Files\Bouwer-Rice 1976\MMW-P-14D OUT (B-R 1976).aqt
Date: 04/10/13
Time: 16:55:37

PROJECT INFORMATION

Company: Mundell & Associates Inc.
Client: AIMCO
Project: M01046
Test Date: 4-1-2013
Test Well: MMW-P-14D

AQUIFER DATA

Saturated Thickness: 17.61 ft
Anisotropy Ratio (Kz/Kr): 1.

SLUG TEST WELL DATA

Test Well: MMW-P-14D

X Location: 0. ft
Y Location: 0. ft

Initial Displacement: 3.008 ft
Static Water Column Height: 17.61 ft
Casing Radius: 0.083 ft
Well Radius: 0.33 ft
Well Skin Radius: 0.33 ft
Screen Length: 5. ft
Total Well Penetration Depth: 15.61 ft

No. of Observations: 73

Observation Data

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
0.251	-0.01	6.721	0.898	28.38	0.004
0.501	-0.007	7.141	0.518	30.06	0.011
0.751	-0.008	7.561	0.302	31.86	0.009
1.001	-0.011	7.981	0.179	33.72	0.009
1.251	-0.011	8.461	0.099	35.76	0.008
1.501	-0.011	9.001	0.04	37.86	0.008
1.751	-0.01	9.481	0.017	40.08	0.004
2.001	-0.009	10.08	0.01	42.48	0.005
2.251	-0.016	10.68	0.011	45.	0.01
2.501	-0.012	11.28	0.01	47.64	0.005
2.751	-0.01	11.94	0.008	50.46	0.008
3.001	-0.008	12.66	0.011	53.46	0.006
3.251	-0.009	13.44	0.015	56.64	0.004

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
3.501	-0.009	14.22	0.015	60.	0.01
3.751	-0.009	15.06	0.007	63.6	0.012
4.001	-0.008	15.96	0.013	67.2	0.007
4.251	-0.009	16.92	0.006	71.4	0.01
4.501	-0.011	17.88	0.005	75.6	0.01
4.751	-0.008	18.96	-0.01	79.8	0.006
5.001	-0.004	20.1	0.012	84.6	0.008
5.251	-0.008	21.3	0.011	90.	0.013
5.501	-0.006	22.56	0.012	94.8	0.009
5.751	1.5	23.88	0.011	100.8	0.001
6.001	3.008	25.32	0.002		
6.361	1.489	26.82	0.001		

SOLUTION

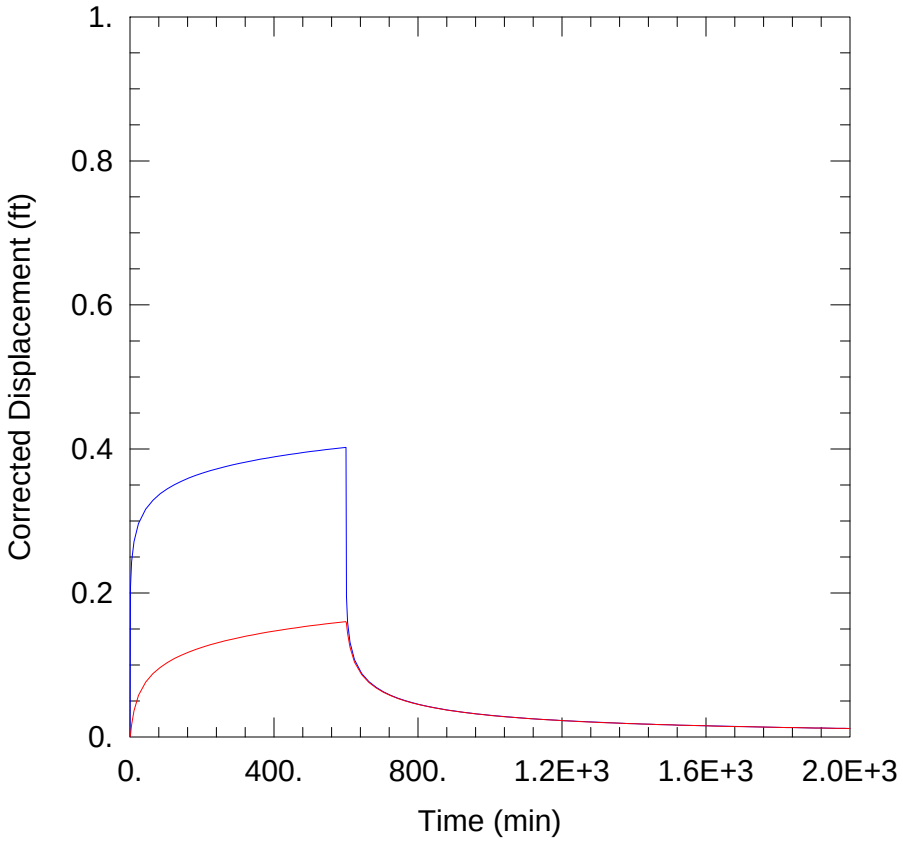
Slug Test
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
ln(Re/rw): 2.199

