<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Willington Lin (R)</td>
<td>Department of Navy (Navy) Base Realignment and Closure (BRAC) Program Management Office (PMO)</td>
</tr>
<tr>
<td>Brian Helland (R)</td>
<td>Navy BRAC PMO</td>
</tr>
<tr>
<td>Jason Speicher</td>
<td>Navy, Naval Facilities Engineering Command (NAVFAC) Atlantic</td>
</tr>
<tr>
<td>Jennifer Good</td>
<td>Navy BRAC PMO</td>
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<tr>
<td>Sarah Kloss (R)</td>
<td>Environmental Projection Agency (EPA) Region 3</td>
</tr>
<tr>
<td>Linda Watson</td>
<td>EPA Region 3</td>
</tr>
<tr>
<td>Deborah Goldblum</td>
<td>EPA Region 3</td>
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<tr>
<td>Larry Brown</td>
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<tr>
<td>Mark Leipert</td>
<td>EPA Region 3</td>
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<tr>
<td>Roger Reinhart</td>
<td>EPA Region 3</td>
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<tr>
<td>Colin Wade (R)</td>
<td>Pennsylvania Department of Environmental Projection (PADEP) Southeast (SE)</td>
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<tr>
<td>Rob Fogel</td>
<td>PADEP SE</td>
</tr>
<tr>
<td>Bonnie McClenen</td>
<td>PADEP SE</td>
</tr>
<tr>
<td>Jessica Kasmari (R)</td>
<td>PADEP SE</td>
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<tr>
<td>Bill Burger</td>
<td>Tetra Tech</td>
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<td>Tricia Moore</td>
<td>Tetra Tech</td>
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<tr>
<td>Chris Botzum</td>
<td>Air National Guard (ANG)</td>
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<tr>
<td>Major Lydia Stefanik</td>
<td>ANG</td>
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<tr>
<td>Claudia Malone</td>
<td>ANG</td>
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<tr>
<td>Will Acosta</td>
<td>ANG</td>
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<tr>
<td>Lt. Col. Jacqueline Siciliano</td>
<td>ANG</td>
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<tr>
<td>Lora Werner</td>
<td>Agency for Toxic Substances and Disease Registry (ATSDR)</td>
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<tr>
<td>Kyle Shmeck</td>
<td>Montgomery County Health Department</td>
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<tr>
<td>Mike Pickel</td>
<td>Horsham Water and Sewer Authority (HWSA)</td>
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<tr>
<td>Tina O’Rourke</td>
<td>HWSA</td>
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<tr>
<td>Tom Ames</td>
<td>Horsham Land Redevelopment Authority (HLRA)</td>
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<td>Mike McGee</td>
<td>HLRA</td>
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<td>Larry Burns</td>
<td>HLRA</td>
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<tr>
<td>Bill Walker</td>
<td>Horsham Township</td>
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<tr>
<td>Greg Nesbitt</td>
<td>Horsham Township Council</td>
</tr>
</tbody>
</table>
Lara Flynn U.S. Senator Casey’s Office  
Correne Kristiansen Pennsylvania Senator Collett’s Office  
Jenny Wagner The Intelligencer  
Rocco Mercuri Gilmore Associates, Inc.  
Dave Sherman Geosyntec Consultants  
Chris Crockett Aqua America  
Lisa Senior United States Geological Survey (USGS)  
Dan Goode USGS  
Joseph McGrath (R) Restoration Advisory Board (RAB), former employee and veteran  
Jane Smith Resident  
Ed Stevens Resident  
Garth Glenn Resident  
David Fennimore Resident  
Hope Grosse Resident  
Joanne Stanton Resident  
Patricia Leaney Resident  
Mark McCouch Resident  
Joseph Feliciani Resident  
Mark Cuker Resident  
Other Unidentified Attendees  

(R) Designates RAB Member

Willie Lin, the Navy’s BRAC Environmental Coordinator and RAB Co-Chair, opened the meeting by greeting the attendees. Mr. Lin noted that the meeting will include presentations from the Navy, ANG, USGS, EPA, and PADEP. Mr. Lin asked RAB members and government representatives to introduce themselves.

Mr. Lin informed the attendees that the handouts with the presentations and an EPA fact sheet are available. Mr. Lin also noted that representatives from the ATSDR are scheduled after the RAB meeting to discuss health concerns. Mr. Lin also noted changes to the format of the Navy presentation in response to comments received during the previous RAB meeting. The presentation format identifies the most current actions while background information has been moved to the back of the handout.

Brian Helland commenced with the Navy presentation. Mr. Helland provided an update on the cleanup sites, including landfill Sites 3 and 12, and Site 5, the former Fire Training Area. Mr. Helland provided background on Sites 3 and 12 stating that they were former landfills used by the Public Works Department. Remedial investigations (RIs) at both Sites 3 and 12 have been completed. Feasibility studies have been submitted for both sites to present various clean-up alternatives. The final feasibility studies are now available at the Horsham Library. The next step is to prepare the Proposed Remedial Action Plan and Record of Decision (ROD) selecting the cleanup remedy for the sites. A public comment period will occur later in the year.
Mr. Helland discussed the remediation for Site 5 groundwater. The site was a former fire training area where solvents were stored and burned. An active anaerobic bioremediation system is in place to reduce the parent compounds trichloroethene (TCE) and perchloroethylene (PCE). The annual monitoring sampling concluded in May 2019. Monitoring results show good conditions for bioremediation and a reduction in concentrations of volatile organic compounds (VOCs). Additional injections of amendments for the treatment system are currently underway. Reduction of VOCs have continued to be observed.

Mr. Lin discussed the next agenda item, per- and polyfluoroalkyl substances (PFAS). Mr. Lin provided a summary of Navy’s funding support for the HWSA. Mr. Lin provided a summary of the Navy’s private well sampling activities. Tetra Tech., a Navy contractor, has assumed sampling responsibilities previously conducted by EPA. Slides were discussed comparing the private drinking water wells from February 2017 to ones showing the current wells that have been most recently sampled. A few additional wells above the EPA Lifetime Health Advisory Level (HAL) have been identified since that time; however, the number of locations where connections to the public water supply are still needed have been reduced to seven. Resampling of private wells below health standards in the sampling area is also occurring to get updated information and ensure protectiveness.

