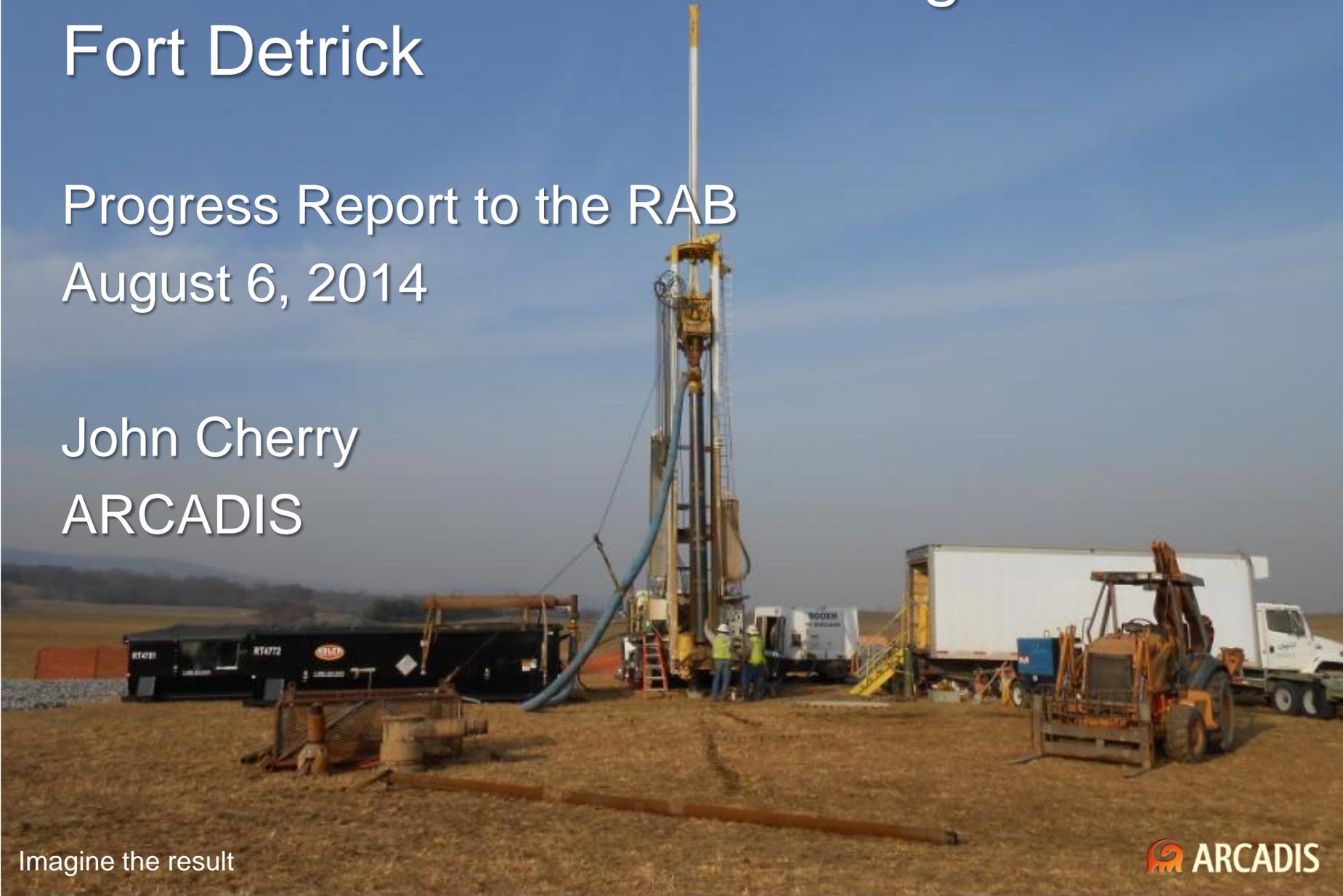


Area B Groundwater Investigation Fort Detrick

Progress Report to the RAB
August 6, 2014

John Cherry
ARCADIS



Imagine the result

Overview of Topics

- ❑ Overview of USACE shallow drilling at Waverley Property
- ❑ Update on On- and Off-Post Deep Drilling

Work Completed Since the Last RAB

- Two new monitoring points installed at County Montevue campus in June '14
- 11 shallow sampling points installed and sampled on Waverley View property (by USACE) in July '14
- Seven decision-making discussion calls with EPA/MDE since March '14 RAB
- New drilling approach identified to address deep drilling challenges

Status of Original RI Work Plan Activities

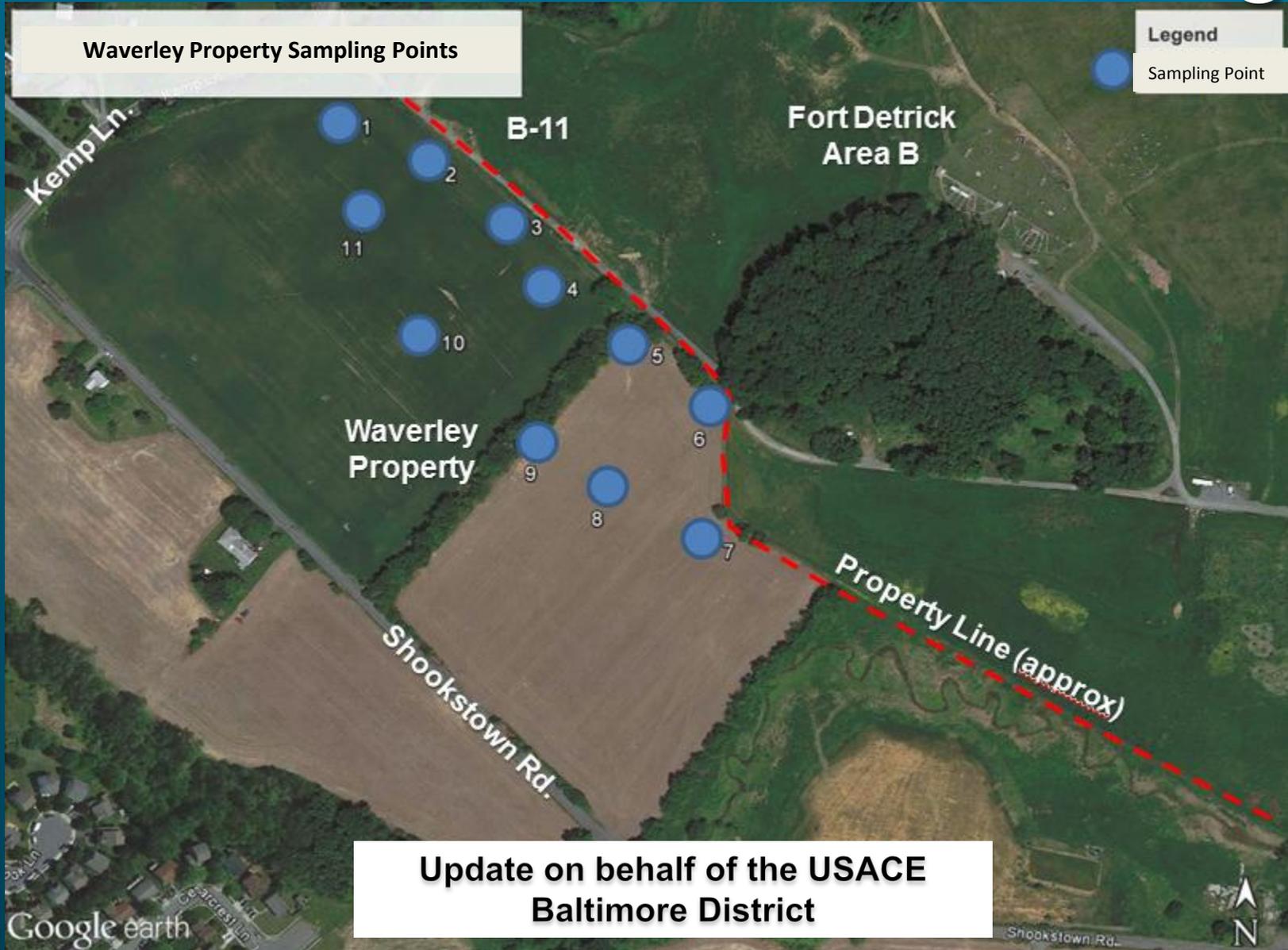
- ✓ Existing monitoring point assessment and repair Feb 2011 to Apr 2011
- ✓ New monitoring point installation (onsite) April 2011 to Mar 2012
- ✓ Direct Push Investigation March 2012
- ✓ Spring and Seep Surveys March 2012
- ✓ Groundwater/Surface Water Sampling April 2012 /Sept 2012
- ✓ Vapor Intrusion Sampling (2 rounds) Jan/Aug 2013
- ✓ Groundwater tracer study Spring 2013 to Fall 2013