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
K	84.4	ft/day
y0	54.51	ft

K = 0.02977 cm/sec
T = K*b = 1486.2 ft²/day (15.98 sq. cm/sec)



WELL TEST ANALYSIS

Data Set: T:\...\OW 10 ft_S = 0.1_ Rate=3 GPM_Recovery at 10 hrs
Date: 04/10/13 Time: 17:05:36

PROJECT INFORMATION

Company: Mundell & Associates Inc.
Client: AIMCO

SOLUTION

Aquifer Model: Unconfined
Solution Method: Theis

T = 1400. ft^2/day
S = 0.1
Kz/Kr = 1.
b = 20. ft

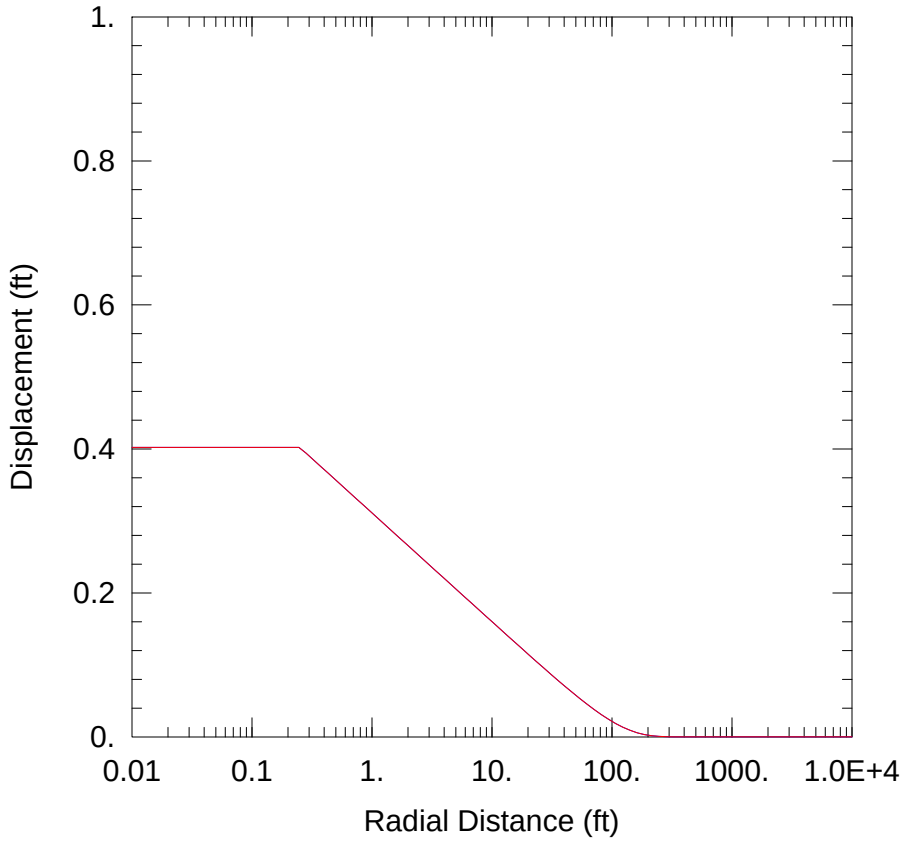
WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
PW	0	0
OW	10	0



WELL TEST ANALYSIS

Data Set: T:\...\OW 10 ft_S = 0.1_ Rate=3 GPM_Recovery at 10 hrs
Date: 04/10/13 Time: 17:06:04

PROJECT INFORMATION

Company: Mundell & Associates Inc.
Client: AIMCO

SOLUTION

Aquifer Model: Unconfined
Solution Method: Theis

T = 1400. ft^2/day
S = 0.1
Kz/Kr = 1.
b = 20. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
PW	0	0
OW	10	0

Data Set: T:\2001\M01046 Michigan Meadows Apts\VC in Residential Wells_Allison Issue\Weston Jan 30 2013 Report EPA\MUNDELL Response Files
Date: 04/10/13
Time: 17:00:18

PROJECT INFORMATION

Company: Mundell & Associates Inc.
Client: AIMCO

AQUIFER DATA

Saturated Thickness: 20. ft
Anisotropy Ratio (Kz/Kr): 1.

