

Former Raritan Arsenal; Edison, New Jersey Formerly Used Defense Site (FUDS)

Public Information Meeting 14 January 2014 Sayreville Borough Hall 167 Main Street • Sayreville, New Jersey

Meeting Summary

Introduction

Sandra Piettro, U.S. Army Corps of Engineers project manager, opened the meeting at 7:15 pm. Attendance: 27 community members and local officials signed in. A member of the nongovernmental group Edison Wetlands Associates set up a video camera and filmed the meeting. Ms. Piettro requested a copy of the recording.

Ms. Piettro introduced the purpose of this meeting, to go over what was found in Phase 1 and what will happen next in Phase 2, and briefly went over the history of Corps investigations of the former Raritan Arsenal in Edison which was used for U.S. Army operations from 1917-63. She noted that the Army Corps is in the beginning phase of investigating the extent of any munitions. This is not a cleanup effort (remediation) — that would occur at the end of the process that the Army Corps is following.

Presentation

Ms. Piettro introduced Mark Callaghan, the project manager from CH2M HILL (the Army Corps' contractor). Mark Callaghan went through the presentation, explaining the three phases of the remedial investigation and reviewing the history of Dredge Spoil Disposal Area (DSA) #5, the 228-acre wetlands area between the river and Sayreville Boulevard. He then presented the results of the Phase 1 investigation and the plans for Phase 2 starting later this month. The following is a brief summary of the presentation. See **Attachment 2** for a copy of the slides that were presented.

In the 1940s and 1950s, the Raritan River was dredged to increase its depth for shipping and deposited in several locations, including an 8-acre parcel near the Sayreville wastewater plant, known as the "Spoils Area." In 1993, the Army Corps removed 245 grenades from the "Spoils Area." DSA #5 was added to the investigation in 2012, when historical maps were identified showing that an area on the southern shore was permitted for disposal of material dredged from the river (dredge spoils).

Mark described the work that was conducted in Phase 1 (Nov – Dec 2013): surface clearance, digital geophysical mapping (DGM), and data analysis. The DGM survey in DSA #5 was conducted December 13-18 and a total of 543 anomalies were mapped. A total of 228 anomalies were randomly selected for further investigation. Random sampling is based on a statistical method approved by the Army Corps and widely uses, that says if we find no munitions at all in DSA #5, then we can be 95% sure that munitions are not present without looking at every single piece of metal.

In Phase 2, unexploded ordnance (UXO) technicians will use metal detectors to relocate (find and flag) those 228 anomalies, dig them up, and dispose of them. These anomalies could be anything: trash containing metal, pipes, fence posts, or they could be munitions.

If there are munitions, they would not be unexploded ordnance — items that were launched but didn't explode and are now unstable. Any munitions items in dredge spoil would have been packaged for shipment, so they would be much more stable than a live item fired down a range would be.

Exclusion zones will be established to keep non-essential personnel away while anomalies are being dug up. Although many of the anomalies are likely to be scrap metal, we have to assume they are munitions and could be dangerous until we know for sure. The size of the safety buffer (exclusion zone) is based on the distance that fragments from the largest potential munition might travel if that munition exploded accidentally.

To minimize disruption to the public, USACE first plans to use advanced electromagnetic equipment called TEMTADS to determine what shape the metallic items are. Basically, most munitions items are generally cylindrical, resulting in similar decays in the electromagnetic responses on their long and short axes. Scrap metal or (for example) a horseshoe decays differently. There is now a library of TEMTADS data that analysts can compare and know whether or not items are munitions and if so, what kind of munitions. Anything that can be identified as not a munitions item doesn't need to be dug up.

If the data are inconclusive (if many items are jumbled together or there is other interference), then we will have to dig that anomaly up. If so, we will communicate with individual residents who live within the exclusion zone and will need to leave their homes for several hours. By using TEMTADS, at least we know we are not asking people to leave while we dig up a hubcap.

Questions from Community Members and Answers Provided

Q: Was the percentage selected by the size of anomalies?

A: No, by the total number of anomalies.

Q: Would grenades still be live?

A: The explosives in the grenade would still be dangerous, but they would not have been shipped with the pins attached. The pins would have been stored separately. It's still not a good idea to fool with them.

Q: What is the largest item that might be there?

A: A 155-millimeter projectile (M107), which would be the worst case scenario. That's the largest item the that the arsenal had. We don't expect to find anything that large but to be safe, we have to assume the worst when planning.

Q: Were all of the anomalies detected inside the bermed area?

