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WDNR-Kewaunee Marsh Treatability Project

Final Report

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Executive Summary

Approximately 15 acres of the Kewaunee Marsh Besadny Wildlife Area, in Kewaunee, Wisconsin, are contaminated with arsenic. The source of the arsenic is likely a spill from the adjacent railroad that occurred in the 1940s. An interim action was completed in 1996 to limit the threat of direct contact to the arsenic; approximately 4 acres of the marsh were capped, and the 15 acres were enclosed in a fence. In 2002, STS Consultants completed a Phase II Site Investigation (SI), and found that the arsenic contamination is limited to the shallow groundwater and the upper 2 feet of the marsh sediment (soil), and that arsenic is entering the Kewaunee River through two surface water sloughs. On the basis of the results of the SI, sitespecific cleanup standards of 19 mg/kg for soil and 148 μ g/L for groundwater/surface water were established for the site.

RMT, Inc., was retained by the Wisconsin Department of Natural Resources (WDNR) to perform treatability studies for selected remedial options, and prepare cost estimates for a set of remedial alternatives for the site.

During the site investigation, as part of the treatability study, RMT identified a source area for arsenic near the railroad tracks. The arsenic in the source area is predominately in the dissolved phase and is slowly transported from the source area with groundwater flow, or during high water elevation events. The arsenic throughout the rest of the marsh is primarily associated with the organic matter in the marsh soil and was found not to leach; rather, the arsenic is slowly released into the pore water of the marsh as the organic matter decomposes over time. The transport of arsenic in the marsh is primarily attributed to surface water flow mixing with the pore water. The concentration of arsenic in the marsh has decreased over time. Based on the results of RMT's laboratory studies and analysis of the site, this decrease can be attributed to volatilization of arsenic to arsine gas under reducing conditions in the marsh.

RMT evaluated remediation of the source area, marsh soil, and slough water to meet the cleanup objectives for the site. Treatability studies were completed to evaluate treatment of the groundwater in the source area, *in situ* stabilization and bioreduction of the marsh soil, and implementation of a Permeable Reactive Barrier (PRB) or treatment for the slough water. *In situ* stabilization and the PRB alternatives were eliminated from the remedial options analysis based on the results of the treatability studies. The alternatives that were evaluated and for which cost estimates were prepared are as follows:

- Source area: (1) Pump and dispose contaminated water off-site, (2) pump and treat contaminated water on-site, or (3) treat contaminated water in situ.
- Marsh soil: (1) Excavate marsh soil that exceeds the cleanup criteria, or (2) bioremediate the marsh soil that exceeds the cleanup criteria that is outside the capped area.
- Slough water: (1) Install an impermeable barrier to contain the surface runoff, or (2) construct an outfall structure around the two sloughs and pump and treat the surface runoff water on-site.

The costs for each alternative are summarized in Table 20. Based on the results of the treatability studies and cost estimates, RMT recommends the following:

- The source area be remediated either through pump and disposal of contaminated groundwater off-site, or *in situ* treatment.
- The marsh soil be remediated using a bioreduction approach, with field trials being conducted prior to any full-scale implementation.
- The slough water be remediated with the construction of an impermeable barrier.

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1.1 Background

Approximately 15 acres of the Kewaunee Marsh Besadny Wildlife Area, in Kewaunee, Wisconsin, are contaminated with arsenic. The marsh is located approximately 1 mile from the mouth of the Kewaunee River, as it flows into Lake Michigan (Figure 1). The source of the arsenic is likely from a spill from the adjacent railroad that occurred in the 1940s. In the mid-1990s, stressed vegetation was observed at the site, which led to soil contamination investigations. The investigations showed high levels of arsenic in the stressed vegetation area, with lower, but still elevated, arsenic levels in much of the surrounding marsh. A map of the site is shown on Figure 1, including the soil concentrations measured during the mid-1990s.

Following identification and confirmation of the impacts, an interim action was completed in 1996 to limit the threat of direct contact to the arsenic. Specifically, the most highly impacted area (approximately 4 acres) was capped, and the 15 acres known to contain arsenic impacts were enclosed within a fence. Following the interim action, a Phase II Site Investigation (SI) was conducted in 2002 in which more soil samples were collected and several groundwater monitoring wells were installed (STS Consultants, 2004, 2006). The soil arsenic concentrations measured in 2002 are shown on Figure 2, and the average arsenic concentrations in the shallow groundwater are shown on Figure 3.

In general, the previous investigations concluded that the arsenic contamination is generally limited to the shallow groundwater and the upper 2 feet of the marsh sediment (soil). The arsenic concentrations in the soil are highest under the capped area and immediately adjacent to the cap, especially to the east and south. The arsenic in the groundwater is in the dissolved state, and occurs predominantly as arsenite or arsenate. Groundwater concentrations are particularly elevated in the well immediately adjacent to the railroad tracks (MW04-10), where the concentrations exceed 1,000,000 μ g/L. Concentrations in the groundwater monitoring wells to the east of the cap are in the low to 1,000 part per billion (μ g/L) range, while the concentrations in the remaining wells are generally in the hundreds of parts per billion or lower. Concentrations to the west of the tracks or outside the fenced area are at background levels (except for MW02-7, east of the cap).

As part of previous studies, water samples from two sloughs (Figure 3) draining the site to the Kewaunee River were sampled (STS Consultants, 2006). Flow rates and arsenic levels in the

slough water vary with the seasons. Arsenic concentrations in the slough water are in the 1,000 part per billion range.

On the basis of the results of the SI, a no further action alternative was evaluated to be unacceptable for the site, and site-specific cleanup standards (19 mg/kg for soil and 148 μ g/L for groundwater/surface water) were developed for the site. Based on the clean-up standards, the Wisconsin Department of Natural Resources (WDNR) identified three potential remedial options for the site: *in situ* solidification or stabilization, construction of a permeable reactive barrier (PRB), and mechanical removal of "hot spot" contamination. RMT, Inc. (RMT) was retained by the WDNR to evaluate these remedial options through treatability work and feasibility assessments.

1.2 Purpose and Scope

The project initially had the following objectives:

- To evaluate the effectiveness of various stabilizing agents and the feasibility of implementing *in situ* stabilization/solidification
- To evaluate the effectiveness of various adsorption agents and the feasibility of constructing a permeable reactive barrier (PRB)
- To evaluate dewatering options and the feasibility of mechanical source area excavation
- To evaluate the cost for the implementation of each remedial option or combination thereof

Following RMT's initial evaluation of possible treatment approaches and based on the results of the initial screening of the soil and groundwater in the marsh, the scope of the project was modified with concurrence from the WDNR. The modified scope, and that presented within this report, includes the following:

- Define the source area and prepare a conceptual fate and transport model for the site.
- Evaluate the effectiveness of various stabilizing agents for *in situ* stabilization/solidification of the marsh soil.
- Evaluate bioremediation of the marsh soil.
- Evaluate groundwater treatment options for the source area.
- Evaluate water treatment options for the slough water.
- Develop feasible conceptual remedial options for the source area, marsh soil, and slough water; and estimate the cost for each alternative.

RMT completed several rounds of sampling and a general evaluation of the fate and transport of arsenic in the marsh, which are described below.

2.1 Hydrogeologic Setting

The spill occurred along a railroad grade constructed through a marsh that is adjacent to the Kewaunee River, shown on Figure 1. The water table occurs at a depth of approximately 0 to 2 feet below ground surface (bgs) in a black organic peat that is 7 to 10 feet thick. The hydraulic conductivity of this unit ranges from 10⁻³ to 10⁻⁴ cm/s. Below the black organic peat is a unit of very dark-gray organic silt that has generally lower hydraulic conductivities ranging from 10⁻³ to 10⁻⁷ cm/s.

This portion of the marsh is located on the inside bend of an oxbow of the Kewaunee River, approximately 1 mile upstream from its mouth, where the river discharges to Lake Michigan. As a result, the water table is very flat and is controlled by the elevation of the Kewaunee River, which borders the marsh on three sides. Therefore, the groundwater flow velocity in the shallow peat is correspondingly low with an estimated range of 0.5 to 5 feet per year.

The marsh level is controlled, in part, by the level of Lake Michigan. The U.S. Army Corps of Engineers maintains monthly lake levels for the Great Lakes. Monthly data from their Web site (<u>www.lre.usace.mil</u>) and a hydrograph of the average lake level between 1945 and 2006 is presented in Appendix A. The surface elevation of Lake Michigan has varied by about 6 feet since the late 1940s when the spill is thought to have occurred. The average lake level was at about 579.5 feet above mean sea level between 1945 and 1950, going up to 581.5 feet in the early 1950s, and then back down to 580 feet in the late 1950s. The level has fluctuated since that time, and is currently at 577.5 feet. The variation in water levels means that mobile arsenic spilled in the marsh will have been spread out or moved into the river by the fluctuating water levels.

The annual precipitation at Kewaunee is 30.30 inches (<u>www.idcide.com/weather/wi/</u> <u>kewaunee.htm</u>). Open water evaporation for northern Wisconsin is about 28 inches per year (Linsley and Franzini, 1979; <u>http://wi.water.usgs.gov/pubs/FS-068-00/</u>, 2007). Transpiration (loss of water due to evaporation from plants) may increase the water loss from the marsh to the point where there should be no net loss of water from the marsh except due to high flow events

(Mitsch and Gosslink, 2000). During the summer, the groundwater levels indicate an inward flow of water from the river to the marsh, reflecting the loss due to evapotranspiration.

2.2 November 2005 Soil Sampling

2.2.1 Sample Collection and Compositional Analysis

A sampling plan was prepared and approved by both the WDNR and the USEPA for the collection of grab samples for use in the treatability studies. Sampling was conducted by RMT in November 2005, and the locations are shown on Figure 4. Sixteen samples were collected by hand from the top foot of material and placed in plastic buckets. Two samples were taken from underneath the cap by digging through the cap and taking a sample from the top 1 to 2 feet of material below the cap.

The samples were stored at 4°C until analysis. The workplan was approved in March 2006, at which time each sample was homogenized, and subsamples were sent to PACE Laboratories for compositional analysis. The laboratory reports are in Appendix B, and the results of the composition analysis are given in Table 1. The quality control checks for samples conducted by PACE Laboratories have been reviewed by RMT and are acceptable.

On the basis of the compositional analysis, two samples were prepared for use in the bench-scale treatability studies. One sample was of highly contaminated material (arsenic >1,000 mg/kg) and consisted of sample T-1. The second sample, the moderately contaminated material, was a composite of all samples with compositional arsenic values ranging from 200 mg/kg to 1,000 mg/kg, and consisted of equal weights (wet weight) of samples T-3, T-5, T-6, T-9, T-10, T-10A, T-10B, T-11, T-12, T-16, and T-17.

2.2.2 Leaching Analysis

Each of the samples collected in November 2005 was subjected to three leaching tests: a screening Toxicity Characteristic Leaching Procedure (TCLP), a screening Synthetic Precipitation Leaching Procedure (SPLP) using simulated eastern acid rain, and a screening SPLP using site groundwater. The groundwater was collected on June 16, 2006, from MW-20. Screening tests were used rather than the standard regulatory tests to facilitate analysis of a large number of options and to reduce the amount of solids and site groundwater needed for the testing.

The screening tests follow the standard USEPA protocols (TCLP-SW 846 Method 1311 and SPLP-SW 846 Method 1312), with the exceptions that the leaching solution is

analyzed directly after acidification, and smaller quantities of solid and leaching solution are used, while still maintaining the 1:20 solid to solution ratio. Test procedures are given in Appendix C. Previous tests have shown that the screening tests correlate well with standard leaching test results. The results of the leaching tests and pore water analyses are given in Table 2.

The correlation between compositional arsenic and screening TCLP for arsenic is shown on Figure 5. With the exception of the highest concentration point, there is almost no relationship between compositional and leachable arsenic. The same is true for the SPLP-east and SPLP-site-specific leaching test results, as well (Figure 6).

The pore water concentrations show a better correlation ($R^2 = 0.6$) with the SPLP concentration, especially the site-specific groundwater SPLP (Figure 7). The slope on the linear regression is 0.05, *i.e.*, the SPLP arsenic concentration is about one-twentieth of the pore water concentration, which is the same as the one-to-twenty dilution used in the SPLP test. This trend suggests that the dissolved arsenic present in the leachate from the leaching test is primarily diluted pore-water arsenic, and is not leaching from the solid material.

Another indication that the arsenic in the leaching tests comes primarily from the dissolved arsenic in the pore water comes from a series of tests using an SPLP (east) test protocol, with varying solid-liquid ratios, ranging from 1:1 to 1:80, and using the moderately contaminated composite sample as the solid material. Results of the tests using different solid-liquid ratios are shown on Figure 8. The linear relationship between the amount of solid used in the leaching test and the resultant arsenic concentration in the leachate supports the idea that there is a soluble fraction of arsenic in the marsh material, which controls the concentration in the leaching test. Only 5 percent of the arsenic present in the leachate can be attributed to leaching; therefore, 95 percent of the arsenic in the sample is not leachable in the SPLP test, and may not be modeled in the treatability studies.

If so, this has important implications for the treatment of the marsh. If the bulk of the arsenic is tied up in an insoluble form that is permanently bound, then treatment of just the pore water is sufficient. However, if the arsenic is bound in the organic matter in the marsh material, and if this arsenic is released over time as the organic matter is decomposed, then treatment of the arsenic in the pore water will not result in long-term site stabilization. During the bioreduction studies discussed in Subsection 3.1.3, up to 40 percent reduction in the total arsenic in the marsh material was observed. This is much greater than the amount of arsenic present in the pore water (roughly 1 percent of the total arsenic over most of the contaminated area), indicating that the solid-bound

arsenic is being solubilized and then lost from the sample. Treatment of the arsenic dissolved in the pore water will not provide long-term site stabilization because the arsenic in the organic matter is released when the organic matter decomposes.

If arsenic stabilization were to be used, then a target concentration for the leaching tests is needed for evaluating successful treatment. Since the target arsenic concentration for groundwater is 148 μ g/L, and the leaching tests essentially dilute the sample pore water by a factor of 20, the target arsenic concentration for successful treatment is in an SPLP (east or site groundwater) is 7.4 μ g/L.

2.3 June 2006 Soil Sampling (Cap Area)

The highest arsenic concentration observed during the November 2005 sampling event was 2,500 mg/kg in sample T-1. This is considerably below the concentration detected in the same area during the 1994 sampling event (10,700 mg/kg), and in general, the arsenic concentrations in the samples collected in November 2005 were lower than samples collected previously at the same approximate locations. Whether these lower numbers reflect simple soil heterogeneity or a real decrease in arsenic concentrations could not be determined without collecting and analyzing additional samples. In addition, only 1.7 mg/L arsenic leached from sample T-1 in the screening TCLP test, which is nonhazardous (<5,000 μ g/L). Since part of the treatability study was aimed at evaluating methods to render marsh material that leached arsenic to nonhazardous levels, additional sampling of the marsh soil with high arsenic concentrations was warranted to confirm the current arsenic concentrations at the site.

Additional soil samples were collected in June 2006 from under the cap area. These samples were taken from locations under the cap that had been previously sampled in order to compare the trends in the concentration of arsenic over time in the marsh (Figure 9). The samples were collected using a Geoprobe, and the borehole abandonment forms are included in Appendix D. The laboratory reports from Pace Laboratories are given in Appendix B, the compositional analysis results of the June 16, 2006, sampling are given in Table 3. The results show that the concentration of arsenic has generally decreased by a factor of 3 to 4 under the cap between 1994 and 2005/2006.

2.4 April 2007 Groundwater Sampling (Source Area)

The high, and relatively isolated, arsenic concentration in the groundwater at MW04-10 suggested that MW04-10 was located in, or close to, the source area for arsenic. Previously, STS collected two soil samples from the area immediately under the railroad tracks (SB02-17 and SB02-18). SB02-18, immediately west of MW04-10, had arsenic concentrations between 1,800 and 6,520 mg/kg, which are similar to the concentrations observed in the most contaminated

area under the cap. SB02-17 had very low arsenic concentrations. These results further indicated that there may be an area of high arsenic concentrations in the area under the railroad tracks in the vicinity of MW04-10. The arsenic concentrations in the groundwater at MW04-10, in the 1,000,000 to 2,000,000 μ g/L range, are sufficiently elevated so as to suggest that this arsenic is a residual of the original spill, and has remained in the dissolved state for the decades since the spill. Based on the available data, it was hypothesized that the dissolved-phase material is acting as the ongoing source area for arsenic at the site.

In order to confirm the hypothesis discussed above, and to delineate the extent of the proposed source area, groundwater samples were collected from the area near MW04-10 on April 3, 2007. A Geoprobe® was used to install 22 borings, and groundwater was collected from 21 of these borings using temporary well points. The locations of the borings are shown on Figure 10 and the borehole abandonment forms are included in Appendix D. Groundwater profiling was completed in 3-foot intervals in the top 24 feet of the saturated zone in boring T2-0, and one groundwater sample was collected from the upper 5 feet of the aquifer in the remaining borings.

The arsenic concentrations measured in the groundwater are summarized in Table 4 and are shown on Figure 10. The results show that there is an area of high arsenic levels (>100,000 μ g/L) in the groundwater under the railroad tracks, near MW04-10, which is the source area for the site. The source area (>100,000 μ g/L) encompasses the entire 20-foot width of the railroad bed and extends approximately 30 feet east from the railroad bed, while the lateral extent is approximately 70 feet long and centered on MW04-10. The persistence of such high arsenic concentrations in the source area since the presumed spill indicates that the groundwater flows at extremely slow rates from this location. It is likely that a low-permeability soil layer surrounds the railroad ballast, resulting in low flow under normal conditions. Surges of arsenic may be allowed to overflow the low-permeability layer and enter the marsh under high water conditions.

Several cation concentrations (calcium, iron, magnesium, and sodium) were also measured in the groundwater, to determine if the arsenic is associated with a counter ion. The concentrations are summarized in Table 4, and plotted versus arsenic concentrations on Figure 11. Arsenic and calcium/magnesium are linearly related, whereas the other cations (especially sodium) have no correlation with the arsenic concentrations. When plotted according to the charge contributed to the water (as mequivalents/L), arsenic is related in a 1:1 relationship with the sum of calcium and magnesium (Figure 12). This suggests that the original spill was of calcium/magnesium arsenate or arsenite (both were used as pesticides). In all likelihood, the original material was a neutral calcium/magnesium arsenate, since the arsenic

at the site is predominantly arsenate, and it is highly unlikely that arsenite would have oxidized to arsenate in reducing conditions at the marsh.

2.5 Conceptual Model of Advective Transport

As described in the Site Assessment and Remedial Alternatives Report (STS, 2004), groundwater flow, alone, does not explain the transport of arsenic from the likely spill area to a distance of over 1,000 feet to the east. Therefore, RMT developed a conceptual model to describe the fate and transport of the arsenic at the site. This model assumes that infiltration and overland surface flow of dissolved phase arsenic are the primary transport mechanisms at the site. The original spill of arsenate was likely as a solid. This solid remained on the ground surface of the railroad embankment until it was dissolved by rain or melting snow. A portion of the arsenate solution infiltrated into the groundwater in the railroad ballast beneath the spill, which accounts for the residual source area of dissolved-phased arsenic described in Subsection 2.4. The rest of the dissolved-phase arsenic was carried across the marsh via overland flow, which accounts for the historical area of distressed vegetation. Once spread across the marsh, the impacted surface water seeped into the shallow water table and was incorporated into the marsh solids and vegetation. In the groundwater, arsenic transport has been limited to slow groundwater migration and to events (i.e., spring snow melt with high river elevation) where overland surface flow would mix with impacted groundwater and organic material and leave the site through a surface water pathway (e.g., the sloughs).

The arsenic in the groundwater and surface water at the site persists likely as a result of the residual source area, the low groundwater flow rate, and the fact that a large portion of the arsenic that was spread across the marsh is now associated with the organic matter in the soil retained in an aerobic layer at the surface of the marsh (described in Subsection 2.2.2).

3.1 Marsh Soil Treatability Studies

The residual arsenic in the upper 2 feet of soil at the marsh requires remediation in order to achieve the cleanup criterion for the site. The following three potential alternatives were considered for the marsh soil:

- 1. Excavation and disposal
- 2. In situ stabilization
- 3. Bioremediation

Laboratory-based treatability studies were completed in order to better evaluate *in situ* treatment and the bioremediation as remedial options. These studies are discussed below following a brief discussion on arsenic environmental chemistry.

3.1.1 Arsenic Environmental Chemistry

Treating the arsenic-contaminated marsh materials involves converting the arsenic to a form that is stable (i.e., nonleachable) in the environment, or reducing the concentration of arsenic to levels that do not pose a threat to human health or the environment. Such treatment involves manipulating the form of the arsenic and the leaching environment to which the arsenic is exposed in order to minimize the leaching potential for the contaminant. An understanding of the environmental chemistry of arsenic is crucial for developing successful treatment approaches. The discussion below is a very brief summary of the applicable portions of the geochemistry of arsenic relevant to the marsh environment.

Arsenic exists in four oxidation states in the environment: -III (arsine), 0 (element), +III (arsenite), and +V (arsenate). Of these, the +III and +V states are by far the most prevalent. The -III oxidation state is found only under very reducing conditions. If the redox potential is in the range where sulfate is reduced to sulfide, or organic matter converted to methane, arsenic can be reduced to the arsine form. This is generally present as H₃As, a gas. Under oxic conditions (where oxygen or air is present), arsenate is the stable form, while under mildly reducing conditions, arsenite is stable. Microorganisms are capable of methylating arsenic to form the methylated arsenates or arsenites. Figure 13 shows the transformations of arsenic in the soil environment.

Arsenate is chemically similar to phosphate, and occurs in a variety of protonation states $-H_3AsO_4$, H_2AsO_4 , $HAsO_4^{2-}$, and AsO_4^{3-} . In the pH range common in the marsh environment (from slightly acidic to slightly basic), $H_2AsO_4^{-}$ and $HAsO_4^{2-}$ are the predominant forms. Arsenate forms very insoluble compounds with several common cations, most notably iron. Arsenate is also very strongly adsorbed on iron oxides or hydroxides, and on several other common metal oxides or hydroxides (e.g., MnO₂, Al(OH)₃). Such adsorption is pH dependent, with the strongest adsorption in the mildly acidic pH range (3 to 6).

Arsenite, which is found under mildly reducing conditions, occurs in either the acid form ($H_3A_sO_3$) or as the monoanion ($H_2A_sO_3$). The conversion from the acid to the anion occurs at a pH of around 9, which means that in neutral to slightly acidic conditions such as are common in a marsh, arsenite occurs in the uncharged acid form. Arsenite is often considered to be more mobile in the environment than arsenate, since the common understanding is that it is less strongly adsorbed on iron hydroxide than arsenate. However, the pH dependence of arsenite adsorption is quite different from that of arsenate, with the maximum adsorption for arsenite occurring at around the pKa of 9.2 (pH at which the acid form is half dissociated). At more acidic and more basic pH values, arsenite adsorption goes down. At slightly acidic pH values (<7), arsenate is much more strongly adsorbed than arsenite. In contrast, at slightly basic pH values (8-10), arsenite is the more strongly adsorbed species. However, under the slightly reducing conditions at which arsenite is stable, ferric iron is reduced to ferrous iron. Since ferric hydroxides are major adsorbents for arsenic species, arsenic is more mobile under slightly reducing conditions than under oxidizing conditions. The release of arsenic under mildly reducing conditions (under which arsenite is the stable form) as ferric hydroxides are reduced may give rise to the popular impression that arsenite is the more mobile form.

3.1.2 Stabilization

The purpose of the stabilization studies was to evaluate different additives that could be used to chemically or physically stabilize arsenic in the marsh material, and consequently reduce the soluble arsenic concentration (and presumably bioavailability). The bench-scale studies evaluated different additives and different doses of the additives, and the effects these had on stabilizing the arsenic in the high arsenic and moderate arsenic composite samples collected in November 2005. Treatment effectiveness was evaluated using the screening leaching tests, including the TCLP and two SPLP tests using simulated eastern rainfall and site groundwater, as described in Subsection 2.2.2. The following additives were tested:

- $Al(OH)_3 Fe_2 (SO_4)_3$
- Fe₂O₃
- Al₂ (SO₄)₃
- Al₂ (SO₄)₃ + CaCO₃

- Fe₂ (SO₄)₃ + CaCO₃
- Pyrite (FeS₂)Cement
- Metallic iron (Fe) Arsenic adsorbent (Anderson)
- Iron foundry byproducts

The tests were run by introducing a specific amount of additive to the sample, allowing the sample to react for several hours (approximately 4), then running the three leaching tests on the treated sample. For cement-treated samples, the treated samples were allowed to set for 1 week prior to testing. The cemented material was broken into pieces (approximately ³/₄ inches in diameter, according to the leaching test protocol) before leaching analysis. Also, some additives (Fe, pyrite) were tested at both 4 hours and after 1 week reaction time to monitor the effect of time on treatment effectiveness. In addition, five replicates of each untreated composite were analyzed throughout the testing, and the mean value from the tests was used for comparison.

The results of the testing are summarized in Table 5. The results from the test using SPLP site-specific groundwater are presented graphically on Figures 14 and 15, for the high and moderate arsenic samples, respectively. The additives can be grouped based on their effectiveness (i.e., reduction in SPLP leachable arsenic), as follows:

- Little or no effectiveness (arsenic reduction of less than 20%) Al(OH)₃, pyrite
- Moderate effectiveness (arsenic reduction of 50 to 80%) Al₂ (SO₄)₃, Fe₂ (SO₄)₃, Fe₂O₃, foundry byproducts, Anderson arsenic adsorbent
- Good effectiveness (arsenic reduction of >90%) Fe₂(SO₄)₃ + CaCO₃, Fe, cement

Al(OH)₃ and pyrite had little consistent reduction on leachable arsenic in the SPLP, suggesting that sorption on the aluminum hydroxide or pyrite surface was not strong enough to lower arsenic concentrations. It should be noted that, originally, sodium sulfide (Na₂S) was also going to be tested. However, strong hydrogen sulfide (H₂S) odors were encountered during sample preparation. Because H₂S is highly toxic, further testing was not conducted because of the health and safety concerns associated with the use of the material in the field.

Several of the additives reduce arsenic by between 50 and 80 percent at one or more of the doses tested, including Al_2 (SO₄)₃, Fe₂ (SO₄)₃, and Fe₂O₃. The reduction indicates that the chemistries are moderately effective, but are not as effective as the last set.

The third group of additives reduced arsenic concentrations in the tests by greater than 90 percent. These include metallic iron, ferric sulfate plus calcium carbonate, and cement.

Metallic iron may work via one (or more) of several mechanisms. Iron is a strong reducing agent and could reduce arsenic to arsenic metal or arsenic gas. Both are relatively insoluble and would not leach (arsenic gas would be lost from the test). Iron will also reduce sulfur species to sulfide, which could precipitate arsenic as an arsenic sulfide. Iron addition reduced arsenic concentrations to relatively low values (in some cases <6 μ g/L), although there is some scatter in the data. Iron is commonly used in reactive barrier walls to remove chlorinated solvents. An added advantage is that metallic iron works in an anaerobic environment, and so would be effective in the marsh subsurface. It would not be effective in a reactive barrier wall that is exposed to air or oxygenated water since the iron would quickly oxidize and lose its treatment effectiveness.

The combination of ferris sulfate and calcium carbonate was also effective in lowering arsenic concentrations and was more effective in the TCLP or SPLP-East tests than in the SPLP-Site tests. Ferric sulfate acts as both a precipitant and as an adsorbant; the calcium carbonate (limestone) serves to neutralize the acid generated from the iron hydrolysis. It is well known that arsenate and arsenite are strongly adsorbed on iron hydroxide (Pierce and Moore, 1982; Sun and Doner, 1996; and Jain et al., 1999). Forming the iron hydroxide *in situ* provides a very high surface area solid on which the adsorption can occur.

Under certain conditions, iron hydroxide will be reduced to ferrous iron, which releases any arsenic associated with the solid. Thus, ferric sulfate treatment will be effective only as long as the sample remains oxic (at the surface of the marsh or in the aerated section of a reactive barrier wall).

Cement was also effective in reducing arsenic concentrations. Cement physically traps arsenic in the cement matrix and prevents contact between the marsh water and the solids. The high calcium content of cement may also precipitate arsenic as calcium arsenate. Cement treatment should be relatively permanent as long as the cement remains intact. Normally, cement is used to form a large monolith. However, the cement marsh material mixture can also be formed into smaller pieces that can still reduce arsenic leaching. The smaller pieces would have two advantages over a large block. They would have less effect on the local groundwater flow, and the pieces would tend to sink over time, removing the material from contact with the surface water.

As discussed in Subsection 2.2.2, the majority of arsenic in the marsh is insoluble and non-leachable. Therefore, although some stabilization additives have been evaluated as effective, they are likely only controlling the soluble arsenic and will have little effect on solid-bound arsenic at the site. Given the low mineral content of the marsh material, the arsenic is likely tied up in an organic form which is slowly released to a soluable form as the organics decompose. If *in situ* stabilization was selected as a remedial option at the site, it would require that a stabilization agent be continuously applied to the marsh for decades as the arsenic is slowly released from the organic matter. On the basis of this interpretation from the results of the leaching test and the stabilization treatability tests, *in situ* stabilization, although effective, is not a feasible approach to remediating the marsh, and further evaluation of *in situ* stabilization is therefore not recommended. Consequently, further consideration of this alternative and a cost for this option was not prepared for this report.

3.1.3 Bioreductants

Arsenic can be converted to a volatile form (either arsine or methyl arsines) under very reducing conditions. Such conditions are found in marshes. If this natural process could be enhanced, it might be possible to eliminate arsenic from the marsh by converting arsenic to a gaseous form that would volatilize from the marsh.

Marshes are known to be major producers of methane, and arsines can be generated under the highly reducing conditions required for methane generation. One laboratory study showed that methane-generating bacteria can convert arsenate and arsenite to arsine gas from arsenic-contaminated soil, although in their study, only a small fraction of the arsenic in the soil was volatilized (Bachofen, *et al.* 1995).

The confinement of the arsenic to the top 2 feet of the marsh raises the question as to why the arsenic is not more uniformly distributed throughout the marsh, particularly into the deeper sediment. Arsenic would be expected to move throughout the site with the groundwater and infiltrate into the deep soil over time. The confinement of the arsenic to the top 2 feet of the marsh suggests a chemical, biological, or physical process is controlling the arsenic distribution at the site.

3.1.3.1 Site Arsenic Concentrations Over Time

Samples have been taken of the marsh material during three different time periods (1994-1996, 2002, 2004-2006) and appear to show a general decrease in arsenic concentration through time. However, there is considerable heterogeneity in the arsenic distribution in the marsh, such that two samples taken in the same area may have different arsenic concentrations. In order to evaluate whether there has been an overall decrease in the arsenic concentration in the marsh, all of the sampling points for which samples have been taken in the different time intervals were combined and the total arsenic mass represented by those samples was compared. The change in arsenic concentrations in the marsh material between the different sampling dates was made by estimating the concentration in the area around each sampling location on the different sampling periods. This approach assumes that the local heterogeneity effects are eliminated by using a larger number of sample locations. This approach does not estimate the total mass of arsenic in the marsh, but rather the mass of arsenic in the sample areas. The mass estimates represent only a fraction of the total arsenic in the marsh and were only used to compare the relative change in mass during the period between 1995 and 2006.

The mass of arsenic in the sampled area of the marsh, outside of the cap, was estimated for the soil samples collected in 1995, 2002, and 2005/6. The results are presented on Figures 16 and 17. The calculations indicated that there was a 56 percent decrease in arsenic mass between 1995 and 2002, and a further 4 percent between 2002 and 2004/5, for a total decrease of 60 percent between 1995 and 2005, or approximately 5,000 kg. This compares well with the measured decrease in concentrations of the marsh material under the cap of 61 percent, and summarized in Table 3. This analysis shows that there has been a significant decrease in the mass of arsenic in the marsh over the period of study (1995-2006), but it cannot be used to estimate the overall rate of decay since the presumed spill, or the total mass of arsenic in the marsh historically or currently. It is also unclear whether the decrease is linear or exponential with time.

STS had also estimated that between 1 and 5 pounds (0.5 to 2.5 kg) of arsenic are lost per year (for the year analyzed – 2005). STS attributed this loss to flow through the sloughs (STS Addendum, 2006). However, the amount lost from the marsh used in the mass lost estimation for 1995-2002 was 5,000 kg, whereas only 25 kg of arsenic could be accounted for by loss through the slough flow. Although both numbers are subject to large uncertainties, the magnitude of the

difference in the mass loss as calculated by RMT and by STS indicates that there has been a major loss of arsenic from the marsh through a route other than flow to the river. Since groundwater movement is negligible, the most likely other route of loss is volatilization.

3.1.3.2 Laboratory Bioreduction Studies

To evaluate the volatilization of arsenic at the site, RMT completed two benchscale bioreductant experiments. Strong bioreductants were added to the marsh material to stimulate and enhance methane formation and arsine generation in both experiments.

Bioreductant Test 1 - The first experiment tested the concept of creating very reducing conditions in the marsh material to enhance arsine production and loss using a known methane-generating material as the bioreductant, cow manure. Samples of the moderate arsenic composite sample were mixed with different amounts of a bioreductant (5, 10, and 25 percent on a wet-weight basis) placed in anaerobic gas generation vessels, and the gas generation was monitored over time. Samples of the material were taken after 2 weeks and 6 weeks reaction time for analysis of both compositional and leachable arsenic.

The sample generated considerable amounts of gas (presumably methane) over the duration of the experiment, with the amount of gas proportional to the amount of manure added (Figure 18). This indicates that under the proper conditions, the marsh material-bioreductant mix can generate methane.

The results of the compositional and leaching analysis on the original material and after two months biodegradation are summarized in Table 6. Compositional arsenic was reduced from 803 mg/kg to 453 mg/kg in the 25 percent bioreductant sample, or a reduction of 25 percent after accounting for dilution due to the bioreductant. Pore water arsenic concentrations actually increased with increasing bioreductant use, indicating that the loss was from the solid-bound arsenic and not due simply to loss from pore water. **Bioreductant Test 2** - A second bioreductant experiment was conducted using a variety of bioreductants, as follows:

- Cow manure (25%)
- Whey wastewater from cheese manufacturing⁽¹⁾ (25%)
- Wastewater treatment sludge from cheese manufacturing⁽¹⁾ (25%)
- _ Lactate (2,500 mg/L)
- Sugar (2,500 mg/L)
- Ethanol (2,500 mg/L)

In each case, 50 mL of solution or 50 g of slurry were added to 200 g of the moderately contaminated sample of marsh material, to give the same final volume in the test. The experiment was run for 75 days.

Gas generation results are shown on Figure 19 and summarized in Table 7. Gas generation was considerably more variable than in the first experiment, and achieved much lower gas generation rates. For the sugar-treated sample, the gas volumes fluctuated during the experiment—first increasing, then decreasing—indicating that the sample was re-adsorbing the gas it had previously generated. The ethanol-treated sample required 50 days before gas generation started. The variability in gas generation rates and lag times may reflect the sensitivity of the methane-generating bacteria to the precise conditions in the experiment.

Arsenic concentrations were significantly reduced in the test samples. Arsenic concentrations were reduced by between 20 and 40 percent of the original value. Cow manure and sugar were the most effective additives at reducing arsenic concentrations, and the cheese manufacturing wastewater solids were the least effective; however, even the untreated sample lost 20 percent of the original arsenic when placed under anaerobic conditions. The results show clearly that, under anaerobic conditions, arsenic is lost from the marsh, and that the addition of bioreductants can enhance this loss. The variability of the results, both in gas generation and in arsenic loss, makes it difficult to reliably rank the bioreductants as to effectiveness. The choice of bioreductant to be used (if any) depends on ease of application, availability, price, public

⁽¹⁾ Cheese manufacturing waste products were supplied by Trega Foods, Luxemburg, Wisconsin. Their cooperation was greatly appreciated.

perception, and the results of field-scale studies that are discussed in the cost section of this report.

These results are consistent with the field observations of the decrease in arsenic concentrations over time, and the relative persistence of arsenic in the upper foot of the marsh. Cattails will transfer oxygen to the roots and create an aerobic zone around the roots (Mitsch and Gosselink, 2000). Under the aerobic conditions, arsenic will not be reduced to arsine gas and remains in the marsh material. In order to create the reducing conditions required for arsine generation in the upper foot of the marsh, the influx of oxygen into the root zone needs to be disrupted by removing the cattails during the duration of the marsh treatment until arsenic is reduced to acceptable levels.

One concern about bioreduction is that the arsenic is converted to a highly toxic form—arsine gas—which is being released into the environment. (The air quality standard [TLV®-TWA] for arsine is 0.050 ppm-V.) However, the rate of arsine generation through bioreduction at the marsh is relatively slow, resulting in a low concentration. Given the remote nature of the site, the mixing ratios of the generated gas and air would be expected to be more than sufficient in the marsh setting, to lower the concentrations of arsine gas at the site to well below the TLV.

3.2 Source Area Treatability Study

The April 2007, sampling under the railroad tracks identified the residual source area of arsenic contamination in the marsh, as described in Subsection 2.4. The arsenic in the source area is primarily dissolved in the groundwater, and the source area groundwater must be remediated in order to meet the cleanup criterion for the marsh. The following three alternatives were considered for the source area remediation:

- 1. Pump and treat the contaminated groundwater on-site.
- 2. Treat the source area groundwater *in situ*.
- 3. Pump and dispose of the contaminated groundwater off-site.

A laboratory treatability study was performed to evaluate treatment options that could be applied to Alternatives 1 or 2. The main objective of the study was to develop a treatment approach that would reduce the arsenic concentrations to below the cleanup criterion, and render any solids generated in the treatment process as nonhazardous. The procedure and the results of the groundwater treatment study are discussed below.

3.2.1 Testing Procedure and Results

An unpreserved sample of groundwater from MW04-10, collected by Ms. Annette Weissbach of the WDNR, was provided to RMT for the treatment study. There are several approaches that could be used for treating the water, but with arsenic concentrations in the millions of microgram-per-liter range, precipitation is a reasonable approach. Arsenate forms precipitates with several common cations. Initial tests showed that the arsenic in the water from MW04-10 would form precipitates with ferrous and ferric iron, calcium, copper, and magnesium. Tests were run using both ferrous and ferric iron to remove arsenic, and the results are summarized in Table 8.

The addition of either ferrous or ferric iron precipitated arsenic (presumably ferrous and ferric arsenate, respectively). Ferric iron is clearly more effective at reducing arsenic concentrations. Ferric iron is commonly used to remove arsenate from solution (either through precipitation or sorption), and is readily available and inexpensive. Therefore, further tests were run using ferric iron (as ferric sulfate) to remove arsenic from the contaminated water from MW04-10.

Note that ferric iron is a moderately strong acid, and an alkaline material needs to be introduced to neutralize the acid that is generated. The next test involved higher doses of both ferrous and ferric iron, with pH adjustment to bring the pH back to the neutral range (pH 6-8). Arsenic concentrations were measured both before and after pH adjustment of the iron-treated solution.

Ferric iron is able to reduce arsenic concentrations to low levels. The next step is to determine the optimum pH for arsenic removal. This was done by forming the ferric arsenate, dividing the ferric arsenate into several aliquots, adjusting the pH to different values with a base (magnesium oxide), and measuring the dissolved arsenic concentration after filtration. The results are given in Table 10. Ferric iron can reduce arsenic to low levels even at acidic pH values. However, once the pH is above 5, the concentrations were not reduced with increasing pH values.

The next step was to try a two-step ferric iron addition, in an attempt to remove the bulk of arsenic as ferric arsenate, with the residual removed as adsorbed arsenate. In addition, the solids were removed and subjected to both compositional metals analysis and TCLP tests (Table 11).

The results show that treatment with ferric iron can reduce arsenic to low levels if done in a two-step process, and that the solids resulting from the first step are slightly above the hazardous criterion for arsenic. The next step is to see if a single addition of ferric iron at a higher dose can both reduce arsenic levels to low values and generate a nonhazardous sludge. Three different doses of ferric iron were added, along with sufficient magnesium (Mg(OH)²) to neutralize the acid generated from the ferric iron precipitate. The results are presented in Table 12.

The results demonstrate that higher doses of ferric iron can reduce arsenic to low levels (~50 μ g/L), while at the same time generating a nonhazardous sludge. The next step is to optimize the conditions by evaluating the influence of pH and iron dose on the final dissolved arsenic concentration.

A new sample of contaminated water from MW 04-10 was collected on April 3, 2007, and was used for the remaining testing. Five doses of ferric iron were added to the sample, the solids were allowed to form, and the slurries were then divided into several smaller aliquots. The pH values of the aliquots were adjusted to different values, the solids were allowed to equilibrate for several days, and the samples were then filtered, with the filtrate being analyzed for pH and arsenic concentration. The results are given in Table 13 and shown on Figure 20.

The results demonstrate that arsenic reduction depends, in part, on ferric iron dose and on pH. Iron doses of greater than 0.20 M reduce arsenic to low levels (low part per million range) over the neutral pH range. The results also demonstrate that calcium carbonate (CaCO₃) brings the pH to the mid-5s, but does not raise the pH to the higher values needed to reduce arsenic to below part per million levels.

TCLP tests were run on four of the solids generated from the iron dose experiments. The results, given in Table 14, demonstrate that the iron effectively immobilizes arsenic so that the solids are not hazardous.

The inability of the higher iron doses to reduce arsenic concentrations to below $1,000 \ \mu g/L$ suggests that some of the arsenic in the new sample may still be in the arsenite (As(III)) form. The next test evaluated whether adding hydrogen peroxide (H₂O₂), either in a single-step or dual step treatment, would improve treatment, and whether use of magnesium oxide (MgO) to raise the pH to higher values could improve treatment. The results are given in Table 15.

These results show that a single-step iron addition with initial peroxide treatment to convert any arsenite to arsenate can effectively lower arsenic to low levels (<130 μ g/L). The next test was to evaluate the effect of different peroxide dosages on treatment effectiveness (Table 16). These results show that the lowest dosage of peroxide will oxidize the arsenite to the point where it is removed from solution.

3.2.2 Conclusions and Confirmation Testing

The results of the testing on the contaminated groundwater from MW04-10 have shown that arsenic can be removed from the groundwater to meet the cleanup criterion for the site using the following steps:

- 1. Add 2.5 mL 30% hydrogen peroxide per liter of water.
- 2. Add 0.30 M ferric iron and $+ 60 \text{ g/L CaCO}_3$.
- 3. Remove the solids from solution by settling or filtration.

A larger-scale test of the treatment process was run to confirm the results, and to generate samples for confirmatory laboratory analysis. One liter of the MW04-10 groundwater was mixed with the reagents given above. The sample was allowed to react overnight, and filtrate and solids were then analyzed for arsenic. In addition, the mass of solids generated and the toxicity of the solids (TCLP test for arsenic) were measured. The results are summarized in Table 17.

The treatment results in arsenic concentrations in the treated water of less than $11 \mu g/L$ and solids that are nonhazardous. However, it should be noted that the solids are a mixture of ferric arsenate and arsenate adsorbed on ferric hydroxide. Even though they are nonhazardous, they will still need to be disposed off-site in a manner that protects the environment.

Further lowering of arsenic concentrations can be done, if needed, by the addition of a second, smaller (0.05 M) dose of ferric iron, with additional CaCO₃ or MgO to bring the pH to neutral. This polishing step is recommended if the water is to be released outside of the treatment area in the marsh.

3.3 Slough Water Treatability Studies

The water draining from the marsh to the Kewaunee River through the two sloughs (north and south) has concentrations of arsenic over 1,000 μ g/L. The WDNR has requested that remedial alternatives be evaluated to reduce the concentration of arsenic reaching the Kewaunee River. The following three approaches were considered for the slough water remediation:

- 1. Contain and treat the slough water on-site.
- 2. Construct a permeable reactive barrier (PRB).
- 3. Construct an impermeable barrier.

A laboratory-based treatability study was completed for the on-site treatment alternative, and a conceptual evaluation of the permeable reactive barrier was completed in order to better

evaluate these remedial options. The results of the study and evaluation are summarized in the subsections that follow.

3.3.1 Slough Water Treatment

A common method to remove high levels of arsenic from water is to use adsorption on ferric hydroxide, similar to the concept used in the second iron addition discussed in Subsection 3.2.1. Therefore, experiments were conducted using ferric iron addition along with limestone for neutralization. Three doses of iron were added to a grab sample of south slough water collected on April 3, 2007. In addition, 0.5 g/L CaCO₃ was added for pH control. pH was measured after both iron and limestone addition, while arsenic was measured after the CaCO₃ addition step. The results are presented in Table 18.

The results show that arsenic concentrations can be lowered to low levels using ferric iron addition, with neutralization. Collected surface water could be treated using the following:

- 1. Addition of 0.002 M ferric iron and 0.5 g/L CaCO₃
- 2. Filtration of the resultant solids
- 3. Discharge of the treated water back to the marsh or river

3.3.2 Permeable Reactive Barrier Wall

One method for removing contaminants from groundwater is a permeable reactive barrier (PRB) wall, in which the contaminated groundwater moves through a wall of material that chemically removes the contaminants of concern from the groundwater. The concept has frequently been used for chlorinated solvents in groundwater, often using finely divided metallic iron as the reactive material. The concept has appeal for use in the marsh to remove arsenic from the slough water before it enters the river since PRBs are passive, simple in concept, and a number of additives are available, such as those additives identified as having "good effectiveness" in the stabilization treatability studies discussed in Subsection 3.1.2. However, a preliminary and conceptual valuation of the PRB option for the marsh indicated that the PRB is not a feasible option for the marsh, and further evaluation and treatability testing of the PRB was not completed. A justification for eliminating the PRB as a remedial alternative is presented below.

Varying redox conditions in the marsh. In typical PRB applications, the groundwater has a consistent redox status over time. In contrast, the redox conditions in the marsh vary during the year between anaerobic and aerobic. Therefore, a treatment process would need to be designed for both anaerobic and

aerobic conditions. During the *in situ* treatment testing, additives that would be effective under aerobic conditions (ferric sulfate plus calcium carbonate) and others that would be effective under anaerobic conditions (metallic iron) were identified. However, the additives intended to work under both sets of conditions (e.g., aluminum oxide) were not effective at reducing arsenic concentrations in the leaching tests. Therefore, finding a treatment additive that would be effective in a reactive barrier wall under both the aerobic and anaerobic conditions would be difficult.

- Biological growth on barrier wall material. The high biological activity in a marsh, as compared to a typical groundwater setting, would limit the effectiveness of the PRB over an extended period of time. The treatment solids may become covered with biological growth (bacteria, algae, plants) and lose reactivity.
- Flow variation. Groundwater flows are slow and relatively uniform, providing a relatively long contact time between the water and the reactants in the PRB. In contrast, much of the arsenic transport out of the marsh occurs during high flow events (storms or spring runoff), with the arsenic both in dissolved and particulate form. Designing a system that could trap the arsenic in the short residence time that the rapidly moving water would be in contact with the PRB would be difficult.

Section 4 Cost Estimates

Remedial action is required to address the arsenic contamination in the source area groundwater, marsh soil, and slough water entering the Kewaunee River, in order to meet the cleanup criterion for the site. The *in situ* stabilization alternative for the marsh soil and the PRB alternative for the slough water were eliminated as feasible options for the site based on the information provided in Section 3. Conceptual and feasible implementation approaches were developed for other remedial alternatives for each area of the marsh, and cost estimates were prepared for each option. The results of the treatability studies were used to develop the costs for those options that required treatability testing.

The estimated costs for each option, and the assumptions used to develop the costs, including long-term monitoring requirements, are summarized in Tables 19 and 20. In addition, the detailed cost-estimating spreadsheets are presented in Appendix E. The cost for each alternative is presented as a stand-alone cost; however, the selection of a combination of options that will treat the source area, marsh soil, and slough water is recommended to meet the cleanup objectives for the marsh. The costs presented in this report are based on preliminary concepts for comparative purposes only, and are not for budgetary purposes. The costs represent the best judgment of cost based on the conceptual approach described herein for each option; however, the range in cost may vary from -30 to +50 percent of the best judgment value. These costs are not intended to be used without the descriptions, assumptions, and uncertainties described in Table 19.

A general outline of each alternative is shown on Figure 21. The conceptual model, along with key constructability issues, for each alternative are presented below.

4.1 Source Area

In order to meet the clean-up criteria for the marsh, the on-going source of arsenic contamination to the marsh must be remediated. The arsenic in the source area is primarily in the dissolved phase and contained within the railroad ballast. Approximately 42,000 gallons of contaminated groundwater are assumed to comprise the source area based on the 50-foot by 70-foot area defined in Subsection 2.4, an estimated depth of 4 feet of saturated material, and a porosity of 40 percent. In order to eliminate the on-going source, the source area groundwater must be removed, or the arsenic in the groundwater must be immobilized. Three different source area remediation alternatives were evaluated.

