CORRECTIVE ACTION UNIT EVALUATION FOR TNT UNIT WASTEWATER TREATMENT AREAS (SSAs 2, 3, 81 and MUs 2, 4)

RFAAP, Radford Virginia

RCRA Corrective Action Permit Number VA 1210020730

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Radford Army Ammunition Plant
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CORRECTIVE ACTION UNIT EVALUATION FOR TNT AREA UNITS (SSAs 2, 3 and 81, AND MUs 2 and 4)

1.0 EXECUTIVE SUMMARY

As defined in the February 23, 2010 meeting between representatives of Radford Army Ammunition Plant (RFAAP) and US EPA Region III, specific Site Screening Areas (SSAs) would be grouped either programmatically or geographically to more effectively evaluate the criteria for their inclusion in the upcoming renewal of RCRA Corrective Action Permit VA 1210020730. The Units discussed herein are SSAs that:

- Serve as wastewater treatment components in the TNT Area of the RFAAP Facility (SSAs 2, 3 and 81),
- Miscellaneous Units (MUs) that include the drainage ditches within the TNT area, and (MU-2),
- An MU at the 1974 explosion site within the TNT area of the RFAAP Facility (MU-4).

All of the Units are located within an active production area of the RFAAP Facility with the exception of some of the ditches that could be interpreted to be included in MU-2.

The tanks at SSA 2 and SSA 3 have met the appropriate regulatory requirements in place at the time of operation. Additionally, the units did meet the appropriate American Concrete Institute (ACI) codes in place at the time of operation. In addition, according to 40 CFR Part 261.4, SSA 2 and SSA 3 are excluded from RCRA Corrective Action because the areas are regulated as waste water treatment units under VPDES. Additionally, there have been no documented releases from these areas.

The drainage ditches in the TNT area (MU 2) are monitored under Stormwater Pollution Prevention Plan (SWPPP) or Virginia Pollutant Discharge Elimination System (VPDES) permits. Specifically, the drainage ditches servicing HWMU 4 (also identified as SWMU 4 in the 2000 RCRA Corrective Action Permit as well as the 1987 RCRA Facility Assessment) are monitored under SWPPP and the drainage ditches servicing the TNT area are monitored in accordance with the VPDES permit. Surface water originating from the southern portion of the TNT area is conveyed through the TNT Area wastewater treatment system prior to discharge through a permitted outfall. Any surface waters that are not conveyed to the TNT Area wastewater treatment system are monitored under the SWPPP or VPDES Stormwater permit. The TNT area is currently an active area at the Facility. Additionally, post closure activities and monitoring were discontinued at HWMU-4, per an August 16, 2007 Virginia Department of Environmental Quality letter.

The TNT/DNT explosion area (MU 4) has no indication of contaminant release from the May 1974 explosion.

Accordingly, as described below, it is appropriate to remove these units from further consideration under the Facility RCRA Corrective Action Permit.

2.0 INTRODUCTION AND BACKGROUND

In accordance with the RCRA Corrective Action Permit VA 1210020730, the scope of this investigation has been determined by the RFAAP and the US EPA (the parties). See Part II – *Specific Facility Conditions* – Section D.7 below. The language in bold provides the regulatory basis for the scope of this investigation:

"D- 7. Attachment A contains a list of thirty-one (31) identified Site Screening Areas (SSAs) which may pose a threat, or potential threat to human health and the environment. The Permittee shall submit to the EPA and the VDEQ SSP Work Plan(s) which shall outline the activities necessary to determine if there have been releases of hazardous substances, solid wastes, pollutants, contaminants, hazardous wastes, or hazardous constituents to the environment from the SSAs. ***The scope of the SSPs shall be determined by the Parties.*** *The SSP Work Plan(s) shall include a proposed Deadline or Milestone for the submittal of an SSP Report(s)…."*

Each of the Units described in this report are located within the TNT area at the RFAAP Facility. **Figure 1 (see Attachment 1)** shows the locations of the Units. The TNT Manufacturing Facility produced trinitrotoluene (TNT) from 1968–1974, and operations resumed from 1983 through 1986. Attempts were made to convert the TNT facility to a DNT facility in 1996; however, the process was never proved out, and ran for one day in October of 1996. The TNT manufacturing process was upgraded in 2005 The upgraded process did not generate red or pink water. The area is still active currently manufacturing specialty energetics. The 1987 RCRA Facility Assessment noted there were no visible signs of releases at the Units described in this report. No other observations were made or documentation produced that indicated spills or releases have occurred at these Units. Photographic documentation of the Units described in this report is located in **Attachment 2**.

