APPENDIX F

DERIVATION OF MUNITIONS CONSTITUENT CONCENTRATIONS IN POTOMAC RIVER TEST RANGE SEDIMENT AND WATER

THIS PAGE INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

Figure Page

F.1 Introduction

This appendix discusses how the concentrations of munitions constituents (MCs) in the Potomac River Test Range (PRTR) in sediment and water were derived for use in screening potential effects on human health (Section 4.8 of the Environmental Impact Statement) and the environment (Sections 4.10, 4.11, 4.12, and 4.13 of the Environmental Impact Statement). It is divided into the following three sections:

- **Section 1**: Quantification of munitions, focusing on large-caliber projectiles.
- **Section 2**: Selection of munitions constituents of potential concern (MCOPCs), based on the mass of MCs fired into the river and the potential for toxic effects.
- **Section 3**: Modeling of MCOPCs in sediments and water.

The PRTR Complex (Figure F-1, Potomac River Test Range Complex) consists of land and water test areas that support research, development, test, and evaluation (RDT&E). The PRTR allows the Navy to conduct testing in a realistic, controlled environment – it effectively operates as a "ship on shore," collecting real-time data from a number of instrument stations. The water portion of the range is 51 NM long, covers 169 square nm (sq NM), and is divided into areas designated on nautical charts as the Upper, Middle, and Lower Danger Zones (UDZ, MDZ, and LDZ, respectively)[1]. The MDZ receives the heaviest use; it is 2.6 NM wide, 15.4 NM long, and covers 38.5 sq NM. Figure F-2 (Potomac River Test Range Primary Gunnery Target Area) shows the main gunnery target area. Danger zones are controlled during test events by Naval Surface Warfare Center, Dahlgren Division (NSWCDD) range boats and by staff observers stationed at range stations along the Potomac River. Live fire can be performed up to 20 NM or 40,507 yards (yds) down range.

F.2 Quantification of Munitions Use on the Potomac River Test Range

The US Navy established the Naval Proving Ground at Dahlgren, Virginia (VA) during World War I "to obtain the long ballistic water range (40,000 yards [yds]) (36,576 meters [m]) required for testing modern, high-power guns" (Rife and Carlyle, 2006). On October 16, 1918, the US Marines fired the first shot from a 7"/45 tractor-mounted Army gun down the Potomac River on the new proving ground (Rife and Carlyle, 2006).

Since 1918, the Navy has used the PRTR continuously for ranging and proving naval guns. The river range has also been used for testing, including all types of ordnance used by the US Navy and US Marine Corps on ships, aircraft, or land. The tempo of testing and operations, and therefore, the rate at which ordnance and other materials has been deposited in the PRTR, has

[1] The limits of the danger zones are defined in 33 Code of Federal Regulations (CFR) § 334.230 and shown on the National Oceanic and Atmospheric Administration's Nautical Chart 12286, Potomac River – Piney Point to Lower Cedar Point.

varied through the more than 90 years the range has been in operation. Testing and operations increased to varying degrees during war years – World War II (1939-1945), the Korean War (1950-1953), the Vietnam War (circa 1964-1975), the Persian Gulf War (1991-1992), and the ongoing wars in Afghanistan (2001-) and Iraq (2003-). During war years, the need to ensure that ordnance items received from manufacturers met military specifications before being delivered to ships resulted in the increase of lot acceptance and proof testing activities.

The tempo of operations is also influenced by the development of new weapons and weapon systems requiring RDT&E. RDT&E activities are cyclical by nature, and tests on a particular type of weapon, weapon component, or weapon system may take place once every three, five, or even ten years. When the weapon or system is being tested, it may be tested daily for weeks or months. Hence, firing levels may be higher in a particular year because a new gun or a new type of ammunition is being tested. Warfare spurs the development of new technology, which contributes to the increased amount of RDT&E activity taking place during wartime.

F.2.1 Large-Caliber Gun Firing

Through the decades, NSWCDD's ordnance mission has evolved from component (single-element) testing to systems integration and testing with defense networks connected to most shipboard combat-system elements (such as gun fire control, sensors, radars, and the Naval Fire Control System). The large-caliber guns fired most frequently are 5" guns. The MK 45 Mod 1/2 5"/54, a gun commonly found on ships in the Fleet, has a maximum sustained firing rate of 20 projectiles per minute and a maximum firing range of 13 NM (24 km). The 5" projectiles typically contain 6-10 pounds (lbs) (2.7 to 4.5 kilograms [kg]) of explosives (net explosive weight [(NEW]). The largest explosive projectiles fired at NSWCDD today are from a 155mm howitzer used by the US Marine Corps and US Army. Most 155 mm projectiles contain 11-15 lbs of explosives, and while 155 mm projectiles of up to 30 lbs (13.6 kg) NEW are available, NSWCDD's use of such larger projectiles would be very rare. The largest gun fired is the 8", but it is fired rarely and only inert projectiles are used.

In recent years, over 70 percent of the projectiles fired from the main gun line and other shot lines towards the Potomac River have been inert. The component most often being tested on inert projectiles is the fuze or detonator. A fuze typically contains a few ounces of non-explosive talcum-like powder that produces a puff of smoke to indicate to observers that the fuze has been successfully triggered. The remaining projectiles are live. Guns can shoot multiple bursts or intermittent single rounds.

The types of operations conducted at NSWCDD today that use large-caliber guns include:

- **Lot acceptance and proof testing.** NSWCDD conducts tests to ensure the safety and effectiveness of newly-delivered weapons and ammunition for most types of naval weapons, such as land attack systems, anti-aircraft guns, missiles, and projectiles, as part of Naval Surface Fire Support, a central mission of the Navy. NSWCDD serves as the final inspection and acceptance point for most naval gun barrels, ammunition, and all associated components,

Potomac River Test Range Complex

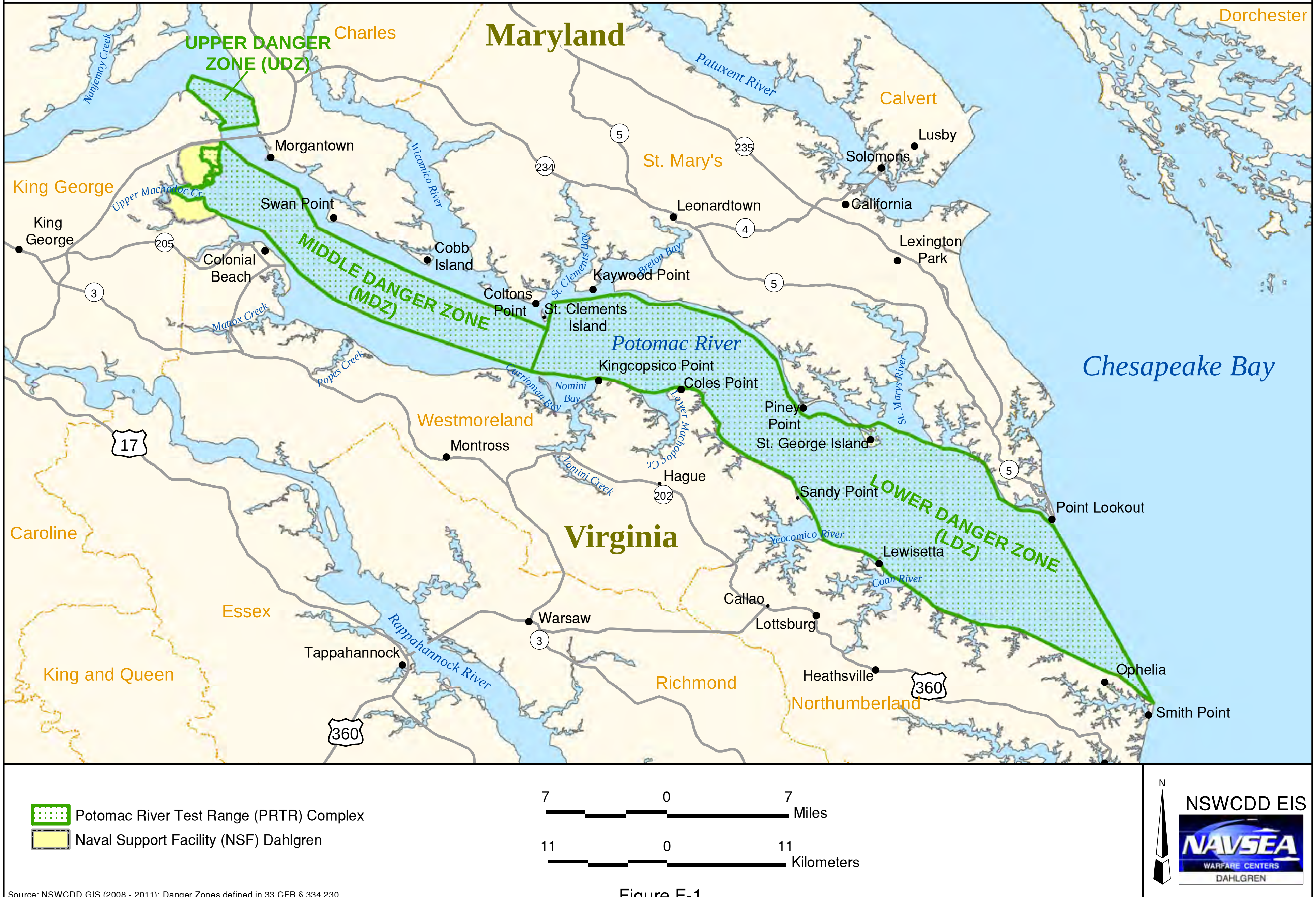


Figure F-1

THIS PAGE INTENTIONALLY LEFT BLANK

Potomac River Test Range Primary Gunnery Target Area

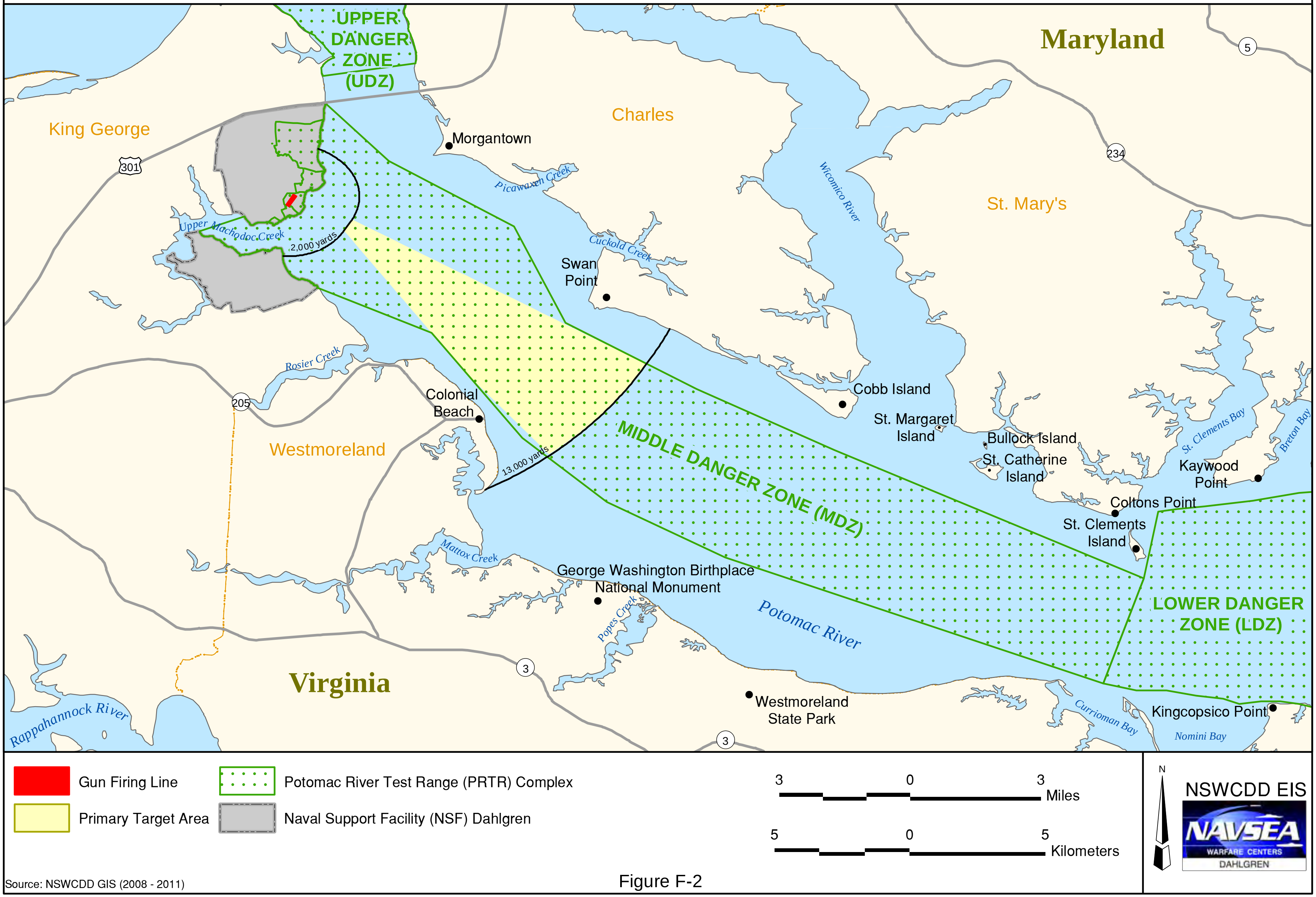


Figure F-2

THIS PAGE INTENTIONALLY LEFT BLANK

- including fuzes, primers and propellants, to ensure that sailors and marines are provided with safe, accurate, and reliable weapons. While missile components are tested at NSWCDD, no missiles are physically launched from the range complexes or Mission Area. Lot acceptance and proof testing, once a major portion of NSWCDD's ordnance operations, represents now only about 10 percent of the workload.

- **Projectile and fuze testing.** NSWCDD tests projectiles and their fuzes by firing them from actual Navy guns over the PRTR's combined water and land range, which accurately replicates real wartime (at-sea and littoral) environments and their associated "background clutter." Background clutter includes such things as surface reflectivity, optical glint, and EM interference. Because radio frequency, infrared, and other sensor characteristics are affected by water surfaces and moist atmospheric conditions differently from what occurs over land, testing on a water range is necessary to realistically assess munitions and fuzes to be against sea-based targets.

- **Development and certification of integrated targeting and fire control systems.** Today, a sensor such as radar or a laser not only detects a target, but must also transmit the information to one or more platforms, such as ships and aircraft, simultaneously. NSWCDD is working to enable almost immediate communication among sensors and platforms in order to make it possible to instantly engage a detected target with the most appropriate weapon from each platform.

- **Reactive materials.** Reactive materials are inert under normal conditions, but when they impact a target at very high speeds, they "react" with a high level of explosive force. The performance and effectiveness of reactive materials are being studied at NSWCDD.

- **Missiles, rockets, and launcher components.** This work focuses not on launches and flights of fully-operational missiles and rockets, but rather on the operation of some of their components, such as sensors and telemetry systems.

- **Operational improvements in reliability, accuracy and safety of weapons and ammunition.** One example of such work is RDT&E to produce longer-lasting, lighter weapons by using light composite materials in gun barrels.

- **Long-range guns that can fire accurate and reliable projectiles at distances in excess of 50 NM (93 km).** While NSWCDD is developing and testing the capabilities of these new guns and projectiles, they would not be tested at full range at the PRTR.

- **High-speed penetrating projectiles.** NSWCDD is working on developing new forms of high-speed penetrating weapons to serve as “bunker busters.”

NSWCDD has been and will continue to be the primary Navy RDT&E facility for improving existing ordnance and developing new types of ordnance. In the coming years, RDT&E to improve existing types of ordnance will decline while RDT&E for newer types of ordnance will increase. As a result, the tempo of large-caliber gun testing is expected to remain relatively constant for the foreseeable future.

Additionally, the use of sophisticated computer modeling and simulation to predict some aspects of ordnance behavior in place of actual live firing is contributing to keeping gun use from increasing. Modeling has played a substantial role in reducing the number of rounds fired into the PRTR. In the 1970s, from 15,000 to 18,000 rounds were fired in a year; since 1993, fewer than 5,000 rounds per year have been fired. However, as each new conflict demonstrates, no amount of modeling can completely replicate real-world environments, and, therefore, firing guns and projectiles will continue to be needed.

Over the last 15 years (1994-2008), NSWCDD has fired an average of 2,664 large-caliber (defined here as having a projectile diameter of greater than 20 mm [0.8 in] in diameter) projectiles annually. While some projectiles are fired into gun butts along the shore, most are aimed at targets in the river. The number of projectiles fired annually from large-caliber guns varies based on the types of tests being conducted in a given year. RDT&E testing is cyclical by nature and tests on a particular type of weapon, weapon component, or weapon system may take place once every three, five, or even ten years. When a weapon or system is being tested, it may be tested daily for weeks or months. Therefore, firing levels may be higher than average in a particular year because a new gun or a new type of ammunition is being tested.

NSWCDD fired an average of 2,900 projectiles annually in the years from 1995 to 2009, ranging from a low of 910 fired in the year with the smallest number of firings (2005) to a high of 6,170 (all inert) in 2004. In particularly active years since 1995, the average has been approximately 4,700 large-caliber projectiles fired annually.

Large-caliber gun firing in the foreseeable future is not expected to increase beyond the levels typical of the last 15 years. In an average year, the number of projectiles fired is expected to be less than 3,000. Because of the cyclical nature of ordnance RDT&E, the actual number fired annually and the proportions of each type of gun will vary from year to year.

F.2.2 Small-Arms Firing

Firing of small arms (defined here as having a projectile diameter of less than or equal to 20 mm) can take place on any of the ranges, but primarily occur on the Machine Gun Range, AA Fuze Range, and Main Range. In addition, penetration testing of light armor materials and testing of primers (caps or tubes containing a small amount of explosive used to detonate the main explosive charge of a firearm) of all sizes occurs at the Machine Gun Range. Active gun mounts are available for firing hundreds of types of small-caliber handguns, machine guns, and rifles.

Usually, the projectile of a gun smaller than or equal to 20 mm is referred to as a "bullet." Approximately 6,000 bullets are fired on the ranges annually. Most bullets fired are inert – made of solid metal with no explosive filler – but some are explosive. Approximately 90 percent of small arm firings take place entirely on the land ranges, with bullets being fired at gun butts. Approximately 10 percent of the bullets are fired into the river.

The number of bullets fired outdoors from small arms is expected to increase in the foreseeable future from the current 6,000 up to 30,000 per year to support potential Marine Corps requirements for the evaluation and development of small arms and related systems. For example, the evaluation of a Marine Corps squad assault rifle could require the test-firing of between 10,000 and 30,000 rounds outdoors per year. Future firing would take place mainly on the Machine Gun Range, but also on the Terminal Range, Churchill Range, and Harris Range. While most bullets will be fired into gun butts, approximately 10 percent of the bullets are expected to be fired into the waters of the PRTR, within 1,000 yds (914 m) of the shore. Based on the limited number and mass of smalls-arms fire entering the PRTR, the quantification of MCs into the PRTR focuses on large-caliber projectiles, as described in the next section.

F.2.3 Records of Projectiles Fired on the PRTR

Past use of munitions on the PRTR is based on fragmentary records and historical accounts for older records, with the exception of a series of firing logbooks that NSWCDD and its predecessor organizations have kept since the beginning of 1919 to the current day. These records are complete, with the exception of firing data from 1926 to 1935; for estimating the total number of projectiles fired into the PRTR, the missing data have been extrapolated. The data considered here include only large-caliber projectiles (defined as greater than 20 mm in diameter). For each projectile, the firing logs record:

- The type of gun fired
- The range or distance fired
- The date
- Whether the projectile was inert (non-explosive) or live (filled with explosives)

This section summarizes the available current and historical information regarding the types and approximate quantities of projectiles fired on the PRTR. The comprehensiveness of record-keeping has improved over time, and, therefore, recent records provide a fuller picture of munitions usage than do older records.

The total number of inert and live projectiles tested each year over the 90-year period from 1918 to 2007 is

Munitions Included

Included:
- Projectile firings recorded in the firing logbooks and with a diameter greater than 20 mm
- Projectile firings extrapolated for years with no log records (1926-1934)

Not Included:
- Firings not recorded in the firing logbooks
- Projectile with a diameter less than or equal to 20 mm
- Guns with limited usage
- Bombs, rockets, missiles, depth charges, mines, mortars, grenades

presented in Figure F-3, Total Number of Projectiles Tested on the PRTR (1918 - 2007). Based on the available records, from 1918 to 2007, NSWCDD tested 291,971 inert projectiles and 51,844 live projectiles on the PRTR, for a total of 343,815 projectiles. Inert projectiles accounted for 84.9 percent of the total and live projectiles accounted for 15.1 percent. Over the 90 years under consideration, an average of 3,820 projectiles – comprising an estimated 3,244 inert projectiles and 576 live projectiles – were tested each year. Table F-1 presents a summary of the quantity of testing for each munitions type.

Based on available records, 343,815 projectiles have been fired into the PRTR since 1918. Most of the projectiles (99.7 percent) have been fired into the MDZ, with a small number of projectiles (0.3 percent) tested in the LDZ, as shown in Table F-2 and Figure F-4, Distribution of Large-caliber Projectiles in the Potomac River Test Range. The UDZ was primarily used as a bombing target and there are no records of projectiles fired into the UDZ.

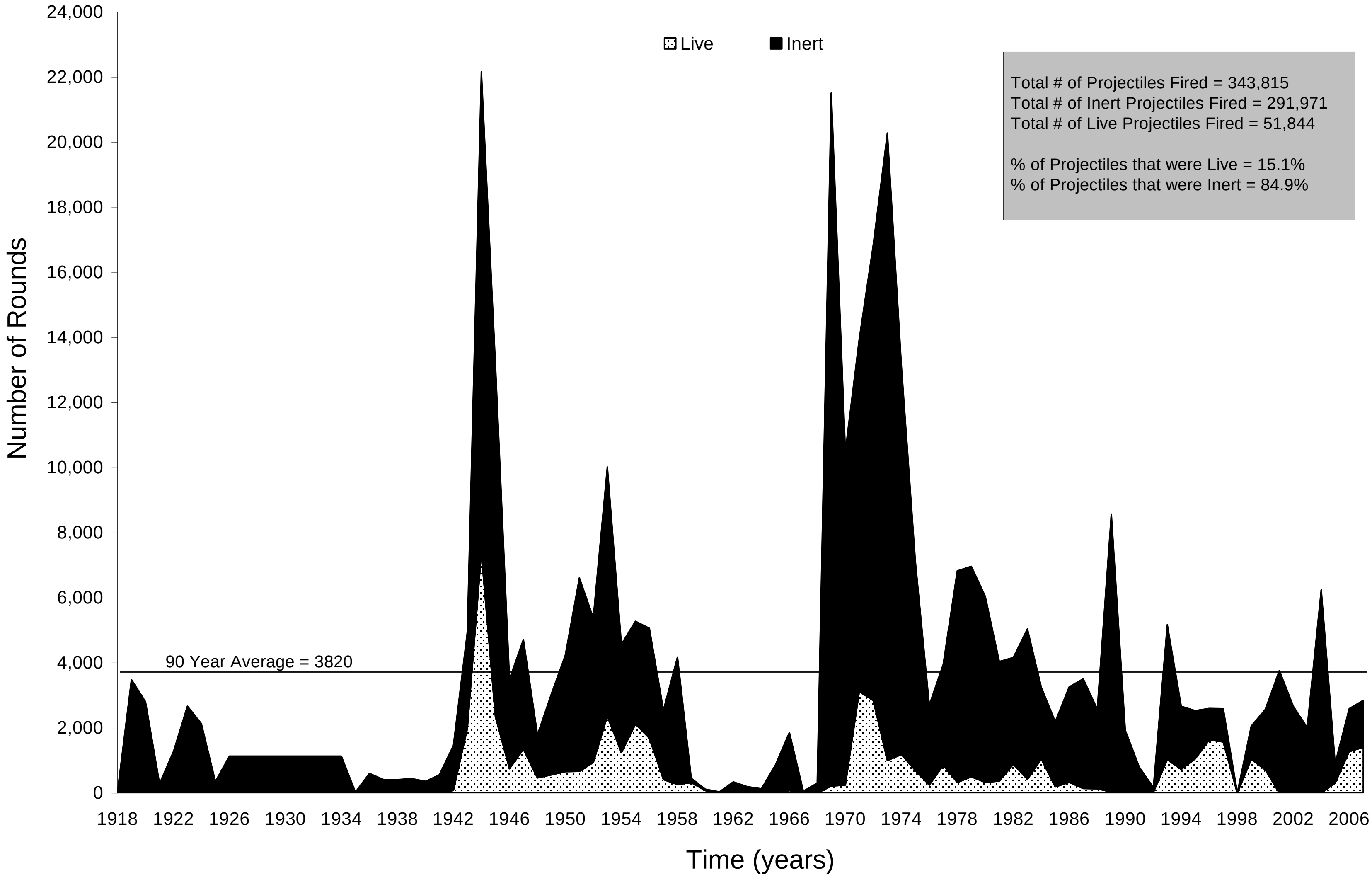
Although an overall density of 8,841 projectiles per sq NM (2,574 projectiles per sq km) can be estimated for the MDZ, the projectiles were not evenly distributed throughout the danger zone, as shown in Table F-3 and Figure F-5, Distribution of Large-caliber Projectiles in the Middle Danger Zone. Rather, there are zones within the MDZ that have higher or lower densities of projectiles. The zone between the Gun Firing Line (0 yd[2]) and 25,000 yds (22,860 m) accounts for 341,706 projectiles, or 99.4 percent of all munitions tested in the PRTR (Table F-3). This zone has a surface area of 31.19 sq NM (107 sq km). Assuming an even distribution of projectiles throughout this zone, there are approximately 10,956 projectiles per sq NM (3,190 projectiles per sq km).

Another heavily used target area within the MDZ is the zone from 10,000 to 17,000 yds (9,144 to 15,545 m). This zone covers approximately 8.5 sq NM (29 sq km), and was the target area for 248,798 projectiles from the last 90 years, yielding a density of approximately 29,270 projectiles per sq NM (8,579 projectiles per sq km). Within the 10,000- to 17,000-yd (9,144- to 15,545-m) zone, the zone from 11,000 to 13,000 yds (10,058 to 11,887 m) has the highest density of projectiles. This zone has a surface area of approximately 2.29 sq NM (7.86 sq km) and approximately 159,580 projectiles were fired into it, yielding a density of 69,686 projectiles per sq NM (20,303 projectiles per sq km). This appendix focuses on the two zones with the highest density of projectiles, with the zone from 11,000 to 13,000 yds (10,058 to 11,887 m) referred to as the “dense zone” and the larger zone from 10,000- to 17,000-yds (9,144- to 15,545-m) referred to as the “diffuse zone,” which includes the dense zone.

---

[2] Although 0 (zero) yd is used here, the gun firing line is actually about 150 yds (137 m) from the Potomac River.

Figure F-3
Total Number of Projectiles Tested on the PRTR (1918 - 2007)



THIS PAGE INTENTIONALLY LEFT BLANK

Distribution of Large-caliber Projectiles in the Potomac River Test Range

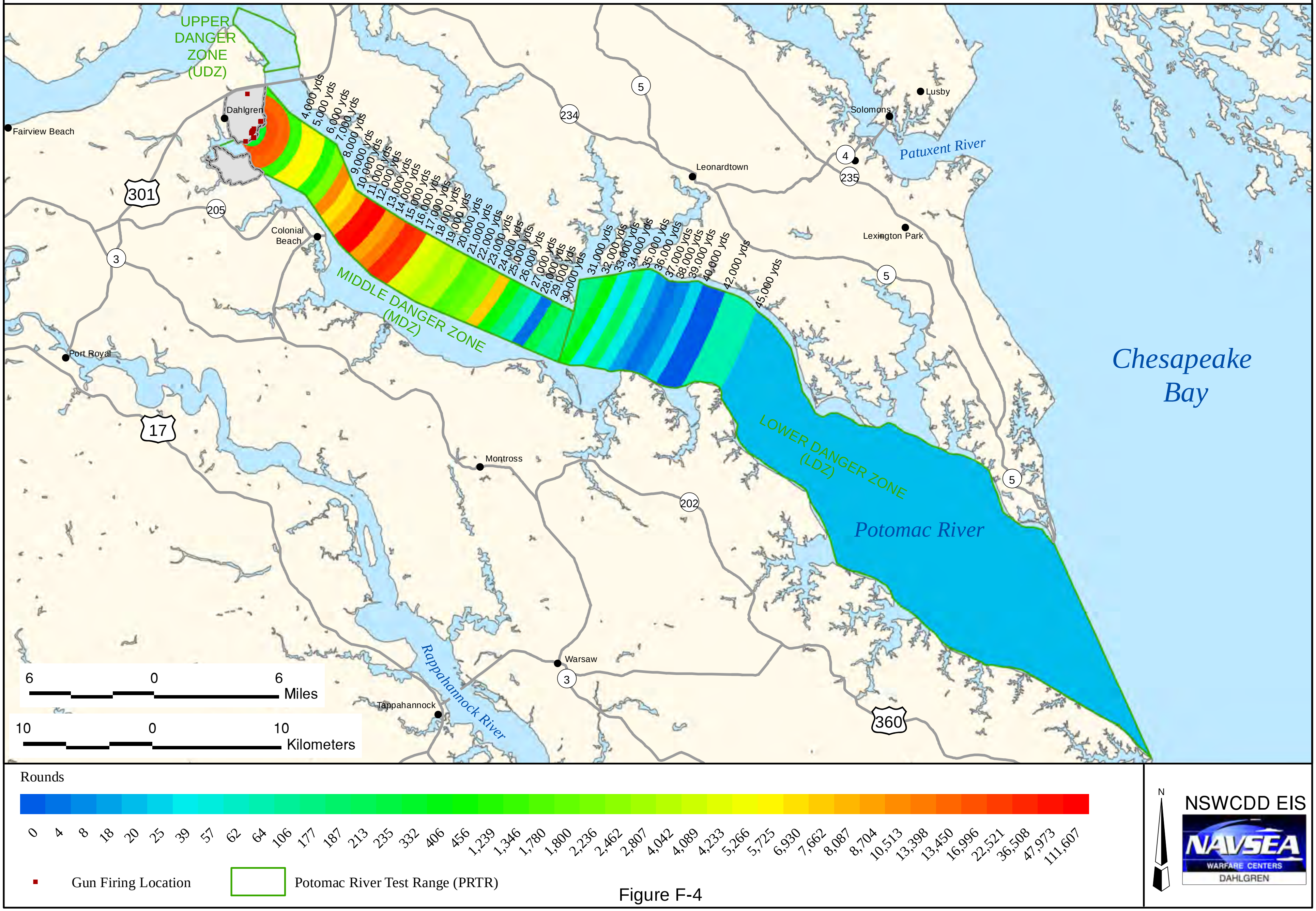


Figure F-4

Source: NSWCDD DES (2008 – 2011); Danger Zones defined in 33 CFR § 334.230.

THIS PAGE INTENTIONALLY LEFT BLANK

Distribution of Large-caliber Projectiles in the Middle Danger Zone

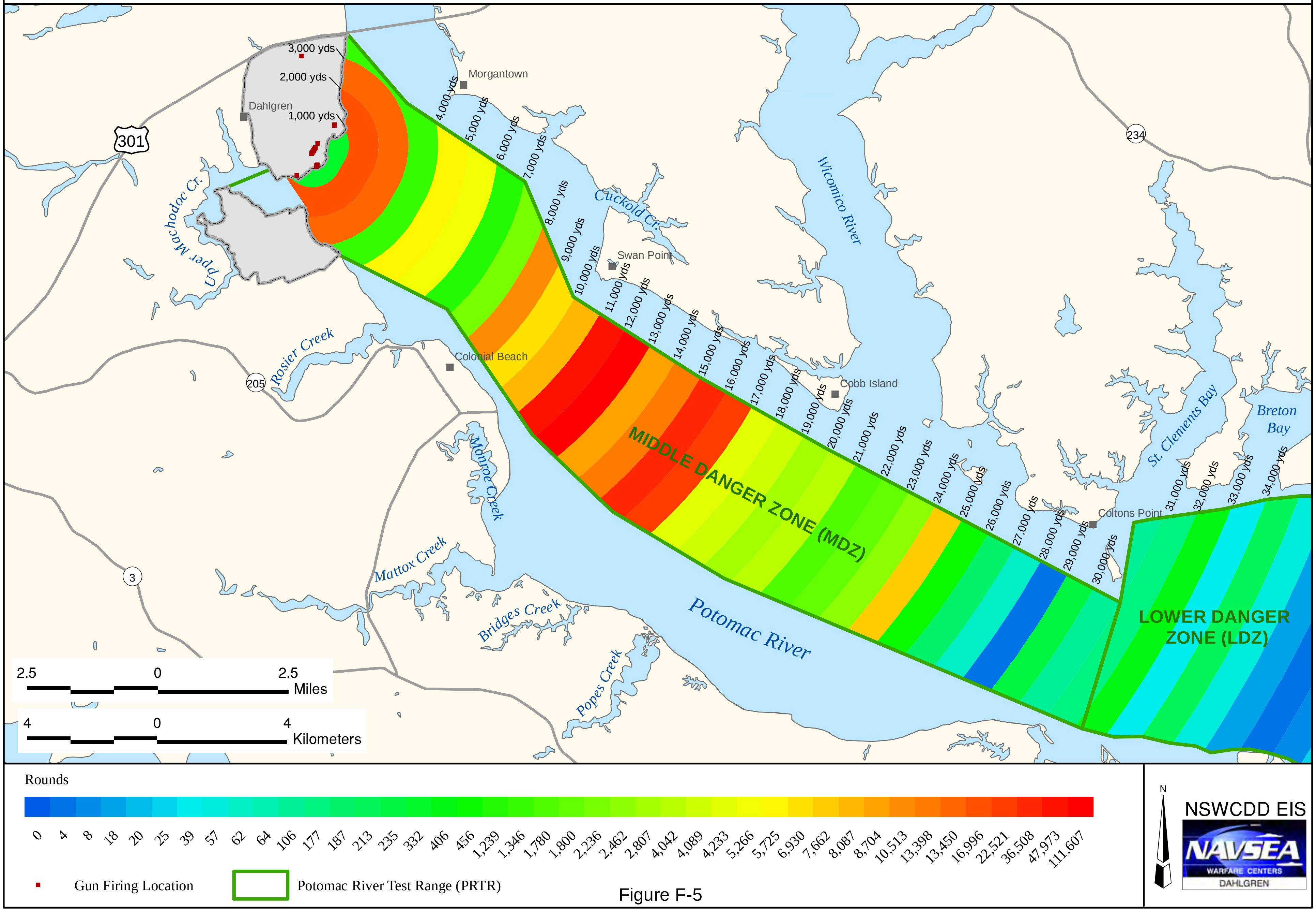


Figure F-5

Source: NSWCDD (2008-2011); Danger Zones defined in 33 CFR § 334.230.

THIS PAGE INTENTIONALLY LEFT BLANK

Table F-1
Quantity of Large-caliber Projectiles Fired on the PRTR from 1918 to 2007

Gun	# Inert	# Live	Total
30-mm	3,984	165	**4,149**
35-mm	0	358	**358**
1-pounder	729	4	**733**
40-mm	6,917	7,491	**14,408**
57-mm	4,384	240	**4,624**
6-pounder	171	2	**173**
60-mm	85	34	**119**
75-mm	65	36	**101**
76-mm	36,627	6,112	**42,739**
81-mm	37	23	**60**
83-mm	198	15	**213**
90-mm	334	42	**376**
105-mm	766	693	**1,459**
120-mm	252	105	**357**
122-mm	45	0	**45**
155-mm	524	151	**675**
3"	3,452	27	**3,479**
3” 15 caliber	154	1	**155**
3" 20 caliber	437	581	**1,018**

Gun	# Inert	# Live	Total
3" 23 caliber	72	0	**72**
3" 50 caliber	5,334	1,976	**7,310**
3" 70 caliber	15,861	954	**16,815**
4"	2,766	11	**2,777**
4" 50 caliber	1,841	75	**1,916**
5"	1,605	60	**1,665**
5" 15 caliber	7	45	**52**
5" 25 caliber	320	2	**322**
5" 38 caliber	81,335	10,749	**92,084**
5" 40 caliber	770	10	**780**
5" 51 caliber	1,778	15	**1,793**
5" 54 caliber	86,118	14,410	**100,528**
5" 62 caliber	5,110	959	**6,069**
5” 70 caliber	445	0	**445**
6"	114	0	**114**
6" 23 caliber	10	0	**10**
6” 25 caliber	12	0	**12**
6" 40 caliber	1,029	8	**1,037**
6" 45 caliber	970	5	**975**

Gun	# Inert	# Live	Total
6" 47 caliber	8,221	4,724	**12,945**
6" 53 caliber	1,525	4	**1,529**
7"	35	0	**35**
7" 45 caliber	809	1	**810**
8"	883	25	**908**
8" 35 caliber	134	2	**136**
8" 51 caliber	336	0	**336**
8" 55 caliber	6,900	79	**6,979**
12"	47	0	**47**
12" 40 caliber	41	0	**41**
12" 45 caliber	35	0	**35**
12" 50 caliber	38	0	**38**
14"	756	0	**756**
14" 33 caliber	11	0	**11**
14" 45 caliber	879	1	**880**
14" 50 caliber	166	1	**167**
16"	740	0	**740**
16" 45 caliber	4,506	1,610	**6,116**
16" 50 caliber	1,251	38	**1,289**

THIS PAGE INTENTIONALLY LEFT BLANK

Table F-2
Usage of the Danger Zones in the PRTR

Danger Zone	Surface Area (sq NM)	Number of Projectiles*	Density (projectiles per sq nmi)
UDZ	3.79	NA	NA
MDZ	38.77	342,756	8,841
LDZ	126.58	1,059	8.37
PRTR Total	169.14	343,815	2,033
Notes: NA – not available, as there are no records of projectiles fired into the UDZ. * Only rounds with a diameter of greater than 20 mm are included.			

Table F-3
Heavily-used Target Areas in the MDZ

Target Area	Surface Area (sq NM)	Number of Projectiles*	Density (projectiles per sq NM)
11,000 yards to 13,000 yards	2.29	159,580	69,686
10,000 yards to 17,000 yards	8.50	248,798	29,270
15,000 yards to 17,000 yards	2.67	59,029	22,108
0 yards to 25,000 yards	31.19	341,706	10,956
0 yards to 3,000 yards	3.43	30,778	8,973
24,000 yards to 25,000 yards	1.24	7,662	6,179
Notes: * Only projectiles with a diameter of greater than 20 mm are included here.			

F.2.4 Munitions Constituents

Raw firing activity data obtained from NSWCDD and Philadelphia National Archives Branch (PNAB) were sorted, compiled, and cross-referenced with common MCs and the uniquely military property constituents (hereafter “constituents”) information that was obtained from the Munitions Items Disposition Action System (MIDAS) database. The MIDAS database (https://midas.dac.army.mil) is a program developed by the US Army for storing, searching, processing, and retrieving data. MIDAS contains detailed technical data for a wide range of munitions, including the weight and material specifications for individual munitions. These specifications were used to determine the constituents associated with each munitions type (in this case, projectile) used on the PRTR.

Separate reports were obtained for all live and inert projectiles. Data were gathered on each projectile, excluding the cartridge (when appropriate), because the cartridge casing usually stays in the vicinity of the gun and does not enter the water range.

The MCs from the MIDAS database, combined with the firing activity data, provided information on the type of munitions used on the PRTR, the number of times that each type was tested, the year it was tested, the distance it was fired, whether it was live or inert, and the constituents associated with each type. The total weight for each constituent associated with each munitions type was calculated by multiplying the number of times a munitions type was tested by the weight of the constituent in each type. Summing those data across munitions types provided the total amount of each constituent associated with live and inert testing.

Several types of projectiles were not contained in MIDAS database, so their constituents had to be estimated using the constituents of similar munitions types as surrogates. For example, several of the 3” projectiles (i.e., 3”, 3” 15 caliber, 3” 20 caliber, and 3” 23 caliber) were not in MIDAS; therefore, their constituents were estimated based on those of the 3” 50 caliber projectile, which was available in the database. Overall, 110 constituents were identified in the 57 different munitions types tested at the PRTR. A total of approximately 33 million lbs (15 million kg) of constituents are associated with the 343,815 total projectiles fired into the PRTR.

Table F-4 lists the top 50 constituents, sorted by their total weight.

Table F-4
Top 50 Constituents in Live and Inert Projectiles Fired on the PRTR from 1918-2007 by Total Weight

Rank	Constituent	Total Sum of Weight (lbs)	Rank	Constituent	Total Sum of Weight (lbs)
1	IRON	30,980,921.82	26	COBALT	67.84
2	COPPER	958,087.21	27	CALCIUM SILICIDE	56.99
3	MANGANESE	463,238.57	28	LEAD AZIDE	55.43
4	AMMONIUM PICRATE	436,228.55	29	STRONTIUM NITRATE	44.72
5	ALUMINUM	148,631.69	30	CHARCOAL	39.54
6	RDX	85,165.59	31	ZINC CHROMATE	37.56
7	ZINC	61,467.90	32	HMX	36.38
8	NICKEL	47,957.43	33	SULFUR	26.36
9	PHOSPHORUS	13,862.73	34	CALCIUM STEARATE	21.67
10	TNT	12,524.58	35	LEAD STYPHNATE	16.27
11	ETHYLBENZENE	9,158.53	36	STEARIC ACID	15.24
12	LEAD	8,417.13	37	BERYLLIUM	14.83
13	WAX	7,719.48	38	CHARCOAL PWDR	14.29
14	METHYL ALCOHOL	4,948.83	39	LINSEED OIL	14.12
15	TETRYL	1,858.29	40	VANADIUM	12.55
16	ZINC PHOSPHATE	1,777.80	41	GRAPHITE	10.68
17	CHROMIUM	442.15	42	ISOPROPYL ALCOHOL	8.23
18	XYLENE	315.84	43	NITROCELLULOSE	8.08
19	POTASSIUM NITRATE	285.68	44	BARIUM STEARATE	7.82
20	SODIUM NITRATE	199.68	45	SHELLAC	7.45
21	CADMIUM	186.94	46	ANTIMONY	6.71
22	TOLUENE	144.33	47	PARAFFIN WAX	6.21
23	LEAD NAPHTHENATE 36%	103.52	48	POLYISOBUTYLENE	5.94
24	MAGNESIUM PWDR	77.08	49	NITROGLYCERIN	5.90
25	BARIUM PEROXIDE	76.63	50	N-BUTYL ALCOHOL	5.15

These top 50 constituents make up 99.9 percent of the total constituent weight. The constituents comprising the majority of the total weight are metals in the projectile's casing, which are common to both live and inert projectiles. The predominant constituent is iron, contributing 31 million lbs (14 million kg), or 93.2 percent of the total constituent weight. The second largest contributor is copper, at 958,087 lbs (434,580 kg), followed by manganese at 463,239 lbs (197,874 kg), contributing 2.9 percent and 1.4 percent of the total amount of constituent weight, respectively. Combined, iron, copper, and manganese account for 97.5 percent of the total constituent weight of munitions over the 90 years of testing. Figure F-6, Total Constituent Weight Associated with Munitions (1918 - 2007), shows the annual usage of constituents.

F.3 Selection of Munitions Constituents (MCs) of Potential Concern (MCOPCs)

MCs are any materials originating from UXO, discarded military munitions, or other military ordnance and munitions, including explosive and non-explosive materials, and the emission, degradation, or breakdown products of such ordnance and munitions (US Navy, 2008). The MCs evaluated here are associated with projectiles from large-caliber guns fired into the PRTR during RDT&E activities.

Military expended material constituents (MEMCs) are any materials originating or released into the environment from the use of military expended material (MEM). MEM include munitions as well as items, devices, equipment, and materials such as sonobuoys, flares, chaff, drones, targets, bathymetry measuring devices, communications devices, items used as training substitutes, and other instrumentation, that are uniquely military in nature and are used and expended in the conduct of military training and testing missions (US Navy, 2008). MEMC include constituents from explosive and non-explosive materials as well as the emission, degradation, or breakdown products from MEM. MEMC also include materials expended (such as propellants, weights, guidance wires) from items that typically are recovered (such as aerial target drones and practice torpedoes).

The majority of targets used during activities on the PRTR are virtual (i.e., locations defined by coordinates rather than physical targets), which minimizes the quantity of MEMCs generated during testing. As these materials constitute a small proportion of material used on the PRTR, only MCs were considered for this assessment.

F.3.1 Selection of Metal MCOPCs

To focus the study on those MCs most likely to contribute to human health and ecological risks, a subset MCs – munitions constituents of potential concern (MCOPCs) – was identified taking into account the total mass of constituents contained in the projectiles (cumulative over the 90 years under consideration), the toxicity of each constituent, and US Navy RSEPA guidance (US Navy, 2006).

For this purpose, MCs were divided into metals and explosives. As discussed in Section 3.3.5, the constituents comprising the majority of the total constituent weight are metals from the projectile casing that is common to both live and inert projectiles. Combined, iron, copper, and manganese account for 97.5 percent of the total constituent weight of the munitions fired over the 90 years of testing under consideration. Table F-5 provides a summary of the metal constituents by weight, obtained using information from the MIDAS database.

Table F-5
Metal Constituents by Weight in Live and Inert Projectiles

Rank	Constituent	Total Sum of Weight (lbs)
1	IRON	30,980,921.81
2	COPPER*	958,087.21
3	MANGANESE*	463,238.58
4	ALUMINUM	148,631.69
5	ZINC*	61,467.90
6	NICKEL*	47,957.43
7	LEAD*	8,417.13
8	CHROMIUM*	442.15
9	CADMIUM*	186.94
10	COBALT	67.84
11	BERYLLIUM	14.83
12	VANADIUM	12.55
13	ANTIMONY	6.71
14	SILVER	2.64
15	ARSENIC	0.33
16	SELENIUM	0.01

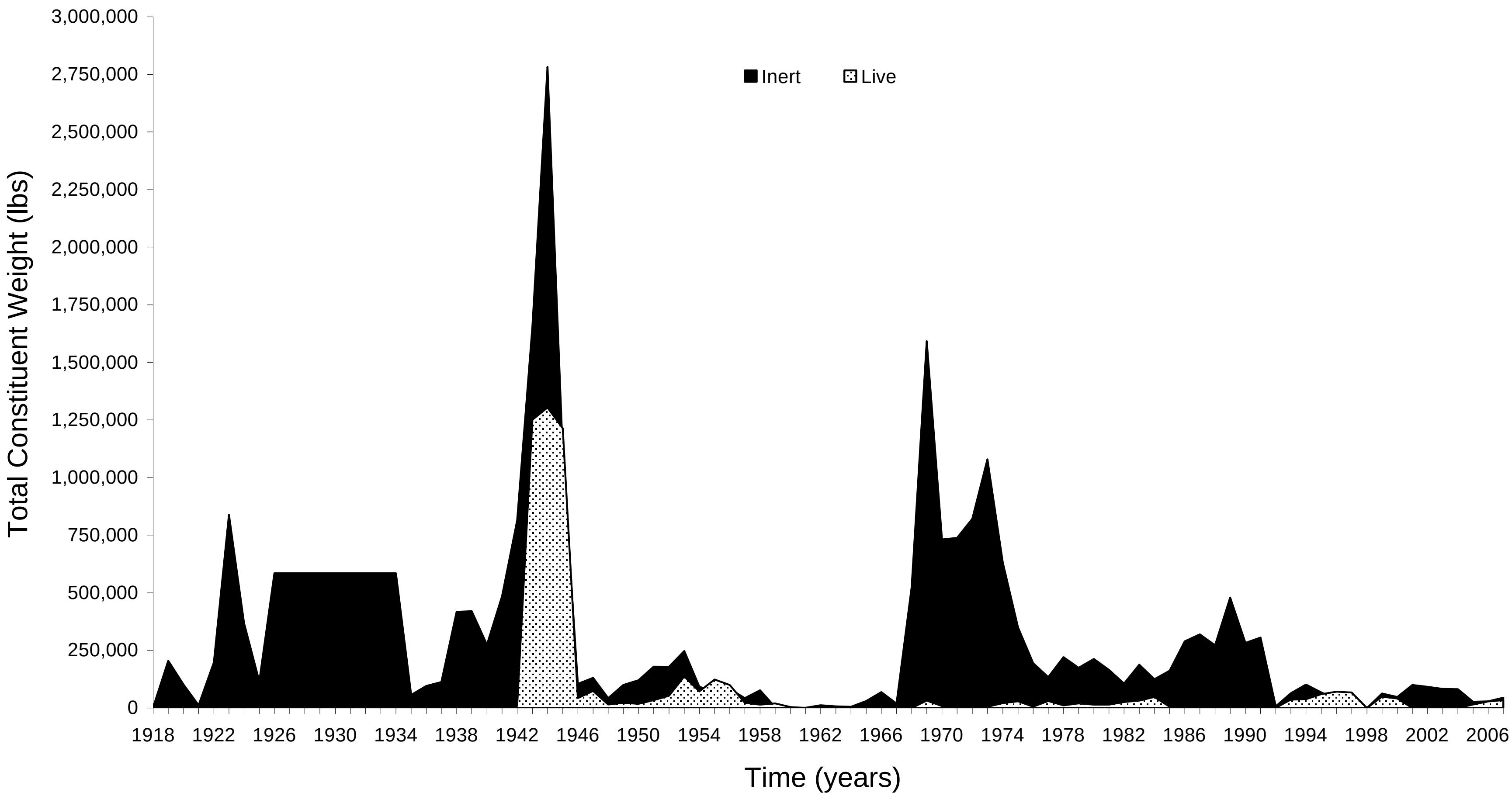
Note: * Selected for further analysis.
Source: MIDAS database.

Based on the overall mass introduced into the PRTR and potential toxicity, the following seven metals were selected for fate and transport modeling and for conducting the human health and ecological screening-level risk assessments summarized in Sections 4.8, 4.11, 4.12, and 4.13 of the Draft Environmental Impact Statement (DEIS), respectively:

- Cadmium
- Chromium
- Copper
- Lead
- Manganese
- Nickel
- Zinc

These seven metals are among the top ten contributors of metals to the PRTR by weight. The remaining three top-ten contributors were not selected for further evaluation. Although iron is the single greatest contributor, it was not selected because it is a common element that is ubiquitous in the environment and commonly used in everyday materials. Although ingestion of large

Figure F-6
Total Constituent Weight Associated with Munitions (1918 - 2007)



THIS PAGE INTENTIONALLY LEFT BLANK

quantities of iron can be harmful, iron in the PRTR sediments and water is not expected to be readily bioavailable, because it is not chelated (bound) to amino acids. (Chelated iron is contained in many iron supplements.) Aluminum is another major contributor, ranking fourth by weight, which was not selected because like iron it is an element used in everyday materials, common in the environment, and not bioavailable within the PRTR. The US Environmental Protection Agency (USEPA) considers aluminum to be biologically available only when present in soils and waters of less than 5.5 pH, whereas the Potomac River sediments and water are above 5.5 pH. Finally, the relatively small total quantity of cobalt released – about 68 lbs (31 kg) over 90 years, making it the tenth-ranked metal – combined with its low toxicity resulted in its being eliminated from further consideration as well.

The six remaining metals in Table F-5 – beryllium, vanadium, antimony, silver, arsenic, and selenium, in descending order of their total weights – were not selected because of the small amount of each of these metals introduced into the river by RDT&E operations on the PRTR.

F.3.2 Selection of Organic Munitions Constituents of Potential Concern

Organic constituents, focusing on the explosives used in munitions, were also selected as MCOPCs. As was done for metals, the selection was based on the total mass of constituents contained in the projectiles (cumulative over the 90 years of use), the toxicity of each constituent, and US Navy Range Sustainability Environmental Program Assessment (RSEPA) guidance (US Navy, 2006). The MIDAS database provided the total quantity of organics contained in the munitions. The top ten organic constituents by weight contained in live and inert projectiles are listed in Table F-6. The weight of the remaining organic compounds did not exceed 15.2 lbs (6.9 kg) for any individual compound. It is important to note that successfully detonated munitions (high-order detonations) consume almost all explosive material present in the round, leaving very little to enter the Potomac River. Thus, most of the organic explosive constituents are expended prior to entering the water, with only 0.001 percent of high-order detonation explosives entering the surface water/sediments of the PRTR (based on US Navy, 2006).

The following five explosives were selected as MCOPCs for modeling:

- Ammonium picrate
- HMX
- RDX
- Tetryl
- TNT

Table F-6
Top 10 Organic/Explosive Constituents by Weight in Live and Inert Projectiles

Rank	Organic/Explosive Constituent	Total Sum of Weight (lbs)
1	Ammonium picrate*	436,228.55
2	RDX*	85,165.59
3	Phosphorus[1]	13,862.73
4	TNT*	12,524.58
5	Ethylbenzene	9,158.53
6	Wax	7,719.48
7	Tetryl*	1,858.29
8	Xylene	315.84
9	Toluene	144.33
10	Charcoal	39.54
11	HMX*	36.38

Notes: * Selected for further analysis.
[1] Phosphorus is a non-metal inorganic element, which is included here because it can be used as an explosive.
Source: US Army Defense Ammunition Center, 2009, MIDAS database

The top seven constituents – ammonium picrate, RDX, phosphorus, TNT, ethylbenzene, wax, and tetryl – comprise more than 99.9 percent of the weight of all organics/explosives. Three of these compounds – RDX, TNT, and tetryl – and also HMX (11th by weight) are listed as munitions constituents of potential concern (MCOPCs) in US Navy RSEPA guidance (US Navy, 2006). Previous work on Army ranges identified RDX, HMX, TNT, and perchlorate as the principal energetic compounds of concern (e.g., Pennington et al. 2006; Jenkins et al. 2005). Because the Marines train with the same weapon systems as the Army, with the exception of some small arms systems, the energetic compounds of concern are the same for both services (Clausen et al., 2007). TNT, RDX, and tetryl are recommended for modeling in the RSEPA guidance (US Navy, 2006). Therefore, RDX, HMX, TNT, and tetryl were selected as MCOPCs for this study.

Perchlorate (ClO_4^-) is a naturally occurring and man-made anion that consists of one chlorine atom bonded to four oxygen atoms (USEPA, 2010). Perchlorate is used as an energetics booster or oxidant in solid propellant in some rockets, missiles, explosives, and pyrotechnics (Xu et al., 2003). From 1964 to 1974, 2.75” FFAR and 5” Zuni rockets were tested on the PRTR. A total of 34 Department of Defense Identification Codes (DODIC) were found in the Naval Ordnance Maintenance Management Program (NOMMP) for the 2.75”FFAR) and the 5” Zuni rockets. The summary of all compounds and the Toxic Release Inventory (TRI) data sheets were pulled from MIDAS for all 34 DODIC and checked for perchlorate. Of the 34 rockets examined, three 2.75” FFARs contained ammonium perchlorate and potassium perchlorate in their warheads. No 5” Zuni rockets contained perchlorate. As the rocket testing used almost exclusively inert rockets, it is extremely unlikely that warheads were tested on the PRTR.

Virtually no large-caliber projectiles contain perchlorate. Potassium perchlorate was recorded as being used only once in large-caliber projectiles fired by NSWCDD – in 1986, a total of 1.15 lbs (0.52 kg) of potassium perchlorate were used as part of 83mm munitions (US Army Defense

Ammunition Center, 2009) and was probably used as a stab primer (a pyrotechnic initiator) or as a delay in this projectile, rather than as fuel. Almost all of this explosive – more than 99.99 percent – would have been expended during firing (US Navy, 2006). Less than one thousandth of a gram is assumed to have entered the PRTR over twenty years ago and this amount is considered negligible. As there are other DoD installations up river (Naval Surface Warfare Center Indian Head, Marine Corps Base Quantico, and US Army Garrison Fort Belvoir), and perchlorate is found in fertilizers, any perchlorate detected in the river is unlikely to be attributable to the 1986 testing.

NSF Dahlgren has voluntarily tested for perchlorate in surface water, groundwater, soil, drinking water, and sediment across the facility to assess possible releases to the environment associated with range activities. Sampling for perchlorate was initiated in 2001 and is ongoing. Perchlorate concentrations have been detected in shallow groundwater predominantly at the open burning/open detonation (OB/OD) unit in the EEA Range Complex, used for land-based ordnance RDT&E. Perchlorate is present in this area due to the testing of rocket motors, mortars, smoke pots, and grenades. The contaminated shallow groundwater at the OB/OD unit on the EEA is being sampled and monitored in compliance with the OB/OD Resource Conservation and Recovery Act (RCRA) Subpart X Permit requirements. The Range Condition Assessment (RCA) report (NAVSEA, 2010) concluded that monitoring is currently in compliance with the permit requirements and that shallow groundwater contamination does not have the potential to migrate off-range. Therefore, no deficiencies in compliance were noted for the OB/OD unit (NAVSEA, 2010).

There is no evidence from surface water sampling results that perchlorate is leaving the land ranges and entering the Potomac River, although the Potomac River has not been sampled for perchlorate (Lovejoy, pers. comm., 2010). Therefore, based upon the RCA findings and the lack of evidence that perchlorate is entering the Potomac River, perchlorate was not selected to be an MCOPC.

The top-ranking explosive by weight, ammonium picrate, is a relatively insensitive[3] substance that was used widely during the First World War. It is used as a booster charge to set off secondary explosives, such as TNT. However, due to the large mass of ammonium picrate used, it was also selected as an MCOPC.

Phosphorus was used primarily in inert projectiles (over 86 percent), for which it likely served as a propellant. Almost all the phosphorus used in inert projectiles is assumed to be consumed prior to the projectile’s entering the water. The phosphorus used in live projectiles is not white phosphorus (used for screening, spotting, and signaling purposes), which is listed separately on MIDAS chemical inventory sheets. Phosphorus, an essential element for plant life, is not included in the list of MCOPCs in RSEPA guidance (US Navy, 2006). Phosphorus is a common constituent of agricultural fertilizers, manure, and organic wastes in sewage and industrial effluent, and large quantities in water can speed up eutrophication (a reduction in dissolved oxygen in water bodies caused by an increase of mineral and organic nutrients) (USGS, 2011). Quantities of phosphorus entering the Potomac River from munitions are minuscule when considered against the 30 million pounds per year of phosphorus entering Chesapeake Bay, about

[3] The sensitivity of an explosive refers to the ease with which it can be ignited or detonated.

25 percent of which comes from the Potomac River (USGS, 1995). Therefore, phosphorus was not selected as a MCOPC.

Ethylbenzene was not selected because it is a compound that was used primarily in inert projectiles (99.8 percent), for which it likely served as a propellant; therefore, it can be assumed that it was consumed prior to the projectile's entering the water. Ethylbenzene is found in natural products, such as coal tar and petroleum, and in manufactured products, such as inks, insecticides, and paints; it is also used as a solvent, in fuels, and in the fabrication of other chemicals (ATSDR, 2007). Wax, which was used in live projectiles, was not selected for further evaluation because waxes are generally non-toxic and the amount of wax used is not considered to pose potential risks to humans or the environment.

Conversely, although only about 36 lbs (16 kg) of HMX are recorded as having been used at the PRTR, this compound was selected as a MCOPC because of its potential toxicity and following recommendations provided in the RSEPA guidance (US Navy, 2006).

F.4 Mass Loading of Munitions Constituents in the PRTR

F.4.1 Distribution of Munitions in the PRTR

As discussed in Section 1, most munitions fired on the PRTR landed in the MDZ. After examination of the distribution of the projectiles, the following two areas within the MDZ (shown in Figure F-7, Areas Used for Munitions Modeling) were selected for modeling:

- **Dense zone.** The area 11,000 to 13,000 yards (yds) (10,058 to 11,887 m) from the firing line, where the largest concentration of munitions fired into the PRTR landed.

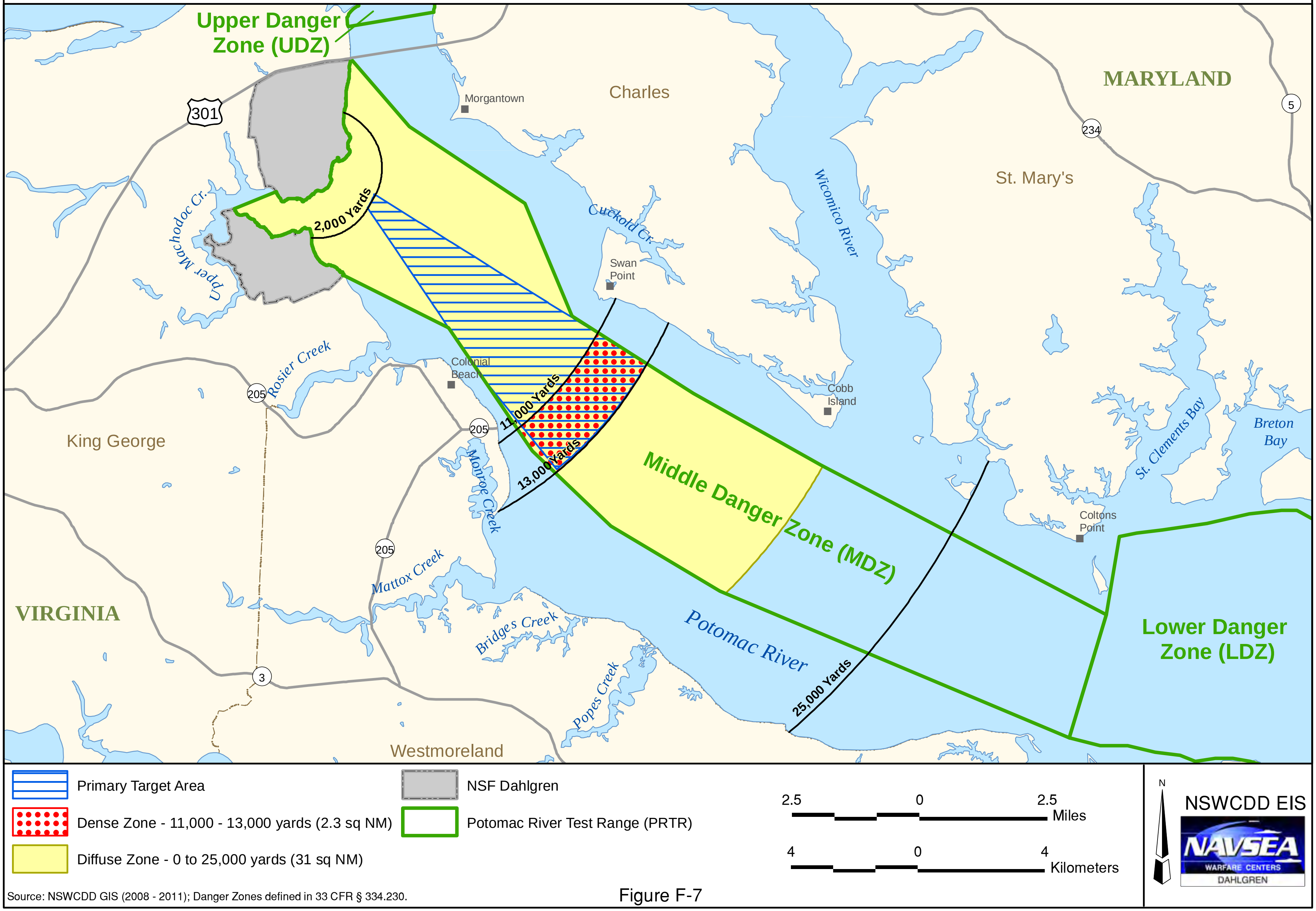
- **Diffuse zone.** The area 0[4] to 25,000 yds (0 to 22,860 m) from the firing line, where more than 99 percent of the munitions fired into the PRTR landed. The diffuse zone includes the dense zone.

Based on the available records, 165,204[5] of the 342,756 projectiles fired in the MDZ, or approximately 48 percent, landed in or exploded over the dense zone, which covers 2.3 sq NM (7.8 sq km) of the river, about 6 percent of the MDZ surface area. This zone is used to represent the "worst case" exposure because of the dense concentration of munitions deposited here.

The diffuse zone, encompassing 31 sq NM (106 sq km), was also considered for the three following reasons. First, only 25 of the 57 documented munitions types fired into the Potomac

[4] Although 0 yds is used here, gun munitions land a minimum of 100 to 150 yds away from the gun emplacement area.
[5] The number of rounds included in the dense zone differs slightly from that listed in Table F-3 for 11,000 to 13,000 yds because the dense zone in this evaluation includes rounds assumed to have landed at 11,000 yds, whereas in Table F-3, the 11,000- to 13,000-yds category includes rounds from about 11,001 to 13,000 yds. Using the larger number of rounds results in a more conservative evaluation of impacts to this zone.

Areas used for Munitions Modeling



Source: NSWCDD GIS (2008 - 2011); Danger Zones defined in 33 CFR § 334.230.

Figure F-7

THIS PAGE INTENTIONALLY LEFT BLANK

River have been fired into the dense zone, while all 57 types have been fired into the larger diffuse zone. Thus, the evaluation of a greater area provides a more complete chemical inventory, as chemical composition varies by munitions type. Second, the chemical composition of river water and sediments is influenced by the river's flow and tidal movement, which have a larger impact on a smaller zone than on a larger zone. Finally, the larger area of the diffuse zone provides a larger potential exposure area for human and ecological receptors that move up and down the river.

The diffuse zone received 99.4 percent (341,706 projectiles) of all munitions tested (343,815 projectiles; see Table F-5). Given the surface area of 31 sq NM (106 sq km) and assuming an even distribution of projectiles throughout this zone, the density of projectiles in the diffuse zone is 10,956 projectiles per sq NM (3,190 projectiles per sq km).

F.4.2 Munitions Groups

Munitions fired into the PRTR were divided into three groups:

- Live projectiles
- Duds (no detonation)
- Inert projectiles

Constituents from each of these categories enter the water and sediments of the Potomac River in different ways, as described below.

F.4.2.1 Live Projectiles

Live projectiles fired on the PRTR generally explode above the surface of the water. The casing of live projectiles is fragmented during the detonation and metals enter the water as pieces or small particles. These pieces settle on bottom sediments with no loss of metal to the atmosphere. For this study, all live-round metal fragments were assumed to settle on the surface of sediments at the sediment/river water interface. These fragments were conservatively assumed to take 100 years for complete dissolution in the Potomac River. This is considered conservative based on the results of Chendorain et al. (2002), who studied corrosion rates in unexploded ordnance (UXO) in soil and estimated perforation rates of ½-inch casings to range between 320 to 4,200 years. Therefore, the assumption that one percent of the metal remaining from live projectiles is completely dissolved each year is considered to be exceedingly conservative and actual rates could be 3 to more than 42 times slower.