- 1. **Pump and dispose off-site** This alternative would accomplish direct removal of the soluble arsenic in the source area. A groundwater extraction well would be constructed in the source area, and groundwater pumped, and contained in batches on-site. The flow rate achieved from the extraction well has been assumed to be 0.5 gpm; however the specific flow rate and capture zone from the well would need to be based on in-field pump tests. Additional wells may be needed to capture the entire source area. The extracted groundwater would be contained in a 5,000-gallon holding tank housed inside the fence near the source area. When the holding tank is full, the pumping would be temporarily stopped until the groundwater could be pumped from the holding tank into a tanker truck and disposed off-site as a hazardous waste. Once the holding tank is emptied, pumping would resume. The process would be simple to control and power would be provided by a portable generator, and would continue until the highly contaminated water from the source area had been removed. RMT estimates that this would take up to 3 months to complete.
- **Pump and treat on-site** This alterative would immobilize the arsenic in the groundwater. 2. A groundwater extraction well would be constructed in the source area, and groundwater would be pumped from the well and treated in batches on site based on the treatability results present in Subsection 3.2.2. The flow rate achieved from the extraction well has been assumed to be 0.5 gpm; however, the specific flow rate and capture zone from the well would need to be based on in-field pump tests. Additional wells may be needed to capture the entire source area. Because of the high doses of treatment chemicals required to treat the groundwater, the water would need to be treated in 1,000-gallon batches. The extracted groundwater would be stored in a 1,000-gallon equalization tank, and a small wastewater treatment process would be set up near the tank. The treatment process would require a person to be on-site to refill the treatment chemicals at the start of each 1,000-gallon batch. The groundwater extraction would be temporarily stopped, until the groundwater housed in the equalization tank was treated and discharged. The treated groundwater would be discharged to the surface, and the residual solids would be transported off-site for disposal as a nonhazardous waste. RMT assumes that a filter press would be used to dewater the solids, and that approximately 35 tons of solids would be generated from the wastewater treatment. The process would be controlled using a basic control panel, powered by a propane generator, and would continue until the 42,000 gallons of water from the source area were treated. It is estimated that this would take 3 to 4 months to complete.
- 3. *In situ* remediation This alterative would immobilize the arsenic in the groundwater, and is based on the treatability study results presented in Subsection 3.2.2. The railroad ballast and any other overburden soil in the source area would be excavated and stockpiled on-site to expose the saturated zone. Treatment chemicals would be mechanically mixed into the saturated source area using a backhoe, and the treated material would be left in place. The treatment chemicals would be based on the treatability results presented in Subsection 3.2.2. The railroad ballast and overburden soil would be replaced following

treatment, and the site restored to existing conditions. It is estimated that this process would take approximately 2 weeks to complete.

4.2 Marsh Soil

The arsenic impacts in the marsh area are primarily associated with the pore water and the organic matter in the upper 2 feet of the marsh. The arsenic is slowly released to the pore water as the organic matter decomposes, and the arsenic appears to be volatilizing to arsine gas in the anaerobic portions of the marsh. In order to remediate the arsenic in the marsh area, the impacts can be removed through excavation, or the volatilization of arsenic can be enhanced through bioreduction. The cap currently eliminates a direct contact threat and reduces impacts to the surface water runoff; however, capping was not considered for the entire area since capping would require a significant time to achieve the clean-up criteria for the site.

Because the cap is effectively addressing the impacts in a portion of the marsh, leaving the cap in place was considered for two of the remedial alternatives described below. If the cap and material under the cap are left in place, then remedial action to address the uncapped marsh material and slough water impacts must be considered, since a source to the surface water impacts will remain on the site until volatilization of the arsenic has effectively remediated the residual impacts. Another option would be to excavate the entire marsh area including the cap and impacted soil below the cap. If this alternative is considered, remedial action on the slough water would not be necessary.

- 1. Excavation (large area) The top 2 feet of marsh sediment exceeding the soil cleanup criterion (including the marsh material under the cap) would be excavated and disposed off-site as nonhazardous waste. The large excavation area (approximately 10.8 acres) shown on Figure 21, is the basis for estimating the quantity of material that would be handled for this alternative; however, additional sampling would be conducted to define the specific area requiring excavation if this alternative was implemented. Stabilized hauling roads would need to be constructed up to and within the marsh to facilitate the excavation. Erosion control would be in place during the excavation, and dewatering of the solids would be required prior to hauling the material off-site. The cost of excavation does not include any backfilling or wetlands restoration, and these items would significantly increase the cost, if required. RMT assumes that the full-scale application would take 2 months to complete. Implementation of this alternative would eliminate the need for a separate remedial alterative for the slough water.
- 2. Excavation (small area) The top 2 feet of marsh sediment exceeding the soil cleanup criterion outside the capped area would be excavated and disposed off-site as nonhazardous waste. The small excavation area shown on Figure 21, is the basis for estimating the quantity of material that would be handled for this alternative; however, additional sampling would be conducted to define the specific area requiring excavation if

this alternative was implemented. Stabilized hauling roads would need to be constructed up to and within the marsh to facilitate the excavation. Erosion control would be in place during the excavation, and dewatering of the solids would be required prior to hauling the material off-site. The cost of excavation does not include any backfilling or wetlands restoration, and these items would significantly increase the cost, if required. RMT assumes that the full-scale application would take 2 months to complete. Implementation of this alternative would require implementing a separate remedial alterative for the slough water.

Bioreduction – This alternative would be applied to the same area defined for the small 3. excavation; however, this alternative would rely on enhanced volatilization based on the bioreduction treatability studies. The natural methane-generating potential of the marsh would be enhanced by adding a bioreductant to the water. Prior to full-scale implementation, field trials would be performed. Small test plots would be constructed outside the capped area to evaluate the performance of different bioreductants in reducing the arsenic concentrations in the field. These test plots would be evaluated over 6 months, and the results would be used to develop a workplan for implementing the full-scale bioreduction option in the field. The specific bioreductant and field application approach would be based on the results of the test plot study; however, for costing purposes, sodium lactate applied using a temporary irrigation system was assumed. The Kewanee River would serve as the water supply for the irrigation, and above-grade piping would connect the irrigation system to a pump in the river. A 21,000-gallon tank would be used to store and mix a stock solution of the lactate. After the tank is filled with the solution, a high head pump would run the irrigation system at as much as 600 gpm. Six sprinkler heads, each with an approximately 200-foot spray radius, would spray the solution on the site. The solution from the tank would be introduced to the irrigation system via a venturi chemical injection system. RMT assumes that the full-scale application would take 1 month to complete, and that only one application would be required. Implementation of this alternative would require implementing a separate remedial alterative for the slough water.

4.3 Slough Water

The arsenic impacts to the surface water entering the Kewaunee River through the two sloughs must be addressed until the source of the surface water impacts have been adequately remediated. In order to prevent impacted surface water from entering the Kewaunee River, the water from the slough can be captured and treated on-site or a barrier can be constructed to physically stop the flow to the river.

1. **Impermeable barrier -** An impermeable barrier would be constructed along the fence line at the site to prevent surface water runoff from reaching the Kewaunee River. The barrier would be constructed out of ¼-inch polyethylene material. RMT assumes that the barrier would be installed in the winter. The barrier would extend approximately 2 feet above

ground surface and 3 feet below grade. The current configuration of the barrier has it keying into the railroad bed on the northern and southern end of the project area in order to maximize capture of the surface water. However, the northern 900 feet of the barrier could be eliminated, and significant capture of the surface water could still be achieved. The hydrology and hydrogeology of the marsh would contain the water in the marsh, and additional management of the water would not be necessary. Given the very low groundwater flow, the low vertical gradients in the groundwater, and the balance between annual evapotranspiration and annual precipitation, there would be little net influx of water to or from the groundwater. During high water flow periods, there would be a hydraulic gradient driving the surface water into the deeper, anoxic zone of the groundwater. However, during the summer, evapotranspiration would reverse this gradient and the water would be brought back toward the surface. Blocking the flow of surface water from the marsh to the river would allow time for the bioreduction to eliminate arsenic from the marsh. It is not anticipated that the impermeable barrier would change the water level inside the barrier, since the water is hydraulically connected under the impermeable barrier.

2. **Collection and treatment on-site -** Surface water runoff would be collected from the two sloughs and pumped to an on-site treatment facility located near the railroad tracks. A dam/outfall structure would be constructed in each slough to capture the surface water. Because the surface flow is mainly limited to times when the temperature is above freezing, the plumbing connecting the sloughs to a treatment staging would be constructed above grade. The treatment facility would be constructed inside the fence near the existing access point for the site. To remain a feasible option, this alternative would only be sized to capture 10,000 gallons of water per run event. This equates to an average sustained flow rate of 0.7 gpm from the two sloughs for 10 days, or a 10-gpm surge in the two sloughs over 16 hours. If additional flow occurs, this water would be allowed to overflow and enter the Kewaunee River. The extracted groundwater would be sized in a 10,000-gallon equalization tank. A small wastewater treatment process would be set up near the tank. The treated groundwater would be discharged to the surface, and the residual solids would be transported off-site for disposal as a nonhazardous waste. RMT assumes that bag filters would be able to dewater the solids, and that approximately 2 tons of solids would be generated from the wastewater treatment each year. The process would be controlled using a basic control panel, powered by a propane generator, and would require approximately seven site visits per year to maintain operation of the system. RMT assumes that the system would operate for 5 years.

5.1 Site Evaluation

- 2005/2006 Marsh soil sampling: Samples were collected from the marsh in areas that previously had shown high arsenic levels, including under the cap. Arsenic concentrations were still elevated, although they were generally lower than the concentrations measured previously.
- Source area delineation: A source area for arsenic was identified beneath the railroad bed near MW04-10. The arsenic is predominately in the dissolved phase at concentrations greater than 100,000 μg/L. A conceptual model was developed for the source area, which posits that a low permeability soil layer surrounds the railroad ballasts, resulting in the low flow of arsenic from the source under normal conditions. During high water conditions the dissolved phase arsenic is able to flow from the source area into the marsh above this low permeable layer.
- Leaching tests on marsh soil samples: Leaching tests were conducted on the marsh soil, using both standard and site-specific leaching tests. Arsenic in the leachates from the leaching studies came predominantly from the arsenic already dissolved in the pore water, indicating that the majority of arsenic in the marsh is insoluble and nonleachable. The arsenic is likely tied up in an organic form, which is slowly released to a soluble form as the organics decompose. This indicates that the marsh soil contributes dissolved arsenic to the water in the marsh over an extended period of time.
- Hydrogeology: The site sits in the inside bend of a large oxbow of the Kewaunee River within a mile of the mouth of the river. Therefore, the groundwater table is very flat and is controlled by the elevation of the Kewaunee River. There is no major upward or downward gradient in the groundwater. The groundwater is estimated to flow at between 0.5 and 5 feet per year toward the river. This flow is insufficient to account for the distribution of arsenic at the site, indicating that surface runoff is the primary transport mechanism for arsenic.
- Site arsenic concentrations over time: A 60 percent decrease in the mass of arsenic at the site, both inside and outside the capped area, was calculated to occur between 1994 and 2006. The amount of arsenic lost from the site is much greater than can be accounted for by loss through surface water, suggesting that arsenic is being lost by volatilization as arsine gas from very reduced (e.g., methane-generating) environments in the marsh.

5.2 Marsh Soil Treatability Studies

- In situ stabilization: Eleven additives were tested for effectiveness in reducing arsenic concentrations in three leaching tests. Cement, ferric sulfate plus limestone and iron were found to be effective additives (90 percent or greater reduction in arsenic concentration). However, *in-situ* stabilization was eliminated as a feasible remedial option based on the results of the leaching tests for the marsh material. Stabilization is only effective at reducing soluble arsenic concentrations. Because the soluble arsenic represents only a minor fraction of the arsenic in the marsh, and arsenic may be released slowly as the organics decompose, stabilizing agents would need to be applied for decades to effectively treat the marsh material.
- Bioreduction: Bioreduction tests were conducted to evaluate whether arsine volatilization can be enhanced as a means to meet the cleanup criterion for arsenic. The results demonstrate that the introduction of some bioreductants enhanced methane formation and arsenic volatilization. Approximately a 40 percent loss of the total arsenic was found after 70 days reaction time. This indicates that bioreduction is a potential method for removing arsenic from the marsh with minimal long-term impact on the marsh environment. However, field studies are needed to evaluate the optimal bioreductant and application technique.

5.3 Source Area Treatability Studies

Groundwater treatment: High levels of dissolved arsenic were found in the groundwater under and near the railroad bed near monitoring well MW04-10. This arsenic is presumably the residual from the original spill and acts as a continuing source of arsenic to the marsh. Treatment of this water to lower the dissolved arsenic concentration was evaluated. This could be done by removing the groundwater and disposing of it off-site, or by treating the groundwater to immobilize the arsenic so that it does not leach to the marsh. Laboratory testing was completed to develop an approach to treat the groundwater in the source area to lower the dissolved concentration and generate a nonhazardous solid in the process. It was found that adding a combination of hydrogen peroxide, ferric iron, and limestone removed arsenic from the groundwater to 11 μg/L, and resulted in a solid that leached low-level (<1.0 mg/L) arsenic in a TCLP test.</p>

5.4 Slough Water Treatability Studies

- Slough water treatment: Laboratory testing was performed to develop an approach to reduce the concentration of arsenic in the slough water. The addition of ferric iron and limestone will reduce dissolved arsenic concentrations to <13 μg/L.</p>
- Permeable reactive barrier wall: One of the remedial options to be evaluated in a treatability study in the original proposal was a PRB located between the river's edge and

the marsh. Arsenic in the water moving through the barrier would be removed using a treatment reagent. However, a treatability study on the PRB was not completed for the following reasons:

- Redox conditions in the marsh vary over time, such that it would be difficult for treatment to be effective under both the aerobic and anaerobic conditions expected during the year.
- The high biological activity in the marsh would inhibit effectiveness of the PRB.
- Much of the arsenic transport out of the marsh occurs during high flow events, and designing a system that could trap the arsenic in the short residence time that the rapidly moving water would be in contact with the PRB would be impractical.

5.5 Cost Estimates

Based on the results of the treatability studies and a feasibility assessment for the remedial alternatives at the site, conceptual approaches for several remedial options for the source area, marsh soil, and slough water were developed. These approaches include the following:

- Source Area: (1) Pump and dispose of contaminated water off site, (2) Pump and treat contaminated water on-site, or (3) treat contaminated water in-situ.
- Marsh Soil: (1) Excavate marsh soil that exceeds the clean-up criteria that is outside the capped area, or (2) perform bioremediation on the marsh soil that exceeds the clean-up criteria that is outside the capped area
- Slough Water: (1) Excavate all the soil that exceed the clean-up criteria, eliminating the source of the surface water impacts, (2) install an impermeable barrier to contain the surface runoff, or (3) construct an outfall structure around the two sloughs and pump and treat the surface runoff water on-site.

The conceptual approaches and costs are summarized in Table 19 and Table 20. The costs presented in this report are based on preliminary concepts for comparative purposes only, and are not for budgetary purposes. The costs represent the best judgment of cost based on the conceptual approach described herein for each option; however, the range in cost may vary from -30 to +50 percent of the best judgment value. These costs are not intended to be used without the descriptions, assumptions, and uncertainties described in Table 19.

Based on the results of the treatability studies and remedial options/cost analysis, RMT recommends that the following steps be taken to remediate the marsh:

- 1. **Source area** Eliminate the on-going source of dissolved-phase arsenic by either pumping the contaminated groundwater and disposing it off-site as a hazardous waste, or treating the groundwater *in situ*. The costs for these two options are similar such that selection of one option over the other can be based on the WDNR's preference for the remediation approach.
- 2. **Slough water** Eliminate the source of arsenic to the Kewaunee River by constructing an impermeable barrier along the fence line at the site. The impermeable barrier would eliminate the migration of arsenic from the marsh to the river and allow time to address remediation of the marsh soil. Given the very low groundwater flow and the minimal net flow of water from the marsh to the river, isolating the contaminated area would have minimal impact on the environment of the area. The impermeable barrier is preferred over the capture and treat alternative based on cost and on effectiveness (the capture and on-site treat alternative is limited in the volume of water that it can treat).
- 3. **Marsh soil** Reduce the concentration of arsenic in the marsh soil to meet the clean-up criteria using bioreduction. RMT strongly recommends that field trials be conducted before full-scale implementation of the approach in order to confirm the effectiveness of this option, and to determine the most cost-effective approach for bioreduction at a full-scale level.

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	SOLIDS		CC	OMPOSITIONAL	ANALYSIS (mg/	kg) (DRY WEI	GHT)
SAMPLE	%	VOLATILE (%)	тос	ARSENIC	CALCIUM	IRON	PHOSPHORUS
T-1	17.6	61.3	630,000	2,500	92,000	6,400	830
T-3	18.4	61.3	380,000	900	33,000	5,300	680
T-5	11.7	61.9	350,000	720	58,000	7,400	1,400
T-6	19.6	42.0	480,000	240	61,000	8,200	1,100
T-7	31.1	26.8	380,000	86	35,000	10,000	1,300
T-8	14.0	75.9	560,000	140	34,000	6,500	1,200
T-9	14.4	79.1	640,000	660	22,000	5,000	1,300
T-10	7.35	80.2	490,000	760	30,000	5,600	1,600
T-10A	8.64	83.1	510,000	590	26,000	4,600	2,100
T-10B	8.86	82.7	430,000	850	38,000	6,700	1,700
T-11	8.29	53.5	290,000	670	87,000	16,000	2,600
T-12	11.3	60.6	340,000	570	25,000	5,700	2,200
T-14	10.8	79.3	450,000	110	24,000	6,100	1,900
T-15	5.93	88.6	480,000	120	15,000	2,900	1,600
T-16	13.5	70.9	460,000	490	44,000	8,500	980
T-17	6.62	79.9	410,000	520	24,000	4,900	1,400

Table 1 Compositional Analysis of Samples Collected in November 2005 Kewaunee Marsh, Kewaunee, Wisconsin

			SCRE	ENING LEAG	CHINGTESTI	RESULTS		
	COMPOSITIONAL	тс	CLP	SPLP	' - East	SPLI	? - Site	
SAMPLE	As (mg/kg)	рН	ARSENIC (µg/L)	pН	ARSENIC (µg/L)	рН	ARSENIC (µg/L)	
	Criteria		5,000		148		148	
T-1	2,500	5.54	1,720	7.46	806	7.51	562	
T-3	900	5.13	239	7.82	136	7.54	104	
T-5	720	5.27	688	8.07	202	7.55	125	
T-6	240	5.13	947	7.62	479	7.59	294	
T-7	86	5.23	696	7.58	308	7.34	248	
T-8	140	5.02	384	7.17	181	7.40	144	
T-9	660	5.01	1,090	7.24	769	7.40	493	
T-10	760	5.00	247	7.49	164	7.49	119	
T-10A	590	4.99	374	7.48	204	7.59	233	
T-10B	850	5.01	831	7.56	462	7.56	399	
T-11	670	5.03	584	7.39	164	7.57	128	
T-12	570	5.01	514	7.46	241	7.56	173	
T-14	110	4.98	272	7.09	102	7.47	66.5	
T-15	120	4.96	203	6.90	120	7.50	102	
T-16	490	5.17	801	7.89	99.2	7.52	75.3	
T-17	520	4.98	301	7.11	168	7.45	146	
Mod		5.03	518	7.79	221	7.52	189	
	Site	groundwa	ter			7.66	12.1(1)	

Table 2Leaching and Compositional Arsenic Concentrations – November 2005

Notes:

Leachate arsenic concentrations shown in μ g/L.

SPLP-Site = synthetic precipitation leaching procedure using site groundwater.

Footnote:

⁽¹⁾ Above Limit of Detection, but below Limit of Quantitation (absolute value uncertain).

Mod = moderately contaminated composite sample (T-3, -5, -6, -9, -10, -10A, -10B, -11, -12, -16, and -17).

	ARSENIC CONCENTRATION (mg/kg)							
LOCATION	1994	NOVEMBER 2005	JUNE 2006					
TS-18	2,030		340					
TS-1/19	10,700	2,500	6,100					
TS-20	4,600		910					
TS-21	2,660		640					
TS-22	5,480		1,800					
TS-23	4,500		1,500					
TS-24	1,880		1,100					
Mean	4,550		1,770					

 Table 3

 Comparison of Historical and Current Arsenic Concentrations

LOCA	ATION				CONCENTRATIO	DN	
TRANSECT		SITE	ARSENIC (μg/L)	CALCIUM (mg/L)	IRON (mg/L)	MAGNESIUM (mg/L)	SODIUM (mg/L)
	20) NW	82,000	180	1.6	78	16
T(-1)		0	44,000	170	1.1	97	14
	2	20 SE	118,000	290	0.77	100	33
	40) NW	1,140	130	0.46	50	11
	30) NW	100,000	140	0.43	62	11
	20) NW	122,000	140	0.28	59	8.3
T1	10) NW	640,000	220	0.77	140	12
11	0 (M	W04-10)	2,200,000*	470	0.072	240	15
	1	0 SE	46,000	130	0.54	57	8.5
	20 SE		22,000	340	8.8	80	95
	3	0 SE	14,800	110	0.21	50	13
		1-4'	5,400	110	<0.025	65	66
		6-9′	3,600	120	<0.025	66	64
Т2	0	11-14′	5,600	120	<0.025	67	63
		16-19′	4,600	120	<0.025	67	60
		21-24′	5 <i>,</i> 200	120	<0.025	66	55
	40) NW	38	120	0.82	30	12
	30) NW	94,000	150	8.9	36	14
	10) NW	1,160,000	320	0.093	140	12
T4		0	1,300,000	310	0.28	150	14
	1	0 SE	660,000	190	0.11	90	17
	2	0 SE	340,000	180	0.091	69	13
	3	0 SE	78,000	120	<0.025	45	10
	20) NW	680,000	240	0.041	90	11
T5		0	560,000	220	0.076	84	10
	2	0 SE	86,000	120	<0.025	45	9.1
N. Slough			1,700	43	0.14	18	9.2

Table 4Source Area Groundwater Concentrations – April 3, 2007

Notes:

1. Samples were collected using a Geoprobe®.

2. Arsenic analysis (except for MW04-10) was performed by Pace Laboratories; all other analyses were performed in the RMT Applied Chemistry Laboratory.

		:	SCREENING LEA	ACH TEST RESUL	TS	
	TCLI	2	SPLP	(EAST)	SPLP (SITE GRO	DUNDWATER)
SAMPLE	рН	ARSENIC (µg/L)	рН	ARSENIC (µg/L)	рН	ARSENIC (µg/L)
			Untreated			
	Un	treated Hig	h Arsenic Con	nposite (T-1)	_	
Replicate 1	5.54	1,720	7.46	806	7.51	562
Replicate 2	5.63	1,640	7.82	765	7.54	522
Replicate 3	5.83	1,430	8.42	753	7.53	563
Replicate 4	5.90	2,550	8.38	1,760	7.59	1,320
Replicate 5	5.94	2,060	8.26	1,170	7.78	715
Mean	5.77	1,880	8.07	1,050	7.59	736
	Uı	ntreated Mo	derate Arsenio	. Composite		
Replicate 1	5.03	518	7.79	221	7.52	189
Replicate 2	5.08	497	7.56	303	7.52	215
Replicate 3	5.18	558	8.15	190	7.53	135
Replicate 4	5.10	767	7.82	339	7.54	330
Replicate 5	5.03	664	7.64	243	7.66	249
Mean	5.10	600	7 .7 9	259	7.55	224
		Aluminum	n Hydroxide (A	Al(OH)3)		
		High Ars	enic Composi	te (T-1)		
Untreated	5.77	1,880	8.07	1,050	7.59	736
1% Al(OH)3	5.65	2,000	8.21	980	7.37	753
2.5% Al(OH)3	5.52	1,890	8.13	1,000	7.44	781
5% Al(OH)3	5.87	1,630	8.22	913	7.42	680

Table 5Kewaunee Marsh Treatability Results

.

		S	CREENING LEA	CH TEST RESU	LTS	
	TCLP		SPLP (EAST)	SPLP (SITE GF	OUNDWATER)
SAMPLE	рН	ARSENIC (µg/L)	рН	ARSENIC (µg/L)	рН	ARSENIC (μg/L)
		Aluminum 1	Hydroxide (co	ntinued)		
		Moderate	Arsenic Com	posite		_
Untreated	5.10	600	7.79	259	7.55	224
1% Al(OH)3	5.09	610	7.84	298	7.42	248
2.5% Al(OH)3	5.05	596	7.88	298	7.53	232
5% Al(OH)3	5.07	615	7.96	266	7.48	227
ŀ		Ferri	c Oxide (Fe2O	3)		·
		High Arse	enic Composit	e (T-1)		
Untreated	5.77	1,880	8.07	1,050	7.59	736
1% Fe2O3	5.56	1,340	8.27	519	7.44	368
2.5% Fe2O3	5.76	766	8.25	382	7.44	245
5% Fe2O3	5.52	645	8.36	262	7.46	183
·		Moderate	Arsenic Com	posite		·
Untreated	5.10	600	7.79	259	7.55	224
1% Fe2O3	5.10	473	8.04	217	7.38	119
2.5% Fe2O3	5.12	273	7.92	132	7.45	103
5% Fe2O3	5.10	229	7.88	77.5	7.39	57
·		Aluminur	n Sulfate (Al2	(SO ₄)3)		·
		High Arse	enic Composit	e (T-1)		
Untreated	5.77	1,880	8.07	1,050	7.59	736
1% Al2(SO4)3	5.49	988	7.54	232	7.15	267
2.5% Al2(SO ₄) ₃	5.36	640	6.80	113	6.68	119
5% Al2(SO4)3	5.01	597	5.34	539	6.05	127

		5	SCREENING LEA	ACH TEST RESUI	LTS			
	TCL	Р	SPLP	(EAST)	SPLP (SITE GRO	OUNDWATER)		
SAMPLE	рН	ARSENIC (µg/L)	рН	ARSENIC (µg/L)	рН	ARSENIC (µg/L)		
		Moderate	e Arsenic Com	posite				
Untreated	5.10	600	7.79	259	7.55	224		
1% Al2(SO4)3	5.04	414	6.26	49.2	6.88	57.9		
2.5% Al2(SO4)3	4.93	210	4.66	139	6.07	21.5		
5% Al2(SO4)3	4.83	286	4.15	249	5.35	80.7		
High Arsenic Composite (T-1)								
Untreated	5.77	1,880	8.07	1,050	7.59	736		
1% Al2(SO4)3	5.57	252	7.54	133	7.21	211		
2.5% Al2(SO4)3	5.47	146	5.59	43.4	6.92	88.9		
5% Al2(SO4)3	5.36	194	5.48	148	5.97	42.5		
		Moderate	e Arsenic Com	posite				
Untreated	5.10	600	7.79	259	7.55	224		
1% Al2(SO4)3	5.03	183	5.15	42.6	6.62	39.5		
2.5% Al ₂ (SO ₄) ₃	5.04	163	5.11	31.3	5.72	30.8		
5% Al2(SO4)3	4.88	136	4.24	140	4.88	39.9		
	Alu	minum Sulfa	ate plus Calciu	ım Carbonate				
		High Arso	enic Composi	te (T-1)		i		
Untreated	5.77	1,880	8.07	1,050	7.59	736		
1% Al ₂ (SO ₄) ₃ + 1% CaCO ₃	5.88	172	7.70	95.3	7.76	336		
2.5% Al2(SO4)3 + 2.5% CaCO3	5.90	413	8.58	202	8.09	94.9		
5% Al2(SO4)3 + 5% CaCO3	6.09	166	8.49	107	8.07	112		

		S	SCREENING LE	ACH TEST RESU	LTS	
	TC	LP	SPLP	(EAST)	SPLP (SITE GF	ROUNDWATER)
SAMPLE	рН	ARSENIC (µg/L)	рН	ARSENIC (µg/L)	рН	ARSENIC (µg/L)
		Moderate	e Arsenic Cor	nposite		
Untreated	5.10	600	7.79	259	7.55	224
1% Al2(SO4)3 + 1% CaCO3	5.23	167	7.74	39.3	7.37	35.5
2.5% Al2(SO4)3 + 2.5% CaCO3	5.13	65.2	7.51	26.7	7.22	31.4
5% Al2(SO4)3 + 5% CaCO3	5.26	58.8	7.64	16.0	7.57	26.9
		Me	tallic Iron (Fe	2)		
		High Arse	enic Composi	te (T-1)		
Untreated	5.77	1,880	8.07	1,050	7.59	736
1% Iron metal	6.45	45.8	8.20	271	7.55	98.9
2.5% Iron metal	6.74	33.7	8.46	221	7.59	18.1
5% Iron metal	6.90	54.1	7.93	60	7.96	14.4
		Moderate	Arsenic Cor	nposite	-	
Untreated	5.10	600	7.79	259	7.55	224
1% Iron metal	5.35	97	7.94	55.8	7.55	23.4
2.5% Iron metal	5.97	37.7	8.10	21.9	7.67	19.0
5% Iron metal	6.73	51.7	8.25	46.9	7.85	17.3
		High Arse	enic Composi	ite (T-1)		·
Untreated	5.77	1,880	8.07	1,050	7.59	736
0.5% Iron metal (immediate)	5.66	81.4	8.27	156	7.53	82.4
1% Iron metal (immediate, duplicate)	5.55	1150	8.32	418	7.54	170

		5	SCREENING LEA	ACH TEST RESU	LTS					
	TCL	Р	SPLP	(EAST)	SPLP (SITE GR	OUNDWATER)				
SAMPLE	рН	ARSENIC (µg/L)	рН	ARSENIC (µg/L)	рН	ARSENIC (µg/L)				
2.0% Iron metal (immediate)	5.74	82.9	8.39	53.8	7.92	10.5				
2.5% Iron metal (immediate, duplicate)	6.44	48.4	8.52	32.8	7.82	10				
Moderate Arsenic Composite										
Untreated	5.10	600	7.79	259	7.55	224				
0.5% Iron metal (immediate)	5.28	48.7	8.19	42.9	7.53	21.9				
1% Iron metal (immediate, duplicate)	5.27	76.3	8.26	11.7	7.61	17.6				
2.0% Iron metal (immediate)	5.16	155	8.11	55	7.62	14.6				
2.5% Iron metal (immediate, duplicate)	5.35	75.2	8.36	19.2	7.79	13.4				
		High Arse	enic Composit	te (T-1)						
Untreated	5.77	1,880	8.07	1,050	7.59	736				
0.5% Iron metal (1 week)	5.82	731	8.13	295	7.56	197				
1% Iron metal (1 week)	5.61	405	8.26	258	7.59	92.8				
2.0% Iron metal (1 week)	6.39	52.2	8.50	23.2	7.84	<6				
2.5% Iron metal (1 week)	5.88	634	8.36	73.8	7.64	55.9				

		S	CREENING LE	ACH TEST RESU	LTS	
	TCL	P	SPLP	(EAST)	SPLP (SITE GR	OUNDWATER)
SAMPLE	рН	ARSENIC (µg/L)	рН	ARSENIC (µg/L)	pН	ARSENIC (µg/L)
		Moderate	Arsenic Con	nposite		
Untreated	5.10	600	7.79	259	7.55	224
0.5% Iron metal (1 week)	5.19	65.5	7.73	20.2	7.60	21.9
1% Iron metal (1 week)	5.20	59	7.88	<6	7.72	<6
2.0% Iron metal (1 week)	5.18	40.7	7.63	36.6	7.70	<6
2.5% Iron metal (1 week)	5.40	53.4	7.70	9.2	7.56	<6
		Foundry	Waste Bypro	ducts	•	·
		Moderate	Arsenic Con	nposite		
Untreated	5.16	340	7.94	140	7.72	170
5% Kohler Foundry byproducts	5.15	200	8.28	78	7.79	69
10% Kohler Foundry byproducts	5.08	35	8.21	84	7.74	65
25% Kohler Foundry byproducts	5.08	37	8.20	78	7.84	31
5% Manitowoc Foundry byproducts	5.16	290	8.04	130	7.75	83
5% Sharon Foundry byproducts	5.21	200	8.29	140	7.81	85

		SCREENING LEACH TEST RESULTS							
	TCLI	2	SPLP ((EAST)	SPLP (SITE GROUNDWATER)				
SAMPLE	рН	ARSENIC (µg/L)	рН	ARSENIC (µg/L)	рН	ARSENIC (µg/L)			
5% Metals Technology Foundry byproducts	5.72	250	8.30	140	7.87	91			
		Anderson	n Arsenic Adso	orbent					
Moderate Arsenic Composite									
10% Adsorbent	5.14	110	8.33	87	7.92	65			

SAMPLE	1	SOLIDS	VOLATILE SOLIDS	ARSENIC	PORE WATER As ARSENIC	
TREATMENT	REP	%	%	mg/kg	рН	As (µg/L)
Untreated	А			830		
	В	10.2	75.8	750	7.66	120
	С			830		
	Avg			803		
5% Bioreductant	A			710		
	В	9.86	70.1	760	7.61	130
	С			770		
	Avg			745		
10% Bioreductant	А			590		
	В	12.6	76.6	640	7.61	170
	С			650		
	Avg			627		
25% Bioreductant	A			440		
	В	14.4	71.6	450	7.99	310
	С	1		470		
	Avg			453		

Table 6Bioreductant Test 1 - Effect on Soil Arsenic Concentration

		ARSENIC	SOLIDS		
SAMPLE	GAS GENERATION, mL	CONCENTRATION, PORE WATER µg/L	ARSENIC CONCENTRATION, mg/kg	% REDUCTION*	
Original	-	770	645	-	
Untreated	6	440	517	20.1	
Cow manure	340	550	448	39.7	
Whey wastewater	498	1,330	462	29.7	
Cheese wastewater solids	16	720	422	28.8	
Lactate	2	1,550	467	30.7	
Sugar	304	330	546	36.8	
Ethanol	326	480	532	30.7	

Table 7Bioreductant Test 2 - Effect on Soil Arsenic Concentration

Note:

* The % reduction was calculated from the arsenic concentration in the solids and solids concentration in the flask, and accounting for the dilution due to the bioreductant addition.

SAMPLE	OBSERVATION	рН	DISSOLVED ARSENIC (µg/L)
Untreated			2,300,000
4 mM Fe(II)		5.53	1,700,000
8 mM Fe(II)		4.12	1,400,000
16 mM Fe(II)	Olive-green solids	3.76	1,300,000
32 mM Fe(II)		3.65	1,100,000
8 mM Fe(III)		3.64	1,400,000
16 mM Fe(III)		3.07	640,000
32 mM Fe(III)		2.90	3,900
40 mM Fe(III) + 40 mM HCO₃	Cream-colored solids	3.50	460,000
40 mM Fe(III) + 80 mM HCO3		6.01	390,000
40 mM Fe(III) + 120 mM HCO ₃ -		6.39	400,000
40 mM Fe(III) + 160 mM HCO ₃ -		6.61	360,000

Table 8Arsenic Concentrations in MW04-10 Water Treated With Ferrous II and Ferric III Iron

		BEFO	BEFORE pH ADJUSTMENT AFTER pH Adjustment		ent		
		LIQUID		LIQUID			
SA	MPLE	рН	As (µg/L)	Fe (mg/L)	рН	As (µg/L)	Fe (mg/L)
Untreated	l	6.39	2,235,000	BD			
	0.024 M	4.14	1,429,000	379	7.00	798,000	157
Fe(II)	0.032 M	3.97	1,356,000	607	6.86	498,000	8.64
	0.040 M	3.85	1,308,000	868	6.72	184,000	27.2
	0.048 M	3.80	1,273,000	996	6.60	74,800	72
	0.048 M	1.87	375,000	46.5	7.03	266,000	0.37
Fe(III)	0.064 M	1.69	231,000	228	7.01	9,640	0.27
	0.080 M	1.63	336,000	580	6.63	630	0.58
	0.092 M	1.60	484,000	907	6.38	190	0.83

Table 9Effect on Dissolved Arsenic Concentration of Ferrous (I) and Ferric (III) IronDoses With and Without pH Adjustment

Table 10
Effect of pH Adjustment on Arsenic Concentrations
in MW04-10 Water Treated With Ferric Iron

		SOLUTION CONCENTRATION			
0.080 M Fe(III) AND MgO DOSE		рН	ARSENIC, µg/L		
Fe(III)	MgO Dose				
Untreated		6.39	2,200,000		
	0 MgO	1.46	465,000		
	0.020 M MgO	1.84	96,600		
	0.040 M MgO	2.36	10,200		
0.080 M	0.060 M MgO	5.15	230		
	0.080 M MgO	8.10	1,680		
	0.10 M MgO	8.95	2,000		
	0.20 M MgO	9.53	2,880		
	0.30 M MgO	9.87	1,860		
	0.40 M MgO	10.13	1,000		
	0.50 M MgO	10.15	420		

Table 11Effect of Two- Step Ferric Iron Addition on Arsenic Concentrationsin MW04-10 Water and the Composition and TCLP ArsenicConcentrations of the Resultant Solids

SAMPLE	ANALYTICAL RESULTS	
SOLUTION	-	
	рН	ARSENIC (μg/L)
Untreated solution	6.39	2,200,000
First iron addition – 0.60 M Fe(III) + 2.5 g Mg(OH) ₂ /L	5.36	210
Second iron addition 0.0225 M Fe(III) + 0.2 g Mg(OH) ₂ /L	9.01	40
SOLIDS FROM STEP 1		
	ARSENIC	IRON
Composition (mg/kg)	210,000	220,000
	pН	ARSENIC (μg/L)
TCLP	5.17	5,200

Table 12
Effect of Ferric Iron Dose on Dissolved Arsenic Concentration
in MW04-10 Water and TCLP Arsenic Concentrations on the Resultant Sludge

	SOLUTION		TCLP ON SOLIDS	
SAMPLE	pН	ARSENIC, μg/L	pН	ARSENIC, µg/L
Untreated	6.39	2,200,000		
+ 0.10 M Fe(III) & 5 g Mg(OH) ₂ /L	6.34	120	8.65	3,800
+ 0.15 M Fe(III) + 7.5 g Mg(OH) ² /L	5.13	66	8.80	1,700
+ 0.20 M Fe(III) + 10 g Mg(OH) ₂ /L	4.63	51	8.85	710

Table 13
Effect of Iron Dose of pH Adjustment on Arsenic Concentration
in April 3, 2007, Sample of MW04-10 Groundwater

SA	SAMPLE		UTION
FERRIC IRON DOSE	FERRIC IRON DOSE pH ADJUSTMENT AGENT		ARSENIC, µg/L
Un	treated	6.58	2,380,000
		2.0	820,000
		4.90	565,000
0.05 M		5.25	519,000
		5.69	463,000
		6.63	316,000
		7.41	207,000
		8.94	178,000
0.10 M		1.95	1,119,000
		3.98	116,000
	N-OU	4.58	66,700
	NaOH	5.91	30,100
		6.95	16,200
		7.76	9,240
		11.47	660,000
0.20 M		1.81	1,937,000
		3.32	22,600
		4.32	7,540
		5.52	3,960
		8.39	2,150
		9.98	27,000
		11.30	264,000
0.30 M	0 g CaCO ₃ /L	1.64	1,763,000
	35	5.62	5,100
	40	5.49	5,080
	45	5.57	3,550
	50	5.58	3,490
	60	5.74	8,930
0.40 M	0	1.64	1,696,000
	50	5.74	1,710
	55	5.62	1,700
	60	5.67	1,360
	65	5.75	2,080
	70	5.68	2,490

Table 14
Effect of Iron and Limestone Dose on Arsenic Concentration in MW04-10
Groundwater and TCLP Arsenic Concentration of Resultant Solids

	GROUNDWATER		SOLIDS TCLP	
SAMPLE	pН	ARSENIC, µg/L	pН	ARSENIC, µg/L
0.30 M Fe(III) + 35 g/L CaCO ₃	5.62	5,100	6.23	2,700
0.30 M Fe(III) + 60 g/L CaCO ₃	5.74	8,930	6.33	2,400
0.40 M Fe(III) + 50 g/L CaCO ₃	5.74	1,710	6.26	1,300
0.40 M Fe(III) + 70 g/L CaCO ₃	5.638	2,490	6.29	1,400
Hazardous waste criterion				5,000

Table 15Effect of Hydrogen Peroxide Addition on Arsenic Concentration in Ferric Iron and
Limestone-treated MW04-10 Groundwater

	GROU	NDWATER	SOLIDS	
SAMPLE	pН	ARSENIC, µg/L	WEIGHT	MOISTURE
NO PEROXI	DE INITIALLY	,		
0.20 M Fe(III), no peroxide, 25 g CaCO ₃ /L	NA	410	138.8 g/L	58.6
+ peroxide & 0.05 M Fe(III), 5 g/L MgO	10.63	25		
+ 0.05 M Fe(III), 5 g/L MgO	10.59	25		
WITH PEROX	IDE INITIALL	Υ		
0.20 M Fe(III), 10 mL 30% H2O2/L, 25 g CaCO3/L	6.06	<130	147.4 g/L	66.6
+0.05 M Fe(III), 5 g/L MgO	10.23	30		

Note:

NA = not analyzed.

Table 16Effect of Different Hydrogen Peroxide Doses on Arsenic Concentration in MW04-10Water Treated With Ferric Iron and Limestone

SAMPLE	ANALYTICAL RESULTS
MW04-10 + 0.30 M Fe(III) + 50 g/L CaCO3	ARSENIC µg/L
+ 0 H2O2	1,000
+ 2.5 mL 30% H ₂ O ₂	<130
+ 5.0 mL 30% H ₂ O ₂	<130
+ 10 mL 30% H ₂ O ₂	<130

Table 17
Results of Larger-Scale Test on Groundwater Treatment

PARAMETER	RESULTS				
FILTR	ATE				
Dissolved arsenic concentration	11 µg/L				
pH	4.9				
SOL	IDS				
Wet weight	327 g				
Dry weight	107 g				
Composition: – arsenic	22,000 mg/kg				
– iron	170,000 mg/kg				
TCLP ON SOLIDS					
Arsenic concentration	<1,000 µg/L				

Note:

A 1L sample was treated with 2.5 mL 30% hydrogen peroxide, 0.3 M ferric iron, 60 g/L limestone.

Table 18
Treatment of the South Slough Water Using Ferric Iron and Limestone

		AFTER IRON ADDITION	AFTER LIMESTO	ONE ADDITION
SAMPLE	AMOUNT FERRIC IRON	рН	рН	ARSENIC μg/L
Untreated	0	6.8	6.89	1,400
	0.002 M Fe(III)	3.80	7.03	<13
	0.004 M Fe(III)	2.80	6.74	<13
	0.006 M Fe(III)	2.70	7.42	<13

Note:

0.5 gm/L limestone added.

IMPACTED MEDIA	SCENARIO	REMEDIAL OPTION	CONCEPTUAL COST ESTIMATES BEST JUDGMENT	ASSUMPTIONS
Source Area	1	Pump and Dispose Off-Site	\$280,000	 A groundwater extraction well will be constructed in the source area, and groundwater will be pumped from the well and contained in batches on-site. The batches will be transported off-site for disposal as a hazardous waste. This scenario assumes that pumping of 42,000 gallons of water will remove the source area contamination. This scenario assumes that the groundwater will be pumped into a 5,000 gallon holding tank, and each batch will be transported off-site by a tanker truck for disposal as a hazardous waste. This scenario assumes that a pumping rate of 0.5 gpm can be sustained by the extraction well, and that a total run time of 80 days will be needed to capture the 42,000 gallons of source area groundwater. The 80 days accounts for start-up time, and downtime in the pumping when the batch holding tank is full and awaiting disposal. This scenario assumes that a propane generator will be used to power the pump and a control panel. Operation and maintenance for this scenario includes a start-up and shakedown visit, and 6 site visits associated with transport and disposal of each batch of groundwater (tank full). Monitoring associated with this scenario includes sampling 3 groundwater monitoring wells for arsenic. The monitoring will be completed quarterly during the first year of operation, and semi-annually for the next 2 years. This scenario assumes that the 2-years of groundwater monitoring will be sufficient to demonstrate successful remediation of the source area.

Notes:

- 1. All costs based on preliminary concepts. They are intended for remedial option comparison and not for budgetary purposes. The detailed cost estimating spreadsheets that provide a basis for the opinion of probable cost are included in Appendix E of this report.
- 2. The best judgment value is presented in the table. However, at this level of cost estimating, the range in cost may vary from -30 percent to +50 percent of the best judgment value. This approach is consistent with USEPA guidance on feasibility study level estimating of remediation costs.
- 3. Costs are rounded to the nearest ten thousand dollar.
- 4. Total costs include direct and indirect capital costs, and present worth costs of the annual O&M and monitoring costs. The total cost for each option is based on the option completed as a standalone alternative. However, additional Scenarios are listed under each option to clarify how the specific option would be used with the other Scenarios to provide comprehensive remediation of the area.
- 5. Costs do not include monitoring and evaluation to bring the site to closure.

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IMPACTED MEDIA	SCENARIO	REMEDIAL OPTION	CONCEPTUAL COST ESTIMATES BEST JUDGMENT	ASSUMPTIONS
Source Area	2	Pump and Treat On-site	\$640,000	 A groundwater extraction well will be constructed in the source area, and groundwater will be pumped from the well and treated in batches on-site. The treated groundwater will be discharged to the surface, and the residual solids will be transported off-site for disposal as a non-hazardous waste. This scenario assumes that treatment of 42,000 gallons of water will remove the source area contamination. The cost is based on treating the groundwater with 85 g/L ferric sulfate, 60 g/L limestone, and 1 mL/L peroxide (30%). The cost and feasibility is based on treating the groundwater in 1,000 gallon batches. The cost assumes that the solids can be dewatered with a filter press, and that approximately 60 tons of solids will be generated from the treatment process. This scenario assumes that a pumping rate of 0.5 gpm can be sustained by the extraction well, and that a total run time of 24 weeks will be needed to treat the 42,000 gallons of source area groundwater. The 24 weeks accounts for start-up time, and assumes that a least two 1,000 gallon batches will be completed per week. This scenario assumes that a propane generator will be used to power the pump, water treatment equipment, and a control panel. Operation and maintenance for this scenario includes a start-up and shakedown visit, and 26 site visits associated with restarting the batch treatment (refilling the hoppers with treatment chemicals) after each 1,000-gallon batch is complete, and controlling the solids dewatering operation.

Notes:

- 1. All costs based on preliminary concepts. They are intended for remedial option comparison and not for budgetary purposes. The detailed cost estimating spreadsheets that provide a basis for the opinion of probable cost are included in Appendix E of this report.
- 2. The best judgment value is presented in the table. However, at this level of cost estimating, the range in cost may vary from -30 percent to +50 percent of the best judgment value. This approach is consistent with USEPA guidance on feasibility study level estimating of remediation costs.
- 3. Costs are rounded to the nearest ten thousand dollar.
- 4. Total costs include direct and indirect capital costs, and present worth costs of the annual O&M and monitoring costs. The total cost for each option is based on the option completed as a standalone alternative. However, additional Scenarios are listed under each option to clarify how the specific option would be used with the other Scenarios to provide comprehensive remediation of the area.
- 5. Costs do not include monitoring and evaluation to bring the site to closure.

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IMPACTED MEDIA	SCENARIO	REMEDIAL OPTION	CONCEPTUAL COST ESTIMATES BEST JUDGMENT	ASSUMPTIONS
Source Area (cont.)	2 (cont.)	Pump and Treat On-site (cont.)	\$640,000	 Monitoring associated with this scenario includes sampling 3 groundwater monitoring wells for arsenic. The monitoring will be completed quarterly during the first year of operation, and semi-annually for the next 2 years. This scenario assumes that the 2- years of groundwater monitoring will be sufficient to demonstrate successful remediation of the source area. The monitoring also includes Wisconsin Pollutant Discharge Elimination System (WPDES) sampling for the treated groundwater, and verification sampling of up to 20 samples for arsenic during the in-situ treatment.
Source Area	3	In-situ Treatment	\$250,000	 The railroad ballast and any other overburden soils in the source area will be excavated and stockpiled on-site to expose the saturated zone. Treatment chemicals will be mechanically mixed into the saturated source area with a backhoe to treat the groundwater in-situ. The railroad ballast and other overburden soils will be replaced following treatment, and the site restored to existing conditions. This scenario assumes that treatment of 4 feet of saturated material in a 50 ft by 70 ft area (42,000 gallons of water) will remove the source area contamination. The cost is based on treating the groundwater in-situ with 85 g/L ferric sulfate, 60 g/L limestone, and 1 mL/L peroxide (30%). The cost is based on mixing in the treatment chemical in-situ with construction equipment, such as a backhoe. This cost assumes that the in-situ treatment and site restoration can be completed in two weeks, and that only one in-situ treatment will be necessary to achieve the clean-up criteria. There are no operation and maintenance costs associated with this option.

Notes:

- 1. All costs based on preliminary concepts. They are intended for remedial option comparison and not for budgetary purposes. The detailed cost estimating spreadsheets that provide a basis for the opinion of probable cost are included in Appendix E of this report.
- 2. The best judgment value is presented in the table. However, at this level of cost estimating, the range in cost may vary from -30 percent to +50 percent of the best judgment value. This approach is consistent with USEPA guidance on feasibility study level estimating of remediation costs.
- 3. Costs are rounded to the nearest ten thousand dollar.
- 4. Total costs include direct and indirect capital costs, and present worth costs of the annual O&M and monitoring costs. The total cost for each option is based on the option completed as a standalone alternative. However, additional Scenarios are listed under each option to clarify how the specific option would be used with the other Scenarios to provide comprehensive remediation of the area.
- 5. Costs do not include monitoring and evaluation to bring the site to closure.

IMPACTED MEDIA Source Area (cont.)	SCENARIO 3 (cont.)	REMEDIAL OPTION In-situ Treatment	CONCEPTUAL COST ESTIMATES BEST JUDGMENT \$250,000	ASSUMPTIONS Monitoring associated with this scenario includes sampling 3 groundwater monitoring wells for arsenic. The monitoring will be completed quarterly during the first year of
	(cont.)	(cont.)		operation, and semi-annually for the next 2 years. This scenario assumes that the 2- years of groundwater monitoring will be sufficient to demonstrate successful remediation of the source area.
Marsh Soil (and surface water runoff)	1	Excavation Large Area + Source Area Scenarios 1, 2, or 3	\$2,990,000	 The top 2 feet or marsh soil exceeding the soil clean-up criteria (including the marsh material under the cap) will be excavated and disposed off-site as non-hazardous waste. The cost is based on excavating the top 2 feet marsh material over 470,400 sf (10.8 acres). This equates to approximately 67,500 tons of marsh material. The cost assumes that the cap will be excavated and stockpiled on-site, and will be replaced as general fill over the site following the excavation of the marsh sediment. The cost assumes that stabilized haul roads will be constructed in the marsh to provide access to the site for excavation. The cost assumes that the marsh sediment can be disposed as non-hazardous waste. The excavated marsh sediment will require dewatering on-site prior to disposal, and erosion control at the site will be necessary. The cost assumes that the site preparation, excavated area, or wetlands restoration. The cost assumes that the site preparation, excavation, and restoration, can be completed in two months. There are no operation and maintenance costs associated with this option. Monitoring associated with this scenario includes collecting 50 confirmation samples from the base of the excavation for arsenic analysis. The monitoring will be completed during the excavation.

Notes:

1. All costs based on preliminary concepts. They are intended for remedial option comparison and not for budgetary purposes. The detailed cost estimating spreadsheets that provide a basis for the opinion of probable cost are included in Appendix E of this report.