A draft RCRA Facility Investigation (RFI) Report was completed in November 2009 for SWMU 41. **Figure 2** shows the location of SWMU 41 in relation to the Units described in this report. As shown, SWMU-41 was broken down into two separate subunits, designated as Area A and Area B, respectively. Each subarea was monitored for potential impacts to groundwater, soil, sediment and surface water. Subarea B is located downgradient of SSA-81, MU-4, and is directly adjacent to SSA-2 and SSA-3. The groundwater flow map (see **Figure 3** of this report) indicates that a release has not occurred from SSA-2 and SSA-3 as no mounding of the

potentiometric surface is evident. The limited impacts detected in the 2009 RFI were primarily attributed to the operational history of Area A. The operational history of Area B is more representative of the TNT area as a whole. Although there were some minor detections above tap water screening levels, no constituents analyzed in the groundwater and surface water (from the adjacent unnamed tributary of Stroubles Creek) at Area B were above maximum contaminant levels (MCLs). Chloroform, detected in the surface water adjacent to Area B is a site wide contaminant associated with drinking water distribution line leaks throughout the plant. Accordingly, the data indicate that no releases of concern have occurred from the currently active TNT area as whole.

SWMU 41 Area B Groundwater				
Sample ID	**Analyte**	**Concentration (µg/L)**	**Tapwater Screening Level (µg/L)**	**Maximum Contaminant Level (µg/L)**
41MW1	Tetrachloroethene	0.35[1]	0.11	5
	Arsenic	5[1]	0.045	10
41MW2	Tetrachloroethene	1.7[1]	0.11	5
	Arsenic	7.9[1]	0.045	10
	Cobalt	7[1]	1.1	N/A
41MW2	Tetrachloroethene	0.8	0.11	5

[1] Value <Method Reporting Limit and >Method Detection Limit are considered estimated
Values from Table 4-4 of the Draft 2009 RFI

N/A = not applicable

SWMU 41 Area B Surface Water				
Sample ID	**Analyte**	**Concentration (µg/L)**	**Tapwater Screening Level (µg/L)**	**Maximum Contaminant Level (µg/L)**
41SW2	Chloroform	0.59	0.19	80

Values from Table 4-10 of the Draft 2009 RFI

Current land use for SSA 2 and 3, and MU 2 and 4 is defined as industrial/commercial. It is not reasonable to assume that the TNT area will ever be utilized for residential purposes.

3.0 UNIT DESCRIPTION AND EVALUATION

3.1 SSA 2: TNT WASTEWATER EQUALIZATION BASIN

This is an active site located at Building 9546-3. The SSA-2 facility is comprised of three subunits. The two basins are referred to as Unit 2a. Wastewater is gravity conveyed to the basins via an 8-inch stainless steel gutter system, referred to as Unit 2b. The two basins are separated by a concrete wall and are approximately 170 feet in length, 60 feet wide, and 10 feet deep. Additionally, a concrete and steel-grated sump gallery, referred to as Unit 2c, contains piping systems, which connect the basins. The gallery runs along the entire length of the facility and is used to pump the wastewater to the treatment unit.

Historical Information of Site

1968–1986: The TNT Manufacturing Facility produced trinitrotoluene (TNT) from 1968–1974, and operations resumed from 1983 through 1986. During operational periods of TNT manufacturing, wastewater, referred to as "pink water", was generated and processed through these equalization basins before being treated at the adjacent TNT Wastewater Treatment Unit. Pink water is a listed reactive hazardous waste (K047 per 40 CFR Part 261.32), containing dilute concentrations of TNT and having a pH of 2 to 3. The equalization basins are located approximately 600 feet east of the Barracks Complex and 650 feet northeast of the main TNT Manufacturing Area.

1995–1996: Attempts were made to convert the TNT facility to a DNT facility in 1996; however, the process was never proved out, and ran for one day in October of 1996. During the conversion from TNT to DNT, the VDEQ requested that the equalization basins be retrofitted with a 3,500 psi strength concrete tank liner to meet the definition of a RCRA tank per 40 CFR Part 260.10. The basins were originally designed in accordance with ACI-318 in 1977, using 3,000 psi strength concrete. The basins were upgraded in 1996 to meet the more stringent ACI-350R requirements and satisfy RCRA tank requirements.

2005 to Present: The area was upgraded to manufacture TNT in 2005. The upgraded process did not generate red or pink water. The area is still active currently manufacturing specialty energetics.