Mr. Helland began to discuss the RI for PFAS. A draft report was submitted in November 2016 summarizing the data collected and identifying data gaps and strategies to collect additional needed data. Additional data was collected and presented in the draft Phase I Remedial Investigation (RI) report which was submitted to the regulators in December 2018. Comments were provided by the regulators in April and May of 2019. The draft RI is available in the information repository at the library, and the final report will be issued around the end of September 2019.

As part of the Phase I RI, a storm water and stream sampling investigation were conducted. The outfalls were sampled with results showing concentrations are lower during storm events. A contract has also been awarded to rebuild sections of the storm sewer to prevent contaminated groundwater from leaving the base.

Tricia Moore discussed the Phase II PFAS investigation that is now in preparation. Project scoping sessions were conducted, and work plans are in development. The source areas that were identified in the Phase I RI, particularly the aircraft maintenance facilities and Site 5 will be investigated further. The Phase II RI will include the installation of additional onsite and offsite monitoring wells to evaluate the extent of the contamination. Surface water discharge monitoring and additional soil samples will also be conducted. The first round of sampling of surface water and sediment sampling was performed in July 2019. The sampling was performed in conjunction with the USGS and also that the local water purveyors were invited to participate. Surface water samples are being validated. The Navy will continue quarterly sampling for one year. The Navy will coordinate future events with the ANG. The Navy is funding the USGS to install additional stream gauges to assess mass loading.

Ms. Moore discussed the upcoming pilot test for groundwater treatment in the aircraft maintenance facility area around Hangar 680 where the highest PFAS levels were identified. The final work plan as well as construction of the system have been completed. Approval to discharge was received early in the month. Full-time operations of the pilot test are tentatively scheduled to
begin at the end of September 2019. Once startup testing begins, routine sampling should occur almost daily at the beginning and then move to biweekly as the project continues. An example of the treatment system was shown on a slide. The slide shows a container with a series of treatment vessels. Ms. Moore explained that the treatment vessels will contain carbon and ion exchange resin to treat PFAS to concentrations below the HAL. The system will be operated for a six-month period.

Ms. Moore discussed the Site 5 pilot test for PFAS. The wells will be located away from the bioremediation system. Lessons learned from the Hangar 680 pilot test will be applied. The work plan is anticipated to be completed in December 2019.

Mr. Lin briefly discussed the environmental research programs funded by the Department of Defense (DoD) with relation to PFAS. Mr. Lin explained the DoD has funded millions of dollars into research related to PFAS, including, toxicology, chemistry, assessment, and remediation. Research is being conducted for soil, groundwater, and stormwater treatment, and assessment of transport of PFAS in waterways. Mr. Lin finished by giving a short recap of the current progress that had just been discussed including the removal of soil. Soils were transported to a Resource Conservation Recovery Act (RCRA) Title D landfill, which is a lined nonhazardous waste landfill.

Mr. Lin introduced Major Lydia Stefanik for the Air National Guard (ANG) presentation.

Maj. Stefanik gave a brief update on changes that have occurred since the last RAB meeting. The PFAS remedial investigation contract is expected to be rewarded by September 30, 2019. The Phase 2 system to treat surface water is continuing to operate, and the Phase 3 system is in the procurement stage.

Maj. Stefanik began the discussion on PFAS at the facility. A preliminary assessment conducted in 2015 identified ten potential PFAS source areas. These include areas where PFAS may have been used or stored, such as hangars, or where firefighting foam may have flowed to, such as the storm basin and waste water treatment plant. A treatment system has been put in at the storm basin outfall. The current system treats 60 to 100 gallons per minute. An improved system is in design now with the target of treating 250 gallons per minute. Improvements were made to the stormwater basin to retain precipitation runoff to allow more time to process at the treatment system.

Maj. Stefanik discussed perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) in drinking water. There is an agreement with Warrington Township to install carbon filtration on five of their supply wells and extend water mains for connections. Private well locations with detections above 70 parts per trillion (ppt) are being connected to the public supply. Maj. Stefanik presented a slide showing the number of private wells sampled with the number above the 70 ppt health advisory level and number of connections completed.

Maj. Stefanik presented the actions that are planned for the following three months from the RAB meeting. The contract to conduct a remedial investigation is expected to be awarded. The Phase 3 system is expected to be built, and the draft National Pollutant Discharge Elimination System (NPDES) storm water permit will be under review. Quarterly sampling of private wells will continue.
Dan Goode commenced the USGS’s discussion. Mr. Goode gave a brief overview of the function of the USGS and how they cooperate with other government agencies. Mr. Goode began an overview of how the groundwater contamination in the Willow Grove and Warminster areas is affected by multiple factors. One possible factor was the change in the using fractured rock areas for the groundwater supply. Over the last few decades, there has been a dramatic decrease in the pumping of water from this type of source. The discharges are large compared to the recharge of the system which has a strong effect on the migration of the water as well as any that the water is carrying with it. A conceptual model of how groundwater moves was shown to all those in attendance.

Mr. Goode continued by explaining the different methods for which groundwater can move though an area. Diagrams showing permeable and less permeable layers, the effect of dip on the layers, and fractures in bedrock were explained to the audience. A brief flowchart explaining how the models the USGS prepares was displayed before Mr. Goode continued with an update on the USGS models of Willow Grove.

Mr. Goode clarified that they are not able to release their current results as the reports have yet to get final approval. Modeling has been completed, and the steps taken to create the model were then shown. The extent of the model was explained followed by examples of data that has been collected. Over 1,000 water levels as well as continuous stream gauge readings were used to help calibrate the model and estimate flow rates. The geology of the area was then discussed to show the effects that the different formations have on the spread of groundwater.

Mr. Goode concluded the USGS section of the presentation with the next steps the USGS will be taking. The modeling has been completed, and field data will continue to be collected. A report will be prepared using the model and what it suggests is occurring with the groundwater flow paths. Two technical colleague reviews will need to occur prior to the report being approved by the USGS. Once it has been approved, slides showing the results will be made available.

Sarah Kloss commenced EPA’s discussion. Ms. Kloss covered the EPA’s role in the project. A broad overview of the proposed goal of the pilot test study was presented.

