# Final Former Water Production Wells and Oil and Gas Wells Survey at Ravenna Army Ammunition Plant and Camp Ravenna

Ravenna Army Ammunition Plant Ravenna, Ohio

Contract No. W912QR-11-P-0086 Task Number 2



United States Army Corps of Engineers, Louisville District 600 Martin Luther King Jr. Place Louisville, Kentucky 40202-0059

Prepared by:



Donald Trocchio, Registered Ohio Surveyor Serial No. 6445 Vista Sciences Corporation Ravenna Army Ammunition Plant 8451 State Route 5 Ravenna, Ohio 44266-9244

April 17, 2013

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#### STATEMENT OF INDEPENDENT TECHNICAL REVIEW

Vista Sciences Corp. has completed the *Draft of Former Water Production Wells Survey at Ravenna Army Ammunition Plant and Camp Ravenna*. Notice is hereby given that an independent technical review has been conducted that is appropriate to the level of risk and complexity inherent in the project. During the independent technical review, compliance with established policy, principles, and procedures, utilizing justified and valid assumptions, was verified. This included review of technical assumptions, methods, procedures and materials to be used, and whether the product meets customer's needs consistent with law and existing Corps policy.

Reviewed/Approved by:

Date: 01/30/12

John Mills, Environmental Program Manager



John R. Kasich, Governor Mary Taylor, Lt. Governor Scott J. Nally, Director

April 22, 2013

RE:

Mr. Mark Patterson, Facility Manager Ravenna Army Ammunition Plant 8451 State Route 5 Ravenna, OH 44266 E: RAVENNA ARMY AMMUNITION PLANT PORTAGE/TRUMBULL COUNTIES FACILITY-WIDE GROUNDWATER WELL SURVEY APPROVAL OHIO EPA ID # 267-000859-036

#### CERTIFIED MAIL 7012 1010 0000 9467 6233

Dear Mr. Patterson:

On April 17, 2013, the Ohio Environmental Protection Agency (Ohio EPA), Northeast District Office (NEDO), Division of Environmental Response and Revitalization (DERR) received replacement pages for the document entitled: "Former Water Production Wells and Oil and Gas Wells Survey at Ravenna Army Ammunition Plant." The replacement pages were prepared for the U.S. Army Corps of Engineers (USACE) – Louisville District, by VISTA Sciences Corporation under contract number W912QR-11-P-0086.

The replacement pages were compared to the original text and the response to comment tables. All comments were adequately addressed, appropriate changes were made within the replacement pages, and the document is approved.

At this time, I would like to recognize the outstanding work of Mr. Don Trocchio of VISTA Sciences in locating as many wells (and suspected well casings) as he did, and in his detailed log sheets and photographic record. This report will provide the foundation for the reacquisition of these wells and ultimately the proper plugging and abandonment of these wells by the Army under Ohio rules, laws, and regulations. Please advise Ohio EPA as to the potential schedule for plugging and abandonment.

If you have any questions concerning this correspondence, please do not hesitate to contact me at (330) 963-1221.

Sincerely,

Eileen T. Mohr, Project Manager Division of Environmental Response and Revitalization

ETM/kss

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## Document Distribution For the Final Former Water Production Wells and Oil and Gas Wells Survey at Ravenna Army Ammunition Plant and Camp Ravenna Ravenna Army Ammunition Plant, Ravenna, Ohio Contract No. W912QR-11-P-0086, Task 2

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NGB – National Guard Bureau

OHARNG-CRJMTC-ENV – Ohio Army National Guard, Camp Ravenna Joint Military Training Center – Environmental

Ohio EPA – Ohio Environmental Protection Agency

REIMS – Ravenna Environmental Information Management System

RVAAP - Ravenna Army Ammunition Plant

USACE - U.S. Army Corps of Engineers

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#### ACRONYMS AND ABBREVIATIONS

