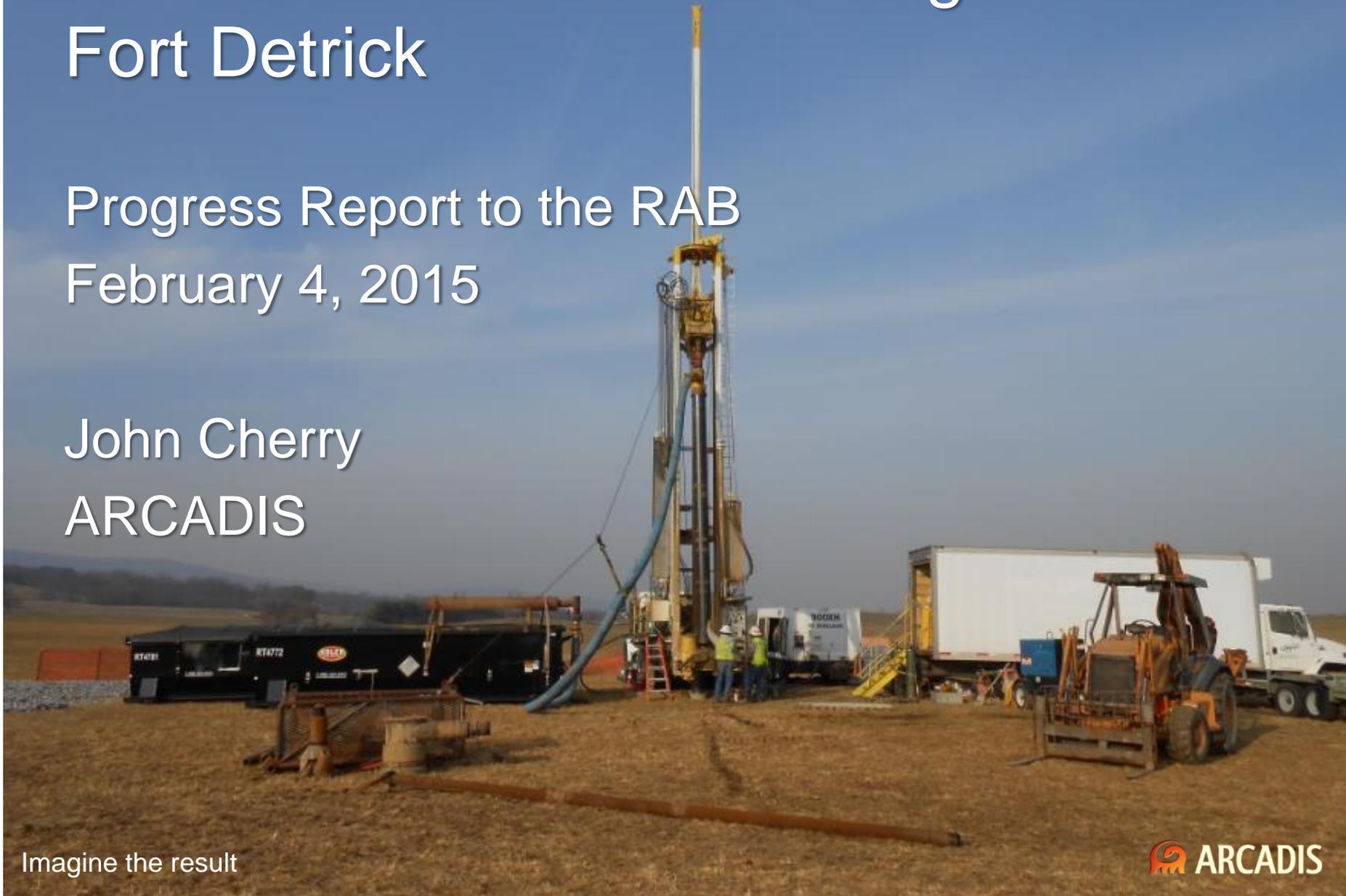


Area B Groundwater Investigation Fort Detrick

Progress Report to the RAB
February 4, 2015

John Cherry
ARCADIS



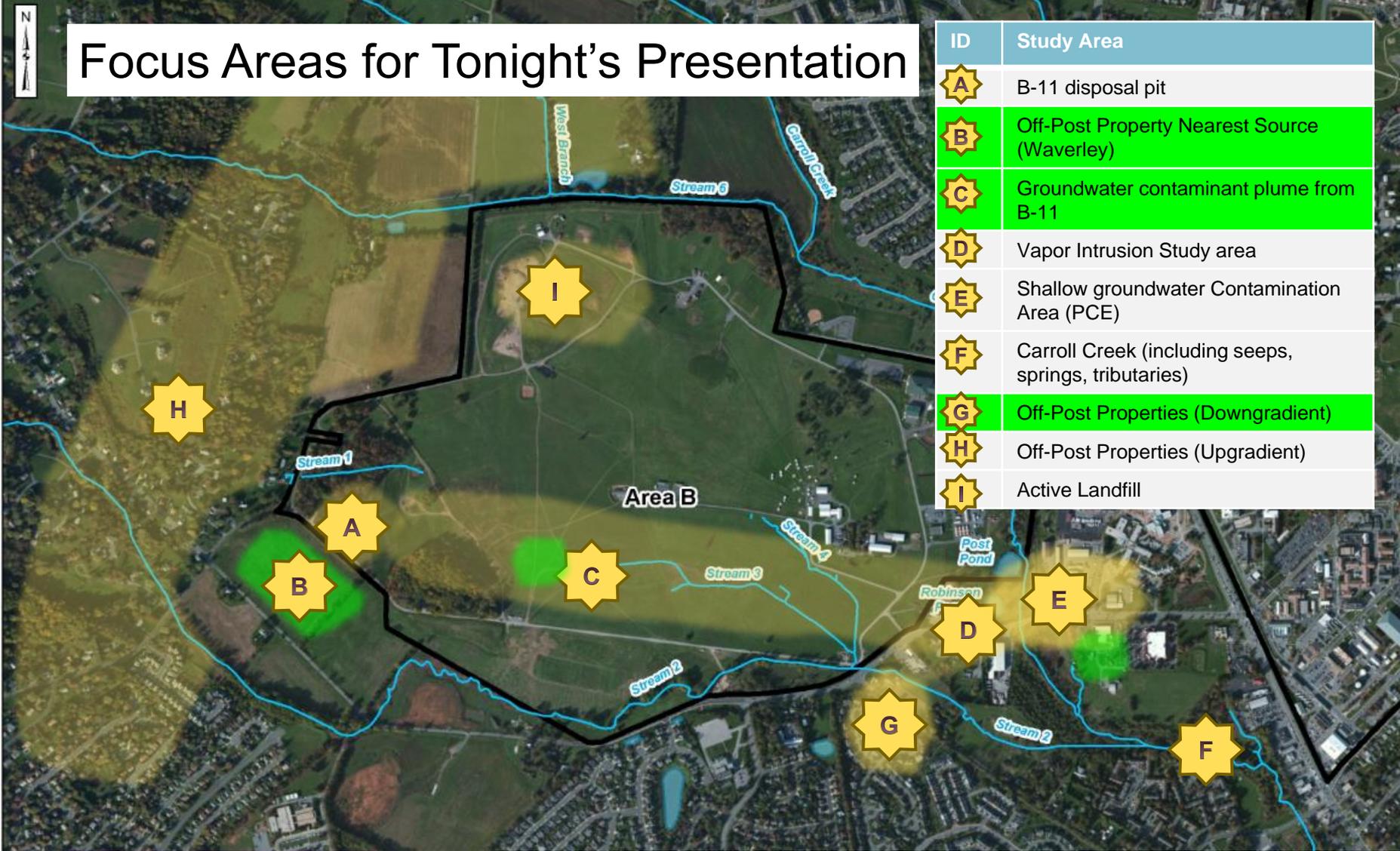
Imagine the result

Overview of Topics

- ❑ Area B Overview and Snapshot summary of new analytical results and observations since the November 2014 RAB
- ❑ Deep Drilling Update (On- and Off-Post Deep Drilling):
- ❑ New Groundwater Results
 - ❑ Waverley Property
 - ❑ County Property
 - ❑ Area B
- ❑ Schedule and Next Steps

Focus Areas for Tonight's Presentation

ID	Study Area
	B-11 disposal pit
	Off-Post Property Nearest Source (Waverley)
	Groundwater contaminant plume from B-11
	Vapor Intrusion Study area
	Shallow groundwater Contamination Area (PCE)
	Carroll Creek (including seeps, springs, tributaries)
	Off-Post Properties (Downgradient)
	Off-Post Properties (Upgradient)
	Active Landfill



New Analytical Data presented tonight for areas in green

There are multiple on-going and overlapping investigation efforts in and around Area B. This figure provides a generalized representation of the current on- and off-post Area B study areas. Phased investigation activities are being conducted with EPA and MDE oversight and in accordance with approved work plans following the CERCLA process within these areas. For RAB meetings this figure is included in the slides to indicate which areas are the focal points of the meeting, recognizing that all areas cannot be discussed during each quarterly meeting.

Snapshot Updates Since the Last RAB



- Deep drilling phase completed.
(The last of 8 additional permanent points completed in January 2015 with depths ranging from 86 to 443 ft deep)
- Packer test data results received from one depth interval in on-post deep boring BMW-79 near the center of Area B. 
(Results presented tonight show concentrations consistent with other adjacent points. Deep point constructed here at 433-443 ft to be sampled in March)
- Monitoring point data received from 6 completed permanent monitoring points on off-post Waverley and County properties.  
(Results presented tonight show concentrations in the new deep off-post points all below MCLs, except for TCE at 340 ug/L, PCE at 12 ug/L, Chloroform at 160 ug/L, and 1,1-DCE at 14 ug/L in Wvly-1 closest to the Area B property line. As a reminder, MCL exceedances in shallow wells along the property boundary were discussed during the November 2014 RAB meeting.)

Overview of Topics

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2013/2014 Deep Drilling Locations

**DRILLING FOR
2013 WORK PLAN
COMPLETED**

For more information regarding objectives and background for this deep drilling, see RAB slides from Feb '13 and Nov '13.

Waverley property (multiple intermediate and deep drilling locations), assessing flow to the south/southwest

Area B, one deep borehole targeting 400-500 ft depths

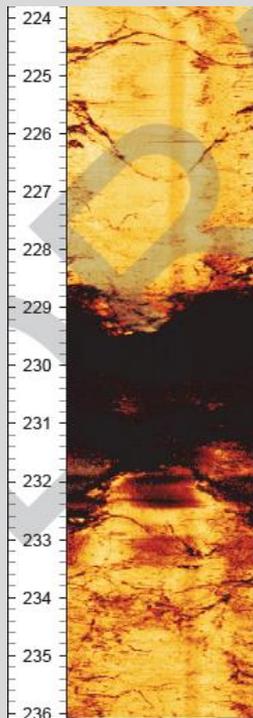
County parcel, one deep borehole to 400 ft assessing flow to the southeast of Carroll Creek

Deep Drilling Recap (2013/2014)

Methodology Reminders!

Packer sample intervals are selected in collaboration with EPA and MDE, based on:

- Geophysical testing of the borehole to identify fractures using calipers, imagery of the borehole walls, and other tools.



For more information, about the drilling and sampling approach, see RAB slides from June 2011, February 2013, & March 2014.

• Waverley **B**

- 4 boring locations at Waverley Property to assess deep impacts south/southwest of Area B.

Wvly-1	Drilled to 175 ft. Screened 145-155 ft
Wvly-2	Drilled to 142 ft Screened 86-91 ft
Wvly-3	Drilled to 161 ft Screened 100-115 ft
Wvly-5	Drilled to 400 ft Screened 225-235 ft and 347-377 ft

• County **G**

- 1 boring location completed to 400 ft deep to assess deep groundwater quality east of Area B and Carroll Creek.

Cnty-1s & -1d	Drilled to 400 ft. Screened 99-109 ft (Cnty-1s) and 382-397 ft (Cnty-1d)
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• Area B **C**