Ms. Kloss stated that the EPA is responsible for oversight of both the Navy and the ANG. The EPA is tasked with reviews of the data that has been collected and providing input on what needs to be investigated further. The primary role is to oversee the cleanup and make sure that the Navy and ANG are protecting human health and the environment.

Ms. Kloss proceeded the presentation by recapping from the previous meeting the ways in which surface water can infiltrate to groundwater. The potential exposure pathways that can affect human health were then covered. A brief description ingestion, dermal absorption, and inhalation were described. Ms. Kloss then clarified the difference between screening levels and cleanup levels. Currently Region 3 has no screening levels for surface water for recreational purposes. As a result, the screening levels used at the site are the Navy screen values.

Ms. Kloss continued with a short explanation of the Superfund process. A slide with the general steps of the process was given followed by a brief description of each of the steps.
The EPA presentation concluded with Ms. Kloss detailing the short-term actions that are currently being taken for the protection of human health and the environment. The Navy has begun pumping groundwater following the previous RAB meeting to attempt to contain more of the onsite contamination. Additional monitoring of the streams surrounding the base have also occurred. The Navy will also install more monitoring wells offsite to ensure that conditions are stable. A second pilot test extraction and treatment will occur in the fire training area.

Mr. Lin opened the floor to questions from those in attendance.

Patricia Leaney inquired about the number of compounds being tested and the availability of the results. An unidentified EPA representative stated that 18 different PFAS compounds are being tested, and that the analytical results are available once the report is issued.

Correne Kristiansen asked about the potential testing of the corn that is next to the base due to the impact it could have on the food stream. Linda Watson of EPA explained that currently there is no way to analyze that in the form of food. There is currently not enough research to determine if it is safe or not.

Ms. Kristiansen additionally requested to know the method in which residents could be included in the well sampling program. Residents can contact either Wood or Tetra Tech. Mr. Lin added the Navy is resampling wells that were previously sampled. Tetra Tech has sent letters in attempts to contact property owners where property ownership may have transferred. If the property has changed ownership, previous sampling results can be made available to the new owner.

Mark McCouch asked about locations of wells that had been previously tested with results below 70 ppt that are now above 70 ppt. Mr. Lin replied that it is not common for many wells in the monitoring program to go above 70 ppt if they have previously been below that level. Only two wells have gone above 70 ppt since the last round of sampling.

Mr. McCouch followed up by inquiring as to the source of the pumping wells used in the USGS model. Mr. Goode responded that the map that was shown used information for Pennsylvania DEP files that reflected industrial use and large water supply. The pumping of private wells is small comparatively speaking.

Ms. Leaney requested to know the level of PFAS in the surface water leaving the base into the streams. Maj. Stefanik replied that the water going through the filtration system into the streams is non-detect for PFAS.

Joanne Stanton inquired about the actions needed in order to have a private well sampled. Mr. Lin responded that either he or Tetra Tech should be contacted to set up the sampling if the well is within the sampling boundaries.

Ms. Stanton also asked about the possibility of testing the fish tissue for PFAS in areas near the base for the recreational assessment. Ms. Kloss replied that fish tissue will not be used in the recreational number. Currently there are no EPA approved methods to test the fish tissue. Some states have set their own standards, but the EPA has not set a method or standard as of yet.
An unidentified resident requested to know when the feasibility studies would be published online. Mr. Lin answered that the exact date is not known, however a physical copy is available at the library.

An unidentified resident inquired about the effect removing the 4.5 tons contaminated soil has had on the PFAS levels. Mr. Lin explained that to answer that additional sampling will need to occur. An updated sampling plan is anticipated in early 2020 to address that.

An unidentified resident asked about the rationale of beginning the USGS model in 1999. Mr. Goode replied that in 1999 a cooperative project with the Delaware River Basin Commission began to collect GIS data sets for Southeastern Pennsylvania. The USGS began using these data sets to model the Willow Grove and Warminster areas in 2016 or 2017.

Joe Feliciani requested a spreadsheet with all of the onsite monitoring wells, the results, and the dates they were sampled for the next meeting. Mr. Lin responded that sampling figures and sheets of results are available in the reports currently on file at the library.

Mr. Feliciani followed up with an inquiry about testing breast milk in the population around the base. Lora Werner responded that they are working with the health department to do blood and urine analysis. It is unlikely that they will conduct any other tests.

Greg Nesbitt asked about the possibility of testing the soil in Graeme Park. Mr. Lin responded that the request is currently being reviewed by management.

Mr. Nesbitt asked about the possibility of testing the soil in Graeme Park. Ms. Werner responded that they are working with the health department to do blood and urine analysis. It is unlikely that they will conduct any other tests.

Mr. Nesbitt then inquired about the status of the PFAS chemicals being listed under the Superfund section. Ms. Kloss answered that the EPA is moving through the process as quickly as possible to designate PFOS and PFOA as hazardous substances. The reclassification of the PFAS compounds should not affect how the EPA does oversight at Willow Grove as clean up for the contaminants has already been initiated.

Mr. Nesbitt requested a timetable on the final permit so construction can begin renovating the basin on the base. Colin Wade replied that there is currently no specific time range. Permitting and construction of the ANG designs is being done simultaneously in order to not have significant delays.

An unidentified speaker suggested two papers for the USGS to consider implementing into their groundwater model.

Ms. Leaney inquired about the effectiveness of ion exchange being used on drinking water to treat PFAS. Mr. Wade answered that he was unable to say how effective that treatment would be. Ongoing studies are currently being done with the technology.
An unidentified speaker asked about the timeline for DEP to release a standard for PFAS in drinking water and classify PFAS as a hazardous substance. Mr. Wade answered that a drinking water standard under the Pennsylvania Safe Drinking Water Act is in development, but there is no update for the time frame. It was reiterated that PFAS does not need to be a classified a hazardous substance in order for the DEP to start an investigation and take action.

Joe McGrath requested to know the cost of moving the soil that had been excavated from the site to the landfill. Mr. Lin answered that a completion report is being prepared that will outline what occurred through the process of the soil removal.