- CERCLA Comprehensive Environmental Response, Compensation, and Liability Act
- CRJMTC Camp Ravenna Joint Military Training Center
- GIS Geographic Information System
- GOCO Government-Owned, Contractor-Operated
- GPS Global Positioning System
- H&C Hunkin-Conkey Construction Company
- NGB National Guard Bureau
- OHARNG Ohio Army National Guard
- Ohio EPA Ohio Environmental Protection Agency
- ODNR Ohio Department of Natural Resources Division
- POD Portage Ordnance Depot
- REIMS Ravenna Environmental Information Management System
- RA Risk Assessment
- ROP Ravenna Ordnance Plant
- RVAAP Ravenna Army Ammunition Plant
- USACE United States Army Corps of Engineers
- USAEC United States Army Environmental Command
- VSC Vista Sciences Corporation

## **Executive Summary**

#### ES.1 Purpose, Introduction, and Scope

The purpose of this well survey is to identify and locate the existing historical water production wells remaining on the Ravenna Army Ammunition Plant (RVAAP) property in order to assist in the future plugging and abandonment of the applicable wells. This document supports future Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Remedial Activities (RA) for RVAAP-66 Facility-Wide Groundwater at those locations where impacted groundwater encounters or may encounter the existing historical water production wells.

The Ohio Environmental Protection Agency (Ohio EPA) noted in a December 3, 2010 meeting with the United State Army Corps of Engineers (USACE), Louisville District that existing, openhole wells historically drilled on the Ravenna property might serve as open conduits to groundwater contamination at RVAAP. Further, the open-hole wells could also serve as preferential flow-paths for impacted groundwater to flow between multiple water-bearing zones (aquifers). As such, the Ohio EPA indicated the wells needed to be located, and then properly plugged and abandoned.

The primary target of this investigation was to locate unused water production wells installed within RVAAP during the war effort. This project was assigned to Vista Sciences Corporation (VSC) under an existing USACE contract number W912QR-11-P-0086, Task 2 of the Environmental Restoration Field Support Services. The investigative field work was performed in 2012 by Don Trocchio, Registered Ohio Surveyor Serial No. 6445.

Most of these wells were drilled in the early 1940's by the Hunkin-Conkey Construction Company (H&C). At the time they were considered "temporary construction wells" in support of the war effort. As far as it has been determined the temporary construction wells were not used for drinking water. There are no records, public or otherwise, documenting these wells as having been sealed before their abandonment. It was unknown how many of these wells could be located. It was also determined that the wells could present an environmental risk to the aquifer below and should be properly closed and sealed. A secondary task was included for the location and mapping of abandoned and active oil and gas wells at RVAAP.

Comprehensive and detailed maps in Geographic Information System (GIS) format and photographic logs were prepared including forty-four (44) detailed map exhibits for each water well and an exhibit showing the two (2) oil and gas wells which are currently in active production.

## **ES.2** Conclusions of the Survey

Thirty-eight (38) visible well casings were located of which six (6) of these wells were found in former production Load Lines. There are six (6) suspected buried well casings and twelve (12) wells could not be located.

Two (2) oil and gas wells in current active production were located and mapped and two (2) abandoned historical oil and gas wells could not be located.

# 1.0 RVAAP HISTORY

## **1.1 Land Procurement**

In August 1940, multiple tracts of privately owned farmland (approximately 22,000 acres) were purchased by the United States Government with the intention of building an ammunition plant. This land is situated in the northeastern section of Ohio and spans two counties – Portage and Trumbull.

## **1.2 Contractors and Production**

Soon the United States Government entered into several contracts with independent contractors for the construction and the design of this facility. The H&C Company was awarded the contract to build a shell loading plant. Another contract was awarded to Wilbur-Watson and Associates who were contracted for the planning and designing of the buildings and equipment. In August 26, 1940 the Atlas Powder Company was contracted to perform Management Services for the Government-Owned, Contractor-Operated (GOCO) industrial facility known as the Ravenna Ordnance Plant (ROP).

On August 18, 1941 production began with the first 75mm complete round to come out of Load Line 1. During that same year in October the installation was divided into two separate units. One unit was designated as the Portage Ordnance Depot (POD) with its primary function to be depot storage while the ROP primary activities were for ammunition loading.

## **1.3 Construction and Temporary Wells**

The initial contract was for two hundred (200) buildings which quickly grew to almost twelve hundred (1200). The amount of concrete doubled from the originally estimated seventy-five thousand (75,000) cubic yards to three hundred thousand, six hundred seventy-seven (300,677) cubic yards by the beginning of December 1941.