Spill / Cleanup Records of Site

No materials, other than pink water, were stored or processed at the Building 9546-3 Wastewater Equalization Basins. Plant wastewater utilities and former TNT Area personnel were consulted to determine if any spills or cleanup actions have occurred at the site. Utilities personnel reported no records of spills, releases, or cleanup actions, from this facility during its years of operation. TNT Area personnel stated there were small cracks in the surface of the basin's concrete walls in the early 1980's. The cracks were repaired and the basin returned to service. Exact dates were

unknown. Additionally, no visible signs of degradation and release to the sump gallery were noted during the 1987 RCRA Facility Assessment. No other observations were made or documentation produced that indicated spills or releases have occurred at this site.

Historical Studies and Investigations Conducted at SSA-2

- RCRA Facility Assessment of Radford Army Ammunition Plant; 1987; Prepared by A. T. Kearney for the Environmental Protection Agency; Section IV, pages 3-4.
- Baseline Study of TNT Manufacturing Area; 1996; Conducted by U.S. Army and Alliant Techsystems (no report, only data collection).

Migration Pathways Analysis

- Soil and Groundwater: The equalization basin is a concrete structure that is seamless and has no evidence of degradation. The unit is in good repair and exhibits no loss of integrity. The integrity of the concrete prohibits the infiltration of water contained in the unit to soil and groundwater (See **Photo Number 1**).
- Surface Water: There is no migration pathway from the unit to surface water.

Basis for Removal from the RCRA Corrective Action Permit

According to the RCRA Facility Assessment (1987 RFA), the TNT Wastewater Equalization Basins are a "RCRA regulated unit consisting of five (5) identical and contiguous below grade reinforced concrete equalization basins." This information is in error for three reasons: (1) The basins are above ground, not below grade; (2) the facility has since been divided into two (2) identical basins, separated by one concrete wall; (3) the facility is not a RCRA regulated facility. When the units were in use they met the appropriate regulatory requirements in place at the time of operation. Additionally, the units did meet the appropriate American Concrete Institute (ACI) codes in place at the time of operation. Accordingly, the equalization basins have met the definition of a RCRA tank per 40 CFR Part 260.10; therefore, they are excluded from RCRA Corrective Action regulation. Additionally, in accordance with 40 CFR Part 261.4, they are exempt from RCRA regulation as they were regulated under VPDES wastewater treatment unit under the Clean Water Act.

This SSA should be removed from the RCRA Corrective Action Permit because there is no documentation or indication that a reportable quantity of pink water or other listed hazardous substances/wastes have been released from this facility.

3.2 SSA 3: TNT WASTEWATER TREATMENT UNIT

The TNT Wastewater Treatment Unit is an active site consisting of the following 11 subunits:

- Unit 3a; Primary Neutralization Tank (Bldg. 9546-1): An above ground steel tank, which received effluent wastewater from the Equalization Basins (SSA-2), and neutralized the wastewater using soda ash.

- Unit 3b; Sludge Settling / Equalization Basin No. 1 (Bldg. 9546-2): A two (2) compartment, above ground concrete basin, which received effluent from Unit 3a. The settling compartment was used to precipitate the solids from the wastewater prior to overflow into the adjacent equalization compartment.
- Unit 3c; Neutralization Mix Tank (Near Bldgs. 9546-1 and 9546-2): An aboveground tank, used as a secondary neutralization tank, which collected the effluent from Unit 3b and mixed pink water with soda ash.
- Unit 3d; Diatomaceous Earth Filters (Bldg. 9560): Building 9560 is currently in use and active. The Earth filter units located inside of building 9560 are not currently in use. During their operation they served to remove residual TNT from the effluent wastewater from Unit 3c. The generated sludge from this filtration operation was collected and treated at the open burning ground for thermal destruction.
- Unit 3e; Treated Water Surge Tanks (Bldg. 9560): Two above ground steel storage tanks, which served to equalize and moderate the flow of wastewater between the diatomaceous earth filter (Unit 3d) and the Activated Carbon Columns (Unit 3f).
- Unit 3f; Activated Carbon Columns (Bldg. 9560): Two vertical columns, approximately 5 feet in diameter X 60 feet in height, were used to receive influent wastewater from Unit 3e. Residual TNT was adsorbed onto the carbon beds, and the effluent wastewater was discharged into Final Equalization Basin No. 2 (Unit 3h).
- Unit 3g; Spent Activated Carbon Storage Area (Bldg 9560): The ground floor of Building 9560, which was formerly used to accumulate drums of spent carbon (listed hazardous waste).
- Unit 3h; Final Equalization Basin No. 2 (Bldg. 9546-4): An equalization basin of similar design and size to the TNT Wastewater Equalization Basin at Building 9546-3 (SSA-2). Effluent from Unit 3f was discharged to this basin and overflowed into the Final Neutralization Tank (Unit 3i).
- Unit 3i; Final Neutralization Tank (Near Bldg. 9546-4): An aboveground tank used to perform the final soda ash neutralization step of the wastewater before being discharged to Stroubles Creek and the New River through Outfall 012, via the Parshall Flume (Unit 3j).
- Unit 3j; Parshall Flume: A concrete flume, which served as the final discharge monitoring point for TNT wastewater prior to discharge to the New River. (NOTE: The RCRA Facility Assessment incorrectly refers to the Parshall flume as Unit 3i.)
- Unit 3k; Activated Carbon Dust Collector (Bldg. 9560): A dust collector used to collect fugitive carbon fines generated during recharging of the two activated carbon columns (Unit 3f).

