AREA B GROUNDWATER INVESTIGATION

Progress Report to the RAB
July 18 2012

Tim Llewellyn

John Cherry

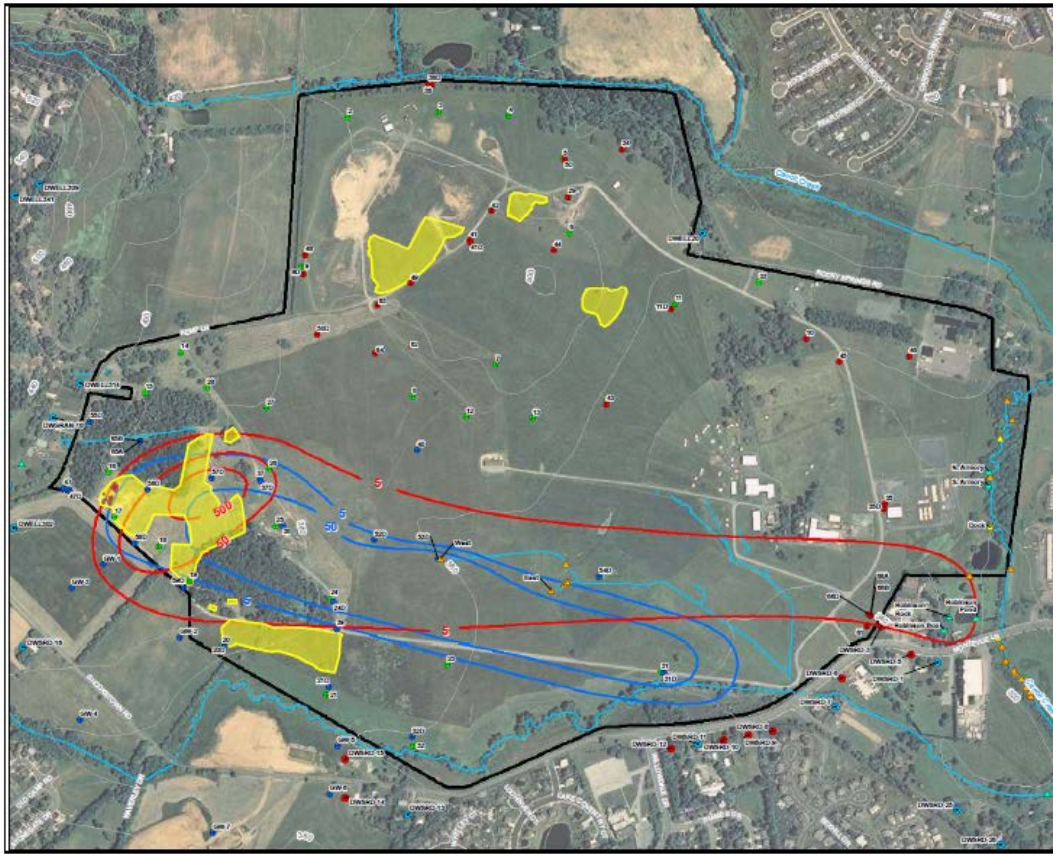
ARCADIS MALCOLM PIRNIE

Overview of Topics

- Objectives and status of current work
- Conceptual Site Model (CSM)
- April 2012 Sampling Results
- Summary and anticipated path forward

Objectives of the Current Study

- Further assess groundwater flow directions
- Further assess the depth and extent of contamination
- Further assess the full range of possible chemical compounds
- Further assess the potential for contaminant migration off-site



ARCADIS MALCOLM PIRNIE

Status of Current Phase

✓ Existing well assessment and repair	Feb 2011 to Apr 2011
✓ New well installation (onsite)	April 2011 to Mar 2012
✓ Direct Push Investigation	March 2012
✓ Spring and Seep Surveys	March 2012
✓ Groundwater/Surface Water Sampling	April 2012 /**Sept 2012**
► **Vapor Intrusion Sampling**	**Fall 2012**
► **Dye trace study**	**Summer/Fall 2012**

Status of CERCLA Process

- Remedial Investigation (Characterization of Site/CSM)
- Feasibility Study (Assessment of possible remedies)
- Proposed Plan (Public document to solicit input on preferred remedy)
- Record of Decision (Final legal document selecting remedy)
- Remedial Action (Implement Remedy)

Conceptual Site Model

CONCEPTUAL SITE MODEL

CSM integrates all the information gathered into a succinct format allowing clear understanding of groundwater flow and potential contaminant nature and extent

CSM is used to identify possible data-gaps (if any) and guides future work including assessment of possible remedies at the Feasibility Study stage

ELEMENTS OF THE CSM

Geologic Framework

Geologic structure is the basic foundation of a CSM

- **Drilling program**

Groundwater and surface water flow patterns

Flow patterns drive migration of contaminants

- **Elevation data from wells and streams**

ARCADIS MALCOLM PIRNIE

ELEMENTS OF THE CSM

Groundwater discharge areas

Indicates where contaminated groundwater may discharge to the surface

- **Stream survey provides this information**
- **Dye trace studies**

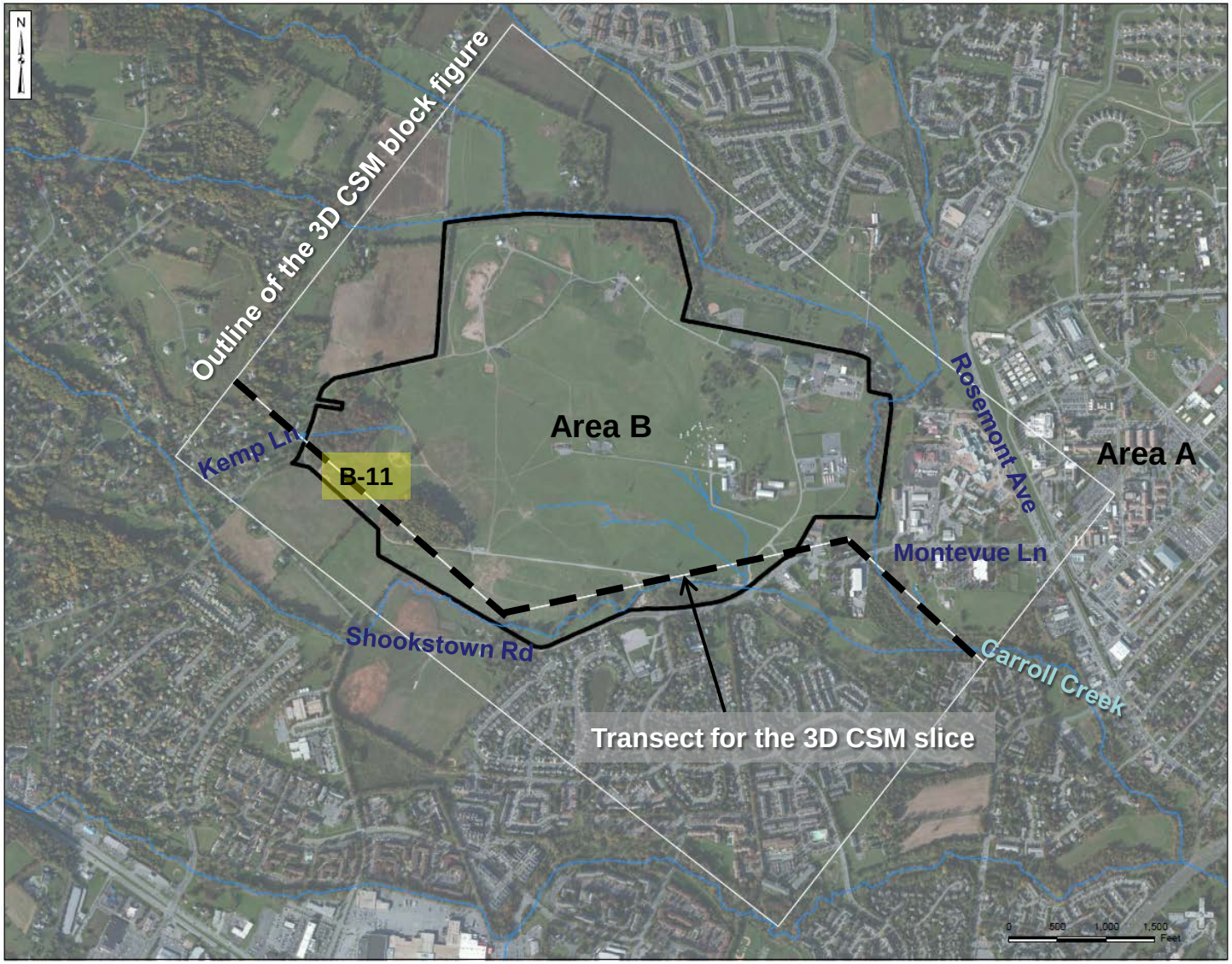
Nature and extent of contamination

Actual extent of groundwater contamination and documents contaminated groundwater discharge locations