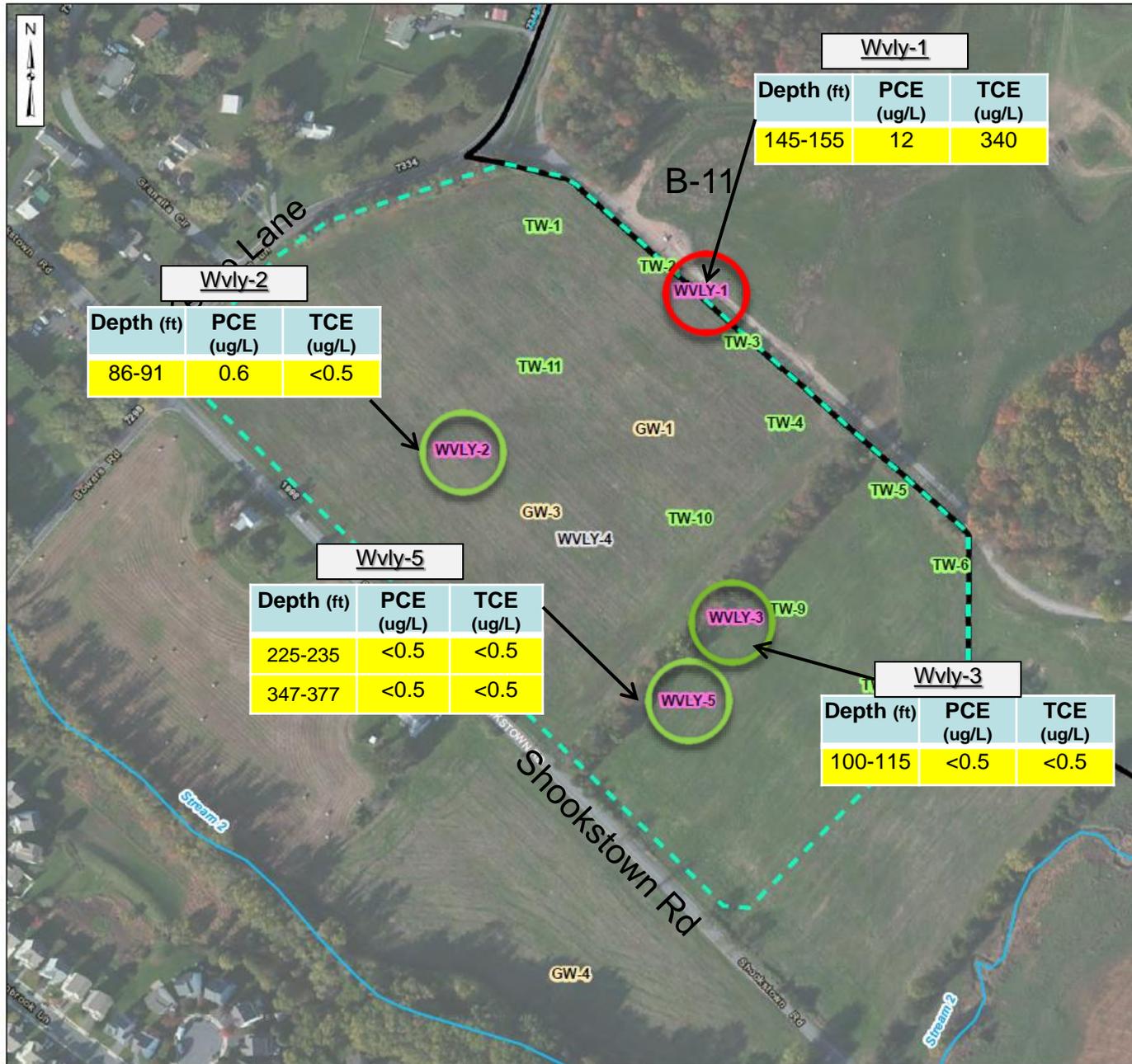
- 1 boring drilled to 500 ft deep to assess deep impacts downgradient of B-11.

BMW-79	Drilled to 500 ft. Screened 433-443 ft	New: Permanent Sampling Point Construction Completed Since Last RAB
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Summary of Results from Deep Monitoring Points



- Legend**
- Fort Detrick Boundary
 - Approximate ROE Boundary
 - Stream
 - WVLY-2** Waverley Monitoring Point (2014)
 - TW-1** USACE Temp Sampling Point
 - WVLY-4** Abandoned Boring Location
 - GW-1** Waverley Monitoring Point (2004)

- TCE and/or PCE exceeds MCL at this location in deep groundwater.
- No MCL exceedances at this location in deep groundwater.

NEW Monitoring Point Results*

* See full list of detections on following slide.

Waverley Property

Area B Groundwater Investigation
Fort Detrick
Frederick, MD



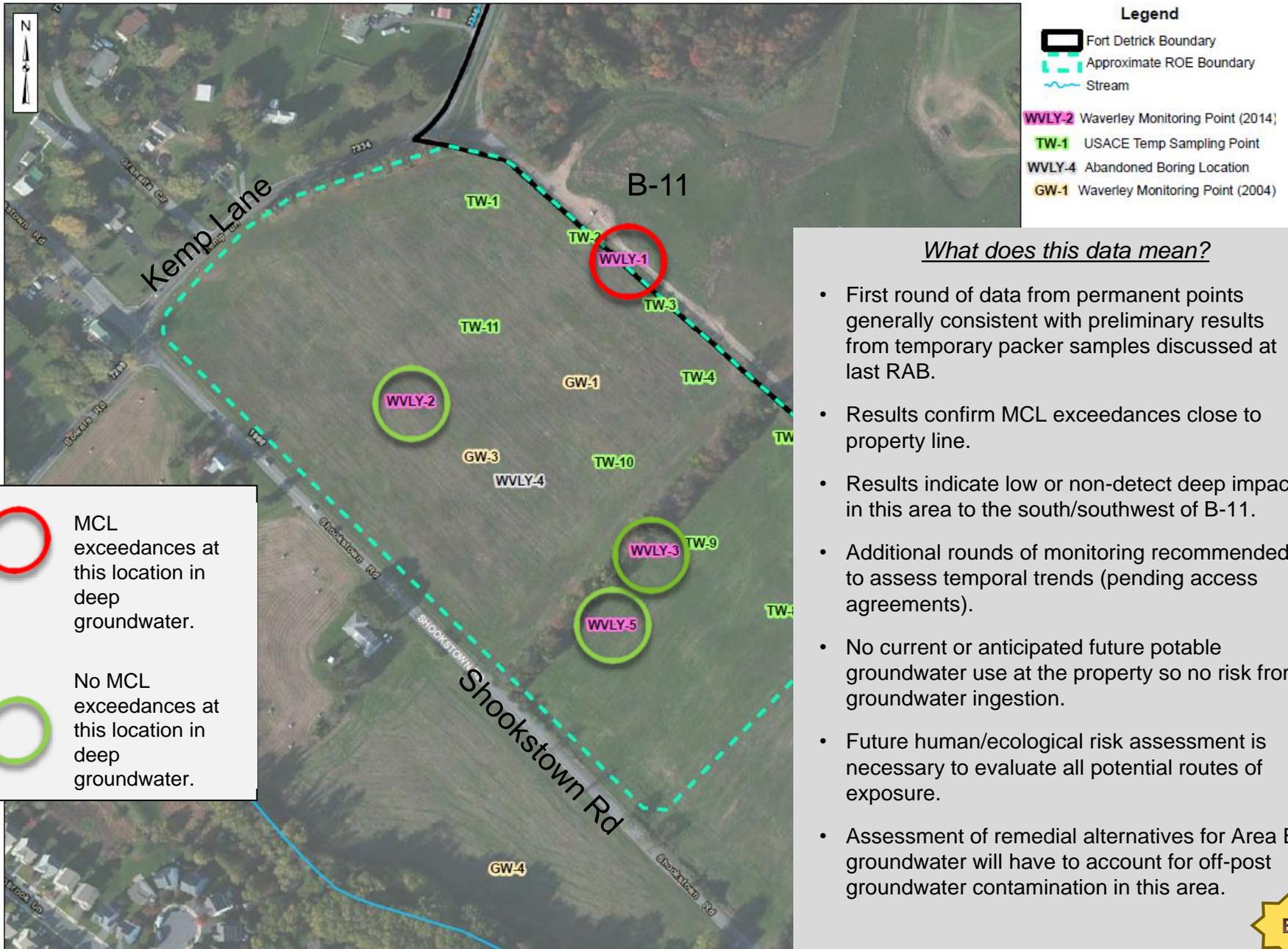
Summary of Detections in Permanent Monitoring Points at Waverley Property (November 2014 Sampling Event)