There were no other questions and Mr. Lin adjourned the RAB meeting. After a short break, Lora Werner of the ATSDR led a health discussion with community members.
• Welcome
• Navy Presentation
  – Environmental Restoration
  – Per- and Polyfluoroalkyl Substances (PFAS)
• USGS Presentation
• Air National Guard Presentation
• EPA/Regulator Update
• Questions
• RAB meeting adjournment
A Restoration Advisory Board (RAB) is a stakeholder group that meets on a regular basis to discuss environmental restoration at a specific property that is either currently or was formerly owned by Department of Defense (DoD), but where DoD oversees the environmental restoration process.

RABs enable people interested in the environmental cleanup at a specific installation to exchange information with representatives of regulatory agencies, the installation, and the community.

RABs may only address issues associated with environmental restoration activities.

Health related issues are not addressed by the RAB. Health agency professionals will be available after the Navy and Air National Guard Environmental Restoration presentations.

Source: DoD RAB Rule Handbook
Environmental Restoration Status
Site 3 and Site 12 Landfills

• Two former landfills, Remedial Investigations showed:
  ▪ elevated levels of metals and PAHs in surface and subsurface soils.
  ▪ Site 3 groundwater has low levels of PCE.

• Feasibility Studies (FS) status.
  ▪ August 29, 2019 - Final Site 3 FS completed.
  ▪ August 30, 2019 - Final Site 12 FS completed.
  ▪ Documents will be available in the administrative record.
Site 3 and Site 12 Landfills (cont.)

- Proposed Remedial Action Plans (PRAPs) under review by EPA and PADEP.
  - May 13, 2019 - Draft-Final Site 3 PRAP submitted. EPA/PADEP comments provided.
  - August 28, 2019 - Draft Site 12 PRAP submitted.

- PRAP Public Comment period
  - A public meeting will be held during the 45 day public comment period.
  - Tentatively scheduled for late 2019.
Site 5 - Fire Training Area Groundwater
Site 5 Groundwater Remedial Action

• Anaerobic bioremediation system continues to operate successfully.

• Annual performance monitoring is being conducted in accordance with approved Operation, Maintenance, and Monitoring Plan.
  - May 2019 - Annual performance monitoring was performed.
  - August 2019 - Additional injections of amendments was started and will continue through October 2019.

• Results continue to show good conditions for biodegradation of volatile organic compounds (VOCs) and decreasing trends of VOCs.
Per- and Polyfluoroalkyl Substances (PFAS) Status
Summary of Drinking Water Actions

- The Navy has provided funds to HWSA for filtration system costs and drinking water connections above the HA. The total funding is over $18 million. Additional funds were provided in 2019.
- The Navy has funded filtration systems at five Horsham Water and Sewer Authority (HWSA) public wells (#10, 17, 21, 26, and 40) which were found to be above the HA. All are back to drinking water service.

<table>
<thead>
<tr>
<th>Private well sampling</th>
<th>Feb 2017</th>
<th>Current</th>
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<tbody>
<tr>
<td>Private wells sampled for PFOA/PFOS *</td>
<td>490</td>
<td>512</td>
</tr>
<tr>
<td>Private wells above lifetime HA (&gt;70 ppt)</td>
<td>89</td>
<td>100</td>
</tr>
<tr>
<td>Private wells not yet connected</td>
<td>27</td>
<td>7 **</td>
</tr>
<tr>
<td>Private wells below HA/monitored (&gt;40 ppt)</td>
<td>70</td>
<td>60</td>
</tr>
</tbody>
</table>

* Includes 47 wells sampled in Warrington, now managed by Air National Guard
** Of these, two (2) are currently being scheduled.
Private drinking water well sampling for PFOA/ PFOS and provision of bottled drinking water is being performed by Tetra Tech, a U.S. Navy contractor.

Point-of-contact is:
Tricia Moore,
Tetra Tech Project Manager
tricia.moore@tetratech.com
Phone: (610) 382-1171
The Navy is re-sampling most private drinking water wells, within the sampling area, that are not being regularly monitored.

- Obtains updated information and to ensure protectiveness.
- The wells closest to NASJ RB Willow Grove were sampled first.
- Tetra Tech is contacting property owners to schedule sampling.
- Re-sampling expected to complete in early 2020.
The Navy is performing a Remedial Investigation (RI) to better understand the nature and extent of the PFAS contamination, and facilitate evaluation of potential remedies.

Draft Phase I RI Report issued for regulatory review December 2018 with a copy provided to Horsham Township Library. Report identifies data gaps for further investigation, including potential migration pathways via storm water systems. Final report expected in October 2019.
Phase I PFAS Investigation
Stormwater System Evaluation

• The NASJ RB storm water system was evaluated to locate portions where PFAS impacted groundwater may infiltrate and discharge to local surface water. Over two miles of storm sewer lines reviewed, using remote video inspections in the fall of 2018.

• A technical memorandum identifying leaking storm sewer lines was completed in March 2019. A copy was provided to the Horsham Township Library.

• The Navy has awarded a contract to carry out the report recommendations. Work expected to commence in Fall 2019.

• Video inspection of additional sections planned for Fall 2019.
• Scoping Sessions with PADEP and EPA held in December 2018 and January 2019.

• The Phase II investigation includes, but is not limited to:
  ▪ Evaluation of groundwater extraction and treatment systems using pilot test information.
  ▪ Periodic surface water monitoring.
  ▪ Additional monitoring wells and soil sampling in source areas.
  ▪ Further evaluation of on-base storm water systems.
  ▪ Off-base monitoring wells
• The Navy has prepared a sampling and analysis plan (SAP) for monitoring off-site surface waters and sediment that may be impacted by PFAS from former NASJRB Willow Grove.

• First round of surface water and sediment monitoring was performed in July 2019, with support from the USGS. Drinking water purveyors were invited to participate. Sampling results are currently being validated.

• Navy is funding USGS to install additional stream gages to assess mass loading.