- **Groundwater/surface water sampling**

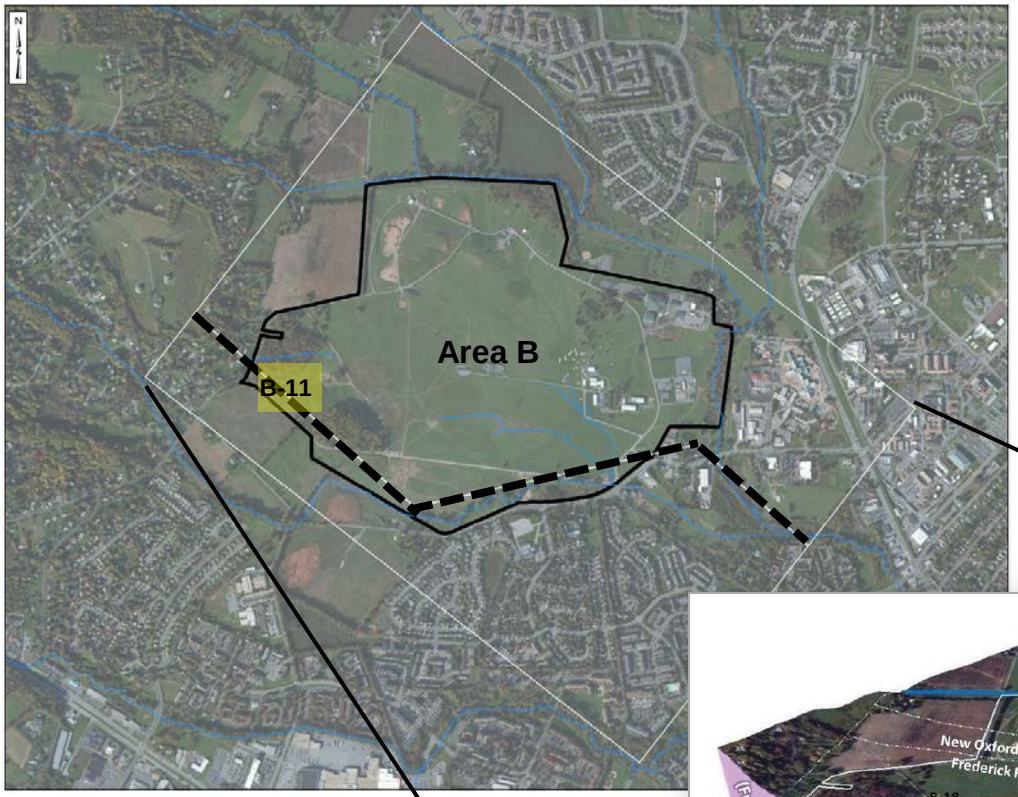
ARCADIS MALCOLM PIRNIE

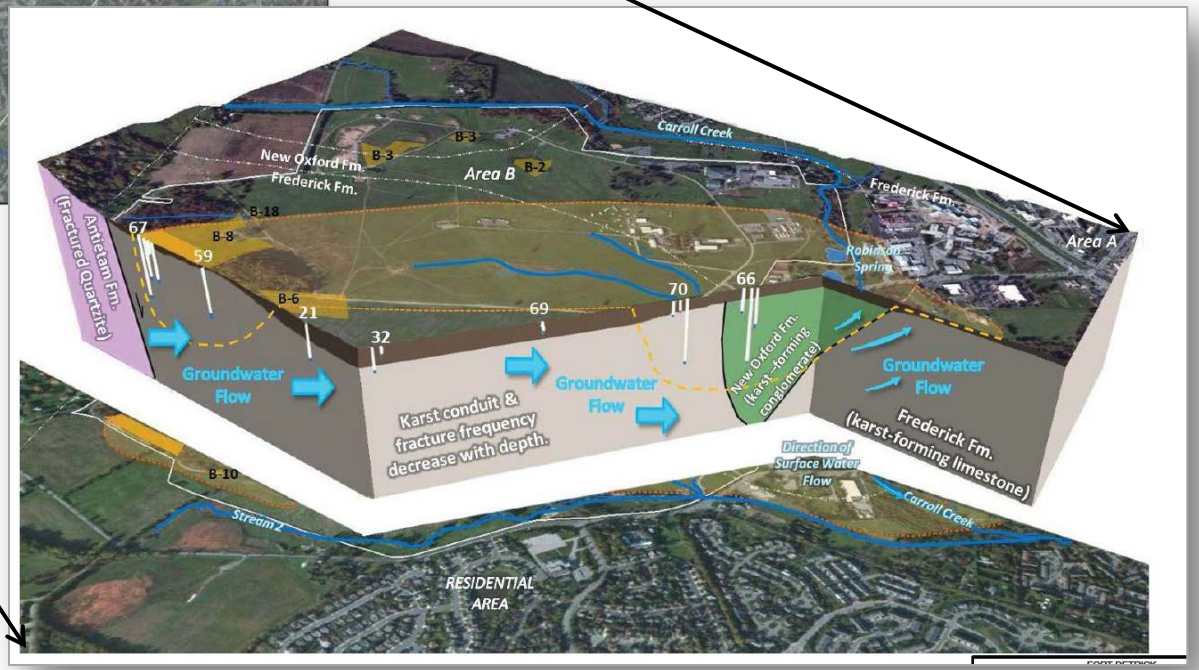
Area B Conceptual Site Model



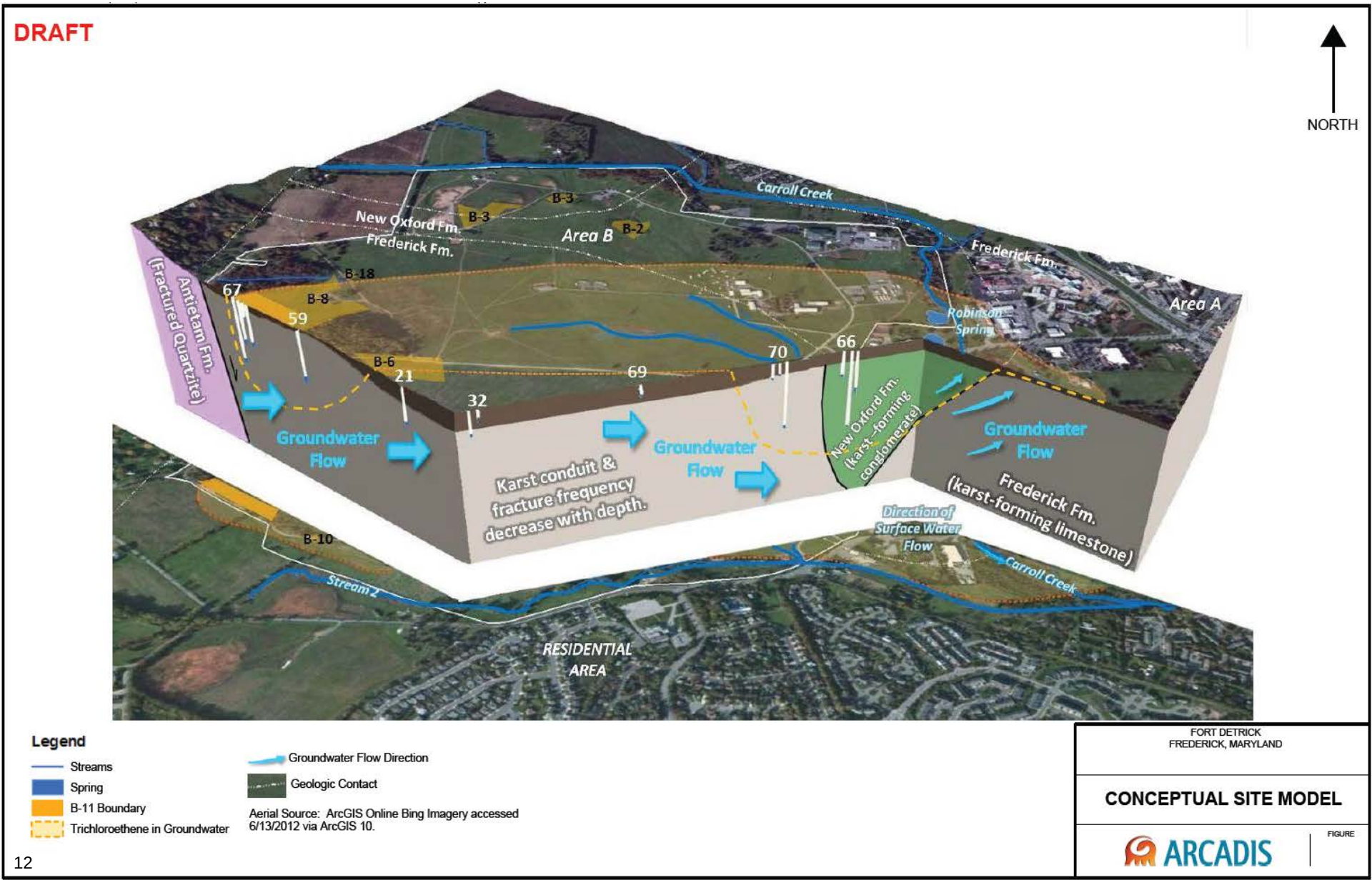
ARCADIS MALCOLM PIRNIE

Area B Conceptual Site Model

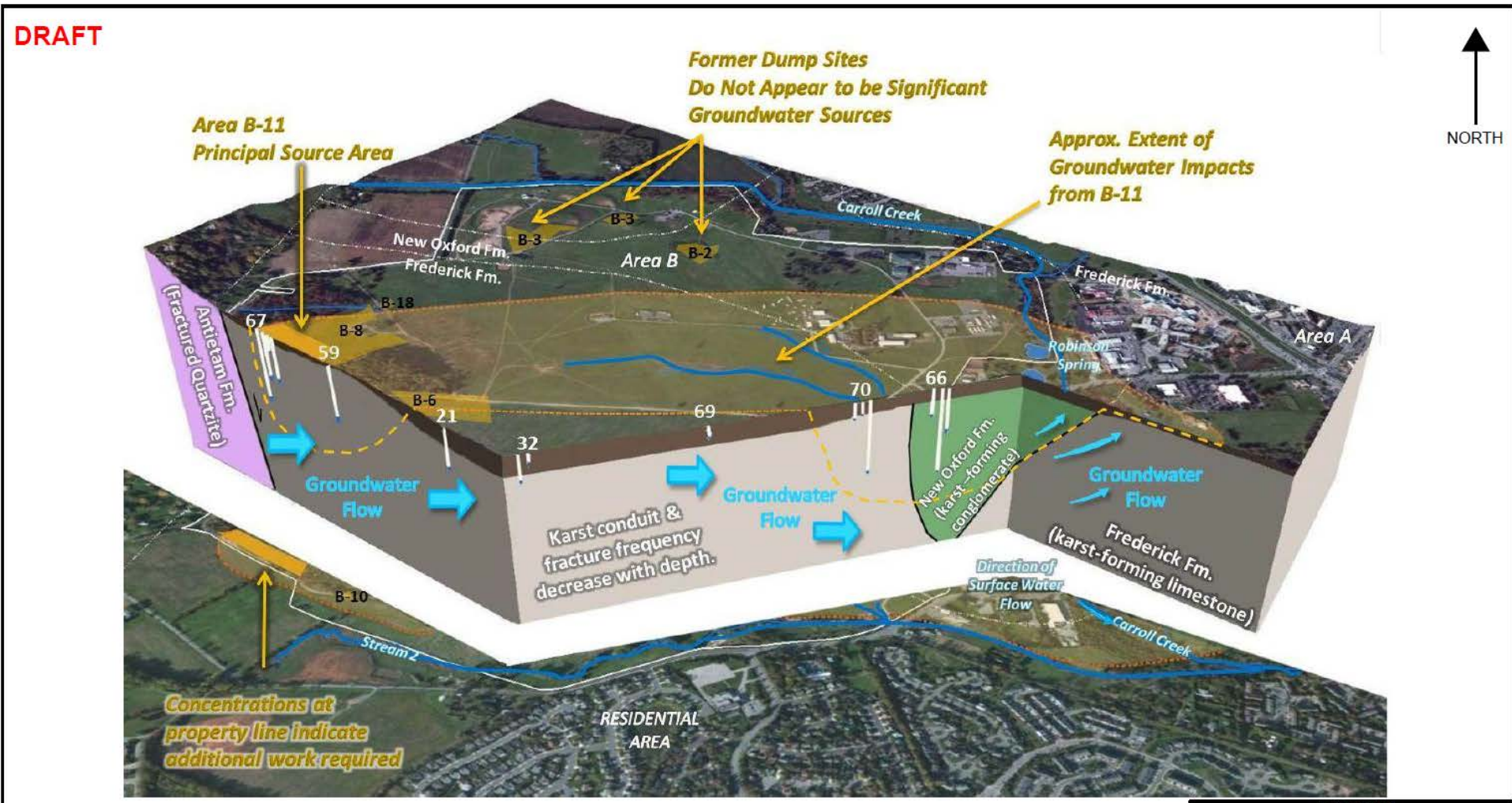




Area B Conceptual Site Model



Area B Conceptual Site Model



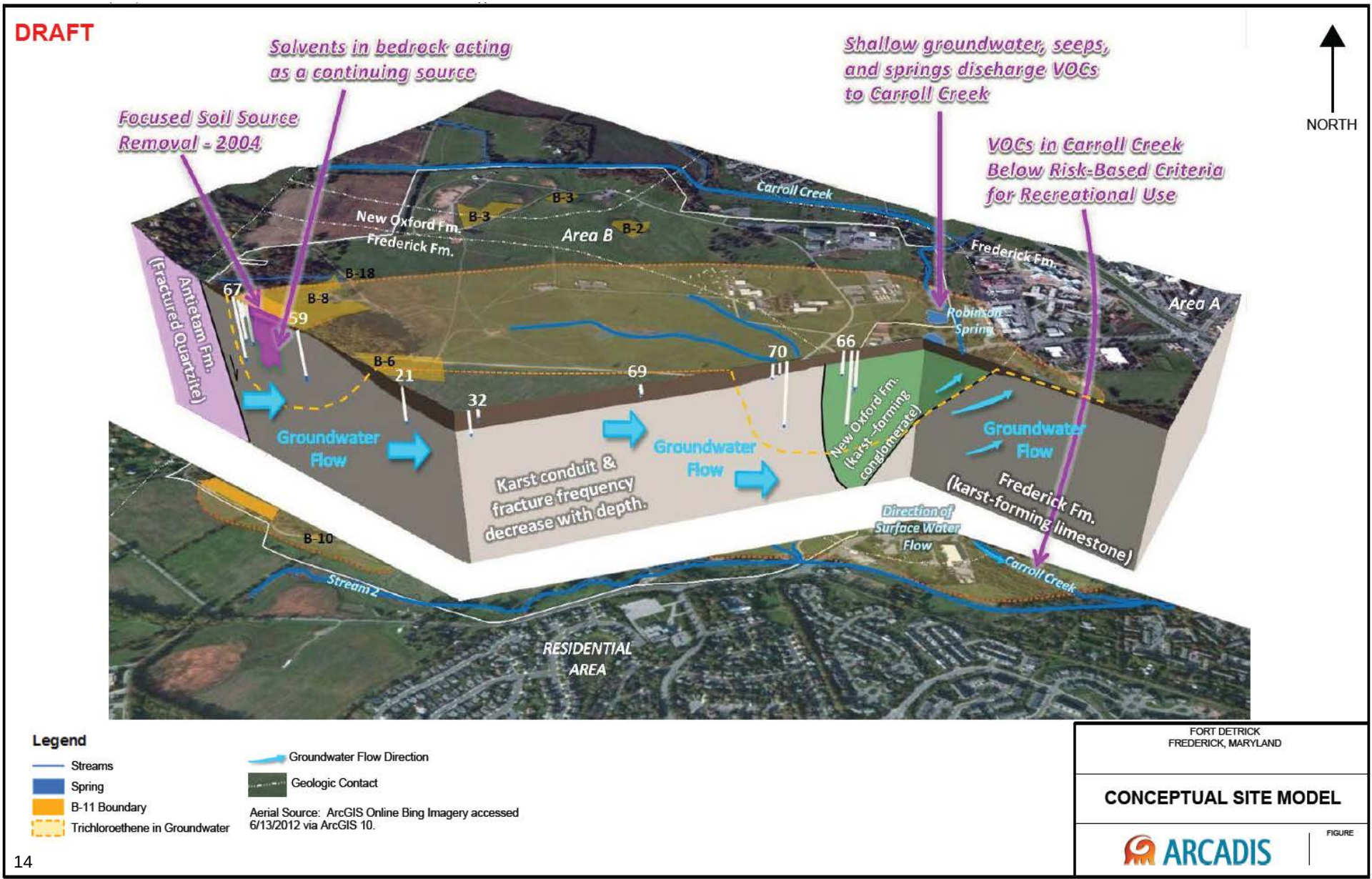
FORT DETRICK
FREDERICK, MARYLAND

CONCEPTUAL SITE MODEL

ARCADIS

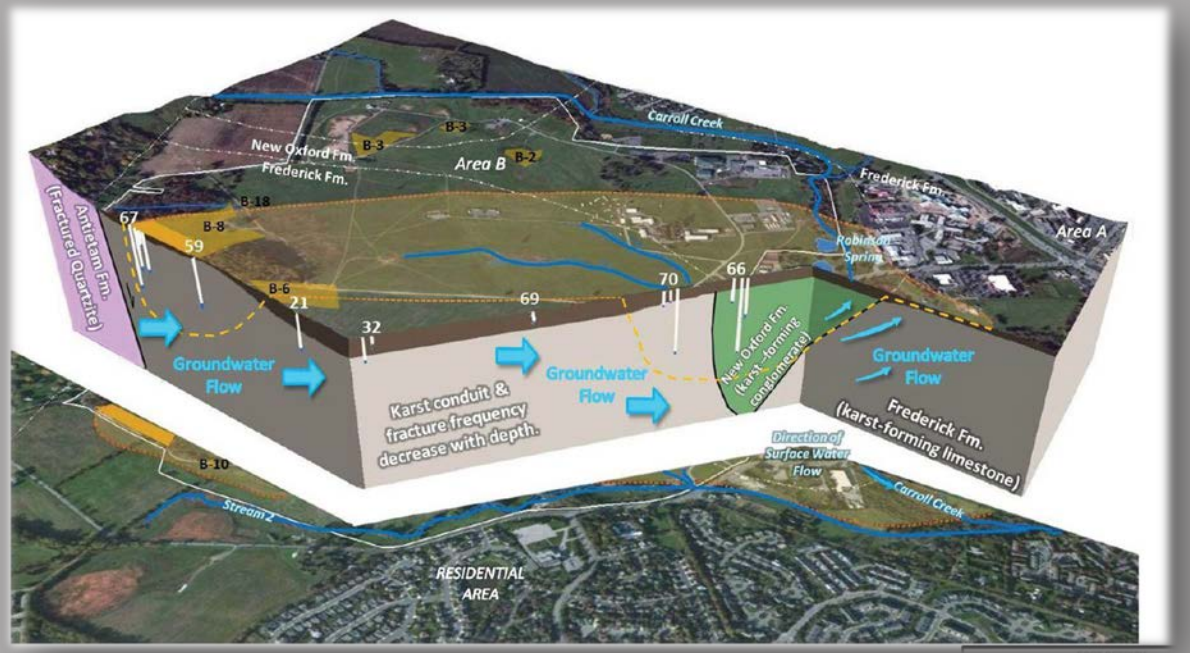
FIGURE

Area B Conceptual Site Model



April 2012 Sampling Results

Groundwater



2011/12 Drilling Program

- 29 new monitoring wells up to 325 feet deep
- 3,966 linear feet of drilling completed
- 3,028 linear feet of geophysical logging completed

ARCADIS MALCOLM PIRNIE

