United States Environmental Protection Agency
Region 1

Decision Document
Addendum No. 1
Demolition Area 2

Joint Base Cape Cod Cape Cod, Massachusetts

September 2015

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Decision Document Addendum No. 1
Demolition Area 2

A. SITE NAME

The subject site is the Demolition Area 2 ("the Site"), which is located at Camp Edwards in the northern portion of the Joint Base Cape Cod (JBCC) (Figure 1). This Decision Document Addendum No. 1 (Addendum No. 1) has been prepared to document a new prediction for the year when the aquifer would be restored and a modification to the monitoring program which is the installation of two downgradient groundwater monitoring wells. The Site is composed of a groundwater plume and a former source area which was remediated. The *Western Boundary, Demolition Area 2 and Northwest Corner Soil and Groundwater Operable Units Decision Document*, dated March 2010 (the 2010 Decision Document) established No Further Action for the source area, and Monitored Natural Attenuation and Land Use Controls for groundwater as the selected remedy for the site.

The 2010 Decision Document predicted that that hexahydro-1,3,5-trintro-1,3,5-triazine (RDX) concentrations would attenuate to below the 2 µg/L Health Advisory by 2011, and the 0.6 µg/L 10^{-6} risk-based level by 2013. However, the timeframe to achieve aquifer restoration at Demolition Area 2 is longer than was predicted in the 2010 Decision Document. Groundwater monitoring results in the *Demolition Area 2 2014 Annual Environmental Monitoring Report* (IAGWSP, September 2014) identified RDX concentrations in groundwater samples collected in 2013 still exceeded the risk-based 0.6 µg/L remedial action goal at three locations (Figure 2). No other explosives were detected in the network of monitoring wells. In response to these findings, EPA required a reassessment of the restoration timeframe for the Demolition Area 2 groundwater plume via Monitored Natural Attenuation and targeted groundwater extraction, the two alternatives presented in the 2010 Decision Document. The targeted groundwater extraction model simulation assumed installing an extraction well at the leading edge of the 0.6 µg/L RDX plume.

The *Demolition Area 2 Plume Shell Development and Proposed Well Locations* project note (IAGWSP March, 2015) provides an updated plume shell to represent contamination in groundwater at Demolition Area 2 and revised predicted timelines to reach cleanup goals at the site for the two alternatives. Additionally, it proposes locations for additional monitoring wells to assess the extent of contamination along the base boundary (Figure 3).

B. STATEMENT OF BASIS AND PURPOSE

This Decision Document Addendum No 1. (Addendum No. 1) modifies the 2010 Decision Document presenting a new prediction for the year when cleanup goals would be achieved. A modification to the monitoring program with the installation of two additional groundwater monitoring wells is also described.

Addendum No. 1 supplements, incorporates, and is incorporated into and made part of the 2010 Decision Document, and every requirement in Addendum No. 1 is enforceable as a requirement of the 2010 Decision Document. The 2010 Decision Document contains the Demolition Area 2 site description, selected response action, response action objectives, land use controls, community participation and state role.

This decision is based on the Administrative Record, which has been developed in accordance with the third EPA administrative order issued for Camp Edwards pursuant to the Safe Drinking Water Act, SDWA 1-2000-0014 ("AO3") and with a previous EPA Administrative Order, SDWA 1-97-1019 ("AO1"), including consideration of the substantive cleanup standards of the Massachusetts Contingency Plan (MCP) 310 CMR 40.0000. The Administrative Record is available for review at the Impact Area Groundwater Study Program (IAGWSP) office, PB 516 West Outer Road, Camp Edwards, MA.

C. ASSESSMENT OF THE SITE

On July 13, 1982, EPA determined that the Cape Cod Aquifer is the sole or principal source of drinking water for Cape Cod, Massachusetts, and that the Cape Cod Aquifer, if contaminated, would create a significant hazard to public health (47 Fed. Reg. 30282). Contaminants from the Training Ranges and Impact Area at Camp Edwards at JBCC are present in and may enter and migrate in the aquifer. The response actions selected in Addendum No. 1 are necessary to protect the Cape Cod Aquifer, an underground source of drinking water on which the public relies.

D. DESCRIPTION OF RESPONSE ACTION

Addendum No. 1 modifies the 2010 Decision Document to revise the restoration timeframe for the Demolition Area 2 groundwater plume. Additionally, based on the revised plume shell and forward particle tracks, two additional groundwater monitoring wells are proposed to evaluate contaminant migration along the base boundary.

Data collected from June of 2013 through June of 2014 indicate that RDX contamination continues to be present in the Demolition Area 2 monitoring network at concentrations exceeding the remedial goal of 0.6 µg/L. Updated groundwater modeling predicts that no concentrations above the risk-based level of 0.6 µg/L will migrate beyond the base boundary. Some RDX plumelets of concentration greater than the 0.25 µg/L background level are predicted to migrate slightly downgradient of the base boundary. The model predicts RDX concentrations in groundwater at Demolition Area 2 will be below the USEPA Health Advisory level of 2.0 µg/L by 2016, concentrations below 0.6 µg/L by 2018, and that all RDX concentrations will be below background (0.25 µg//L) after 10.5 years (2025).

1. Evaluation of Groundwater Alternative

In addition to the Monitored Natural Attenuation analysis, a groundwater alternative simulating an extraction well and treatment system was developed and evaluated in the Project Note *Demolition Area 2 Plume Shell Development and Proposed Well Locations* (Appendix D). The alternative was simulated to mirror the decision-making process in the 2010 Decision Document and to determine if Monitored Natural Attenuation remains the appropriate cleanup remedy with respect to cleanup timeframe.

The simulation assumed placement of an extraction well pumping at 100 gallons per minute (gpm) at the leading edge of the 0.6 µg/L RDX plume downgradient from MW-573M1/M2 (Figure 4). It was assumed that the extraction well would being operation in June 2016. Under this simulation, the model predicts RDX concentrations in groundwater at Demolition Area 2 will be below the USEPA Health Advisory level of 2.0 µg/L by 2016, below 0.6 µg/L by 2018, and that all RDX concentrations will be below background (0.25 µg//L) after 10.5 years (2025). These results are basically the same cleanup timelines as Monitored Natural Attenuation. The two primary reasons for similar cleanup timelines are: (1) the system starts operation in June 2016 (due to contractual acquisition timelines, regulatory approval cycles, and the time needed to build the extraction well and treatment system), and (2) the time to attenuate the smaller plume of RDX near the source area at MW-161S also impacts the cleanup timelines.

2. Selected Response Action

The remedy selected in the 2010 Decision Document, Monitored Natural Attenuation and Land

Use Controls, continues to be the appropriate remedy for the site, however; the time to achieve aquifer restoration has changed from 2013 to 2018. While the plume has not attenuated in the timeline originally predicted, active treatment is not warranted at this time. The selected alternative continues to achieve cleanup goals in a reasonable timeframe and protects human health through the use of groundwater monitoring to ensure that groundwater modeling predictions regarding the reduction and migration of contamination at the Site are correct and that any residual contamination remains below risk-based levels. Human health will be further protected through continued monitoring of the land use controls as described in the 2010 Decision Document. These controls will continue to prevent use of contaminated portions of the aquifer at the Site for drinking water purposes until groundwater data confirm that contamination has been reduced to below risk-based levels. Five year reviews will continue as part of base-wide future evaluation.

Land Use Controls

A complete description of the land use controls can be found in Part II of the 2010 Decision Document. The land use controls are needed until the groundwater contamination no longer poses an unacceptable risk. The land use controls area will be updated, as necessary, as part of the annual Environmental Monitoring Reports to reflect changes in the plume.

E. DETERMINATIONS

The response actions selected in the 2010 Decision Document will protect the public health from any endangerment which may be presented by the presence or potential migration of COCs from the Site into the underlying Sole Source Aquifer. This Addendum, issued pursuant to AO3 and Section 1431 of the SDWA, notes the change to the aquifer restoration timeframe from the original date of 2013 presented in the 2010 Decision Document to the new aquifer restoration date of 2018. Additionally, two new groundwater monitoring wells will be installed along the base boundary to evaluate contaminant migration in this area.

In addition to annual reports on groundwater monitoring and verification of land use controls, the selected response actions include periodic reviews at frequencies not to exceed five years. The scope of each review will include, but not be limited to, sampling data, modeling data, and other relevant data. EPA, in consultation with MassDEP, will review this and any other relevant information to determine if additional measures are necessary for the protection of human health. This will include information acquired after the implementation of the selected

response actions (such as new regulatory requirements or changes in the environmental conditions of the Site).

F. SUPPORTING DATA

Detailed information on the Site is included in the 2010 Decision Document, and the Demolition Area 2 Project Note; *Demolition Area 2 Plume Shell Development and Proposed Well Locations* dated March 20, 2015. Additional information can be found in the Administrative Record for the Site.

G. AUTHORIZING SIGNATURE

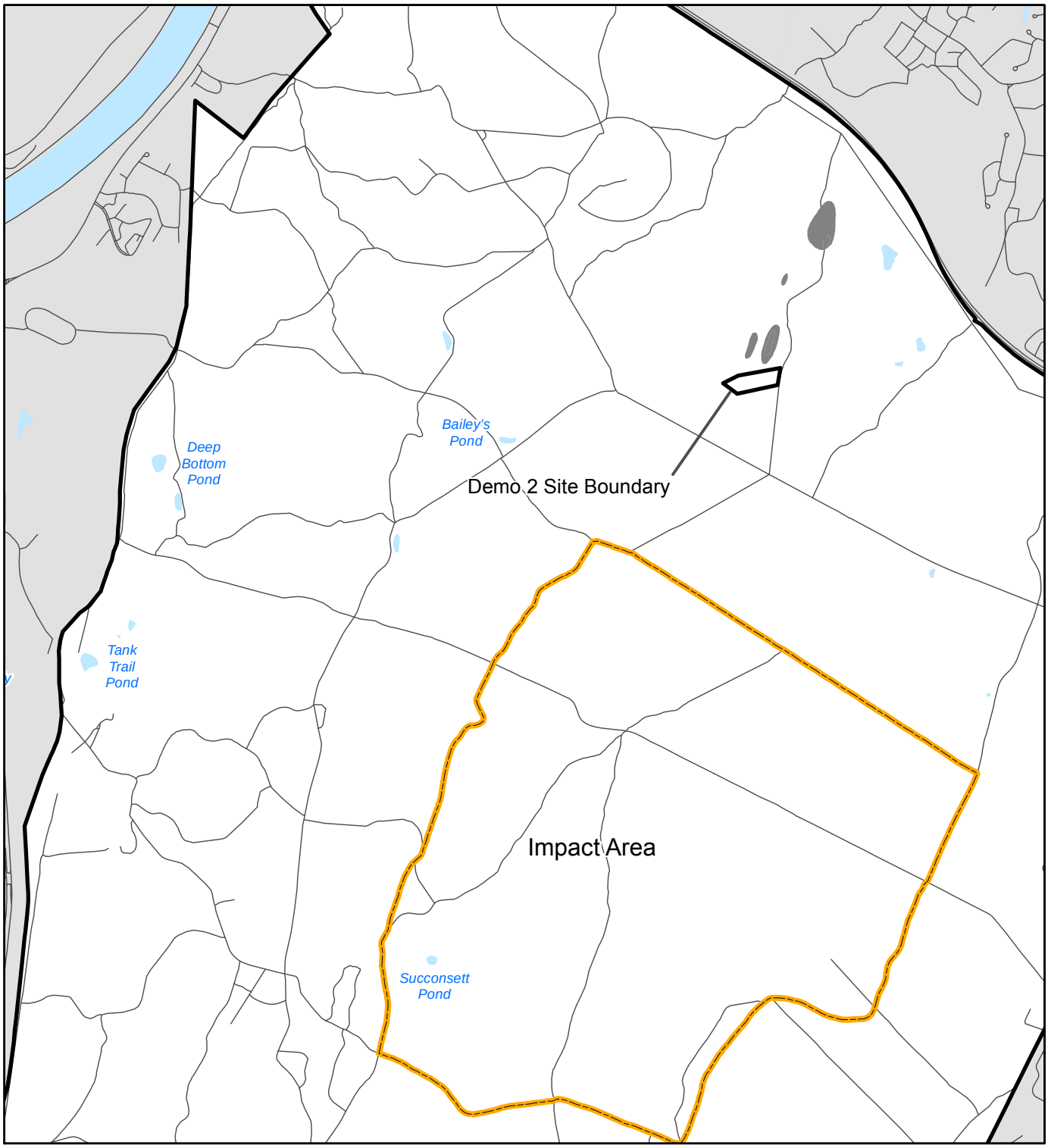
This addendum modifies the 2010 Decision Document to document the change in aquifer restoration from 2013 to 2018 and a modification to the long-term monitoring program by the installation of two new groundwater monitoring wells near the base boundary. These changes were selected by EPA under the authority of the SDWA. The MassDEP concurs with this decision.