2. The best judgment value is presented in the table. However, at this level of cost estimating, the range in cost may vary from -30 percent to +50 percent of the best judgment value. This approach is consistent with USEPA guidance on feasibility study level estimating of remediation costs.

3. Costs are rounded to the nearest ten thousand dollar.

4. Total costs include direct and indirect capital costs, and present worth costs of the annual O&M and monitoring costs. The total cost for each option is based on the option completed as a standalone alternative. However, additional Scenarios are listed under each option to clarify how the specific option would be used with the other Scenarios to provide comprehensive remediation of the area.

5. Costs do not include monitoring and evaluation to bring the site to closure.

IMPACTED MEDIA	SCENARIO	REMEDIAL OPTION	CONCEPTUAL COST ESTIMATES BEST JUDGMENT	ASSUMPTIONS
Marsh Soil	2	Excavation Small Area + Source Area Scenarios 1, 2, or 3 + Slough Water Scenarios 1 or 2	\$1,680,000	 The top two feet or marsh soil exceeding the soil clean-up criteria outside the capped area will be excavated and disposed off-site as non-hazardous waste. The cost is based on excavating the top 2 feet marsh material over 315,000 sf (7.3 acres). This equates to approximately 37,500 tons of marsh material. This area is conservative, and could likely be reduced to more discrete areas based on additional soil sampling prior to the excavation. The cost assumes that the cap and material below the cap will be left in place. The cost assumes that the marsh sediment can be disposed as non-hazardous waste. The cost assumes that stabilized haul roads will be constructed in the marsh to provide access to the site for excavation. The excavated marsh soil will require dewatering on-site prior to disposal, and erosion control at the site will be necessary. The cost assumes that the site preparation, excavated area, or wetlands restoration. The cost assumes that the site preparation, excavation, and restoration, can be completed in two months. There are no operation and maintenance costs associated with this option. Monitoring associated with this scenario includes collecting 30 confirmation samples from the base of the excavation for arsenic analysis. The monitoring will be completed during the excavation.
Marsh Soil	3	Bioreduction (Total)	\$610,000	Bioreduction is broken into a test plot portion and a full scale application which are summarized below.

Notes:

1. All costs based on preliminary concepts. They are intended for remedial option comparison and not for budgetary purposes. The detailed cost estimating spreadsheets that provide a basis for the opinion of probable cost are included in Appendix E of this report.

2. The best judgment value is presented in the table. However, at this level of cost estimating, the range in cost may vary from -30 percent to +50 percent of the best judgment value. This approach is consistent with USEPA guidance on feasibility study level estimating of remediation costs.

3. Costs are rounded to the nearest ten thousand dollar.

4. Total costs include direct and indirect capital costs, and present worth costs of the annual O&M and monitoring costs. The total cost for each option is based on the option completed as a standalone alternative. However, additional Scenarios are listed under each option to clarify how the specific option would be used with the other Scenarios to provide comprehensive remediation of the area.

5. Costs do not include monitoring and evaluation to bring the site to closure.

IMPACTED MEDIA	SCENARIO	REMEDIAL OPTION	CONCEPTUAL COST ESTIMATES BEST JUDGMENT	ASSUMPTIONS
Marsh Soil	3A	Bioreduction Test Plots (to be used in development of Scenario 3B)	\$80,000	 Small test plots would be constructed outside the capped area to evaluate the performance of different bioreductants in reducing the arsenic concentrations in the field. These test plots would be used to develop a workplan for implementing the full scale bioreduction option in the field. The cost is based constructing five 10 ft x 10 ft test plots using general manual labor (no large construction equipment). The scenario assumes that bioreductants such as lactate, molasses, whey, or manure will be evaluated in the test plots. The cost assumes that the construction and performance monitoring for the test plots can be completed in six months. There are no operation and maintenance costs associated with this option. Monitoring associated with this scenario includes collecting 10 samples from each test plot for arsenic analysis. Baseline samples will be collected from the 10 locations within each plot prior to the application of the bioreductant, and monthly sampling will be completed for 5 months following the application of the bioreductant.

Notes:

1. All costs based on preliminary concepts. They are intended for remedial option comparison and not for budgetary purposes. The detailed cost estimating spreadsheets that provide a basis for the opinion of probable cost are included in Appendix E of this report.

2. The best judgment value is presented in the table. However, at this level of cost estimating, the range in cost may vary from -30 percent to +50 percent of the best judgment value. This approach is consistent with USEPA guidance on feasibility study level estimating of remediation costs.

3. Costs are rounded to the nearest ten thousand dollar.

4. Total costs include direct and indirect capital costs, and present worth costs of the annual O&M and monitoring costs. The total cost for each option is based on the option completed as a standalone alternative. However, additional Scenarios are listed under each option to clarify how the specific option would be used with the other Scenarios to provide comprehensive remediation of the area.

5. Costs do not include monitoring and evaluation to bring the site to closure.

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IMPACTED MEDIA	SCENARIO	REMEDIAL OPTION	CONCEPTUAL COST ESTIMATES BEST JUDGMENT	ASSUMPTIONS
Marsh Soil	3B	Bioreduction Full Scale + Source Area Scenarios 1, 2, or 3 + Slough Water Scenarios 1 or 2	\$530,000	 The same area targeted for excavation under Scenario 2 will be treated with a bioreductant to enhance the reduction of arsenic in the field. The specific bioreductant and field application approach will be based on the results of the test plot study (Scenario 3A). The cost is based on treating marsh material over 315,000 sf (7.3 acres). This area is conservative, and could likely be reduced to more discrete areas based on additional soil sampling prior to the excavation. The cost is based on using lactate as the bioreductant, and applying sufficient quantity of lactate to the site to penetrated approximately 1 foot of soil to a concentration of 7,500 mg/L. The use of lactate as the bioreductant is conservative, and the specific bioreductant and concentration will be selected based on the results of the test plot studies. The cost assumes that the irrigation system will operate for approximately one month and that only one application of the bioreductant will be required. The irrigation system will be rented, and removed from the site following the application. The cost assumes that stabilized haul roads will be constructed in the marsh to provide access to the site. Operation and maintenance for this scenario include annual clearing of the cattails and placement of the cut cattails across the treatment area to enhance the anaerobic conditions. The operation and maintenance will be completed for 5 years following the application of the bioreductant.

Notes:

- 1. All costs based on preliminary concepts. They are intended for remedial option comparison and not for budgetary purposes. The detailed cost estimating spreadsheets that provide a basis for the opinion of probable cost are included in Appendix E of this report.
- 2. The best judgment value is presented in the table. However, at this level of cost estimating, the range in cost may vary from -30 percent to +50 percent of the best judgment value. This approach is consistent with USEPA guidance on feasibility study level estimating of remediation costs.
- 3. Costs are rounded to the nearest ten thousand dollar.
- 4. Total costs include direct and indirect capital costs, and present worth costs of the annual O&M and monitoring costs. The total cost for each option is based on the option completed as a standalone alternative. However, additional Scenarios are listed under each option to clarify how the specific option would be used with the other Scenarios to provide comprehensive remediation of the area.
- 5. Costs do not include monitoring and evaluation to bring the site to closure.

IMPACTED MEDIA	SCENARIO	REMEDIAL OPTION	CONCEPTUAL COST ESTIMATES BEST JUDGMENT	ASSUMPTIONS
Marsh Soil (cont.)	3B (cont.)	Bioreduction Full Scale + Source Area Scenarios 1, 2, or 3 + Slough Water Scenarios 1 or 2 (cont.)	\$530,000	 Monitoring associated with this scenario includes collecting 30 samples across the treatment area for arsenic analysis. One baseline monitoring event will be completed prior to the application of the bioreductant, and semi-annual sampling will be completed at the same 30 locations for 5 years. The sample locations will be identified and replicated using a GPS unit. This scenario assumes that the 5-years of sediment monitoring will be sufficient to demonstrate successful remediation of the marsh area.
Slough Water	1	Impermeable barrier + Source Area Scenarios 1, 2, or 3 + Marsh Area Scenarios 2 or 3	\$410,000	 An impermeable barrier would be constructed along the fence line at the site to prevent surface water runoff from reaching the Kewaunee river. The scenario assumes that the barrier will be constructed along the fence route, and span approximately 2,000 feet, extend 3 feet below ground surface, and extend approximately 2 feet above the surface. The cost assumes that the impermeable barrier will be constructed of ¼-inch polyethylene material. The scenario assumes that the barrier will effectively restrict the flow of surface water off the site, and that the trapped water will infiltrate back into the marsh such that additional management of the surface water will not be required. This scenario assumes that the barrier will be constructed during the winter to allow access to the site and improved construction conditions. The cost assumes that the barrier will be left in place after the site remediation is complete.

Notes:

1. All costs based on preliminary concepts. They are intended for remedial option comparison and not for budgetary purposes. The detailed cost estimating spreadsheets that provide a basis for the opinion of probable cost are included in Appendix E of this report.

- 2. The best judgment value is presented in the table. However, at this level of cost estimating, the range in cost may vary from -30 percent to +50 percent of the best judgment value. This approach is consistent with USEPA guidance on feasibility study level estimating of remediation costs.
- 3. Costs are rounded to the nearest ten thousand dollar.
- 4. Total costs include direct and indirect capital costs, and present worth costs of the annual O&M and monitoring costs. The total cost for each option is based on the option completed as a standalone alternative. However, additional Scenarios are listed under each option to clarify how the specific option would be used with the other Scenarios to provide comprehensive remediation of the area.

5. Costs do not include monitoring and evaluation to bring the site to closure.

IMPACTED MEDIA	SCENARIO	REMEDIAL OPTION	CONCEPTUAL COST ESTIMATES BEST JUDGMENT		ASSUMPTIONS
Slough Water (cont.)	1 (cont.)	Impermeable barrier + Source Area Scenarios 1, 2, or 3 + Marsh Area Scenarios 2 or 3 (cont.)	\$410,000	•	Operation and maintenance for this scenario include semi-annual site visits to evaluate the integrity of the barrier. The operation and maintenance will be completed for 5 years following the completion of one of the Marsh Soil Remediation scenarios. If this option is used as a stand alone alternative (without treating the marsh sediment) the operation and maintenance would extend indefinitely, and the cost of the alternative would increase by a factor of 4 to 5. Monitoring associated with this scenario includes semi-annual collection of surface water from the two slough areas on the site for arsenic analysis. The monitoring will be completed for 5 years following the completion of one of the Marsh Sol Remediation scenarios. If this option is used as a stand alone alternative (without treating the marsh soil) the monitoring would extend indefinitely, and the cost of the alternative would increase by a factor of 4 to 5.

Notes:

1. All costs based on preliminary concepts. They are intended for remedial option comparison and not for budgetary purposes. The detailed cost estimating spreadsheets that provide a basis for the opinion of probable cost are included in Appendix E of this report.

2. The best judgment value is presented in the table. However, at this level of cost estimating, the range in cost may vary from -30 percent to +50 percent of the best judgment value. This approach is consistent with USEPA guidance on feasibility study level estimating of remediation costs.

3. Costs are rounded to the nearest ten thousand dollar.

4. Total costs include direct and indirect capital costs, and present worth costs of the annual O&M and monitoring costs. The total cost for each option is based on the option completed as a standalone alternative. However, additional Scenarios are listed under each option to clarify how the specific option would be used with the other Scenarios to provide comprehensive remediation of the area.

5. Costs do not include monitoring and evaluation to bring the site to closure.

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Table 19 (continued) Summary of Conceptual Estimated Costs WDNR – Kewaunee Marsh Remediation – Kewaunee, Wisconsin

IMPACTED MEDIA	SCENARIO	REMEDIAL OPTION	CONCEPTUAL COST ESTIMATES BEST JUDGMENT	ASSUMPTIONS
Slough Water	2	Collection and On-site Treatment + Source Area Scenarios 1, 2, or 3 + Marsh Area Scenarios 2 or 3	\$730,000	 Surface water run-off would be collected from the two sloughs and pumped to a staging area near the railroad tracks to be treated on-site. The treated water would be discharged to the surface, and the residual solids would be disposed off-site as non-hazardous waste. This scenario assumes only 10,000 gallons of runoff water will be captured per flow event at the site. Any additional flow volume would be discharged to the Kewaunee river. This flow volume equates to an average sustained flow rate for 0.7 gpm from the two sloughs for 10 days, or a 10 gpm surge in the two sloughs over 16 hours. The scenario includes the construction of an outlet structure around each slough outlet to create surface water capture zones, and to allow overflow during high flow events. The scenario includes construction of above grade plumbing to connect the surface water capture zones around the sloughs to a on-site treatment staging area near the railroad. The staging area will include four 2,500 gallon equalization tanks and the water treatment equipment.

Notes:

1. All costs based on preliminary concepts. They are intended for remedial option comparison and not for budgetary purposes. The detailed cost estimating spreadsheets that provide a basis for the opinion of probable cost are included in Appendix E of this report.

2. The best judgment value is presented in the table. However, at this level of cost estimating, the range in cost may vary from -30 percent to +50 percent of the best judgment value. This approach is consistent with USEPA guidance on feasibility study level estimating of remediation costs.

3. Costs are rounded to the nearest ten thousand dollar.

4. Total costs include direct and indirect capital costs, and present worth costs of the annual O&M and monitoring costs. The total cost for each option is based on the option completed as a standalone alternative. However, additional Scenarios are listed under each option to clarify how the specific option would be used with the other Scenarios to provide comprehensive remediation of the area.

5. Costs do not include monitoring and evaluation to bring the site to closure.

Table 19 (continued) Summary of Conceptual Estimated Costs WDNR – Kewaunee Marsh Remediation – Kewaunee, Wisconsin

IMPACTED MEDIA	SCENARIO	REMEDIAL OPTION	CONCEPTUAL COST ESTIMATES BEST JUDGMENT	ASSUMPTIONS
Slough Water (cont.)	2 (cont.)	Collection and On-site Treatment + Source Area Scenarios 1, 2, or 3 + Marsh Area Scenarios 2 or 3 (cont.)	\$730,000	 The cost is based on treating the groundwater with 0.056 g/L ferric sulfate, and 0.5 g/L limestone. The cost assumes that the solids can be dewatered with bag filters, and that approximately 2 tons of solids will be generated per year from the treatment process. This scenario assumes that a propane generator will be used to power the pumps, water treatment equipment, and a control panel. The cost assumes that the above grade all equipment and facilities will be decommissioned at the end of the slough water treatment. Operation and maintenance for this scenario includes seven visits per year to evaluate the operation of the water treatment system. The operation and maintenance will be completed for 5 years following the completion of one of the Marsh Soil Remediation scenarios. If this option is used as a stand alone alternative (without treating the marsh soil) the operation and maintenance would extend indefinitely, and the cost of the alternative would increase by a factor of 2 to 3. Monitoring associated with this scenario includes semi-annual collection of surface water from the two slough areas on the site for arsenic analysis. The monitoring will be completed for 5 years following the completion of one of the Marsh Soil Remediation scenarios. If this option is used as a stand alone alternative (without treating the marsh soil) the operation and maintenance would extend indefinitely, and the cost of the alternative would increase by a factor of 2 to 3.

Notes:

- 1. All costs based on preliminary concepts. They are intended for remedial option comparison and not for budgetary purposes. The detailed cost estimating spreadsheets that provide a basis for the opinion of probable cost are included in Appendix E of this report.
- 2. The best judgment value is presented in the table. However, at this level of cost estimating, the range in cost may vary from -30 percent to +50 percent of the best judgment value. This approach is consistent with USEPA guidance on feasibility study level estimating of remediation costs.
- 3. Costs are rounded to the nearest ten thousand dollar.
- 4. Total costs include direct and indirect capital costs, and present worth costs of the annual O&M and monitoring costs. The total cost for each option is based on the option completed as a standalone alternative. However, additional Scenarios are listed under each option to clarify how the specific option would be used with the other Scenarios to provide comprehensive remediation of the area.
- 5. Costs do not include monitoring and evaluation to bring the site to closure.

Table 20Comparative Summary of Conceptual Estimated Costs Presented (1)WDNR – Kewaunee Marsh Remediation

			BEST JUDGMENT REMEDIATION CONCEPTUAL COST ESTIMATES							
IMPACTED			TOTAL COST		ANNUAL COSTS					
MEDIA	SCENARIO	REMEDIAL OPTION	PRESENT WORTH ⁽²⁾	YEAR 1 COSTS ⁽³⁾	O&M	MONITORING	DURATION			
Source Area	1	Pump and Dispose Off-site	\$280,000	\$230,000		\$30,000	2 years			
	2	Pump and Treat On-Site	\$640,000	\$590,000		\$30,000	2 years			
	3	In situ Treatment	\$250,000	\$200,000		\$30,000	2 years			
Marsh Soil + Slough Water	1	Excavation (large area)	\$2,990,000	\$2,990,000						
Marsh Soil	2	Excavation (small area)	\$1,680,000	\$1,680,000						
	3	Bioreduction Total	\$610,000	\$370,000	\$20,000	\$30,000	5 years			
	А	Test Plots	\$80,000	\$80,000						
	В	Fullscale	\$530,000	\$290,000	\$20,000	\$30,000	5 years			
+ Slough Water	1	Impermeable Barrier	\$410,000	\$290,000	\$15,000	\$15,000	5 years			
	2	Collection and Treatment On- Site	\$730,000	\$410,000	\$55,000	\$20,000	5 years			

Notes:

(1) This table is a summary of information presented in Table 19, and is not intended to be used as a standalone document. This summary is compiled for comparative purposes only. Important descriptions, assumptions and uncertainties are discussed in Table 19, which must be read to correctly use this cost information.

(2) The best judgment value is presented in the table. However, at this level of cost estimating, the range in cost may vary from -30 percent to +50 percent of the best judgment value. This approach is consistent with USEPA guidance on feasibility study level estimating of remediation costs. Costs rounded up to the nearest \$10,000; total costs include year 1 costs, and present worth costs of the annual O&M and monitoring.

⁽³⁾ Year 1 costs include direct and indirect capital costs, as well as the first year O&M and monitoring costs.

(4) Costs do not include monitoring and evaluation to bring the site to closure.

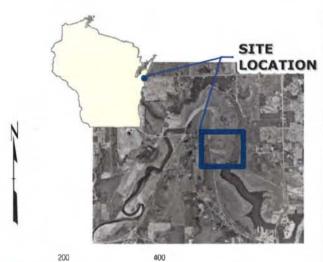


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ISEGEND 1994 ARSENIC CONCENTRATIONS (mg/kg) • < 100</td> • 100 - 1.000 • > 1.000 • > 1.000 • > ENCE • CAPPED AREA

NOTES

1. ARSENIC CONCENTRATIONS AND SAMPLE LOCATIONS FROM STS CONSULTANTS.



1 " EQUALS 200 * 1:2,400

PROJECT:

WISCONSIN DEPARTMENT OF NATURAL RESOURCES KEWAUNEE MARSH

FEET

SHEET TITLE:

SOIL ARSENIC CONCENTRATIONS - 1994

DRAWN BY:	HANKLEY C	SCALE:	PROJ. NO.	00-07201.05
CHECKED BY:	SELLWOOD A	AS NOTED	FILE NO.	72010502.mxd
APPROVED BY:	STANFORTH B	DATE PRINTED:		
DATE:	AUGUST 2007	8/3/2007		FIGURE 1



744 Heartland Trail Madison, WI 53717-1934 P.O. Box 8923 53708-8923 Phone: 608-831-4444 Fax: 608-831-3334



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LEGEND 2002 ARSENIC CONCENTRATIONS (mg/kg) <100 10 - 1,000 >1,000 > FENCE CAPPED AREA

NOTES

- 1. ARSENIC CONCENTRATIONS AND SAMPLE LOCATIONS FOR HISTORICAL SAMPLES FROM STS CONSULTANTS.
- 2. SAMPLES SHOWN WHERE SAMPLE DEPTH IS LISTED AS: BLANK, SOIL EX, OR 0-2.



1 * EQUALS 200 * 1:2.400

PROJECT:

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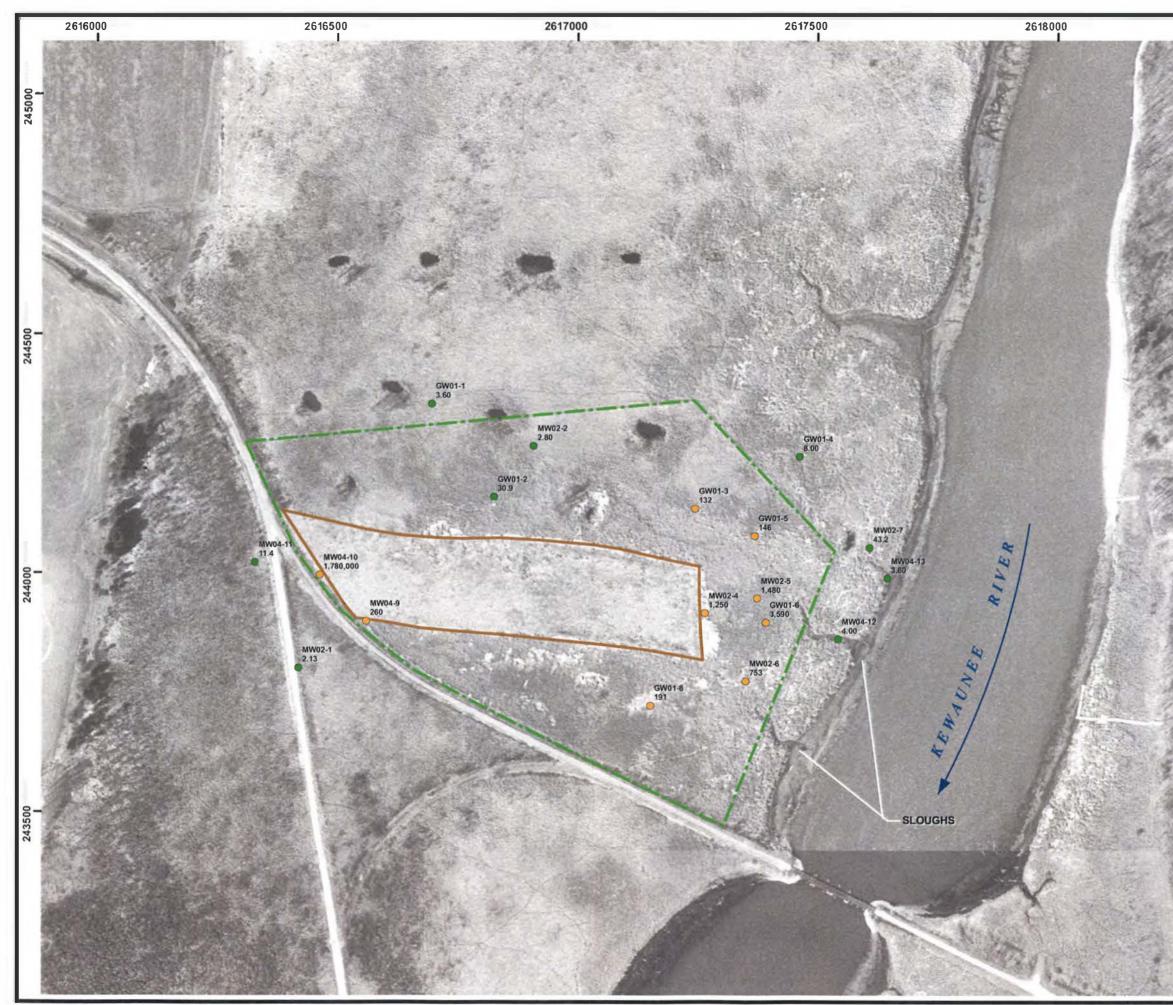
WISCONSIN DEPARTMENT OF NATURAL RESOURCES KEWAUNEE MARSH

SOIL ARSENIC	CONCENTRATIONS
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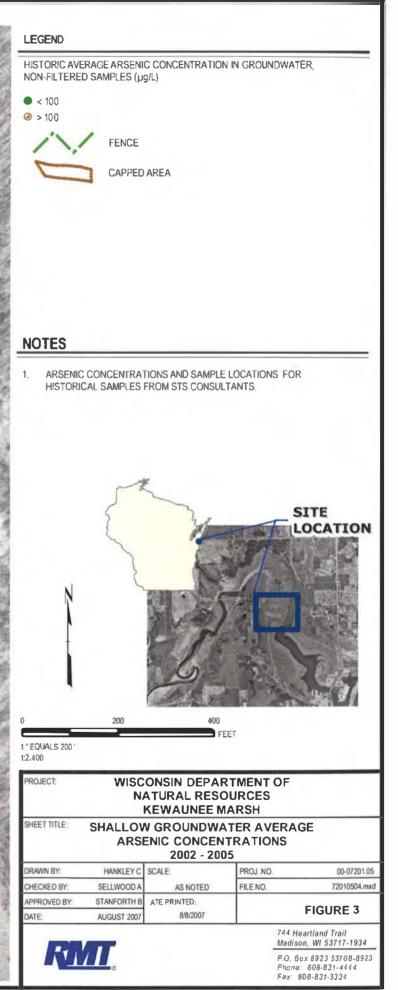
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744 Heartland Trail Madison, WI 53717-1934 P.O. Box 8923 53708-8923 Phone: 608-831-4444 Fax: 608-831-3334

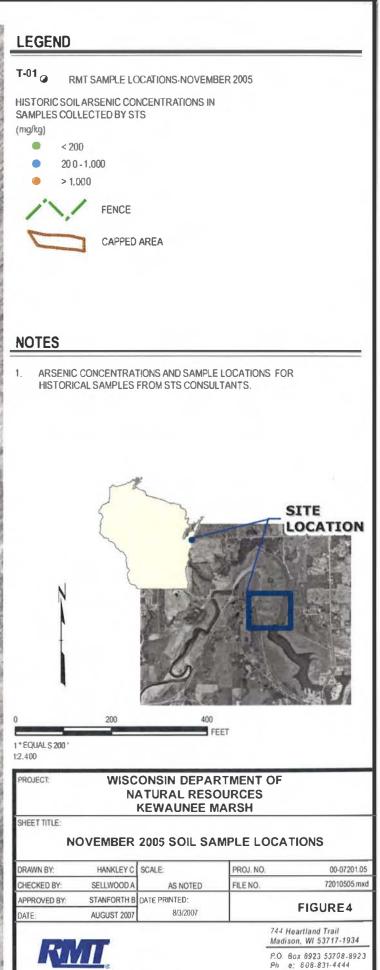


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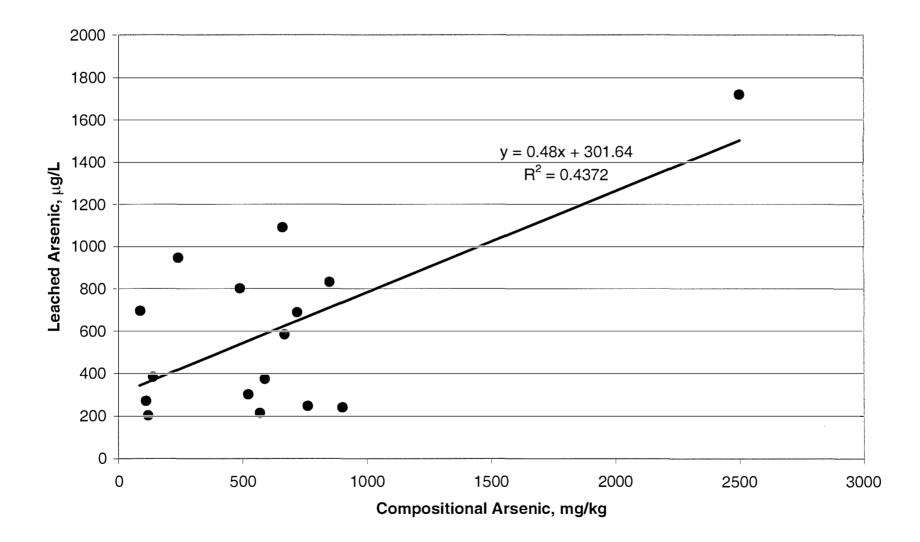


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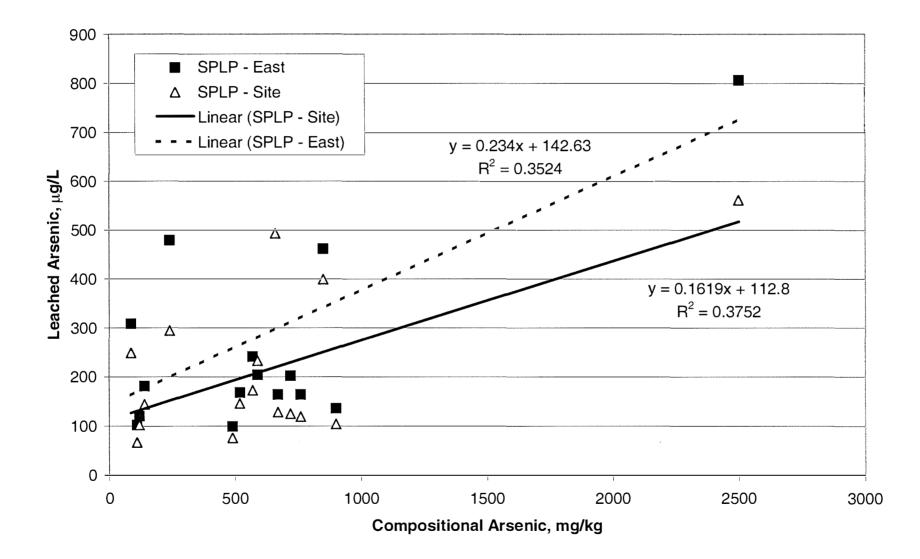
P.O. Box 8923 53708-8923 Ph e: 608-831-4444 Fax: 608-831-3334

FIGURE 5: Compositional Arsenic vs TCLP Arsenic



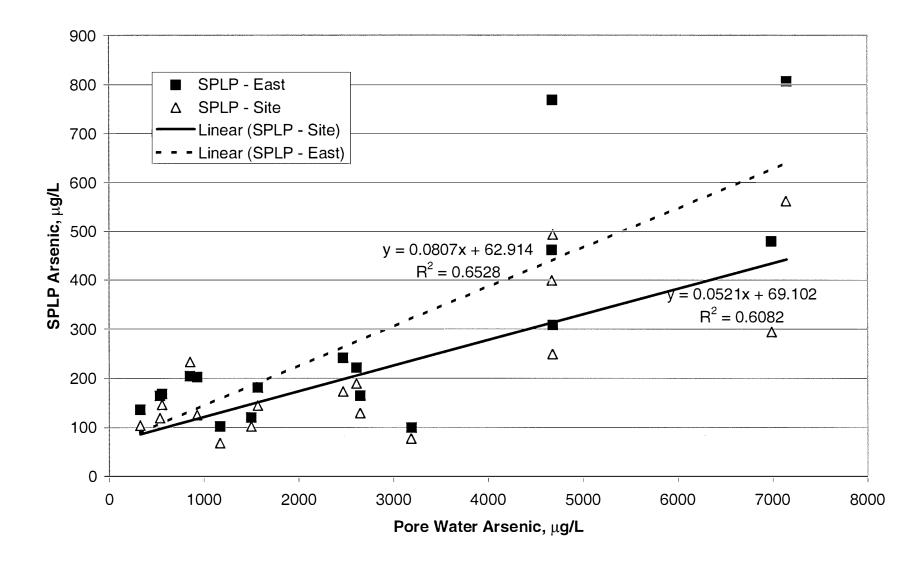
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FIGURE 6: Compositional Arsenic vs SPLP Arsenic



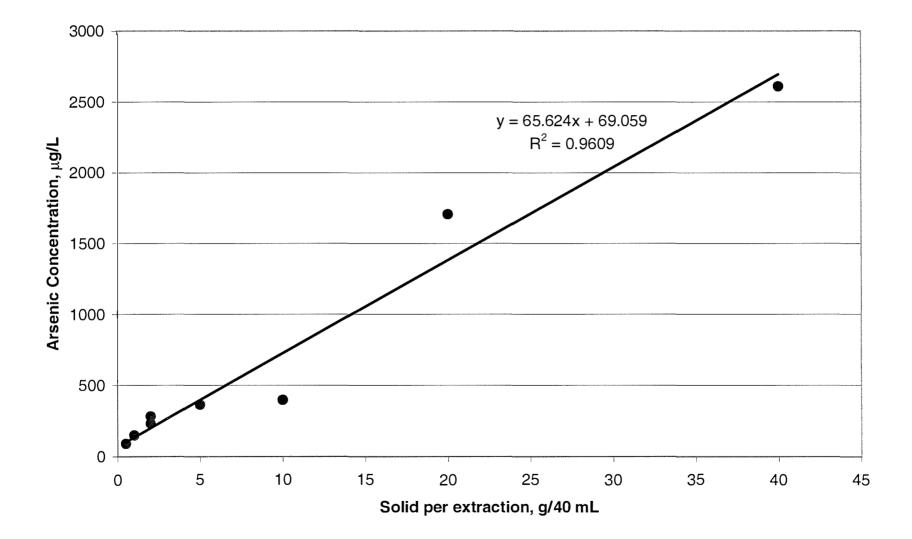
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FIGURE 7: Pore Water vs SPLP Arsenic Concentration



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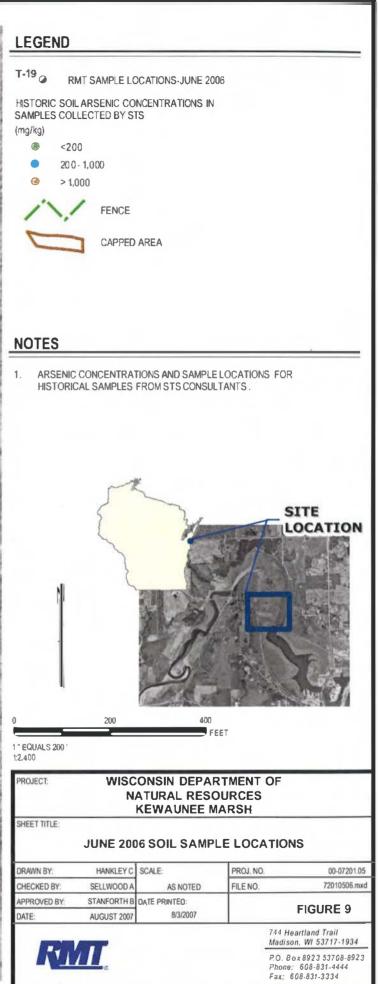
FIGURE 8: Solid-Solution Ratio Effect on Arsenic Leaching, Moderate Arsenic Composite



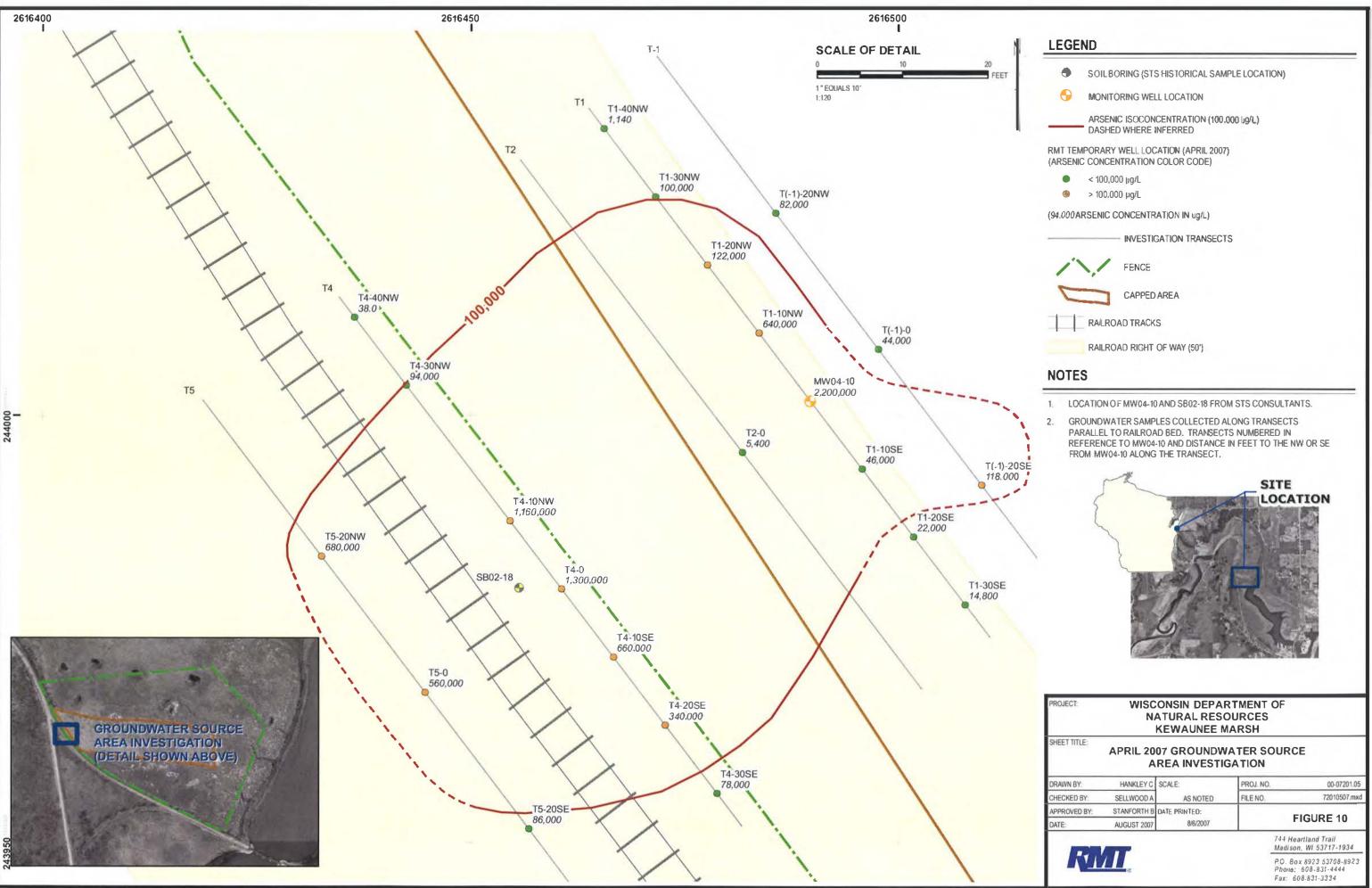
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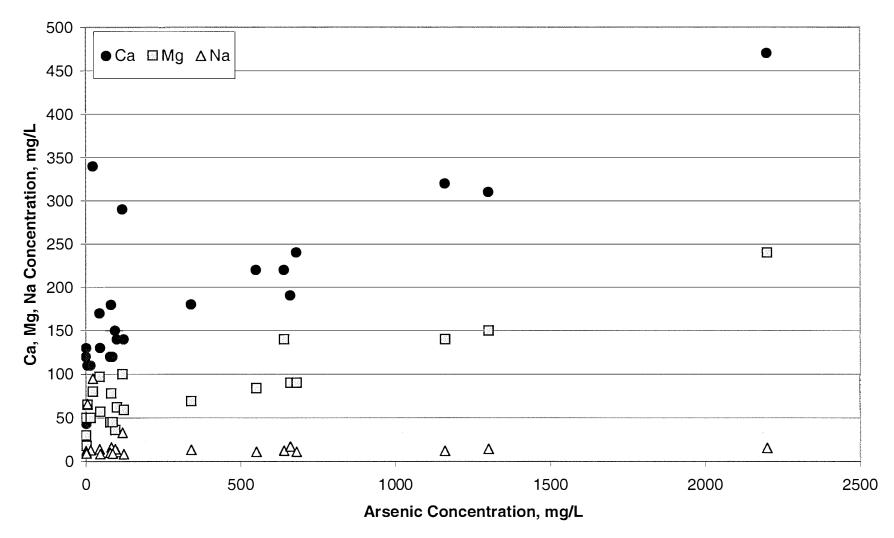
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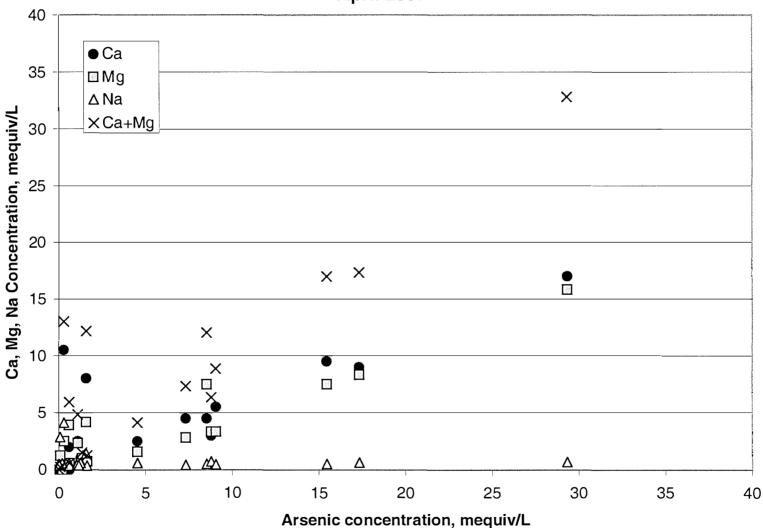


FIGURE 12: Arsenic vs Cation Concentration in Groundwater (mequiv/L) April 2007

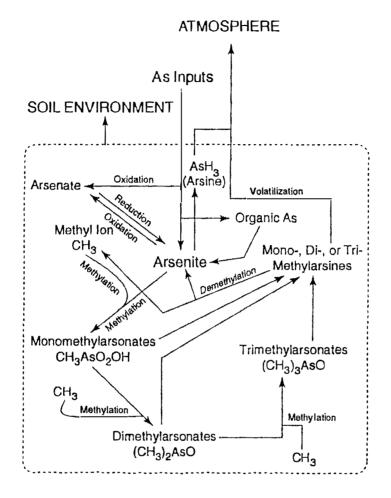
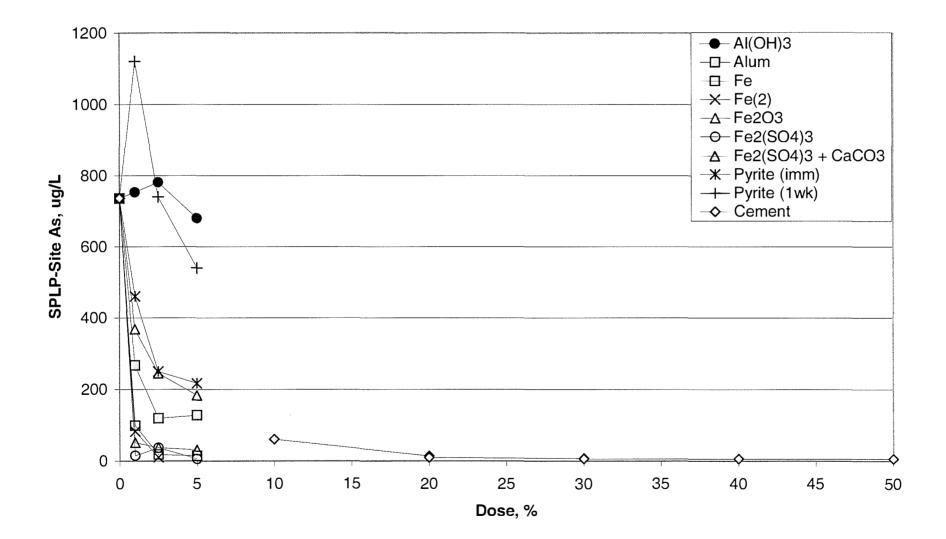


Figure 13 Biological Transformations of Arsenic in Soil

From Frankenberger, W.T. Jr. and M. Arshad. Volatilization of Arsenic In *Environmental Chemistry of Arsenic.* W.T. Frankenberger, Jr. Marcel Dekker, Inc. 2002. pg 365.