Additional On- and Off-Post Drilling

On-Going

Grey = completed

Shallow “First-Water” Drilling



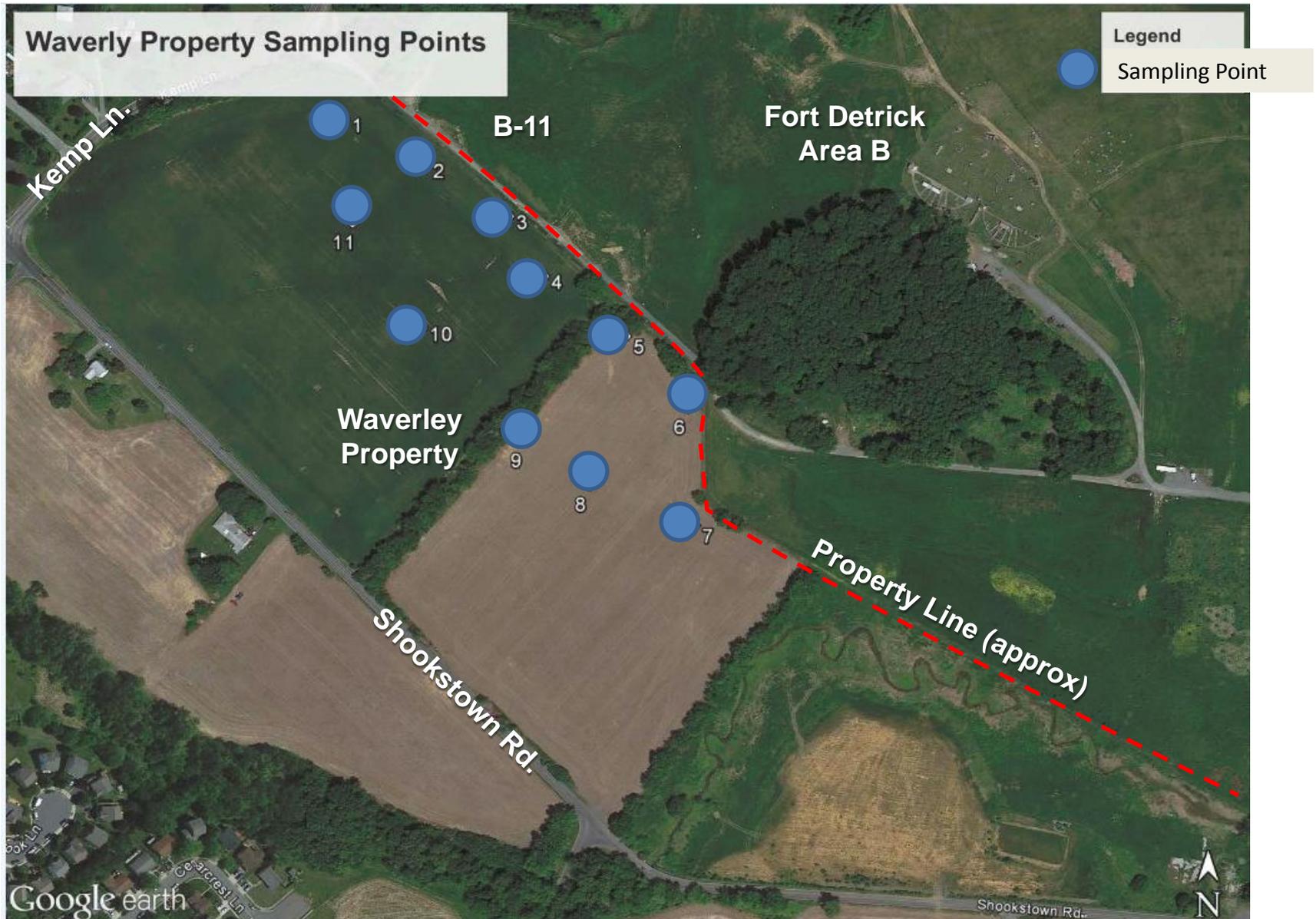
Waverley Property Shallow First Water Groundwater Sampling

1. The Army considered the lack of first water groundwater data for the Waverley property to be a data gap.
2. In June, a plan was developed to sample the shallow first groundwater.
 - The approach and plan were approved by MDE and EPA
3. The purpose was to analyze the groundwater and assess the risk for potential vapor intrusion from volatile constituents that may be in shallow groundwater.
4. There is currently no data to suggest there is a potential vapor intrusion issue, this analysis is being done as a precautionary and assessment effort.
5. The drilling work was conducted by staff in the US Army Corp of Engineers (USACE) Baltimore District – Geology and Investigations Section.

Waverley Property Shallow First Water Groundwater Sampling

1. Temporary first water shallow sampling points were installed at 11 locations across the Waverley Property to determine if there are Volatile Organic Compound (VOC) detections.
2. The USACE began drilling on July 14th 2014 using auger and rock coring bits. (no air rotary)
3. 11 locations were completed and sampled.

