Summary of Findings
TAPP Grant Topic
Facility-Wide Ground Water Monitoring Program (FWGWMP)

February 19, 2014

Restoration Advisory Board (RAB)
Ravenna Army Ammunition Plant, Ravenna, Ohio

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History of FWGWMP

2004-2011

- In 2004, the United States Army and Ohio EPA finalized the FWGWMP Plan.
- The **FWGWMP Plan** (RVAAP-66) discusses future ground-water remedial efforts at the RVAAP, including pursuing a record of decision for ground-water using a **facility-wide approach.**
- To date, **243 wells** have been sampled a minimum of four quarters.

2012-date

- In 2012, **38 new wells** were installed.
- Current ground-water monitoring (*the focus of this review*) (October 1, 2011 thru September 30, 2012)
- Existing wells will be sampled **semi-annually**; new wells will be sampled for four consecutive quarters.

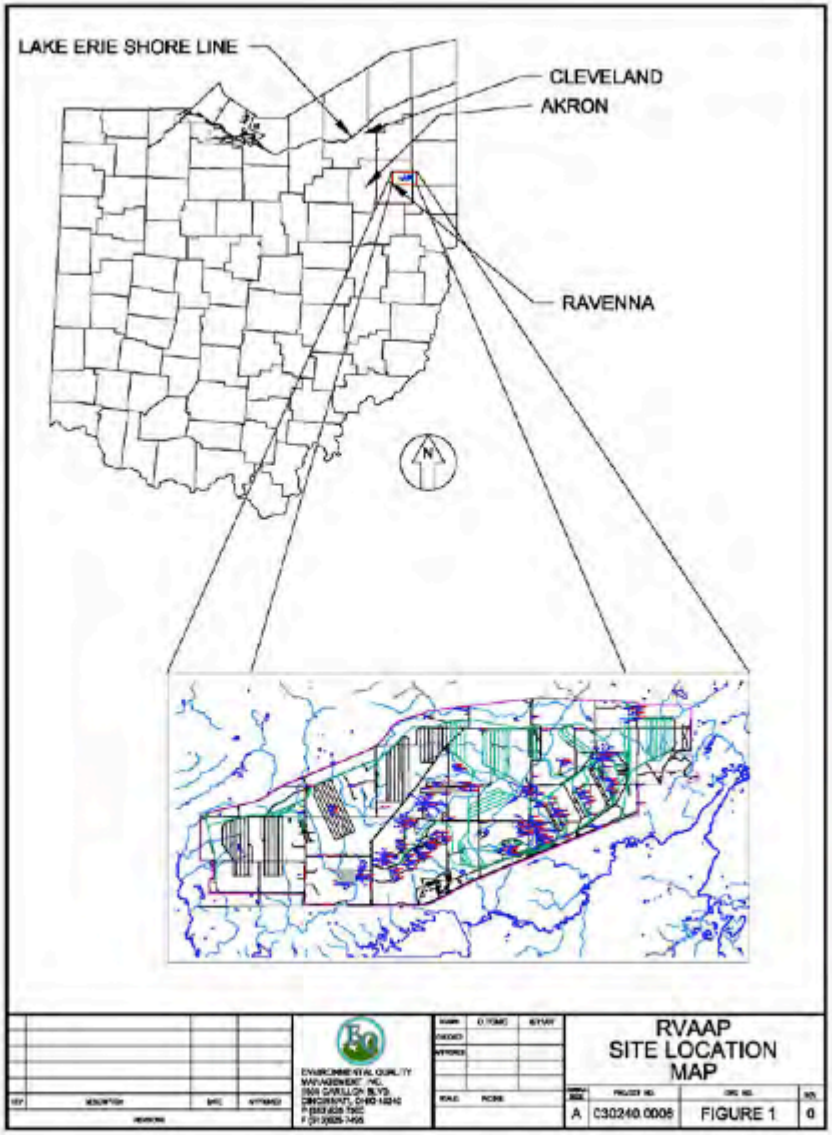


Figure 1-1. RVAAP General Location Map

What is the purpose of the FWGWMP?

- Implementing a FWGWMP will help determine if constituents from past activities may be posing a current or future risk via ground-water use on-site, or via ground-water migration to off-site receptors.