To comply with the definition of a RCRA tank, the Final Equalization Basin No. 2 (Bldg. 9546-4) and the Sludge Settling / Equalization Basin No. 1 (Bldg. 9546-2), were retrofitted with 3,500 psi concrete basin liners in 1996. The previous basins were designed to operate at 3,000 psi.

RCRA requires the basins be rated for 3,500 psi. No further modifications or activities were performed at this facility.

Historical Information of Site

1968–1986: The TNT Manufacturing Facility produced trinitrotoluene (TNT) from 1968–1974, and operations resumed from 1983 through 1986. During operational periods of TNT manufacturing, wastewater, referred to as "pink water", was generated and processed through these equalization basins before being treated at the adjacent TNT Wastewater Treatment Unit. Pink water is a listed reactive hazardous waste (K047 per 40 CFR Part 261.32), containing dilute concentrations of TNT and having a pH of 2 to 3. The equalization basins are located approximately 600 feet east of the Barracks Complex and 650 feet northeast of the main TNT Manufacturing Area.

1995–1996: Attempts were made to convert the TNT facility to a DNT facility in 1996; however, the process was never proved out, and ran for one day in October of 1996. During the conversion from TNT to DNT, the VDEQ requested that the equalization basins be retrofitted with a 3,500 psi strength concrete tank liner to meet the definition of a RCRA tank per 40 CFR Part 260.10. The basins were originally designed in accordance with ACI-318 in 1977, using 3,000 psi strength concrete. The basins were upgraded in 1996 to meet the more stringent ACI-350R requirements and satisfy RCRA tank requirements.

2005 to Present: The area was upgraded to manufacture TNT in 2005. The upgraded process did not generate red or pink water. The area is still active currently manufacturing specialty energetics.

Spill / Cleanup Records of Site

Plant wastewater utilities and former TNT Area personnel were consulted to determine if any spills or cleanup actions have occurred at the site. Utilities personnel reported no records of spills, releases, or cleanup actions, from this facility during its years of operation. TNT Area personnel stated there were small cracks in the surface of the basin's concrete walls in the early 1980's. The cracks were repaired and the basin returned to service. Exact dates were unknown. The 1987 RFA noted there were no visible signs of releases. No other observations were made or documentation produced that indicated spills or releases have occurred at this site.

Historical Studies and Investigations Conducted at SSA-3

- RCRA Facility Assessment of Radford Army Ammunition Plant; 1987; Prepared by A. T. Kearney for the Environmental Protection Agency; Section IV, pages 5-9
- Baseline Study of TNT Manufacturing Area; 1996; Conducted by U.S. Army and Alliant Techsystems (no report, only data collection)

Migration Pathways Analysis

- Soil and Groundwater: The equalization basin is a concrete structure that is seamless and has no evidence of degradation. The unit is in good repair and exhibits no loss of integrity. The integrity of the concrete prohibits the infiltration of water contained in the unit to soil and groundwater (See **Photo Number 2**).
- Surface Water: There is no migration pathway from the unit to surface water.

Basis for Removal from the RCRA Corrective Action Permit

According to Reference 1 (1987 RFA), the TNT Wastewater Treatment Unit is a "RCRA regulated unit." This information is in error. The treatment unit is not a RCRA regulated facility. When the units were in use they met the appropriate regulatory requirements in place at the time of operation. Additionally, the units did meet the appropriate American Concrete Institute (ACI) codes in place at the time of operation. The equalization basins associated with this are excluded from RCRA regulation under 40 CFR Part 261.4, as they are regulated as a VPDES wastewater treatment unit under the Clean Water Act.