Waverley Property Shallow Groundwater Sampling Points



Waverley Property Groundwater Sampling Points

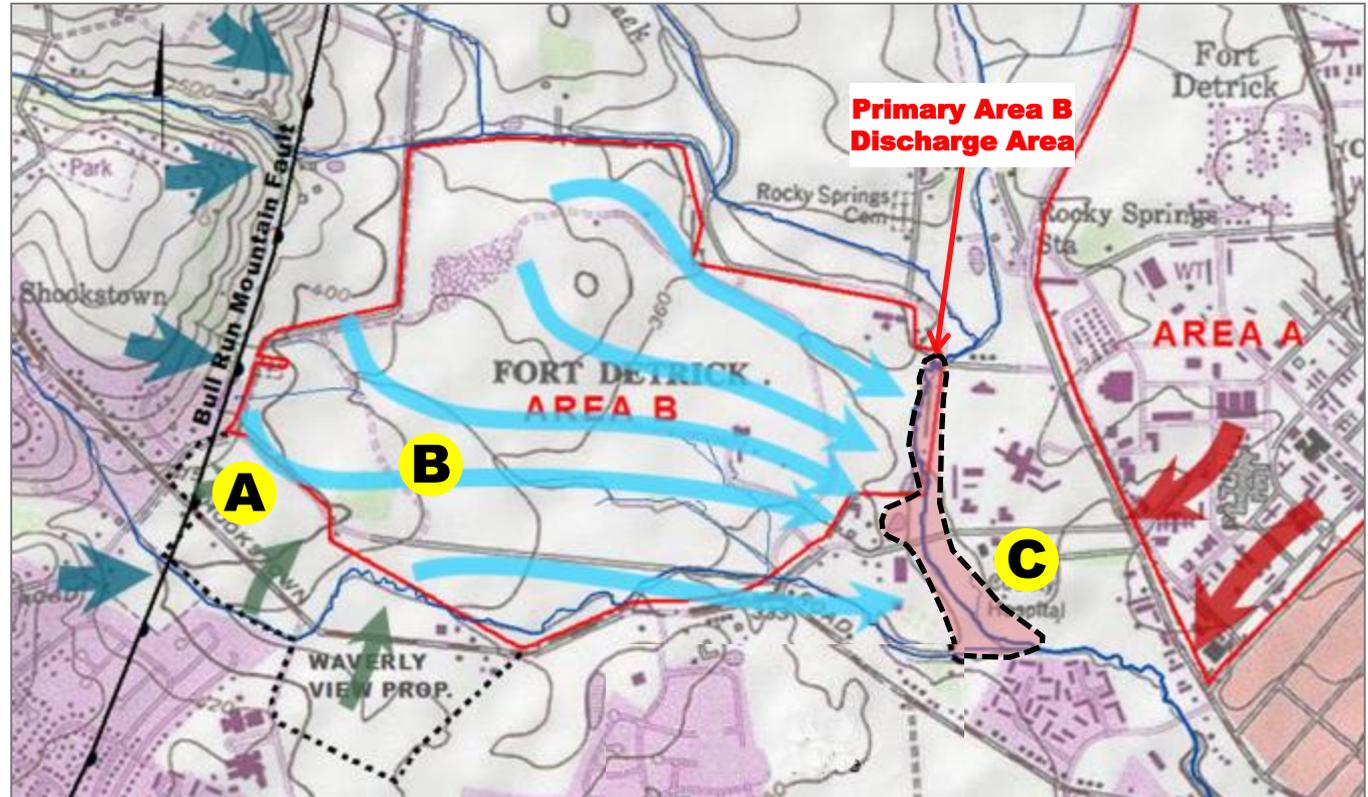
1. Each location is a temporary two-inch diameter PVC sampling point which intersects the first encountered groundwater.
2. The locations have been sampled for dissolved phase volatile constituents that could present a risk for vapor intrusion.
3. The sampling was completed at the end of July 2014 and the results are not yet available.
4. The results will be incorporated into the remedial investigation report.

Update on Additional On- and Off-Post Drilling



Supplemental Deep Drilling Locations

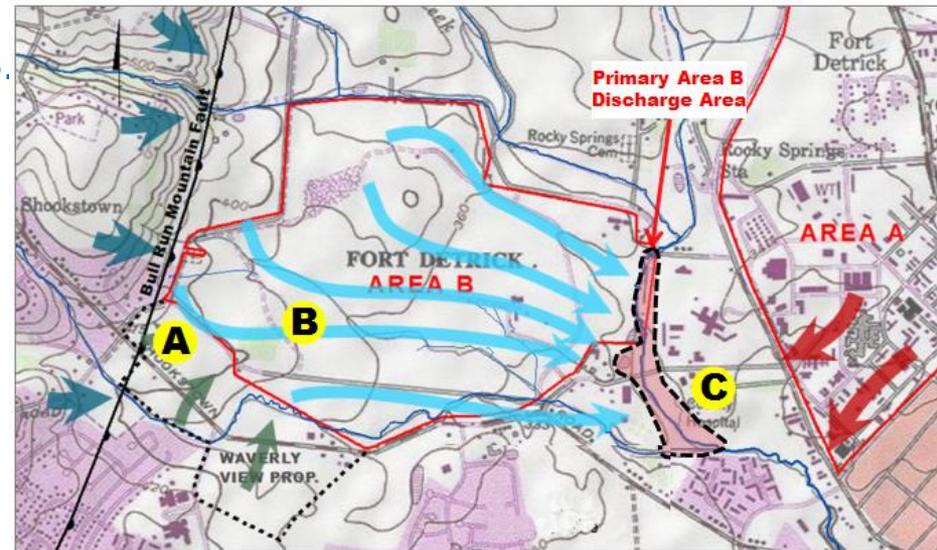
- A. Delineation south of B-11 area (Waverley Property) (~7 shallow/deep points)
- B. Vertical delineation downgradient of B-11 to depths greater than 325 ft. (~ 2 nested points)
- C. Vertical delineation east of Carroll Creek (underflow) (~ 2 nested points)



Arrows = Generalized patterns of groundwater flow

Additional Deep On-Post & Off-Post Drilling

- Scope called for 7 borings with installation of up to 11 shallow and deep monitoring points.
- Drilling commenced December 6, 2013.
- 1 deep and 4 shallow sample points have been completed.
- At the Waverley Property, the scope called for two borings to ~400 ft, but safety concerns with the geology at several drilling locations has slowed progress and prevented drilling deeper than 218 ft bgs.
- Drilling to resume next week (week of August 11th) at the Waverley property using an alternate approach to try to reach the target depth (~400 ft) at one location.



Arrows = Generalized patterns of groundwater flow

Overall Summary

5 Completed Sampling Points

- Waverley-1 Screened 145-155 ft (drilled to 175 ft)
- Waverley-2 Screened 86-91 ft (drilled to 142 ft but collapsed)
- Waverley-3 Screened 100-115 ft (drilled to 161 ft but collapsed)
- County-1 Screened 99-109 and 382-397

2 Abandoned Boreholes

- BMW-52E (drilled to 90 ft; unsustainable water/IDW; sinkhole concerns)
- Waverley-4 (drilled to 218 ft, collapse, major voids, sinkhole concerns)

2 On-Hold Boreholes

- Waverley-5 (drilling halted at 147 ft, to resume week of 8/11/14)
- BMW-79 (drilling halted at 140 ft)

IDW = investigation derived waste (e.g., drill cuttings, water, sediment from the borehole)

Packer Sampling - Interim Borehole Results (pre-monitoring point construction)

Waverley-1

- Located approximately 100 feet from the Detrick property boundary.
- TCE detected above the MCL but significantly below levels detected in the B-11 monitoring points.

Waverley-2

- TCE non-detect.

Waverley-3

- Trace TCE detections reported at low estimated concentrations well below the MCL.

County-1 (99-109 ft bgs)

- Trace TCE detections reported at low estimated concentrations well below the MCL.