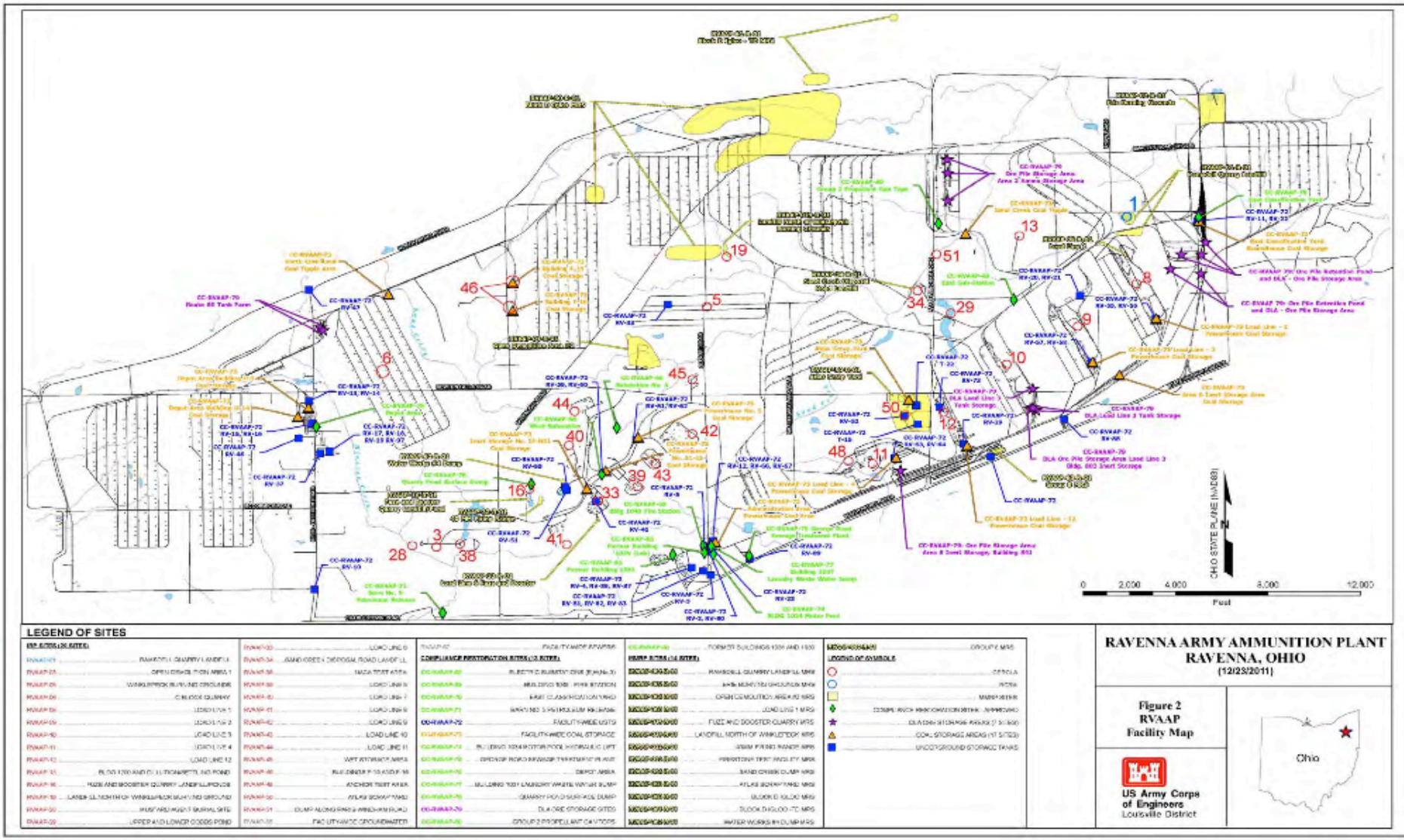


Figure 1-2. RVAAP Facility Map

What is the advantage of a facility-wide approach to ground water?

- AOC constituents have the ability to migrate beyond identified AOC boundaries
- Constituents that reach ground water have the potential to become mobile.
- Identify and monitor a network of wells that represent the overall facility ground-water picture.
- Determine if some AOC constituents pose a risk on the RVAAP or off-site.

Potential Goals & Tasks

- Review & assess historic monitoring data for selected wells
- Identify constituents that exceed target levels (i.e., MCLs or RSLs)
- Emphasis on constituents detected near facility boundary
- Review results for shallow vs. deep aquifer wells
- Identify potential health implications of constituents

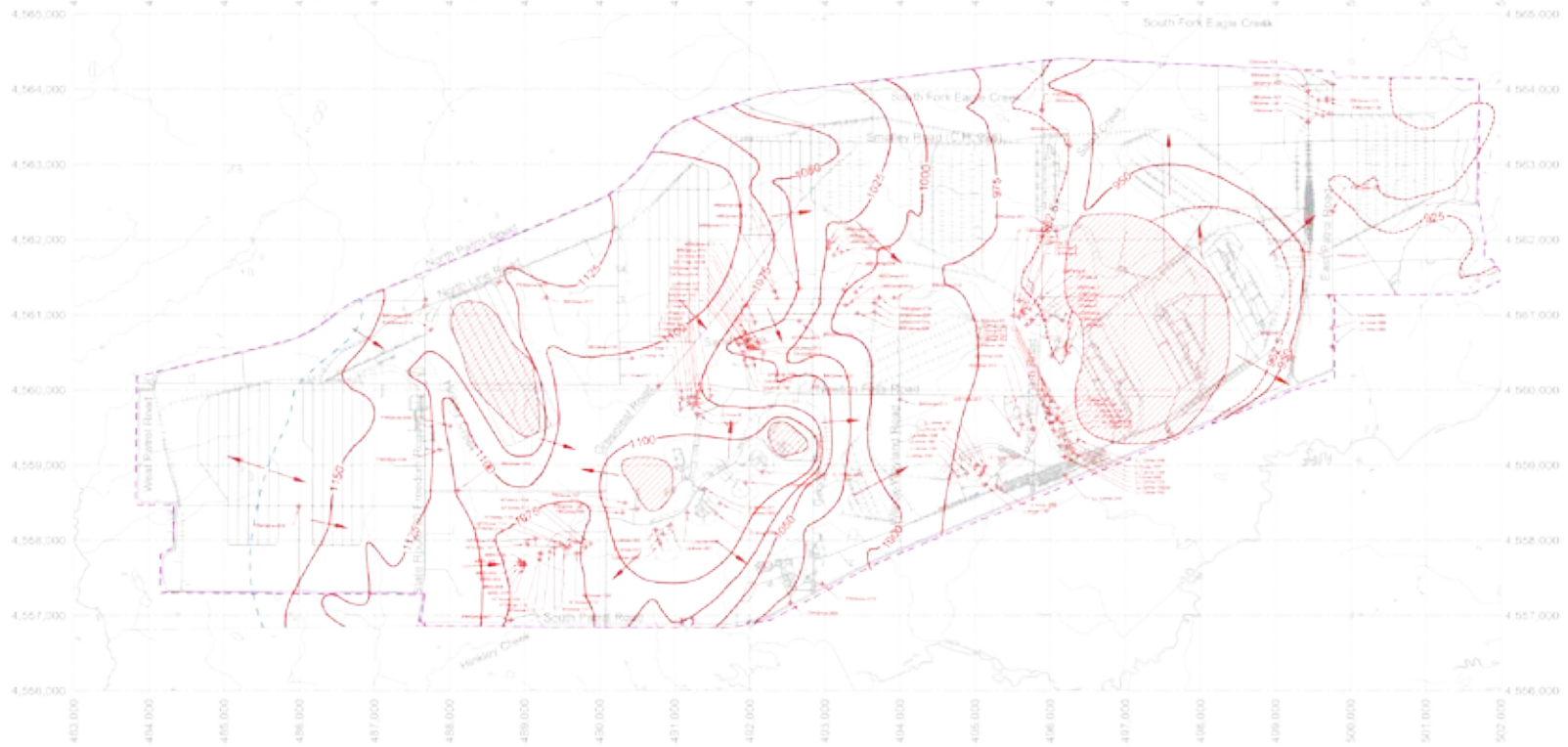
Task 1 – tonight's focus

- Recap FY2011 sampling results (previously presented)
- Discuss findings of 2012 FWGWMP Annual Report
- Includes 4 sampling events (October 2011 thru September 2012)
- Identify exceedances/trends