Location (sample date)	WVLY-1 (111014)	WVLY-2 (111014)	WVLY-3 (111114)	WVLY5s (111214)	WVLY5d (111214)
Screen Depth (ft bgs)	(145-155)	(86-91)	(100-115)	(225-235)	(347-377)
Detected VOCs	Result (ug/L)				
Tetrachloroethene (PCE)	12	0.6	N.D.	N.D.	N.D.
Trichloroethene (TCE)	340	N.D.	N.D.	N.D.	N.D.
cis-1,2-Dichloroethene	7.4	N.D.	N.D.	N.D.	N.D.
Trichlorofluoromethane	130	N.D.	N.D.	N.D.	N.D.
Freon 113	1.9 J	N.D.	N.D.	N.D.	N.D.
Chloroform	160	N.D.	N.D.	1.2	1.3
Acetone	N.D.	4.9 J	N.D.	N.D.	3.6 J
Bromodichloromethane	N.D.	N.D.	N.D.	0.1 J	0.1 J
Dichlorodifluoromethane	0.6 J	N.D.	N.D.	N.D.	N.D.
1,1-Dichloroethane	0.7 J	N.D.	N.D.	N.D.	N.D.
1,2-Dichloroethane	1.6 J	N.D.	N.D.	N.D.	N.D.
1,1-Dichloroethene (1,1-DCE)	14	N.D.	N.D.	N.D.	N.D.
1,1,1-Trichloroethane	3.8	N.D.	N.D.	N.D.	N.D.
1,1,2-Trichloroethane	N.D.	N.D.	N.D.	N.D.	N.D.
Toluene	N.D.	N.D.	N.D.	N.D.	0.2 J
m+p-Xylene	N.D.	N.D.	0.2 J	N.D.	N.D.
o-Xylene	N.D.	N.D.	N.D.	N.D.	N.D.

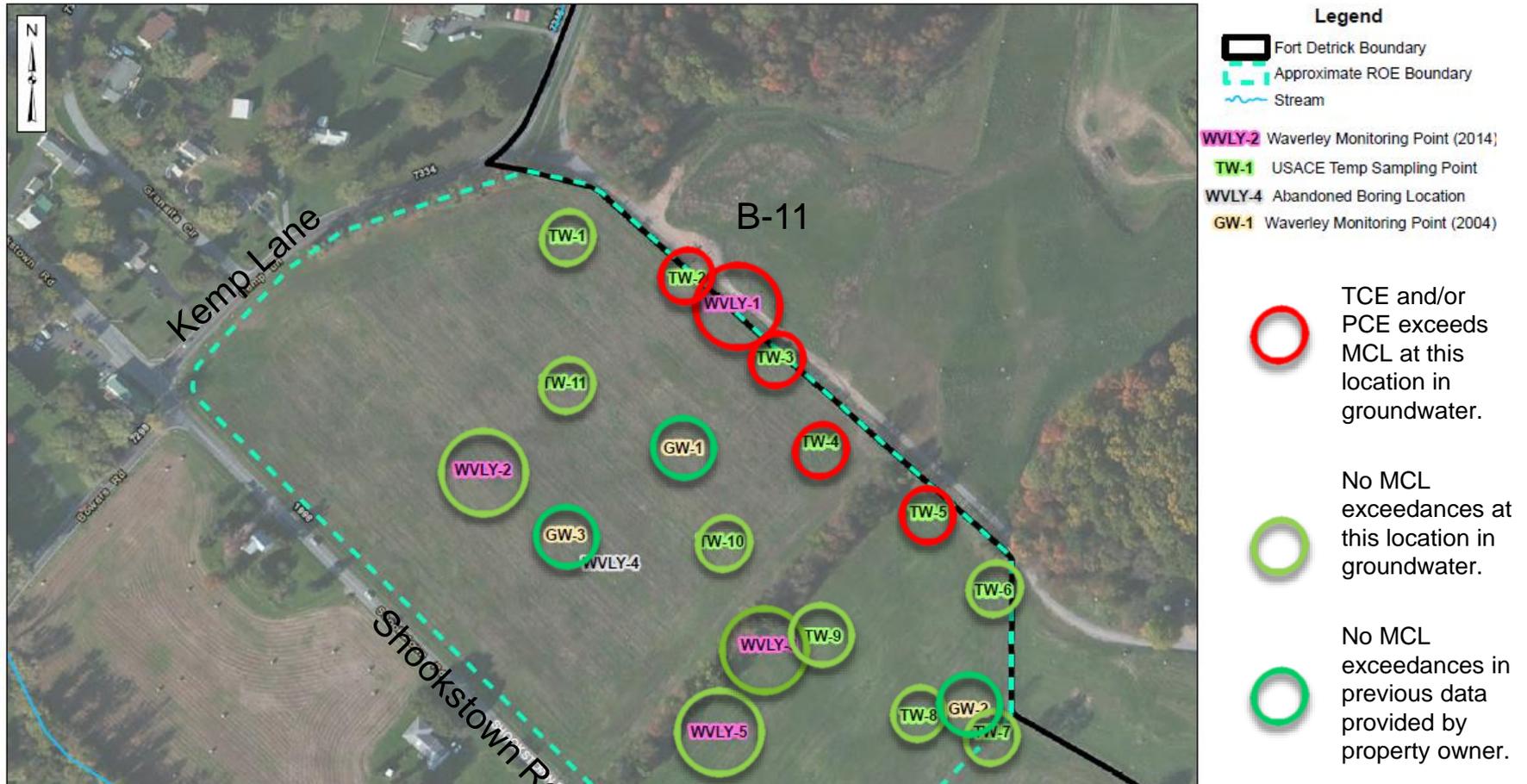
MCL exceedances
marked in red.

PCE	5 ug/L
TCE	5 ug/L
Chloroform	70 ug/L
1,1-DCE	7 ug/L

Summary of Results from Deep Borings/Monitoring Points



Combined Summary of Deep & Shallow Test Results



The Army's preliminary observations to date are consistent with the original conceptual site model :

- **Groundwater impacts south of the Detrick property line do not extend far beyond the property line and concentrations drop off quickly in this direction by orders of magnitude. Additional rounds of monitoring are recommended.**



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New Deep Groundwater Data Presented Tonight