County-1 (382-397 ft bgs)

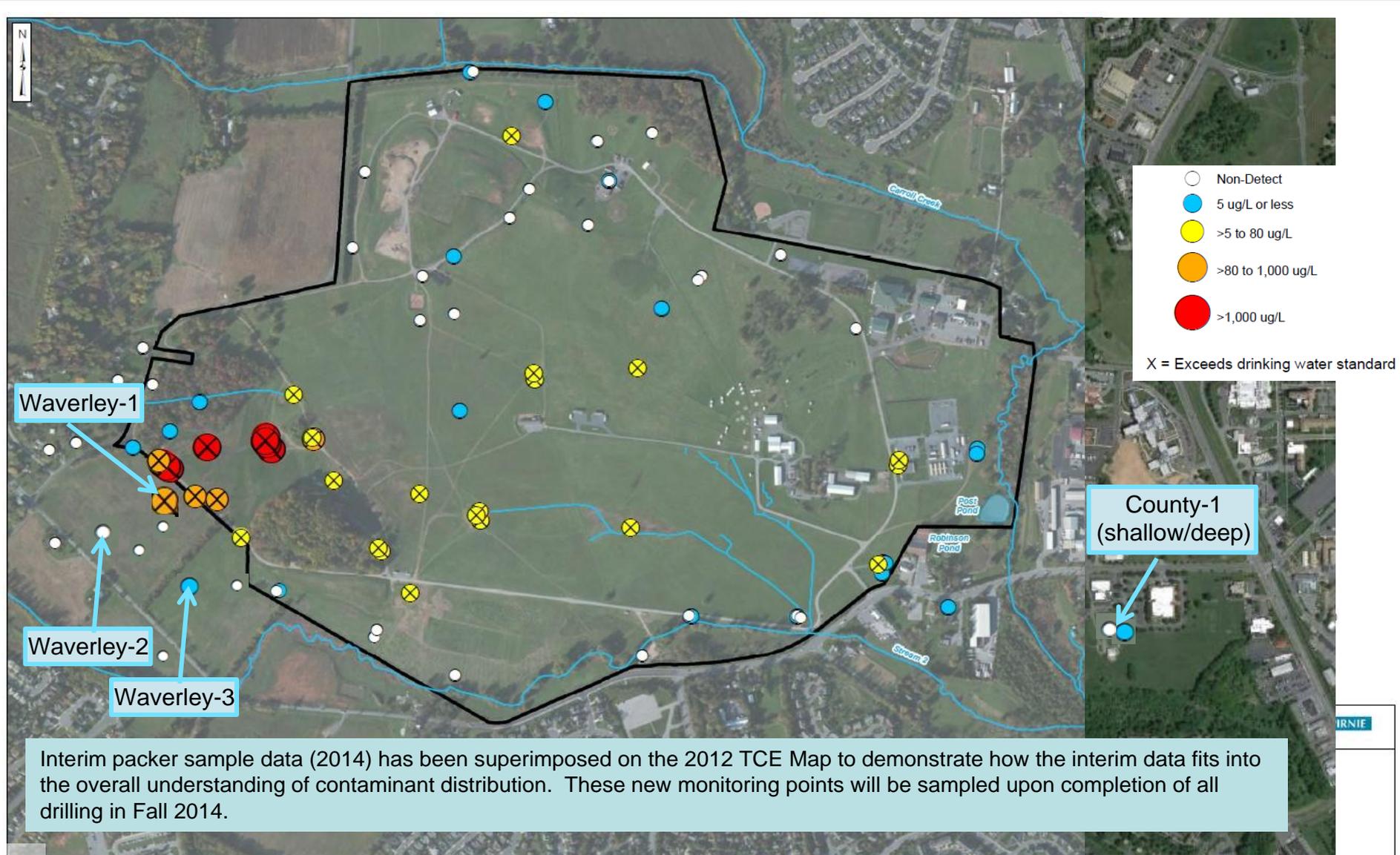
- TCE non-detect.

Preliminary observations are consistent with 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.
- No MCL exceedances at depth on east side of Carroll Creek.

TCE in Groundwater

2014 interim packer test results shown with TCE data from comprehensive 2012 sampling event



Next Steps

Next Steps

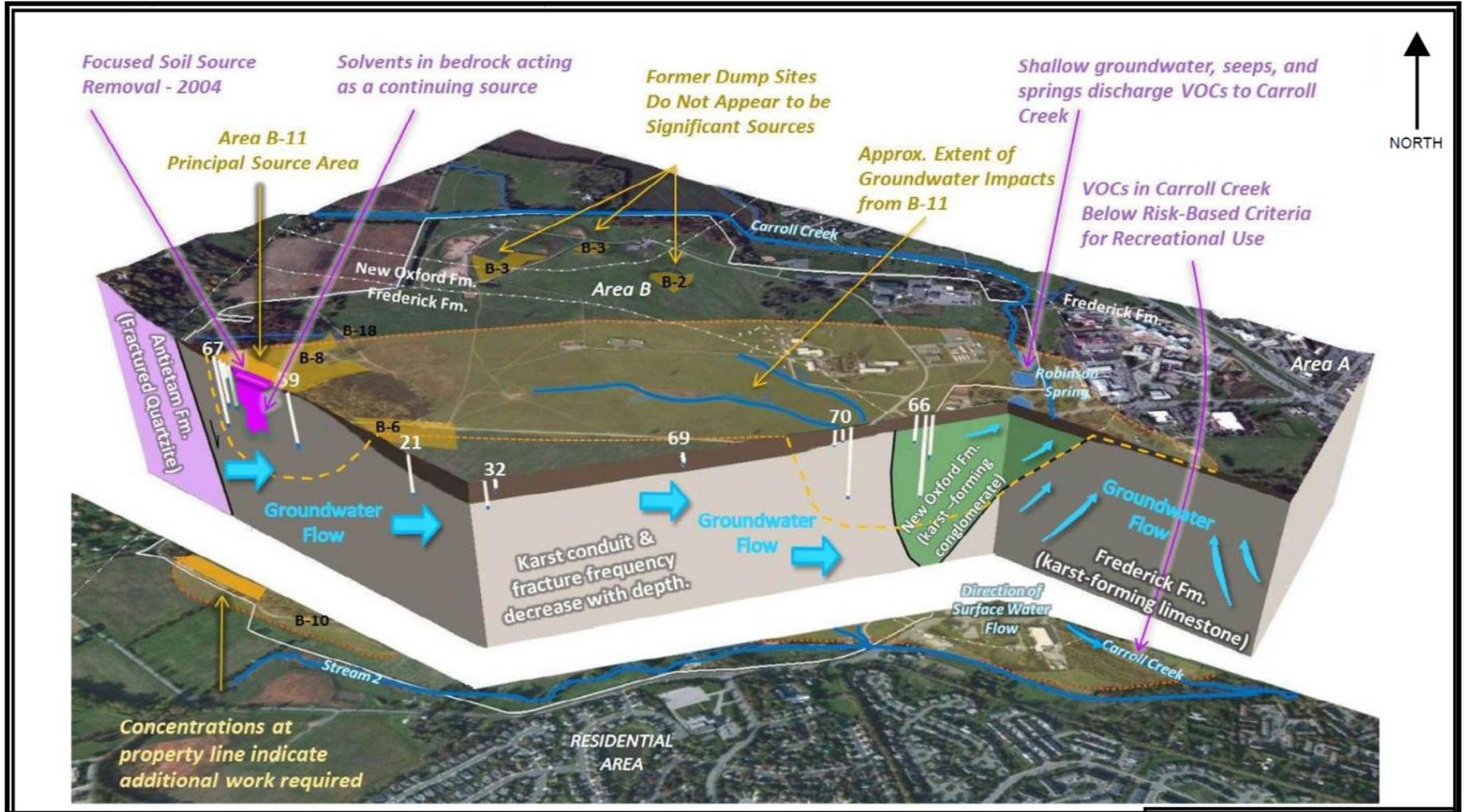
- Continue with deep drilling at two locations (Waverley property and Area B location) and install monitoring points.
- Sample all new monitoring points concurrently (Fall 2014)
- Coordinate with EPA and MDE to identify and resolve any other data needs to complete investigation.
- Prepare Remedial Investigation report including Human Health Risk Assessment.