Site Ground Water Basics

- Three ground-water formations
  1. Unconsolidated aquifer
  2. Sharon Sandstone (predominant)
  3. Homewood Sandstone (secondary)
- Ground water in all aquifers flows in a general <u>easterly</u> direction
- Wells represent *unconsolidated* wells and *bedrock* wells…reflecting a more regional flow pattern

Unconsolidated Wells



LEGEND

- UNCONSOLIDATED WELL
- PROPERTY LINE
- 1100 LINE OF EQUAL GROUNDWATER ELEVATION (ft. amsl) [DASHED WHERE INFERRED]
- GROUNDWATER DIRECTION
- UNCONSOLIDATED AQUIFER MISSING
- INFERRED GROUNDWATER DIVIDE

N

0 500 1000

SCALE (METERS)

COORDINATE SYSTEM UTM NAD 83 ZONE 17

POTENTIOMETRIC SURFACE OF UNCONSOLIDATED AQUIFER (JULY 2012)

E 030174 0016 PLATE 2 2

Homewood Sandstone

LEGEND

- HOMEWOOD MEMBER WELL
- PROPERTY LINE
- 1100 — LINE OF EQUAL GROUNDWATER ELEVATION (ft. amsl)
- 1050 (INTERMEDIATE DASHED)
- GROUNDWATER DIRECTION
- HOMEWOOD MEMBER
- SHARON MEMBER
- SHARON SHALE

NOTES

1. BEDROCK GEOLOGY ADOPTED FROM "GEOLOGY AND GROUND-WATER RESOURCES OF PORTAGE COUNTY, OHIO" (WINSLOW AND WHITE, 1966). NOT ALL LITHOLOGIC UNITS ARE PRESENTED.

N

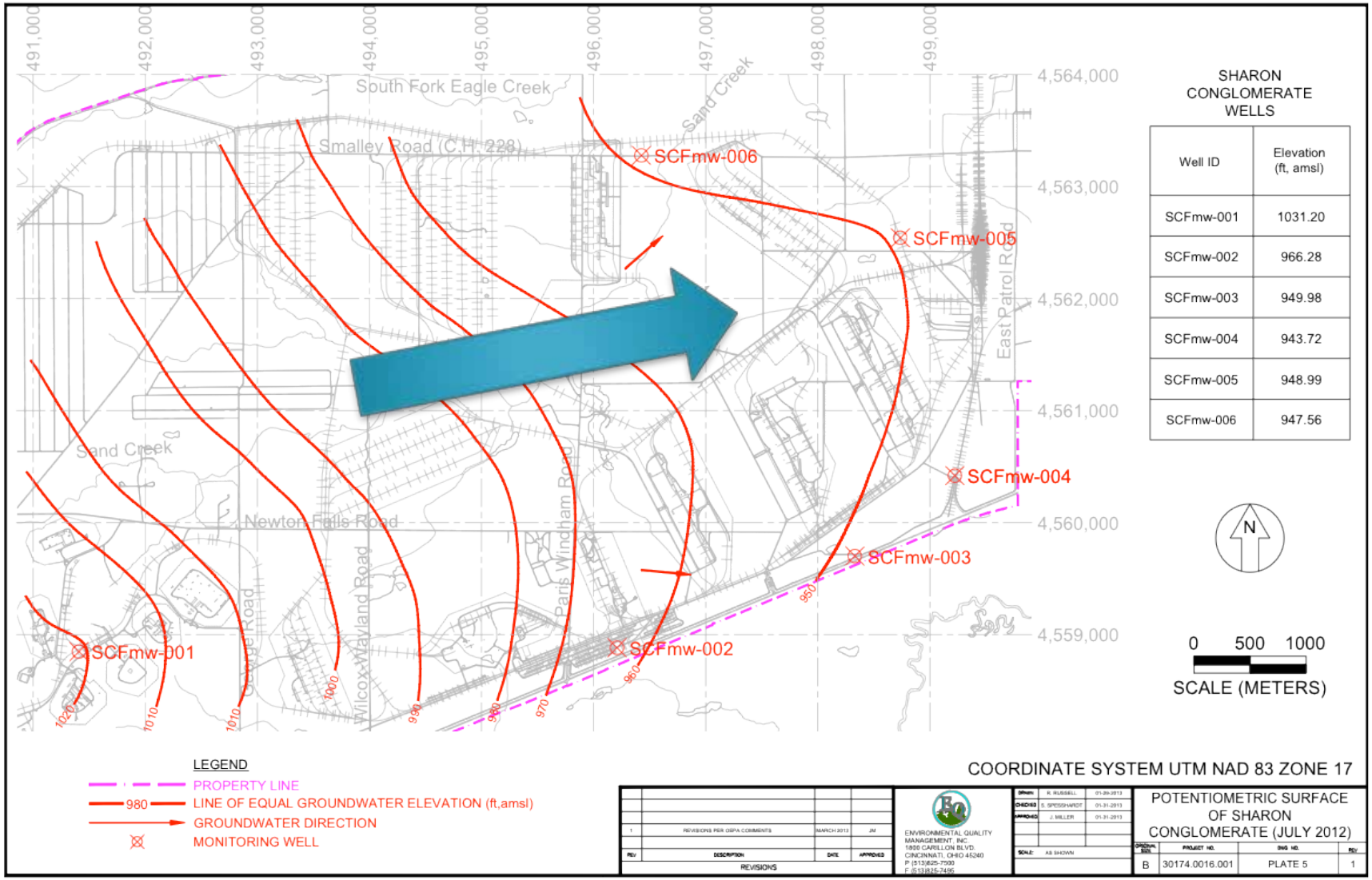
0 500 1000
SCALE (METERS)

COORDINATE SYSTEM: UTM NAD 83 ZONE 17

POTENTIOMETRIC SURFACE OF HOMEWOOD (JULY 2012)