County Property

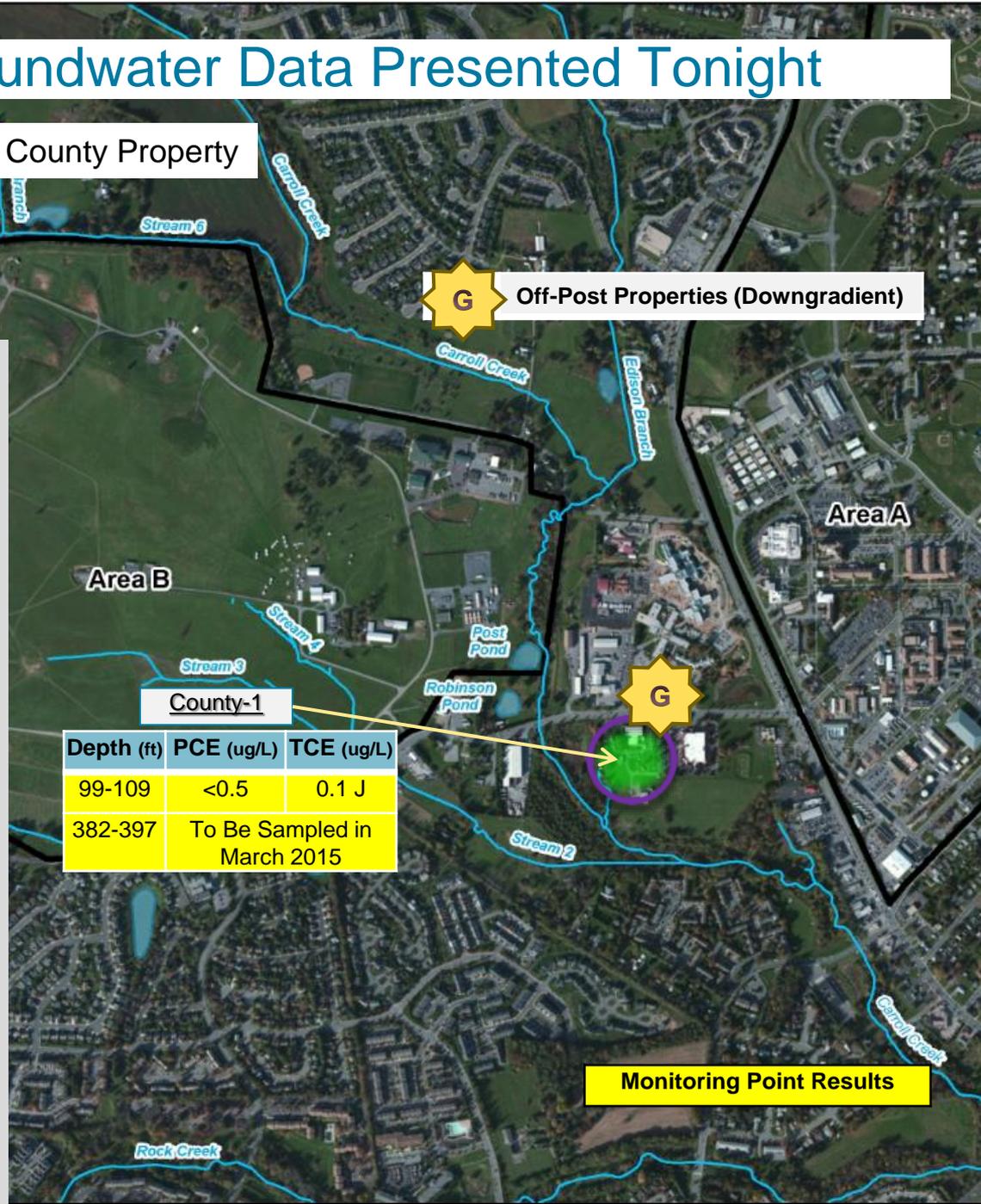
G Off-Post Properties (Downgradient)

What does this data mean?

- Six packer test interval samples were tested. No MCL exceedances identified. Discussed during August 2014 RAB.
- Two permanent monitoring points installed (99-109 ft and 382-397 ft). Only one sampled so far.
- Very little groundwater flow found in the deepest packer test intervals.
- Possible routes of exposure to groundwater at this depth are limited. No current or anticipated future potable groundwater use at the property so no risk from groundwater ingestion.
- The 0.1 J ug/L detection of TCE at 99-109 ft is an estimated value (J-flagged by laboratory). Based on the low estimated detection, there is no indication of significant contaminant migration southeast of Carroll Creek at this location. Chloroform also detected below MCL. Further monitoring is recommended to confirm.
- The detection of 0.1 J ug/L TCE at this depth does not present a concern for vapor intrusion. (But note there are other shallower VOC detections in the vicinity that are still under investigation.)
- Both County-1 monitoring points to be sampled in March 2015.

Depth (ft)	PCE (ug/L)	TCE (ug/L)
99-109	<0.5	0.1 J
382-397	To Be Sampled in March 2015	

Monitoring Point Results



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New Deep Groundwater Data Presented Tonight

Area B – BMW-79



Groundwater contaminant plume from B-11

What does this data mean?

- In this portion of Area B, there are numerous shallower points, including 5 permanent points clustered at BMW-53 to depths of 305 ft.
- The detection of 24 ug/L TCE at 340-350 is very similar to the concentrations generally detected in this area. For comparison, TCE has been detected in BMW-53F (295-305 ft) at 41 and 31 ug/L in prior sampling events.
- The objective at this boring was to characterize the formation downgradient of B-11 at deeper depths than existing monitoring points.
- Four deeper intervals were assessed down to 470 ft. Water flow was so minimal at these depths, no packer samples could be collected.
- One permanent monitoring point was constructed based on indication of minimal water flow in a small fracture at that location. This point will be sampled in March 2015.
- The infrequent fractures and lack of water flow in the deep portion of this borehole (350 to 500 ft deep) are consistent with the Conceptual Site Model (CSM). In this area, fractures and groundwater flow are more predominant in the shallower portion of the formation and decrease with depth. Note that CSM is still being refined based on ongoing and upcoming investigations with EPA/MDE oversight.

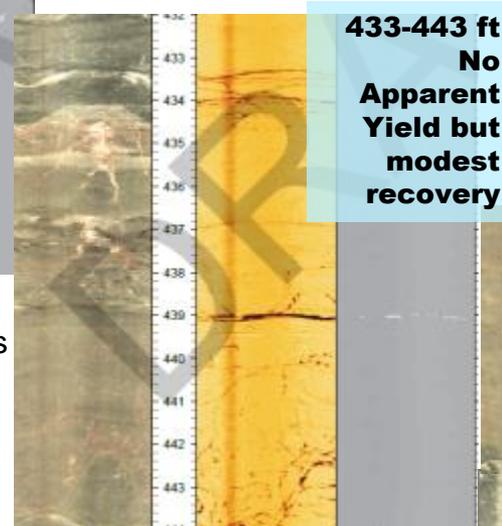
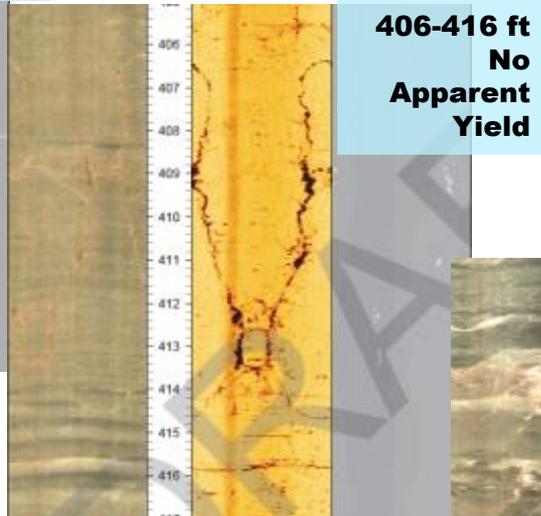
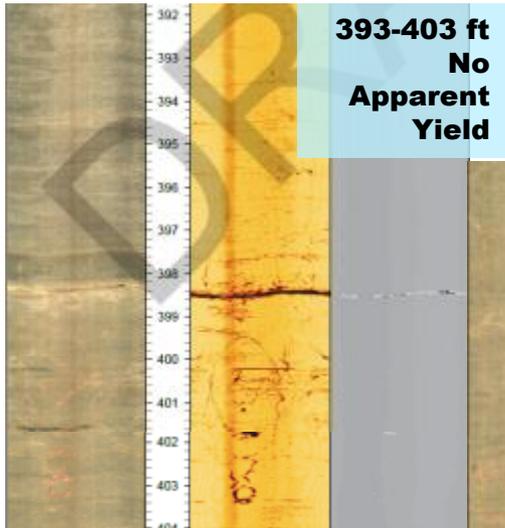
BMW-79

