Raytheon

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January 31, 2002

Massachusetts Department of Environmental Protection
Northeast Regional Office
Bureau of Waste Site Cleanup
205 Lowell Street
Wilmington, MA 01887

Re: Release Abatement Measure 120-Day Status Report
Former Raytheon Facility
430 Boston Post Road
Wayland, Massachusetts
RTN 3-13574, Permit No. 133939

Dear Sir or Madam:

Enclosed please find a Release Abatement Measure (RAM) 120-Day Status Report for the above referenced Site. The RAM 120-Day Status Report was prepared by Environmental Resources Management, Inc. (ERM), on behalf of Raytheon Company (Raytheon).

If you have any questions regarding the report, please contact me at (508) 490-1707 or at the address listed below.

Sincerely,

Ronald C. Slager, Jr.
Raytheon Company
Restoration Program Manager
1001 Boston Post Road
M/S 1-2-1567
Marlborough, MA 01752

Enclosure

cc: Mr. John Drobinski, ERM, 399 Boylston Street, 6th Floor, Boston, MA 02116
PIP Participants

31 January 2002
Reference: 143.60

Massachusetts Department of Environmental Protection
Northeast Regional Office
Bureau of Waste Site Cleanup
205 Lowell Street
Wilmington, MA 01887

Re: Release Abatement Measure 120-Day Status Report
In Situ Chemical Oxidation Pilot Study
Former Raytheon Facility
430 Boston Post Road
Wayland, Massachusetts (the "Site")
RTN 3-13574, Permit No. 133939

Dear Sir or Madam:

On behalf of Raytheon Company (Raytheon), Environmental Resources Management (ERM) is submitting this Release Abatement Measure (RAM) 120-Day Status Report for the above-referenced Site. This RAM Status Report was prepared in accordance with the requirements of 310 CMR 40.0445 of the Massachusetts Contingency Plan (MCP). The original RAM Transmittal Form BWSC-106 is included as Appendix A.

BACKGROUND

ERM prepared a RAM Plan, dated 11 September 2001, that was submitted to the Department of Environmental Protection (DEP or Department) on 12 September 2001. The RAM Plan presented plans for a pilot study in two areas involving in-situ chemical oxidation (ISCO) of chlorinated hydrocarbons (primarily trichloroethene (TCE)) in groundwater. The purpose of the RAM was to evaluate the ability to reduce the concentrations of chlorinated volatile organic compounds (CVOCs) in groundwater using in-situ chemical oxidation. The two pilot study areas were designed to evaluate two different delivery methods for introducing oxidants to the subsurface. Figure 1 presents a site locus map and Figure 2 presents a site layout map.

The Department issued a Conditional Approval of Release Abatement Measure letter, dated 6 November 2001 (Appendix B), regarding the

proposed RAM activities presented in the above-referenced RAM Plan. Subsequent to issuing this letter, the Department filed a Form BWSC-102B for the Site (Appendix B), which indicates that a Conditional Approval letter was not necessary to implement the RAM. In accordance with the Form BWSC-102B, Raytheon will evaluate DEP's recommendations for any future oxidant applications at the Site.

A chronology of events related to the RAM is provided in Table 1. The remainder of this RAM Status Report is formatted consistent with the requirements of Massachusetts Contingency Plan (MCP), 310 CMR 40.0445 (2).

A) STATUS OF RESPONSE OPERATIONS

As part of the RAM, two concurrent ISCO pilots were conducted to evaluate the efficacy of the following delivery methods:

- Direct Push Injection (MW-33 pilot study area): this pilot study consisted of a single injection point located 55 feet north-northeast of the MW-33 well cluster. Oxidant was injected into seven discrete three-foot vertical intervals, which were designed to facilitate oxidant delivery from the top of the silt unit (28 feet below grade) to slightly above the water table (12 feet below grade). The use of short vertical injection intervals was designed to enable relatively uniform oxidant delivery within the lithology. The oxidant (potassium permanganate) was injected under pressure using a pneumatic fracturing and liquid atomized injection (PFLAI) technique and allowed to migrate via natural advective and diffusive flow from the injection point throughout the study area. The RAM Plan indicated that two or three injection points would be used. However, geologic data obtained during the initial characterization phase suggested that one point could be used for the pilot study. Monitoring well couplets (i.e., a water table well and an adjacent deeper well) were installed up-gradient, cross-gradient and down-gradient of the injection point (Figures 2 and 3). Groundwater samples were collected as per the RAM Plan to evaluate the flow rate of oxidants through the aquifer, dispersivity within the aquifer and the rate of mass reduction achieved using this technology.
- Single Well Injection (MW-43 pilot study area): this pilot study was conducted as a single-well injection-drift test utilizing

existing monitoring well MW-43S as the injection well. The oxidant (sodium permanganate) was passively injected (i.e., via gravity feed) and allowed to migrate via natural advective and diffusive flow. Six monitoring wells were installed around and down-gradient of the injection well (Figures 2 and 3) to evaluate the radius of influence of the injection and the efficacy of the oxidants in reducing TCE concentrations down-gradient of the MW-43 pilot study injection area.

The pilot studies consisted of the following tasks:

- Install monitoring wells
- Conduct bench-scale oxidant demand tests
- Establish baseline hydrogeochemistry
- Apply reagent
- Post-injection groundwater monitoring

A description of the pilot study activities is provided below.

Install Monitoring Wells

The purpose of this task was to conduct a detailed evaluation of hydrogeology within the pilot study areas and provide a detailed well network to evaluate the effectiveness of the pilots.

On 25 August 2001, ERM provided oversight for installation of 15 monitoring wells at the Site. Nine borings were advanced in the vicinity of the MW-33 well cluster by ConeTec, Inc. of West Berlin, New Jersey using a cone penetrometer (CPT). A CPT is a direct push drill rig that uses electronic instrumentation to measure various parameters that, when interpreted, provide real time hydrogeologic information. Six borings were advanced adjacent to and down gradient of the MW-43 well couplet by Geosearch, Inc. of Sterling, Massachusetts using a Geoprobe direct-push drill rig. On 24 September 2001, an additional well was installed in the MW-33 pilot study area by Geosearch using a Geoprobe direct-push drill rig.

Monitoring wells were constructed in all borings using ¾-inch or one-inch inside diameter (ID), Schedule 40, polyvinyl chloride (PVC) riser pipe and well screen, sand filter pack, bentonite seal, concrete surface

seal and flush-mounted roadbox. A summary of monitoring well construction data is presented in Table 2. Monitoring well locations are shown on Figure 2. Boring logs are presented in Appendix C.

In the MW-33 pilot study area, five borings were advanced to a depth of 35 feet and logged using the CPT. The CPT data indicated heterogeneity with a general change in stratigraphy from silty sand and sand to sandy silt and silt at approximately 25 feet depth (Appendix B). Monitoring well couplets were installed at each of the five locations allowing for monitoring of the silty sand and sand interval (15 feet to 25 feet depth) and the lower sandy silt and silt interval (25 feet to 35 feet depth). Three monitoring wells were installed in the MW-43 pilot study area to depths of 20 feet, consistent with the depth of the injection well, MW-43S. Three additional wells were installed down gradient of the MW-43 pilot study area to depths of 30 feet, which generally coincides with the top of a silt layer in this portion of the Site.

Conduct Bench-Scale Oxidant Demand Tests

The purpose of this task was to evaluate the soil oxidant demand (SOD) for the aquifer to ensure that an adequate amount of oxidant was injected to facilitate destruction of the contaminants within the pilot study areas while minimizing the amount of residual permanganate remaining after completion of the pilot studies. Potassium permanganate and sodium permanganate, the oxidants used for the pilot studies, are strong and somewhat non-selective oxidants. Therefore, in addition to chlorinated hydrocarbons, they can oxidize other reduced soil and groundwater constituents, including natural organic carbons (e.g., humic and fulvic acids) and reduced minerals (e.g., ferrous iron). The oxidation process is a destructive process that degrades organic compounds to produce carbon dioxide and water. The SOD data, along with the observed CVOC concentrations in groundwater were used to calculate the concentration of permanganate that was injected in each study area.

To perform the SOD test, ERM collected a composite soil sample from boring MW-101 (Figure 2), including soil from both sandy and silty intervals. This boring was chosen because it was located near the MW-33 pilot study area and exhibited similar geologic characteristics. Soil samples were not collected during advancement of the CPT borings, due to the nature of this drilling technology.

The composite soil sample was submitted to ERM's Remediation Technology Group in West Chester, Pennsylvania, where the SOD test was conducted for the oxidants permanganate and persulfate. Based on varying reaction times, the permanganate test was designed to occur over a seven-day period whereas the persulfate test was designed for a 28-day period. At the completion of the permanganate test, ERM concluded that the SOD for the soil sample was very low, favoring permanganate as the preferred oxidant.

The seven-day permanganate SOD fell in the range of 0.033 to 0.068 g/kg of wet soil, which translates to a required range of 0.09 to 0.18 pounds of permanganate per cubic yard of soil (assuming a soil density of 100 pounds per cubic foot and 30% porosity). The mass of permanganate injected during the pilot studies was determined by combining the oxidant demands for native soil (i.e., SOD) and the calculated mass of CVOCs within the pilot study area. Details of the reagent application are presented below.

Establish Baseline Hydrogeochemistry

The purpose of this task was to establish baseline conditions for groundwater flow and quality within the pilot test areas prior to conducting the oxidant injections. The locations and elevations of the newly-installed monitoring wells were surveyed relative to the existing Site datum.

From 27 to 29 August 2001, ERM conducted a comprehensive groundwater monitoring round at the Site, including the 33 existing and 15 newly installed wells. Prior to sample collection, all monitoring wells were gauged using an electronic water level indicator to determine groundwater elevations. Groundwater samples were collected using a variety of sampling techniques. The 33 existing monitoring wells were sampled using either dedicated polyethylene bailers or Waterra inertia-lift methods. Low-flow sampling techniques were utilized for sample collection at 15 newly installed pilot study wells. Geochemical field parameters (pH, conductivity, temperature, oxidation-reduction potential and dissolved oxygen) were measured during sample collection. Groundwater sampling equipment (i.e., bailers, rope and/or tubing) was dedicated to prevent cross-contamination between monitoring points. Groundwater samples were collected from all wells for analysis of CVOCs by EPA Method 8021C. Groundwater samples

were collected from selected pilot study wells for analysis of manganese, chromium and fluoride, per the RAM Plan.

Results of the comprehensive groundwater-monitoring round are presented in Appendix D. Laboratory analytical reports are presented in Appendix F. Groundwater elevations, flow directions and chemistry were consistent with historical data for the Site. A more detailed discussion of these data relative to the post injection data is presented below.

Apply Reagent

On 6 and 7 October 2001, ERM provided oversight during the injection of sodium permanganate, potassium permanganate and sodium fluoride (tracer) at the Site. Approximately 2,500 gallons of 2% potassium permanganate along with a 50 mg/L of sodium fluoride tracer were injected at a rate of 250 gallons per hour using the PFLAI method approximately 55 feet north-northeast of the MW-33 well cluster (Figure 3). The injections were conducted at pressures ranging from 25 to 50 pounds per square inch (psi). ERM elected to inject potassium permanganate at this location rather than sodium permanganate because it is easier to handle when working with large volumes. An injection concentration of 2% potassium permanganate was determined based on the SOD and CVOC concentrations on the projected radius of influence for this portion of the Site.

Approximately 250 gallons of 4% sodium permanganate followed by 120 gallons of potable water were injected into MW-43S via the gravity feed injection technique at a rate of 25 gallons per hour. ERM elected to inject sodium permanganate at this location rather than potassium permanganate because it is easier to handle when working with small volumes. Based on the SOD and CVOC concentrations on the projected radius of influence for this portion of the Site, ERM determined that a 4% sodium permanganate solution should be adequate to treat CVOCs within and immediately down gradient of the pilot study area.

Post-Injection Groundwater Monitoring

Sixteen post-injection field parameter monitoring rounds were conducted over a three-month period (Table 1). These monitoring rounds included measurements of groundwater elevations and field parameters, and collection of groundwater samples for analysis of fluoride, a

conservative tracer used in the MW-33 pilot study area. Groundwater samples were submitted for analysis of CVOCs by EPA Method 8021C for two of these monitoring rounds:

- 12 – 13 November 2001: groundwater samples were collected from the MW-33 pilot study area only. Groundwater samples were not collected from the MW-43 pilot study area because visible concentrations of sodium permanganate were present in two wells.
- 10 – 12 December 2001: groundwater samples were collected from both pilot study areas. Visible sodium permanganate was still present in the MW-43 pilot study area, but groundwater samples were collected to evaluate groundwater quality prior to submission of this report.

Table 1 summarizes the wells and analytical parameters included in each monitoring round. Tables 3 through 5 present the monitoring results. Table 3 in Appendix D presents monitoring results for all wells at the Site. Laboratory analytical reports are presented in Appendix F.

Low flow sampling techniques were used to collect groundwater samples during the post-injection monitoring period. For well MW-33S, which had historically been sampled using a bailer, ERM collected two samples on 10 December using both bailer and low flow sampling techniques to evaluate the effect of the sampling technique on CVOC concentrations. The results of this test indicated that the type of sampling method used did not affect CVOC concentrations for this well (Table 5A).

Groundwater Elevation Data

Groundwater elevations at the Site are consistent with historical data (Appendix D, Table 1; Figure 4). The fluoride tracer data (Table 5A) were used to calculate an approximate groundwater flow velocity of 0.7 feet per day within the MW-33 pilot study area during November 2001 (Appendix E). As shown in Figures 5A and 5B, groundwater elevations in the MW-33 pilot study wells increased by approximately 0.8 feet over baseline conditions immediately following oxidant injection and steadily decreased through the December 2001 monitoring round. As shown in Table 3, the groundwater elevation in the injection well (MW-43S) increased immediately following oxidant injection. However, groundwater elevations in the other MW-43 pilot study wells decreased

following oxidant injection, indicating that the injection had no immediate hydraulic effect on these wells.

Field Observations, Field Parameter and Tracer Data

Immediately following injection in the MW-33 pilot study area, evidence of the permanganate solution was detected in well couplet MW-109/110 (i.e., based on increased conductivity and pink-purple color; Table 4), approximately 20 feet southwest of the injection point. However, no evidence of the permanganate solution was observed at well couplet MW-107/108, approximately 10 feet northeast of the injection point. Though permanganate was not observed in MW-107/108, oxidizing groundwater was noted based on elevated oxidation-reduction potentials (ORP). This suggests that permanganate either reached these wells and was rapidly consumed or that it was present in close proximity to these wells. Evidence of permanganate has not been observed in any other wells in the MW-33 pilot study area.