E 030174.0016 PLATE 3 2

Sharon Sandstone



SHARON CONGLOMERATE WELLS

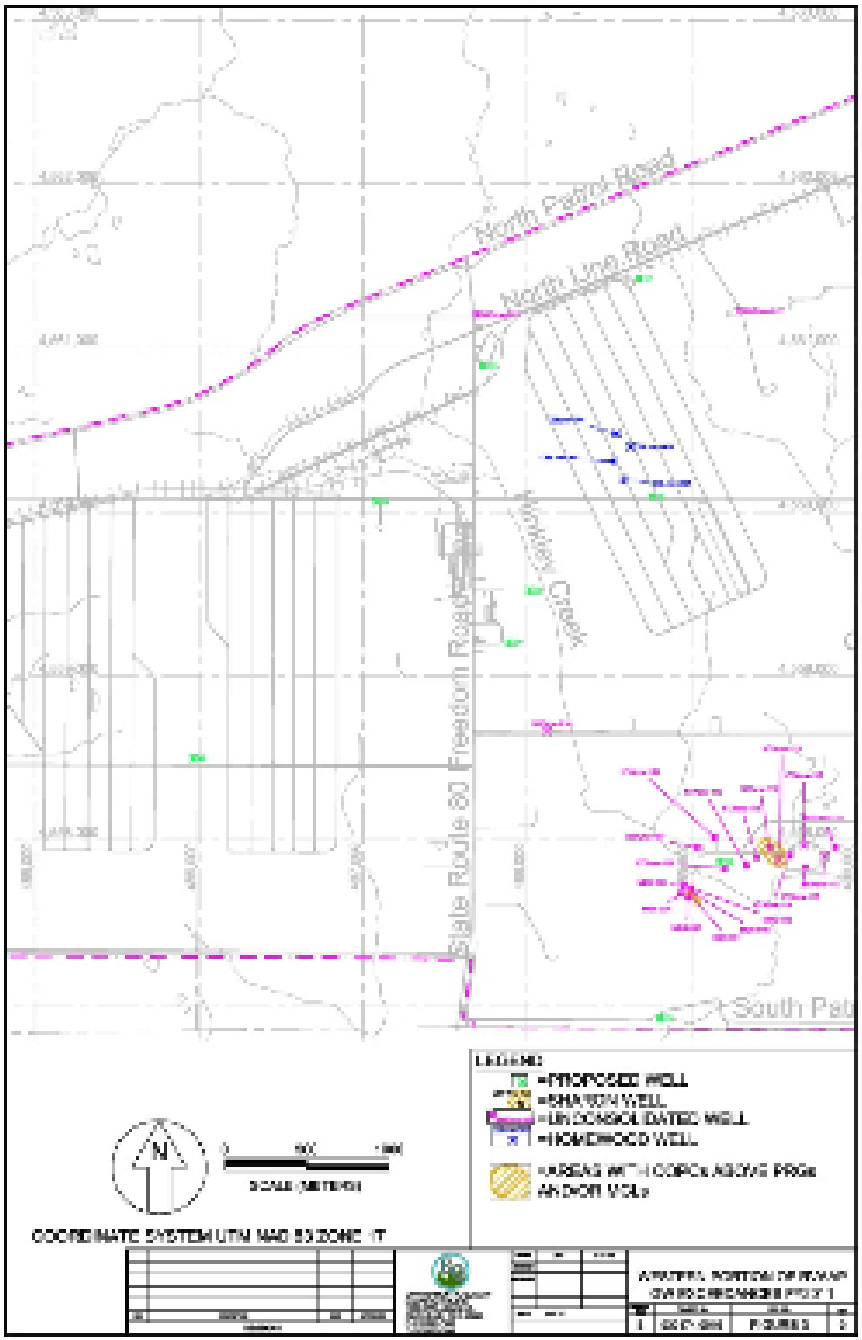
Well ID	Elevation (ft, amsl)
SCFmw-001	1031.20
SCFmw-002	966.28
SCFmw-003	949.98
SCFmw-004	943.72
SCFmw-005	948.99
SCFmw-006	947.56