Construction activities of this magnitude would have required a great volume of water. H&C began to drill for water in various locations throughout the facility creating so-called "temporary construction wells." The decisions on the approximate locations for various groups of buildings resulted in test borings being used to determine soil conditions. Due to the scarcity of water some fourteen (14) test wells were drilled which resulted in the decision to use wells throughout the facility. The wells drilled to service construction purposes were anywhere from ninety (90) to two hundred fifty (250) feet in depth while some thirty-six (36) pumps of various sizes were put into service in connection with these wells. Approximately eighty (80) wells were developed from these drillings. Later some of these temporary constructions wells became permanent production water wells.

#### **1.4 Background Setting**

In August of 1957, just sixteen (16) years after the first shell rolled off of the Load Line 1 assembly line all at-plant production had ceased and later that same year the installation was placed on standby status. From 1957 to 1993 RVAAP experienced a series of reactivations and

deactivations until 1992 when RVAAP's mission was discontinued and was placed on the "Inactive Maintained" status. Finally, in September of 1993, RVAAP was determined to be excess property to the U.S. Army. By 1996, procedures for transferring accountability for RVAAP's real property to the Ohio Army National Guard (OHARNG) were initialized.

#### 1.5 General Location and Environmental Setting

The facility is located in northeastern Ohio and spans two counties, Portage and Trumbull (see Figure 1.1). The RVAAP portion (approximately 1,260 acres) of the facility is situated only in Portage County while portions (approximately (20,423 acres) of the Camp Ravenna Joint Military Training Center (CRJMTC) are located in both counties. The general climate of the area is considered that of a continental interior and is characterized by moderately warm, humid summers and cold, cloudy winters, along with wide fluctuations in precipitation from year to year. The decline of RVAAP's maintenance and the climatic conditions created a proliferation of dense vegetative overgrowth, which characterizes much of the current day facility. This dense vegetation hindered visual observation for identifying and locating the former production wells at RVAAP and CRJMTC.



Figure 1.1 The General Location and Orientation of the RVAAP/Camp Ravenna

# 2.0 INITIAL INVESTIGATION

The purpose of the well survey was to identify and locate the existing historical water production wells remaining on RVAAP property in order to assist in the future plugging and abandonment of the target wells. Initially, USACE provided a map titled, "A Study of Water Development and Conservation, Location of Wells" dated 1950 and prepared by a consulting engineer, Mr. George E. Baines (See Plate P-3). This map depicted symbols that represented drinking water wells, temporary construction wells, and a few "observation wells." The sketch also showed contour lines at forty (40) foot intervals including major creeks and roads. Also shown on this map were three (3) lines of cross sections which traversed through the major clusters of wells. Profiles of most of the wells were shown on accompanying sheets. The map and profiles did indicate they knew a substantial amount of data about each well and in particular the depth and the ground elevation at each well casing. For some of the wells where data was missing additional fieldwork was required.

#### 2.1 Records Review

An initial search of both public and private records was performed prior to any fieldwork. The Ohio Army National Guard (OHARNG) Environmental Building produced a number of maps that proved to be useful. A map titled "Ravenna Ordnance Plant, Original Dwelling Location Water Supply Facilities and Wells" provided extensive information. This map was prepared by Wilbur Watson in 1953 with a reference no. of 1140.120 and was drawn to a scale of 1" =  $1000' \pm$  (see Plate P-2). It proved to be productive in actually locating a few wells but more importantly it verified their existence.

The coordinates shown on well permit applications are approximate. The search area needed to be reduced. Further document review led to the discovery of additional old surveyor field books. One field book titled, "Well-Tanks-Stacks" was responsible for 85% or more of the wells which were eventually found (see Figure 2.1).