A: No, some were outside the berms; probably scrap metal, not munitions

Q: How do we know munitions were not washed elsewhere when super storm Sandy came in? One of my neighbors had 20 tons of soil/sediment in her living room.

A: These items would be 4 feet or more under the soil, so unless Sandy washed away 4 feet of soil, it's unlikely that any munitions were moved.

Q: Did you see evidence of scouring when you were out on the site?

A: No, we didn't.

Q: Are all munitions metallic?

A: Yes, from the timeframe when the arsenal was active.

Q: Did you use some kind of sonar to see what was there, 4 feet under the ground?

A: The digital geophysical survey equipment works somewhat like that, but it detects metal.

Q: Can you point out on the map where EWA [Edison Wetlands Associates] found a munition?

A: Mr. Siegel said he found it on the Superfund site [northeast of DSA #5]. The Army Corps has no record of that; we are meeting with EPA tomorrow and will ask them if they have a record of where it was found.

Q: Is there a possibility that a backhoe could hit a munition and detonate it?

A: We don't dig on top of the item. We dig down beside it until we're level with it, and then carefully move dirt away by hand until we see it. It's a very precise method to avoid what is called "intentional contact."

Q: To what depth is TEMTADS effective, 4 feet or more?

A: To whatever depth the anomalies are, 8 feet or more.

Q: Was Sheffield Town built on the site?

A: On the permitted extent of the disposal area, but we don't think dredge spoils were actually deposited there. If you walk around out in the wetlands, you'll see berms that were constructed to hold the dredge spoils in place.

Q: Would the berms have been removed during construction?

A: Probably not, but we can't be entirely sure.

Q: Do you anticipate closing any roads or homes?

A: We don't know yet, but if we do have to do that we will come back and let people know first.

Q: When does the second phase start?

A: Next week we'll start reacquiring anomalies, and on January 21st we will start using TEMTADS. That part is not intrusive, similar to Phase 1.

Q: What is the rectangle on the map?

A: That is the "Spoils Area" where the Army Corps removed munitions in 1993.

Q: What is the plan for the anomalies?

A: If all the anomalies selected for investigation are not munitions, then we can be 95% certain that the remaining anomalies also are not munitions.

Q: But 250 isn't 95% of the total number of anomalies.

A: The 95% confidence level doesn't mean 95% of anomalies have to be investigated. It is based on the statistical method called "Estimating a Proportion" from the Visual Sample Plan. There is a curve showing the number of samples you need to reach a given level of confidence and there is a point at which that curve levels off. It's similar to polling; they don't have to ask 50% of all voters a question to estimate that 50% of voters are in favor of/opposed to something. [Note: **Attachment 2** provides a detailed explanation of how this statistical method is applied to the munitions investigation.]

Q: Is it important to know what percentage are munitions?

A: This is just the beginning. If we do find munitions there, we may need to do more investigation to learn more about the extent of munitions.

Q: Are the 250 anomalies the most likely ones to be munitions?

A: No, they were randomly selected.

Q: What if you are digging next to another anomaly that was not selected, will you know the other one is there?

A: Yes, we have the exact GPS coordinates of each anomaly. They are not as close together as they appear on the slide.

Q: Who brought this to the Corps' attention to come here? It seems awfully convenient.

A: I know what you're referring to, the proposed Bypass. We only found out about that in the fall of 2013; the munitions investigation was already being planned by then and is not related. In 2011, money was appropriated allowing the Corps to investigate the dredge spoils disposal area [on both sides of the river]. The investigation area was identified in 2012 when we found a 1950s map.

Q: If the DGM can only see 4 feet down, it could be a risk if they do construction for the road and dig deeper. How do you prevent that risk?

A: We keep digging until we find a metallic object, remove it, and then run a metal detector over to be sure if there is nothing below it. The DGM device is not limited to 4 feet deep.

Q: There is always the chance that something could be found. You might want to up [increase] the sampling to protect the workers.

A: We have to follow the CERCLA process; this is only the first step to determine the nature and extent of munitions. In later steps, the Corps will determine the need for a cleanup action. Right now, we don't know if there are actually any munitions.

Q: What happens to the remaining 315 anomalies?

A: If everything that we dig up are not munitions, then based on the statistical method, we are 95% confident that the rest are not munitions. This is a good first step, but if the results show that any munitions are present, then the Corps may need to do more investigation before making any cleanup decisions.

Q: This is a long process. Would construction on that property be prohibited until the process is complete? A: We have to follow the CERCLA process and we don't own the property. There are multiple owners who gave us permission to investigate.