U.S. Environmental Protection Agency

By: Nancy Barmakian Date: 09/30/15

Nancy Barmakian
Acting Director, Office of Site Remediation and Restoration
Region 1

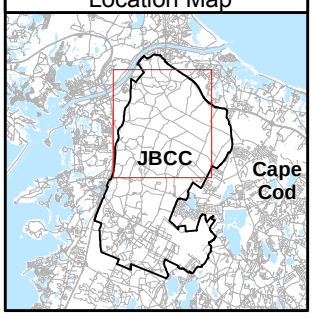
FIGURES



Legend

- JBCC Boundary
- Impact Area Boundary
- Demo 2 RDX
  June 2013 - June 2014
  (Shown to 0.6 µg/L)

Location Map



0 1,500 3,000 Feet

US Army Corps of Engineers
New England District

N

Location of Demolition Area 2

FIGURE 1

M:\MMR\2015\Demo2\Figures\LocMap_042115.pdf
M:\MMR\2015\Demo2\MXDs\LocMap_042115.mxd
April 21, 2015 DWN: MTW CHKD: PJR

Impact Area Groundwater Study Program

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JBCC Boundary

Goat Pasture Rd

Monument Swamp Rd

Swamp Rd

MW-572M1
MW-312M1
MW-435M1,M2
MW-573M1,M2
MW-311M1,M2
MW-406M1,M2
MW-380M1,M2
MW-404M1,M2
MW-404S
LRWS1-4
MW-262M1
MW-259M1
MW-160S
MW-161S
MW-260M1
MW-261M1,M2
Demo 2 Site Boundary
MW-16S
MW-16D

0 250 500 1,000
Feet

LEGEND

RDX in Groundwater
Based on MT3D Transport Model Result

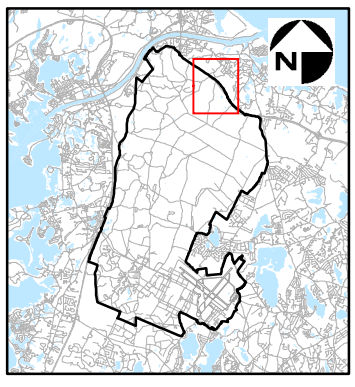
- 0.6 to 2 µg/L
- Greater than 2 µg/L

Monitoring Wells

- ● Well Included in Monitoring Plan
- ○ Well Not Included in Monitoring Plan
- **MW-16S** Screen Included in Monitoring Plan
- MW-16D Screen Not Included in Monitoring Plan

Demolition Area 2
June 2014 Plume Shell
RDX Concentrations - June 2014 (2014.5)

LOCATION MAP



Impact Area Groundwater Study Program

FIGURE

2

NOTES & SOURCES
Base Data from US Geological Survey
7 1/2 minute Topgraphic Maps
Source: MassGIS

M:\MMR\2014\Demo2\AnnRpt\PlumeShell_Working\EW_Modeling\Fig1-5.pdf
M:\MMR\2014\Demo2\AnnRpt\PlumeShell_Working\Extraction Well Modeling 4-7-15.mxd
April 7, 2015 DWN: PJM

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1

A

B

Goat Pasture Rd

JBCC Boundary

MW-572M1

MW-312M1

MW-435M1,M2

MW-573M1,M2

MW-311M1,M2

MW-406M1,M2

1,M2

MW-404M1,M2

MW-404S

LRWS1-4

0 250 500 1,000 Feet

LEGEND

Monitoring Wells

- Well Included in Monitoring Plan
- Well Not Included in Monitoring Plan

MW-16S Screen Included in Monitoring Plan

MW-16D Screen Not Included in Monitoring Plan

- Proposed Location for New Monitoring Well

RDX in Groundwater - Model Predicted Values (2016)

0.6 to 2.0 µg/L

MODPATH Forward (Downgradient) Particle Tracks

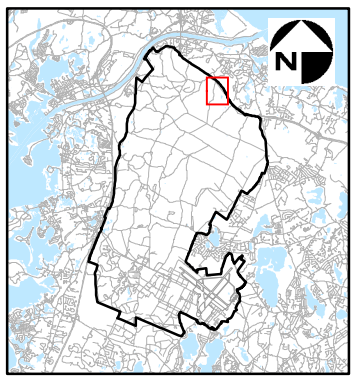
Arrows Denote 1-Year Migration Time Interval

Proposed Screened Intervals for New Monitoring Wells:

Well "A": -5 to -15 ft msl,
-20 to -30 ft msl

Well "B": 5 to -5 ft msl,
-10 to -20 ft msl

LOCATION MAP



Impact Area Groundwater Study Program

Demolition Area 2
Proposed Monitoring Well Locations
RDX (2016) Plume Shell

FIGURE 3

NOTES & SOURCES
Base Data from US Geological Survey
7 1/2 minute Topgraphic Maps
Source: MassGIS

M:\MMR\2014\Demo2\AnnRpt\PlumeShell_Working\EW_Modeling\Fig1-11.pdf
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April 7, 2015 DWN: PJM

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JBCC Boundary

Goat Pasture Rd

Monument Swamp Rd

EXT. WELL

INJ. WELL

MW-572M1
MW-312M1
MW-435M1,M2
MW-573M1,M2
MW-311M1,M2
MW-406M1,M2
MW-380M1,M2
MW-404M1,M2
MW-404S
LRWS1-4
MW-262M1
MW-259M1
MW-160S
MW-161S
MW-260M1
MW-261M1,M2
Demo 2 Site Boundary
MW-16S
MW-16D
Swamp Rd

0 250 500 1,000
Feet

LEGEND

RDX in Groundwater
Based on MT3D Transport Model Result

- 0.6 to 2 µg/L
- Greater than 2 µg/L

Monitoring Wells

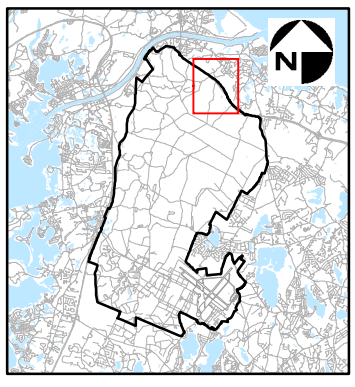
- ● Well Included in Monitoring Plan
- ○ Well Not Included in Monitoring Plan
- **MW-16S** Screen Included in Monitoring Plan
- MW-16D Screen Not Included in Monitoring Plan

Modeled Treatment System

- Extraction Well Location
- Re-injection Well Location

Demolition Area 2
Simulated Extraction Well System Location
June 2014 Plume Shell
(Two Years Prior to Assumed System Start-up)

LOCATION MAP



Impact Area Groundwater Study Program

FIGURE

4

M:\MMR\2014\Demo2\AnnRpt\PlumeShell_Working\EW_Modeling\Fig1-5.pdf
M:\MMR\2014\Demo2\AnnRpt\PlumeShell_Working\Extraction Well Modeling 4-7-15.mxd
April 7, 2015 DWN: PJM

NOTES & SOURCES
Base Data from US Geological Survey
7 1/2 minute Topgraphic Maps
Source: MassGIS

APPENDIX A
MassDEP Letter of Concurrence

Commonwealth of Massachusetts
Executive Office of Energy & Environmental Affairs

Department of Environmental Protection
One Winter Street Boston, MA 02108 • 617-292-5500

Charles D. Baker
Governor

Karyn E. Polito
Lieutenant Governor

Matthew A. Beaton
Secretary

Martin Suuberg
Commissioner

September 29, 2015

Ms. Nancy Barmakian, Acting Director
Office of Site Remediation and Restoration
U.S. Environmental Protection Agency, Region I
5 Post Office Square Suite 100
Boston, MA 02109-3912

RE: **BOURNE**
Release Tracking Number: 4-0015031
Joint Base Cape Cod (JBCC)
Decision Document Addendum No. 1
Demolition Area 2, Concurrence

Dear Ms. Barmakian:

The Massachusetts Department of Environmental Protection (MassDEP) has reviewed the document entitled **"Decision Document Addendum No. 1 Demolition Area 2"** (the Decision Document Addendum), dated August, 2015. The Decision Document Addendum documents a change in the predicted time for aquifer restoration for the Demolition Area 2 (Demo-2) groundwater plume and a modification to the Demo-2 monitoring program. The Demo-2 groundwater plume is located on Camp Edwards at Joint Base Cape Cod (JBCC), in Bourne, Massachusetts. The remedy was selected by the United States Environmental Protection Agency (EPA) in accordance with Section 1431(a) of the Safe Drinking Water Act (SDWA), 42 USC §300i(a), as amended and Administrative Order No. SDWA-1-2000-0014 (AO3), which includes consideration of the substantive cleanup standards set forth under M.G.L. c. 21E and 310 CMR 40.0000, the Massachusetts Contingency Plan (MCP). The U.S. Army (Army) and the National Guard Bureau (NGB) are Respondents under USEPA AO3.