Based on information in the literature (e.g., Walsh, 2007) and RSEPA guidance (US Navy, 2006), most of the organic (explosive) constituents from live projectiles can be assumed to be expended during detonation prior to entering the water. However, the percentage of organic constituents remaining and entering the water depends on whether the detonation is high- or low-order. A low-order detonation will result in a greater amount of explosives remaining from the round than a high-order detonation. For this analysis, per RSEPA guidance (US Navy, 2006), it was assumed that one thousandth of one percent (0.0001 percent) of the energetic filler remains following high-order detonation (Hewitt et al., 2003; Jenkins et al., 2000), whereas 50 percent remain following a low-order detonation (Hewitt et al., 2003; Lewis et al., 2002).

The US Army Defense Ammunition Center (USADAC, 2000, as cited in Clausen et al., 2006) calculated the average occurrence of low-order detonation for various munitions types (Table F-7). Twelve of these munitions types were used on the PRTR and the corresponding rate of low-detonation occurrence were applied to this analysis. For munitions not listed, a low-order detonation rate of 0.06 percent was applied, as directed in RSEPA guidance (US Navy, 2006).

F.4.2.2 Duds

Live projectiles that do not undergo low- or high-order detonation are duds. Duds have the same chemical content as live shells but their final location and weathering rate can be assumed to be similar to those of inert projectiles. Table F-7 provides percentages of live projectiles that can be assumed to be duds for munitions types based on data from the US Army Defense Ammunition Center (USADAC) (2000, as cited in Clausen et al., 2006). Site-specific dud rates contained in records provided by NSWCDD are also provided in Table F-7. For the remainder of munitions types, for which neither site-specific nor munitions-specific data were available, a dud rate of 3.0 percent was used as directed in the RSEPA guidance (US Navy, 2006).

F.4.2.3 Inert Projectiles

Most of the projectiles used during training are inert – that is, they do not detonate and, therefore, contain minimal quantities of explosives, which are generally expended as propellants or in fuzes. Overall, 85 percent of all fired projectiles recorded were inert.

Inert projectiles and duds can be assumed to be buried in Potomac River sediment due to the force at which they are propelled into the river and hit the bottom (Swope, NSWCDD, pers. comm., October 22, 2008). In addition, the upper layer of sediments has a water content of 90 percent or more (Goodwin et al., 1984), indicating that the soft sediments in the PRTR would not support heavy projectiles for long before they start sinking.

Inert projectiles and duds remain intact upon impact with the sediment because of their thick casings (Jenkins et al., 2001). Therefore, they are a potential source of metals as they corrode, and, in the case of duds, of explosives when corrosion breaches the casing[6]. However, most such munitions can be assumed to be buried deeply enough in the sediments – approximately 8 ft (2.4 m) below the surface – that the products of corrosion would not impact surface water or the upper sediment layers where most biota occur. In addition, the limited data available for metals in deeper sediments in the PRTR suggest that corrosion rates have been slow (e.g., Callender et al., 1984[7]).

[6] The explosives content of exposed inert shells, although small, was included in calculations.
[7] Callender *et al*. (1984) provides a copper and zinc profile for sediments near the dense zone. There is no metals peak in the deeper sediments, where most munitions are expected to be located.

Table F-7
Percentages of Low-order Detonations and Duds

Munitions Type	Low-order Detonation	Dud
Percentages from USADAC[a]		
Fuze	0.02%	3.96%
105-mm	1.07%	4.65%
106-mm	0.20%	2.68%
120-mm	0.00%	2.59%
152-mm	0.00%	0.00%
155-mm	0.99%	2.26%
165-mm	1.09%	1.63%
2.75”	0.00%	11.70%
3.5”	0.00%	1.08%
4.2”	0.14%	5.13%
40-mm	0.15%	1.37%
57-mm	0.00%	0.53%
60-mm	0.02%	2.34%
66-mm	0.04%	4.52%
75-mm	0.20%	5.70%
76-mm	0.12%	8.72%
8”	0.00%	0.99%
81-mm	0.11%	2.33%
83-mm	1.25%	1.96%
84-mm	0.15%	0.00%
90-mm	0.40%	8.06%
Percentages based on count provided by NSWCDD[b]		
76-mm	--	0.6%
6" 47 caliber	--	6.4%
5" 62 caliber	--	1.4%
5" 54 caliber	--	1.3%
5" 38 caliber	--	6.7%
3" 70 caliber	--	3.6%
16" 45 caliber	--	5.2%
155-mm	--	13.9%
Average:	0.28%	3.8%

Note: For munitions not listed, a low-order detonation rate of 0.06 percent and a dud rate of 3 percent were applied, as directed in RSEPA guidance (US Navy, 2006).

Sources:

[a] US Army Defense Ammunition Center (USADAC), 2000, as cited in Clausen et al., 2006.

[b] As contained in available NSWCDD PRTR records.

There are occasional reports of UXO or inert ordnance washing up along the Potomac River shoreline following storms. NSWCDD conducts recovery operations when such finds are reported (R. Mason, US Navy, pers. comm., April 6, 2005, as cited in ATSDR, 2006). Based upon the limited number of projectile that has been reported, it is estimated that 0.1 percent of the duds and inert projectiles fired (i.e., one in a thousand) are present at the sediment/river water interface due to exposure by storms, extremely high water flows, or other factors.

The metals in the inert projectiles and duds were conservatively assumed to take at least 400 years for complete dissolution in the Potomac River (i.e., 0.25 percent of total metal is assumed to dissolve each year). This rate is slower than the rate assumed for live projectiles because the exposed area of a non-fragmented projectile is less than for the remnants of an exploded live projectile and the metal has not been similarly stressed.

F.4.3 Additional Modeling Assumptions

The assumed rates of dissolution of the metal casing into river water of 1 percent per year for live projectiles and 0.25 percent per year for duds and inert projectiles do not take into account the initial form of the metal or its location on or within the round. In nature, metals are often present as alloys and the form of the metal affects corrosion rates. For example, the corrosion rate of nickel alloyed with copper is less than that of pure nickel.

Applying conservative assumptions, the casings of inert projectiles and duds were assumed to be breached after 50 years. This would allow the explosives contained in the duds and inert projectiles to enter the river water. It was assumed that the explosives in these projectiles entered river water over a one-year time period.

Explosives and metals were modeled using the averaged metals and explosives load and assuming 90 years of environmental exposure for corrosion. Concentrations of organic explosives and metals constituents were calculated based on the assumptions described above and following the steps described in the text boxes provided below. The constituent concentrations released to the environment over the 90-year time period, also referred to as the “source term” were then assigned to river water or sediment based on distribution or geochemical modeling, as described in the following section.

F.4.4 Fate of Explosives and Metals in Sediments and River Water

The environmental fate of organics and metal constituents varies depending on the environmental factors, geochemical conditions, and attenuation mechanisms that redistribute these constituents in the environment. Some natural attenuation mechanisms, such as advection, dispersion, dissolution, precipitation, and sorption, reduce concentrations in water and redistribute constituents between river water and sediment. Other processes, such as biodegradation, hydrolysis, and photolysis, may change or destroy the original explosive compound but are not applicable to metals. For this evaluation, adsorption – the adhesion of a chemical species onto the surface of particles – was the key process evaluated.

Quantitative Determination of the Distribution of Organic Explosives after Entering the Environment (Source Term): Stepwise Approach

1. Sum the number of rounds by type of munitions in each (dense and diffuse) zone.
2. Divide the total rounds into live and inert rounds by type of munitions.
3. Multiply the number of inert or live rounds by the explosives content in pounds for each type of round to get total pounds of each type of explosive. (Note: explosives compositions for live rounds include ammonium picrate, HMX, RDX, tetryl, and TNT and only tetryl and TNT for inert rounds.)
4. Determine the number of duds for each munitions type using (see Table F-7):
    a. The known number of duds at the PRTR - applicable to eight munitions types.
    b. The known percent of duds from the literature (USADAC, 2000 as cited in Clausen et al., 2006) - applicable to 10 munitions types.
    c. The average dud rate of 3.0 percent from the literature (US Navy, 2006; USADAC, 2000 as cited in Clausen et al., 2006) -applicable to 39 munitions types.
5. Subtract the explosives in duds from the live rounds and add them to the inert rounds.
6. Multiply the inert round and dud round explosives by 0.001 to obtain the explosives in rounds exposed at the river water/sediment interface.
7. Divide the pounds of explosives from live rounds into high-order and low-order detonations by using (see Table F-7):
    a. The percentage of low-order detonations - applicable to 12 munitions types.
    b. A low-order detonation rate of 0.06 percent (US Navy, 2006) - applicable to 45 munitions types.
8. Multiply high-order explosives by 0.00001 and low-order explosives by 0.5 to determine the pounds of live explosives entering water. Explosives in inert rounds and duds are not multiplied by any factor because they have not exploded.
9. Divide the total explosives by the total number of years of record (90 years) to get an average annual input and convert from pounds of explosives to milligrams per liter of explosives using:
    a. For explosives from live rounds, the volume of river water in the applicable zone.
    b. For explosives from inert rounds and duds, the volume of water in 10 cm of water overlying the sediments extending across the area of the applicable zone.
10. Combine explosives from live rounds, duds, and inert rounds to get total explosives in water in contact with the sediment surface.
11. Compare concentrations with water solubility to make sure these values are not exceeded.
12. Determine the distribution of explosives between sediment and river water using the adsorption distribution coefficient (see Equation F-1).
13. Divide the resulting concentration adsorbed to obtain monthly concentration adsorbed to sediment (mg/kg dry weight) due to sedimentation rates of greater than 1 mm per month.

F.4.4.1 Environmental Distribution of Explosives

The adsorption of explosive constituents by sediment results in partitioning between sediments and river water. There is evidence that explosives are adsorbed by organic carbon, clay, and minerals containing a large percentage of iron (e.g., Pennington and Brannon, 2002; Larson et al., 2008). The present evaluation considered adsorption of explosives by organic carbon only. The distribution of explosives between the organic fraction of the sediments and river water can be determined using the adsorption distribution coefficient:

$$K_d = K_{oc} \times f_{oc} \qquad \text{(Equation F-1)}$$

where:

K_d = concentration adsorbed to soil / equilibrium concentration in water
K_{oc} = adsorption factor for organic carbon specific to the adsorbed constituent
f_{oc} = fraction of organic carbon in sediments at the river water-sediment interface

The K_{oc} values for this evaluation listed in Table F-8 were obtained from the existing literature (Walsh et al., 1995; Talmage et al., 1999). The fraction of organic carbon (f_{oc}) values of 0.016 (1.6 percent total organic carbon [TOC]) for the dense zone and 0.023 (2.3 percent TOC) for the diffuse zone were used based on data from sediment cores collected within or close to these zones (Goodwin et al., 1984; Glenn, 1988; Versar, 2008).

Table F-8
Water Solubility and Organic Carbon Partitioning Factors

Explosive	Water Solubility [a] (mg/l)	Organic Carbon Partition Coefficient (K_{oc}) (l/kg) [b]
Ammonium Picrate	10,000	0.0214[c]
HMX	5.0	2.8[d]
RDX	42	0.88 - 2.4 (0.832[e])
Tetryl	80	2140[a]
TNT	130	1830[a]

[a] Walsh et al., 1995.
[b] l/kg = liters per kilogram.
[c] Based on conversion from K_{ow} to K_{oc}: $\log10 K_{oc} = 0.00028 + 0.983 \log10 (K_{ow})$ from Talmage et. al., 1999. K_{ow} value from Clu-In.org web site (Undated).
[d] Talmage et. al., 1999.
[e] Data from Talmage et. al., 1999, who used conversion factor from K_{ow} to K_{oc} (see note c).

Table F-9 presents calculated surface sediment and overlying water concentrations of explosives for the dense and diffuse zones. The first column for each zone lists the concentration of explosives in the water column resulting from the input from live projectiles and the second column provides the concentration in river water near the sediment resulting from the explosives in inert projectiles and duds.

Table F-9
Modeled Explosive Concentrations in Potomac River Sediment and Overlying Water

Explosive	Annual Input		Adsorption coefficient (Kd)[a] (l/kg)	Sediment Concentration Adsorbed (mg/kg dw)		Daily Concentration in Water Column [d] (mg/l)
	From Live Projectiles into Water Column (mg/l)	From Duds and Inert Projectiles Near Sediment Surface (mg/l)		Annual [b]	Monthly [c]	
Dense Zone						
Ammonium Picrate	1.89E-02	8.80E-05	3.42E-04	6.49E-06	5.41E-07	5.17E-05
HMX	1.63E-06	1.06E-08	4.48E-02	7.34E-08	6.11E-09	4.46E-09
RDX	1.23E-02	1.71E-04	1.33E-02	1.66E-04	1.38E-05	3.37E-05
Tetryl	2.09E-04	1.81E-06	3.42E+01	7.23E-03	6.03E-04	5.74E-07
TNT	1.22E-03	2.14E-06	2.93E+01	3.58E-02	2.98E-03	3.34E-06
Diffuse Zone						
Ammonium Picrate	9.81E-04	8.53E-06	4.92E-04	4.87E-07	4.06E-08	2.69E-06
HMX	9.49E-07	4.17E-10	6.44E-02	6.12E-08	5.10E-09	2.60E-09
RDX	2.09E-04	2.48E-06	1.91E-02	4.05E-06	3.37E-07	5.73E-07
Tetryl	6.00E-06	9.38E-08	4.92E+01	3.00E-04	2.50E-05	1.64E-08
TNT	2.32E-04	2.71E-07	4.21E+01	9.77E-03	8.14E-04	6.35E-07

Notes:
l/kg = liters per kilogram.
mg/l = milligrams per liter or parts per million.
mg/kg dw = milligrams per kilogram dry weight or parts per million.
[a] Kd = Koc x foc.
[b] Concentration adsorbed = concentration in river water near sediment river water interface x Kd.
[c] Sediment refreshed monthly due to sedimentation rate in dense zone of 1.8 cm per year and in diffuse zone of 1.3 cm per year (Knebel et. al, 1981).
[d] Adsorption is localized and has minimal impact on explosives concentrations in water column; therefore, daily concentrations are calculated from water-column concentrations.

F.4.4.2 Environmental Distribution of Metal Constituents

Metal mobility varies depending on geochemical conditions. Highly acidic or alkaline conditions may induce dissolution, and oxidation-reduction (redox) conditions impact mobility. Knowledge of the geochemical environment is important for understanding the distribution of metals between river water and sediment. Studies performed in the Chesapeake Bay system, which includes the Potomac River, have resulted in the collection of geochemical, chemical, and other environmental data. In particular, Martin et al. (1981) and Goodwin et al. (1984) provide comprehensive data for sediment and pore water[8] composition based on the analysis of sediment coring taken in the Potomac River in 1978-80. Information from these reports is used in the following discussion. A text box describing the stepwise procedure used to calculate metal concentrations in sediments and water is provided at the end of the previous section.

The pH of water and sediments influences the fate of metals River water and sediments in the MDZ have neutral-to-slightly alkaline pH values. According to data collected by Goodwin et al. (1984), the pore-water pH ranges from 6.9 to 7.9 in the upper sediments of the diffuse zone. Pore-water Eh[9] values vary from oxidizing to reducing at different locations. However, concentrations of organic carbon and sulfide indicate that sulfate-reducing conditions occur in deeper sediments, beginning at about 2 ft (0.6 m) below the sediment surface.

Most inert munitions and duds can be assumed to be buried about 8 ft (2.4 m) deep in the sediments. This estimate is based on 8-inch canisters that Explosives Ordnance Disposal units have recovered from the river. The 8-inch canister is a blunt-nosed projectile, the descending velocity of which is greatly reduced by a deployed parachute. Recovery of these canisters ranged from 2 to 8 ft (0.6 to 2.4 m) below the river bottom (Goss, NSWCDD, pers. comm. October 19, 2009). The limited data for sediment at this depth indicate that conditions are sulfate reducing, which would result in most metals precipitating as sulfides. The data from a core at the mouth of the Potomac River indicate that sulfate-reducing conditions occur in sediments at a depth of about 1.6 ft (0.5 m). A deeper zone of oxidized conditions may exist, but the extent of such a zone is unknown (Pohlman, 2008). Total carbon data plotted for a sediment core near the dense zone to a depth of 27 ft (8.3 m) at 20-in (0.5-m) intervals indicate an abundant reserve of carbon in sediments that should be available to retain reducing conditions (Callender et al., 1984).

In addition to the expected metal immobility due to sulfate-reducing conditions, most munitions can be assumed to be buried deeply enough in the sediments that the products of corrosion, if any, would not impact either the surface water or the upper sediment layers, where biota occur. Therefore, this evaluation focused on fragments and particles from live munitions and intact munitions casings that can be expected to be at or near the river water-sediment interface. DO is present at the sediment surface, although concentrations fluctuate seasonally (Jaworski et al., 2007). In this type of environment, adsorption is the dominant mechanism that removes dissolved metals from the water.

To determine metal partitioning between river water and sediment, the geochemical modeling program PHREEQC (Parkhurst and Appelo, 1999) was used for equilibrium modeling. PHREEQC simulates chemical reactions and transport process in water and distributes metals to different phases (dissolved, precipitated, or adsorbed) based on reactions and governing equilibrium constants. The USGS WATEQ4F database (Ball and Nordstrom, 1991; Parkhurst and Appelo, 1999 updates) includes data on these types of reactions for metals of interest, with the exception of chromium. The MINTEQ database[10] was used for modeling chromium;

[8] Pore water is the water filling the spaces between grains of sediment.
[9] Eh is the reduction potential or redox potential, which is a measure of the tendency of a solution to donate or accept electrons. 1 Eh = redox in terms of the standard hydrogen electrode units.
[10] See PHREEQC FAQs for more information; available at: http://wwwbrr.cr.usgs.gov/projects/GWC_coupled/phreeqc/

however, adsorption data for chromium are not part of the database. Therefore, to evaluate the possible impact of chromium adsorption to sediment, it was conservatively assumed that the concentration adsorbed to sediment was the same as the concentration in river water near the river water-sediment interface. Other metals were modeled together, to simulate the effects of competitive adsorption.

Geochemical modeling requires input data for water and the adsorptive solid. River water chemistry input was based on pore-water data for the shallowest available pore-water interval (1 cm [0.4 in] for most parameters) from corings near or within the dense and diffuse zones (Goodwin et al., 1984). Input parameters used for the PHREEQC model are listed in Tables F-10 and F-11 for water and sediments, respectively. The concentrations of metals in water were calculated using the method in the metals distribution textbox. Sodium hydroxide was used to maintain the solution charge balance and pH; DO was used to maintain redox conditions. These additions are needed because the river water provides a large buffer to pH and redox compared to the small volume assumed for modeling.

Other input to the model included reactions for aluminum, iron, manganese, and nickel dissolution (thermodynamic data from Woods and Garrels, 1987) and information about the adsorptive solid (i.e., the iron-containing mineral). Amorphous ferric hydroxide, a noncrystalline iron mineral, is often the first precipitate when conditions become favorable (e.g., when pH increases from acidic conditions or redox becomes oxidizing). However, amorphous ferric hydroxide may alter over time to more stable, crystalline iron oxyhydroxide or iron hydroxide minerals. Therefore, it is more likely that the dominant iron oxyhydroxide in the sediments is goethite (an iron-bearing oxide mineral) rather than amorphous iron oxyhydroxide (Luther et al., 1982; Dzombak and Morel, 1990).

Modeling was used to ascertain the range of conditions under which goethite would be stable and would likely occur in sediments. Goethite was stable under a broad range of conditions ranging from pH 6.5 to pH 8.0 and Eh -40 millivolts (mV) to 600 mV. Goethite has a smaller surface area than amorphous iron hydroxide, indicating that it has a smaller capacity to adsorb metals. Therefore, the surface area was changed from the default value of 600 square meters per gram (m^2/g) to 80 m^2/g (Swedlund, 2004).

Table F-10
River Bottom Water - Input Parameters for the PHREEQC Model

Parameter	Unit	Pore Water [a]
Alkalinity as $CaCO_3$	mg/l	220
Ammonium as N	mg/l	0.84
Calcium	mg/l	133
Chloride	mg/l	2,308
Iron	mg/l	0.56
Magnesium	mg/l	343.6
Manganese[b]	mg/l	2.09
Phosphate as P	mg/l	0.16
Potassium	mg/l	144
Silica	mg/l	4.7
Sodium	mg/l	3,031
Sulfate as SO_4	mg/l	264
Total Organic Carbon	mg/l	103
pH	standard unit	7
Dissolved Oxygen[c]	mg/l	2 to 10
Temperature [d]	^{o}C	6
Eh[e]	mV[g]	375
pe[f]	--	6.77

Notes:

[a] Pore water concentrations represent the average of locations 7805-V11 and 7805-V9, 1 cm deep in sediment, except for unreported major cations: calcium, magnesium, potassium, sodium from average of top 9 cm from boring 7908-VBB. Data from Goodwin et al. (1984).

[b] Manganese was used to model metal distributions other than manganese.

[c] Dissolved oxygen varies seasonally from about 2 to 10 mg/l according to Jaworski et al. (2007). Starting concentration of 10 mg/l used for most simulations except to check the stability of goethite.

[d] Approximate bottom water temperature average at the Nice Bridge in 1999 (Jaworski et al., 2007).

[e] 1 Eh = redox in terms of the standard hydrogen electrode units. This is a measure of the tendency of a solution to donate or accept electrons.

[f] The pe is a log-converted form of the Eh measurement.

[e, f] Elevated values of Eh or pe correspond to oxidizing conditions; small (or negative) values of Eh or pe correspond to reducing conditions.

[g] mV = millivolts.

Table F-11
Metals from Munitions in Upper Sediment - Input Parameters for the PHREEQC Model

Metal	Unit	Dense Zone	Diffuse Zone
Aluminum	mg/l	6.91E-03	1.56E-03
Cadmium	mg/l	4.79E-04	6.90E-05
Chromium	mg/l	1.85E-04	4.26E-05
Copper	mg/l	2.15E-01	5.65E-02
Iron	mg/l	4.93E-00	1.81E-00
Lead	mg/l	3.94E-03	8.66E-04
Manganese	mg/l	7.70E-02	2.64E-02
Nickel	mg/l	2.61E-03	2.69E-03
Zinc	mg/l	3.77E-02	6.32E-03

The amount of adsorptive material (i.e., goethite) present (0.11 grams) was based on iron concentrations in the top 2 cm of sediment of about 4 percent (Martin et al., 1981), using a typical sediment density of 2.5 (such as used by Goodwin et al., 1984 and Defries, 1986) and reported porosity for upper sediments of 0.9 (Goodwin et al., 1984, based on the average porosity of the upper 1 cm of the two samples closest to the dense zone or the average upper 2 cm of the four samples closest to the diffuse zone). Other default surface-adsorption parameters in the WATEQ4F database were retained for modeling to assure consistency. Two adsorption site densities were modeled to determine sensitivity to whether a binding site was considered to be strong or weak[11]. To assure a conservative model outcome, the results for the higher site densities were used for sediment metals concentrations and the results for lower site densities were used for river water concentrations near the sediments. Higher site densities promote more adsorption and therefore higher sediment concentrations, while lower site densities result in less adsorption and therefore higher concentrations in river water.

Table F-12 summarizes the modeling results for metals concentrations in sediment and river water in the dense and diffuse zones, shown as annual concentrations. Sediment concentrations were divided by 12 to obtain the monthly exposure, as sedimentation rates of 1.8 centimeters (cm) per year in the dense zone and 1.3 cm per year in the diffuse zone have been reported (Knebel et al., 1981), indicating that the sediment surface is refreshed rapidly. This sediment renewal provides a new substrate for adsorption. Sedimentation also gradually buries exposed metal fragments and projectiles, thereby decreasing the source of metals available for concentration in river water and the upper portion of the sediment. River-water concentrations were divided by 365 to obtain daily input to the water column. Metals are expected to dissolve and be adsorbed on a daily basis because the corrosion process, once started, results in a slow but relatively continuous addition of metals. In the last column of the table, river-water concentrations are listed as concentrations for the volume of river water within the applicable zone (dense or diffuse); that is, diluted by the water column.

[11] Default values of 0.005 moles strong binding sites and 0.02 moles weak binding sites, as well as 0.00005 moles strong binding sites and 0.0002 moles weak binding sites were modeled.

Table F-12
Geochemical Modeling Results for Metals

Metal	Percent Adsorbed		Monthly Amount Adsorbed to Sediment		River Water Addition	
					Annual[a]	Daily[b]
	Large Sorptive Area	Small Sorptive Area	Large Sorptive Area (mg/kg)	Small Sorptive Area (mg/kg)	Small Sorptive Area (mg/l)	
Dense Zone: 11,000 - 13,000 yds						
Cadmium	100%	77%	**1.45E-02**	1.12E-02	1.10E-04	**5.04E-09**
Chromium[c]	na	na	**5.61E-03**	5.61E-03	1.85E-04	**8.45E-09**
Copper	100%	100%	**6.50E+00**	6.50E+00	1.29E-04	**5.91E-09**
Lead	100%	100%	**1.19E-01**	1.19E-01	1.26E-07	**5.77E-12**
Manganese	99%	70%	**2.32E+00**	1.64E+00	2.27E-02	**1.04E-06**
Nickel	100%	81%	**7.87E-02**	6.41E-02	4.84E-04	**2.21E-08**
Zinc	100%	97%	**1.14E+00**	1.11E+00	1.00E-03	**4.58E-08**
Diffuse Zone: 0 – 25,000 yds						
Cadmium	100%	78%	**2.09E-03**	1.63E-03	1.52E-05	**6.94E-10**
Chromium[c]	na	na	**1.29E-03**	1.29E-03	4.26E-05	**1.94E-09**
Copper	100%	100%	**1.71E+00**	1.71E+00	3.29E-05	**1.50E-09**
Lead	100%	100%	**2.62E-02**	2.62E-02	2.61E-08	**1.19E-12**
Manganese	100%	61%	**7.97E-01**	5.72E-01	7.49E-03	**3.42E-07**
Nickel	100%	82%	**8.15E-02**	6.71E-02	4.81E-04	**2.20E-08**
Zinc	100%	98%	**1.92E-01**	1.87E-01	1.60E-04	**7.29E-09**

Notes:
mg/kg = milligrams per kilogram.
Bold results for sorbed metals using large sorptive site densities and for dissolved metals remaining after adsorption using small sorptive site densities.
Sedimentation rate in dense zone of 1.8 cm per year and 1.3 cm per year in diffuse zone, so 1 month was assumed for sediment adsorptive surface renewal.
[a] Annual addition of metal to bottom 10 cm of river water overlying sediments and not adsorbed by sediments.
[b] Daily concentration is for volume of water in zone listed; volume calculated using average depth for Potomac river of 6 m.
[c] Conservative assumption for sediment concentration used: all available chromium may adsorb.

F.4.5 Summary of the Geochemical Modeling Results

Munitions are a potential source of organic and metal constituents to river water and sediments. Using conservative assumptions, the expected concentrations of organic explosive compounds and metals were calculated. These concentrations were then distributed between river water and sediment using a simple adsorption-coefficient method for explosives and a geochemical equilibrium model for metals. As a conservative assumption, river-water concentrations of explosives are assumed not to be affected by adsorption. Table F-13 summarizes the modeling results for explosives in the dense and diffuse zones of the PRTR. These concentrations indicate that the explosives from munitions may be estimated to result in MCOPC concentrations of 3 parts per billion (ppb) or less in the sediments of those parts of the river where munitions are most concentrated (on a dry weight basis). River-water concentrations are projected to be 0.05 ppb or less in the dense zone, where munitions are most concentrated.

Table F-13
Summary of Modeled Explosives Concentrations

Explosive	Dry Sediment Concentration - Monthly Adsorption (mg/kg)		Daily Concentration in River Water Column (mg/l)	
	Dense Zone	Diffuse Zone	Dense Zone	Diffuse Zone
Ammonium Picrate	5.41E-07	4.06E-08	5.17E-05	2.69E-06
HMX	6.11E-09	5.10E-09	4.46E-09	2.60E-09
RDX	1.38E-05	3.37E-07	3.37E-05	5.73E-07
Tetryl	6.03E-04	2.50E-05	5.74E-07	1.64E-08
TNT	2.98E-03	8.14E-04	3.34E-06	6.35E-07

Notes: mg/kg = milligrams per kilogram.
mg/l = milligrams per liter.

Table F-14 summarizes the modeling results for metals adsorbed to sediments and dissolved in Potomac River water for the dense and diffuse zones. Metals are naturally occurring in sediments and river water and can also be present because of activities upstream of the PRTR. Therefore, the table also provides data from upstream samples of sediment and river water for comparative purposes. Based on this table, contributions of MCOPCs from RDT&E in the PRTR are orders of magnitude less than concentrations already present in the Potomac River. This indicates that munitions activities on the PRTR have not contributed significant concentrations of metals in river water and sediments.

Table F-14
Summary of Modeled Metals Concentrations

Metal	Monthly Sediment Adsorption Due to Munitions (mg/kg)		Sediment Upstream [a]	Daily River Water Column Concentration Due to Munitions (mg/l)		River Water Upstream [b] (mg/l)
	Dense Zone	Diffuse Zone		Dense Zone	Diffuse Zone	
Cadmium	1.45E-02	2.09E-03	5.60E-01	5.04E-09	6.94E-10	1.10E-05
Chromium	5.61E-03	1.29E-03	8.31E+01	8.45E-09	1.94E-09	1.00E-04
Copper	6.50E+00	1.71E+00	4.62E+01	5.91E-09	1.50E-09	1.75E-03
Lead	1.19E-01	2.62E-02	4.53E+01	5.77E-12	1.19E-12	1.37E-04
Manganese	2.32E+00	7.97E-01	2.32E+03	1.04E-06	3.42E-07	5.50E-02
Nickel	7.87E-02	8.15E-02	5.40E+01	2.21E-08	2.20E-08	1.00E-03
Zinc	1.14E+00	1.92E-01	2.15E+02	4.58E-08	7.29E-09	2.78E-04

Notes:
[a] Upstream sediment data from USEPA (undated).
[b] Upstream river water data from Maryland Department of the Environment (2006a) for cadmium, chromium, copper, lead; Maryland Department of the Environment (2006b) for manganese; Jaworski, et al., (2007) for nickel and zinc.
Metals from filtered samples except for manganese. Note that adsorbed chromium is based on the assumption that all available chromium may adsorb.
mg/kg = milligrams per kilogram. mg/l = milligrams per liter.

F.5 References

Agency for Toxic Substances and Disease Registry (ATSDR). 2006. Public Health Assessment for Naval Support Facility (NSF) DAHLGREN (A/K/A Naval Surface Warfare Center – Dahlgren) Dahlgren, Virginia EPA Facility ID: VA7170024684 October 11, 2006.

Agency for Toxic Substances and Disease Registry (ATSDR). 2007. Public Health Statement, Ethylbenzene CAS #100-41-4. Division of Toxicology and Environmental Medicine. September 2007. [website] Accessed on 8 January 2010. Available from <http://www.atsdr.cdc.gov/toxprofiles/phs110.html>.

Ball, J.W. and Nordstrom, D.K. 1991. *User's Manual for WATEQ4F, with Revised Thermodynamic Data Base and Test Cases for Calculating Speciation of Major, Trace, and Redox Elements in Natural Waters.* US Geological Survey Open-File Report 91-183. Reprinted and Revised April, 2001.

Callender, E., Carter, V., Hahl, D. C., Hitt, K., Schultz, B.I. (eds.) 1984. A water-quality study of the Tidal Potomac River and Estuary; an Overview. US Geological Survey Water Supply Paper 2233.

Chendorain, M.D., C.D. Stewart, and B. Packer, B. 2002. *UXO Corrosion in Soil*. Presented at the Partners in Environmental Technology Technical Symposium & Workshop: Meeting DoD's Environmental Challenges, December 3-5, 2002. Marriott Wardman Park Hotel, Washington, DC.

Clausen, J.L., N.K., M. Dodson, J. Robb, and S. Rieven. 2006. Conceptual Model for the Transport of Energetic Residues from Surface Soil to Groundwater by Range Activities. Cold Regions Research and Engineering Laboratory US Army Engineer Research and Development Center. ERDC/CRREL TR-06-18. November 2006.

Clausen, J.L., C.L. Scott, R.J. Cramer. 2007. Development of Environmental Data for Navy, Air Force, and Marine Munitions. Strategic Environmental Research and Development Program: Report ER-1480 ERDC/CRREL TR-07-7. June.

Defries, R.S., 1986. Effects of Land-Use History on Sedimentation in the Potomac Estuary, Maryland; A Water-Quality Study of the Tidal Potomac River and Estuary. US Geological Survey Water-Supply Paper 2234-K.

Glenn, J.L., 1988. Bottom Sediments and Nutrients in the Tidal Potomac System, Maryland and Virginia. US Geological Survey Water-Supply Paper 2234-F.

Goodwin, S.D., Schultz, B.I., Parkhurst, D.L., Simon, N.S., Callender, E., 1984. *Methods for the Collection of Geochemical Data from the Sediments of the Tidal Potomac River and Estuary, and Data for 1978-1980.* US Geological Survey Open-File Report 84-074.

Goss, William. 2009. Safety and Environmental Office, Naval Surface Warfare Center Dahlgren Laboratory (NSWCDD). Personal communication via e-mail to Penny Douglas, AECOM. October 19, 2009.

Hewitt, A.D., T.F. Jenkins, T.A. Ranney, J.A. Stark, M.E. Walsh. 2003. Estimates for Explosives Residue from the Detonation of Army Munitions. Engineer Research and Development Center Hanover NH, Cold Regions Research and Engineering Lab.

Jaworski, N.A., Romano, B., Buchanan, C. 2007. A Treatise: The Potomac River Basin and its Estuary: Landscape Loadings and Water Quality Trends, 1895-2005. Edition 1.0. March 1, 2007.

Jenkins, T.F., Miyares, P.H., Walsh, M.E., Collins, N.H. and Ranney, T.A. 2000. Evaluation of the Use of Snow Covered Ranges to Estimate the Explosives Residues that Result from Detonation of Army Munitions. ERDC/CRREL TR-00-15, US Army Engineer Research and Development Center, Hanover, New Hampshire.

Dzombak, D.A. and Morel, F.M.M., 1990. Surface Complexation Modeling: Hydrous Feric Oxide. Wiley-Interscience.

Jenkins, T. F., S. Thiboutot, G. Ampleman, A. D. Hewitt, M. E. Walsh, T. A. Ranney, C. A. Ramsey, C. L. Grant, C. M. Collins, S. Brochu, S. R. Bigl, and J. C. Pennington. 2005. Identity and Distribution of Residues of Energetic Compounds at Military Live-Fire Training Ranges. ERDC TR-05-10. US Army Engineer Research and Development Center, Cold Regions Research and Engineering Laboratory. Hanover, NH. November.

Knebel, H.J., Martin, E.A., Glenn, J.L., Needell, S.W. 1981. *Sedimentary Framework of the Potomac River Estuary*, Maryland in Geological Society of America Bulletin, Part 1, Vol. 92, p. 578-589. August.

Larson, S.L., Martin, W.A., Escalon, B.L., Thompson, M. 2008. Dissolution, sorption, and kinetics involved in systems containing explosives, water, and soil. *Environmental Science and Technology*. 42:786-792.

Lewis, A.M., P.S. Verlinde, M.P. Acheroy, A.J. Sieber. 2002. “Recent Progress in the Joint Multisensor Mine-Signatures Database Project,” in Detection and Remediation Technologies for Mines and Minelike Targets VII, J. T. Broach, R. S. Harmon, and G. J. Dobeck, eds., Seattle: International Society for Optical Engineering, 2002. As cited in US Navy 2006.

Lovejoy, Vanessa. 2010. Naval Surface Warfare Center, Dahlgren Division, e-mail to Helen Chernoff, AECOM, March 5, 2010.

Luther, G.W. III, Giblin, A., Howarth, R.W., Ryans, R.A., 1982. Pyrite and oxidized iron mineral phases formed from pyrite oxidation in salt marsh and estuarine sediments. *Geochimica et Cosmochimica Acta* 46:2665-2669.

Martin, E.A., J.L. Glenn, C.A. Rice, G. Harrison, E. Gum, and M. Curington. 1981. Concentrations of Selected Trace Metals in Shallow Cores from the Tidal Potomac River and Estuary: 1978 and 1979. US Geological Survey Open-File Report 81-1175.

Naval Sea Systems Command (NAVSEA). 2010. Final Range Condition Assessment Report; Naval Surface Warfare Center - Dahlgren Laboratory (NSWCDL Ranges), Dahlgren, Virginia. Prepared by Science Applications International Corporation (SAIC) for Naval Sea Systems Command. United States Navy, Naval Sea Systems Command.

Parkhurst, D.L. and Appelo, C.A.J. 1999. User’s Guide to PHREEQC (Version 2) – A Computer Program for Speciation, Batch-Reaction, One-Dimensional Transport, and Inverse Geochemical Calculations. US Geological Survey Water-Resources Investigations Report 99-4259. http://wwwbrr.cr.usgs.gov/projects/GWC_coupled/phreeqc/

Pennington, J.C. and J.M. Brannon. 2002. Environmental fate of explosives. *Thermochimica Acta*. 384:163-172.

Pennington, J. C., T. F. Jenkins, G. Ampleman, S. Thiboutot, J. M. Brannon, A. D. Hewitt, J. Lewis, S. Brochu, E. Diaz, M. R. Walsh, M. E. Walsh, S. Taylor, J. C. Lynch, J. Clausen, T. A. Ranney, C. A. Ramsey, C. A. Hayes, C. L. Grant, C. M. Collins, S. R. Bigl, S. Yost, and K. Dontsova. 2006. Distribution and Fate of Energetics on DoD Test and Training Ranges: Final Report. US Army Engineer Research and Development Center, Environmental Laboratory. Vicksburg, Mississippi. ERDC TR-06-13.

Pohlman, John. 2008. US Geological Survey, personal communication with Anne Lewis-Russ, AECOM. September 2008.

Swedlund, P., 2004. Modelling Cu, Zn, Cd and Pb Adsorption by Iron Oxyhydroxides in SO_4-rich Systems Simulating Acid Mine Drainage. Dissertation. University of Auckland, New Zealand**.**

Swope, Ann. 2008. Director, Safety and Environmental Office, Naval Surface Warfare Center Dahlgren Division (NSWCDD). Personal communication via e-mail to Penny Douglas, AECOM. October 22, 2008.

Talmage, S.S., Opresko, D.M., Maxwell, C.J., Welsh, C.J., Cretella, F.M., Reno, P.H., Daniel, E.B. 1999. Nitroaromatic munition compounds: environmental effects and screening values. *Reviews of Environmental Contamination and Toxicity* 161:1-156. (As cited in US Navy, 2002).

United States Army (US Army) Defense Ammunition Center (USADAC). 2009. Munitions Items Disposition Action System (MIDAS). [website] Accessed multiple times in 2009. Available from <https://midas.dac.army.mil>.

United States Army Defense Ammunition Center (USADAC). 2000. Report of Findings for Study of Ammunition Dud and Low Order Detonation Rates. US Army Technical Center for Explosives Safety. As cited in Clausen et al. 2006.

United States Environmental Protection Agency (USEPA). Undated. Environmental Monitoring & Assessment Program Mid-Atlantic Integrated Assessment, Estuaries 1997-1998. [website] Accessed on 11 December 2008. <http://www.epa.gov/emap/maia/html/data/estuary/9798/>.

United States Environmental Protection Agency (USEPA). 2007. Perchlorate. [website] Accessed on 18 February 2010. <http://www.epa.gov/fedfac/documents/perchlorate.htm>.

United States Geological Survey (USGS). 1995. Chesapeake Bay: Measuring Pollution Reduction. [website] Accessed on 15 February 2010. <http://water.usgs.gov/wid/html/chesbay.html>.

United States Geological Survey (USGS). 1999. Selected Elements and Organic Chemicals in Bed Sediment and Fish Tissue of the Tualatin River Basin, Oregon, 1992-96. United States Geological Survey. Water-Resources Investigations Report 99-4107, 61 pages.

United States Geological Survey (USGS). 2011. The effects of urbanization on water quality: Phosphorus. [website] Accessed on 30 August 2011. <http://ga.water.usgs.gov/edu/urbanpho.html>.

United States Navy (US Navy). 2002. Environmental Effects of Underwater Ordnance. Internal Draft. Naval Facilities Engineering Service Center. January.

United States Navy (US Navy). 2006. US Navy Range Sustainability Environmental Program Assessment Policy Implementation Manual, Revision 1. Chief of Naval Operations Environmental Readiness Division (N45).

United States Navy (US Navy). 2008. Draft Final Navy Policy for Conducting Operational Water Range Sustainability Environmental Program Assessments. July 14, 2008.

Versar, 2008. Chesapeake Bay Benthic Monitoring Program Web Site, Maryland 2007 Sediment Data. [website] Accessed on 11 September 2011. <http://www.esm.versar.com/vcb/benthos/data.htm> (07 Sediment data).

Walsh, M.R. 2007. Explosives Residues Resulting from the Detonation of Common Military Munitions: 2002-2006. Cold Regions Research and Engineering Laboratory. ERDC/CRREL TR-07-2. [website] Accessed on 29 December 2008. <http://www.dtic.mil/cgibin/GetTRDoc?AD=ADA465866&Location=U2&doc=GetTRDoc.pdf >.

Woods, T.L. and Garrels, R.M. 1987. Thermodynamic Values at Low Temperature for Natural Inorganic Materials: An Uncritical Summary. Oxford University Press, New York.

Xu, J., Y. Song, B. Min, L. Steinberg, and B.E. Logan. 2003. Microbial Degradation of Perchlorate: Principles and Applications. *Environmental Engineering Science* 20(5): 405-422.

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX G

NATURAL RESOURCES COORDINATION

THIS PAGE INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

Coordination Letter or E-mail — Page

DEPARTMENT OF THE NAVY
NAVAL SURFACE WARFARE CENTER
DAHLGREN DIVISION
6149 WELSH ROAD, SUITE 203
DAHLGREN, VIRGINIA 22448-5130

IN REPLY REFER TO

5090
Ser XDC8/016
10 Apr 08

Ms. Patricia A. Kurkul
Regional Administrator
National Marine Fisheries Service
Northeast Region
One Blackburn Drive
Gloucester, MA 01930-2298

Dear Ms. Kurkul,

SUBJECT: NSWCDL RDT&E EIS TECHNICAL ASSISTANCE

The Naval Surface Warfare Center, Dahlgren Site (NSWCDL), a tenant on Naval Support Facility Dahlgren, Dahlgren, Virginia, is preparing an environmental impact statement (EIS) to evaluate the potential environmental consequences of expanding our research, development, test and evaluation (RDT&E) activities taking place outdoors on the Potomac River Test Range (PRTR) Complex. We request technical assistance from your office concerning the proposed action on the lower Potomac River. RDT&E activities are conducted in support of NSWCDL's mission requirements in surface warfare, surface ship combat systems, strategic systems, ordnance, and special warfare systems. These activities include outdoor operations using ordnance, lasers, electromagnetic fields, and chemical and biological simulants. Enclosed are five fact sheets that describe our operations and support the EIS. We foresee evaluating the impacts of three alternatives as described in the in the EIS.

To help us describe existing conditions and evaluate the impacts of the proposed action, we ask that your agency:

a. Clarify what listed, proposed, and candidate species may be in the action area (the PRTR) by concurring with or revising our list of species (details provided in the enclosed PRTR Species Summary);

b. Clarify whether and, if so, what designated or proposed critical habitats may be in the action area;

c. Provide points of contact for those having information on these species or critical habitats; and

d. Provide preliminary indication of whether a survey of the action area will be needed.

For further information, please contact Dr. Thomas Wray II at (540) 653-4186 (thomas.wray@navy.mil). Thank you in advance for your assistance.

Sincerely,

ANN G. SWOPE
Head, Safety & Environmental Office
By direction of the Commander

Enclosures:
1. Environmental Impact Statement Fact Sheet
2. Test Range Operations Fact Sheet
3. Chemical & Biological Sensor Tests Fact Sheet
4. Dahlgren: A Unique National Asset Fact Sheet
5. Dahlgren: A Vital Mission Fact Sheet
6. Potomac River Test Range Species Summary

Copy to (w/encl):
Commander
Naval Sea Systems Command
Ms. Vicki Writt (SEA 04RE)
1333 Isaac Hull Avenue SE
Washington Navy Yard, DC 20376

Commander
Naval Surface Warfare Center
Ms. Tanya Robinson
1333 Isaac Hull Avenue SE, Bldg 197
Washington Navy Yard, DC 20376

Copy to: (w/encl) (Cont'd)
Chief of Naval Operations
Ms. Elizabeth Phelps (N45)
2511 Jefferson Davis Highway
NC-1, Suite 2000
Arlington, VA 22202

Ms. Christine Porter
Commander, Navy Region, Mid-Atlantic
Regional Environmental Programs (N45)
1510 Gilbert St.
Norfolk, VA 23511-2737

Mr. Lane Willson
Earth Tech
675 N. Washington Street
Suite 300
Alexandria, VA 22314

Blind copy to (w/encl):

NAVFAC (Wray)
XDC8 (Goss)
XDC809

POTOMAC RIVER TEST RANGE SPECIES SUMMARY

The Naval Surface Warfare Center, Dahlgren Site's (NSWCDL) Potomac River Test Range (PRTR) (Figure 1) extends over a 169-square-nautical-mile area along the lower 51 miles of the Potomac River. The range is divided into three areas identified on nautical charts as the Upper, Middle, and Lower Danger Zones. For many years, NSWCDL's guns have fired projectiles primarily into the Middle Danger Zone. The Lower and Upper Danger Zones are used for other types of testing, such as boat or aircraft maneuvers, but rarely for gunnery. Figure 2 shows the main gunnery target area within the Middle Danger Zone.

As the Navy's research, development, test and evaluation (RDT&E) center for chemical and biological protection and detection systems, NSWCDL has been conducting tests of chemical sensors on the river range the last few years. We coordinated with National Marine Fisheries Service (NMFS) in 2002 during preparation of the Environmental Assessment, Infrared Sensor Testing at Naval Surface Warfare Center Dahlgren. The benign chemicals used in the tests are chemical simulants that were dispersed into the air to mimic the dangerous ones that terrorists might use. Future work covered by the environmental impact statement (EIS) would involve similar and different chemical simulants and an increase in the annual number of tests. Outdoor testing of biological sensors using benign simulants would be new at NSWCDL; such testing is now being conducted in an indoor laboratory, but sensors must eventually be tested over water to ensure shipboard protection of our sailors.

As the Navy's center for developing integrated warfare systems and for directed energy systems RDT&E, NSWCDL conducts RDT&E activities using electromagnetic energy transmitted through the air, including lasers, microwaves, and radar. These types of RDT&E activities, which we propose to increase, are expected to have no negative effects on biota in the river. Lasers, microwaves, and radar would be used in the air above the river and any electromagnetic energy entering the water would be of low enough intensity that the energy would be immediately absorbed and dissipated.

Our initial research indicates that several species protected under the Endangered Species Act (ESA), the Marine Mammal Protection Act (MMPA), and the Magnuson-Stevens Fishery Conservation and Management Act occur in the PRTR. We welcome any further information you may have on their occurrence and abundance in the lower 51 miles of the Potomac River.

STURGEON

Both the shortnose sturgeon (listed as endangered under the ESA) and the Atlantic sturgeon occur in the Potomac River. Of the 19 Distinct Population Segments identified in the NMFS Final Recovery Plan for the Shortnose Sturgeon, the Chesapeake Bay segment includes those that occur in the Potomac River in Maryland and in tributaries to the Potomac River in Virginia. The Atlantic sturgeon was listed as a candidate species on October 17, 2006.

While the distribution and abundance of shortnose sturgeon in the Chesapeake Bay are not well known, the Atlantic Sturgeon and Shortnose Sturgeon Reward Program being carried out by the United States Fish and Wildlife Service (USFWS), in cooperation with the Chesapeake Bay Program and the Maryland Department of Natural Resources (as reported in United States Army Corps of Engineers (USACE), 2007), provides some useful information. From 1996 through May 2007, eight shortnose sturgeon were captured in fishermen's gill nets and pound nets in the Potomac River as part of the reward program. The most recent capture, in March 2006, was at the mouth of Popes Creek, along the PRTR Middle Danger Zone (Westmoreland County). Four fish were documented at: the mouth of the Potomac River near Ophelia, Virginia (Northumberland County in the Lower Danger Zone near the mouth of the river) (May 3, 2000; March 26, 2001; December 10, 2004; and May 22, 2005); one at the mouth of the Saint Mary's River (St. Mary's County on the Lower Danger Zone) (April 12, 1998); and three at the mouth of Potomac Creek (about five miles upriver from the NSWCDL Upper Danger Zone) (May 17, 1996 and March 8, 2002).

The USFWS sturgeon reward program, (USACE, 2007), recorded the capture of 225 Atlantic sturgeon in the Potomac River from February 1996 through April 2007. Captures in the first four years were sporadic but have grown substantially since, culminating in the capture of 70 Atlantic sturgeon during the month of April 2007. Most sturgeon were caught in the spring.

The sturgeon captures appeared to be concentrated in and around the PRTR Middle Danger Zone, the upper part of the PRTR Lower Danger Zone, and around Ophelia, Virginia, near the mouth of the Potomac River (Northumberland County).

SEA TURTLES

Anecdotally, people living along the PRTR Lower Danger Zone report seeing sea turtles in this part of the river. Three species of sea turtles are regularly sighted in the Chesapeake Bay: loggerhead, Kemp's Ridley, and to a lesser extent, leatherback sea turtles (Litwiler, 2001). All of these species are listed as threatened or endangered under the ESA, and in accordance with the ESA, recovery plans were completed for these species in 1991 and 1992. The recovery plans for the loggerhead and Kemp's Ridley sea turtles are currently being revised.

The Virginia Institute of Marine Science (VIMS) recorded strandings of three species of sea turtles in St. Mary's and Northumberland counties from 2000 through May 2006: loggerhead, green, and Kemp's Ridley (VIMS Stranding Data, 2006). (Note that these counties front both the Potomac River and the Chesapeake Bay, so strandings could have occurred in either body of water). While green turtles are rarely found in the bay, an incidental take was recorded in St. Mary's County in 2001.

MARINE MAMMALS

The only marine mammal regularly sighted in the Potomac River is the bottlenose dolphin. The Western North Atlantic coastal migratory stock, of which dolphins in the Chesapeake Bay form a part, is considered depleted under the MMPA. In Virginia, bottlenose dolphins occur along the entire coast, within one mile of shore, and in the Chesapeake Bay and its tributaries from late spring into the winter (Blaylock, 1985). Since 1995, approximately ten bottlenose dolphin strandings have been reported in the Potomac River and the Chesapeake Bay near the mouth of the Potomac (NMFS Stranding Data, 2007).

While little is known about their distribution in the Chesapeake Bay and its tributaries, there are two relatively recent records of harbor porpoise strandings in the Potomac

River: (1) in 1999, a harbor porpoise stranded near Leonardtown, Maryland (within the PRTR Lower Danger Zone in St. Mary's County), and (2) in 2003, a harbor porpoise stranded near Scotland, Maryland (within the PRTR Lower Danger Zone near the entrance to the bay in St. Mary's County) (NMFS Stranding Data, 2007).

Several other species of marine mammals have stranded in the Potomac River, but they are primarily coastal offshore species and likely are not regular visitors to the river. In 2002, a Risso's dolphin stranded in Charles County (in either the Middle or Upper Danger Zone). In 1995, a minke whale stranded in the Potomac River near Piney Point, Maryland (within the PRTR Lower Danger Zone in St. Mary's County) (NMFS Stranding Data, 2007). These species are not ESA-listed, nor are they considered depleted under the MMPA.

Other marine mammals that have stranded in the Chesapeake Bay include a humpback whale, a sei whale, and other species of dolphins. These are thought to be rare occurrences, as these species are not considered to be inhabitants of or regular visitors to the bay.

ESSENTIAL FISH HABITAT

Seven species of fish and three species of skate have designated essential fish habitat in the lower Potomac River: bluefish, red drum, summer flounder, windowpane flounder, king mackerel, Spanish mackerel, cobia, winter skate, little skate, and clearnose skate. We would appreciate any information you may have on the abundance and distribution of these species in the area of the PRTR.

REFERENCES

Blaylock, R.A. 1985. *The Marine Mammals of Virginia*. Virginia Institute of Marine Science. VSG-85-05. July 1985.

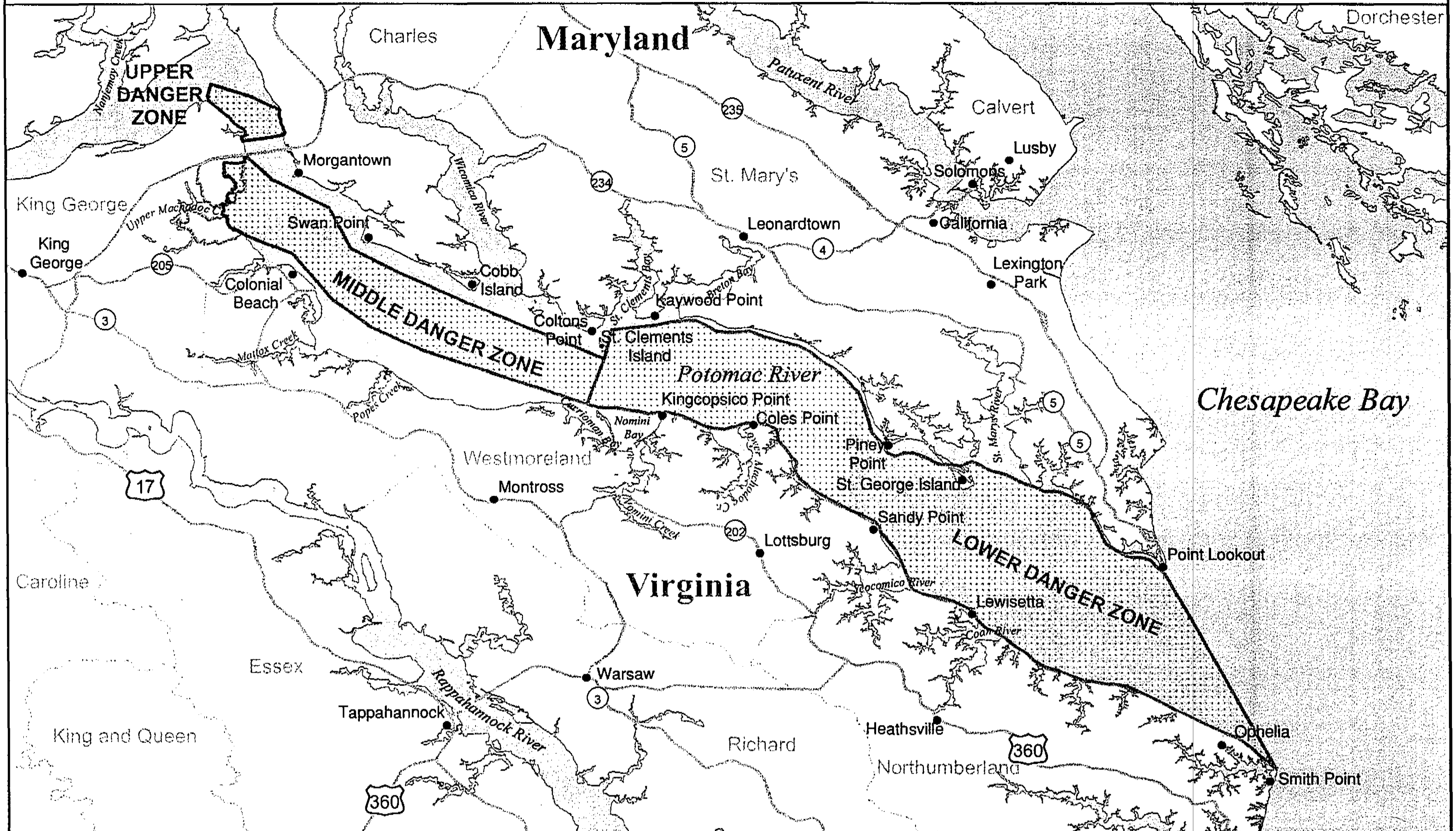
Litwiler, T. 2001. *Conservation Plan for Sea Turtles, Marine Mammals, and the Shortnose Sturgeon in Maryland. Maryland Department of Natural Resources and Sarbanes Cooperative Oxford Laboratory, Oxford, Maryland*. Technical Report FS-SCOL-01-2. November 2001.

NMFS. 2007. National Marine Mammal Stranding Database. June 11, 2007 query.

U.S. Army Corps of Engineers, Baltimore District. 2007. *Biological Assessment on the Potential Impacts of Dredging and Dredged Material Placement Operations on Shortnose Sturgeon in the Chesapeake Bay*. August 2007.

Virginia Institute of Marine Science. 2006. VIMS Sea Turtle Stranding Program. March 15, 2006 query.

Potomac River Test Range Complex



Potomac River Test Range Complex
Naval Support Facility Dahlgren

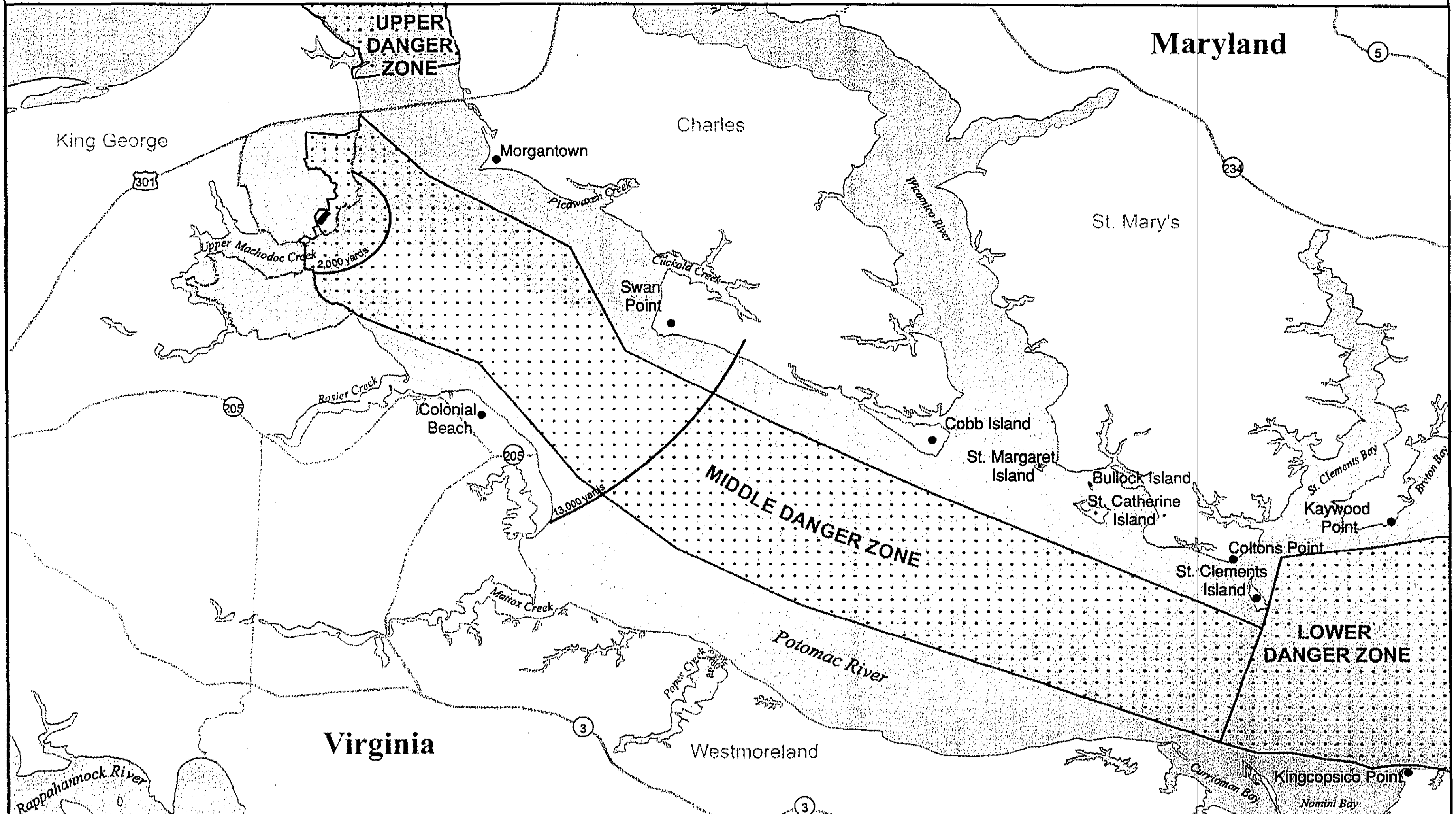
7 0 7 Miles
11 0 11 Kilometers

NSWCDL EIS
NAVSEA WARFARE CENTERS DAHLGREN

Source: NSWCDL GIS; Danger Zones defined in CFP 33, Part 33.230.

Figure 1

Potomac River Test Range Primary Gunnery Target Area



Gun Firing Line

Target Area

Potomac River Test Range Complex

Naval Support Facility Dahlgren

3 0 3 Miles

5 0 5 Kilometers

Figure 2

NSWCDL EIS

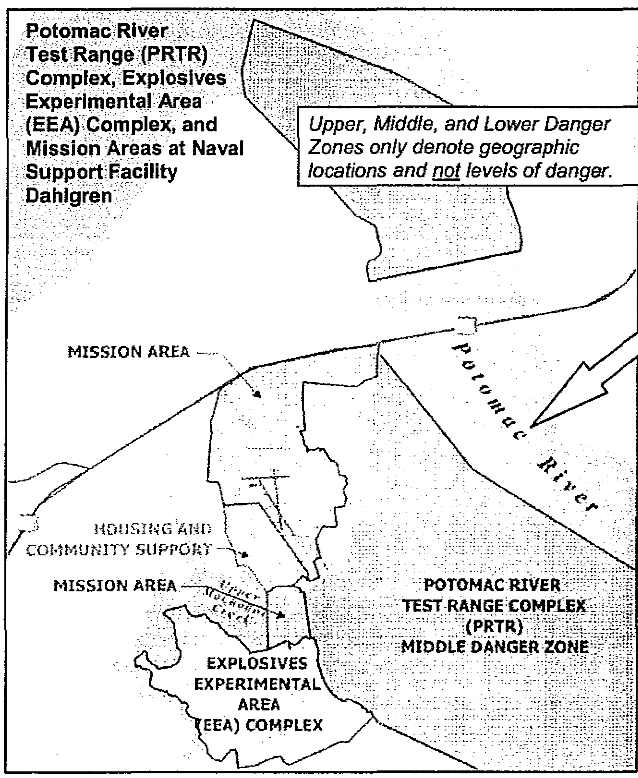
NAVSEA WARFARE CENTERS DAHLGREN

NAVSEA WARFARE CENTERS DAHLGREN

Environmental Impact Statement

A Dahlgren Public Affairs Fact Sheet

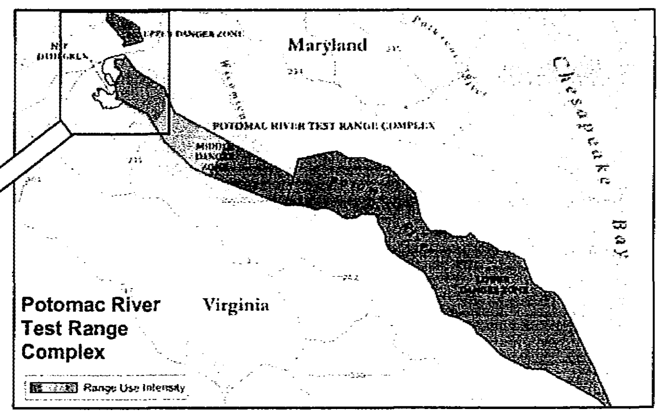
Under the National Environmental Policy Act (NEPA), any federal action that may have an impact on the human or natural environment must have an environmental impact analysis prepared to identify potential impacts and to identify ways such impacts can be lessened. Future work here at Dahlgren is considered a federal action under NEPA, so we are preparing an



environmental impact statement (EIS) that will cover current and future research, development, testing, and evaluation (RDT&E) activities conducted outdoors on our two test range complexes – the Explosives Experimental Area (EEA) Complex and the Potomac River Test Range (PRTR) Complex – in the adjoining Mission Areas, and in our Special Use Airspace.

In this EIS we will evaluate the impacts of increasing our RDT&E activities in four program areas that are critical to national defense:

- **Warfare Systems Elements** entails testing the functionality of a warfare component such as a gun or other type of weapon.
- **Military Standards Testing** involves checking the safety of a warfare component by simulating transport and shipboard handling and storage in normal and emergency conditions.
- **Chemical & Biological Defense** entails testing the ability to rapidly and accurately detect or defend against chemical or biological agents.
- **Warfare Systems Integration** involves testing any or all of the above components once they are integrated into a larger system, such as an unmanned vehicle, ship, or complete strike group.



Not only do we plan to increase the number of activities annually in these key program areas, but we also need to conduct some of the tests under conditions in which we do not now normally run tests, such as at night and in bad weather.

The EIS will focus on RDT&E activities that take place outdoors, and could therefore have an impact on the environment. Much of our research and development takes place inside laboratories and will not be analyzed in this EIS.

We are aiming for this EIS to cover activities that we can reasonably foresee taking place within the next seven to fifteen years. During this period, we foresee enhancing existing technologies by expanding our existing RDT&E capabilities rather than developing new ones, so:

The Proposed Action for this EIS is to expand Dahlgren's outdoor RDT&E capabilities within the EEA and PRTR ranges, the Mission Areas, and the Special Use Airspace.