#### 2.2 WELLS-TANKS-STACKS

The notebook titled, 'Wells-Tanks-Stacks' is a surveyor's field book (see Figure 2.1). The field book notes were kept by survey crews from the H&C Company who was the Ravenna Arsenal General Contractor. The field book is a log containing handwritten measurements from observations in the field during the period December 1940 to December 1941. The field book contains raw field data, horizontal angles and measured distances, referencing the wells to man-made features, i.e., road intersections, buildings, and railroads. Vertical angles were observed to tops of water towers "tanks" to determine elevations. Vertical angles were also observed to smoke "stacks" to determine if they were leaning and out of plumb. Also embedded within the field book were sections of "level notes". The survey crews not only established the horizontal location of some of the wells, they also determined the elevation above sea level. Typically, in those days, the raw field data was then later "reduced" in the office to arrive at the final calculations, i.e., northing and easting coordinates and elevations.

The raw field data of horizontal angles and distances were transferred to the current RVAAP base map via Arc Map software. Many of the buildings and railroads the survey crews used for reference have long since been demolished and removed. Prior to removal though, the features were digitized from aerial photography to create the current RVAAP base map. This routine produced an approximate location of the well. Once that location was determined, navigating to the coordinates was the next step to begin the search.

Figure 2.1 Wells-Tanks-Stacks surveyor's field book



Figure 2.2 shows the location of Well No. 33 in relationship to the railroad line near Smalley Road as taken from the pages in the surveyor's field book. The railroad line can be seen on the base map to which the location of the switch was estimated. After a few trips the well was found inside heavy brush.



n 20 Nol nis

The location of Well No. 8 was referenced to roads (see Figure 2.3). Minyoung Road has been vacated and unused for many years but can still be seen on a 1952 aerial map of the facility. This particular well is a good example of how the location was calculated from the notes and base maps thus shrinking the search area to a small window. Once the calculated position was established on the ground the area was searched for visible signs. The magnetic locator detected this well casing just under the surface close to the calculated position.





# 3.0 TOOLS USED IN LOCATING WELLS

## 3.1 Software and Digital Equipment

A computer with ESRI ArcMap installed was used to generate the maps and exhibits. A Trimble Geo Explorer 2008 with an external antenna was the mobile GPS unit. Arc Pad was used to generate the shape files that updated the base map. A Trimble Geo Beacon Receiver was used for real time corrections.

A Ricoh digital camera took the georeferenced photographs of the wells. A Panasonic Lumex camera was also used to take required photographs (See Appendix B – Additional GEO Referenced Photographs of Water Wells from Detail Sheet Insets).

A True Pulse Range Finder was used to measure distances. The wells, which referenced building corners with the building still in existence, enabled navigation to the well point. A magnetic locator, similar to a Schonstedt brand was used. A well casing possesses exceptional magnetic properties. In some instances the magnetic device allowed finding wells even when the thick vegetation prevented a visual sighting. As shown on the Water Well Detail exhibits, there was no "typical" well. Some of the well casings were protruding a foot or two, others only inches, and some just inches below the surface. Of the suspected six (6) wells buried below the surface they are most likely well casings. In numerous situations the magnetic locator detected the well casing before they were visually observed.

#### **3.2 Transportation**

Since access to some of the wells is very poor and being that they are situated in remote and isolated locations the transportation use of a 4x4 Diesel Kubota Utility Vehicle enabled the "one man survey crew," Mr. Trocchio and his equipment to arrive within a reasonable walking distance to the search area.

# 4.0 RVAAP WELL DESCRIPTIONS

## 4.1 Well Houses

Water wells used for drinking water were typically enclosed in a small 10' x 10' building and referred to as a "well house." All wells which fell into this category were closed and sealed off (see Appendix C – Historical Abandoned Wells Documentation 1992 - 1993).

#### 4.2 Multipurpose Wells

Well No's. 7, 49, and 49A may have had multiple uses. Well No. 7 was enclosed in a pit below grade adjacent to the old Sand Creek Waste Water Treatment Plant. Water from this well may have been used in support of the treatment process. There is evidence on the ground that wells 49 & 49A were at one time enclosed in a small common structure. Remains of a concrete footer can be seen in some of the photos. Additionally, nearby there is a post indicator valve suggesting there are buried waterlines.

#### 4.3 Wells without Records

Well No. 96 apparently at one time serviced a nearby cabin. Well No. 100 was used by the former Boy Scout Camp. Well Nos. 49A and 98 were found by chance. Well No. 95's location was shown to V SC surveyor Don Trocchio by MSG Rex Hufenbach of the OHARNG who indicated they would like to retain this well for potential future use. No records of these wells were found thus they were assigned arbitrary well numbers.