Depth (ft)	PCE (ug/L)	TCE (ug/L)
340-350	0.8	24
393-403	Small fracture but flow too low for packer sampling	
406-416	~ same ~	
433-443	~ same ~	
460-470	~ same ~	
433-443	To Be Sampled in March 2015	

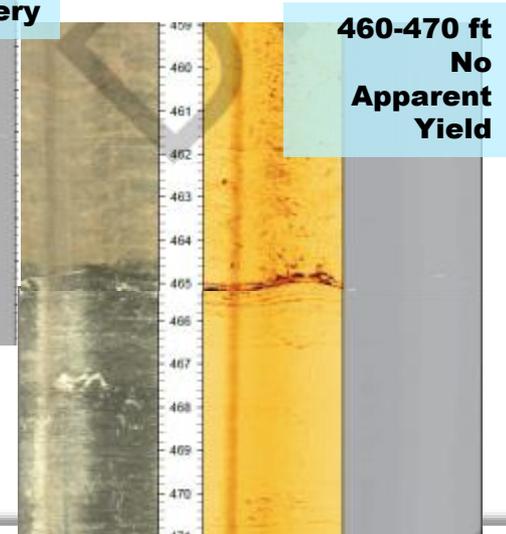
Packer Test Results

Monitoring Point Results

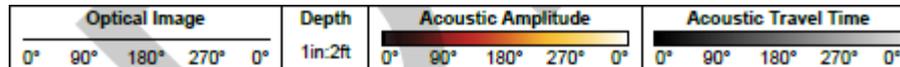
BMW-79 Packer Tests (Deeper Intervals)



See RAB slides from June 2011, February 2013, & March 2014 for detailed review of drilling & logging approach



- Review of logs identified four small features deeper than 350 ft that were considered possible water-bearing fractures worth packer testing.
- However, all 4 deep test intervals produced insufficient water to sample via pumping packer tests
- Also monitored for water level recovery in these intervals and found one zone (433-433 ft) produced approximately 55 ml/min (very low flow rate). Well constructed at this zone. Will be sampled in March.



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Status of On-going Area B RI Activities

2011-2013 RI WP (Original 2010 Work Plan)

- ✓ Existing monitoring point assessment and repair
- ✓ New monitoring point installation (onsite)
- ✓ Direct Push Investigation
- ✓ Spring and Seep Surveys
- ✓ Groundwater/Surface Water Sampling
- ✓ Vapor Intrusion Sampling (2 rounds) at 4 off-post & 1 on-post location.
- ✓ Groundwater tracer study
- ✓ Off-post point survey and sampling
- ✓ CSM Report

99% complete

2013-2014 RI Supplemental Data Gap Work

- ✓ Drilling on Waverley Property
- ✓ Deep drilling on County property (SE of Carroll Creek)
- ✓ Vapor intrusion at Daycare property & County Montevue building (ECC).
- ✓ Quarterly sampling (subset of Area B points)
- ✓ DPT in off-post Lake Coventry and Shookstown Rd areas. (Completed but DPT refusal in some areas)
- ✓ Deep drilling on Area B
- > Sample new/existing points (Additional sampling in March 2015)

99% complete

2015 Additional Data Gap Work (Pending)

- > Air rotary drilling in off-post Shookstown Rd area where DPT was unsuccessful.
- > Shallow drilling on County Montevue Property to further evaluate shallow PCE detections in this area.
- > Re-Survey & Resample Springs, Seeps, and Surface Water in Carroll Creek primary discharge area.
- > Surface water modeling evaluation.
- > Forensics evaluation of VOC detections at County Montevue property.
- > Follow-on vapor intrusion testing
- > Work Plan pending