ENCLOSURE (1)

ACTIVITY	NO ACTION ALTERNATIVE	ALTERNATIVE 1	ALTERNATIVE 2 (PREFERRED)	CHANGE
Laser Operations (Class 3 & 4)	60 Events	125 Events	145 Events	↑
Electromagnetic Operations	103 Events	210 Events	240 Events	↑
Guns/Projectile Tests *	4,700 Projectiles	4,700 Projectiles	4,700 Projectiles	—
Small Arms Tests *	6,000 Bullets	6,000 Bullets	6,000 Bullets	—
Detonations *	192 Events	200 Events	230 Events	↑
Chemical & Biological Sensor Tests	54 Events	324 Events	372 Events	↑
* Noise Production	Steady	Steady	Steady	—
Potomac River Test Range Use	750 Hours	770 Hours	890 Hours	↑

EIS Alternatives

Part of any EIS process is to determine what is presently happening in order to be able to look at possible future activity and analyze the impacts that activity may have. Over three years, we collected data and interviewed more than 75 Dahlgren program managers. This process helped us accurately describe existing conditions, analyze what will be needed in the future, and develop two possible alternatives for future levels of activity, as shown in the EIS Alternatives Table.

- Under the No Action **Alternative**, the annual level of outdoor RDT&E activities taking place on the PRTR, EEA, Mission Areas, and Special Use Airspace would remain constant; there would be no expansion of Dahlgren's outdoor RDT&E capabilities. This alternative addresses past and current mission activities.
- Under **Alternative** 1, which would include existing baseline activities, Dahlgren's outdoor RDT&E capabilities would increase (with the exception of Gun/Projectile and Small Arms tests) over approximately the next seven years to accommodate known workload requirements.
- Under **Alternative 2**, the preferred alternative, Dahlgren would gain the greatest flexibility to adapt to program changes in the future. This alternative includes existing baseline activities, the increased activities under Alternative 1, plus projected increases in test activities over approximately the next 15 years. The alternative generally provides for a 15 percent increase in mission activities above Alternative 1 levels plus new applications of existing technology.

Future Activities Covered under the EIS

Here's what we anticipate for the future at NSWCDL, as shown in the EIS Alternatives table:

- Overall, *Warfare Systems Elements* RDT&E will increase. Specifically, we anticipate a transition from explosive projectiles launched with explosive powder to high-energy and electric weapons. While testing of new, longer range conventional guns and projectiles will occur, the frequency of testing of existing guns may decline. Hence, on average, the number of firings of large-caliber weapons is expected to remain constant, but the percentage of live ordnance will drop because modeling of tests will continue to increase. We expect testing of high-energy weapons such as lasers, rail guns, reactive materials, and directed energy projects to increase significantly over the next seven to fifteen years.
- Under **Military Standards Testing**, the requirement to subject all modified and new ordnance and systems to stressful transport and shipboard conditions, such as fire, will remain critical, and we expect the tempo to slightly increase.
- The emerging threat of **Chemical** and **Biological** agents against American military and civilian populations will require increases in the testing of viable and accurate sensors using various chemical and biological substitutes. See the fact sheet on Chemical and Biological Sensor Tests for information on the substitutes used to mimic dangerous chemicals and biological organisms. We expect baseline chemical and biological sensor testing to see a marked increase overall.
- Under the fourth program area, Warfare Systems Integration, Dahlgren combines component technologies from the other three operations areas into integrated systems. For example, the Department of Homeland Security may have an urgent need to be able to detect a chemical that may be used against our troops or citizens. In response, Dahlgren could take several sensors developed under our chemical and biological defense program and integrate them onto an existing unmanned aerial system, along with cameras and communications equipment, and test the new device under a range of environmental conditions. Merging technologies is a major area of growth anticipated at Dahlgren, as the Navy's Integration Center of Excellence. Overall, Warfare Systems Integration will experience substantial growth in the future.

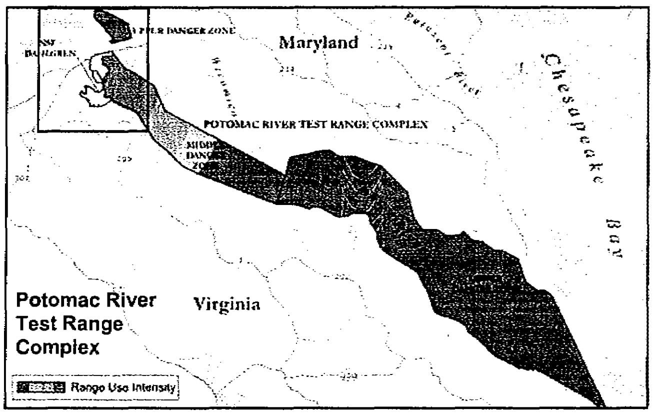
NAVSEA WARFARE CENTERS

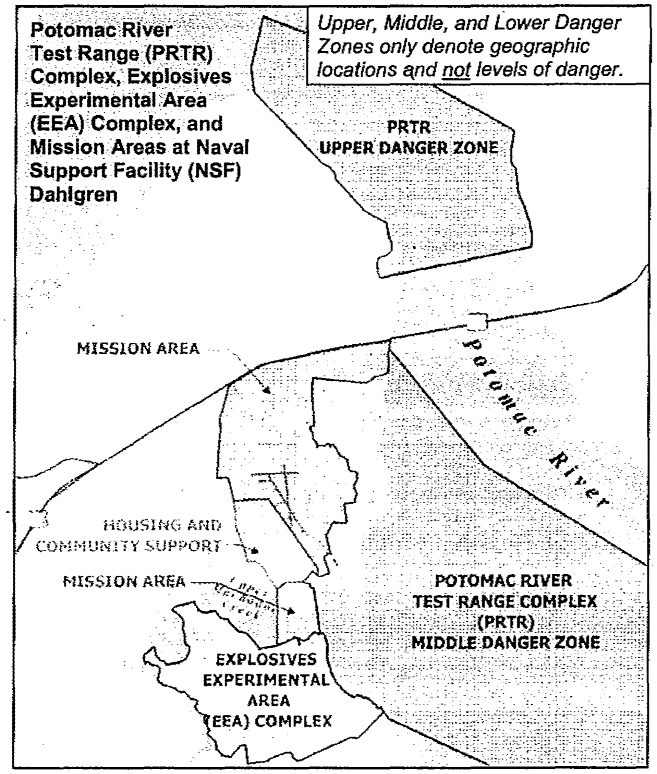
DAHLGREN

Test Range Operations

A Dahlgren Public Affairs Fact Sheet

Since 1918 Dahlgren has been an important national resource for the testing of naval guns and ammunition as well as for a wide variety of military testing and training efforts utilizing explosive and non-explosive ordnance. Highlights of Dahlgren's ordnance work include test-firing every type of naval gun and its ammunition, and conducting a variety of short-term programs, such as serving as a bombing range for military pilot training during World War II. Dahlgren has two range complexes where most ordnance is tested: the Potomac River Test Range (PRTR) and the Explosives Experimental Area (EEA).





Potomac River Test Range (PRTR)

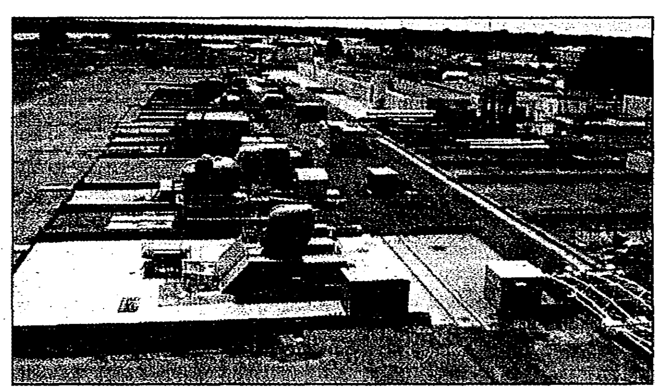
The PRTR Complex consists of a 715-acre land area and a 169-square-nautical-mile water area that stretches along the lower 51 miles of the Potomac River. Three geographic zones are defined on nautical charts – the Upper, Middle, and Lower Danger Zones – so called to alert mariners that access to the areas may be restricted when test activities are taking place. The Middle Danger Zone receives the heaviest use. Restricted airspace zones extend to 60,000 feet above the river surface. Danger zones and airspace restrictions are only in effect during test operations.

Explosives Experimental Area (EEA)

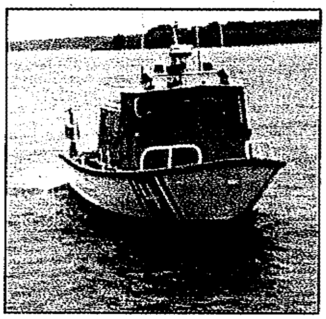
The 1,641-acre EEA Complex is a land range used to test ordnance performance, lethality, and safety. One of Dahlgren's missions is to perform testing and evaluation to certify that ordnance items and weapons systems are safe for fleet use. This testing occurs on the EEA. A restricted airspace zone 7,000 feet in altitude in is effect over the EEA during testing.

Test Range Safety

During test operations on the PRTR or the EEA, range safety considerations may require restrictions on river traffic. In order to ensure that such testing does not endanger watercraft, range boats (painted international orange with a white hull) patrol areas rendered hazardous by the test operations. It is the responsibility of these boats to ensure that no watercraft are endangered by the test operation. Normally, these boats are stationed near Lower Cedar Point, Maryland; near Swan Point, Maryland; offshore at Colonial Beach, Virginia; and at the mouth of Upper Machodoc Creek, Virginia.



During test operations, range boats fly red flags, warning watercraft not to enter an area without having obtained permission from the nearest range patrol boat. Depending on the type of operation, traffic can frequently be safely rerouted around the test area. Range control personnel carefully minimize delays to both commercial and recreational boat traffic.



Dahlgren's Range Control Communications Center can be reached at 1-540-653-8791. Range Control monitors marine ship-to-shore channels 14 and 16 and will respond to requests for information. More specific information on the danger zone and on tests scheduled for a particular day can be found on the Web at http://www.nswc.navy.mil/RANGE.

Frequency of Testing

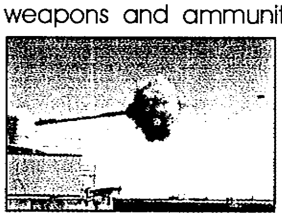
Dahlgren typically conducts operations Monday through Friday between 9 am and 5 pm. Operations outside these times are infrequent. In recent years, an average of about 4,700 rounds have been fired annually from large-caliber guns on the PRTR. Guns shoot multiple bursts or intermittent single rounds. An average of 192 detonations take place every year, primarily on the EEA. Detonations usually are heard as booms or rumbles. Because Dahlgren is able to model test firings on computers, the number of rounds fired annually has dropped by 80 percent since the 1960s.

Scheduled operations are listed on our range website at http://www.nswc.navy.mil/RANGE or accessed by calling our toll-free number at 1-877-845-5656.

Ammunition in the Potomac River

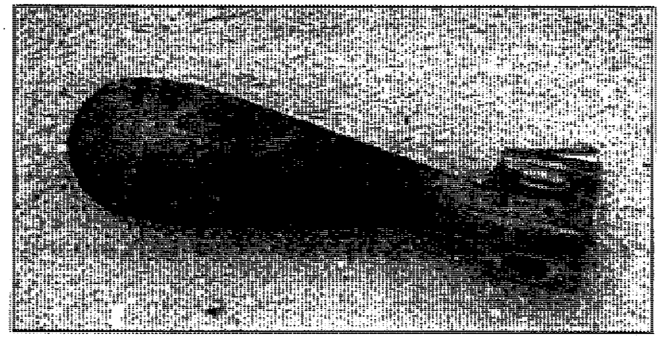
Over Dahlgren's more than eight decades of operations, millions of rounds of ammunition have been fired or launched within the bounds of the PRTR. Most of the ammunition fired on Dahlgren's ranges has been inert, composed of a steel case surrounding an inert filler material, such as cement. The cement replicates the weight of a live projectile. Spent projectiles typically become embedded in river sediments.

When there is a requirement to test-fire explosive ammunition, the filler in the projectile is composed of explosive materials designed to detonate just above the water or upon impact with the water. As the very nature of Dahlgren's mission is to develop and test weapons and ammunition in order to develop more effective systems, some tests fail. A small percentage of live ammunition fired over the years has failed to detonate. Such ammunition is called unexploded ordnance or UXO.



Unexploded Ordnance (UXO)

UXO still contains explosives, chemicals, or propellants after firing or use because the ordnance did not explode. On the PRTR, unexploded projectiles rapidly sink to the bottom of the river and are covered with sediment and silt.

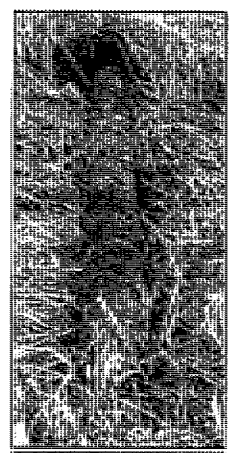


The broad variety of research, development, testing, evaluation, and training activities conducted on Dahlgren's ranges have resulted in four different types of UXO: naval gun ammunition; small explosives such as grenades; aircraft bombs; and small rockets.

If disturbed, UXO can explode and injure people handling it. In the event that UXO or potential UXO is located by the public in shallow water, or is found washed ashore following a storm, Dahlgren responds immediately to secure the item and safely remove it.

If you find a projectile:

1. DO NOT TOUCH OR ATTEMPT TO MOVE THE ITEM.
2. Treat any suspected UXO as if it IS UXO – Dahlgren will provide experts who will identify and if necessary remove and properly treat the item.
3. Phone the Dahlgren base operator – (540) 653-8531 – and give your name, address, phone number, and location of the suspect item.
4. Mark the area (avoid direct contact with the suspect item).
5. If possible, take a digital picture of the suspect item to email to the Explosives Ordnance Disposal (EOD) response team after they contact you.



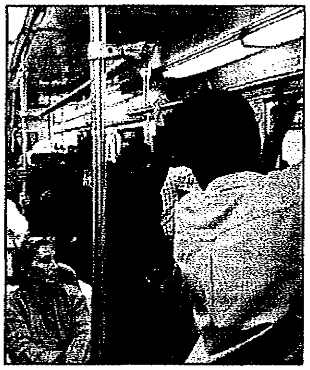
The base operator will contact the EOD response team – on call 24 hours a day – who will follow up with you.

NAVSEA WARFARE CENTERS

Chemical & Biological Sensor Tests

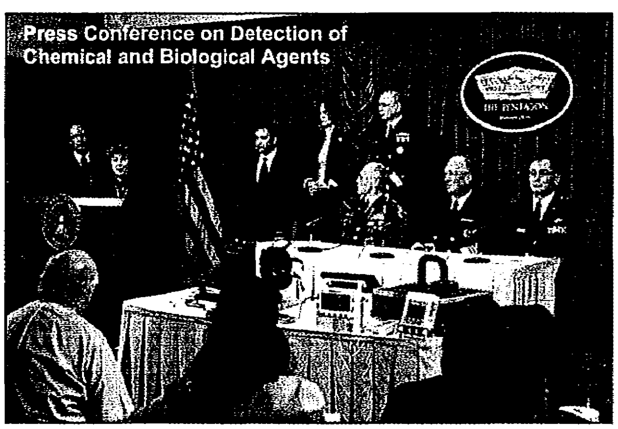
DAHLGREN | A Dahlgren Public Affairs Fact Sheet

The possibility that weapons of mass destruction might be used against us has become all too real in today's world. It is far easier and cheaper for potential adversaries to make and deliver chemical or biological weapons than nuclear weapons, and the potential for harm is very high. The 1995 sarin nerve gas chemical attack on the Tokyo subway system and the 2001 anthrax biological attack through the Washington, DC postal service demonstrate the need to focus significant efforts to protect our homeland and our troops.



Chemical and biological weapons are very difficult to detect, and the key to surviving an attack is early detection and warning. As the primary Navy laboratory for the Department of Defense (DoD) chemical and biological defense program, Dahlgren has been working with other DoD agencies, the Department of Homeland Security, and civilian industry to develop rapid and accurate methods for detecting, or sensing, chemical agents outdoors in the coastal environment. Efforts will soon be expanding into the detection of biological agents or combinations of chemical and biological agents outdoors.

Because actual chemical and biological agents are dangerous, Dahlgren will conduct outdoor tests using only non-hazardous chemical and biological substitutes for the real, dangerous agents that terrorists might use.



Non-hazardous Chemical and Biological Substitute Agents Used in Testing

For outdoor tests of chemical and biological sensors, Dahlgren will use benign chemical compounds or biological materials, many of which are in common everyday use. These compounds simulate or mimic chemical or biological agents that might be used in a terrorist attack, and therefore are crucial in allowing us to determine whether the sensors we are testing could detect actual agents. In order to mimic the real chemical or biological agents effectively, these substitute materials must have the same characteristics – such as size, density, and aerosol behavior – as the real agents would have, but must also carry minimum risk, so that they can be used safely in outdoor tests.

Acetic acid and methyl salicylate are two examples of chemicals that are similar to dangerous chemical agents in physical characteristics. Both are common in everyday life. Common vinegar is actually diluted acetic acid, and methyl salicylate is a non-toxic chemical better known as oil of wintergreen. *Bacillus globigii* is an example of a substitute for biological agents that is used to mimic anthrax in tests. *Bacillus globigii* is commonly found in decomposing organic material, and some strains are used to make antibiotics.

Safety When Using Non-hazardous Chemical and Biological Substitute Agents

The substitute chemical compounds and biological materials that Dahlgren will use are specifically designed to pose minimum risk to humans and the environment. In fact, the types of chemicals that people use every day in cleaning their homes and killing bugs and weeds in their gardens are far more dangerous than anything that Dahlgren will use in its tests. However, to ensure safety, our scientists will use caution in handling these chemical and biological substitute agents, just as people use caution when handling chemicals in their homes.

As an example, vinegar – a dilute version of one chemical agent substitute – is an excellent disinfectant and cleaning solution in the

ENCLOSURE (3)

home, and is much safer than most of the other chemicals available in the grocery store. Although you can use vinegar to dress a salad or rinse your hair, it is still an acid, and can hurt your eyes and irritate your lungs if sprayed near your face. Therefore, when Dahlgren scientists and engineers conduct tests that involve releasing chemical subtitute agents outdoors, they wear appropriate protective gear. However, once airborne, the chemical mist quickly dilutes and dissipates, so that no protective gear is required beyond the immediate release point.

Household dust, mold spores that emerge from digging in the garden, pollen in the spring and summer, or leaf dust raked up in the fall are examples of biological substances that often cause us more problems when inhaled than the biological substitute agents Dahlgren will use. The Centers for Disease Control, for example, considers *Bacillus globigii*, the biological substitute agent previously mentioned, safe to be around. It is very common and we inhale it almost everywhere. Nevertheless, at Dahlgren we will only use *Bacillus globigii* spores under strict safety guidelines, as inhaling too many live spores can still cause respiratory distress to sensitized individuals and anyone with severe respiratory ailments. Just as you would not want to breathe in or get in your eyes perfectly safe substances such as flour dust, Dahlgren scientists will wear protective gear to avoid inhaling large amounts of substitute biological agents. Again, the concentration of substitute bioligical materials used in tests will quickly decrease, and protective gear will only be required near the release point.

What will Dahlgren do with these Non-hazardous Chemical and Biological Substitute Agents?

The Navy and the DoD need to know whether the detection methods under development actually work, and – of particular importance to the Navy – whether and how well they work in a maritime environment. Dahlgren scientists and engineers will use various chemical and biological substitute agents to test both our sensor methods and our equipment.

We at Dahlgren are on the cutting edge of technology, using the electromagnetic spectrum to develop unique sensors. Our scientists will use electromagnetic frequencies and sophisticated computer software to analyze substitute chemical and bilogical agents as they develop effective methods for rapidly identifying the presence of real chemical or biological agents – in a matter of seconds or minutes, rather than the hours and sometimes days it currently takes. Accuracy is equally important: sensors must correctly identify the relevant agents and not give false alarms. Using a variety of safe chemical and biological substitute agents in sensor testing will help ensure that we achieve the required accuracy.

In addition to sensor development, Dahlgren scientists and engineers will use these chemical and biological subsitiue agents for two other important applications:

1. To develop ways of protecting personnel from contact with real chemical and biological agents, such as through the use of protective clothing and equipment.

2. To develop ways of both handling and decontaminating people and equipment exposed to real chemical and biological agents while minimizing danger to others.

NAVSEA
WARFARE CENTERS
DAHLGREN

Dahlgren: A Unique National Asset

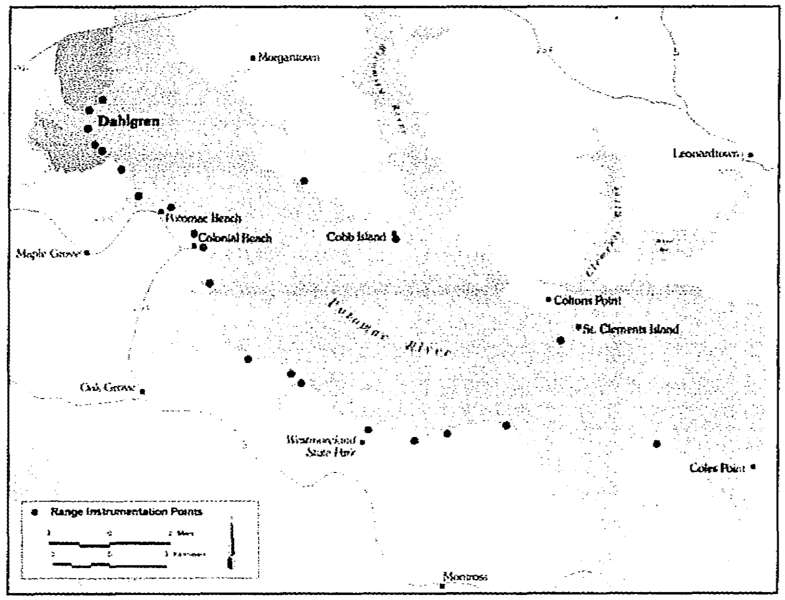
A Dahlgren Public Affairs Fact Sheet

Four characteristics that make Dahlgren a unique national asset:

1. Coastal environment and varied climate
2. Fully instrumented over-the-water range
3. On-site expertise and equipment for complete development process
4. Proximity to other key military and government installations

Dahlgren has been at the core of US Naval strength for nearly a century. Today, it also supports other branches of the military, the joint forces of our allies, and the Department of Homeland Security. From surface combat systems and advanced weapons to strategic strike capabilities and homeland protection, Dahlgren provides overwhelming technological advantage to our nation and our troops. The nation is very fortunate to have this unique research, development, testing and evaluation (RDT&E) facility. Four characteristics make Dahlgren invaluable to our nation:

Coastal Environment and Varied Climate

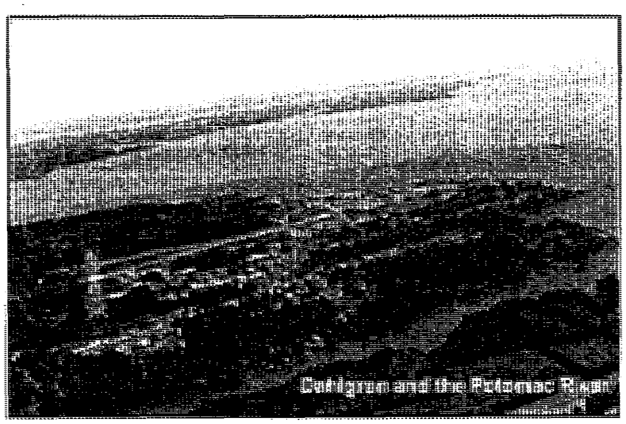


Because weapon systems and sensors function differently over water than over land, it is necessary to test them in a coastal environment that blends land, air, and water with varying weather conditions.

At Dahlgren, we can test and evaluate weapons and equipment in a riverine location that is similar to the coastal environments around the world where many of today's conflicts occur. Dahlgren is one of the few Navy locations that can provide a coastal environment for RTD&E supporting military preparedness. .

Fully Instrumented Over-the-Water Range

Dahlgren has a multitude of test facilities that support its RDT&E activities. Among them are the Potomac River Test Range (PRTR) complex and the Explosives Experimental Area (EEA) range complex (see map on back page). Dahlgren's PRTR is the nation's largest fully-instrumented over-the-water gun firing range. It allows the Navy to efficiently conduct testing in a realistic, controlled environment. Using the PRTR together with our other RDT&E facilities, we can interact in real time with actual operating forces of the Navy or other branches of the military to test how well they operate together and how well weapon system components are working. This not only provides the Navy with a cost-effective method of developing new weapons and systems, but also speeds the development process.



Dahlgren and the Potomac River

For information on Dahlgren, please visit:

General Web site:
www.nswc.navy.mil

Range Web site:
www.nswc.navy.mil/RANGE/

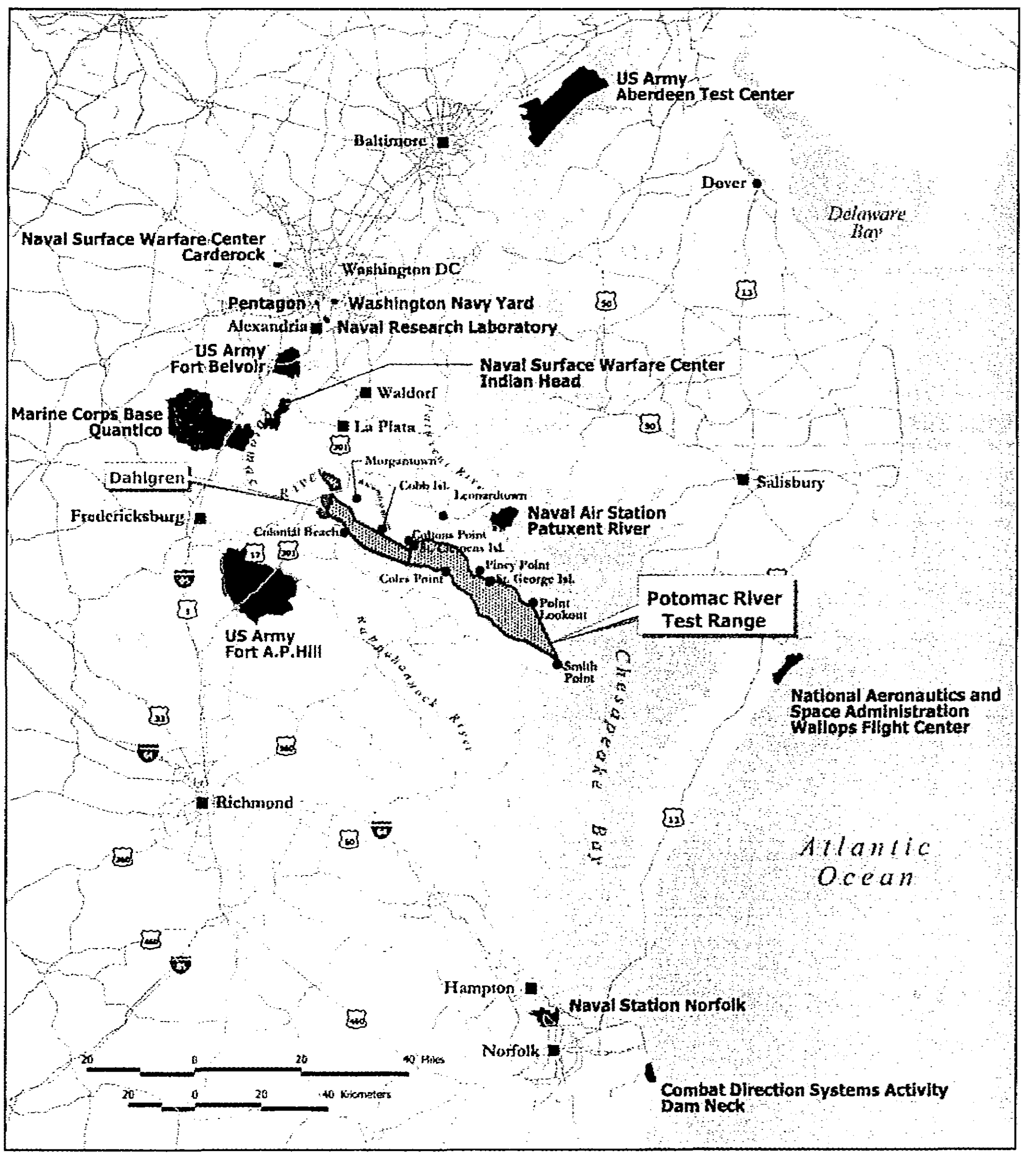
On-site Expertise and Equipment for Complete Development Process

With our extraordinary team of scientists and engineers, extensive and cutting-edge equipment, and fully integrated RDT&E capabilities, we can take entire projects from idea to prototype to deployment right here at Dahlgren.

These assets also enable us to respond quickly and effectively to ever-changing situations. One example of rapid response is the recent need by the Marines in Iraq for improved armor plating and windshield material. Many of the military's transportation vehicles have minimal armor protection against attacks by small arms fire, improvised explosive devices (IEDs), and rocket-propelled grenades. The Marines came to Dahlgren urgently requesting assistance. In response, Dahlgren's engineers and scientists worked 24/7 to develop – in just a few weeks' time – improved shielding. In addition to being protective, the new armor had to be lightweight, and more than a dozen materials were tested. The final product is protection that can literally be sprayed onto the vehicles in layers, providing added security and flexibility. Another advantage is that this process can be performed on equipment in place, precluding the need for vehicles to be removed from the field for upgrade.

Proximity to Key Military Installations and Government Agencies

Finally, the proximity of Dahlgren and its resident scientists and engineers to the seat of government and numerous military installations (from the Pentagon to Naval Station Norfolk) fosters scientific, technical, and operational collaboration across services and government agencies. The combination of our outstanding RDT&E capabilities, our testing facilities, and our physical location makes us a hub within this important network of military installations and government agencies.



NAVSEA WARFARE CENTERS
DAHLGREN

Dahlgren: A Vital Mission

A Dahlgren Public Affairs Fact Sheet

Research, development, test, and evaluation for:

- Military safety testing
- Integrated warfare systems
- Weapons and ammunition
- Sensors and directed energy
- Homeland and force (military personnel and equipment) protection

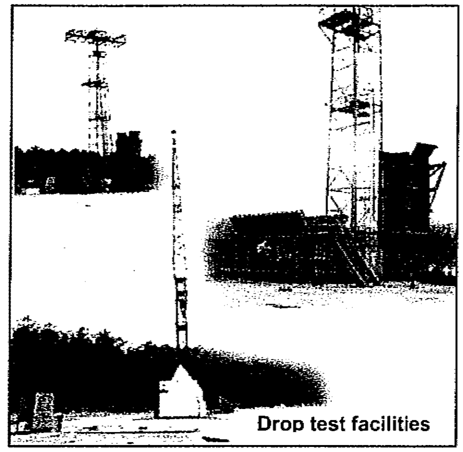
For information on Dahlgren, please visit:

General Web site: www.nswc.navy.mil

Range Web site: www.nswc.navy.mil/RANGE/

The mission of the Naval Surface Warfare Center at Dahlgren focuses on research, development, test, and evaluation (RDT&E) in the fields of military safety testing, integrated warfare systems, weapons and ammunition, sensors and directed energy, and homeland and force (military personnel and equipment) protection.

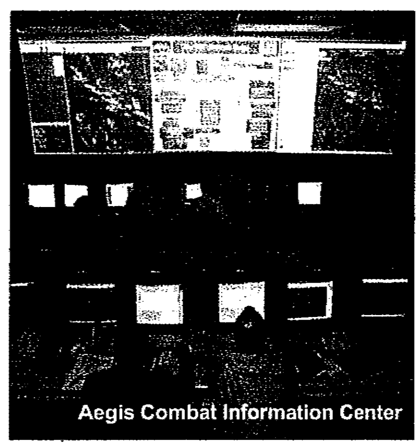
Military Safety Testing


Drop test facilities

When aboard ship, sailors literally sleep adjacent to ammunition and their weapons. Therefore, it is important to ensure that all weapons and every lot of ammunition that goes to the fleet are tested for stability and safety under a variety of conditions. For example, if sailors accidentally drop a projectile they are handling, an explosion could occur, potentially resulting in serious damage, injury, or loss of life. To help design projectiles that will not explode if dropped, we test their stability by dropping them from a height of 40 feet.

Other tests are conducted to ensure that weapons and ammunition will withstand a range of environmental conditions, including extreme heat, cold, and humidity; shock; vibrations; and electromagnetic energy (such as radio and cell phone signals). For instance, Dahlgren is an advanced RDT&E center for determining the adverse effects that electromagnetic energy can have on ammunition or electro-explosive devices. Such effects include premature firing and failure to fire. Test programs in this field are a growing activity at Dahlgren.

Integrated Warfare Systems


Aegis Combat Information Center

As recently as Desert Storm (early 1990s), the different branches of the armed forces could not communicate or operate effectively with one another. Waste and unnecessary loss of life were the unfortunate result. Technology has changed this, by allowing the weapons and communications systems of all branches of the armed forces to work together. This is called integrated warfare and has become absolutely critical to military effectiveness.

The first-ever integrated warfare system was Dahlgren's Aegis. It remains the most successful. Today, Dahlgren tests, upgrades, and ensures the seamless functioning of multiple integrated warfare systems.

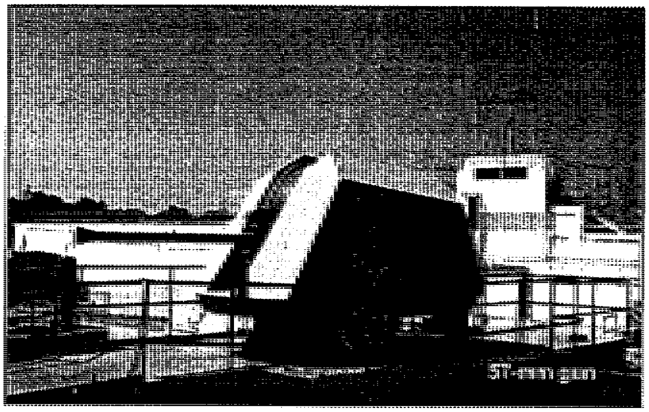
Weapons and Ammunition

Dahlgren uses its resources to conduct a variety of tests to ensure the safety and effectiveness of our military's inventory of naval guns, ammunition, and barrels. Almost every naval gun barrel comes to Dahlgren for testing before going to the fleet. We inspect them and test them by firing rounds of ammunition under conditions that ensure their proper functioning in the field. All forms of naval fuzes (detonating devices) are

ENCLOSURE (5)

likewise thoroughly tested at Dahlgren, as it is essential that fuzes work as intended under all conditions. Finally, random samples of each lot of ammunition purchased by the Navy are sent to Dahlgren for testing and evaluation.

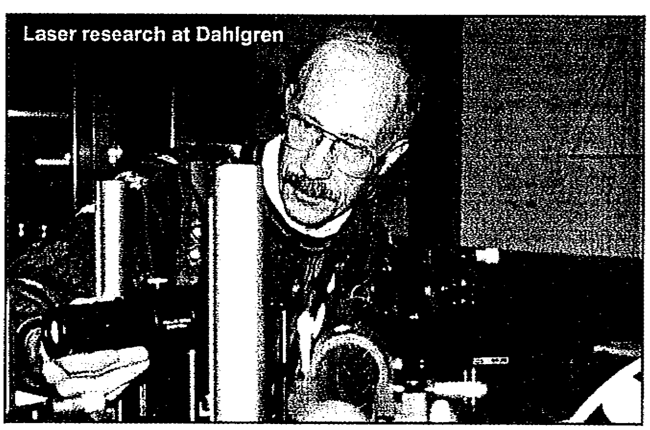
We also develop and test new forms of weapons and ammunition, such as long-range projectiles. Long-range projectiles will allow Naval ships to stay well offshore in hostile areas and bombard targets farther inland than is possible using current Naval guns and projectiles.



Sensors and Directed Energy

Passive and active sensors are critical in modern warfare and homeland protection. Both kinds of sensors are tested at Dahlgren.

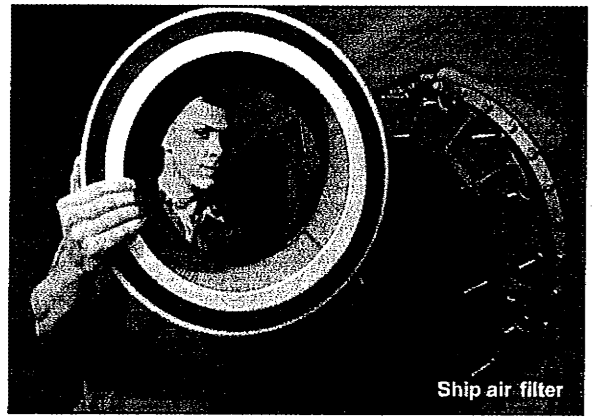
Passive sensors pick up signals from targets without emitting any potentially detectable energy. Examples include nighttime vision devices that amplify existing light, infrared detectors that sense heat emitted by targets, and surveillance television cameras. Active sensors, such as radar, send out their own signals in order to identify and track a given target or threat. Most active sensors involve the use of directed energy. Lasers and high-powered microwaves such as radars are forms of directed energy. With sufficient energy and technical design, directed energy can also be developed into weapons. RDT&E of directed energy devices is a dynamic field at Dahlgren.



Laser research at Dahlgren

Sensors allow our military to respond effectively to a wide range of threats, both conventional and unconventional, and help provide real-time situational awareness of the battlefield. For instance, sensors can be used for all-weather night and day surveillance; precision targeting; detection and tracking of moving targets such as cruise missiles; and detection of mines and submarines.

Homeland and Force (Military Personnel and Equipment) Protection



Ship air filter

Dahlgren's homeland and force protection RDT&E activities draw on the full range of expertise available on base. Examples include:

- Rapid prototyping of troop-protection devices.
- Chemical/biological/radiological defense, including contamination avoidance, individual and collective protection, and decontamination.
- Testing of air filters used onboard ships.
- Gear-entanglement systems that can stop small high-speed boats by launching a mesh of rope or similar material to entangle the boat or its propulsion system.
- Infrastructure Assurance Program, which identifies and finds ways to protect critical United States technology and intellectual capital, particularly in the areas of national defense .

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
NORTHEAST REGION
One Blackburn Drive
Gloucester, MA 01930-2298

JUN 20 2008

Ms. Ann G. Swope
Head, Safety & Environmental Office
Department of the Navy
Naval Surface Warfare Center, Dahlgren Division
6149 Welsh Road, Suite 203
Dahlgren, VA 22448-5130

Re: NSWCDL RDT&E EIS Technical Assistance

Dear Ms. Swope:

This is in response to your letter dated April 10, 2008 requesting information on the presence of any species listed as threatened or endangered under the Endangered Species Act of 1973 (ESA), as amended, in the vicinity of the Potomac River Test Range (PRTR) Complex. The Naval Surface Warfare Center, Dahlgren Site (NSWCDL) is preparing an environmental impact statement (EIS) to evaluate the potential environmental consequences of expanding the research, development, test and evaluation (RDT&E) activities taking place outdoors on the PRTR. These activities include use of ordnance, lasers, electromagnetic fields, and chemical and biological simulants. Your letter included fact sheets about the activities conducted at the PRTR, as well as a summary of protected species known to occur in the Potomac River in the vicinity of the PRTR, and requested concurrence with the species list and any further information regarding endangered and threatened species that could assist in preparation of the EIS.

The PRTR Species Summary enclosed with your letter identified the presence of ESA-listed shortnose sturgeon (*Acipenser brevirostrum*), loggerhead sea turtles (*Caretta caretta*), Kemp's ridley sea turtles (*Lepidochelys kempii*), green sea turtles (*Chelonia mydas*), and leatherback sea turtles (*Dermochelys coriacea*) in the vicinity of the PRTR. NMFS concurs with this species list. Although ESA-listed whales are known to transit past the mouth of Chesapeake Bay, large whale species would be considered rare transients within the Bay and are not likely to occur within the Potomac River. There is no designated or proposed critical habitat in the action area.

Sea turtles are generally present in the Chesapeake Bay from April 1-November 30 each year, when water temperatures are relatively warm. An estimated 3,000 - 10,000 loggerhead turtles and 500 Kemp's ridley sea turtles are found in the Chesapeake Bay annually. In the Chesapeake Bay, Kemp's ridleys frequently forage in shallow embayments, particularly in areas supporting submerged aquatic vegetation and on tidal flats. Approximately 95 percent of the loggerheads found in the Chesapeake Bay are juveniles; these turtles are found most commonly from the mouth of the Bay to the Potomac River while foraging along channel edges. Leatherback sea turtles are predominantly pelagic but are also seasonally present in the Chesapeake Bay. As noted in the summary provided by your office, sea turtles are more likely to be found in the

Lower Danger Zone in areas closer to the mouth of the river. For more information about sea turtles in the Chesapeake Bay, please contact Carrie Upite at (978) 281-9300, ext. 6525, or Carrie.Upite@noaa.gov.

The federally endangered shortnose sturgeon is known to be present in the Chesapeake Bay. During the 1996-2005 time period, the incidental capture of seventy-two different shortnose sturgeon in the Chesapeake Bay and its tributaries had been reported via the US Fish and Wildlife Service's Atlantic sturgeon reward program. This number includes eight shortnose sturgeon captured incidentally in fishing gear in the Potomac River. As your letter indicates, several of these captures were within the PRTR. Additionally, researchers conducting a survey for shortnose sturgeon in the river captured one mature egg bearing female in September 2005 and an additional mature egg bearing female in the same location in March 2006. Both fish have been outfitted with sonic tags and are being actively tracked by researchers. Information available to date indicates that these fish have remained within the Potomac River since they were tagged. The female caught in September overwintered in the Potomac River near Mattawoman Creek. One of the females was documented at the presumed spawning grounds near Little Falls in the spring of 2006. The occurrence of pre-spawning females in the Potomac River suggests that a spawning population of shortnose sturgeon continues to exist in this river system. Although the two tagged sturgeon appeared to spend most of their time in areas upriver of the PRTR, one was captured at rkm 63 in 2006, which is within the Middle Danger Zone of the PRTR. For further information about shortnose sturgeon in the Potomac River, please contact Mike Mangold, US Fish and Wildlife Service, at (410) 573-4509.

Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) are distributed along the entire East Coast of the United States and have been designated a Candidate Species by NMFS. Atlantic sturgeon are known to be present in the Chesapeake Bay and its tributaries, including the Potomac River. As a candidate species, Atlantic sturgeon receive no substantive or procedural protection under the ESA; however, NMFS recommends that project proponents consider implementing conservation actions to limit the potential for adverse effects on Atlantic sturgeon from any proposed project. Many populations, including those found in the Chesapeake Bay, have undergone drastic declines in abundance since the late 1800s. In 2006, NMFS initiated a status review for this species to determine if listing as threatened or endangered under the ESA is warranted. NMFS is currently reviewing the findings of the Status Review team. If the species is proposed for listing, the conference provisions of Section 7 become applicable (see 50 CFR §402.10) and the consultation requirement becomes applicable if the species is listed. The Status Review report is available at: *http://www.nero.noaa.gov/prot_res/CandidateSpeciesProgram/AtlSturgeonStatusReviewReport.pdf*.

Sturgeon and sea turtles may be impacted by the types of activities proposed in the PRTR, including direct impacts from the use of explosives as well as impacts to habitat from expended ordnance or chemical and biological simulants. As you know, Section 7(a)(2) of the ESA states that each Federal agency shall, in consultation with the Secretary, insure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat. As listed shortnose sturgeon and sea turtles are known to be present in the vicinity of the PRTR and effects to listed species may result from the activities taking place on the PRTR, NMFS recommends that the Navy initiate consultation pursuant to section 7 of the ESA.

To initiate section 7 consultation for this action, the Navy should submit a complete project description along with a determination of effects and justification for the determination (i.e., a Biological Assessment) and a request for concurrence to NMFS. We do not anticipate requiring any site surveys to assess the distribution of listed species in the action area; however, NMFS does expect a complete and accurate assessment of shortnose sturgeon and sea turtle presence in the vicinity of project activities based on the best available data, as well as a thorough assessment of the potential impacts of the RDT&E activities on listed species in the PRTR.

While not protected under the ESA, several other species of marine mammals may occur in the Chesapeake Bay and its tributaries. All marine mammals are protected under the Marine Mammal Protection Act of 1972 (MMPA). If it is felt that this project has the potential to take marine mammals through injury, harassment, or mortality, then the Navy is responsible for obtaining an incidental take permit from NMFS. For more information about the permitting process, please visit http://www.nmfs.noaa.gov/pr/permits/.

Consultation for Essential Fish Habitat (EFH) under the Magnuson-Stevens Fishery Conservation and Management Act (MSA) may be necessary for this project due to the presence of federally managed species in the project area. If EFH may be adversely affected, the Navy must submit an EFH Assessment to NMFS analyzing the effects of the action on EFH and federally managed species. A guide to essential fish habitat designations in the Northeastern United States is located on the Habitat Conservation Division web site at http://www.nero.noaa.gov/hcd/webintro.html. Questions concerning EFH in Maryland and Virginia can be directed to John Nichols at (410)267-5675.

My staff looks forward to working with you on the conservation of listed species in the Chesapeake Bay and is available to further discuss protected resources in this area that may be affected by the proposed project. Please contact Kristen Koyama of my staff at (978) 281-9300 x6531 or by e-mail (Kristen.Koyama@noaa.gov) if you would like to discuss these comments or the procedures for initiating consultation.

Sincerely,

Mary A. Colligan
Assistant Regional Administrator
for Protected Resources

Cc: Nichols, Colosi - F/NER4

File Code: Sec 7 tech assist 2008 – Navy Potomac River Test Range RDT&E
PCTS: T/NER/2008/03640

THIS PAGE INTENTIONALLY LEFT BLANK

DEPARTMENT OF THE NAVY
NAVAL SURFACE WARFARE CENTER
DAHLGREN DIVISION
6149 WELSH ROAD, SUITE 203
DAHLGREN, VIRGINIA 22448-5130

IN REPLY REFER TO

5090
Ser XDC8/027
24 Jun 08

Ms. Lori Byrne
DNR Wildlife and Heritage Service
580 Taylor Avenue
Tawes State Office Building E-1
Annapolis, MD 21401

Dear Ms. Byrne,

SUBJECT: TECHNICAL ASSISTANCE FOR NSWCDL OUTDOOR RESEARCH, DEVELOPMENT, TESTING & EVALUATION ACTIVITIES ENVIRONMENTAL IMPACT STATEMENT

The Naval Surface Warfare Center, Dahlgren Site (NSWCDL), a tenant on Naval Support Facility (NSF) Dahlgren, Virginia, is preparing an environmental impact statement (EIS) to evaluate the potential environmental consequences of expanding our research, development, test and evaluation (RDT&E) activities taking place outdoors on the Potomac River Test Range (PRTR) Complex, the Explosives Experimental Area (EEA) Complex, mission areas, and in special use airspace over the ranges. RDT&E activities are conducted in support of NSWCDL's mission requirements in surface warfare, surface ship combat systems, strategic systems, ordnance, and special warfare systems. These activities include outdoor operations using ordnance, lasers, electromagnetic energy, and chemical and biological simulants.

The project areas for the proposed action are our ranges and mission areas (Figures 1 and 2), which include:

a. The PRTR Complex, which consists of a 715-acre land area and a 169-square-nautical-mile water area that stretches along the lower 51 miles of the Potomac River. Three geographic zones are defined on nautical charts - the Upper, Middle, and Lower Danger Zones - so called to alert mariners that access to the areas may be restricted when test activities are taking place. The areas of interest in the PRTR Complex are subdivided into land ranges, Upper Danger Zone, Middle Danger Zone, and Lower Danger Zone. The Middle Danger Zone is the focus of most outdoor RDT&E activities. Figure 3 shows the main gunnery target area in the PRTR.

b. The counties surrounding the PRTR include King George, Westmoreland and Northumberland counties in Virginia and Charles and St. Mary's counties in Maryland. The geographic coordinates of the danger zones may be found at: http://edocket.access.gpo.gov/cfr_2007/julqtr/pdf/33cfr334.230.pdf. The PRTR is shown on parts of the following US Geological Survey quadrangle maps: Nanjemoy, MD; Popes Creek, MD; Charlotte Hall, MD; Mechanicsville, MD; Rock Point, MD; Leonardtown, MD; Hollywood, MD; Mathias Point, MD-VA; King George, VA-MD; Dahlgren, VA-MD; Colonial Beach North, VA-MD; Colonial Beach South, VA-MD; Stratford Hall, VA-MD; St. Clements Island, MD-VA; Piney Point, MD-VA; and Kinsale, VA-MD.

c. The 1,641-acre EEA Complex, which is bordered by Upper Machodoc Creek to the north and west and the Potomac River to the east (Figure 2).

d. NSWCDL's Mission Areas, which include a 1,593-acre land area on NSF Dahlgren and a 164-acre water area (see Figure 2). The water area lies on Upper Machodoc Creek, immediately north of the EEA Complex and south and west of the PRTR land complex. The land area lies immediately north and west of the PRTR land ranges.

Enclosed are seven fact sheets that describe our operations and support the EIS. We foresee evaluating the impact of three alternatives in the EIS as described in the EIS Fact Sheet. Further information on the EIS may be obtained from our website http://www.nswc.navy.mil/EIS/index.html.

To help us describe existing conditions and evaluate the impacts of the proposed action, we request that your agency

5090
Ser XDC8/027
24 Jun 08

provide a list of endangered, threatened, and proposed species and designated and proposed critical habitats that may be present in the project areas. Please note that we are also sending coordination letters to the US Fish & Wildlife Service's Chesapeake Bay and Virginia Field Offices, the National Marine Fisheries Service's Northeast Regional Office, the Virginia Department of Game and Inland Fisheries, and the Virginia Department of Conservation and Recreation-Division of Natural Heritage.

For further information, please contact Dr. Thomas Wray II, at (540) 653-4186 (thomas.wray@navy.mil). Thank you in advance for your assistance.

Sincerely,

ANN G. SWOPE
Head, Safety and Environmental Office
By direction of the Commander

Enclosures:
1. Figure 1. Potomac River Test Range Complex
2. Figure 2. Dahlgren's Ranges and Mission Areas
3. Figure 3. Potomac River Test Range Primary Gunnery Target Area
4. Environmental Impact Statement
5. Test Range Operations
6. Chemical & Biological Sensor Tests
7. Laser Technology
8. Electromagnetic Energy
9. Dahlgren: A Unique National Asset
10. Dahlgren: A Vital Mission

THIS PAGE INTENTIONALLY LEFT BLANK

DEPARTMENT OF THE NAVY
NAVAL SURFACE WARFARE CENTER
DAHLGREN DIVISION
6149 WELSH ROAD, SUITE 203
DAHLGREN, VIRGINIA 22448-5130

IN REPLY REFER TO

5090
Ser XDC8/032
24 Jun 08

Ms. Rene Hypes, Environmental Review Coordinator
Virginia Department of Conservation and Recreation
Division of Natural Heritage
217 Governor Street, 3rd Floor
Richmond, VA 23219

Dear Ms. Hypes,

SUBJECT: TECHNICAL ASSISTANCE FOR NSWCDL OUTDOOR RESEARCH, DEVELOPMENT, TESTING & EVALUATION ACTIVITIES ENVIRONMENTAL IMPACT STATEMENT

The Naval Surface Warfare Center, Dahlgren Site (NSWCDL), a tenant on Naval Support Facility (NSF) Dahlgren, Dahlgren, Virginia, is preparing an environmental impact statement (EIS) to evaluate the potential environmental consequences of expanding our research, development, test and evaluation (RDT&E) activities taking place outdoors on the Potomac River Test Range (PRTR) Complex, the Explosives Experimental Area (EEA) Complex, mission areas, and in special use airspace over the ranges. RDT&E activities are conducted in support of NSWCDL's mission requirements in surface warfare, surface ship combat systems, strategic systems, ordnance, and special warfare systems. These activities include outdoor operations using ordnance, lasers, electromagnetic energy, and chemical and biological simulants.

The project areas for the proposed action are our ranges and mission areas (Figures 1 and 2), which include:

a. The PRTR Complex, which consists of a 715-acre land area and a 169-square-nautical-mile water area that stretches along the lower 51 miles of the Potomac River. Three geographic zones are defined on nautical charts - the Upper, Middle, and Lower Danger Zones - so called to alert mariners that access to the areas may be restricted when test activities are taking place. The areas of interest in the PRTR Complex are subdivided into land ranges, Upper Danger Zone, Middle Danger Zone, and Lower

Danger Zone. The Middle Danger Zone is the focus of most outdoor RDT&E activities. Figure 3 shows the main gunnery target area in the PRTR.

b. The counties surrounding the PRTR include King George, Westmoreland and Northumberland counties in Virginia and Charles and St. Mary's counties in Maryland. The geographic coordinates of of the danger zones may be found at: http://edocket.access.gpo.gov/cfr 2007/julqtr/pdf/33cfr334.230.pdf. The PRTR is shown on parts of the following US Geological Survey quadrangle maps: Mathias Point, MD-VA; King George, VA-MD; Dahlgren, VA-MD; Colonial Beach North, VA-MD; Colonial Beach South, VA-MD; Port Royal, VA; Rollins Fork, VA; Stratford Hall, VA-MD; St. Clements Island, MD-VA; Piney Point, MD-VA; Machodoc, VA; and Kinsale, VA-MD.

c. The 1,641-acre EEA Complex, which is bordered by Upper Machodoc Creek to the north and west and the Potomac River to the east (Figure 2).

d. NSWCDL's Mission Areas, which include a 1,593-acre land area on NSF Dahlgren and a 164-acre water area (see Figure 2). The water area lies on Upper Machodoc Creek, immediately north of the EEA and south and west of the PRTR land complex. The land area lies immediately north and west of the PRTR land ranges.

Enclosed are seven fact sheets that describe our operations and support the EIS. We foresee evaluating the impact of three alternatives in the EIS as described in the EIS Fact Sheet. Further information on the EIS may be obtained from our website: http://www.nswc.navy.mil/EIS/index.html.

To help us describe existing conditions and evaluate the impacts of the proposed action, we request that your agency provide a list of endangered, threatened, and proposed species and designated and proposed critical habitats that may be present in the project areas. Please note that we are also sending coordination letters to the US Fish & Wildlife Service's

Chesapeake Bay and Virginia Field Offices, the National Marine Fisheries Service's Northeast Regional Office, the Virginia Department of Game and Inland Fisheries, and the Maryland Department of Natural Resources-Wildlife and Heritage Service.

For further information, please contact Dr. Thomas Wray II, at (540) 653-4186 (Thomas.Wray@navy.mil). Thank you in advance for your assistance.

Sincerely,

ANN G. SWOPE
Head, Safety and Environmental Office
By direction of the Commander

Enclosures:
1. Figure 1. Potomac River Test Range Complex
2. Figure 2. Dahlgren's Ranges and Mission Areas
3. Figure 3. Potomac River Test Range Primary Gunnery Target Area
4. Environmental Impact Statement
5. Test Range Operations
6. Chemical & Biological Sensor Tests
7. Laser Technology
8. Electromagnetic Energy
9. Dahlgren: A Unique National Asset
10. Dahlgren: A Vital Mission

THIS PAGE INTENTIONALLY LEFT BLANK

L. Preston Bryant, Jr.
Secretary of Natural Resources

Joseph H. Maroon
Director

COMMONWEALTH of VIRGINIA

DEPARTMENT OF CONSERVATION AND RECREATION

217 Governor Street
Richmond, Virginia 23219-2010
(804) 786-7951 FAX (804) 371-2674

July 29, 2008

Anne Swope
Naval Surface Warfare Center
6149 Welsh Road, Suite 203
Dahlgren, VA 22448

Re: Technical Assistance for NSWCDL Outdoor Research, Development, Testing & Evaluation Activities – Environmental Impact Statement

Dear Ms. Swope,

The Department of Conservation and Recreation's Division of Natural Heritage (DCR) has searched its Biotics Data System for occurrences of natural heritage resources from the area outlined on the submitted map. Natural heritage resources are defined as the habitat of rare, threatened, or endangered plant and animal species, unique or exemplary natural communities, and significant geologic formations.

According to the information currently in our files, many Bald Eagle nest sites (*Haliaeetus leucocephalus*, G5/S2S3B,S3N/NL/LT) have been documented in the project vicinity. Bald Eagle nest sites are often found in the midst of large wooded areas near marshes or other bodies of water (Byrd, 1991). Bald Eagles feed on fish, waterfowl, seabirds (Campbell et. al., 1990), various mammals and carrion (Terres, 1980). Threats to this species include human disturbance of nest sites (Byrd, 1991), habitat loss, biocide contamination, decreasing food supply and illegal shooting (Herkert, 1992). Please note that this species is currently classified as threatened by the Virginia Department of Game and Inland Fisheries (VDGIF).

Due to the legal status of the Bald Eagle, DCR recommends coordination with the VDGIF to ensure compliance with protected species legislation.

Under a Memorandum of Agreement established between the Virginia Department of Agriculture and Consumer Services (VDACS) and the Virginia Department of Conservation and Recreation (DCR), DCR represents VDACS in comments regarding potential impacts on state-listed threatened and endangered plant and insect species. The current activity will not affect any documented state-listed plants or insects.

State Parks • Soil and Water Conservation • Natural Heritage • Outdoor Recreation Planning
Chesapeake Bay Local Assistance • Dam Safety and Floodplain Management • Land Conservation

In addition, our files do not indicate the presence of any State Natural Area Preserves under DCR's jurisdiction in the project vicinity.

New and updated information is continually added to Biotics. Please contact DCR for an update on this natural heritage information if a significant amount of time passes before it is utilized.

The Virginia Department of Game and Inland Fisheries maintains a database of wildlife locations, including threatened and endangered species, trout streams, and anadromous fish waters, which may contain information not documented in this letter. Their database may be accessed from http://www.dgif.virginia.gov/wildlife/info_map/index.html , or contact Shirl Dressler at (804) 367-6913.

Should you have any questions or concerns, feel free to contact me at 804-692-0984. Thank you for the opportunity to comment on this project.

Sincerely,

Kristal McKelvey
Coastal Zone Locality Liaison

Cc: Amy Ewing, DGIF

Literature Cited

Byrd, M.A. 1991. Bald eagle. In Virginia's Endangered Species: Proceedings of a Symposium. K. Terwilliger ed. The McDonald and Woodward Publishing Company, Blacksburg, Virginia. Pp. 499-501.

Campbell, R.W., N.K. Dawe, I. McTaggart-Cowan, J.M. Cooper, G.W. Kaiser, and M.C.E. McNall. 1990. The Birds of British Columbia. Vol. 1. Nonpasserines: Introduction and loons through waterfowl. Royal British Columbia Museum, Victoria, British Columbia, Canada.

Herkert, J. R., editor. 1992. Endangered and threatened species of Illinois: status and distribution. Vol. 2: Animals. Illinois Endangered Species Protection Board. iv + 142 pp.

Terres, J.K. 1980. The Audubon Society encyclopedia of North American birds. Alfred A. Knopf, New York.

THIS PAGE INTENTIONALLY LEFT BLANK

DEPARTMENT OF THE NAVY
NAVAL SURFACE WARFARE CENTER
DAHLGREN DIVISION
6149 WELSH ROAD, SUITE 203
DAHLGREN, VIRGINIA 22448-5130

IN REPLY REFER TO

5090
Ser XDC8/029
24 Jun 08

Project Review Coordinator
Virginia Department of Game and Inland Fisheries
Environmental Services Section
4010 West Broad Street
Richmond, VA 23230

Dear Sir/Madam,

SUBJECT: TECHNICAL ASSISTANCE FOR NSWCDL OUTDOOR RESEARCH, DEVELOPMENT, TESTING AND EVALUATION ACTIVITIES ENVIRONMENTAL IMPACT STATEMENT

The Naval Surface Warfare Center, Dahlgren Site (NSWCDL), a tenant on Naval Support Facility (NSF) Dahlgren, Virginia, is preparing an environmental impact statement (EIS) to evaluate the potential environmental consequences of expanding our research, development, test and evaluation (RDT&E) activities taking place outdoors on the Potomac River Test Range (PRTR) Complex, the Explosives Experimental Area (EEA) Complex, mission areas, and in special use airspace over the ranges. RDT&E activities are conducted in support of NSWCDL's mission requirements in surface warfare, surface ship combat systems, strategic systems, ordnance, and special warfare systems. These activities include outdoor operations using ordnance, lasers, electromagnetic energy, and chemical and biological simulants.

The project areas for the proposed action are our ranges and mission areas (Figures 1 and 2), which include:

a. The PRTR Complex, which consists of a 715-acre land area and a 169-square-nautical-mile water area that stretches along the lower 51 miles of the Potomac River. Three geographic zones are defined on nautical charts - the Upper, Middle, and Lower Danger Zones - so called to alert mariners that access to the areas may be restricted when test activities are taking place. The areas of interest in the PRTR Complex are subdivided into land ranges, Upper Danger Zone, Middle Danger Zone, and Lower

Danger Zone. The Middle Danger Zone is the focus of most outdoor RDT&E activities. Figure 3 shows the main gunnery target area in the PRTR.

b. The counties surrounding the PRTR include King George, Westmoreland and Northumberland counties in Virginia and Charles and St. Mary's counties in Maryland. The geographic coordinates of the danger zones may be found at: http://edocket.access.gpo.gov/cfr_2007/julqtr/pdf/33cfr334.230.pdf. The PRTR is shown on parts of the following US Geological Survey quadrangle maps: Mathias Point, MD-VA; King George, VA-MD; Dahlgren, VA-MD; Colonial Beach North, VA-MD; Colonial Beach South, VA-MD; Port Royal, VA; Rollins Fork, VA; Stratford Hall, VA-MD; St. Clements Island, MD-VA; Piney Point, MD-VA; Machodoc, VA; and Kinsale, VA-MD.

c. The 1,641-acre EEA Complex, which is bordered by Upper Machodoc Creek to the north and west and the Potomac River to the east (Figure 2).

d. NSWCDL's Mission Areas, which include a 1,593-acre land area on NSF Dahlgren and a 164-acre water area (see Figure 2). The water area lies on Upper Machodoc Creek, immediately north of the EEA and south and west of the PRTR land complex. The land area lies immediately north and west of the PRTR land ranges.

Enclosed are seven fact sheets that describe our operations and support the EIS. We foresee evaluating the impact of three alternatives in the EIS as described in the EIS Fact Sheet. Further information on the EIS may be obtained from our website: http://www.nswc.navy.mil/EIS/index.html.

To help us describe existing conditions and evaluate the impacts of the proposed action, we request that your agency provide a list of endangered, threatened, and proposed species and designated and proposed critical habitats that may be present in the project areas. Please note that we are also sending coordination letters to the US Fish & Wildlife Service's Chesapeake Bay and Virginia Field Offices, the National Marine

5090
Ser XDC8/029
24 Jun 08

Fisheries Service's Northeast Regional Office, the Virginia Department of Conservation and Recreation-Division of Natural Heritage, and the Maryland Department of Natural Resources - Wildlife and Heritage Service.

For further information, please contact Dr. Thomas Wray II, at (540) 653-4186 (Thomas.Wray@navy.mil). Thank you in advance for your assistance.

Sincerely,

ANN G. SWOPE
Head, Safety and Environmental Office
By direction of the Commander

Enclosures:
1. Figure 1. Potomac River Test Range Complex
2. Figure 2. Dahlgren's Ranges and Mission Areas
3. Figure 3. Potomac River Test Range Primary Gunnery Target Area
4. Environmental Impact Statement
5. Test Range Operations
6. Chemical & Biological Sensor Tests
7. Laser Technology
8. Electromagnetic Energy
9. Dahlgren: A Unique National Asset
10. Dahlgren: A Vital Mission

THIS PAGE INTENTIONALLY LEFT BLANK

-----Original Message-----
From: Amy.Ewing@dgif.virginia.gov [mailto:Amy.Ewing@dgif.virginia.gov]
Sent: Friday, August 15, 2008 13:58
To: Wray, Thomas II CIV NAVFAC Washington, Environmental Dept
Cc: Rene.Hypes@dcr.virginia.gov; Mitchell.Norman@dgif.virginia.gov; Glen.Askins@dgif.virginia.gov; John.Kleopfer@dgif.virginia.gov; Jeff.Cooper@dgif.virginia.gov
Subject: ESSLog# 25464_EIS Scoping_Dahlgren

We received a letter from the Navy asking for a list of wildlife resources known from the sites associated with The Potomac River Test Range, The Explosive Experimental Area Complex, mission areas and in special use airspace over the ranges.

According to our records, the following listed wildlife resources are known from these areas:

- state Threatened bald eagle (nesting sites and concentration areas)
- Anadromous Fish Use Areas: Potomac River, Upper Machodoc Creek, Williams Creek, Gambo Creek
- Colonial Waterbird colonies containing great blue heron
- federal species of concern state special concern northern diamond-back terrapin

In addition, federal Threatened state Threatened northeastern beach tiger beetle has been documented in the project area. We recommend coordination with the Virginia Department of Conservation and Recreation's Division of Natural Heritage and the Virginia Department of Agriculture and Consumer Services regarding the protection of this species.

We recommend coordination with the USFWS regarding protection of wildlife resources under their jurisdiction.

We recommend that the EIS address all possible impacts upon these resources and all actions to avoid, minimize and mitigate any impacts upon the above mentioned resources, wildlife habitat, wildlife management, and any recreational opportunities associated with the installation. Further, we recommend that all proposed activities adhere to the guidelines and initiatives set forth in the most recently approved Integrated Natural Resources Management Plan (INRMP) for Dahlgren.

Thank you, Amy

Amy M. Ewing
Environmental Services Biologist
Virginia Dept. of Game and Inland Fisheries 4010 West Broad Street
Richmond, VA 23230
804-367-2211
amy.ewing@dgif.virginia.gov

THIS PAGE INTENTIONALLY LEFT BLANK

DEPARTMENT OF THE NAVY

NAVAL SURFACE WARFARE CENTER
DAHLGREN DIVISION
6149 WELSH ROAD, SUITE 203
DAHLGREN, VIRGINIA 22448-5130

IN REPLY REFER TO

5090
Ser XDC8/026
24 Jun 08

Mr. John Wolflin
Chesapeake Bay Field Office
U.S. Fish and Wildlife Service
177 Admiral Cochrane Dr.
Annapolis, MD 21401

Dear Mr. Wolflin,

SUBJECT: TECHNICAL ASSISTANCE REQUEST FOR NSWCDL OUTDOOR RESEARCH, DEVELOPMENT, TESTING AND EVALUATION ACTIVITIES ENVIRONMENTAL IMPACT STATEMENT

The Naval Surface Warfare Center, Dahlgren Site (NSWCDL), a tenant on Naval Support Facility (NSF) Dahlgren, Virginia, is preparing an environmental impact statement (EIS) to evaluate the potential environmental consequences of expanding our research, development, test and evaluation (RDT&E) activities taking place outdoors on the Potomac River Test Range (PRTR) Complex, the Explosives Experimental Area (EEA) Complex, mission areas, and in special use airspace over the ranges. RDT&E activities are conducted in support of NSWCDL's mission requirements in surface warfare, surface ship combat systems, strategic systems, ordnance, and special warfare systems. These activities include outdoor operations using ordnance, lasers, electromagnetic energy, and chemical and biological simulants.