## 4.4 Well Map Figures

Figure 4.1 is a comprehensive map of the area searched for the former temporary construction wells within the facility. It serves as an index map to the general location of each well casing and suspected well casing found and directs the reader to each specific well detail sheet (see Appendix A – Detail Sheet of Each Located Former Production Water Wells as Shown on Figure 4.1). The legend provides a quick reference to the status and data pertinent to each well. The key utilizes colors, symbols and text (i.e., diameter of well and Well ID), for both confirmed and suspected wells including those wells which were found covered. The well ID numbers direct the user to detail sheets of each well. Data along the right hand side of the Figures 4.1 thru 4.5 outside of the map area is self-explanatory.

Figure 4.2 is a comprehensive map of the area searched within the facility's boundary. It serves as an index map to the general location of wells that were searched for but not found. No detail sheets were prepared for these wells.

Figure 4.3 is a comprehensive map of the area searched within the facility. It serves as an index map to the general location of each well which was formerly used for drinking water. No detail sheets were prepared for these wells. It is the intent of Figure 4.3 to indicate:

- 1. Which of the wells were formerly used for drinking water
- 2. Which of the wells were enclosed in a 10' x 10' brick structure referred to as a "Well House"
- 3. And which of the wells were closed and sealed (refer to Appendix C Historical Abandoned Wells Documentation 1992 1993)

Figure 4.4 depicts an area near the west central portion of the facility where there are two (2) active and producing oil and gas wells. The images incorporated within the figure identify them as Units 1 and 2. A tank battery (a series of vessels and connecting lines designed to separate oil, water, and gas) is located near the south end of the lease road and is identified and shown on the figure.

Figure 4.5 depicts the area near the central portion of the facility where two (2) oil and gas wells were drilled but apparently were never brought into production. As shown in Figure 4.5, the Rees Unit No.1 was a "dry hole" and the Miller Unit No.1 was "plugged back" per the Ohio Well Completions Report , an online Oil and Gas database (updated 01/28/2009) of the Ohio Department of Natural Resources Division (ODNR). These 2 units were completed in 1935 and 1933 respectively. Based on the coordinates given in the report, no visible remaining evidence of these wells could be found. The Rees Unit No.1 is just south of Group 4 in a wooded area with visibility being only fair. The Miller Unit No.1 is near the southeast corner of Slagle and Smalley Rds. and is located within heavily overgrown vegetation where visibility and access to this area is poor.

A Well Summary Table (Table 5.1 Well Summary Table) was created as a quick reference tool with pertinent data about each well such as color coded well casing diameters, coordinates, site conditions, access to site, etc. and can be found at the end of this section.

