Regular updates to be provided during community RAB meetings.

Questions and Discussion

Backup Slides

Area B Conceptual Site Model Review



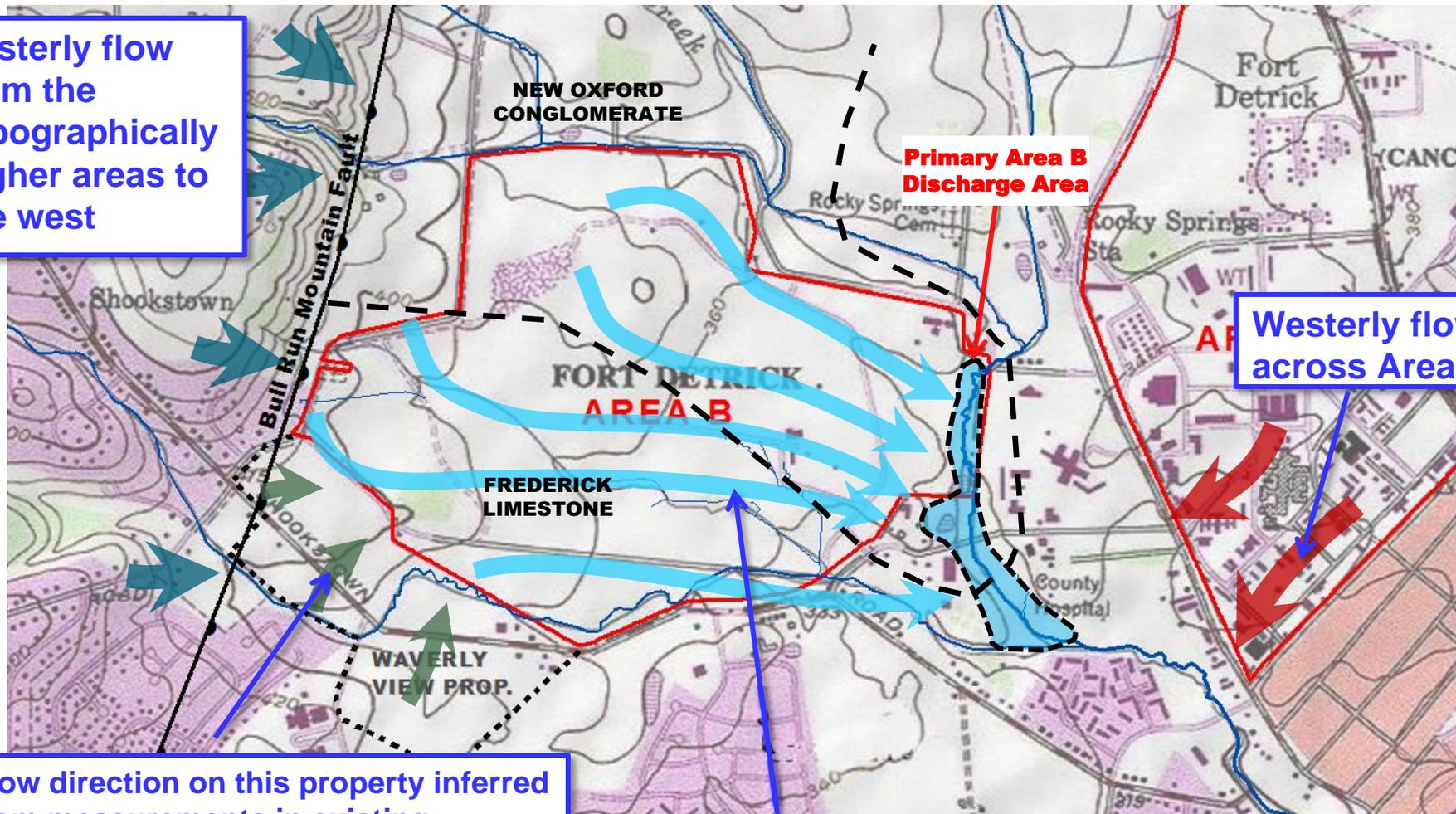
Legend

- 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.