As noted above, immediately following injection permanganate was detected in wells MW-109/110. However, permanganate in MW-109 (deep well) was expended within approximately one week following injection whereas low levels of permanganate were still present in MW-110 (shallow well) five weeks after injection. This may be attributable to one or more of the following:

- baseline CVOC concentrations in MW-109 were higher than MW-110 (Table 5);
- different injection radii for MW-109 (deeper well screened in sandy silt and silt) and MW-110 (shallow well screened in silty sand and sand), based on differences in geology;
- finer-grained soil present around MW-109 likely exhibits higher SOD than the coarser-grained soil present at the depth of MW-110.

Immediately following injection in the MW-43 pilot study area, no evidence of permanganate was noted in any wells. Within one week after the permanganate injection, evidence of permanganate (pink to purple color and increased conductivity; Table 4) was noted in wells MW-43S and MW-104, indicating that advective, dispersive or diffusive transport of permanganate had occurred. Since mid-October, the electrical conductivity of water in these wells has steadily decreased suggesting a

decrease in permanganate concentrations over time. However, permanganate is still visibly present in both of these wells. To date, the radius of influence of the gravity feed injection was greater than five feet based on presence of permanganate in MW-104.

CVOC Data

In the MW-33 pilot study area, TCE concentrations decreased by an average of 55% through December 2001 in half of the wells sampled (MW-111, MW-112, MW-113, MW-114, MW-115 and MW-116; Table 5; Figure 6). These wells are located immediately downgradient of the permanganate injection area (i.e., radius of influence) and were not directly affected by the injection (i.e., there has been no visual or field parameter evidence to suggest that permanganate is or has been present in these wells). Therefore, it is likely that treated groundwater from within the permanganate radius of influence has migrated down gradient and mixed with untreated groundwater in the vicinity of these wells, resulting in a reduction of CVOC concentrations.

Four of the five wells (MW-107, MW-108, MW-33S and MW-33M) that exhibited increases in TCE concentrations are located outside of the permanganate radius of influence. These increases in TCE concentration are within the historical variations observed for the wells in this portion of the Site and are attributed to the lack of precipitation and groundwater recharge during the pilot study. For instance, historical variations in TCE concentrations in MW-33S have ranged from 170 micrograms per liter (µg/L) to 530 µg/L. During the pilot study, TCE concentrations increased from 240 µg/L to 380 µg/L. Concurrent with the increase in TCE at these wells, groundwater elevations in the pilot study area have decreased by approximately 0.5 feet due to a lack of groundwater recharge (Figures 5A and 5B).

However, TCE concentrations also increased in MW-109, which is located within the permanganate radius of influence. ERM believes that the concentration increase most likely resulted from desorption of TCE from clay minerals via an ion exchange-type reaction where potassium replaces the TCE, resulting in increases in dissolved phase concentrations.

In the MW-43 pilot study area, TCE concentrations decreased by an average of 75% through December 2001 in three of four wells sampled (MW-43S, MW-104 and MW-106; Table 5; Figures 6). Permanganate is

still present in MW-43S and MW-104, which both exhibit 100% decreases in TCE concentrations. MW-106 exhibits a 25% decrease in TCE concentration, which is likely attributable to the migration of treated groundwater and mixing with untreated groundwater. The increase in TCE concentration at the upgradient well, MW-105, is likely attributable to the decrease in groundwater elevations at the Site.

Summary

In analyzing the results of the pilot studies, it is evident that there are a number of interrelated processes and phenomena occurring. The importance of these processes varies with time. The following provides an interpretation of the results in light of these processes.

1. The first process was the injection of the permanganate solution, which was conducted under pressure using PFLAI (MW-33 pilot study area) and via gravity feed (MW-43 pilot study area). The PFLAI injection resulted in an apparent radius of influence of at least 20 feet. Gravity feed injection resulted in an apparent radius of influence of five to ten feet.

2. Immediately following injection, the permanganate displaced and mixed with groundwater. Direct evidence (color and increased conductivity) of permanganate was observed in wells MW-109 and MW-110 in the MW-33 pilot study area and MW-43S and MW-104 in the MW-43 pilot study area. Indirect evidence (increased ORP) was noted in wells MW-107 and MW-108 in the MW-33 pilot study area.

3. Permanganate reacted with oxidizable species in the soil (i.e., SOD), as well as the dissolved VOCs. In the MW-33 pilot study area, most of the permanganate was rapidly consumed. However, in the MW-43 pilot study area, the permanganate persisted. This is likely due to the higher permanganate concentration (4% v. 2%) injected in this pilot study area. Oxidizing groundwater was observed in several wells in both pilot study areas, based on increases in ORP.

4. Advective groundwater migration transported the treated groundwater and any residual permanganate in the down-gradient direction. Some lateral distribution also occurred due to dispersion and diffusion. The CVOC depleted groundwater mixed with unreacted groundwater, resulting in decreased CVOC concentrations but not complete elimination of CVOCs.

5. Increases in TCE concentrations were noted at some monitoring wells in the MW-33 pilot study area. These concentration variations fall within the historical range for wells in this portion of the Site. The increases are believed to be related to a significant decrease in the water table or desorption of CVOCs following oxidant injection.

B) NEW SITE INFORMATION

New Site information obtained as part of the ISCO pilot studies is discussed above in Section A.

C) MANAGEMENT OF REMEDIATION WASTE, REMEDIAL WASTEWATER AND/OR REMEDIAL ADDITIVES

Because the application of Remedial Additives to existing wells is an in-situ technique, no Remediation Waste or Remediation Wastewater was generated as part of RAM activities. The application of Remedial Additives was discussed above in Section A.

D) REMEDIAL SYSTEM MONITORING DATA

Data associated with monitoring the ISCO pilot studies are discussed above in Section A. The data is also presented in the attached tables.

E) OTHER INFORMATION

Further performance groundwater sampling will be conducted to further monitor the effectiveness of the technology.

F) LSP OPINION

The LSP opinion is provided in Section J of BWSC-106 (Appendix A).

If the Department requires additional information or clarification, please contact either of the undersigned at (617) 267-8377.

Sincerely,

John C. Drobinski, P.G., LSP
Principal-in-Charge

R. Joseph Fiacco, Jr., P.G.
Project Manager

Enclosures:

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	Table 3	Groundwater Elevation Data
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	Figure 4	Groundwater Elevation Data - Deep Wells
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Appendices:	Appendix A: RAM Transmittal Form BWSC-106	
	Appendix B: DEP Correspondence	
	Appendix C: Boring Logs	
	Appendix D: Comprehensive Groundwater Monitoring Round Data	
	Appendix E: Groundwater Velocity Calculations	
	Appendix F: Laboratory Analytical Reports	

cc: Mr. Edwin Madera, Environmental Restoration Program, Raytheon Company, 1001 Boston Post Rd., MS-1-2-1567, Marlborough, MA 01752-3789

Public Repository (Primary Location), Wayland Public Library, Louise Brown, 5 Concord Road, Wayland, MA 01778

Public Repository (Secondary Location), Board of Health, Wayland Town Hall, 41 Cochituate Road, Wayland, MA 01778

Karen Stromberg, PIP Coordinator, MA Department of Environmental Protection, Northeast Regional Office, 205A Lowell Street, Wilmington, MA 01887

PIP Mailing List (see attached)

PIP Participant Mailing List

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Tables

Table 1
Chronology of RAM Activities
Raytheon Company
Wayland, Massachusetts

Date	Activity	Wells	Parameters
27-Aug-01	Groundwater Monitoring	All Wells in MW-33 Pilot StudyArea All Wells in MW-43 Pilot Study Area and MW-43D	Field Parameters, VOCs
5-Oct-01	Groundwater Monitoring	All Wells in MW-33 Pilot StudyArea All Wells in MW-43 Pilot Study Area	Field Parameters
6-Oct-01, 7-Oct-01	Oxidant Injection	Injection Well (MW-33 Pilot Study Area) MW-43S	-
8-Oct-01	Groundwater Monitoring	All Wells in MW-33 Pilot StudyArea All Wells in MW-43 Pilot Study Area	Field Parameters, Fluoride
10-Oct-01	Groundwater Monitoring	All Wells is MW-33 Pilot Study Area except MW-33M	Field Parameters, Fluoride
12-Oct-01	Groundwater Monitoring	MW-33S, MW-111, MW-112, MW-113, MW-114, MW-115, MW-116	Field Parameters, Fluoride
14-Oct-01	Groundwater Monitoring	MW-33S, MW-111, MW-112, MW-113, MW-114, MW-115, MW-116	Field Parameters, Fluoride
16-Oct-01	Groundwater Monitoring	All Wells in MW-33 Pilot StudyArea All Wells in MW-43 Pilot Study Area	Field Parameters, Fluoride
18-Oct-01	Groundwater Monitoring	MW-33S, MW-111, MW-112, MW-113, MW-114, MW-115, MW-116	Field Parameters, Fluoride
20-Oct-01	Groundwater Monitoring	MW-33S, MW-111, MW-112, MW-113, MW-114, MW-115, MW-116	Field Parameters, Fluoride
22-Oct-01	Groundwater Monitoring	All Wells in MW-33 Pilot StudyArea All Wells in MW-43 Pilot Study Area	Field Parameters, Fluoride
24-Oct-01	Groundwater Monitoring	MW-33S, MW-111, MW-112, MW-113, MW-114, MW-115, MW-116	Field Parameters, Fluoride
26-Oct-01	Groundwater Monitoring	MW-33S, MW-111, MW-112, MW-113, MW-114, MW-115, MW-116	Field Parameters, Fluoride
28-Oct-01	Groundwater Monitoring	MW-33S, MW-111, MW-112, MW-113, MW-114, MW-115, MW-116	Field Parameters, Fluoride
30-Oct-01	Groundwater Monitoring	All Wells in MW-33 Pilot StudyArea All Wells in MW-43 Pilot Study Area	Field Parameters, Fluoride
1-Nov-01	Groundwater Monitoring	MW-33S, MW-111, MW-112, MW-113, MW-114, MW-115, MW-116	Field Parameters, Fluoride
5-Nov-01	Groundwater Monitoring	All Wells in MW-33 Pilot StudyArea All Wells in MW-43 Pilot Study Area	Field Parameters, Fluoride
12-Nov-01	Groundwater Monitoring	All Wells is MW-33 Pilot Study Area	Field Parameters, Fluoride, VOCs
10-Dec-01	Groundwater Monitoring	All Wells in MW-33 Pilot StudyArea All Wells in MW-43 Pilot Study Area and MW-43D	Field Parameters, Fluoride, VOCs

Notes:

Fluoride Samples only taken at MW-33 Pilot Study Area

Field Parameters = Depth to Water, Conductivity, Oxygen Reduction Potential, Dissolved Oxygen, Temperature, Color

All Wells in MW-33 Pilot Study Area = MW-33S, MW-33M, MW-107, MW-108, MW-109, MW-110,W-111, MW-112, MW-113, MW-114, MW-115, MW-116

All Wells in MW-43 Pilot Study Area = MW-43S, MW-104, MW-105, MW-106

Table 2
Monitoring Well Construction Summary
ISCO Pilot Study Wells
Raytheon Company
Wayland, Massachusetts

Well Designation	Date Installed	Ground Surface Elevation (feet ASL)	Screen Length (feet)	Total Well Depth (feet)	Screened Interval		Screened Material
					Bottom Elevation (feet ASL)	Top Elevation (feet ASL)	
MW-33S	14-May-98	133.91	5	30	103.91	108.91	Silt
MW-33M	13-May-98	133.91	5	50	83.91	88.91	Sand & Silt
MW-43S	2-Nov-98	134.37	5	20	114.37	119.37	Sand & Silt
MW-43D	24-Mar-00	134.55	5	55	79.55	84.55	Till
MW-104	25-Aug-01	134.52	10	20	114.52	124.52	Sand
MW-105	25-Aug-01	134.18	10	20	114.18	124.18	Sand & Silt
MW-106	25-Aug-01	133.86	10	20	113.86	123.86	Sand & Silt
MW-107	25-Aug-01	135.01	10	35	100.01	110.01	Sand
MW-108	25-Aug-01	135.01	10	25	110.01	120.01	Sand & Silt
MW-109	25-Aug-01	134.55	10	35	99.55	109.55	Sand & Silt
MW-110	25-Aug-01	134.52	10	25	109.52	119.52	Sand & Silt
MW-111	25-Aug-01	134.27	10	35	99.27	109.27	Sand
MW-112	25-Aug-01	134.27	10	25	109.27	119.27	Sand & Silt
MW-113	25-Aug-01	134.26	10	35	99.26	109.26	Sand
MW-114	25-Aug-01	134.29	10	25	109.29	119.29	Sand & Silt
MW-115	25-Aug-01	134.25	10	35	99.25	109.25	Sand
MW-116	25-Aug-01	134.25	10	25	109.25	119.25	Sand & Silt

Notes:

ASL = Above Mean Sea Level

Table 3
Groundwater Elevation Data
Raytheon Company
Wayland, Massachusetts

Well ID	Depth to Water (Feet Below Ground Surface)																
	(Baseline) 5-Oct-01	8-Oct-01	10-Oct-01	12-Oct-01	14-Oct-01	16-Oct-01	18-Oct-01	20-Oct-01	22-Oct-01	24-Oct-01	26-Oct-01	28-Oct-01	30-Oct-01	1-Nov-01	5-Nov-01	12-Nov-01	10-Dec-01
MW-43 Pilot Study Area																	
MW-104	*15.96*	16.01	-	-	-	16.32	-	-	16.45	-	-	-	16.64	-	16.73	-	17.14
MW-105	*16.07*	16.16	-	-	-	16.36	-	-	16.43	-	-	-	16.68	-	16.71	-	17.17
MW-106	*15.57*	16.67	-	-	-	16.79	-	-	16.93	-	-	-	17.12	-	-	-	17.53
MW-43S	*16.15*	15.88	-	-	-	16.06	-	-	16.23	-	-	-	16.36	-	16.48	-	16.90
MW-43D	*17.35*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18.36
MW-33 Pilot Study Area																	
MW-107	*19.98*	19.85	20.06	-	-	20.09	-	-	20.21	-	-	-	20.24	-	20.03	20.35	20.61
MW-108	*22.60*	20.05	20.17	-	-	20.39	-	-	20.49	-	-	-	20.59	-	20.63	20.75	20.91
MW-109	*19.73*	20.26	-	-	-	19.91	-	-	20.02	-	-	-	20.13	-	20.10	20.21	20.49
MW-110	*19.76*	19.54	-	-	-	19.82	-	-	19.94	-	-	-	20.06	-	20.15	20.26	20.41
MW-111	*19.51*	19.43	19.48	19.52	19.59	19.65	19.71	19.71	19.76	19.80	19.83	19.88	19.87	19.92	19.96	20.02	20.23
MW-112	*19.30*	19.10	19.20	19.25	19.34	19.39	19.45	19.51	19.52	19.56	19.57	19.62	19.64	19.67	19.72	19.81	19.97
MW-113	*19.30*	19.19	19.28	19.32	19.46	19.53	19.52	19.50	19.54	19.58	19.61	19.68	19.68	19.70	19.72	19.82	19.99
MW-114	*19.21*	19.06	19.17	19.21	19.27	19.32	19.36	19.42	19.45	19.48	19.49	19.55	19.56	19.59	19.63	19.72	19.90
MW-115	-	19.26	19.33	19.37	19.42	19.50	19.55	19.36	19.61	19.65	19.66	19.71	19.71	19.75	19.78	19.86	20.04
MW-116	*19.50*	19.37	19.46	19.48	19.50	19.62	19.68	19.70	19.74	19.81	19.80	19.86	19.85	19.91	19.92	20.01	20.17
MW-33S	*19.33*	19.21	19.26	19.26	19.36	19.43	19.48	19.51	19.54	19.58	19.60	19.66	19.66	19.72	19.76	19.80	20.00
MW-33M	*20.22*	19.76	-	-	-	19.81	-	-	19.82	-	-	-	19.86	-	19.84	19.86	19.94

Notes:
- = Not Measured
Baseline depth to water for MW-43D was measured on 8/27/01.