This SSA should be removed from the RCRA Corrective Action Permit because there is no documentation or indication that reportable quantities of pink water or other listed hazardous substances/wastes have not been released at this site.

3.3 SSA 81: RED WATER PRE-TREATMENT FACILITY (TNT BUILDING C-9529)

The Red Water Pre-Treatment Facility consists of the following. Detailed descriptions of the operations are not provided because the facility never fully operated, and design and construction drawings were never finalized.

- Below grade reinforced concrete basin which contains all pre-treatment process tanks, piping, and pump systems, and provides secondary containment for the tanks
- Five (5) open top stainless steel settling and pH adjustment process tanks (Tanks T-71, T-72, T-73, T-74, and T-74)
- Associated pump and piping systems for the above tanks
- Concrete overflow basin to collect any overflow from the 5 tanks
- Steam coils (used to heat red water in tanks T-73 and T-74 prior to off-site shipment)
- Soda ash mix tank
- Concrete 55-gallon drum staging area (drums intended to hold red water sludge from settling)
- Red Water Railcar Loading Area

Historical Information of Site

The Red Water Pre-Treatment Facility was completed in 1973 to allow the settling of solids in the wastewater and provide pH adjustment with soda ash. The pre-treatment facility never proved successful at pre-treating red water, and the facility was rendered inactive after the incident in 1974. The red water generated during TNT manufacturing operations was shipped off-site.

Spill / Cleanup Records of Site

Former TNT Area employees and wastewater utilities personnel were consulted to determine if any spills or cleanup actions have occurred at the site. No employees recalled any chemical or wastewater spills or cleanup actions from this facility during its years of operation. The 1987 A. T. Kearney RFA noted there were no visible signs of releases.

Historical Studies and Investigations Conducted at SSA-81

- RCRA Facility Assessment of Radford Army Ammunition Plant; 1987; Prepared by A. T. Kearney for the Environmental Protection Agency; Section IV, pages 126-130

Migration Pathways Analysis

- Soil and Groundwater: The treatment unit is a stainless steel tank inside concrete containment structure that is seamless and has no evidence of degradation. The unit is in good repair and exhibits no loss of integrity. The integrity of the concrete prohibits the infiltration of water contained in the unit to soil and groundwater (See **Photo Number 3**).
- Surface Water: There is no migration pathway from the unit to surface water.

Basis for Removal from the RCRA Corrective Action Permit

This SSA is currently active manufacturing specialty energetics in Building 9503. This SSA should be removed from the RCRA Corrective Action Permit because there is no documentation or indication that a reportable quantity of red water or other listed hazardous substances/wastes have been released from this facility.

3.4 DRAINAGE DITCHES – PROXIMATE TO HWMU-4, THE TNT AREA AND SELECTED DITCHES DRAINING THE MAIN MANUFACTURING AREA TO THE NEW RIVER (MU-2)

These ditches convey stormwater to various monitored outfalls throughout the Plant facility. They are typically vegetated and flow is conveyed through culverts at infrastructure crossings.

Migration Pathways Analysis

- Soil and Groundwater: The majority of storm water in the TNT area is conveyed to water treatment units in concrete lined ditches. The integrity of the concrete prohibits the infiltration of water contained in the unit to soil and groundwater (See **Photo Number 4**).
- Surface Water: The remaining unlined ditches throughout the main plant area convey surface to monitored outfalls under the facility storm water VPDES permit.

Basis for Removal from the RCRA Corrective Action Permit

All of these units are monitored under the SWPPP or wastewater VPDES Permit. Drainage ditches in the vicinity of HWMU – 4 **(**also identified as SWMU 4 in the 2000 RCRA Corrective Action Permit as well as the 1987 RCRA Facility Assessment) are monitored under the SWPPP. Discharge from the TNT Area is monitored under the facility waste water VPDES Permit. The TNT Area is an active area. Surface waters originating from the southern portion of the TNT area is conveyed through the TNT Area wastewater treatment system prior to discharge through a permitted outfall. Any surface waters that are not conveyed to the TNT Area wastewater treatment system are monitored under the SWPP or VPDES permits. An example of typical ditches in the TNT area is shown in **Photograph 4** (**Attachment B**). The selected ditches throughout the Main Manufacturing Area to the New River are monitored under the SWPPP and the VPDES Stormwater Permit. Additionally, post closure activities and monitoring were ceased at HWMU – 4 in accordance with a DEQ letter dated August 16, 2007.