The project areas for the proposed action are our ranges and mission areas (Figures 1 and 2), which include:

a. The PRTR Complex, consisting of a 715-acre land area and a 169-square-nautical-mile water area that stretches along the lower 51 miles of the Potomac River. Three geographic zones are defined on nautical charts - the Upper, Middle, and Lower Danger Zones - so called to alert mariners that access to the areas may be restricted when test activities are taking place. The areas of interest in the PRTR Complex are subdivided into land ranges, Upper Danger Zone, Middle Danger Zone, and Lower Danger Zone.

The Middle Danger Zone is the focus of most outdoor RDT&E activities. Figure 3 shows the main gunnery target area in the PRTR.

b. The counties surrounding the PRTR include King George, Westmoreland and Northumberland counties in Virginia and Charles and St. Mary's counties in Maryland. The geographic coordinates of the danger zones may be found at http://edocket.access.gpo.gov/cfr 2007/julqtr/pdf/33cfr334.230.pdf. The PRTR is shown on parts of the following US Geological Survey quadrangle maps: Nanjemoy, MD; Popes Creek, MD; Charlotte Hall, MD; Mechanicsville, MD; Rock Point, MD; Leonardtown, MD; Hollywood, MD; Mathias Point, MD-VA; King George, VA-MD; Dahlgren, VA-MD; Colonial Beach North, VA-MD; Port Royal, VA; Rollins Fork, VA; Colonial Beach South, VA-MD; Stratford Hall, VA-MD; St. Clements Island, MD-VA; Piney Point, MD-VA; Machodoc, VA; and Kinsale, VA-MD.

c. The 1,641-acre EEA Complex, bordered by Upper Machodoc Creek to the north and west and the Potomac River to the east (Figure 2).

d. NSWCDL's Mission Areas, including a 1,593-acre land area on NSF Dahlgren and a 164-acre water area (see Figure 2). The water area lies on Upper Machodoc Creek, immediately north of the EEA Complex and south and west of the PRTR land complex. The land area lies immediately north and west of the PRTR land ranges.

Enclosed are seven fact sheets that describe our operations and support the EIS. We foresee evaluating the impact of three alternatives in the EIS as described in the EIS Fact Sheet. Further information on the EIS may be obtained from our website: http://www.nswc.navy.mil/EIS/index.html.

To help us describe existing conditions and evaluate the impacts of the proposed action, we request that your agency provide a list of endangered, threatened, and proposed species and designated and proposed critical habitats that may be present in the project areas. Please note that we are also sending coordination letters to the US Fish & Wildlife Service's Virginia Field Office, the National Marine Fisheries Service's Northeast Regional Office, the Virginia Department of Game and Inland Fisheries, the Virginia Department of Conservation and Recreation-Division of Natural Heritage, and the Maryland Department of Natural Resources-Wildlife and Heritage Service.

For further information, please contact Dr. Thomas Wray II, at (540) 653-4186 (thomas.wray@navy.mil). Thank you in advance for your assistance.

Sincerely,

Ann G. Swope

ANN G. SWOPE
Head, Safety and Environmental Office
By direction of the Commander

Enclosures:
1. Figure 1. Potomac River Test Range Complex
2. Figure 2. Dahlgren's Ranges and Mission Areas
3. Figure 3. Potomac River Test Range Primary Gunnery Target Area
4. Environmental Impact Statement
5. Test Range Operations
6. Chemical & Biological Sensor Tests
7. Laser Technology
8. Electromagnetic Energy
9. Dahlgren: A Unique National Asset
10. Dahlgren: A Vital Mission

Copy to: (w/encl)
Commander
Naval Sea Systems Command
Ms Vicki Writt (SEA 04RE)
1333 Isaac Hull Avenue SE
Washington Navy Yard, DC 20376

Copy to: (w/encl) (Cont'd)
Commander
Ms. Tanya Robinson
1333 Isaac Hull Avenue SE, Bldg 197
Washington Navy Yard, DC 20376

Chief of Naval Operations
Ms. Elizabeth Phelps (N45)
2511 Jefferson Davis Highway
NC-1, Suite 2000
Arlington, VA 22202

Ms. Christine Porter
Commander, Navy Region, Mid-Atlantic
Regional Environmental Programs (N45)
Norfolk, VA 23511-2737

Mr. Lane Willson
Earth Tech
675 N. Washington Street
Suite 300
Alexandria, VA 22314

DEPARTMENT OF THE NAVY
NAVAL SURFACE WARFARE CENTER
DAHLGREN DIVISION
6149 WELSH ROAD, SUITE 203
DAHLGREN, VIRGINIA 22448-5130

IN REPLY REFER TO

5090
Ser XDC8/028
24 Jun 08

Ms. Karen Mayne, Supervisor
Virginia Field Office
U.S. Fish and Wildlife Service
6669 Short Lane
Gloucester, VA 23061

Dear Ms. Mayne,

SUBJECT: TECHNICAL ASSISTANCE FOR NSWCDL OUTDOOR RESEARCH, DEVELOPMENT, TESTING & EVALUATION ACTIVITIES ENVIRONMENTAL IMPACT STATEMENT

The Naval Surface Warfare Center, Dahlgren Site (NSWCDL), a tenant on Naval Support Facility (NSF) Dahlgren, Virginia, is preparing an environmental impact statement (EIS) to evaluate the potential environmental consequences of expanding our research, development, test and evaluation (RDT&E) activities taking place outdoors on the Potomac River Test Range (PRTR) Complex, the Explosives Experimental Area (EEA) Complex, mission areas, and in special use airspace over the ranges. RDT&E activities are conducted in support of NSWCDL's mission requirements in surface warfare, surface ship combat systems, strategic systems, ordnance, and special warfare systems. These activities include outdoor operations using ordnance, lasers, electromagnetic energy, and chemical and biological simulants.

The project areas for the proposed action are our ranges and mission areas (Figures 1 and 2), which include:

a. The PRTR Complex, which consists of a 715-acre land area and a 169-square-nautical-mile water area that stretches along the lower 51 miles of the Potomac River. Three geographic zones are defined on nautical charts - the Upper, Middle, and Lower Danger Zones - so called to alert mariners that access to the areas may be restricted when test activities are taking place. The areas of interest in the PRTR Complex are subdivided into land ranges, Upper Danger Zone, Middle Danger Zone, and

Lower Danger Zone. The Middle Danger Zone is the focus of most outdoor RDT&E activities. Figure 3 shows the main gunnery target area in the PRTR.

b. The counties surrounding the PRTR include King George, Westmoreland and Northumberland counties in Virginia and Charles and St. Mary's counties in Maryland. The geographic coordinates of the danger zones may be found at http://edocket.access.gpo.gov/cfr_2007/julqtr/pdf/33cfr334.230.pdf. The PRTR is shown on parts of the following US Geological Survey quadrangle maps: Mathias Point, MD-VA; King George, VA-MD; Dahlgren, VA-MD; Colonial Beach North, VA-MD; Colonial Beach South, VA-MD; Port Royal, VA; Rollins Fork, VA; Stratford Hall, VA-MD; St. Clements Island, MD-VA; Piney Point, MD-VA; Machodoc, VA; and Kinsale, VA-MD.

c. The 1,641-acre EEA Complex, which is bordered by Upper Machodoc Creek to the north and west and the Potomac River to the east (Figure 2).

d. NSWCDL's Mission Areas, which include a 1,593-acre land area on NSF Dahlgren and a 164-acre water area (see Figure 2). The water area lies on Upper Machodoc Creek, immediately north of the EEA and south and west of the PRTR land complex. The land area lies immediately north and west of the PRTR land ranges.

Enclosed are seven fact sheets that describe our operations and support the EIS. We foresee evaluating the impact of three alternatives in the EIS as described in the EIS Fact Sheet. Further information on the EIS may be obtained from our website: http://www.nswc.navy.mil/EIS/index.html.

To help us describe existing conditions and evaluate the impacts of the proposed action, we request that your agency provide a list of endangered, threatened, and proposed species and designated and proposed critical habitats that may be present in the project areas. Please note that we are also sending coordination letters to the US Fish & Wildlife Service's

5090
Ser XDC8/028
24 Jun 08

Chesapeake Bay Field Office, the National Marine Fisheries Service's Northeast Regional Office, the Virginia Department of Game and Inland Fisheries, the Virginia Department of Conservation and Recreation-Division of Natural Heritage, and the Maryland Department of Natural Resources-Wildlife and Heritage Service.

For further information, please contact Dr. Thomas Wray II, at (540) 653-4186 (Thomas.Wray@navy.mil). Thank you in advance for your assistance.

Sincerely,

ANN G. SWOPE
Head, Safety and Environmental Office
By direction of the Commander

Enclosures:
1. Figure 1. Potomac River Test Range Complex
2. Figure 2. Dahlgren's Ranges and Mission Areas
3. Figure 3. Potomac River Test Range Primary Gunnery Target Area
4. Environmental Impact Statement
5. Test Range Operations
6. Chemical and Biological Sensor Tests
7. Laser Technology
8. Electromagnetic Energy
9. Dahlgren: A Unique National Asset
10. Dahlgren: A Vital Mission

3

THIS PAGE INTENTIONALLY LEFT BLANK

DEPARTMENT OF THE NAVY
NAVAL SUPPORT ACTIVITY SOUTH POTOMAC
6509 SAMPSON ROAD SUITE 217
DAHLGREN, VIRGINIA 22448-5108

IN REPLY REFER TO
5090
Ser PRSD41TW/098
November 23, 2011

Ms. Mary A. Colligan
Assistant Regional Administrator for Protected Resources
NOAA Fisheries Service
Northeast Region
55 Great Republic Drive
Gloucester, Massachusetts 01930

RE: Naval Surface Warfare Center, Dahlgren Division, Research, Development, Test, and Evaluation Environmental Impact Statement Biological Assessment

Dear Ms. Colligan:

As was described in our April 10, 2008 letter, the Naval Surface Warfare Center, Dahlgren Division (NSWCDD) at Dahlgren, Virginia, a tenant on the Naval Support Facility, Dahlgren, is preparing an environmental impact statement (EIS) to evaluate the potential environmental consequences of expanding research, development, test, and evaluation (RDT&E) activities taking place outdoors on the Potomac River Test Range (PRTR). In accordance with Section 7 of the Endangered Species Act (ESA) of 1973, as amended, the enclosed Biological Assessment (BA) has been prepared to consider the impacts of our proposed action on five ESA-listed or proposed for listing species found in the PRTR: shortnose sturgeon (*Acipenser brevirostrum*), Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*), loggerhead turtle (*Caretta caretta*), Kemp's ridley turtle (*Lepidochelys kempii*), and green turtle (*Chelonia mydas*).

The BA concludes that NSWCDD's proposed RDT&E activities will have no effect on the ESA-listed marine turtle species: loggerhead turtle, Kemp's ridley turtle, and green turtle. As described in the BA, sea turtles are documented as being restricted to the lower, more saline part of the Potomac River in the Lower Danger Zone portion of the PRTR. There is no ordnance (live firing) testing and only limited testing of lasers and electromagnetic energy proposed in this area. Potential impacts from laser and electromagnetic energy would be confined to decks of vessels used as targets.

The BA concludes that the proposed action may affect, but is not likely to adversely affect, the following ESA-listed or proposed for listing marine species: shortnose sturgeon and Atlantic sturgeon. Both direct and indirect effects of the proposed action were considered and were found to be unlikely.

Consultation for Essential Fish Habitat under the Magnuson-Stevens Fishery Conservation and Management Act will be included as an analysis in the EIS. A copy of the Draft EIS will be sent to you for review when the document is released for agency and public review.

In addition to the ESA-listed species, four marine mammal species have been sighted or stranded in the Potomac River: bottlenose dolphin (*Tursiops truncatus*), harbor porpoise (*Phocoena phocoena*), Risso's dolphin (*Grampus griseus*), and minke whale (*Balaenoptera acutorostrada*). These species are not ESA-listed, nor are they considered depleted under the Marine Mammal Protection Act. The only marine mammal regularly sighted in the Potomac River is the bottlenose dolphin, found in the lower Potomac River from the mouth to Sandy Point, Virginia (the same part of the river where sea turtles are observed). As discussed above for sea turtles and described in the Draft EIS, there would be no ordnance (live firing) testing and limited testing of lasers and electromagnetic energy in this area. Potential impacts would be confined to decks of vessels used as targets for lasers and directed energy. Therefore, the proposed RDT&E activities will have no effect on marine mammals.

We request your concurrence with our conclusions and hereby request informal consultation under Section 7(2)(a) of the ESA.

If you should have any questions or need additional information, please contact Dr. Thomas Wray II at (540) 653-4186 or e-mail thomas.wray@navy.mil.

Sincerely,

JEFFREY C. BOSSART
By direction

Enclosure: 1. Biological Assessment, Shortnose Sturgeon, Atlantic Sturgeon, Loggerhead Turtle, Kemp's Ridley Turtle, and Green Turtle, November, 2011

5090
Ser PRSD41TW/098

Blind copy to: (w/o encl)
PRSD41TW (Legg, Wray)
CX8 (Boyd)

Writer: T. Wray, PRSD41TW, x34186
Typist: C. McGinniss, 16 Nov 11

THIS PAGE INTENTIONALLY LEFT BLANK

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
NORTHEAST REGION
55 Great Republic Drive
Gloucester, MA 01930-2276

JAN 11 2012

Jeffrey C. Bossart
Director, Environmental Division
Department of the Navy
Naval Support Activity South Potomac
6509 Sampson Rd, Suite 217
Dahlgren, Virginia 22448

Re: Naval Surface Warfare Center, Dahlgren Division, Research, Development, Test, and Evaluation

Dear Mr. Bossart,

Your letter, dated November 23, 2011, requesting consultation with us regarding a proposal by the Navy for the Naval Surface Warfare Center, Dahlgren Division at Dahlgren (NSWCDD) to expand its research, development, test, and evaluation activities. These activities would take place outdoors on the Potomac River Test Range (PRTR) and Explosives Experimental Area (EEA) Range Complexes, the adjoining Mission Area, and the special-use airspace (SUA) at Naval Support Facility (NSF) Dahlgren, Virginia. The PRTR is 51 nautical miles (NM) long and covers 169 square NMs, and is divided into areas designated on nautical charts as the Upper, Middle, and Lower Danger Zones (UDZ, MDZ, LDZ, respectively). The Navy has made the preliminary determination that the proposed project is not likely to adversely affect any species listed as threatened or endangered under the jurisdiction of NOAA's National Marine Fisheries Service (NMFS). We concur with this determination and justification for this determination follows. This consultation has been conducted in accordance with Section 7 of the ESA of 1973, as amended, and is based on information provided to NMFS on November 25, 2011.

Proposed Project

The proposed project will enable NSWCDL to meet current and future mission-related warfare and force protection requirements by providing research, development, test, and evaluation of surface ship combat systems, ordnance, lasers and directed energy, force-level warfare, and homeland and force protection. The proposed action will expand NSWCDD's research, development, test, and evaluation activities within the PRTR and EEA Range complexes, the adjoining Mission Area, and SUA. These activities include outdoor activities that require the use of ordnance, electromagnetic (EM) energy, high-energy lasers and chemical and biological simulants.

Ordnance

NSWCDD will be firing large and small-caliber projectiles up to 4,000 yards downriver from the Main Range located on the land just north of Upper Machodoc Creek. Most of the gunfire is directed at target areas in the MDZ, but target areas in the upper part of the LDZ may be used on occasion. Large-caliber projectiles can be live (explosive) or inert (non-explosive). Between 1995 and 2009, 74 percent of the projectiles fired into the Potomac River have been inert. The component most often being tested on inert projectiles is the fuze or detonator which contains a few ounces of non-explosive talcum-like powder to produce a puff of smoke to indicate that the fuze has been successfully triggered. Twenty-six percent of the projectiles have been live, explosive projectiles. The largest explosive projectiles fired are 5", which contain approximately 6 to 10 pounds of explosives. NSWCDD also occasionally fires a 6.1" howitzer. Very rarely, NSWCDD fires an 8" gun loaded with a canister filled with electronics equipment to test the capability of the equipment to withstand high G-forces, but explosive projectiles are not used. Both the fuzes and the live projectiles are programmed to detonate above the water. Those that enter the water generally do not detonate, although a few may have a slight delay and detonate shortly after entering the water. It is estimated that two percent of live projectiles tested detonate underwater, generally within the upper 6 feet of the water column. Twenty-six percent of the projectiles fired are live and of those less than 2 percent detonate underwater, resulting in an estimate of 24 projectiles detonating underwater each year. Historically, 99.7 percent of large-caliber projectiles were fired into the MDZ and 0.3 percent into the LDZ. NSWCDD fired an average of 4,700 projectiles in the particularly active years and will not expect the number of projectiles fired to increase above 4,700 in the foreseeable future. Long range guns would fire into a target area up to 40,000 yards in the upper LDZ approximately 10 days a year.

The number of small-arms firing would increase from historic levels of 6,000 bullets per year to 30,000 bullets per year. Approximately 90 percent of this increase would be on land, with the remaining 10 percent potentially entering the water, mainly within 1,000 yards of the shoreline.

Electromagnetic Energy

The proposed project will emit EM energy in a frequency range that includes radio waves or radio frequency, microwaves, infrared light, visible light, and ultraviolet light. The devices that will be used operate at frequencies ranging from 300 kilohertz to 300 gigahertz and at average powers ranging from 10 watts to more than 500 megawatts. NSWCDD directs EM energy at targets on the PRTR and from special facilities on one land range to another across the entrance to Upper Machodoc Creek. Operation of EM sensors and directed energy equipment mainly take place in the UDZ and LDZ. Waves of EM energy do not move easily through water. The only EM activity that the NSWCDD would conduct in waters of the PRTR uses modified sonobuoys to receive, but not send, sound. The sonobuoys are small floating devices from which tiny attached microphones drop down to a fixed depth of water to detect submarines. Any sounds that are picked up are amplified by the sonobuoy and are converted into EM waves in the air and transmitted to a receiver where the sounds can be analyzed. The number of annual EM energy events would increase from the current 490 to 680. The majority of these events take place on the land ranges.

Lasers

Lasers are categorized into four classes according to the power of light they emit, expressed in watts. Class 1 & 2 lasers are not considered to be hazardous to the environment according to existing standard operating procedures. Therefore class 1 & 2 lasers will have no effect on ESA-listed species. Lasers using power levels from less than 5 milliwatts (Class 3) to 500 kilowatts (Class 4) are considered high energy lasers and have the capability to adversely affect ESA-listed species. In the proposed action over water Class 3 and 4 laser operations will be conducted along three corridors that cross over the waters of Upper Machodoc Creek and the Potomac River. The lasers will be tested outdoors firing slightly downwards into a target with a backstop lined with absorbent material. There would be 145 high energy laser operation events per year, which is an increase from previous levels of 60 events per year. All lasers would be directed to targets at, or above the surface of the water, not into the water.

Chemical Simulants

Chemical simulants are chosen for their low toxicity, low environmental impacts, and ability to closely simulate the actual agent the sensor is designed to detect. Prior to use, all simulants would be approved by the NSWCDD Safety and Environmental Office in consultation with NSF Dahlgren personnel as applicable. Simulants will only be approved for use after considering toxicity data relative to the intended quantity and concentration of the simulant to be used. Chemical simulants are dispersed into the air as a vapor on the Potomac River to test various kinds of chemical agent detection equipment. The test would be conducted over one or more weeks and one or two tests can be conducted per day. Over water operations would be conducted on the MDZ and would involve a vapor or chemical simulant released from a vessel in a variety of weather conditions. Sensors are mounted on and operated from vessels and/or on shore and would be aimed upriver or downriver to detect the simulant vapor against a sky/water background. The release for each operational test would take about 2 minutes, and the resulting vapor would dissipate in less than 10 minutes. A typical test would involve the release of approximately 10 gallons of simulant, but the amount could vary from a few ounces up to 20 gallons.

Biological Simulants

The test of biological simulants would be very similar to chemical detector operations using chemical simulants. Biological simulants are microorganisms that exhibit a quality similar to that of an actual biological threat agent. NSWCDD would use only Biosafety Level 1 simulants which are suitable for work involving well characterized agents not known to consistently cause disease in healthy adult humans, and of minimal potential hazard to laboratory personnel and the environment. Prior to use, all simulants would be approved by the NSWCDD Safety and Environmental Office in consultation with NSF Dahlgren personnel as applicable. Simulants will only be approved for use after considering Bio safety level data relative to the intended use of the simulant and purpose of the test. Operations will likely be conducted over a two-week period, with up to two tests per day, for a maximum of up to 20 releases in a two-week test period.

Vessel Traffic
Several range control boats will be on river whenever public access to the part of the PRTR being used is restricted. The range boats would be on the water for about 1,000 hours a year and would primarily be limited to the perimeter of the range to restrict access during testing. Activities may employ vessels and/or unmanned systems to perform a variety of tasks in the action area (e.g., serve as platforms for operations, tow targets, test sensors). NSWCDD maintains a group of small watercraft in Upper Machodoc Creek that will be used during the proposed action. Additionally, larger Navy or Coast Guard vessels may occasionally come up the river to participate in operations.

NMFS listed species in Project Area
The proposed project is located in the lower Potomac River. The action area is defined as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 CFR§402.02). For this project, the action area includes the project footprint as well as the underwater area where effects of the action will be experienced. As vessels involved in the test program will be transiting to and from the test location, the action area also includes the routes transited by project vessels while conducting the test program within the Potomac River. This area is expected to encompass all effects of the proposed action.

Although ESA-listed whales are known to transit past the mouth of Chesapeake Bay, large whale species would be considered rare transients within the Bay and are not likely to occur within the Potomac River.

Sea turtles are generally present in the Chesapeake Bay from April 1 – November 30 each year, when water temperatures are relatively warm. An estimated 3,000 – 10,000 loggerhead turtles and 500 Kemp's ridley sea turtles are found in Chesapeake Bay annually. In the Chesapeake Bay, Kemp's ridleys frequently forage in shallow embayments, particularly in areas supporting submerged aquatic vegetation and on tidal flats. Approximately 95 percent of the loggerheads found in Chesapeake Bay are juveniles; these turtles are found most commonly from the mouth of the Bay to the Potomac River while foraging along channel edges. Leatherback sea turtles are predominantly pelagic but are also seasonally present in the Chesapeake Bay. Loggerhead, Kemp's ridley, green, and leatherback sea turtles may occasionally be present in the lower Potomac River during warmer months of the year, but have not been recorded farther upstream than Piney Point, Maryland/Sandy Point, Virginia in the lower LDZ. Based on data, these occurrences are infrequent, and sea turtles are considered to be to be restricted to the lower part of the Potomac River.

The federally endangered shortnose sturgeon (*Acipenser brevirostrum*) is known to be present in the Potomac River. Fifteen shortnose sturgeon have been captured in the Potomac River between 1996 and 2010. The fifteen shortnose sturgeon captured in the Potomac River and reported via the USFWS Atlantic Sturgeon Reward Program, as well as other research, were documented in the following locations: four at the mouth of the river (May 3, 2000, March 26, 2001, December 10, 2004, May 22, 2005); one at the mouth of the Saint Mary's River (April 21, 1998); three at the mouth of Potomac Creek (May 17, 1996, two on March 8, 2002); one near Craney Island (September 20, 2005); one near the mouth of Popes Creek (March 22, 2006); three captures around Cobb Bar (one of which was a fish that was captured twice within a few days (December 23, 2007, March 14 and 17, 2008); one near Colonial Beach (March 13, 2009); and one near Cole's Point (April 9, 2009). It is important to note that the presence of shortnose sturgeon in the Potomac River is not limited to these capture locations. Based on tagging information (see below), the range of shortnose sturgeon in the Potomac River extends from the Little Falls to the confluence with the Chesapeake Bay. Use of discrete areas of the Potomac River is seasonal and is described below.

An ongoing tagging and telemetry study of shortnose sturgeon in the Potomac River began in 2004 (Kynard *et al.* 2007). Three shortnose sturgeon (the 9/20/05, 3/22/06 and 3/14/08 fish mentioned above) have been tagged with CART tags (Combined Acoustic and Radio Transmitting). While the sex and reproductive status of the 2008 fish is unknown, the 2005 and 2006 fish were both females with late stage eggs. The occurrence of pre-spawning females in the Potomac River combined with documented habitat that is consistent with preferred shortnose sturgeon spawning habitat suggests that a spawning population of shortnose sturgeon continues to exist in this river system. The 2005 female migrated upstream in spring 2006 to a 2-km reach (river km 187–185) containing habitat determined to be suitable for spawning (Kynard *et al.* 2007). The fish tagged in 2008 has not been detected by the telemetry array that is within the Potomac River. This suggests that the fish either shed the tag or that the fish has left the Potomac River. Information available to date from this study is summarized below.

While an extensive study of shortnose sturgeon in the Potomac River has not been conducted, the data resulting from the tracking of the two females by Kynard *et al.* (2007, 2009) provides valuable information on habitat use and the likely distribution of the species within the river. The two tracked fish have been concentrated in a 124 km stretch of the river, from rkm 187 (Little Falls/Chain Bridge) to rkm 63 (just downstream of the confluence with the Port Tobacco River). Within this reach, a summering-wintering concentration area was identified from rkm 63-141 (Kynard *et a*l. 2009). The researchers also indicate that not much change would be expected in the size of the foraging-overwintering concentration area even with a larger sample size of tracked adults. The type of habitat used did not change based on season, with the majority of time spent in the channel or channel edge and in locations with substrate comprised primarily with mud. The range of water depth used was 4.1 – 21.3 meters. The limited use of areas outside of the deep water channel is likely due to the lack of forage items in those habitats, which is supported by evidence of limited shortnose sturgeon forage items in the River (Kynard *et al.* 2007). As shortnose sturgeon use similar habitats in other rivers throughout their range, it is possible to make some conclusions regarding the likelihood of shortnose sturgeon to occur in a particular location in the Potomac. Shortnose sturgeon are typically found in the deepest areas (i.e., greater than 3 meters) with suitable dissolved oxygen (i.e., greater than 5 parts per million); often this type of habitat occurs in deepwater navigation channels. While foraging, shortnose sturgeon can also be found in shallower water over mudflats of shellfish beds with submerged aquatic vegetation. During the winter or during the summer, while seeking out thermal refugia, shortnose sturgeon are known to occur in deep holes. These statements regarding shortnose sturgeon distribution are well supported by Kynard *et al.* (2007).

Based on the best available scientific information, the action area, located in the lower Potomac River, is likely to be used as a migratory corridor to and from potential spawning grounds (i.e., approximately rkm 187–185) as well as a possible summering area (i.e., one shortnose sturgeon detected in vicinity of action area in June 2007; Kynard *et al.* 2009). Due to the distance from the spawning grounds (i.e., greater than 55 km downstream), shortnose sturgeon eggs or larvae, whose occurrence is limited to the waters near the spawning grounds, are not likely to occur within the action area.

Effects of the Action

SEA TURTLES

Sea turtles are known to occasionally occur in the lower LDZ; however the proposed action activities will take place outside of the lower LDZ. The only potential overlap is the use of range boats, barges and occasionally larger vessels in the lower LDZ. The probability of any one of these vessels coming into contact with a sea turtle is the same as any other vessel near the mouth of the Potomac River and is anticipated to be extremely low. Therefore, no direct effects on sea turtles are expected from the proposed action.

SHORTNOSE STURGEON

Ordnance

Shortnose sturgeon are known to occur in the area where the ordnance will be tested. The large caliber projectiles (inert and live) are all programmed to detonate above the surface of the water, and it is estimated that approximately 98% of them will. Above water detonations are not expected to affect shortnose sturgeon as the air-water interface would reflect most of the energy from the shock wave outward and upward. Less than 2% of the live rounds are expected to detonate underwater, although near the surface. Live projectiles that detonate underwater may directly strike a sturgeon or the pressure pulses generated by the detonation may injure or kill a sturgeon. However, as noted above, shortnose sturgeon are found in the deepest areas of the river channel, approximately one meter from the bottom. Shock waves attenuate exponentially away from the point of detonation and a substantial portion of its energy is expected to dissipate before reaching a sturgeon near the bottom. Additionally, the expanding bubble that contains the gaseous products would break the water surface quickly, allowing a significant portion of the energy to escape into the less dense air, thus reducing the peak pressure.

Given the small number of projectiles detonating underwater annually (24), the small area that would be encompassed by a projectile detonating close to the surface of the water, the large area where almost all projectiles are fired (31 sq NM), the intermittent nature of the testing, and the small number of sturgeon in the Potomac River overall, the effect of large-caliber projectiles on shortnose sturgeon is expected to be insignificant and discountable.

The small caliber projectiles (bullets) have the potential to hit a shortnose sturgeon. However, the bullets will be entering the water at an angle of less than 5 to 7 degrees, which causes them to bounce along the water because of the surface tension, losing momentum, and entering the water with less velocity than when hitting the water at angles greater than seven degrees. Small caliber bullets may also shatter upon impact with the water. Given the extent of the MDZ (38.8 sq NM), the size of the small-caliber bullets (20 mm or less), and the angle at which the bullets hit the water, the effect of small-caliber bullets on shortnose sturgeon is expected to be insignificant and discountable.

Gunfire may destroy or damage physical targets on the Potomac River. The environmental impacts of fragmenting these targets are minimized by removing hazardous materials to the extent possible prior to destroying or damaging them. After a target is impacted and the test completed, all remaining debris and waste remaining on the surface is cleaned up. For these reasons, impacts from target debris are considered insignificant and discountable.

Electromagnetic energy
Almost all EM energy being tested in the proposed action would occur above the surface of the water and would have no contact with any ESA-listed species or their habitat. EM that does reach the surface would be rapidly absorbed, scattered, or reflected off of organic and inorganic molecules. Any incidental EM energy that reaches the water surface would be reflected at the air-water boundary or quickly dissipated by the water molecules, and a negligible amount of energy would enter the water, which is not expected to effect shortnose sturgeon. Therefore, the effect of EM energy on shortnose sturgeon is expected to be insignificant and discountable.

Lasers
The lasers being tested in the proposed action are extremely accurate and the likelihood of missing a target is small. In the event the laser light hits the water, the amount and intensity of the energy would be immediately decreased as a result of the attenuation and propagation of the laser beam. Laser beams are not expected to enter the water and in the unlikely event that they do, the beam would be immediately reduced. Further, the surface area of the PRTR is massive in comparison to the surface area of a sturgeon and the small cross section of a laser beam, and therefore, the likelihood of a laser beam striking a sturgeon is discountable.

Chemical and biological simulants
Chemical and biological simulants deposited on the surface of the water have the potential to affect shortnose sturgeon. There would be limited deposition of chem/bio simulants on the water surface during the testing events. Many of the biological simulants that may be used are ubiquitous and often found in high concentrations in nature, including in water. Based on water testing conducted by NSWCDD immediately after chemical sensor tests on the PRTR, concentrations of chemical and biological simulants would be diluted down to barely detectable levels by the time they reach the river bottom where sturgeon are found. Therefore, the effect of chemical and biological simulants on shortnose sturgeon is expected to be insignificant and discountable.

Vessel Traffic
As shortnose sturgeon are known to occur in the action area, there is a potential for vessels to interact with shortnose sturgeon; however, the overall vessel traffic on the PRTR would decrease during operations, as public assess would be restricted. At such times, approximately 3 range boats would be stationed along the perimeter of the range, and barges or vessels associated with testing, would be present on the restricted part of the range. Given that the proposed action

would reduce overall vessel traffic on the river during testing, and shortnose sturgeon are generally found in the deepest areas of the river channel, it is extremely unlikely that an interaction between an individual shortnose sturgeon and a vessel will occur as vessels will not be operating within one meter or closer to the river bottom where shortnose sturgeon are likely to occur. Based on the best available information, NMFS is able to conclude that the interaction of a shortnose sturgeon with a vessel is discountable.

Alteration of Habitat
As described above, shortnose sturgeon are found in the deepest areas of the river channel and migrate along the river channel to other areas of the river, depending on season, to reach spawning, overwintering, and foraging grounds. Based on the above analysis of ordnance, EM energy, lasers, chemical/biological simulants and vessel traffic effects on shortnose sturgeon, the proposed action is not expected to alter the habitat or create any barriers that would disrupt or prevent the continuation of these essential behaviors (e.g., migrating and foraging) of shortnose sturgeon. Based on this information, the effects of the proposed action on shortnose sturgeon migration and foraging are expected to be insignificant and discountable

Conclusions
Based on the analysis that any effects to listed sea turtles and shortnose sturgeon will be insignificant or discountable, NMFS is able to concur with the determination that the proposed action by the Navy is not likely to adversely affect any listed species under NMFS jurisdiction. Therefore, no further consultation pursuant to section 7 of the ESA is required. Reinitiation of consultation is required and shall be requested by the Federal agency or by the Service, where discretionary Federal involvement or control over the action has been retained or is authorized by law and: (a) If new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered in the consultation; (b) If the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the consultation; or (c) If a new species is listed or critical habitat designated that may be affected by the identified action.

Technical Assistance for Proposed Species
On October 6, 2010, NMFS published two proposed rules to list five distinct population segments (DPS) of Atlantic sturgeon under the ESA. NMFS is proposing to list four DPSs as endangered (New York Bight, Chesapeake Bay, Carolina and South Atlantic) and one DPS of Atlantic sturgeon as threatened (Gulf of Maine DPS). Once a species is proposed for listing, as either endangered or threatened, the conference provisions of the ESA may apply (see 50 CFR 402.10 and ESA Section 7(a)(4)). As stated at 50 CFR 402.10, "Federal agencies are required to confer with NMFS on any action which is likely to jeopardize the continued existence of any proposed species or result in the destruction or adverse modification of proposed critical habitat."

NMFS has reviewed the proposed action in order to provide guidance to the Navy as to whether a conference is required in this case. Atlantic sturgeon are known to occur in the Potomac River and may be present in the action area. If present in the action area during the proposed action, NMFS anticipates that effects to Atlantic sturgeon would be similar to those described for shortnose sturgeon above. As such, all effects resulting from the test program are expected to be insignificant and discountable. As all effects of the proposed action are likely to be insignificant and discountable and the proposed action is not likely to result in the injury, mortality, or reduction in the reproduction, numbers, and distribution of any Atlantic sturgeon, the action is not likely to appreciably reduce the survival and recovery of any DPS of Atlantic sturgeon and therefore it is not reasonable to anticipate that this action would be likely to jeopardize the continued existence of any DPS of Atlantic sturgeon. As such, NMFS concludes that a conference is not required at this time for Atlantic sturgeon. Should project plans change, NMFS recommends that the Navy discuss the potential need for conference with NMFS.

Should you have any questions about this correspondence please contact Dan Marrone at (978) 282-8465 or by e-mail (Daniel.Marrone@Noaa.gov).

Sincerely,

Daniel S. Morris
Acting Regional Administrator

References

Kynard, B., M. Breece, M. Atcheson, M. Kieffer, and M. Mangold. 2007. Status of Shortnose Sturgeon in the Potomac River, Part I – Field Studies. USGS Natural Resources Preservation Project: E 2002-7.

Kynard, B., M. Breece, M. Atcheson, M. Kieffer, and M. Mangold. 2009. Life History and Status of Shortnose Sturgeon *(Acipenser brevirostrum)* in the Potomac River. J. Appl. Ichthyol: 1-5.

Ec: Marrone, NMFS/PRD
Wray, Navy

File Code: Navy Surface Warfare Center, Dahlgreen Division
PCTS: I/NER/2011/06208
H:\H2.0\Section 7\Non-Fisheries\Navy\Informal\2011\Navy Surface Warfare Center, Dahlgreen Division

United States Department of the Interior
U.S. Fish & Wildlife Service
Chesapeake Bay Field Office
177 Admiral Cochrane Drive
Annapolis, MD 21401
410/573 4575

Online Certification Letter

Today's date: August 9, 2012

Project: The Navy proposes to expand research, development, test, and evaluation activities on NSF Dahlgren and in the Lower Potomac River. Letter 1 of 3

Dear Applicant for online certification:

Thank you for choosing to use the U.S. Fish and Wildlife Service Chesapeake Bay Field Office online list request certification resource. This letter confirms that you have reviewed the conditions in which this online service can be used. On our website (www.fws.gov/chesapeakebay) are the USGS topographic map areas where **no** federally proposed or listed endangered or threatened species are known to occur in Maryland, Washington D.C. and Delaware.

You have indicated that your project is located on the following USGS topographic map

Colonial Beach North, Charles County
Mathias Point, Charles County
Piney Point, St. Mary's County

Based on this information and in accordance with section 7 of the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*), we certify that except for occasional transient individuals, no federally proposed or listed endangered or threatened species are known to exist within the project area. Therefore, no Biological Assessment or further section 7 consultation with the U.S. Fish and Wildlife Service is required. Should project plans change, or if additional information on the distribution of listed or proposed species becomes available, this determination may be reconsidered.

This response relates only to federally protected threatened or endangered species under our jurisdiction. For additional information on threatened or endangered species in Maryland, you should contact the Maryland Wildlife and Heritage Division at (410) 260-8540. For information in Delaware you should contact the Delaware Natural Heritage and Endangered Species Program, at (302) 653-2880. For information in the District of Columbia, you should contact the National Park Service at (202) 535-1739.

The U.S. Fish and Wildlife Service also works with other Federal agencies and states to minimize loss of wetlands, reduce impacts to fish and migratory birds, including bald eagles, and restore habitat for wildlife. Information on these conservation issues and how development projects can avoid affecting these resources can be found on our website (www.fws.gov/chesapeakebay).

We appreciate the opportunity to provide information relative to fish and wildlife issues, and thank you for your interest in these resources. If you have any questions or need further assistance, please contact Chesapeake Bay Field Office Threatened and Endangered Species program at (410) 573-4531.

Sincerely,

Genevieve LaRouche
Field Supervisor

United States Department of the Interior
U.S. Fish & Wildlife Service
Chesapeake Bay Field Office
177 Admiral Cochrane Drive
Annapolis, MD 21401
410/573 4575

Online Certification Letter

Today's date: August 9, 2012

Project: The Navy proposes to expand research, development, test, and evaluation activities on NSF Dahlgren and in the Lower Potomac River. Letter 2 of 3

Dear Applicant for online certification:

Thank you for choosing to use the U.S. Fish and Wildlife Service Chesapeake Bay Field Office online list request certification resource. This letter confirms that you have reviewed the conditions in which this online service can be used. On our website (www.fws.gov/chesapeakebay) are the USGS topographic map areas where **no** federally proposed or listed endangered or threatened species are known to occur in Maryland, Washington D.C. and Delaware.

You have indicated that your project is located on the following USGS topographic map

Point Lookout, St. Mary's County
Popes Creek, Charles County
Rock Point, Charles and St. Mary's Counties

Based on this information and in accordance with section 7 of the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*), we certify that except for occasional transient individuals, no federally proposed or listed endangered or threatened species are known to exist within the project area. Therefore, no Biological Assessment or further section 7 consultation with the U.S. Fish and Wildlife Service is required. Should project plans change, or if additional information on the distribution of listed or proposed species becomes available, this determination may be reconsidered.

This response relates only to federally protected threatened or endangered species under our jurisdiction. For additional information on threatened or endangered species in Maryland, you should contact the Maryland Wildlife and Heritage Division at (410) 260-8540. For information in Delaware you should contact the Delaware Natural Heritage and Endangered Species Program, at (302) 653-2880. For information in the District of Columbia, you should contact the National Park Service at (202) 535-1739.

The U.S. Fish and Wildlife Service also works with other Federal agencies and states to minimize loss of wetlands, reduce impacts to fish and migratory birds, including bald eagles, and restore habitat for wildlife. Information on these conservation issues and how development projects can avoid affecting these resources can be found on our website (www.fws.gov/chesapeakebay).

We appreciate the opportunity to provide information relative to fish and wildlife issues, and thank you for your interest in these resources. If you have any questions or need further assistance, please contact Chesapeake Bay Field Office Threatened and Endangered Species program at (410) 573-4531.

Sincerely,

Genevieve LaRouche
Field Supervisor

United States Department of the Interior
U.S. Fish & Wildlife Service
Chesapeake Bay Field Office
177 Admiral Cochrane Drive
Annapolis, MD 21401
410/573 4575

Online Certification Letter

Today's date: August 9, 2012

Project: The Navy proposes to expand research, development, test, and evaluation activities on NSF Dahlgren and in the Lower Potomac River. Letter 3 of 3

Dear Applicant for online certification:

Thank you for choosing to use the U.S. Fish and Wildlife Service Chesapeake Bay Field Office online list request certification resource. This letter confirms that you have reviewed the conditions in which this online service can be used. On our website (www.fws.gov/chesapeakebay) are the USGS topographic map areas where **no** federally proposed or listed endangered or threatened species are known to occur in Maryland, Washington D.C. and Delaware.

You have indicated that your project is located on the following USGS topographic map

Saint George Island, St. Mary's County
Saint Marys City, St. Mary's County
Stratford Hall, St. Mary's County

Based on this information and in accordance with section 7 of the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*), we certify that except for occasional transient individuals, no federally proposed or listed endangered or threatened species are known to exist within the project area. Therefore, no Biological Assessment or further section 7 consultation with the U.S. Fish and Wildlife Service is required. Should project plans change, or if additional information on the distribution of listed or proposed species becomes available, this determination may be reconsidered.

This response relates only to federally protected threatened or endangered species under our jurisdiction. For additional information on threatened or endangered species in Maryland, you should contact the Maryland Wildlife and Heritage Division at (410) 260-8540. For information in Delaware you should contact the Delaware Natural Heritage and Endangered Species Program, at (302) 653-2880. For information in the District of Columbia, you should contact the National Park Service at (202) 535-1739.

The U.S. Fish and Wildlife Service also works with other Federal agencies and states to minimize loss of wetlands, reduce impacts to fish and migratory birds, including bald eagles, and restore habitat for wildlife. Information on these conservation issues and how development projects can avoid affecting these resources can be found on our website (www.fws.gov/chesapeakebay).

We appreciate the opportunity to provide information relative to fish and wildlife issues, and thank you for your interest in these resources. If you have any questions or need further assistance, please contact Chesapeake Bay Field Office Threatened and Endangered Species program at (410) 573-4531.

Sincerely,

Genevieve LaRouche
Field Supervisor

RECEIVED
AUG 16 2012
Virginia Field Office

DEPARTMENT OF THE NAVY
NAVAL SURFACE WARFARE CENTER
DAHLGREN DIVISION
6149 WELSH ROAD SUITE 203
DAHLGREN VIRGINIA 22448-5130

IN REPLY REFER TO
5090
Ser CX8/042
14 AUG 2012

From: Commander, Dahlgren Division, Naval Surface Warfare Center

Subj: NAVAL SURFACE WARFARE CENTER, DAHLGREN DIVISION OUTDOOR RESEARCH, DEVELOPMENT, TEST, AND EVALUATION ACTIVITIES DRAFT ENVIRONMENT IMPACT STATEMENT

Encl: (1) Outdoor Research, Development, Test and Evaluation Activities Draft Environmental Impact Statement

1. Enclosure (1) is an electronic copy of the Draft Environmental Impact Statement (EIS) prepared by the Department of the Navy, Naval Surface Warfare Center, Dahlgren Division (NSWCDD) for your review and comment. The draft EIS evaluates the effects of expanding outdoor research, development, test, and evaluation activities within the Potomac River Test Range and Explosives Experimental Area Complexes, the Mission Area, and Special-Use Airspace at Naval Support Facility Dahlgren.

2. The Navy will conduct three public hearings to receive oral and written comments on the draft EIS. Federal, state, and local agencies, elected officials, and other interested individuals and organizations are invited to be present or represented at the public hearings. Public hearings will be held on:

a. 11 September 2012 at the Newburg Volunteer Rescue Squad and Fire Department, 12245 Rock Point Road, Newburg, MD 20664.

b. 12 September 2012 at the A. T. Johnson Alumni Museum, 18849 Kings Highway, Montross, VA 22520.

c. 13 September 2012 at University of Mary Washington-Dahlgren Campus, 4224 University Drive, King George, VA 22485.

3. All hearings will be held from 6 p.m. to 8 p.m. and will begin with a presentation followed by public comments. All venues are wheelchair accessible. Anyone needing special assistance, such as a sign language interpreter, please contact

Subj: NAVAL SURFACE WARFARE CENTER, DAHLGREN DIVISION OUTDOOR RESEARCH, DEVELOPMENT, TEST, AND EVALUATION ACTIVITIES DRAFT ENVIRONMENT IMPACT STATEMENT

the NSWCDD Public Affairs Office at 540-653-8154 or e-mail dlgr_nswc_eis@navy.mil.

4. Written comments may be submitted at the hearings or mailed during the comment period to:

> Naval Surface Warfare Center Dahlgren Division
> 6149 Welsh Road, Suite 203
> Dahlgren, VA 22448-5117
> Attn: Code C6 Fax: 540-653-4679
> E-mail: dlgr_nswc_eis@navy.mil.

5. All written comments must be received by 1 October 2012 to ensure they become part of the official record and are assessed and considered as part of the final EIS.

6. If you have any questions about the enclosed statement or need additional information, please contact the NSWCDD Public Affairs Office at 540-653-8154 or e-mail dlgr_nswc_eis@navy.mil.

7. Thank you for your participation in the EIS process.

M. H. SMITH

Distribution:
(See Attached Sheets)

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
6669 Short Lane
Gloucester, Virginia 23061

APR 13 2012

Greetings:

Due to increases in workload and refinement of our priorities in Virginia, this office will no longer provide individual responses to requests for environmental reviews. However, we want to ensure that U.S. Fish and Wildlife Service trust resources continue to be conserved. When that is not possible, we want to ensure that impacts to these important natural resources are minimized and appropriate permits are applied for and received. We have developed a website, http://www.fws.gov/northeast/virginiafield/endspecies/Project_Reviews_Introduction.html, that provides the steps and information necessary to allow landowners, applicants, consultants, agency personnel, and any other individual or entity requiring review/approval of their project to complete a review and come to the appropriate conclusion.

The website will be frequently updated to provide new species/trust resource information and methods to review projects, so refer to the website for each project review to ensure that current information is utilized.

If you have any questions about project reviews or need assistance, please contact Kimberly Smith of this office at (804) 693-6694, extension 124, or kimberly_smith @fws.gov. For problems with the website, please contact Mike Drummond of this office at mike_drummond@fws.gov.

Sincerely,

Cynthia A. Schulz

Cindy Schulz
Supervisor
Virginia Field Office

THIS PAGE INTENTIONALLY LEFT BLANK

Fisher, John (DEQ)

From: Ewing, Amy (DGIF)
Sent: Wednesday, September 26, 2012 12:32 PM
To: Fisher, John (DEQ)
Cc: Cason, Gladys (DGIF); Cooper, Jeff (DGIF); Greenlee, Bob (DGIF)
Subject: ESSLog# 25464_12-152F_Outdoor Research, Development, Test and Evaluation Activities_Dahlgren

We have reviewed the subject project that proposes to perform increased training, research, and testing activities within the Potomac River Test Range and Explosives Experimental Area complexes, the Mission Area, and special-use airspace at Naval Support Facility Dahlgren (Dahlgren).

According to our records and as reflected in the EIS, a number of state Threatened bald eagle nests are known from Dahlgren. In addition, the shoreline of the Potomac River upstream of Dahlgren has been designated a bald eagle concentration zone. We recommend coordination with us and the USFWS for any activities resulting in bald eagle habitat alterations within 660ft of any active bald eagle nest or within the designated concentration zone. Although increased activities generating more frequent loud noise may temporarily impact nesting, roosting, or foraging eagles, the eagles occupying territory at Dahlgren are likely to be habituated to loud noise emanating from Dahlgren. We recommend adherence to the currently approved Integrated Natural Resources Management Plan (INRMP) for Dahlgren, including adherence to protective measures for bald eagles and their habitats.

The Potomac River, Upper Machodoc Creek, Gambo Creek, and Williams Creek have been designated Anadromous Fish Use Areas. We recommend that any construction, restoration, or relocation activities within these waters be coordinated with us and NOAA Fisheries. We recommend adherence to the currently approved Integrated Natural Resources Management Plan (INRMP) for Dahlgren, including adherence to protective measures for Anadromous fishes and their habitats.

Assuming adherence to all necessary BMP's, we find this project consistent with the Fisheries Management Section of the CZMA.

Thanks, Amy

Amy Ewing | Environmental Services Biologist | VDGIF - Richmond HQ | 4010 West Broad St. Richmond, VA 23230 | 804-367-2211 | www.dgif.virginia.gov

THIS PAGE INTENTIONALLY LEFT BLANK

United States Department of the Interior

FISH AND WILDLIFE SERVICE
VIRGINIA ECOLOGICAL SERVICES FIELD OFFICE
6669 SHORT LANE
GLOUCESTER, VA 23061
PHONE: (804)693-6694 FAX: (804)693-9032
URL: www.fws.gov/northeast/virginiafield/

Consultation Tracking Number: 05E2VA00-2013-SLI-0673 January 21, 2013
Project Name: NSWCDD Outdoor RDT&E EIS

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project.

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, and proposed species, designated critical habitat, and candidate species that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment

Official Species List

Provided by:

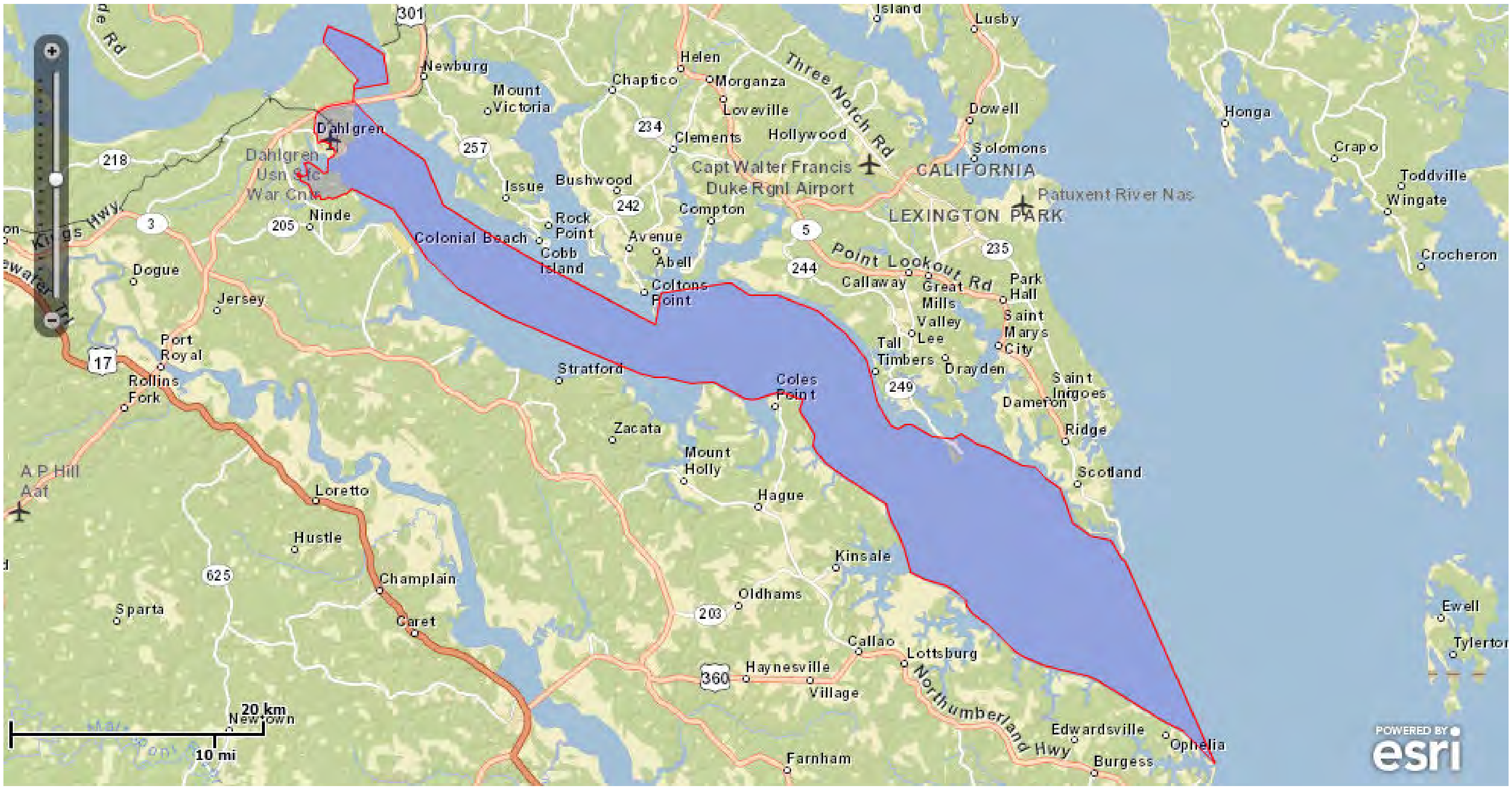
VIRGINIA ECOLOGICAL SERVICES FIELD OFFICE
6669 SHORT LANE
GLOUCESTER, VA 23061
(804) 693-6694
http://www.fws.gov/northeast/virginiafield/

Expect additional Species list documents from the following office(s):

CHESAPEAKE BAY ECOLOGICAL SERVICES FIELD OFFICE
177 ADMIRAL COCHRANE DRIVE
ANNAPOLIS, MD 21401
(410) 573-4500

Consultation Tracking Number: 05E2VA00-2013-SLI-0673
Project Type: Military Operations / Maneuvers
Project Description: Naval Surface Warfare Center, Dahlgren Division proposes to expand research, development, test, and evaluation activities using ordnance, electromagnetic energy, high-energy lasers, and chemical and biological simulants within the Potomac River Test Range and Explosives Experimental Area Range complexes, the Mission Area, and special-use airspace at Naval Support Facility Dahlgren, located 25 mi east of Fredericksburg, VA and 53 mi south of Washington, DC.

Project Location Map:



Project Coordinates: MULTIPOLYGON (((-77.0154014 38.368362, -77.016486 38.358879, -77.0148867 38.3590774, -77.0148839 38.3590403, -77.0144374 38.3590858, -76.9884257 38.3374268, -76.9519444 38.3183333, -76.9349434 38.2864057, -76.8913601 38.2644336, -76.8456633 38.2440739, -76.7429369 38.2015186, -76.7382108 38.2236884, -76.6797939 38.2308782, -76.6744016 38.2308782, -76.6591233 38.2227897, -76.6339591 38.2227897, -76.5962127 38.2111063, -76.5710485 38.1949293, -76.5521754 38.1760561, -76.5422894 38.1454996, -76.5306061 38.1302213, -76.524315 38.1275252, -76.5180239 38.1302213, -76.5108342 38.1302213, -76.4928597 38.1221328, -76.4748853 38.1203354, -76.4667968 38.1239303, -76.4524173 38.1167405, -76.4416326 38.1140443, -76.4119748 38.1014622, -76.4002914 38.1005635, -76.3899993 38.0920056, -76.3772533 38.0851655, -76.36614 38.0610197, -76.349963 38.0511338, -76.3319885 38.0484376, -76.3219798 38.0353284, -76.3189529 38.0337401, -76.2376227 37.8893639, -76.2663818 37.9127306, -76.2825588 37.9190217, -76.3418745 37.9477808, -76.3508617 37.9513757, -76.3931016 37.9594642, -76.4128735 37.9666539, -76.4209374 37.9711467, -76.4425313 37.9882233, -76.4569109

37.9963118, -76.4622579 38.0016405, -76.4625692 38.0049498, -76.469493 38.0106913, -76.4802776 38.0160837, -76.5000495 38.0205773, -76.5126316 38.0259696, -76.5180239 38.0412479, -76.5234163 38.0529312, -76.5306061 38.0628172, -76.5349076 38.0742987, -76.5755421 38.0951712, -76.589023 38.1032597, -76.5971115 38.1104494, -76.6007064 38.1158418, -76.5989089 38.1230316, -76.612731 38.1403855, -76.6095275 38.1493921, -76.6142517 38.1493623, -76.6304646 38.153887, -76.6537309 38.1481958, -76.6627182 38.1490945, -76.6908902 38.160811, -76.7112491 38.1598791, -76.7355146 38.1643728, -76.7454006 38.1643728, -76.7565278 38.1666667, -76.8819139 38.2084622, -76.9211087 38.2269074, -76.9492753 38.2481863, -76.9793892 38.2830177, -77.0174137 38.2979277, -77.0225214 38.2939129, -77.0240555 38.2940463, -77.0350202 38.2903509, -77.0374832 38.2917619, -77.0413311 38.2906855, -77.0411546 38.2904526, -77.0456264 38.2900526, -77.0460606 38.2930694, -77.0464492 38.2930002, -77.0507276 38.2914564, -77.0562246 38.3007212, -77.0640179 38.3037255, -77.0639638 38.3061239, -77.0669579 38.3069914, -77.0651918 38.3094041, -77.062314 38.3064861, -77.0580633 38.3073885, -77.0587846 38.3138423, -77.0609029 38.3156332, -77.0563901 38.3168297, -77.047775 38.3122373, -77.0429754 38.3087113, -77.0390529 38.3094195, -77.0389207 38.3188028, -77.0333015 38.3216747, -77.0322699 38.3239196, -77.0341226 38.3267861, -77.0359694 38.3268887, -77.0364497 38.3295284, -77.0442066 38.3320971, -77.0476934 38.3300143, -77.0490893 38.3370019, -77.0514478 38.3371054, -77.0504471 38.3451053, -77.0506601 38.3464853, -77.0487372 38.3519403, -77.0481604 38.3523519, -77.0423828 38.3550536, -77.0409571 38.355537, -77.038425 38.3559956, -77.024141 38.3581815, -77.0223474 38.3583908, -77.0164891 38.3588787, -77.0154524 38.3684054, -77.0159073 38.3710313, -77.0116518 38.3743962, -77.0123236 38.3754868, -77.0423493 38.4008749, -77.0428621 38.4009805, -77.0427681 38.4052153, -77.0387608 38.4128942, -77.0094183 38.4034858, -76.9885843 38.3931797, -76.9846634 38.3724766, -77.0154014 38.368362)))

Project Counties: Charles, MD | St. Mary's, MD | King George, VA | Northumberland, VA | Westmoreland, VA

Endangered Species Act Species List

Species lists are not entirely based upon the current range of a species but may also take into consideration actions that affect a species that exists in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. Please contact the designated FWS office if you have questions.

Northeastern Beach tiger beetle *(Cicindela dorsalis dorsalis)*

Listing Status: Threatened

Sensitive joint-vetch *(Aeschynomene virginica)*

Listing Status: Threatened

From:	Wray, Thomas II CIV NAVFAC Washington, Environmental Dept
To:	Mike Drummond
Cc:	Goss, William E CTR NSWCDD, CX8; Frankenthaler, Vic; Legg, Walter CIV NAVFAC Washington
Subject:	Consultation Tracking Number 05E2VA00-2013-SLI-0673
Date:	Wednesday, January 23, 2013 8:34:27 AM
Attachments:	Step 2, Official Species List - USFWS Virginia ESFO 2013, Official Speci....pdf Species Conclusion Table, NSWCDD RDT&E EIS 2013-01-21.doc Fig 1 Potomac River Test Range Complex.pdf.pdf Fig 2 Range Complexes and Mission Area.pdf.pdf Step 6A, VaEagles Map King George County.pdf.pdf

The Naval Support Activity Dahlgren has reviewed Online Project Review Request, NSWCDD Outdoor RDT&E EIS, King George, Westmoreland, and Northumberland Counties, Virginia, Consultation Tracking Number: 05E2VA00-2013-SLI-0673 and is submitting our project review package in accordance with the instructions for further review.

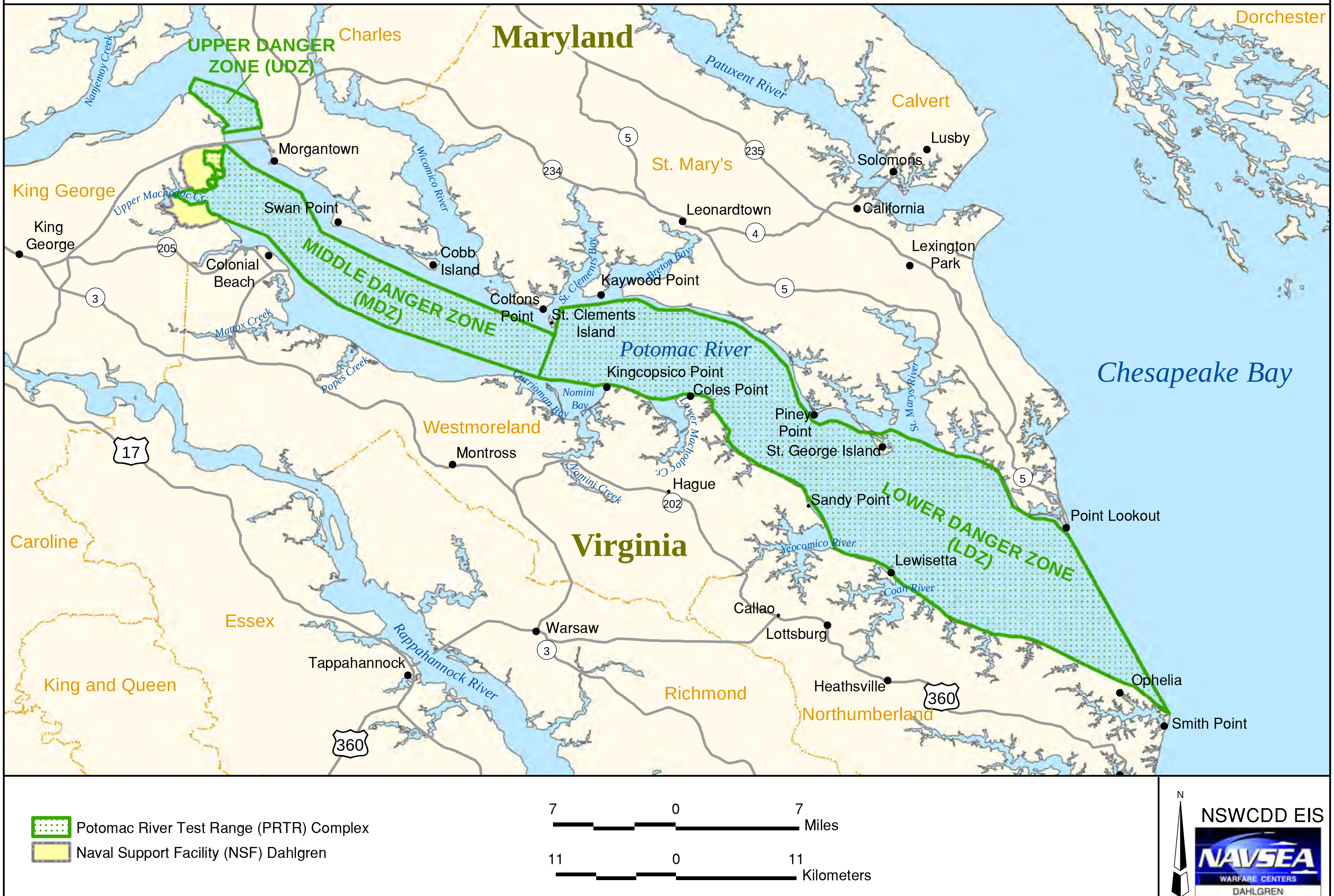
Our proposed action consists of: Naval Surface Warfare Center, Dahlgren Division proposes to expand research, development, test, and evaluation activities using ordnance, electromagnetic energy, high-energy lasers, and chemical and biological simulants within the Potomac River Test Range and Explosives Experimental Area Range complexes, the Mission Area, and special-use airspace at Naval Support Facility Dahlgren, located 25 miles east of Fredericksburg, VA and 53 miles south of Washington, DC. Under the Proposed Action, the average number of events that could take place annually (with the exception of large-caliber gun firing events) would increase above recent levels. To ensure that equipment and materials work effectively, even in less-than-ideal conditions, some activities would take place under conditions in which activities are now rarely/never conducted, such as at dusk, dawn, and night, and in adverse weather. The proposed action is expected to be carried out over th e next 15 years.

The location of the project and the action area are identified on the attached Figures 1 and 2.

We are submitting the attached project review package for Endangered Species Act Section 7 and Eagle Act coordination for the proposed action. The project review package provides the information about the species, critical habitat, and bald eagles considered in our review, and the species conclusions table included in the package identifies our determinations for the resources that may be affected by the proposed action.

THIS PAGE INTENTIONALLY LEFT BLANK

Potomac River Test Range Complex



Source: NSWCDD GIS (2008 - 2011); Danger Zones defined in 33 CFR § 334.230.