PUMPING WELL DATA

No. of pumping wells: 1

Pumping Well No. 1: PW

X Location: 0. ft
Y Location: 0. ft

Casing Radius: 0.1 ft
Well Radius: 0.25 ft

Fully Penetrating Well

No. of pumping periods: 2

Pumping Period Data

Time (min)	Rate (gal/min)	Time (min)	Rate (gal/min)
0.	3.	600.	0.

OBSERVATION WELL DATA

No. of observation wells: 2

Observation Well No. 1: PW

X Location: 0. ft
Y Location: 0. ft

Radial distance from PW: 0. ft

Fully Penetrating Well

No. of Observations: 0

Observation Well No. 2: OW

X Location: 10. ft
Y Location: 0. ft

Radial distance from PW: 10. ft

Fully Penetrating Well

No. of Observations: 0

SOLUTION

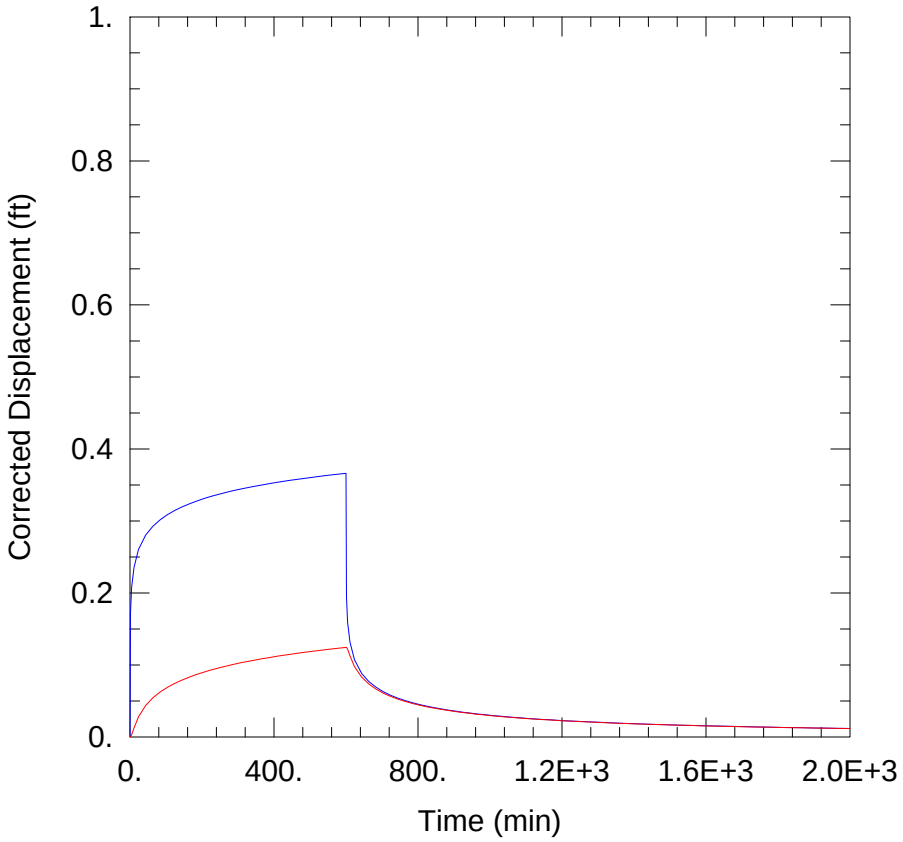
Pumping Test
Aquifer Model: Unconfined
Solution Method: Theis

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
T	1400.	ft^2/day
S	0.1	
Kz/Kr	1.	
b	20.	ft

K = T/b = 70. ft/day (0.02469 cm/sec)
Ss = S/b = 0.005 1/ft



WELL TEST ANALYSIS

Data Set: T:\...\OW 10 ft_S = 0.3_ Rate=3 GPM_Recovery at 10 hrs
Date: 04/10/13 Time: 17:06:26