3.5 TNT/DNT PLANT AREA (MU-4)

The focus of this MU is the site of the May 1974 explosion. There is very little information available from the time period that addresses the nature of the post explosion restoration efforts. Data from other explosion sites on the plant indicate that the vast majority of energetic material is typically consumed by the explosion. Current conditions at the site indicate no evidence of a release of contaminants.

Migration Pathways Analysis

- Soil and Groundwater: The majority of former explosion site is currently covered in impervious materials. The integrity of those materials prohibits the infiltration of water contained in the unit to soil and groundwater (See **Photo Number 5**).
- Surface Water: The majority of storm water in the TNT area is conveyed to water treatment units in concrete lined ditches as described in the discussion for MU-2 (See **Photo Number 4**).

Basis for Removal from the RCRA Corrective Action Permit

No indication of a release of hazardous materials at the MU has been documented. Additionally, the TNT area is an active area.

ATTACHMENT 1
FIGURES

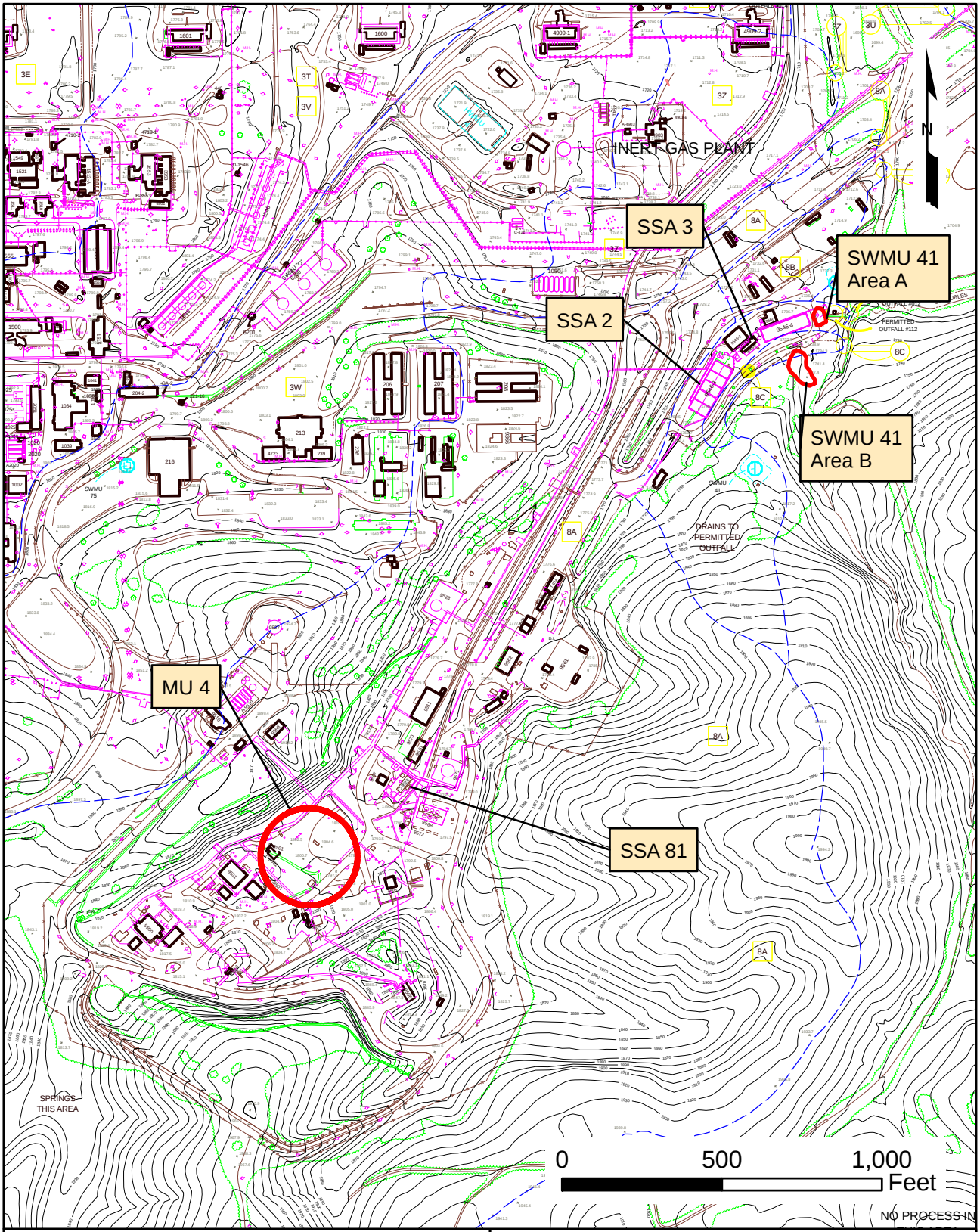

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Figure 1
TNT Area - SSAs and MUs
Location and Topography
Radford Army Ammunition Plant
June 2010