Table 3
Groundwater Elevation Data
Raytheon Company
Wayland, Massachusetts

Well ID	Measuring Pt. Elevation (feet ASL)	Groundwater Elevation (Feet ASL)																
		(Baseline) 5-Oct-01	8-Oct-01	10-Oct-01	12-Oct-01	14-Oct-01	16-Oct-01	18-Oct-01	20-Oct-01	22-Oct-01	24-Oct-01	26-Oct-01	28-Oct-01	30-Oct-01	1-Nov-01	5-Nov-01	12-Nov-01	10-Dec-01
MW-43 Pilot Study Area																		
MW-104	133.77	*117.81*	117.76	-	-	-	117.45	-	-	117.32	-	-	-	117.13	-	117.04	-	116.63
MW-105	134.29	*118.22*	118.13	-	-	-	117.93	-	-	117.86	-	-	-	117.61	-	117.58	-	117.12
MW-106	134.47	*118.90*	117.80	-	-	-	117.68	-	-	117.54	-	-	-	117.35	-	-	-	116.94
MW-43S	133.82	*117.67*	117.94	-	-	-	117.76	-	-	117.59	-	-	-	117.46	-	117.34	-	116.92
MW-43D	134.55	*117.20*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	116.19
MW-33 Pilot Study Area																		
MW-107	134.87	*114.89*	115.02	114.81	-	-	114.78	-	-	114.66	-	-	-	114.63	-	-	114.52	114.26
MW-108	134.91	*112.31*	114.86	114.74	-	-	114.52	-	-	114.42	-	-	-	114.32	-	-	114.16	114.00
MW-109	134.33	*114.60*	114.07	-	-	-	114.42	-	-	114.31	-	-	-	114.20	-	-	114.12	113.84
MW-110	134.27	*114.51*	114.73	-	-	-	114.45	-	-	114.33	-	-	-	114.21	-	-	114.01	113.86
MW-111	134.10	*114.59*	114.67	114.62	114.58	114.51	114.45	114.39	114.39	114.34	114.30	114.27	114.22	114.23	114.18	114.14	114.08	113.87
MW-112	133.90	*114.60*	114.80	114.70	114.65	114.56	114.51	114.45	114.39	114.38	114.34	114.33	114.28	114.26	114.23	114.18	114.09	113.93
MW-113	133.82	*114.52*	114.63	114.54	114.50	114.36	114.29	114.30	114.32	114.28	114.24	114.21	114.14	114.14	114.12	114.10	114.00	113.83
MW-114	133.69	*114.48*	114.63	114.52	114.48	114.42	114.37	114.33	114.27	114.24	114.21	114.20	114.14	114.13	114.10	114.06	113.97	113.79
MW-115	133.80	-	114.54	114.47	114.43	114.38	114.30	114.25	114.44	114.19	114.15	114.14	114.09	114.09	114.05	114.02	113.94	113.76
MW-116	133.95	*114.45*	114.58	114.49	114.47	114.45	114.33	114.27	114.25	114.21	114.14	114.15	114.09	114.10	114.04	114.03	113.94	113.78
MW-33S	133.78	*114.45*	114.57	114.52	114.52	114.42	114.35	114.30	114.27	114.24	114.20	114.18	114.12	114.12	114.06	114.02	113.98	113.78
MW-33M	133.57	*113.35*	113.81	-	-	-	113.76	-	-	113.75	-	-	-	113.71	-	-	113.71	113.63

Notes:
- = Not Measured
Baseline groundwater elevation for MW-43D was measured on 8/27/01.

Table 4
Groundwater Field Parameter Data
Raytheon Company
Wayland, Massachusetts

Well ID	Oxidation Reduction Potential (ORP) (mV)																
	(Baseline) 5-Oct-01	8-Oct-01	10-Oct-01	12-Oct-01	14-Oct-01	16-Oct-01	18-Oct-01	20-Oct-01	22-Oct-01	24-Oct-01	26-Oct-01	28-Oct-01	30-Oct-01	1-Nov-01	5-Nov-01	12-Nov-01	10-Dec-01
MW-43 Pilot Study Area																	
MW-104	*266*	337	-	-	-	538	-	-	655	-	-	-	653	-	638	-	646
MW-105	*289*	485	-	-	-	470	-	-	309	-	-	-	298	-	564	-	497
MW-106	*285*	396	-	-	-	433	-	-	286	-	-	-	268	-	500	-	257
MW-43S	*252*	404	-	-	-	542	-	-	643	-	-	-	596	-	599	-	591
MW-33 Pilot Study Area																	
MW-107	*154*	535	210	-	-	46	-	-	8	-	-	-	14	-	6	-65	-71
MW-108	*81*	635	287	-	-	268	-	-	461	-	-	-	472	-	455	366	251
MW-109	*369*	415	-	-	-	380	-	-	334	-	-	-	199	-	239	165	203
MW-110	*237*	500	-	-	-	441	-	-	645	-	-	-	618	-	561	559	207
MW-111	*287*	224	285	245	209	262	245	185	340	367	269	231	263	338	221	190	175
MW-112	*271*	222	262	221	195	238	278	206	370	384	269	275	344	364	264	293	198
MW-113	*289*	224	261	212	200	237	234	169	277	339	215	204	227	313	176	83	96
MW-114	*268*	217	237	180	176	200	231	171	340	364	268	258	313	375	264	287	203
MW-115	*271*	240	190	172	176	158	213	132	244	304	225	177	205	320	197	284	65
MW-116	*255*	237	217	146	153	131	251	179	331	376	286	285	315	412	300	260	211
MW-33S	*181*	233	91	101	111	55	183	231	269	349	270	261	263	439	301	296	223
MW-33M	*242*	245	-	-	-	106	-	-	309	-	-	-	279	-	280	-33	-133

Notes:
- = Not Measured

Table 4
Groundwater Field Parameter Data
Raytheon Company
Wayland, Massachusetts

Well ID	Conductivity (mS/cm)																
	(Baseline) 5-Oct-01	8-Oct-01	10-Oct-01	12-Oct-01	14-Oct-01	16-Oct-01	18-Oct-01	20-Oct-01	22-Oct-01	24-Oct-01	26-Oct-01	28-Oct-01	30-Oct-01	1-Nov-01	5-Nov-01	12-Nov-01	10-Dec-01
MW-43 Pilot Study Area																	
MW-104	*1,721*	1,573	-	-	-	2,759	-	-	2,812	-	-	-	2,265	-	2155	-	1603
MW-105	*1,387*	1,245	-	-	-	1,420	-	-	1,266	-	-	-	1,144	-	1140	-	1192
MW-106	*753*	700	-	-	-	946	-	-	978	-	-	-	952	-	900	-	1078
MW-43S	*1,107*	397	-	-	-	5,348	-	-	2,945	-	-	-	1,746	-	1644	-	1172
MW-33 Pilot Study Area																	
MW-107	*807*	785	937	-	-	917	-	-	841	-	-	-	850	-	848	797	789
MW-108	*219*	91	206	-	-	233	-	-	216	-	-	-	241	-	285	370	453
MW-109	*428*	916	-	-	-	400	-	-	384	-	-	-	390	-	412	373	407
MW-110	*70*	2,728	-	-	-	265	-	-	129	-	-	-	94	-	83	74	75
MW-111	*276*	213	252	248	239	221	206	196	205	208	198	186	197	193	195	180	179
MW-112	*140*	426	135	119	106	105	97	102	103	105	98	93	100	103	103	100	91
MW-113	*342*	278	370	365	342	336	309	301	321	330	307	287	305	311	310	288	290
MW-114	*109*	245	117	100	97	95	93	101	97	102	92	82	87	91	85	93	92
MW-115	*325*	265	341	334	320	311	271	283	299	301	283	272	290	290	293	284	297
MW-116	*149*	152	177	186	155	149	128	136	140	138	127	118	124	120	124	115	114
MW-33S	*65*	76	90	130	79	76	70	67	76	77	74	69	74	73	73	70	76
MW-33M	*271*	242	-	-	-	297	-	-	277	-	-	-	264	-	263	255	237

Notes:
- = Not Measured

Table 4
Groundwater Field Parameter Data
Raytheon Company
Wayland, Massachusetts

Well ID	Dissolved Oxygen (mg/L)																
	(Baseline) 5-Oct-01	8-Oct-01	10-Oct-01	12-Oct-01	14-Oct-01	16-Oct-01	18-Oct-01	20-Oct-01	22-Oct-01	24-Oct-01	26-Oct-01	28-Oct-01	30-Oct-01	1-Nov-01	5-Nov-01	12-Nov-01	10-Dec-01
MW-43 Pilot Study Area																	
MW-104	*9.3*	9.0	-	-	-	3.6	-	-	6.6	-	-	-	11.9	-	17.1	-	8.4
MW-105	*8.4*	7.2	-	-	-	2.7	-	-	2.1	-	-	-	6.7	-	12.2	-	5.9
MW-106	*8.2*	9.6	-	-	-	6.8	-	-	7.1	-	-	-	10.0	-	12.0	-	7.7
MW-43S	*8.2*	8.3	-	-	-	8.0	-	-	7.0	-	-	-	7.8	-	12.3	-	9.1
MW-33 Pilot Study Area																	
MW-107	*5.6*	7.4	2.7	-	-	3.5	-	-	0.9	-	-	-	2.3	-	6.2	0.3	0.3
MW-108	*6.5*	7.6	2.0	-	-	4.1	-	-	5.2	-	-	-	4.0	-	4.1	1.0	0.6
MW-109	*4.2*	6.2	-	-	-	5.8	-	-	0.9	-	-	-	1.6	-	1.9	0.2	0.2
MW-110	*8.8*	6.2	-	-	-	3.1	-	-	3.0	-	-	-	3.8	-	4.0	3.9	4.4
MW-111	*5.2*	7.3	2.8	2.7	1.6	2.8	2.7	2.7	2.3	1.5	3.0	1.4	1.9	1.8	1.8	0.6	0.2
MW-112	*6.6*	8.6	6.2	5.6	5.5	5.5	5.9	6.2	5.2	4.8	6.4	5.3	5.1	4.7	5.3	4.3	4.1
MW-113	*6.2*	6.8	1.5	2.7	1.0	1.3	1.4	3.6	1.3	1.0	1.2	1.3	1.3	1.3	1.5	0.3	0.3
MW-114	*7.4*	8.0	5.1	4.6	3.9	4.2	3.5	5.1	3.2	3.3	3.9	4.2	4.2	4.1	4.1	3.0	2.6
MW-115	*2.0*	6.2	1.6	1.4	1.4	1.0	1.5	3.4	1.1	0.9	1.2	1.5	1.9	2.1	1.5	0.3	0.2
MW-116	*6.6*	7.3	2.4	4.5	3.8	3.1	4.1	5.2	3.5	3.7	4.3	4.2	4.8	4.5	4.9	3.8	3.7
MW-33S	*9.4*	5.8	4.0	4.4	4.3	4.9	4.6	5.0	5.1	4.0	4.1	4.3	4.7	4.3	4.4	3.8	4.1
MW-33M	*8.0*	5.6	-	-	-	2.1	-	-	3.0	-	-	-	1.8	-	1.8	0.4	0.2

Notes:
- = Not Measured

Table 4
Groundwater Field Parameter Data
Raytheon Company
Wayland, Massachusetts

Well ID	pH																
	(Baseline) 5-Oct-01	8-Oct-01	10-Oct-01	12-Oct-01	14-Oct-01	16-Oct-01	18-Oct-01	20-Oct-01	22-Oct-01	24-Oct-01	26-Oct-01	28-Oct-01	30-Oct-01	1-Nov-01	5-Nov-01	12-Nov-01	10-Dec-01
MW-43 Pilot Study Area																	
MW-104	*7.9*	7.8	-	-	-	6.9	-	-	6.8	-	-	-	7.2	-	7.3	-	7.3
MW-105	*7.0*	7.9	-	-	-	7.1	-	-	7.0	-	-	-	7.3	-	7.3	-	7.1
MW-106	*7.7*	8.1	-	-	-	7.2	-	-	7.1	-	-	-	7.3	-	7.4	-	7.7
MW-43S	*7.4*	7.9	-	-	-	7.5	-	-	7.3	-	-	-	7.7	-	7.7	-	7.9
MW-33 Pilot Study Area																	
MW-107	*6.0*	6.3	6.3	-	-	6.6	-	-	6.3	-	-	-	6.6	-	6.6	6.8	6.9
MW-108	*6.5*	6.9	6.3	-	-	6.1	-	-	6.3	-	-	-	6.0	-	6.1	5.7	5.8
MW-109	*6.5*	11.4	-	-	-	9.8	-	-	8.4	-	-	-	8.7	-	8.1	9.3	8.7
MW-110	*7.4*	9.8	-	-	-	6.7	-		5.8	-	-	-	6.2	-	6.1	6.0	5.9
MW-111	*6.5*	6.7	6.1	5.8	6.1	5.9	6.0	6.2	5.5	5.5	6.1	6.1	6.2	5.9	6.0	6.0	6.2
MW-112	*6.1*	6.5	6.5	6.2	6.4	6.2	6.1	6.1	5.6	5.6	6.2	6.2	6.1	5.9	6.0	5.9	5.9
MW-113	*6.3*	7.2	6.5	6.5	6.7	6.6	6.7	6.8	6.4	6.4	6.7	6.9	6.8	6.9	6.7	6.9	7.0
MW-114	*6.5*	7.2	5.9	6.1	6.1	6.1	6.3	6.3	5.5	5.7	6.1	6.2	6.0	6.0	6.0	5.9	6.0
MW-115	*6.6*	6.8	6.0	6.2	6.4	6.5	6.6	7.3	6.3	6.1	6.5	6.6	6.5	6.6	6.6	6.6	7.0
MW-116	*6.7*	7.5	5.6	6.2	6.0	6.0	6.1	6.4	5.6	5.4	5.9	6.0	5.9	6.0	6.0	5.8	5.8
MW-33S	*6.1*	8.0	6.0	7.3	6.8	5.9	5.9	5.8	5.7	5.6	6.3	5.9	5.6	6.2	5.8	5.6	5.8
MW-33M	*6.5*	6.6	-	-	-	6.8	-	-	6.5	-	-	-	7.0	-	7.2	7.5	7.8