• The Navy will sample quarterly for a year and will coordinate future surface sampling with the Air National Guard.
Pilot Test at former Aircraft Maintenance Hangar 680

- Final Work Plan was submitted March 20, 2019
- **Pilot test progress:**
  - September 3, 2019 - PADEP discharge approval.
  - September 6, 2019 - Construction completed.
  - September 10, 2019 - Startup testing initiated. Treated water stored until confirmation of discharge reqmts.
  - Full-time operations will commence upon laboratory confirmation and PADEP concurrence that system is operating as designed.
    - Tentatively scheduled for late September 2019.
  - System will operate for an initial 6-month period.
- Pilot test provides groundwater and treatment information for design of a full-scale system.
Pilot Test Treatment System
Note:
Monitoring will be performed prior to discharge for parameters identified in the PADEP NPDES permit equivalency.
(1): Frac tanks will be utilized to hold the treated water while awaiting initial laboratory results to confirm discharge limits are met.
Pilot Test at former Fire Training Area (Site 5)

- The former fire training area (site 5) has elevated levels of PFOA and PFOS in the groundwater, and is a likely source area due to historical activities.

- An in-situ bio-stimulation remedy is operating successfully to reduce VOCs.
  - PFAS treatment cannot interfere with that remedy.
  - Extraction wells will likely be between the VOC plume and the base boundary.

- Lessons learned from the Hangar 680 pilot test will be used to prepare the draft work plan, which is anticipated by December 2019.
Phase II PFAS Investigation

Other plans in development:

• Draft Sampling and Analysis Plan (SAP) for on-base groundwater wells – expected in early 2020.

• Draft Sampling and Analysis Plan (SAP) for off-site groundwater monitoring wells.
  ▪ Draft prepared July 2019.
  ▪ Comments received and being reviewed.
Participation in DoD Funded PFAS Research

- SERDP/ESTCP are DoD-funded environmental research programs.
- NASJ RB Willow Grove is supporting ~$8M of SERDP/ESTCP funded research investigating new PFAS assessment and remediation technologies.
- Will continue to seek participation in additional SERDP/ESTCP work at NASJ RB Willow Grove or nearby NAWC Warminster.
- Participate in other Navy or USEPA funded research.

SERDP/ESTCP Projects and organizations leading the research:
- **Soil or Groundwater Treatment**
  12 Total Projects Participated
  Projects Since Last RAB
  - ER-1026 – Cornell University
  - ER-1497 – Univ. of CA Riverside
  - ER-1491 – Univ. of Illinois at Chicago
  - ER18-1300 – College of Wooster
  Working with College on field column study on new adsorptive resin.
- **Passive Treatment of Storm Water**
  ER18-1230 – Oregon St. Univ.
- **Assessment of Fate and Transport of PFAS in Surface Water**
  ER19-1073 (New Start) – Academy of Natural Sciences of Drexel University
  ER19-1193 (New Start and potential participation) – Towson State University

DoD’s SERDP/ESTCP PFAS website:
ACTIONS COMPLETED

- Final Site 3 and Site 12 FS completed.
- Draft Site 12 PRAP provided to regulators.
- First round of surface water and sediment monitoring completed.
- Hangar 680 pilot test construction completed, startup initiated.
- Draft SAP for off-site monitoring wells completed.
- Soil disposal – In July 2019, approx. 4,500 tons of PFAS were disposed at a RCRA* subtitle D non-hazardous waste lined landfill.

* Resource Conservation Recovery Act
ACTION Summary since previous RAB

ACTIONS SOON TO BE COMPLETED

- Final Site 3 and 12 Proposed Plans submitted to regulators.
- Site 3 and 12 proposed plan public meeting.
- Second round surface water and sediment monitoring.
- Draft work plan - pilot test at Former Fire Training Area (Site 5).
- Final Phase I PFAS Remedial Investigation report.
• Next RAB Meetings
  - December 4, 2019 @ 2:00 p.m. (Wed.)
  - March 2020 (date/location TBD)
  - May/June 2020 (date/location TBD)
Back-up / Additional Information
Environmental Restoration Program

Notes:
Yellow boxes indicate “Phases” of the ER Process. Boxes with blue horizontal stripes indicate “milestones.”
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<td>2</td>
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<td>Soil - OU 5</td>
<td>No Action ROD Signed June 17, 2010</td>
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<tr>
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<td>Groundwater - OU 9</td>
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<td>3</td>
<td>Ninth Street Landfill</td>
<td>Soil - OU 6</td>
<td>RI Completed Oct. 2011/FS Pending</td>
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<td></td>
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<td>Groundwater - OU 10</td>
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<tr>
<td>5</td>
<td>Fire Training Area</td>
<td>Soil - OU 4</td>
<td>Soil (OU 4) NFA ROD signed Sept. 2007</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Groundwater - OU 2</td>
<td>Groundwater (OU 2) ROD signed Sept. 2012</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Groundwater (OU 2) RACR Signed Sept. 2014</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Groundwater (OU 2) Final OPS and OM&amp;M Plan May 2015</td>
</tr>
<tr>
<td>6</td>
<td>Abandoned Rifle Range No. 1</td>
<td>. . .</td>
<td>Consensus Agreement for No Action Dec. 2007</td>
</tr>
<tr>
<td>7</td>
<td>Abandoned Rifle Range No. 2</td>
<td>. . .</td>
<td>Consensus Agreement for No Action Aug. 2008</td>
</tr>
<tr>
<td>8</td>
<td>Building 118 Abandoned Fuel Tank</td>
<td>. . .</td>
<td>NFA Agreement Oct. 2006</td>
</tr>
<tr>
<td>SSA 11</td>
<td>Aircraft Parking Apron</td>
<td>. . .</td>
<td>Eliminated From Consideration</td>
</tr>
<tr>
<td>12</td>
<td>South Landfill</td>
<td>OU 11</td>
<td>Final RI Feb. 2014, FS to follow</td>
</tr>
<tr>
<td>PFCs/PFAS</td>
<td>Perfluorinated Compounds/Per- and Polyfluoroalkyl substances</td>
<td>OU 12</td>
<td>TCRA Sept. 2015, Final PA/SI Mar. 2016, RI in progress.</td>
</tr>
</tbody>
</table>
**PFOA / PFOS Background**

- In mid-2014, PFCs known as Perfluorooctanoic Acid (PFOA) and Perfluorooctane Sulfonate (PFOS) were found in public drinking water wells near NASJ RB Willow Grove through an EPA program known as the Unregulated Contaminant Monitoring Rule (UCMR).