April 2012 Groundwater Sampling (Round 1)

- Groundwater samples
  - 79 monitoring wells
  - 8 former/current residential wells
- Groundwater elevation
  - 127 locations
- *Second round of sampling planned for Fall 2012*

ARCADIS MALCOLM PIRNIE

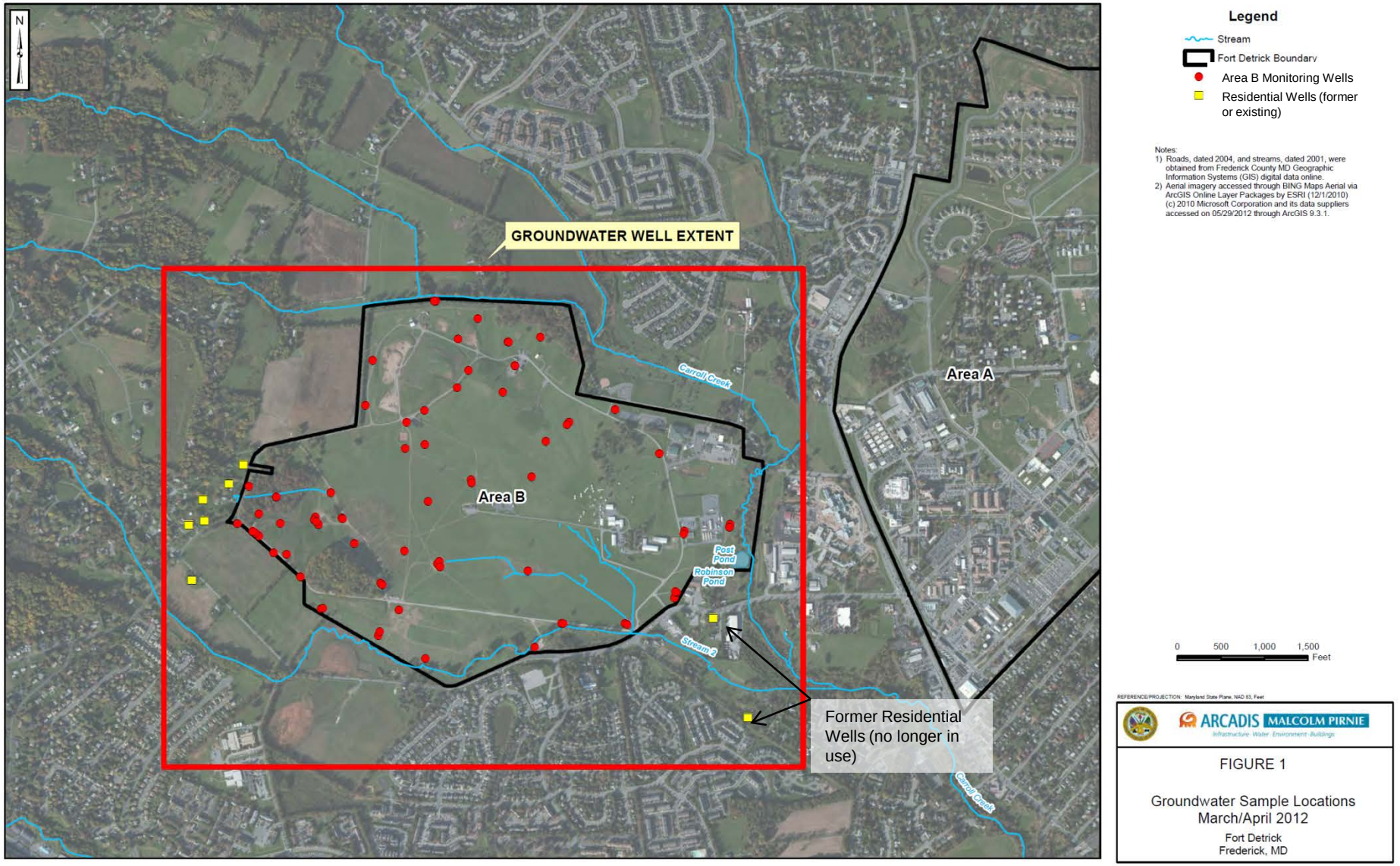
Initial Draft Data Review & Observations

Laboratory data reports are currently undergoing third-party data validation review. Final data expected in late July.

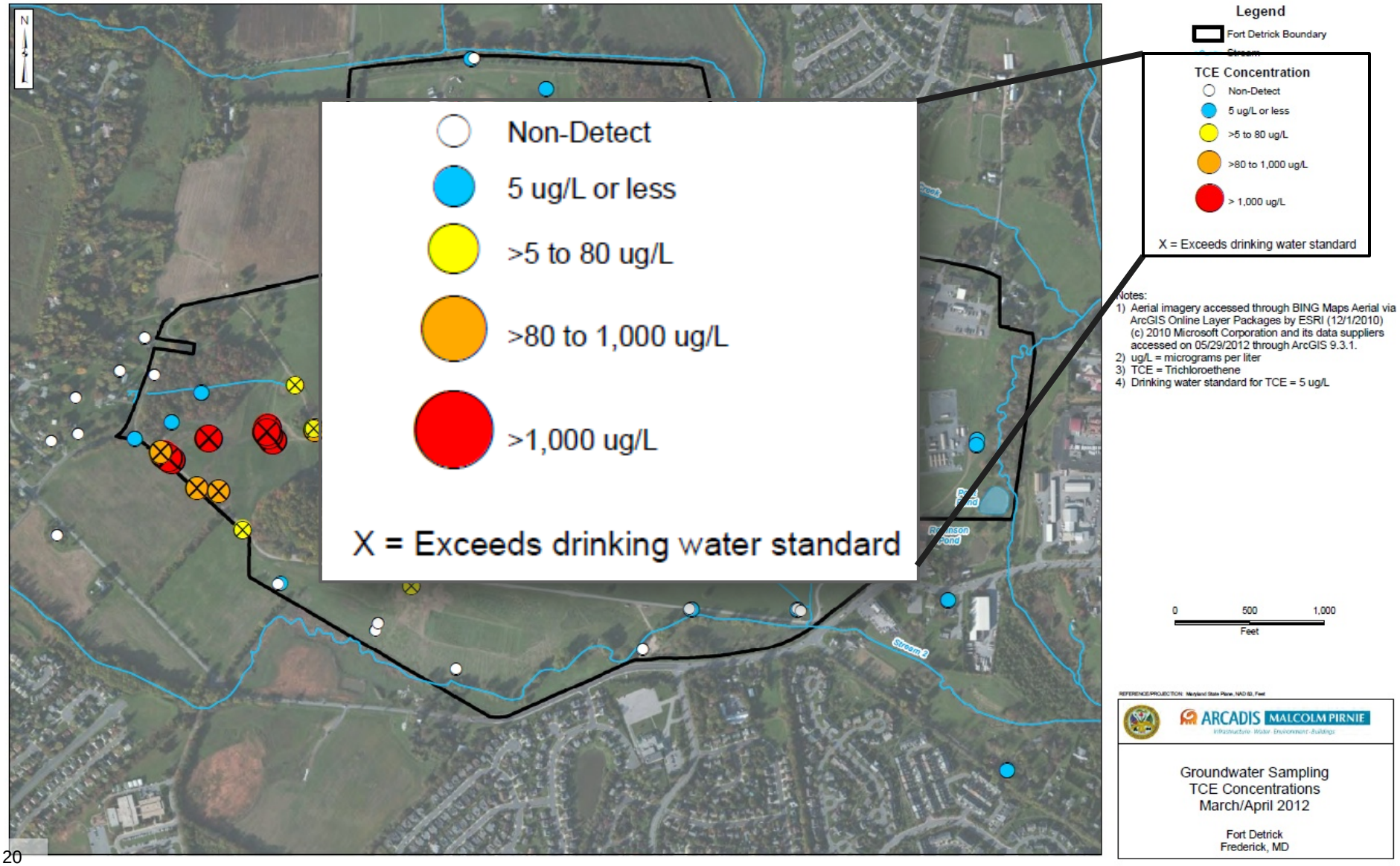
- Solvents are the main contaminant and are present at part per million levels in the vicinity of B-11
- Other parameters analyzed are absent or present at much lower concentrations
- Solvents are present in shallow groundwater and surface water off-site to the east of Area B
- Primary solvents are TCE, PCE, and Chloroform.