Notes:
- = Not Measured

Table 4
Groundwater Field Parameter Data
Raytheon Company
Wayland, Massachusetts

Well ID	Temperature (°C)																
	(Baseline) 5-Oct-01	8-Oct-01	10-Oct-01	12-Oct-01	14-Oct-01	16-Oct-01	18-Oct-01	20-Oct-01	22-Oct-01	24-Oct-01	26-Oct-01	28-Oct-01	30-Oct-01	1-Nov-01	5-Nov-01	12-Nov-01	10-Dec-01
MW-43 Pilot Study Area																	
MW-104	*16.4*	11.3	-	-	-	17.3	-	-	15.3	-	-	-	12.3	-	12.8	-	10.7
MW-105	*16.0*	12.2	-	-	-	17.0	-	-	15.4	-	-	-	13.1	-	12.8	-	11.1
MW-106	*17.7*	11.3	-	-	-	16.5	-	-	16.8	-	-	-	13.7	-	12.3	-	11.6
MW-43S	*16.3*	14.1	-	-	-	16.6	-	-	15.3	-	-	-	14.0	-	13.3	-	11.6
MW-33 Pilot Study Area																	
MW-107	*17.9*	12.1	17.7	-	-	17.9	-	-	17.2	-	-	-	15.1	-	13.8	14.1	13.5
MW-108	*17.3*	12.5	17.9	-	-	17.4	-	-	18.0	-	-	-	15.9	-	14.4	14.5	14.5
MW-109	*18.4*	13.4	-	-	-	16.3	-	-	15.7	-	-	-	14.5	-	13.4	14.0	13.6
MW-110	*16.8*	12.7	-	-	-	17.7	-	-	18.4	-	-	-	14.7	-	12.9	13.9	12.5
MW-111	*18.7*	11.2	16.2	17.1	15.3	16.7	14.4	14.0	15.3	16.0	13.6	12.0	13.1	14.2	12.9	12.0	11.5
MW-112	*20.1*	11.1	16.5	17.0	15.1	16.4	14.7	13.8	15.0	16.3	13.9	12.7	13.2	14.2	13.1	11.3	11.3
MW-113	*19.0*	11.5	17.8	17.2	15.2	16.4	14.7	14.5	15.6	16.8	14.2	11.6	13.3	13.9	12.5	10.3	10.3
MW-114	*19.0*	12.1	16.9	17.0	16.1	16.2	15.1	13.9	15.6	16.2	13.7	12.2	13.6	13.7	13.0	11.5	12.1
MW-115	*18.1*	10.7	17.0	16.8	15.2	15.9	12.4	14.1	15.5	16.0	13.9	12.3	13.9	13.5	13.0	11.6	11.7
MW-116	*18.2*	10.0	17.3	17.8	15.4	15.9	12.9	14.6	16.0	16.4	14.7	12.6	13.9	13.6	13.5	11.9	12.3
MW-33S	*14.4*	10.2	16.8	16.6	14.5	15.7	13.9	13.6	15.3	16.7	15.2	12.2	14.1	12.7	12.2	10.9	10.7
MW-33M	*16.5*	10.2	-	-	-	16.9	-	-	15.8	-	-	-	13.5	-	12.0	11.4	11.5

Notes:
- = Not Measured

Table 4
Groundwater Field Parameter Data
Raytheon Company
Wayland, Massachusetts

Well ID	Color																
	(Baseline) 5-Oct-01	8-Oct-01	10-Oct-01	12-Oct-01	14-Oct-01	16-Oct-01	18-Oct-01	20-Oct-01	22-Oct-01	24-Oct-01	26-Oct-01	28-Oct-01	30-Oct-01	1-Nov-01	5-Nov-01	12-Nov-01	10-Dec-01
MW-43 Pilot Study Area																	
MW-104	Brown	Brown	-	-	-	Dark Pink/Purple	-	-	Dark Pink/Purple	-	-	-	Dark Pink/Purple	-	Dark Pink/Purple	-	Dark Pink/Purple
MW-105	Brown	Brown	-	-	-	Light Brown	-	-	Light Brown	-	-	-	Brown/Grey	-	Brown/Grey	-	Clear
MW-106	Brown/Grey	Brown/Grey	-	-	-	Brown	-	-	Brown	-	-	-	Brown/Grey	-	Brown/Grey	-	Clear
MW-43S	Clear	DarkPink/Purple	-	-	-	DarkPink/Purple			Dark Pink/Purple	-	-	-	Dark Pink/Purple	-	Dark Pink/Purple	-	Dark Pink/Purple
MW-33 Pilot Study Area					-												
MW-107	Brown/Grey	Brown/Grey	Grey	-	-	Brown/Grey	-	-	Grey	-	-	-	Grey	-	Brown/Grey	Clear	Grey
MW-108	Clear	Clear	Clear	-	-	Clear	-	-	Clear	-	-	-	Clear	-	Clear	Clear	Clear
MW-109	Brown	Dark Pink/Purple	-	-	-	Light Pink/Pink	-	-	Dark Tan/Brown	-	-	-	Grey	-	Brown/Grey	Brown/Grey	Brown
MW-110	Brown	Dark Pink/Purple	-	-	-	DarkPink	-	-	Light Pink/Pink	-	-	-	Light Pink	-	Light Pink/Brown	Light Pink	Light Brown
MW-111	Clear	Brown/Grey	Brown	Grey	Clear	Clear	Grey/Brown	Clear	Brown	Brown/Grey	Clear	Clear	Clear	Clear	Clear	Clear	Clear
MW-112	Clear	Brown	Brown	Brown	Brown	Clear	Grey	Clear	Brown	Brown/Grey	Grey	Grey	Grey	Clear	Clear	Clear	Clear
MW-113	Brown	Brown	Brown/Grey	Brown/Grey	Brown	Clear	Grey	Clear	Brown/Grey	Clear	Clear	Clear	Grey	Clear	Brown/Grey	Brown/Grey	Brown
MW-114	Brown	Brown/Grey	Brown/Grey	Clear	Brown	Clear	Clear	Clear	Brown/Grey	Clear	Clear	Brown	Grey	Clear	Brown/Grey	Clear	Clear
MW-115	Brown	Clear	Brown/Grey	Clear	Clear	Clear	Clear	Clear	Brown/Grey	Clear	Clear	Brown	Clear	Clear	Clear	Clear	Clear
MW-116	Clear	Clear	Brown/Grey	Clear	Clear	Clear	Clear	Clear	Brown/Grey	Clear	Clear	Brown	Clear	Clear	Clear	Clear	Clear
MW-33S	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear
MW-33M	Clear	Brown/Grey	-	-	-	Clear	-	-	Clear	-	-	-	Clear	-	Clear	Clear	Clear

Notes:
- = Not Measured

Table 5A
Groundwater Quality Data
MW-33 Pilot Study Area
Raytheon Company
Wayland, Massachusetts

Parameter / Sample I.D. / Date Sampled / Comments	Method 1 GW-1 Cleanup Standard (mg/L)	MW-33S 27-Aug-01	MW-33S 05-Nov-01	MW-33S 12-Nov-01	MW-33S 10-Dec-01 low-flow	MW-33S 10-Dec-01 bailer
Organics						
Volatile Organic Compounds (VOCs) (µg/l)			NA			
Trichloroethene	5	240		380	360	350
cis-1,2-Dichloroethene	70	-		-	-	-
1,1,1-Trichloroethane	200	78		120	110	110
1,1-Dichloroethene	7	-		-	-	-
Inorganics						
Dissolved Metals (mg/L)			NA	NA	NA	NA
Manganese	NS	0.01				
Chromium (III)	100	-				
Other Ions						
Fluoride (mg/L)	NS	0.39	-	-	-	-
Field Parameters						
pH	NS	6.0	5.8	5.6	5.8	5.8
Conductivity (mS/cm)	NS	76	73	70	76	85
Temperature (°C)	NS	13.3	12.2	10.9	10.7	11.8
Oxidation Reduction Potential (mV)	NS	307	301	296	223	123
Dissolved Oxygen (mg/L)	NS	6.5	4.4	3.8	4.1	4.9
Color	NS	Brown	Clear	Clear	Clear	Clear

Notes:

- = Analytical result below the method detection limit.
NA = Not Analyzed
NS = No Standard
µg/l=micrograms per liter (parts per billion (ppb))
GW samples were collected during step drawdown tests for well MW-33S on August 27, 2001.
Analytical results are not representative of ambient

Table 5A
Groundwater Quality Data
MW-33 Pilot Study Area
Raytheon Company
Wayland, Massachusetts

Parameter / Sample I.D. / Date Sampled / Comments	Method 1 GW-1 Cleanup Standard (mg/L)	MW-33M 27-Aug-01	MW-33M 05-Nov-01	MW-33M 12-Nov-01	MW-33M 10-Dec-01
Organics					
Volatile Organic Compounds (VOCs) (µg/l)			NA		
Trichloroethene	5	3.1		8.6	9.3
cis-1,2-Dichloroethene	70	-		0.97	0.69
1,1,1-Trichloroethane	200	-		-	-
1,1-Dichloroethene	7	-		-	-
Inorganics					
Dissolved Metals (mg/L)			NA	NA	NA
Manganese	NS	0.73			
Chromium (III)	100	-			
Other Ions					
Fluoride (mg/L)	NS	0.28	-	-	-
Field Parameters					
pH	NS	6.7	7.2	7.5	7.8
Conductivity (mS/cm)	NS	215	263	237	237
Temperature (°C)	NS	17.9	12.0	11.4	11.5
Oxidation Reduction Potential (mV)	NS	188	280	-33	-1,328
Dissolved Oxygen (mg/L)	NS	5.0	1.8	0.4	0.2
Color	NS	Grey	Clear	Clear	Clear

Notes:

- = Analytical result below the method detection limit.
NA = Not Analyzed
NS = No Standard
µg/l=micrograms per liter (parts per billion (ppb))
GW samples were collected during step drawdown tests for well MW-33S on August 27, 2001.
Analytical results are not representative of ambient

Table 5A
Groundwater Quality Data
MW-33 Pilot Study Area
Raytheon Company
Wayland, Massachusetts

Parameter / Sample I.D. / Date Sampled / Comments	Method 1 GW-1 Cleanup Standard (mg/L)	MW-107 28-Aug-01	MW-107 08-Oct-01	MW-107 16-Oct-01	MW-107 05-Nov-01	MW-107 13-Nov-01	MW-107 11-Dec-01
Organics							
Volatile Organic Compounds (VOCs) (µg/l)			NA	NA	NA		
Trichloroethene	5	34				65	68
cis-1,2-Dichloroethene	70	2.0				3.4	2.6
1,1,1-Trichloroethane	200	-				-	-
1,1-Dichloroethene	7	-				-	-
Inorganics							
Dissolved Metals (mg/L)			NA	NA	NA	NA	NA
Manganese	NS	3.3					
Chromium (III)	100	-					
Other Ions							
Fluoride (mg/L)	NS	1.6	0.45	-	0.62	0.36	0.73
Field Parameters							
pH	NS	6.8	6.3	6.6	6.6	6.8	6.9
Conductivity (mS/cm)	NS	592	785	917	848	797	789
Temperature (°C)	NS	17.1	12.1	17.9	13.8	14.1	13.5
Oxidation Reduction Potential (mV)	NS	-438	535	46	6	-65	-71
Dissolved Oxygen (mg/L)	NS	1.0	7.4	3.5	6.2	0.3	0.3
Color	NS	-	Brown/Grey	Brown/Grey	Brown/Grey	Clear	Grey

Notes:

- = Analytical result below the method detection limit.
NA = Not Analyzed
NS = No Standard
µg/l=micrograms per liter (parts per billion (ppb))
GW samples were collected during step drawdown tests for well MW-33S on August 27, 2001.
Analytical results are not representative of ambient

Table 5A
Groundwater Quality Data
MW-33 Pilot Study Area
Raytheon Company
Wayland, Massachusetts

Parameter / Sample I.D. / Date Sampled / Comments	Method 1 GW-1 Cleanup Standard (mg/L)	MW-108 28-Aug-01	MW-108 08-Oct-01	MW-108 16-Oct-01	MW-108 05-Nov-01	MW-108 13-Nov-01	MW-108 11-Dec-01
Organics							
Volatile Organic Compounds (VOCs) (µg/l)			NA	NA	NA		
Trichloroethene	5	1.4				3.7	4.6
cis-1,2-Dichloroethene	70	-				-	-
1,1,1-Trichloroethane	200	-				-	-
1,1-Dichloroethene	7	-				-	-
Inorganics							
Dissolved Metals (mg/L)			NA	NA	NA	NA	NA
Manganese	NS	1.7					
Chromium (III)	100	-					
Other Ions							
Fluoride (mg/L)	NS	-	-	-	-	-	-
Field Parameters							
pH	NS	5.7	6.9	6.1	6.1	5.7	5.8
Conductivity (mS/cm)	NS	159	91	233	285	370	453
Temperature (°C)	NS	17.8	12.5	17.4	14.4	14.5	14.5
Oxidation Reduction Potential (mV)	NS	100	635	268	455	366	251
Dissolved Oxygen (mg/L)	NS	1.1	7.6	4.1	4.1	1.0	0.6
Color	NS	Clear	Clear	Clear	Clear	Clear	Clear

Notes:

- = Analytical result below the method detection limit.
NA = Not Analyzed
NS = No Standard
µg/l=micrograms per liter (parts per billion (ppb))
GW samples were collected during step drawdown tests for well MW-33S on August 27, 2001.
Analytical results are not representative of ambient

Table 5A
Groundwater Quality Data
MW-33 Pilot Study Area
Raytheon Company
Wayland, Massachusetts

Parameter / Sample I.D. / Date Sampled / Comments	Method 1 GW-1 Cleanup Standard (mg/L)	MW-109 28-Aug-01	MW-109 08-Oct-01	MW-109 16-Oct-01	MW-109 05-Nov-01	MW-109 13-Nov-01	MW-109 11-Dec-01
Organics							
Volatile Organic Compounds (VOCs) (µg/l)			NA	NA	NA		
Trichloroethene	5	18				26	35
cis-1,2-Dichloroethene	70	1.6				2.0	2.3
1,1,1-Trichloroethane	200	-				-	-
1,1-Dichloroethene	7	-				-	-
Inorganics							
Dissolved Metals (mg/L)			NA	NA	NA	NA	NA
Manganese	NS	1.5					
Chromium (III)	100	-					
Other Ions							
Fluoride (mg/L)	NS	0.55	4.4	2.6	2.2	0.45	2.6
Field Parameters							
pH	NS	6.5	11.4	9.8	8.1	9.3	8.7
Conductivity (mS/cm)	NS	271	916	400	412	373	407
Temperature (°C)	NS	17.5	13.4	16.3	13.4	14.0	13.6
Oxidation Reduction Potential (mV)	NS	-151	415	380	239	165	203
Dissolved Oxygen (mg/L)	NS	1.2	6.2	5.8	1.9	0.2	0.2
Color	NS	-	Purple	Pink	Brown/Grey	Brown/Grey	Brown