Recap: FY2011 FWGWMP Summary

EQM Presentation to RAB – "Facility-Wide Groundwater", January 2012

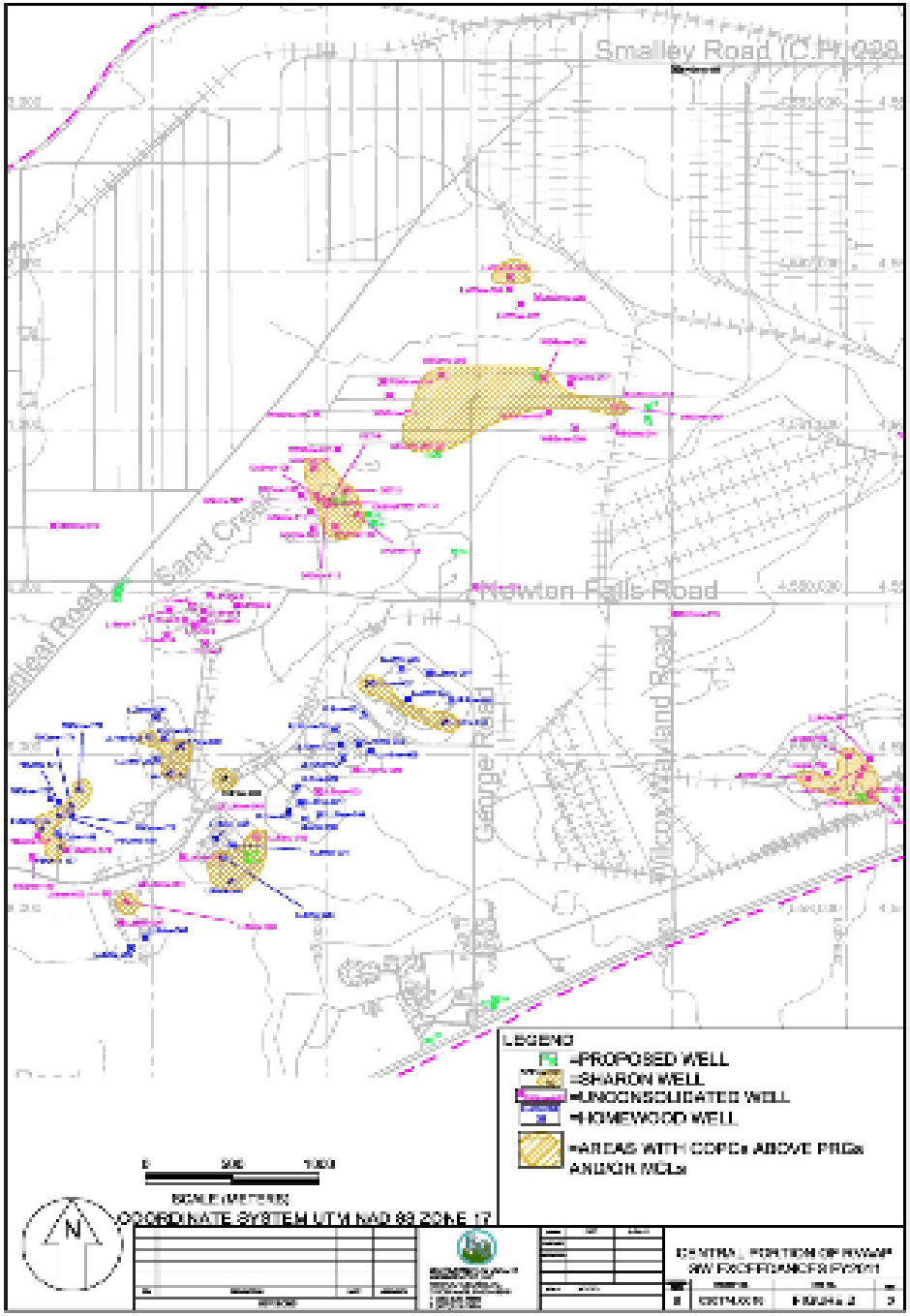
CPOCs detected above MCLs/RSLs

- Metals
- VOCs
- SVOCs
- Pesticides
- Explosives
- Nitrates (as Nitrites)



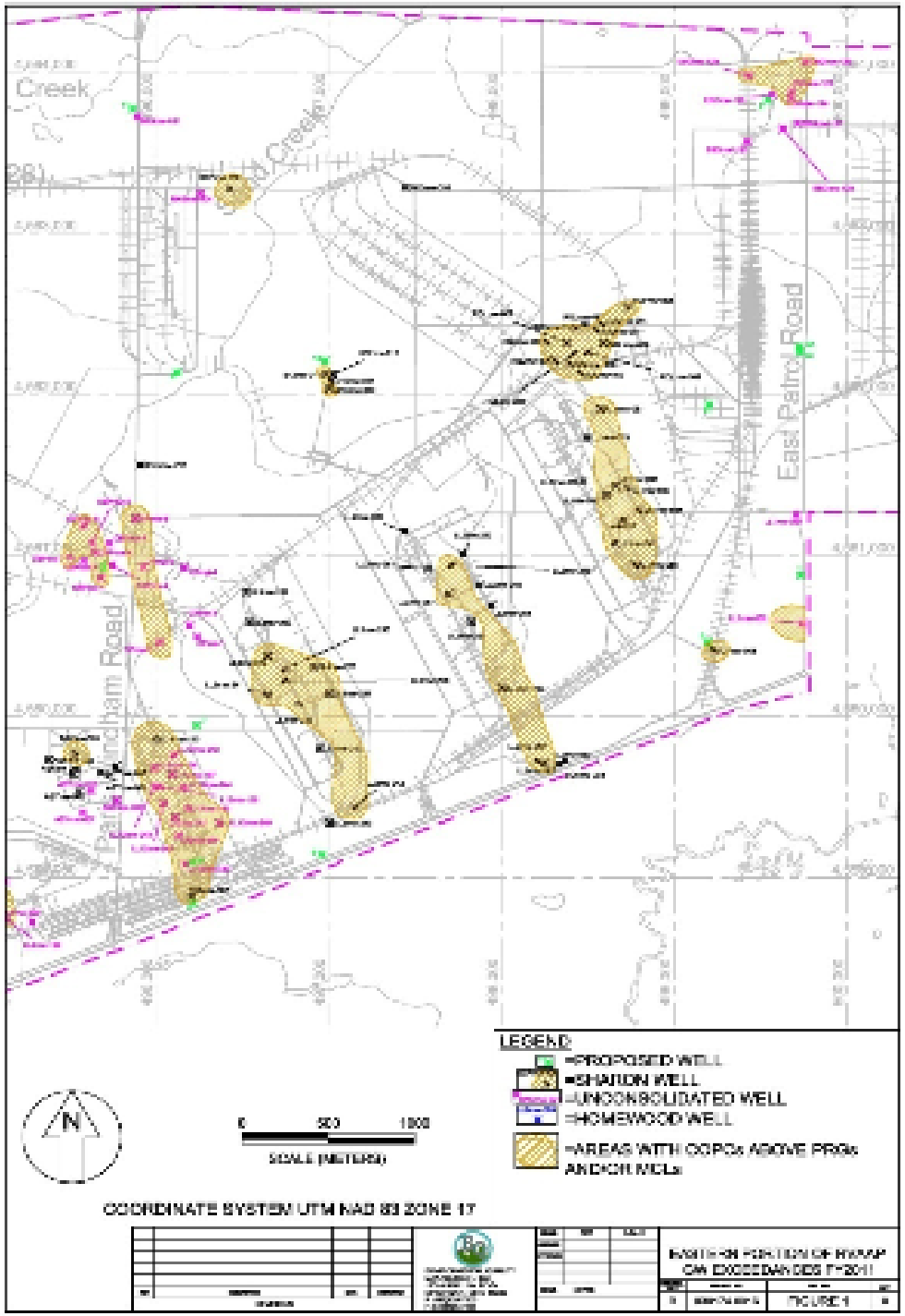
West Portion of RVAAP

Monitoring well locations with CPOCs above MCL/RSL – All constituents of concern



Central Portion of RVAAP

Monitoring well locations with CPOCs above MCL/RSL – All constituents of concern



East Portion of RVAAP

Monitoring well locations with CPOCs above MCL/RSL – All constituents of concern

FY2012 FWGWMP Results

CPOCs detected above MCLs/RSLs

- Metals (inorganics)
- VOCs
- SVOCs
- Pesticides/Herbicides
- Explosives
- Nitrate (as Nitrites)

Inorganics (metals)

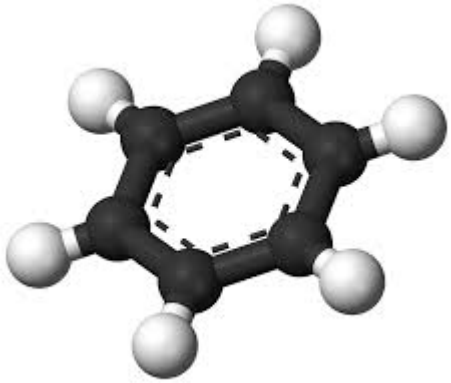
- Aluminum (15 wells)
- **Arsenic (36 wells)**
- Beryllium (1 well)
- Chromium (I well)
- Cobalt (18 wells)
- **Iron (58 wells)**
- Lead (1 well)
- **Manganese (73 wells)**
- Thallium (1 well)
- Vanadium (1 well)
- Hex Chromium (5 wells)