ARCADIS MALCOLM PIRNIE

Area B GW Sampling Location Map



TCE in Groundwater April 2012



TCE in Groundwater April 2012

PCE in Groundwater April 2012

Chloroform in GW April 2012

Shallow Groundwater Results (Direct Push Technology)

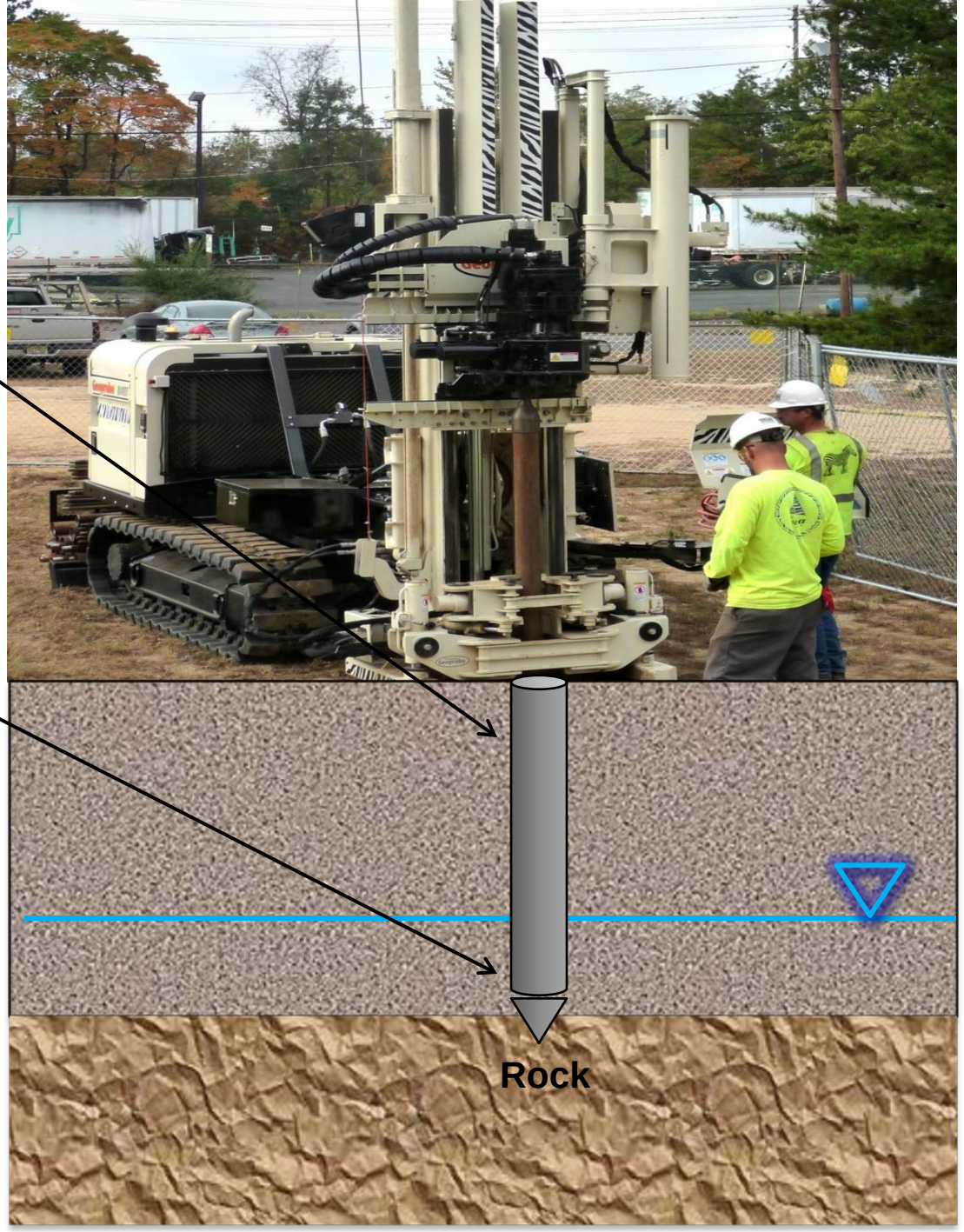
- DPT work completed March 2012
- 52 locations in anticipated groundwater discharge area
- Shallow bedrock prevented groundwater sampling at 13 locations. Multiple attempts in each area
- 39 groundwater samples collected and submitted for laboratory analysis

DPT METHODOLOGY

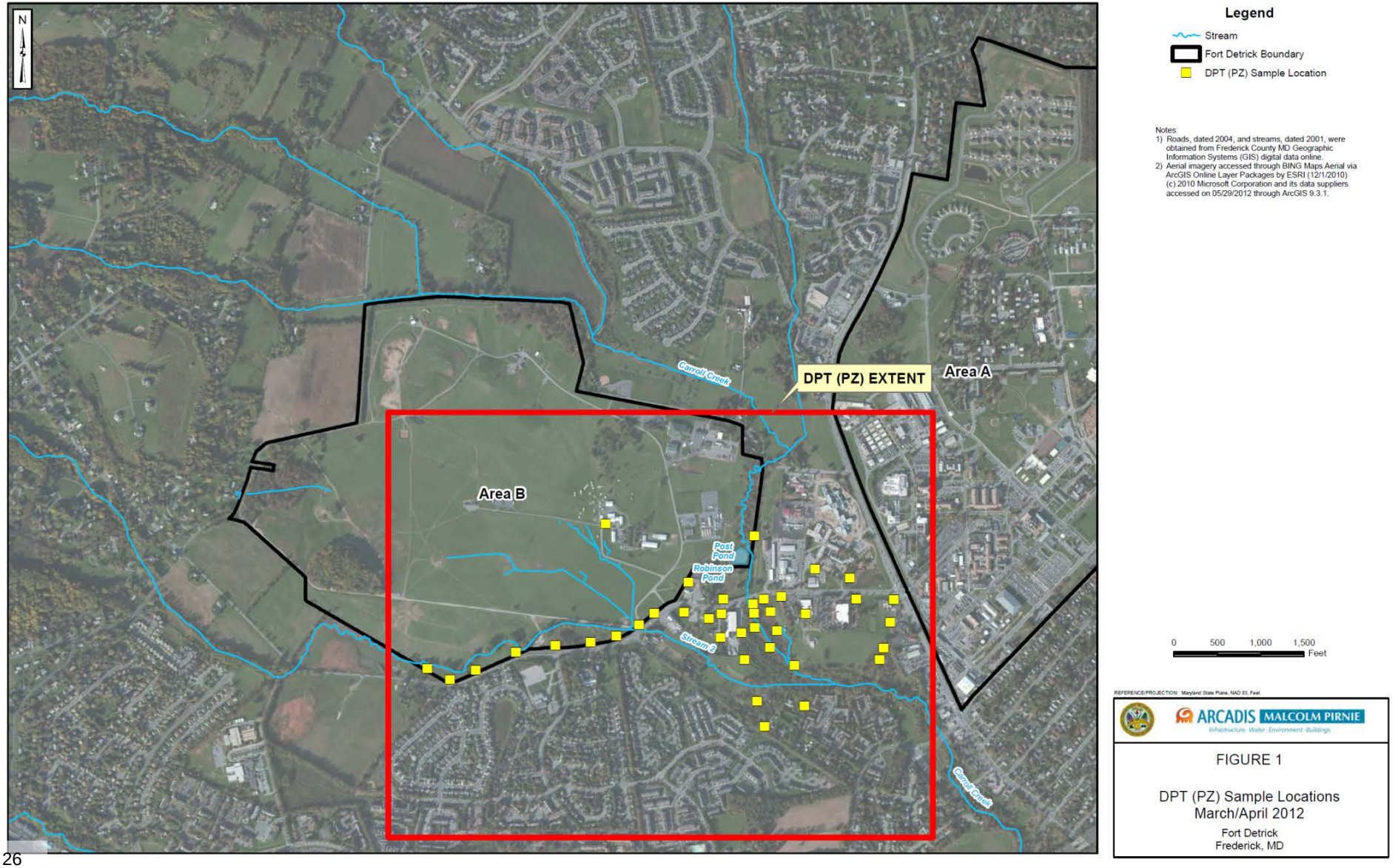
Hydraulic pressure used to advance 3-inch steel tube to top of rock

Temporary well screen exposed or small diameter well installed

Groundwater samples are then collected via surface pump for analyses



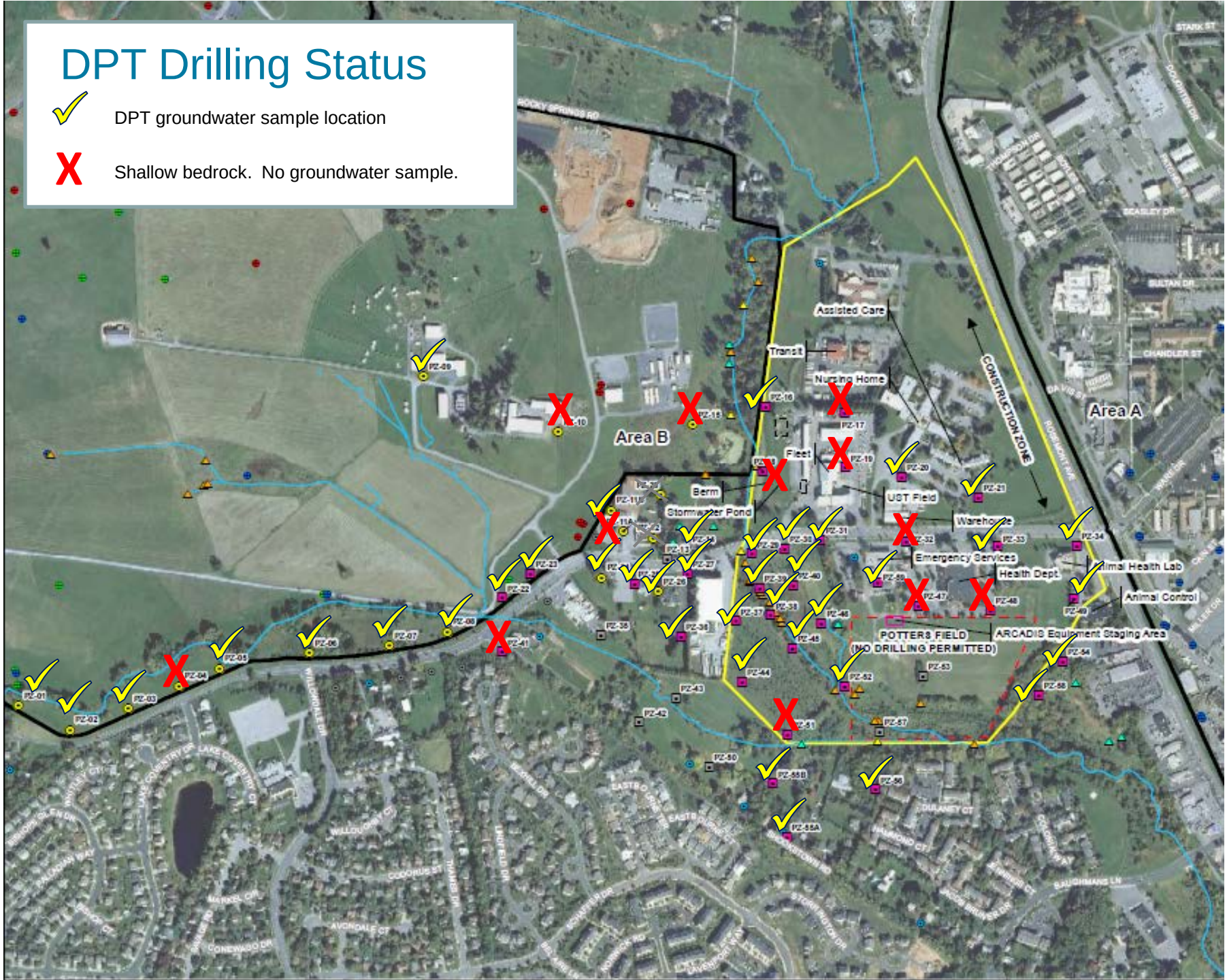
Area B GW Sampling--DPT



DPT Drilling Status

✓ DPT groundwater sample location

X Shallow bedrock. No groundwater sample.



TCE in Shallow Groundwater

April 2012

Legend

- Fort Detrick Boundary
- Stream

TCE Concentration

- Non-Detect
- 5 ug/L or less
- >5 to 80 ug/L
- >80 to 1,000 ug/L
- >1,000 ug/L

X = Exceeds drinking water standard

Notes:

1) Aerial imagery accessed through BING Maps Aerial via ArcGIS Online Layer Packages by ESRI (12/1/2010) (c) 2010 Microsoft Corporation and its data suppliers accessed on 05/29/2012 through ArcGIS 9.3.1.
2) ug/L = micrograms per liter
3) TCE = Trichloroethene
4) Drinking water standard for TCE = 5 ug/L

0 500 1,000
Feet

REFERENCE PROJECTION: Maryland State Plane, NAD 83, Feet

ARCADIS MALCOLM PIRNIE

DPT (PZ) Sampling
TCE Concentrations
March/April 2012

Fort Detrick
Frederick, MD

PCE in Shallow Groundwater
April 2012

Legend

- Fort Detrick Boundary
- Stream

PCE Concentration

- Non-Detect
- 5 ug/L or less
- >5 to 80 ug/L
- >80 to 1,000 ug/L
- >1,000 ug/L

X = Exceeds drinking water standard

Notes:
1) Aerial imagery accessed through BING Maps Aerial via ArcGIS Online Layer Packages by ESRI (12/1/2010) (c) 2010 Microsoft Corporation and its data suppliers accessed on 05/29/2012 through ArcGIS 9.3.1.
2) ug/L = micrograms per liter
3) PCE = Tetrachloroethene
4) Drinking water standard for PCE = 5 ug/L

0 500 1,000
Feet

REFERENCE PROJECTION: Maryland State Plane, NAD 83, Feet

ARCADIS MALCOLM PIRNIE

DPT (PZ) Sampling
PCE Concentrations
March/April 2012

Fort Detrick
Frederick, MD

Chloroform in Shallow Groundwater
April 2012

Legend

Fort Detrick Boundary

Stream

Chloroform Concentration

- Non-Detect
- 5 ug/L or less
- >5 to 80 ug/L
- >80 to 1,000 ug/L
- >1,000 ug/L

X = Exceeds drinking water standard

Notes:

1) Aerial imagery accessed through BING Maps Aerial via ArcGIS Online Layer Packages by ESRI (12/1/2010) (c) 2010 Microsoft Corporation and its data suppliers accessed on 05/29/2012 through ArcGIS 9.3.1.
2) ug/L = micrograms per liter
3) Drinking water standard for total trihalomethanes (including chloroform) = 80 ug/L

0 500 1,000
Feet

REFERENCE/PROJECTION: Maryland State Plane, NAD 83, Feet

ARCADIS MALCOLM PIRNIE

DPT (PZ) Sampling
Chloroform Concentrations
March/April 2012

Fort Detrick
Frederick, MD

Supplemental DPT Study Areas

Fall 2012

Legend

- Fort Detrick Boundary
- Stream

PCE Concentration

- Non-Detect
- 5 ug/L or less
- >5 to 80 ug/L
- >80 to 1,000 ug/L
- >1,000 ug/L

X = Exceeds drinking water standard

Notes:

1) Aerial imagery accessed through BING Maps Aerial via ArcGIS Online Layer Packages by ESRI (12/1/2010) (c) 2010 Microsoft Corporation and its data suppliers accessed on 05/29/2012 through ArcGIS 9.3.1.
2) ug/L = micrograms per liter
3) PCE = Tetrachloroethene
4) Drinking water standard for PCE = 5 ug/L

= Supplemental round of Direct Push (DPT) drilling anticipated in these areas, pending right of entry agreement negotiation.