The Demo-2 Study Area is located on the Camp Edwards portion of JBCC and is composed of a source area which has been remediated and a groundwater plume. The explosive compound hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX) is the contaminant of concern for the Demo-2 groundwater. In 2010, EPA issued a Decision Document that selected a comprehensive remedy for the Demo-2 Study Area. The remedy consisted of No Further Action for the source area and Monitored Natural Attenuation (MNA) and Land Use Controls (LUCs) for groundwater. The applicable MCP groundwater cleanup standard for RDX is 1.0 microgram per liter (µg/L). The USEPA remedial action goal calculated for RDX in groundwater that results in an increased lifetime cancer risk of one in a million is 0.6 µg/L. The Decision Document predicted that RDX concentrations in groundwater would attenuate to below the remedial action goal by 2013. However, RDX concentrations in groundwater samples collected in 2013 exceeded the remedial action goal at three locations, which necessitated a revision to the predicted aquifer restoration date. Groundwater modeling predicts that RDX concentrations above the remedial action goal will not migrate beyond the JBCC boundary. The model predicts that RDX concentrations in groundwater will be below 0.6 µg/L by 2018, and that all RDX concentrations will be below background (0.25 µg/L) by 2025.

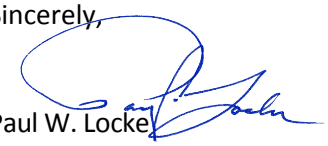
Determination

MassDEP concurs with the remedy proposed in the Decision Document Addendum for the Demo-2 groundwater. The Decision Document Addendum does not modify the 2010 Decision Document remedy of MNA and LUCs but presents a new prediction for the year when cleanup goals will be achieved (2018). A modification to the groundwater monitoring program to include the installation of two additional groundwater monitoring wells is also presented. In addition to annual reports on groundwater monitoring and verification of LUCs, the remedy proposed includes 5 year periodic reviews. The selected remedy will ensure a sufficient and protective level of control for the Demo-2 groundwater such that none of the contamination associated with the Demo-2 groundwater will present a significant risk of harm to health, safety, public welfare or the environment during any foreseeable period of time. Moreover, the groundwater remedy has been designed to reduce the level of contaminants to background levels, consistent with MCP requirements.

MassDEP's concurrence with the remedy selected by the EPA set forth in the Decision Document Addendum is based upon representations made to MassDEP by the Army/NGB and assumes that all information provided is substantially complete and accurate. Without limitation, if MassDEP determines that any material omissions or misstatements exist, if new information becomes available, if LUCs are not properly implemented, monitored and/or maintained or if conditions within the Demolition Area 2 changes, resulting in potential or actual human exposure or threats to the environment, MassDEP reserves its authority under M.G.L. c. 21E, Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), the MCP, the National Contingency Plan (NCP) and any other applicable law or regulation to require further response actions. MassDEP will review relevant information as it becomes available to determine if additional investigative and/or remedial measures are necessary for the protection of public health, safety, welfare or the environment at the Demolition Area 2. This includes information acquired after the implementation of the groundwater remedy, such as new regulatory requirements or changes in the environmental conditions at the Demolition Area 2.

Please incorporate this letter into the Administrative Record for the Demolition-2 Study Area. If you have any questions regarding this matter, please contact Leonard J. Pinaud, Chief, State & Federal Sites Management Section in the MassDEP's Southeast Regional Office at (508) 946-2871.

Sincerely,



Paul W. Locke
Acting Assistant Commissioner
Bureau of Waste Site Cleanup

PL/LP/EJ/lg

Ec: Gary Moran, Deputy Commissioner - Operations
Millie Garcia-Serrano, Acting Regional Director
Gerard Martin, Acting Deputy Regional Director, BWSC-SERO
Leonard J. Pinaud, Chief, State & Federal Site Management
Dawn Stolfi Stalenhoef, Chief Regional Counsel
Richard Lehan, Department of Fish and Game
LTC Brian Saunders, Camp Edwards Impact Area Groundwater Study Program
COL William J. O'Brien, Post Commander, HQ Camp Edwards
JBCC Cleanup Team
Upper Cape Boards of Selectmen
Upper Cape Boards of Health
Lara Goodine [RAONR DEPMOU]

APPENDIX B
Glossary of Terms and Acronyms

GLOSSARY OF TERMS AND ACRONYMS

AO	Administrative Order
COC	Contaminant of Concern
DWEL	Drinking Water Equivalent Level
EPA	United States Environmental Protection Agency
GPM	gallons per minute
HA	Health Advisory; EPA guidelines that represent the concentration of a chemical in drinking water that, given a lifetime of exposure, is not expected to cause adverse, non-cancerous, effects.
IAGWSP	Impact Area Groundwater Study Program
JBCC	Joint Base Cape Cod
LUC	Land Use Control
MassDEP	Massachusetts Department of Environmental Protection
MCL	Maximum Contaminant Level (Federally-promulgated)
MMCL	Massachusetts Maximum Contaminant Level (State-promulgated)
MMR	Massachusetts Military Reservation
MTU	Mobile treatment unit
perchlorate	A water-soluble salt used as an oxidizer
RDX	Hexahydro-1,3,5-trinitro-1,3,5-triazine / Royal Demolition Explosive, an explosive compound
SDWA	Safe Drinking Water Act
TNT	Trinitrotoluene (an explosives compound)
µg/L	Micrograms per Liter, a measure of concentration in liquid, e.g. one part of contaminant in one billion parts of water is 1 µg/L, or 1 microgram per liter

APPENDIX C
Index of Key Supporting Documents

INDEX OF KEY SUPPORTING DOCUMENTS

Western Boundary, Demolition Area 2 and Northwest Corner Soil and Groundwater Operable Units Decision Document, March 2010

Demolition Area 2 2014 Annual Environmental Monitoring Report, September 2014

The *Demolition Area 2 Plume Shell Development and Proposed Well Locations* Project Note, March, 2015

APPENDIX D
Project Note

FINAL PROJECT NOTE

Impact Area Groundwater Study Program
National Guard Bureau
Camp Edwards, MA

Subject: **Demolition Area 2 Plume Shell Development and Proposed Well Locations**

Date: **20 March 2015**

1.0 PURPOSE

This Project Note summarizes the process used to develop an updated plume shell to represent RDX contamination in groundwater from the Demolition Area 2 (Demo 2) site, and documents regulatory concurrence on the locations of two monitoring wells to be installed near the base boundary. The updated plume shell was used as a basis for transport modeling to determine revised timelines to reach cleanup goals, and helped to determine the locations of the two groundwater monitoring wells.

The predicted timelines specified in the March 2010 Decision Document (DD) have been exceeded. The revised predicted restoration estimates developed through the transport modeling will be documented in a forthcoming Decision Document Addendum. For comparison purposes, a model simulation was also performed assuming the installation of an extraction well at the leading edge of the 0.6 µg/L RDX plume.

2.0 MODELING PROCESS

RDX groundwater profile and sampling data for all Demo 2 monitoring wells (1997 – 2014) were forward migrated to June 2014 (2014.5) positions using MODPATH. The migrated particle results, when adjusted using only the existing five-year attenuation curve (30 May 2013 USACE Project Note), depicted some RDX concentrations unrealistically remaining above 2.0 µg/L at off-base locations after more than five years of migration. These results were deemed unrealistic because the migrated concentrations were not attenuated beyond the first five years. As an example, the maximum detected RDX concentration of 6.7 ppb detected in MW-404M2 in August 2006 would be attenuated to a concentration of 3 ppb by August 2011 (55% attenuation after 5 years). However, after 2011, the particle would continue to migrate further down-gradient unattenuated and remain at 3 ppb using the current methodology. This represents a potential flaw in the methodology currently used to account for attenuation of migrated data older than five years.

In order to account for additional attenuation beyond five years for historic Demo 2 sampling data, the subset of data from 2002 through January 2008 was forward migrated and a plume shell created to represent January 2008 concentrations. This 2008 plume shell was then run to 2014.5 in the MT3D transport model, which includes a built-in attenuation factor. A second subset of data (early 2008 – 2014) was then forward migrated in MODPATH so that both datasets were brought forward to 2014.5. At this point, all migrated data were contoured and included in a second plume shell representing predicted concentrations for June 2014. The concentrations from this plume shell were run in the MT3D transport model 15 years into the future, and model results were analyzed to determine the updated times for predicted achievement of cleanup goals.

It should be noted that in cases where migrated concentrations did not agree with contemporaneously measured sample data at a particular location, the migrated data (including some older data migrated from MW-404, MW-160S, MW-161, and MW-259) were removed from the comprehensive data set used for 2014 plume shell development This approach is consistent with modeling conducted at other JBCC sites, and contaminated sites in general.

3.0 TRANSPORT MODEL RESULTS / TIME TO CLEANUP GOALS

The MT3D transport model results predict that no concentrations above the risk-based level of 0.6 µg/L will migrate beyond the base boundary. Some RDX plumelets of concentration greater than the 0.25 µg/L background level are predicted to migrate slightly downgradient of the base boundary. The model predicts RDX concentrations in groundwater at Demolition Area 2 will be below the USEPA Health Advisory level of 2.0 µg/L by 2016, concentrations below 0.6 µg/L by 2018, and that all RDX concentrations will be below background (0.25 ug/L) after 10.5 years (2025). Attached are four figures (Figures 1-1 through 1-4) illustrating the results of the model runs for 2014.5 (plume shell), 2016, 2020, and 2025.

A simulation was also run on the same model assuming the activation of an extraction well pumping at 100 gpm at the leading edge of the 0.6 µg/L RDX plume downgradient from MW-573M1/M2. In the simulation, it was assumed that the extraction well would being operation in June 2016. Under this simulation, the model predicts RDX concentrations in groundwater at Demolition Area 2 will be below the USEPA Health Advisory level of 2.0 µg/L by 2016, concentrations below 0.6 µg/L by 2018, and that all RDX concentrations will be below background (0.25 ug/L) after 10.5 years (2025). This is basically the same cleanup timelines as without the extraction well. There are two primary reasons why the cleanup timelines are similar; (1) the system is not started until June 2016 (due to contractual acquisition timelines and regulatory approval cycles), and (2) the time to attenuate the smaller plume of RDX near MW-161S also impacts the cleanup timelines. Attached are six additional figures (Figures 1-5 to 1-10) illustrating the results of the model run with the simulated extraction well.

4.0 PROPOSED MONITORING WELL LOCATIONS

Based on the revised plume shell, and the forward particle tracks, two well locations are proposed to evaluate contaminant migration along the base boundary (see Figure 1-11). The wells will be installed downgradient of MW-572 and MW-573. Groundwater profile samples will be collected for explosives analysis at both locations. Profile samples will be collected starting at the water table and every 10 feet thereafter until approximately 50 feet (5 sample intervals) below the anticipated screen depths. Samples will be analyzed for explosives using SW-846 Method 8330. The screen depths of new monitoring wells will be determined based on groundwater profile results and groundwater modeling in consultation with the regulatory agencies. Upon completion of installation, the wells will be developed in accordance with existing protocols, and the horizontal and vertical coordinates of each well will be surveyed by a professional land surveyor.