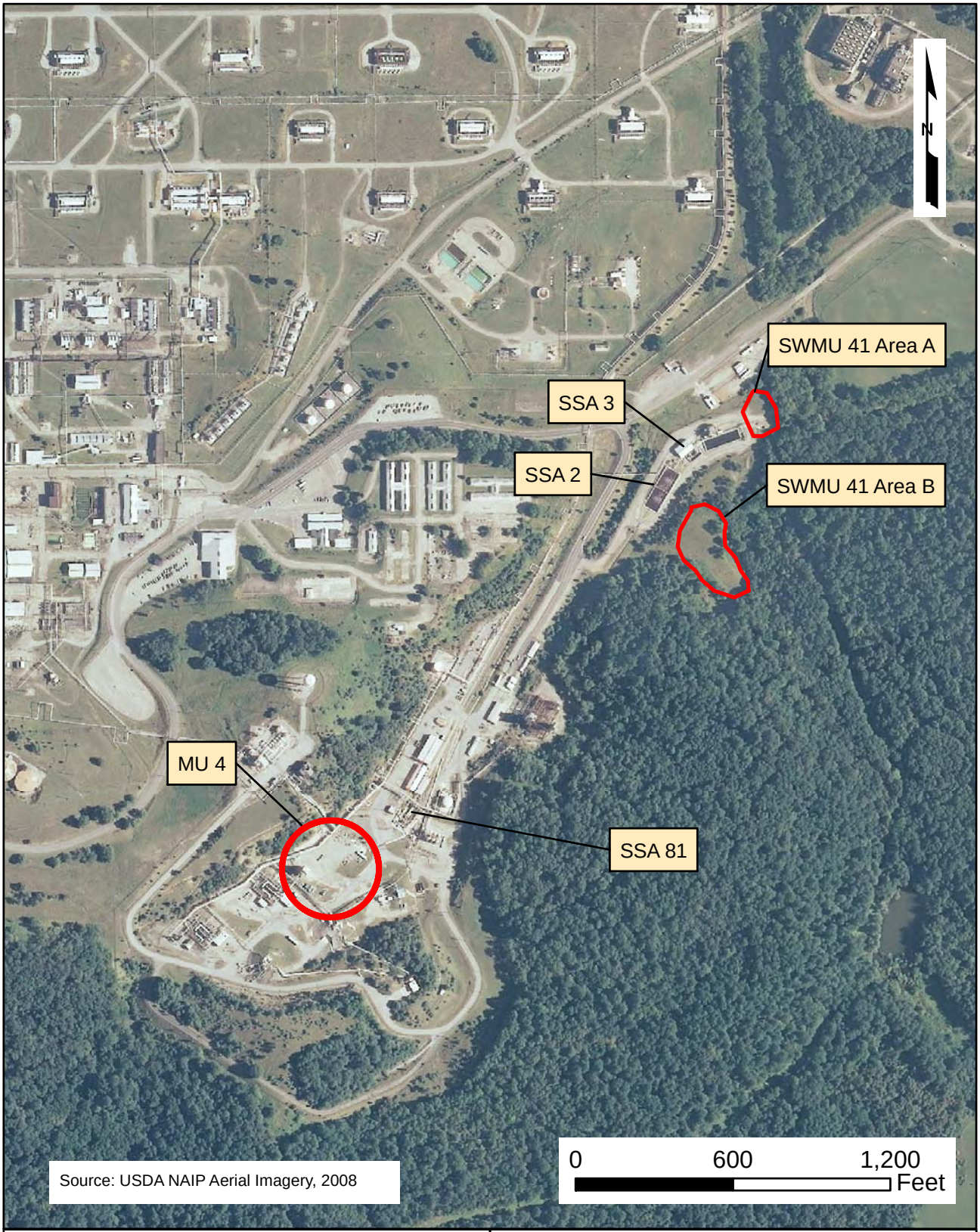

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Figure 2
TNT Area - SSAs and MUs
Radford Army Ammunition Plant
June 2010