FIGURE 14: SPLP-Site Groundwater Dose Response: High Arsenic Sample



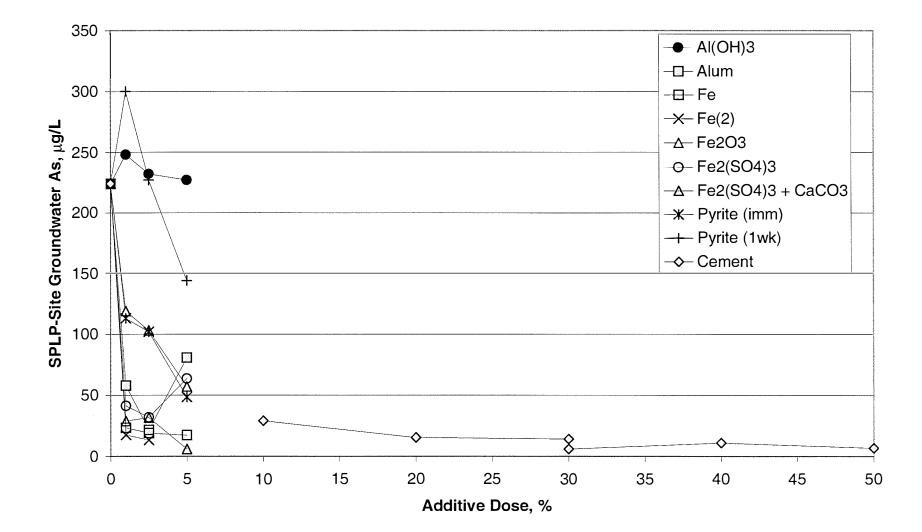
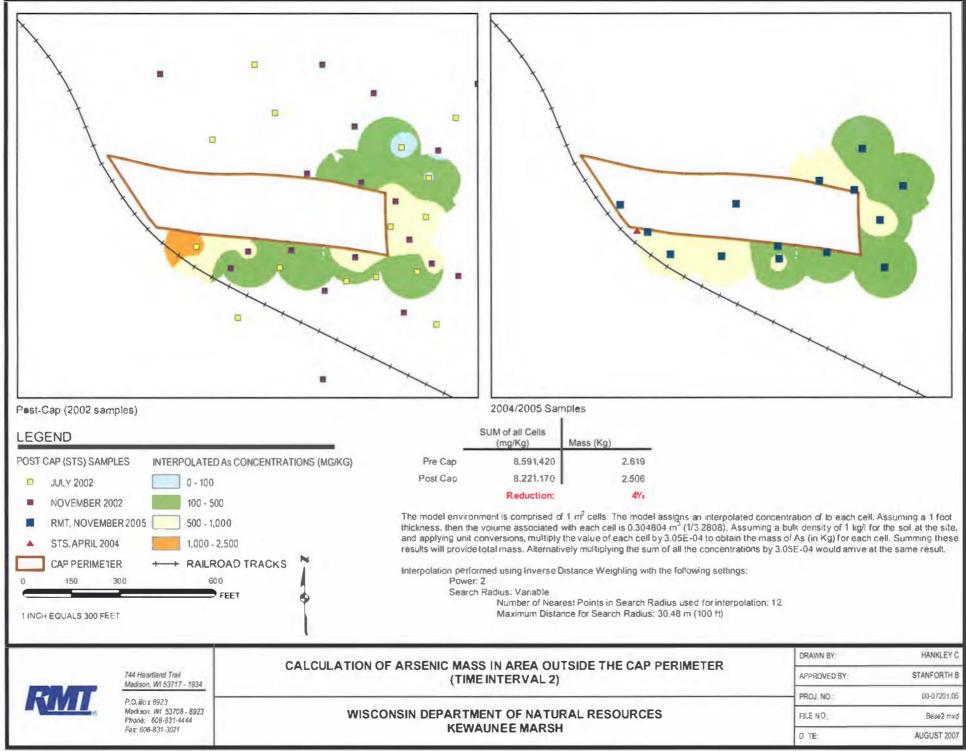


FIGURE 15: SPLP-Site Groundwater Dose-Response Results: Moderate Arsenic Composite

Pre-Cap (1994. 1995. 1996 samples) LEGEND	Post-Cap (2002 samples)	Assuming a 1 foot thickness, the lying unit conversions, multiply i litematively multiplying the sum	en the volume the value of of all the
LEGEND CAP PERIMETER → RAILROAD TRACKS INTERPOLATED As CONCENTRATIONS 0 - 100 100 - 500 500 - 1,000 100 - 2,500 0 150 300 600 FEET	SUM of all Cells (mg/Kg) Mass(Kg) Pre Cap 21.997.100 6.705 Post Cap 12.291.400 3.746 Reduction: 56% The model environment is comprised of 1 m ² cells. The model assigns an interpolated concentration of to each cell. J associated with each cell is 0.304804 m ³ (1/3.2808). Assuming a bulk density of 1 kg/l for the soil at the site, and app each cell by 3.05E-04 to obtain the mass of As (in Kg) for each cell. Summing these results will provide total mass. A concentrations by 3.05E-04 would arrive at the same result. Interpolation performed using Inverse Distance Weighting with the following settings: Power: 2 Search Radius: Variable Number of Nearest Points in Search Radius used for interpolation: 12	Assuming a 1 foot thickness, the lying unit conversions, multiply litematively multiplying the sum	en the volume the value of of all the HANKLEY C
LEGEND CAP PERIMETER CAP PERIMETER RAILROAD TRACKS INTERPOLATED AS CONCENTRATIONS 0 - 100 100 - 500 500 - 1,000 1,000 - 2,500 0 150 300 600 FEET 1 INCH EQUALS 300 FEET	SUM of all Cells (mg/Kg) Mass(Kg) Pre Cap 21.997.100 6.705 Post Cap 12.291.400 3.746 Reduction: 56% The model environment is comprised of 1 m ² cells. The model assigns an interpolated concentration of to each cell. J associated with each cell is 0.304804 m ³ (1/3.2808). Assuming a bulk density of 1 kg/l for the soil at the site, and app each cell by 3.05E-04 to obtain the mass of As (in Kg) for each cell. Summing these results will provide total mass. A concentrations by 3.05E-04 would arrive at the same result. Interpolation performed using Inverse Distance Weighting with the following settings: Power: 2 Search Radius: Variable Number of Nearest Points in Search Radius used for interpolation: 12	Itematively multiplying the sum	of all the
LEGEND CAP PERIMETER → RAILROAD TRACKS INTERPOLATED AS CONCENTRATIONS 0 - 100 100 - 500 500 - 1,000 1000 - 2,500 0 150 300 600 FEET	SUM of all Cells (mg/Kg) Mass(Kg) Pre Cap 21.997.100 6.705 Post Cap 12.291.400 3.746 Reduction: 56% The model environment is comprised of 1 m² cells. The model assigns an interpolated concentration of to each cell A associated with each cell is 0.304804 m³ (1/3.2808). Assuming a bulk density of 1 kg/l for the soil at the site, and app exocentrations by 3.05E-04 to obtain the mass of As (in Kg) for each cell. Summing these results will provide total mass. A concentrations by 3.05E-04 would arrive at the same result. Interpolation performed using Inverse Distance Weighting with the following settings: Power: 2 Search Radius: Variable Number of Nearest Points in Search Radius used for interpolation: 12 Maximum Distance for Search Radius: 30.480371 m (100 ft) CALCULATION OF ARSENIC MASS IN AREA OUTSIDE THE CAP PERIMETER	DRAWN BY	of all the HANKLEY C
LEGEND CAP PERIMETER → RAILROAD TRACKS INTERPOLATED AS CONCENTRATIONS 0 - 100 100 - 500 500 - 1,000 100 - 2,500 0 150 300 600 FEET	SUM of all Cells (mg/Kg) Mass(Kg) Pre Cap 21.997.100 6.705 Post Cap 12.291.400 3.746 Reduction: 56% The model environment is comprised of 1 m² cells. The model assigns an interpolated concentration of to each cell. A associated with each cell is 0.304804 m³ (1/3.2808). Assuming a bulk density of 1 kg/l for the soil at the site, and app each cell by 3.05E-04 to obtain the mass of As (in Kg) for each cell. Summing these results will provide total mass. A concentrations by 3.05E-04 would annee at the same result. Interpolation performed using Inverse Distance Weighting with the following settings: Power: 2 Search Radius: Variable Number of Nearest Points in Search Radius used for interpolation: 12 Maximum Distance for Search Radius: 30.480371 m (100 ft)	DRAWN BY APPROVED BY:	of all the HANKLEY C STANFORTH B

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Figure 18 Gas Generation From Treated Marsh Solids in Bioreductant Test 1

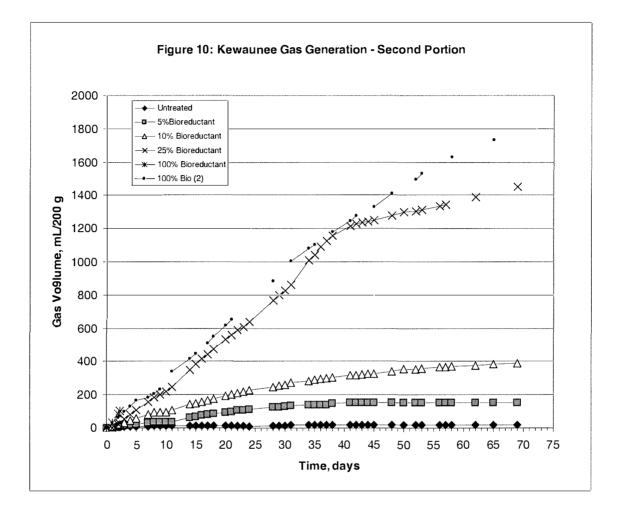


Figure 19 Gas Generation From Treated Marsh Solids in Bioreductant Test 2

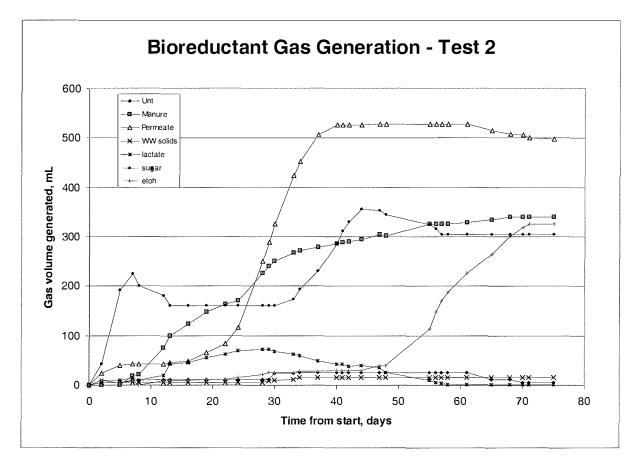
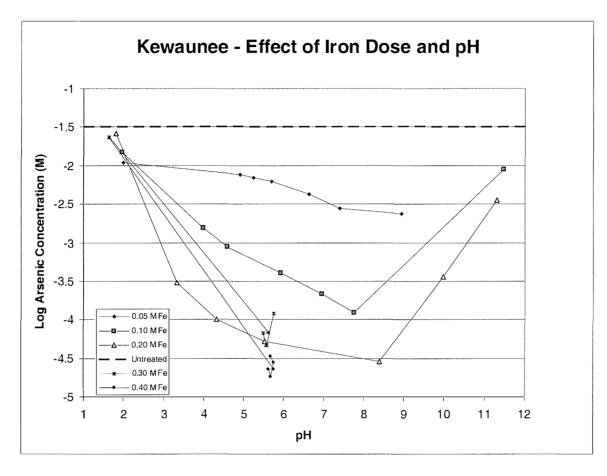
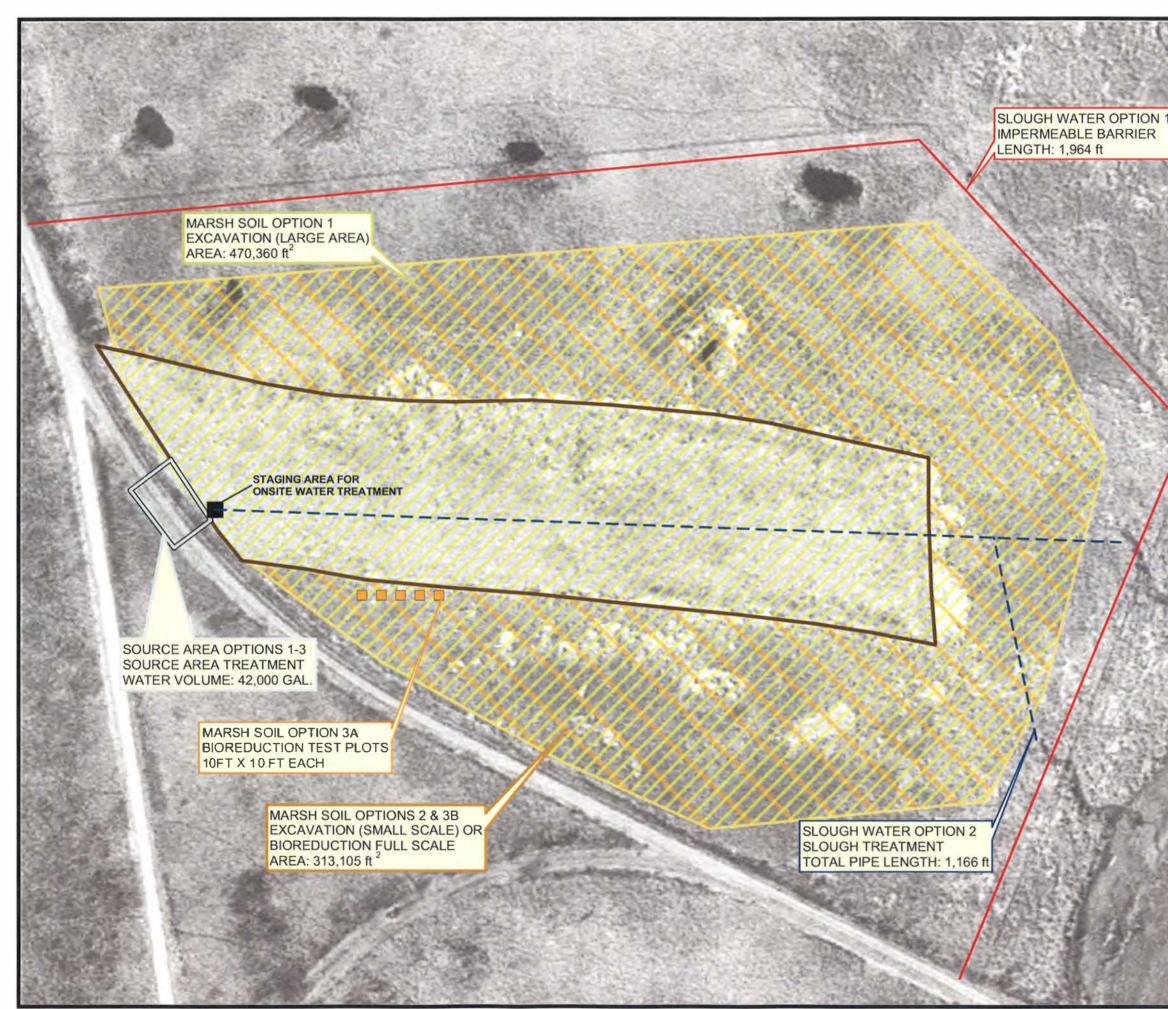


Figure 20 Log Arsenic Concentration vs. pH Plot for MW04-10 Groundwater Treated With Various Doses of Iron





D:\07201\05\72010501.mxd 8/3/2007 12:46:18

LEGEND

CAPAREA

SOURCEAREA

SOURCE AREA TREATMENT - OPTIONS 1-3

MARSH SOIL

EXCAVATION (LARGE AREA) - OPTION 1

EXCAVATION (SMALL AREA) OR **BIOREDUCTION FULL SCALE - OPTIONS 2& 3B**

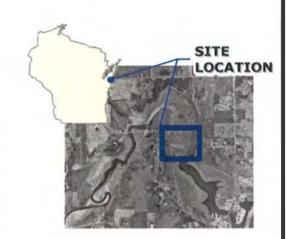
BIOREDUCTION TEST PLOTS - OPTION 3A

SLOUGH WATER

2

IMPERMEABLE BARRIER - OPTION 1

ON-SITE TREATMENT- OPTION 2



1 " EQUALS 100 ' 1:1,200

ROJECT WISCONSIN DEPARTMENT OF NATURAL RESOURCES KEWAUNEE MARSH

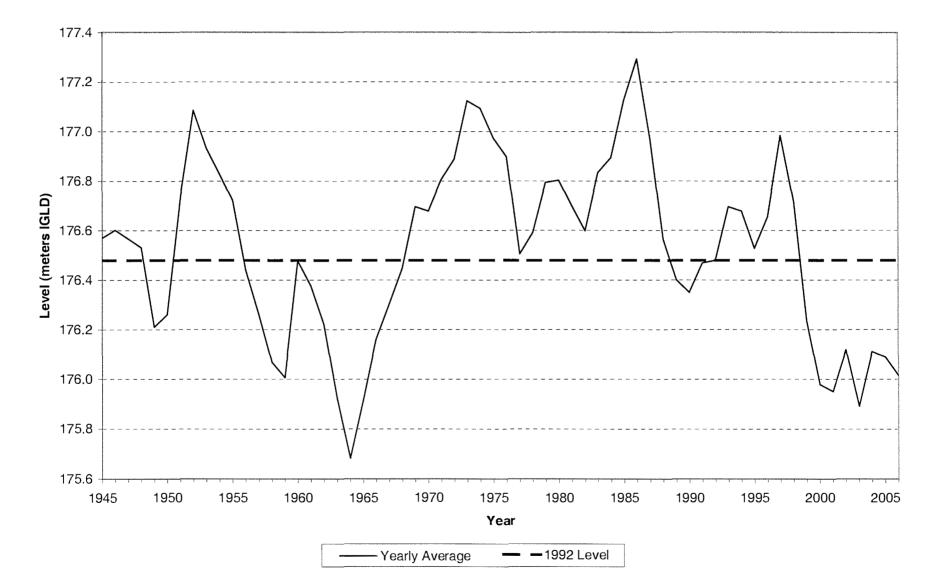
SHEET TITLE:

REMEDIAL OPTIONS ANALYSIS

DRAWN BY:	PAPEZJ	SCALE:	PROJ. NO.	00-007201.05
CHECKED BY:	SELLWOOD A	AS NOTED	FILE NO.	72010501.mxd
APPROVED BY:	STANFORTH B	DATE PRINTED:		
DATE:	AUGUST 2007	8/3/2007	_	FIGURE 21
				744 Heartland Trail Madison, WI 53717-1934
				P.O. Box 8923 53708-8923

P.O. Box 8923 53708-8923 Phone: 608-831-4444 Fax: 608-831-3334

Appendix A Lake Michigan Hydrograph and Water Level Data



Average Water Level for Lake Michigan/Huron

Data from USACE Web site (www.lre.usace.army.mil) IGLD = International Great Lakes Datum

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P:\7201\05\Lake Level Hydrograph.xls 8/6/2007



United States Army Corps of Engineers

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Great Lakes Water Level Table for Lake Michigan/Huron

Lake Michigan/Huron: 1945-2006 (Meters, IGLD 1985)

Historic Great Lakes Water Levels												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1945	176.36	176.33	176.36	176.45	176 .55	176.72	176.78	176.74	176.70	176.66	176.62	176.57
1946	176.56	176.57	176.65	176.70	176.70	176.7 5	176.77	176.69	176.60	176.49	176.42	176.32
1947	176.28	176.28	176.25	176.39	1 76 .5 7	176.72	176.80	176.81	176.77	176.72	17 6.65	176.56
1948	176.48	176.42	176.47	176.61	176.72	176.73	176.72	176.67	176.57	176.40	176.32	176.26
1949	176.20	176.19	176.19	176.26	176.31	176.34	176.38	176.34	176.22	176.14	176.02	175.94
1950	1 7 5.96	175.99	176.02	176.17	176.27	176.34	176.42	176.44	176.43	176.40	176.34	176.35
1951	176.34	176.34	176.41	176.58	176.75	176.82	176.91	176.93	176.92	176.93	1 7 6.95	176.95
1952	1 7 6.95	176.96	176.96	177.08	177.17	177.22	177.26	177.28	177.22	177.06	176.94	176.92
1953	1 7 6.85	176.82	176.83	176.91	177.00	177.07	177.12	177.11	177.02	176.92	176.81	176.74
1954	176.63	176.60	176.64	176.71	176.83	176.92	176.96	176.94	176.90	176.98	176.9 5	176.89
1955	176.83	176.78	176.76	176.82	176.88	176.91	176.88	176.79	176.64	176.54	176.46	176.38
1956	176.31	176.30	176.32	176.37	176.50	176.57	176.62	176.62	176.56	176.45	176.37	176.29
1957	176.22	176.19	176.17	176.20	176.28	176.35	176.43	176.38	176.33	176.24	176.21	176.16
1958	176.15	176.13	176.12	176.14	176.12	176.12	176.15	176.11	176.07	175.98	1 7 5.91	1 7 5.81
1959	1 7 5. 7 5	17 5. 7 5	175.79	175.92	176.06	176.11	176.12	176.12	176.10	176.10	176.13	176.12
1960	176.14	176.16	176.14	176.24	176.50	176.64	176.72	176.77	176.73	176.64	176.57	176.48
1961	176.38	176.31	176.33	176.36	176.42	176.44	176.46	1 7 6.45	176.43	176.38	176.32	176.24
1962	176.20	176.17	176.19	176.26	176.34	176.37	176.36	176.32	176.26	176.17	176.06	1 7 5.97
1963	1 7 5.89	175.8 5	17 5.85	175.94	176.02	176.06	176.04	176.03	175.98	1 7 5.90	175.80	175.71
1964	175.63	1 7 5.59	1 7 5.58	175.61	175.74	17 5. 7 6	175.78	175.77	175.76	175.70	175.65	17 5.62
1965	1 7 5.60	175.62	175.67	175.77	17 5.94	176.00	176.02	176.04	176.07	176.10	176.07	176.09
1966	176.10	176.08	176.13	176.20	176.26	176.30	176.28	176.24	176.17	176.08	1 7 6.01	176.08
1967	176.07	176.07	176.06	176.23	176.35	176.45	176.50	176.48	176.40	176.34	176.34	176.32
1968	176.29	176.30	176.27	176.35	176.40	176.47	176.55	1 7 6.58	176.60	176.57	176.50	176.48
1969	176.47	176.47	1 7 6.45	176.54	176.70	176.82	176.94	176.9 5	176.86	176.78	176.73	176.64

Great Lakes Water Level Table for Lake Michigan/Huron

Page 2 of 3

1970	176.59	176.56	176.53	176.58	176.68	176.76	176.80	176.78	176.77	176.73	176.69	176.67
1971	176.63	176.62	176.68	176.76	176.86	176.94	176.96	176.96	176.90	176.84	176.76	176.75
1972	176.73	176.65	176.65	176.72	176.88	176.93	176.99	177.05	177.07	177.03	177.00	176.96
1973	176.98	176.95	176.98	177.10	177.20	177.30	177.30	177.29	177.21	177.13	177.04	177.00
1974	176.95	176.97	177.00	177.07	177.19	177.28	177.32	177.26	177.15	177.04	176.98	176.91
1975	176.87	176.86	176.87	176.92	177.06	177.14	177.15	177.10	177.07	176.95	176.87	176.82
1976	176.76	176.75	176.87	177.02	177.11	177.15	177.15	177.08	176.95	176.80	176.64	176.51
1977	176.42	176.38	176.44	176.56	176.57	176.55	176.56	176.54	176.53	176.50	176.50	176.51
1978	176.48	176.45	176.43	176.51	176.61	176.67	176.69	176.68	176.71	176.70	176.62	176.54
1979	176.51	176.48	176.54	176.71	176.88	176.95	176.98	177.00	176.96	176.88	176.83	176.81
1980	176.78	176.72	176.68	176.77	176.84	176.90	176.93	176.93	176.90	176.82	176.72	176.65
1981	176.59	176.56	176.60	176.67	176.75	176.80	176.82	176.81	176.80	176.73	176.66	176.59
1982	176.51	176.46	176.45	176.56	176.62	176.66	176.69	176.69	176.65	176.62	176.60	176.67
1983	176.67	176.66	176.68	176.76	176.90	177.02	177.02	176.98	176.93	176.87	176.77	176.74
1984	176.70	176.70	176.72	176.81	176.91	177.01	177.06	177.04	177.02	176.96	176.93	176.88
1985	176.88	176.86	176.98	177.14	177.24	177.25	177.23	177.19	177.20	177.16	177.19	177.20
1986	177.14	177.11	177.12	177.23	177.28	177.33	177.39	177.39	177.38	177.50	177.38	177.26
1987	177.18	177.10	177.06	177.07	177.06	177.07	177.04	176.99	176.90	176.79	176.70	176.68
1988	176.63	176.60	176.57	176.67	176.70	176.67	176.61	176.57	176.48	176.42	176.43	176.42
1989	176.38	176.33	176.32	176.41	176.44	176.56	176.57	176.54	176.47	176.34	176.27	176.18
1990	176.15	176.16	176.19	176.27	176.35	176.44	176.51	176.49	176.45	176.41	176.39	176.39
1991	176.36	176.31	176.33	176.48	176.60	176.66	176.64	176.59	176.48	176.40	176.38	176.40
1992	176.38	176.36	176.38	176.44	176.53	176.52	176.54	176.53	176.52	176.49	176.52	176.54
1993	176.54	176.51	176.48	176.58	176.70	176.82	176.91	176.88	176.83	176.76	176.70	176.64
1994	176.57	176.56	176.59	176.63	176.70	176.72	176.82	176.81	176.78	176.71	176.66	176.59
1995	176.53	176.49	176.47	176.49	176.58	176.64	176.63	176.64	176.55	176.46	176.44	176.41
199 6	176.37	176.39	176.39	176.46	176.63	176.76	176.83	176.84	176.82	176.80	176.79	176.77
1997	176.79	176.82	176.89	176.95	177.07	177.13	177.19	177.16	177.12	177.02	176.89	176.78
1998	176.74	176.71	176.74	176.89	176.91	176.90	176.88	176.80	176.68	176.55	176.44	176.36
1999	176.27	176.28	176.24	176.25	176.28	176.34	176.40	176.36	176.24	176.14	176.04	175.99
2000	175.92	175.87	175.90	175.92	176.00	176.10	176.13	176.13	176.09	175.98	175.89	175.81
2001	175.77	175.78	175.78	175.85	175.95	176.06	176.05	176.03	176.01	176.03	176.05	176.05
2002	175.99	175.95	175.99	176.06	176.19	176.29	176.33	176.32	176.24	176.14	176.01	175.91
2003	175.82	175.75	175.73	175.82	175.92	176.00	176.04	176.02	175.94	175.87	175.89	175.90
2004	175.87	175.84	175.90	175.98	176.12	176.31	176.37	176.33	176.28	176.15	176.10	176.08
2005	176.08	176.10	176.10	176.14	176.19	176.21	176.19	176.17	176.09	176.00	175.93	175.88
2006	175.88	175.92	175.93	176.01	176.09	176.14	176.14	176.13	176.04	175.99	175.94	175.98

Great Lakes Water Level Table for Lake Michigan/Huron

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NOTICE: All data contained herein is preliminary in nature and therefore subject to change. The data is for general information purposes ONLY and SHALL NOT be used in technical applications such as, but not limited to, studies or designs. All critical data should be obtained from and verified by the United States Army Corps of Engineers, Detroit District, Engineering and Technical Services, Great Lakes Hydraulics and Hydrology Office, 477 Michigan Ave., Detroit, MI 48226. The United States of America assumes no liability for the completeness or accuracy of the data contained herein and any use of such data inconsistent with this disclaimer shall be solely at the risk of the user.

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Appendix B Laboratory Reports

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- November 2005 Samples
- June 2006 Samples
- April 2007 Samples

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November 2005 Samples

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Pace Analytical *

1241 Bellevue Street, Suite 9 Green Bay, WI 54302 920-469-2436, Fax: 920-469-8827

Analytical Report Number: 872615

Lab Contact: Tod Noltemeyer

Client: RMT - MADISON Project Name: KEWAUNEE Project Number: 7201.02

Lab Sample Number	Field ID	Matrix	Collection Date
872615-001	T-1 0512017	SED	06/01/06
872615-002	T-3 0512018	SED	06/01/06
872615-003	T-5 0512019	SED	06/01/06
872615-004	T-6 0512020	SED	06/01/06
872615-005	T-7 0512021	SED	06/01/06
872615-006	T-8 0512022	SED	06/01/06
872615-007	T-9 0512023	SED	06/01/06
872615-008	T-10 0512024	SED	06/01/06
872615-009	T-10A 0512025	SED	06/01/06
872615-010	T-10B 0512026	SED	06/01/06
872615-011	T-11 0512027	SED	06/01/06
872615-012	T-12 0512028	SED	06/01/06
872615-013	T-14 0512029	SED	06/01/06
872615-014	T-15 0512030	SED	06/01/06
872615-015	T-16 0512031	SED	06/01/06
872615-016	T-17 0512032	SED	06/01/06

I certify that the data contained in this Final Report has been generated and reviewed in accordance with approved methods and Laboratory Standard Operating Procedure. Exceptions, if any, are discussed in the accompanying sample comments. Release of this final report is authorized by Laboratory management, as is verified by the following signature. This report shall not be reproduced, except in full, without the written consent of Pace Analytical Services, Inc. The sample results relate only to the analytes of interest tested.

Approval Signature

100 4/15 Date

Pace Analytical Services, Inc.		Anal	Analytical Report Number: 872615						1241 Bellevue Street Green Bay, WI 54302 920-469-2436			
Client : RMT - MAD Project Name : KEWAUNE Project Number : 7201.02 Field ID : T-1 0512017	2						La	Collecti Repo	rix Type : SEDIN on Date : 06/01/ ort Date : 06/14/ Number : 87261	06 06		
INORGANICS												
Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method		
Arsenic	2500	4.8	16		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B		
Calcium	92000	57	190		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B		
Iron	6400	28	95		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B		
Percent Solids	17.6				1	%		06/07/06	SM M2540G	SM M2540G		
Phosphorus	830	66	220		1	mg/kg	А	06/07/06	EPA M365.4	EPA M365.4		
TOC as NPOC Avg of Reps 1-4	630000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060		
TOC as NPOC Replicate 1	590000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060		
TOC as NPOC Replicate 2	710000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060		
TOC as NPOC Replicate 3	440000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060		
TOC as NPOC Replicate 4	760000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060		
Total Volatile Solids	61.3			1.00	1	%		06/06/06	EPA 160.4	EPA 160.4		

Pace Analytical Services, Inc.				Repo	rt Nu	mber: 8	1241 Bellevue Street Green Bay, WI 54302 920-469-2436			
Client : RMT - MAD Project Name : KEWAUNE Project Number : 7201.02 Field ID : T-3 0512018	Ξ						La	Collectio Repo	ix Type: SEDIN on Date: 06/01/ ort Date: 06/14/ Number: 87261	06 06
INORGANICS										
Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic	900	4.6	15		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Calcium	33000	54	180		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Iron	5300	27	91		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Percent Solids	18.4				1	%		06/07/06	SM M2540G	SM M2540G
Phosphorus	680	48	160		1	mg/kg	А	06/07/06	EPA M365.4	EPA M365.4
TOC as NPOC Avg of Reps 1-4	380000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 1	300000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 2	390000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 3	280000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060

1

1

1.00

mg/kg

%

80000

560000 24000

61.3

TOC as NPOC Replicate 4

Total Volatile Solids

SW846 9060

EPA 160.4

SW846 9060

EPA 160.4

06/13/06

06/06/06

Pace Analytical Services, Inc.		Anal	ytical	Repo	rt Nu	mber: 8	1241 Bellevue Street Green Bay, WI 54302 920-469-2436			
Client : RMT - MAD Project Name : KEWAUNE Project Number : 7201 02 Field ID : T-5 0512019	Ξ						rix Type : SEDIN on Date : 06/01/ ort Date : 06/14/ Number : 87261	/01/06 /14/06		
INORGANICS										
Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic	720	7.1	24		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Calcium	58000	85	280		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Iron	7400	43	140		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Percent Solids	11.7				1	%		06/07/06	SM M2540G	SM M2540G
Phosphorus	1400	66	220		1	mg/kg	А	06/07/06	EPA M365.4	EPA M365.4
TOC as NPOC Avg of Reps 1-4	350000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 1	570000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 2	270000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 3	240000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 4	310000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
Total Volatile Solids	61.9			1.00	1	%		06/06/06	EPA 160.4	EPA 160.4

Pace Analytical Services, Inc.		Analytical Report Number: 872615							1241 Bellevue Street Green Bay, WI 54302 920-469-2436			
Client : RMT - MAD Project Name : KEWAUNEI Project Number : 7201 02 Field ID : T-6 0512020	Ξ					Matrix Type : SEDIMENT Collection Date : 06/01/06 Report Date : 06/14/06 Lab Sample Number : 872615-004						
INORGANICS												
Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method		
Arsenic	240	4.3	14		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B		
Calcium	61000	51	170		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B		
Iron	8200	25	85		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B		
Percent Solids	19.6				1	%		06/07/06	SM M2540G	SM M2540G		
Phosphorus	1100	45	150		1	mg/kg	А	06/07/06	EPA M365.4	EPA M365.4		
TOC as NPOC Avg of Reps 1-4	480000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060		
TOC as NPOC Replicate 1	320000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060		
TOC as NPOC Replicate 2	530000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060		
TOC as NPOC Replicate 3	760000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060		
TOC as NPOC Replicate 4	320000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060		
Total Volatile Solids	42.0			1.00	1	%		06/06/06	EPA 160.4	EPA 160.4		

Pace Analytical Services, Inc.		Anal	Analytical Report Number					2615 1241 Bellevue Street Green Bay, WI 54302 920-469-2436				
Client : RMT - MAD Project Name : KEWAUNE Project Number : 7201.02 Field ID : T-7 0512021	5						La	Matrix Type : SEDIMENT Collection Date : 06/01/06 Report Date : 06/14/06 Lab Sample Number : 872615-005				
INORGANICS												
Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method		
Arsenic	86	2.7	9.0		1	mg/Kg		06/08/06	SW846 3050B	SW8466010B		
Calcium	35000	32	110		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B		
Iron	10000	16	54		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B		
Percent Solids	31.1				1	%		06/07/06	SM M2540G	SM M2540G		
Phosphorus	1300	26	88		1	mg/kg		06/07/06	EPA M365.4	EPA M365.4		
TOC as NPOC Avg of Reps 1-4	380000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060		
TOC as NPOC Replicate 1	520000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060		
TOC as NPOC Replicate 2	410000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060		
TOC as NPOC Replicate 3	360000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060		
TOC as NPOC Replicate 4	230000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060		
Total Volatile Solids	26.8			1.00	1	%		06/06/06	EPA 160.4	EPA 160.4		

Pace Analytical Services, Inc.		Analytical Report Number: 872615 Green 920-46							evue Street y, WI 54302 2436	
Client : RMT - MAD Project Name : KEWAUNE Project Number : 7201.02 Field ID : T-8 0512022	Ξ	Matrix Type: SEDIMENT Collection Date: 06/01/06 Report Date: 06/14/06 Lab Sample Number: 872615-006								706 706
INORGANICS										
Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic	140	6.0	20		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Calcium	34000	71	240		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
lron	6500	36	120		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Percent Solids	14.0				1	%		06/07/06	SM M2540G	SM M2540G
Phosphorus	1200	57	190		1	mg/kg	А	06/07/06	EPA M365.4	EPA M365.4
TOC as NPOC Avg of Reps 1-4	560000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 1	610000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 2	570000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 3	540000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 4	500000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
Total Volatile Solids	75.9			1.00	1	%		06/06/06	EPA 160.4	EPA 160.4

Pace Analytical Services, Inc.		Anal	ytical	Repo	rt Nu	mber: 8	1241 Bellevue Street Green Bay, WI 54302 920-469-2436					
Client : RMT - MAD Project Name : KEWAUNE Project Number : 7201 02 Field ID : T-9 0512023	Ξ							Matrix Type : SEDIMENT Collection Date : 06/01/06 Report Date : 06/14/06 Lab Sample Number : 872615-007				
INORGANICS												
Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method		
Arsenic	660	5.8	19		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B		
Calcium	22000	69	230		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B		
Iron	5000	35	120		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B		
Percent Solids	14.4				1	%		06/07/06	SM M2540G	SM M2540G		
Phosphorus	1300	100	330		1	mg/kg	А	06/07/06	EPA M365.4	EPA M365.4		
TOC as NPOC Avg of Reps 1-4	640000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060		
TOC as NPOC Replicate 1	630000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060		
TOC as NPOC Replicate 2	630000	24000	80000		1	rng/kg		06/13/06	SW846 9060	SW846 9060		
TOC as NPOC Replicate 3	790000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060		
TOC as NPOC Replicate 4	520000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060		
Total Volatile Solids	79 1			1.00	1	%		06/06/06	EPA 160.4	EPA 160.4		

Pace Analytical Services, Inc.		Anal	ytical	Repo	rt Nu	mber: 8	1241 Bellevue Street Green Bay, WI 54302 920-469-2436			
Client: RMT - MAD Project Name: KEWAUNE Project Number: 7201.02 Field ID: T-10 051202	Ξ						La	Collectio Repo	ix Type : SEDIN on Date : 06/01/ ort Date : 06/14/ Number : 87261	06 06
INORGANICS										
Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic	760	11	38		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Calcium	30000	140	450		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Iron	5600	68	230		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Percent Solids	7.35				1	%		06/07/06	SM M2540G	SM M2540G
Phosphorus	1600	120	390		1	mg/kg	А	06/07/06	EPA M365.4	EPA M365.4
TOC as NPOC Avg of Reps 1-4	490000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 1	310000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 2	380000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 3	490000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060

1

1

1.00

mg/kg

%

06/13/06 SW846 9060

06/06/06 EPA 160.4

SW846 9060

EPA 160.4

780000 24000 80000

80.2

TOC as NPOC Replicate 4

Total Volatile Solids

Pace Analytical Services, Inc.		Analytical Report Number: 872615 1241 Bellevue Stru Green Bay, WI 54 920-469-2436						y, WI 54302			
Client : RMT - MAD Project Name : KEWAUNE Project Number : 7201.02 Field ID : T-10A 05120	Ξ						La	Matrix Type : SEDIMENT Collection Date : 06/01/06 Report Date : 06/14/06 Lab Sample Number : 872615-009			
INORGANICS											
Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method	
Arsenic	590	9.7	32		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B	
Calcium	26000	120	390		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B	
Iron	4600	58	190		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B	
Percent Solids	8.64				1	%		06/07/06	SM M2540G	SM M2540G	
Phosphorus	2100	130	450		1	mg/kg	А	06/07/06	EPA M365.4	EPA M365.4	
TOC as NPOC Avg of Reps 1-4	510000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060	
TOC as NPOC Replicate 1	440000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060	
TOC as NPOC Replicate 2	440000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060	
TOC as NPOC Replicate 3	520000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060	
TOC as NPOC Replicate 4	650000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060	
Total Volatile Solids	83.1			1.00	1	%		06/06/06	EPA 160.4	EPA 160.4	

Pace Analytical Services, Inc.		Anal	ytical	Repo	rt Nu	mber: 8	72615	1241 Bellevue Street Green Bay, WI 54302 920-469-2436				
Client : RMT - MAD Project Name : KEWAUNE Project Number : 7201.02 Field ID : T-10B 05120	Ē	Collection D Report D							on Date: 06/01/ ort Date: 06/14/	x Type: SEDIMENT n Date: 06/01/06 rt Date: 06/14/06 umber: 872615-010		
INORGANICS												
Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method		
Arsenic	850	9.5	32		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B		
Calcium	38000	110	380		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B		
Iron	6700	56	190		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B		
Percent Solids	8.86				1	%		06/07/06	SM M2540G	SM M2540G		
Phosphorus	1700	79	260		1	mg/kg	А	06/07/06	EPA M365.4	EPA M365.4		
TOC as NPOC Avg of Reps 1-4	430000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060		
TOC as NPOC Replicate 1	510000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060		
TOC as NPOC Replicate 2	410000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060		
TOC as NPOC Replicate 3	340000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060		
TOC as NPOC Replicate 4	440000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060		
Total Volatile Solids	82.7			1.00	1	%		06/06/06	EPA 160.4	EPA 160.4		

Pace Analytical Services, Inc.		Analytical Report Number: 872615 1241 Bellevue : Green Bay, WI 920-469-2436						y, WI 54302		
Client : RMT - MAD Project Name : KEWAUNE Project Number : 7201.02 Field ID : T-11 051202	Ē						Matrix Type: SEDIMENT Collection Date: 06/01/06 Report Date: 06/14/06 Lab Sample Number: 872615-011			
INORGANICS										
Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic	670	10	34		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Calcium	87000	120	400		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Iron	16000	60	200		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Percent Solids	8.29				1	%		06/07/06	SM M2540G	SM M2540G
Phosphorus	2600	110	380		1	mg/kg	А	06/07/06	EPA M365.4	EPA M365.4
TOC as NPOC Avg of Reps 1-4	290000	24000	80000		1	mg/kg	*	06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 1	350000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 2	170000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 3	400000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 4	260000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
Total Volatile Solids	53.5			1.00	1	%	*	06/06/06	EPA 160.4	EPA 160.4

Pace Analytical Services, Inc.		Anal	ytical	Repo	rt Nu	mber: 8	72615			evue Street y, WI 54302 2436
Client : RMT - MAD Project Name : KEWAUNE Project Number : 7201.02 Field ID : T-12 051202	5						La	Collecti Repo	rix Type: SEDIN on Date: 06/01/ ort Date: 06/14/ Number: 87261	06 06
INORGANICS										
Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic	570	7.4	25		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Calcium	25000	88	290		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Iron	5700	44	150		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Percent Solids	11.3				1	%		06/07/06	SM M2540G	SM M2540G
Phosphorus	2200	76	250		1	mg/kg		06/07/06	EPA M365.4	EPA M365.4
TOC as NPOC Avg of Reps 1-4	340000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 1	430000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 2	410000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 3	320000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 4	220000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
Total Volatile Solids	60.6			1.00	1	%		06/06/06	EPA 160.4	EPA 160.4

Pace Analytical Services, Inc.		Anal	ytical	Repo	rt Nu	mber: 8	72615			evue Street y, WI 54302 2436
Client: RMT - MAD Project Name: KEWAUNE Project Number: 7201.02 Field ID: T-14 051202	E						La	Collecti Repo	rix Type: SEDIN on Date: 06/01/ ort Date: 06/14/ Number: 87261	06 06
INORGANICS										
Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Ani Method
Arsenic	110	7.8	26		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Calcium	24000	93	310		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Iron	6100	46	150		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Percent Solids	10.8				1	%		06/07/06	SM M2540G	SM M2540G
Phosphorus	1900	90	300		1	mg/kg	А	06/07/06	EPA M365.4	EPA M365.4
TOC as NPOC Avg of Reps 1-4	450000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 1	440000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 2	390000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 3	400000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 4	570000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060

1.00 1

%

06/06/06 EPA 160.4

EPA 160.4

79.3

Total Volatile Solids

Matrix Type : SEDIMENT Collection Date : 06/01/06

Report Date: 06/14/06

Lab Sample Number: 872615-014

Client: RMT - MADISON Project Name : KEWAUNEE Project Number : 7201.02 Field ID : T-15 0512030

INORGANICS

Pace Analytical

Services, Inc.

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic	120	14	47		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Calcium	15000	170	560		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Iron	2900	84	280		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Percent Solids	5.93				1	%		06/07/06	SM M2540G	SM M2540G
Phosphorus	1600	200	650		1	mg/kg	А	06/07/06	EPA M365.4	EPA M365.4
TOC as NPOC Avg of Reps 1-4	480000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 1	460000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 2	540000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 3	570000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 4	360000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
Total Volatile Solids	88.6			1.00	1	%		06/06/06	EPA 160.4	EPA 160.4

Project Name : KEWAUNEE Project Number: 7201.02 Field ID : T-16 0512031

INORGANICS

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic	490	6.2	21		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Calcium	44000	74	250		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Iron	8500	37	120		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Percent Solids	13.5				1	%		06/07/06	SM M2540G	SM M2540G
Phosphorus	980	38	130		1	mg/kg	А	06/07/06	EPA M365.4	EPA M365.4
TOC as NPOC Avg of Reps 1-4	460000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 1	730000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 2	250000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 3	500000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 4	350000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
Total Volatile Solids	70.9			1.00	1	%		06/06/06	EPA 160.4	EPA 160.4

Client: RMT - MADISON

Matrix Type : SEDIMENT Collection Date: 06/01/06 Report Date: 06/14/06 Lab Sample Number: 872615-015

Pace Analytical Services, Inc.

Matrix Type : SEDIMENT Collection Date : 06/01/06

Report Date: 06/14/06

Lab Sample Number: 872615-016

Client: RMT - MADISON Project Name : KEWAUNEE Project Number: 7201.02 Field ID: T-17 0512032

INORGANICS

Pace Analytical

Services, Inc.

Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic	520	13	42		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Calcium	24000	150	500		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Iron	4900	76	250		1	mg/Kg		06/08/06	SW846 3050B	SW846 6010B
Percent Solids	6.62				1	%		06/07/06	SM M2540G	SM M2540G
Phosphoru s	1400	120	390		1	mg/kg	А	06/07/06	EPA M365.4	EPA M365.4
TOC as NPOC Avg of Reps 1-4	410000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 1	350000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 2	350000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 3	520000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
TOC as NPOC Replicate 4	410000	24000	80000		1	mg/kg		06/13/06	SW846 9060	SW846 9060
Total Volatile Solids	79.9			1.00	1	%		06/06/06	EPA 160.4	EPA 160.4

Pace Analytical Services, Inc. 1241 Bellevue Street Green Bay, WI 54302 920-469-2436 Fax: 920-469-8827

Lab Number	TestGroupID	Field ID	Comment
872615	W-TPO4-S	All Samples	A - Analyte is detected in the method blank at a concentration of 4.0 mg/kg for samples 001- 004, 006-011 and 013-016.
872615-011	W-TOCQA-S	T-11 0512027	* - Duplicate analyses not within control limits.

Qualifier Codes

Ą	Inorganic	Analyte is detected in the method blank. Method blank criteria is evaluated to the laboratory method detection limit. Additionally,
	morganic	method blank acceptance may be based on project specific criteria or determined from analyte concentrations in the sample and are evaluated on a sample basis.
3	Inorganic	The analyte has been detected between the method detection limit and the reporting limit.
3	Organic	Analyte is present in the method blank. Method blank criteria is evaluated to the laboratory method detection limit. Additionally, method blank acceptance may be based on project specific criteria or determined from analyte concentrations in the sample and are evaluated on a sample by sample basis.
2	All	Elevated detection limit.
)	All	Analyte value from diluted analysis or surrogate result not applicable due to sample dilution.
Ξ	Inorganic	Estimated concentration due to matrix interferences. During the metals analysis the serial dilution failed to meet the established control limits of 0-10%. The sample concentration is greater than 50 times the IDL for analysis done on the ICP or 100 times the IDL for analysis done on the ICP-MS. The result was flagged with the E qualifier to indicate that a physical interference was observed.
Ξ	Organic	Analyte concentration exceeds calibration range.
=	Inorganic	Due to potential interferences for this analysis by Inductively Coupled Plasma techniques (SW-846 Method 6010), this analyte has been confirmed by and reported from an alternate method.
-	Organic	Surrogate results outside control criteria.
G	All	The result is estimated because the concentration is less than the lowest calibration standard concentration utilized in the initial calibration. The method detection limit is less than the reporting limit specified for this project.
H	All	Preservation, extraction or analysis performed past holding time.
ΗF	Inorganic	This test is considered a field parameter, and the recommended holding time is 15 minutes from collection. The analysis was performed in the laboratory beyond the recommended holding time.
J	All	Concentration detected equal to or greater than the method detection limit but less than the reporting limit.
<	Inorganic	Sample received unpreserved. Sample was either preserved at the time of receipt or at the time of sample preparation.
,	Organic	Detection limit may be elevated due to the presence of an unrequested analyte.
	All	Elevated detection limit due to low sample volume.
1	Organic	Sample pH was greater than 2
1	All	Spiked sample recovery not within control limits.
0	Organic	Sample received overweight.
2	Organic	The relative percent difference between the two columns for detected concentrations was greater than 40%.
ב	All	The analyte has been detected between the limit of detection (LOD) and limit of quantitation (LOQ). The results are qualified due to the uncertainty of analyte concentrations within this range.
5	Organic	The relative percent difference between quantitation and confirmation columns exceeds internal quality control criteria. Because the result is unconfirmed, it has been reported as a non-detect with an elevated detection limit.
J	All	The analyte was not detected at or above the reporting limit.
(All	Sample received with headspace.
V	All	A second aliquot of sample was analyzed from a container with headspace.
(All	See Sample Narrative.
	Organics	This compound was separated in the check standard but it did not meet the resolution criteria as set forth in SW846.
k.	All	Laboratory Control Spike recovery not within control limits.
	All	Precision not within control limits.
•	Inorganic	The sample result is greater than four times the spike level: therefore, the percent recovery is not evaluated.
:	All	The analyte was not detected at or above the reporting limit.
	Inorganic	Dissolved analyte or filtered analyte greater than total analyte; analyses passed QC based on precision criteria.
-	Inorganic	Dissolved analyte or filtered analyte greater than total analyte; analyses failed QC based on precision criteria.
5	Inorganic	BOD result is estimated due to the BOD blank exceeding the allowable oxygen depletion.
ļ	Inorganic	BOD duplicate precision not within control limits. Due to the 48 hour holding time for this test, it is not practical to reanalyze and try to correct the deficiency.
5	Inorganic	BOD result is estimated due to insufficient oxygen depletion. Due to the 48 hour holding time for this test, it is not practical to reanalyze and try to correct the deficiency.
6	Inorganic	BOD laboratory control sample not within control limits. Due to the 48 hour holding time for this test, it is not practical to reanalyz and try to correct the deficiency.
7	Inorganic	BOD result is estimated due to complete oxygen depletion. Due to the 48 hour holding time for this test, it is not practical to reanalyze and try to correct the deficiency.

Test Group Name	872615-001	872615-002	872615-003	872615-004	872615-005	872615-006	872615-007	872615-008	872615-009	872615-010	872615-011	872615-012	872615-013	872615-014	872615-015	872615-016
ARSENIC	В	В	В	В	В	В	В	В	В	В	В	В	В	В	В	В
CALCIUM	В	В	В	В	В	В	В	В	В	В	В	В	В	В	В	В
IRON	В	В	В	В	В	В	В	В	В	В	В	В	В	В	В	В
PERCENT SOLIDS	В	В	В	В	В	В	В	В	В	В	В	В	В	В	В	В
PHOSPHORUS, TOTAL	В	В	В	В	В	В	В	В	В	В	В	В	В	В	В	В
SOLIDS, TOTAL VOLATILE	В	В	В	В	В	В	В	В	В	В	В	В	В	В	В	В
TOC AS NPOC, QUAD + AVERAGE	К	К	к	к	К	к	К	к	К	К	К	К	К	К	К	к

Code	Facility	Address	WI Certification
В	Green Bay Lab (Bellevue St)	1241 Bellevue Street, Suite 9 Green Bay, WI 54302	405132750 / DATCP: 105-444
к	Kimberly Laboratory	1090 Kennedy Ave. Kimberly, WI 54136	445134030

Pace Analytical Services, Inc.

QC Summary

1241 Bellevue Street Green Bay, WI 54302 920-469-2436 Fax: 920-469-8827

Batch:	872	2615											ОС Туре	Clien	it Samj	ple ID		Lab	Sample	D				
Lab Section:	WE	ETCHE	M									-	MB	WCG	G1888-0)32MB		WC	G1888-0	32MB				
QC Batch Num	ber: 118	317										l	CS	WCG	G1888-C)32MBL	CS	WC	G1888-0	32MBL	CS			
Prep Method:		A M36	E 1									I	MS	T-17	051203	32MS		8726	615-016	MS				
•												1	MS	T-10	051202	24MS		872	615-008	MS				
Analytical Meth	iod: EP	A M36	5.4									1	MSD	T-17	051203	32MSD		8726	615-016	MSD				
												I	MSD	T-10	051202	24MSD		872	615-008	MSD				
Client Sample ID		Lab Sar	mple ID	МВ	ID			CI	ient S	ample	ID		Lab San	nple ID	МВ	ID								
T-1 0512017		872615-0	001	MB				T-3	3 05120	18			872615-0	02	MB									
T-5 0512019		872615-0		MB					6 05120				872615-0		MB									
T-7 0512021		872615-0		MB					3 0 5 1 2 0				872615-0		MB									
T-9 0512023		872615-0		MB					10 0512				872615-0		MB									
T-10A 0512025		872615-0		MB MB					10B 051				872615-0		MB									
T-11 0512027 T-14 0512029		872615-0 872615-0		MB					12 0512 15 0512				872615-0 872615-0		MB MB									
T-16 0512029		872615-0		MB					17 0512				872615-0		MB									
		1	T T			1						1		1	1		1]						
	Method							LCS	/ C	_CS/LCS										MS			S/MSI trol Lir	
	Blank	2000										Parent	Parent	MS			MSD		_	MS				
TestName	Result						1		-	RPD	Sample	Result	Spiked	1	ecovery	Spiked		Recovery				UCL	RPD	
	Conc	1				Conc	76 (%	%	Number	Conc	Conc	Conc	% C	Conc	Conc		C %	C	%	%	%
Phosphorus	20	500.00	499.3	99.9					79	125	20	872615-008	1634.2	3887.3	5191.1	91.5	3887.3	4911.4	84.3	5.5		54	139	20
Phosphorus	20	500.00	499.3	99.9					79	125	20	872615-016	1353.3	3873.3	5691.8	112.0	3873.3	5901.6	117.4	3.6		54	139	20

Conc = mg/kg unless otherwise noted

C = QC Code, see Qualifer Sheet

Report Date: 6/29/2006

QC Batch Number: 11817

 $\label{eq:parent} Parent \ Result \ is \ reported \ down \ to \ MDL \ in \ order \ to \ allow \ Validation \ of \ this \ worksheet$

Pace Analytical Services, Inc.

QC Summary

1241 Bellevue Street Green Bay, WI 54302 920-469-2436 Fax: 920-469-8827

Batch:	872	2615											QC Туре	Clien	t Samp	ole ID		Lab	Samp	le IC)			
Lab Section:	WE	ETCHE	M									Ĩ	MВ	WCG	1892-0	62MB		WC	G1892	-062	MB			
QC Batch Number	er: 118	319										l	CS	WCG	1892-0	62MBL	CS	WC	G1892	-062	MBLCS	5		
Prep Method:	FP	A 160.	4									[DUP	T-11	051202	7DUP		872	615-01	1 DU	Р			
Analytical Method												[OUP	T-1 0	512017	DUP		872	615-00	1DU	Ρ			
Client Sample ID		Lab Sa	mple ID	MB II	C			Clie	ent Sa	mple	ID		LabSam	nple ID	МВ	ID								
T-1 0512017		872615-0	001	MB				T-3	05120 ⁻	18			872615-00	02	MB									
T-5 0512019		872615-0	003	MB				T-6	051202	20			872615-00	04	MB									
T-7 0512021		872615-0		MB					051202				872615-00		MB									
T-9 0512023		872615-0		MB					0 05120				872615-00		MB									
T-10A 0512025		872615-0		MB					DB 0512				872615-0		MB									
T-11 0512027		872615-0		MB					2 05120				872615-0		MB									
T-14 0512029		872615-0	-	MB					505120				872615-0		MB									
T-16 0512031		872615-0	15	MB				1-1/	7 05120	32			872615-01	6	MB					********				
	Method Blank	LCS			LCSD			LCS/ LCSD	1	CS/LCS		Parent	Parent	MS			MSD				MS/ MSD	1	MS/MSI Introl Lir	
Test Name	Result	Spiked	LCSR	ecovery	Spiked	LCSD	Recovery		LCL	UCL	RPD	Sample	Result	Spiked	MS B	ecovery	Spiked	MSD	Recove	rv	RPD	LCL	UCL	RPD
	Conc	Conc	Conc	% C	Conc	Conc	% C	1	1	%	%	Number	Conc	Conc	Conc	% (Conc		c	% C	1	%	%
Total Volatile Solids <	1	100.0	100	100.0					80	120	20	872615-001	61.27								-			
Total Volatile Solids <	1	100.0	100	100.0					80	120	20	872615-011	53.45								[

Conc = % unless otherwise noted C = QC Code, see Qualifer Sheet

Report Date: 6/29/2006

QC Batch Number: 11819

Parent Result is reported down to MDL in order to allow Validation of this worksheet

The %R and RPD results are calculated from raw data values with more significant figures than are reported on this form.