0 500 1,000
Feet

REFERENCE/PROJECTION: Maryland State Plane, NAD 83, Feet

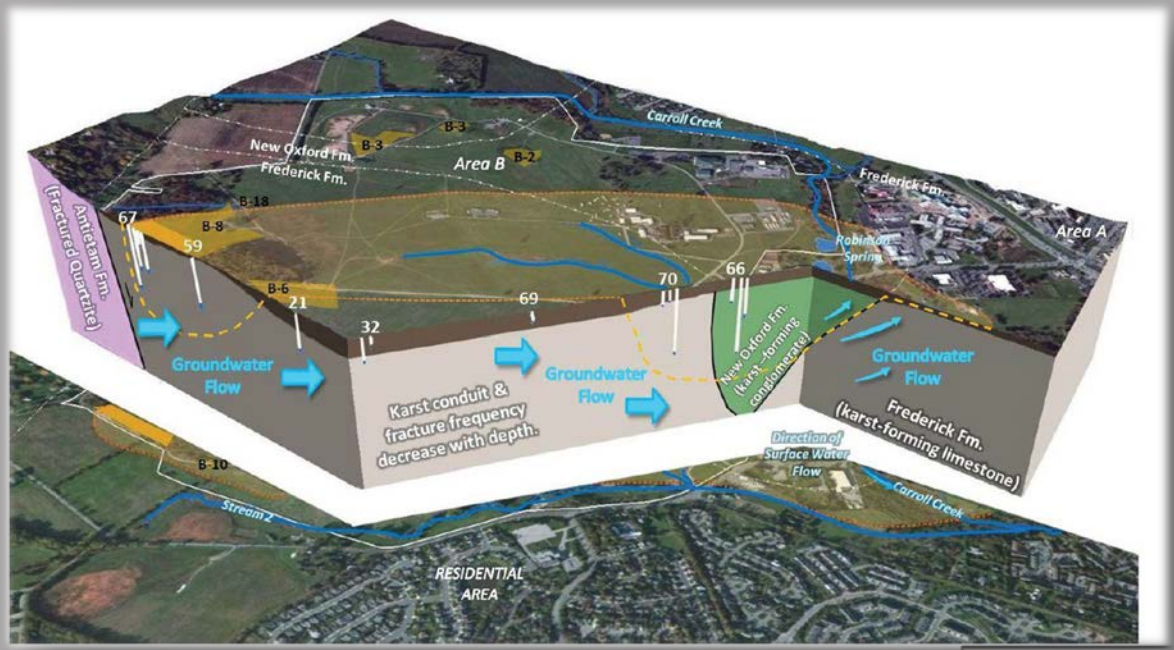
ARCADIS MALCOLM PIRNIE

DPT (PZ) Sampling
PCE Concentrations
March/April 2012

Fort Detrick
Frederick, MD

April 2012 Sampling Results

Seeps and Springs



Seep and Spring Survey

13,000 feet of stream bed surveyed

Visual inspection for seeps and springs

Approx. 40 seeps and springs identified.

58 spring & surface water sample locations

ARCADIS MALCOLM PIRNIE

TCE in Seeps/Springs April 2012

Legend

- Fort Detrick Boundary
- Stream

TCE Concentration

- Non-Detect
- 5 ug/L or less
- >5 to 80 ug/L
- >80 to 1,000 ug/L
- >1,000 ug/L

X = Exceeds drinking water standard

Notes:

1) Aerial imagery accessed through BING Maps Aerial via ArcGIS Online Layer Packages by ESRI (12/1/2010) (c) 2010 Microsoft Corporation and its data suppliers accessed on 05/29/2012 through ArcGIS 9.3.1.
2) ug/L = micrograms per liter
3) TCE = Trichloroethene
4) Drinking water standard for TCE = 5 ug/L

0 500 1,000 1,500
Feet

REFERENCE/PROJECTION: Maryland State Plane, NAD 83, Feet

ARCADIS MALCOLM PIRNIE
Infrastructure, Water, Environment, Buildings

Spring Sampling
TCE Concentrations
March/April 2012

Fort Detrick
Frederick, MD

PCE in Seeps/Springs April 2012

Legend

- Fort Detrick Boundary
- Stream

PCE Concentration

- Non-Detect
- 5 ug/L or less
- >5 to 80 ug/L
- >80 to 1,000 ug/L
- >1,000 ug/L

X = Exceeds drinking water standard

Notes:

1) Aerial imagery accessed through BING Maps Aerial via ArcGIS Online Layer Packages by ESRI (12/1/2010) (c) 2010 Microsoft Corporation and its data suppliers accessed on 05/29/2012 through ArcGIS 9.3.1.
2) ug/L = micrograms per liter
3) PCE = Tetrachloroethene
4) Drinking water standard for PCE = 5 ug/L

0 500 1,000 1,500
Feet

REFERENCE/PROJECTION: Maryland State Plane, NAD 83, Feet

ARCADIS MALCOLM PIRNIE

Spring Sampling
PCE Concentrations
March/April 2012

Fort Detrick
Frederick, MD

Chloroform in Seeps/Springs
April 2012

Legend

Fort Detrick Boundary

Stream

Chloroform Concentration

- Non-Detect
- 5 ug/L or less
- >5 to 80 ug/L
- >80 to 1,000 ug/L
- >1,000 ug/L

X = Exceeds drinking water standard

Notes:

1) Aerial imagery accessed through BING Maps Aerial via ArcGIS Online Layer Packages by ESRI (12/1/2010) (c) 2010 Microsoft Corporation and its data suppliers accessed on 05/29/2012 through ArcGIS 9.3.1.
2) ug/L = micrograms per liter
3) Drinking water standard for total trihalomethanes (including chloroform) = 80 ug/L

0 500 1,000
Feet

REFERENCE/PROJECTION: Maryland State Plane, NAD 83, Feet

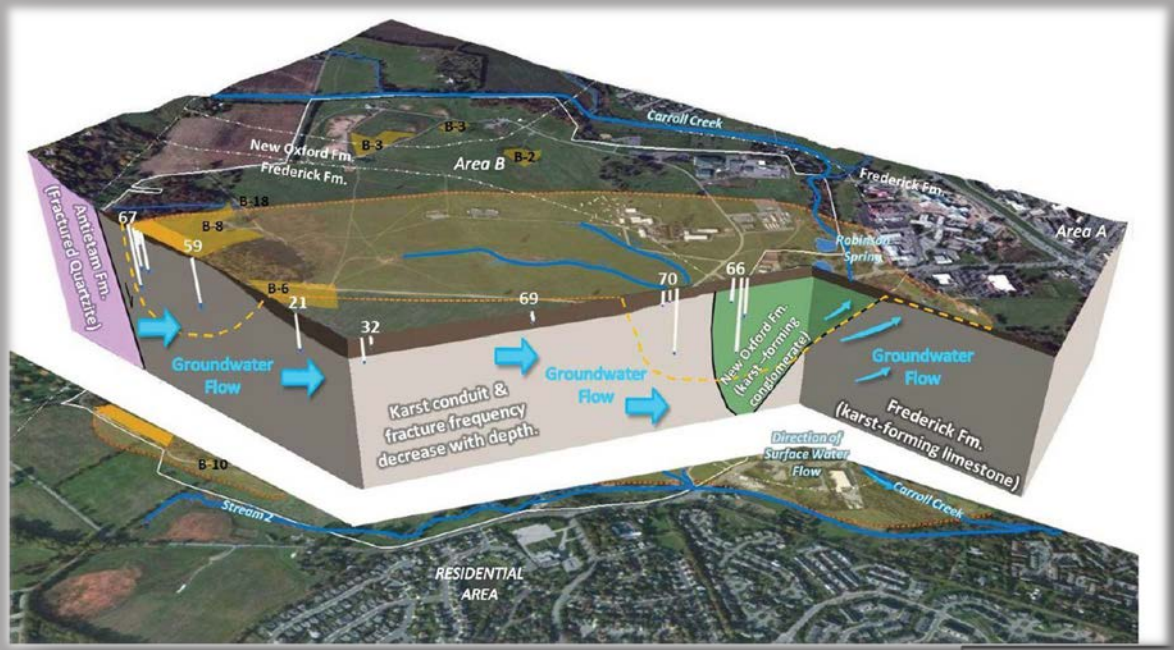
ARCADIS MALCOLM PIRNIE
Infrastructure · Water · Environment · Buildings

Spring Sampling
Chloroform Concentrations
March/April 2012

Fort Detrick
Frederick, MD

April 2012 Sampling Results

Streams/Surface Water

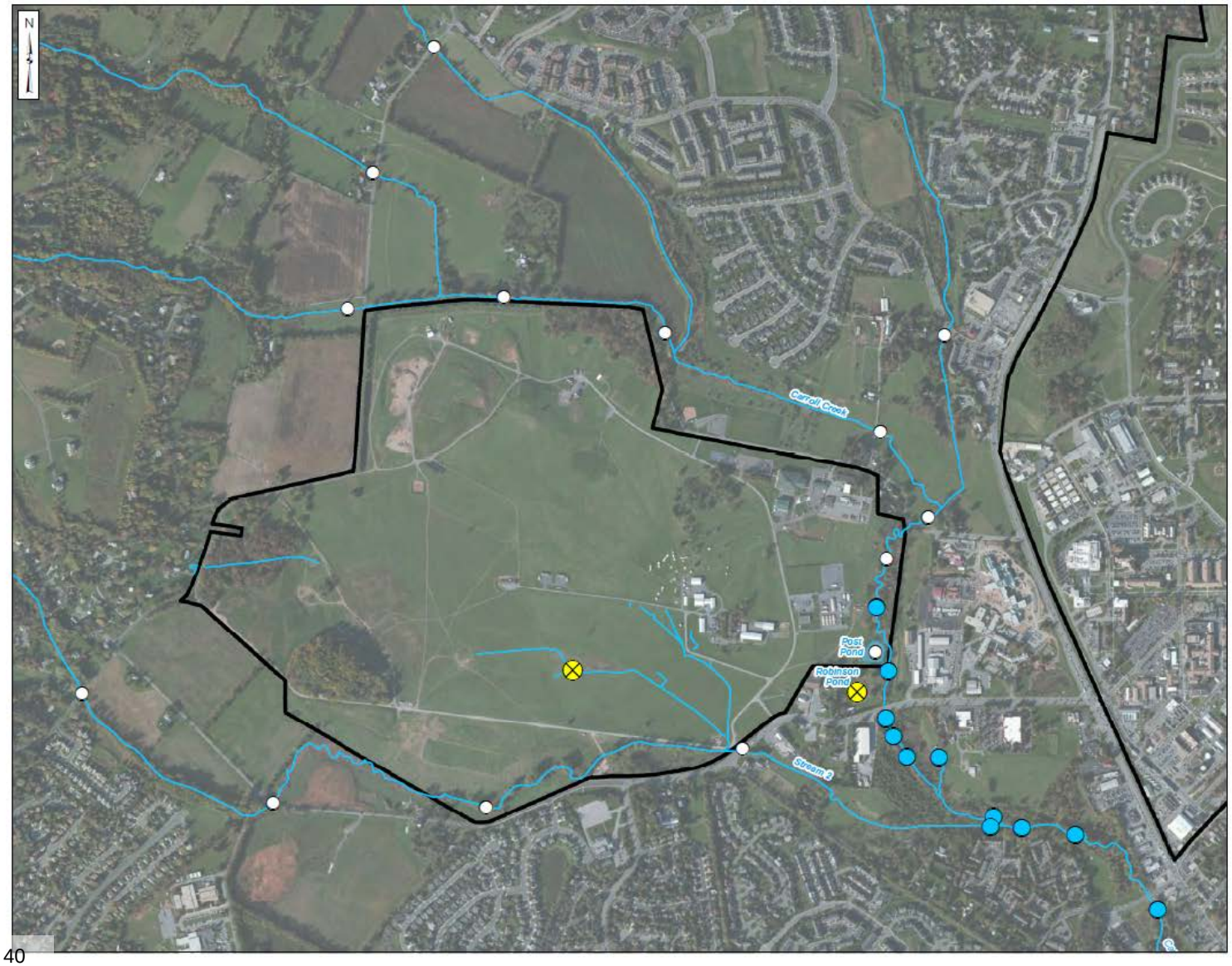


Surface Water (Stream) Samples

32 Surface water/Stream samples collected

ARCADIS MALCOLM PIRNIE

TCE in Surface Water April 2012



Legend

- Fort Detrick Boundary
- Stream

TCE Concentration

- Non-Detect
- 5 ug/L or less
- >5 to 80 ug/L
- >80 to 1,000 ug/L
- >1,000 ug/L

X = Exceeds drinking water standard

Notes:

1) Aerial imagery accessed through BING Maps Aerial via ArcGIS Online Layer Packages by ESRI (12/1/2010) (c) 2010 Microsoft Corporation and its data suppliers accessed on 05/29/2012 through ArcGIS 9.3.1.
2) ug/L = micrograms per liter
3) TCE = Trichloroethene
4) Drinking water standard for TCE = 5 ug/L

0 500 1,000 1,500
Feet

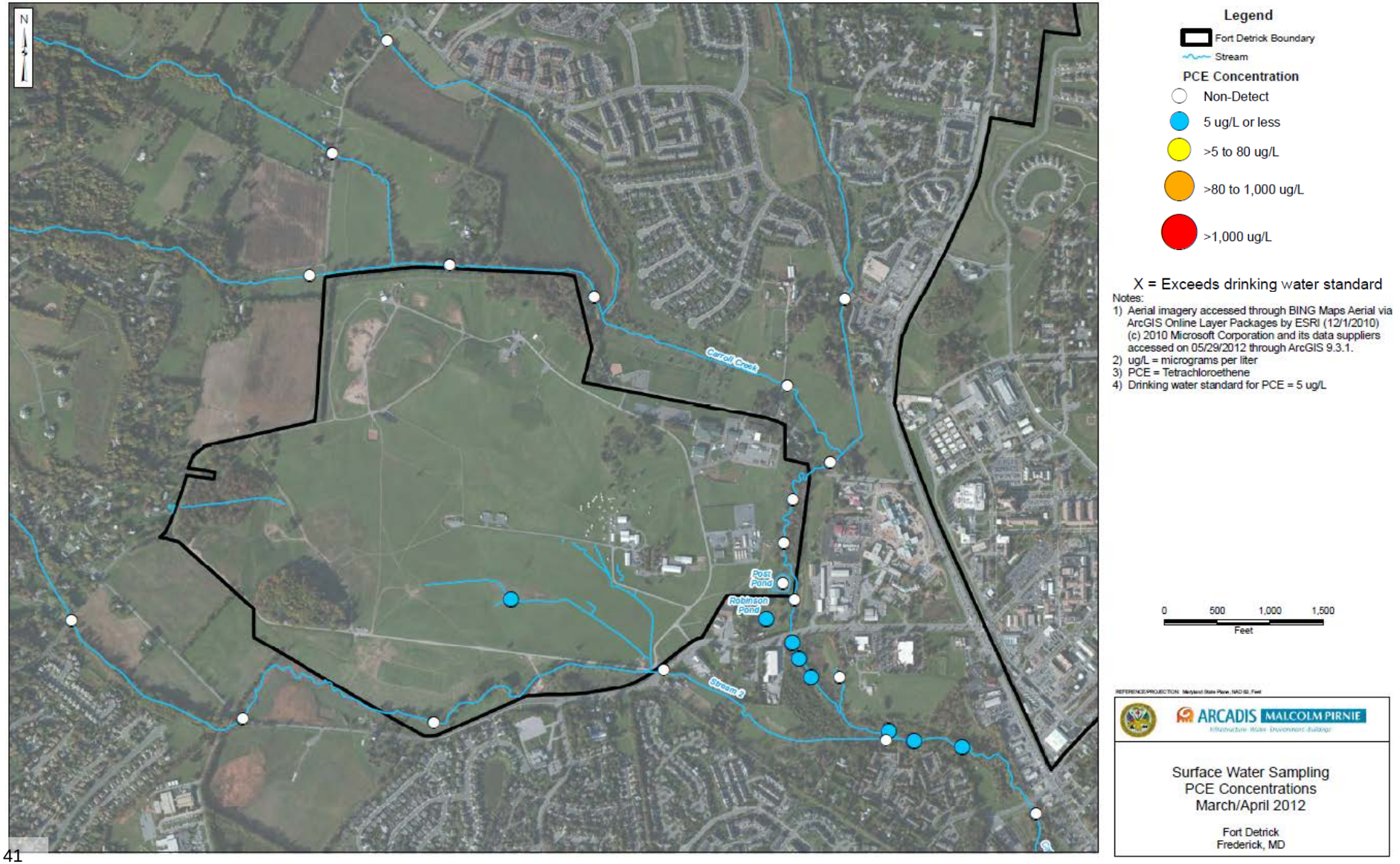
REFERENCE/PROJECTION: Maryland State Plane, NAD 83, Feet

ARCADIS MALCOLM PIRNIE

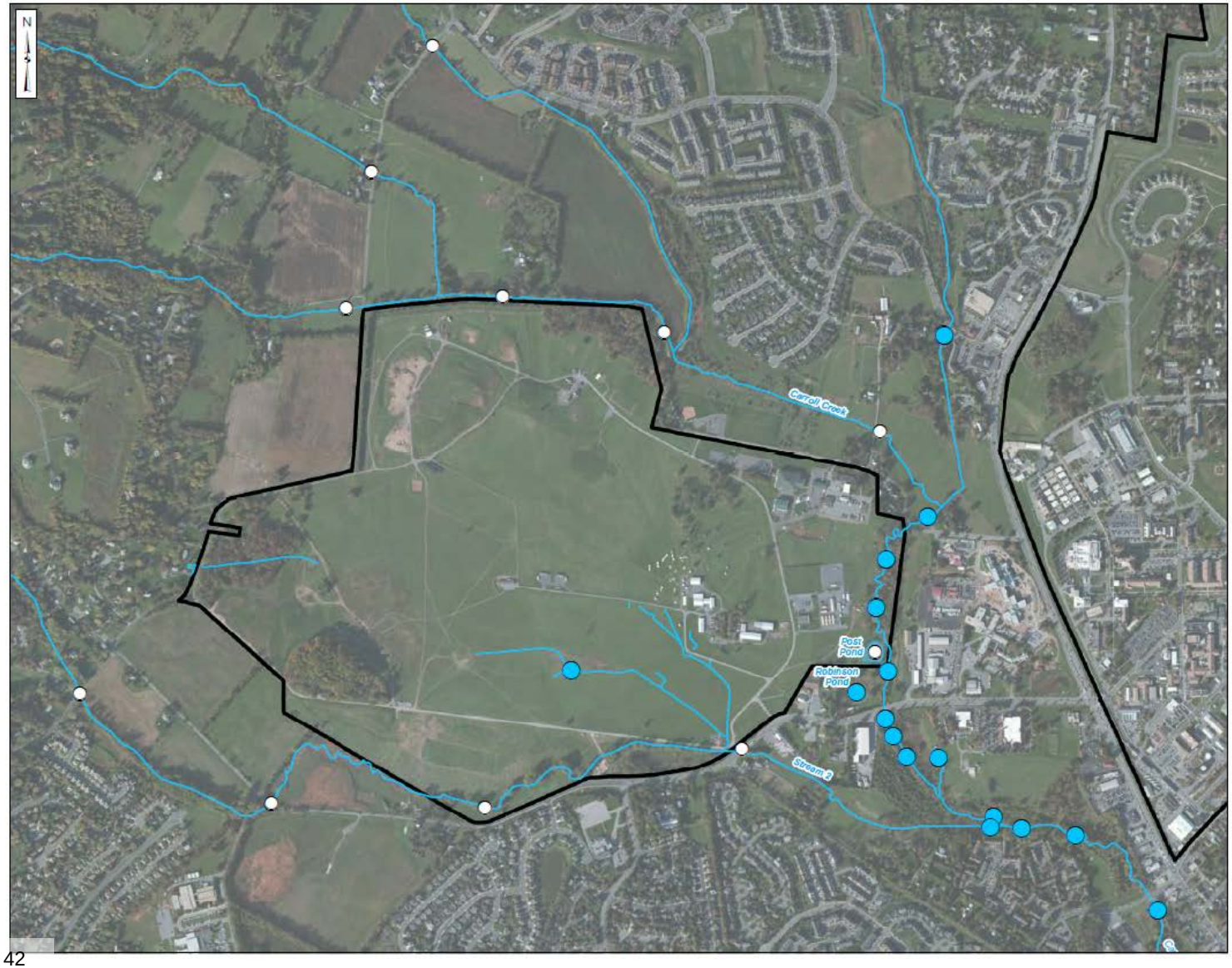
Surface Water Sampling
TCE Concentrations
March/April 2012

Fort Detrick
Frederick, MD

PCE in Surface Water April 2012



Chloroform in Surface Water
April 2012



Legend

- Fort Detrick Boundary
- Stream

Chloroform Concentration

- Non-Detect
- 5 ug/L or less
- >5 to 80 ug/L
- >80 to 1,000 ug/L
- >1,000 ug/L

X = Exceeds drinking water standard

Notes:
1) Aerial imagery accessed through BING Maps Aerial via ArcGIS Online Layer Packages by ESRI (12/1/2010) (c) 2010 Microsoft Corporation and its data suppliers accessed on 05/29/2012 through ArcGIS 9.3.1.
2) ug/L = micrograms per liter
3) Drinking water standard for total trihalomethanes (including chloroform) = 80 ug/L