Notes:

- = Analytical result below the method detection limit.
NA = Not Analyzed
NS = No Standard
µg/l=micrograms per liter (parts per billion (ppb))
GW samples were collected during step drawdown tests for well MW-33S on August 27, 2001.
Analytical results are not representative of ambient

Table 5A
Groundwater Quality Data
MW-33 Pilot Study Area
Raytheon Company
Wayland, Massachusetts

Parameter / Sample I.D. / Date Sampled / Comments	Method 1 GW-1 Cleanup Standard (mg/L)	MW-110 28-Aug-01	MW-110 08-Oct-01	MW-110 16-Oct-01	MW-110 05-Nov-01	MW-110 13-Nov-01	MW-110 11-Dec-01
Organics							
Volatile Organic Compounds (VOCs) (µg/l)		-	NA	NA	NA	-	-
Trichloroethene	5						
cis-1,2-Dichloroethene	70						
1,1,1-Trichloroethane	200						
1,1-Dichloroethene	7						
Inorganics							
Dissolved Metals (mg/L)			NA	NA	NA	NA	NA
Manganese	NS	0.24					
Chromium (III)	100	-					
Other Ions							
Fluoride (mg/L)	NS	0.32	7.9	2.4	0.66	0.43	0.44
Field Parameters							
pH	NS	5.9	9.8	6.7	6.1	6.0	5.9
Conductivity (mS/cm)	NS	72	2728	265	83	74	75
Temperature (°C)	NS	16.6	12.7	17.7	12.9	13.9	12.5
Oxidation Reduction Potential (mV)	NS	110	500	441	561	559	207
Dissolved Oxygen (mg/L)	NS	5.0	6.2	3.1	4.0	3.9	4.4
Color	NS	-	Purple	Pink	Light Pink	Pink/Brown	Brown

Notes:

- = Analytical result below the method detection limit.
NA = Not Analyzed
NS = No Standard
µg/l=micrograms per liter (parts per billion (ppb))
GW samples were collected during step drawdown tests for well MW-33S on August 27, 2001.
Analytical results are not representative of ambient

Table 5A
Groundwater Quality Data
MW-33 Pilot Study Area
Raytheon Company
Wayland, Massachusetts

Parameter / Sample I.D. / Date Sampled / Comments	Method 1 GW-1 Cleanup Standard (mg/L)	MW-111 28-Aug-01	MW-111 14-Oct-01	MW-111 24-Oct-01	MW-111 05-Nov-01	MW-111 13-Nov-01	MW-111 11-Dec-01
Organics							
Volatile Organic Compounds (VOCs) (µg/l)			NA	NA	NA		
Trichloroethene	5	70				9.3	6.6
cis-1,2-Dichloroethene	70	-				-	-
1,1,1-Trichloroethane	200	24				2	-
1,1-Dichloroethene	7	0.72				-	-
Inorganics							
Dissolved Metals (mg/L)			NA	NA	NA	NA	NA
Manganese	NS	1.1					
Chromium (III)	100	-					
Other Ions							
Fluoride (mg/L)	NS	0.48	-	-	-	-	-
Field Parameters							
pH	NS	6.0	6.1	5.5	6.0	6.0	6.2
Conductivity (mS/cm)	NS	239	239	208	195	180	179
Temperature (°C)	NS	16.0	15.3	16.0	12.9	12.0	11.5
Oxidation Reduction Potential (mV)	NS	-434	209	367	221	190	175
Dissolved Oxygen (mg/L)	NS	0.8	1.6	1.5	1.8	0.6	0.2
Color	NS	-	Brown/Grey	Clear	Clear	Clear	Clear

Notes:

- = Analytical result below the method detection limit.
NA = Not Analyzed
NS = No Standard
µg/l=micrograms per liter (parts per billion (ppb))
GW samples were collected during step drawdown tests for well MW-33S on August 27, 2001.
Analytical results are not representative of ambient

Table 5A
Groundwater Quality Data
MW-33 Pilot Study Area
Raytheon Company
Wayland, Massachusetts

Parameter / Sample I.D. / Date Sampled / Comments	Method 1 GW-1 Cleanup Standard (µg/L)	MW-112 28-Aug-01	MW-112 14-Oct-01	MW-112 24-Oct-01	MW-112 05-Nov-01	MW-112 13-Nov-01	MW-112 11-Dec-01
Organics							
Volatile Organic Compounds (VOCs) (µg/l)			NA	NA	NA		
Trichloroethene	5	82				47	37
cis-1,2-Dichloroethene	70	-				-	-
1,1,1-Trichloroethane	200	29				15	12
1,1-Dichloroethene	7	-				-	-
Inorganics							
Dissolved Metals (mg/L)			NA	NA	NA	NA	NA
Manganese	NS	0.13					
Chromium (III)	100	-					
Other Ions							
Fluoride (mg/L)	NS	-	-	-	-	-	-
Field Parameters							
pH	NS	6.1	6.4	5.6	6.0	5.9	5.9
Conductivity (mS/cm)	NS	324	106	105	103	100	91
Temperature (°C)	NS	16.2	15.1	16.3	13.1	11.3	11.3
Oxidation Reduction Potential (mV)	NS	161	195	384	264	293	198
Dissolved Oxygen (mg/L)	NS	6.2	5.5	4.8	5.3	4.3	4.1
Color	NS	-	Brown	Clear	Clear	Clear	Clear

Notes:

- = Analytical result below the method detection limit.
NA = Not Analyzed
NS = No Standard
µg/l=micrograms per liter (parts per billion (ppb))
GW samples were collected during step drawdown tests for well MW-33S on August 27, 2001.
Analytical results are not representative of ambient

Table 5A
Groundwater Quality Data
MW-33 Pilot Study Area
Raytheon Company
Wayland, Massachusetts

Parameter / Sample I.D. / Date Sampled / Comments	Method 1 GW-1 Cleanup Standard (mg/L)	MW-113 29-Aug-01	MW-113 12-Oct-01	MW-113 24-Oct-01	MW-113 05-Nov-01	MW-113 12-Nov-01	MW-113 11-Dec-01	MW-113 11-Dec-01 DUP-1
Organics								
Volatile Organic Compounds (VOCs) (µg/l)			NA	NA	NA			
Trichloroethene	5	24				14	14	12
cis-1,2-Dichloroethene	70	-				0.9	0.71	-
1,1,1-Trichloroethane	200	6.5				0.55	-	-
1,1-Dichloroethene	7	-				-	-	-
Inorganics								
Dissolved Metals (mg/L)			NA	NA	NA	NA	NA	NA
Manganese	NS	1.5						
Chromium (III)	100	-						
Other Ions								
Fluoride (mg/L)	NS	-	-	-	-	-	-	-
Field Parameters								
pH	NS	6.1	6.5	6.4	6.7	6.9	7.0	7.0
Conductivity (mS/cm)	NS	306	365	330	310	288	290	290
Temperature (°C)	NS	16.3	17.2	16.8	12.5	10.3	10.3	10.3
Oxidation Reduction Potential (mV)	NS	-410	212	339	176	83	96	96
Dissolved Oxygen (mg/L)	NS	0.4	2.7	1.0	1.5	0.3	0.3	0.3
Color	NS		Brown	Clear	Brown/Grey	Brown/Grey	Brown	Brown

Notes:

- = Analytical result below the method detection limit.
NA = Not Analyzed
NS = No Standard
µg/l=micrograms per liter (parts per billion (ppb))
GW samples were collected during step drawdown tests for well MW-33S on August 27, 2001.
Analytical results are not representative of ambient

Table 5A
Groundwater Quality Data
MW-33 Pilot Study Area
Raytheon Company
Wayland, Massachusetts

Parameter / Sample I.D. / Date Sampled / Comments	Method 1 GW-1 Cleanup Standard (mg/L)	MW-114 28-Sep-01	MW-114 14-Oct-01	MW-114 24-Oct-01	MW-114 05-Nov-01	MW-114 12-Nov-01	MW-114 10-Dec-01
Organics							
Volatile Organic Compounds (VOCs) (µg/l)			NA	NA	NA		
Trichloroethene	5	23				24	14
cis-1,2-Dichloroethene	70	-				-	-
1,1,1-Trichloroethane	200	5.5				8.4	4.2
1,1-Dichloroethene	7	-				-	-
Inorganics							
Dissolved Metals (mg/L)			NA	NA	NA	NA	NA
Manganese	NS	1.7					
Chromium (III)	100	-					
Other Ions							
Fluoride (mg/L)	NS	-	-	-	-	-	-
Field Parameters							
pH	NS	6.7	6.1	5.7	6.0	5.9	6.0
Conductivity (mS/cm)	NS	139	97	102	85	93	92
Temperature (°C)	NS	14.5	16.1	16.2	13.0	11.5	12.1
Oxidation Reduction Potential (mV)	NS	-197	176	364	264	287	203
Dissolved Oxygen (mg/L)	NS	2.1	3.9	3.3	4.1	3.0	2.6
Color	NS	-	Brown/Grey	Clear	Brown/Grey	Brown/Grey	Clear

Notes:

- = Analytical result below the method detection limit.
NA = Not Analyzed
NS = No Standard
µg/l=micrograms per liter (parts per billion (ppb))
GW samples were collected during step drawdown tests for well MW-33S on August 27, 2001.
Analytical results are not representative of ambient

Table 5A
Groundwater Quality Data
MW-33 Pilot Study Area
Raytheon Company
Wayland, Massachusetts

Parameter / Sample I.D. / Date Sampled / Comments	Method 1 GW-1 Cleanup Standard (mg/L)	MW-115 29-Aug-01	MW-115 14-Oct-01	MW-115 24-Oct-01	MW-115 05-Nov-01	MW-115 12-Nov-01	MW-115 10-Dec-01
Organics							
Volatile Organic Compounds (VOCs) (µg/l)			NA	NA	NA		
Trichloroethene	5	81				60	41
cis-1,2-Dichloroethene	70	-				-	-
1,1,1-Trichloroethane	200	24				17	10
1,1-Dichloroethene	7	-				-	-
Inorganics							
Dissolved Metals (mg/L)			NA	NA	NA	NA	NA
Manganese	NS	1.7					
Chromium (III)	100	-					
Other Ions							
Fluoride (mg/L)	NS	-	-	-	-	-	-
Field Parameters							
pH	NS	6.3	6.4	6.1	6.6	6.6	7.0
Conductivity (mS/cm)	NS	315	320	301	293	284	297
Temperature (°C)	NS	16.4	15.2	16.0	13.0	11.6	11.7
Oxidation Reduction Potential (mV)	NS	-480	176	304	197	284	65
Dissolved Oxygen (mg/L)	NS	1.5	1.4	0.9	1.5	0.3	0.2
Color	NS		Clear	Clear	Clear	Clear	Clear

Notes:

- = Analytical result below the method detection limit.
NA = Not Analyzed
NS = No Standard
µg/l=micrograms per liter (parts per billion (ppb))
GW samples were collected during step drawdown tests for well MW-33S on August 27, 2001.
Analytical results are not representative of ambient

Table 5A
Groundwater Quality Data
MW-33 Pilot Study Area
Raytheon Company
Wayland, Massachusetts

Parameter / Sample I.D. / Date Sampled / Comments	Method 1 GW-1 Cleanup Standard (mg/L)	MW-116 28-Aug-01	MW-116 14-Oct-01	MW-116 24-Oct-01	MW-116 05-Nov-01	MW-116 12-Nov-01	DUP-1 12-Nov-01	MW-116 10-Dec-01
Organics								
Volatile Organic Compounds (VOCs) (µg/l)			NA	NA	NA			
Trichloroethene	5	180				130	120	81
cis-1,2-Dichloroethene	70	-				-	-	-
1,1,1-Trichloroethane	200	64				44	39	26
1,1-Dichloroethene	7	-				-	-	-
Inorganics								
Dissolved Metals (mg/L)			NA	NA	NA	NA	NA	NA
Manganese	NS	0.41						
Chromium (III)	100	-						
Other Ions								
Fluoride (mg/L)	NS	-	-	-	-	-	-	0.29
Field Parameters								
pH	NS	5.8	6.0	5.4	6.0	5.8	5.8	5.8
Conductivity (mS/cm)	NS	122	155	138	124	115	115	114
Temperature (°C)	NS	17.4	15.4	16.4	13.5	11.9	11.9	12.3
Oxidation Reduction Potential (mV)	NS	58	153	376	300	260	260	211
Dissolved Oxygen (mg/L)	NS	2.9	3.8	3.7	4.9	3.8	3.8	3.7
Color	NS	-	Clear	Clear	Clear	Clear	Clear	Clear

Notes:

- = Analytical result below the method detection limit.
NA = Not Analyzed
NS = No Standard
µg/l=micrograms per liter (parts per billion (ppb))
GW samples were collected during step drawdown tests for well MW-33S on August 27, 2001.
Analytical results are not representative of ambient

Table 5B
Groundwater Quality Data
MW-43 Pilot Study Area
Raytheon Company
Wayland, Massachusetts

Parameter / Sample I.D. / Date Sampled / Comments	Method 1 GW-1 Cleanup Standard (mg/L)	MW-43S 27-Aug-01	MW-43S 12-Dec-01	MW-43D 27-Aug-01	MW-43D 12-Dec-01
Organics					
Volatile Organic Compounds (VOCs) (µg/l)			-	-	-
Tetrachloroethene	5	5.8			
Trichloroethene	5	290			
cis-1,2-Dichloroethene	70	-			
Bromoform	5	-			
Inorganics					
Dissolved Metals (mg/L)			NA	NA	NA
Chromium (III)	100	0.01			
Manganese	NS	-			
Other Ions					
Fluoride (mg/L)	NS	1.2	NA	NA	NA
Field Parameters					
pH	NS	7.3	7.9	7.7	7.8
Conductivity (mS/cm)	NS	965	1,172	353	292
Temperature (°C)	NS	15.9	11.6	18.1	9.8
Oxidation Reduction Potential (mV)	NS	308	591	283	3,968
Dissolved Oxygen (mg/L)	NS	8.8	9.1	5.5	2.7
Color	NS	Brown	Purple	Brown/Grey	Clear

Notes:

- = Analytical result below the method detection limit.
NA = Not Analyzed
NS = No Standard
µg/l=micrograms per liter (parts per billion (ppb))
GW samples were collected during step drawdown
tests for well MW-43S on August 27, 2001.
Analytical results are not representative of ambient

Table 5B
Groundwater Quality Data
MW-43 Pilot Study Area
Raytheon Company
Wayland, Massachusetts