- The health advisory levels at that time were 0.4 micrograms per liter (µg/L), or 400 parts-per trillion (ppt), for PFOA and 0.2 µg/L, or 200 ppt, for PFOS.

- PFOA/PFOS are man-made chemicals used in many products, including fire-fighting solutions known as aqueous film-forming foam (AFFF), which were used at NASJ RB Willow Grove.

- In the summer of 2014, the Navy began sampling for PFOA/PFOS in private drinking water wells and worked with Horsham Water and Sewer Authority (HWSA) on the municipal drinking water wells.
• In May 2016, the Environmental Protection Agency established a lifetime Health Advisory (HA) level of 70 parts-per-trillion (0.07 μg/L) for combined PFOA and PFOS.

• The Navy’s priority continues to be eliminating exposure to PFOA/PFOS above health advisory levels in drinking water.

• Any health concerns should be addressed with your health professional. Weblinks to health information is provided at the end of this presentation.
Soils with high levels of PFAS were excavated between November 2018 and January 2019. Excavation areas were adjacent to fire station and Hangar 175. The Time-Critical Removal Action Memorandum and work plan are available in the administrative record and the Horsham library. Excavation was backfilled to grade with clean fill material that was tested prior to use.
PFAS Information and Resources

Department of the Navy (DON) Perfluorinated Compounds (PFC) / Perfluoroalkyl Substances (PFAS) website

NAVFAC BRAC PMO Websites (includes links to environmental information and the administrative record):

A subscription service is available on these websites to receive e-mail notification of new information.
PFAS Information and Resources (continued)

Environmental Protection Agency
https://www.epa.gov/pfas

Agency for Toxic Substances and Disease Registry

Pennsylvania Department of Environmental Protection
http://www.dep.pa.gov/Citizens/My-Water/drinking_water/Pages/default.aspx

Horsham Township

Warminster Township
http://warminstertownship.org/information-on-perfluorinated-chemicals-pfoa-and-pfos/
Horsham Water and Sewer Authority
https://www.horshamwater-sewer.com

Warminster Township Municipal Authority
https://www.warminsterauthority.com/

Pennsylvania Department of Health
http://www.health.pa.gov/My%20Health/Environmental%20Health/Pages/default.aspx

Horsham Township Library Information Repository
http://oldhtl.mclinc.org/WillowGroveNASindex.html
Restoration Advisory Board
Horsham Air Guard Station

Maj Lydia Stefanik
111 ATKW
19 September 2019
Updates Since May

- Environmental Restoration Program Sites:
  - No change

- PFAS Remedial Investigation:
  - Contract award expected by 30 September

- PFAS surface water treatment:
  - Phase II system continuing to operate
  - Phase III system and basin upgrades in procurement
  - Draft NPDES Industrial Stormwater permit under review
In 2015, ANG completed a Preliminary Assessment of potential PFOS/PFOA release sites at the Horsham Air Guard Station (AGS). Ten potential source areas identified in the PA include:

- Buildings that contained foam fire suppression systems
- Areas that may have received runoff from foam releases
- Stormwater sediment basin
- Former waste water treatment plant
- Former storage area for wastewater treatment sludge
- These potential source areas are being further investigated by Leidos in a PFOS/PFOA Facility Investigation
Potential PFOS/PFOA Source Areas
PFOS/PFOA in Surface Water on Horsham AGS

- PFOS/PFOA has been detected in surface water leaving the Horsham Air Guard Station. This water flows from a stormwater detention basin on the northwest boundary of the Base to Park Creek which flows to the Little Neshaminy Creek.
  - ANG is taking action to reduce this release of PFOS/PFOA to the Creek:
    - An updated carbon filtration system was installed on the outfall in August 2018 replacing the original system from September 2017. The system is designed to reduce dry weather flow PFOS/PFOA concentrations to below 70 PPT. Treats 60-100 gallons per minute.
    - Improved system in design now with target of treating 250 gallons per minute. This will treat all dry weather flow with capacity to treat some wet weather flow. Improvements to the stormwater basin will retain some precipitation runoff to allow system time to treat it.
The Air National Guard has a $13.5 million Cooperative Agreement with Warrington Township to:

- Connect residents with PFOS/PFOA impacted drinking water wells above the Health Advisory to municipal water and abandon the impacted private wells
- Install water mains as needed
- Installation and maintenance of carbon filters on five Township wells
- Install municipal water system interconnections with North Wales Water Authority to ensure Warrington Township has adequate access to water until carbon filtration is installed on municipal wells
Private Well Sampling

• ANG has contract in place with Wood to provide PFOS/PFOA testing of private drinking water wells and supply bottled water to properties with PFOS/PFOA at or above the lifetime health advisory level (HAL) for residents within our area of responsibility in Horsham, Warminster, and Warrington
  – The number of private wells sampled by ANG are:
  – Horsham: 5, all above HAL; 4 have been connected to municipal water (remaining one not in use)
  – Warrington: 150, 46 are above HAL; 33 have been connected
  – Warminster: 12*, 11 are above HAL; 8 have been connected

*Some of these properties are on Valley Road with Warminster mailing addresses but are located in Warrington Township

• Sampling contact for ANG area of responsibility: David Side at david.side@woodplc.com or (610) 877-6111
Private Well Sampling Map

PFC Sample Location Map as of October 2018
Horsham Air Guard Station
Horsham and Warrington Township

Legend
Health Advisory Level (HAL)
HAL is the sum of both PFOA+PFOS
(PFOA 0.070 µg/L, PFOS 0.70 µg/L)
- Sum of PFOA+PFOS concentrations above 0.070 µg/L
- Sum of PFOA+PFOS concentrations detected between
  0.040 µg/L and 0.070 µg/L
- Sum of PFOA+PFOS concentrations detected at or below
  0.040 µg/L

- PFOA & PFOS not detected
- Horsham Air Guard
- Former NAS JRB Willow Grove
- Sampling Area
- Air Force Administrative Order Boundary
- Horsham Township
- Warrington Township
- Warminster Township

Notes & Sources
Sources:
Street Base Map hosted by ESRI.
Wood Environment & Infrastructure, Inc.
751 Arbor Way
Blue Bell, PA 19422
(610) 828-8100

Figure 2
Private Well Sampling Map
Actions Planned for Next 3 Months

• PFAS Remedial Investigation:
  – Contract award expected with work plan development immediately following

• Surface water treatment:
  – Phase III system to be built
  – Draft NPDES Stormwater Permit is under review

• Continued private well sampling
Questions?