All work will be conducted in accordance with established protocols.

5.0 SCHEDULE

The proposed monitoring wells will be installed within 120 days of approval of this Project Note. The DD Addendum will be submitted by 31 March 2015.

SIGNATURES

The signatures below represent concurrence with the above documentation.

3/20/2015
EPA Representative

3/23/15
DEP Representative

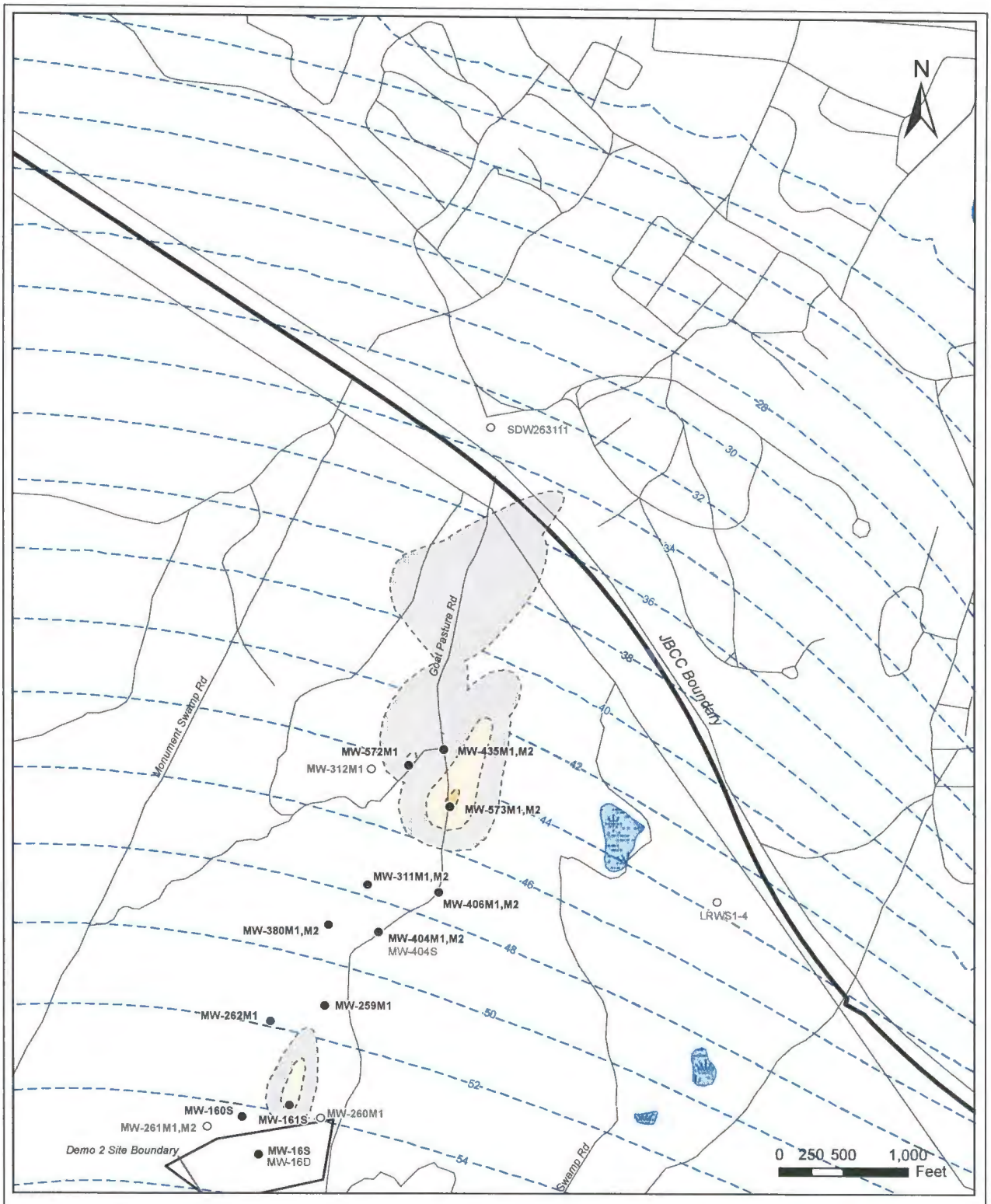
3/27/2015
Impact Area Groundwater Study Program

Attachments:

Figure 1-1 – June 2014 Demo 2 RDX Plume Shell
Figure 1-2 – Model Predicted RDX Concentrations – 2016
Figure 1-3 – Model Predicted RDX Concentrations – 2020
Figure 1-4 – Model Predicted RDX Concentrations – 2025
Figure 1-5 – Location of Simulated Extraction Well
Figure 1-6 – Capture Zone for Extraction Well (June 2016)
Figure 1-7 – RDX Plumes at Extraction System Start (June 2016)
Figure 1-8 – RDX Plumes in June 2017
Figure 1-9 – RDX Plumes in January 2018 (All Below 0.6 µg/L)
Figure 1-10 – RDX Plumes in 2020
Figure 1-11 – Proposed Monitoring Well Locations

References:

United States Army Corp of Engineers (USACE), 30 May 2013 Project Note, RDX Attenuation Factor Evaluation



LEGEND

RDX in Groundwater Based on Model Forward Particle Migration
(Contours Dashed Where Inferred)

- 0.25 to 0.6 µg/L
- 0.6 to 2 µg/L
- Greater than 2 µg/L

Monitoring Wells

- ● Well Included in Monitoring Plan
- ○ Well Not Included in Monitoring Plan
- **MW-16S** Screen Included in Monitoring Plan
- MW-16D Screen Not Included in Monitoring Plan

Demolition Area 2
June 2014 Plume Shell
RDX Concentrations - June 2014 (2014.5)

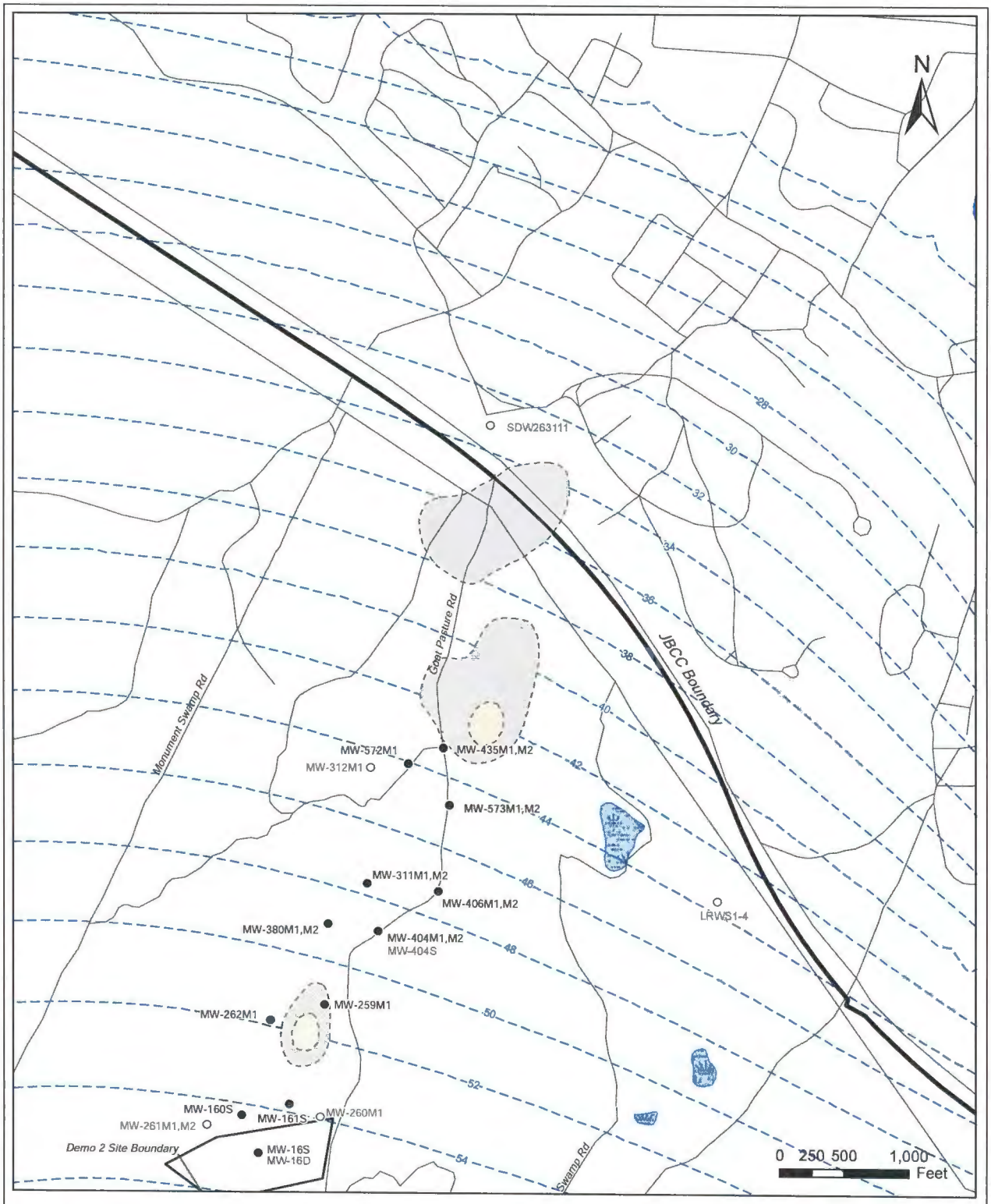
LOCATION MAP

Impact Area Groundwater Study Program

FIGURE 1-1

NOTES & SOURCES
Base Data from US Geological Survey 7 1/2 minute Topographic Maps
Source: MassGIS

M:\MMR\2014\Demo2\AnnRpt\PlumeShell_Working\Fig1-1_02112015.pdf
M:\MMR\2014\Demo2\AnnRpt\PlumeShell_Working\PlumeContours 2-4-15.mxd
February 11, 2015 DWN: PJM



LEGEND

RDX in Groundwater
Based on MT3D Transport Model Result

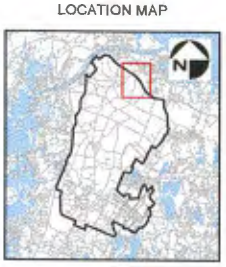
- 0.25 to 0.6 µg/L
- 0.6 to 2 µg/L
- Greater than 2 µg/L

Monitoring Wells

- ● Well Included in Monitoring Plan
- ○ Well Not Included in Monitoring Plan
- MW-16S Screen Included in Monitoring Plan
- MW-16D Screen Not Included in Monitoring Plan

Demolition Area 2
June 2014 Plume Shell
Model Predicted RDX Concentrations - 2016