PROJECT INFORMATION

Company: Mundell & Associates Inc.
Client: AIMCO

SOLUTION

Aquifer Model: Unconfined
Solution Method: Theis

T = 1400. ft^2/day
S = 0.3
Kz/Kr = 1.
b = 20. ft

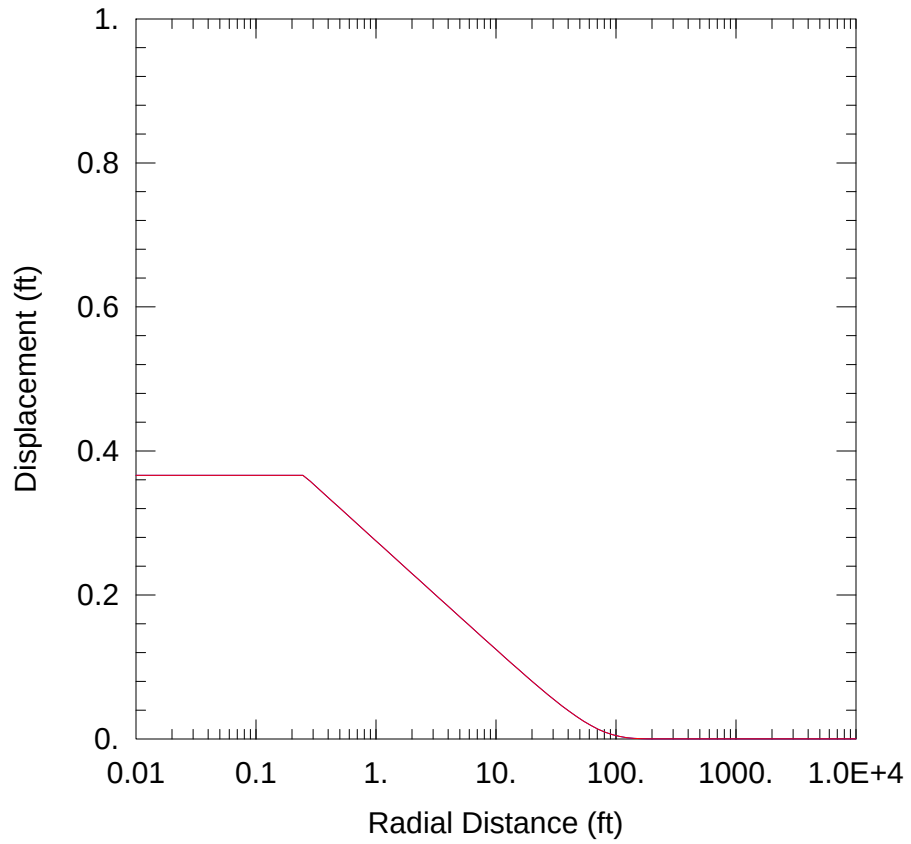
WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
PW	0	0
OW	10	0



WELL TEST ANALYSIS

Data Set: T:\...\OW 10 ft_S = 0.3_ Rate=3 GPM_Recovery at 10 hrs
Date: 04/10/13 Time: 17:06:43

PROJECT INFORMATION

Company: Mundell & Associates Inc.
Client: AIMCO

SOLUTION

Aquifer Model: Unconfined
Solution Method: Theis

T = 1400. ft^2/day
S = 0.3
Kz/Kr = 1.
b = 20. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PW	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
PW	0	0
OW	10	0

Data Set: T:\2001\M01046 Michigan Meadows Apts\VC in Residential Wells_Allison Issue\Weston Jan 30 2013 Report EPA\MUNDELL Response Files
Date: 04/10/13
Time: 16:59:22

PROJECT INFORMATION

Company: Mundell & Associates Inc.
Client: AIMCO

AQUIFER DATA

Saturated Thickness: 20. ft
Anisotropy Ratio (Kz/Kr): 1.

PUMPING WELL DATA

No. of pumping wells: 1

Pumping Well No. 1: PW

X Location: 0. ft
Y Location: 0. ft

Casing Radius: 0.1 ft
Well Radius: 0.25 ft

Fully Penetrating Well

No. of pumping periods: 2

Pumping Period Data

Time (min)	Rate (gal/min)	Time (min)	Rate (gal/min)
0.	3.	600.	0.

OBSERVATION WELL DATA

No. of observation wells: 2

Observation Well No. 1: PW

X Location: 0. ft
Y Location: 0. ft

Radial distance from PW: 0. ft

Fully Penetrating Well

No. of Observations: 0

Observation Well No. 2: OW

X Location: 10. ft
Y Location: 0. ft

Radial distance from PW: 10. ft

Fully Penetrating Well

No. of Observations: 0

SOLUTION

Pumping Test
Aquifer Model: Unconfined
Solution Method: Theis

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
T	1400.	ft^2/day
S	0.3	
Kz/Kr	1.	
b	20.	ft

K = T/b = 70. ft/day (0.02469 cm/sec)
Ss = S/b = 0.015 1/ft