E

Pace Analytical Services, Inc.

QC Summary

1241 Bellevue Street Green Bay, WI 54302 920-469-2436 Fax: 920-469-8827

Batch:		872	2615											QC Туре	Clier	it Samj	ole ID		Lab	Sample	ID			
Lab Section:		ME	TALS										-	MB	MBS	MTG19	12-39		MBS	SMTG19	12-39			
QC Batch Num	be	er: 118	333										I	LCS	LCSS	SMTG1	912-39		LCS	SMTG19	12-39			
Prep Method:	~ ~		/846 3	050R									1	MS	8725	77-018	MS		872	577-018 N	N S			
Analytical Meth	oc												I	MSD	8725	77-018	MSD		872	577-018 N	ISD			
Client Sample ID			Lab Sa	mple ID	MB	ID			С	ient S	Sample	ID		Lab San	nple ID	MB	ID							
T-1 0512017			872615-0		MB					3 0512				872615-0		MB								
T-5 0512019			872615-0		MB					6 0512				872615-0		MB								
T-7 0512021 T-9 0512023			872615-0 872615-0		MB MB					3 0512 10 051				872615-0 872615-0		MB MB								
T-10A 0512025			872615-0		MB						12024			872615-0		MB								
T-11 0512027			872615-0		MB					12 051				872615-0		MB								
T-14 0512029			872615-0	013	MB				Т-	15 051	2030			872615-0	14	MB								
T-16 0512031			872615-0	15	MB				T-	17 051	2032			872615-0	16	MB		مدينية مرجورة						
		Method Blank	LCS						LCS LCS	/ (LCS/LC Control L		- Parent	Parent	MS			MSD			MS/ MSD		MS/MS ontrol L	
Test Name		Result	Spiked	LCSF	Recovery		LCSD	Recover			L UCL	RPD	Sample	Result	Spiked	MSR	ecovery	1	MSD	Recovery		LCI	. UCL	RPD
		Conc	Conc	Conc		C Conc	Conc	%	C %	C %	%	%	Number	Conc	Conc	Conc	%	C Conc	Conc			C %	%	%
Arsenic	<	0.84	50.0	47.6	95.2					80	120	20	872577-018	1.72	55.0	51.1	89.8	55.0	53	93.1	3.5	75	125	20
Calcium		13	500.00	491.9	98.4					80	120	20	872577-018	1749.3	550.36	1863.8	20.8	V 550.36	2013.1	47.9 M	7.7	75	125	20
iron		5.5	500	504	100.8					80	120	20	872577-018	1.5E+7	550000	2.5e+007	1910.1	+ 550000	2.2e+00	7 1374.0 +	12.4	75	125	20

Conc = mg/Kg unless otherwise noted

C = QC Code, see Qualifer Sheet

Report Date: 6/29/2006

QC Batch Number: 11833

Parent Result is reported down to MDL in order to allow Validation of this worksheet

Pace Analytical Services, Inc.

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QC Summary

1241 Bellevue Street Green Bay, WI 54302 920-469-2436 Fax: 920-469-8827

Batch:	8	72615											QC Туре	Clien	t Samp	ole ID		Lab	Sample	e ID			
Lab Section:	V	/ETCH	EM-K									-	MB	WCK	0927-0	12MB		WCF	<0927-0	12MB			
QC Batch Num	ber: 1	1960											LCS	WCK	0927-0	12MBLC	CS	WCK	(0927-0	12MBLC	S		
Prep Method:	S	W846 9	060										MS		512018				615-002				
Analytical Meth		W846 9											MSD	T-3 0	512018	MSD		8726	615-002	MSD			
Client Sample ID		Lab Sa	mple ID	ME	ID			Cli	ent Sa	mple	ID		Lab San	ple ID	МВ	ID							
T-1 0512017 T-5 0512019		872615- 8 7 2615-		MB MB					05120 051202				872615-00 872615-00		MB MB								
T- 7 0512021 T-9 0512023		872615-		MB MB					051202 0 05120				872615-00	-	MB								
T-10A 0512025		872615- 872615-		MB					DB 05120				872615-00 872615-01	-	MB MB								
	Methoo Blank	LCS			LCSD			LCS/	Co	CS/LCS		Parent	Parent	MS	2 164 166		MSD			MS/ MSE		MS/N Control	
Test Name	Result	Spiked	1	Recovery			Recovery	RPD	LCL		RPD	Sample	Result	Spiked		ecovery	Spiked		Recovery			CL UC	
	Cond		Conc	%	C Conc	Conc	% C	% C	-	%	%	Number	Conc	Conc	Conc	% C	000	Conc		C %	- 1	% %	
TOC as NPOC Avg of Reps	< 60	1000	972.9	97.3					80	120	10	872615-002	380000	200000	570000	93.0	200000	630000	123.6	10.2		50 150) 30
TOC as NPOC Replicate 1	< 60			-								872615-002	300000							-			
TOC as NPOC Replicate 2	< 60						-					872615-002	390000										
TOC as NPOC Replicate 3	< 60	-		-								872615-002	280000	-									
TOC as NPOC Replicate 4	< 60									<u> </u>		872615-002	560000										

Conc = mg/kg unless otherwise noted

C = QC Code, see Qualifer Sheet

Report Date: 6/29/2006

QC Batch Number: 11960

Parent Result is reported down to MDL in order to allow Validation of this worksheet

Pace Analytical Services, Inc.

QC Summary

1241 Bellevue Street Green Bay, WI 54302 920-469-2436 Fax: 920-469-8827

Batch:		873	2615												QC Type	Clien	t Sam	ole ID		Lab	Sample	ID			
Lab Section:		WE	ETCHE	EM-K										·	MB	WCK	0927-0	13MB		WCH	(0927-01	3MB			
QC Batch Numl	be	r: 11	979												LCS	WCK	0927-0	13MBL0	CS	WCK	0927-01	3MBLCS			
Prep Method:		SV	V846 9	060											MS	T-11	051202	27MS		8726	615-011 M	S			
Analytical Method	od		V 846 9												MSD	T-11	051202	27MSD		8726	515-011 M	SD			
Client Sample ID			Lab Sa	mple IC	וכ	мв II	C			С	lient	Sample	e ID		Lab San	nple ID	МВ	ID							
T-11 0512027			872615-0			MB					12 05				872615-0		MB MB								
T-14 0512029 T-16 0512031			872615-0 872615-0	-		MB MB					15 05 17 05				872615-0 872615-0		MB								
				1			[]	·		- T				1		1	[Τ	1		1			
		vlethod Blank	LCS				LCSD			LCS		LCS/LC Control L		Parent	Parent	MS			MSD			MS/ MSD	1	MS/MS	
Test Name		Result	Spiked	LCS	Recov	very	Spiked	LCSD F	Recover			L UCL	RPD		Result	Spiked	MS R	ecovery	Spiked	MSD	Recovery	RPD	LCL	UCL	RPD
		Conc	Conc	Conc	%	, C	Conc	Conc	%	C %	C %	%	%	Number	Conc	Conc	Conc	<u>%</u> C	Conc	Conc	% C	% 0	%	%	%
TOC as NPOC Avg of Reps	<	60	1000	964.2	96.	4					8) 120	10	872615-011	290000	200000	430000	70.5	200000	590000	147.2	30.0	50	150	30
TOC as NPOC Replicate 1	<	60	_	-	-									872615-011	350000								-		
TOC as NPOC Replicate 2	<	60	-											872615-011	170000								-		
TOC as NPOC Replicate 3	<	60												872615-011	400000										
TOC as NPOC Replicate 4	<	60		_						-				872615-011	260000								-		

Conc = mg/kg unless otherwise noted

C = QC Code, see Qualifer Sheet

Report Date: 6/29/2006

QC Batch Number: 11979

Parent Result is reported down to MDL in order to allow Validation of this worksheet

	San	nple (Conc	lition	Upon Re	eceipt			
Pace Analytical C	lient Nam	ie:	<u><u>P</u></u>	MT	17 BURNESS II	F	Project #	872	615
Courier: Fed Ex UPS	_		M Comm no		· _	Other] yes [tional), Due Da), Name:	te:
Packing Material: 反 Bubble Wra Thermometer Used 기용	ap <u>(</u> Bubble			one Wet	Other Blue No	one j	Samples on ic	e, cooling pro	
Cooler Temperature <u>PC</u> Temp should be above freezing to 6°C		Biolo	gical ⁻	Fissue	is Frozen: Comments			nitials of pe s: <u>hf</u> b C(6	rson examining 1/04 1/64 0 5
Chain of Custody Present:		ØYes	□No	□n/A	1.		•	/	1
Chain of Custody Filled Out:		⊠Yes	□No	□n/a	2.				
Chain of Custody Relinquished:		⊠Yes	□No	□n/A	<u>3.</u>				
Sampler Name & Signature on CO	C:	¢۲es	□No	□n/A	4.				
Samples Arrived within Hold Time:		I ¥ Yes	□No	□n/A	5.				
Short Hold Time Analysis (<72hr)):)⊠(Yes.	- ANO		6. TVS	; >			
Rush Turn Around Time Request	ed:	′□Yes	₿No	□n/A	<u>7.</u>				
Sufficient Volume:		Ì⊠Yes	□No	□n/A	8.				
Correct Containers Used:	ž.	Yes	□No		9.				
-Pace Containers Used:	47	Yes	□No	□n/A					
Containers Intact:		⊡Yes	□No		10.				
Filtered volume received for Dissolv	ved tests	□Yes	⊠́No	□n/A	11.				
Sample Labels match COC:		Yes	□No	□n/A	12.				
-Includes date/time/ID/Analysis	Matrix:	Sel.							
All containers needing preservation have t	been checked.	□Yes	□No	ĎĮ́N/A	13.				
All containers needing preservation are compliance with EPA recommendation.	found to be in	□Yes	□No						
exceptions: VOA, coliform, TOC, O&G, WI-D	RO (water)	□Yes			Initial when con	npleted			
Samples checked for dechlorination	ו:	□Yes	Ю́No	□n/A	<u>14.</u>				
Headspace in VOA Vials (>6mm):		□Yes	□No	₿ M/A	<u>15.</u>				
Trip Blank Present:		□Yes	□No	Ì́⊠N/A	<u>16.</u>				
Trip Blank Custody Seals Present		□Yes	□No	🖸 N/A					
Pace Trip Blank Lot # (if purchased): <u></u>								
Client Notification/ Resolution: Person Contacted: Comments/ Resolution:				Date/			Field Data Red	quired?	Y / N
Project Manager Review:	Kal	<u>Z</u>					Date:		5/0700
Note: Whenever there is a discrepancy Certification Office (i.e out of hold, inco	prrect preservative	e, out of t	temp, i	nce sar	t containers)		will be sent to the	e North Card	

. ,	RMT, INC MASISON			EN	V	C	CH	EM				1241 Bellevue Green Bay, WI 920-469-2 Fax 920-469	54302 436		
	Greg Graf				.			INC.				rax 920-409	-0841 //		
	608-662-5306							ervices, Inc.		οου		No 1 71 701		Page of	
Project Number:	7201.02			C		AI						No.131761		ote #:	
	KEWAUNER	•				A=Non		=HCL C=	H2S04	tion Codes D=HN03	E=EnC		/	eport To: <u>Bak Stranfork</u> R. 197	
Project State	<u>(a) 1</u>				FIL		um bisu ? (Yes	Ifate Solution		Sodium Thio	suitate	J=Other		MADISON	
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	2	Regula		Matrix			Ð			[5 ³]	K	Invoice	e To:	Sa wa e	
Data Package Opti Sample Results Only	ons - (please circle if requested (no OC) t to Surcharge)	Progra UST RCR SDW NPDE CERC	A W A W A S S C= LA B	<u>Codes</u> Ground Water I=Water S=Soil A=Air Charcoal I=Biota =Sludge P=Wipe	14. 1				16	<u>3</u> °/		Company:			
LABORATORY ID (Lab Use Only)	FIELD ID	and management of the second	TIME	MATRIX	/k		, 87 ,		./ /			CLIENT COMINIENTS	2	LAB COMMENTS (Lab Use Only)	
Óai	T-1 0512017	6-1	12:01	Sed	<u>X</u>	X	X	X			1		1-4	12 Alter	
i se al	7-3 0512018		12:03	for second second							. 41.7006				
mr. h.	T-5 0512019	ganalisi''''' a ja dillar	12:05			a na seconda da seconda	Social dynamics approxi-				ann na sta				
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NOT	7-7 0512021		12:09			A Do good an Albert					t and the second				
seri.	T-8 0512022		12:11			- Contraction of the second					1				
	7-9 0512023		12:13		_										
	7-10 0512024		12:15				ture enclosers				ł				
004	T-10A 0512025		12:17										The second se	999 1999 299 299 299 20 / 1990 20 / 200 20 / 200 20 / 200 20 / 200 20 / 200 20 / 200 20 / 200 20 / 200 20 / 20	
	T-10B 0512026		1,2:19							2771.0. No. 7				an a	
hii	7-11 05/2027	-	12:21				6. ALUGARIAN								
1/12	7-12 05/2028	V	12:23		ý	Ý	Y.		s						
ush Turnaround Ti	me Requested (TAT) - Prelim approval/surcharge)	Relinqu	ished By	[sh	n S	ha	n/	Date/Time		Received	anterne		ate/Time:	En Chem Project No.	
ate Needed:		· ·	ished By			1,1		Date/Time		Received	By:		ate/Time: 14-25	Sample Receipt Temp.	
ansmit Prelim Rush Phone none #:	Fax E-mail	Relinqui	<u>) ∂∈ti</u> ished By	- <u>48-55444</u> /:	<u>- (- Pa</u>)	<u>ng</u>	<u>(1-5</u>	- <u>AG 14</u> Date/Time		Received	v	art <u>1711X0</u> Di	ate/Time:	Sample Receipt pH (WeV/Metals)	
		Relir:qu	ished By	/:				Date/Time	:	Received	By:	Da	ate/Time:	Cooler Custody Seal	
Mail Address:	on HOLD are subject to	Relinqu	iquished By: Date/Time: Rec					Received By: Date/Time:			Present / Not Present				
special pric	ing and release of liability													Version 4.0: 09/04	

Project State:	
Internation TAOLODY No.131/62 Outro # Project Number: TAOLODY No.131/62 No.131/62 Project Number: TAOLODY No.131/62 No.131/62 Project Number: TAOLODY No.131/62 No.131/62 Sampled By Profit: Lot Protect Number: Lot Protect Numer: Lot Protect Number:	. 2
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DIS T-16 DS R. 031 12:24 1 1 DIM T-17 05:2032 12:31 4 4 1 DIM T-17 05:2032 12:31 4 4 1 DIM T-17 05:2032 12:31 4 4 1 DIM DIM DIM DIM DIM 1 1 DIM DIM DIM DIM DIM DIM DIM DIM DIM DIM DIM DIM DIM DIM DIM DIM DIM DIM DIM DIM DIM DIM Ush Turnaround Time Requested (TAT) - Prelim Nash TAT subject to approval/surcharge) Relinquished By: DIM DIM <t< td=""><td></td></t<>	
Citize 7-17 CS 12032 12:31 Y Y Y 1 Image: Citize Image: Cititit	
ush Turnaround Time Requested (fAT) - Prelim Relinquished By: Date/Time: Received By: Date/Time: Sample Received By: ush Turnaround Time Requested (fAT) - Prelim Relinquished By: Date/Time: Received By: Date/Time: Sample Received By: Date/Time: Sample Received By: Sample Received	
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-Mail Address:	Not Present

June 2006 Samples

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Pace Analytica Services, Inc.	I	Ana	lytical	Repo	ort Nu	mber: 8	73179			evue Street y, WI 54302 2436
							Lab	Collectio Repo	x Type: SOIL on Date: 06/16/ ort Date: 06/29/ umber: 87317	06
INORGANICS										
Test	Result	LOD	LOQ	EQL	Dil.	Units	C●de	Anl Date	Prep Method	Anl Method
Arsenic	340	3.5	12		1	mg/Kg		06/27/06	SW846 3050B	SW846 6010B
Percent Solids	23.8				1	%		06/22/06	SM M2540G	SM M2540G

Pace Analytical Services, Inc.	Ana	lytical	Repo	ort Nu	mber: 8	73179			evue Street y, WI 54302 2436
Client : RMT - MADISON Project Name : KEWAUNEE MARSH								ix Type: SOIL on Date: 06/16/	06
Project Number: 7201.02 Field ID: TS-18,6.5-7		Collection Date: 06/16/06 Report Date: 06/29/06 Lab Sample Number: 873179-005							
INORGANICS									
Test Resul	t LOD	LOQ	EQL	Dil.	Units	Code	Ani Date	Prep Method	Anl Method
Arsenic 3.8	3.2	11		1	mg/Kg	Q	06/27/06	SW846 3050B	SW846 6010B
Percent Solids 26.2				1	%		06/22/06	SM M2540G	SM M2540G

Pace Analytical Services, Inc.		Ana	lytical	Repo	ort Nu	mber: 8	73179			evue Street y, WI 54302 2436
Client: RMT Project Name: KEW Project Number: 7201 Field ID: TS-1	AUNEE MARSH						Lal	Collectio Repo	x Type: SOIL on Date: 06/16/ ort Date: 06/29/ lumber: 87317	06
INORGANICS										
Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic	2.6	2.3	7.6		1	mg/Kg	Q	06/27/06	SW846 3050B	SW846 6010B
Percent Solids	36.9				1	%		06/22/06	SM M2540G	SM M2540G

Pace Analytical Services, Inc.	Ana	llytical	Repo	ort Nu	mber: 8	73179			evue Street y, WI 54302 2436
Client: RMT - MADISON							Matr	ix Type: SOIL	
Project Name : KEWAUNEE MARSH							Collectio	on Date: 06/16/	06
Project Number: 7201.02							Repo	ort Date : 06/29/	06
Field ID: TS-19,2-4						Lat	o Sample N	lumber: 87317	9-001
INORGANICS									
Test Resul	t LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
				1			00107100	011/0 / 0 00505	
Arsenic 6100	2.7	9.1		1	mg/Kg		06/27/06	SW846 3050B	SW846 6010B

All soil results are reported on a dry weight basis unless otherwise noted.

Pace Analytical Services, Inc.		Anal	ytical	Repo	ort Nu	mber: 8	73179			evue Street iy, WI 54302 2436
Client: RMT - MADISON Project Name: KEWAUNEE MARS Project Number: 7201.02 Field ID: TS-19,6-8	SH						Lab	Collectio Repo	x Type: SOIL on Date: 06/16 ort Date: 06/29 lumber: 87317	/06
INORGANICS										
Test Res	sult	LOD	LOQ	EQL	Dil.	Units	Code	Ani Date	Prep Method	Anl Method
Arsenic 510	0	5.6	19		1	mg/Kg		06/27/06	SW846 3050B	SW846 6010B
Percent Solids 15.0	C				1	%		06/22/06	SM M2540G	SM M2540G

Pace Analytical Services, Inc.	An	alytica	l Repo	ort Nu	mber: 8	73179			evue Street ly, WI 54302 2436
Client: RMT-MADISON Project Name: KEWAUNEE MARSH Project Number: 7201.02 Field ID: TS-19,13-15						Lab	Collectio Repo	ix Type: SOIL on Date: 06/16 ort Date: 06/29 lumber: 87317	/06
INORGANICS									
Test Resu	t LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic 36	2.0	6.6		1	mg/Kg		06/27/06	SW846 3050B	SW846 6010B
Percent Solids 42.4				1	%		06/22/06	SM M2540G	SM M2540G

All soil results are reported on a dry weight basis unless otherwise noted.

Pace Analytical Services, Inc.		Analytical Report Number: 873179 1241 Bellevue Street Green Bay, WI 54302 920-469-2436 Matrix Type : SOIL								
Client: RMT - MADIS Project Name: KEWAUNEE M Project Number: 7201.02 Field ID: TS-20,3-5							Lat	Collectio Repo	x Type : SOIL on Date : 06/16/ rt Date : 06/29/ lumber : 87317	06
INORGANICS										
Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Ani Date	Prep Method	Anl Method
Arsenic Percent Solids	910 33.6	2.5	8.3		1 1	mg/Kg %		06/27/06 06/22/06	SW846 3050B SM M2540G	SW846 6010B SM M2540G

Pace Analytical Services, Inc.	Ana	lytical	Repo	ort Nu	mber: 8	73179			evue Street y, WI 54302 2436
Client: RMT - MADISON							Matr	ix Type: SOIL	
Project Name : KEWAUNEE MARSH							Collectio	on Date: 06/16/	06
Project Number: 7201.02							Repo	ort Date: 06/29/	06
Field ID : TS-21,2-4						Lab	Sample N	lumber: 87317	9-008
INORGANICS									
Test Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic 640	3.4	11		1	mg/Kg		06/27/06	SW846 3050B	SW846 6010B
Percent Solids 24.4				1	%		06/22/06	SM M2540G	SM M2540G

Pace Analytical Services, Inc.	Þ	Analy	ytical	Repo	rt Nu	mber: 8	73179			evue Street ay, WI 54302 2436
Client: RMT - MADISON Project Name: KEWAUNEE MARSH Project Number: 7201.02 Field ID: TS-22,2.5-3.5							Lab	Collectio Repo	x Type: SOL on Date: 06/16 ort Date: 06/29 lumber: 87317	/06
INORGANICS										
Test Resu	lt L	OD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic 1800	4	.5	15		1	mg/Kg		06/27/06	SW846 3050B	SW846 6010B
Percent Solids 18.7					1	%		06/22/06	SM M2540G	SM M2540G

Pace Analytical Services, Inc.	Ana	lytical	Repo	rt Nu	1241 Bellevue Street Green Bay, WI 54302 920-469-2436				
Client: RMT - MADISON Project Name: KEWAUNEE MARSH Project Number: 7201.02 Field ID: TS-23,1.5-3.5						Lat	Collectio Repo	x Type: SOL on Date: 06/16/ ort Date: 06/29/ lumber: 87317	06
INORGANICS									
Test Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic 1500	3.8	13		1	mg/Kg		06/27/06	SW846 3050B	SW846 6010B
Percent Solids 22.2				1	%		06/22/06	SM M2540G	SM M2540G

Pace Analytical Services, Inc.		Ana	lytical	Repo	ort Nu	mber: 8	73179	1241 Bellevue Street Green Bay, WI 54302 920-469-2436				
Client: RMT - MADISC	N							Matri	ix Type: SOIL			
Project Name : KEWAUNEE M	1ARSH					Collectio	ection Date: 06/16/06					
Project Number: 7201.02								Report Date: 06/29/06				
Field ID: TS-24,1.5-3.5							Lab	Sample N	lumber: 87317	9-011		
INORGANICS												
Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method		
Arsenic	1100	5.1	17		1	mg/Kg		06/27/06	SW846 3050B	SW846 6010B		
Percent Solids	16.4					%		06/22/06	SM M2540G	SM M2540G		

April 2007 Samples



1241 Bellevue Street, Suite 9 Green Bay, WI 54302 920-469-2436, Fax: 920-469-8827

Analytical Report Number: 882460

Client: RMT - MADISON Project Name: KEWAUNEE MARSH Project Number: 7201.04

Lab Contact: Tod Noltemeyer

Lab Sample Number	Field ID	Matrix	Collection Date
882460-001	AC 0704014 1:1 DIL	WATER	04/09/07
882460-002	AC 0704015 1:1 DIL	WATER	04/09/07
882460-003	AC 0704018 1:1 DIL	WATER	04/09/07
882460-004	AC 0704019 1:1 DIL	WATER	04/09/07
882460-005	AC 0704021 1:1 DIL	WATER	04/09/07
882460-006	AC 0704022 1:1 DIL	WATER	04/09/07
882460-007	AC 0704023 1:1 DIL	WATER	04/09/07
882460-008	AC 0704024 1:1 DIL	WATER	04/09/07
882460-009	AC 0704025 1:1 DIL	WATER	04/09/07
882460-010	AC 0704026 1:1 DIL	WATER	04/09/07
882460-011	AC 0704027 1.1 DIL	WATER	04/09/07
882460-012	AC 0704028 1:1 DIL	WATER	04/09/07
882460-013	AC 0704029 1:1 DIL	WATER	04/09/07
882460-014	AC 0704001 1:1 DIL	WATER	04/09/07
882460-015	AC 0704002 1:1 DIL	WATER	04/09/07
882460-016	AC 0704003 1:1 DIL	WATER	04/09/07
882460-017	AC 0704004 1:1 DIL	WATER	04/09/07
882460-018	AC 0704005 1:1 DIL	WATER	04/09/07
882460-019	AC 0704006 1:1 DIL	WATER	04/09/07
882460-020	AC 0704007 1:1 DIL	WATER	04/09/07
882460-021	AC 0704008 1:1 DIL	WATER	04/09/07
882460-022	AC 0704009 1:1 DIL	WATER	04/09/07
882460-023	AC 0704010 1:1 DIL	WATER	04/09/07
882460-024	AC 0704011 1:1 DIL	WATER	04/09/07
882460-025	AC 0704012 1:1 DIL	WATER	04/09/07
882460-026	AC 0704013 1:1 DIL	WATER	04/09/07

I certify that the data contained in this Final Report has been generated and reviewed in accordance with approved methods and Laboratory Standard Operating Procedure. Exceptions, if any, are discussed in the accompanying sample comments. Release of this final report is authorized by Laboratory management, as is verified by the following signature. This report shall not be reproduced, except in full, without the written consent of Pace Analytical Services, Inc. The sample results relate only to the analytes of interest tested.

Un for Tod N

Approval Signature

4/18/05

Page 1 of 35

Pace Analytical Services, Inc.		Ana	lytical	evue Street y, WI 54302 2436						
Client : RMT -	MADISON							Mati	rix Type : WATE	R
Project Name : KEWA	UNEE MARSH		Collection Date: 04/09/07							
Project Number: 7201.0	04							Rep	ort Date : 04/17/	07
Field ID: AC 07	04014 1:1 DIL		Lab Sample Number : 882460-							0-001
INORGANICS										
Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic - Dissolved	2300	1.3	4.2		10	ug/L		04/16/07	SW846 3020A	SW846 6020

Pace Analytical Services, Inc.		Ana	lytical	Repo	rt Nu	mber: 8	82460	920-469-2436					
Client: RMT - Project Name: KEWA							Matrix Type: WATER Collection Date: 04/09/07 Report Date: 04/17/07						
Project Number: 7201.0 Field ID: AC 07)4												
INORGANICS													
Test	Result	LOD	LOQ	EQL	Dil,	Units	Code	Anl Date	Prep Method	Anl Method			
Arsenic - Dissolved	2600	1.3	4.2		10	ug/L		04/16/07	SW846 3020A	SW846 6020			

Pace Analytical Services, Inc.		Analytical Report Number: 882460 1241 Bellev Green Bay, 920-469-243								
Client : RMT -	MADISON							Mati	rix Type : WATE	R
Project Name : KEWA	UNEE MARSH							Collecti	on Date : 04/09/	07
Project Number: 7201.0)4							Rep	ort Date: 04/17/	07
Field ID: AC 07	04018 1:1 DI L						Li	ab Sample I	Number: 88246	0-003
INORGANICS										
Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Ani Date	Prep Method	Anl Method
Arsenic - Dissolved	190	0.13	0.42		1	ug/L		04/16/07	SW846 3020A	SW846 6020

Pace Analytical Services, Inc.		Analytical Report Number: 882460 1241 Bellevue Stre Green Bay, WI 543 920-469-2436									
Client: RMT - MA	DISON							Matr	ix Type : WATE	R	
Project Name : KEWAUN	NEE MARSH		Collection Date: 04/09/07								
Project Number: 7201.04		Report Date: 04/17/07								07	
Field ID: AC 07040	019 1:1 DIL						La	ab Sample I	Number: 88246	0-004	
INORGANICS											
Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method	
Arsenic - Dissolved	47000	16	52		100	ug/L		04/16/07	SW846 3020A	SW846 6020	

Pace Analytic Services, Inc.		Analytical Report Number: 882460								1241 Bellevue Street Green Bay, WI 54302 920-469-2436			
Client :	RMT - MADISON							Matr	i x Type : WATE	R			
Project Name :	KEWAUNEE MARSH							Collecti	on Date: 04/09/	07			
Project Number :	7201.04							Repo	ort Date : 04/17/	07			
Field ID :	AC 0704021 1.1 DIL						La	ab Sample I	Number : 88246	0-005			
INORGANICS													
Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method			
Arsenic - Dissolved	580000	25	84		200	ug/L		04/16/07	SW846 3020A	SW846 6020			

Pace Analytic Services, Inc.		Ana	lytical	Repo	rt Nu	1241 Bellevue Street Green Bay, WI 54302 920-469-2436				
	RMT - MADISON KEWAUNEE MARSH								rix Type:WATE on Date: 04/09/	
Project Number :	7201 04	Report Date: 04/17/07								
Field ID :	AC 0704022 1:1 DIL						La	ab Sample I	Number: 88246	0-006
INORGANICS										
Test	Result	LOD	LOQ	EQL	Dil,	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic - Dissolved	330000	25	84		200	ug/L		04/16/07	SW846 3020A	SW846 6020

Pace Analytic Services, Inc.		Ana	lytical	Repo	rt Nu	mber:	882460		D 1241 Bellevue Street Green Bay, WI 54302 920-469-2436				
Client :	RMT - MADISON							Mati	rix Type : WATE	R			
Project Name :	KEWAUNEE MARSH		Collection Date: 04/09										
Project Number :	7201.04			ort Date : 04/17/	07								
Field ID :	AC 0704023 1:1 DIL						La	ab Sample I	Number: 88246	0-007			
INORGANICS													
Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method			
Arsenic - Dissolved	170000	25	84		200	ug/L		04/16/07	SW846 3020A	SW846 6020			

Pace Analytical Services, Inc.	Analy	tical	Repo	rt Nu	mber:	882460	1241 Bellevue Street Green Bay, WI 54302 920-469-2436				
Client: RMT - MADISON							Mat	r ix Type : WATE	R		
Project Name : KEWAUNEE MARSH				Collection Date: 04/09/07							
Project Number: 7201.04	Report Date: 04/17/07										
Field ID: AC 0704024 1:1 DIL						La	b Sample	Number: 88246	0-008		
INORGANICS											
Test Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method		
Arsenic - Dissolved 39000	13	42		100	ug/L		04/16/07	SW846 3020A	SW846 6020		

Pace Analytical Services, Inc.		Anal	lytical	Repo	rt Nu		1241 Bellevue Street Green Bay. WI 54302 920-469-2436						
Client : RMT - MAD	SON							Mati	rix Type : WATE	R			
Project Name : KEWAUNE	E MARSH		Collection Date: 04/09/07										
Project Number: 7201.04							Report Date: 04/17/07						
Field ID: AC 070402	5 1:1 DIL						La	ab Sample I	Number: 88246	0-009			
INORGANICS													
Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method			
Arsenic - Dissolved	340000	25	84		200	ug/L		04/16/07	SW846 3020A	SW846 6020			

Pace Analytical Services, Inc.		Anal	lytical	Repo	rt Nu	mber: 8	1241 Bellevue Street Green Bay, WI 54302 920-469-2436					
Client : RMT - MA	ADISON							Matr	rix Type : WATE	R		
Project Name : KEWAUN	VEE MARSH							Collecti	on Date : 04/09/	07		
Project Number: 7201.04							Report Date: 04/17/07					
Field ID: AC 07040	026 1:1 DIL						ab Sample Number: 882460-010					
INORGANICS												
Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method		
Arsenic - Dissolved	280000	25	84		200	ug/L		04/16/07	SW846 3020A	SW8466020		

Pace Analytical Services, Inc.		Analytical Doport Number: 882460							evue Street y, WI 54302 2436	
Client: RMT - M	1ADISON							Mat	rix Type : WATE	R
Project Name : KEWAU	INEE MARSH							Collecti	on Date: 04/09/	07
Project Number: 7201.04								Rep	ort Date: 04/17/	07
Field ID: AC 0704	1027 1:1 DIL						Li	ab Sample I	Number: 88246	0-011
INORGANICS										
Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic - Dissolved	43000	13	42		100	ug/L		04/16/07	SW846 3020A	SW846 6020

Pace Analytic Services, Inc.		Ana	lytical	Repo	rt Nu	1241 Bellevue Street Green Bay, WI 54302 920-469-2436				
Client :	RMT - MADISON							Matr	ix Type : WATE	R
Project Name :	KEWAUNEE MARSH	Collection Date: 04/09/07								
Project Number :	7201.04		ort Date : 04/17/	07						
Field ID :	AC 0704028 1:1 DIL						La	ab Sample I	Number: 88246	0-012
INORGANICS										
Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic - Dissolved	25	84		200	ug/L		04/16/07	SW846 3020A	SW846 6020	

Pace Analytical Services, Inc.		Ana	lytical	Repo	rt Nu		1241 Bellevue Street Green Bay, WI 54302 920-469-2436			
Client: RMT - Project Name: KEWA Project Number: 7201.(UNEE MARSH		Matrix Type: WATER Collection Date: 04/09/07 Report Date: 04/17/07							
Field ID : AC 07							La	ab Sample I	Number: 88246	0-013
INORGANICS										
Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic - Dissolved	540	1.3	4.2		10	ug/L		04/16/07	SW846 3020A	SW846 6020

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Pace Analytical Services, Inc.		Ana	lytical	Repo	rt Nu	1241 Bellevue Street Green Bay, WI 54302 920-469-2436						
Client : RMT ·	- MADISON							Mati	rix Type : WATE	R		
Project Name : KEWA	AUNEE MARSH						Collection Date: 04/09/07					
Project Number: 7201.0	04							Rep	ort Date: 04/17/	07		
Field ID: AC 07	704001 1:1 DIL						La	ab Sample	Number: 88246	0-014		
INORGANICS												
Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method		
Arsenic - Dissolved	13	42		100	ug/L		04/16/07	SW846 3020A	SW846 6020			

6

Pace Analytical Services, Inc.	Anal	ytical	Repo	rt Nu	mber:			evue Street y, WI 54302 2436	
Client: RMT - MADISON							Matr	ix Type : WATE	R
Project Name : KEWAUNEE MARSH		on Date: 04/09/	07						
Project Number: 7201.04			ort Date : 04/17/	07					
Field ID: AC 0704002 1.1 DIL							ab Sample I	Number: 88246	0-015
INORGANICS									
Test Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic - Dissolved 22000	13	42		100	ug/L		04/16/07	SW846 3020A	SW846 6020

Pace Analytical Services, Inc.	Anal	ytical	Repor	rt Nu	mber: 8	1241 Bellevue Street Green Bay, WI 54302 920-469-2436					
Client : RMT - MADISON							Matr	rix Type : WATE	ĒR		
Project Name : KEWAUNEE MARSH						Collecti	ion Date : 04/09/	/07			
Project Number: 7201.04							Rep	ort Date : 04/17/	/07		
Field ID: AC 0704003 1:1 DIL						La	ab Sample I	Number: 88246	0-016		
INORGANICS											
Test Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method		
Arsenic - Dissolved 59000	13	42		100	ug/L		04/16/07	SW846 3020A	SW846 6020		

Pace Analytical Services, Inc.	Analy	ytical	Repo	rt Nu	mber: 8	82460			evue Street y, WI 54302 2436		
Client: RMT - MADISON							Matr	ix Type : WATE	R		
Project Name : KEWAUNEE MARSH	Collection Date: 04/09/07										
Project Number: 7201.04	Report Date: 04/17/07										
Field ID : AC 0704004 1.1 DIL						La	b Sample I	Number: 88246	0-017		
INORGANICS											
Test Result	Result LOD LOQ EQL Dil. Units Code Anl Date Prep Method										
Arsenic - Dissolved 570	1.3	4.2		10	ug/L		04/16/07	SW846 3020A	SW846 6020		

Pace Analytica Services, Inc.	ıl	Ana	lytical	Repo	rt Nu	mber: 8	882460	1241 Bellevue Street Green Bay, WI 54302 920-469-2436				
Client : F	RMT - MADISON							Matr	ix Type : WATE	R		
Project Name : 🕴	KEWAUNEE MARSH			on Date: 04/09/	07							
Project Number : 7	7201.04							Rep	ort Date : 04/17/	07		
Field ID : A	AC 0704005 1:1 DIL						La	ab Sample I	Number: 88246	0-018		
INORGANICS												
Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method		
Arsenic - Dissolved	50000	13	42		100	ug/L		04/16/07	SW846 3020A	SW846 6020		

Pace Analytical Services, Inc.	Ana	lytical	Repo	rt Nu		1241 Bellevue Street Green Bay, WI 54302 920-469-2436				
Client : RMT	Matrix Type: WATER									
Project Name : KEW		Collection Date: 04/09/07								
Project Number: 7201.	Report Date: 04/17/07									
Field ID : AC 07	704006 1:1 DIL						Li	ab Sample I	Number: 88246	0-019
INORGANICS										
Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic - Dissolved	61000	13	42		100	ug/L		04/16/07	SW846 3020A	SW8466020

Pace Analytical Services, Inc.	Anal	lytical	Repo	rt Nu		1241 Beilevue Street Green Bay, WI 54302 920-469-2436					
Client : RMT - MAI	DISON	Matrix Type: WATER									
Project Name : KEWAUNE	EE MARSH	Collection Date: 04/09/07									
Project Number: 7201.04								Rep	ort Date: 04/17/	07	
Field ID : AC 070400	07 1:1 DIL						Li	ab Sample	Number : 88246	0-020	
INORGANICS											
Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method	
Arsenic - Dissolved	320000	25	84		200	ug/L		04/16/07	SW846 3020A	SW846 6020	

Pace Analytical Services, Inc.		Ana	lytical	Repo	rt Nu	mber: 8	82460		evue Street ly. WI 54302 2436	
Client : RMT - Project Name : KEWA Project Number : 7201.0 Field ID : AC 07						La	Collecti Rep	rix Type: WATE on Date: 04/09/ ort Date: 04/17/ Number: 88246	/07 /07	
INORGANICS Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic - Dissolved	23000	13	42		100	ug/L		04/16/07	SW846 3020A	SW846 6020

Pace Analytical Services, Inc.	Anal	ytical	Repo	rt Nu		1241 Bellevue Street Green Bay, WI 54302 920-469-2436			
Client : RMT - MADISON								ix Type: WATE	
Project Name : KEWAUNEE MARSH	Collection Date: 04/09/07								
Project Number: 7201.04	Report Date: 04/17/07								
Field ID : AC 0704009 1:1 DIL	Lab Sample Number: 882460-022						0-022		
INORGANICS									
Test Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic - Dissolved 11000	13	42		100	ug/L		04/16/07	SW846 3020A	SW846 6020

Pace Analytical Services, Inc.	Ana	lytical	Repo	rt Nu	mber: 8	1241 Bellevue Street Green Bay, WI 54302 920-469-2436					
Client: RMT -				Mati	Matrix Type: WATER						
Project Name : KEWA		Collection Date: 04/09									
Project Number: 7201.0	04		ort Date : 04/17/	7/07							
Field ID: AC 07	04010 1:1 DIL						La	ab Sample I	Number: 88246	0-023	
INORGANICS											
Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method	
Arsenic - Dissolved	7400	13	42		100	ug/L		04/16/07	SW846 3020A	SW846 6020	

Pace Analytical Services, Inc.	Anal	ytical	Repo	rt Nu	mber:	1241 Bellevue Street Green Bay, WI 54302 920-469-2436					
Client : RMT - MADISON							Mati	ix Type : WATE	R		
Project Name : KEWAUNEE MARSH		Collection Date: 04/09/									
Project Number: 7201.04	Report Date : 0								7/07		
Field ID: AC 0704011 1:1 DIL						La	ab Sample I	Number: 88246	0-024		
INORGANICS											
Test Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method		
Arsenic - Dissolved 2700	0.16	0.52		1	ug/L		04/12/07	SW846 3020A	SW846 6020		

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Pace Analytical Services, Inc.	Ana	lytical	Repo	rt Nu	mber: 8	1241 Bellevue Street Green Bay, WI 54302 920-469-2436						
Client: RMT - N	IADISON	Matrix Type : WATER										
Project Name: KEWAU		Collection Date: 04/09/0										
Project Number: 7201.04		Report Date: 04/17/0)7		
Field ID : AC 0704	4012 1:1 DIL						L	ab Sample I	Number: 88246	0-025		
INORGANICS												
Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method		
Arsenic - Dissolved	1800	0.13	0.42		1	ug/L		04/12/07	SW846 3020A	SW846 6020		

Pace Analytic Services, Inc.		Ana	lytical	Repo	rt Nu	mber: 8	1241 Bellevue Street Green Bay, WI 54302 920-469-2436			
Project Name : Project Number :	RMT - MADISON KEWAUNEE MARSH 7201.04 AC 0704013 1:1 DIL	Matrix Type: WATER Collection Date: 04/09/07 Report Date: 04/17/07 Lab Sample Number: 882460-026								/07 /07
INORGANICS Test	Result	LOD	LOQ	EQL	Dil.	Units	Code	Anl Date	Prep Method	Anl Method
Arsenic - Dissolved	2800	0.13	0.42	- 46	1	ug/L		04/12/07	SW846 3020A	SW846 6020

1241 Bellevue Street Green Bay, WI 54302 920-469-2436 Fax: 920-469-8827

Lab Number	TestGroupID	Field ID	Comment
882460	M-AS-D	All Samples	Inadequate sample volume received to perform the method required MS/MSD This flag applies to samples 1-20.

Qualifier Codes

Flag	Applies ⊺o	Explanation
A	Inorganic	Analyte is detected in the method blank. Method blank criteria is evaluated to the laboratory method detection limit. Additionally, method blank acceptance may be based on project specific criteria or determined from analyte concentrations in the sample and are evaluated on a sample by sample basis.
В	Inorganic	The analyte has been detected between the method detection limit and the reporting limit.
В	Organic	Analyte is present in the method blank. Method blank criteria is evaluated to the laboratory method detection limit. Additionally, method blank acceptance may be based on project specific criteria or determined from analyte concentrations in the sample and are evaluated on a sample by sample basis.
С	Ail	Elevated detection limit.
D	All	Analyte value from diluted analysis or surrogate result not applicable due to sample dilution.
Ε	Inorganic	Estimated concentration due to matrix interferences. During the metals analysis the serial dilution failed to meet the established control limits of 0-10%. The sample concentration is greater than 50 times the IDL for analysis done on the ICP or 100 times the IDL for analysis done on the ICP-MS. The result was flagged with the E qualifier to indicate that a physical interference was observed.
Е	Organic	Analyte concentration exceeds calibration range.
F	Inorganic	Due to potential interferences for this analysis by Inductively Coupled Plasma techniques (SW-846 Method 6010), this analyte has been confirmed by and reported from an alternate method.
F	Organic	Surrogate results outside control criteria.
G	All	The result is estimated because the concentration is less than the lowest calibration standard concentration utilized in the initial calibration. The method detection limit is less than the reporting limit specified for this project.
Н	All	Preservation, extraction or analysis performed past holding time.
ΗF	Inorganic	This test is considered a field parameter, and the recommended holding time is 15 minutes from collection The analysis was performed in the laboratory beyond the recommended holding time.
J	All	Concentration detected equal to or greater than the method detection limit but less than the reporting limit
К	Organic	Detection limit may be elevated due to the presence of an unrequested analyte.
L	All	Elevated detection limit due to low sample volume.
М	Organic	Sample pH was greater than 2
Ν	All	Spiked sample recovery not within control limits.
0	Organic	Sample received overweight.
Р	Organic	The relative percent difference between the two columns for detected concentrations was greater than 40%
Q	All	The analyte has been detected between the limit of detection (LOD) and limit of quantitation (LOQ). The results are qualified due to the uncertainty of analyte concentrations within this range.
S	Organic	The relative percent difference between quantitation and confirmation columns exceeds internal quality control criteria. Because the result is unconfirmed, it has been reported as a non-detect with an elevated detection limit.
U	All	The analyte was not detected at or above the reporting limit.
V	All	Sample received with headspace.
W	All	A second aliquot of sample was analyzed from a container with headspace.
Х	All	See Sample Narrative.
Z	Organics	This compound was separated in the check standard but it did not meet the resolution criteria as set forth in SW846.
&	All	Laboratory Control Spike recovery not within control limits.
	All	Precision not within control limits.
+	Inorganic	The sample result is greater than four times the spike level: therefore, the percent recovery is not evaluated.
<	All	The analyte was not detected at or above the reporting limit.
1	Inorganic	Dissolved analyte or filtered analyte greater than total analyte; analyses passed QC based on precision criteria.
2	Inorganic	Dissolved analyte or filtered analyte greater than total analyte; analyses failed QC based on precision criteria.
3	Inorganic	BOD result is estimated due to the BOD blank exceeding the allowable oxygen depletion.
4	Inorganic	BOD duplicate precision not within control limits. Due to the 48 hour holding time for this test, it is not practical to reanalyze and try to correct the deficiency.
5	Inorganic	BOD result is estimated due to insufficient oxygen depletion. Due to the 48 hour holding time for this test, it is not practical to reanalyze and try to correct the deficiency.
6	Inorganic	BOD laboratory control sample not within control limits. Due to the 48 hour holding time for this test, it is not practical to reanalyze and try to correct the deficiency.
7	Inorganic	BOD result is estimated due to complete oxygen depletion. Due to the 48 hour holding time for this test, it is not practical to reanalyze and try to correct the deficiency.
8	Inorganic	Sample was received unpreserved. Sample was preserved either at the time of receipt or at the time of sample preparation.
9	Inorganic	Sample was received with insufficient preservation. Acid was added either at the time of receipt or at the time of sample preparation

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882460-025	m
882460-024	m
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882460-022	m
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882460-020	m
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882460-01 7	m
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882460-006	ш
882460-005	ш
882460-004	ш
882460-003	É
882460-002	ш
882460-001	É
Test Group Name	ARSENIC - DISSOLVED
Ц. Ц.	AR

Code WI Certification	405132750 / DATCP: 105-444
Code	В

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Pace Analytical Services, Inc.			QC Summ	ary		1241 Bellevue Street Green Bay, WI 54302 920-469-2436 Fax: 920-469-8827
Batch:	882460			QC ⊺ype	Client Sample ID	Lab Sample ID
Lab Section:	METALS			MB	MBDMTG2102-66	MBDMTG2102-66
QC Batch Number:	19714			LCS	LCSDMTG2102-66	LCSDMTG2102-66
Prep Method:	SW846 3020A			MS	882481-001MS	882481-001MS
Analytical Method:	SW846 6020			MSD	882481-001MSD	882481-001MSD
Client Sample ID A C 0704008 1.1 DIL AC 0704010 1:1 DIL AC 0704012 1:1 DIL	Lab Sample ID 882460-021 882460-023 882460-025	MBID MB MB MB	Client Sample ID AC 0704009 1.1 DIL AC 0704011 1:1 DIL AC 0704013 1:1 DIL	Lab San 882460-0: 882460-0: 882460-0:	22 MB 24 MB	
BI Test Name Re	thod ank LCS sult Spiked LCS Re Conc Conc Conc	, ,	LCS/LCSD LCS/ Control Limits LCSD CSD Recovery RPD LCL UCL RPD conc % C % C % % %	Parent Parent Sample Result Number Conc	MS MSD Spiked MS Recovery Spike Conc Conc % C Conc	d MSD Recovery RPD LCL UCL RPD
Arsenic - Dissolved <	0.13 200.0 200.6	100.3	75 125 20	382481-001 0.3800	200.0 200 99.8 200.0	192 95.8 4.1 75 125 20

Conc = ug/L unless otherwise noted Report Date: 4/17/2007 C = QC Code, see Qualifer Sheet QC Batch Number: 19714 Parent Result is reported down to MDL in order to allow Validation of this worksheet The %R and RPD results are calculated from raw data values with more significant figures than are reported on this form.

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Pace Analytical Services, Inc.

QC Summary

1241 Bellevue Street Green Bay. WI 54302 920-469-2436 Fax: 920-469-8827

Batch:	882460								QC ⊺ype	Clien	t Sample ID		Lab Sample	e ID	
Lab Section:	METAL	S							MB	MBD	MTG2102-65		MBDMTG21	02-65	
QC Batch Number	19715								LCS	LCSE	0MTG2102-65		LCSDMTG2	102-65	
Prep Method:	SW846	3020A							LCSD	LCSE	DMTG2102-65	i	LCSDDMTG	2102-65	
Analytical Method	SW846	6020													
Client Sample ID	Lab S	Sample ID	MBID			Clie	nt Sample ID		Lab Sam	nple ID	MBID				
AC 0704014 1:1 DIL	88246	0-001	MB			ACC	704015 1:1 DIL		882460-00	02	MB				
AC 0704018 1:1 DIL	88246	0-003	MB			ACC	704019 1:1 DIL		882460-00	04	MB		*		
AC 0704021 1:1 DIL	88246	0-005	MB			ACC	704022 1:1 DIL		882460-00	06	MB				
AC 0704023 1:1 DIL	88246	0-007	MB			AC 0	704024 1:1 DIL		882460-00	08	MB				
AC 0704025 1:1 DIL	88246	0-009	MB			AC 0	704026 1:1 DIL		882460-01	10	MB				
AC 0704027 1:1 DIL	88246	0-011	MB			AC 0	704028 1:1 DIL		882460-01	12	MB				
AC 0704029 1:1 DIL	88246	0-013	MB			AC 0	704001 1:1 DIL		882460-01	14	MB				
AC 0704002 1:1 DIL	88246	0-015	MB			AC C	704003 1:1 DIL		882460-01	16	MB				
AC 0704004 1:1 DIL	88246	0-01 7	MB			AC 0	704005 1:1 DIL		882460-01	18	MB				
AC 0704006 1:1 DIL	88246	0-019	MB			AC C	704007 1:1 DIL		882460-02	20	MB				
E	ethod Blank LCS			CSD		LCS/ LCSD	LCS/LCSD Control Limits	Parent	Parent	MS		MSD		MS/ MSD	MS/MSD Control Limits
Test Name F	tesult Spike Conc Con		,	piked LCS Conc Cor	D Recovery nc % C	1	LCL UCL RPD % % %	Sample Number	Result Conc	Spiked Conc	MS Recovery Conc % C	Spiked Conc	MSD Recovery Conc %	r RPD C % C	LCL UCL RPE % % %
Arsenic - Dissolved <	0.13 200.0	201	100.5	200.0 201	5 100.8	0.2	75 125 20								· ·

Conc = ug/L unless otherwise noted

Report Date: 4/17/2007

QC Batch Number: 19715

C = QC Code, see Qualifer Sheet

Parent Result is reported down to MDL in order to allow Validation of this worksheet

The %R and RPD results are calculated from raw data values with more significant figures than are reported on this form.