Generalized Patterns of Groundwater Flow

Easterly flow from the topographically higher areas to the west



Primary Area B Discharge Area

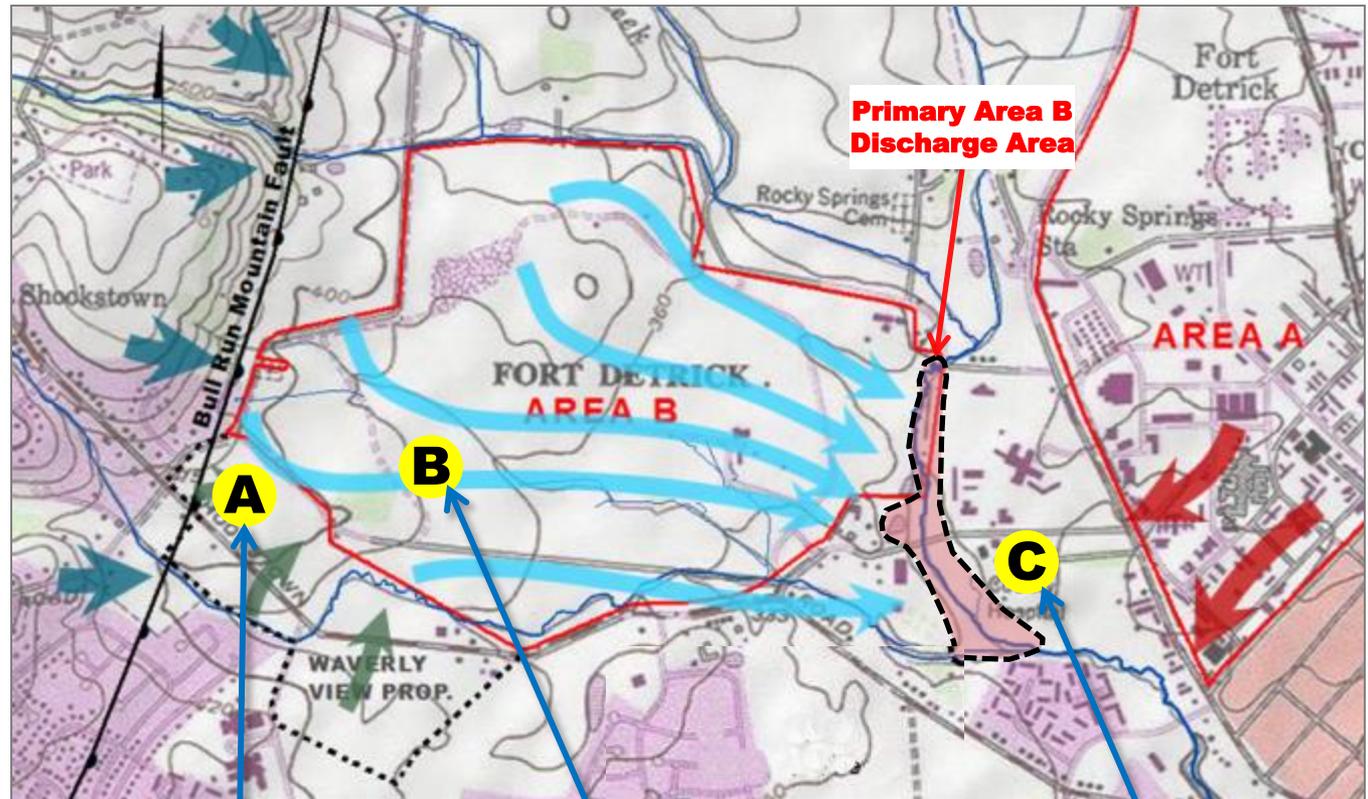
Westerly flow across Area A

Flow direction on this property inferred from measurements in existing monitoring points; on-going drilling will confirm.

Easterly flow across Area B

Supplemental Deep Drilling Locations

- A. Delineation south of B-11 area (Waverley Property) (~7 shallow/deep points)
- B. Vertical delineation downgradient of B-11 to depths greater than 325 ft. (~ 2 nested points)
- C. Vertical delineation east of Carroll Creek (underflow) (~ 2 nested points)



Arrows = Generalized patterns of groundwater flow

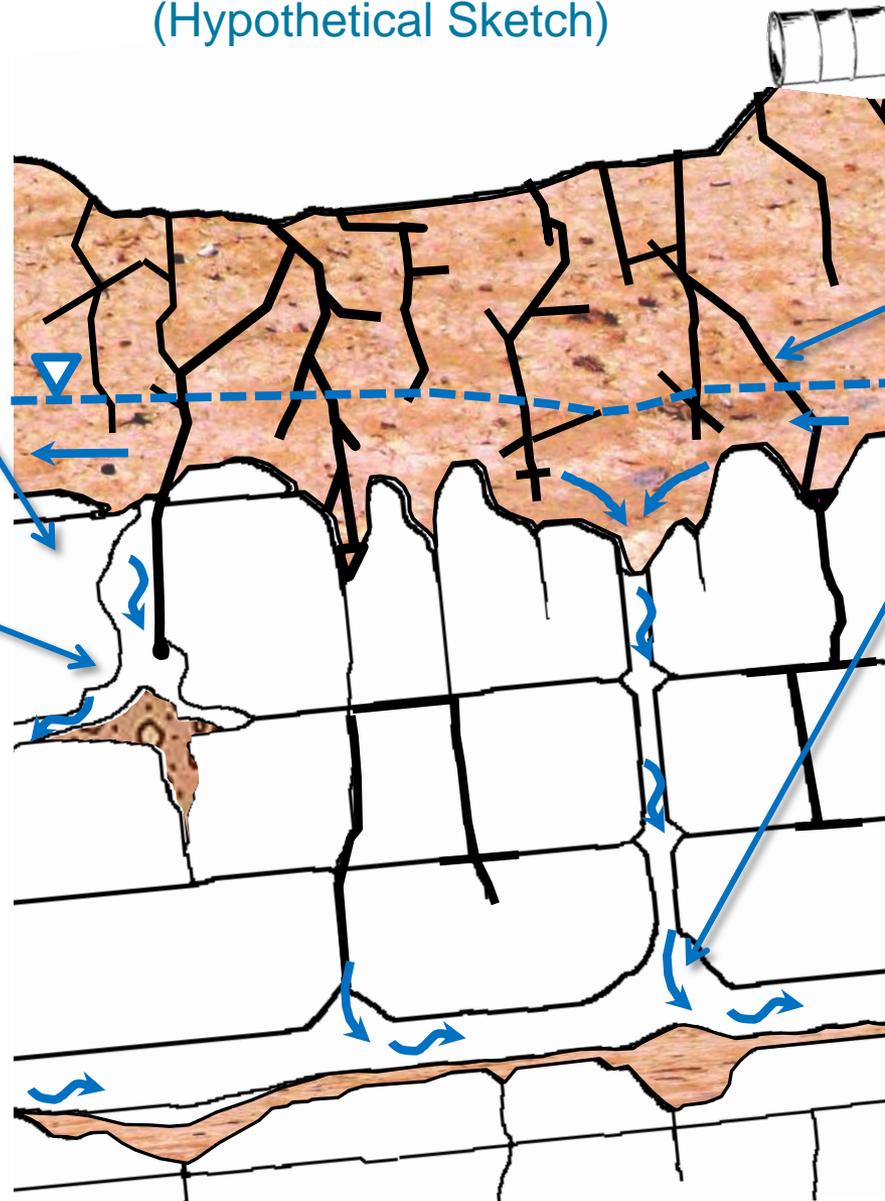
Drilling started but on-hold currently

Drilling started but on-hold currently

Drilling Completed; two sample points installed

Karst Geology – A Quick Refresher

(Hypothetical Sketch)



Limestone geology

Dissolution along fractures and bedding planes can lead to small and large conduits

Water infiltrates from the surface and drains through the system.