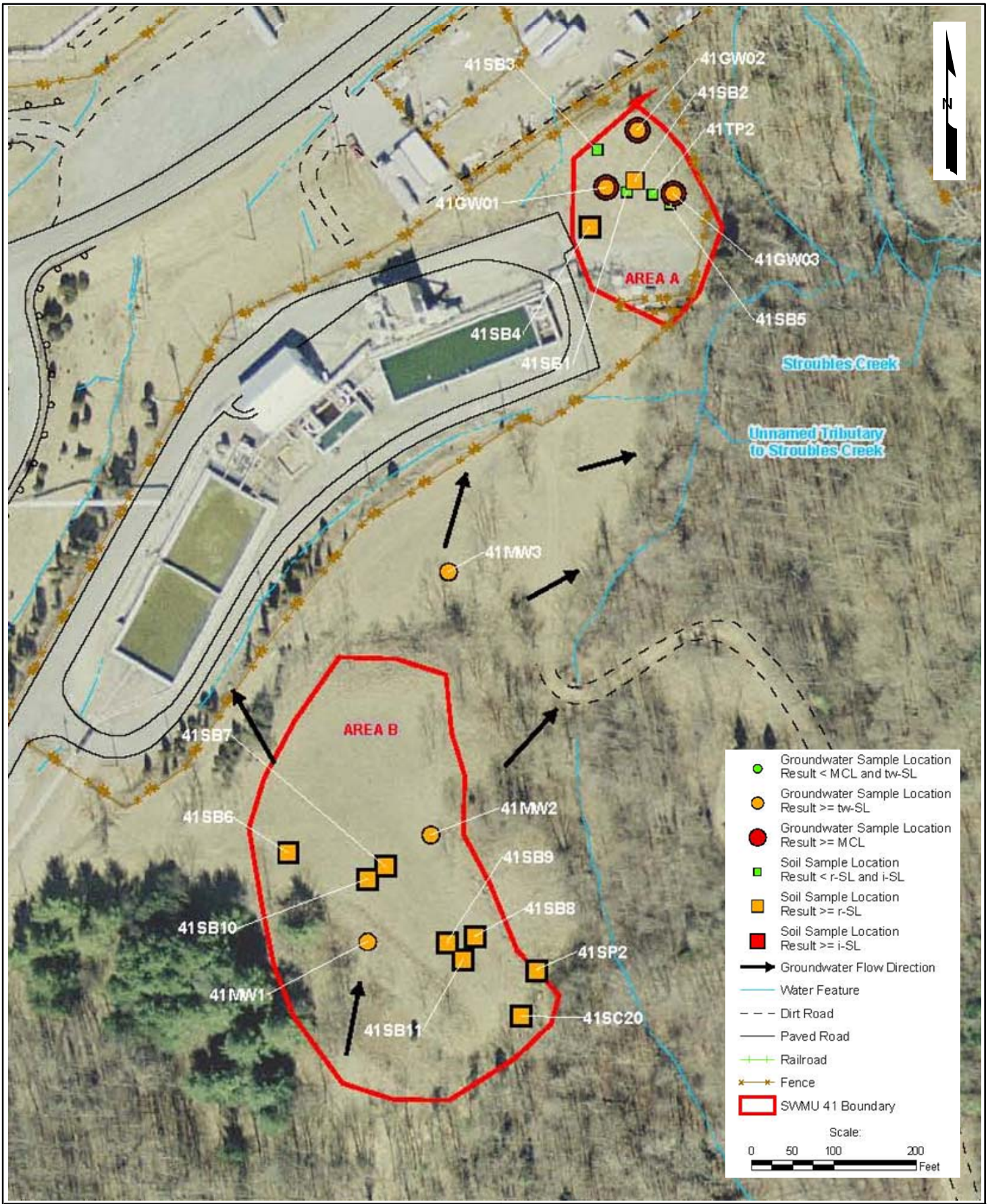

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Figure 3
TNT Area – Potentiometric Surface Map
Radford Army Ammunition Plant

June 2010

ATTACHMENT 2
PHOTOGRAPHS

Photo 1. SSA 2 – TNT Wastewater Equalization Basin (Bldg. 9546-3).

Photo 2. SSA 3 – TNT Wastewater Treatment Unit (Bldgs. 9546-1, 9546-2 and 9560)

Photo 3. SSA 81 – Red Water Pre-Treatment Facility (Bldg. C-9529).

Photo 4. MU 2 – Example of Stormwater Ditches in TNT Area.

Photo 5. MU 4 – TNT Area Explosion Site (east of Bldg. 9501).