Figure 1

Range Complexes and Mission Area

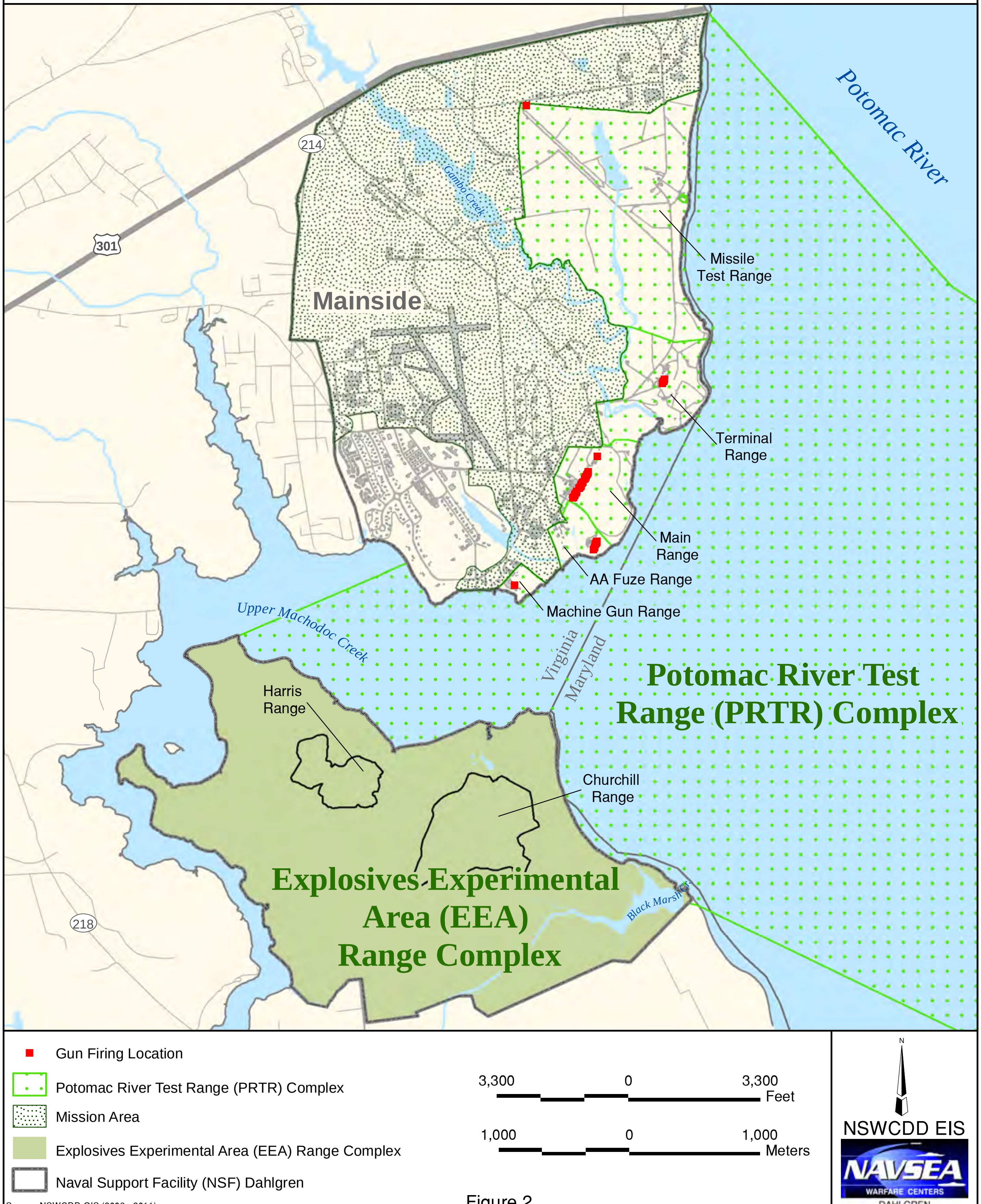


Figure 2

United States Department of the Interior

FISH AND WILDLIFE SERVICE
VIRGINIA ECOLOGICAL SERVICES FIELD OFFICE
6669 SHORT LANE
GLOUCESTER, VA 23061
PHONE: (804)693-6694 FAX: (804)693-9032
URL: www.fws.gov/northeast/virginiafield/

Consultation Tracking Number: 05E2VA00-2013-SLI-0673 January 21, 2013
Project Name: NSWCDD Outdoor RDT&E EIS

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project.

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, and proposed species, designated critical habitat, and candidate species that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment

Official Species List

Provided by:

VIRGINIA ECOLOGICAL SERVICES FIELD OFFICE
6669 SHORT LANE
GLOUCESTER, VA 23061
(804) 693-6694
http://www.fws.gov/northeast/virginiafield/

Expect additional Species list documents from the following office(s):

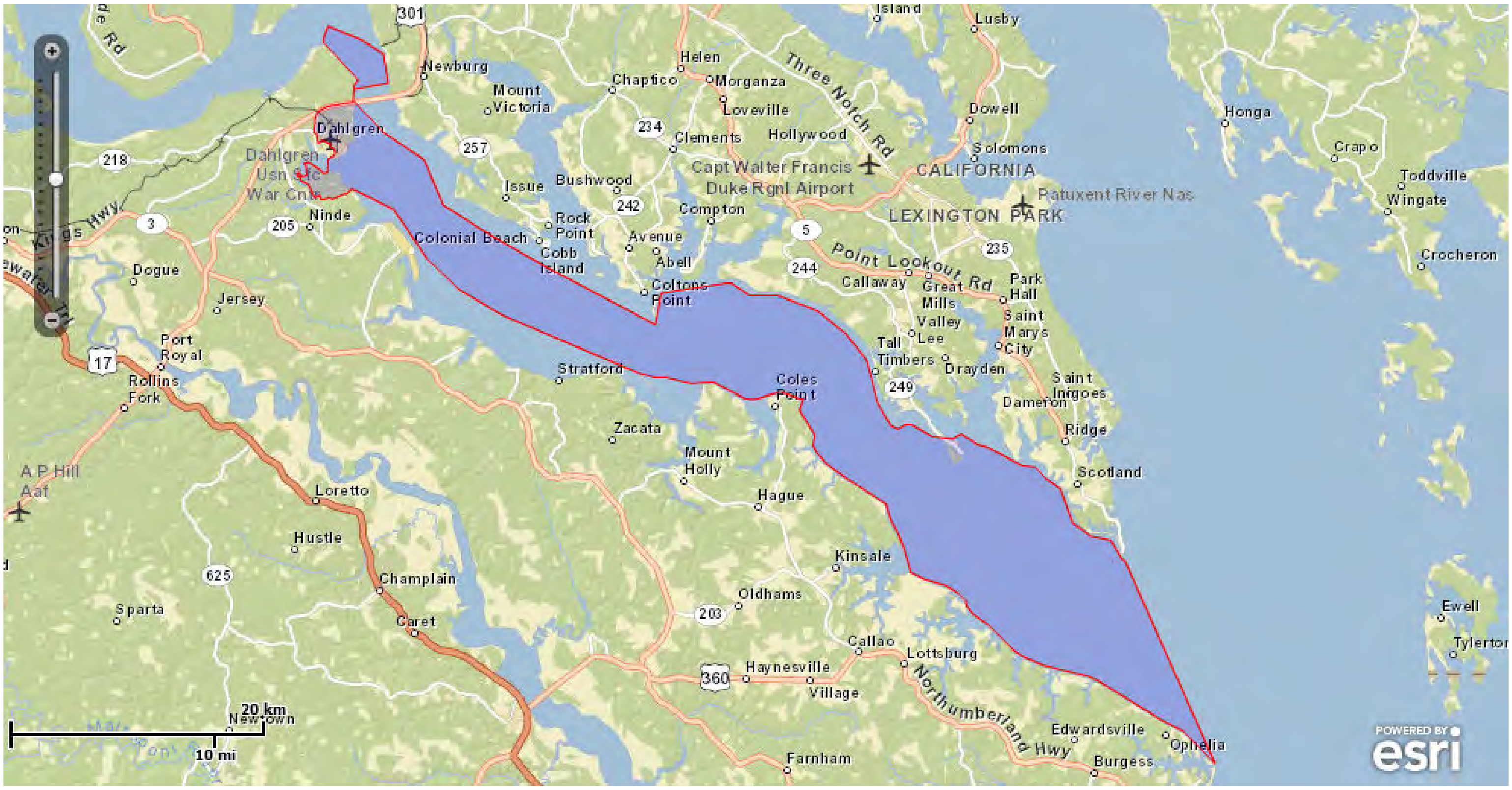
CHESAPEAKE BAY ECOLOGICAL SERVICES FIELD OFFICE
177 ADMIRAL COCHRANE DRIVE
ANNAPOLIS, MD 21401
(410) 573-4500

Consultation Tracking Number: 05E2VA00-2013-SLI-0673
Project Type: Military Operations / Maneuvers
Project Description: Naval Surface Warfare Center, Dahlgren Division proposes to expand research, development, test, and evaluation activities using ordnance, electromagnetic energy, high-energy lasers, and chemical and biological simulants within the Potomac River Test Range and Explosives Experimental Area Range complexes, the Mission Area, and special-use airspace at Naval Support Facility Dahlgren, located 25 mi east of Fredericksburg, VA and 53 mi south of Washington, DC.

United States Department of Interior
Fish and Wildlife Service

Project name: NSWCDD Outdoor RDT&E EIS

Project Location Map:



Project Coordinates: MULTIPOLYGON (((-77.0154014 38.368362, -77.016486 38.358879, -77.0148867 38.3590774, -77.0148839 38.3590403, -77.0144374 38.3590858, -76.9884257 38.3374268, -76.9519444 38.3183333, -76.9349434 38.2864057, -76.8913601 38.2644336, -76.8456633 38.2440739, -76.7429369 38.2015186, -76.7382108 38.2236884, -76.6797939 38.2308782, -76.6744016 38.2308782, -76.6591233 38.2227897, -76.6339591 38.2227897, -76.5962127 38.2111063, -76.5710485 38.1949293, -76.5521754 38.1760561, -76.5422894 38.1454996, -76.5306061 38.1302213, -76.524315 38.1275252, -76.5180239 38.1302213, -76.5108342 38.1302213, -76.4928597 38.1221328, -76.4748853 38.1203354, -76.4667968 38.1239303, -76.4524173 38.1167405, -76.4416326 38.1140443, -76.4119748 38.1014622, -76.4002914 38.1005635, -76.3899993 38.0920056, -76.3772533 38.0851655, -76.36614 38.0610197, -76.349963 38.0511338, -76.3319885 38.0484376, -76.3219798 38.0353284, -76.3189529 38.0337401, -76.2376227 37.8893639, -76.2663818 37.9127306, -76.2825588 37.9190217, -76.3418745 37.9477808, -76.3508617 37.9513757, -76.3931016 37.9594642, -76.4128735 37.9666539, -76.4209374 37.9711467, -76.4425313 37.9882233, -76.4569109

37.9963118, -76.4622579 38.0016405, -76.4625692 38.0049498, -76.469493 38.0106913, -76.4802776 38.0160837, -76.5000495 38.0205773, -76.5126316 38.0259696, -76.5180239 38.0412479, -76.5234163 38.0529312, -76.5306061 38.0628172, -76.5349076 38.0742987, -76.5755421 38.0951712, -76.589023 38.1032597, -76.5971115 38.1104494, -76.6007064 38.1158418, -76.5989089 38.1230316, -76.612731 38.1403855, -76.6095275 38.1493921, -76.6142517 38.1493623, -76.6304646 38.153887, -76.6537309 38.1481958, -76.6627182 38.1490945, -76.6908902 38.160811, -76.7112491 38.1598791, -76.7355146 38.1643728, -76.7454006 38.1643728, -76.7565278 38.1666667, -76.8819139 38.2084622, -76.9211087 38.2269074, -76.9492753 38.2481863, -76.9793892 38.2830177, -77.0174137 38.2979277, -77.0225214 38.2939129, -77.0240555 38.2940463, -77.0350202 38.2903509, -77.0374832 38.2917619, -77.0413311 38.2906855, -77.0411546 38.2904526, -77.0456264 38.2900526, -77.0460606 38.2930694, -77.0464492 38.2930002, -77.0507276 38.2914564, -77.0562246 38.3007212, -77.0640179 38.3037255, -77.0639638 38.3061239, -77.0669579 38.3069914, -77.0651918 38.3094041, -77.062314 38.3064861, -77.0580633 38.3073885, -77.0587846 38.3138423, -77.0609029 38.3156332, -77.0563901 38.3168297, -77.047775 38.3122373, -77.0429754 38.3087113, -77.0390529 38.3094195, -77.0389207 38.3188028, -77.0333015 38.3216747, -77.0322699 38.3239196, -77.0341226 38.3267861, -77.0359694 38.3268887, -77.0364497 38.3295284, -77.0442066 38.3320971, -77.0476934 38.3300143, -77.0490893 38.3370019, -77.0514478 38.3371054, -77.0504471 38.3451053, -77.0506601 38.3464853, -77.0487372 38.3519403, -77.0481604 38.3523519, -77.0423828 38.3550536, -77.0409571 38.355537, -77.038425 38.3559956, -77.024141 38.3581815, -77.0223474 38.3583908, -77.0164891 38.3588787, -77.0154524 38.3684054, -77.0159073 38.3710313, -77.0116518 38.3743962, -77.0123236 38.3754868, -77.0423493 38.4008749, -77.0428621 38.4009805, -77.0427681 38.4052153, -77.0387608 38.4128942, -77.0094183 38.4034858, -76.9885843 38.3931797, -76.9846634 38.3724766, -77.0154014 38.368362)))

Project Counties: Charles, MD | St. Mary's, MD | King George, VA | Northumberland, VA | Westmoreland, VA

Endangered Species Act Species List

Species lists are not entirely based upon the current range of a species but may also take into consideration actions that affect a species that exists in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. Please contact the designated FWS office if you have questions.

Northeastern Beach tiger beetle *(Cicindela dorsalis dorsalis)*

Listing Status: Threatened

Sensitive joint-vetch *(Aeschynomene virginica)*

Listing Status: Threatened

THE CENTER FOR CONSERVATION BIOLOGY

VAEAGLES

Virginia's bald eagle information site

CCB HOME

SUPPORT EAGLE CONSERVATION

Viewing Eagle Nest Data

Report New Nests

Overview Map

Regulatory Contacts

You have successfully entered the **VaEagles Nest Locator**. Your session will automatically end if you navigate away from this page, or after 20 minutes of inactivity.

2011 Virginia Bald Eagle Nest Survey Data

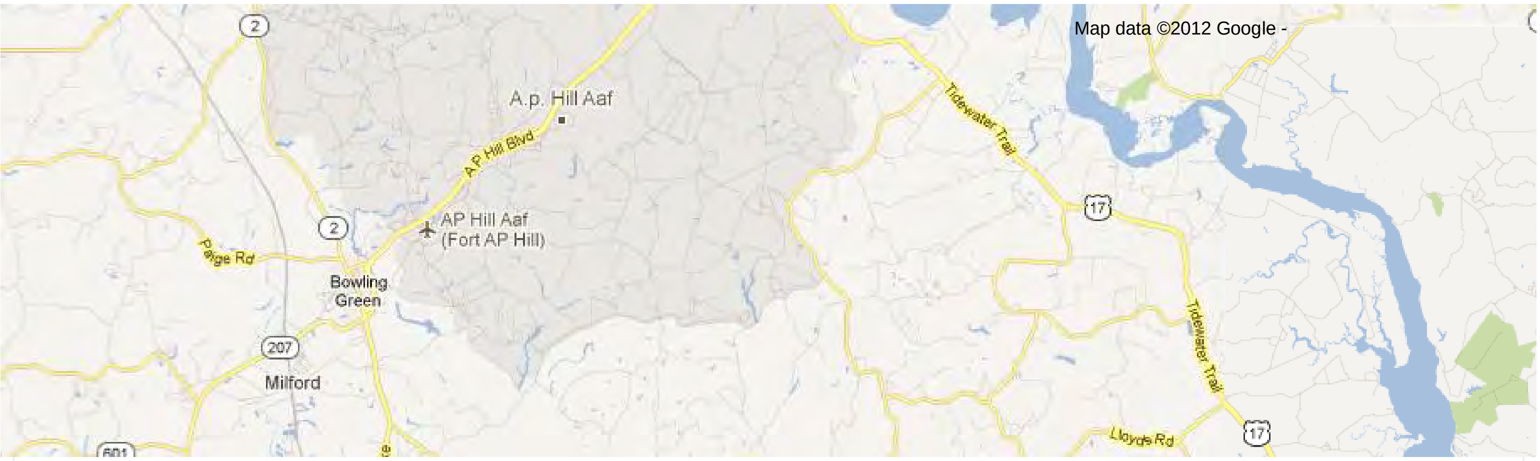
The **2011 Virginia Eagle Nest Survey Report** is now available in pdf format.

Instructions

1) First choose a city or county in which to view nest data, then click **Submit**.
The data for the independent city or county you select will be displayed on a map centered in the space below. - select a city/county - Submit
Cities and counties that do not appear in the list have no known/reported bald eagle nests for which we have location information from the most recently concluded annual survey. If you think you know of an occupied or recently active nest, please refer to the page on **Reporting New Nests**.
2) Use the "+" and "-" in the top left corner to zoom in and out, and the arrows to navigate. You an also drag the map to navigate and change the view by clicking "Map," "Satellite" or "Hybrid."
3) To select a different city/county, choose another from the pull-down list and again click **Submit**.
[Link to VA county map, US Census Bureau]

[**FYI: You will see an empty black box below until a county has been submitted and is loaded.**]
The VaEagles map displaying Virginia's known eagle nests in the city or county selected may take a few moments to load, depending on the amount of data for the locality requested and upon your browser and connection speeds.

The Center for Conservation Biology - Virginia Eagles Nest Locator
Currently displaying 2011 survey data from: KING GEORGE



Report New/Unknown Nests >>

Return to top

Webpage design & production: Carla Schneider | Eagle banner image: John DiGiorgio

Species Conclusions Table

Project Name: NSWCDD Outdoor RDT&E EIS

Date: January 21, 2013

Species / Resource Name	Conclusion	ESA Section 7 / Eagle Act Determination	Notes / Documentation
Northeastern Beach tiger beetle *(Cicindela dorsalis dorsalis)*	No suitable habitat present	No effect	Northeastern beach tiger beetle habitat includes open, undisturbed beaches, sand flats, dunes, water edges, woodland paths, and sparse grassy areas (USFWS, 1994[1]). Adult beetles are usually active along the water's edge on bright, clear, sunny days; and eggs are usually deposited below the surface of the sand, above the high-tide mark (Lippson and Lippson, 2006[2]). The beetle has been observed on beaches along the lowest reaches of the Virginia side of the Potomac River – along the lower PRTR LDZ[3]. Potomac River northeastern beach tiger beetle populations were surveyed in 1998 and again in 2004 (Knisley, pers. comm., September 24, 2008[4]). Populations of tiger beetles were observed between Hull Creek and the mouth of the Little Wicomico River, along the Virginia side of the LDZ, 25 mi south of the MDZ's downriver boundary.

[1] United States Fish and Wildlife Service (USFWS). 1994. *Northeastern Beach Tiger Beetle (Cicindela dorsalis dorsalis Say) Recovery Plan*. Hadley, Massachusetts.

[2] Lippson, A.J. and R.L Lippson. 2006. *Life in the Chesapeake Bay: An Illustrated Guide to the Fishes, Invertebrates, Plants, Birds, and Other Inhabitants of the Bays and Inlets from Cape Cod to Cape Hatteras*. 3rd edition. Baltimore and London: Johns Hopkins University Press.

[3] The limits of the danger zones are defined in 33 Code of Federal Regulations § 334.230 and shown on National Oceanic and Atmospheric Administration's Nautical Charts: 12288, Lower Cedar Point to Mattawoman Creek; 12286, Potomac River – Piney Point to Lower Cedar Point; and 12233, Chesapeake Bay to Piney Point.

[4] Knisley, B.C. Professor of Biology, Tiger Beetle (*Cicindelidae*) expert, Randolph-Macon College. September 24, 2008. Email to A. Foley, AECOM.

Species / Resource Name	Conclusion	ESA Section 7 / Eagle Act Determination	Notes / Documentation
			Suitable habitat is absent within the action area. None of the proposed activities would directly or indirectly affect Northeastern beach tiger beetle suitable habitat along the PRTR LDZ, as the PRTR is a water range, NSWCDD's proposed activities would take place in deep water well away from the LDZ shoreline, and NSWCDD does not propose to undertake any activities near or shoreward of the shoreline of the LDZ.
Sensitive joint-vetch *(Aeschynomene virginica)*	Potential habitat present and no current survey conducted	May adversely affect	In 2004, a rare-plant survey was completed for state-listed and federally-listed rare, threatened, and endangered plant species that are known to occur in the vicinity of NSF Dahlgren (DoN, 2004[5]). Surveyors searched for sensitive joint-vetch, as well as other rare plant species. Although potential habitat exists for these rare plants, none of the target species or any other rare plants were found on the installation (DoN, 2004). Even if sensitive joint-vetch occurs somewhere on the installation, it is unlikely to be present in the part of the range used for ground disturbing activities, as there is no suitable habitat in these areas. Further, the Proposed Action would not cause ground disturbance outside of existing target areas and other areas subject to recent and continuing disturbance.
Critical habitat	No critical habitat present	No effect	
Bald eagle	Unlikely to disturb nesting bald eagles	No Eagle Act permit required	The action area potentially is within 660 feet of bald eagle nests on NSF Dahlgren; specifically the following nests in King George County,

[5] Department of the Navy (DoN). 2004. *Rare, Threatened, and Endangered Plant Species Survey at Naval District Washington-West, Dahlgren*. Prepared by Environmental Systems Analysis, Inc., Annapolis, Maryland. Prepared for Navy Planning Installation Division, Washington, D.C.

Species / Resource Name	Conclusion	ESA Section 7 / Eagle Act Determination	Notes / Documentation
			listed by nest identifier: ▪ KG0708 ▪ KG0709 ▪ KG0407 ▪ KG0710 ▪ KG0906 ▪ KG9705 ▪ KG0606 ▪ KG1007 ▪ KG1109 NSF Dahlgren's bald eagle management practices are outlined in the installation's *Bald Eagle Management Plan* (NSF Dahlgren and NAVFAC Washington, 2007[6]) and are implemented in cooperation with VDGIF and USFWS to ensure protection of the species and compliance with the BGEPA. Management includes the protection of documented nesting and foraging habitat, the monitoring of nesting activity and success, and the enforcement of the Bald Eagle Protection Guidelines for Virginia developed by the USFWS and VDGIF (USFWS and VDGIF, 2001[7]) and National Bald Eagle Guidelines (USFWS, 2007[8]). Requests for deviations from these guidelines must be approved by USFWS and VDGIF.

[6] Naval Support Facility Dahlgren (NSF Dahlgren) and Naval Facilities Engineering Command, Washington (NAVFAC Washington). 2007. *Bald Eagle Management Plan Naval Support Facility Dahlgren. Dahlgren, Virginia*. Prepared by Geo-marine, Inc. for Naval Support Facility Dahlgren and Naval Facilities Engineering Command, Washington. United States Navy, Naval Support Facility Dahlgren and Naval Facilities Engineering Command, Washington.

[7] United States Fish and Wildlife Service (USFWS) and Virginia Department of Game and Inland Fisheries (VDGIF). 2001. *Bald Eagle Protection Guidelines for Virginia*. Gloucester and Richmond, Virginia.

[8] United States Fish and Wildlife Service (USFWS). 2007. National Bald Eagle Management Guidelines. May 2007. Available from <http://www.fws.gov/pacific/eagle/NationalBaldEagleManagementGuidelines.pdf>

Species / Resource Name	Conclusion	ESA Section 7 / Eagle Act Determination	Notes / Documentation
			NSWCDD RDT&E activities at NSF Dahlgren have the potential to disturb bald eagles due to human activity, aircraft operation, and loud noises generated by explosives. However, aircraft use and ordnance testing at the ranges is intermittent, has a historic presence, is consistent with past practices, and bald eagles have demonstrated tolerance for these activities at NSF Dahlgren. Therefore, these activities are allowed to proceed during the bald eagle nesting season, as specified in the National Bald Eagle Management Guidelines (USFWS, 2007). Guidelines in the NSF Dahlgren *Bald Eagle Management Plan* (NSF Dahlgren and NAVFAC Washington, 2007) require that, when prudent, the USFWS be consulted if the following circumstances occur: ▪ A bald eagle builds a nest within a quarter-mile of existing test ranges, if testing was not routinely conducted at the time of nest establishment. ▪ A given test on an existing range is significantly different from those conducted historically. ▪ A new testing area is proposed. Currently, approximately 408 ac on Mainside and 552 ac on the EEA are constrained by bald eagle protection zones (PZs) around active bald eagle nests. The first PZ – PZ1 – extends from the nest tree to a radius of 750 ft, and the second zone – PZ2 – extends from 750 ft to 1,320 ft (a quarter-mile) in radius (NSF Dahlgren and NAVFAC Washington, 2007). Historical nesting sites are assumed to be inactive unless aerial or ground surveys document otherwise. PZs remain in place while the nest is active and for three consecutive

Species / Resource Name	Conclusion	ESA Section 7 / Eagle Act Determination	Notes / Documentation
			nesting seasons after the last season during which the nest was occupied (USFWS and VDGIF, 2001; NSF Dahlgren and NAVFAC Washington, 2007).
Bald eagle	Does not intersect with an eagle concentration area	No Eagle Act permit required	The VDGIF and the USFWS have defined a Potomac River Bald Eagle Concentration Area that includes most of the Virginia shoreline between Pohick Creek and the Harry Nice Bridge (Wetland Studies and Solutions, 2006[9]) – areas adjacent to the UDZ. The action area—here identified by the 130 dBP composite peak noise contour with 8"/55 gun firing—does not intersect with either the winter or summer Potomac River concentration area.

[9] Wetland Studies and Solutions. 2006. *Endangered and Threatened Species Alert: Potomac River Bald Eagle Concentration Area Redefined and Expanded.* Vol. 14(5). July 17, 2006. Available from <http://www.newsletters.wetlandstudies.com/fieldNotesArticle.cfm?id=18>.

THIS PAGE INTENTIONALLY LEFT BLANK

Willson, Lane

Subject: FW: INRMP - Dahlgren, Consultation Tracking Number 05E2VA00-2013-SLI-0673

From: Mike Drummond [mailto:mike_drummond@fws.gov]
Sent: Tuesday, February 19, 2013 14:09
To: Wray, Thomas II CIV NAVFAC Washington, Environmental Dept
Subject: RE: INRMP - Dahlgren, Consultation Tracking Number 05E2VA00-2013-SLI-0673

We have reviewed the project package received by email on January 23, 2013 for the referenced project. The following comments are provided under provisions of the Endangered Species Act of 1973 (16 U.S.C. 1531-1544, 87 Stat. 884), as amended, and Bald and Golden Eagle Protection Act (16 U.S.C. 668-668c, 54 Stat. 250) as amended.

We concur with the determinations provided in the Species Conclusion Table dated January 23, 2013 and have no further comments. Should project plans change or if additional information on the distribution of listed species or critical habitat becomes available, this determination may be reconsidered. If you have any questions, or need a signature on the INRMP document, please contact me.

Mike Drummond
Endangered Species Biologist
U.S. Fish and Wildlife Service
Virginia Field Office
6669 Short Lane
Gloucester, VA 23061
(804) 693 - 6694 x122
(804) 654 - 1771 cell

THIS PAGE INTENTIONALLY LEFT BLANK

DEPARTMENT OF THE NAVY
NAVAL SUPPORT ACTIVITY SOUTH POTOMAC
6509 SAMPSON ROAD SUITE 217
DAHLGREN, VIRGINIA 22448-5108

IN REPLY REFER TO
5090
Ser PRSD41TW/043
April 29, 2013

Mr. John K. Bullard
Acting Regional Administrator
National Marine Fisheries Service
Northeast Region
55 Great Republic Drive
Gloucester, MA 01930-2276

Dear Mr. Bullard:

SUBJECT: NAVAL SURFACE WARFARE CENTER, DAHLGREN DIVISION OUTDOOR RESEARCH, DEVELOPMENT, TEST, AND EVALUATION ACTIVITIES DRAFT ENVIRONMENTAL IMPACT STATEMENT

Enclosed for your consideration is one electronic copy on compact disc of the Draft Environmental Impact Statement (EIS) prepared by the Department of the Navy, Naval Surface Warfare Center, Dahlgren Division. The Draft EIS evaluates the effects of expanding research, development, test, and evaluation (RDT&E) activities within the Potomac River Test Range and Explosives Experimental Area complexes, the Mission Area, and special-use airspace at Naval Support Facility Dahlgren.

The Draft EIS and the information contained therein represent the Navy's initiation of essential fish habitat (EFH) consultation. The Navy has determined that the proposed RDT&E activities may adversely affect EFH, but likely would result in minimal adverse effects on EFH, as the resulting changes to EFH and its ecological functions would be relatively insignificant.

If you have any questions about the enclosed statement or need additional information, please contact Dr. Thomas Wray, Natural Resources Program Manager, at (540) 653-4186.

Sincerely,

JEFFREY C. BOSSART
By direction

Enclosure: 1. Outdoor Research, Development, Test & Evaluation Activities Draft EIS

5090
Ser PRSD41TW/043

Blind copy to: (w/o encl)
Reading File
PRSD41TW (Wray)

Writer: T. Wray, PRSD41TW, x34186
Typist: C. McGinniss, 16 Apr 13

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
NORTHEAST REGION
Virginia Field Office
1375 Greate Rd.
P.O. Box 1346
Gloucester Point, Virginia 23062

June 7, 2013

Mr. Jeffrey C. Bossart
Department of the Navy
Naval Support Activity South Potomac
6509 Sampson Rd., Suite 217
Dahlgren, Virginia 22448-5108

Re: Naval Surface Warfare Center (NSWC), Draft Environmental Impact Statement
Essential Fish Habitat Consultation; 5090 Ser PRSD41TW/043

Dear Mr. Bossart,

I have reviewed the Draft Environmental Impact Statement (DEIS) you sent regarding the expanded research, development, test, and evaluation (RDT&E) activities to be conducted within the Potomac River Test Range and Explosives Experimental Area complexes, and special-use airspace located at Naval Support Facility Dahlgren, King George County, Virginia. As you know, the Potomac River is designated as essential fish habitat (EFH) for 12 federally managed spp. and is also designated a confirmed anadromous fish use area by the Virginia Department of Game and Inland Fisheries (DGIF). Anadromous species known to occur in the Potomac River include the Atlantic and shortnose sturgeon, both listed by NOAA Fisheries Service under the Endangered Species Act.

Following our review of DEIS, NOAA Fisheries Service concurs with your determination that the proposed expansion of RDT&E activities at Naval Support Facility Dahlgren will not substantially adversely affect EFH or habitat areas of particular concern (HAPC). Therefore, we have no EFH conservation recommendations to provide at this time.

Please note that this EFH determination does not relieve you of your responsibilities for consultation regarding potential impacts to threatened and endangered species under the purview of NOAA Fisheries Service. Therefore, please contact Ms. Christine Vaccaro, NOAA Protected Resources Division (christine.vaccaro@noaa.gov) 978-281-9167 to discuss your consultation obligations under Section 7 of the Endangered Species Act.

Thank you for the opportunity to comment on the DEIS for expanded RDT&E activities at Naval Support Facility Dahlgren. Please feel free to contact me if you have any questions

Sincerely,

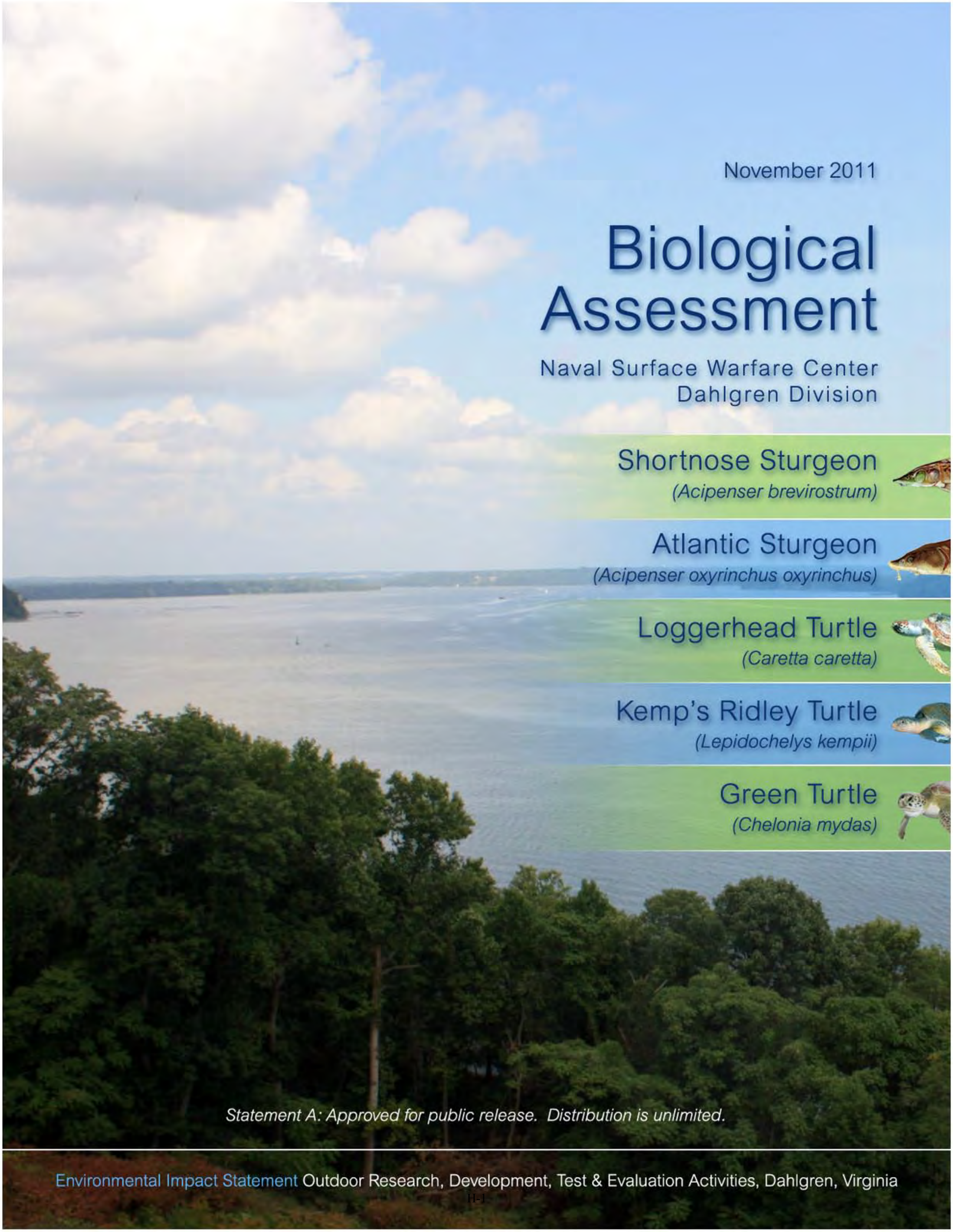
David L. O'Brien
Fisheries Biologist

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX H

BIOLOGICAL ASSESSMENT

THIS PAGE INTENTIONALLY LEFT BLANK



November 2011

Biological Assessment

Naval Surface Warfare Center Dahlgren Division

Shortnose Sturgeon
(Acipenser brevirostrum)

Atlantic Sturgeon
(Acipenser oxyrinchus oxyrinchus)

Loggerhead Turtle
(Caretta caretta)

Kemp's Ridley Turtle
(Lepidochelys kempii)

Green Turtle
(Chelonia mydas)

Statement A: Approved for public release. Distribution is unlimited.

THIS PAGE INTENTIONALLY LEFT BLANK

BIOLOGICAL ASSESSMENT

SHORTNOSE STURGEON (*Acipenser brevirostrum*)
ATLANTIC STURGEON (*Acipenser oxyrinchus oxyrinchus*)
LOGGERHEAD SEA TURTLE (*Caretta caretta*)
KEMP'S RIDLEY SEA TURTLE (*Lepidochelys kempii*)
GREEN SEA TURTLE (*Chelonia mydas*)

November 2011

Naval Surface Warfare Center Dahlgren Division
Dahlgren, Virginia

THIS PAGE INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

Section Page

Figure		Page

Table		Page

Acronyms and Abbreviations

AET	apparent effects threshold
AWQC	ambient water quality criteria
BA	biological assessment
BCF	bioconcentration factor
BSL	Biosafety Level
chem/bio	chemical and biological
°C	degree(s) Celsius
DEEP	diethyl ethyl phosphonate
DEIS	draft environmental impact statement
DEM	diethyl malonate
DEP	diethyl phthalate
DMA	dimethyl adipate
DMMP	dimethyl methylphosphonate
DoD	Department of Defense
DPGME	dipropylene glycol methyl ether
dw	dry weight
EC50	(lowest) effect concentration 50
EEA	Explosive Experimental Area
EM	electromagnetic
ER-L	effects range-low
ER-M	effects range-median
ESA	Endangered Species Act
FCM	food chain multiplier
FGD	flue gas desulfurization
ft	foot/feet
FW	freshwater
°F	degree(s) Fahrenheit
GAA	glacial acetic acid
gal(s)	gallon(s)
GHz	gigahertz
gpm	gallon(s) per minute
HE	high-energy
HMX	High-Melting eXplosive (octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine)
HPM	high-power microwave
IR	infrared
km	kilometer(s)
kg	kilogram(s)
kHz	kilohertz
kW	kilowatt(s)
l	liter(s)
lb(s)	pound(s)
LC0	lethal concentration 0
LC50	lethal concentration 50
LDZ	Lower Danger Zone

LOEC	lowest-observed-effect concentration
m	meter(s)
m^2	square meter(s)
m^3	cubic meter(s)
MDE	Maryland Department of the Environment
MDNR	Maryland Department of Natural Resources
MdTA	Maryland Transportation Authority
MDZ	Middle Danger Zone
MeS	methyl salicylate
mg	milligram(s)
mg/kg	milligram(s) per kilogram
mg/kg ww	milligram(s) per kilogram wet weight
mg/l	milligram(s) per liter
mg/m^2	milligram(s) per square meter
mgpd	million gallon(s) per day
mi	mile(s)
mlpd	million liter(s) per day
mm	millimeter(s)
mW	milliwatt(s)
µg	microgram(s)
µg/kg dw	microgram(s) per kilogram dry weight
µm	micrometer(s)
NA	Not Available
NAVSEA	Naval Sea Systems Command
NEW	net explosive weight
NFS	NOAA Fisheries Service
NM	nautical mile(s)
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOEC	no-observed-effect concentration
NSF	Naval Support Facility
NSWCDD	Naval Surface Warfare Center, Dahlgren Division
NSWCDL	Naval Surface Warfare Center, Dahlgren Division at Dahlgren
PEG	polyethylene glycol
PEL	probable effects level
POTMH	Potomac mesohaline
POTOH	Potomac oligohaline
POTTF	Potomac tidal fresh
ppb	part(s) per billion
ppm	part(s) per million
ppt	part(s) per thousand
PRTR	Potomac River Test Range
RDT&E	research, development, test, and evaluation
RDX	Royal Demolition eXplosive (cyclotrimethylenetrinitramine)
RF	radio frequency
rkm	river kilometer(s)

rm	river mile(s)
ROC	Range Operations Center
SAV	submerged aquatic vegetation
SCL	straight carapace length
SF_6	sulfur hexafluoride
SOP	Standard Operating Procedure
sq km	square kilometer(s)
sq NM	square nautical mile(s)
SUA	special-use airspace
SW	saltwater
TEL	threshold effects level
TEP	triethyl phosphate
TNT	2,4,6-trinitrotoluene
UAV	unmanned aerial vehicle
UDZ	Upper Danger Zone
UET	upper effects threshold
US	United States
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USV	Unmanned surface vehicle
UV	ultraviolet
VDEQ	Virginia Department of Environmental Quality
VIMS	Virginia Institute of Marine Science
W	watt(s)
ww	wet weight
yd(s)	yard(s)

THIS PAGE INTENTIONALLY LEFT BLANK

Executive Summary

The Naval Surface Warfare Center, Dahlgren Division at Dahlgren (NSWCDL) proposes to expand its research, development, test, and evaluation (RDT&E) activities within the Potomac River Test Range (PRTR) and Explosives Experimental Area (EEA) Range Complexes, the adjoining Mission Area, and the special-use airspace (SUA) at Naval Support Facility (NSF) Dahlgren, Dahlgren, Virginia. The PRTR, which is 51 nautical miles (NM) (94 kilometers [km]) long and covers 169 square nautical miles (sq NM) (580 square kilometers [sq km]), is divided into areas designated on nautical charts as the Upper, Middle, and Lower Danger Zones (UDZ, MDZ, and LDZ, respectively), as shown on Figure ES-1, Potomac River Test Range (PRTR) Complex. The 2.6-NM-wide (4.8-km-wide), 15.4-NM-long (28.5-km-long) MDZ, covering 38.8 sq NM (133.0 sq km), receives the heaviest use.

Five species recorded in the PRTR are federally listed under the Endangered Species Act (ESA) or have been proposed for listing as threatened or endangered species (Table ES-1): shortnose sturgeon (*Acipenser brevirostrum*), Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*), loggerhead turtle (*Caretta caretta*), Kemp's ridley turtle (*Lepidochelys kempii*), and green turtle (*Chelonia mydas*). This BA evaluates the potential effects of the proposed action on these species.

Table ES-1
Endangered and Threatened Species Potentially Found in the PRTR

Federal Status	Common Name	Scientific Name
Fish		
E	Shortnose sturgeon	*Acipenser brevirostrum*
PE	Atlantic sturgeon	*Acipenser oxyrinchus oxyrinchus*
Sea Turtles		
T/PE	Loggerhead turtle	*Caretta caretta*
E	Kemp's ridley turtle	*Lepidochelys kempii*
T	Green turtle	*Chelonia mydas*
Notes: E = Endangered; T= Threatened; PE= Proposed Endangered. Status refers to the distinct population segment covering the Potomac River, when applicable.		

The determination of effect was completed based on: evaluation of the available scientific data and literature; correspondence with federal and state agencies and independent researchers working on the Potomac River and other rivers; and currently-available information documented in the draft environmental impact statement (DEIS) for NSWCDL's outdoor RDT&E activities (NSWCDL, in preparation).

ES.1 Proposed Action

The purpose of the proposed action is to enable NSWCDL to meet current and future mission-related warfare and force-protection requirements by providing RDT&E of surface ship combat systems, ordnance, lasers and directed energy, force-level warfare, and homeland and force protection. The proposed action is to expand NSWCDL's RDT&E activities within the PRTR and EEA Range complexes, the adjoining Mission Area, and SUA. These activities include outdoor activities that require the use of:

- **Ordnance** – Since its beginnings in 1918 as the US Naval Proving Ground, NSWCDL has been doing proof testing, lot acceptance, safety testing, and RDT&E for large-caliber (larger than 0.8" [20 millimeter (mm)]) guns, small-caliber (smaller than or equal to 0.8" [20mm]) arms, and other types of military munitions. Today it is the Navy's primary center for such work. Large guns are usually fired at targets on the surface of the PRTR; about one-quarter of the projectiles contain explosives. Large-caliber gun firing would remain at current levels, but the frequency of firing into the PRTR's upper LDZ would increase to up to 10 days a year.
- **Electromagnetic (EM) Energy –** EM energy is naturally occurring and man-made energy created by the interaction of fluctuating electrical and magnetic forces that travel through space at the speed of light. The equipment used outdoors at NSWCDL emits EM energy in a frequency range that includes radio waves or radio frequency, microwaves, and infrared, visible, and ultraviolet light. Only emitters that require safety zones when operating (because their power, frequency, and exposure levels are above established standards for hazards of EM energy to personnel, ordnance, fuel, and/or EM interference) are included in the proposed action. The proposed action would increase the number of annual activities and the power level of some activities; expand activities on the PRTR; and increase use of platforms such as unmanned systems to transmit, receive, or reflect EM energy.
- **High-energy (HE) Lasers –** NSWCDL's expertise in laser safety and lasers includes RDT&E of sensors, rangefinders, target designators, guidance systems, simulators, communications equipment, and weapons. The proposed action would increase the number of annual HE laser activities and the power level of some activities; expand activities on the PRTR; and increase use of platforms such as unmanned systems to serve as laser emitters, targets, or reflectors.
- **Chemical and Biological (Chem/Bio) Simulants –** The threat of terrorist attacks has prompted the Department of Defense to step up RDT&E to counter chem/bio terrorism. Chem/bio agents are very difficult to detect, and the key to minimizing the effects of an attack is early detection and warning. As the Navy's center for RDT&E on chemical and biological warfare sensors and protection systems, NSWCDL uses chemical simulants rather than dangerous agents in the open air to test detection and protection systems. Simulants are substances – many of which are found in common, everyday use, such as acetic acid (strong vinegar) and oil of wintergreen – that mimic chemical and biological agents but do not have the agents' adverse health and environmental effects. To imitate the real chemical or biological agents effectively for RDT&E detection purposes, simulants must have at least one physical property similar to that of the agents, such as molecular size, density, or aerosol behavior. The proposed action includes increasing the number of outdoor test events using chemical simulants annually, introducing biological simulants, and expanding the areas where testing could take place. The biological simulants proposed for use would be common bacteria, fungi, proteins, and/or bacteriophages that are naturally found in the environment.

Potomac River Test Range (PRTR) Complex

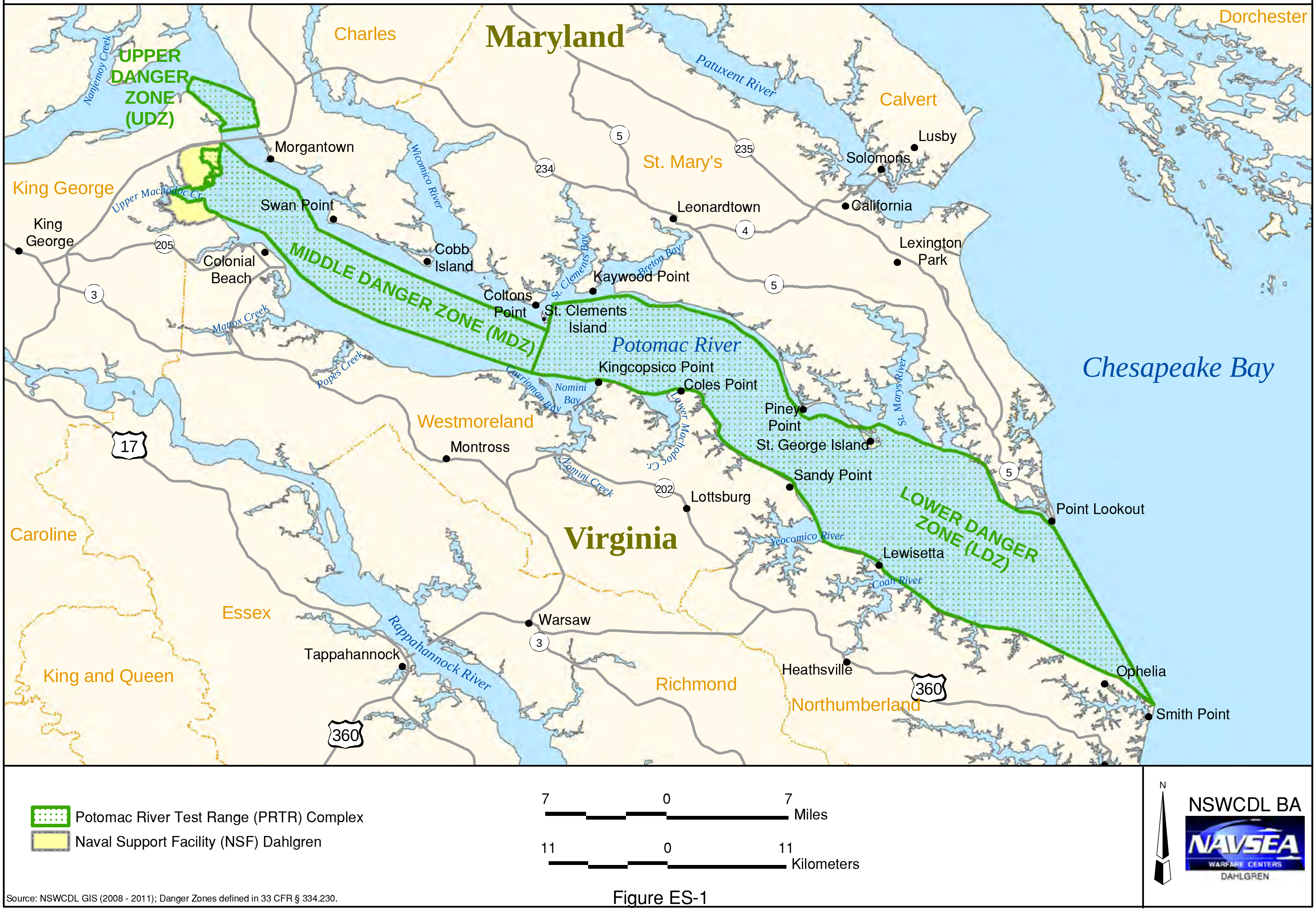


Figure ES-1

THIS PAGE INTENTIONALLY LEFT BLANK

- Under the proposed action, the average number of events that could take place annually would increase above recent levels (with the exception of large-caliber gun firing events). Increased vessel usage of the river would also be associated with the operations.

ES.2 Status and Life History

ES.2.1 Shortnose and Atlantic Sturgeon

The US Fish and Wildlife Service (USFWS) listed the shortnose sturgeon as endangered throughout its range in 1967 under the Endangered Species Preservation Act of 1966. The National Marine Fisheries Service (NMFS) took over jurisdiction of the listed species in 1974, following the enactment of the Endangered Species Act (ESA) of 1973. There are 19 Distinct Population Segments (DPSs) of shortnose sturgeon in 25 river systems. The Chesapeake Bay (CB) DPS includes shortnose sturgeon that occur in the Potomac River in Maryland and Virginia.

NMFS proposed the Atlantic sturgeon for listing under the ESA on October 6, 2010. The Atlantic sturgeon is comprised of five DPSs that qualify as endangered or threatened species under the ESA. The CB DPS, which includes Atlantic sturgeon found in the Potomac River, is proposed for listing as endangered.

The shortnose and the Atlantic sturgeon share many characteristics – both are long-lived, late-maturing, estuarine-dependent, anadromous (ascending rivers from the sea to spawn) species. Atlantic sturgeon grow larger, spend more time in marine environments, and have a more northerly range than the shortnose sturgeon.

Shortnose sturgeon habitat varies depending on life stage, but they spend part of their time in freshwater reaches of tidal rivers throughout all life-history phases. Although classified as anadromous, shortnose sturgeon spend only a limited amount of time at sea and do not venture far offshore. Shortnose sturgeon spawn at or above the head-of-tide (the farthest point upstream affected by tidal fluctuations) in most rivers, which mature adults migrate to in spring. The area immediately downstream from Little Falls on the Potomac River above Washington, DC would likely be the primary potential spawning area on the Potomac River. However, there are no records of shortnose sturgeon spawning in the Potomac River. After hatching, the young-of-year remain in freshwater for about one year before moving downstream to the zone where fresh and salt water interface. This interface is located generally in and upstream of the upper MDZ in the spring and upstream of the UDZ in the fall. Juveniles (three to ten years of age) occur at the fresh-saline water interface in most rivers, where they shift slightly upstream in spring and summer and downstream in fall and winter. Adults are generally found upstream while spawning in the spring and spend the remainder of the year at the fresh and saltwater interface.

Atlantic sturgeon are primarily marine and spend a smaller portion of their time in fresh or brackish water than do shortnose sturgeon. Atlantic sturgeon spawning is thought to take place between the salt front and fall line of large rivers. In the Potomac River, this area is located between Little Falls, just upstream of Washington D.C., and Great Falls 10 miles (16 km) upriver of Little Falls, well above the proposed action area. However, there are no records of Atlantic sturgeon spawning in the Potomac River. Juvenile Atlantic sturgeon primarily stay within freshwater, but move progressively seaward with time. In general, juveniles remain within the riverine system for one to six years before migrating to the coast and out to the continental shelf where they grow to maturity.

Both shortnose and Atlantic are demersal (living on or near the bottom) omnivores that use their flattened snouts to search through bottom sediments and their sensitive barbels (whisker-like tactile organs) to find crustacea, insects, worms, and small mollusks, which they suck into their mouths. Feeding activity of the two species generally does not overlap except for brief periods, probably because the two species occur in different river stretches/salinity zones, at different water depths, and seek different prey.

There is little scientific evidence that an historic shortnose sturgeon population lived in the Potomac River with the exception of one capture recorded in 1876. A limited number of shortnose sturgeon are currently found in the Potomac River. In the years 1996 to 2010, 15 shortnose sturgeon were documented in the river as a result of the USFWS's Sturgeon Reward Program, including captures in the PRTR.

In contrast, the Atlantic sturgeon was a well-documented, important commercial species in the Chesapeake Bay area from colonial times until the population crashed as a result of overfishing at the beginning of the 20th century. From 1996 to 2010, a total of 226 Atlantic sturgeon have been reported in the Potomac River, primarily through the Reward Program.

Sturgeon have been captured most frequently in moderately brackish portion of the river, which includes much of the PRTR. Sturgeon occurrences have been recorded year-round in the river, with the largest number of captures in the spring (March, April).

ES.2.2 Sea Turtles

All three sea turtle species found in the lower Potomac River are listed under the ESA of 1973. The loggerhead sea turtle was listed as threatened throughout its range on July 28, 1978. On March 16, 2010 the NMFS and USFWS proposed listing the North Pacific and Northwest Atlantic DPSs as endangered (USFWS and NMFS 2010, 75 Federal Register 12598). The Kemp's ridley sea turtle was listed as endangered on December 2, 1970. The green sea turtle was listed as threatened on July 28, 1978, except for breeding populations in Florida and the Pacific coast of Mexico, which were listed as endangered.

The general life history of these sea turtles is for females to lay their eggs on coastal beaches where the eggs incubate in sandy nests. Hatchlings emerge together and swim offshore into deeper, ocean water. In the ocean they feed and grow to a larger size before returning to nearshore coastal habitats.

The waters off the Virginia and North Carolina coasts are important developmental habitat for juvenile sea turtles. These turtles exhibit seasonal foraging movements, migrating north along the Atlantic coast in the early spring and south in the fall. The presence of juvenile sea turtles in the Chesapeake Bay area and in Virginia coastal waters peaks during the warmer months from May through October.

Records of sea turtle strandings and incidental captures from 1991 to 2010 were examined to determine their distribution in the Potomac River. Seventy-two percent of recorded incidents (69 of 96) have been incidental captures of sea turtles in fishing nets, with the remaining 28 percent (27 of 96) consisting of strandings. The majority (84 percent) of turtles found in the Potomac River have been loggerheads, with Kemp's ridley comprising most of the remaining turtles (13 percent).

Sea turtles may occasionally be present in the lower Potomac River during warmer months of the year, but have not been recorded farther upstream than Piney Point, Maryland/Sandy Point, Virginia in the lower LDZ. Based upon stranding, incidental captures, tagging, and tracking data, these occurrences are infrequent, and sea turtles are considered to be restricted to the lower, more saline part of the Potomac River.

ES.3 Assessment of Potential Effects

The assessment of impacts focuses on potential direct and indirect effects on the populations of species covered (or proposed to be covered) by the ESA in the proposed action area. Direct effects are considered to be any adverse effects arising from proposed action activities that could result in immediate impacts on individuals or changes to their habitat. These effects include physical injury or death, disruption of migration or reproduction, disruption of egg development, and direct alteration of existing habitat. Indirect effects are defined as any effects that are caused by or could result from the proposed action later in time, but which are still reasonably certain to occur. These effects include water/sediment quality impairment and indirect alteration of habitat.

ES.3.1 Shortnose and Atlantic Sturgeon

The potential direct effects on shortnose and Atlantic sturgeon from implementation of the proposed action include physical injury or death, disruption of migration or reproduction, and direct alteration of habitat. Considering that no increase in the number of projectiles fired annually is proposed, the small number of live projectiles estimated to detonate underwater annually (24), the large area where munitions are fired most of the time (31 sq NM (106 sq km) (a small number are fired into the upper LDZ annually), the intermittent nature of the testing, and the small number of sturgeon in the Potomac River (with even fewer in target areas), the probability of a migrating or resident sturgeon being hit by a projectile or by an associated shockwave are discountable.

RDT&E activities associated with EM energy, HE lasers, and chem/bio simulants would not have the potential for direct effects on shortnose sturgeon as these activities occur primarily at or above the surface of the water and shortnose sturgeon are bottom-dwelling fish. EM energy and laser beams that breach the water surface would be absorbed by, scattered, or reflected off organic and inorganic molecules, rapidly dissipating the energy.

Vessel traffic in the PRTR would be reduced during RDT&E activities because of public access safety restrictions during testing. As a result, the proposed increase in the number of hours that the PRTR may be used for activities would have discountable direct effects on sturgeon.

Potential indirect effects on the shortnose and Atlantic sturgeon from implementation of the proposed action include increases in suspended sediment, decreases in water quality, and habitat disturbance. Indirect effects based on modeled concentrations of munitions constituents in water, sediments, and fish tissue as the result of 90 years of munitions tests would be well below levels associated with adverse effects. Indirect effects on concentrations of suspended sediments, migration, and habitat as a food source are also considered to be insignificant.

No indirect effects from HE lasers or EM energy emissions are anticipated, as any EM energy and laser beams that breach the water surface would be absorbed, scattered, or reflected off of organic and inorganic molecules, rapidly dissipating the energy and minimizing the effect on biological organisms in the water.

Based on water quality sampling following tests in recent years, testing of chem/bio simulants would deposit minimal concentrations of simulants on the water surface. All exposure concentrations would be well below the lowest aquatic toxicity values found. Because of the low concentrations deposited, the low chemical toxicity, the rapid dilution of simulants, and the natural widespread presence in the environment of the organisms used for biological testing, no indirect effects would result from chem/bio simulant RDT&E activities.

The proposed increase in the number of hours that the PRTR may be used for activities would not result in an increase in vessel usage because public vessel traffic through the test area is restricted during testing. Therefore, there would be insignificant, if any, effects on water and sediment quality.

The potential direct and indirect effects on the shortnose and Atlantic sturgeon under the proposed action are considered to be discountable and, therefore, no specific conservation measures are required. If any unexpected developments arise in the future that could adversely affect the shortnose or Atlantic sturgeon, NSWCDL would promptly initiate coordination with NMFS and implement measures to minimize any potential effects.

ES.3.2 Sea Turtles

There would be no direct effects from the proposed action on sea turtles, as RDT&E activities evaluated in this report would be well removed from the lower portion of the LDZ, where sea turtles are known to occur. Projectile testing would occur more than 7 NM (13 km) upriver of where sea turtles may be present. The only potential spatial overlap is the use of range boats, barges, and occasionally larger vessels in the lower LDZ. The probability of any of these vessels coming into contact with a sea turtle is the same as any other vessel near the mouth of the

Potomac River and is anticipated to be insignificant. Therefore, no direct effects on sea turtles are expected from any RDT&E activities included in the proposed action.

Potential indirect effects on sea turtles from implementation of the proposed action include increases in suspended sediment, decreases in water quality, habitat disturbance, and disturbance of sea turtles. As discussed for the sturgeon, indirect effects of munitions constituents in water, sediments, and fish tissue would be well below levels associated with adverse effects and are considered insignificant.

No indirect effects from HE lasers or EM energy emissions are anticipated, as any EM energy and laser beams that breach the water surface would be rapidly absorbed, scattered, or reflected off of organic and inorganic molecules. Concentrations of chem/bio simulants used in RDT&E would well below levels associated with adverse effects.

The change in vessel traffic on the Potomac River would be minimal, resulting in insignificant, if any, effects on water and sediment quality.

NSWCDL will continue to coordinate with NMFS, MDNR, and researchers to stay abreast of information on sea turtles in the Potomac River, in order to determine whether any conservation measures are necessary and should be implemented.

ES.4 Conclusions

The RDT&E activities conducted by NSWCDL on the PRTR under the proposed action are predicted to have discountable effects on shortnose and Atlantic sturgeon. Therefore, the proposed action may affect, but is not likely to adversely affect, the shortnose and Atlantic sturgeon.

There would be minimal spatial overlap between RDT&E activities conducted by NSWCDL on the PRTR under the proposed action and sea turtles using the lower Potomac River, so potential effects are considered insignificant. Therefore, the proposed action will have no effect on sea turtles in the Potomac River.

THIS PAGE INTENTIONALLY LEFT BLANK

1 Introduction

1.1 Background

The Naval Surface Warfare Center, Dahlgren Division at Dahlgren (NSWCDL) proposes to expand research, development, test, and evaluation (RDT&E) activities that take place outdoors on ranges, the Mission Area, and in special-use airspace (SUA) at Naval Support Facility (NSF) Dahlgren, Dahlgren, Virginia. These activities include operations that require the use of ordnance, electromagnetic (EM) energy, lasers, and chemical and biological (chem/bio) simulants that are benign imitations of warfare agents.

The Potomac River Test Range (PRTR) Complex consists of land and water test areas. The PRTR allows the Navy to conduct testing in a realistic, controlled environment – it effectively operates like a "ship on shore," collecting real-time data from a number of instrument stations. The water portion of the range is 51 nautical miles (NM) (94 kilometers [km]) long, covers 169 square nautical miles (sq NM) (580 square kilometers [sq km]), and is divided into areas designated on nautical charts as the Upper, Middle, and Lower Danger Zones (UDZ, MDZ, and LDZ, respectively)[1], as shown on Figure 1-1, Potomac River Test Range (PRTR) Complex. The 2.6-NM-wide (4.8-km-wide), 15.4-NM-long (28.5-km-long) MDZ, which is 38.8 sq NM (133.0 sq km) in area, receives the heaviest use. The land ranges and Mission Area, as well as the portions of the PRTR adjacent to them, are shown on Figure 1-2, Range Complexes and Mission Area. Figure 1-3, Potomac River Test Range (PRTR) Primary Ordnance Target Area, shows the main gunnery target area as well as the maximum extent of the target area at 40,000 yards (yds) (36,576 meters [m]) downriver from the Main Range (see Figure 1-2).

NSWCDL's Range Operations Center (ROC) restricts access to the danger zone(s) and deploys range control boats to clear the range of public watercraft, if required.

1.2 Requirements for a Biological Assessment

Under Section 7 of the Endangered Species Act (ESA) of 1973, NSWCDL is required to consult with the United States Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration's (NOAA's) National Marine Fisheries Service (NMFS) to determine whether any species federally listed as an endangered or threatened species or any species proposed for such listing, or their designated critical habitats, occur in the vicinity of a proposed project. In the event that a federally-listed or proposed endangered or threatened species, or its designated critical habitat, occurs in the vicinity of a "major construction activity[2]," a biological assessment (BA) must be prepared to determine whether the proposed

[1] The limits of the danger zones are defined in 33 Code of Federal Regulations § 334.230– Potomac River, and shown on National Oceanic and Atmospheric Administration (NOAA)'s Nautical Charts: 12286, Piney Point to Lower Cedar Point; 12288 Cedar Point to Mattawoman Creek; and 12233, Chesapeake Bay to Piney Point.

[2] Major construction activities are federal actions that may significantly affect the quality of the human environment as referred to in the National Environmental Policy Act (NEPA) of 1969.

federal action would affect that species. The regulations promulgated pursuant to the ESA require every federal agency to ". . .[e]nsure that any action it authorizes, funds, or carries out, in the United States or upon the high seas, is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat" (50 Code of Federal Regulations § 402.01). Coordination to date with the USFWS and NMFS is included in Appendix A.

Five species recorded in the PRTR are federally listed or are proposed for listing as threatened or endangered species (Table 1-1): shortnose sturgeon (*Acipenser brevirostrum*), Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*), loggerhead turtle (*Caretta caretta*), Kemp's ridley turtle (*Lepidochelys kempii*), and green turtle (*Chelonia mydas*). This BA evaluates the potential effects of the proposed action (as described in Chapter 2) on these species, using information available at the time of submittal. The determination of effect was completed based on an evaluation of available scientific data and literature, and on information collected for the draft environmental impact statement (DEIS) for NSWCDL's outdoor RDT&E activities (NSWCDL, in preparation). The information used in this BA was compiled from the following sources:

- Literature and scientific data, which were reviewed to determine the distribution of these species, their habitat needs and use, and other biological requirements.
- Correspondence with NMFS, USFWS, Maryland Department of Natural Resources (MDNR), and independent researchers working on the Potomac and other rivers.
- The NSWCDL DEIS.

Table 1-1
Endangered and Threatened Species Potentially Found within the PRTR

Federal Status	Common Name	Scientific Name
Fish		
E	Shortnose sturgeon	*Acipenser brevirostrum*
P	Atlantic sturgeon	*Acipenser oxyrinchus oxyrinchus*
Sea Turtles		
T/PE	Loggerhead turtle	*Caretta caretta*
E	Kemp's ridley turtle	*Lepidochelys kempii*
T	Green turtle	*Chelonia mydas*

Notes: E = Endangered; T= Threatened; PE= Proposed Endangered. Status refers to the distinct population segment covering the Potomac River, when applicable.
Sources: NFS, 2011; USFWS, 2011.

The remainder of this BA is organized as follows:

- Chapter 2 describes the proposed action.
- Chapter 3 describes the environment of the proposed action area.
- Chapter 4 discusses the status of the five species.
- Chapter 5 assesses potential direct and indirect effects on these species.
- Chapter 6 presents the conclusions of the BA.