Barry Eck stepped up, introduced himself as the Sayreville Emergency Management Coordinator, and talked about a previous site that was investigated using this same process. Near the La-Mer development, they did find a lot of munitions and removed them. *[Note: this was a removal action in 1993-1994, near the La-Mer townhouses in Sayreville. Ordnance from a 1918 explosion at the former Morgan Depot in Sayreville had scattered ordnance over a large area.]* Any place that was going to be constructed *[Note: on the former arsenal side of the river]*, the Army Corps came in and checked it first. They went far down, well below 4 or 8 feet. The Borough of Sayreville is built on a number of former munitions plants. Eisenhower School was another munitions investigation, where the school had to be closed down. It was also successful, all the munitions were removed and with no explosions. If they do find munitions [on this site] and if the Bypass is ever built, the Corps will come back and clear to whatever depth is necessary to keep the workers safe.

Q: How will we be notified if we have to evacuate?

A: Ginny Farris, CH2M HILL community relations lead, explained the process for notifying any residents who might need to be out of their home while munitions are being dug up. The first thing we will do is send a letter, either hand-delivered or by certified mail, that will say that you are in one of the exclusion zones, this is what we expect to happen, and this is when we expect to come out and do the work. Usually we would work from 9:00 am to 2:00 pm, when many people are out of the house anyway. It should just be for one day. There will be a place where people can stay and be comfortable if they need to, probably the Sayreville Senior Center. The day before work starts, notices would be placed on front doors. On the morning before work starts, we'll knock on doors to make sure the homes are empty. After the work is complete, another notice will be posted on doors to let people know that. In the very unlikely chance that a large munition is found and it can't be moved, someone might have to stay away from home overnight; we would put them up in a hotel. We've never had to do that, though.

Barry Eck added that, if evacuations are needed, police officers will be down there the entire time protecting property, and said that he is totally confident in the procedure if the Army Corps has to detonate a munitions in place.

Q: What exactly did Congress say when appropriating money for this investigation?

A: Money was not appropriated separately for this site. The Army Corps and all the services estimate how much money they need for all their sites, then some amount is appropriated in the defense authorization bill. Around 2002, Congress established the Military Munitions Response Program, which requires all the services to go out and look at all their old ranges and old disposal sites to address any hazards; it's a nationwide program.

Q: Is there any possibility for property damage?

A: No, if an item is not acceptable to move and has to be blown in place, engineering controls [sand bags and soil on top] will reduce the shock waves to essentially zero.

Q: How will you move an item to a remote area to be destroyed?

A: We would pick it up and move it by hand if it's safe to do that. We aren't allowed to cross public roads or waterways, so it would be somewhere further away on DSA #5.

Q: What about DSA #4, DSA #6, Area 13-terrestrial that have not yet been surveyed, is there a timeline to finish them?

A: DSA #4 [island] was so muddy that people got stuck in the mud up to their knees, one worker up to his chest. That can actually be fatal. We made the decision to stop work and come back in March when it might be drier. At DSA # 6 [island], we cut all the transects and did the surface clearance, but the Marsh Master that is supposed to go through anything was stuck there for 6 hours until high tide. We'll try to think of another way to complete that one. Area 13-terrestrial *[on the northern shore]* currently has a tenant who is fabricating structures for the Tappan Zee Bridge. The owner is working to move him, so we'll be able to do the work there probably around March.

Q: Someone was out in my back yard and poking holes with a stick. He said he was looking for bombs. I called Vargo, the company he works for.

A: Vargo are licensed surveyors who were laying out control points and survey reference points to help us in mapping where the anomalies were. They were not looking for bombs.

Q: Hunters are out often there. Will you put up signs to keep them safe?

A: It's difficult to warn hunters; how do you know who is planning to go out there? It's private property, so we can't put up signs and fencing all over it. If we see anyone in the cleared transects while we are working, we will ask them to move.

Q: When were the lines shown on the map drawn? There has been a lot of climate change, how do you know the lines are actually in the right place?

A: The map is from 1947. Again, what you see on the map is simply the permitted area for dredge disposal. If you go out there, you'll see the berms many feet high around the area where dredge spoils would have been placed.

Q: There are two known archeological sites (shell midden beds, Native American sites) out there. How will you protect them?

A: We're doing a surgical investigation, digging fairly small holes. If we find that an anomaly is in the middle of a shell midden bed, we can move elsewhere. We have no intention of destroying archeological sites.