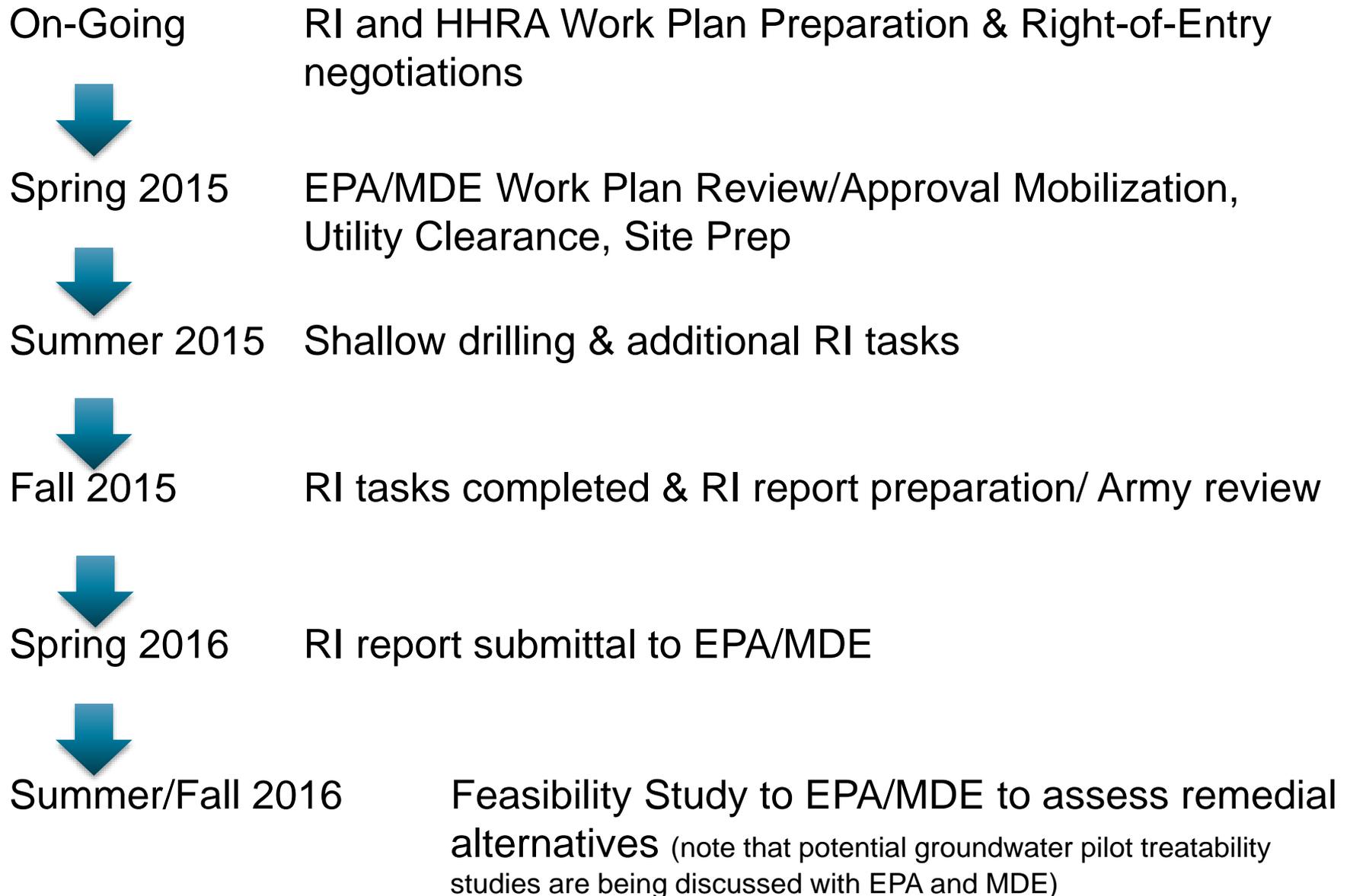
Pending

Remedial Investigation Report

- Updated CSM
- Human health & ecological risk assessment
- Spring 2016 to EPA & MDE