\sim	Sam	iple (Cond	lition	Upon Receipt
Pace Analytical"	Client Name:		R	MT	Project # <u>8824160</u>
Courier: Fed Ex UP	S USPS Client	t 🗆 d	Comme	ercial	Pace Other Optional Proj Oue Date Proj Name
Custody Seal on Cooler/Bo	x Present: 🗌 yes	Дı	ю	Seals	intact: yes no
Packing Material: 🗌 Bubb	le Wrap 🔄 Bubble I	Bags	ЙN	lone	Other
Thermometer Used		Туре	of Ice:	Wet	Blue None Samples on ice, cooling process has begun
Cooler Temperature Temp should be above freezing	<u>Cot</u> to 6°C	Biolog	gical 1	Fissue	is Frozen: Yes No Date and Initials of person examining contents: $4-10-07$ Comments: $2m$ $4-10-07$
Chain of Custody Present:		Yes	□n₀	□n/a	1.
Chain of Custody Filled Out:		Yes	□No	□n/a	2.
Chain of Custody Relinquishe	ed:	Yes	□No	□n/a	3.
Sampler Name & Signature o	on COC:	Yes	□No	□n/a	4.
Samples Arrived within Hold	Time:	Yes	□No	□n/a	5.
Short Hold Time Analysis (<72hr):	□Yes	ΔNο	□n/a	6.
Rush Turn Around Time Re	equested:	□Yes	D/No	□n/a	7.
Sufficient Volume:		Yes	□No	□n/a	8.
Correct Containers Used:		₩Yes	□No	□n/a	9.
-Pace Containers Used:		□Yes	ДNo	□n/A	
Containers Intact:		ÌΩYes	□No	□n/a	10.
Filtered volume received for I	Dissolved tests	Yes	□No	□n/a	11.
Sample Labels match COC:		Yes	□No	□n/A	12. No date or time on samples. Cy. 4-10-07
-Includes date/time/ID/Ana		<u>GW</u>			
All containers needing preservation	n have been checked.	Yes	□No	□n/a	13. Added , 3 ML to A28 (xcapt 004/015) 13. 4-10-07 16:40 -16:47
All containers needing preservat compliance with EPA recommen		□Yes	D(No	□n/A	CCJ 4-10-07-
exceptions: V OA, coliform, TOC, O8	G, WI-DRO (water)	□Yes	□No		completed CF preservative A10040
Samples checked for dechlor	rination:	□Yes	□n₀		14.
Headspace in VOA Vials (>6	Smm):	□Yes	□No		15.
Trip Blank Present:		□Yes	μnο	□n/a	16.
Trip Blank Custody Seals Pre	esent	□Yes	□No	QN/A	
Pace Trip Blank Lot # (if purc	chased):				
Client Notification/ Resolut	ion:				Field Data Required? Y / N
Person Contacted:				Date/	
Comments/ Resolution:				_	
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Project Manager Review Note: Whenever there is a discr		arolina c	TO2	ince sar	Date: <u>4//S//</u>
Certification Office (i.e out of he					

L	(Please Print Clearly)						UPPER MIDWEST REGION MN: 612-607-1700 WI: 920-469-2436											Page	1 of	39	
Company Na	ame:	RM	T								18			MN: 6	5 1 2-607-7	1700	WI: 920-469-2436			10010	
Branch/Loca	tion:	MAS	DISON					Pace		acelabs								COC No	. U.	13219	
Project Cont	act:	Bob	Stanton	th			1.1	s V	www.p	aceiaos	.com						Quote #:				
Phone:			-662-531			ĺ	· ` (CHA	λIN	O	FC	US	TC	DY	•		Mail To Contact:	Bob 3	Stan for	H	
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		111	On your samp (billable)	C = Char		GW = G	rinking Water Ground Water										Invoice To Phone:				
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PACE LAB #		CLIE	NT FIELD ID				MATRIX	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	6								COMMENTS		Use Only)		
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Appendix C Screening Leaching Test Procedures

Table of Contents

- Screening TCLP Procedure
- Screening SPLP Test Procedure

Screening TCLP Procedure



SCREENING TCLP TEST PROCEDURE APPLIED CHEMISTRY LABORATORY RMT, INC.

1. Background

RMT uses a modified TCLP test for screening possible additives for the treatment of hazardous waste. The modified TCLP procedure uses one-tenth of the prescribed sample weight and reagent volume, and uses the same sample preparation guidelines and TCLP solutions as prescribed in EPA Method 1311. Metals analyses are performed using either Inductively Coupled Plasma (ICP) or Graphite Furnace Atomic Absorption (GFAA) spectrometry, with no digestion or matrix spikes. The test was designed primarily for use in optimizing dosages of treatment chemicals in treatability studies.

2. Procedure

Pretest for Determination of the Appropriate TCLP Extraction Solution

- 1. Weigh 5 g of sample into a beaker.
- 2. Add 96.5 m/L deionized water, cover, and stir vigorously for 5 minutes.
- 3. Measure pH.
- 4. If pH < 5.0, then use extraction solution #1.
- 5. If pH > 5.0, then add 3.5 mL 1N HCl, and cover.
- 6. Heat, with stirring, to 50°C; and maintain the temperature at 50°C for 10 minutes.
- 7. Cool to room temperature.
- 8. Measure pH.
- 9. If pH < 5.0, then use extraction solution #1. If pH is greater than *or equal to* 5.0, then use extraction solution #2.

Leaching Procedure

- 1. Run the pretest (above) to determine the appropriate extraction solution, unless this is clearly known from prior experience with the waste.
- 2. Place 10 g of sample in a 250-mL plastic bottle.
- 3. Add 200 mL of the appropriate TCLP extraction solution (from step 1).
- 4. Shake on the rotary mixer overnight.
- 5. Filter the sample through an 0.45-micron pore-size filter.
- 6. Measure the pH of the filtrate.

- 7. Acidify the filtrate to pH < 2 with concentrated nitric acid.
- 8. Record the TCLP solution used, the final pH, and the sample number (AC number) on the "Screening Test Lab Form"; and analyze for the metals of interest. Mercury is to be analyzed using the cold vapor technique. All others may be analyzed using ICP spectroscopy.

Solution Preparation

 TCLP Solution #1. Add 11.4 mL glacial acetic acid to 1,000 mL deionized water. Add 128.6 mL 1N NaOH to the acetic acid solution, and dilute to 2,000 mL. Solution pH should be in the range 4.95 ± 0.05.

TCLP Solution #2. Dilute 11.4 mL glacial acetic acid to 2,000 mL with deionized water. Solution pH should be in the range 2.88 ± 0.05 .

Screening SPLP Test Procedure

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SCREENING SPLP APPLIED CHEMISTRY LABORATORY RMT, INC.

1. Background

RMT uses a scaled-down version of the Synthetic Precipitation Leaching Procedure (SPLP) for screening the leaching potential of soil and screening possible additives for the treatment of hazardous waste. The screening SPLP uses on tenth of the prescribed sample weight and reagent volume, and uses the same sample preparation guidelines and SPLP solutions as prescribed in EPA SW846 Method 1312. Analyses of the metals are performed using an ICP, with no digestion or matrix spikes. The test was designed primarily for use in optimizing dosages of treatment chemicals in treatability studies, and is not intended as the sole source of leaching data for regulatory submittals.

2. Equipment

- Plastic bottles with air/liquid-tight closures, 250 mL
- Balance, accurate to <u>+</u> 0.01 g
- Solution dispenser, 100 mL
- Tumble box
- pH meter
- Filter, cartridge, Whatman Autovial®, 0.45 μ, PTFE.
- Vial, 28 mL plastic for ICP auto sampler.

3. Reagents

- pH Buffers, calibration, 4.0 and 7.0
- Deionized water
- Sulfuric Acid (H₂SO₄), concentrated analytical reagent grade
- Nitric Acid (HNO3) , concentrated analytical reagent grade

4. Procedure

Solution Preparation

Prepare sulfuric acid/nitric acid, 60/40 weight percent mixture in dilute solution:

- To 90 grams of deionized water, <u>cautiously</u> add 6.0 grams concentrated sulfuric acid and 4.0 grams concentrated distilled nitric acid. (This solution will be used to prepare a synthetic acid rain fluid.)
- **SPLP East Extraction Fluid:** Add the 60/40 acid mixture drop wise to deionized water until the pH is 4.20 ± 0.05.
- **SPLP West Extraction Fluid:** Add the 60/40 acid mixture drop wise to deionized water until the pH is 5.00 <u>+</u> 0.05.

Leaching Procedure

- 1. Prepare a bench sheet for recording the sample data.
- 2. Label a 250-mL plastic bottle with the appropriate sample information.
- 3. Place 10.0 g of sample in the 250-mL plastic bottle.
- 4. Dispense 200 mL of the appropriate SPLP extraction fluid to the bottle.
- 5. Seal the bottle with the closure and place the bottle in the tumbler.
- 6. Tumble the sample overnight (18 ± 2 hours).
- 7. Measure and record the pH of the leachate.
- 8. Filter the sample using a filter cartridge.
- 9. Acidify/preserve the filtrate to a pH < 2 with concentrated nitric acid.
- 10. Record any pertinent information on the bench sheet.
- 11. Analyze the sample using the standard ICP laboratory method.

Appendix D Borehole Abandonment Forms

Well / Drillhole / Borehole Filling & Sealing

Form 3300-005 (R 8/07)

Page 1 of 2

Route to:	ned/Wastewater [Waste Management	Remedia	ition/Redevel	opment Other:	
1. Well Location Information]		2. Facility	/ Owner Inf	ormation	
	que Well # of ved Well	^{нісар} # T2 - 0	Facility Name الرحي Facility ID (Fl	vannee	Marsh	
Lattitude / Longitude (Degrees an	d Minutes) Metho 'N 'W		License/Pern] #	
Variation Variation Variation Variation Variation Variation Or Gov't Lot # Well Street Address		wnship Range ⊠ E 23 N 25 ⊡ W	Original Well WDN Present Well	IR - B	urean of Remodi	icition and Reclarchipp
	dar sh	Well ZIP Code 54,211,0 Lot #	Mailing Addr 2984 City of Prese	Shauur	10 AVC Sta	ate ZIP Code UI 54307
Reason For Removal From Servi Michney Investigative Bard	where	II # of Replacement Well	4. Pump, L Pump and	iner, Scree	n, Casing & Sealing	Material
3. We'll / Drillhole / Borehole	Original Construct 04/0	tion Date (mm/dd/yyyy))ろ/2007- ction Report is available,	Was casin	moved? <u>t in place?</u> ig cut off belo		Yes No N/A Yes No N/A Yes No N/A Yes No N/A Yes No N/A Yes No N/A Yes No N/A Yes No N/A Yes No N/A
	Sandpoint) mbz. (Diuct	Dug Push)	Did materi If yes,	al settle after was hole ret		□Yes ☑No □N/A □Yes □No □N/A
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If yes, to what depth (feet)?	Depth to Wa	ater (feet)	Granula	ite Chips ar Bentonite		- Cement Grout - Sand Slurry alant: Mix Ratio or
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6. Comments			<u> </u>			

7. Supervision of Work					DNR Use Only
Name of Person or Firm Doing Filling & Sea	Iling Lice	ense #	Date of Filling & Sealing (mm/dd/yyyy)	Date Received	Noted By
ON-SILE ENVIRONMENTAL SEMICEST	INC.		04/03/2007		
Street or Route			Telephone Number	Comments	1ha
P.n. Box 280			(608) 837-8992		120
City Sun Praivir	State .∖W ∖	ZIP Code 5359		Work	Date Signed
			T		

Well / Drillhole / Borehole Filling & Sealing

Form 3300-005 (R 8/07)

Page 1 of 2

Route to:		Waste Management		tion/Redevelo	opment Other						
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	'N		License/Perm	_	#						
V4/V4 V4 Syst or Gov't Lot # Well Street Address	Section Town	ship Range ⊠E 3 N 25 □ W	Original Well いしい Present Well	<u>R - Pi</u>	Man of Rom.	intration	and Rentancloper				
	darsh	Well ZIP Code 54 えれ _の Lot #	Mailing Addre 29 § 4 City of Prese Xewi	Shiwun	O AVE	State ZI	P Code 54307				
Reason For Removal From Servi Condumnal Inversived Mac. Cond		 # of Replacement Well		iner, Screer	n, Casing & Seali ved?	Yes					
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5. Material Used To Fill Well /	Drillhole		From (ft.)	To (ft.)	No. Yards, Sacks or Volume (circ		Mix Ratio or Mud Weight				
Scienced and Document	Rentrality Cla	05	Surface	/0	< 19 bac	1					
6. Comments											

Name of Person or Firm Doing Filling & Sealing License # Date of Filling & Sealing (mm/dd/yyyy) Date Received Noted By Ont - St R_ 2m/information filling & Sealing License # 04/103/2007 04/103/2007 Date Received Noted By Street or Route Telephone Number Comments P.O. Box 280 (908) 837-8792 Street or Route	
P.O. Box 280 (608) 837-8992	
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City State ZIP Code Signature of Person Doing Work Date Signature of Person Date Signature of Person Date Signature of Person Date Signature of Person Date Signature of Person Date Signature of Person Date Signature of Person Date Signature of Person Date Signature of Person Date Signature of Person Date Signature of	2007

Well / Drillhole / Borehole Filling & Sealing

Form 3300-005 (R 8/07)

Page 1 of 2

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X Other (specify): <u>Chropping (Think This</u> Formation Type:	Dug		al settle after		□Yes □Ves	
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<u> </u>				sate source? g Sealing Material	LYes	
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If yes, to what depth (feet)? Depth to Water (f	feet)		<i>g weils and N</i> ite Chips	Ionitoring Well Bore	enoies Oniy: onite - Cement (Grout
5			ar Bentonite		onite - Sand Slu	
5. Material Used To Fill Well / Drillhole		From (ft.)	To (ft.)	No. Yards, Sacks or Volume (circ	s Sealant)	Mix Ratio or Mud Weight
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7. Supervision of Work			DI	NR Use Only	
Name of Person or Firm Doing Fi On - SIL EnglyDownerd7d S		Date of Filling & Sealing (mm/dd/y) 04/03/ 200チ	yyy) Date Received	Noted By	
Street or Route P.O. Bax 280		Telephone Number (608) 837-8992	Comments		3
City Sun Praivie	State ZIP Co W\ 53	Separature of Person Doi	ing Work	Date Signed	2007

Well / Drillhole / Borehole Filling & Sealing Form 3300-005 (R 8/07)

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1. Well Location Information	1		2. Facility	Owner Inf	ormation			
	ique Well # of ved Well	⊨icap#- T(-1)-20SE	Facility Name	KULUN ZIL	Marsh			
Lattitude / Longitude (Degrees ar	nd Minutes) Method	d Code (see instructions)						
· · ·	'N 'W		License/Perm	it/Monitoring	#			
<u>₩/₩</u> or Gov't Lot #	1 1	vnship Range 戻 E 2ろ N 25 一 W	Original Well いしい	R - Pi	alland Rema	duction	and Redailion	
Well Street Address	I	- Secred		Owner				
Kewauner J Well City, Village or Town Kewawarer		Well ZIP Code 54 XII.0	-Mailing Addre	Shawn	o AVE	<u>Obata</u>		
Subdivision Name		Lot #		UNRE		WI	P Code 54307	
Reason For Removal From Servi	ce WI Unique Wel	I # of Replacement Well	4. Pump, L	iner, Scree	n, Casing & Sealir	ig Material		
million Invisionative Boreb			-	piping remov	ved?	□ Yes	·	
3. Well / Drillhole / Borehole			Liner(s) re			Yes		
Monitoring Well		ion Date (mm/dd/yyyy) 3 2007-	Screen rer Casing lef					
	If a Well Construc please attach.	If a Well Construction Report is available,			Was casing cut off below surface?			
Construction Type:			Did sealing	g material ris	e to surface?	L Yes		
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Was well annular space grouted?	? 🗌 Yes				۲کر Monitoring Well Boret	Bentonite Cl	nips	
If yes, to what depth (feet)?	Depth to Wa	ter (feet)	Benton	ite Chips ar Bentonite	Benton	nite - Cement nite - Sand Sl		
5. Material Used To Fill Well /	ı Drillhole	<u> </u>	From (ft.)	To (ft.)	No. Yards, Sacks	Sealant)	Mix Ratio or	
Symmed and Power		A.Y. (25)	Surface	10	or Volume (circl ≤ 1/4 bata		Mud Weight	
	· ·		1		9			

7. Supervision of Work				DN	IR Use Only
Name of Person or Firm Doing Filling & On - Sile Zhankuman and Sanku		nse#[Date of Filling & Sealing (mm/dd/yyyy) 04/03/2007	Date Received	Noted By
Street or Route P.O. Box 280			Telephone Number (608) 837-8792	Comments	4
City Sun Provie	State .\\\/\	ZIP Code 53590	Signature of Person Doing V		Date Signed

n

Well / Drillhole / Borehole Filling & Sealing

Form 3300-005 (R 8/07)

Page 1 of 2

Drinking Water Water	shed/Wastewater	Waste Management	Remedia	tion/Redevelo	opment	Other:	
1. Well Location Information	n		2. Facility / Owner Information				
	nique Well # of oved Well	hicap#- TI - 40NW	Facility Name	JOULN 22	Marsh		
Lattitude / Longitude (Degrees a	and Minutes) Meth	od Code (see instructions)	Facility ID (Fi	D 01 PW3)			
° ·	' N	, <u></u>	License/Pern	-	#		
И/И И <u>Sup-(</u> or Gov't Lot #	Section To	$\begin{array}{c c} \text{wnship} & \text{Range} & \blacksquare \\ 23 & N & 25 & \Box \\ \end{array} \\ W$	Original Well ルカN Present Well	<u>R - R</u>	11/2014	Bennihat	ion and Redevelop
Well Street Address Kewawaee	Marsh					······	
Well City, Village or Town	/ 24	Well ZIP Code 54 みれの	Mailing Addro <u> </u>	Shaw	,	State	ZIP Code
Subdivision Name		Lot #		auner			54307
Reason For Removal From Ser	vice WI Unique W	ell # of Replacement Well	4. Pump, L	iner, Scree	n, Casing	& Sealing Mat	
activities Touresheatrice Boreholde			· ·	piping remov	ved?		
3. Well / Drillhole / Borehol			Liner(s) re			Line Line Line Line Line Line Line Line	
Monitoring Well		tion Date (mm/dd/yyyy)) 3[2007	Screen rei <u>Casing lef</u>	moved? t in clace?			⊥Yes ⊠No □N/A <u>]_{Yes} □_{No} ⊠N/A</u>
Water Well If a Well Construct please attach.		ction Report is available,		ig cut off belo			
Construction Type:				g material ris		? L	
	n (Sandpoint)			ial settle after			
び Other (specify):		— 、 ³	If yes, was hole retopped? └────────────────────────────────────				
Formation Type:				thod of Placin			
	Bed	Irock	Conduc	tor Pipe-Grav	vity 🔲 Cor	nductor Pipe-Pu	mped
Total Well Depth From Ground		g Diameter (in.)		ed & Poured nite Chips)	🗌 Oth	ner (Explain):	
10		-	Sealing Mate				
Lower Drillhole Diameter (in.)	Casin	g Depth (ft.)	Neat C	ement Grout		Clay-S	and Slurry (11 lb./gal. wt.)
			Sand-C	Cement (Conc	rete) Grout	Benton	ite-Sand Slurry " "
Was well annular space groute	d? 🗌 Yes	No Unknown				· \	nite Chips
If yes, to what depth (feet)?	Depth to W			-	Monitoring V	Vell Boreholes O	
		5		ite Chips ar Bentonite		Bentonite - Ce Bentonite - Sa	
5. Material Used To Fill Well	/ Drillhole	\sim	From (ft.)	To (ft.)	No. Yards	s, Sacks Sealar me (circle one)	,
Source Albert Pourse	Puntovit (Nios	Surface	70			
		,				U I	
••••••••••••••••••••••••••••••••••••••							
6. Comments							

7. Supervision of Work				DN	IR Use Only
Name of Person or Firm Doing Filling On - Sile Environmental Servi		nse # [Date of Filling & Sealing (mm/dd/yyyy) 04/03/ 200チ	Date Received	Noted By
Street or Route P.(), B() x = 280			Telephone Number (608) 837-8992	Comments	5
City Sun Plaine	State .₩\	ZIP Code 5359(Signature of Person Doing		Date Signed

Well / Drillhole / Borehole Filling & Sealing

Farm 3300-005 (R 8/07)

Page 1 of 2

Drinking Water Waters	hed/VVastewater	Waste Management	Remedia	tion/Redevelo	opment	Other:	
1. Well Location Information	n		2. Facility	Owner Inf	ormation		
	nique Well # of wed Well 	Hieap# TI-30NW	Facility Name	KULINER	Mansh		
Lattitude / Longitude (Degrees a	nd Minutes) Metho	d Code (see instructions)	Facility ID (FI	D OF PVVS)			
°	'N 'W		License/Perm	iit/Monitaring	#	an an an an an an an an an an an an an a	
¼ / ¼ ¼ ≦ or Gov't Lot #	Section Tov	wnship Range 反 E えろ N 25 回 W	Original Well ルルト Present Well	<u>R - P</u>	u///www.st	Remultication	Named Reitanclopy
Well Street Address							
	Mursh		Mailing Addre	ess of Preser	nt Owner		
Well City, Village or Town Kewinnee		Well ZIP Code	2984	Shaw	to AVL		
		<u>54 入れ。</u> Lot #	City of Prese	nt Owner			ZIP Code
Subdivision Name			_ Keni	une		WI	54307
Reason For Removal From Serv	vice WI Unique We	I # of Replacement Well	4. Pump, L	iner, Scree	n, Casing 8	Sealing Materi	al
actions Invisionation Borcholz				piping remov	ved?	\Box_{Y}	es 🗌 No 🖸 N/A
3. Well / Drillhole / Borehole Information			Liner(s) re	moved?		X	es No N/A
Original Construction Date (mm/dd/yyyy)		tion Date (mm/dd/yyyy)	Screen rer	noved?			es No N/A
Monitoring Well		3/2007	Casing lef	in olace?			ies 🗆 No 🗵 N/A
Water Well	If a Well Construct please attach.	ction Report is available,		g cut off belo	ow surface? e to surface?		íes □ _{No} ⊠ _{N/A}
Construction Type:							
Drilled Driven	(Sandpoint)	Dug	Did material settle after 24 hours? Yes Yes No N/A If yes, was hole retopped? Yes No N/A If bentonite chips were used, were they hydrated with water from a known safe source? Yes No N/A				
· · · · · · · · · · · · · · · · · · ·	orobe (Direct	Deshi					
Formation Type:	_				ig Sealing Ma		
Unconsolidated Formation		rock	Conductor Pipe-Gravity Conductor Pipe-Pumped				
Total Well Depth From Ground S	Surface (ft.) Casing	Diameter (in.)		ite Chips)	U Othe	er (Explain):	
/0			Sealing Mate				
Lower Drillhole Diameter (in.)	Casing	Depth (ft.)		ement Grout			Slurry (11 lb./gal. wt.)
				ement (Conc	rete) Grout		Sand Slurry " "
Was well annular space grouted	? Yes	🛛 No 🗌 Unknown			Monitoring W	,Rentonite ell Boreholes Only	
If yes, to what depth (feet)? Depth to Water (feet)				g <i>vvens and i</i> te Chips		Bentonite - Ceme	
		5		ar Bentonite		Bentonite - Sand	
5. Material Used To Fill Well /	Drillhole		From (ft.)	To (ft.)		, Sacks Sealant	Mix Ratio or Mud Weight
Strand I and Poural		la vot	Surface	10	or volun ≤ 1/4	he (circle one) o∉⊴	
<u></u>	sjeratati ∖	ere più		<i>v</i> -		<u>0</u> #12 (1
			<u> </u>				<u> </u>
6. Comments			11		1		L

7. Supervision of Work				DN	IR Use Only
Name of Person or Firm Doing Filli On - SUL Environmental Sec		nse # 🛛 🛛	Date of Filling & Sealing (mm/dd/yyyy) 04/03/200チ	Date Received	Noted By
Street or Route P. D. Box 280	, , , , , , , , , , , , , , , , , , ,	<u> </u>	Telephone Number (1998) 837-8992	Comments	6
City Sun France	State .\w/	ZIP Code	Signature of Person Doing		Date Signed

Well / Drillhole / Borehole Filling & Sealing

Form 3300-005 (R 8/07)

Page 1 of 2

Drinking Water Water	shed/\Wastewater	Waste Management	Remedia	tion/Redevelo	opment Othe	er:	
1. Well Location Informatio	n		2. Facility / Owner Information				
	nique Well # of oved Well	Hicap# TI-20NW		HUNN 22	Newsm		
Lattitude / Longitude (Degrees a	and Minutes) Metho	d Code (see instructions)	Facility ID (FI	D or PWS)			
° ·	' N		License/Pern	nit/Monitoring	#		
74 / 74 74 Sin/ or Gov't Lot #	Section Tov	wnship Range ∑ E 23 N 25 □ W	Original Well いう N Present Well	R - R	allow of Err	Architection	and Rechardups
Well Street Address	Marsh						
Kewaunee Well City, Village or Town Kewaunee	<u>, 1071 9.8</u>	Well ZIP Code 54 XILo	Mailing Addre えዓ ş ዓ City of Prese	Shawr	t Owner の パソン	State Z	IP Code
Subdivision Name		Lot #		ALLALL-		UI	54307
Reason For Removal From Ser	vice MI Unique We	II # of Replacement Well	4. Pump, L	iner, Scree	n, Casing & Sea	ling Materia	al
Molyman Invistigation Bur			Pump and	piping remov	ved?		
3. Well / Drillhole / Borehole Information			Liner(s) re			<u></u> Υε	
Monitoring Well		tion Date (mm/dd/yyyy) 3 2.00フ	Screen rei Casing lef				
Water Well Borehole / Drillhole	If a Well Construct please attach.	ction Report is available,		g cut off belo			
	n (Sandpoint) om be 1 David	Dug Duch	Did materi If yes,	al settle after was hole ret			
Formation Type:					g Sealing Material		
Unconsolidated Formation	Bed	rock		tor Pipe-Grav	vity 🔲 Conductor	r Pipe-Pumpe	d
Total Well Depth From Ground	Surface (ft.) Casing	Diameter (in.)	Screened & Poured Other (Explain):				
10			Sealing Mate			_	<u></u>
Lower Drillhole Diameter (in.)	Casing	Depth (ft.)		ement Grout Cement (Conc		Bentonite-S	Slurry (11 lb./gal. wt.) Sand Slurry " "
Was well annular space grouted	d? 🗌 Yes					Rentonite C	Chips
If yes, to what depth (feet)?	Depth to Wa	ater (feet)	Benton	ig Wells and i ite Chips ar Bentonite		<i>reholes Only:</i> conite - Cemer conite - Sand S	
5. Material Used To Fill Well	/ Drillhole		From (ft.)	To (ft.)	No. Yards, Sach or Volume (cli	s Sealant	Mix Ratio or Mud Weight
Symmed land Present	Prentimite CI	wios.	Surface	10	≤ 1/4 bu	1	
		,				0	
6. Comments							
o. oonmenta							

7. Supervision of Work				DN	IR Use Only
Name of Person or Firm Doing Fil On - Sike Znuvilinowi entril S		nse # D	ate of Filling & Sealing (mm/dd/yyyy) 04/03/2007	Date Received	Noted By
Street or Route P. (). Box 280			Telephone Number (608) 837-8992	Comments	7
City Sun Prairie	State 	ZIP Code 53590	Signature of Person Doing		Date Signed

Well / Drillhole / Borehole Filling & Sealing Page 1 of 2

Form 3300-005 (R 8/07)

Drinking Water Watersh	ned/Wastewater	Waste Management	Remedia	tion/Redevelo	opment	Other:	
1. Well Location Information	I		2. Facility	/ Owner Inf	ormation		
County WI Uni Kew aunes	ique Well # of ved W/ell 	Hicap# TI-IUNW		KULAZ	Maysh		
Lattitude / Longitude (Degrees an	d Minutes) Metho	d Code (see instructions)	Facility ID (FI	D or PWS)			
• • • •	' N , w		License/Pern	nit/Monitoring	#		
Y4 / Y4 Y4 S47 / or Gov't Lot #	Section Tov	vnship Range ⊠ E 23 N 25 ⊡ W	Original Well いしい	R - PA	u (1014. +	Remuchati	on and Redardoor
Well Street Address	Alur sh						
Kewaunee / Well City, Village or Town Kewiwinee	1911 - 734 1917 - 734	Well ZIP Code 54 XII.0	Mailing Addre 고수홍식 City of Prese	Shauur	it Owner 10 AVE	State	ZIP Code
Subdivision Name		Lot #	- 17			UI	54307
Reason For Removal From Servi	ce MUUnique We	II # of Replacement Well	≓. Pump, L	iner, Scree	n, Casing a	& Sealing Mate	
molymm Invirshighter Burch			Pump and	piping remov	ved?		Yes No NA
3. Well / Drillhole / Borehole Information			Liner(s) re			X	
Monitoring Well		ion Date (mm/dd/yyyy) 3/2.007	Screen rei Casing lef				Yes ⊠No □N/A Yes □No ⊠N/A
Water Well	If a Well Construct please attach.	tion Report is available,		g cut off belo g material ris		, [Yes No N/A Yes No N/A
	Sandpoint) mbe (Dirict)	Dug Push)	Did materi If yes, If bentonite	al settle after was hole ret chips were t from a knowr	· 24 hours? opped? used, were th	ney hydrated	Yes ⊠No □N/A Yes □No □N/A Yes ⊠No □N/A
Formation Type:	Bedr	ock	Required Mer	hod of Placin		aterial nductor Pipe-Pum	nped
Total Weil Depth From Ground S	urface (ft.) Casing	Diameter (in.)	Screen (Bentor) Sealing Mate	ed & Poured iite Chips)	Oth	er (Explain):	
Lower Drillhole Diameter (in.)	Casing	Depth (ft.)	Neat C	ement Grout ement (Conc	rete) Grout	Bentonit	nd Slurry (11 lb./gal. wt.) e-Sand Slurry " "
Was well annular space grouted?	Yes					, Bentonit	
If yes, to what depth (feet)?	Depth to Wa	ter (feet)		g Wells and I ite Chips ar Bentonite	vionitoring W	<i>(ell Boreholes Or.</i>] Bentonite - Cer] Bentonite - Sar	ment Grout
5. Material Used To Fill Well / I	Drillhole		From (ft.)	To (ft.)		, <u>Sacks Sealant</u> ne (circle one)	
Stynna About Provide	Rundmilt Cl	A.). (57)	Surface	10		baa	

6. Comments			1				

7. Supervision of Work				DNR Use Only		
Name of Person or Firm Doing Filling On - Sike Emaktrowitz Mith Sena		# Date	of Filling & Sealing (mm/dd/yyyy) 04/03/2007) Date Received	Noted By	
Street or Route P. (). Box 280			Telephone Number (1/208) 837-8997	Comments	Å	
City Sun Francise	State Z	ZIP Code 53590	Signature of Person Doing		Date Signed	
				•	p l	

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Well / Drillhole / Borehole Filling & Sealing Page 1 of 2

Form 3300-005 (R 8/07)

	ique Well # of		2. Facility / Owner Information					
	ved Well	$\frac{\text{Hicap}\#}{TI - 10SE}$		HUNNEL	Maursia			
attitude / Longitude (Degrees ar	nd Minutes) Metho	d Code (see instructions)	Facility ID (FI	D or PWS)				
میں میں میں میں میں میں میں میں میں میں	' N	(,						
			License/Perm	nt/Monitoring	#			
° '	'W							
14 14 SIN		wnship Range 🔀 E	Original Well いしN		1000 A BIMIN	12.1		
· Gov't Lot #	-7	23 N 25 Hw	Present Well		MARK CRIMIN	USU OA (Jak) SEA-	246 (12.4	
/ell Street Address			Present well	Owner				
Kewaanee /	ular sh		Mailia a Adda		+ Ourses			
ell City, Village or Town		Well ZIP Code	Mailing Addre 29 홍낙					
Kewaunee		542110	City of Preser	Shruun		ate ZIP Code		
ubdivision Name		Lot #	1			UI 54307		
						1 2 7 7 2 7		
eason For Removal From Serv	ice WI Unique We	II # of Replacement Well	#. Pump, L	iner, Scree	n, Casing & Sealing			
during Investigative Borel	hole		Pump and	piping remov	ved?		N/A	
. Well / Drillhole / Borehole	e Information		Liner(s) re	moved?				
	Original Construct	tion Date (mm/dd/yyyy)	Screen rer	moved?		Yes XNO		
Monitoring Well	0 4/0	3/2007	Casing left	t in place?			⊠ _{N/A}	
Water Well	If a Well Construc	ction Report is available,	Was casin	g cut off belo	w surface?	Yes No E	N/A	
Borehole / Drillhole	please attach.			-	e to surface?		N/A	
onstruction Type:				al settle after		🗆 Yes 🖾 No 🛛		
Drilled Driven	(Sandpoint)	Dug	1	was hole ret		□ _{Yes} □ _{No} [
Other (specify):	mobel (Direct	Push)	If bentonite	chips were	used, were they hydrate a safe source?			
ormation Type:		<u></u>			g Sealing Material			
<u> </u>				tor Pipe-Grav		e-Pumped		
			·	ed & Poured				
otal Well Depth From Ground S	Surface (ft.) [Casing	Diameter (in.)	Bentor	nite Chips)	U Other (Explain)	/:		
7 =			Sealing Mater					
ower Drillhole Diameter (in.) γ		Depth (ft.)		ement Grout		lay-Sand Slurry (11 lb./		
				ement (Conc		entonite-Sand Slurry "		
Vas well annular space grouted	? Yes	No 🗌 Unknown			eبکا Monitoring Well Borehol	entonite Chips		
yes, to what depth (feet)?	Depth to Wa	ater (feet)		ig vveils and i ite Chips	-	e - Cement Grout		
		5		ar Bentonite		e - Sand Slurry		
. Material Used To Fill Well /		0	From (ft.)	To (ft.)	No. Yards, Sacks Se	ealant Mix Ratio	or	
		· ·	1		or Volume (circle	one) Mud Weig	gnt	
Scienced Clark Privat	MWATNIK (A > 195	Surface	10	$\leq 1/4$ bac	l		

7. Supervision of Work				DN	IR Use Only	
Name of Person or Firm Doing Fi On - Site Environmented S		se#Da	ite of Filling & Sealing (mm/dd/yyyy) 04/ 03 / 200チ	Date Received	Noted By	
Street or Route P. (). Box 280			Telephone Number ((408) 837-8992	Comments	9	
City Sun France	State .W\	ZIP Code 53590	Signature of Person Doing		Date Signed	7

Well / Drillhole / Borehole Filling & Sealing

Form 3300-005 (R 8/07)

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Drinking Water Watersh	ed/Wastewater	Waste Management	🔀 Remedia	tion/Redevelo	opment Other:		
1. Well Location Information			2. Facility	/ Owner Inf	ormation		
County WI Unit Kew/aunze Miner	que Well # of ed Well 	h icap#- T1-205E	Facility Name <u>(</u> /u Facility ID (FI	JAULA 22	Maysh		
Lattitude / Longitude (Degrees an	d Minutes) Metho	d Code (see instructions)	Facility ID (FI	D 01 PW3)			
·	'N		License/Pern	nit/Monitoring	#		
✓ ✓	Section Tov	 vnship Range ⊠ ε 23 Ν 25 ⊡ W	Original Well いうN Present Well	R - R	WILLIAM REMA	duction	ania Reclair look
Well Street Address Kewaunee	lur sh		Mailing Addre		nt Owner		
Well City, Village or Town		Well ZIP Code 54 XILo	2984 City of Prese	Shaw	io AVE	State ZI	^o Code
Subdivision Name		Lot #	Kew	ULM IL		WI	54307
Reason For Removal From Servic	ce WI Unique We	II # of Replacement Well	<mark>≓. Pump, L</mark>	iner, Scree	n, Casing & Sealir	ng Material	
adminis Investigative Burgh			Pump and	piping remo	ved?		
3. Well / Drillhole / Borehole	Information		Liner(s) re	moved?		Yes	
Monitoring Well	Original Construct 0 4/0	ion Date (mm/dd/yyyy) 3 2007	Screen rei				
Water Well	If a Well Construct please attach.	tion Report is available,	1	ig cut off belo			
	Sandpoint) mbe (Daract	Dug Push)	Did mater If yes,	al settle after was hole ret			
Formation Type:	Bedrurface (ft.) Casing			thod of Placin tor Pipe-Graved ed & Poured hite Chips)	g Sealing Material vity Conductor P Other (Explai		
Lower Drillhole Diameter (in.)	Casing	Depth (ft.)	Sand-C	ement Grout Cement (Conc	rete) Grout	Bentonite-Sa	lurry (11 lb./gal. wt.) and Slurry ""
Was well annular space grouted?	Yes	No Unknown			,	Bentonite Cl	nips
If yes, to what depth (feet)?	Depth to Wa	iter (feet)	Benton	ig Wells and i ite Chips ar Bentonite		noles Only: ite - Cement ite - Sand Sl	
5. Material Used To Fill Well / [Drillhole	-	From (ft.)	To (ft.)	No. Yards, Sacks or Volume (circl	Sealant)	Mix Ratio or Mud Weight
Strongel Unit Poursel	Bentonik (1	Nigs	Surface	/0	≤ 74 baa		
6. Comments							

7. Supervision of Work			DNR Use Only			
Name of Person or Firm Doing F On - Site Environmendal S		nse # [Date of Filling & Sealing (mm/dd/yyyy) 04/03/2007) Date Received	Noted By	
Street or Route P.O. Box 280			Telephone Number (1708) 837-8992	Comments		10
City Stin France	State MV	ZIP Code ちろらり	Signature of Person Doing	F (A)	Date Signed	2007

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Well / Drillhole / Borehole Filling & Sealing

Form 3300-005 (R 8/07)

Page 1 of 2

Drinking Water Watersh	ed/Wastewater	Waste Management	Remedia	tion/Redevelo	opment	Other:	
1. Well Location Information			2. Facility	Owner Inf	ormation		
County WI Uni Kew aunes	que Well # of ed Well	TI- JUSE		Jaunee	Havsh		
Lattitude / Longitude (Degrees an	d Minutes) Metho ' N ' W	d Code (see instructions)	Facility ID (FI	, 	#		
V4 / V4 SIM or Gov't Lot #		vnship 23 N 25 ₩ W	Original Well いたい Present Well	<u>R - B</u>	1/10/14	Zemulturtion	and Rectancion
Well Street Address Kewsumer Well City, Village or Town Kewsaumer Subdivision Name	lar sh	Well ZIP Code 54 2.110 Lot #	Mailing Addre 2934 City of Prese XLU	Shawn		State Z	IP Code 54307
Reason For Removal From Servic advance Trowish (Cathur Barch 3. Well / Drillhole / Borehole		# of Replacement Well 		piping remov		Sealing Materia	
	Original Construct 0 4/()	ion Date (mm/dd/yyyy) 3/2007- tion Report is available,	Screen rei <u>Casing lef</u> Was casin Did sealing	moved? : in olace? g cut off belo	e to surface?		$\begin{array}{c c} ss & \overbrace{No} & \underset{No}{\boxtimes} & \underset{N/A}{\boxtimes} \\ ss & \underset{No}{\boxtimes} & \underset{N/A}{\boxtimes} \\ ss & \underset{No}{\boxtimes} & \underset{N/A}{\boxtimes} \\ \end{array}$
	Sandpoint) <u> mbe</u> (<u>Dicest</u> Bedr urface (ft.) (Casing	rock	If bentonite with water Required Mel	from a knowr	used, were the safe source? g Sealing Mate vity Cond		es No N/A
Lower Drillhole Diameter (in.)	Casing	Depth (ft.)	Sealing Mate	rials ement Grout ement (Conc te	·		Slurry (11 lb./gal. wt.) and Slurry " " Chips
If yes, to what depth (feet)?	Depth to Wa	ter (feet) 5	Benton	ite Chips ar Bentonite		Bentonite - Cemer Bentonite - Sand S	
5. Material Used To Fill Well / [From (ft.)	To (ft.)	or Volume	Sacks Sealant) e (circle one)	Mud Weight
Stored and Pourd	Pratmik (1)	nigs	Surface	10	<u>≤ 1/4</u>	bra U	
6. Comments					1		

7. Supervision of Work				DNR Use Only		
Name of Person or Firm Doing Fillin On - St. E. Environmental Ser		nse #	Date of Filling & Sealing (mm/dd/yyyy) 04/03/2007	Date Received	Noted By	
Street or Route P.(). Box 280			Telephone Number (1208) 837-8992	Comments		ll
City Sun Prairie	State .\\\\\	ZIP Code	Signature of Person Doing	Work	Date Signed	2007
			· · · · · · · · · · · · · · · · · · ·		J	,

Well / Drillhole / Borehole Filling & Sealing Form 3300-005 (R 8/07)

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Route to:	ned/Wastewater	Waste Management	Remedia	tion/Redevelo	opment	Other:	and a support of the support
1. Well Location Information	l		2. Facility	/ Owner Inf	ormation		
	ved Well	ticap# T4 - 40 NW	Facility Name <u>Kruccunze</u> Haysh Facility ID (FID or PWS)				
	' N		License/Pern		#		
¼ /¼ ¼ Śự l or Gov't Lot #		nship Range ⊠ E 23 N 25 □ W	Original Well ルカN Present Well	<u>R - P</u>	1124 H	Remulticities	n and Redardoom
	dar sh	Well ZIP Code 54 XI(o Lot #	Mailing Addre <u>2934</u> City of Prese	Shiciun nt Owner	nt Owner らーりし	State	ZIP Code
Reason For Removal From Servi			. Pump, L	iner, Scree	· · · · · ·	& Sealing Materi	54307 ial 'es 🗆 No 🖾 N/A
3. Well / Drillhole / Borehole			Liner(s) re			,⊠ _Y	'es 🗆 No 🗆 N/A
Monitoring Well Water Well Sorehole / Drillhole	04/03	on Date (mm/dd/yyyy) 5/2.007 ion Report is available,					$\begin{array}{c c} \text{'es} & \fbox{No} & \fbox{N/A} \\ \hline \text{'es} & \fbox{No} & \fbox{N/A} \\ \hline \text{'es} & \fbox{No} & \fbox{N/A} \\ \hline \text{'es} & \fbox{No} & \fbox{N/A} \end{array}$
	Sandpoint) Obe (Direct T	Dug Ach)	Did mater If ye s ,	al settle after was hole ret chips were t from a knowr	r 24 hours? opped?		
Formation Type:		Diameter (in.)	Screen	tor Pipe-Graved ad & Poured hite Chips)	vity Cor	er (Explain):	
Lower Drillhole Diameter (in.)		Depth (ft.)	Sand-C		·	Bentonite-	
If yes, to what depth (feet)?		er (feet) 5	Benton	ig vveils and i ite Chips ar Bentonite		/ell Boreholes Only Bentonite - Ceme Bentonite - Sand S Sacks Sealant	ent Grout
5. Material Used To Fill Well /			From (ft.)	To (ft.)	or Volur	me (circle one)	Mud Weight
Strongel Class Porced	Buntonik Ch		Surface	10	<u>≤</u> '/4	<u>bra</u>	• • • • • • • • • • • • • • • • • • •
6. Comments							

CityState ZIP Code Signature of Person Doing Work Date Signed	7. Supervision of Work			DNR Use Only			
P.0. Box 280 (1/08) 837-8992 City State ZIP Code Signature of Person Doing Work Date Signed		nse# [Date Received	Noted By		
City State ZIP Code Signature of Person Doing Work Date Signed	P.D. Box 280		•	Comments		12	
	City Sun France	 ZIP Code 53590				2007	

Well / Drillhole / Borehole Filling & Sealing

Page 1 of 2

Form 3300-005 (R 8/07)

Route to:	hed/Wastewater	Waste Management	Remedia	tion/Redevelo	ppment	Other:	
1. Well Location Information	n		2. Facility	Owner Inf	ormation		
		ficap #	Facility Name				
Kewlannee Remo	oved Well	T4-30 NW)	<u> </u>	HUUR EL	Accessin	······	
Lattitude / Longitude (Degrees a	nd Minutes) Method		Facility ID (FI	D or PWS)			
	' N						
			License/Pern	hit/Monitoring	#		
۵ ــــــــــــــــــــــــــــــــــــ	' W		0	0			
1/4/1/4 1/4 SW/		nship Range 🔀 E	Original Well	Dwner 12 R	1/2011	Praducto	UN AND Reitarloom
or Gov't Lot #	$\neg \neg \downarrow$	23 N 25 🗒 W	Present Well		AT CAR PO	Server and an	MARINE STREET. CH
Well Street Address	, I			Owner			
Kewauner)	Mar 3h		Mailing Addre	ess of Preser	nt Owner		
Well City, Village or Town		Well ZIP Code	2984	Shawn	(,	
Kewaunee		542110	City of Prese			State	ZIP Code
Subdivision Name		Lot #	Kew	111122		WI	54307
Reason For Removal From Serv	ing Millipique Mell	# of Ronlacomont Woll	. Pump, L	iner, Scree	n, Casing	& Sealing Mate	rial
Manning Invisionation Burg			Bump and	piping remov			Yes No WNA
3. Well / Drillhole / Borehole			Liner(s) re		veu:	 A	
		on Date (mm/dd/yyyy)	Screen rei				$Y_{es} \boxtimes_{No} \square_{N/A}$
Monitoring Well		3/2007	Casing lef				
Water Well		ion Report is available,					$ _{Yes} \square_{No} \boxtimes_{N/A}$
Borehole / Drillhole	please attach.		[g cut off belo			$ _{Yes} \square_{No} \boxtimes_{N/A}$
Construction Type:	- !			g material ris al settle after			$ _{Yes} \square_{No} \square_{N/A}$
	(Sandpoint)			was hole ret	-		$ _{Yes} \square_{No} \square_{N/A}$
	omber 1 Direct	Buch)	If bentonite	e chins were i	used, were t	hey hydrated	
· · · · · · · · · · · · · · · · · · ·			with water Required Met	from a known			Yes MNO N/A
Formation Type:				tor Pipe-Grav		nductor Pipe-Pum	hed
				ed & Poured		ner (Explain):	ped
Total Well Depth From Ground S	surface (ft.) Casing I	Diameter (in.)		nite Chips)	0		
Lower Drillhole Diameter (in.)	Casing	Depth (ft.)	Sealing Mate	rials ement Grout			nd Slurry (11 lb./gal. wt.)
	Casing			ement (Conc	rete) Grout		e-Sand Slurry " "
				•			
V as well annular space grouted					Monitoring V	Vell Boreholes On	
If yes, to what depth (feet)?	Depth to Wat			ite Chips	Ĩ	Bentonite - Cerr	
		5	Granula	ar Bentonite		Bentonite - San	
5. Material Used To Fill Well /	Drillhole		From (ft.)	To (ft.)	No. Yard or Volu	s, <u>Sacks Sealant</u> me (circle one)	Mix Ratio or Mud Weight
Seven at land Pour at	Buntmiller Ch	á ors	Surface	10	<u> </u>		
		•				U	
6. Comments							

7. Supervision of Work	<u> </u>		DNR Use Only			
Name of Person or Firm Doing Fill On -Sik Smartmoneter MTILS		nse #	Date of Filling & Sealing (mm/dd/yyyy) 04/03/ えの0チ) Date Received	Noted By	
Street or Route P.O. Box 280	a an an an an an an an an an an an an an		Telephone Number (608) 837-8792	Comments		13
City Sun Phante.	State M/	ZIP Code 5359	Signature of Person Doing		Date Signed	, 2007

Well / Drillhole / Borehole Filling & Sealing

Form 3300-005 (R 8/07)

Page 1 of 2

Drinking Water Watersh	ned/Wastewater	Waste Management	Remedia	tion/Redevelo	opment	Other:	
1. Well Location Information	I		2. Facility	/ Owner Inf	ormation	a Manada ana a	
County WI Un Kewaunee Remov	ique Well # of ved Well 	Hicao# T4-10NW		MULINZE	Maush		
Lattitude / Longitude (Degrees an	d Minutes) Metho	d Code (see instructions)	Facility ID (FI	D or PWS)			
• • •	'N 'W		License/Pern	-	#		
1/4 1/4 547.1 or Gov't Lot #	Section Tov	wnship Range ≥ E 23 N 25 ⊡ W	Original Well いしい Present Well	R - R	计位计划	Constanti	mand Rectavelion
Well Street Address Kewaanze	d com as			e uno			
Well City, Village or Town	1914 J.M	Well ZIP Code 54 Allo	Mailing Addre <u> </u>	Shawn	t Owner	State	ZIP Code
Subdivision Name		Lot #	·			U/I	54307
Reason For Removal From Servi	ce MUUnique We	II # of Replacement Well	. Pump, L	iner, Scree	n, Casing	& Sealing Mate	rial
Molymour Trongestachic Bord			Pump and	piping remov	ved?		Yes No KNA
3. Well / Drillhole / Borehole			Liner(s) re	moved?			Yes No N/A
Monitoring Well		tion Date (mm/dd/yyyy) 3/2007	Screen rei Casing lef				Yes No N/A Yes No N/A
Water Well	If a Well Construct please attach.	ction Report is available,		g cut off belo g material ris			Yes No N/A
=	Sandpoint) mbe (Durch	Dug Duch	Did mater If yes, If bentonite	al settle after was hole ret	24 hours? opped? used, were t	hev hydrated	Yes M Yes N No N/A Yes N N N/A
Formation Type:	Bedr	rock		thod of Placin		aterial nductor Pipe-Pump	ped
Total Well Depth From Ground S			Bentor) بتتر	ed & Poured hite Chips)		ner (Explain):	
Lower Drillhole Diameter (in.)	Casing	Depth (ft.)		rials ement Grout cement (Conc	rete) Grout		nd Slurry (11 lb./gal. wt.) e-Sand Slurry " "
Was well annular space grouted?	Yes					Rentonite	
If yes, to what depth (feet)?	Depth to Wa	iter (feet) 5	Benton	g Wells and I ite Chips ar Bentonite	vionitoring V	Vell Boreholes Onl Bentonite - Cem Bentonite - Sand	nent Grout
5. Material Used To Fill Well /	Drillhole		From (ft.)	To (ft.)		s, Sacks Sealant. me (circle one)	
Sugar A Good Pourse	Pentonity (1)	hios	Surface	10			
6. Comments	****						