Metals - Frequent detections

Inorganic	Conc. Range (ug/l)	Potential Health Effects (drinking water)	MCL (ug/L)	USEPA RSL (ug/L)	Highest Detections
Arsenic (As)	10-170	Skin damage, circulation system effects, increased cancer risk	10 *Primary*	0.045	**South-east/East portion of RVAAP** – unconsolidated & bedrock
Iron	300-340,000	Taste, color	300 *Secondary*	11,000	**South-east/East portion of RVAAP** – unconsolidated & bedrock
Manganese	57-11,000	Nervous system, neurological effects	50 *Secondary*	320	**Eastern portion of RVAAP –** unconsolidated & bedrock

VOCs

- Benzene (1 well)



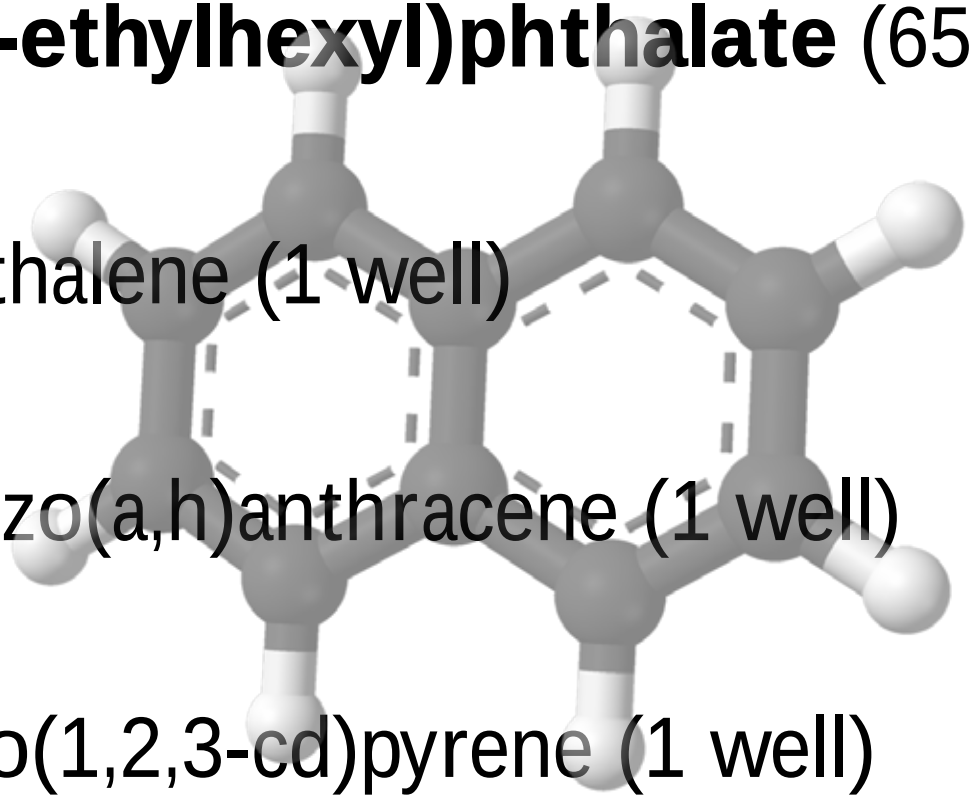
- Carbon Tetrachloride (1 well)
- Chloroform (1 well)

VOCs - Frequent detections

Organic	Conc. Range (ug/l)	Potential Health Effects (drinking water)	MCL (ug/L)	USEPA RSL (ug/L)	Highest Detections
Benzene	0.67-1.5	Anemia, decrease in blood platelets, increased cancer risk	5.0	0.39	**Western portion of RVAAP** – unconsolidated
Carbon Tetrachloride	0.47-2.1	Liver problems, increased cancer risk	5.0	0.39	**Central portion of RVAAP** – bedrock
Chloroform	0.25	Blood, liver and kidney problems	None	0.19	**Central portion of RVAAP** – bedrock

SVOCs

- **Bis(2-ethylhexyl)phthalate** (65 wells)
- Naphthalene (1 well)
- Dibenzo(a,h)anthracene (1 well)
- Indeno(1,2,3-cd)pyrene (1 well)

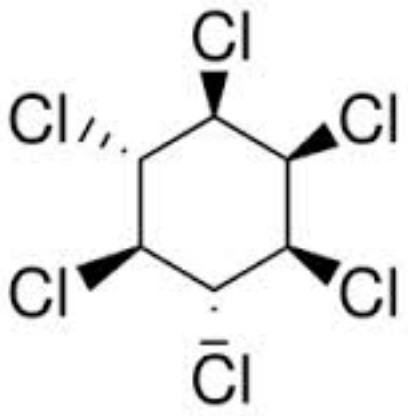


SVOCs - Frequent detections

Organic	Conc. Range (ug/l)	Potential Health Effects (drinking water)	MCL (ug/L)	USEPA RSL (ug/L)	Highest Detections
Bis(2-ethylhexyl) phthalate	0.76-32	Liver problems, reproductive difficulties, increased cancer risk	6.0	0.071	**Sitewide**– unconsolidated & bedrock

Pesticides/Herbicides

- Beta-BHC (3 wells)

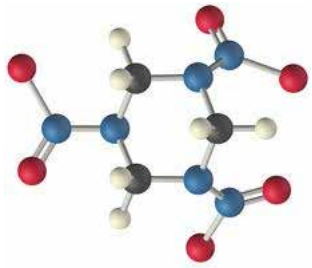


Pesticides - Frequent detections

Inorganic	Conc. Range (ug/l)	Potential Health Effects (drinking water)	MCL (ug/L)	USEPA RSL (ug/L)	Highest Detections
beta-BHC (beta-hexachloro-cyclohexane)	0.0095-0.075	Central nervous system, human reproduction	-	0.022	**Eastern portion of RVAAP** – unconsolidated & bedrock