See RAB slides from November 2014 for discussion of pending 2015 Data Gap Work

Area B Schedule



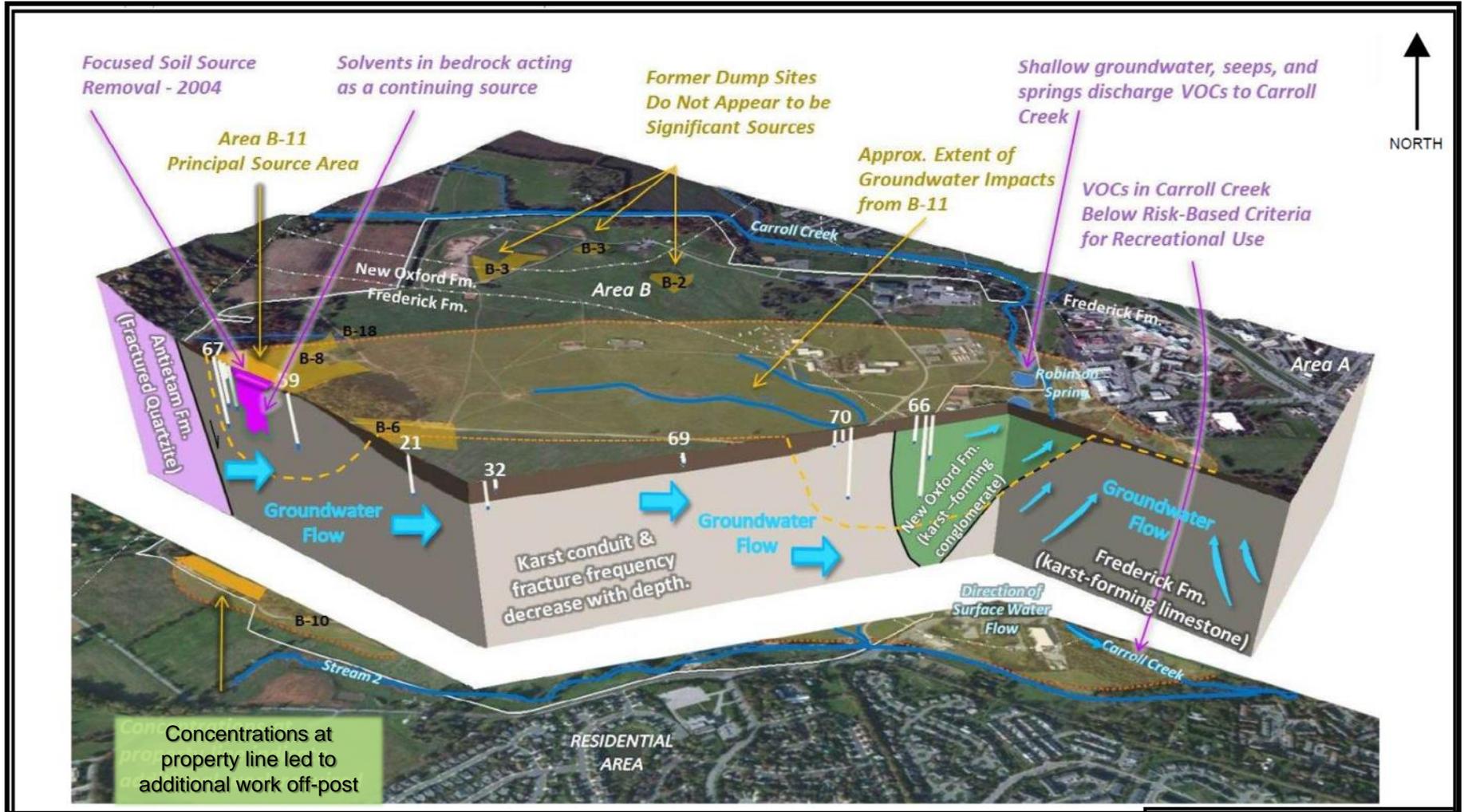


Questions and Discussion



Area B 360° Overview Slides

Area B Conceptual Site Model Review



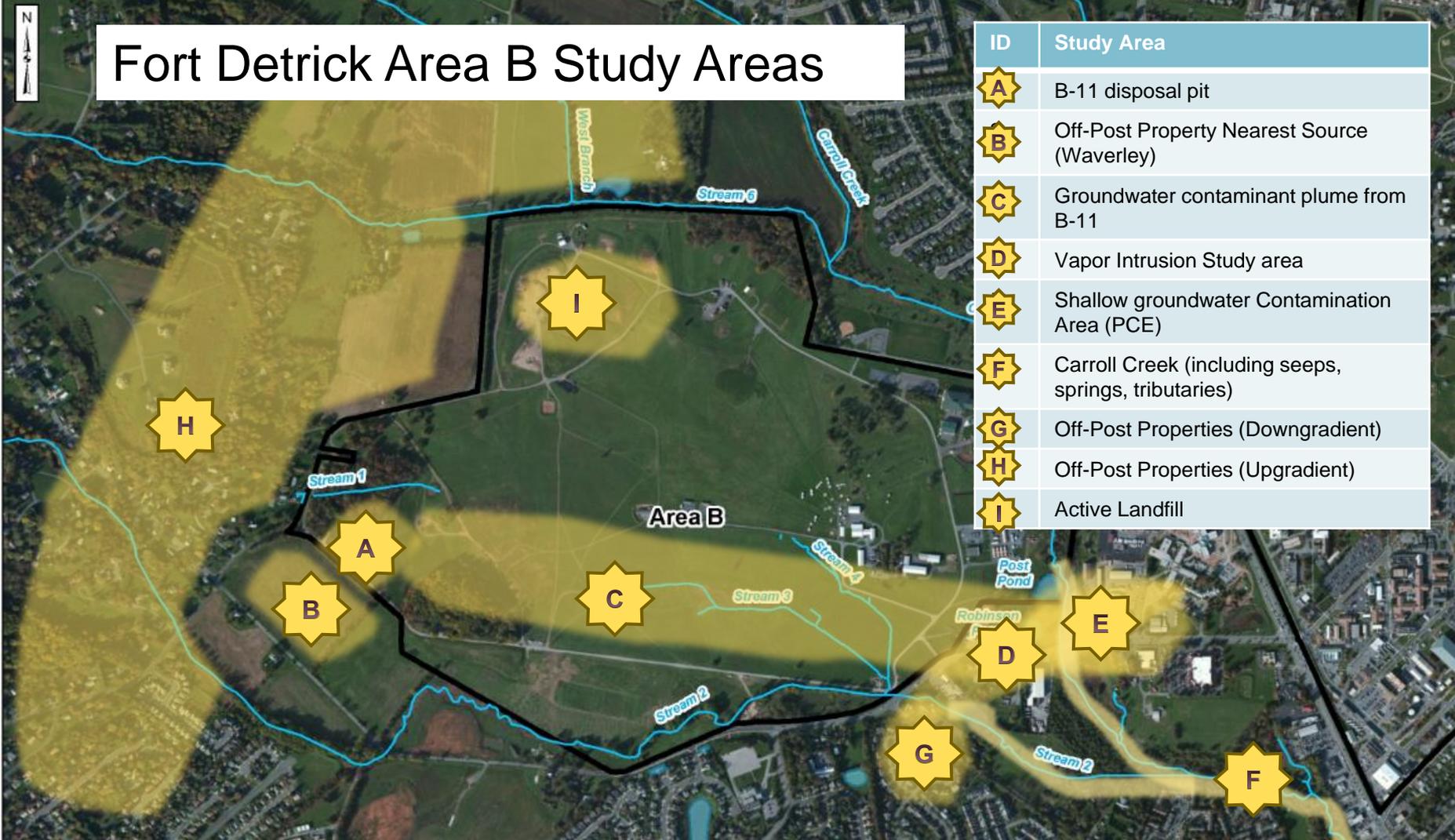
Legend

- Streams
- Spring
- B-11 Boundary
- Trichloroethene in Groundwater
- Groundwater Flow Direction
- Geologic Contact

Aerial Source: ArcGIS Online Bing Imagery accessed 6/13/2012 via ArcGIS 10.

Fort Detrick Area B Study Areas

ID	Study Area
A	B-11 disposal pit
B	Off-Post Property Nearest Source (Waverley)
C	Groundwater contaminant plume from B-11
D	Vapor Intrusion Study area
E	Shallow groundwater Contamination Area (PCE)
F	Carroll Creek (including seeps, springs, tributaries)
G	Off-Post Properties (Downgradient)
H	Off-Post Properties (Upgradient)
I	Active Landfill



There are multiple on-going and overlapping investigation efforts in and around Area B. This figure provides a generalized representation of the current on- and off-post Area B study areas. Phased investigation activities are being conducted with EPA and MDE oversight and in accordance with approved work plans following the CERCLA process within these areas. For RAB meetings this figure is included in the slides to indicate which areas are the focal points of the meeting, recognizing that all areas cannot be discussed during each quarterly meeting. Moving forward, the Army will develop and maintain summary slides for each area to keep stakeholders updated on the work in these areas as well as next steps. These slides will be included at the end of the presentation.

Area B 360° Overview Slides

Map ID	Study Area	Previous RAB Presentations for Additional Information	Status of 360° Overview Slides
	B-11 disposal pit	See "C" for RAB presentations discussing groundwater contamination originating from B-11 area.	<i>Pending</i>
	Off-Post Property Nearest Source (Waverley)	Nov '13, Mar '14, Nov '14, Feb '15 (drilling updates with data)	Updated January 2015
	Groundwater contaminant plume from B-11	Nov '12 (April 2012 data summary) Feb '13 (Sept 2012 data summary; vertical contaminant distribution discussion; karst drilling, geophysical logging, permanent point construction decisions) Mar '14 (dye trace study recap)	<i>Pending</i>
	Vapor Intrusion Study area	May '13 (VI overview)	<i>Pending</i>
	Shallow groundwater Contamination Area (PCE)	Aug '13 (direct push study summary)	<i>Pending</i>
	Carroll Creek (including seeps, springs, tributaries)	Mar '14 (dye trace study recap)	<i>Pending</i>
	Off-Post Properties (Downgradient)	Aug '13, Nov '13 (direct push study summary), Feb '15 (deep monitoring point east of Carroll Creek)	<i>Pending</i>
	Off-Post Properties (Upgradient)	Feb '13 through Aug '14 Mar '14 (dye trace study recap)	<i>Pending</i>