7. Supervision of Work	DNR Use Only					
Name of Person or Firm Doing Fill On - SIL Environmentation		ense #	Date of Filling & Sealing (mm/dd/yyyy) 04/03/ 200チ	Date Received	Noted By	
Street or Route P.O. Box 280			Telephone Number ((708) 837-8992	Comments		14
City Sun Prante	State .w/\	ZIP Code 53590	Signature of Person Doing V Colout Strenfes		Date Signed	20007

Well / Drillhole / Borehole Filling & Sealing

Form 3300-005 (R 8/07)

Page 1 of 2

Route to:	ed/Wastewater 🔲 Waste Management	Remediation/Redevelopment Other:				
1. Well Location Information		2. Facility / Owner Information				
	que Well # of Hicap # red Well T4- 0	Facility Name Kruncumen Marsh Facility ID (FID or PVVS)				
Lattitude / Longitude (Degrees an	d Minutes) Nethod Code (see instructions) ' N W	License/Permit/Monitoring #				
<u> </u>	Section Township Range E E	Original Well Owner WDNR - RUMANN Remudication and Redevice Present Well Owner				
Well Street Address <u>Kewware</u> Well City, Village or Town	lar 3h Well ZIP Code	Mailing Address of Present Owner				
Subdivision Name	54 2110 Lot #	2984 Shawno AVC City of Present Owner State ZIP Code Kewayane W1 54307				
Reason For Removal From Servic Cardwood Troyzshiataz Barzh		4. Pump, Liner, Screen, Casing & Sealing Material Pump and piping removed?				
Monitoring Well	Information Original Construction Date (mm/dd/yyyy) 0 4/0 3/ 2007	Liner(s) removed? Image: Constraint of the second seco				
Water Well Borehole / Drillhole Construction Type:	If a Well Construction Report is available, please attach.	Was casing cut off below surface?				
Other (specify):	Sandpoint) Dug whe / Dury + Dusk	If yes, was hole retopped? If bentonite chips were used, were they hydrated with water from a known safe source? Yes No N/A Yes No N/A				
Formation Type:	Bedrock urface (ft.) Casing Diameter (in.)	Required Method of Placing Sealing Material Conductor Pipe-Gravity Screened & Poured (Bentonite Chips) Cother (Explain): Sealing Materials				
Lower Drillhole Diameter (in.)	Casing Depth (ft.)	Image: State of a state				
Was well annular space grouted? If yes, to what depth (feet)?	Depth to Water (feet)	For Monitoring Wells and Monitoring Well Boreholes Only: Bentonite Chips Granular Bentonite Bentonite - Sand Slurry				
5. Material Used To Fill Well / [Drillhole	From (ft.) To (ft.) No. Yards, Sacks Sealant Mix Ratio or or Volume (circle one) Mud Weight				
Stand and Poural	Buntmile Children	Surface $/O$ \leq $/A$ $back$				
6. Comments						

7. Supervision of Work	DNR Use Only				
Name of Person or Firm Doing Fill On - St. E. Environmental S		Date of Filling & Sealing (mm/dd/yyyy 04/03/2007) Date Received	Noted By	
Street or Route P.O. Box 280		Telephone Number (608) 837-8992	Comments		15
City Dun Pigurie.	State ZIP Coo .w\ 535			Date Signed	2007

Well / Drillhole / Borehole Filling & Sealing

Form 3300-005 (R 8/07)

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Route to:	ed/Wastewater	Remediat	ticn/Redevelo	opment Other:		
1. Well Location Information		2. Facility /	Owner Info			
County WI Unique Well # of Hicap # Kemoved Well T4 - 10 SE			Facility Name <u>LAUCULARE</u> MOVSA Facility ID (FID or PWS)			
Lattitude / Longitude (Degrees an	d Minutes) Method Code (see instructions) ' N	License/Perm	it/Monitoring	#		
74 / 74 Sip 4 or Gov't Lot #	Section Township Range E E 7 23 N 25 W	Original Well いりれ Present Well	<u> </u>	MAN H REMIC	cation and Reduction	
Well Street Address Kewannee Well City, Village or Town Kewannee Subdivision Name	Harsh Well ZIP Code 54 Alto Lot #	Mailing Addre 고G중닉 City of Preser	ss of Preser Shawa	o AVUS	ate ZIP Code UI 54307	
Indunua Innesharime Porch		Pump and	piping remov	n, Casing & Sealing		
3. Well / Drillhole / Borehole	Information Original Construction Date (mm/dd/yyyy) 0 4/0 3/ 2.00 1 If a Well Construction Report is available,	Liner(s) ren Screen ren <u>Casing left</u> Was casing	noved?	w surface?	Yes No N/A Yes No N/A Yes No N/A Yes No N/A Yes No N/A	
	please attach. Sandpoint) Dug	Did sealing Did materia If yes, If bentonite	g material ris al settle after was hole ret chips were t	e to surface? 24 hours?	yes □No □NA yes □No □NA yes □No □NA NA	
Formation Type:	Bedrock urface (ft.) Casing Diameter (in.)	Required Met	hod of Placin tor Pipe-Grav ed & Poured ite Chips)	g Sealing Material	e-Pumped	
Lower Drillhole Diameter (in.)	Casing Depth (ft.)	Neat Ce	ement Grout ement (Conc	rete) Grout 📃 Be	ay-Sand Slurry (11 lb./gal. wt.) entonite-Sand Slurry " " entonite Chips	
If yes, to what depth (feet)?	Depth to Water (feet)	Bentoni	g Wells and I te Chips Ir Bentonite		e - Cement Grout e - Sand Slurry	
5. Material Used To Fill Well / [From (ft.)	To (ft.)	No. Yards, Sacks Se or Volume (circle			
Symmed and Poused	Pontonite Chipe	Surface	10	≤ 1/4 baa		
6. Comments						

7. Supervision of Work	DNR Use Only						
Name of Person or Firm Doing Filling & Sealing License #			e of Filling & Sealing (mm/dd/yyyy) 04/03/2007	Date Received	Noted By		
Street or Route P.O. Box 280	· · · ·		Telephone Number (668) 837-8992	Comments		16	
City Sun Prairie	State .₩\	ZIP Code 53590	Signature of Person Doing	Work He	Date Signed	2007	

Well / Drillhole / Borehole Filling & Sealing Form 3300-005 (R 8/07)

Page 1 of 2

Route to:	shed/Wastewater	Waste Management	Remedia	tion/Redevelo	opment	Other:	
1. Well Location Informatio	n		2. Facility	Owner Info	ormation		
	nique Well # of oved Well	Hicap# T4-205E	Facility Name	MULIN 22	Maysh		
Lattitude / Longitude (Degrees a	Ind Minutes) Method ' N ' W	d Code (see instructions)	License/Perm	, 	#		
Val Val Val Swn or Gov't Lot # Well Street Address	Section Tow	nship Range ⊠ E 23 N 25 ⊡ W	Original Well ルウN Present Well	$R = R_1$	1/12.12.2-1	Remudicatio	Mand Reduction
Kewaunez Well City, Village or Town Kewaunze Subdivision Name	Marsh	Well ZIP Code 54 Alto	Mailing Addre 2984 City of Prese	Sh(LLUn ht Owner	4		ZIP Code
Reason For Removal From Sen Molynay Thirdshidthan Bin		I # of Replacement Well	4. Pump, L	iner, Scree			
3. Well / Drillhole / Borehol			Liner(s) re	moved?		<u> </u>	Yes No N/A
	04/0	ion Date (mm/dd/yyyy) 3 2.00] - tion Report is available,	Did sealing Did materi If yes,	<u>in place?</u> g cut off belo g material rise al settle after was hole rete	e to surface 24 hours? opped?	?	Yes No N/A Yes No N/A Yes No N/A Yes No N/A Yes No N/A Yes No N/A Yes No N/A Yes No N/A Yes No N/A Yes No N/A Yes No N/A
Formation Type: Unconsolidated Formation Total Well Depth From Ground /O Lower Drillhole Diameter (in.)	Bedr Surface (ft.) Casing	ock	Required Met	hod of Placin tor Pipe-Grav ed & Poured ite Chips) rials ement Grout	g Sealing M /ity Cor Oth	aterial nductor Pipe-Pump ter (Explain): Clay-San	d Slurry (11 lb./gal. wt.)
Was well annular space grouted	d? Yes		Concre		-	Bentonite	
If yes, to what depth (feet)?	Depth to Wa	ter (feet) 5	Benton	te Chips ar Bentonite		Bentonite - Cem Bentonite - Sanc	ent Grout Slurry
5. Material Used To Fill Well	/ Drillhole		From (ft.)	To (ft.)		s, Sacks Sealant) me (circle one)	Mix Ratio or Mud Weight
Steared and Power	Bentmite (1	NI OR	Surface	/Ô	<u> </u>		
6. Comments	n	ann a chuir an sun ann ann an sun ann an sun ann an sun ann an sun ann an sun ann an sun ann an sun ann an sun					

7. Supervision of Work			DNR Use Only			
Name of Person or Firm Doing Fill On Sile Englishmenter St. Se		Dated	of Filling & Sealing (mm/dd/yyyy) 04/03/2007	Date Received	Noted By	
Street or Route P.O. Box 280		I	Telephone Number (608) 837-8797	Comments	en <u>e e e e e e e e e e e e e e e e e e </u>	17
City Prave	State ZIP Cod		Signature of Person Doing V Poont Stonforff		Date Signed	20057

Well / Drillhole / Borehole Filling & Sealing Page 1 of 2

Form 3300-005 (R 8/07)

Drinking Water Watersh	ed/Wastewater 🗌 Waste Ma	anagement		tion/Redevelo		ſ:	
1. Well Location Information			2. Facility		ormation		
	que Well # of H icap # red Well 	OSE	Facility Name <u>(</u> /) Facility ID (FI	MULLA 22	Maysh		
Lattitude / Longitude (Degrees an	d Minutes) Method Code (see	instructions)					
• · · · · · · · · · · · · · · · · · · ·	'N		License/Pern	nit/Monitoring	#		
		25 H K	Original Well 以	<u>R. R</u>	ATTAIN A BAN	uduation	and Reduction
Well Street Address	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,			Owner			
	dar sh	1	Mailing Addre	ess of Preser	it Owner		
Well City, Village or Town	Well ZIP		2984	Shawn			
Subdivision Name	Lot #	2110	City of Prese				P Code
Subdivision Name			Kew	UNLL		$ \mathcal{W} $	54307
Reason For Removal From Servi	ce WI Unique Well # of Replac		4. Pump, L	iner, Scree	n, Casing & Seal	ing Material	1
Conclumny Inversible alter Borel		·	Pump and	piping remov	ved?	Yes	
3. Well / Drillhole / Borehole	Information		Liner(s) re	moved?		Yes	s Uno Un/A
	Original Construction Date (mr	m/dd/yyyy)	Screen rei	moved?			
	04/03/2007		Casing lef	t in olace?			
Borehole / Drillhole	If a Well Construction Report is please attach.	s available,	Was casin	g cut off belo	w surface?		
Construction Type:			Did sealin	g material ris	e to surface?		s ∐ _{No} ⊠n/A
	Sandpoint) Dug			al settle after			
	(a hu, / Direct Rush)		If yes, was hole retopped? If bentonite chips were used, were they hydrated with water from a known safe source?				
Formation Type:			1		g Sealing Material		s 🖾 No 🗀 N/A
	Bedrock			tor Pipe-Grav		Pipe-Pumped	1
Total Well Depth From Ground S		n)	Screen	ed & Poured	Other (Expl	· ·	
		1.)	Sealing Mate	nite Chips)			······································
Lower Drillhole Diameter (in.)	Casing Depth (ft.)			ement Grout	Г	Clay-Sand S	Slurry (11 lb./gal. wt.)
2				ement (Conc	rete) Grout	7	and Slurry " "
	y Ves 🖾 No [-		Bentonite Cl	•
Was well annular space grouted?		Unknown			 Monitoring_Well Bor	eholes Only:	
If yes, to what depth (feet)?	Depth to Water (feet)		Benton	ite Chips		onite - Cement	t Grout
	5		Granul	ar Bentonite		onite - Sand S	
5. Material Used To Fill Well /	Drillhole		From (ft.)	To (ft.)	No. Yards, Sack or Volume (cir		Mix Ratio or Mud Weight
Symmed And Donnal	Pantonia Chica		Surface	10	$\leq 1/4$ by		
						J	
6. Comments							

7. Supervision of Work		DNR Use Only				
Name of Person or Firm Doing Filli On - Sile Environmendal Se		nse # 🛛 🛛	Date of Filling & Sealing (mm/dd/yyyy) 04/03/ えの0구	Date Received	Noted By	
Street or Route P.O. Box 230			Telephone Number ((708) 837-8992	Comments		18
City Sun Arame	State M/\	ZIP Code 53590	Signature of Person Doing		Date Signed	2007

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Well / Drillhole / Borehole Filling & Sealing

Form 3300-005 (R 8/07)

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Drinking Water Watersh	ed/Wastewater	Waste Management	Remedia	tion/Redevel	opment	Other:	
1. Well Location Information			2. Facility	/ Owner Inf	ormation		
	que Well # of ed Well 	T5-20NW	Facility Name (21) Facility ID (FI	KULMER	Maush		
Lattitude / Longitude (Degrees an	d Minutes) <mark>M</mark> etho	d Code (see instructions)		00 - 103)			
· • • · ·	'N		License/Pern	nit/Monitoring	#		
1/4 / 1/4 //4 //4 //4 or Gov't Lot #	Section Tov	vnship Range ⊠ E 23 N 25 ⊡ W	Original Well ルルト Present Well	R R	a (Piana A	Bennichtath	un and Pritarilion
Well Street Address	{	2	1163611 1161	Owner			
Kewaunee Mell City, Village or Town Kewaunee	larsh	Well ZIP Code 54 2110	Mailing Addre 2984	Shauun	,		
Subdivision Name	1	Lot #	City of Prese Keywi	nt Owner		State LI/I	ZIP Code 54307
Reason For Removal From Servic		II # of Replacement Well	🕂. Pump, L	iner, Scree	n, Casing	& Sealing Mat	erial
motimum Immeshilistic Borch			Pump and	piping remov	ved?		Yes No KINA
3. Well / Drillhole / Borehole			Liner(s) re				Yes No N/A
Monitoring Well Original Construction Da							
└── Water Well └── Borehole / Drillhole	If a Well Construc please attach.	tion Report is available,		g cut off belo			
Construction Type:				g material ris		γ <u>Γ</u>	JYes ∐No ≦N/A JYes ≦No □N/A
	Sandpoint) The I Direct		lf yes,	ial settle after was hole ret chips were u from a knowr	opped?	ney hydrated	
Formation Type:				thod of Placin			
Unconsolidated Formation Total Well Depth From Ground St	Bedr urface (ft.) Casing	-	Screen	ctor Pipe-Grav ed & Poured hite Chips)	· =	nductor Pipe-Pun er (Explain):	nped
. 10			Sealing Mate				₩ <u>₩₩₩₩</u> ₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩
Lower Drillhole Diameter (in.)	Casing	Depth (ft.)		ement Grout Cement (Conc	rete) Grout		and Slurry (11 lb./gal. wt.) te-Sand Slurry " "
Was well annular space grouted?	Yes	No Unknown				· · ·	te Chips
If yes, to what depth (feet)?	Depth to Wa	ter (feet)	Benton	ng Wells and I ite Chips ar Bentonite		/ell Boreholes Or Bentonite - Cel Bentonite - Sal	ment Grout
5. Material Used To Fill Well / [Drillhole	<u> </u>	From (ft.)	To (ft.)	No. Yards	s, Sacks Sealan me (circle one)	U Mix Ratio or
Swarned Und Porced		AJOS	Surface	10 10	or volui ≤ \/4	6# a	Mud Weight
						<i>ر</i>)	
6. Comments			1	<u> </u>	<u> </u>		

7. Supervision of Work		DNR Use Only				
Name of Person or Firm Doing Fi On - SIL Environmer dal S		Date	e of Filling & Sealing (mm/dd/yyy 04/03/ 200구	y) Date Received	Noted By	
Street or Route P.O. Box 280			Telephone Number (608) 837-8992	Comments		19
City Sun Phanie	State ZIP Co WI 53	ode 590	Signature of Person Doing	work		, ren

Well / Drillhole / Borehole Filling & Sealing Page 1 of 2

Form 3300-005 (R 8/07)

Route to:	_		_		_		
Drinking Water Waters	ned/W/astewater	Waste Management	🔀 Remedia	tion/Redevelo	opment 🔄	Other:	
1. Well Location Information	1		2. Facility	Owner Inf	ormation		
	ique Well # of ved Well		Facility Name		1 curata		
Kendanee Remo	<u> </u>	T4-0		MUUNEL	MUNDA		
Lattitude / Longitude (Degrees ar	nd Minutes) Metho	d Code (see instructions)	Facility ID (FI	D OF P WS)			
° ·	' N		License/Perm	uit/Monitoring	±		
۵ <u></u> ٬ <u></u>				in the first starting			
1/4/1/4 1/4 Syrst	Section Tov	wnship Range Nale	Original Well	Owner			
or Gov't Lot #	- 7	23 N 25 Hw	いしN Present Well		AL ALLAN H	CANULUTE	s and Kedan loor
Well Street Address			riesent wei	Owner			
	lar sh		Mailing Addre	ss of Preser	t Owner	<u></u>	
Well City, Village or Town		Well ZIP Code	2984		o AVU		
Kewauree		542110	City of Prese				ZIP Code
Subdivision Name		Lot ≉	Kew	UNLL		101	54307
Reason For Removal From Serv	ice WI Unique We	II # of Replacement Well	4. Pump, L	iner, Scree	n, Casing &	Sealing Materi	
Induning Impostation Bord	. 1		Pump and	piping remov	ved?	Ωy	
3. Well / Drillhole / Borehole	Information		Liner(s) re	moved?		<u>⊠</u> γ	
	Original Constructio						
	04/0	3/2007	Casing lef	in place?		<u> </u>	
Water Well	If a Well Construct	ction Report is available,	Was casin	g cut off belo	w surface?		es INO N/A
				-	e to surface?		es L _{No} K _{N/A}
	(Sandpoint)			al settle after			
	robe (Darrit	<u> </u>	If bentonite	was hole ret chips were i	used, were the	v hydrated	<u>`</u>
	NARRA TELATION	<u> 24778)</u>	with water	from a knowr	n safe source?		es No N/A
Formation Type:					g Sealing Mat		
Unconsolidated Formation	Bedi			tor Pipe-Graved ad & Poured		uctor Pipe-Pumpe	ea
Total Well Depth From Ground S	iurface (ft.) Casing	Diameter (in.)	(Bentor	ite Chips)	U Other	(Explain):	
10	0		Sealing Mate				
Lower Drillhole Diameter (in.)	Casing	Depth (ft.)		ement Grout			Slurry (11 lb./gai. wt.) Sand Slurry " "
				ement (Conc	rete) Grout		
Was well annular space grouted	? Yes	🖾 No 🔛 Unknown			Monitorina We	pentonite النظرية المراجع الم المراجع ال	
If yes, to what depth (feet)?	Depth to Wa	ater (feet)		te Chips		Bentonite - Ceme	
		5		ar Bentonite		Bentonite - Sand	
5. Material Used To Fill Well /	Drillhole		From (ft.)	To (ft.)	No, Yards,	Sacks Sealant) e (circle one)	Mix Ratio or Mud Weight
Stynn a lines Damed	Buntonik (Mids	Surface	10	<u>≤</u> %4		
- <u> </u>			1			Ű	
6. Comments							

		DNR Use Only				
Name of Person or Firm Doing Filling On - St.L. Envariante mini Serva		nse # 🛛	Date of Filling & Sealing (mm/dd/yyyy) 04/03/ 200チ	Date Received	Noted By	
Street or Route P.D. Box 280	and a first set of the set		Telephone Number ((403) 837-8797	Comments	1	20
City Sun Prairie	State .w/\	ZIP Code 53590	Signature of Person Doing	Work	Date Signed	7007

Well / Drillhole / Borehole Filling & Sealing Page 1 of 2

Form 3300-005 (R 8/07)

1. Well Location Information	ı		2 Eacility	2. Facility / Owner Information				
County WI Un	ique Well # of Hicap #	5-20SE	Facility Name)CULNEL				
Lattitude / Longitude (Degrees al	nd Minutes) Method Code (s 'N	see instructions)	Facility ID (FI License/Perm		1 #	**************************************		
$\frac{1}{\sqrt{4}}$	'W Section Township	Range NIE	Original Well	-				
or Gov't Lot #	$-\frac{1}{23}$ N	Range Z E 25 W	니)) M Present Well	<u>R - R</u> i	alland Bin	uduation	and Redeators	
	ulur sh		Mailing Addre	ess of Presen	nt Owner			
Well City, Village or Town Kendimmee	5	ZIP Code 14 2110	<u>29ँ</u> ६५ City of Preser	Shawn			P Code	
Subdivision Name	Lot #			iner. Scree	n, Casing & Seal	ーレル ing Material	54307	
Reason For Removal From Serv advinu Trayesheame Bord	nol2		Pump and	piping remov				
3. Well / Drillhole / Borehole	Information Original Construction Date 04/03/200		Liner(s) rei	noved?			s X _{No} N/A	
Water Well	If a Well Construction Repo			g cut off belo				
Construction Type:	(Sandpoint) Dug		Did materi If yes,	al settle after was hole reto		□Ye □Ye □Ye rated □Ye	s No N/A s No N/A	
Formation Type: Unconsolidated Formation Total Well Depth From Ground S	Bedrock urface (ft.) Casing Diameter	r (in.)	Required Met	hod of Placin tor Pipe-Grav ed & Poured iite Chips)	ig Sealing Material	Pipe-Pumped		
Lower Drillhole Diameter (in.)	Casing Depth (ft		Neat Ce	ement Grout ement (Conc		,	Slurry (11 lb./gal. wt.) and Slurry " " hips	
Was well annular space grouted If yes, to what depth (feet)?	Pepth to Water (feet)	Unknown	For Monitorin Bentoni		Monitoring Well Bor	eholes Only: onite - Cemen onite - Sand S	t Grout	
5. Material Used To Fill Well /	Drillhole		From (ft.)	To (ft.)	No. Yards, Sack or Volume (cire		Mix Ratio or Mud Weight	
Scienced Clark Power	Protent Chica		Surface	10	≤ 1/4 ba			

7. Supervision of Work				DN	DNR Use Only		
			Date of Filling & Sealing (mm/dd/yyyy)	Date Received	Noted By		
ON-SIR FRANKING MERTIL SANAC	15.1.wc_		04/03/2007				
Street or Route			Telephone Number	Comments		21	
P.O. BOX 280			(1,1)8) 837-8992				
City Sun Prairie	State	ZIP Code	Signature of Person Doing	Work	Date Signed		
SUN MANNE		5359/	Cobert Sten	Josh	Auc R	7005	
				1		/	

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Well / Drillhole / Borehole Filling & Sealing

Form 3300-005 (R 8/07)

Page 1 of 2

Drinking Water Watersh	ed/Wastewater	Waste Management	Remedia	tion/Redevel	opment Other:	
1. Well Location Information			2. Facility	/ Owner Inf	ormation	
	que Well # of red Well	Hicap# TS-18		Jaunee	Marsh	
Lattitude / Longitude (Degrees an	d Minutes) Metho	d Code (see instructions)	Facility ID (FI	D or PWS)		
• · · · · · · · · · · · · · · · · · · ·	'N 'W		License/Pern	nit/Monitoring	#	
74/74 74 SW or Gov't Lot #			Original Well いうN Present Well	<u>R - R</u>	urean of Romadi	nation and Redardop
Well Street Address	{			Owner		
Kewaunee J. Well City, Village or Town Kewaunee	larsh	Well ZIP Code 54 XILo	Mailing Addro 고우 & 니 City of Prese	Shawr	1	ate ZIP Code
Subdivision Name		Lot #	1	anne	l li	UI 54307
Reason For Removal From Servic	ce MI Unique We	 # of Replacement Well	<mark>⊢</mark> f. Pump, L	iner, Scree	n, Casing & Sealing	Material
inducing Investigative Borch			Pump and	piping remo	ved?	□ _{Yes} □ _{No} ⊠ _{N/A}
3. Well / Drillhole / Borehole			Liner(s) re			Yes No N/A
Monitoring Well	Original Construct のし月し月	ion Date (mm/dd/yyyy) 200 (a	Screen rei <u>Casing lef</u>			Yes No XN/A
Water Well	If a Well Construct please attach.	tion Report is available,		g cut off belo o material ris	ow surface? e to surface?	□ _{Yes} □ _{No} ⊠ _{N/A} □ _{Yes} □ _{No} ⊠ _{N/A}
Construction Type:	Sandpoint) 19 be. (Dirzet	Dug Pack)	Did mater If yes,	al settle after was hole ret	24 hours?	Yes ⊠No □N/A Yes □No □N/A
Formation Type: Unconsolidated Formation Total Well Depth From Ground St	Bedr urface (ft.) Casing		Conduct Screen (Bentor	tor Pipe-Graved ad & Poured hite Chips)	g Sealing Material vity D Conductor Pipe Other (Explain):	
Lower Drillhole Diameter (in.)	Casing	Depth (ft.)	Sand-C	ement Grout ement (Conc	rete) Grout 📃 Ber	ay-Sand Slurry (11 lb./gal. wt.) ntonite-Sand Slurry " "
Was well annular space grouted?	Yes		Eor Monitorin		ل∐ل_ Monitoring Well Borehole	ntonite Chips es O <i>ply:</i>
If yes, to what depth (feet)?	Depth to Wa	ter (feet) 3		ite Chips ar Bentonite		- Cement Grout - Sand Slurry
5. Material Used To Fill Well / [Drillhole		From (ft.)	To (ft.)	No. Yards, Sacks Se or Volume (circle o	alant) Mix Ratio or
Symmul and Pourd		vies	Surface	15	$\leq 1/4 \ baa$	
6. Comments	**************************************					

7. Supervision of Work			DNR Use Only		
Name of Person or Firm Doing Filling On - Sile Environmental Serv		Date of Filling & Sealing (mm/dd/yyyy) 01ه/ 1 (ه 200 (چ	Date Received	Noted By	
Street or Route P.(). Box 280		Telephone Number (608) 837- 8992	Comments	22	
City Sun Praine	State ZIP Co MI 531	de Signature of Person Doing 590 Colout Stan		Date Signed	

Well / Drillhole / Borehole Filling & Sealing Page 1 of 2

Form 3300-005 (R 8/07)

Route to:	ershed/Wastewater	Waste Management		ation/Redevel	opment Other:		
1. Well Location Informati	C		2. Facility				
		Hicap #-	Facility Name				
	noved Well	TS-19		Jaunee	Marsh		
			Facility ID (F				
Lattitude / Longitude (Degrees		d Code (see instructions)					
· ·	' N		License/Pern	nit/Monitoring	#		
· · · · · · · · · · · · · · · · · · ·	'w						
1/4/1/4 1/4 SIN	Section Tow	vnship Range NZ E	Original Well		10	1	. 0
or Gov't Lot #	- 7	23 N 25 AW	WDN		Wreaw of Revue	CLUCTION	and Krdeveliph
Well Street Address			Present Well	Owner			
Kewaanee	Marsh		Mailing Adds				
Well City, Village or Town		Well ZIP Code	29×4	ess of Preser Shawr			
Kewaunee		54216	<u> スイネラ</u> City of Prese			State ZIF	P Code
Subdivision Name		Lot #		aunt		WI	54307
					n, Casing & Sealir		
Reason For Removal From Se		I # of Replacement Well		-	, U	<u> </u>	
cmplimma Investigative Bo			1	piping remo	ved?	⊡Yes [\]	
3. Well / Drillhole / Boreho			Liner(s) re				
	-	ion Date (mm/dd/yyyy)	Screen re				
Water Well	067	16/2006	Casing lef	t in place?			
	If a Well Construc please attach.	tion Report is available,	Was casin	g cut off belo	w surface?		
Construction Type:	please attach.		Did sealin	g material ris	e to surface?		
			Did mater	ial settle after	24 hours?		s [≍[No └─ N/A
	en (Sandpoint)			was hole ret	opped? used, were they hydra		
Other (specify):	probe (Direct	Push)	with water	from a knowr	safe source?		s ⊠ _{No} □ _{N/A}
Formation Type:			Required Me	thod of Placin	g Sealing Material		
Unconsolidated Formatio	n 🗌 Bedr	ock		tor Pipe-Grav	/ity 📙 Conductor P	ipe-Pumped	
Total Well Depth From Ground	Surface (ft.) Casing	Diameter (in.)		ed & Poured hite Chips)	U Other (Explai	in):	
15			Sealing Mate	rials			
Lower Drillhole Diameter (in.)	Casing	Depth (ft.)	Neat C	ement Grout		Clay-Sand S	lurry (11 lb./gal. wt.)
				ement (Conc	· ~		and Slurry " "
Was well annular space groute	ed? Ves				r	Bentonite Ch	nips
If yes, to what depth (feet)?	Depth to Wa			-	Monitoring Well Boreh		
		3		ite Chips		ite - Cement	
		2	<u> </u>	ar Bentonite	No. Yards, Sacks	ite - Sand SI	Mix Ratio or
5. Material Used To Fill Well			From (ft.)	To (ft.)	or Volume (circl	e one)	Mud Weight
Schoonal and Prive	d Bantonike Ch	vios	Surface	15	≤ 1/4 baa		
		,	1		0		
6. Comments							

7. Supervision of Work	DN	IR Use Only	
	Date of Filling & Sealing (mm/dd/yyyy)	Date Received	Noted By
On-Sile Environmental Senalds. Inc. Street or Route P.D. Box 280	06/16/2006 Telephone Number (608) 837- 8997	Comments	23
City Sun Prairie IIP Code WI 5359	Signature of Person Doing V	Nork HL	Date Signed

Well / Drillhole / Borehole Filling & Sealing

Form 3300-005 (R 8/07)

Page 1 of 2

1. Well Location Information	1		2. Facility	Owner Inf	ormation		
County WI Un	ique Well # of ↓ <mark>⊨icap-#</mark> ved Well		Facility Name	NULARE			
Lattitude / Longitude (Degrees ar	nd Minutes) Method Code	(see instructions)	Facility ID (FI	D or PWS)			
• • • • •	' N ' W		License/Perm	it/Monitoring	ı #		
74 / 74 1/4 SYM or Gov't Lot #	Section Township	Range K E	Original Well いしN Present Well	<u>R - R</u>	uleau of Reiv	udiation	and Reclarchopw
Well Street Address Kewanee J	dar sh		Mailing Addre		nt Owner		
Well City, Village or Town Kewaunee		ZIP Code う々えん	2984 City of Prese	Shaw	10 AVL	State ZI	P Code
Subdivision Name	Lot #	ŧ	Kewa	IUNLL		$ \mathcal{U} $	54307
Reason For Removal From Servi		eplacement Well	4. Pump, L	iner, Scree	n, Casing & Seal	ing Materia	
molynum Investigative Bores				piping remov	ved?	∐Yes ⊠	
3. Well / Drillhole / Borehole			Liner(s) re			X _{Yes}	
Monitoring Well	Original Construction Date りしれい200		Screen rer Casing left				
Water Well	If a Well Construction Rep			g cut off belo	w surface?		
Borehole / Drillhole	please attach.			-	e to surface?		
Construction Type:	_			al settle after			Neliu I I
	(Sandpoint)	g	lf yes,	was hole ret	opped?		s no N/A
Other (specify):	robe (Direct Push))	If bentonite with water	chips were (from a knowr	used, were they hyd n safe source?	rated	s 🖾 No 🗆 N/A
Formation Type:	······································				g Sealing Material		
Unconsolidated Formation	Bedrock			tor Pipe-Grav	vity 📙 Conductor	Pipe-Pumped	
Total Well Depth From Ground S	urface (ft.) Casing Diamet		Sealing Mater	ed & Poured ite Chips) rials	U Other (Expl	ain):	
Lower Drillhole Diameter (in.)	Casing Depth (ft.)	Neat Ce	ement Grout ement (Conc	· · · · · ·	Bentonite-Sa	lurry (11 lb./gal. wt.) and Slurry " "
Was well annular space grouted?	Yes XNC	Unknown			<u>× اِ</u> Monitoring Well Bore		lips
If yes, to what depth (feet)?	Depth to Water (feet)		te Chips Ir Bentonite	Bento	nite - Cement nite - Sand Sl	
5. Material Used To Fill Well / [From (ft.)	To (ft.)	No. Yards, Sacks	s Sealant)	Mix Ratio or
Stypen and Charle Powerd			Surface	7	or Volume (circ $\leq 1/4$ bar		Mud Weight
LYDERAL CRAIN TOMPACE	TOWARDAN A WARKS		Jurrace	T		7 J	

7. Supervision of Work				DN	IR Use Only
Name of Person or Firm Doing Filling		nse# [Date of Filling & Sealing (mm/dd/yyyy)	Date Received	Noted By
On-Site Environmental Serv	rices, Inc		06/10/2006		
Street or Route			Telephone Number	Comments	24
P.O. BOX 280			(608) 837-8992		
City Sun Praine	State	ZIP Code	Signature of Person Doing \		Date Signed
JUN MANNE	- MV (53590	Robert Stendor	,the	Hux 8 2007

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Well / Drillhole / Borehole Filling & Sealing

Form 3300-005 (R 8/07)

Page 1 of 2

Drinking Water Watersh	ned/Wastewater	Waste Management		ation/Redevel	opment 🔲 (Other:	
1. Well Location Information	l		2. Facility	/ Owner Inf	ormation		
County WI Uni Kewaunee Remov	ique Well # of ved Well	Hicap#_ TS-21	Facility Name	vaunee	Marsh		
Lattitude / Longitude (Degrees an	d Minutes) Metho	d Code (see instructions)	Facility ID (F	ID of PVVS)			
° · ·	'N		License/Perr	nit/Monitoring	g #		
74 / 74 Sty or Gov't Lot #	Section Tov	vnship Range ⊠ E 23 N 25 □ W	Original Well いしい Present Well	IR - B	M/ZAM + E	Zemuchiatrion	and Reclarchiph
Well Street Address	<i>Acirsh</i>						
Kewauner J Well City, Village or Town Kewauner	IN THE TRACE	Well ZIP Code 54 XILo	Mailing Addr 2984	Shawr	6		12 Q
Subdivision Name		Lot #		aune		$ \mathcal{U} $	1P Code 54307
Reason For Removal From Servio	ce MI Unique We	II # of Replacement Well	<mark>≓</mark> . Pump, L	iner, Scree	n, Casing & S	Sealing Materia	al
molimum Investigative Boreh			- ·	piping remo	ved?		
3. Well / Drillhole / Borehole			Liner(s) re	moved?			
	-	ion Date (mm/dd/yyyy) 6/200 6	Screen re <u>Casing lef</u>				
Water Well	If a Well Construc please attach.	tion Report is available,		ng cut off belo			
Construction Type:	Sandpoint) 19 be (Dirret)	\square Dug $P_{u \leq k}$	Did mater If yes,	- ial settle after was hole ret			
Formation Type:	Bedr urface (ft.) Casing		Required Me Conduct Screen (Bentor	thod of Placin ctor Pipe-Grav ed & Poured hite Chips)	ng Sealing Mate		
Lower Drillhole Diameter (in.)	Casing	Depth (ft.)	Sand-C	ement Grout Cement (Conc	rete) Grout	Bentonite-S	Slurry (11 lb./gal. wt.) Sand Slurry " "
Was well annular space grouted?	Yes				· · · · · · · · · · · · · · · · · · ·		Chips
If yes, to what depth (feet)?	Depth to Wa	ter (feet)	Benton	ite Chips		Boreholes Only: Bentonite - Cemer	
	1		1	ar Bentonite		Bentonite - Sand Stacks Sealant	Mix Ratio or
5. Material Used To Fill Well / C Screened and Poured		105	From (ft.) Surface	To (ft.) 	or Volume ≤ \/4	(circle one)	Mud Weight
LOTOTINA (LANDE TOUTAC	<u>i na kunit ()</u>			<u> </u>	- /9	U U	
6. Comments							

7. Supervision of Work				DN	R Use Only
Name of Person or Firm Doing Filling & Sea		se# [Date of Filling & Sealing (mm/dd/yyyy)	Date Received	Noted By
On-Sik Environmental Services, I	we	1	010/110/2006		
Street or Route			Telephone Number	Comments	25
P.O. Box 280			(608) 837-8992		
City Sun Prairie		ZIP Code 5359/	Signature of Person Doing V	Vork	Date Signed
JUN MAINE	/	<u></u>	Bout Sten	sth	Aug 2007
			Г		5-1

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Well / Drillhole / Borehole Filling & Sealing

Form 3300-005 (R 8/07)

Page 1 of 2

1. Well Location Information 2. Facility / Owner Information County Mill Unique Weil # of Milling Address Hickpit. K2WGULN 22. Mill Unique Weil # of Milling Address Facility / Name Milling Address Latitude / Longitude (Degrees and Minutes) Method Code (see instructions) Facility / D (FID or PWS) Latitude / Longitude (Degrees and Minutes) Method Code (see instructions) License/Permit/Monitoring # X/14 W Synt Section Formatip Range Mill Division Name X/14 W Synt Section Formatip Range Mill Division Name Mill ZIP Code Subdivision Name State ZI 9.4 Shut Site ZIP Code Shut Site ZIP Code Subdivision Name State Site ZIP Code Shut Site Will Site Site ZIP Code Subdivision Name State Site Site ZIP Code Site ZIP Code Site ZIP Code Subdivision Name Site Site ZIP Code Site ZIP Code No ZIP Site Site ZIP Code Site ZIP Code No ZIP Site Site ZIP Code	Route to:	r	_			_	-	
County Mill Unique Weil # of Removed Weil TS - 22. Latitude / Longitude (Degrees and Minutes) Method Code (see instructions) Facility Name	Drinking Water Waters	hed/Wastewater	Waste Management			· –	Other:	***
Kew au nee. Removed Weil TS-22. Kew au nee. Marsh Latitude / Longitude (Degrees and Minutes) Method Code (see instructions) Facility Di [FD or PWS)				1		ormation		
Latitude / Longitude (Degrees and Minutes) Method Code (see instructions)			1	Kei,	Jaunee	Marsh		
Well Zip Code Township Range E WD NR Ru / Raw H Rewerd action and Reday Well Street Address Well Zip Code Well Zip Code Mailing Address of Present Owner Kew durvee Mar Sh Yell Zip Code Yell Zip Code Yell Zip Code Well Zip Code Yell Zip Code Yell Zip Code Yell Zip Code Yell Zip Code Kew durvee State Zip SA Yell Zip Code Yell Zip Code Subdivision Name Lot # Will Zip Code Yell Zip Code Yell Zip Code Kew durvee State Zip Code Well Zip Code Well Zip Code Well Zip Code Kew durvee Yell Zip Code Yell Zip Code Well Zip Code Well Zip Code Well Zip Code Reason For Removal From Service Milling Address of Present Owner Will Counce Will Sign Material Streamed Township Original Construction Date (mm/dd/yyy) Casina left in placa? Yes No Monitoring Well Original Construction Report is available, please attach. Did sealing material rise to surface? Yes No Other (specify): ////////////////////////////////////	Lattitude / Longitude (Degrees a	nd Minutes) Metho	d Code (see instructions)	Facility ID (F	D or PWS)			
ATA p SW Security T 23 N 25 W Well Street Address Kew (Aursh T 23 N 25 W Present Well Owner Readed to A and Redex Well Street Address Kew (Aursh Marsh Mailing Address of Present Owner 29 Shadows Ave. Well City, Ullage or Town State State Site	• • • • •			License/Perr	nit/Monitoring	#		<u></u>
Weil Street Address Keursh Weil City, Village or Town Kewrath Weil Zit Code SA2110 214 Shouth or Ave Subdivision Name Lot# Weil Zity, Village or Town Kewrath State ZiP Code Subdivision Name Lot# Weil Zity, Village or Town Kewrath State ZiP Code Subdivision Name Lot# Weil Zity, Village or Town Kewrath State ZiP Code Subdivision Name Lot# Pump and piping removed? State <td< td=""><td></td><td></td><td></td><td>WDN</td><td><u>IR - R</u></td><td>uteria at</td><td>Remudiatio</td><td>manch Recharchepa</td></td<>				WDN	<u>IR - R</u>	uteria at	Remudiatio	manch Recharchepa
Well City, Village or Town Well ZiP Code State Under Subdivision Name Lot # City of Present Owner State ZIP Code Subdivision Name Lot # City of Present Owner State ZIP Code Reason For Removal From Service Mi Unique Well # of Replacement Well 4. Pump, Liner, Screen, Casing & Sealing Material Pump and piping removed? Ves No Mol Monitoring Well Original Construction Date (mm/dd/yyyy) Screen removed? Ves No Monitoring Well Original Construction Report is available, Ves No Mol Monitoring Well Original Construction Report is available, Ves No Mol Construction Type: If a Well Construction Report is available, Ves No Mol Monitoring Well Driver (Sandpoint) Dug If yes, was hole retopped? Ves No Mol Monitoring Vereitor Type: Construction Type: Construction Type: Conductor Pipe-Gravity Conductor Pipe-Pumped Yes No Mol Unconsolidated Formation Bedrock Toral Well Depth From Ground Surface (ft.) Casing Depth (ft.) Conducto		Mural			•			
Subdivision Name Lot # <td>Well City, Village or Town</td> <td>- W. 24</td> <td></td> <td>2984</td> <td>Shauur</td> <td>*</td> <td></td> <td></td>	Well City, Village or Town	- W. 24		2984	Shauur	*		
Reason For Removal Prom Service With Under Weil 3. Weil / Drillhofe / Borehole Information Pump and piping removed? Wantoring Weil Original Construction Date (mm/dd/yyyy) Monitoring Weil Original Construction Report is available, please attach. Construction Type: If a Weil Construction Report is available, please attach. Drilled Driven (Sandpoint) Duite (specify): If Construct PlackA Formation Type: If a Weil Construct PlackA Construction Type: If a weil construct PlackA Formation Type: Required Method of Placing Sealing Material Municoring Weil Point From Ground Surface (ft.) Casing Depth (ft.) Screened K on the Concete (ft.) Casing Depth (ft.) Sealing Materials Screened Grout Metrial State attack (ft.) Casing Depth (ft.) Screened K on the concete (ft.) Casing Depth (ft.) Screened Grout Bentonite Chips Screened Grout </td <td>Subdivision Name</td> <td></td> <td></td> <td>1 /</td> <td></td> <td></td> <td></td> <td></td>	Subdivision Name			1 /				
Swddmut Tover Shidting Weil Driginal Construction Date (mm/dd/yyyy) Screen removed? Yes No S. Weil Driginal Construction Date (mm/dd/yyyy) Screen removed? Yes No Water Weil If a Weil Construction Report is available, please attach. Screen removed? Yes No Construction Type: Driven (Sandpoint) Dug Did sealing material rise to surface? Yes No Monitoring Weil Driven (Sandpoint) Dug If yes, was hole retopped? Yes No Construction Type: Driven (Sandpoint) Dug If yes, was hole retopped? Yes No Yes No Screener & Pourse used, were they hydrated with water from a known sate source? Yes No Yes No Screener & Pourse Conductor Pipe-Pumped Screener & Pourse Yes No Zormation Type: Screener & Pourse Conductor Pipe-Fourse Conductor Pipe-Pumped Yes No Yes Lower Drillhole Diameter (in.) Casing Depth (ft.) Screener & Pourse Conductor Pipe-Pumped Screener & Pourse Sealing Materials Sealing Materials and Monitoring Well Barcholes Crity: Se	Reason For Removal From Sen		I # of Replacement Well	4. Pump, L	iner, Scree	n, Casing a	& Sealing Mater	ial
3. Well / Drillhole / Borehole Information Liner(s) removed? Xes No Monitoring Well Original Construction Date (mm/dd/yyyy) Screen removed? Yes No Water Well If a Well Construction Report is available, please attach. If a Well Construction Report is available, please attach. Was casing cut off below surface? Yes No Xes Construction Type: If a Well Construction Cance (m. //do trop be. If the top top top top top top top top top top				Pump and	piping remo	ved?		
Monitoring Well Ob/16/2006 Water Well If a Well Construction Report is available, please attach. Construction Type: Driven (Sandpoint) Drilled Driven (Sandpoint) Did sealing material rise to surface? Yes Vas casing cut off below surface? Yes Drilled Driven (Sandpoint) Dug Monitoring Well If e Well Construction Report is available, please attach. Construction Type: Driven (Sandpoint) Dug Monitoring Well Driven (Sandpoint) Dug Monitoring Well Driven (Sandpoint) Dug Monitoring Well Driven (Sandpoint) Dug Monitoring Well Driven (Sandpoint) Dug Monitoring Well Driven (Sandpoint) Dug Monitoring Well Driven (Sandpoint) Dug Monitoring Well Driven (Sandpoint) Dug Monitoring Well Driven (Sandpoint) Dug Monitoring Well Driven (Sandpoint) Dug Monitoring Well Sand Metrials Conductor Pipe-Gravity Conductor Pipe-Pumped Cold Well Metrials No Unconsolidated Formation				Liner(s) re	moved?		X	
Water Well If a Well Construction Report is available, please attach. Was casing cut off below surface? Yes No Construction Type: Drilled Driven (Sandpoint) Dug Did sealing material rise to surface? Yes No Ø Other (specify): <u>MCORR be.</u> <u>Direct Pusch</u> Did material settle after 24 hours? Yes No Formation Type: <u>McORR be.</u> <u>Direct Pusch</u> If bentonite chips were used, were they hydrated with water from a known safe source? Yes No Formation Type: <u>McORR be.</u> <u>Conductor Pipe-Gravity</u> Conductor Pipe-Pumped <u>McCorrectore</u> <u>Required Method of Placing Sealing Material</u> Conductor Pipe-Pumped <u>McCorrectore</u> <u>Provend</u> <u>McCorrectore</u> Conductor Pipe-Pumped <u>McCorrectore</u> <u>McCorrectore</u> <u>Conductor Pipe-Pumped</u> <u>Screened & Poured</u> Other (Explain): Lower Drillhole Diameter (in.) <u>McCorrectore</u> <u>McCorrectore</u> <u>McCorrectore</u> <u>McCorrectore</u> Was well annular space grouted? Yes No <u>McCorrectore</u> <u>McCorrectore</u> <u>McCorrectore</u> <u>Materials</u> <u>McCorrectore</u> <u>McCorrectore</u> <u>Mcorrectorecore</u> <u>Mconinite - Sand Slurr</u>	Monitoring Well							
Construction Type: Did sealing material rise to surface? Ves No Did sealing material rise to surface? Ves No Did sealing material rise to surface? Ves No Did sealing material rise to surface? Ves No Did material settle after 24 hours? Ves No If yes, was hole retopped? Ves No Formation Type: If bentonite chips were used, were they hydrated with water from a known safe source? Ves No Total Well Depth From Ground Surface (ft.) Casing Diameter (in.) Conductor Pipe-Gravity Conductor Pipe-Pumped Sealing Materials Conductor Pipe-Gravity Conductor Pipe-Pumped Sealing Materials Lower Drillhole Diameter (in.) Casing Depth (ft.) Sealing Materials Clay-Sand Slurry (11 lb/gal Sealing Materials Concrete Bentonite-Sand Slurry " " Concrete Bentonite-Sand Slurry " " Was well annular space grouted? Yes No Unknown Bentonite Chips Bentonite - Cement Grout Bentonite - Cement Grout If yes, to what depth (feet)? Depth to Water (feet) Bentonite Chips Bentonite - Cement Grout S. Material Used To Fill Well / Drill			ction Report is available,		-			
Formation Type: Required Method of Placing Sealing Material Unconsolidated Formation Bedrock Total Well Depth From Ground Surface (ft.) Casing Diameter (in.) Screened & Poured (Bentonite Chips) Other (Explain): Lower Drillhole Diameter (in.) Casing Depth (ft.) 2 Sand-Cement Grout Clay-Sand Slurry (11 lb./gal Sand-Cement (Concrete) Grout Bentonite Chips Was well annular space grouted? Yes No Unknown Concrete Bentonite Chips For Monitoring Wells and Monitoring Well Boreholes Only: Bentonite - Sand Slurry If yes, to what depth (feet)? Depth to Water (feet) Bentonite Chips 5. Material Used To Fill Well / Drillhole From (ft.) To (ft.) No. Yards, Sacks Sealant? Mix Ratio or or Volume (circle one) Stypennet Concret Surface To (ft.) Volume (circle one) Mix Ratio or or Volume (circle one)	Construction Type:		— , [°]	Did mater If yes,	- ial settle after was hole ret	· 24 hours? opped?		
Image: Second second	Cher (specify):	probe. (Direct	Prish)	with water	from a knowr	used, were th n safe source	e?	Yes 🖾 No 🗆 N/A
Lower Drillhole Diameter (in.) Casing Depth (ft.) Neat Cement Grout Clay-Sand Slurry (11 lb./gal 2 2 Sand-Cement (Concrete) Grout Bentonite-Sand Slurry " Bentonite-Sand Slurry " Was well annular space grouted? Yes No Unknown Concrete Bentonite Chips If yes, to what depth (feet)? Depth to Water (feet) Bentonite Chips Bentonite - Cement Grout 3 Granular Bentonite Bentonite - Sand Slurry 5. Material Used To Fill Well / Drillhole From (ft.) To (ft.) No. Yards, Sacks Sealant? Mix Ratio on Mud Weigh Stype Nd Clark Poused Bentonite Chips Surface 7 14 bag				Conduct Screen (Bentor	ctor Pipe-Graved ed & Poured Nite Chips)	vity 🗌 Cor	nductor Pipe-Pump	ed
Was weil annual space globed? If yes, to what depth (feet)? Depth to Water (feet) For Monitoring Wells and Monitoring Well Boreholes Only: If yes, to what depth (feet)? Depth to Water (feet) Bentonite Chips Bentonite - Cement Grout 3 Granular Bentonite Bentonite - Sand Slurry 5. Material Used To Fill Well / Drillhole From (ft.) To (ft.) No. Yards, Sacks Sealant) Mix Ratio on Mud Weigh Stypenvid Cond Pouved Bentonice Surface 7 5'/4 bag	Lower Drillhole Diameter (in.)	Casing		Neat C	ement Grout Cement (Conc	rete) Grout	Bentonite	-Sand Slurry " "
If yes, to what depth (feet)? Depth to Water (feet) Bentonite Chips Bentonite - Cement Grout 3 Granular Bentonite Bentonite - Sand Slurry 5. Material Used To Fill Well / Drillhole From (ft.) To (ft.) No. Yards, Sacks Sealant) Mix Ratio on Mud Weight 5. Material Used To Fill Well / Drillhole From (ft.) To (ft.) To (ft.) Mix Ratio on Mud Weight 5. Material Used To Fill Well / Drillhole From (ft.) To (ft.) Vander Chips Mix Ratio on Mud Weight 5. Material Used To Fill Well / Drillhole From (ft.) To (ft.) Or Volume (circle one) Mud Weight	Was well annular space grouted	? 🗌 Yes	🖂 No 🛛 Unknown			Monitorina W		
5. Material Used To Fill Well / Drillhole From (ft.) To (ft.) No. Yards, Sacks Sealant Mix Ratio of Mud Weigh Screand and Powerd Bentonic Chips Surface 7 5 1/4 bag	If yes, to what depth (feet)?	Depth to Wa		Benton	ite Chips		Bentonite - Ceme	ent Grout
Stypenul and Powert Bentonik Chips Surface 7 514 bag	5. Material Used To Fill Well /	Drillhole					, Sacks Sealant)	Mix Ratio or
6. Comments	Screened and Powerd	Bentonik (1	Mos	Surface	7			
6. Comments				1			U	
	6. Comments			1				