Potomac River Test Range (PRTR) Complex

Potomac River Test Range (PRTR) Complex
Naval Support Facility (NSF) Dahlgren

7 0 7 Miles
11 0 11 Kilometers

N

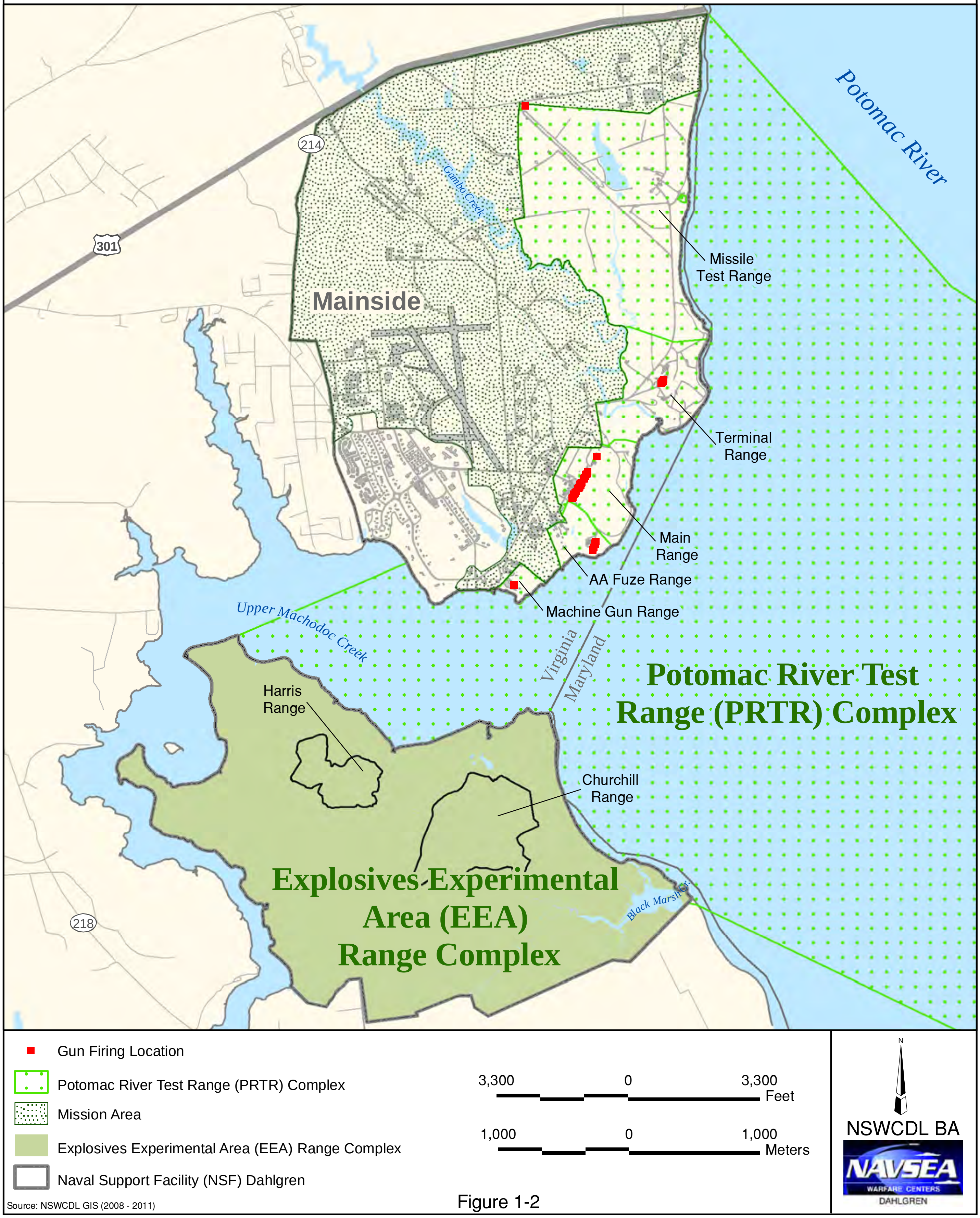
NSWCDL BA
NAVSEA WARFARE CENTERS DAHLGREN

Source: NSWCDL GIS (2008 - 2011); Danger Zones defined in 33 CFR § 334.230.

Figure 1-1

THIS PAGE INTENTIONALLY LEFT BLANK

Range Complexes and Mission Area

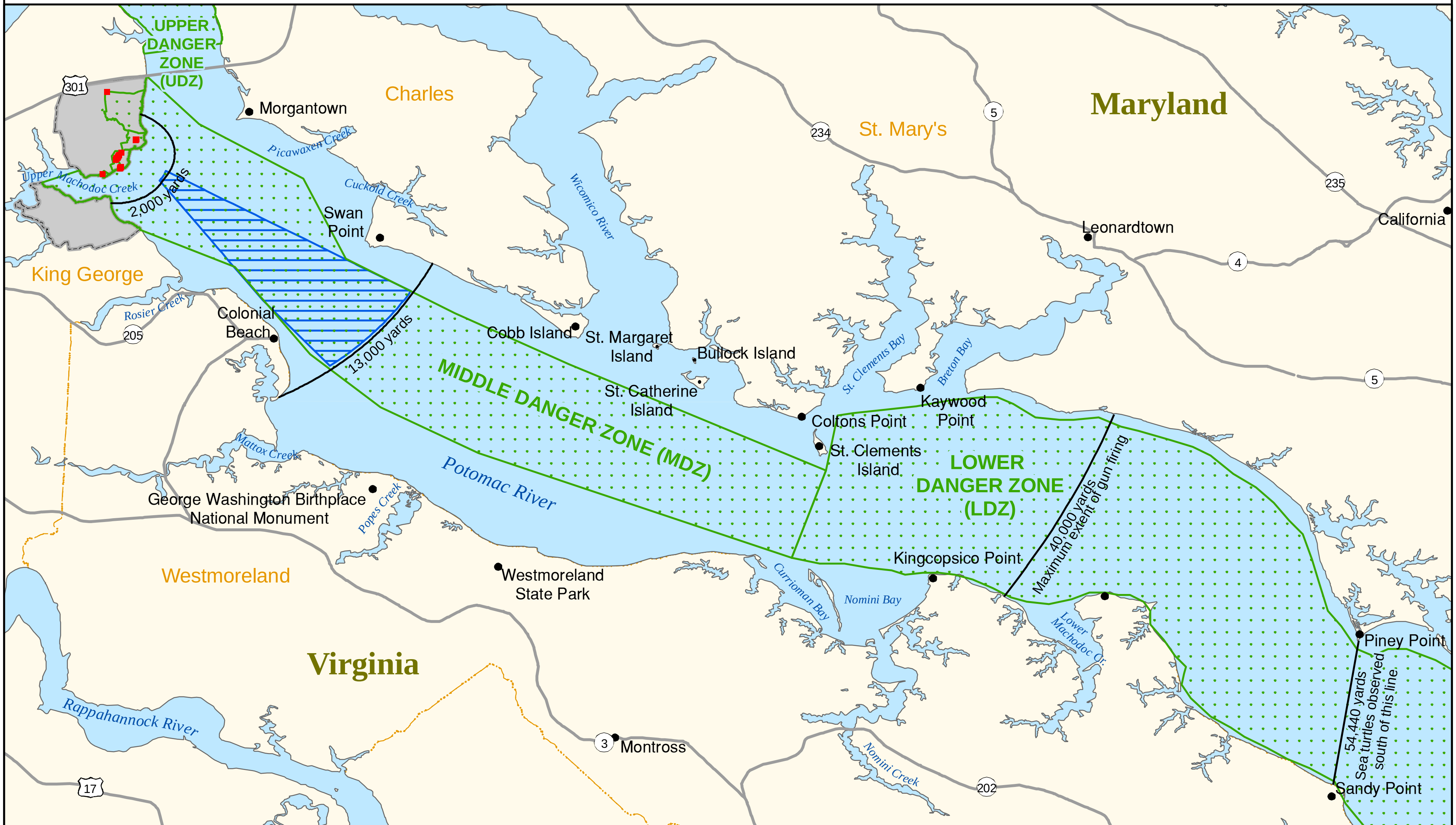


Source: NSWCDL GIS (2008 - 2011)

Figure 1-2

THIS PAGE INTENTIONALLY LEFT BLANK

Potomac River Test Range (PRTR) Primary Ordnance Target Areas



Gun Firing Location

Primary Target Area (Area of greatest gun firing activity)

Potomac River Test Range (PRTR) Complex

Naval Support Facility (NSF) Dahlgren

4 0 4 Miles

6.5 0 6.5 Kilometers

N

NSWCDL BA

NAVSEA WARFARE CENTERS DAHLGREN

Source: NSWCDL GIS (2008 - 2011); Danger Zones defined in 33 CFR § 334.230.

Figure 1-3

THIS PAGE INTENTIONALLY LEFT BLANK

2 Description of Proposed Action

The proposed action is to expand NSWCDL's RDT&E activities within the PRTR and Explosives Experimental Area (EEA) Range Complexes, the adjoining Mission Area, and the SUA at NSF Dahlgren. (See Figures 1-1 and 1-2 for locations of range complexes and Mission Area.) In this BA only operations that could potentially affect the Potomac River and hence the two species of sturgeon and three species of turtles are discussed. These include outdoor operations that require the use of:

- Ordnance
- EM energy
- Lasers
- Chem/bio simulants

NSWCDL's increased vessel usage on the river associated with the outdoor operations is also discussed in this BA.

Under the proposed action, the average number of operations and hence the average number of firings, detonations, and EM energy, laser, and chem/bio simulant events – including those on the Potomac River – that could take place annually would increase above recent levels, with the exception of large-caliber (larger than 0.8" [20 mm]) gun firing, which would remain at current levels. To ensure that equipment and materials work effectively, even in less-than-ideal conditions, some operations would take place under conditions in which operations are not now conducted such as at dusk, dawn, and night, and in adverse weather.

Operations, Tests, and Events

An **operation** is a group of **tests** that has a common objective and that may take place over one or more days under one **standard operating procedure (SOP)**.

For purposes of this BA, an **event** consists of **all the tests that take place under one SOP on one day**. If two groups of tests are conducted on the same day under separate SOPs, then each group counts as a separate event.

If an operation continues for a number of days, the tests conducted on each additional day under the same SOP are considered as separate events. As an example, if an operation continues for 10 days with tests taking place on each day under the same SOP, then this operation would include 10 events, for purposes of this BA.

The purpose of the proposed action is to enable NSWCDL to meet current and future mission-related warfare and force-protection requirements by providing RDT&E of surface ship combat systems, ordnance, lasers and directed energy, force-level warfare, and homeland and force protection. The need for the proposed action is to enable the Navy and other stakeholders to successfully meet current and future national and global defense challenges by developing a robust capability to carry out assigned RDT&E activities on range complexes, in the Mission Area, and in SUA at NSF Dahlgren.

The focus of this BA is to determine the:

1. Presence or absence of the shortnose sturgeon, Atlantic sturgeon, loggerhead turtle, Kemp's ridley turtle, and green turtle in the proposed action area.

As well as potential impacts from:

2. Ordnance fired into the Potomac River, inclusive of constituents associated with ordnance fired into the river.
3. The use of higher-power EM energy.
4. The use of high-energy (HE) lasers.
5. The use of chem/bio simulants.
6. Increases in NSWCDL's vessel traffic.

Three alternatives are being considered in the DEIS – No Action (continuing historical and current mission activities), Alternative 1 (an increase in operations addressing known future requirements), and Alternative 2 (addressing known future requirements plus increased operations to maximize NSWCDL's operational capability). DEIS Alternative 2 is NSWCDL's Preferred Alternative and is the focus of the analysis in the BA because, of the three alternatives, it has the greatest potential for generating environmental impacts.

2.1 Ordnance

NSWCDL fires projectiles up to 40,000 yds (36,576 m) downriver from the Main Range (Figures 1-2 and 1-3). Figure 1-2 shows the location of the large gun emplacements or firing points on the PRTR's land ranges. Most large-caliber gunfire is directed at target areas in the MDZ, but target areas in the upper part of the LDZ may be used on occasion. Figure 1-3 shows the part of the MDZ that is the primary target area for most of the projectiles fired in the last two decades. The main target area for the 57 millimeter (mm) and 76 mm guns is between 5,000 and 9,000 yds (4,572 to 8,230 m) downriver from the Main Range. The main target area for the 5" (127 mm) guns is between 9,000 and 13,000 yds (8,320 to 11,887 m) downriver from the Main Range. An occasional long-range projectile may be fired between 30,000 and 40,000 yds (27,432 to 36,576 m). The main target area for small-caliber (smaller than or equal to 0.8" [20mm]) guns and fuze testing is between 2,000 and 6,000 yds (1,829 to 5,486 m) from the land ranges. NSWCDL does not fire projectiles into the UDZ or the middle-to-lower part of the LDZ.

Projectiles fired by NSWCDL can be live (explosive) or inert (non-explosive). Live projectiles are composed of energetic material (the explosive core or the propellant for a projectile), plus an outer casing, fragmentation material, a fuze (a detonating device), sensors, timers, and/or other items. Inert projectiles have a core composed of sand or concrete with no energetic material – no explosive core – but could have a fuze with a small amount of explosive material (typically less than 0.004 pounds [lbs] or 2 grams), a sensor, and/or other items for testing.

Over the years 1995 to 2009, on average, 74 percent of the projectiles fired into the Potomac River have been inert (NSWCDL, in preparation). The component most often being tested on inert projectiles is the fuze or detonator. A fuze typically contains a few ounces of non-explosive talcum-like powder to produce a puff of smoke to indicate to observers that the fuze has been successfully triggered. The other 26 percent of the projectiles have been live, explosive projectiles. The largest explosive projectiles fired from US Navy ships today are 5” (127 mm) projectiles, which contain approximately 6 to 10 lbs (2.7 to 4.5 kilograms [kg]) net explosive weight (NEW) of explosives. NSWCDL occasionally fires a 155 mm (6.1”) howitzer, used by the Marine Corps and US Army. Very rarely, NSWCDL fires an 8” (203 mm) gun loaded with a canister filled with electronics equipment to test the capability of the equipment to withstand high G-forces (the force acting on a body as a result of acceleration or gravity), but explosive projectiles are not used (the canisters are recovered). Both the fuzes and the live projectiles are programmed to detonate above the water. Those that enter the water generally do not detonate, although a few might have a slight delay and detonate shortly after entering the water. It is conservatively estimated that two percent of live projectiles tested detonate underwater, generally within the upper 6 feet (ft) (1.8 m) of the water column.

Based on available records, a total of 343,815 known large-caliber gun projectiles were fired into the PRTR from 1918 through 2008. Most of the projectiles (99.7 percent) were fired into the MDZ, with a small number of projectiles (0.3 percent) fired into the LDZ, as shown in Table 2-1. The UDZ was used as a bombing target from the 1920s to the 1940s, but there are no records of projectiles ever being fired into the UDZ.

Table 2-1
Usage of the Danger Zones in the PRTR 1918-2008

Danger Zone	Surface Area (sq NM)	Number of Large-caliber Projectiles	Density (Projectiles per sq NM)
UDZ	3.8	NA	NA
MDZ	38.8	342,756	8,834
LDZ	126.6	1,059	8.4
PRTR Total	169.1	343,815	2,033

Notes: NA – not available, as there are no records of projectiles fired into the UDZ.
The surface area total differs from the sum of the individual danger zone totals due to rounding.

The number of large-caliber projectiles fired varies considerably from year to year depending on the volume of proof testing and whether and how many new types of ordnance are being tested in a given year. NSWCDL fired an average of 2,900 projectiles annually in the years from 1995 to 2009, ranging from a low of 910 fired in the year with the smallest number of firings (2005) to a high of 6,170 (all inert) in 2004. In particularly active years since 1995, the average has been approximately 4,700 large-caliber projectiles fired annually. Some projectiles are fired at targets within the land ranges rather than into the river. The projectiles fired into the PRTR are aimed at gunnery targets – mainly virtual targets (effectively, fixed points on the river surface) and floating targets within the MDZ and rarely in the upper part of the LDZ on the Potomac River. As NSWCDL expects the number of large-caliber gun projectiles fired in the foreseeable future to remain at recent levels, under the Preferred Alternative, the number of projectiles fired in most years in the future would be less than 4,700 projectiles, but 4,700 would remain the average number fired annually in particularly active years.

The Preferred Alternative includes an increase in small-arms firing, from No Action levels of 6,000 bullets per year to 30,000 bullets per year. Approximately 90 percent of the increased number of small-arms firings would be on land, with the remaining 10 percent potentially entering the water, mainly within 1,000 yds (914 m) of the shoreline. Bullets hitting the water at an angle of less than five to seven degrees bounce along the water because of the surface tension of the water, like a skipped stone (New Scientist, 2006), losing momentum and entering the water with less velocity than when hitting the water at angles greater than seven degrees. Small-caliber bullets may also shatter upon impact with the water. Bullets entering the Potomac River are very unlikely to hit a shortnose or Atlantic sturgeon – given the extent of the MDZ (38.8 sq NM), the size of the bullets (20 mm or less), the fact that sturgeon are demersal (living on or near the bottom) dwelling fish and unlikely to be near the surface of the water, and the limited number of sturgeon present in the Potomac River (see Section 4.1), the probability of a hit is discountable. The range of the sea turtles in the Potomac River does not extend upriver above the lower LDZ (refer to Figure 1-3) and hence there is no spatial overlap of small-caliber bullets and sea turtles (see Section 4.2). Therefore, small arms are not considered further in this BA.

By design, gunfire may destroy or damage some physical targets, such as floating radar reflectors, fixed platforms in the river, unmanned aerial vehicles (UAVs), vessels, towed sleds, and causeway sections. The environmental impacts of fragmenting these targets are minimized by removing hazardous materials such as batteries, oil, gasoline, and antifreeze to the extent possible prior to destroying or damaging them. After a physical target is impacted and the test completed, all remaining debris and any waste remaining on the surface of the river is cleaned up. Tracking and calibration targets, which are not fired upon but rather used for taking bearings, may include UAVs, manned aircraft, aerostats (tethered balloons or blimps), range patrol boats, diving tenders and other vessels, pilings in the river, land vehicles, and points of land.

2.2 Electromagnetic Energy

The equipment used outdoors by NSWCDL emits EM energy in a frequency range that includes radio waves or radio frequency (RF), microwaves, infrared (IR) light, visible light, and ultraviolet (UV) light[3]. Many types of EM energy emitters are present at NSWCDL, ranging from everyday low-power radios, cell phones, and car door openers to higher-power, sophisticated one-of-a-kind test equipment. EM energy devices evaluated in this BA operate at frequencies ranging from 300 kilohertz (kHz) (300,000 cycles per second) to 300 gigahertz (GHz) (3 billion cycles per second) and at average powers ranging from 10 watts (W) to more than 500 megawatts. (While lasers are a type of directed EM energy, they are treated separately because of their distinctive mode of operation).

[3] The relationship between frequency and wavelength is such that as frequency increases the wavelength decreases, and as frequency decreases the wavelength increases. The equation that relates wavelength and frequency for electromagnetic waves is: $\lambda\nu=c$ where λ is the wavelength, ν is the frequency, and c is the speed of light.

The Navy is developing applications of directed, or focused, energy not only for future shipboard weapons, but also for counter-terrorism and force protection. Through RDT&E, NSWCDL can better understand EM energy sources, propagation, and effects, and thereby develop ways to counter them.

In recent years, NSWCDL has been moving work on directed energy from indoor laboratory science to outdoor development, test, and evaluation. The PRTR provides a unique test capability not found elsewhere within the Department of Defense (DoD): an instrumented maritime range with a directed energy propagation source close to the water, allowing study of the effects of maritime conditions on directed energy tests. Directed-energy propagation-path outcomes are not well understood because laboratory conditions cannot capture the shifting humidity and wind conditions outdoors. Higher-power radars are tested at the Search and Track Sensor Test Site on Main Range and would continue to operate over the PRTR, but would not be directed below the surface of the water.

NSWCDL currently directs EM energy at targets on the PRTR and from special facilities on one land range to another across the entrance to Upper Machodoc Creek. Targets used to test EM sensors can include many of the gunnery targets described previously. Operation of EM sensors and directed-energy equipment mainly takes place in the MDZ and would continue to do so into the future. Some operations could also take place in the UDZ and LDZ, such as those testing whether sensors could detect vessels or aircraft. In the future, EM directed energy may be emitted from sources on land or vessels, bounced off UAVs, and directed at targets over the horizon on barges in the UDZ, MDZ, or LDZ, but not into the water.

Waves of EM energy do not move easily through water, in contrast to sound which travels in water's dense environment much farther and more effectively than in the air. The only RDT&E NSWCDL conducts in the waters of the PRTR uses modified sonobuoys to receive, but not send, sound. The sonobuoys are small, passive floating devices from which tiny attached microphones drop down to a fixed depth of water to detect submarines. Any sounds that are picked up by the microphones are amplified by the sonobuoy and are converted into EM waves in the air and transmitted to a receiver where the sounds can be analyzed.

Under the Preferred Alternative, the number of annual EM energy events would increase from the current 490 to 680. The majority of these events currently take place on the land ranges, and this would continue to be true in the future. Directed-energy power levels would increase to allow for high-power directed-energy microwave and higher-power RF emissions[4].

2.3 Lasers

Lasers are categorized into four classes according to the power of the light they emit, expressed in watts (Table 2-2). NSWCDL currently operates all four classes of lasers outdoors, up to 100 kilowatts (kW) (100,000 W) of power. Because Class 1 and 2 lasers are not considered

[4] High-power directed-energy microwave weapons technology can be used to protect systems against potential RF weapons threats.

hazardous to the environment, RDT&E operations for lasers at these power levels are not included in the proposed action. Environmental considerations for Class 1 and 2 lasers are addressed by existing standard operating procedures (SOPs). Lasers using power levels from less than 5 milliwatts (mW) (0.005 watts) (Class 3) to 500 kW (Class 4) are considered high-energy (HE) lasers and are included in the proposed action because of their potential hazards to eyes and skin. HE laser power levels would be limited to 500 kW under the Preferred Alternative.

Table 2-2
Laser Power

Laser Class	Description	Energy Emitted	Safety Issues	Examples
Class 1*	Low-powered devices considered safe from all potential hazards.	NA	No injury, regardless of exposure time, to eyes or skin. No safety measures necessary.	Laser printers, toys, CD players, CD ROM devices, laboratory analytical equipment.
Class 2*	Low-power, visible-light lasers that could possibly cause damage to a person's eyes.	< 1 mW	Usually safe. Eye protection normally afforded by the aversion response (turning away from a bright light source or closing or blinking eyes). If directly viewed for long periods of time with no blinking or with binoculars, damage to eyes could result.	Pointers used in presentations, toys, range- finding equipment, aiming devices.
Class 3**	Medium Power	1 - 500 mW	May be hazardous to eyes under direct and specular reflection (almost perfect reflection, such as from a mirror) viewing conditions.	Laser scanners, military hand-held laser rangefinders, entertainment light shows, target illuminators.
Class 4	High power	> 500 mW	Direct beam or specular reflection is hazardous to eyes and skin. May pose a diffuse reflection (reflection off a rough surface) hazard or fire hazard.	Medical surgery, research, drilling, cutting, welding, aircraft target designator used for guided weapons, military laser weapons.

Source: ANSI, 2007.
*Class 1M and 2M categories also exist, which have the same parameters, except that direct viewing with an optical instrument such as a telescope could be potentially hazardous.
**Two subcategories exist under Class 3: Class 3R lasers are potentially hazardous if the eye is appropriately focused and stable, but the probability of injury is low. Class 3B may be hazardous under direct and specular reflection viewing conditions.

Current over-water Class 3 and 4 laser operations are conducted along three corridors that cross over the waters of Upper Machodoc Creek and the Potomac River. Laser beams are coherent, narrow, and focused; they retain their energy over long distances. Safe use of lasers includes controlling the beam, conducting a test at low power prior to using high power, ensuring that humans and wildlife stay out of the path of the laser when it is fired, and using a backstop to absorb the beam. Currently, lasers tested outdoors by NSWCDL are fired slightly downwards into a target within a backstop lined with absorbent material.

Outdoor testing of laser beams over water is necessary because in humid conditions (such as above the surface of the river) they become slightly less focused, and the width of the beam expands. Therefore, testing of lasers only in dry conditions (such as desert test sites) or on land is not sufficient to fully understand how they will react when employed in the marine conditions in which the Navy operates.

Under the Preferred Alternative, HE laser operations would increase to 145 events per year from the current 60 events per year. Laser RDT&E activities in the foreseeable future would continue along the path of the work already being conducted. Operating power levels, currently using a maximum of 100 kW, would increase up to 500 kW for some tests. The size of targets/backstops would be increased and more material would be added to targets to absorb the increased energy. Lasers would also emit energy at targets in the sky, such as UAVs. In addition to the existing operations described above, lasers may also be: directed from a source on the LDZ and bounced via UAV to a target on a barge in the MDZ or to land ranges; and, lasers may be directed from a source on the land ranges or on a barge in the MDZ via UAV to a target on a barge in the UDZ or the LDZ. Lasers would be directed to targets at or above the surface of the water, not into the water.

2.4 Chemical and Biological Simulants

Based on the current state of the technology, the likely progression of chem/bio defense RDT&E over the next 10 to 15 years by NSWCDL would be as follows:

1. More operational events on the PRTR similar to ones conducted in 2003, 2005, and 2009 using comparable chemical simulants but representing a wider range of chemical agents, to test updated or new point and stand-off detector systems.
2. Biological point or stand-off sensor tests on the MDZ using biological simulants to challenge detectors.
3. Chem/bio point or stand-off sensor tests on the MDZ using a mixture of chem/bio simulants to challenge detectors.
4. Tests of the effectiveness of point and stand-off sensor/detector systems to sense chem/bio simulants in an environment with various interferents, smokes, and obscurants on the MDZ.
5. Decontamination operations on equipment on the MDZ using chem/bio simulants representing known or expected threats.
6. Outdoor collective protection system operations on the MDZ using chem/bio simulants representing known or expected threats.

The number of chem/bio simulant events may significantly increase from the current baseline level of 12 events (chemical simulants only) to up to 70 events annually (chemical and biological simulants).

2.4.1 Chemical Detector Tests

A typical operational scenario for outdoor testing of a chemical-detector system using chemical simulants would be similar to the Joint Service Lightweight Stand-off Chemical Agent Detector testing that NSWCDL conducted in 2003, 2005, and 2009 (NSWCDL, 2004; NSWCDL, 2005; NSWCDL, 2009). Chemical simulants would be dispersed into the air as a vapor on the Potomac River to test various kinds of chemical agent- detection equipment.

Chemical simulants are chosen for their low toxicity, low environmental impacts, and ability to closely simulate, or mimic, the actual agent the sensor is designed to detect. The toxicity of a chemical is defined by the extent of its adverse effects on a biological organism. The chemical simulants used in NSWCDL's past indoor or outdoor RDT&E operations include the following:

- Polyethylene glycol (PEG)
- Methyl salicylate (MeS)
- Sulfur hexafluoride (SF_6)
- Triethyl phosphate (TEP)
- Glacial acetic acid (GAA)
- Dipropylene glycol methyl ether (DPGME)
- Dimethyl methylphosphonate (DMMP)
- Diethyl malonate (DEM)
- Diethyl phthalate (DEP)
- Dimethyl adipate (DMA)
- Diethyl ethyl phosphonate (DEEP)

PEG and MeS were used in NSWCDL outdoor chemical simulant tests in the 1980s. SF_6 was used as a simulant in outdoor tests in 1996 and to calibrate the Joint Service Lightweight Stand-off Chemical Agent Detector equipment for the 2003 and 2005 tests. TEP and GAA were used as chemical simulants for the tests on the PRTR in 2003 and 2005. The 2009 test activities involved release of the liquids MeS, TEP, GAA, and the gases R-134 and R-152a. DPGME, DMMP, DEM, DEP, DMA, and DEEP have not been used as simulants outdoors by NSWCDL but have been used in laboratory settings.

Future operations might use any of these simulants or other ones with similar or lesser toxicities. Prior to use, all simulants would be approved by the NSWCDL Safety and Environmental Office in consultation with NSF Dahlgren personnel as applicable. Simulants would only be approved for use after considering toxicity data relative to the intended quantity and concentration of the simulant to be used. If such a test were done on the PRTR, the Maryland Department of the Environment (MDE), which has jurisdiction over most of the waters of the PRTR, and the Virginia Department of Environmental Quality (VDEQ), which has jurisdiction over a small portion of the waters of the PRTR near the installation, would be consulted prior to testing (by the Host Command via the Naval Facilities Engineering Command Environmental Division). All operations would be conducted in accordance with local, state, and federal regulations.

Other materials and chemicals that have been used during chemical-detector operations include thickening agents, flavorings, and UV dye indicators, as noted below. These materials are used to aid in dispersal and identification, and future testing could use similar accessory chemicals:

- Polymethyl methacrylate, Acryloid K-125 (thickening agent; trademark Rohm and Haas)
- Isoamyl acetate (banana oil)
- Tinopal CBS-X (trademark Ciba-Geigy), which has a UV dye (used as a shirt whitener in laundry detergents)

Operational tests would be conducted over one or more weeks on days with suitable weather. One or two tests could be conducted a day. Operations over water would be conducted on the MDZ. Over-water operations would involve release from a vessel of a vapor of chemical simulant in a variety of weather conditions.

Sensors mounted on and operated from vessels and/or on shore would be aimed upriver or downriver to detect the simulant vapor against a sky/water background. The release for each operational test would take about 2 minutes, and the resulting vapor would dissipate in less than 10 minutes.

Repetitive operational tests would be conducted with each simulant or group of simulants. A typical test would involve the release of approximately 10 gallons (gals) (38 liters [l]) of simulant, but the amount could vary from a few ounces up to 20 gals (76 l). The amount of simulant used would be the minimum amount needed to test the lowest level of simulant the sensor can detect (its threshold capacity). Thus, the concentrations produced within each vapor cloud would be extremely low.

2.4.2 Biological Detector Tests

Outdoor testing of biological agent detectors under the Preferred Alternative would be similar to chemical-detector operations using chemical simulants. Biological simulants are microorganisms that exhibit a quality similar to that of an actual biological threat agent. NSWCDL would use only Biosafety Level 1 (BSL-1) simulants. BSL-1 is suitable for work involving well-characterized agents not known to consistently cause disease in healthy adult humans, and of minimal potential hazard to laboratory personnel and the environment.

Future operations would use the simulants listed below or similar BSL-1 organisms. All simulants would be approved through the NSWCDL Safety and Environmental Office in consultation with NSF Dahlgren personnel as applicable. Simulants would be approved only after considering BSL data relative to the intended use of the simulant and purpose of the test. All operations would be conducted in accordance with local, state, and federal regulations.

Operational tests of biological detectors would use the following BSL-1 bio-simulants or BSL-1 organisms similar to them:

- *Bacillus atrophaeus* (formerly referred to as *Bacillus globigii*) (spore-forming bacteria)
- *Bacillus subtilis* (spore-forming bacteria)
- *Bacillus thuringiensis* (spore-forming bacteria)
- *Pantoea agglomerans* (non-spore-forming bacteria)
- *Deinococcus radiodurans*(non-spore-forming bacteria)
- *Aspergillus niger* (fungus)
- Ovalbumin (protein)
- MS2 bacteriophage

The amount of simulant used would be the amount necessary to complete the test objectives – usually the lowest simulant level the sensor can detect. Operations would likely be conducted over a two-week period, with up to two tests per day, for a maximum of up to 20 releases in a two-week test period.

2.5 Use of Vessels for Operations

Outdoor RDT&E activities may employ vessels and/or unmanned systems (e.g., radio-controlled systems on water) to:

- Serve as tracking objects to test sensors
- Tow targets or tracking objects
- Observe tests and measure outcomes
- Test active and passive sensors, such as radar
- Carry new sensor systems for evaluation
- Disperse chem/bio simulants
- Serve as weapons platforms
- Function as links in tests of integrated systems
- Serve as targets

NSWCDL maintains a group of small watercraft in Upper Machodoc Creek, including “go-fast” boats, inflatable Zodiac-type craft, landing craft, and barges. Sometimes larger Navy or Coast Guard vessels come up the river to participate in operations, but they are not based at NSF

Dahlgren. With more firings and events on the PRTR in support of RDT&E activities, range use would increase from 750 hours a year to 1,000 hours a year.

2.6 Summary of the Preferred Alternative

Table 2-3 summarizes the proposed annual outdoor RDT&E activity levels that may affect the Potomac River under the Preferred Alternative (DEIS Alternative 2). The Preferred Alternative provides for an increase in the average number of firings, detonations, and events that could take place annually, with projected increases addressing known future requirements plus increased operations to maximize NSWCDL's operational capability. Under the Preferred Alternative:

- Use of large guns would remain at current levels.
- Long-range guns would fire into a target area from 32,000 to 35,000 yds in the upper LDZ approximately 10 days a year, which is more frequently than over the last 15 years.
- Smalls arms use outdoors would increase threefold from 6,000 to 25,500 bullets fired annually.
- EM energy operations would increase from 490 events to 680 events annually, some of which would take place over the river.
- Directed EM energy emitters may be mobile.
- EM energy may be directed at UAVs and unmanned vessels on the MDZ. Unmanned vessels may be disabled or destroyed; UAVs would only be tracked.
- EM energy emitted from a land range or a vessel on the PRTR may be reflected off a UAV or similar airborne platform over the horizon to a target on the land ranges or a platform (such as a barge) located in the UDZ, MDZ, or LDZ.
- Laser power levels would increase from the current 100 kW upper limit up to 500 kW. The number of annual events would increase from 60 to 145.
- HE lasers would be directed from land ranges to floating targets on the MDZ.
- HE lasers could target UAVs by tracking and disabling/destroying mobile targets such as unmanned vessels on the water and mortar shells in the air.
- HE laser beams emitted from a land range or a vessel on the PRTR may be reflected off a UAV or similar airborne platform located over the horizon to a target on land ranges or on various types of platforms (such as a barge) in the UDZ, MDZ, or LDZ.
- If lighter-weight power sources are developed, lasers may be fired from UAVs at targets on the MDZ water surface.
- Biological simulants would be used as well as chemical simulants for chem/bio defense RDT&E. Chem/bio defense operations would increase from 12 events to 70 events annually.

- A wider range of chemical simulants would be used for outdoor chemical defense operations. Chemical and biological simulants would be used together.
- Some activities would take place beyond the normal 8 am to 4 pm, Monday-to-Friday PRTR range schedule because of the increasing need to test systems in all kinds of weather conditions and at dawn, dusk, and at night.
- Public access to the PRTR UDZ and LDZ would be restricted approximately two days a year each to allow for weapon systems integration operations using vessels and aircraft.
- The increase in activities and the requirement to test beyond normal range operations hours would increase in the number of hours that access to some part of the PRTR would be restricted, from 750 hours annually to 1,000 hours.

Table 2-3
Average Annual RDT&E Activity Levels

RDT&E Activity	No Action Alternative Activity Magnitude	No Action Alternative Average Annual Activity Levels	Alternative 1 Average Annual Activity Levels	Alternative 2 Average Annual Activity Levels
Guns/ Projectiles	>20 mm to 8" caliber gun/ projectile	**4,700 projectiles**	**4,700 projectiles**	**4,700 projectiles**
Small-Arms	≤20 mm caliber gun/bullet	**6,000 bullets**	**25,500 bullets**	**30,000 bullets**
EM Energy	300 kHz to 300 GHz frequency 10 W to 500 MW average power	**490 events**	**590 events**	**680 events**
Lasers	500 nm to 11 µm wavelength 1 mW to 100 kW maximum power	**60 events** 100 kW maximum power	**125 events** 500 kW maximum power	**145 events** 500 kW maximum power
Chemical & Biological Defense	≤20 gals of simulant	**12 events** Chemical simulants only	**60 events** Chemical and biological simulants used separately	**70 events** Chemical and biological simulants used separately and together
PRTR Use	750 hours annually	**750 hours**	**870 hours**	**1,000 hours**

3 Existing Environment

3.1 Water Body Description

The PRTR portion of the Potomac River is an estuary – i.e., a partially enclosed body of water that has a free connection to the open sea and where salt water from the sea mixes with freshwater from rivers, streams, and creeks (NOAA, 2011a). The PRTR portion of the Potomac River exhibits features that are characteristic of a partially mixed estuary – strong tidal currents, moderate vertical stratification, and considerable longitudinal variation in salinity (Wilson, 1977). Moderate vertical stratification is characterized by the occurrence of two basic water layers – a less saline upper water zone provided by the river and a deeper marine water zone – separated by a zone of mixing (Thurman, 1994).

The tidal Potomac River can be divided into three segments by salinity regimes, as shown in Figure 3-1, Potomac River Salinity Levels (1985-2006): tidal fresh, oligohaline, and mesohaline (Landwehr et al., 1999). Landwehr et al. (1999) delimit and characterize the segments as follows:

- Tidal fresh – includes the area of the tidal river above Quantico, Virginia. The water is fresh, with salinity of less than 0.5 parts per thousand (ppt), except in extremely dry years, and the net flow is seaward at all depths.
- Oligohaline – covers the transition zone between Quantico, Virginia, and the Governor Harry W. Nice Memorial Bridge, commonly known as the Nice Bridge. The salinity is generally low, ranging from 0.5 to 5 ppt, except during drought. Extensive saltwater-freshwater mixing occurs in this segment.
- Mesohaline – extends from the Nice Bridge to the mouth of the river. This segment has moderately brackish water, with salinities typically ranging from 5 to 18 ppt.

Oligohaline and mesohaline waters, along with the polyhaline waters (18 to 30 ppt) found in the lower part of the Chesapeake Bay below the mouth of the Potomac River, all fall under the terms "brackish" or "mixohaline," with a salinity range from 0.5 to 30 ppt. Ocean water, by comparison, has an average salinity level of 35 ppt.

The Potomac River Estuary circulation is affected by local wind forcing and also by sea level in the Chesapeake Bay proper. Within the PRTR, the mean salinity of the Potomac ranges from approximately 4 to 8 ppt in the vicinity of NSF Dahlgren to approximately 11 to 16 ppt around the downstream end of the LDZ (based on MDNR, 2010).

Tidal height data obtained from temporary tide gauges established between NSF Dahlgren and Lewisetta, Virginia, encompassing both the MDZ and the LDZ, indicate that the PRTR portion of the Potomac River has a semidiurnal tide period of 12.4 hours (Wilson, 1977). According to Wilson (1977), the tidal range decreases from about 2.17 ft (0.66 m) at NSF Dahlgren to about 1.57 ft (0.48 m) at Lewisetta, and the high tide at NSF Dahlgren occurs approximately 1.8 hours after that at Lewisetta. A permanent tide gauge (NOAA Station 8635750) was installed in July 1990 in Lewisetta (Figure 3-2, Water Quality Monitoring Stations). The mean tidal range at the

Lewisetta station is 1.24 ft (0.38 m) and the diurnal range is 1.50 ft (0.46 m) (NOAA, 2011b). Current phases at NSF Dahlgren lag those near Lewisetta by 1.5 to 2 hours (Wilson, 1977).

Because of the constriction in the Potomac River channel cross-section above NSF Dahlgren at the Nice Bridge Station (near the upper end of the MDZ), current velocities there are higher than downstream (Wilson, 1977). In the vicinity of the MDZ, the river makes a bend to the south and widens considerably. As this occurs, the velocity magnitude decreases drastically, causing this location within the river to have a high potential for the rapid deposition of sediment.

Sediments are classified based on their grain size and/or composition. Grain sizes range from boulders (> 10.1” [>256 mm] to mud (< 0.0025” [< 62.5 micrometers (μm)]), while composition is dependent on parent rock lithology (visible physical characteristics), mineral composition, and chemical make-up. Sediments in rivers settle out when the forces responsible for sediment transportation, such as velocity, are no longer sufficient to overcome the forces of particle weight and friction. Larger particles settle out before smaller particles so that coarser-grained sediments, such as sands (grain size between 0.0025 to 0.079” [62.5 μm to 2 mm]) typically accumulate in higher-energy environments, while finer-grained sediments, such as muds consisting of silts (grain size between 0.00015 to 0.0025” [3.9 to 62.5 μm]) and clays (grain size < 0.00015” [<3.9 μm]), generally occur in low-energy environments. Figure 3-3 (Sediments in the Potomac River Test Range [PRTR]) illustrates the deposition of finer-grained muds near NSF Dahlgren.

The MDE established standards for several stream water quality parameters based on their use classification (Code of Maryland Regulations 26.08.02.03-3 - *Water Quality*). The Potomac River is classified as Use II (supports estuarine and marine aquatic life and shellfish harvesting), and all tributaries to the Potomac River in Maryland are classified as Use I (water contact recreation and protection of aquatic life).

The acceptable water-temperature and pH values are the same for Use I and Use II streams – 90 degrees Fahrenheit (°F) (32 degrees Celsius [°C]) maximum ambient temperature and 6.5 to 8.5 pH, respectively. The dissolved oxygen criteria for this section of the Potomac River are based on the tidal tributary subcategories: Seasonal and Migratory Fish Spawning and Nursery; Shallow-Water Submerged Aquatic Vegetation; Open-Water Fish and Shellfish; Deep-Water Fish and Shellfish; and Deep-Channel Refuge.

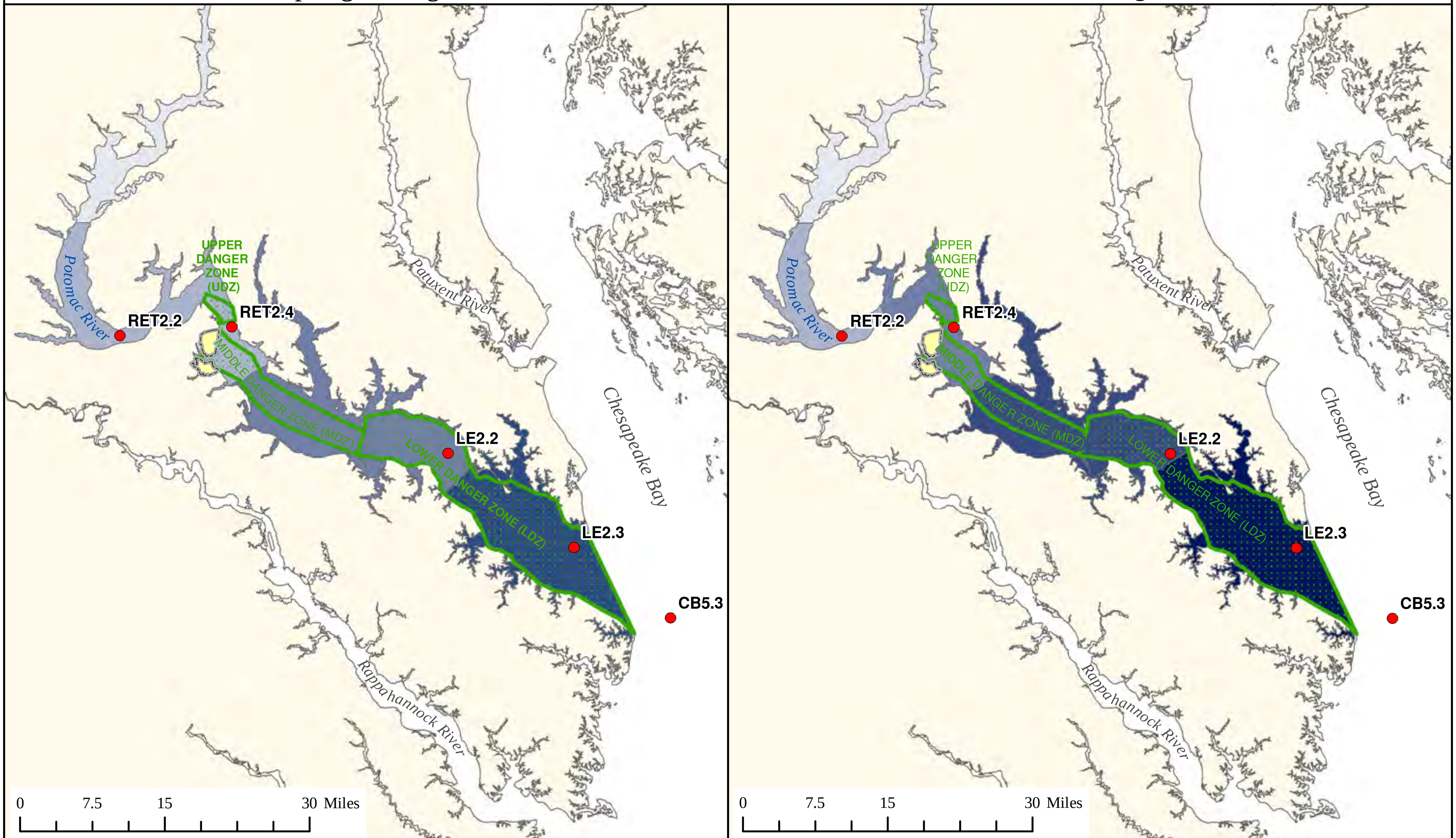
3.2 PRTR Habitats

The aquatic biological resources of the proposed action study area in and around NSF Dahlgren are concentrated in the Potomac River. Within the study area, aquatic habitats in the Potomac River include unvegetated sub-tidal bottoms, intertidal flats, submerged aquatic vegetation (SAV), and emergent marshes.

Water depths along the Virginia shore are approximately 4 ft (1.2 m), increasing to depths of 15 ft (4.6 m) as the bottom slopes closer to the channel. Similarly, depths along the Maryland shoreline range from 1 to 15 ft (0.3 to 4.6 m). Greater depths of 10 to 15 ft (3.0 to 4.6 m) are common closer to the shipping channel in the eastern portion of the Potomac, with some depths

Potomac River Salinity Levels (1985-2006)

Spring Average | Fall Average



- MDNR Fixed Water Quality Monitoring Station
- Naval Support Facility (NSF) Dahlgren
- Potomac River Test Range (PRTR)
- Tidal Fresh < 0.5 parts per thousand (ppt)
- Oligohaline 0.5 to 5.0 ppt
- Low Mesohaline 5.0 to 9.3 ppt
- Medium Mesohaline 9.3 to 13.7 ppt
- High Mesohaline 13.7 to 18 ppt

N

NSWCDL BA

NAVSEA WARFARE CENTERS DAHLGREN

Source: NSWCDL GIS (2008 - 2011); Based on Landwehr et al., 1999 and Maryland Department of Natural Resources (MDNR), November 2007.

Figure 3-1

THIS PAGE INTENTIONALLY LEFT BLANK

Water Quality Monitoring Stations

Lewisetta, VA Station – NOAA Station 8635750

MDNR Fixed Water Quality Monitoring Station

Naval Support Facility (NSF) Dahlgren

8 0 8 Miles

13 0 13 Kilometers

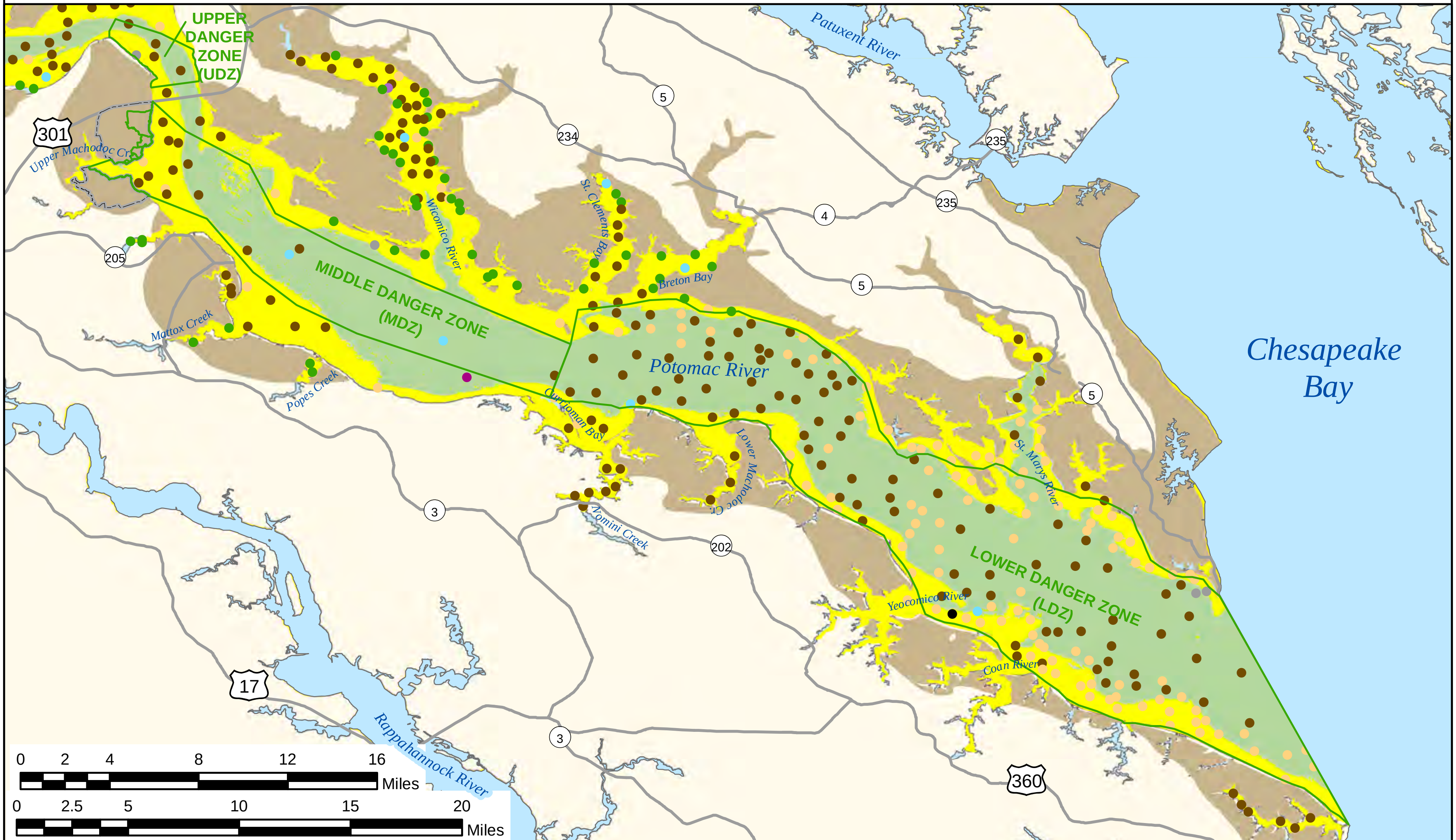
NSWCDL BA

Source: NSWCDL GIS (2008 - 2011); Danger Zones defined in 33 CFR § 334.230.

Figure 3-2

THIS PAGE INTENTIONALLY LEFT BLANK

Sediments - PRTR



Clay
Mud
Sand
SAV
Oysters
Shells
Gravel
Rock /Rocky

Source: National Oceanic and Atmospheric Administration (NOAA) electronic navigational chart, 2007.

Silty Clay

Approximate Shoreward limit of "mud"

Source: Knebel et al., 1981

Figure 3-3

"Lowland Deposits" consisting of coarse (sandy) and fine (clayey or silty) sediments with cobbles and boulders.

Source: Draft Physiographic Map of Maryland, Maryland Geologic Survey (MGS), 2008.

NSF Dahlgren

Potomac River Test Range (PRTR) Complex

Source: NSWCDL GIS (08 -11); Danger Zones defined in CFR 33, Part 33.230.

N

NSWCDL BA

THIS PAGE INTENTIONALLY LEFT BLANK

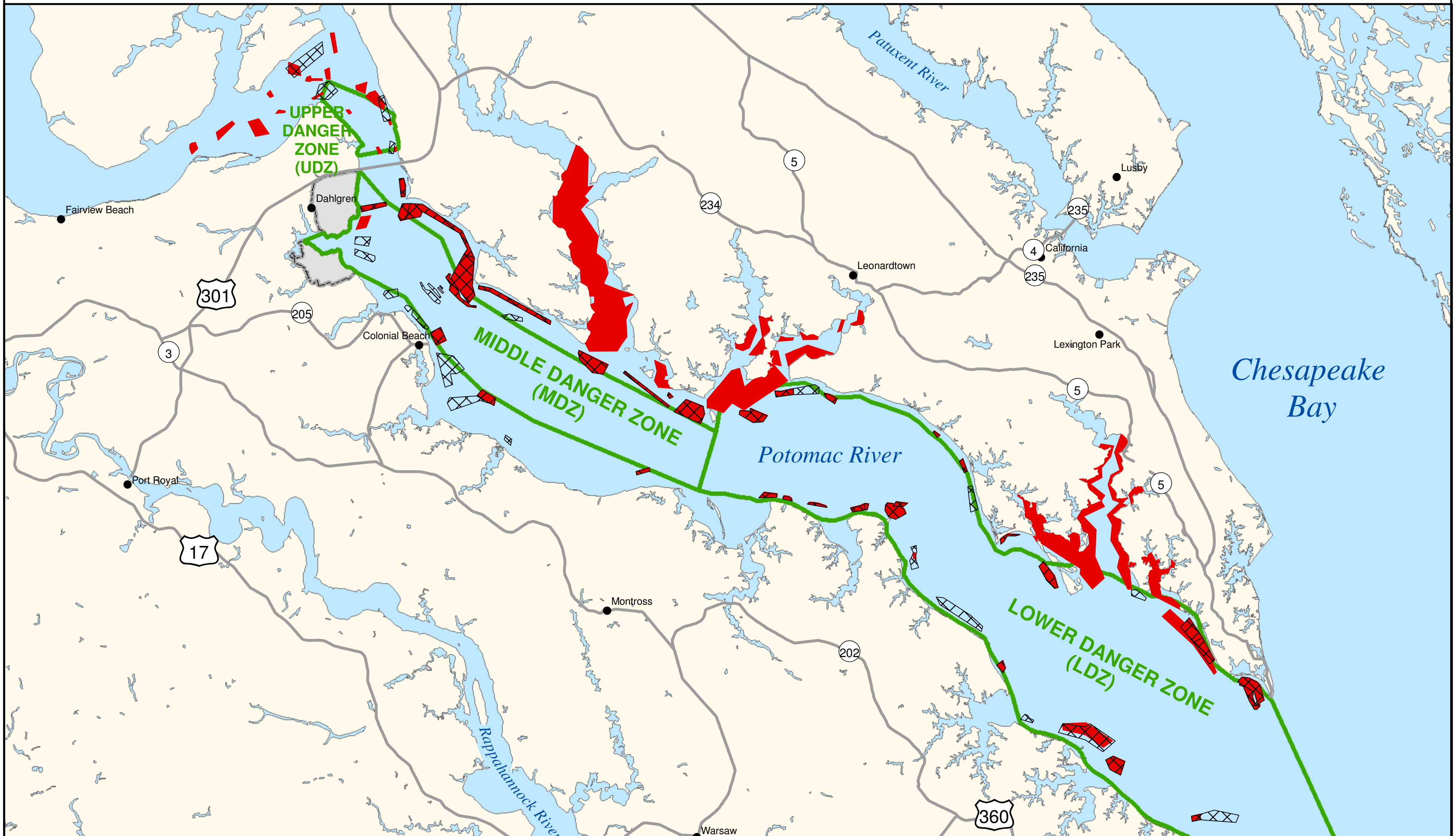
reaching 80 ft (24 m). The substrate of the Potomac River channel and side slopes consist of "firmer muds and clays of moderate to high compaction, locally mixed with sand and other deposits" (Lippson et al., 1981).

SAV is a critical component of the Potomac River ecosystem, providing important biological and physical functions (Rybicki et al., 2007). SAV forms an important part of the food web in the Chesapeake Bay, providing shelter and nursery grounds for shellfish and finfish, as well as providing food for a diversity of waterfowl (Ruhl et al., 1999). In addition, SAV stabilizes bottom sediment. Common species of SAV in the Potomac River include wild celery (*Vallisneria americana*, also called American eelgrass or tapegrass), coontail (*Ceratophyllum demersum*), naiad (*Najas* spp.), and common elodea (*Elodea canadensis*) (Orth and Moore, 1984). The growing season for SAV in the Potomac River extends from April through October (Carter et al., 1998). In 2010, SAV acreage in the mesohaline portion of the lower Potomac River, where the MDZ and LDZ are located, was estimated to be 207 acres (84 hectares) (Orth et al., 2010).

Oyster bars are also found in the PRTR, as seen on Figure 3-4, Potomac River Oyster Bars. This figure shows the boundaries of MDNR's natural oyster bars and historical oyster bars. Natural oyster bars are legally-defined locations where oyster bars are found in Maryland waters, which include most of the Potomac River. Since they have legal boundaries that were drawn to encompass potential oyster habitat, they may include some areas that do not support oyster growth. The natural oyster bar charts are based on surveys in 1928, 1975 through 1985, and 1994 (MDNR, 2011).

THIS PAGE INTENTIONALLY LEFT BLANK

Potomac River Oyster Bars



MDNR Natural Oyster Bars (NOB) Data

Naval Support Facility (NSF) Dahlgren

Maryland's Historic Oyster Bottom (1976 - 1983)

6 0 6 Miles

10 0 10 Kilometers

N

NSWCDL BA

Sources: MDNR, 2008; NSWCDL GIS (2008 - 2011).
Danger Zones defined in 33 CFR § 334.230.

Disclaimer: The Natural Oyster Bar/lease lines shown are for oyster management purposes only.
For the official boundaries consult the current official Natural Oyster Bar Chart.

Figure 3-4

THIS PAGE INTENTIONALLY LEFT BLANK

4 Endangered and Threatened Species in the PRTR

4.1 Shortnose Sturgeon and Atlantic Sturgeon

4.1.1 Species Status of Shortnose Sturgeon and Atlantic Sturgeon

On March 11, 1967, the USFWS listed the shortnose sturgeon as endangered throughout its range under the Endangered Species Preservation Act (32 *Federal Register* 4001). NMFS took over jurisdiction of the listed species in 1974, following the enactment of the ESA. There are 19 Distinct Population Segments (DPSs) in 25 river systems identified in the NMFS *Final Recovery Plan for the Shortnose Sturgeon Acipenser brevirostrum* (NMFS, 1998). In 1996, USFWS and NMFS published a joint policy defining the phrase “distinct population segment” (USFWS and NMFS 1996, 61 Federal Register 4722). The Chesapeake Bay (CB) DPS includes sturgeon that occur in the Potomac River in Maryland and Virginia. Three elements are considered in a decision regarding the listing, delisting, or reclassification of a DPS as endangered or threatened under the ESA: discreteness of the population segment in relation to the remainder of the species, significance of the population segment to the species, and conservation status. The shortnose sturgeon is also listed as endangered by the states of Maryland and Virginia (MDNR, 2009; Virginia Department of Game and Inland Fisheries, 2011). The State of Maryland has jurisdiction over most of the Potomac River, inclusive of almost all of the PRTR.

NMFS proposed the Atlantic sturgeon for listing under the ESA on October 6, 2010. Based on the *Status Review of Atlantic Sturgeon* (*Acipenser oxyrinchus oxyrinchus*) (ASSRT, 2007) and other subsequent information, NMFS has determined that the Atlantic sturgeon is comprised of five DPSs that qualify as endangered or threatened species under the ESA. The CB DPS, which includes Atlantic sturgeon found in the Potomac River, is proposed for listing as endangered.

4.1.2 Species Description

The shortnose and the Atlantic sturgeon share many common characteristics – both are long-lived, late maturing, estuarine dependent, anadromous (ascending rivers from the sea to spawn) species. Atlantic sturgeon grow larger, spend more time in marine environments, and have a more northerly range than the shortnose sturgeon (NMFS, 1998). Morphological differences that differentiate the two species include snout shape, mouth width, and bony plates along the anal fin. Distinguishing characteristics of adults of these two species are summarized in Table 4-1.

Recently hatched shortnose and Atlantic sturgeon can be differentiated by the distance between the two lobes of the lower lip (greater for the shortnose sturgeon). For individual sturgeon over 2.4” (60 mm) standard length, the number of pelvic and anal fin rays differentiate the two species (NMFS, 1998). Although adult Atlantic sturgeon grow much larger than shortnose sturgeon, newly hatched shortnose sturgeon are generally larger than Atlantic sturgeon in total length and continue to be slightly larger than Atlantic sturgeon at the same developmental stage until they reach 2.4” (60 mm) standard length (NMFS, 1998). Atlantic sturgeon grow more quickly than shortnose sturgeon found in the same geographic region, with clear size differences seen at two years of age and increasing differences in size in older fish (NMFS, 1998). At the northern extent of their range, shortnose sturgeon reach maximum lengths of about 4.3 ft (1.3 m) fork length (fork length is measured from the tip of the snout to the fork in the tail), less than half the maximum lengths attained by Atlantic sturgeon (Dadswell, 1979).

Table 4-1
Distinguishing Characteristics of Shortnose and Atlantic Sturgeon

Characteristic	Atlantic Sturgeon *Acipenser oxyrinchus oxyrinchus*	Shortnose Sturgeon *Acipenser brevirostrum*
Maximum length	> 9 ft (2.7 m)	> 4 ft (1.2 m)
Snout	Longer and more sharply pointed (less pronounced in older individuals)	Shorter and blunter
Mouth	Width inside lips; 55% of bony interorbital width[1]	Width inside lips >65% of bony interorbital width
Bony plates	2-6 bony plates along base of anal fin	No row of bony plates along the base of anal fin
Habitat	Anadromous; spawn in freshwater but primarily lead a marine existence	Anadromous; spawn at or above head-of-tide in most rivers. Aside from seasonal migration to estuarine waters, rarely occurs in marine environment.
Range	Hamilton Inlet, Labrador, Canada south to the Saint Johns River, Florida	Saint John River, New Brunswick, Canada, south to the Saint Johns River, Florida
Note: [1] Interorbital width is the distance between the nearest edges of the eyes, measured across the top of the head). **Sources**: NMFS, 1998: ASSRT, 1997.		

The range of shortnose sturgeon extends from the Saint John River in New Brunswick, Canada south to the Saint Johns River in northeastern Florida (NMFS, 1998). Atlantic sturgeon range farther north – to Hamilton Inlet on the coast of Labrador – but like shortnose sturgeon, the southern extent of their range is the Saint Johns River in Florida (ASSRT, 2007).

Atlantic sturgeon are primarily marine and spend a smaller portion of their time in fresh or brackish water than do shortnose sturgeon. Although classified as anadromous, shortnose sturgeon spend only a limited amount of time at sea and do not venture far offshore. Shortnose sturgeon have been characterized as "freshwater amphidromous" by Bemis and Kynard (1997), since while older juveniles and adults are frequently found in saline waters (up to 35 ppt), in most rivers all life history phases occur at least at certain times in the freshwater reaches. Dadswell et al. (1984) reported that all shortnose sturgeon caught in the Atlantic Ocean were captured within a few miles of shore.

The Atlantic sturgeon has long been an important commercial species in North America, beginning with Jamestown, the first successful English colony in the Americas founded in 1607 on the James River, Virginia (Smith, 1624). The early colonists survived by dining on sturgeon when other food was scarce. Later, pickled sturgeon and caviar roe (eggs) became one of the first exports from the New World (Roberts, 2007). One hundred and fifty years after the founding of Jamestown, an English visitor to the Potomac River commented that "*Sturgeon and shad are in such prodigious numbers that in one day within the space of two miles only, some gentlemen in canoes caught above six hundred of the former with hooks…*"(Roberts, 2007).

Records from the 1700s and 1800s continued to document large numbers of sturgeon in many rivers along the Atlantic coast, and in 1870 a caviar market was established (ASSRT, 1997; Smith and Clugston, 1997). Both the shortnose sturgeon and Atlantic sturgeon were of commercial importance along the eastern shores of North America in the 1800s because of the quality and taste of their flesh and caviar.

During the late 1800s, the Chesapeake Bay supported the second largest caviar fishery in the eastern United States. However, in the early 1900s sturgeon populations collapsed as a result of overfishing (Murawski and Pacheco, 1977, as cited in ASSRT, 1997). Record landings were reported in 1890, when over 3,692 tons (3,350 metric tons) of Atlantic sturgeon were landed from coastal rivers along the Atlantic Coast (Smith and Clugston, 1997). The fishery collapsed in 1901, when less than 10 percent of the 1890 peak landings (only 325 tons [295 metric tons]) were reported (Smith and Clugston, 1997). During the 1950s, the remaining sturgeon fishery switched to targeting sturgeon for flesh, rather than caviar. Commercial fisheries were active in many rivers during all or some of the period from 1962 to 1997, resulting in further overfishing, which prompted the Atlantic States Marine Fisheries Commission to impose a coast-wide moratorium for fisheries targeting Atlantic sturgeon in 1998 and for NMFS to close the U.S.' Exclusive Economic Zone (waters 3 to 200 miles [5 to 322 km] offshore in the Atlantic) to Atlantic sturgeon retention in 1999 (ASSRT, 2007; NFS, 2010). Factors other than overfishing, such as deterioration of habitat and blockage of spawning runs, have also contributed to the decline or extirpation of Atlantic sturgeon populations (Stevenson and Secor, 1999).

4.1.3 Shortnose and Atlantic Sturgeon Habitat and Life History Information

4.1.3.1 Lifespan and Reproduction

Shortnose Sturgeon

The lifespan of the long-lived shortnose sturgeon varies with latitude and can extend from 50 years to more than 60 years (Dadswell et al., 1984), with fish living longer in rivers north of Cape Fear (Kynard, 1997). Seasonal distribution within the rivers where shortnose sturgeon are found appears to depend on life stage, reproductive state, and latitude (Bain, 1997; Dadswell, 1979; Dovel, 1981, as cited in NMFS, 1998; Kieffer and Kynard, 1993). Available information indicates that the number of eggs spawned annually varies greatly over the species' range, complicating estimates of annual egg production (NMFS, 1998).

Shortnose sturgeon spawning begins in freshwater from late winter/early spring (south of Chesapeake Bay) to mid to late-spring (Chesapeake Bay to the Merrimack River) (Kynard et al., 2009). Spawning generally occurs from mid-April to mid-May when water temperatures increase to 46º to 48º F (8º to 9º C). Spawning usually ceases when water temperatures reach 54º to 59º F (12º to15º C) (NMFS, 1998). However, shortnose sturgeon may spawn at higher temperatures and have been documented as spawning at 64ºF (18ºC) (Kynard, 1997). The specific environmental conditions that initiate spawning are not fully understood and likely include a combination of temperature, flow, and possibly day length (Bain, 2003).

Spawning reportedly occurs primarily over gravel or cobble in areas of relatively fast-moving water. Fertilized eggs of shortnose sturgeon are adhesive and demersal (Meehan, 1910, as cited in Crance, 1986). The eggs hatch in eight days. About two days after hatching, the yolk-sac fry seek concealment and become strongly photonegative. Within 12 days the yolk sac is completely absorbed and the fry feed on zooplankton (Buckley and Kynard, 1981, as cited in NMFS, 1998).

Within their respective natal rivers, shortnose sturgeon typically spawn in the vicinity of the farthest upstream location to which they have access (Dadswell et al., 1984; NMFS, 1998). Among sturgeon researchers of the Chesapeake Bay area, it is generally agreed that the area immediately downstream from Little Falls (which is dammed and just above the head of tide) on the Potomac River would likely be the primary potential spawning area on the Potomac River (Kynard et al., 2007). This potential spawning area is about 56 NM (104 km) upstream of the PRTR UDZ and 61 NM (113 km) upstream of the MDZ, where most RDT&E occurs. However, no spawning has been documented in the Potomac River to date.

Although shortnose sturgeon habitat varies depending on life stage, they spend part of their time in freshwater reaches of tidal rivers throughout all life-history phases (Kynard, 1997). Shortnose sturgeon spawn at or above the head-of-tide in most rivers, which mature adults migrate to in spring (NMFS, 1998). After hatching, the young of the year remain in freshwater for about one year before moving downstream to the oligohaline zone, where fresh and salt water interface (salinity between 0.5 and 5 ppt – refer to Figure 3.1 for salinity zones in the Potomac River).