0 500 1,000 1,500
Feet

REFERENCE/PROJECTION: Maryland State Plane, NAD 83, Feet

ARCADIS MALCOLM PIRNIE

Surface Water Sampling
Chloroform Concentrations
March/April 2012

Fort Detrick
Frederick, MD

April 2012 Sampling Results

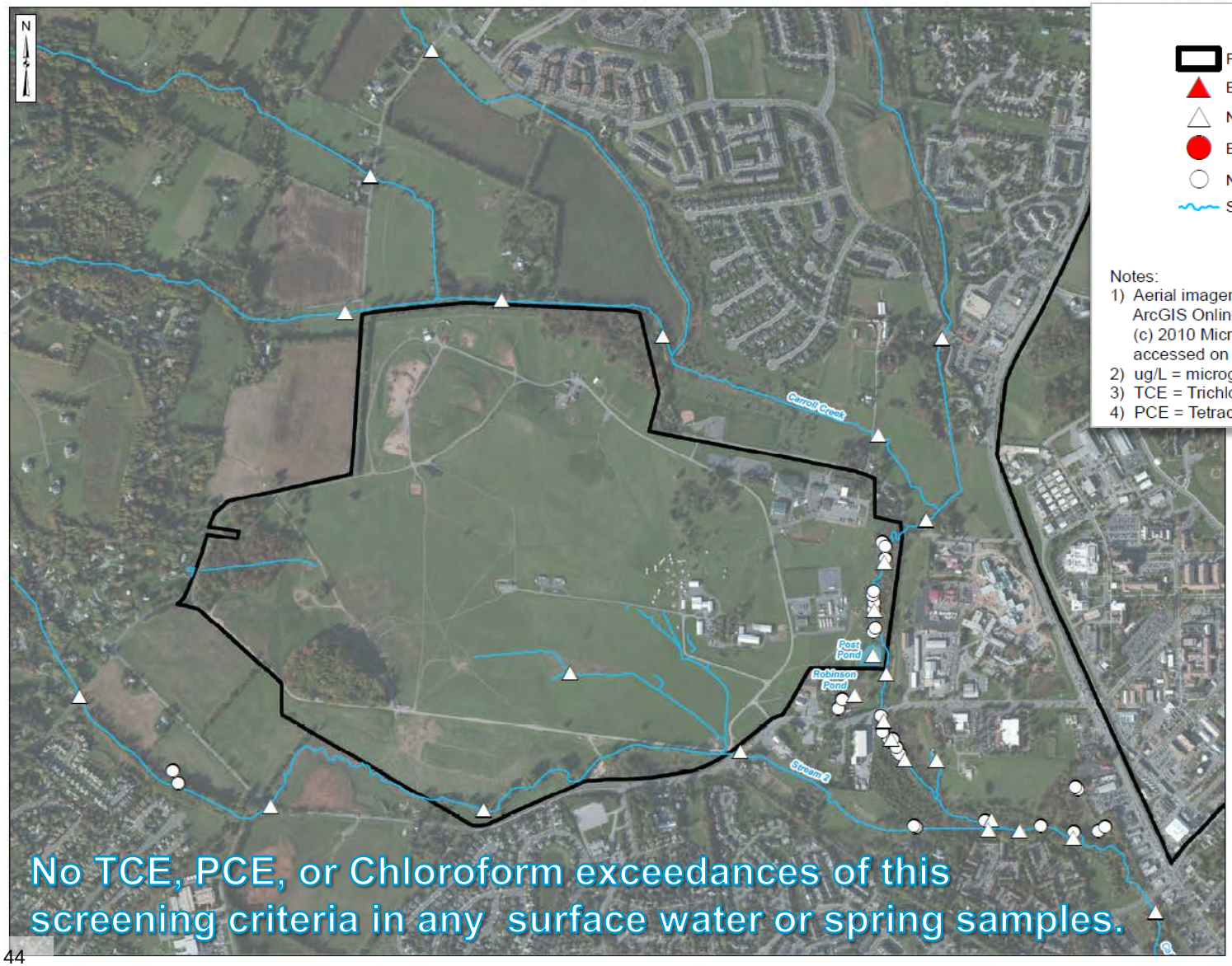
Combined Seep/Spring and Surface Water

Comparison to Human Health Screening Criteria:

1. Recreational use of the stream (child & adult)
2. Ingestion of fish from the stream
3. Use of the water from the stream for drinking water purposes (hypothetical)

ARCADIS MALCOLM PIRNIE

Comparison of Surface Water & Spring Data to:
Recreational Use Screening Criteria



Legend

- Fort Detrick Boundary
- Exceedance (Surface Water Sample)
- Non-Exceedance (Surface Water Sample)
- Exceedance (Spring Sample)
- Non-Exceedance (Spring Sample)
- Stream

Notes:
1) Aerial imagery accessed through BING Maps Aerial via ArcGIS Online Layer Packages by ESRI (12/1/2010) (c) 2010 Microsoft Corporation and its data suppliers accessed on 05/29/2012 through ArcGIS 9.3.1.
2) ug/L = micrograms per liter
3) TCE = Trichloroethene
4) PCE = Tetrachloroethene

Recreational Use Screening Criteria

TCE	16 ug/L
PCE	336 ug/L
Chloroform	119 ug/L

0 500 1,000 1,500
Feet

REFERENCE/PROJECTION: Maryland State Plane, NAD 83, Feet

ARCADIS MALCOLM PIRNIE

Surface Water / Spring Sampling

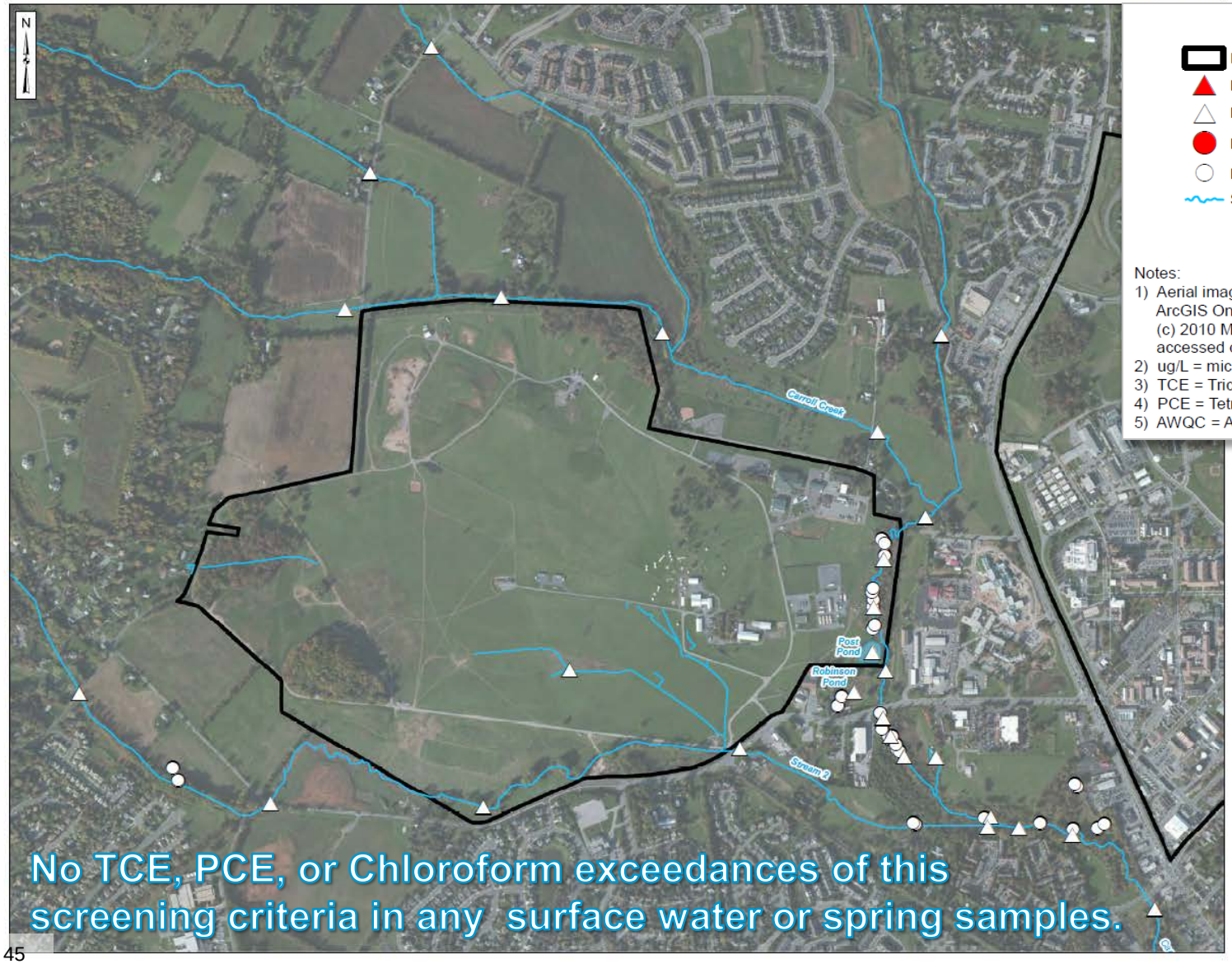
TCE, PCE, Chloroform Comparison to Risk-Based Screening Levels for Recreational Use

March/April 2012

Fort Detrick
Frederick, MD

No TCE, PCE, or Chloroform exceedances of this screening criteria in any surface water or spring samples.

Comparison of Surface Water & Spring Data to: Human Health Criteria based on Fish Ingestion



Legend

- Fort Detrick Boundary
- Exceedance (Surface Water Sample)
- Non-Exceedance (Surface Water Sample)
- Exceedance (Spring Sample)
- Non-Exceedance (Spring Sample)
- Stream

Notes:

1) Aerial imagery accessed through BING Maps Aerial via ArcGIS Online Layer Packages by ESRI (12/1/2010) (c) 2010 Microsoft Corporation and its data suppliers accessed on 05/29/2012 through ArcGIS 9.3.1.
2) ug/L = micrograms per liter
3) TCE = Trichloroethene
4) PCE = Tetrachloroethene
5) AWQC = Ambient Water Quality Criteria

AWQC Screening Criteria (Human Health via Fish Ingestion)

TCE	30 ug/L
PCE	3.3 ug/L
Chloroform	470 ug/L

0 500 1,000 1,500
Feet

REFERENCE/PROJECTION: Maryland State Plane, NAD 83, Feet

ARCADIS MALCOLM PIRNIE

Surface Water / Spring Sampling

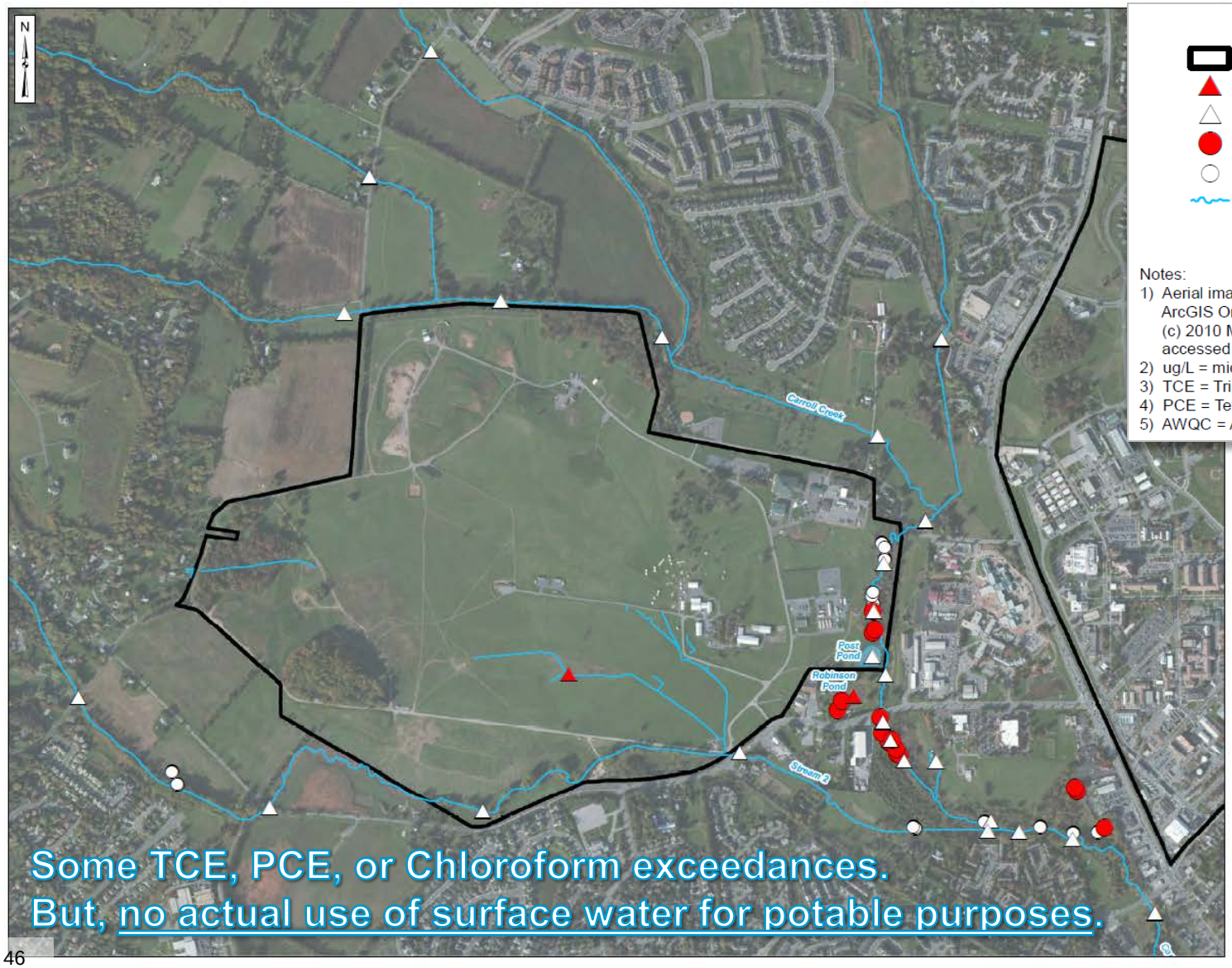
TCE, PCE, Chloroform Comparison to AWQC Human Health Guidance Values for Fish Ingestion

March/April 2012

Fort Detrick
Frederick, MD

No TCE, PCE, or Chloroform exceedances of this screening criteria in any surface water or spring samples.