Q: The Corps of Engineers has allocated money for groups to review documents for the community, right? A: That TAPP [Technical Assistance for Public Participation] funding comes out of the active work budget, so it takes away from the funds needed to do the job. FUDS [Formerly Used Defense Sites] cleanup money can fluctuate. 2011 was the first year in awhile when we got money to do this work. With budget cuts, we don't see more money coming our way any time soon. Also, NJDEP has another subject matter specialist who reviews everything, providing an independent set of eyes on what we're doing.

As there were no more questions, the meeting was adjourned at 8:50 pm.

Attachment 1 – Public Meeting Presentation for Sayreville Residents





US Army Corps of Engineers ®

Former Raritan Arsenal Remedial Investigation – Phase 2



Open House and Public Information Meeting – Sayreville Council Chambers – January 14, 2014 Formerly Used Defense Sites Program (FUDS) Former Raritan Arsenal Edison, New Jersey Contract # W912DY-09-D-0060, Task Order 003

Update on the Munitions Remedial Investigation

This presentation provides information about Phase 2 of the work along the south shore of the Raritan River, in the wetlands between the river and Sayreville Boulevard. We Are Committed To Keeping The Public Informed

Focus of the Remedial Investigation (RI)



- Since 1989, numerous investigations and removal actions have been completed at the former Raritan Arsenal.
- This investigation focuses on 12 specific areas to:
 - Characterize the *nature* (what is it) and *extent* (where is it) of munitions and explosives of concern (MEC), munitions constituents (MC), and other hazardous and toxic wastes that are specifically related to a known Department of Defense release.
 - Perform human health and ecological risk evaluations, as well as complete a munitions hazard assessment.
 - Collect sufficient data to define remedial alternatives in the Feasibility Study that will follow.

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A Phased Approach



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Investigation Area in Sayreville

Dredge Spoils Area #5

- 228-acre area of wetlands along the southern shore of the Raritan River, just north of Sheffield Towne community
- The lower Raritan River was dredged in the World War I and World War II eras to maintain a channel and turning basin for ships loading and unloading at the former Raritan Arsenal.
- Dredged materials ("dredge spoils") might have contained discarded military munitions that fell off cargo ships during loading and unloading.
 - Munitions packed for shipping would not be armed or have fuzes attached





Brief History of Dredge Spoils Area (DSA) # 5



Dredges from the 1950s-1970s (Historical photos - U.S. Army Corps of Engineers Dredging Operations Support Program

- 1940s-1950s: Raritan River dredged to increase its depth for shipping
 - Dredge spoils were deposited in several locations, including an 8-acre parcel near the Sayreville wastewater plant, known as the "Spoils Area"
 - The "Spoils Area" was also used by the town of Sayreville, during installation of a sewer plant effluent diffuser in the river bed
- 1993: USACE conducted a munitions removal action in the Spoils Area
 - A total of 245 ordnance items were removed from a depth of 4-8 feet below the ground
 - 14 Mk II hand grenades
 - 231 French rifle grenades





(Historical photos - Wikimedia Commons)

Brief History of Dredge Spoils Area (DSA) #5 (continued)

- 2012: Records research identified historical maps showing the permitted limits of six dredge spoils disposal areas
 - Including one on the southern shore of the river
 - Added to the munitions investigation as DSA #5
- Examination of the site suggested that the actual area used for dredge disposal at DSA #5 was probably smaller than the permitted area shown here



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Dredge Spoils Area (DSA) #5







Phase I Work is Complete (Nov – Dec 2013)



- Surface preparation
 - Vegetation was cut and cleared to allow for surface clearance.
 - Teams walked over the area and picked up metallic objects on the surface.
- Digital Geophysical Mapping (DGM)
 - Electromagnetic induction (EMI) instruments were used to electronically record and create a digital map the locations of subsurface "anomalies" (metallic objects).
 - Anomalies may be any metallic objects, not necessarily munitions, for example pipes and fence posts
- Data Analysis
 - Skilled geophysicists and munitions experts evaluated the data collected in Phase 1
 - Selected subsurface anomalies that might be munitions for further investigation





Phase 1 Results- DSA #5

- The DGM survey of DSA #5 was conducted December 13-18, 2013, along 3-meter-wide parallel transects with 80-meter spacing between transects.
- A total of 543 anomalies (unknown metallic objects) were detected beneath the ground surface.