LOCATION MAP

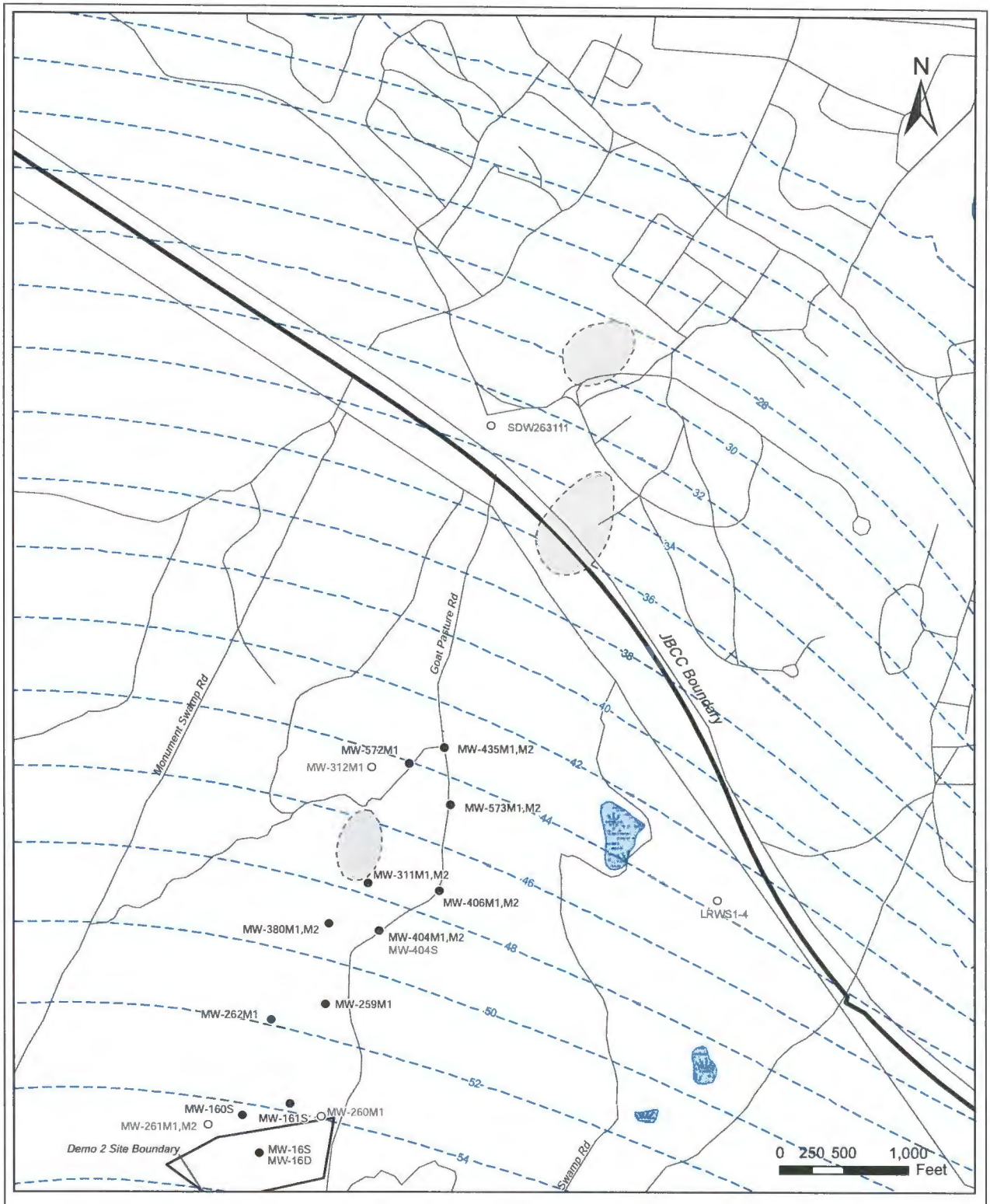


Impact Area Groundwater Study Program

FIGURE 1-2

NOTES & SOURCES
Base Data from US Geological Survey
7 1/2 minute Topographic Maps
Source: MassGIS

M:\MMR\2014\Demo2\AnnRpt\PlumeShell_Working\Fig1-2_02112015.pdf
M:\MMR\2014\Demo2\AnnRpt\PlumeShell_Working\PlumeContours 2-4-15.mxd
February 11, 2015 DMN: PJM



LEGEND

RDX in Groundwater
Based on MT3D Transport Model Result

- 0.25 to 0.6 µg/L
- 0.6 to 2 µg/L
- Greater than 2 µg/L

Monitoring Wells

- ● Well Included in Monitoring Plan
- ○ Well Not Included in Monitoring Plan
- MW-16S Screen Included in Monitoring Plan
- MW-16D Screen Not Included in Monitoring Plan

Demolition Area 2
June 2014 Plume Shell
Model Predicted RDX Concentrations - 2020

LOCATION MAP

Impact Area Groundwater Study Program

FIGURE 1-3

NOTES & SOURCES
Base Data from US Geological Survey
7 1/2 minute Topographic Maps
Source: MassGIS

M:\MMR\2014\Demo2\AnnRpt\PlumeShell_Working\Fig1-3_02112015.pdf
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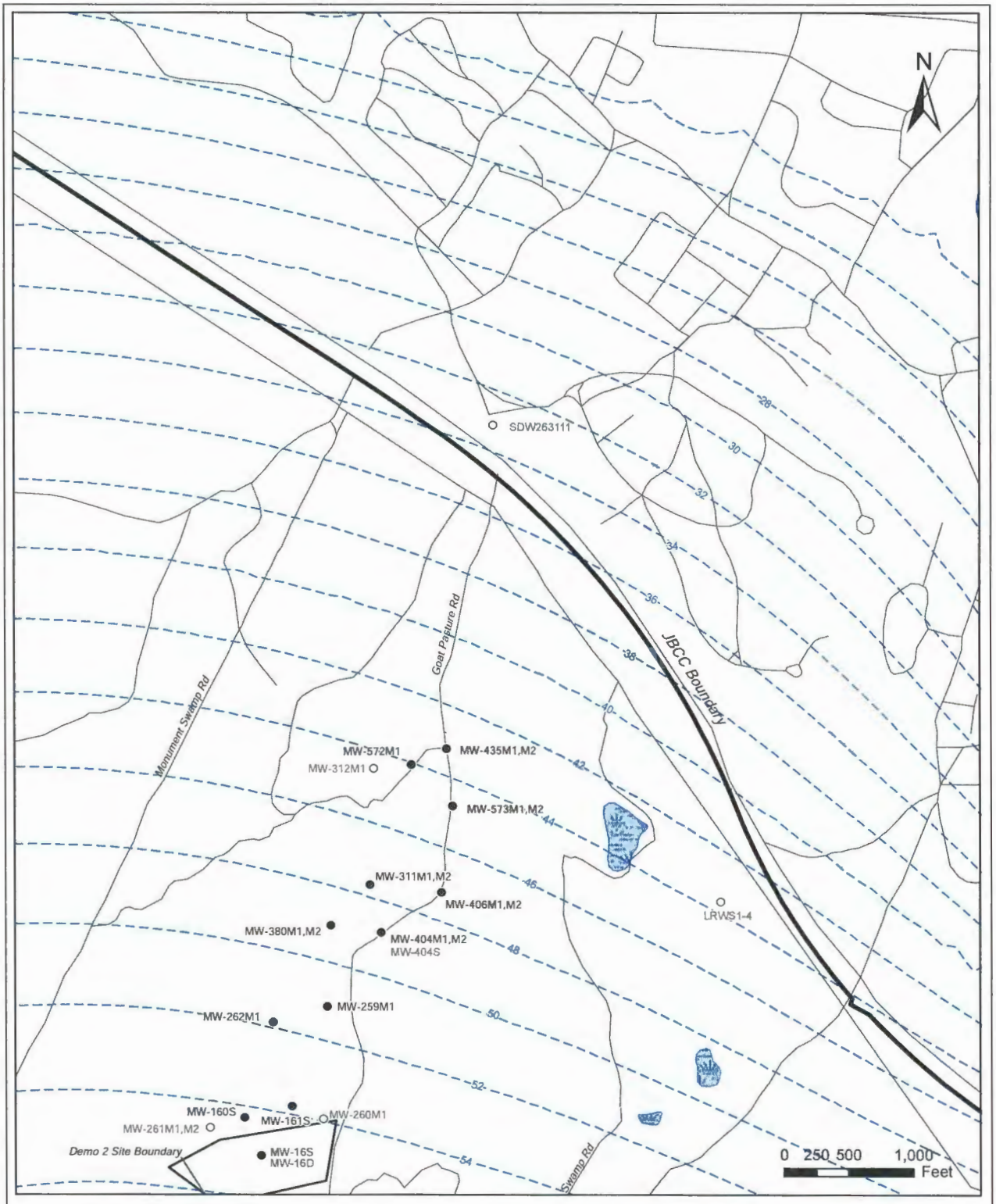

LEGEND

RDX in Groundwater
Based on MT3D Transport Model Result

- 0.25 to 0.6 µg/L
- 0.6 to 2 µg/L
- Greater than 2 µg/L

Monitoring Wells

- ● Well Included in Monitoring Plan
- ○ Well Not Included in Monitoring Plan
- MW-16S Screen Included in Monitoring Plan
- MW-16D Screen Not Included in Monitoring Plan

Demolition Area 2
June 2014 Plume Shell
Model Predicted RDX Concentrations - 2025

LOCATION MAP

Impact Area Groundwater Study Program

FIGURE 1-4

NOTES & SOURCES
Base Data from US Geological Survey
7 1/2 minute Topographic Maps
Source: MassGIS