# Table 4.1 Well Summary Table

WELL NO.	X Coordinate	Coordinate	Z Elevation	Casing Diameter and Length	Record Depth	Access to Site	Suspected Well Casing	Confirmed Well Casing	Site Conditions	Nearby Utilities	Comments
3	2367248	556387	977	8" x 38.5'	149'	Poor		Х	Wooded/Brush	Nothing showing	Approx. 300' w of Paris-Windham Rd.
5	2366730	561922	974	8" x 34'	100'	Good	X		Brush	Nothing showing	Near old central burn pit area
6	2366670	561452	977	8"x 50'	95'	Good		Х	Brush	Nothing showing	Follow old railroad ballast right of way to point opposite site
7	2366910	563056	974	6" x 34.5'	60'	Good		Х	Mowed area	Nothing showing	Well is in a pit approx. 6' below grade
8	2367368	554478	987	6" x 22.5'	175'	Good		Х	Mowed area	Nothing showing	Top of casing is slightly below grade with a threaded cap
10	2357892	549618	1014	6" x 52'	250'	Good	Х		Mowed area	Yes	Sprint fiber optic marker nearby
12	2357703	567263	1043	6" x 26'	222'	Good		Х	Brush	Nothing showing	Near SW corner of Area 1
13	2367594	569133	968	6" x 60'	120'	Good		Х	Mowed area	Nothing showing	Top of casing is damaged
14	2380168	570036	945	6" x 36'	170'	Fair		Х	Wooded/Brush	Nothing showing	Casing is rusted through at ground level
16	2341542	548152	1107	6" x 30'	238'	Good		Х	Mowed area	Nothing showing	Casing flush with grass outside of perimeter fence
17	2357916	557845	1068	6" x 12'	215'	Good		Х	Mowed area	Nothing showing	abandoned power line right-of-way
18	2349002	548415	1102	6" x 36.5'	228'	Good	Х		Brush	Nothing showing	Approx. 53' E. of Greenleaf & approx 150' N. of fence
20	2340712	561168	1148	6" x 158'	195'	Good	Х		Wooded/Brush	Nothing showing	Approx. 115' W. of Route 80
21	2365472	556968	984	8" x 55.5'	158'	Poor		х	Wooded/Brush	Nothing showing	About 300' NW of most northerly corner of LL4 fence angle point
22	2371803	569037	987	6" x 11.2'	91'	Fair		Х	Wooded/Brush	Nothing showing	Access from South, grades are better
23	2367760	568078	974	6" x 73'	133'	Good		Х	Mowed Area	Nothing showing	Caution: High Voltage transformer pad nearby
24	2377157	563190	1000	6" x 8.8'	167'	Good		Х	Brush	Nothing showing	Inside Load Line 1
31	2375326	558868	992	6" x 8.5'	101'	Good		Х	Paved area	Nothing showing	Casing has welded cap on top
32	2366388	561916	977	8" x 41'	106'	Good	X		Wooded/Brush	Nothing showing	Near old Central Burn Pit area
33	2365883	569454	973	6" x 112'	156'	Good		Х	Brush	Nothing showing	Near western edge of OHARNG parking lot
35	2374164	566933	987	6" x 11'	143'	Good		X	Wooded/Brush	Nothing showing	Inside Area 3
36	2374395	560215	1013	6" x 14.5'	118'	Good		Х	Brush	Nothing showing	Inside Load Line 2; caution, sinkhole has developed here
37	2373666	561682	1014	6" x 16'	155'	Good		Х	Wooded/Brush	Nothing showing	Inside Load Line 2
38	2375918	564287	994	6" x 9'	169'	Good	X		Wooded/Brush	Nothing showing	Inside Load Line 1
39	2376468	559647	987	6" x 12'	137'	Good		Х	Brush	Nothing showing	Casing at toe of fill along South Service Rd.
41	2359449	554449	1004	6" x 36'	130'	Good		Х	Wooded/Brush	Nothing showing	Inside Area 4
48	2354624	552949	1112	12" x 10.67'	175'	Poor		X	Wooded/Brush	Nothing showing	Top of casing is at grade level in a slightly depressed area and is acting as a drain
49	2356709	549780	1043	12" x 37.7'	173'	Fair		X	Wooded/Brush	Maybe	Could be abandoned waterlines nearby; casing has welded cap
49A	2356724	549776	1043	4" x ?	?	Fair		X	Wooded/Brush	Maybe	Casing appears to be 6" dia. at base of 4" extension; no records found for this well;
50	2371487	558338	1007	6" x 19'	136'	Good		Х	Mowed area	Nothing showing	Inside Load Line 3
51	2370696	559817	1010	6" x 9'	142'	Good		Х	Mowed area	Nothing showing	Inside Load Line 3
53	2350457	567212	1109	8" x 39.4'	250'	Good		X	Brush	Nothing showing	Approx. 45' S. of Smalley Rd. & approx. 260' E. of creek
54	2335387	553102	1181	6" x 17'	150'	Good		Х	Wooded/Brush	Nothing showing	At SW corner of McCormick & Knapp Rds.; water well is about 52' SW of a nearby monitor well
55	2335040	558626	1194	6" x 22'	150'	Good		Х	Wooded/Brush	Nothing showing	Approx. 115' North of Newton Falls Rd.
56	2344846	558709	1148	6" x 27.4'	148'	Good		Х	Wooded/Brush	Nothing showing	Inside C Block about 62' North of centerline of Newton Falls Rd.
57	2352878	561019	1112	6" x ?	176'	Good		Х	Wooded/Brush	Nothing showing	Approx. 40' nw of the Greenleaf Rd. pavement
58	2350849	560675	1119	6" x 96.6'	182'	Good		Х	Wooded/Brush	Nothing showing	Inside D Block
62	2351981	557152	1092	12" x 43'	221'	Poor		X	Wooded/Brush	Nothing showing	Well is situated in a heavily wooded area
63	2353790	556509	1089	12" x 41'	214'	Poor		X	Wetlands	Nothing showing	Well is situated within wetlands; access to site is difficult
66	2365874	555471	987	6" x 50'	172'	Good		Х	Wooded/Brush	Nothing showing	Inside Load Line 4
95	2357876	560572	1023	6" x ?	?	Good		Х	Brush	Nothing showing	Inside MK-19 firing range; set below grade inside vertical set 4' dia.conc/pipe w/wood cover; no records of this well;OHARNG has indicated they would like to keep this well;
96	2344436	551180	1086	4" x ?	?	Poor		x	Wooded/Brush	Nothing showing	Access to site is very poor through woods; serviced old hunter's cabin at one time; no records of this well;
98	2345492	551728	1076	6" x ?	?	Good		Х	Mowed area	Nothing showing	At West end of NACA Test Site; casing out of ground 4.4'; no records of this well;
100	2358044	570306	1056	6" x ?	?	Good		Х	Brush	Nothing showing	Serviced the nearby old Boy Scouts Camp at one time; casing still has old hand pump installed; no records of this well
							6 TOTAL	38 TOTAL			