Water flows through interconnected fractures and conduits

EXPLANATION

▽ = WATER TABLE

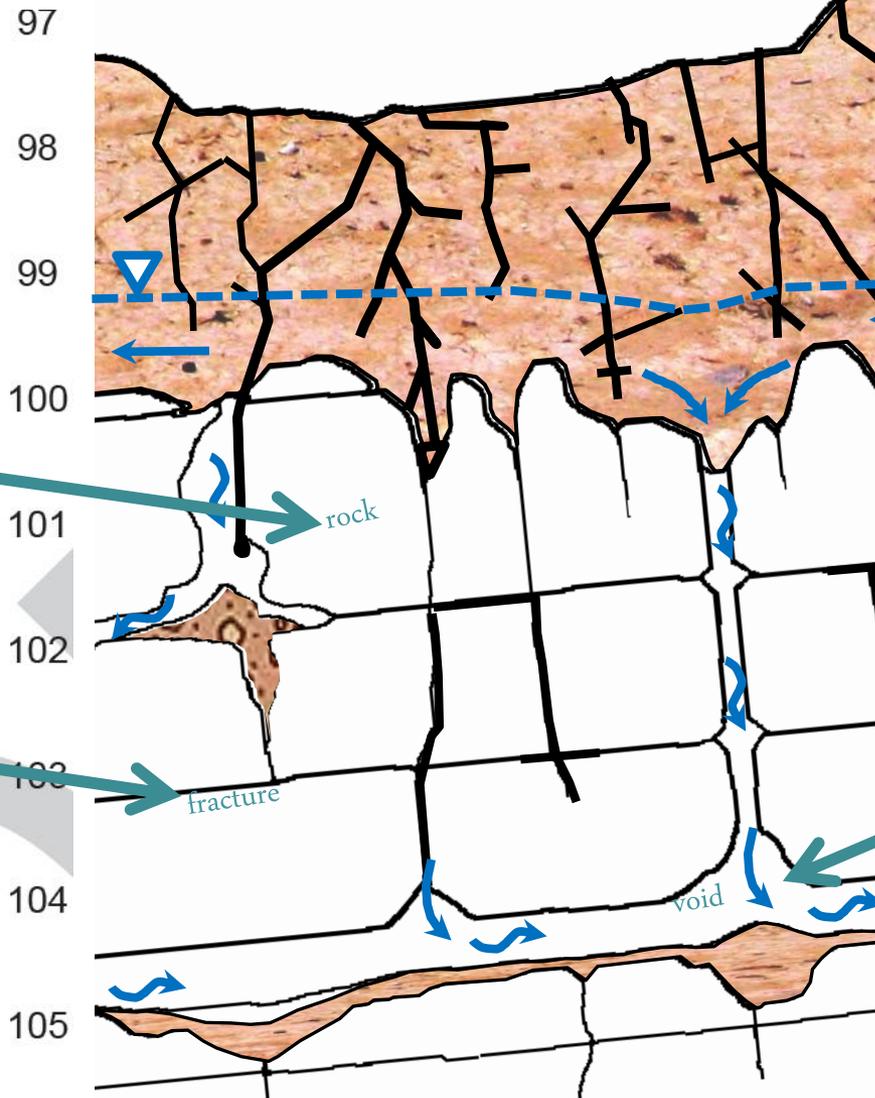
← = GROUNDWATER MOVEMENT

✚ = MACROPORES

■ = SOIL OR SEDIMENT

Understanding Karst Geology

(Hypothetical Sketch)



41
42
43
44

Understanding How Contamination Behaves in Karst

(Hypothetical Sketch)

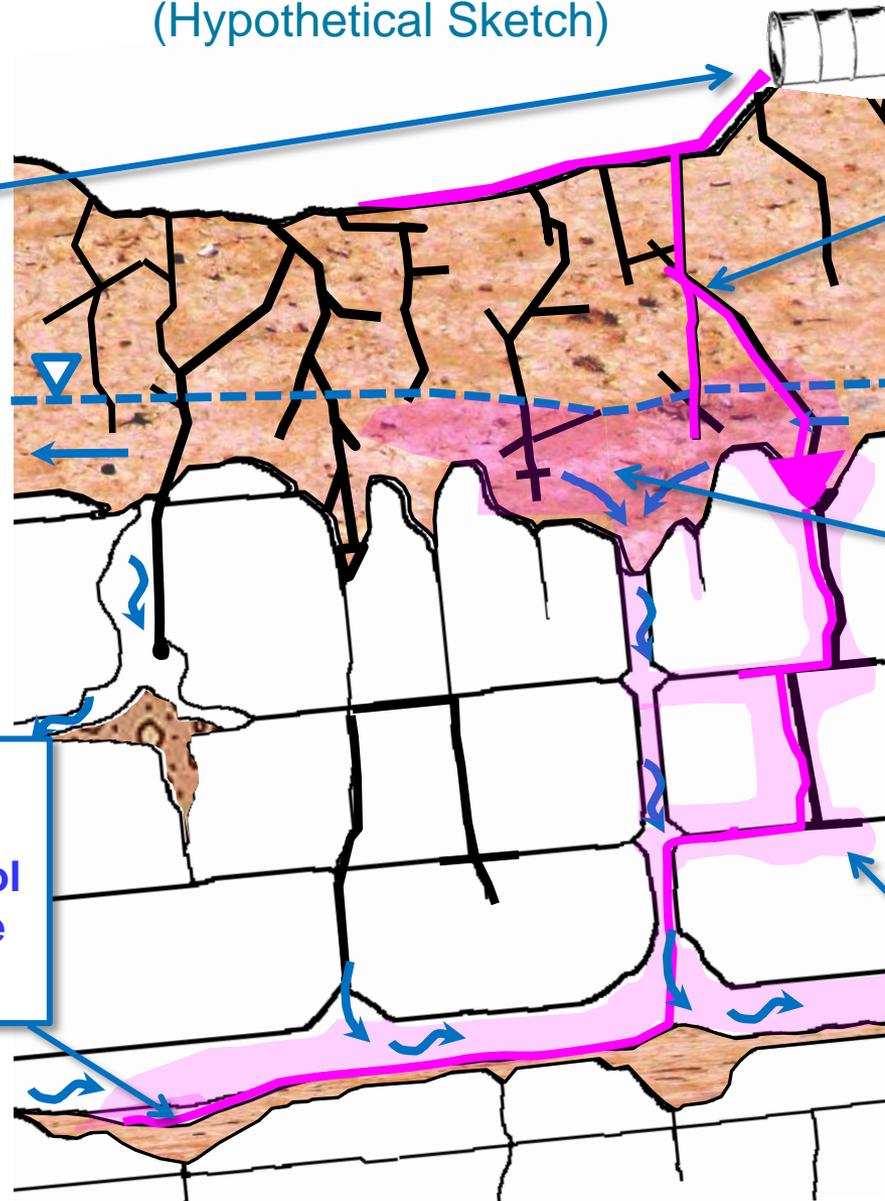
Assume a hypothetical DNAPL release

DNAPL release migrates downward into the subsurface

Dissolves into groundwater creating a dissolved contaminant plume that migrates with groundwater flow

DNALP migrates downward through fractures and can pool in depressions in the rock surface

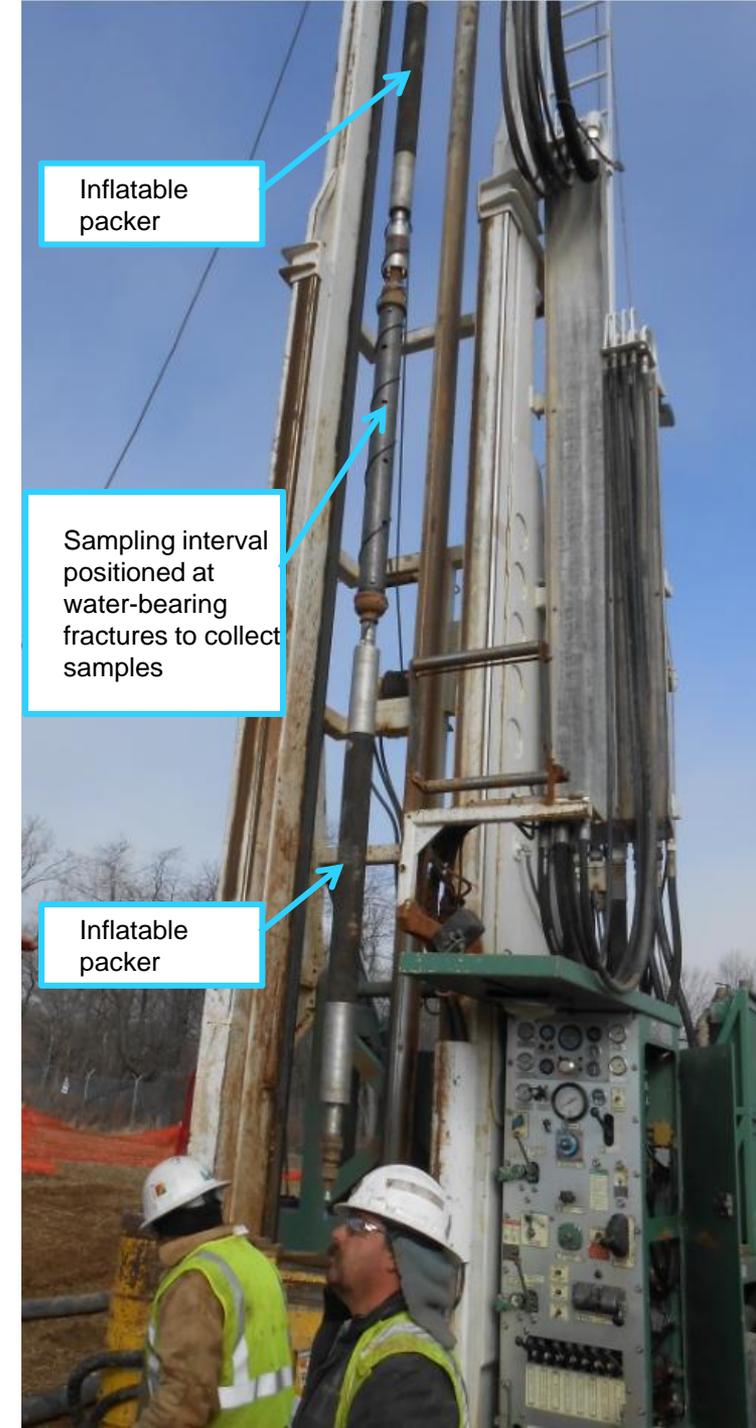
DNAPL diffuses into the soil/rock matrix