Keith Freihofer
keith.e.freihofer.civ@mail.mil
240-612-8762

Air National Guard Administrative Record:
select “Air National Guard”, then “Horsham AGS”, then click Search
Previously Presented Data
Environmental Restoration Program

Sites

Horsham AGS Boundary

ST-01 POL

Privet Road Compound
**Air Force Reserve ST-01 POL**

- **Former Air Force Reserve Petroleum Tank Area**
  - Originated from a jet fuel spill in the 1970’s
  - Injections of persulfate and Epsom salt replaced the biosparging system in 2016
  - Petroleum tanks were dismantled in 2016
    - Disposed 175 tons of petroleum impacted soil at licensed facility
    - Confirmatory sampling contract underway in accordance with 25 Pennsylvania Code, Section 245.310 of the Department of Environmental Protection (DEP)'s Rules and Regulations
- Results will be provided in a Supplemental Remedial Investigation Report and a Site Characterization Report in accordance with:
  - Closure Requirements for Aboveground Storage Tank Systems Technical Guidance Number 263-4200-001 (PADEP, 2017)
  - Pennsylvania Code, Chapter 245-310 Site Characterization Report

- **POC:** Ms. Margaret Patterson: margaret.patterson@us.af.mil
Privet Road Compound

- Former waste management area for Naval Air Station Joint Reserve Base Willow Grove
- Sampling completed in 2017 indicates trichloroethene (TCE) and tetrachloroethene (PCE) exist in the groundwater but levels are below maximum contaminant levels (MCL) set by the U.S. Environmental Protection Agency for drinking water quality
- Leidos, Inc. is contracted for continued long-term monitoring. Biannual groundwater sampling and land use control inspections will continue to be conducted pending a final site remedy
- Second Five-Year Review for Privet Road groundwater contamination was finalized in September 2018 and is available on the ANG Admin Record
PFAS Field Investigation Update

- GW sampling event conducted in March 2018
- Joint gauging event conducted 8-9 March 2018
- Baseflow SW sampling conducted 19 March 2018
- Rain event SW sampling conducted 28-29 June 2018
PFAS Reporting Update

• Documents available on Administrative Record
  – Final Facility Investigation Report
  – Final Groundwater Monitoring Reports for December 2017 Sampling Event
  – Final Groundwater Monitoring Reports for March 2018 Sampling Event
  – [Link to documentation]

• Final Stormwater Study Tech Memo submitted March 2019
• Final Conceptual Design Report submitted to ANG
• NPDES stormwater permit application submitted to PADEP 28 August
Groundwater Data Update

- Gauging conducted 8-9 March 2018
  - Semi-confined multilayer aquifer system, subdivided into four zones for contouring
  - Gradients trends northwest in each zone
- Sampling event conducted 5-15 March, 2018
  - Concentrations similar to previous events
  - 78 of 85 locations exceeded 70 PPT (ng/l) (combined PFOA/PFOS)
  - Highest concentrations found in three general areas: along the southern boundary, near Building 335, and near Building 201.
  - Highest concentrations at PMW01, Zones A, B, and C: 329,500 PPT, 147,400 PPT, and 186,900 PPT, respectively.
  - Next highest concentration at IMW-06 (49,000 PPT) along the southern boundary.
  - Four wells near Buildings 201 and 335 contained concentrations above 10,000 PPT.
GW Results: March 2018
Preliminary Evaluation of Regional Groundwater-Flow Paths near Willow Grove NASJRB and NAWC Warminster – Update –

September 19, 2019

Dan Goode and Lisa Senior
U.S. Geological Survey
Pennsylvania Water Science Center
U.S. Department of the Interior

in cooperation with U.S. Navy

This information is preliminary or provisional and is subject to revision. It is being provided to meet the need for timely best science. The information has not received final approval by the U.S. Geological Survey (USGS) and is provided on the condition that neither the USGS nor the U.S. Government shall be held liable for any damages resulting from the authorized or unauthorized use of the information.
Data from Navy and Air National Guard
Decreasing Pumping since 1990’s

Withdrawal Volume
‘Footprint’

More in 2017

More in 1999

Same in Both

Groundwater system in fractured bedrock and overlying weathered rock and soil, common in Piedmont of eastern United States

Water budget for PA Piedmont Region

Groundwater base flow to Streams

Figures modified from Pennsylvania Department of Environmental Protection, 2006.
2018 Field Conference of Pennsylvania Geologists
Geologic Cross Section near Willow Grove Naval Air Station showing dipping beds of the Stockton Formation (sandstone, siltstone, mudstone)

Geologic structure can affect groundwater flow - Beds of different lithologies and flow properties dip to the northwest; Diabase dike may act as a barrier.

From Rima and others, 1962
Cross-sectional Model of Groundwater Flow in Dipping Sedimentary Rock Layers with Two Types of Uniform Beds

Groundwater flow through dipping HIGH- and LOW-permeability beds

Figure modified from Risser and Bird (2003)
Non-Uniform Properties WITHIN Beds Also Affect Flow and Contaminant Transport Predominantly in Fractures, Limited in Unfractured Rock
Individual Fractures are Non-Uniform at Even Smaller Scales

Focused groundwater discharge from sandstone on road cut

www.youtube.com/watch?v=npFt8IZSVpI

“Groundwater models afford hydrologists a framework on which to organize their knowledge and understanding of groundwater systems, and they provide insights water-resources managers need to plan effectively . . . USGS software will continue to provide the tools they need.”
Purpose of Current Modeling

• “To describe and improve understanding of groundwater flow rates and directions under various pumping scenarios by developing a preliminary numerical groundwater-flow model . .”