	Active Landfill	See Nov '12, Feb '13 groundwater data near landfill, but not discussed directly.	<i>Pending</i>

Off-Post Property Nearest Source (Waverley Property)



Description

- Undeveloped privately-owned property across property line from former B-11 disposal pit (See Map ID A)
- Currently used for agriculture (corn, soybeans)
- Future residential development considered likely.
- Depth to first water is approx. 25-50 ft bgs.

Relevant Investigation Work Completed

- 2004: seven monitoring points installed to depths up to 100 ft bgs (installed by property owner)
- 2013/2014: eleven monitoring points to ~50 ft bgs installed along the property line; five intermediate/deeper points to 91, 115, 155, 235, and 377 ft bgs (installed by Army)
- Points on property monitored during Area B tracer study.
- The 5 intermediate/deeper points sampled in November 2014.

Investigation Highlights

- TCE detected above MCL (5 ppb) in four shallow groundwater sample points closest to the across from B-11. Highest concentration was 61.9 ppb.
- Boring Wvly-1 to 170 ft bgs, located ~100 ft from property boundary found TCE at 70 to 210 ppb in four screening packer samples collected during drilling. TCE detected at 340 ug/L in a permanent monitoring point.
- During tracer study, no tracer introduced at B-11 was detected in any monitoring points on this property or other areas to the south and west.
- Data from the five permanent intermediate/deep points indicate low or non-detect deep impacts in this area to the south/southwest of B-11. Additional sampling rounds recommended.

Risk & Potential Receptors

- No current risks identified but future risks need to be considered.
- Current and future groundwater use is prohibited, so no potential exposure to contaminated groundwater.
- Groundwater contamination migrates onto the property at depth, so no soil contamination.
- Corn, soybeans not at risk due to depth of groundwater.
- No current vapor intrusion issues, but future development along the property boundary next to B-11 should consider monitoring, vapor barriers, vapor removal systems, or similar approaches to prevent potential exposure.

Data Gaps & Next Steps

- 4 of the shallow temporary points with MCL exceedances near property boundary may be converted to permanent points.
- Currently, no other drilling or investigation on this off-post property is planned or recommended (pending EPA/MDE review)
- Draft human health risk assessment & Area B RI report slated for Summer 2016 (pending completion of work in other areas).
- Draft Feasibility Study report to assess remedial alternatives for Area B anticipated in late 2016. Pilot treatability studies may be considered too. Path forward decisions require EPA and MDE concurrence.