Juveniles occur at the fresh-saline water interface in most rivers (NMFS, 1998). Juveniles shift slightly upstream in spring and summer and downstream in fall and winter, but these movements usually occur in the low-salinity portion of the salt wedge (NMFS, 1998). Adults are generally found upstream while spawning in the spring and spend the remainder of the year at the interface of the fresh tidal water and saline estuaries (Dadswell et al., 1984; Moser and Ross, 1995, as cited in Litwiler, 2001).

From late fall until early April, pre-spawning adults overwinter in deep channels (Kynard, 1997; NMFS, 1998). Aside from seasonal migrations to estuarine waters, shortnose sturgeon rarely occur in marine waters (NMFS, 1998).

Atlantic Sturgeon

The life span of Atlantic sturgeon is similar to shortnose sturgeon, with Atlantic sturgeon living up to 60 years (Mangin, 1964, as cited in ASSRT, 1997 and NMFS, 2010). In contrast to shortnose sturgeon, Atlantic sturgeon spend most of their adult life in the marine environment (Atlantic Ocean) (ASSRT, 2007). They spawn in freshwater, and the time of spawning is dependent on geographical location, occurring as early as February in southern rivers and as late as July in Canadian rivers (ASSRT, 2007; NMFS, 2010), with spawning beginning in April in the Chesapeake Bay area (Musick, 2005).

Atlantic sturgeon spawning is thought to take place between the salt front and fall line of large rivers (NFS, 2011). In the Potomac River, this area is located between Little Falls, just upstream of Washington DC, and Great Falls, 10 miles (16 km) upriver of Little Falls (14 mi [23 km]) (although the dam at Little Falls would restrict sturgeon progress upstream). Little Falls is 56 NM (104 km) upstream of the PRTR and 61 NM (113 km) upstream of the MDZ, well above the proposed action area. However, there are no records of Atlantic sturgeon spawning in the Potomac River. Like the shortnose sturgeon, Atlantic sturgeon eggs are also highly adhesive and are deposited on the bottom substrate, usually on hard surfaces (Smith and Clugston, 1997). Preferred conditions are depths of 36 to 86 ft (11 to 27 m) with flows ranging from 46 to 76 cubic meters (m^3)/second (ASSRT, 2007). Flowing water provides oxygen, disperses eggs, and excludes predators (Musick, 2005).

The fecundity (reproductive ability) of Atlantic sturgeon has been correlated with age and body size, with the number of eggs produced ranging from 400,000 to 8 million eggs (ASSRT, 2007). The average age at which 50 percent of maximum lifetime egg production is achieved is estimated to be 29 years (ASSRT, 2007), with females maturing between 7 and 27 years, depending on latitude (Smith, 1985). In the Hudson River, sturgeon females mature at about 14 to 17 years and males mature at 10 to 12 years of age (Van Eenennaam et al., 1997). Atlantic sturgeon exhibit a long interspawning period (spawning frequency) of about 2 to 5 years (Smith, 1985).

Hatching occurs approximately 94 hours (at 68ºF [20 ºC]) to 140 hours after egg deposition (64 º F [18 º C]) and larvae are demersal (Dean, 1894, as cited in Smith, 1985). The yolk sac larval stage is completed in about 8 to 12 days, during which time the larvae move downstream to rearing grounds over a 6 to 12 day period (Kynard and Horgan, 2002). Juvenile sturgeon continue to move further downstream into brackish waters, and eventually become residents in estuarine waters for months or years (Kieffer and Kynard, 1993). A summary of the age, fork length, and total length associated with each life stage of Atlantic sturgeon is provided in Table 4-2 based upon Greene et al. (2009).

Table 4-2
Age and Size Range of Atlantic Sturgeon

Life Stage	Age Range (Years)	Fork Length (mm)	Total Length (mm)
Larvae	<0.08		<300
Juvenile	0.08-11	~20-1340	~300-1490
Non-spawning Adults	>12	>1350	>1500
Female Spawners	>15	>1800	>2000
Male Spawners	12-20	>1350-1900	>1500-2100

Note: Fish in southern latitudes reach maturity sooner than those in northern latitudes.
Source: Greene et al. (2009)

Juvenile Atlantic sturgeon primarily stay within fresh water, but move progressively seaward with time (Smith, 1985). Like adults, they feed on a wide variety of plant and animals, rooting along the bottom and sucking in materials through their mouth (Smith, 1985). In general, juveniles remain within the riverine system for one to six years before migrating to the coast and out to the continental shelf where they grow to maturity (Smith, 1985). In the James River area, south of the Potomac River, juveniles are thought to remain in the area where they were spawned for about three years (Hager, pers. comm., January 14, 2011). Juveniles can be found anywhere in the estuary at any time of the year. Afterwards, they move offshore and may return to their native river at about 10 to 12 years of age (about 39” [1000 mm] fork length).

Atlantic sturgeon stay at the bottom of the river and move into deeper waters (197 to 213 ft [60 to 65 m]) when the temperature drops to about 37º to 46 ºF (3º to 8ºC). They disperse back into shallower waters when the weather warms up. Limited tracking has shown that sturgeon can stay in the same area for months, although subadults may move over large areas of the coast (Hager, pers. comm., January 14, 2011). In the James River adult fish enter in late April and exit about mid-May. They may also return in later August and stay until the end of October, when they exit again; residence time can be variable (Hager, pers. comm., January 14, 2011).

Although there has been no tracking, Atlantic sturgeon from the Chesapeake Bay area are thought to move into the open sea (e.g., they have been sighted off Virginia Beach) or down to the North Carolina area in winter (January, February, and March), moving back up the coast in mid-April (Hager, pers. comm., January 14, 2011).

Atlantic sturgeon return to their natal river to spawn, as indicated from tagging records and the relatively low rates of gene flow reported in population genetic studies (ASSRT, 2007). Males usually begin their spawning migration early and leave after the spawning season, while females make rapid spawning migrations upstream and quickly depart following spawning (Bain, 1997).

4.1.3.2 Atlantic and Shortnose Sturgeon Feeding

Both the shortnose sturgeon and Atlantic sturgeon are demersal omnivores that use their flattened snouts to search through bottom sediments and their sensitive barbels (whisker-like tactile organs) to find crustacea, insects, worms, and small mollusks, which they suck into their mouths. Sturgeon are opportunistic and feed on organisms in mud substrates or on plant surfaces (Van Den Avyle, 1984). Habitat for both shortnose sturgeon and Atlantic sturgeon occurs within the study area, particularly in nearshore SAV beds and clam and oyster beds. Sturgeon do not feed during spawning.

Although these two species are sympatric (occurring in the same geographic areas), they usually do not compete for food (ASSRT, 2007). Several studies in the Northeastern U.S. (Hudson and Merrimack Rivers) found that shortnose and Atlantic sturgeon feeding activity generally does not overlap except for brief periods, likely because the two species occur in different river stretches/salinity zones, at different water depths, and seeking different prey (Haley and Bain, 1997; Kahnle and Hattala, 1988; both as cited in ASSRT, 2007; Kieffer and Kynard, 1993). During warmer months, shortnose sturgeon feed on macroinvertebrates within the oligohaline region of rivers, where they are found during the summer. Most shortnose sturgeon feed in water depths of 3 to 16 ft (1 to 5 m), but may forage as deep as 82 ft (25 m) (Dadswell et al., 1984). An analysis of stomach contents of Atlantic and shortnose sturgeon in the Hudson River found that Atlantic sturgeon feed primarily on polychaetes and isopods, while amphipods were the dominant food found in shortnose sturgeon (Haley and Bain, 1997, as cited in ASSRT, 2007).

4.1.4 Potomac River Sturgeon

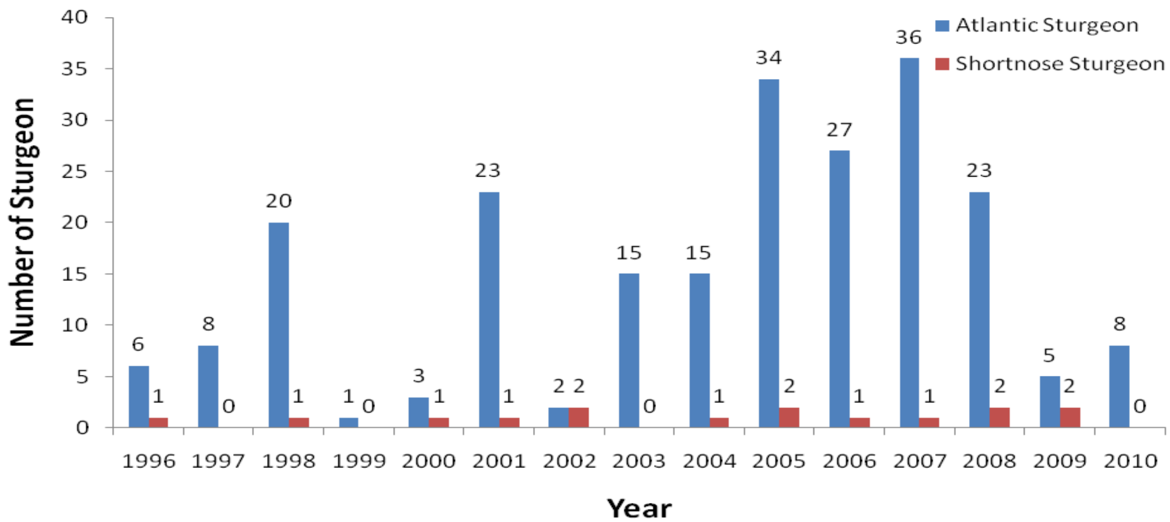
4.1.4.1 Shortnose Sturgeon

The first published accounts of shortnose sturgeon in the Potomac River in the late 1800s (Uhler and Lugger, 1876; Smith and Bean, 1899, both as cited in NMFS, 1998) were based on a sample collected by Milner in 1876. These accounts are the first published account of shortnose sturgeon in the Chesapeake Bay system (NMFS, 1998). No additional shortnose sturgeon were collected in the Potomac River after 1876 by any scientist until the late 20th century. Because of this data gap, there is limited information to explain the current status of the species in the Potomac River.

The single specimen collected in the Potomac River on March 19, 1876 is the only scientific evidence that supports the idea that historically a shortnose sturgeon population may have lived in the river. Historical data on the commercial fishery in the Potomac River does not clarify the presence of shortnose sturgeon. There is poor documentation of the commercial sturgeon fishery that existed in the late 19th and early 20th centuries, and many of the Virginia records were lost. Furthermore, shortnose sturgeon were caught along with Atlantic sturgeon, and fishermen did not separately identify the two species when reporting fisheries catches.

In order to determine the population and characteristics of shortnose and Atlantic sturgeon in the Potomac River, the USFWS has been conducting a Sturgeon Reward Program since 1996 that pays commercial fishermen to report sturgeon that are caught incidentally. Personnel from the USFWS and MDNR check each fish caught on the river, and most are released (some larger Atlantic sturgeon are kept for breeding stock). Figure 4-1 (Sturgeon Captures in the Potomac River 1996-2010) shows the number of shortnose and Atlantic sturgeon captured annually.

Figure 4-1
Sturgeon Captures in the Potomac River 1996-2010



Note: Total includes recaptured sturgeon.
Source: Eyler, USWFS, pers. comm., January 11, 2011.

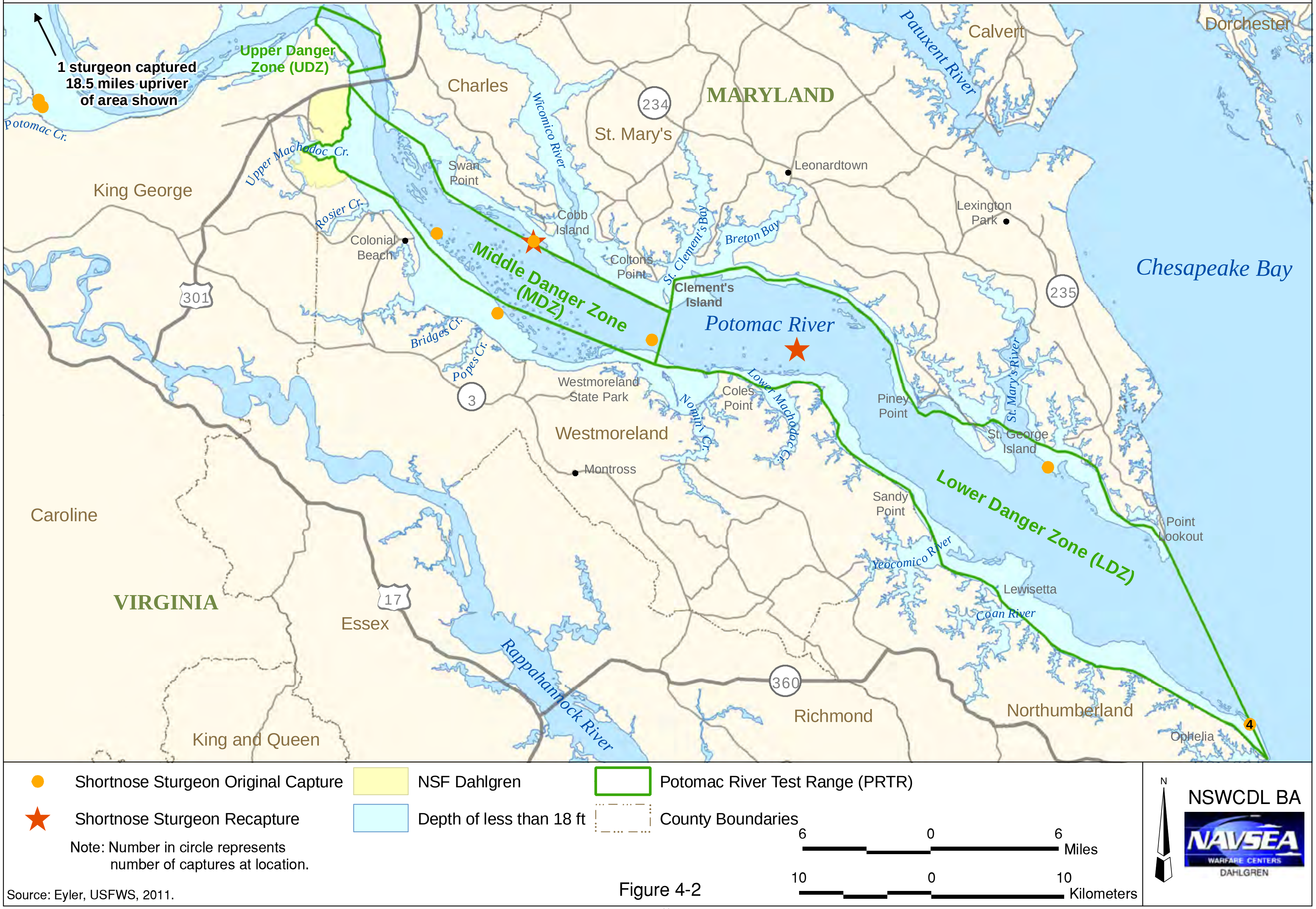
Between 1996 and 2010, 15 shortnose sturgeon were documented in the Potomac River, primarily as a result of the USFWS's Sturgeon Reward Program but also as the result of other research (Figure 4-2, Potomac River Shortnose Sturgeon Captures (1996-2010)). Fish have been documented at the following locations (Eyler, pers. comm., January 11, 2011):

- Four near the mouth of the river around Ophelia, Virginia (caught on May 3, 2000; March 26, 2001; December 10, 2004; and May 22, 2005) where the Potomac River enters the bay.
- One at the mouth of the Saint Mary's River (April 12, 1998) in the PRTR LDZ.
- Three at the mouth of Potomac Creek, which is approximately 5 NM (8 km) upriver from the PRTR UDZ (one on May 17, 1996 and two on March 8, 2002).
- One near Craney Island (September 20, 2005), which is well upstream of the UDZ.
- One near the mouth of Popes Creek, along the PRTR MDZ (March 22, 2006).
- Three captures around Cobb Bar (near Cobb Island in the MDZ); one of which was a fish that was captured twice within a few days (March 14 and 17, 2008).
- One near Colonial Beach, also in the MDZ (March 13, 2009).
- One near Cole's Point in the LDZ (April 9, 2009).

The reward program operated year round from 1996 through 2005. Beginning in 2006 the USFWS discontinued the reward program from May 31st to October 1st due to concern that the water temperatures in the summer months were too high for sturgeon to be held safely, especially with the large numbers of Atlantic sturgeon being reported in 2006 (Eyler and Mangold, pers. comm., January 11, 2011). USFWS has continued to shut down the reward program in the summer months to protect sturgeon from the stress of being held during warm weather, with no reward offered from June 1st through September 30th. However, it is likely that sturgeon are present during the summer months in the Potomac River based on information collected when the reward program operated from June through September (Eyler and Mangold, pers. comm., January 11, 2011).

The locations of the sturgeon collected by the reward program are based on where fishermen are setting their fishing gear (Eyler and Mangold, pers. comm., January 11, 2011). Fishermen target commercial fish species and are not targeting sturgeon, as they are not a commercial fish. The Potomac River Fisheries Commission reports that by pounds landed, the fish species caught by far the most in the PRTR UDZ and MDZ (Potomac River Fisheries Commission's zone boundaries are close to the PRTR danger zone boundaries) is striped bass (*Morone saxatilis*) followed by American eel (*Anguilla rostrata*). In the LDZ, menhaden (*Brevoortia tyrannus*) is by far the fish caught most, followed by croaker (*Micropogonias undulatus*), striped bass, and spot (*Leiostomus xanthurus*) (Cosby, pers. comm., 2009). Therefore, the sturgeon captures on the Potomac River may or may not reflect areas preferred by sturgeon.

Potomac River Shortnose Sturgeon Captures (1996 - 2010)



Source: Eyler, USFWS, 2011.

Figure 4-2

THIS PAGE INTENTIONALLY LEFT BLANK

In addition to the reward program, the USFWS conducted a Potomac River sturgeon sampling study between 1998 and 2000 in the Maryland waters of the Chesapeake Bay watershed to determine the occurrence of shortnose and Atlantic sturgeon in areas of proposed dredge-fill operations (Hogarth, 2001). This study included 4,590 fishing hours at five sites in the middle Potomac River, ranging from approximately 26 to 64 NM (48 to 119 km) downstream of the Washington Aqueduct discharge site in the Chesapeake and Ohio Canal National Historical Park. During this study, no shortnose sturgeon were found.

In 2005 and 2006, a team of scientists from the United States Geological Survey's Conte Anadromous Fish Laboratory tagged two female pre-spawning shortnose sturgeon in the Potomac River (one was retagged in 2007) and followed their movements using radio telemetry (Kynard et al., 2007, 2009). The purpose of the study was to understand their biological status in the river. One pre-spawning female shortnose sturgeon was telemetry-tagged in September 2005 near Craney Island, Virginia at river mile (rm) 86 (river kilometer [rkm] 139) and another female was tagged in March 2006 near Mattawoman Creek in Maryland at rm 39 (rkm 63) in the MDZ. The total reach used by the two tracked sturgeons was 77 rm (124 rkm) from rm 39 to rm 116 (rkm 63 to rkm 187), of which the last mile contained potential spawning habitat. The two sturgeons used different reaches during some seasons, with the individual tagged near Mattawoman Creek using saline water more than the other. The sturgeon homed to small reaches in the same month each year, with one of them using the same freshwater reach during three summers. The most downstream location of either fish during the tracking period of 2005 to 2007 was near Nanjemoy Creek at rm 58 (rkm 94), with the exception of one occurrence of the 2006 tagged fish at rm 53 (rkm 85). This female was never tracked as far downstream as her original capture site, but tracking did not locate her during many months in 2007 when she could have moved farther downstream. The pre-spawning female did not spawn during the two years of the study, but based on her movements the likely spawning area would be near Little Falls, just above Washington, DC, if spawning were to occur (Kynard et al., 2009).

The tagged shortnose sturgeon were tracked in water depths ranging from 13.5 to 70 ft (4.1 to 21 m), but most fish locations were in channel habitat regardless of season or river condition (Kynard et al., 2009). Almost 90 percent of fish locations in 2005 to 2006, were in the channel (90 of 102 locations), with another 8 percent on the channel edge (8 of 102) and the remaining 2 percent (2 of 102) were in shoals (Kynard et al., 2009). The two shallow water locations were recorded in February 2006 when the 2005 female used a dredge deposition area near Craney Island. Foraging adults in other rivers use both channel and shoals for foraging (Kynard, 1997); the use of only the channel in the Potomac River suggests that the shoals are not suitable habitat (Kynard et al., 2009).

Adult shortnose sturgeon in north-central rivers of the Atlantic coast remain mostly in freshwater, with occasional visits to weakly-saline water, particularly after spawning. This is in contrast to adults in southern rivers that spend more time in saline water, particularly in the winter (Kynard, 1997). The shortnose sturgeon capture and tracking data from the Potomac River indicate that shortnose sturgeon in the Potomac River are very rare and are either a remnant of the natal Potomac River population or are colonizers from another north-central river, possibly the Delaware River (Kynard et al., 2007, 2009). There are fewer adult shortnose sturgeon present in the Potomac than in rivers with documented sustaining populations (Kynard, 1997; Kynard et al., 2007).

4.1.4.2 Atlantic Sturgeon

Historically, Atlantic sturgeon were common throughout the Chesapeake Bay and its tributaries, as described in Section 4.1.1. Juvenile and subadult Atlantic sturgeon are thought to be routinely taken as bycatch throughout the Chesapeake Bay in a variety of fishing gear, including gill nets, pound nets, and fyke nets (large hoop nets that act as funnels to trap fish) (ASSRT, 2007).

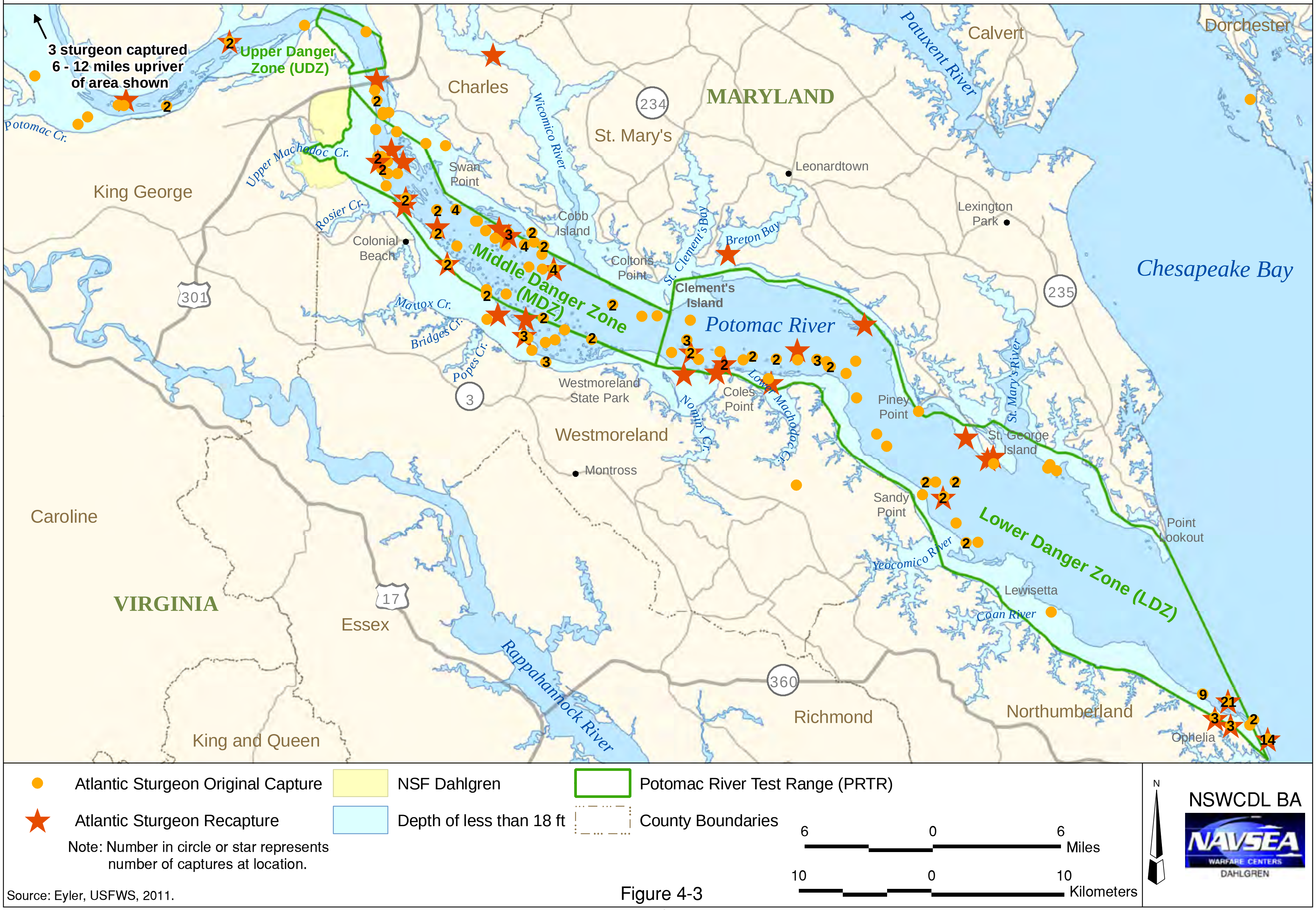
Within the Chesapeake Bay, the USFWS has been funding the Maryland Reward Program since 1996, which resulted in the documentation of approximately 1,700 Atlantic sturgeon through 2009 (NMFS, 2010). About one-third of these fish were hatchery-raised and the remaining two-thirds were wild (NMFS, 2010). In an effort to increase the Chesapeake Bay sturgeon population, the MDNR, USFWS, and Chesapeake Biological Laboratory operate a stocking program. In 1996, three thousand Atlantic sturgeon were stocked in the Nanticoke River (Secor et al., 2000). All sturgeon were injected with an internal code wire tag to identify size class and stocking site. Between 1996 and 2000, 262 hatchery Atlantic sturgeon were collected under the Reward Program, including sturgeon captured at five locations in the Potomac River in 1997 (Secor et al., 2000).

In the Potomac River, a total of 226 Atlantic sturgeon have been reported, primarily through the Reward Program (Eyler, pers. comm., January 11, 2011). As shown in Figure 4-3 (Potomac River Atlantic Sturgeon Captures (1996-2010)), most Atlantic sturgeon have been captured below the Nice Bridge in the areas covered by the MDZ and LDZ. The number reported varies annually and was highest during the period of 2005 to 2008 (Figure 4-1). The fluctuations in the number of captures are thought to reflect changes in the sturgeon population, not the participation of the fishermen. There seem to be stronger year classes of sturgeon that move up into the Chesapeake Bay in certain years and not others (Eyler and Mangold, pers. comm., January 11, 2011).

Voluntary logbook reporting of Atlantic sturgeon bycatch in the spring gill net fishery in the Delaware River suggest that sturgeon numbers vary year to year with no indication of decline or increase, primarily because the number of bycatch reports by commercial fishers varies considerably (ASSRT, 2007). Another factor that could influence the number of sturgeon captured each year is the fact that Atlantic sturgeon spawn at intervals, which have been recorded to be between 1 and 5 years for South Carolina populations (Smith, 1985).

Virginia also instituted an Atlantic Sturgeon Reward Program in the Chesapeake Bay in 1997 and 1998 (ASSRT, 2007). In the 1990s Atlantic sturgeon were believed to have been extirpated in the Chesapeake Bay area, but a limited sampling effort showed that active reproduction is occurring in the James River (Hager, pers. comm., January 14, 2011; Blankenship, 2007; Pelton, 2010). Young-of-year fish have been documented near the mouth of the James River (ASSRT, 2007), and several males producing milt (sperm) were captured in the James River in 2007 and

Potomac River Atlantic Sturgeon Captures (1996 - 2010)



Source: Eyler, USFWS, 2011.

Figure 4-3

THIS PAGE INTENTIONALLY LEFT BLANK

2008 (NMFS, 2010). Reproduction may also be occurring in the York and other rivers, but there is no funding available for researchers to determine whether these rivers have active breeding populations (Hager, pers. comm., January 14, 2011). There are no records of Atlantic sturgeon spawning in the Potomac River, but if spawning were to occur it would likely be well upriver, above Washington, DC in the stretch from Little Falls to Great Falls (if they could navigate the dam at Little Falls).

Although there are likely to be more sturgeon found in the Potomac River than the number captured, the total number of individual shortnose and Atlantic sturgeon using the river is still considered to be quite small.

In June 1998, the Atlantic Marine Fisheries Commission closed the entire coast to Atlantic sturgeon fishing for the next four decades based on stock assessments indicated that only remnant populations of Atlantic sturgeon remain along much of the East Coast (USFWS Chesapeake Bay, 2011). At the current time, there are only two US populations for which an abundance estimate is available – the Hudson River with about 870 spawning adults per year and the Altamaha River with about 343 spawning adults per year (ASSRT, 2007). These populations are presumed to be the healthiest populations within the US, with other spawning populations predicted to have less than 300 adults spawning per year.

There are no Atlantic sturgeon recorded spawning in the Potomac River; however, this may be because there has been no concerted effort to look for spawning Atlantic sturgeon (Hager, pers. comm., January 14, 2011) or it may be due to curtailed or absent spawning stock or spawning habitat (Secor, 2000). Atlantic sturgeon are thought to spawn between the salt front [Little Falls on the Potomac River just above Washington DC] and fall line [Great Falls, which is ten miles above Little Falls on the Potomac River, but sturgeon are unlikely to get over the dam at Little Falls to reach Great Falls] in gravel, cobble, or rocky areas (NFS, 2011). Factors affecting spawning habitat include increased silting from dredging and stormwater runoff that reduces the areas of hard rocky bottom required for successful spawning. In the James River, south of the Potomac River, a stone reef has been constructed in an effort to provide an artificial reef for Atlantic sturgeon spawning (Virginia Commonwealth University, 2010; James River Association, 2011).

4.1.4.3 Summary

Atlantic sturgeon and shortnose sturgeon are present in the Potomac River in limited numbers. Most sturgeon captures have been Atlantic sturgeon in the mesohaline portion of the river, which extends from the Nice Bridge down to the mouth of the river and coincides with the PRTR MDZ and LDZ. Sturgeon occurrences have been recorded year-round in the river, with the largest number of captures in the spring (March, April). No spawning has been recorded for either species in the Potomac River; however, if sturgeon were to spawn it would likely occur well upriver of the PRTR in the vicinity of Little Falls.

4.2 Sea Turtles

4.2.1 Status of Sea Turtles

The loggerhead sea turtle was listed as threatened throughout its range on July 28, 1978. On March 16, 2010 NMFS and USFWS proposed listing of nine loggerhead DPSs, of which the Northwest Atlantic DPS is proposed for listing as endangered (USFWS and NMFS 2010, 75 Federal Register 12598). Kemp's ridley was listed as endangered on December 2, 1970 and the green sea turtle (*Chelonia mydas*) was listed as threatened on July 28, 1978, except for breeding populations in Florida and the Pacific coast of Mexico, which were listed as endangered. All three species were listed under the ESA of 1973.

These three sea turtle species are known to occur in the lower Potomac River based on reported stranding and/or incidental capture incidents. Leatherback sea turtles (*Dermochelys coriacea*) are also known to visit Maryland waters (Litwiler, 2001), but as none are known to occur in the Potomac River, they are not discussed here. Brief summaries of each of the three species that has been recorded in the Potomac River are provided below.

4.2.2 Sea Turtle Species Descriptions

4.2.2.1 Loggerhead

The loggerhead turtle is a large, hard-shelled sea turtle that is named for its disproportionately large head. The average straight carapace length (SCL) of adults in the southeast US is approximately 3.0 ft (92 cm) with a weight of about 255 lbs (116 kg) (Ehrhart and Yoder 1978, as cited in NMFS and USFWS, 2008). Adults are mainly reddish-brown in color on the carapace (dorsal part of the shell) and yellowish underneath on the plastron (ventral side of the shell) (NMFS and USFWS, 2008).

Loggerhead sea turtles inhabit the temperate and tropical regions of the Atlantic, Pacific, and Indian Oceans, and nest from Texas to Virginia in the continental US (NMFS and USFWS, 2008). The loggerhead turtle occurs in habitats ranging from coastal estuaries to waters far beyond the continental shelf and may be found hundreds of miles out to sea, as well as in inshore areas such as bays, lagoons, salt marshes, creeks, ship channels, and the mouths of large rivers (Dodd, 1988). The loggerhead is the most abundant sea turtle species in US coastal waters (NFS, 2011) and in Maryland waters, and has been found stranded as far north as Hart Miller Island, Baltimore County in the Chesapeake Bay (Litwiler, 2001).

The general life history of loggerhead and other sea turtles is for females to lay their eggs on coastal beaches where the eggs incubate in sandy nests. The eggs incubate for about two months (depending on temperature), and then the hatchlings emerge together and swim offshore into deeper, ocean water. The hatchlings are approximately 0.8" (20 mm) SCL and weigh 0.7 ounces (20 grams) (Dodd, 1988). After the hatchlings emerge, they crawl rapidly toward the ocean, where they find food and protection among floating mats of vegetation in the Gulf Stream

(USFWS, 1999). In the ocean they feed and grow until returning at a larger size to nearshore coastal habitats. This life history pattern is characterized by three basic ecosystem zones:

- **Terrestrial zone –** the nesting beach where both egg laying and embryonic development occur.
- **Neritic zone –** the nearshore (including bays and sounds) marine environment where water depths do not exceed 660 ft (200 m), including the continental shelf.
- **Oceanic zone –** the vast open ocean environment (from the surface to the sea floor) where water depths are greater than 660 ft (200 m) (NMFS, USFWS, and SEMARNAT 2010).

The diet of loggerhead turtles changes with age and size. Very little is known of the diet of oceanic juveniles, but they are thought to be primarily carnivorous, consuming mainly sea jellies and other invertebrates (NMFS and USFWS, 2008). Between the ages of 7 to 12 years, oceanic juveniles migrate to the neritic zone (NFS, 2011). Juvenile loggerhead turtles are omnivorous and feed on a wide variety of organisms inhabiting the neritic zone. Although they may forage on pelagic (free swimming) crabs, mollusks, jellyfish, and vegetation captured at or near the surface, benthic (bottom dwelling) invertebrates such as mollusks, and benthic crabs comprise the majority of the diet (Dodd, 1988; NMFS and USFWS, 2008).

Adult foraging loggerheads are also found in the neritic zone. Limited studies of adult loggerheads indicate that mollusks and benthic crabs make up their primary diet, similar to the more thoroughly-studied neritic juvenile stage (Youngkin, 2001, as cited in NMFS and USFWS, 2008). On average, loggerheads spend most (over 90 percent) of their time underwater (Byles, 1988), generally remaining at depths shallower than 328 ft (100 m).

The waters off the Virginia and North Carolina coasts are important transitional habitat for juvenile sea turtles. Juvenile sea turtles along the US Atlantic Coast exhibit seasonal foraging movements, migrating north along the coast in the early spring to coastal development habitats and south in the fall (Morreale and Standora, 2005). Coastal waters of Virginia, particularly the Chesapeake Bay, serve as developmental habitat for juvenile loggerhead and Kemp's ridley sea turtles, which take up residency during the summer months (Lutcavage and Musick, 1985). The presence of juvenile sea turtles in the Chesapeake Bay area and in Virginia coastal waters peaks from May through October (VIMS, 2008). As waters cool in the fall, most sea turtles migrate out of the Chesapeake Bay and Virginia coastal waters to travel southward at least as far as Cape Hatteras, North Carolina to avoid cold stunning[5].

In the Chesapeake Bay some prey species of the loggerhead such as crabs have declined significantly within the Bay since the 1980s (Lipcius and Stockhausen, 2002, as cited in Seney, 2003). The Virginia Institute of Marine Science (VIMS) Sea Turtle Program has collected diet data and gut samples from stranded and incidentally caught sea turtles in Virginia since 1979. Loggerheads stranded in Virginia during the late 1970s and early 1980s indicated that

[5] Cold stunning is the state that turtles enter when they are suddenly exposed to very cold water of about <50°F (< 10 °C). In these circumstances, they may become lethargic and begin to float on the surface of the water, making them susceptible to predators, accidental boat strikes, and even death if water temperatures continue to drop (Witherington and Ehrhart, 1989).

loggerheads fed primarily on Atlantic horseshoe crab (*Limulus polyphemus*), but shifted during the early to mid-1980s to predominantly blue crab (*Callinectes sapidus*) (Seney, 2003). Their diet in later samples (mid-1990s and 2000 to 2002) was dominated by finfish, in particular menhaden and croaker, suggesting that fishery-related declines in horseshoe crab and blue crab populations caused loggerheads to forage on fish caught in nets or on discarded bycatch (Seney, 2003). The surge in the Chesapeake Bay blue crab population in recent years may cause them to switch back to blue crabs.

Along the US coast loggerheads successfully nest from Texas to Virginia with the majority of nests – about 80 percent – occurring in six Florida counties (NMFS and USFWS, 2008). The loggerhead is the only sea turtle to nest as far north as Virginia (USFWS, 1999). Three nests (non viable) have been documented in Maryland in the last three decades, one in Ocean City in 1979 and two in the summer of 1999 (Litwiler, 2001). There are no records of nesting in the vicinity of the Potomac River.

4.2.2.2 Kemp’s Ridley Sea Turtle

Kemp's ridleys are considered the smallest marine turtle in the world, with a SCL of approximately 2.0 to 2.3 ft (60 to 70 cm) (with shell length and width being nearly equal) and weight of about 100 lbs (45 kg) (NMFS, USFWS, and SEMARNAT, 2010; NFS, 2011). The carapace is round to somewhat heart-shaped and the coloration changes from grey-black in hatchlings to the lighter grey-olive carapace and cream-white or yellowish plastron of adults (NMFS, USFWS, and SEMARNAT, 2010).

Kemp's ridleys range includes the US Atlantic seaboard from New England to Florida, and the Gulf of Mexico. Kemp’s ridleys share a general life history pattern similar to other sea turtles, such as the loggerhead (NMFS, USFWS, and SEMARNAT, 2010). Feeding grounds and developmental areas are found on the Atlantic and Gulf coasts of the U.S. Young Kemp’s ridley hatchlings and small juveniles feed on the macroalgae *Sargassum* and associated infauna and epipelagic species in habitats of the North Atlantic Ocean. Kemp’s ridleys move as large juveniles and adults to benthic, nearshore feeding grounds along the U.S. Atlantic and Gulf coasts (Morreale and Standora, 2005).

Kemp’s ridley turtles feed primarily on portunid crabs, such as the blue crab, and other types of crabs (Lutcavage and Musick, 1985; NMFS, USFWS, and SEMARNAT, 2010). However, they are also known to prey on mollusks, shrimp, fish, jellyfish, and plant material (Marquez, 1994; Frick et al., 1999). A limited amount of data collected by VIMS suggests that blue crabs and spider crabs (*Libinia* spp.) were important components of Kemp’s ridleys’ diet in the Chesapeake Bay during 1987 to 2002 (Seney, 2003).

Next to loggerheads, the Kemp’s ridley is the second most abundant sea turtle in mid-Atlantic waters. Some Kemp’s ridley juveniles may migrate as far north as New York and New England, arriving in these areas around June (Morreale and Standora, 2005). Young Kemp’s ridleys may forage during warmer months in the Chesapeake Bay area, generally heading southward out of Chesapeake Bay by early November (Lutcavage and Musick 1985, Keinath, 1993). During the winter, Kemp’s ridleys migrate south to warmer waters in Florida (Marquez, 1994).

Nesting is primarily limited to the beaches of the western Gulf of Mexico (NMFS, USFWS, and SEMARNAT, 2010). Kemp's ridleys display synchronized nesting, a behavior known as arribada (Spanish for arrival), and gather in large numbers at three main beaches in the state of Tamaulipas, Mexico (NMFS, USFWS, and SEMARNAT, 2010; NFS, 2011). A few additional nests also occur, primarily in Mexico and Texas (NMFS, USFWS, and SEMARNAT, 2010).

The worldwide population declined from tens of thousands of nesting females in the late 1940s to approximately 300 nesting females currently (TEWG, 2000; NMFS, USFWS, and SEMARNAT, 2010). Since the 1990s the population has shown a steady rise. Time and population models predict that the population will grow about 12 to 16 percent per year, assuming that current survival rates within each life stage remain constant (Heppell et al. 2005, as cited in NMFS, USFWS, and SEMARNAT, 2010). It should be noted that sea turtle population assessments in the U.S. are based heavily on estimates of abundance of adult females on nesting beaches; however, without knowledge of accompanying changes in demographic rates at all life stages, the short and long-term population trends cannot be predicted (NRC, 2010).

4.2.2.3 Green Sea Turtle

The green turtle is the largest hard-shelled sea turtle, with adults commonly reaching an SCL of 3.3 ft (1 m) and 300 to 350 lbs (136 to 159 kg) in weight and a maximum size of 4.0 ft (1.2 m) and 440 lbs (200 kg) in weight (NMFS and USFWS, 1991; NFS, 2011; USFWS, 2001). The adult carapace ranges in color from solid black to gray, yellow, green, and brown, while the plastron is yellowish white (NFS, 2011). The common name refers to the color of the green turtle's fat.

Very young green turtles (hatchlings) eat a variety of plants and animals, but adult green turtles feed mainly on seagrasses and marine algae (USFWS, 2001). While offshore, green turtles are not obligate herbivores and may consume invertebrates (NMFS and USFWS, 2007). Important adult feeding areas are found in Florida, where seagrasses are abundant.

In U.S. Atlantic and Gulf of Mexico waters, green turtles are found in inshore and nearshore waters from Texas to Massachusetts, and are also found around the U.S. Virgin Islands and Puerto Rico (NMFS and USFWS, 1991; NFS, 2011). The green sea turtle has only been recorded twice in Maryland waters as of 2001 (Litwiler, 2001), making it an infrequent visitor to the area. Green turtles also share a general life history pattern similar to other sea turtles, using three types of habitat – oceanic beaches (for nesting), convergence zones in the open ocean, and benthic feeding grounds in coastal areas (NFS, 2011).

Similar to the loggerhead and Kemp's ridley sea turtles, post-hatchling and early-juvenile green turtles are found in the convergence zones in the open ocean (NMFS and USFWS, 1991; USFWS, 2001; NFS, 2011). Green turtles grow slowly (NMFS and USFWS, 1991). Once they reach a carapace length of about 7.9 to 9.8 in (20 to 25 cm), they migrate to shallow, nearshore areas (<164 ft [50 m] in depth) where they tend to remain. The optimal developmental habitats for late juveniles and foraging adults are warm, shallow waters (10 to 16 ft [3 to 5 m] in depth), with an abundance of submerged aquatic vegetation, close to nearshore reefs or rocky areas that are used by green turtles for resting.

Juvenile green turtles use estuaries along the Atlantic coast as summer developmental habitat, including Chesapeake Bay (Epperly et al., 1995a, 1995b). Adults are predominantly tropical and are only occasionally found north of southern Florida. Green turtles nest from North Carolina south, with most of the primary nesting beaches occurring in a six-county area in east central and southeastern Florida (NMFS and USFWS, 1991).

4.2.3 Sea Turtles in the Potomac River

4.2.3.1 Stranding and Incidental Capture Records

VIMS and the MDNR record sea turtle strandings and incidental captures in commercial fishing nets in Virginia and Maryland; data are then provided to NMFS. Figure 4-4 (Sea Turtle Strandings in the Potomac River (1991-2010)) shows locations of sea turtle strandings in the Potomac River and Figure 4-5 (Incidental Captures of Sea Turtles in the Potomac River (1991-2010)) depicts locations where sea turtles were incidentally captured in fishing nets. In recorded strandings, the sea turtle is often found dead or in poor condition and therefore, it should be noted that strandings data provides the location where the turtle was found and not necessarily the location where the mortality occurred in the case of dead turtles. Some degree of transport may have occurred prior to the turtle's washing up at the stranding site.

Tables 4-3 and 4-4 list sea turtle strandings and incidental takes, respectively, in the Potomac River from 1991 through 2010 (VIMS, 2008; Tulipani, pers. comm., March 4, 2009 and January 7, 2010; Schofield, MDNR, pers. comm., December 4, 2009; Testa, MDNR, pers. comm. January 11, 2011; Trapani, pers. comm., January 11, 2011). Data are based on sea turtles records from St. Mary's County, Maryland and Northumberland County, Virginia. Both these counties front both the Potomac River and the Chesapeake Bay (see Figures 4-4 and 4-5), but only occurrences of turtles in the Potomac River are presented here. No sea turtles have been recorded from the Potomac River upriver of St Mary's and Northumberland Counties.

Seventy-two percent of recorded incidents (69 of 96) have been incidental captures of sea turtles in fishing nets, with the remaining 28 percent (27 of 96) consisting of strandings. The majority (84 percent) of turtles found in the Potomac River have been loggerheads, with Kemp's ridley comprising most of the remaining turtles (13 percent) (Tables 4-3 and 4-4).

Most sea turtle occurrences in the Potomac River were recorded from May through July, with a few incidents later in the year. These observations confirm that the Chesapeake Bay area serves as developmental habitat for juvenile loggerhead and Kemp's ridley sea turtles and that the presence of juvenile sea turtles in the Chesapeake Bay area is highest during warmer months (Coles, 1999; Tulipani, VIMS, pers. comm., March 4, 2009 and January 7, 2010; Schofield, MDNR, pers. comm., December 4, 2009; Testa, MDNR, pers. comm. January 11, 2011; Trapani, Virginia Aquarium, pers. comm., January 11, 2011).

Sea Turtle Strandings in the Potomac River (1991-2010)

Unidentified
Kemp's Ridley
Potomac River Test Range (PRTR)
Loggerhead
Loggerhead, Kemp's Ridley

Note: Number in circles indicates number of strandings at location.

Sources: Tulipani, VIMS, 2009, 2010; Schofield, MDNR, March 2009, December 2009, January, 2011; Trapani, Virginia Aquarium Stranding Response Program, 2011.

3 0 3 Miles
5 0 5 Kilometers

N

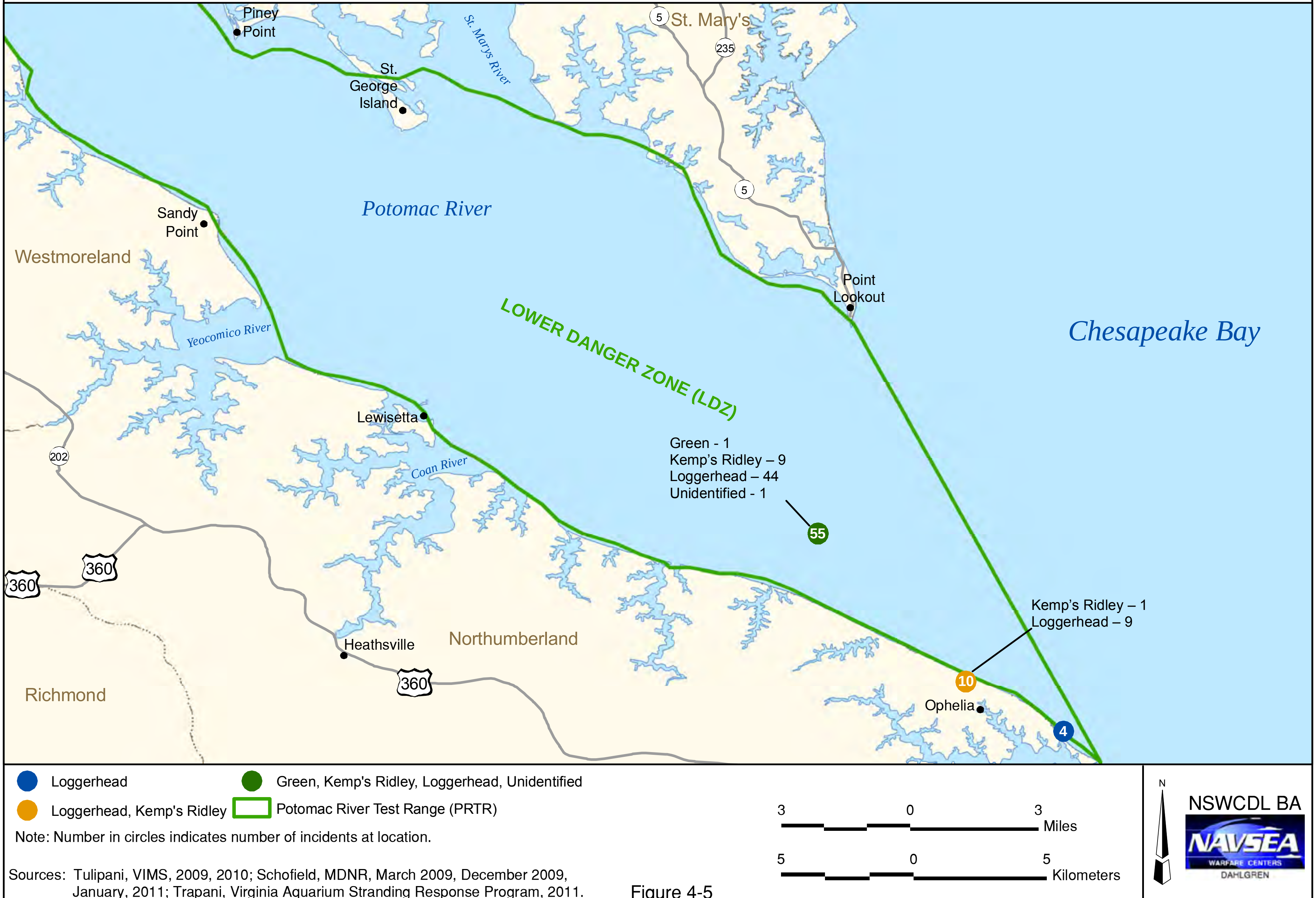
NSWCDL BA

NAVSEA WARFARE CENTERS DAHLGREN

Figure 4-4

THIS PAGE INTENTIONALLY LEFT BLANK

Incidental Captures of Sea Turtles in the Potomac River (1991-2010)



Note: Number in circles indicates number of incidents at location.

Sources: Tulipani, VIMS, 2009, 2010; Schofield, MDNR, March 2009, December 2009, January, 2011; Trapani, Virginia Aquarium Stranding Response Program, 2011.

Figure 4-5

THIS PAGE INTENTIONALLY LEFT BLANK

Table 4-3
Sea Turtle Strandings in the Potomac River

Species	Loggerhead	Kemp's ridley	Green	Leatherback	Unidentified
1991*	1	0	0	0	0
1992*	0	0	0	0	0
1993*	0	0	0	0	0
1994*	0	0	0	0	0
1995*	1	0	0	0	0
1996*	1	0	0	0	0
1997	6	1	0	0	0
1998	2	0	0	0	0
1999	6	0	0	0	1
2000	1	0	0	0	0
2001	0	1	0	0	0
2002	0	0	0	0	0
2003	0	0	0	0	0
2004	0	0	0	0	0
2005	0	0	0	0	0
2006	0	0	0	0	0
2007	3	0	0	0	0
2008	1	0	0	0	0
2009	0	0	0	0	0
2010	2	0	0	0	0
Total	24	2	0	0	1

Notes: * Only Maryland data.

Numbers represent total from Maryland and Virginia shorelines. Only sea turtles found in the Potomac River are listed here. The only counties where sea turtles were recorded are St. Mary's County, Maryland and Northumberland County, Virginia.

Sources:; Tulipani, VIMS, pers. comm., March 4, 2009 and January 7, 2010; Schofield , MDNR, pers. comm., December 4, 2009; Testa, MDNR, pers. comm. January 11, 2011; Trapani, Virginia Aquarium, pers. comm., January 11, 2011.

Table 4-4
Sea Turtle Incidental Captures in the Potomac River

Species	Loggerhead	Kemp's ridley	Green	Leatherback	Unidentified
1991*	0	0	0	0	0
1992*	0	0	0	0	0
1993*	0	0	0	0	0
1994*	0	0	0	0	0
1995*	0	0	0	0	0
1996*	0	0	0	0	0
1997	23	2	0	0	0
1998	11	1	0	0	0
1999	12	2	0	0	0
2000	2	1	0	0	0
2001	3	3	1	0	0
2002	6	1	0	0	1
2003	0	0	0	0	0
2004	0	0	0	0	0
2005	0	0	0	0	0
2006	0	0	0	0	0
2007	0	0	0	0	0
2008	0	0	0	0	0
2009	0	0	0	0	0
2010	0	0	0	0	0
Total	57	10	1	0	1

Notes: * Only Maryland data.

Numbers represent total from Maryland and Virginia shorelines. Only sea turtles found in the Potomac River are listed here. The only counties where sea turtles were recorded are St. Mary's County, Maryland and Northumberland County, Virginia.

Sources: Tulipani, VIMS, pers. comm., March 4, 2009 and January 7, 2010; Schofield, MDNR, pers. comm., December 4, 2009; Testa, MDNR, pers. comm. January 11, 2011; and Trapani, Virginia Aquarium, pers. comm., January 11, 2011.

As shown in Figure 4-6 (Number of Incidental Captures and Stranded Sea Turtles), the number of sea turtle strandings and incidental captures has decreased from its peak in the late 1990s. Almost 70 percent (67 turtles) of incidental captures/strandings were recorded in a three-year period from 1997 to 1999.The large number of turtles recorded in 1997 and 1999 reflect the numerous turtles that were captured or stranded at one location near the mouth of the river between Ophelia and Point Lookout, as shown in Figures 4-4 and 4-5. A large number of turtles were incidentally captured by fishing boats at this location and most of the turtles stranded at this location were live turtles that were released back into the water. Excluding the large number of sea turtles captured/stranded in 1997 to 1999, there has been an average of less than two (1.4) sea turtle strandings or incidental captures per year in the Potomac River.

The reduction in the number of turtles recorded since the early 2000s may be due to a recovery in crab populations, thus reducing turtle foraging on fish caught in nets; less fishing activity in the Lower Potomac River; use of turtle exclusion devices (TEDs) by fishing boats; lower reporting of sea turtle incidents, fewer sea turtles in the area due to reduced prey abundance; or some combination of these and perhaps other factors.

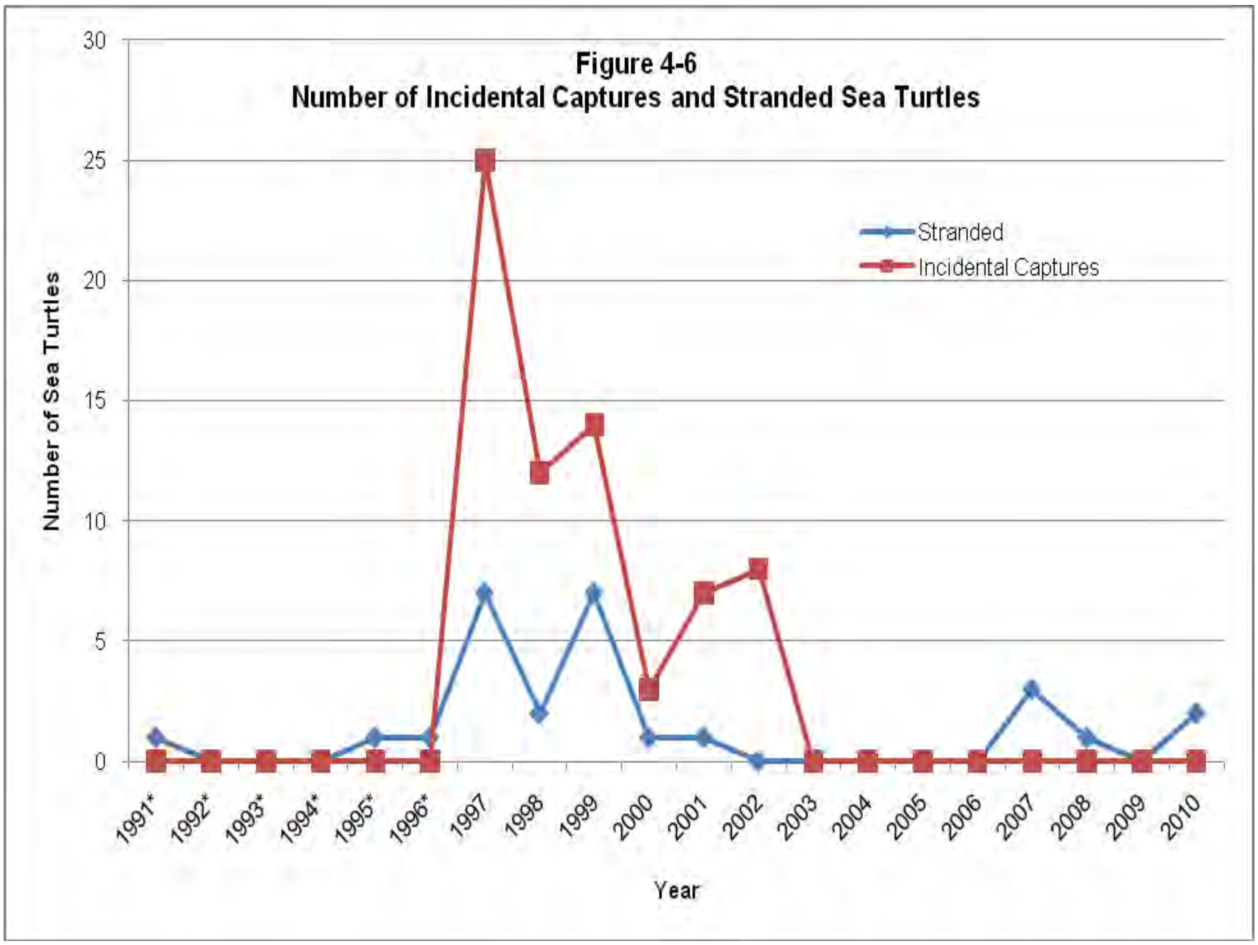


Figure 4-6
Number of Incidental Captures and Stranded Sea Turtles

4.2.3.2 Tagging and Tracking Studies

The MDNR studied sea turtles in the Maryland portion of Chesapeake Bay from 2001 to 2007 (Kimmel, 2004, 2007). Fifty-four loggerheads, 19 Kemp's ridleys and 4 green turtles were examined as part of a sea turtle tagging and health-assessment study from July 2001 to August 2006, (MDNR, 2011). These turtles were reported by pound netters with nets at various locations throughout Maryland's Chesapeake Bay, including Herring Bay, Fishing Bay, and the Pocomoke River. In the Potomac River, the most upriver sea turtle stranding recorded during this time period was slightly above Piney Point in the Lower Danger Zone (LDZ) (Kimmel, 2004).

Potomac River fishermen have cooperated with VIMS on sea turtle surveys since the mid-1980s (Mansfield, 2006). One Potomac River fisherman provided incidental capture data from 1979 to 2002 from nets set near Ophelia (Mansfield, 2006) (see Figure 4-4 and 4-5 for incidents in this area). A total of 436 turtles were captured in pound nets located around the Virginia side of the mouth of the Potomac River from 1980 to 1999. Annual captures ranged from 14 to 94 turtles (Mansfield, 2006). Aerial data suggest that the concentration of sea turtles in upper Chesapeake Bay is less than in the lower Chesapeake Bay (Mansfield et al., 2002a, 2002b), but the aerial surveys did not extend as far north as the Potomac River.

A large juvenile Kemp's ridley turtle tracked in 2002 (Mansfield, 2006) had a primary home range of 86 square nautical miles (NM^2) near Smith Island across the main bay channel from the mouth of the Potomac River and a secondary home range of 38 NM^2 in the vicinity of Mobjack Bay near the mouth of the North River. This study also recorded the capture of loggerheads near the mouth of the Potomac River (Mansfield, 2006).

Sea turtles have not been sighted in the PRTR MDZ by NSF Dahlgren's range control boat operators, who are present there five days a week (Patteson, pers. comm., August 4, 2008). Although sea turtles spend only a fraction of their time at the surface, the lack of sightings combined with other information on their distribution indicates that they are unlikely to be found upriver from the lower LDZ.

4.2.3.3 Summary

Sea turtles may occasionally be present in the lower Potomac River during warmer months of the year. Based upon stranding, incidental captures, tagging, and tracking data, these occurrences are considered to be infrequent and sea turtles are considered to be restricted to the lower, more saline part of the Potomac River, rarely venturing farther upstream than Piney Point, Maryland/Sandy Point, Virginia.

5 Assessment of Potential Effects

The assessment of impacts focuses on potential direct and indirect effects on the species covered (or proposed to be covered) by the ESA in the proposed action area. The following were determined to be indicators of direct and indirect effects:

- **Direct effects.** Direct effects are considered to be any adverse effects arising from proposed action activities that could result in immediate impacts on individuals or changes to their habitat. These effects include physical injury or death; disruption of migration or reproduction; disruption of egg development; and direct alteration of existing habitat. Direct effects occur at the same time as the proposed action.
- **Indirect effects.** Indirect effects are defined as any effects that are caused by or will result from the proposed action later in time, but which are still reasonably certain to occur. These effects include water/sediment quality impairment and indirect alteration of habitat.

The effects of the proposed action on sturgeon and sea turtles are described in this chapter.

5.1 Potential Direct Effects

5.1.1 Shortnose and Atlantic Sturgeon

The potential direct effects on shortnose and Atlantic sturgeon from implementation of the proposed action include physical injury or death, disruption of migration or reproduction, and direct alteration of habitat. Direct effects are described below for each of the proposed action's activities on the PRTR: use of ordnance, EM energy, high-energy lasers, and chem/bio simulants.

5.1.1.1 Ordnance

As discussed in Section 2.1, projectiles fired into the MDZ and upper LDZ by NSWCDL can be live or inert. The fuzes tested in inert projectiles and live projectiles are programmed to detonate above the water surface, where detonations can be observed and recorded by researchers. The potential effects from above-water detonations are not expected to be of any consequence to the shortnose or Atlantic sturgeon, as the air-water interface would reflect most of the energy from the shock wave outward and upward. A shock wave can be created when fluid (air or water) is rapidly displaced by a projectile.

A small percentage of projectile fuzes fail to detonate in the air and instead detonate when the projectile hits the water surface or below the surface. Less than two percent of live rounds detonate underwater, and those that do generally detonate near the surface of the water (NSWCDL, 2008). Impacts from live projectiles that detonate underwater may include direct strike of an animal or the effects of pressure pulses generated by the detonation (e.g., organ damage) if an animal is nearby.

Detonations close to the water surface would have low potential to impact sturgeon that, as bottom feeders, live on or near the river bottom. Because the shock wave generated by a detonation below the surface of the water spreads spherically outward (NSWC, 1978), the energy of the shock wave attenuates exponentially away from the point of detonation. Before the shock wave could reach a sturgeon near the bottom, a substantial portion of its energy would have dissipated. In addition, the expanding bubble that contains the gaseous products of the explosion would break the water surface quickly, allowing a significant portion of the energy to escape into the less dense air, thus reducing the peak pressure. Hence, the probability of a shock wave or gas bubble from an underwater explosion close to the surface's affecting an individual sturgeon is minimal.

In addition to the potential for direct effects from the detonation of live projectiles, there is a remote possibility of a direct hit of a breaching[6] sturgeon by a projectile (either live or inert) entering the water, or of a foraging/migrating sturgeon being shot by a projectile as it embeds in the river bottom.

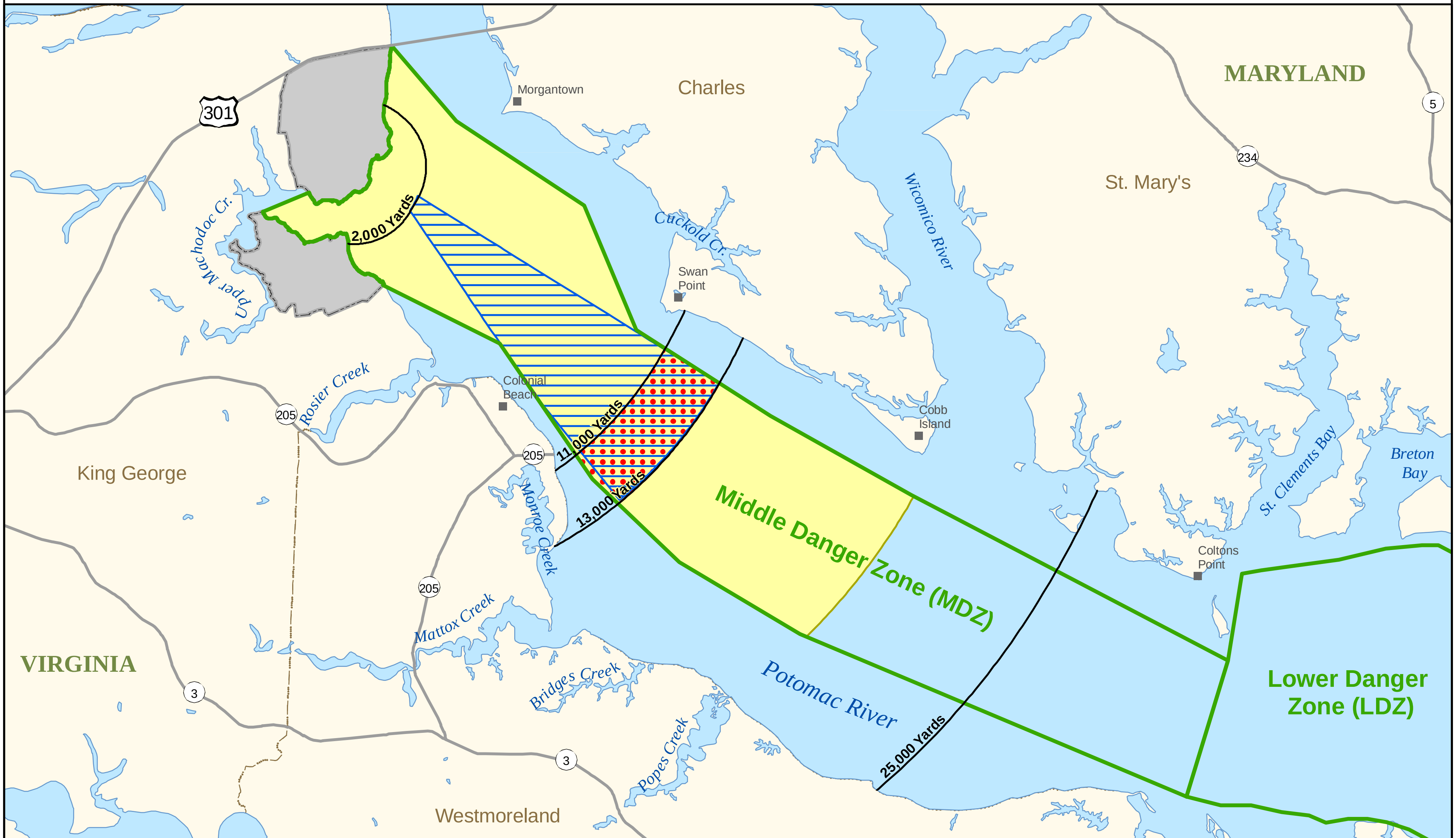
Currently, in particularly active years approximately 4,700 large-caliber projectiles are fired into the PRTR. Under the proposed action, this number would not change. As described in Section 2.1, only 26 percent of projectiles fired are live and of those less than 2 percent detonate under water, resulting in about 24 projectiles detonating under water each year (4,700 x 0.26 x 0.02 = 24.4). The area between the Main Range gun line and 25,000 yds (22,860 m) in the MDZ accounts for 99.4 percent of all munitions tested on the PRTR and is referred to as the diffuse zone (Figure 5-1, Areas used for Munitions Modeling) and covers an area of 31 sq NM (106 sq km).