M:\MMR\2014\Demo2\AnnRpt\PlumeShell_Working\Fig1-4_02112015.pdf
M:\MMR\2014\Demo2\AnnRpt\PlumeShell_Working\PlumeContours 2-4-15.mxd
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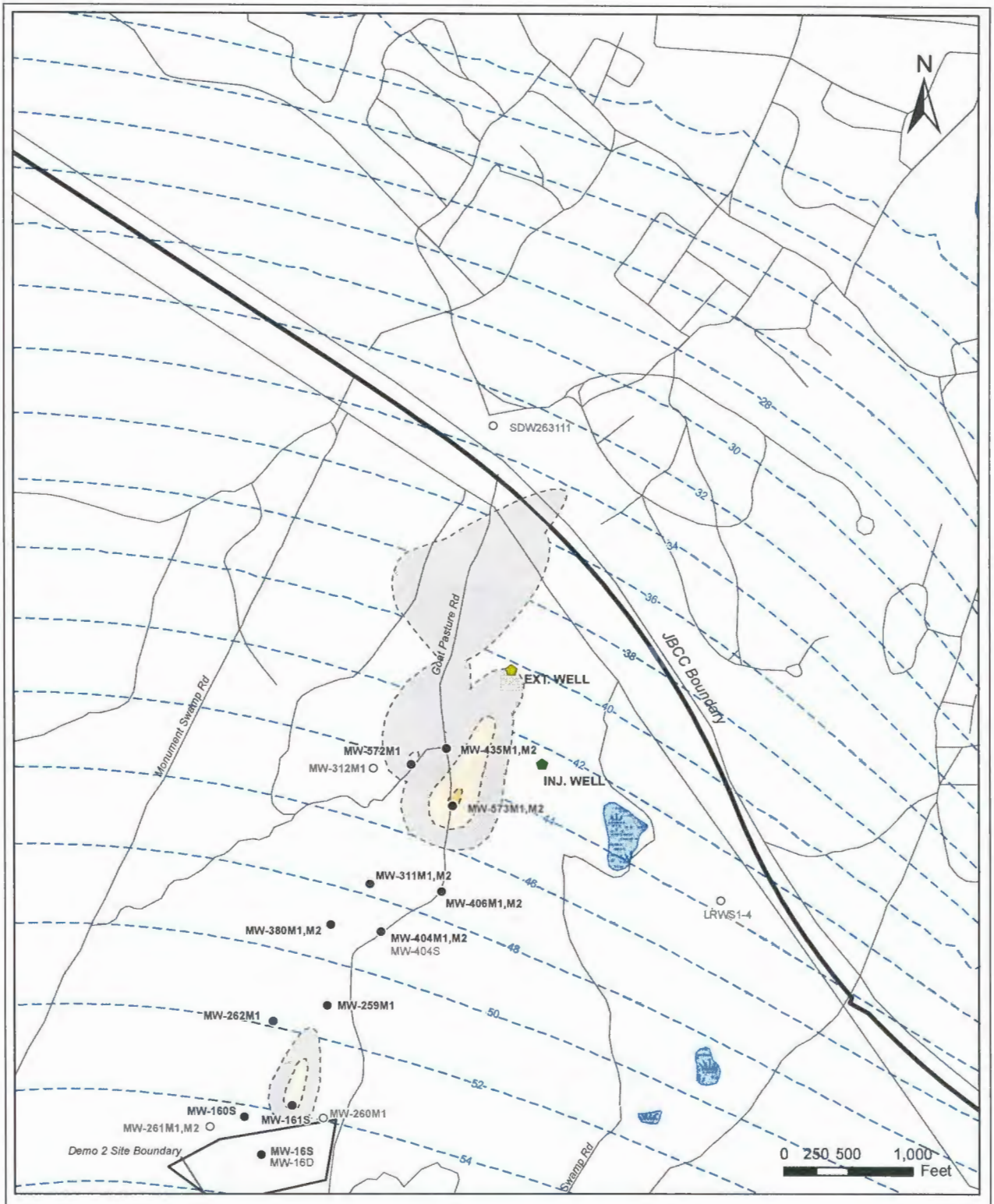


LEGEND

RDX in Groundwater
Based on MT3D Transport Model Result

- 0.25 to 0.6 µg/L
- 0.6 to 2 µg/L
- Greater than 2 µg/L

Monitoring Wells

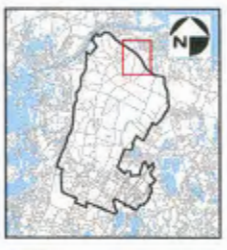
- Well Included in Monitoring Plan
- Well Not Included in Monitoring Plan
- **MW-16S** Screen Included in Monitoring Plan
- MW-16D Screen Not Included in Monitoring Plan

Modeled Treatment System

- Extraction Well Location
- Re-injection Well Location

Demolition Area 2
Simulated Extraction Well System Location
June 2014 Plume Shell
(Two Years Prior to Assumed System Start-up)

LOCATION MAP



Impact Area Groundwater Study Program

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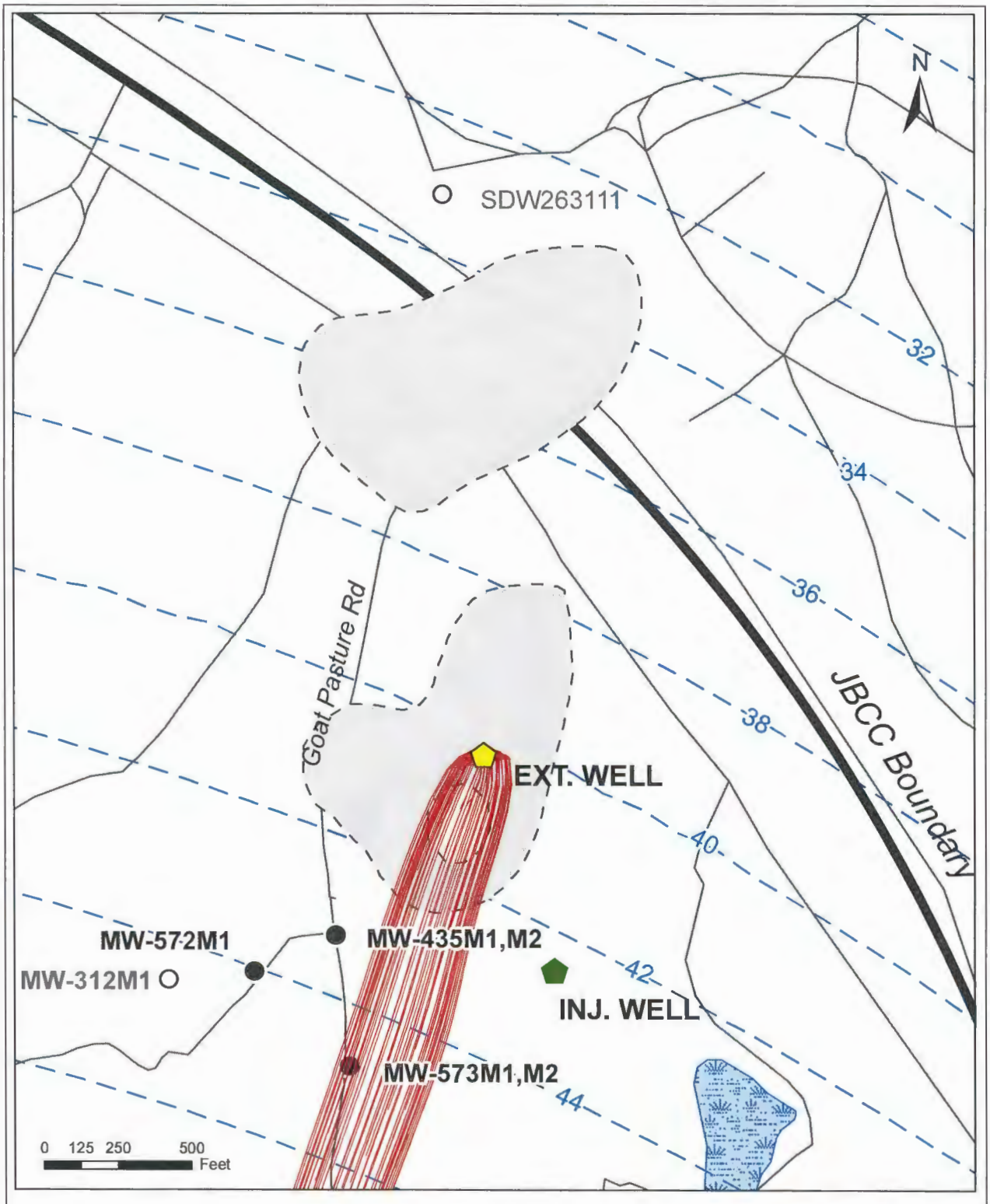
March 16, 2015 DWN: PJM

NOTES & SOURCES
Base Data from US Geological Survey
7 1/2 minute Topographic Maps
Source: MassGIS

FIGURE
1-5



LEGEND

RDX in Groundwater
Based on MT3D Transport Model Result

- 0.25 to 0.6 µg/L
- 0.6 to 2 µg/L

Monitoring Wells

- Well Included in Monitoring Plan
- Well Not Included in Monitoring Plan
- **MW-16S** Screen Included in Monitoring Plan
- MW-16D Screen Not Included in Monitoring Plan

Simulated Treatment System

- Extraction Well Location
- Re-Injection Well Location
- Reverse Particle Tracks (EW Capture Zone)

Demolition Area 2
Simulated Extraction Well System
Capture Zone
Model Predicted RDX Concentrations - June 2016
(Assumed Time of System Completion/Start-up)

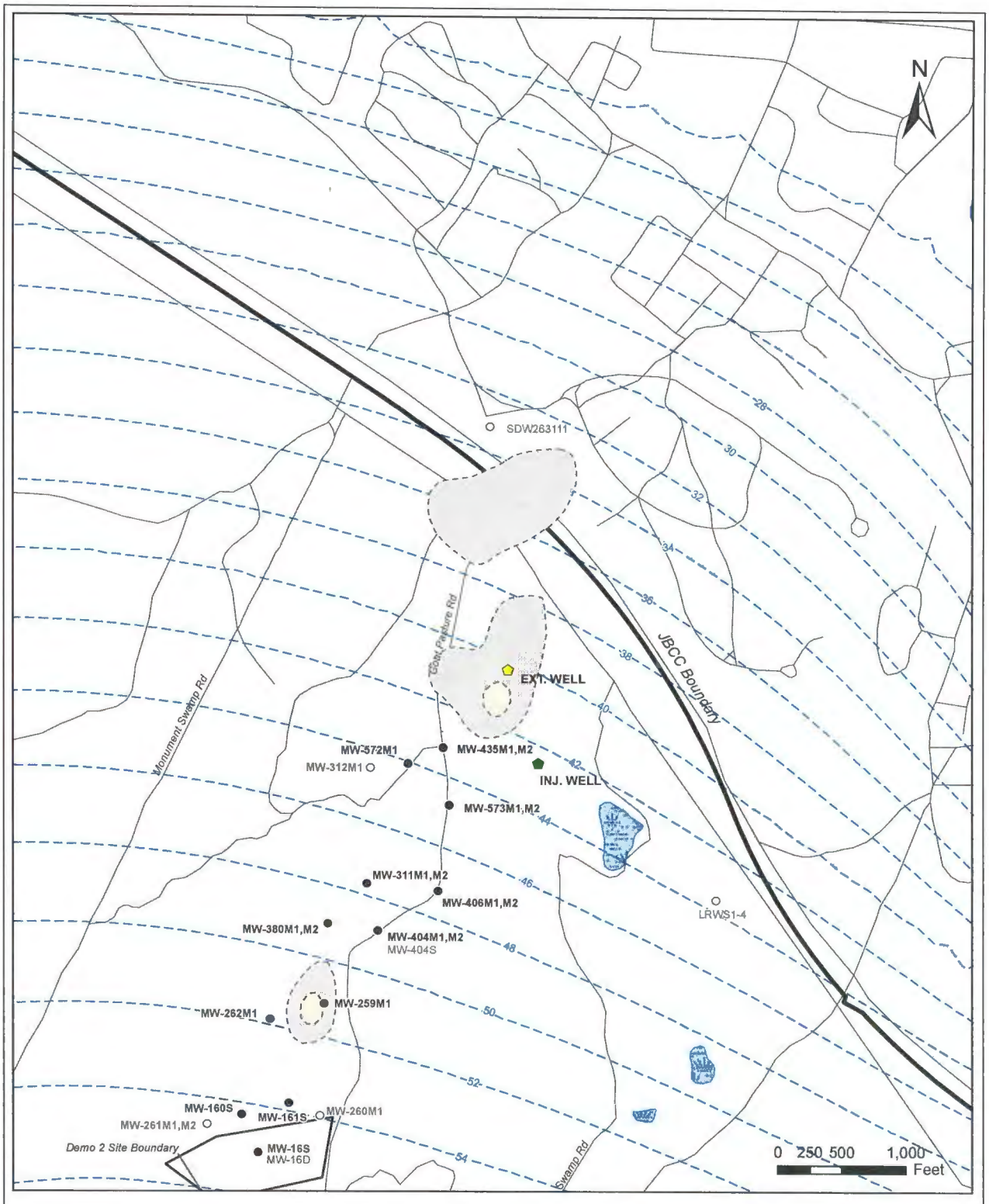
LOCATION MAP

Impact Area Groundwater Study Program

FIGURE 1-6

M:\MMR\2014\Demo2\AnnRpt\PlumeShell_Working\EW_Modeling\Fig1-6.pdf
M:\MMR\2014\Demo2\AnnRpt\PlumeShell_Working\EW Capture Zone 3-16-15.mxd
March 18, 2015 DWN: PJM