Comparison of Surface Water & Spring Data to: Human Health Criteria based on Hypothetical Use of Stream/Spring Water as Drinking Water



Legend

- Fort Detrick Boundary
- Exceedance (Surface Water Sample)
- Non-Exceedance (Surface Water Sample)
- Exceedance (Spring Sample)
- Non-Exceedance (Spring Sample)
- Stream

Notes:

1) Aerial imagery accessed through BING Maps Aerial via ArcGIS Online Layer Packages by ESRI (12/1/2010) (c) 2010 Microsoft Corporation and its data suppliers accessed on 05/29/2012 through ArcGIS 9.3.1.
2) ug/L = micrograms per liter
3) TCE = Trichloroethene
4) PCE = Tetrachloroethene
5) AWQC = Ambient Water Quality Criteria

AWQC Screening Criteria (Human Health assuming hypothetical use as drinking water)

TCE	2.5 ug/L
PCE	0.69 ug/L
Chloroform	5.7 ug/L

0 500 1,000 1,500
Feet

REFERENCE/PROJECTION: Maryland State Plane, NAD 83, Feet

ARCADIS MALCOLM PIRNIE

Surface Water / Spring Sampling

TCE, PCE, Chloroform Comparison to AWQC Human Health Guidance Values for Fish Ingestion and Drinking Water

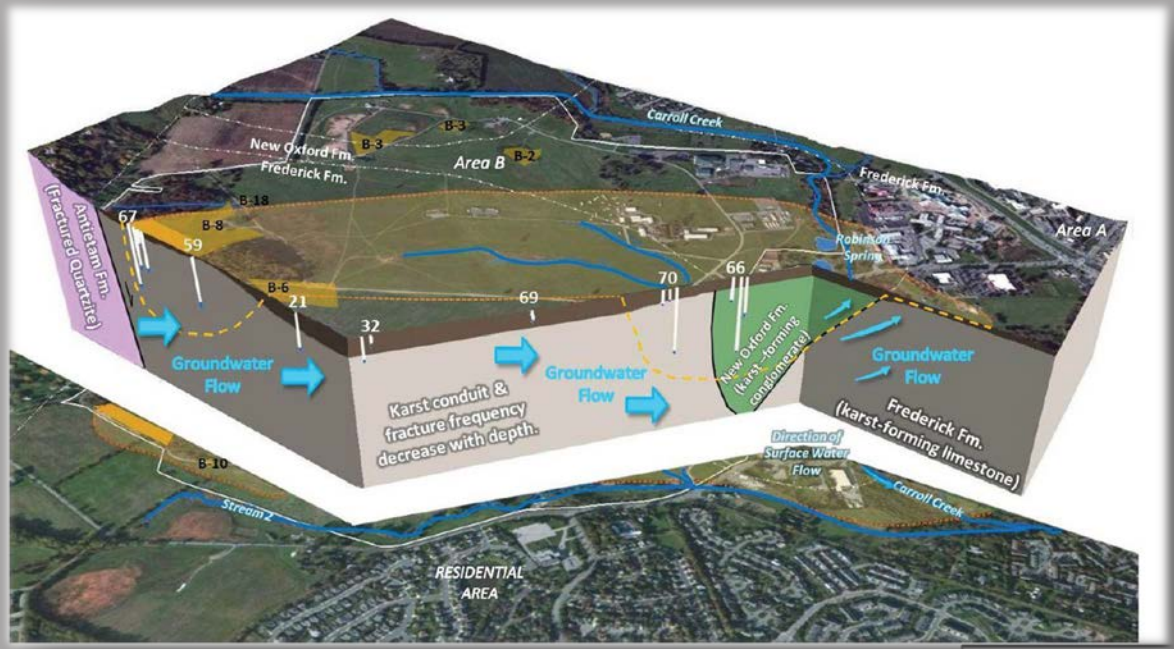
March/April 2012

Fort Detrick
Frederick, MD

Some TCE, PCE, or Chloroform exceedances.
But, no actual use of surface water for potable purposes.

April 2012 Sampling Results

Other Parameters



Samples Tested for an Extensive List of Other Parameters

- TCL volatile organic compounds with library search for unknowns
- TCL semi-volatile organic compounds with library search for unknowns
- TCL Pesticide/PCBs
- Chlorinated herbicides and picloram
- TAL Metals
- Dioxin/Furans
- Gross alpha/Gross beta
- 1,4-Dioxane

ARCADIS MALCOLM PIRNIE

Parameter List (cont)

Freons

1,2,4-trimethylbenzene

1,2,3-trichlorobenzene

1,2,4-trichlorobenzene

1,2,3-trichloropropane

Bis (2-chloroisopropyl) ether

DBCP

EDB

BCEE

Dalapon

Diquat (water only)

Simazine

Monuron

Diuron

Fenuron

Endothall

Cyanide

Boron

Anions

Cations

TDS

Alkalinity

ARCADIS MALCOLM PIRNIE

Draft Data Review – Preliminary Observations

- To date, only draft data reports received from the laboratory for the groundwater, surface water, sediment sampling.
- Draft data reports are currently undergoing third-party data validation review. Final data expected in late July/early August ‘12.
- Final data will be tabulated and incorporated into the forthcoming CSM report (Late Summer/Fall ’12).
- Final data for the broader list of parameters to be summarized at future RAB meetings.

ARCADIS MALCOLM PIRNIE

Draft Data Review – Preliminary Observations

Based on review of draft data:

- Preliminary data review shows minimal or no impacts from SVOCs, PCBs, metals, herbicides, pesticides, or other parameters in groundwater, surface water, or sediment.

- Solvents are the main contaminant and are present at part per million levels in the vicinity of B-11.

- Solvents are present in shallow groundwater and surface water off-site to the east of Area B.

Summary and Anticipated Path Forward

SUMMARY

- Drilling and sampling program generally confirm previous understanding of site conditions
- B-11 is the principal source of solvent contamination in groundwater
- Other former dump sites have minimal issues

SUMMARY

- Solvents are the main contaminant and are present at part per million levels in the vicinity of B-11
- Other parameters analyzed are absent or present at much lower concentrations
- Solvents are present in shallow groundwater and surface water off-site to the east of Area B

PATH FORWARD

- Conduct dye trace study to assess deep groundwater flow (Summer/Fall)
- Conduct vapor intrusion sampling (Fall)
- Conduct groundwater/surface water sampling in Fall 2012
- Further develop CSM and assess additional data required to move toward a final RI document

ARCADIS MALCOLM PIRNIE

QUESTIONS AND DISCUSSION

Off-Post Private Well Investigation

Progress Report to the RAB
July 18 2012

Shelly Morris

PIKA INTERNATIONAL, INC. ARCADIS MALCOLM PIRNIE

Off-Post Private Well Investigation Summary of Project Scope

- Drinking-Water Well Identification and Associated Activities
  - Public outreach (mailings, newspaper announcements, and public meetings)
  - Identify drinking-water wells through research
  - Verify use of drinking-water wells via a door-to-door survey
  - Obtain permission to access and sample drinking-water wells
  - Collect samples from drinking-water wells and analyze for Volatile Organic Compounds
  - Report results

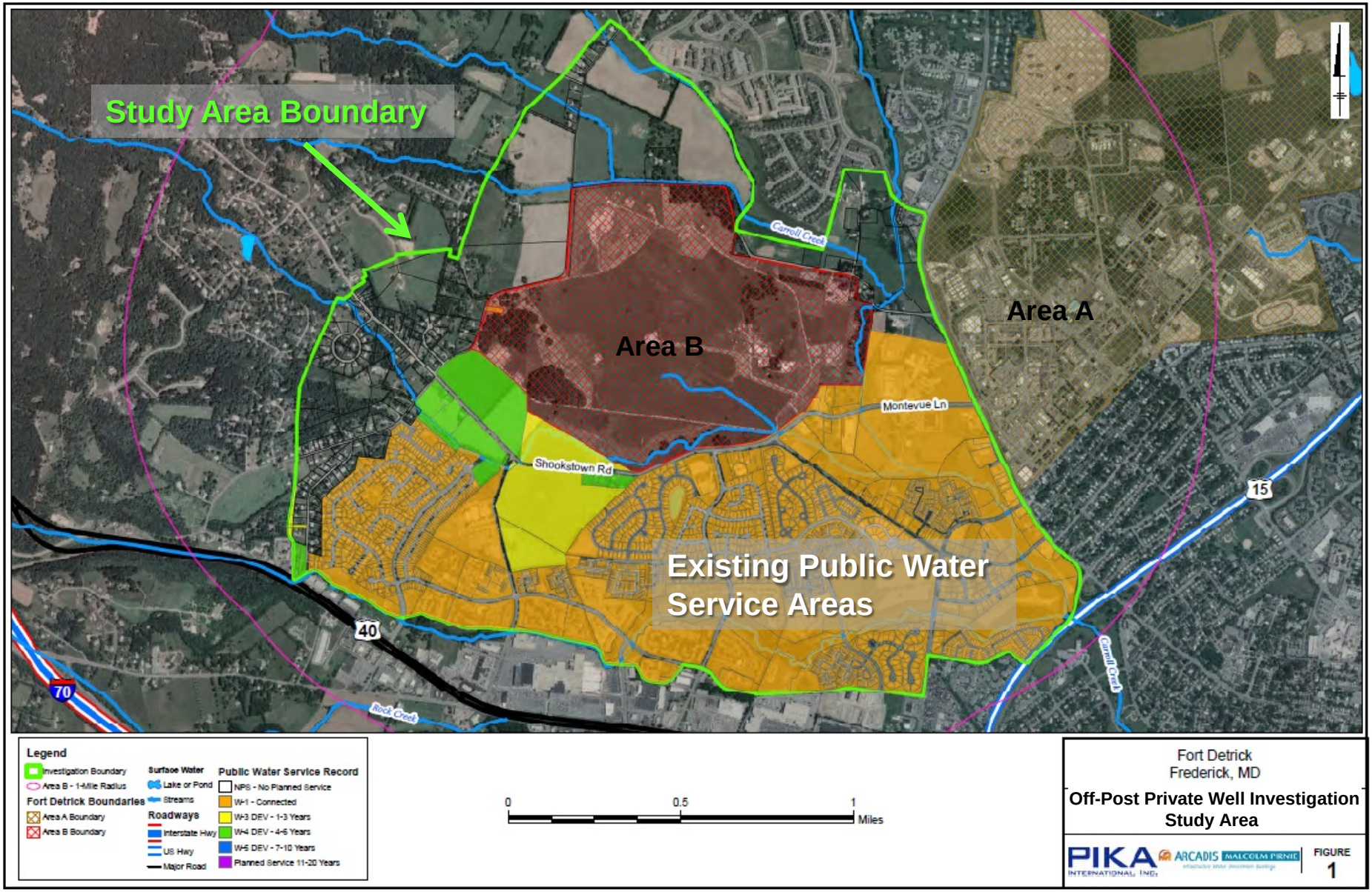
Off-Post Private Well Investigation Study Basis

- To expand upon Fort Detrick's existing drinking-water well sampling program.
- To identify and document drinking-water wells in use surrounding Fort Detrick's Area B.
- To confirm and document that residents consuming the groundwater are not being impacted by Volatile Organic Compounds (specifically PCE and TCE) emanating from Area B.

Off-Post Private Well Investigation Study Area

- Approximately 1,368 acres surrounding Area B based primarily on groundwater flow direction.
- Approximately 2,522 Parcels Identified in the Study Area.
  - Approximately 149 parcels outside of public water service area.
  - The remaining parcels within water service area require drinking-water source verification.

Study Area


Study Area Boundary
Area A
Area B
Existing Public Water Service Areas
Carroll Creek
Montevue Ln
Shookstown Rd
15
40
70
Rock Creek
Legend
Investigation Boundary
Area B - 1-Mile Radius
Fort Detrick Boundaries
Area A Boundary
Area B Boundary
Surface Water
Lake or Pond
Streams
Roadways
Interstate Hwy
US Hwy
Major Road
Public Water Service Record
NPS - No Planned Service
W-1 - Connected
W-3 DEV - 1-3 Years
W-4 DEV - 4-6 Years
W-5 DEV - 7-10 Years
Planned Service 11-20 Years
0
0.5
1
Miles
Fort Detrick
Frederick, MD
Off-Post Private Well Investigation Study Area
PIKA INTERNATIONAL, INC.
ARCADIS
MALCOLM PIRNIE
FIGURE 1

Off-Post Private Well Investigation Timeline for Project Activities

- 1st Mailing (July): Sent to all residents within the study area boundary to announce the project and the public meeting.
- Initial Public Meeting (early August): The meeting will occur ~3 Weeks following today's RAB Meeting.
- 2nd Mailing (early August): Letters will be sent to residences in study area to verify drinking water source and provide information on the planned door-to-door survey.
- Door-to-Door Survey (late August / early September): A door-to-door survey will be conducted at residences not connected to public water.

Off-Post Private Well Investigation Timeline for Project Activities

- 3rd Mailing (mid September): A letter will be sent to residences not connected to public water and that did not respond during door-to-door survey
- 4th Mailing (mid September): A letter will be sent to residences with a private well requesting sampling, if right of entry has not yet been granted
- Sampling (beginning in September): Where permission has been granted, drinking water samples will be collected and analyzed for volatile organic compounds.

QUESTIONS AND DISCUSSION