Phase 2 – DSA #5 Anomalies to be Investigated

The 228 anomalies shown as yellow dots were randomly selected for investigation and classification in Phase 2

- DSA 5 Boundary DGM Survey Lines
- DGM Anomaly
- Random Selection
- QC Seed Item





Phase 2 – Intrusive Investigation (Jan – March 2014)



- Phase 2 is scheduled to start in January 2014. Unexploded ordnance technicians will:
 - Re-locate the mapped anomalies using surveying equipment.
 - Carefully excavate anomalies using a combination of hand tools (*shovels, trowels*) and heavy equipment (*tracked excavators, backhoes*).
 - Identify the anomalies and determine whether they are munitions or unrelated metal objects such as pipes, fence posts, marine debris, etc.
 - Inspect munitions and determine whether they can be moved safely:
 - If an item is deemed safe to move, it will be moved to a remote location where it will be destroyed.
 - If it is not safe to move, engineering controls such as sandbags or soil will be used to conduct a safe controlled detonation.
 - Nearby residents may hear a muffled explosion.





Exclusion Zones

- For safety reasons, exclusion zones are established to keep "non-essential personnel" out of the areas where active digging and handling of munitions is being conducted.
 - Mostly in the unpopulated wetland area
 - May also include temporary road closures, interruptions of river traffic, and any homes that are adjacent to digging areas
- To date, Phase 1 work has been non-intrusive and thus has not required any residential evacuation or road closures
- Every attempt will be made to minimize any impacts on community members during Phase 2.





TEMTADS: Minimizing disruption to the public

- An advanced detection system called TEMTADS will be used to help determine if these anomalies are *munitions* or *unrelated metallic objects*.
 - TEMTADS is not intrusive, so exclusion zones will not be active during this work.
- This will minimize the number of anomalies that need to be dug up for identification and thereby minimize the disruption to the public.





Exclusion Zones – DSA #5

- The **HFD** or Hazardous Fragmentation Distance (yellow line)
 - Is based on the type of munitions expected at a site: 450 feet for DSA #5
- This represents a maximum exclusion zone calculated from the boundary of DSA #5.
- During the investigation, active exclusion zones will be established only around the specific anomalies being investigated at a given time.
- Thus, the active exclusion zone on any given day will include only a small portion (if any) of the area shown here.





Exclusion zones would be limited in size

- Only the anomalies that TEMTADS data show as possible munitions will be dug up. Exclusion zones will center on those and only be active for a brief period.
 - (NOTE: for illustration only, not based on actual data.)





Phase 3 – Sampling & Analysis (June – July 2014)

- Phase 3 will begin after identifying and classifying any munitions that are recovered during Phase 2.
- Munitions experts and scientists will identify the types of compounds (*specific metals and explosives*) that make up those recovered munitions.
- Environmental samples will be collected and analyzed for those specific compounds, to ensure that they have not been released into the environment.





Schedule

All dates are approximate and may change

Phase	Task	Duration
Phase 1	Vegetation Reduction, Surface Clearance, and Digital Geophysical Mapping (DGM)	November – December 2013
Phase 2	Reacquisition and flagging of anomalies, TEMTADS, and Intrusive Investigation	January – February 2014
	• TEMTADS non-intrusive examination of anomalies (multiple areas)	January 20th -30th
	 Analyzing TEMTADS data and planning intrusive investigation 	January 31 st – February 14 th
	 Coordinating with residents in exclusion zones (if any) 	Week of February 17 th – 24 th
	 Intrusive investigation where residents are in exclusion zones 	Late February – early March
Phase 3	Environmental Sampling & Analysis	June – July 2014

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Safety and Coordination

- The US Army Corps of Engineers
 - Is committed to investigating these areas with the utmost concern for the safety of the public.
 - Is committed to keeping the public, property owners, local government, and other interested parties informed about what is happening, and when it will be happening.







Questions

If you have questions that were not answered tonight, please contact:

Ms. Sandra L. Piettro, Project Manager Phone – 917-790-8487 Email – Sandra.L.Piettro@usace.army.mil

- For more information about investigations at the former Raritan Arsenal:
 - Visit the project website:

www.nan.usace.army.mil/Raritan

- To sign up for future notifications:
 - Make sure you signed the sign-in sheet tonight
 - Send an email to <u>Sandra.L.Piettro@usace.army.mil</u>
 - Sign up for the Borough of Sayreville's online mailing list at <u>www.sayreville.com</u>

Thanks for your participation!