Parameter / Sample I.D. / Date Sampled / Comments	Method 1 GW-1 Cleanup Standard (mg/L)	MW-106 27-Aug-01	MW-106 12-Dec-01
Organics			
Volatile Organic Compounds (VOCs) (µg/l)			
Tetrachloroethene	5	3.3	-
Trichloroethene	5	160	120
cis-1,2-Dichloroethene	70	-	-
Bromoform	5	-	-
Inorganics			
Dissolved Metals (mg/L)			NA
Chromium (III)	100	-	
Manganese	NS	0.52	
Other Ions			
Fluoride (mg/L)	NS	0.3	NA
Field Parameters			
pH	NS	7.3	7.2
Conductivity (mS/cm)	NS	949	1,078
Temperature (°C)	NS	18.1	11.6
Oxidation Reduction Potential (mV)	NS	-37	257
Dissolved Oxygen (mg/L)	NS	8.5	7.7
Color	NS	Clear	Clear

Notes:

- = Analytical result below the method detection limit.
NA = Not Analyzed
NS = No Standard
µg/l=micrograms per liter (parts per billion (ppb))
GW samples were collected during step drawdown
tests for well MW-43S on August 27, 2001.
Analytical results are not representative of ambient

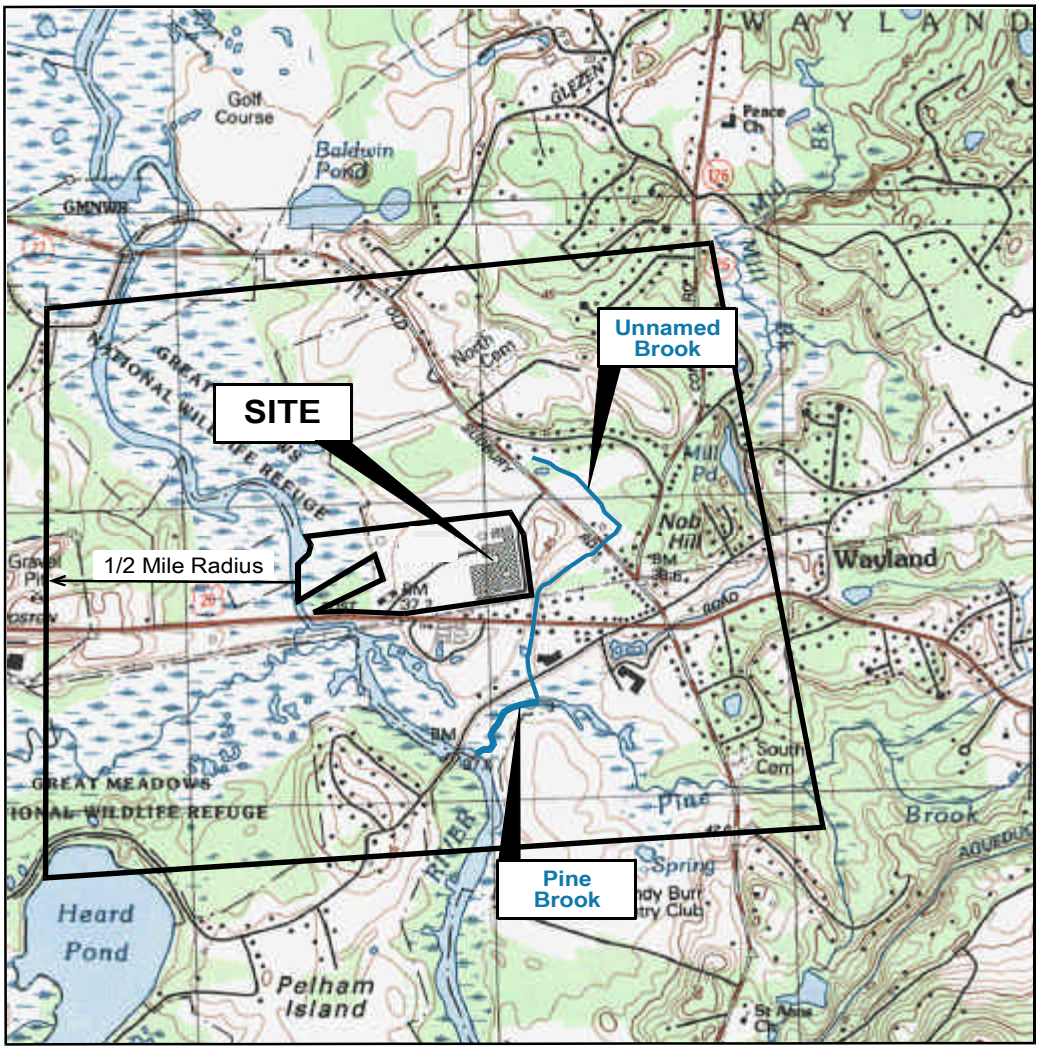
Table 5B
Groundwater Quality Data
MW-43 Pilot Study Area
Raytheon Company
Wayland, Massachusetts

Parameter / Sample I.D. / Date Sampled / Comments	Method 1 GW-1 Cleanup Standard (mg/L)	MW-104 27-Aug-01	MW-104 12-Dec-01	MW-105 27-Aug-01	DUP-1 27-Aug-01	MW-105 12-Dec-01
Organics						
Volatile Organic Compounds (VOCs) (µg/l)						
Tetrachloroethene	5	-	-	1.8	1.8	-
Trichloroethene	5	290	-	60	66	82
cis-1,2-Dichloroethene	70	-	-	12	12	1.6
Bromoform	5	-	34	-	-	-
Inorganics						
Dissolved Metals (mg/L)			NA			NA
Chromium (III)	100	-		-		
Manganese	NS	0.58		0.76	0.82	
Other Ions						
Fluoride (mg/L)	NS	0.43	NA	0.73	0.76	NA
Field Parameters						
pH	NS	7.0	7.3	7.2	7.2	7.1
Conductivity (mS/cm)	NS	1,226	1,603	1,278	1,278	1,192
Temperature (°C)	NS	17.6	10.7	17.5	17.5	11.1
Oxidation Reduction Potential (mV)	NS	-71	646	-517	-517	497
Dissolved Oxygen (mg/L)	NS	8.9	8.4	5.2	5.2	5.9
Color	NS	Clear	Dark Pink	Clear	Clear	Clear

Notes:

- = Analytical result below the method detection limit.
NA = Not Analyzed
NS = No Standard
µg/l=micrograms per liter (parts per billion (ppb))
GW samples were collected during step drawdown
tests for well MW-43S on August 27, 2001.
Analytical results are not representative of ambient

Figures



Scale 1:25,000

0.5 km 0 500 m

0.5 mi 0 1,000 ft

N

ENVIRONMENTAL RESOURCES MANAGEMENT			
399 Boylston Street, Boston, Massachusetts 02116 (617) 267-8377			
CLIENT NAME: Raytheon	*DRAWN BY:* VZ	*DATE:* 12/17/01	
FILE NAME: Locus Map	*SCALE:* 1:25,000	*PROJ:* 143.60	
Raytheon Company 430 Boston Post Road Wayland, Massachusetts			
Site Locus Map		*FIGURE NO.:* 1	
PRINCIPAL-IN-CHARGE: JD	*PROJECT MANAGER:* JMcT		

N

SCALE

140 ft 0 70 ft 140 ft

LEGEND

MW-34 ⊕	Monitoring Well
MW-1 ▲	Microwell

ENVIRONMENTAL RESOURCES MANAGEMENT

399 Boylston Street, Boston, Massachusetts 02116 (617) 267-8377

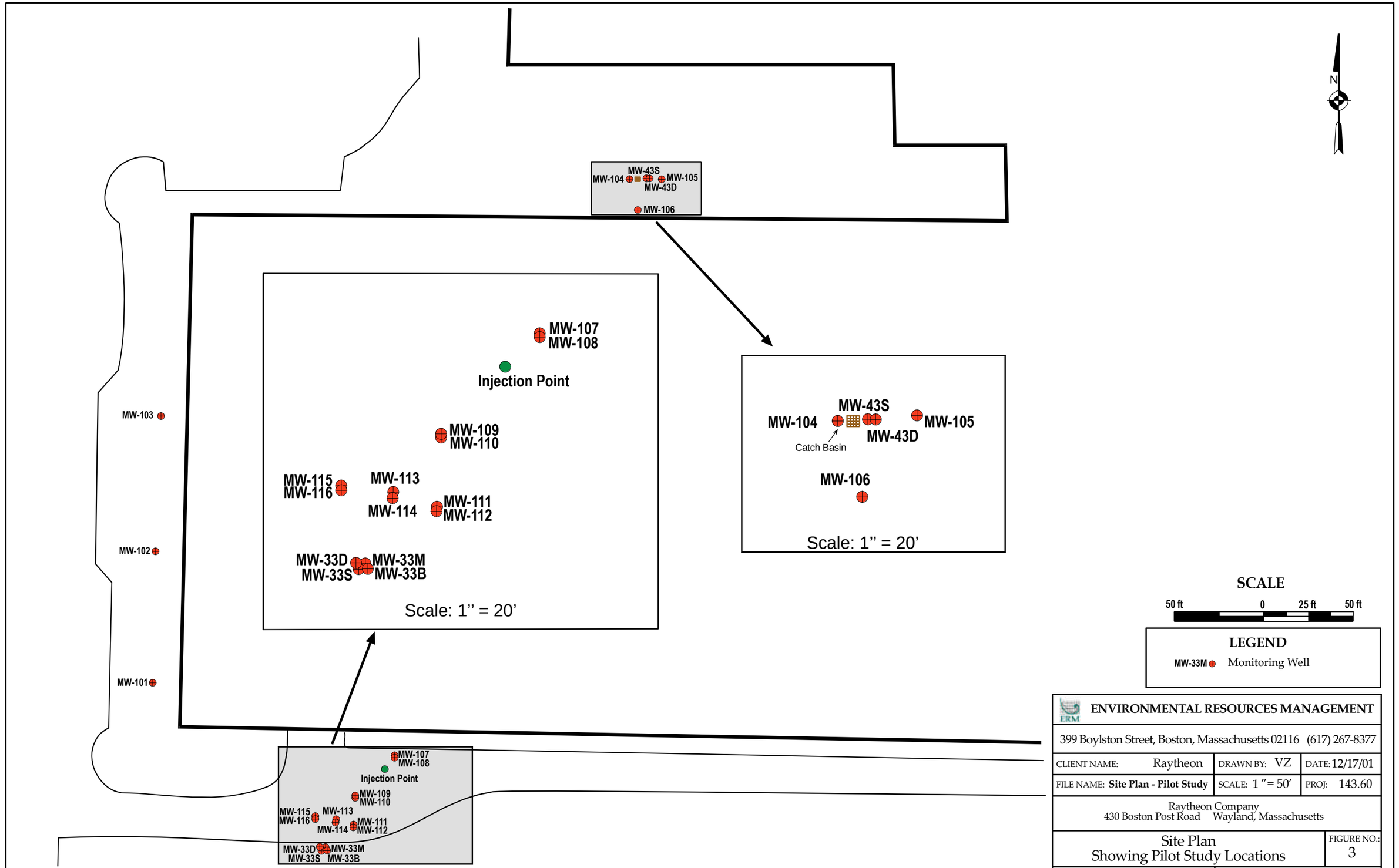
CLIENT NAME:	Raytheon	*DRAWN BY:* VZ	*DATE:* 12/17/01
FILE NAME:	Fig 1 Site Plan	*SCALE:* 1"= 140 '	*PROJ:* 143.60

Raytheon Company
430 Boston Post Road Wayland, Massachusetts

Site Plan

FIGURE NO.: 2

PRINCIPAL-IN-CHARGE: JD *PROJECT MANAGER:* JMcT



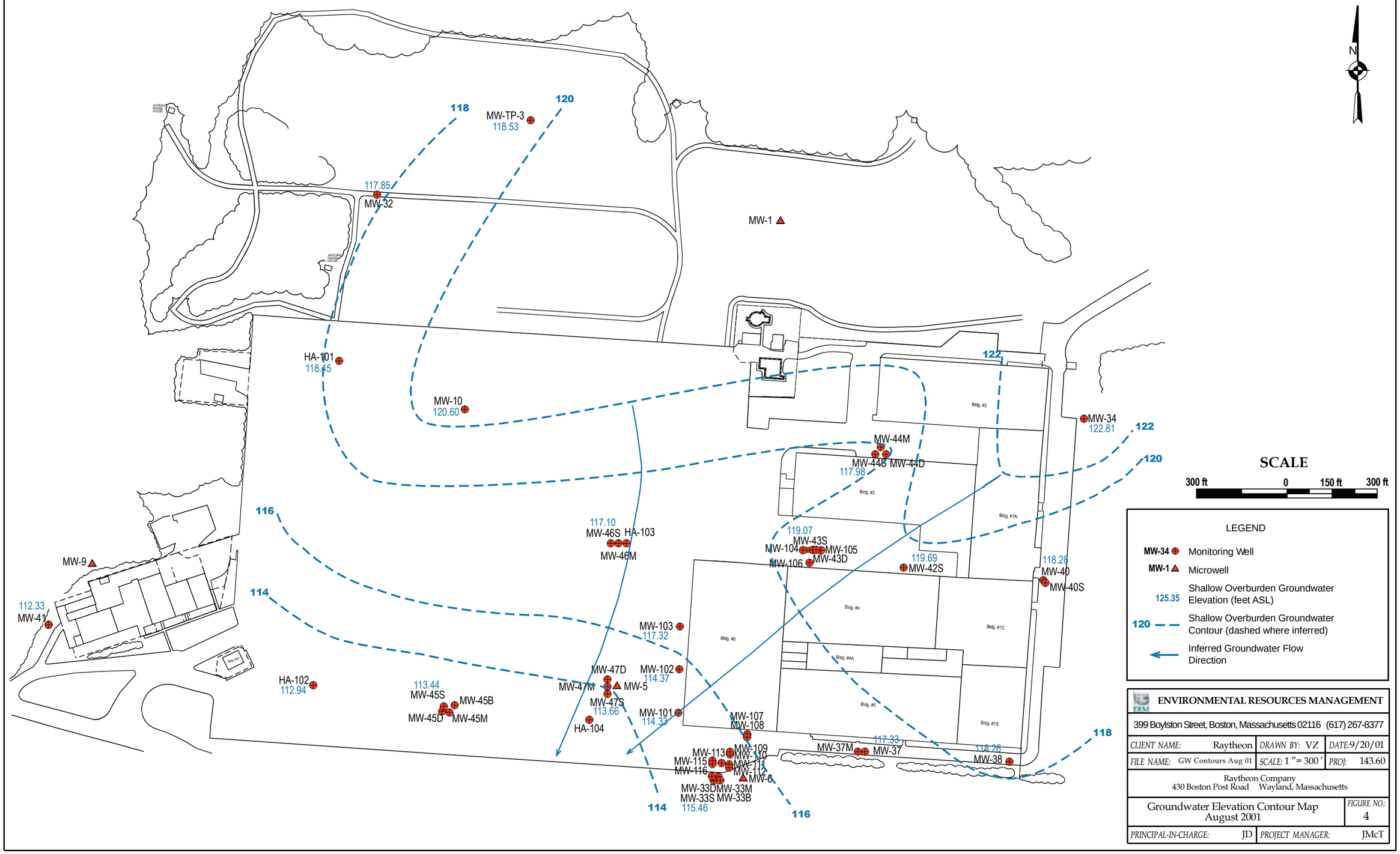
SCALE

50 ft 0 25 ft 50 ft

LEGEND

MW-33M — Monitoring Well

ENVIRONMENTAL RESOURCES MANAGEMENT		
399 Boylston Street, Boston, Massachusetts 02116 (617) 267-8377		
CLIENT NAME: Raytheon	DRAWN BY: VZ	DATE: 12/17/01
FILE NAME: **Site Plan - Pilot Study**	SCALE: 1 ''= 50'	PROJ: 143.60
Raytheon Company 430 Boston Post Road Wayland, Massachusetts		
Site Plan Showing Pilot Study Locations		FIGURE NO.: 3
PRINCIPAL-IN-CHARGE: JD	PROJECT MANAGER: JMcT	