NOTES & SOURCES
Base Data from US Geological Survey
7 1/2 minute Topographic Maps
Source: MassGIS



LEGEND

RDX in Groundwater
Based on MT3D Transport Model Result

- 0.25 to 0.6 µg/L
- 0.6 to 2 µg/L
- Greater than 2 µg/L

Monitoring Wells

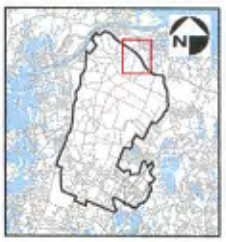
- Well Included in Monitoring Plan
- Well Not Included in Monitoring Plan
- **MW-16S** Screen Included in Monitoring Plan
- MW-16D Screen Not Included in Monitoring Plan

Modeled Treatment System

- Extraction Well Location
- Re-injection Well Location

Demolition Area 2
Simulated Extraction Well System
Model Predicted RDX Concentrations - June 2016
(Assumed Time of System Completion/Start-up)

LOCATION MAP



Impact Area Groundwater Study Program

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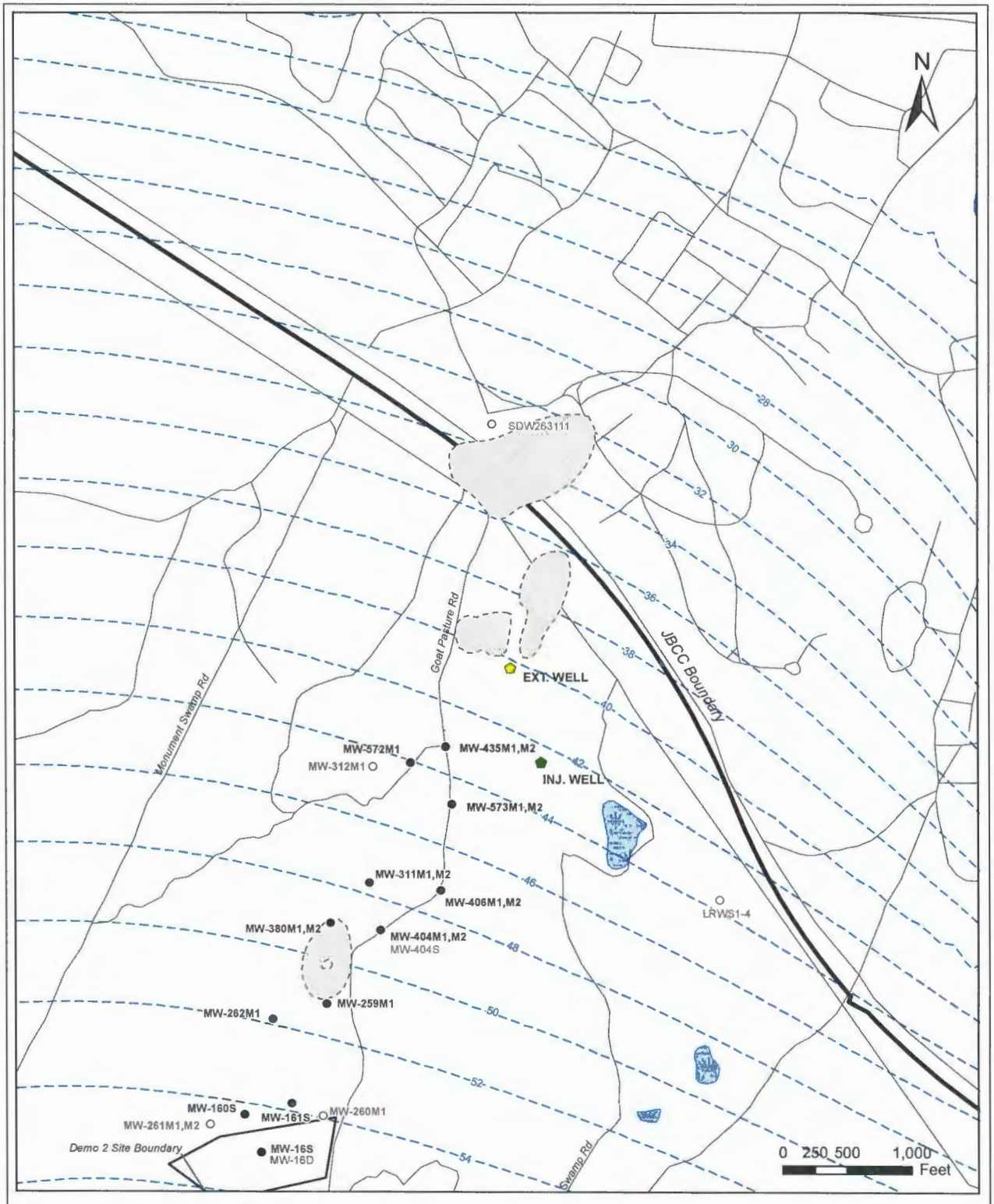
March 16, 2015 DWN: PJM

NOTES & SOURCES
Base Data from US Geological Survey
7 1/2 minute Topgraphic Maps
Source: MassGIS

FIGURE
1-7



LEGEND

RDX in Groundwater
Based on MT3D Transport Model Result

- 0.25 to 0.6 µg/L
- 0.6 to 2 µg/L
- Greater than 2 µg/L

Monitoring Wells

- ● Well Included in Monitoring Plan
- ○ Well Not Included in Monitoring Plan
- **MW-16S** Screen Included in Monitoring Plan
- MW-16D Screen Not Included in Monitoring Plan

Modeled Treatment System

- Extraction Well Location
- Re-injection Well Location

Demolition Area 2
Simulated Extraction Well System
Model Predicted RDX Concentrations - June 2017
(System Running for One Year)

LOCATION MAP

Impact Area
Groundwater Study Program

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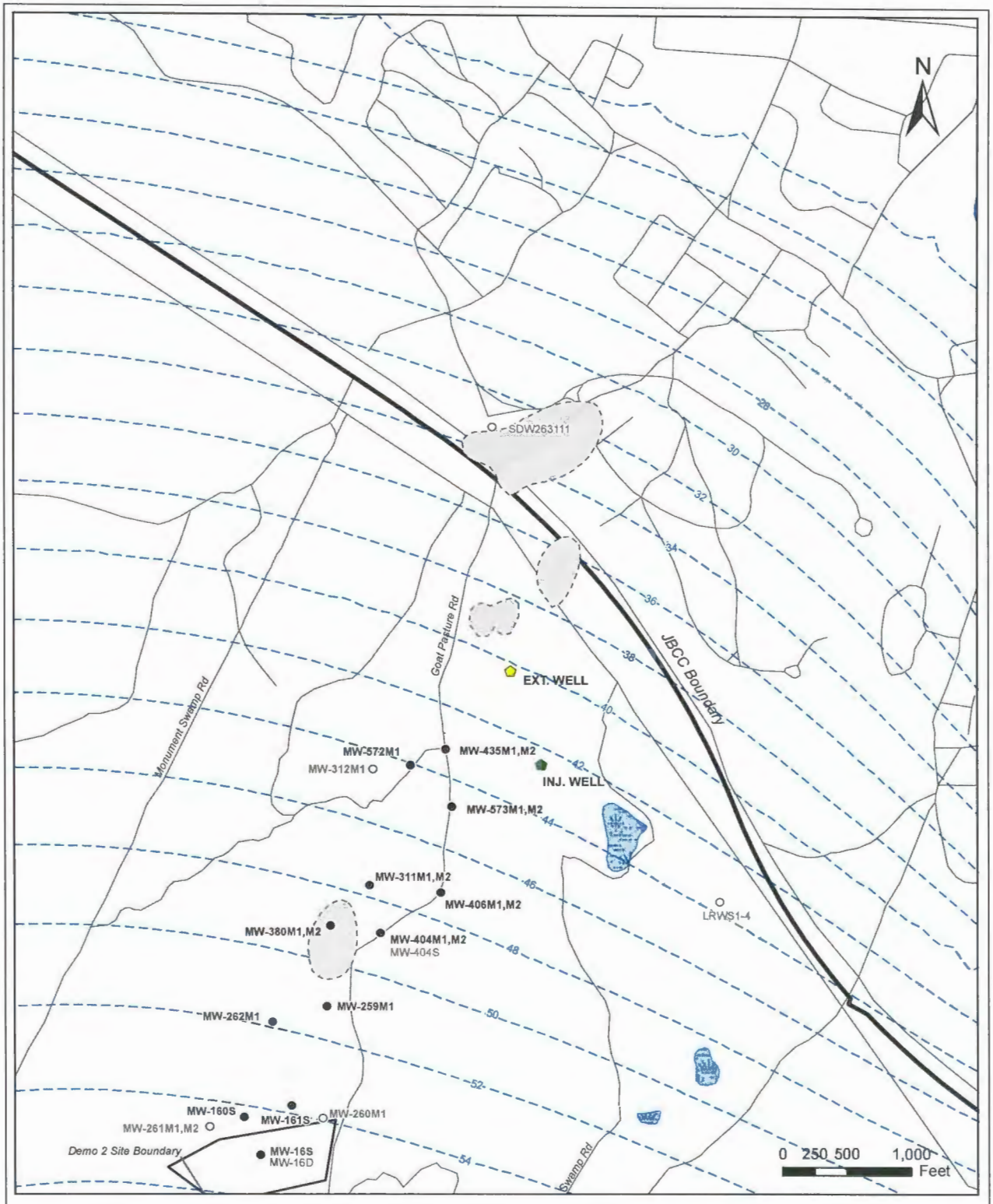
March 18, 2015 DWN: PJM

NOTES & SOURCES
Base Data from US Geological Survey
7 1/2 minute Topgraphic Maps
Source: MassGIS