7. Supervision of Work			D	NR Use Only
Name of Person or Firm Doing Filling & S ON - Site Environmental Server		Date of Filling & Sealing (mm/dd/yyyy) 06/16/2006	Date Received	Noted By
Street or Route P.O. BOX 280		Telephone Number (608) 837-8992	Comments	26
City Sun Prairie	State ZIP Code ₩\ 535°		Nork	Date Signed

Well / Drillhole / Borehole Filling & Sealing

Form 3300-005 (R 8/07)

Page 1 of 2

Route to:	ned/Wastewater Waste Management		tion/Redevel	opment Other:	
1. Well Location Information		2. Facility	/ Owner Inf		
Kewaunee Remov	ique Well # of red Well TS-2.3	Facility Name)aunee		
Lattitude / Longitude (Degrees an	d Minutes) Method Code (see instructions ' N ' W	License/Perr	-	1 #	
¼ / ¼ ¼ ∑ or Gov't Lot # Well Street Address	Section Township Range E 7 23 N 25 W	Original Well いしい Present Well	<u>R - R</u>	urean of Remuch	ation and Redevelopin
	Nell ZIP Code 54 21(0 Lot #	Mailing Addr 2984 City of Prese	Shaw	nt Owner 10 A1/L Stat	
Reason For Removal From Servic Concisional Trough Shillating Burch	sle	F. Pump, L	iner, Scree piping remo	n, Casing & Sealing I ved?	Material
3. Well / Drillhole / Borehole	Information Original Construction Date (mm/dd/yyyy) 06/16/2006 If a Well Construction Report is available, please attach.		moved? <u>t in place?</u> g cut off belo	ow surface? e to surface?	Yes No N/A Yes No X/A Yes No X/A Yes No X/A
Other (specify):	Sandpoint) Dug The (Dirict Push)	Did mater If yes, If bentonite with water	al settle after was hole ret chips were from a knowr	r 24 hours? opped? used, were they hydrated n safe source?	└─Yes ⊠No □N/A □Yes □No □N/A
Formation Type:	Bedrock urface (ft.) Casing Diameter (in.)	Conduction	tor Pipe-Graved ad & Poured nite Chips)		Pumped
Lower Drillhole Diameter (in.)	Casing Depth (ft.)		ement Grout ement (Conc	rete) Grout 📃 Ben	y-Sand Slurry (11 lb./gal. wt.) tonite-Sand Slurry " " tonite Chips
Was well annular space grouted? If yes, to what depth (feet)?	PYes ↓ No ↓_ Unknown Depth to Water (feet) ろ	<i>For Monitorir</i> Benton		Monitoring Well Borehole. - Bentonite - - Bentonite -	s Only: Cement Grout Sand Slurry
5. Material Used To Fill Well / D	Drillhole	From (ft.)	To (ft.)	No. Yards, Sacks Sea or Volume (circle or	llant) Mix Ratio or ne) Mud Weight
Science and Pourd	Buntonile Chios	Surface	7	≤ 1/4 baa_	
6. Comments					

7. Supervision of Work				DN	NR Use Only
Name of Person or Firm Doing Filling		# Date	of Filling & Sealing (mm/dd/yyyy)	Date Received	Noted By
On-Sik Eminionimental Seria	als, Inc.		a,/16/2006		
Street or Route			Telephone Number	Comments	27
P.O. BOX 280			(608) 837- 8992		
City Sun Prhime	State Z	IP Code	Signature of Person Doing	Nork	Date Signed
Jun Maine	JW/	<u>53590</u>	Robert Stan	forth	Aus 8 2007
				T	5.7

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Well / Drillhole / Borehole Filling & Sealing

Form 3300-005 (R 8/07)

Page 1 of 2

Route to:	Remediation/Redevelopment Other:
1. Well Location Information	2. Facility / Owner Information
County WI Unique Well # of Hicap #- Kewaunee TS-24	Facility Name Krucunez Marsh
Lattitude / Longitude (Degrees and Minutes) Method Code (see instructions)	Facility ID (FID or PWS)
° · ' N	License/Permit/Monitoring #
1/4 1/4 Section Township Range E or Gov't Lot # 7 23 N 25 W	Original Well Owner WDNIR - RUTCOURT Rewuch and Redeviclopi Present Well Owner
Well Street Address	
Kewaunee Mursh Well City, Village or Town Kewaunee 54216	Mailing Address of Present Owner 2984 Shawho AVC City of Present Owner State ZIP Code
Subdivision Name Lot #	Kewaunde WI 54307
Reason For Removal From Service	4. Pump, Liner, Screen, Casing & Sealing Material
meason for Removal From Service With Onique Weil # Or Replacement Weil	Pump and piping removed?
3. Well / Drillhole / Borehole Information	Liner(s) removed?
Monitoring Well Original Construction Date (mm/dd/yyyy) Old Old	Screen removed? Image: Screen removed? Casing left in place? Image: Screen removed?
Water Well If a Well Construction Report is available, please attach.	Was casing cut off below surface? Yes No N/A Did sealing material rise to surface? Yes No N/A
Construction Type: Drilled Driven (Sandpoint) Drilled Driven (Sandpoint) X Other (specify):	Did material settle after 24 hours? ☐Yes ☐No N/A If yes, was hole retopped? ☐Yes No N/A If bentonite chips were used, were they hydrated with water from a known safe source? ☐Yes ✓No N/A
Formation Type:	Required Method of Placing Sealing Material
Unconsolidated Formation Bedrock Total Well Depth From Ground Surface (ft.) Casing Diameter (in.)	Conductor Pipe-Gravity Conductor Pipe-Pumped Screened & Poured Other (Explain):
7 -	Sealing Materials
Lower Drillhole Diameter (in.) Casing Depth (ft.)	Image: Neat Cement Grout Image: Clay-Sand Slurry (11 lb./gal. wt.) Image: Sand-Cement (Concrete) Grout Image: Clay-Sand Slurry (11 lb./gal. wt.) Image: Sand-Cement (Concrete) Grout Image: Clay-Sand Slurry (11 lb./gal. wt.)
Was well annular space grouted? Yes No Unknown	Concrete
If yes, to what depth (feet)? Depth to Water (feet)	For Monitoring Wells and Monitoring Well Boreholes Only: Bentonite Chips Bentonite - Cement Grout Granular Bentonite Bentonite - Sand Slurry
5. Material Used To Fill Well / Drillhole	From (ft.) To (ft.) No. Yards, Sacks Sealant) Mix Ratio or Mud Weight
Swaand und Pouvri Bentonik Chios	Surface $7 \leq 1/4$ ba a
6. Comments	

7. Supervision of Work			DN	R Use Only
Name of Person or Firm Doing Filling & Seal OM - Site Environmental ServiceS, I		Date of Filling & Sealing (mm/dd/yyyy) <i>ひし</i> 川し 人のの	Date Received	Noted By
Street or Route P.O. Box 280		Telephone Number ((108) 837-8992	Comments	250/28
City Sun Prairie	State ZIP Code		Work orth	Date Signed
		le la la la la la la la la la la la la la		

Appendix E Detailed Cost Estimate Spreadsheets

MARSH SOIL/SLOUGH WATER: (1) Excavation and Disposal (Large Area)

ITEM	UNIT	UNIT COST	QTY	TOTAL
DIRECT CAPITAL COSTS				
Mobilization	ls	\$10,000	1	\$10,000
Site Preparation (road building)	ls	\$15,000	1	\$15,000
Erosion Control	ls	\$5,000	1	\$5 <i>,</i> 000
Excavation	tons	\$1.5	85,500	\$128,250
Dewatering	days	\$1,000	30	\$30,000
Transportation	tons	\$10	67,500	\$6 7 5,000
Disposal	tons	\$20	67,500	\$1,350,000
Cap Replacement	tons	\$1	18,000	\$18,000
SUBTOTAL OF DIRECT CAPITAL COST	-			\$2,231,250
30 % CONTINGENCY (DIRECT CAPITAL)	%	30%		\$669 <i>,</i> 3 7 5
INDIRECT CAPITAL COSTS				
Project management/administration	hr	\$195	30	\$5 <i>,</i> 850
Workplan	hr	\$130	30	\$3 <i>,</i> 900
Design and subcontracting	hr	\$130	80	\$10,400
Permitting	hr	\$100	30	\$3,000
Construction oversight	hr	\$100	350	\$35,000
Documentation reporting	hr	\$130	40	\$5,200
SUBTOTAL OF INDIRECT CAPITAL COSTS	-	-		\$63,350
SUBTOTAL OF DIRECT AND INDIRECT CAPITAL COSTS				\$2 <i>,</i> 963 <i>,</i> 9 7 5
		1	. 1	
MONITORING (ONE BASELINE AND ONE CONFIRMATIO	I .	¢105	10	¢1.050
Project management/administration	hr	\$195	10	\$1,950
Soil/sediment sampling (50 points, twice)	hr	\$100	80	\$8,000
Field equipment/expenses	ls	\$2,000	1	\$2,000
Lab - As	each	\$15	100	\$1,500
Data evaluation	hr	\$130	30	\$3,900
SUBTOTAL OF FIRST YEAR OF MONITORING				\$1 7, 350
30 % CONTINGENCY	%	30%		\$5,205

MARSH SOIL/SLOUGH WATER: (1) Excavation and Disposal (Large Area)

ITEM	UNIT	UNIT COST	QTY	TOTAL
O&M COST				
None	ls	\$0	1	\$0
SUBTOTAL FOR ANNUAL O&M	•			\$0
30 % CONTINGENCY	%	30%		\$0
LONG-TERM MONITORING COSTS				
None	ls	\$0	1	\$0
SUBTOTAL FOR MONITORING				\$0
30 % CONTINGENCY	%	30%		\$0
PRESENT WORTH OF O&M	5	years @	3%	\$0
PRESENT WORTH OF MONITORING	5	years @	3%	\$0
TOTAL COST (TOTAL CAPITAL + PRESENT WORTH)			Total	\$2,990,000
		Ī	+ 50%	\$4,490,000
		Ī	- 30%	\$2,100,000

Prepared By: A. Sellwood 6/19/07

QA'd By: SAK 6/20/07

ASSUMPTIONS:

GENERAL

- 1. Costs rounded up to the nearest ten thousand dollars.
- 2. Costs determined from experience and estimates from other similar projects.
- 3. Contingency is assumed to be 30% of direct capital costs, monitoring costs, and annual O&M.
- 4. Indirect costs do not include legal fees or public relations assistance.
- 5. Interest rate 3%; the balance of an 8% interest rate less a 5% inflation rate, based on EPA approach for remedial cost estimating.
- 6. All costs are based on preliminary concepts. They are intended for remedial option comparison and not for final budgeting. SPECIFIC
- 1. Assumes all marsh material can be disposed as non-hazardous waste.
- 2. Assumes the cap material will be replaced into the marsh.
- 3. Cost includes minor wetlands restoration, but no backfilling.
- 4. Assumes one round of confirmation soil sampling will be completed following the excavation.

2

MARSH SOIL: (2) Excavation and Disposal (Small Area)

ITEM	UNIT	UNIT COST	QTY	TOTAL
DIRECT CAPITAL COSTS				
Mobilization	ls	\$10,000	1	\$10,000
Site Preparation (road building)	ls	\$15,000	1	\$15,000
Erosion Control	ls	\$5,000	1	\$5,000
Excavation	tons	\$1.5	37,500	\$56 ,2 50
Dewatering	days	\$1,000	25	\$25,000
Transportation	tons	\$10	37,500	\$375,000
Disposal	tons	\$20	37,500	\$750,000
SUBTOTAL OF DIRECT CAPITAL COST	•	•	•	\$1,236,250
30 % CONTINGENCY (DIRECT CAPITAL)	%	30%		\$370,875
INDIRECT CAPITAL COSTS				
Project management/administration	hr	\$195	30	\$5,850
Workplan	hr	\$130	30	\$3,900
Design and subcontracting	hr	\$130	80	\$10,400
Permitting	hr	\$100	30	\$3,000
Construction oversight	hr	\$100	250	\$25,000
Documentation reporting	hr	\$130	40	\$5,200
SUBTOTAL OF INDIRECT CAPITAL COSTS		<u> </u>		\$53,350
SUBTOTAL OF DIRECT AND INDIRECT CAPITAL COS	TS			\$1,660,475
MONITORING (ONE BASELINE AND ONE CONFIRMA	TION ROUND)	I	[[
Project management/administration	hr	\$195	10	\$1,950
Soil/sediment sampling (30 points, twice)	hr	\$100	70	\$7,000
Field equipment/expenses	ls	\$1,000	1	\$1,000
Lab - As	each	\$15	60	\$900
Data evaluation	hr	\$130	30	\$3,900
SUBTOTAL OF FIRST YEAR OF MONITORING		<u>.</u>	<u> </u>	\$14,750
30 % CONTINGENCY	%	30%		\$4,425

MARSH SOIL: (2) Excavation and Disposal (Small Area)

ITEM	UNIT	UNIT COST	QTY	TOTAL
O&M COST				
None	ls	\$0	1	\$0
SUBTOTAL FOR ANNUAL O&M				\$0
30 % CONTINGENCY	%	30%		\$0
LONG-TERM MONITORING COSTS				
None	ls	\$0	1	\$0
SUBTOTAL FOR MONITORING				\$0
30 % CONTINGENCY	%	30%		\$0
PRESENT WORTH OF O&M	5	years @	3%	\$0
PRESENT WORTH OF MONITORING	5	years @	3%	\$0
TOTAL COST (TOTAL CAPITAL + PRESENT WORTH)			Total	\$1,680,000
		Ī	+ 50%	\$2,520,000
			- 30%	\$1,180,000

Prepared By: A. Sellwood 6/19/07

QA'd By: SAK 6/20/07

ASSUMPTIONS:

GENERAL

- 1. Costs rounded up to the nearest ten thousand dollars.
- 2. Costs determined from experience and estimates from other similar projects.
- 3. Contingency is assumed to be 30% of direct capital costs, monitoring costs, and annual O&M.
- 4. Indirect costs do not include legal fees or public relations assistance.
- 5. Interest rate 3%; the balance of an 8% interest rate less a 5% inflation rate, based on EPA approach for remedial cost estimating.
- 6. All costs are based on preliminary concepts. They are intended for remedial option comparison and not for final budgeting. SPECIFIC
- 1. Assumes all marsh material can be disposed as non-hazardous waste, and that the capped area will be left in place.
- 2. Cost includes minor wetlands restoration, but no backfilling.
- 2. Assumes one round of confirmation soil sampling will be completed following the excavation.

MARSH SOIL: (3A) Bioreduction test plots

ITEM	UNIT	UNIT COST	QTY	TOTAL
DIRECT CAPITAL COSTS				
Mobilization	ls	\$5,000	1	\$5,000
Site preparation (test plot marking and clearing)	ls	\$5,000	1	\$5,000
Bioreductant Cost				
- lactate	ls	\$100	1	\$100
- molasses	ls	\$100	1	\$100
- manure	ls	\$100	1	\$100
SUBTOTAL OF DIRECT CAPITAL COST				\$10,300
30 % CONTINGENCY	%	30%		\$3,090
INDIRECT CAPITAL COSTS				ta 000
Project management/administration	hr	\$195	20	\$3,900
Workplan	hr	\$130	40	\$5,200
Design and subcontracting	hr	\$130	50	\$6,500
Test plot construction and bioreductant application	hr	\$100	80	\$8,000
Documentation reporting	hr	\$130	30	\$3,900
SUBTOTAL OF INDIRECT CAPITAL COSTS				\$27,500
SUBTOTAL OF DIRECT AND INDIRECT CAPITAL COSTS				\$40,890
MONITORING				
Project management/administration	hr	\$195	20	\$3,900
Baseline Soil/Sediment Sampling (5 plots, 10 per plot)	hr	\$100	12	\$1,200
Monthly Soil/Sediment Sampling (5 months)	hr	\$100	60	\$6,000
Field Expenses	trip	\$500	6	\$3,000
Lab - As	each	\$15	300	\$4,500
Data evaluation	hr	\$130	40	\$5,200
SUBTOTAL OF MONITORING	· · · · · · · · · · · · · · · · · · ·		•	\$23,800
30 % CONTINGENCY	%	30%		\$7,140

MARSH SOIL: (3A) Bioreduction test plots

ITEM	UNIT	UNIT COST	QTY	TOTAL
			i-	
O&M COST				
None	ls	\$0	1	\$0
SUBTOTAL FOR O&M				\$0
30 % CONTINGENCY	%	30%		\$0
ANNUAL MONITORING COSTS				
None	ls	\$0	1	\$0
SUBTOTAL FOR ANNUAL GROUNDWATER MONITORING				\$0
30 % CONTINGENCY	%	30%		\$0
PRESENT WORTH OF O&M (additional injections)	5	years @	3%	\$0
PRESENT WORTH OF MONITORING	5	years @	3%	\$0
TOTAL COST (TOTAL CAPITAL + PRESENT WORTH)			Total	\$80,000
		Ī	+ 50%	\$120,000
		Ī	- 30%	\$60,000

Prepared By: A. Sellwood 6/19/07

QA'd By: SAK 6/20/07

6

ASSUMPTIONS:

GENERAL

- 1. Costs rounded up to the nearest ten thousand dollars.
- 2. Costs determined from experience and estimates from other similar projects.
- 3. Contingency is assumed to be 30% of direct capital costs, monitoring costs, and annual O&M.
- 4. Indirect costs do not include legal fees or public relations assistance.
- 5. Interest rate 3%; the balance of an 8% interest rate less a 5% inflation rate, based on EPA approach for remedial cost estimating.
- 6. All costs are based on preliminary concepts. They are intended for remedial option comparison and not for final budgeting. SPECIFIC
- 1. Assumes five test plots of 10ft x 10ft each will be constructed in the uncapped area.
- 1. Assumes only one application of the bioreductant will be required for each plot.
- 2. Assumes that 5 months of performance monitoring will be required to evaluate the test plots, 10 monthly samples per test plot.

MARSH SOIL: (3B) Bioreduction full scale

ITEM	UNIT	UNIT COST	QTY	TOTAL
DIRECT CAPITAL COSTS				
Mobilization	ls	\$10,000	1	\$10,000
Site Preparation (staging area and mats/roads)	ls	\$15,000	1	\$15,000
Erosion Control	ls	\$5,000	1	\$5 <i>,</i> 000
Site Clearing (Cattail cutting and placement)	acre	\$1,000	7.5	\$7,500
Bioreductant Cost	lb	\$1.10	99 ,22 5	\$109,148
Bioreductant Application (Irrigation rental)	ls	\$30,000	1	\$30,000
SUBTOTAL OF DIRECT CAPITAL COST	•	•		\$176,648
30 % CONTINGENCY	%	30%		\$52,994
INDIRECT CAPITAL COSTS		** 0 *		#5 .050
Project management/administration	hr	\$195	30	\$5,850
Workplan	hr	\$130	40	\$5,200
Design and subcontracting	hr	\$130	80	\$10,400
Construction Oversight	hr	\$100	200	\$20,000
Documentation reporting	hr	\$130	50	\$6,500
SUBTOTAL OF INDIRECT CAPITAL COSTS				\$47 <i>,</i> 950
SUBTOTAL OF DIRECT AND INDIRECT CAPITAL COST	ſS			\$277,592
MONITORING				
Project management/administration	hr	\$198	10	\$1,980
Soil/sediment sampling (20 points, once)	hr	\$100	36	\$3,600
Field equipment/expenses	ls	\$1,000	1	\$1,000
Lab - As	each	\$15	20	\$300
Data evaluation	hr	\$130	20	\$2,600
SUBTOTAL OF MONITORING				\$9,480
30 % CONTINGENCY	%	30%		\$2 <i>,</i> 844
SUBTOTAL OF CAPITAL AND MONITORING COS	STS			\$289,916
	1	1		
O&M COST				
Mobilization	ls	\$3,000	1	\$3,000
Site Clearing (cattails)	acre	\$1,000	7.5	\$7,500
Project Management	hr	\$195	10	\$1,950
Oversight + travel expenses	Is	\$2,000	1	\$2,000
Reporting	hr	\$130	10	\$1,300
SUBTOTAL FOR O&M				\$15,750
30 % CONTINGENCY	%	30%		\$4,725

7

MARSH SOIL: (3B) Bioreduction full scale

UNIT	UNIT COST	QTY	TOTAL
hr	\$195	30	\$5,850
hr	\$100	50	\$5,000
ls	\$2,000	1	\$2,000
each	\$15	40	\$600
hr	\$100	40	\$4,000
hr	\$130	50	\$6,500
		-	\$23,95 0
%	30%		\$7 <i>,</i> 185
5	years @	3%	\$93,770
5	years 🖲	3%	\$142,589
		Total	\$530,000
	Ī	+ 50%	\$800,000
	Ī	- 30%	\$380,000
	hr hr ls each hr hr %	hr \$195 hr \$100 ls \$2,000 each \$15 hr \$100 hr \$130 % 30%	hr \$195 30 hr \$100 50 ls \$2,000 1 each \$15 40 hr \$100 40 hr \$130 50 % 30% 5 years @ 3% 5 years @ 3% 5 years @ 3% 5 years @ 3%

Prepared By: A. Sellwood 6/19/07

QA'd By: SAK 6/20/07

ASSUMPTIONS:

GENERAL

1. Costs rounded up to the nearest ten thousand dollars.

2. Costs determined from experience and estimates from other similar projects.

3. Contingency is assumed to be 30% of direct capital costs, monitoring costs, and annual O&M.

4. Indirect costs do not include legal fees or public relations assistance.

5. Interest rate 3%; the balance of an 8% interest rate less a 5% inflation rate, based on EPA approach for remedial cost estimating.

6. All costs are based on preliminary concepts. They are intended for remedial option comparison and not for final budgeting. SPECIFIC

1. Assumes only one application of the bioreductant will be required.

2. Assumes the site will require 5 years of performance monitoring to evaluate the bioreduction of arsenic.

3. Assumes lactate will be used as the bioreductant, and will be applied with an irrigation system.

4. Assumes yearly clearing of cattails will be required, and cut vegetation will be used as cover in the marsh.

L

SOURCE AREA: (1) Pump and dispose off-site as hazardous

ITEM	UNIT	UNIT COST	QTY	TOTAL
DIRECT CAPITAL COSTS				
Mobilization	ls	\$5,000	1	\$5 <i>,</i> 000
Site Preparation/Staging Area	ls	\$5,000	1	\$5,000
Electrical service (propane generator or temp power)	ls	\$10,000	1	\$10,000
Well installation	ls	\$10,000	1	\$10,000
Manifold construction	ls	\$5,000	1	\$5,000
Holding tank - Deliver/Pick-Up (6000 gallon)	ls	\$1,200	1	\$1,200
Holding tank - Rental	days	\$50	80	\$4,000
Submersible pump	each	\$2 <i>,</i> 000	1	\$2,000
Control panel	ls	\$15,000	1	\$15,000
Misc electrical/plumbing supplies	ls	\$5,000	1	\$5,000
Transportation	5000 gal	\$1,000	9	\$9,000
Disposal (Hazardous groundwater)	gal	\$0.81	42,000	\$34,020
SUBTOTAL OF DIRECT CAPITAL COST		1		\$105,220
30 % CONTINGENCY	%	30%		\$31,566
NDIRECT CAPITAL COSTS				
Project management/administration	hr	\$195	30	\$5,850
Workplan	hr	\$130	30	\$3,900
Design and subcontracting	hr	\$130	80	\$10,400
Permitting	hr	\$130	20	\$2,600
Construction oversight (10 hr/day + expenses)	day	\$1,000	5	\$5 <i>,</i> 000
System start-up	hr	\$100	60	\$6,000
Documentation reporting	hr	\$130	40	\$5 <i>,</i> 200
SUBTOTAL OF INDIRECT CAPITAL COSTS			ļļ	\$38,950
SUBTOTAL OF DIRECT AND INDIRECT CAPITAL COSTS				\$175,736
FIRST YEAR O&M COSTS		:		
Project Management	hr	\$195	30	\$5,850
Shakedown visits	hr	\$100	20	\$2,000
Tank change out visits	hr	\$100	108	\$10,800
Field equipment and travel expenses	ls	\$2,000	1	\$2, 000
Misc Repairs	ls	\$1,500	1	\$1,500
Utilities/Fuel	mo	\$1,000	3	\$3,000
SUBTOTAL OF FIRST YEAR O&M	•		I	\$25,150
30 % CONTINGENCY	%	30%		\$7,545

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SOURCE AREA: (1) Pump and dispose off-site as hazardous

ITEM	UNIT	UNIT COST	QTY	TOTAL
FIRST YEAR OF GROUNDWATER MONITORING				
Project management/administration	hr	\$195	20	\$3,900
Groundwater sampling (3 samples, 4 times/yr)	hr	\$100	50	\$5,000
Field equipment/expenses	ls	\$2 <i>,</i> 000	1	\$2,000
Lab - As	each	\$15	12	\$180
Data evaluation	hr	\$130	40	\$5,200
SUBTOTAL OF FIRST YEAR OF MONITORING			-	\$16,280
30 % CONTINGENCY	%	30%		\$4,884
SUBTOTAL OF CAPITAL AND FIRST YEAR COSTS				\$229,595
		·		
ANNUAL O&M COSTS				
None	ls	\$0	1	\$0
SUBTOTAL FOR ANNUAL O&M				\$0
30 % CONTINGENCY	%	30%		\$0
MONITORING COSTS (SEMI-ANNUAL)				
Project management/administration	hr	\$195	30	\$5,850
Groundwater sampling (3 wells, twice/yr)	hr	\$100	30	\$3,000
Field equipment and expenses	ls	\$1,000	1	\$1,000
Lab - As	each	\$15	6	\$90
Data evaluation	hr	\$100	30	\$3,000
Reporting	hr	\$130	50	\$6,500
SUBTOTAL FOR ANNUAL GROUNDWATER MONITORI	ING	·	-	\$19,440
30 % CONTINGENCY	%	30%		\$5,832
PRESENT WORTH OF O&M	2	years @	3%	\$0
PRESENT WORTH OF MONITORING	2	years @	3%	\$48,357
TOTAL COST (TOTAL CAPITAL + PRESENT WORTH)			Total	\$280,000
		l	+ 50%	\$420,000
		-	- 30%	\$200,000

Prepared By: A. Sellwood 6/19/07

QA'd By: SAK 6/20/07

SOURCE AREA: (1) Pump and dispose off-site as hazardous

ITEM	UNIT	UNIT COST	QTY	TOTAL
ASSUMPTIONS:				

GENERAL

1. Costs rounded up to the nearest ten thousand dollars.

2. Costs determined from experience and estimates from other similar projects.

3. Contingency is assumed to be 30% of direct capital costs, monitoring costs, and annual O&M.

4. Indirect costs do not include legal fees or public relations assistance.

5. Interest rate 3%; the balance of an 8% interest rate less a 5% inflation rate, based on EPA approach for remedial cost estimating.

6. All costs are based on preliminary concepts. They are intended for remedial option comparison and not for final budgeting. SPECIFIC

1. Assumes source area groundwater can be captured in one year.

2. Assumes 2 years of monitoring will be required to evaluate the performance of the source area treatment.

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SOURCE AREA: (2) Pump and treat on-site

ITEM	UNIT	UNIT COST	QTY	TOTAL
DIRECT CAPITAL COSTS				
Mobilization	ls	\$5,000	1	\$5,000
Site Preparation/Staging Area	ls	\$10,000	1	\$10,000
Electrical service (propane generator or temp power)	ls	\$10,000	1	\$10,000
Well installation	ls	\$10,000	1	\$10,000
Manifold construction	ls	\$5,000	1	\$5,000
Submersible pump	ls	\$1,500	1	\$1,500
Treatment Shed	ls	\$15,000	1	\$15,000
Water Treatment System	ls	\$100,000	1	\$100,000
- Solids handling	ls	\$60,000	1	\$60,000
- Delivery and removal roll-off box	ls	\$1,000	1	\$1,000
- Solids roll off box for disposal	day	\$50	150	\$7 <i>,</i> 500
Control panel	ls	\$30,000	1	\$30,000
Misc electrical/plumbing supplies	ls	\$10,000	1	\$10,000
Treatment Chemicals				
- Ferric sulfate	lb	\$1.04	30,000	\$31,200
- Limestone	tons	\$35	11	\$385
- Peroxide	gal	\$45	45	\$2,025
Transport and disposal of solids (non-hazardous)	tons	\$70	60	\$4,200
Demobilization (Site Restoration and Decommission)	ls	\$10,000	1	\$10,000
SUBTOTAL OF DIRECT CAPITAL COST				\$312,810
30 % CONTINGENCY	%	30%		\$93,843
	-i	· · · · · ·	r	
INDIRECT CAPITAL COSTS				
Project management/administration	hr	\$195	30	\$5,850
Workplan	hr	\$130	40	\$5,200
Design and subcontracting	hr	\$130	80	\$10,400
Permitting	hr	\$130	20	\$2,600
Construction oversight	ls	\$20,000	1	\$20,000
System start-up	hr	\$100	60	\$6,000
Documentation reporting	hr	\$130	40	\$5,200
SUBTOTAL OF INDIRECT CAPITAL COSTS				\$55,250
SUBTOTAL OF DIRECT AND INDIRECT CAPITAL COSTS				\$461,903

SOURCE AREA: (2) Pump and treat on-site

ITEM	UNIT	UNIT COST	QTY	TOTAL
FIRST YEAR O&M COSTS				
Project Management	hr	\$195	50	\$9 ,7 50
Shakedown visits + Travel time	hr	\$100	40	\$4,000
Batch refill visits	hr	\$100	420	\$42,000
Field equipment and travel expenses	ls	\$4,000	1	\$4,000
Misc Repairs	ls	\$1,500	1	\$1,500
Utilities/Fuel	mo	\$3,000	3	\$9,000
SUBTOTAL OF FIRST YEAR O&M				\$70,25 0
0 % CONTINGENCY	%	30%		\$21,075
FIRST YEAR OF GROUNDWATER MONITORING				
Project management/administration	hr	\$195	20	\$3,900
Groundwater sampling (3 samples, 4 times/yr)	hr	\$100	50	\$5,000
WPDES sampling	hr	\$100	50	\$5,000
Field equipment/expenses	ls	\$2,000	1	\$2,000
Lab - As	each	\$15	12	\$180
Lab - WPDES	each	\$7 5	12	\$900
Data evaluation	hr	\$130	40	\$5,200
SUBTOTAL OF FIRST YEAR OF MONITORING	*		•	\$22,180
0 % CONTINGENCY	%	30%		\$6,654

SOURCE AREA: (2) Pump and treat on-site

ITEM	UNIT	UNIT COST	QTY	TOTAL
ANNUAL O&M COSTS				
None	ls	\$0	1	\$0
SUBTOTAL FOR ANNUAL O&M	•			\$0
30 % CONTINGENCY	%	30%		\$0
MONITORING COSTS (SEMI-ANNUAL)				
Project management/administration	hr	\$195	30	\$5,850
Groundwater sampling (3 wells, twice/yr)	hr	\$100	30	\$3,000
Field equipment and expenses	ls	\$1,000	1	\$1,000
Lab - As	each	\$15	6	\$90
Data evaluation	hr	\$100	30	\$3,000
Reporting	hr	\$130	50	\$6,500
SUBTOTAL FOR ANNUAL GROUNDWATER MONITORING	ì			\$19,440
30 % CONTINGENCY	%	30%		\$5,832
PRESENT WORTH OF O&M	2	years @	3%	\$0
PRESENT WORTH OF MONITORING	2	years @	3%	\$48,357
TOTAL COST (TOTAL CAPITAL + PRESENT WORTH)		1	Total	\$640,000
		Ī	+ 50%	\$960,000
		İ	- 30%	\$450,000

Prepared By: A. Sellwood 6/19/07

QA'd By: SAK 6/20/07

ASSUMPTIONS:

GENERAL

- 1. Costs rounded up to the nearest ten thousand dollars.
- 2. Costs determined from experience and estimates from other similar projects.
- 3. Contingency is assumed to be 30% of direct capital costs, monitoring costs, and annual O&M.
- 4. Indirect costs do not include legal fees or public relations assistance.
- 5. Interest rate 3%; the balance of an 8% interest rate less a 5% inflation rate, based on EPA approach for remedial cost estimating.

6. All costs are based on preliminary concepts. They are intended for remedial option comparison and not for final budgeting. SPECIFIC

- 1. Assumes source area groundwater can be captured in one year.
- 2. Assumes 2 years of monitoring will be required to evaluate the performance of the source area treatment.
- 3. Water treatment system includes power generation, chemical metering pumps, solids hoppers, mixing tanks, and mixers.

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SOURCE AREA: (3) In-situ treatment of water

ITEM	UNIT	UNIT COST	QTY	TOTAL
DIRECT CAPITAL COSTS				
Mobilization	ls	\$10,000	1	\$10,000
Site Preparation	ls	\$10,000	1	\$10,000
Excavation and stockpile of overburden soil	су	\$10	650	\$6,500
Mixing of treatment chemicals	day	\$2,000	10	\$20,000
Treatment Chemicals				
- Ferric sulfate	lb	\$1.04	30,000	\$31,200
- Limestone	tons	\$35	11	\$385
- Peroxide	gal	\$45	45	\$2,025
Replace overburden soil and compaction	су	\$10	650	\$6,500
Site restoration	ls	\$7,000	1	\$7,000
SUBTOTAL OF DIRECT CAPITAL COST				\$93,610
30 % CONTINGENCY	%	30%		\$28,083
INDIRECT CAPITAL COSTS				
Project management/administration	hr	\$195	40	\$7,800
Workplan	hr	\$130	40	\$5,200
Design and subcontracting	hr	\$130	100	\$13,000
Permitting	hr	\$130	20	\$2,600
Construction oversight	ls	\$20,000	1	\$20,000
Misc expenses	ls	\$2,000	1	\$2,000
Documentation reporting	hr	\$130	40	\$5,200
SUBTOTAL OF INDIRECT CAPITAL COSTS	-	•	•	\$55,800
SUBTOTAL OF DIRECT AND INDIRECT CAPITAL COSTS				\$177,493
		· ·		
FIRST YEAR O&M COSTS				
None	ls	\$0	1	\$0
SUBTOTAL OF FIRST YEAR O&M				\$0
30 % CONTINGENCY	%	30%		\$0

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SOURCE AREA: (3) In-situ treatment of water

ITEM	UNIT	UNIT COST	QTY	TOTAL
FIRST YEAR OF GROUNDWATER MONITORING				
Project management/administration	hr	\$195	20	\$3,900
Groundwater sampling (3 samples, 4 times/yr)	hr	\$100	50	\$5,000
Field equipment/expenses	ls	\$2,000	1	\$2,000
Lab - As	each	\$15	12	\$180
Lab - As (Field verification sampling - quick turn)	each	\$40	20	\$800
Data evaluation	hr	\$130	40	\$5,200
SUBTOTAL OF FIRST YEAR OF MONITORING				\$17,080
30 % CONTINGENCY	%	30%		\$5,124
				\$100.40 F
SUBTOTAL OF CAPITAL AND FIRST YEAR COSTS				\$199,697
ANNUAL O&M COSTS				
None	ls	\$0	1	\$0
SUBTOTAL FOR ANNUAL O&M				\$0
30 % CONTINGENCY	%	30%		\$0
MONITORING COSTS (SEMI-ANNUAL)	1			
Project management/administration	hr	\$195	30	\$5,850
Groundwater sampling (3 wells, twice/yr)	hr	\$100	30	\$3,000
Field equipment and expenses	ls	\$1,000	1	\$0,000 \$1,000
Lab - As	each	\$15	6	\$90
Data evaluation	hr	\$100	30	\$3,000
Reporting	hr	\$130	50	\$6,500
SUBTOTAL FOR ANNUAL GROUNDWATER MONITORING		Q100	00	\$19,440
30 % CONTINGENCY	%	30%		\$5,832
PRESENT WORTH OF O&M	2	years @	3%	\$0
PRESENT WORTH OF MONITORING	2	years @	3%	\$48,357
FOTAL COST (TOTAL CAPITAL + PRESENT WORTH)			Total	\$250,000
FOTAL COST (TOTAL CAPITAL + PRESENT WORTH)		l	Total + 50%	\$250,000 \$380,000

Prepared By: A. Sellwood 6/19/07

QA'd By: SAK 6/20/07

SOURCE AREA: (3) In-situ treatment of water

ITEM	UNIT	UNIT COST	QTY	TOTAL
ASSUMPTIONS:				
GENERAL				
1. Costs rounded up to the nearest ten thousand dollars.				
2. Costs determined from experience and estimates from other similar	projects.			

3. Contingency is assumed to be 30% of direct capital costs, monitoring costs, and annual O&M.

4. Indirect costs do not include legal fees or public relations assistance.

5. Interest rate 3%; the balance of an 8% interest rate less a 5% inflation rate, based on EPA approach for remedial cost estimating.

6. All costs are based on preliminary concepts. They are intended for remedial option comparison and not for final budgeting. SPECIFIC

1. Assumes one in-situ treatment will adequately address the source area.

2. Assumes 2 years of monitoring will be required to evaluate the performance of the source area treatment.

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SLOUGH WATER: (1) Impermeable barrier

ITEM	UNIT	UNIT COST	QTY	TOTAL
DIRECT CAPITAL COSTS				
Mobilization	ls	\$10,000	1	\$10,000
Site Preparation (road building or mats)	ls	\$15,000	1	\$15,000
Vertical barrier cost (installation included)	sf	\$15	10,000	\$150,000
Erosion Control	ls	\$5,000	1	\$5 <i>,</i> 000
SUBTOTAL OF DIRECT CAPITAL COST				\$180,000
30 % CONTINGENCY (DIRECT CAPITAL)	%	30%		\$54,000
INDIRECT CAPITAL COSTS				
Project management/administration	hr	\$195	30	\$5,850
Workplan	hr	\$130	40	\$5,200
Design and subcontracting	hr	\$130	80	\$10,400
Permitting	hr	\$100	20	\$2,000
Construction oversight	hr	\$100	150	\$15,000
Documentation reporting	hr	\$130	40	\$5,200
SUBTOTAL OF INDIRECT CAPTIAL COSTS				\$43,650
SUBTOTAL OF DIRECT AND INDIRECT CAPITAL COS	TS			\$277,650
FIRST YEAR OF SLOUGH MONITORING				
Project management/administration	hr	\$195	15	\$2,925
Surface water sampling (2 points, twice)	hr	\$100	20	\$2,000
Field equipment/expenses	ls	\$2,000	1	\$2,000
Lab - As	each	\$15	4	\$60
Data evaluation	hr	\$130	25	\$3,250
SUBTOTAL OF FIRST YEAR OF MONITORING	1	•	<u> </u>	\$10,235
30 % CONTINGENCY	%	30%		\$3,071
SUBTOTAL OF CAPITAL AND MONITORING CO	STS			\$290,956

SLOUGH WATER: (1) Impermeable barrier

ITEM	UNIT	UNIT COST	QTY	TOTAL
D&M COST				
Project management/administration	hr	\$175	10	\$1,750
Semi-annual Site Visit	hr	\$100	20	\$2,000
Field Expenses	ls	\$1,000	1	\$1,000
Misc Repairs	ls	\$3,000	1	\$3,000
Reporting	hr	\$130	25	\$3 <i>,</i> 250
SUBTOTAL FOR ANNUAL O&M	•			\$9,250
30 % CONTINGENCY	%	30%		\$2,775
MONITORING COSTS				
Project management/administration	hr	\$195	15	\$2,925
Surface water sampling (2 points, twice a yr)	hr	\$100	20	\$2,000
Field equipment/expenses	ls	\$1,000	1	\$1,000
Lab - As	each	\$15	4	\$60
Data evaluation and reporting	hr	\$130	25	\$3,250
SUBTOTAL FOR ANNUAL MONITORING		•		\$9 <i>,</i> 235
30 % CONTINGENCY	%	30%		\$2 <i>,</i> 771
PRESENT WORTH OF O&M	5	years @	3%	\$55 <i>,</i> 071
PRESENT WORTH OF MONITORING	5	years @	3%	\$54,982
FOTAL COST (TOTAL CAPITAL + PRESENT WORTH)			Total	\$410,000
			+ 50%	\$620,000
			- 30%	\$290,000

Prepared By: A. Sellwood 6/19/07

QA'd By: SAK 6/20/07

ASSUMPTIONS:

GENERAL

- 1. Costs rounded up to the nearest ten thousand dollars.
- 2. Costs determined from experience and estimates from other similar projects.
- 3. Contingency is assumed to be 30% of direct capital costs, monitoring costs, and annual O&M.
- 4. Indirect costs do not include legal fees or public relations assistance.
- 5. Interest rate 3%; the balance of an 8% interest rate less a 5% inflation rate, based on EPA approach for remedial cost estimating.

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^{6.} All costs are based on preliminary concepts. They are intended for remedial option comparison and not for final budgeting. SPECIFIC

^{1.} Assumes this option will be used in conjuction with marsh sediment treatment, such that 5 years of monitoring and O&M will be required following construction. If used as a stand alone option, the time for treatment and cost would increase.

SLOUGH WATER: (1) Impermeable barrier

ITEM	UNIT	UNIT COST	QTY	TOTAL
2. Assumes the barrier will be left in place following the 5 years of moni	itoring.			

3. Assumes no surface water management will be required once the barrier is in place.

4. Assumes a vertical barrier that is 2000 ft long, 5 feet deep, and made of either 100 mil HDPE or 1/4-inch thick polyethylene.

5. Assumes the barrier will be installed using a trench, if conditions are dry enough, or another appropriate method.

SLOUGH WATER: (2) Capture and treat water on-site

ITEM	UNIT	UNIT COST	QTY	TOTAL
DIRECT CAPITAL COSTS				
Mobilization	ls	\$10,000	1	\$10,000
Site Preparation (Staging area and road building)	ls	\$15,000	1	\$15,000
Pipe installation cost (above grade)	ft	\$5	1,100	\$5,500
Electrical service (propane generator or temp power)	ls	\$10,000	1	\$10,000
Control Panel	ls	\$30,000	1	\$30,000
Pumps and control instrumentations	ls	\$5,000	1	\$5,000
Slough retention/overflow structure	each	\$10,000	2	\$20,000
Holding Tanks (2,500 gallons)	each	\$5,000	4	\$20,000
Sump pumps for holding tanks	each	\$200	4	\$800
Treatment Shed	ls	\$15,000	1	\$15,000
Misc electrical and plumbing	ls	\$10,000	1	\$10,000
Water Treatment System	ls	\$100,000	1	\$100,000
Solids separation	ls	\$20,000	1	\$20,000
Treatment Chemicals				
- Ferric sulfate	lb	\$1.04	30	\$31
- Limestone	lb	\$1	250	\$250
- 55-gallon drums for solids	each	\$50	2	\$100
Transport and disposal of solids (non-hazardous)	ls	\$500	1	\$500
SUBTOTAL OF DIRECT CAPITAL COST				\$262,181
30 % CONTINGENCY (DIRECT CAPITAL)	%	30%		\$78,65 4
NDIRECT CAPITAL COSTS				
Project management/administration	hr	\$195	30	\$5 <i>,</i> 850
Workplan	hr	\$130	40	\$5,200
Design and subcontracting	hr	\$130	80	\$10,400
Permitting	hr	\$100	20	\$2,000
Construction oversight	ls	\$20,000	1	\$20,000
Documentation reporting	hr	\$130	15	\$1,950
SUBTOTAL OF INDIRECT CAPITAL COSTS		. 1		\$45,400
SUBTOTAL OF DIRECT AND INDIRECT CAPITAL COSTS				\$386,236

SLOUGH WATER: (2) Capture and treat water on-site

ITEM	UNIT	UNIT COST	QTY	TOTAL
FIRST YEAR O&M COSTS				
Project Management	hr	\$195	40	\$7,800
Shakedown visits	hr	\$195 \$130	40	\$7,800 \$5,200
Site Visits		, ,	40 70	
	hr	\$100	, .	\$7,000
Misc Repairs	ls	\$2	1	\$2
Utilities/Fuel	mo	\$3,000	3	\$9,000
SUBTOTAL OF FIRST YEAR O&M				\$29,002
80 % CONTINGENCY	%	30%		\$8,701
FIRST YEAR OF SLOUGH MONITORING				
Project management/administration	hr	\$195	10	\$1,950
Surface water sampling (2 points, twice)	hr	\$100	20	\$2,000
WPDES Samples (6 times)	hr	\$100	50	\$5,000
Field equipment/expenses	ls	\$1,000	1	\$1,000
Lab - As	each	\$15	4	\$60
Lab - WPDES	each	\$75	6	\$450
Data evaluation	hr	\$130	15	\$1,950
SUBTOTAL OF FIRST YEAR OF MONITORING				\$12,410
0 % CONTINGENCY	%	30%		\$3,723

SLOUGH WATER: (2) Capture and treat water on-site

ITEM	UNIT	UNIT COST	QTY	TOTAL
0.4. M 6.007		1 1	i	
O&M COST			• •	ta
Project management/administration	hr	\$195	20	\$3,900
Site visits	hr	\$100	70	\$7,000
Field expenses	ls	\$3,000	1	\$3,000
Control Panel management	ls	\$5,000	1	\$5,000
Treatment Chemicals				
- Ferric sulfate	lb	\$1.04	30	\$31
- Limestone	lb	\$1	250	\$250
- 55-gallon drums for solids	each	\$50	2	\$100
Transport and disposal of solids (non-hazardous)	ls	\$500	1	\$500
Misc Repairs	ls	\$1,500	1	\$1,500
Documentation	hr	\$130	20	\$2, 600
Utilities/Fuel	mo	\$3,000	4	\$12,000
Decommissioning (cost/5yrs)	ls	\$5,000	1	\$5,000
SUBTOTAL FOR ANNUAL O&M	·	· · · ·	-	\$40,881
30 % CONTINGENCY	%	30%		\$12,264
		· · ·		
MONITORING COSTS				
Project management/administration	hr	\$195	15	\$2,925
Surface water sampling (2 points, twice a yr)	hr	\$100	20	\$2,000
WPDES Samples (6 times)	hr	\$100	50	\$5,000
Field equipment/expenses	ls	\$1,000	1	\$1,000
Lab - As	each	\$15	4	\$60
Lab - WPDES	each	\$7 5	6	\$450
Data evaluation and reporting	hr	\$130	20	\$2,600
SUBTOTAL FOR ANNUAL MONITORING				\$14,035
30 % CONTINGENCY	%	30%		\$4,211
PRESENT WORTH OF O&M	5	years @	3%	\$243,391
PRESENT WORTH OF MONITORING	5	years @	3%	\$83,559
TOTAL COST (TOTAL CAPITAL + PRESENT WORTH)			Total	\$730,000
			+ 50%	\$1,100,000
		İ	- 30%	\$520,000
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ASSUMPTIONS: GENERAL

SLOUGH WATER: (2) Capture and treat water on-site

ITEM UNIT UNIT COST QIY IOTAL

1. Costs rounded up to the nearest ten thousand dollars.

2. Costs determined from experience and estimates from other similar projects.

3. Contingency is assumed to be 30% of direct capital costs, monitoring costs, and annual O&M.

4. Indirect costs do not include legal fees or public relations assistance.

5. Interest rate 3%; the balance of an 8% interest rate less a 5% inflation rate, based on EPA approach for remedial cost estimating.

6. All costs are based on preliminary concepts. They are intended for remedial option comparison and not for final budgeting. SPECIFIC

1. Assumes 10,000 gallons of water = max water captured per flow event, and 6 flow events per year.

2. Assumes above grade plumbing and utilities to run system, and decommissioning of the equipment and plumbing at the end of treatment.

3. Assumes this option will be used in conjunction with marsh sediment treatment, such that 5 years of monitoring and O&M will be required following construction. If used as a stand alone option, the time for treatment and cost would increase.

4. Water treatment system includes power generation, chemical metering pumps, solids hoppers, mixing tanks, and mixers.