Explosives & Propellants

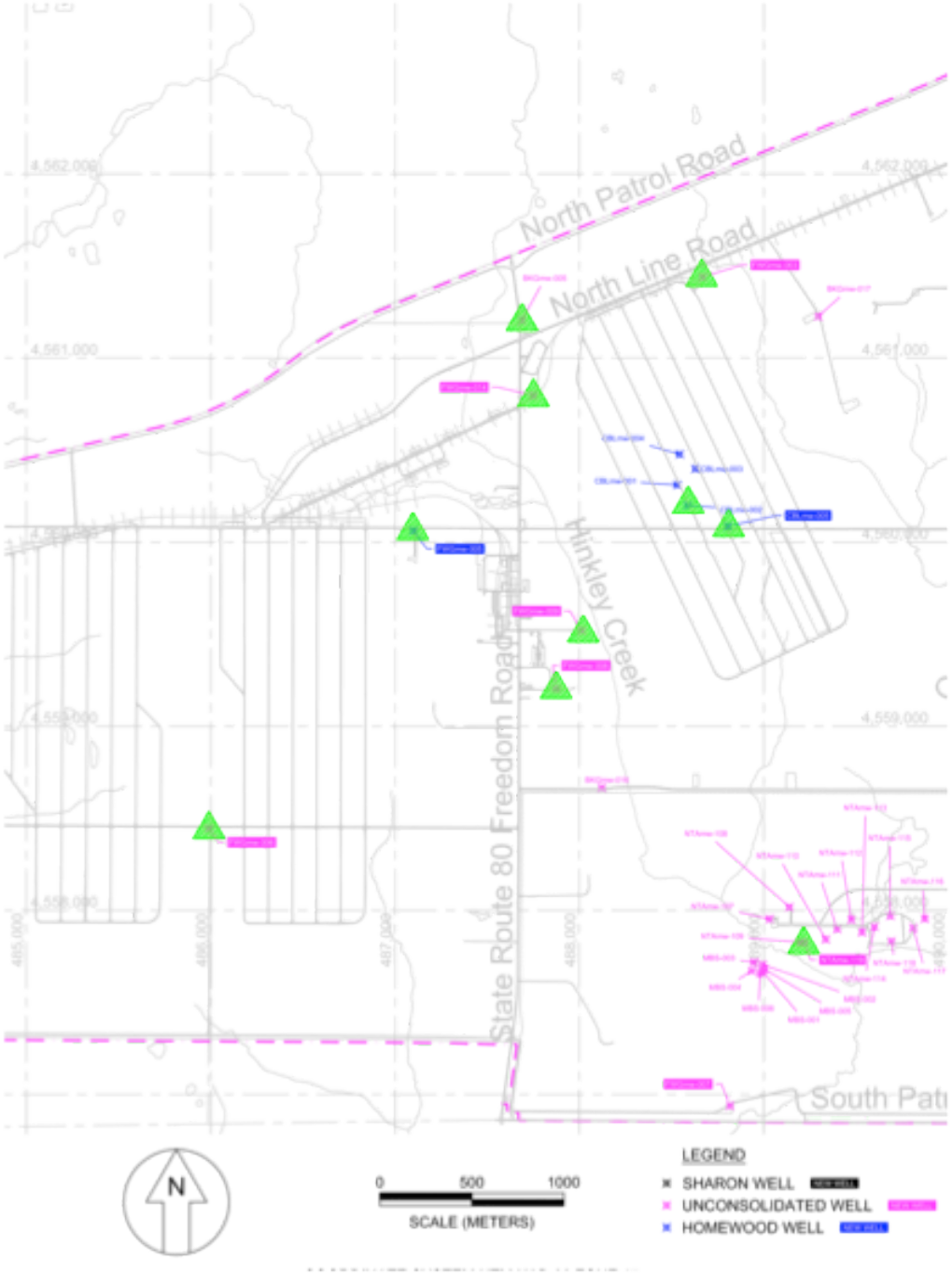
- 2,4-dinitrotoluene (1 well)
- **2,4,6-TNT** (2 wells)
- Nitrobenzene (1 well)
- Nitrate as nitrite (1 well)
- **RDX** (4 wells)