• “The preliminary regional-scale model may help identify data gaps and selection of additional monitoring locations, and will form the basis for a more refined model that incorporates additional detail and data as available to further improve understanding of groundwater flow and contaminant transport in the area.”
Purpose of Current Modeling (continued)

- Framework for synthesis of hydrogeologic understanding, field tests, and monitoring data
- Establish regional groundwater fluxes for use in higher-resolution models of smaller areas
- Delineate areas that are regionally downgradient of contaminant source areas at bases
- Compare flow paths for selected years having different recharge and pumping, 1999 – 2017
- Provide a tool for management decision making – How will future pumping scenarios affect flow paths?
after Li and others (2015)
Model area w/ Land Surface Elevation, Locations of Groundwater levels & Stream gages

Norristown

Doylestown

Newtown

Adjust Model Input to Match Output to Data
1,009 groundwater levels
Stream baseflow at 8 gages

Elevation data from USGS (2016)
Model grid with highest resolution near pumping wells where flow paths converge.

Colored by Geology

Upper Stockton

Middle & Lower Stockton

Lockatong

Brunswick

Crystalline & Metasedimentary

Carbonate

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Illustrative Simulated Pathlines from Possible Sources

Vertical Exaggeration = 10

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Color shows relative travel time
Blue – Short
Red – Long
Regional Groundwater-Flow Paths
- 2010 paths
- 2005 paths
- Overlap of 2005 and 2010 paths

Example of Model Flow Paths for Different Pumping Conditions
North Penn Area 7 Superfund Site
Montgomery County

Well withdrawals (cubic meters per day)

- **2005 > 2005 < 2010**
- **2010**

from Senior and Goode (2017)
Next Steps

• Complete Draft USGS Report

• Complete Draft USGS Data Releases
  • Model
  • Datasets
    • Withdrawals
    • Streamflow

• USGS/DOI Fundamental Science Practices
  • Two technical colleague reviews
  • Approval by USGS

• Release to the Public
  • Reports, Datasets, Complete Model
    • Online @ usgs.gov
References Cited (not shown)


• National Academies of Sciences, Engineering, and Medicine, 2015 (pre-publication), Characterization, Modeling, and Remediation of Fractured Rock: The National Academies Press, 244 p.


U.S. EPA Update

Willow Grove Restoration Advisory Board (RAB) Meeting

September 19, 2019

Sarah Kloss, EPA Remedial Project Manager
U.S. EPA Region 3, Superfund Division
U.S. EPA Willow Grove RAB Update

Agenda Overview

• Recap of Regulator Roles
• Surface Water PFOS/PFOA Exposure
• Short-term vs. Long-Term Actions
Regulator Roles at Willow Grove

• EPA
  ▪ Drinking Water Program – protects current and future drinking water users
  ▪ Superfund Program – oversight of environmental cleanup

• Pennsylvania Department of Environmental Protection (PADEP)
  ▪ Drinking Water Program - protects current and future drinking water users
  ▪ HSCA Program – oversight of environmental cleanup
  ▪ NPDES Permits Program – regulate discharges to streams
Example of Shared Responsibilities

- EPA and PADEP are overseeing the design and goals of the groundwater extraction pilot study.
- PADEP sets the discharge limits for water leaving the treatment building via the discharge pipe.
Examples of EPA Oversight

• Ensure the Superfund process is being followed
• Ensure applicable laws are being followed
• Review sampling plans and identify data gaps
• Approve proposed actions to ensure they will be protective
• Recommend additional actions as needed
Surface Water Exposure
Recap: Ways Water Flows to Streams
Surface Water PFOA/PFOS Exposure

Potential Surface Water Exposure Pathways:

1) Ingestion: Exposure to PFOA and PFOS in surface water could occur through swallowing small amounts of water during recreational activities

2) Dermal absorption: Not a major exposure route for PFOA and PFOS

3) Inhalation: Not a major exposure route for PFOA and PFOS
Surface Water PFOA/PFOS Exposure: Screening Levels

• Screening levels are not cleanup levels, but tell us if further investigation is needed

• Screening levels for surface water recreational exposure are generally much higher than numbers based on drinking water exposure due to lower frequency of exposure and contact duration

• EPA doesn’t have national screening values for PFAS in surface water
Recreational PFOA/PFOS Exposure: Screening Levels

• A few EPA Regions, as well as individual states, have established surface water screening levels for PFAS

• Navy screening value = 1,430 ppt: uses EPA’s Office of Drinking Water oral Reference Dose for PFOA/PFOS
Surface Water PFOS/PFOA Exposure

• Based on the PFOS and PFOA concentrations found in the surface water samples compared to the Navy’s site-specific screening levels, risk from recreational use of the surface water is low

• This exposure pathway will be formally evaluated as part of the remedial investigation
Short-term vs. Long-term Actions

Preliminary Assessment/Site Inspection

Remedial Investigation

Feasibility Study

Proposed Plan

Record of Decision

Remedial Design

Remedial Action

Short-term interim actions
Short-term vs. Long-term Actions

- Preliminary Assessment/Site Inspection
- Remedial Investigation
- Feasibility Study
- Proposed Plan
- Record of Decision
- Remedial Design
- Remedial Action

Groundwater Restoration

Short-term interim actions
Short-term Actions

• Eliminate current drinking water exposures

• Prevent contamination of additional drinking water sources
  ✓ Air National Guard installed treatment system to reduce PFAS entering Park Creek from stormwater basin
  ✓ Navy plugged stormwater outfalls and expanded on-site stormwater basins to minimize discharge to streams
  ✓ Navy excavated and disposed of most highly contaminated soil that could be a source to groundwater
  ✓ Navy initiated groundwater pilot study for extraction and treatment of source area near HAGs boundary

• Monitoring to ensure that conditions are stable
Additional Short-term Actions Planned

• Navy: Installing off-site wells to continue to monitor conditions and assess extent of groundwater contamination

• Navy: Second pilot test extraction and treatment in the Fire Training Area

• Air Guard: Increasing capacity of the storm basin treatment system
Questions?

Sarah Kloss
EPA Remedial Project Manager
215-814-3379
kloss.sarah@epa.gov

Larry Brown
EPA Community Involvement Coordinator
215-814-5527
brown.larry@epa.gov

Rick Rogers
Chief of the Water Branch
215-814-5711
rogers.rick@epa.gov