FIGURE
1-8



LEGEND

RDX in Groundwater
Based on MT3D Transport Model Result

- 0.25 to 0.6 µg/L
- 0.6 to 2 µg/L
- Greater than 2 µg/L

Monitoring Wells

- Well Included in Monitoring Plan
- Well Not Included in Monitoring Plan
- **MW-16S** Screen Included in Monitoring Plan
- MW-16D Screen Not Included in Monitoring Plan

Modeled Treatment System

- Extraction Well Location
- Re-injection Well Location

Demolition Area 2
Simulated Extraction Well System
Model Predicted RDX Concentrations - January 2018
(System Running for 1.5 Years)

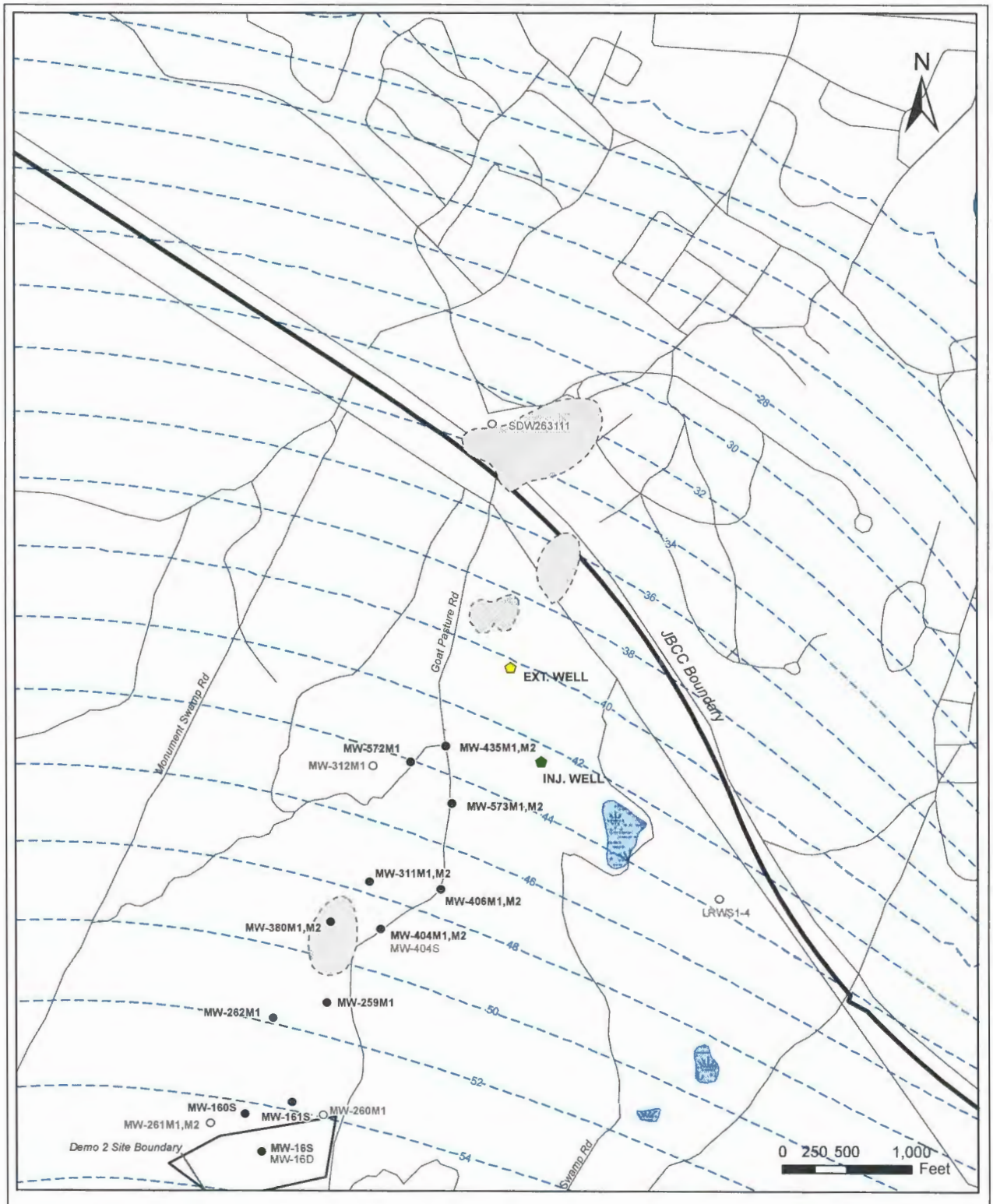
LOCATION MAP

Impact Area Groundwater Study Program

FIGURE 1-9

M:\MMR\2014\Demo2\AnnRpt\PlumeShell_Working\EW_Modeling\Fig1-9.pdf
M:\MMR\2014\Demo2\AnnRpt\PlumeShell_Working\Extraction Well Modeling 3-18-15.mxd
March 18, 2015 DWN: PJM

NOTES & SOURCES
Base Data from US Geological Survey
7 1/2 minute Topographic Maps
Source: MassGIS



LEGEND

RDX in Groundwater
Based on MT3D Transport Model Result

- 0.25 to 0.6 µg/L
- 0.6 to 2 µg/L
- Greater than 2 µg/L

Monitoring Wells

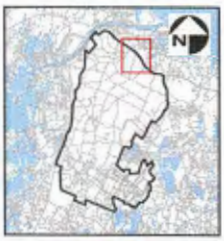
- ● Well Included in Monitoring Plan
- ○ Well Not Included in Monitoring Plan
- **MW-16S** Screen Included in Monitoring Plan
- MW-16D Screen Not Included in Monitoring Plan

Modeled Treatment System

- Extraction Well Location
- Re-injection Well Location

Demolition Area 2
Simulated Extraction Well System
Model Predicted RDX Concentrations - January 2020
(System Running for 3.5 Years)

LOCATION MAP



Impact Area
Groundwater Study Program

FIGURE
1-10

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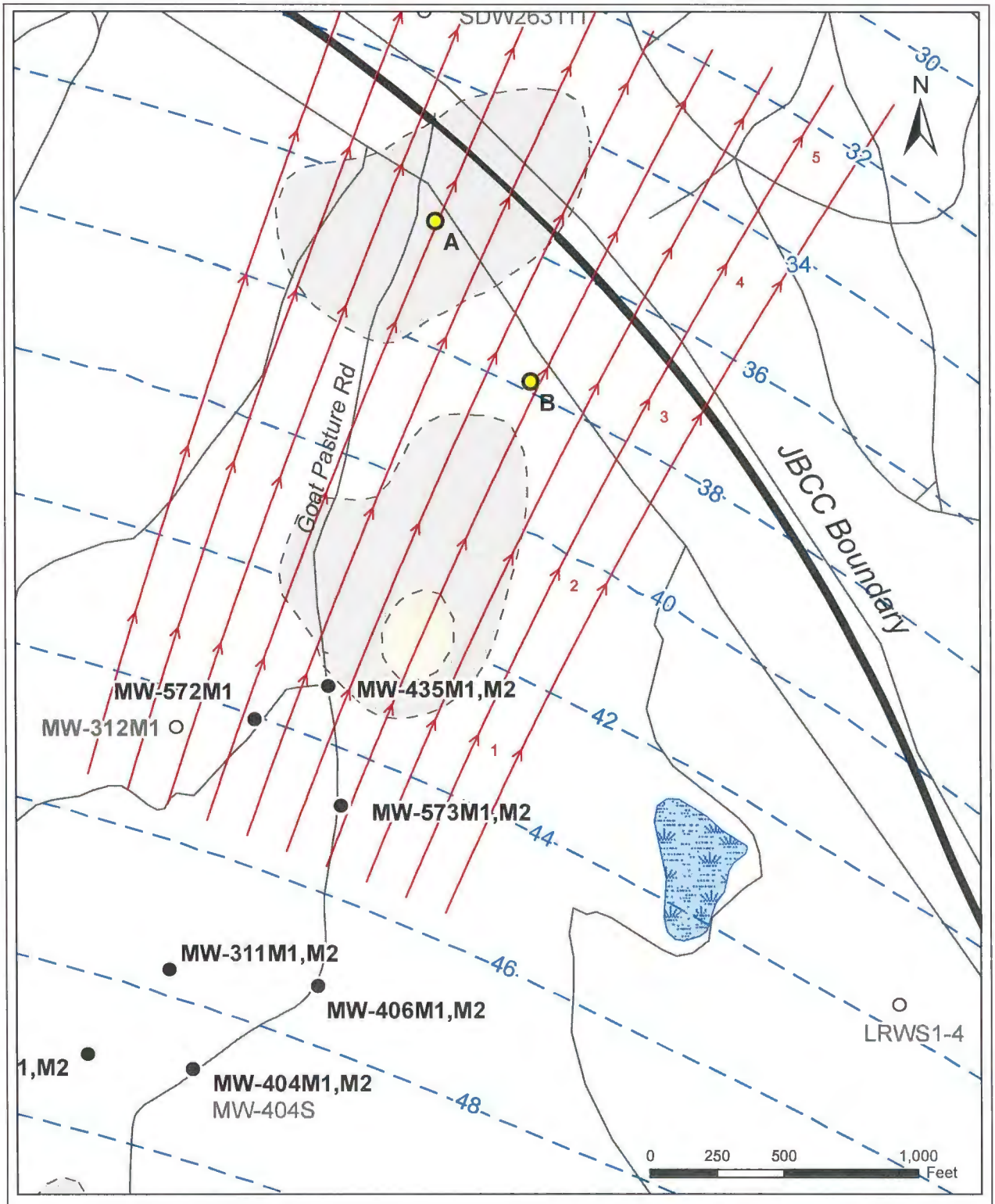
M:\MMR\2014\Demo2\AnnRpt\PlumeShell_Working\Extraction Well Modeling 3-16-15.mxd
March 18, 2015 DWN: PJM

NOTES & SOURCES
Base Data from US Geological Survey
7 1/2 minute Topgraphic Maps
Source: MassGIS



LEGEND

Monitoring Wells

- ● Well Included in Monitoring Plan
- ○ Well Not Included in Monitoring Plan
- **MW-16S** Screen Included in Monitoring Plan
- MW-16D Screen Not Included in Monitoring Plan
- ◎ Proposed Location for New Monitoring Well

RDX in Groundwater - Model Predicted Values (2016)

- 0.25 to 0.6 µg/L
- 0.6 to 2.0 µg/L

MODPATH Forward (Downgradient) Particle Tracks

- → Arrows Denote 1-Year Migration Time Interval

Proposed Screened Intervals for New Monitoring Wells:

Well "A": -5 to -15 ft msl,
-20 to -30 ft msl

Well "B": 5 to -5 ft msl,
-10 to -20 ft msl

Demolition Area 2
Proposed Monitoring Well Locations

LOCATION MAP

Impact Area Groundwater Study Program

FIGURE 1-11

NOTES & SOURCES
Base Data from US Geological Survey
7 1/2 minute Topographic Maps
Source: MassGIS

M:\MMR\2014\Demo2\AnnRpt\PlumeShell_Working\EW_Modeling\Fig1-11.pdf
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March 16, 2015 DWN: PJM