Packer Sampling During Drilling & Interim Borehole Results

Note: Sampling of the new points will not be conducted until after all the new points are completed and properly developed (likely early Fall).

- In the interim, we have screening-level packer sample data that is collected during drilling operations.
- Laboratory results from packer samples are reviewed with EPA and MDE to reach concurrence on monitoring point construction decisions for each borehole.
- Between early January and August 6th, we've had 12 calls with EPA and MDE to review drilling progress, geophysical logs, and interim packer sample data for collaborative decision-making purposes.



Packer Sampling versus Monitoring Point Sampling

Packer sampling

- Conducted during drilling activities using inflatable packers to isolate fractures, purge test intervals, and collect groundwater samples for laboratory analysis.
- Results are considered “screening level” suitable for deciding construction specifications, but not as reliable as data from a completed monitoring points.

Monitoring point sampling

- Once a monitoring point is built and the grout is allowed to set, the location is pumped and surged to “develop” the location. This removes silt and fine-grained material from the vicinity of the screen to establish a reliable monitoring point.
- The location is allowed to settle for a week before sampling to allow the groundwater to return to steady-state conditions.
- These sampling locations provide reliable and reproducible data that can be validated and used to characterize nature and extent of contamination and evaluate risks.

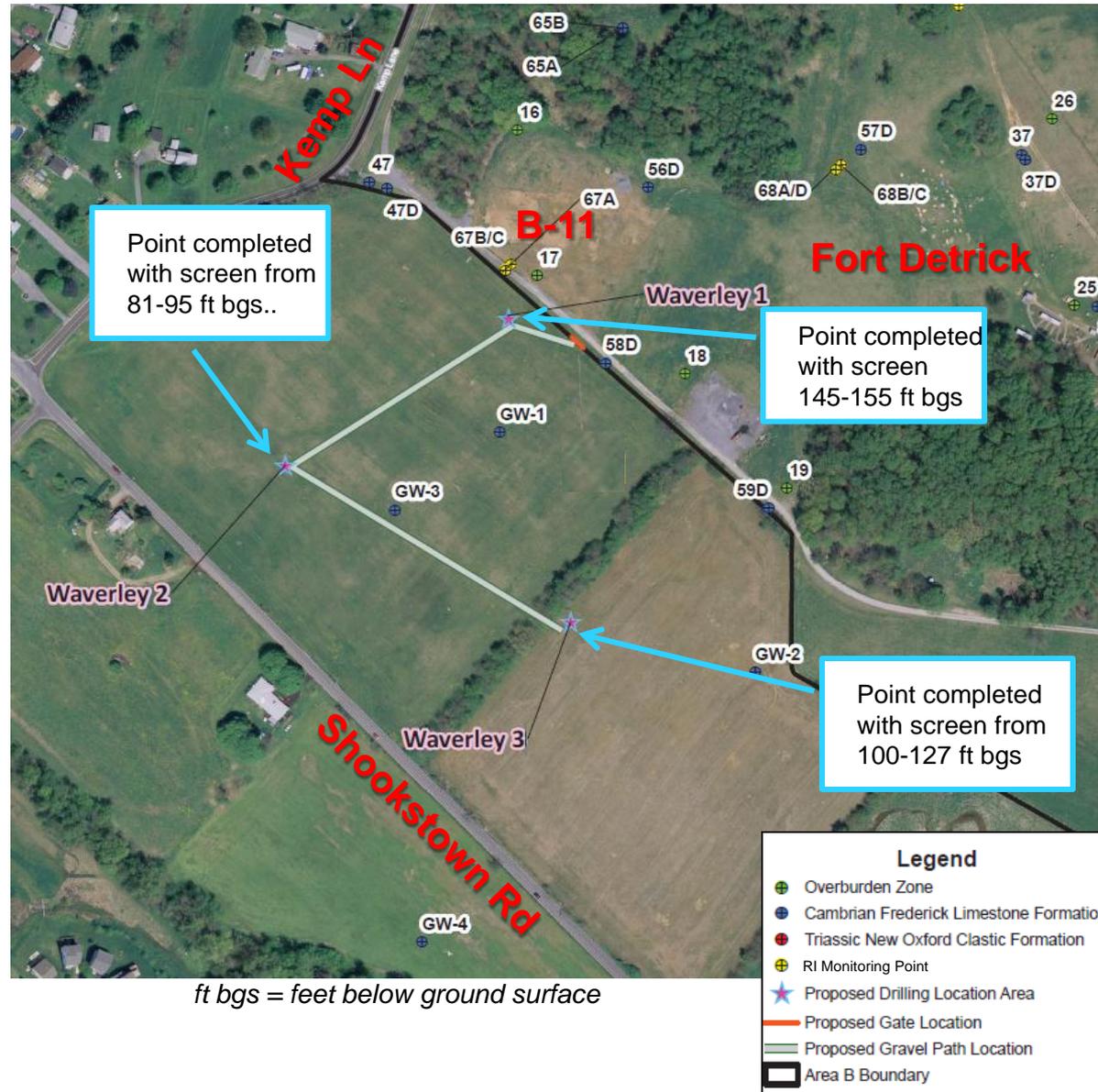
Packer sample and monitoring point results can vary significantly (sometimes higher and sometimes lower) so we default to presenting data from monitoring points and discuss packer sample data in general terms.



Drilling Status (through 8/6/14)

- Three shallow monitoring points completed on the Waverley property:

- Waverley-1: New shallow monitoring point completed near Area B fence line.
- Waverley-2: New shallow monitoring point completed.
- Waverley-3: New shallow monitoring point completed.



Packer Sampling - Interim Borehole Results (pre-monitoring point construction)

1 Waverley-1

- Located approximately 100 feet from the Detrick property boundary.
- TCE detected above the MCL but significantly below levels detected in the B-11 monitoring points.

2 Waverley-2

- TCE non-detect.

3 Waverley-3

- Trace TCE detections reported at low estimated concentrations well below the MCL.

Initial observations are consistent with original conceptual site model:

- Groundwater impacts south of the Detrick Area B do not extend far beyond the property line and concentrations drop off quickly in this direction by orders of magnitude.