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Remember the 3 Rs



The '3 Rs' of munitions safety are always important to know, especially where munitions were used or stored in the past. Munitions are sometimes hard to identify. If you have found something you even *think* might be a munition:

- RECOGNIZE: Do not touch it
- RETREAT: Note the location and move away
- REPORT: Call 911





Attachment 2 - Response to Public Question about Statistical Sampling

On January 15, 2014, a member of the public provided the following comment, as a result of information presented during the public information meeting held in Sayreville, NJ on January 14, 2014. The following documents that comment and the associated response.

Comment: At meeting of Jan. 14, 2014, we were told that after all work was done that there would be a 95% probability or greater that there would be no live munitions remaining on the site. There are about 500 possible anomalies that could be munitions and about 250, at random would be checked. If there is a probability of an anomaly being a munition of .001, this would give a probability of 25% that a munition was found and a 25% probability that there is still at least one remaining munition among the other 250 anomalies. Unless one knew the probability that an anomaly was a munition, how can one estimate a confidence limit of 95%? If the probability of an anomaly being a munition is a little below .0001, no sampling would have to be done to get a confidence probability of 95%.

Response: During the public information meeting, it was not indicated that after work was complete there would be a 95% probability or greater that there would be no live munitions remaining at the site. The investigation and characterization approach was explained, that to determine if the identified DGM anomalies are related to munitions items, a statistically representative subset of the identified anomalies must be intrusively investigated. The "Estimating a Proportion" method was used to calculate the number of randomly selected DGM anomalies that should be intrusively excavated, **to estimate with a 95 percent confidence level**, the proportion of munitions-related to non-munitions-related items within the population of anomalies detected along the DGM transects.

When a population size is large or unknown, the necessary sample size of DGM anomalies to be characterized can be estimated using the following statistical sample size formula:

$$n_0 = \frac{Z_{\alpha}^2 p q}{e^2}$$

 Z_{α} = desired confidence level

p = proportion of DGM anomalies classified as munitions-related

q = proportion of DGM anomalies classified as non-munitions-related (q = 1-p)

e = acceptable margin of error for proportion being estimated

n₀ = statistical sample size for a large population

To conservatively estimate the variance of proportional variables (i.e., munitions-related or non-munitionsrelated), pq (in the equation above), a population proportion of 50 percent (p=0.5) was estimated to maximize the variance, and subsequently maximize the sample size. Using a z-statistic for a 95 percent confidence level (Z_{α} =1.96) and a margin of error of 5 percent (e=0.05), the solution for n₀ becomes:

$$n_0 = \frac{Z_{\alpha}^2 pq}{e^2} = \frac{1.96_{\alpha}^2 (0.5)(0.5)}{0.05^2} = 384$$

A maximum of 384 randomly selected DGM anomalies was estimated for classifying, with 95 percent confidence level and \pm 5 percent sampling error, the proportion of munitions-related to non-munitions-related DGM anomalies in a large or unknown population.

Following the estimation of the population size above, the following finite population correction was used to reduce the number of anomalies required to obtain the same confidence level:

$$\mathsf{n}_1 = \frac{\mathsf{n}_0}{1 + \left(\frac{\mathsf{n}_0}{N}\right)}$$

 n_1 = adjusted statistical sample size for a finite population

n₀ = statistical sample size for a large population

N = size of the population (number of DGM anomalies)



The finite population correction equation used a random number selector process and excluded the anomalies related to quality control (QC) seed items¹. This means that of the 543 anomalies identified along the DGM transects, 540 anomalies were used as the population size ("N" in the equation) to calculate the finite population correction:

$$n_1 = \frac{n_0}{1 + \left(\frac{n_0}{N}\right)} = \frac{384}{1 + \frac{384}{540}} = 224.42$$

¹ These are a few metallic items that were deliberately buried along the transects before the survey, to verify that the equipment was working properly.

The result shows that investigating and classifying 225 anomalies will provide a statistically-derived estimate of the distribution of munitions-related to non-munitions-related items present among the anomalies identified along the DGM transects at 95 percent confidence level and within ± 5 percent sampling error. Adding in the anomalies related to the QC seed items resulted in a total of 228 anomalies for investigation.

Finally, to use a more plain English example at DSA #5: 543 anomalies were detected beneath the ground surface along the transects investigated; of these 543 anomalies, 228 were selected at random (using systematic random sampling) along those transects. If all of those 228 anomalies are investigated and turn out to be cultural debris (i.e., coke cans, hub caps, metal rebar); then we have a 95 percent confidence that the remaining anomalies (i.e., 315 anomalies) are also cultural debris, and not munitions items.