RDX

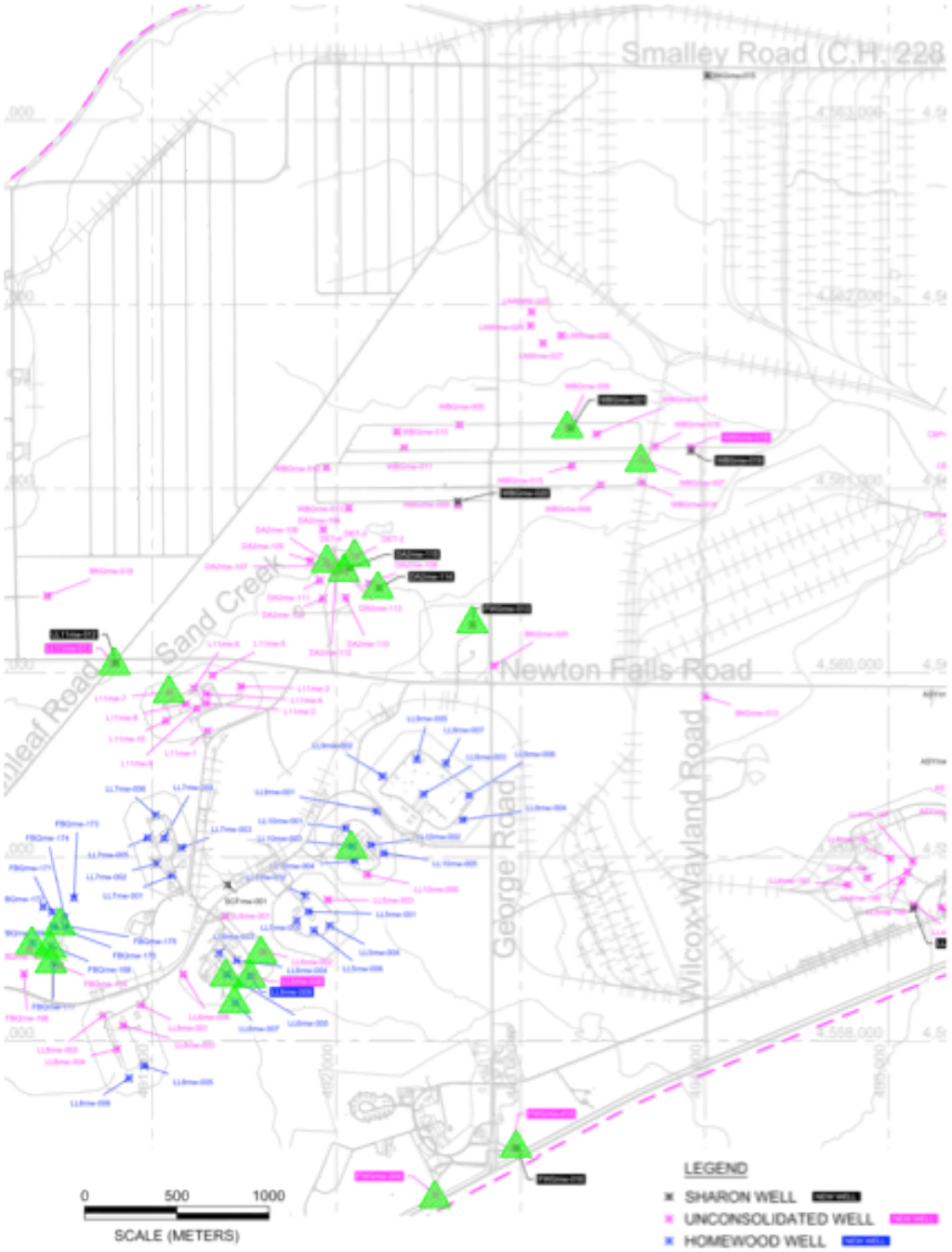
Explosives - Frequent detections

Inorganic	Conc. Range (ug/l)	Potential Health Effects (drinking water)	MCL (ug/L)	USEPA RSL (ug/L)	Highest Detections
2,4,6-TNT	3.5-10	Liver, blood, immune system and reproductive damage	-	2.2	**South-Eastern & Central portion of RVAAP** –bedrock
RDX	0.5-25	Targets the nervous system	-	0.61	**South-Eastern & Central portion of RVAAP** –unconsolidated & bedrock



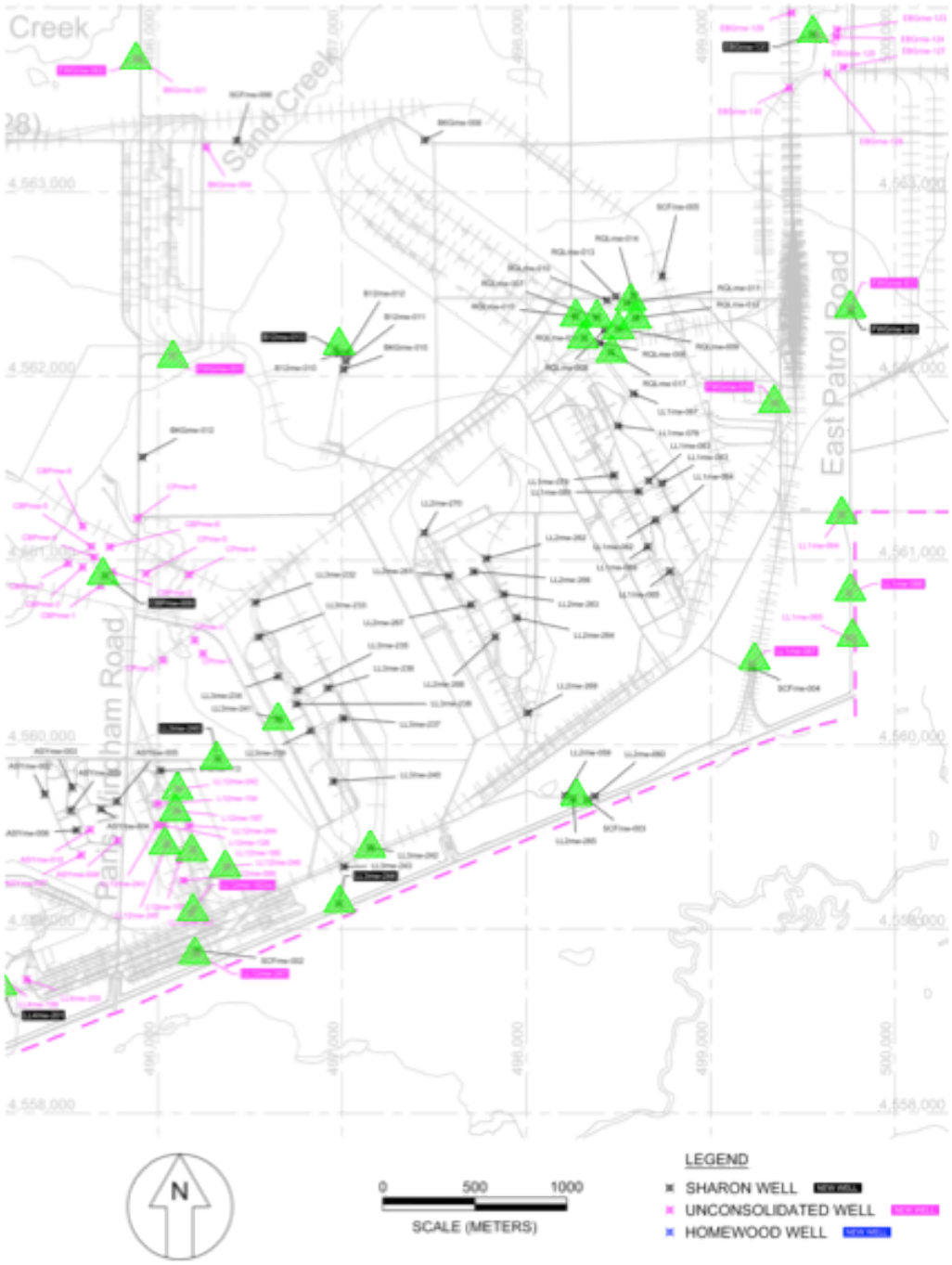
Western Portion of RVAAP

MONITORING WELL LOCATION
WITH CPOCs ABOVE MCL/RSL



Central Portion of RVAAP

MONITORING WELL LOCATION
WITH CPOCs ABOVE MCL/RSL



Eastern Portion of RVAAP

MONITORING WELL LOCATION
WITH CPOCs ABOVE MCL/RSL

Comparison: 2011 vs. 2012

For those wells sampled during both annual events…

- Metal (As, Mn, Fe) concentrations have a general decreasing trend or remain unchanged

Questions & Discussions

- Recommendations for future tasks?