SCALE

300 ft 0 150 ft 300 ft

LEGEND

- MW-34 — Monitoring Well
- MW-1 — Microwell
- 125.35 — Shallow Overburden Groundwater Elevation (feet ASL)
- 120 — Shallow Overburden Groundwater Contour (dashed where inferred)
- Inferred Groundwater Flow Direction

ENVIRONMENTAL RESOURCES MANAGEMENT

399 Boylston Street, Boston, Massachusetts 02116 (617) 267-8377

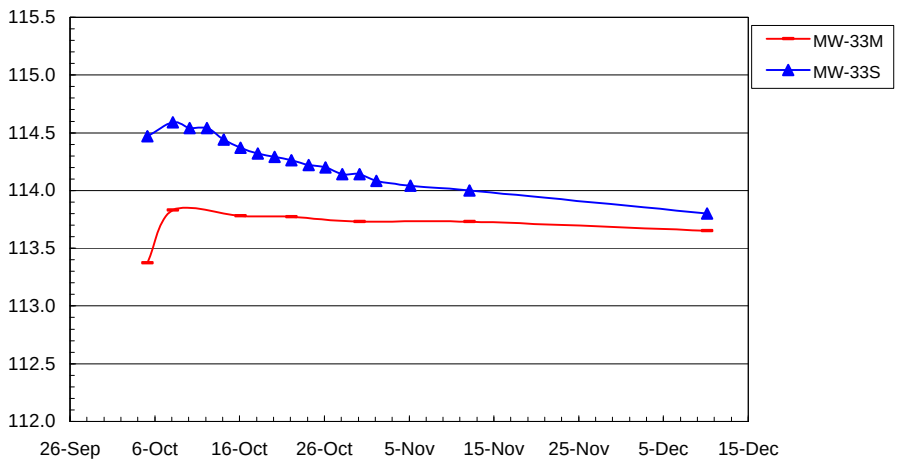
CLIENT NAME:	Raytheon	DRAWN BY: VZ	DATE: 9/20/01
FILE NAME:	GW Contours Aug 01	SCALE: 1 ″ = 300 ′	PROJ: 143.60

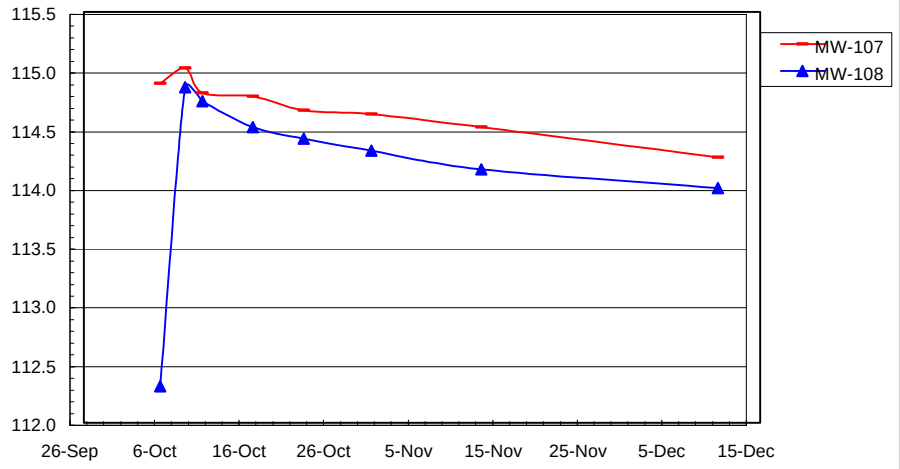
Raytheon Company
430 Boston Post Road Wayland, Massachusetts

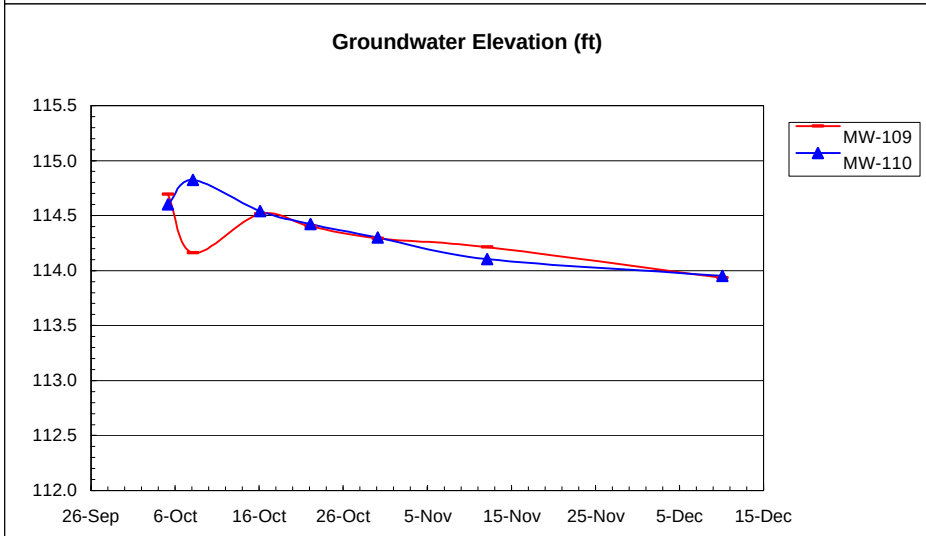
Groundwater Elevation Contour Map
August 2001

FIGURE NO: 4

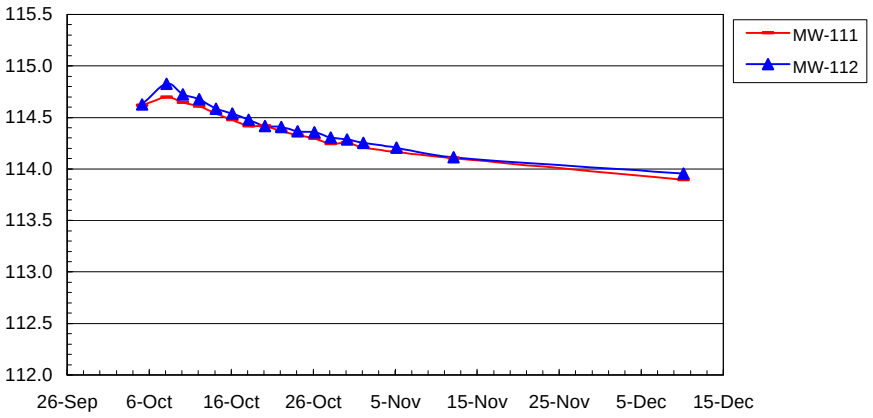
PRINCIPAL-IN-CHARGE: JD | PROJECT MANAGER: JMcT

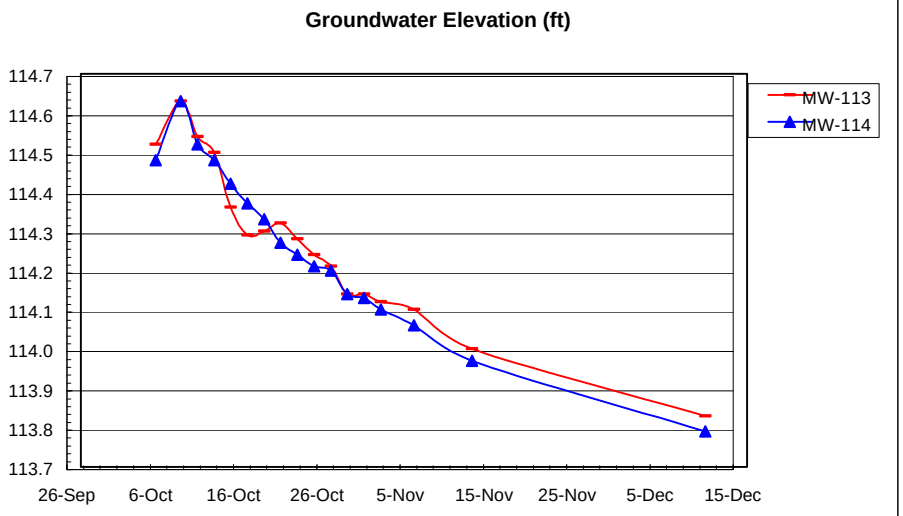


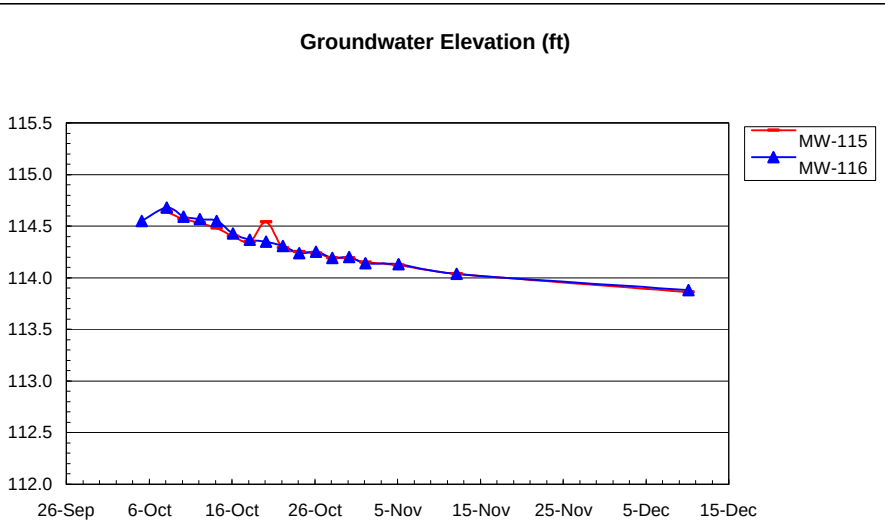




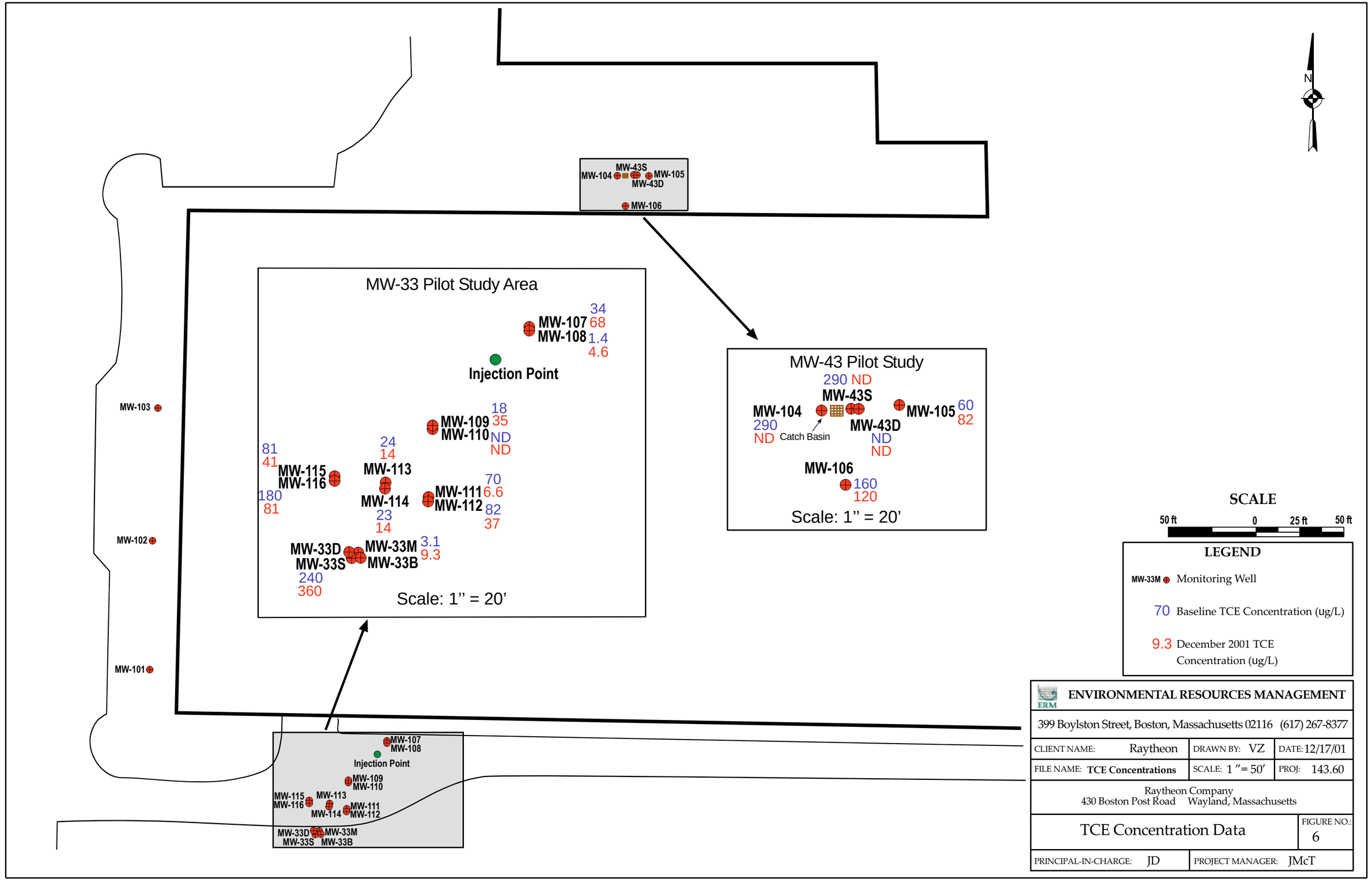
ENVIRONMENTAL RESOURCES MANAGEMENT		
399 Boylston Street, Boston, Massachusetts 02116 (617) 267-8377		
CLIENT NAME: Raytheon	*FILE NAME:* GW Elev Trends	*PROJ:* 143.60
430 Boston Post Road Wayland, MA		
Groundwater Elevation Trends		*FIGURE NO. 5A*
PRINCIPAL-IN-CHARGE: JD	*PROJECT MANAGER:* JMcT	







ENVIRONMENTAL RESOURCES MANAGEMENT		
399 Boylston Street, Boston, Massachusetts 02116 (617) 267-8377		
CLIENT NAME: Raytheon	*FILE NAME:* GW Elev Trends	*PROJ:* 143.60
430 Boston Post Road Wayland, MA		
Groundwater Elevation Trends		*FIGURE NO. 5B*
PRINCIPAL-IN-CHARGE: JD	*PROJECT MANAGER:* JMcT	



ENVIRONMENTAL RESOURCES MANAGEMENT

399 Boylston Street, Boston, Massachusetts 02116 (617) 267-8377

CLIENT NAME: Raytheon	DRAWN BY: VZ	DATE: 12/17/01
FILE NAME: **TCE Concentrations**	SCALE: 1 "= 50'	PROJ: 143.60

Raytheon Company
430 Boston Post Road Wayland, Massachusetts

TCE Concentration Data

FIGURE NO.: 6

PRINCIPAL-IN-CHARGE: JD | PROJECT MANAGER: JMcT

Appendix A
RAM Transmittal Form BWSC-106

Massachusetts Department of Environmental Protection **BWSC-106**
Bureau of Waste Site Cleanup

RELEASE & UTILITY-RELATED ABATEMENT MEASURE (RAM & URAM) TRANSMITTAL FORM

Pursuant to 310 CMR 40.0444 - 0446 and 310 CMR 40.0462 - 0465 (Subpart D)

Release Tracking: 3 - 13574

A. SITE LOCATION:

Site Name: Former Raytheon Facility

Street: 430 Boston Post Road Location Aid: Route 20

City/Town: Wayland ZIP 01778-0000

☑ Check here if a Tier Classification Submittal has been provided to DEP for this Release Tracking Number.