WELL DIAMETER						
ORANGE	= 4"					
TAN	= 6"					
MAUVE	= 8"					
BLUE	= 12"					

Coordinate and Elevations are shown in US Survey Feet Projection Datum is NAD83

Ohio State Plan Rectangular Grid - North Zone

# **5.0 FINDINGS CONCLUSION**

In all a total of thirty-eight (38) "confirmed" water well casings were found while performing the survey (See Exhibit A). "Confirmed" means a part of the water well casing is visible. Six (6) of these confirmed water well casings were found inside former production Load Lines. One (1) water well casing however, Water Well No.16, was found outside of the facility perimeter fence but is still situated within U.S.A. Government owned property.

Additionally there are six (6) "suspected" water well casings which were detected using a magnetic locator (See Figure 4.1). The term "suspected" refers to the strong magnetic pull exhibited by the magnetic locator very close to the calculated position where the well casing top has been broken off and lies buried approximately 2-3 feet under the surface.

There were a total of twelve (12) water wells that could not be located (See Figure 4.2). Only four (4) of these wells are shown in the 1941 surveyors field book (See Section 2.0 Initial Investigation).

The two (2) abandoned oil and gas wells could not be located (See Figure 4.5). However the two (2) active oil and gas wells currently in production along with the tank battery were located (See Figure 4.4).

## **6.0 REFERENCES**

Barnes, George E. Consulting Engineer. A Report on Water Conservation and Development at the Ravenna Arsenal, APCO, Ohio. Cleveland, Ohio. June 1, 1950.

Demolition of Well Houses & Well closures documentation at RVAAP; 1992-1993 (see Appendix C)

Hunkin-Conkey Construction Company. *Building the Ravenna Ordnance Plant: A Job History*. Cleveland, Ohio. 1941.

Hunkin-Conkey Construction Company. Surveyors field book. Wells-Tanks-Stacks. 1941.

Ohio.gov Department of Natural Resources. *ERIN Well Log Application*. <u>http://gisdev1.oit.ohio.gov/Geocortex/Essentials/Web/viewer.aspx?Site=ERINWellLogApp&ReloadKey=Tr</u> <u>ue</u>

http://www2.dnr.state.oh.us

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- SAIC 2011. *Final Facility-Wide Sampling and Analysis Plan for Environmental Investigations*. Ravenna, Ohio. February 24, 2011.
- Wilbur Watson and Associates. *Ravenna Ordnance Plant, Original Dwelling Location Water Supply Facilities and Wells, Drawing number 1140.120.* Ravenna, Ohio. Scale not given. 1953.
- Wilbur Watson and Associates. Sand Creek Sewage Treatment Works Utilities Map, Drawing Number 210.4. Ravenna, Ohio. Scale not given. 1953.