Related Release Tracking Numbers That This RAM or URAM

B. THIS FORM IS BEING USED TO: (check all that apply)

☐ Submit a **RAM Plan** (complete Sections A, B, C, D, E, F, J, K, L and M).

☐ Check here if this RAM Plan is an update or modification of a previously approved written RAM Plan. Date Submitted:

☑ Submit a **RAM Status Report** (complete Sections A, B, C, E, J, K, L and M).

☐ Submit a **RAM Completion Statement** (complete Sections A, B, C, D, E, G, J, K, L and M).

☐ Confirm or Provide **URAM Notification** (complete Sections A, B, H, K, L and M).

☐ Submit a **URAM Status Report** (complete Sections A, B, C, E, J, K, L and M).

☐ Submit a **URAM Completion Statement** (complete Sections A, B, C, D, E, I, J, K, L and M).

You must attach all supporting documentation required for each use of form indicated, including copies of any Legal Notices and Notices to Public Officials required by 310 CMR 40.1400.

C. SITE CONDITIONS:

☑ Check here if the source of the Release or Threat of Release is known.

If yes, check all sources that apply: ☐ UST ☐ Pipe/Hose/Line ☐ AST ☐ Drums ☐ Transformer ☐ Boat

☐ Tanker Truck ☐ Vehicle ☑ Other Specify: former manhole

Identify Media and Receptors Affected: (check all that ☐ Air ☑ Groundwater ☐ Surface Water ☐ Sediments ☐ Soil

☐ Wetlands ☐ Storm Drain ☐ Paved Surface ☐ Private Well ☐ Public Water Supply ☑ Zone 2 ☐ Residence

☐ School ☐ Unknown ☐ Other Specify:

Identify Release and/or Threat of Release Conditions at Site: (check all that apply)

☐ 2 and 72 Hour Reporting Condition(s) ☑ 120 Day Reporting Condition(s) ☐ Other Condition(s)

Describe Groundwater concentrations above applicable reportable concentrations

RAMs may be conducted concurrently with an IRA only with written DEP approval
URAMs may not be conducted if any 2 or 72 Hour conditions exist at the site.

Identify Oils and Hazardous Materials Released: (check all that ☐ Oils ☑ Chlorinated Solvents ☐ Heavy Metals

☐ Others Specify:

D. DESCRIPTION OF RESPONSE ACTIONS: (check all that apply)

☐ Assessment and/or Monitoring Only

☐ Excavation of Contaminated Soils

☐ Re-use, Recycling or Treatment

○ On Site ○ Off Site Est. Vol.: cubic yards

Describe:

☐ Store ○ On Site ○ Off Site Est. Vol.: cubic yards

☐ Deployment of Absorbant or Containment Materials

☐ Temporary Covers or Caps

☐ Bioremediation

☐ Soil Vapor Extraction

☐ Structure Venting System

☐ Product or NAPL Recovery

SECTION D IS CONTINUED ON THE NEXT PAGE.

RELEASE & UTILITY-RELATED ABATEMENT MEASURE (RAM & URAM) TRANSMITTAL FORM

Pursuant to 310 CMR 40.0444 - 0446 and 310 CMR 40.0462 - 0465 (Subpart D)

Release Tracking 3 - 13574

D. DESCRIPTION OF RESPONSE ACTIONS (continued):

☐ Landfill ◯ Cover ◯ Disposal Est. Vol.:_____ cubic yards

☐ Groundwater Treatment Systems

☐ Removal of Drums, Tanks or Containers

☐ Air Sparging

Describe: _____

☐ Temporary Water Supplies

☐ Removal of Other Contaminated Media

☐ Temporary Evacuation or Relocation of Residents

Specify Type and _____

☐ Fencing and Sign Posting

☐ Other Response Actions Describe _____

See 310 CMR 40.0442 for limitations on the scope and type of RAMs.
See 310 CMR 40.0464 for performance standards for URAMs.

☐ Check here if this RAM or URAM involves the use of Innovative Technologies. DEP is interested in using this information to aid in creating an Innovative Technologies Clearinghouse.

Describe _____

E. TRANSPORT OF REMEDIATION WASTE:

(if Remediation Waste has been sent to an off-site facility, answer the following

Name of N/A

Town and State: N/A

Quantity of Remediation Waste Transported to N/A

F. RAM PLAN:

☐ Check here if this RAM Plan received previous oral approval from DEP as a continuation of a Limited Removal Action (LRA).

Date of Oral _____

☐ If a RAM Compliance Fee is required, check here to certify that the fee has been submitted. You **MUST** attach a photocopy of the payment. See 310 CMR 40.0444(2) to learn when a fee is not required.

☐ Check here if the RAM Plan is proposed for a Transition Site. If this is the case, you may need to attach an LSP Evaluation Opinion prior to undertaking the RAM, if not previously provided. See 310 CMR 40.0600 for further information about Transition Sites.

G. RAM COMPLETION STATEMENT:

☐ If a RAM Compliance Fee is required in connection with submission of the RAM Completion Statement, check here to certify that the fee has been submitted. You **MUST** attach a photocopy of the payment. You owe this fee when submitting a RAM Completion Statement if you received oral approval of a RAM that continued an LRA, and have NOT previously submitted a RAM Plan and accompanying fee.

If any Remediation Waste will be stored, treated, managed, recycled or reused at the site following submission of the RAM Completion Statement, you must submit a Phase IV Remedy Implementation Plan, along with the appropriate transmittal form, as an attachment to the RAM Completion Statement.

H. URAM NOTIFICATION:

Identify Location Type: (check all that apply) ☐ Public Right of Way ☐ Utility Easement ☐ Private Property

Identify Utility Type: (check all that ☐ Sanitary/Combined Sewerage ☐ Water ☐ Drainage ☐ Natural Gas

☐ Telephone ☐ Steam Lines ☐ Telecommunications ☐ Electric ☐ Other Specify: _____

☐ Check here if you provided DEP with previous oral notification of this URAM Date of Oral _____

☐ Check here if the property owner was NOT contacted prior to initiation of the URAM. If this is the case, you must attach an explanation of why the owner was not contacted, including the date and time when contact ultimately occurred.

☐ Check here if this URAM will occur in connection with the construction of new public utilities. If this is the case, document the nature and extent of encountered contamination, the scope and expense of necessary mitigation and the benefits amd limitations of project alternatives.

With the exception stated below, the person undertaking the URAM must provide the name and license number of an LSP engaged or employed in connection with the URAM:

LSP Name: _____ LSP License Number: _____

LSP information is not required if the URAM is limited to the excavation and/or handling of not more than 100 cubic yards of soil contaminated by Oil, or not more than 20 cubic yards of soil contaminated either by a Hazardous Material or a mixture of a Hazardous

Massachusetts Department of Environmental Protection **BWSC-106**
Bureau of Waste Site Cleanup

RELEASE & UTILITY-RELATED ABATEMENT MEASURE (RAM & URAM) TRANSMITTAL FORM

Pursuant to 310 CMR 40.0444 - 0446 and 310 CMR 40.0462 - 0465 (Subpart D)

Release Tracking: 3 - 13574

I. URAM COMPLETION STATEMENT:

☐ Check here if this URAM was limited to the excavation and/or handling of not more than 100 cubic yards of soil contaminated by Oil, or not more than 20 cubic yards of soil contaminated by either a Hazardous Material or a mixture of a Hazardous Material and Oil.

If any Remediation Waste will be stored, treated, managed, recycled or reused at the site following submission of the URAM Completion Statement, you must submit either a Release Abatement Measure (RAM) Plan or a Phase IV Remedy Implementation Plan, along with the appropriate transmittal form, as an attachment to the URAM Completion Statement.

J. LSP OPINION:

I attest under the pains and penalties of perjury that I have personally examined and am familiar with this transmittal form, including any and all documents accompanying this submittal. In my professional opinion and judgment based upon application of (i) the standard of care in 309 CMR 4.02(1), (ii) the applicable provisions of 309 CMR 4.02(2) and (3), and (iii) the provisions of 309 CMR 4.03(5), to the best of my knowledge, information and belief,

> *if Section B of this form indicates that a **Release Abatement Measure Plan** is being submitted*, the response action(s) that is (are) the subject of this submittal (i) has (have) been developed in accordance with the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000, (ii) is (are) appropriate and reasonable to accomplish the purposes of such response action(s) as set forth in the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000 and (iii) complies(y) with the identified provisions of all orders, permits, and approvals identified in this submittal;

> *if Section B of this form indicates that a **Release Abatement Measure Status Report** or a **Utility-Related Abatement Measure Status Report** is being submitted*, the response action(s) that is (are) the subject of this submittal (i) is (are) being implemented in accordance with the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000, (ii) is (are) appropriate and reasonable to accomplish the purposes of such response action(s) as set forth in the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000 and (iii) complies(y) with the identified provisions of all orders, permits, and approvals identified in this submittal;

> *if Section B of this form indicates that a **Release Abatement Measure Completion Statement** or a **Utility-Related Abatement Measure Completion Statement** is being submitted*, the response action(s) that is (are) the subject of this submittal (i) has (have) been developed and implemented in accordance with the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000, (ii) is (are) appropriate and reasonable to accomplish the purposes of such response action(s) as set forth in the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000 and (iii) complies(y) with the identified provisions of all orders, permits, and approvals identified in this submittal;

I am aware that significant penalties may result, including, but not limited to, possible fines and imprisonment, if I submit information which I know to be false, inaccurate or materially incomplete.

☐ Check here if the Response Action(s) on which this opinion is based, if any, are (were) subject to any order(s), permit(s) and/or approval(s) issued by DEP or EPA. If the box is checked, you MUST attach a statement identifying the applicable provisions thereof.

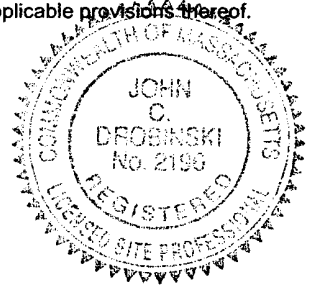
LSP Name: John C. Drobinski LSP #: 2196 Stamp:

Telephone: 617-267-8377 Ext.:

FAX: (optional) 617-267-6447

Signature:

Date: 1/29/07



An LSP Opinion is not required for a Utility-Related Abatement Measure Notification.

An LSP Opinion is not required for a URAM Completion Statement if the URAM is limited to the excavation and/or handling of not more than 100 cubic yards of soil contaminated by Oil, or not more than 20 cubic yards of soil contaminated either by Hazardous Material or a mixture of Hazardous Material and Oil.

K. PERSON UNDERTAKING RAM OR URAM:

Name of: Raytheon Systems Company

Name of: Ronald C. Slager Title: Manager, Env.Rest.Program

Street: 1001 Boston Post Road, MS-1-2-1567

City/Town: Marlborough State: MA ZIP Code: 01752-3789

Telephone: 508-490-1707 Ext.: FAX:

☐ Check here if there has been a change in person undertaking the RAM or URAM.

Massachusetts Department of Environmental Protection **BWSC-106**
Bureau of Waste Site Cleanup

RELEASE & UTILITY-RELATED ABATEMENT MEASURE (RAM & URAM) TRANSMITTAL FORM

Pursuant to 310 CMR 40.0444 - 0446 and 310 CMR 40.0462 - 0465 (Subpart D)

Release Tracking 3 - 13574

L. RELATIONSHIP TO SITE OF PERSON UNDERTAKING RAM or URAM: (check one)

☑ RP or PRP Specify: ○ Owner ○ Operator ○ Generator ○ Transporter Other RP or PRP: Former Operator

☐ Fiduciary, Secured Lender or Municipality with Exempt Status (as defined by M.G.L. c. 21E, s. 2)

☐ Agency or Public Utility on a Right of Way (as defined by M.G.L. c. 21E, s. 5(j))

☐ Any Other Person Undertaking RAM or URAM Specify _____

M. CERTIFICATION OF PERSON UNDERTAKING RAM OR URAM:

I, Ronald C. Slager, attest under the pains and penalties of perjury (i) that I have personally examined and am familiar with the information contained in this submittal, including any and all documents accompanying this transmittal form, (ii) that, based on my inquiry of those individuals immediately responsible for obtaining the information, the material information contained in this submittal is, to the best of my knowledge and belief, true, accurate and complete, and (iii) that I am fully authorized to make this attestation on behalf of the entity legally responsible for this submittal. I/the person or entity on whose behalf this submittal is made am/is aware that there are significant penalties, including, but not limited to, possible fines and imprisonment, for willfully submitting false, inaccurate, or incomplete information.

By: Ronald C. Slager (signature) Title: Manager, Env. Rest. Program

For: Ronald C. Slager (print name of person or entity recorded in Section K) Date: 1/15/02

Enter address of person providing certification, if different from address recorded in Section

Street: _____

City/Town: _____ State: _____ ZIP Code: _____

Telephone: _____ Ext.: _____ FAX: (optional) _____

YOU MUST COMPLETE ALL RELEVANT SECTIONS OF THIS FORM OR DEP MAY RETURN THE DOCUMENT AS INCOMPLETE. IF YOU SUBMIT AN INCOMPLETE FORM, YOU MAY BE PENALIZED FOR MISSING A REQUIRED DEADLINE.