The projectiles are fired at gunnery targets – mainly virtual targets (effectively, the river itself), as well as floating targets – on the Potomac River, most in the MDZ. By design, gunfire may destroy or damage some physical targets, such as floating radar reflectors, fixed platforms in the river, UAVs, vessels, towed sleds, and causeway sections. The environmental impacts of fragmenting these targets are minimized by removing hazardous materials such as batteries, oil, gasoline, and antifreeze to the extent possible prior to destroying or damaging them. After the target is impacted and the test completed, all remaining debris and any waste is cleaned up. Therefore, any impacts from target debris are considered insignificant.

Between 1996 and 2010, 15 shortnose sturgeon and 226 Atlantic sturgeon were documented in the Potomac River as a result of the Atlantic Sturgeon and Shortnose Sturgeon Reward Program. A maximum of two shortnose sturgeon have been captured in any single year, while a maximum of 36 Atlantic sturgeon (including five recaptures) have been caught in any one year. Forty-four of these captures have been within the diffuse zone (43 Atlantic sturgeon and 1 shortnose sturgeon) and nine of which (8 Atlantic sturgeon, 1 shortnose sturgeon) have been within the zone receiving the highest density of projectiles, termed the dense zone (Figure 5-1).

[6] It is not known why sturgeon breach (jump out of the water), but it has been suggested that they may be attempting to rid themselves of parasites.

Areas used for Munitions Modeling



Primary Target Area

Dense Zone - 11,000 - 13,000 yards (2.3 sq NM)

Diffuse Zone - 0 to 25,000 yards (31 sq NM)

NSF Dahlgren

Potomac River Test Range (PRTR)

2.5 0 2.5 Miles

4 0 4 Kilometers

N

NSWCDL BA

NAVSEA WARFARE CENTERS DAHLGREN

Source: NSWCDL GIS (2008 - 2011); Danger Zones defined in 33 CFR § 334.230.

Figure 5-1

THIS PAGE INTENTIONALLY LEFT BLANK

Given the small number of live projectiles detonating underwater annually (24), the small area that would be encompassed by a projectile detonating close to the surface of the water, the large area where almost all munitions are fired (31 sq NM [106 sq km]), the intermittent nature of the testing, and the small number of sturgeon in the Potomac River overall with even fewer in target areas, the probability of a migrating or resident sturgeon's being hit by a projectile or by an associated shockwave is extremely low. There are no records of shortnose or Atlantic sturgeon spawning in the Potomac River. If spawning were to occur, both shortnose and Atlantic sturgeon would spawn many miles upstream of the PRTR near the head of tide, in the vicinity of Little Falls. Therefore, there would be no effects on spawning.

5.1.1.2 Electromagnetic Energy

Almost all EM energy being tested by NSWCDL would occur above the surface of the water and would have no contact with the shortnose or Atlantic sturgeon or their habitat. EM energy that breaches the water surface would be rapidly absorbed, scattered, or reflected off of organic and inorganic molecules (Boulnois, 1986; Dolgaev et al., 2003; Lubatschowski and Heisterkamp, 2004; Bai et al., 2007; De Giacomo et al., 2007; Li et al., 2007; Bai et al. 2008). As EM energy travels through a body of water, it is subjected to propagation (spreading or broadening) and attenuation (lessening of power). Propagation and attenuation of EM energy in water are caused primarily by interaction with the hydrogen bonds of water molecules, resulting in dissipation (loss of energy over time). This is also perpetuated by interactions with suspended particles, including suspended sediments, dissolved inorganic materials, dissolved organic materials, and plankton (Wetzel, 2001; Babin and Stramski, 2002; Dolgaev et al., 2003).Therefore, any incidental EM energy that reached the water surface would be reflected at the air-water boundary or quickly dissipated by the water molecules, so that only a negligible amount of energy would enter the water, which would have insignificant effects on sturgeon.

The only EM sensor testing that has been conducted below water is the occasional deployment of modified passive sonobuoys in the PRTR. Passive sonobuoys do not generate underwater sounds or noise of their own; they only detect sound. The sounds detected by the sonobuoys are amplified, and are converted into and transmitted by EM waves in the air to a receiver where the sounds can be analyzed. As only passive sonobuoys would be deployed in the PRTR, there would be no additional sounds generated by sonobuoys. Therefore, the use of sonobuoys would have no direct effects on shortnose or Atlantic sturgeon.

5.1.1.3 Lasers

Laser testing events would be conducted above the water surface, primarily in the MDZ, although occasional events may involve the UDZ or LDZ. Under the proposed action, laser beams would be directed from facilities on land ranges and the Mission Area above water and across the MDZ. NSWCDL may also emit low-power lasers or HE lasers from a land range or floating platform (e.g., a ship or barge) on one of the PRTR danger zones, and bounce the signal off a UAV to a target in another danger zone or on a land range. Also, in the future when the power source for lasing is smaller and lighter in weight, laser use may include firing lasers directly from UAVs at targets on the water in the MDZ.

The lasers being tested by NSWCDL are extremely accurate and the likelihood of missing a target is small; therefore, interaction with the water surface would be from incidental energy reflected from the laser's striking the target. Further, the surface area of the PRTR is massive (approximately 169 sq NM [580 sq km]) in comparison to the surface area of a sturgeon and the small cross-section of a laser beam, and therefore, the likelihood of a laser beam striking a shortnose or Atlantic sturgeon would be extremely low.

In the event that laser light hits the water, the amount and intensity of the energy would be immediately decreased as a result of the attenuation and propagation of the laser beam, primarily caused by interaction with the hydrogen bonds of water molecules (e.g., De Giacomo et al., 2007), similar to the processes that would occur if EM energy entered the water. Laser beams are not anticipated to enter the water and in the unlikely event of their doing so, the beam power would be immediately reduced. Therefore, there would be no direct effects on the shortnose or Atlantic sturgeon from laser testing.

5.1.1.4 Chemical and Biological Simulants

Potential impacts on the shortnose and Atlantic sturgeon from chem/bio operations would be limited to chem/bio simulants deposited on the surface of the water and their subsequent entry into the river. Many of the BSL-1 simulants (bacteria, fungi, proteins, and bacteriophages) that may be used as biological simulants are ubiquitous and often found in high concentrations in nature, including in water.

There would be limited deposition of chem/bio simulants on the water surface during testing events. Based on water testing conducted by NSWCDL immediately after chemical sensor tests on the PRTR, concentrations of chemical and biological simulants would be diluted down to barely detectable levels – orders of magnitude lower than at the surface – by the time they reach the river bottom where sturgeon are found. Shortnose and Atlantic sturgeon would not be directly exposed to chem/bio simulants, and therefore, there would be no direct effects on the shortnose or Atlantic sturgeon from testing of chemical and/or biological simulants.

5.1.1.5 Vessel Traffic

NSWCDL's performance of various RDT&E activities would increase the annual amount of NSWCDL-related small watercraft traffic on the Potomac River. Several range control boats are currently on the river whenever public access to the part of the PRTR being used is restricted, for about 750 hours a year. Under the proposed action, they would be on the river 1,000 hours a year and would be primarily limited to the perimeter of the range to restrict access during testing. The use of other watercraft, such as barges, would also increase, as they would serve as platforms for a larger number of operations on the river annually.

However, overall vessel traffic on the PRTR would decrease during operations, as public access would be restricted commensurate with the incremental increase in hours over existing usage. At such times, only range control boats – approximately three, stationed along the perimeter of the range – and barges or vessels associated with testing would be present on the restricted part of the range. Even when the range is closed for testing, small watercraft – generally, recreational vessels with shallow drafts – can move up and down the river along the Maryland shoreline, just outside the PRTR boundary. Deep-draft vessels that need to stay in the main channel, which runs through the range, may be advised to slow before reaching the range, or could be delayed up to an hour near the range.

Locations that support large ports and have relatively narrow waterways – such as the Delaware, James, and Cape Fear rivers – have reported strikes of Atlantic sturgeon by vessels (ASSRT, 2007). There are no reported strikes of Atlantic sturgeon in the Potomac River. Twenty-eight Atlantic sturgeon mortalities were reported in the Delaware Estuary between 2005 and 2008, with the majority resulting from apparent vessel strikes (Brown and Murphy, 2010). Based on the external injuries observed, it is suspected that these strikes are from ocean going vessels and not smaller boats, although at least one fisher reported hitting a large sturgeon with his small craft (ASSRT, 2007). As Atlantic sturgeon are bottom-dwelling fish, large vessels that transit shipping channels with drafts close to the bottom are the main threat to them (Brown and Murphy, 2010). Atlantic sturgeon implanted with depth monitoring tags in the Delaware River ranged between 20 and 50 ft (6.1 and 15.5 m) with an average depth of 30 ft (9 m) (Brown and Murphy, 2010).

The bathymetry of the PRTR portion of the Potomac River is illustrated in Figure 5-2, PRTR Bathymetry. The lower Potomac River trench extends from Ragged Point to the mouth of the river through the LDZ (USEPA, 2003). The depth of the trench averages from 49 to 82 ft (15 to 25 m) and a 33- to 49-ft-deep (10-to 15-m) shelf extends from the sides of the trench (USEPA, 2003). Based on the bathymetry, there should be limited interaction between deep draft vessels that remain within the main channel and sturgeon.

At the time tests would be taking place on the PRTR, commercial and recreational vessel traffic within the PRTR's MDZ would largely cease because public use of the range would be restricted. Incidental vessel strikes, which have the potential to occur during adult sturgeon breaching behavior (i.e., not during spawning or migration), are not expected to occur during proposed action activities because of the low number of shortnose and Atlantic sturgeon found in the Potomac River, the limited breaching associated with these individuals, and the overall reduction in vessel traffic when NSWCDL is conducting operations.

5.1.2 Sea Turtles

As described in Section 4.2.3, although three species of sea turtles—the loggerhead, Kemp's ridley, and the green turtle—have been recorded in the lower part of the PRTR close to the Chesapeake Bay, their ranges do not extend upriver to the part of the PRTR where NSWCDL's RDT&E activities could directly impact them. Most of NSWCDL's activities and vessel use on the PRTR take place in the MDZ (Figure 1-1), and this would remain the case under the proposed action. NSWCDL uses the LDZ much less frequently than the MDZ and for only limited types of activities, primarily in the upper LDZ, as described in Chapter 2. No ordnance is fired into the lower LDZ, where sea turtles occur.

The proposed action activities evaluated in this report would be well removed from the lower portion of the LDZ, where sea turtles are known to occur. The maximum extent of projectile testing takes place and would continue to occur in the future more than 7 NM (13 km) upriver of where sea turtles may be present. Therefore, there would be no possibility of a sea turtle's being in the vicinity of a detonation. The only potential spatial overlap is the use of range boats, barges, and occasionally larger vessels in the lower LDZ. The probability of any one of these vessels coming into contact with a sea turtle is the same as any other vessel near the mouth of the Potomac River and is anticipated to be extremely low. The main threats to sea turtles are from fisheries (entanglement in gillnets, pound nets, and the lines associated with longline and trap/pot fishing gear), marine debris, environmental contamination (e.g., associated with dredging), and disease (NFS, 2011). No direct effects on sea turtles are expected from any RDT&E activities that would take place on the PRTR.

5.2 Potential Indirect Effects

5.2.1 Shortnose and Atlantic Sturgeon

The potential indirect effects on the shortnose and Atlantic sturgeon from implementation of the proposed action include increases in suspended sediment, decreases in water quality, and disturbance of habitat, as described below for each component of the action.

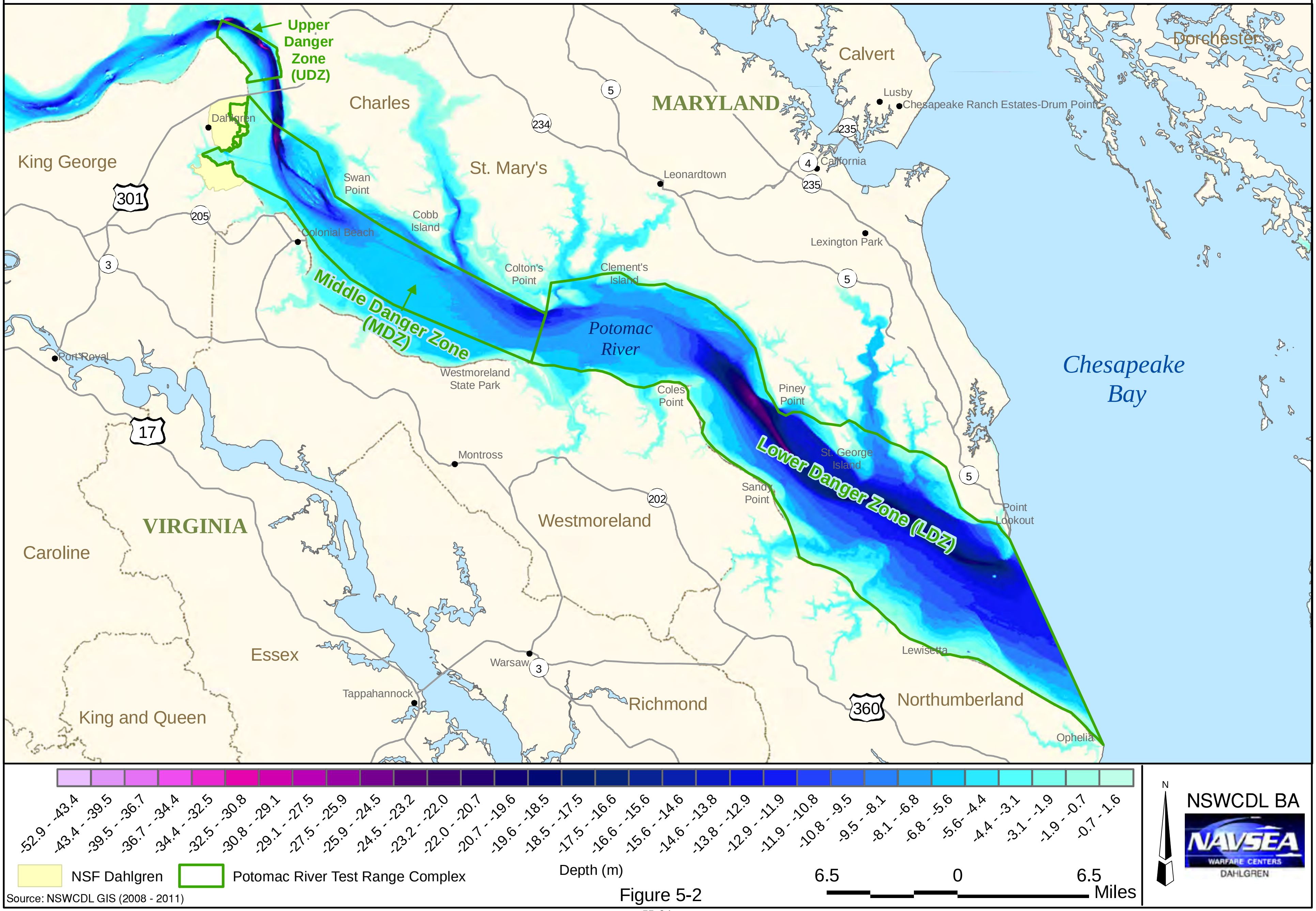
5.2.1.1 Ordnance

Under all alternatives of the proposed action, the number of large-caliber projectiles fired annually in the PRTR would be similar to the levels of the last 15 years. Indirect effects on the shortnose and Atlantic sturgeon from testing are potential increases in suspended sediments in the water column, water and/or sediment quality impairment from munitions constituents, habitat disturbance (i.e., burial of prey by sediment resuspension), and disruption of sturgeon. Each of these potential indirect effects is discussed below.

Increases in Suspended Sediments

When a projectile penetrates river sediment a small crater is created at the entry point, releasing sediment into the water column. Sediment in the main channel of the PRTR is predominantly gray to black clay or silty clay based on samples taken there (Knebel et al., 1981, also see Figure 3-3). Increases in the level of suspended solids would be concentrated near the area where projectiles enter the sediment. No documented estimates of the increase in suspended material could be found, but it is anticipated that the sediments disturbed at the impact site would quickly settle out of the water column and not affect populations of invertebrates that sturgeons feed upon. Increases in levels of suspended sediments caused by projectiles entering the sediment would be localized, and these short-term individual events would not affect the current levels of suspended sediments found in the water column.

PRTR Bathymetry



Source: NSWCDL GIS (2008 - 2011)

Figure 5-2

THIS PAGE INTENTIONALLY LEFT BLANK

Water/Sediment Quality Impairment

The munitions fired into the PRTR over the last 90 years have introduced organic compounds (explosives) and inorganic compounds (metals) into the river. Based on the overall constituent mass introduced into the PRTR and potential toxicity associated with munitions constituents, the following seven metals and five explosives were selected for fate and transport modeling and for screening potential ecological effects (NSWCDL, in preparation):

<u>Metals</u>
- Cadmium
- Chromium
- Copper
- Lead
- Manganese
- Nickel
- Zinc

<u>Explosives</u>
- Ammonium Picrate
- High-Melting eXplosive (HMX)
- Royal Demolition eXplosive (RDX)
- Tetryl
- 2,4,6-Trinitrotoluene (TNT)

A fate and transport model was used to estimate the potential loading of explosives and metals to river water and sediment using conservative assumptions (NSWCDL, in preparation). Concentrations of metals and explosives in water and sediments in the two areas of the PRTR with the highest concentrations – the dense and diffuse zones in the MDZ[7] – were modeled (NSWCDL, in preparation). The diffuse zone includes the area with the highest concentration of munitions, termed the dense zone, as shown in Figure 5-1. The predicted concentrations of metals resulting from munitions testing in the PRTR from 1918 to 2007 are shown in Table 5-1. Predicted concentrations of explosives are shown in Table 5-2. Perchlorate was recorded as being used only once in large-caliber projectiles fired by NSWCDL – in 1986 for a total of 1.15 lbs (0.52 kg) and therefore was not selected for modeling (NSWCDL, in preparation).

Toxicity-based Water and Sediment Criteria and Guidelines for Protection of Aquatic Life

Water and sediment criteria and guidelines for protection of aquatic life were selected for comparison with modeled concentrations of metals, as shown in Tables 5-3 and 5-4. The following guidance was used to select values:

- **USEPA Current National Recommended Water Quality Criteria** (USEPA, 2009). USEPA's national recommended water quality criteria for the protection of aquatic life and human health in surface water include about 150 pollutants. These criteria are published pursuant to Section 304(a) of the Clean Water Act and provide guidance for states and tribes to use in adopting water quality criteria. Aquatic life criteria

[7] The diffuse zone extends between the gun line and 25,000 yds (22,860 m) in the MDZ accounts for 99.4 percent of all munitions tested on the PRTR. Within this area, the zone from 11,000 to 13,000 yds (10,060 to 11,890 m) – the dense zone – has the highest density of rounds.

are intended to be protective of the vast majority of the aquatic communities in the United States. The criteria maximum concentration is an estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed briefly without resulting in an unacceptable effect, while the criteria continuous concentration is an estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed indefinitely without resulting in an unacceptable effect.

- **NOAA Screening Quick Reference Tables** (NOAA, 2008). These tables compiled by NOAA provide a range of screening concentrations for constituents found in sediments. For freshwater sediments the following values are provided:

  - **Threshold effects level (TEL) –** The TEL is calculated as the geometric mean of the 15th percentile concentration of the toxics effects dataset and the 50th percentile (median) of the no-effect data set. It represents the concentration at which toxic effects are expected to occur only rarely.

  - **Probable effects level (PEL) –** The PEL is calculated as the geometric mean of the median concentration of impacted samples and the 85th percentile of the non-impacted samples. It represents the concentration at which toxic effects are frequently expected.

  - **Upper effects threshold (UET) –** The concentration at which biological indicators of adverse effects (e.g., sediment bioassay or reduced benthic infauna) is seen. At concentrations above the UET, adverse biological effects are expected.

  For saltwater, the following values were used:

  - **Effects range-low (ER-L) –** The concentration that represents the lowest 10th percentile of the concentrations at which toxic effects were observed. At concentrations below the ER-L, toxic effects are rarely expected (Long and Morgan, 1990).

  - **Effects range-median (ER-M) –** The concentration that represents the 50th percentile (median) at which toxic effects were observed. At concentrations above the ER-M, toxic effects are likely to occur (Long and Morgan, 1990).

  - **Apparent effects threshold (AET) –** The concentration at which biological indicators of adverse effects (e.g., sediment bioassay or reduced benthic infauna) is seen, essentially equivalent to the concentration in the highest non-toxic sample. At concentrations above the AET, adverse biological effects are always expected.

Table 5-1
Summary of Modeled Concentrations of Metals in Water and Sediment

Metal	Adsorbed in Sediment Due to Munitions (Monthly)		In River Water Column Due to Munitions (Daily)	
	Dense Zone (11,000 to 13,000 yds from Main Gun Line)	Diffuse Zone (150 to 25,000 yds from Main Gun Line)	Dense Zone (11,000 to 13,000 yds from Main Gun Line)	Diffuse Zone (150 to 25,000 yds from Main Gun Line)
	(mg/kg)	**(mg/kg)**	**(mg/l)**	**(mg/l)**
Cadmium	1.45E-02	2.09E-03	5.04E-09	6.94E-10
Chromium	5.61E-03	1.29E-03	8.45E-09	1.94E-09
Copper	6.50E+00	1.71E+00	5.91E-09	1.50E-09
Lead	1.19E-01	2.62E-02	5.77E-12	1.19E-12
Manganese	6.57E+01	6.42E+01	4.06E-05	3.84E-05
Nickel	7.87E-02	8.15E-02	2.21E-08	2.20E-08
Silver	3.91E-05	8.42E-06	1.83E-10	3.93E-11
Zinc	1.14E+00	1.92E-01	4.58E-08	7.29E-09
Notes: mg/kg = milligrams per kilogram; mg/l = milligrams per liter.				

Table 5-2
Summary of Modeled Concentrations of Explosives in Water and Sediment

Explosive	Adsorbed in Sediment Due to Munitions (Monthly)		In River Water Column Due to Munitions (Daily)	
	Dense Zone (11,000 to 13,000 yds from Main Gun Line)	Diffuse Zone (150 to 25,000 yds from Main Gun Line)	Dense Zone (11,000 to 13,000 yds from Main Gun Line)	Diffuse Zone (150 to 25,000 yds from Main Gun Line)
	(mg/kg)	**(mg/kg)**	**(mg/l)**	**(mg/l)**
Ammonium Picrate	5.41E-07	4.06E-08	5.17E-05	2.69E-06
High-Melting eXplosive (HMX)	6.11E-09	5.10E-09	4.46E-09	2.60E-09
Royal Demolition eXplosive (RDX)	1.38E-05	3.37E-07	3.37E-05	5.73E-07
Tetryl	6.03E-04	2.50E-05	5.74E-07	1.64E-08
2,4,6-Trinitrotoluene (TNT)	2.98E-03	8.14E-04	3.34E-06	6.35E-07
Notes: mg/kg = milligrams per kilogram; mg/l = milligrams per liter.				

Table 5-3
USEPA Water Quality Criteria for Metals

Metal	Acute AWQC-FW µg/l	Chronic AWQC-FW µg/l	Acute AWQC-SW µg/l	Chronic AWQC-SW µg/l
Cadmium	2.0	0.25	40	8.8
Chromium III[1]	570	74	NA	NA
Chromium VI[1]	16	11	1,100	50
Copper	13	9.0	4.8	3.1
Lead	65	2.5	210	8.1
Manganese[2]	NA	NA	NA	NA
Nickel	470	52	74	8.2
Zinc	120	120	90	81

Notes: AWQC = ambient water quality criteria; FW = freshwater; SW= saltwater; µg/l = micrograms per liter (parts per billion); NA = not available.

[1] Chromium occurs naturally as trivalent chromium III and hexavalent chromium VI. Both forms of chromium can be toxic at high levels, but chromium VI is generally more toxic than chromium III.

[2] Manganese is a non-priority pollutant.

Source: USEPA, 2009.

Table 5-4
NOAA Sediment Quality Criteria for Metals

Metal	NOAA FW TEL	NOAA FW PEL	NOAA FW UET	NOAA SW TEL	NOAA SW ER-L	NOAA SW PEL	NOAA SW ER-M	NOAA SW AET
	µg/kg dw							
Cadmium	596	3,530	3,000	680	1,200	4,210	9,600	3,000
Chromium	37,300	90,000	95,000	52,300	81,000	160,000	370,000	62,000
Copper	35,700	197,000	86,000	18,700	34,000	108,000	270,000	390,000
Lead	35,000	91,300	127,000	30,240	46,700	112,000	218,000	400,000
Manganese	NA	NA	NA	NA	NA	NA	NA	260,000
Nickel	18,000	36,000	43,000	15,900	20,900	42,800	51,600	110,000
Zinc	123,000	315,000	520,000	124,000	150,000	271,000	410,000	410,000

Notes: FW = freshwater; SW= saltwater; TEL= threshold effects level; PEL = probable effects level; UEL = upper effects level; ER-L = effects range-low; ER-M = effects range-median; AET= apparent effects threshold.

µg/kg dw = micrograms per kilogram dry weight.

NA = Not available.

Source: NOAA, 2008.

Munitions constituents from explosives are not listed on USEPA's Contract Laboratory Program Toxic Compound List (USEPA, 2008) and are generally not included in government criteria or guidelines. Talmage et al. (1999, as cited in United States Navy [US Navy], 2002) calculated freshwater and sediment screening levels based on available data and using the standard USEPA methodology for generation of water quality. These freshwater and sediment screening concentrations are presented in Table 5-5. As noted in the table, no sediment data were available for ammonium picrate or tetryl.

Table 5-5
Freshwater and Sediment Criteria for Explosives

Constituent	Acute WQC (FW)[1] (mg/l)	Chronic WQC (FW)[1] (mg/l)	Sediment[1] (mg/kg)
Ammonium picrate	220 (FW)/66 (SW)[2]	No Data	No Data
High-Melting eXplosive (HMX)	3.8	0.33	0.47
Royal Demolition eXplosive (RDX)	1.44	0.19	1.3
Tetryl	1.2[3]	No Data	No Data
2,4,6-Trinitrotoluene (TNT)	0.57	0.09	9.2

Notes: FW = freshwater; SW= saltwater; mg/l = milligrams per liter (parts per million).

Sources:

[1] Talmage et al., 1999, as cited in US Navy, 2002.

[2] NOAA, 2009; FW based on lethal concentration 50 (LC50) threshold (i.e., the dose that kills 50 percent of the test organisms within a designated period) for a 96-hour exposure of bluegill sunfish; SW based on LC50 for a 96-hour exposure of the inland silverside *Menidia beryllina*.

[3] Naval Facilities Engineering Command, 2000; Saltwater toxicity to red fish larvae based on no observed effect.

Modeled concentrations of munitions-related metals and explosives in the PRTR dense and diffuse zones were then compared to water- and sediment-quality criteria and guidelines to determine if they were above the guidelines for the protection of aquatic life. Tables 5-6 and 5-7 show the ratios of modeled concentrations of metals to water and sediment criteria, respectively. Ratios of less than one indicate that concentrations are below levels that could cause adverse effects to aquatic organisms. The ratios of all comparisons of predicted water concentrations and sediment concentrations were well below one, indicating that there are no exceedances associated with metals from munitions usage in water or sediment. Most concentrations are many orders of magnitude below criteria (more than a million times below effects levels).

Concentrations of explosives in water and sediment were also modeled, as shown in Tables 5-8 and 5-9, respectively. Ratios of modeled concentrations to water and sediment criteria were also orders of magnitude below 1, as shown in these tables, indicating that no adverse effects are associated with metals or explosives released from munitions.

Table 5-6
Ratios of Modeled Concentrations of Metals in Water to Water-Quality Criteria

Metal	USEPA Acute AWQC-FW (Aquatic Life)	USEPA Chronic AWQC-FW (Aquatic Life)	USEPA Acute AWQC-SW (Aquatic Life)	USEPA Chronic AWQC-SW (Aquatic Life)
Dense Zone				
Cadmium	2.52E-06	2.02E-05	1.26E-07	5.73E-07
Chromium III[1]	1.48E-08	1.14E-07	NA	NA
Chromium VI[1]	5.28E-07	7.68E-07	7.68E-09	1.69E-07
Copper	4.55E-07	6.57E-07	1.23E-06	1.91E-06
Lead	8.88E-11	2.31E-09	2.75E-11	7.12E-10
Manganese	NA	NA	NA	NA
Nickel	4.70E-08	4.25E-07	2.99E-07	2.70E-06
Zinc	3.82E-07	3.82E-07	5.09E-07	5.65E-07
Diffuse Zone				
Cadmium	3.47E-07	2.78E-06	1.74E-08	7.89E-08
Chromium III[1]	3.40E-09	2.62E-08	NA	NA
Chromium VI[1]	1.21E-07	1.76E-07	1.76E-09	3.88E-08
Copper	1.15E-07	1.67E-07	3.13E-07	4.84E-07
Lead	1.83E-11	4.76E-10	5.67E-12	1.47E-10
Manganese	NA	NA	NA	NA
Nickel	4.68E-08	4.23E-07	2.97E-07	2.68E-06
Zinc	6.08E-08	6.08E-08	8.10E-08	9.00E-08

Notes: AWQC = ambient water quality criteria; FW = freshwater; SW= saltwater; µg/l = micrograms per liter; NA = Not available. Values below 1 indicate that concentrations are below water-quality criteria.

[1] Chromium III (oxidation state + 3) compounds are stable and occur naturally in the environment, while chromium VI occurs rarely. Chromium VI is more toxic than chromium III.

Table 5-7
Ratios of Modeled Concentrations of Metals in Sediment to Sediment-Quality Criteria

Metal	NOAA FW Lowest ARCS	NOAA FW TEL	NOAA FW PEL	NOAA FW UEL	NOAA SW TEL	NOAA SW ER-L	NOAA SW PEL	NOAA SW ER-M	NOAA SW AET
Dense Zone									
Cadmium	2.5E-02	2.4E-02	4.1E-03	4.8E-03	2.1E-02	1.2E-02	3.4E-03	1.5E-03	4.8E-03
Chromium	1.5E-04	1.5E-04	6.2E-05	5.9E-05	1.1E-04	6.9E-05	3.5E-05	1.5E-05	9.0E-05
Copper	2.3E-01	1.8E-01	3.3E-02	7.6E-02	3.5E-01	1.9E-01	6.0E-02	2.4E-02	1.7E-02
Lead	3.2E-03	3.4E-03	1.3E-03	9.4E-04	3.9E-03	2.5E-03	1.1E-03	5.5E-04	3.0E-04
Manganese	NA	NA	NA	NA	NA	NA	NA	NA	8.9E-03
Nickel	4.0E-03	4.4E-03	2.2E-03	1.8E-03	4.9E-03	3.8E-03	1.8E-03	1.5E-03	7.2E-04
Zinc	1.2E-02	9.3E-03	3.6E-03	2.2E-03	9.2E-03	7.6E-03	4.2E-03	2.8E-02	2.8E-02
Diffuse Zone									
Cadmium	3.6E-03	3.5E-03	5.9E-04	7.0E-04	3.1E-03	1.7E-03	5.0E-04	2.2E-04	7.0E-04
Chromium	3.6E-05	3.5E-05	1.4E-05	1.4E-05	2.5E-05	1.6E-05	8.1E-06	3.5E-06	2.1E-05
Copper	6.1E-02	4.8E-02	8.7E-03	2.0E-02	9.1E-02	5.0E-02	1.6E-02	6.3E-03	4.4E-03
Lead	7.1E-04	7.5E-04	2.9E-04	2.1E-04	8.7E-04	5.6E-04	2.3E-04	1.2E-04	6.6E-05
Manganese	NA	NA	NA	NA	NA	NA	NA	NA	3.1E-03
Nickel	4.2E-03	4.5E-03	2.3E-03	1.9E-03	5.1E-03	3.9E-03	1.9E-03	1.6E-03	7.4E-04
Zinc	2.0E-03	1.6E-03	6.1E-04	3.7E-04	1.5E-03	1.3E-03	7.1E-04	4.7E-03	4.7E-03

Notes: FW = freshwater; SW= saltwater; TEL= threshold effects level; PEL = probable effects level; UEL = upper effects level; ER-L = effects range-low; ER-M = effects range--median; AET= apparent effects threshold.

μg/kg dw = micrograms per kilogram dry weight.

NA – criteria not available.

Values below 1 indicate that concentrations are below sediment guidelines.

Table 5-8
Ratios of Modeled Explosive Concentrations in Water to Water-Quality Values

Explosive	Ratios of Water Concentration: Acute Water Values		Ratios of Water Concentration: Chronic Water Values	
	Dense Zone	Diffuse Zone	Dense Zone	Diffuse Zone
Ammonium Picrate	2.4E-07FW 7.8E-07SW	1.2E-08FW/ 4.1E-08SW	No Data	No Data
High-Melting eXplosive (HMX)	1.2E-09	6.8E-10	1.4E-08	7.9E-09
Royal Demolition eXplosive (RDX)	2.3E-05	4.0E-07	1.8E-04	3.0E-06
Tetryl	4.8E-07	1.4E-08	No Data	No Data
2,4,6-Trinitrotoluene (TNT)	5.9E-06	1.1E-06	3.7E-05	7.1E-06

Notes: FW = freshwater; SW= saltwater.
Ratios below 1 indicate that concentrations are below water-quality values.

Table 5-9
Ratios of Modeled Explosive Concentrations in Sediment to Sediment-Quality Values

Explosive	Ratios of Sediment Concentration: Sediment Values	
	Dense Zone	Diffuse Zone
Ammonium Picrate	No Data	No Data
High-Melting eXplosive (HMX)	1.3E-08	1.1E-08
Royal Demolition eXplosive (RDX)	1.1E-05	2.6E-07
Tetryl	No Data	No Data
2,4,6-Trinitrotoluene (TNT)	3.2E-04	8.9E-05

Note: Ratios below 1 indicate that concentrations are below sediment values.

Comparison of Modeled Fish-Tissue Concentrations to Fish Toxicity Values

Sediment criteria and guidelines are generally based on benthic community metrics and toxicity studies performed on invertebrates and fish. As an additional comparison, shortnose and Atlantic sturgeon metal body burdens were estimated based on bioconcentration factors (BCFs) from the water column, as no reliable biota-sediment accumulation factors are available for metals. BCFs were calculated for sturgeon using BCFs contained in USEPA (1999) based on a review of laboratory and field studies. The basis for each of the BCF values is provided in Table 5-10. Explosives are not included in this analysis due to insufficient data.

Table 5-10
Derivation of Metals Bioconcentration Factors

Metal	BCF	Basis
Cadmium	907	Geometric mean of four field values
Chromium (total)	19	Geometric mean of four laboratory values
Copper	710	Geometric mean of four field values
Lead	0.09	Based on one field value
Manganese	633	Empirical data were not available. Based on the arithmetic mean of the recommended values for 14 inorganics with empirical data
Nickel	78	Geometric mean of three laboratory values
Zinc	2.1	Geometric mean of four field values

Note: BCF = bioconcentration factor.
Source: USEPA, 1999.

To determine the predicted concentration of a constituent in fish tissue, the BCF was multiplied by the constituent concentration in water multiplied by the food chain multiplier (FCM) using the following formula:

Fish Concentration = BCF x Concentration in Water x FCM

The FCM for all metals evaluated in this assessment is 1, based on Sample et al. (1996). The calculated fish-tissue concentrations were then compared to the lowest tissue residue concentration levels associated with adverse effects in Jarvinen and Ankley's database linking effects to tissue residues of aquatic organisms (Jarvinen and Ankley, 1999). Studies on both marine and freshwater fish were evaluated, and the values selected along with the confidence level are shown in Table 5-11.

For cadmium, the lowest no-observed-effect concentration (NOEC) endpoint based on whole-body concentrations was for juvenile seabass (*Lates calcarifer*) at 2.5 milligrams per kilogram wet weight (mg/kg ww) (whole body) (Shazili, 1995). However, the lowest-observed-effect concentration (LOEC) based on whole-body tissue concentrations was lower, at 0.9 mg/kg ww, for adult three-spined stickleback (*Gasterosteus aculeatus*) (Pascoe and Mattey, 1977). Therefore, a cadmium screening toxicity value of 0.9 mg/kg ww was selected.

Table 5-11
Tissue Residue-Based Toxicity Screening Values for Estuarine Fish

Constituent	Screening Concentration	Level of Confidence	Source
Cadmium	0.9 mg/kg	Very low	Stickleback adult LOEC for mortality (Pascoe and Mattey, 1977)
Chromium	NA	NA	Insufficient fish ecotoxicity data
Copper	0.4 mg/kg	Very low to moderate	Reduced oxygen consumption in carp (Jezierska and Sarnowski, 2002)
Lead	0.6 mg/kg	Very low	Mortality NOEC in immature brook trout (Holcombe et al., 1976, as cited in Jarvinen, and Ankley, 1999)
Manganese	NA	NA	Insufficient fish ecotoxicity data
Nickel	0.8 mg/kg	Very low	Rainbow trout mortality NOEC, muscle tissue (Calamari et al., 1982)
Zinc	12 mg/kg	Very low to moderate	Atlantic salmon juvenile growth NOEC – whole tissue (Farmer et al., 1979)
Notes: NA = not available; mg/kg = milligrams per kilogram.			

For copper, the lowest effect level was seen in carp (*Cyprinus carpio*), which showed a reduced oxygen consumption when copper burdens were 0.4 milligrams per kilogram (mg/kg) (Jezierska and Sarnowski, 2002). Although there was no decrease in mortality or growth, a copper screening toxicity value of 0.4 mg/kg was conservatively selected for screening.

For lead, a value of 0.6 mg/kg was selected based on a mortality NOEC in immature brook trout (*Salvelinus fontinalis*) (Holcombe et al., 1976, as cited in Jarvinen, and Ankley, 1999). As no studies on sub-adult estuarine or freshwater fish species were located for manganese, a screening value was not calculated for this metal.

For nickel, a value of 0.8 mg/kg was selected based on a mortality NOEC in rainbow trout (*Oncorhynchus mykiss*) (Calamari et al., 1982). For zinc, an Atlantic salmon (*Salmo salar*) growth NOEC for juveniles of 12 mg/kg was selected (Farmer et al., 1979).

In general, the relationship between tissue residues and toxicity for metals is weak, as the toxicologically active fraction within an organism tends to be obscured by the fact that metals may exist in one or more of several chemical forms, and most if not all of the accumulated metal mass may be bound in a detoxified form (or in a relatively inert storage form for essential metals such as copper or zinc). Whereas free ions within an organism are the major toxicologically active form for most metals/metalloids, the total metal concentration in tissue includes non-toxic metal-protein complexes and selective sequestering of metals in metal-accumulating granules, tertiary lysosomes, and other structures. There is generally a low level of confidence in all metal screening values. However, these values provide a screening comparison to determine whether concentrations of metals in fish resulting from input from ordnance operations on the PRTR have the potential to cause adverse effects. All modeled metal concentrations in fish from exposure to metals released by munitions in the PRTR were orders of magnitude below concentrations potentially resulting in adverse effects, as shown in Table 5-12.

Table 5-12
Comparison of Predicted Fish Tissue Concentrations to Toxicity Screening Values

Metal	Predicted Concentration in Fish Tissues from Munitions (mg/kg ww)		Ratio of Tissue Concentration to NOEC Screening Values	
	Dense Zone	Diffuse Zone	Dense Zone	Diffuse Zone
Cadmium	4.6E-06	6.3E-07	5.1E-06	7.0E-07
Chromium	1.6E-07	3.7E-08	NA	NA
Copper	4.2E-06	1.1E-06	1.0E-05	2.7E-06
Lead	5.2E-13	1.1E-13	8.7E-13	1.8E-13
Manganese	6.6E-04	2.2E-04	NA	NA
Nickel	1.7E-06	1.7E-06	2.2E-06	2.1E-06
Zinc	9.4E-05	1.5E-05	7.9E-06	1.3E-06

Notes: NA – data not available; mg/kg = milligrams per kilogram: ww = wet weight.
Ratios below 1 indicate that concentrations are below fish NOECs.

A comparison of explosives in fish tissue was not performed because of the lack of tissue data associated with toxicity. However, as the studies used to derive water-quality criteria for protection of aquatic life include fish toxicity studies, the water and sediment explosive criteria are considered to be protective of fish.

Disturbance of Sturgeon

As discussed previously, ordnance RDT&E activities on the PRTR are unlikely to disturb shortnose sturgeon or Atlantic sturgeon, as shock waves from the few projectiles denoting below the water surface would have a limited radius, with most of the energy directed upwards, as described in Section 5.1.1.1.

The intermittent nature of the proposed RDT&E work on the PRTR is not expected to disrupt shortnose or Atlantic sturgeon. Most ordnance detonates above the surface of the water, and the limited amount of activity below the water surface is unlikely to overlap with the presence of sturgeon.

Habitat Disturbance

Based on the proposed action, disturbance from projectiles penetrating the river bottom is not anticipated to impact benthic communities, which serve as a food source for shortnose and Atlantic sturgeon. The Lower Potomac River Estuary, where the PRTR is located, is home to a wide range of aquatic invertebrates from dozens of groups of invertebrates (NSWCDL, in preparation). Benthic recolonization of areas where projectiles enter the river bottom is expected to be rapid, as benthic invertebrates from adjacent areas would quickly move in. Most benthic invertebrate communities have been shown to recover within one year of disturbance (e.g., Gore, 1979; Niemi et al., 1990). Habitat disturbance would be temporary and limited to small localized areas, and shortnose and Atlantic sturgeon should experience minimal overall decrease in prey abundance due to localized RDT&E projectile firings.

5.2.1.2 Electromagnetic Energy

As described in Section 5.1.1.2, almost all EM energy being tested by NSWCDL would occur above the surface of the water and would have no contact with shortnose or Atlantic sturgeon or their habitat. There would be no EM energy generated underwater and, therefore, there would be no indirect effects on sturgeon from EM RDT&E activities.

5.2.1.3 Lasers

As described in Section 5.1.1.3, all current or proposed testing using outdoor lasers would occur above the surface of the water. As laser beams are not anticipated to enter the water and, in the unlikely event of their doing so, the beam power would be immediately attenuated, there would be no indirect effects on the shortnose or Atlantic sturgeon from laser testing.

5.2.1.4 Chemical and Biological Simulants

There is a potential for indirect effects on the shortnose and Atlantic sturgeon through exposure to simulants deposited on the water during testing. To estimate risks to the shortnose sturgeon, concentrations of chemical simulants potentially entering the Potomac River were modeled. A detailed description of the modeling methods is provided in the DEIS for outdoor RDT&E activities (NSWCDL, in preparation), and the results of the modeling relevant to the shortnose and Atlantic sturgeon are discussed here.

Chemical Simulant Modeling

The predicted maximum surface deposition levels for representative chemical simulants are summarized in Table 5-13, based on the maximum amount of simulant tested and conditions that would result in the highest deposition rate. The maximum deposition that would occur in any one area, the total mass of simulant deposited, and the surface area that would receive a concentration of more than 0.01 milligram per square meter (mg/m^2) are presented here.

Table 5-13
Predicted Maximum Surface Deposition Levels

Chemical	Maximum Deposition Level (mg/m^2)	Total Mass Deposition (kg)	Surface Area with Concentrations Above 0.01 mg/m^2 (km^2)
Diethyl malonate (DEM)	3.6E +04	2.59	4.3E-03
Dimethyl adipate (DMA)	1.2E+05	75.9	2.3E-01
Dimethyl methylphosphonate (DMMP)	2.8E+01	3.00E-03	6.8E-04
Glacial acetic acid (GAA)	9.9E+04	76.7	2.6E-01
Methyl salicylate (MeS)	8.3E+04	59.9	3.7E-02
Triethyl phosphate (TEP)	2.8E-01	4.00E-04	1.5E-03

Notes: mg/m^2 = milligrams per square meter; kg = kilograms; km^2 = square kilometers.

Aquatic Toxicity of Chemical Simulants

To determine potential impacts of simulants on aquatic organisms, a comparison of aquatic toxicity values of chemical simulants to estimated concentrations of simulants in surface water was performed. Table 5-14 lists aquatic toxicity values for chemical simulants modeled. The lowest available aquatic toxicity available, inclusive of algae, invertebrates, and fish, was selected for comparison with surface water concentrations for each simulant. A fish-based toxicity endpoint was selected for only one simulant, as the invertebrate *Daphnia* was generally more sensitive than fish to simulant exposure. This indicates that the toxicity endpoints selected are highly protective of fish, including the shortnose and Atlantic sturgeon, as they are based on the most sensitive organism tested.

Effect levels presented are generally the lowest lethal concentration 50 (LC50) threshold (i.e., the dose that kills 50 percent of the test organisms within a designated period) or the lowest effect concentration (EC50) threshold (i.e., the dose that has an adverse effect on 50 percent of the test organisms within a designated period) identified for representative organisms.

Table 5-14
Simulant Aquatic Toxicity Endpoints

	Toxicity Endpoint (mg/l)[1]	Reference
Diethyl malonate (DEM)	*Pimephales promelas* (fathead minnow) LC50 96-hr = **163** mg/l	Netzeva et al., 2005
Dimethyl adipate (DMA)	*Daphnia magna* EC50 (immobilization), 48-hr, **72** mg/l Green alga *Selenastrum capricornutum,* EC50 (Growth rate inhibition), 72-hr > 100 mg/l	Dow Chemical Company, 2008
Dimethyl methylphosphonate (DMMP)	Fish LC50 96-hr = 21,503 mg/l *Daphnia* EC50 16-d = **330** mg/l Green algae EC50 96-hr = 10,4967 mg/l	Nyden et al., 2000
Glacial acetic acid (GAA)	Shrimp LC50 48-hr = 100 - 300 mg/l *Pimephales promelas* (fathead minnow) LC50 96-hr = 88 mg/l/ Bluegill/Sunfish: LC50 96-hr = 75 mg/l Goldfish: LC50 24-hr = 423 mg/l *Daphnia*: EC50 96-hr = **32**-47 mg/l	Fischer Scientific Company, 2008
Methyl salicylate (MeS)	*Brachydanio reri* (zebrafish) LC0 96-hr = 42 mg/l *Daphnia* EC50 24-hr = **50** mg/l	The Good Scents Company, 2011
Triethyl phosphate (TEP)	*Leuciscus idus* (ide or orfe [fish]) LC50 48-hr = 2,140 mg/l *Daphnia magna* EC50 48-hr = **350** mg/l *Scenedesmus subspicatus* (alga) EC50 72-hr = 900 mg/l *Daphnia magna* EC50 21-d = 729 mg/l NOEC 21-d = 31.6 mg/l	UNEP, 1998

Notes:
[1] Exposure time varied from 24 hours to 21 days.
mg/l = milligrams per liter.
LC50= lethal concentration 50; LC0 = lethal concentration 0; EC50 = effect concentration 50; NOEC = no observed effect concentration.
Bolded numbers indicate the lowest effect concentration selected for toxicity comparisons.

To estimate the chemical-simulant exposure concentrations for aquatic organisms, the total amount of simulant deposited (in kg) for each test was divided by the area where it would be deposited at a concentration of greater than 0.01 mg/m^2. For example, as shown in Table 5-13, the total deposition of diethyl malonate (DEM) would be 2.59 kg (2.59 x 10^6 mg) over an area of 0.0043 km^2 (4,300 m^2). A 1-m (3-ft) mixing depth in the surface water was assumed so that the deposition rate (m^2 converted to m^3) was divided by 1,000 (1 m^3 = 1,000 liters) to determine the exposure concentration. Assuming a 1-m mixing depth, the exposure concentration of DEM would be:

$$2.59 \text{ x } 10^6 \text{ mg} \div (4.3 \text{ x } 10^3 \div 1{,}000) = 0.60 \text{ mg/l}$$

However, these concentrations would be even further diluted before reaching the shortnose or Atlantic sturgeon, which are bottom-dwellers that generally stay below the surface of the water.

Maximum predicted exposure concentrations are provided for all modeled simulants in Table 5-15 along with a comparison to the lowest aquatic toxicity values found for each simulant. As shown in this table, all exposure concentrations are more than an order of magnitude below the lowest value found, indicating that simulant testing would have no adverse effects on the shortnose or Atlantic sturgeon. In addition, the shortest exposure time used to derive the aquatic values is 24 hours. This is far longer than the time period during which the maximum concentration of simulants would be present, as simulants would be rapidly diluted upon entering the Potomac River, resulting in much lower exposure concentrations than presented here.

Table 5-15
Maximum Predicted Simulant Exposure Concentrations

Chemical	Total Mass Deposition (kg)	Surface Area with Concentration > 0.01 mg/m^2 (km^2)	Exposure Concentration (mg/l)	Lowest Aquatic Toxicity Value (mg/l)
Diethyl malonate (DEM)	2.59	4.30E-03	6.02E-01	163
Dimethyl adipate (DMA)	75.9	2.34E-01	3.25E-01	72
Dimethyl methylphosphonate (DMMP)	3.00E-03	6.79E-04	4.42E-03	330
Glacial acetic acid (GAA)	76.7	2.57E-01	2.98E-01	32
Methyl salicylate (MeS)	59.9	3.71E-02	1.61E+00	42
Triethyl phosphate (TEP)	4.00E-04	1.45E-03	2.765E-04	80

Notes: mg/l = milligrams per liter; kg = kilograms; km^2 = square kilometers.

Monitoring performed during simulant testing in 2003, 2005, and 2009 supports the modeling that indicates that ecological risks from simulant testing are minimal (NSWCDL, 2004; NSWCDL, 2005; NSWCDL, 2009). The 2003 field testing results indicated that one-hundredth of a percent (0.01%) of the 4-gal (15.1-l) release for the GAA test "rained out" over an area of 1,916 sq m (4,962 sq km), resulting in a total deposition mass of about 1.28 g GAA (Naval Surface Warfare Center Dahlgren Division [NSWCDD], 2003) – far lower than the 76.7 kg of

GAA estimated for a 20-gal (75.7-l) release of GAA. All exposure concentrations were more than an order of magnitude below the lowest toxicity value found, indicating that chemical simulant testing would have no adverse effects on aquatic life in the water (NSWCDD, 2003).The use of chemical simulants on the PRTR has not resulted in any observable environmental effects (NSWCDL, 2004; NSWCDL, 2005; NSWCDL, 2009).

Additionally, during previous testing, simulant releases were spaced so that no land or water area was exposed multiple times to the same simulant (NSWCDL, 2009). When quantities of more than 5 gals (18.9 l) are to be used, crosswind releases could be specified by the Test Director in order to limit the dosage of simulant as the cloud passes over any area of land or water.

Biological Simulants

No modeling was performed for biological simulants, for NSWCDL would only use BSL-1 simulants, many of which are ubiquitous and often found in high concentrations in nature, including in water (Center for Research Information, Inc., 2004; USEPA, 1997). There are no published reports of disease associated with these BSL-1 organisms in aquatic plants or animals, nor are they considered to be disease-causing agents. The small concentrations of these simulants deposited on the water are not expected to cause any significant increase in the resident bacteria, fungal, or bacteriophage populations or have any indirect effects on the shortnose or Atlantic sturgeon.

5.2.1.5 Vessel Traffic

As described in Section 5.1.1.5, performance of the various RDT&E activities would reduce the overall vessel traffic on the river during testing, even though the number of hours of usage would increase. There are no indirect effects anticipated from the proposed action, as shortnose and Atlantic sturgeon are generally found near the bottom, well away from vessel traffic, and vessel traffic is considered to have insignificant effects on water and sediment quality. The depth of areas outside of the range where vessels may travel during RDT&E activities is also sufficient so that no indirect effects are anticipated. Therefore, no indirect effects on sturgeon are expected.

5.2.2 Sea Turtles

The potential indirect effects on sea turtles from implementation of the proposed action include increases in suspended sediment, decreases in water quality, habitat disturbance, and disturbance of sea turtles. These potential indirect effects are considered below for each type of proposed action activity.

5.2.2.1 Ordnance

Under all alternatives of the proposed action, the number of large-caliber projectiles fired annually in the PRTR would be similar to the levels of the last 15 years. Indirect effects on sea turtles from testing are potential increases in suspended sediments in the water column and water and/or sediment quality impairment from munitions constituents. The levels of suspended sediments in the water column and concentrations of munitions constituents in water and sediments would be lower than those described in Section 5.2.1.1 for the shortnose and Atlantic sturgeon, as concentrations would be diluted to undetectable levels by the time they reach the level of Sandy Point, Virginia/Piney Point, Maryland in the lower LDZ, the upper limit of where sea turtles have been observed in the Potomac River.

Sea turtle auditory sensitivity is not well studied, although research completed to date suggest that it is limited to low-frequency bandwidths. Studies using green, loggerhead, and Kemp's ridley turtles found that sensitivity varies slightly by species and age class (Ketten and Bartol 2006). Sea turtles possess an overall hearing range of approximately 100 to 1,000 Hz, with an upper limit of 2,000 Hz (Ridgway et al., 1969; Ketten and Bartol, 2006).

Sound travels about 4.5 times faster in water than in air, at a speed of about 1,500 m per second, depending on the depth, temperature, and salinity of the water (OceanLink, 2011). Sea turtles are likely to hear low frequency explosions underwater, but given the current ambient sound levels in the Potomac River, the amount of sound contributed by ordnance RDT&E activities is considered to be low. Preliminary data examining computerized tomography scan images of a 100 pounds per square inch shock wave exposure on a small (12 in [30 cm] long) Kemp's ridley carcass (NFS, 2011). No ear or lung damage was evident on the scans, whereas a dolphin would have shown obvious damage at this level, indicating that turtles are less sensitive to explosions than marine mammals (NFS, 2011). It is not anticipated that sea turtles would suffer any long-term consequences from ordnance sound, particularly because projectiles would not be fired in areas where sea turtles may be found, and the closest explosions would occur over 7 NM (13 km) upriver (Figure 1-3).

5.2.2.2 Electromagnetic Energy

As described in Section 5.1.1.2, almost all EM energy being tested by NSWCDL would occur above the surface of the water and would have no contact with sea turtles or their habitat. There would be no EM energy generated underwater and, therefore, there would be no indirect effects on sea turtles from EM energy RDT&E activities.

5.2.2.3 Lasers

As described in Section 5.1.1.3, all current or proposed testing using outdoor lasers would occur above the surface of the water. As lasers are not anticipated to enter the water and, in the unlikely event of their doing so, the beam power would be immediately reduced, there would be no indirect effects on sea turtles from laser testing.

5.2.2.4 Chemical and Biological Simulants

Simulants deposited on the water during testing may be carried downriver to areas where sea turtles may be found. The chemical simulant modeling presented in Section 5.2.1.4 concluded that concentrations of simulants would be well below aquatic toxicity values. Biological simulants deposited on the water are not expected to cause any significant increase in the resident bacteria, fungal, or bacteriophage populations. The extremely low concentrations of chemical and biological simulants in the LDZ would not result in any indirect effects on sea turtles.

5.2.2.5 Vessel Traffic

As described in Section 5.1.1.5, performance of the various RDT&E activities should slightly reduce the overall vessel traffic on the river during testing, primarily in the MDZ. The overall vessel traffic effects on water and sediment quality are considered to be insignificant. Therefore, there would be no indirect effects on sea turtles.

5.3 Potential Cumulative Effects

Potential cumulative effects discussed in this section cover both the combined effects of the action components and non-action-related cumulative effects (e.g., non-action-related developments along areas of the PRTR) where proposed action activities may occur.

Cumulative impacts to surface water/aquatic habitat would occur in the near future and future time frames and would consist mostly of temporary construction impacts from the Nice Bridge Improvement Project and a planned private development project. These projects are described in detail below. One current project, the Morgantown Power Plant project, also has the potential for long-term cumulative impacts, as described in this section.

Governor Harry W. Nice Memorial Bridge Improvement Project

The Nice Bridge is a section of US Route 301 that crosses the Potomac River, connecting Charles County, Maryland and King George County, Virginia between the PRTR UDZ and MDZ. The Nice Bridge is 1.7 mi (2.7 km) long and has one travel lane in each direction, with no median separation and a narrow offset on each side. In July 2009, the Maryland Transportation Authority (MdTA) released an environmental assessment (MdTA, 2009) that evaluates alternatives to upgrade the bridge, and improve traffic flow and safety by adding two lanes of traffic. Four sets of alternatives were considered: Alternate 1 is the no-build alternative and would include extensive rehabilitation of the existing bridge; Alternates 2 and 4 would rehabilitate the existing two-lane bridge and build a new two-lane span adjacent to it; Alternates 3 and 5 would replace the existing two-lane bridge and build a new two-lane span adjacent to it; and Alternates 6 and 7 would build a new four-lane bridge and take the existing structure out of service. The build alternatives – Alternates 2 through 7 – provide reasonable tie-in points with the existing and planned highway network, capacity for 2030 traffic demand, the ability to maintain two-way traffic flow, improved safety on approach roadways and the bridge, and the ability to comply with navigational-channel guidelines. The build alternatives would require an alignment shift of the US Route 301 approach roadways to connect to the new bridge, and each includes a barrier-separated bicycle/pedestrian path (MdTA, 2009).

A BA was prepared to address construction impacts on the shortnose sturgeon from improvements to the Nice Bridge (MdTA, 2008). This BA is also considered applicable to the Atlantic sturgeon due to the similarity of the two species. The Nice Bridge is located well upriver of the area where sea turtles have been observed and, therefore, would have no direct effect on them. Impacts to shortnose sturgeon habitat due to construction could include increased turbidity, and pollution from disturbed sediments and runoff from impervious surfaces. Sediment deposits and turbidity from dredging also could disrupt the sturgeon's foraging habitat. During the planning and design of the project, avoidance and minimization measures, such as implementation of specialized construction methods, would be used for the protection of sensitive resources, including the shortnose sturgeon. Potential water-quality impacts due to construction and the increase in impervious surfaces related to the project would be managed through implementation of erosion- and sediment-control best management practices within the study area. The BA concluded that the Nice Bridge Improvement Project is not likely to adversely affect the shortnose sturgeon based on the best available scientific data (MdTA, 2008).

NMFS will issue a decision after a proposed action is selected (Blum, pers. comm., June 19, 2009). In May 2010, the MdTA issued for review a draft Preferred Alternate/Conceptual Mitigation document (MdTA, 2010) that recommends Modified Alternate 7 – i.e., Alternate 7 with a modified bicycle/pedestrian option – as the proposed action. Modified Alternate 7 comprises the installation of a new four-lane bridge to the north of the existing bridge, with a single, barrier-separated, two-way bicycle/pedestrian path on the south side of the new bridge. The existing bridge would be removed under Modified Alternate 7.

Villages at Swan Point

US Steel Corporation and Brookfield Homes Corporation are proposing to expand a development project initiated in the 1980s at Swan Point in Issue, Maryland, which is approximately 7 miles (11 km) southeast of NSF Dahlgren along the MDZ. The earlier development built the existing Swan Point Yacht and Country Club community, which consists of 322 homes, a golf course, and a marina. The project would add 1,500 homes to the 897-acre (363-hectare) site on the Weir Peninsula, along with a hotel, a private beach, six observation piers, retail shops, restaurants, and a 150-slip marina on the Potomac River at Weir Creek (Degregorio, 2006; McConaty, 2007). The project also includes shoreline stabilization along the shore of the river and a bridge over Weir Creek.

One of the early concerns regarding the planned Villages at Swan Point was that the 0.07-million gallons per day (mgpd) (0.26-million liters per day [mlpd]) capacity of the Swan Point Wastewater Treatment Plant was insufficient to accommodate the influx of people that would live in the new development. To accommodate the planned development, the plant, which discharges to Cuckold Creek, was upgraded to a 0.6-mgpd (2.3-mlpd) enhanced nutrient removal wastewater treatment plant, capable of achieving an effluent with a total nitrogen goal of 3 mg/l and a total phosphorus goal of 0.3 mg/l (MDE, 2009). MDE (2009) data show a marked decrease in nitrogen and phosphorus loading in Cuckold Creek since the upgrade was completed in 2007.

In 2006, Charles County had approved a master plan and general development plan for the Villages at Swan Point (Dailey, pers. comm., June 3, 2010). The preliminary subdivision plan for the first phase of the development was presented to the county planning commission and reviewed in September 2008. However, certain habitat protection requirements that were imposed as conditions on the growth allocation approvals need to be fulfilled prior to the approval by the county of the first Villages at Swan Point preliminary subdivision plan or preliminary site plan. Initiation of construction of all components of the development has been delayed because of the state of the economy and the housing market. Brookfield Homes anticipates that construction will likely begin in 2012 (Lannin, pers. comm., July 25, 2010).

Morgantown Generating Station Coal Fly Ash Beneficiation Facility

The Morgantown generating station is located just south of the Nice Bridge landing in Charles County, Maryland, across the river from NSF Dahlgren. The owner of the generating station, Mirant Corporation, is proposing to modify the station to install a coal fly ash beneficiation facility and associated truck loading and offloading equipment (Mirant Mid-Atlantic, LLC, 2010). The beneficiation facility would use staged turbulent air reactor thermal process technology to convert high-carbon fly ash that is otherwise unsuitable for commercial use into low-carbon mineral admixture material suitable for use as a Portland cement substitute. The facility would enable the Mirant Corporation to avoid landfilling as much as 400,000 tons of fly ash annually from the Morgantown generating station and the Chalk Point generating station. The facility also would reduce greenhouse gas emissions from the manufacture of Portland cement that is displaced by the sale of processed fly ash. The proposed beneficiation facility and associated equipment would be constructed on previously-disturbed areas within the existing generating station property (Mirant Mid-Atlantic, LLC, 2010).

Mirant Corporation submitted an environmental analysis of the potential environmental effects of the proposed project (Mirant Mid-Atlantic, LLC, 2010) to the Public Service Commission of Maryland in March 2010, as part of its application for a certificate of public convenience and necessity. The proposed beneficiation facility would require water for the flue gas desulfurization (FGD) process (23.5- to 50-gallon per minute [gpm] makeup water rate, with 30-gpm average bleed rate), nitrogen oxides process/control quench (24 gpm), process equipment washdown (up to 50-gpm intermittent use), and non-process potable water use (15 gpm). The water required for operation of the facility would be obtained from the generating station's existing FGD reverse osmosis system. A small amount of water would be obtained from the generating station's existing river water intake, but would not require extra flow and would not impact the current 1,500-mgpd intake rate.

The FGD wastewater would be used in the generating station's sulfur dioxide scrubber absorber and subsequently would be routed to the existing FGD wastewater treatment system. The existing FGD wastewater treatment system discharges a maximum of 275 gpm of effluent at a temperature of 95˚F to the generating station's once-through cooling water discharge canal. The beneficiation facility would not measurably increase the discharge of treated FGD wastewater, and would have no effect on the existing thermal discharge or on the circulation patterns in the Potomac River. Wastewater from the equipment washdown would be routed to the generating station's existing stormwater management system and wastewater from non-process potable water use would be routed to the existing sewage treatment plant.

The permit application for the proposed project currently is being reviewed by the State of Maryland.

5.3.1 Cumulative Direct Effects

Potential cumulative direct effects of the proposed action combined with the other projects described above on the shortnose and Atlantic sturgeon include disruption of migratory movements and spawning, incidental vessel strikes, and habitat disturbance. There would be no direct effects associated with dislodging eggs and increased concentrations of suspended sediment (e.g., burial of eggs, smothering of larvae), as spawning does not and is not expected to occur in the PRTR. Cumulative direct effects of the proposed action and non-action-related direct effects are not expected to impact shortnose sturgeon or Atlantic sturgeon in the PRTR. Increases in NSWCDL vessel traffic would be sporadic and would be offset by reductions in non-NSWCDL vessel traffic so would not result in an increase of overall vessel traffic on the river at any one time.

Sea turtles are not present in the MDZ, where most RDT&E activities would take place. The only potential for direct effects would be from the use of vessels in the LDZ, which is considered to be discountable.

5.3.2 Cumulative Indirect Effects

Potential indirect effects of the proposed action combined with the other projects described above on the shortnose and Atlantic sturgeon include alteration of existing habitat and potential increases in contaminant concentrations in sediments and the water column from the introduction of munitions and chem/bio simulants into the Potomac River. Sea turtles may also be indirectly affected by the introduction of munitions and chem/bio simulants into the Potomac River.

Analyses indicate that no adverse effects are anticipated from any of the potential activities that could increase suspended solids or contaminant concentrations in the water column. It is assumed that non-action-related developments would follow federal, state, and local regulations so that they would not result in any indirect effects on the shortnose sturgeon. Likewise, no water- or sediment-quality impairment would result from the RDT&E activities in areas where the shortnose and Atlantic sturgeon and sea turtles are known to occur. Therefore, cumulative indirect effects are considered insignificant.

5.4 Conservation Measures

At the present time, no conservation measures are required to protect the shortnose sturgeon, Atlantic sturgeon, or sea turtles. If potential impacts to any of these species are identified, they can be effectively avoided or minimized using a combination of commonly-practiced biological impact-reduction techniques.

As discussed above, potential direct and indirect effects on shortnose and Atlantic sturgeon resulting from the expanded use of the PRTR may include disruption of migratory movements through the area before and after spawning, alteration of foraging substrate, increased levels of suspended solids and sedimentation during munitions testing, and exposure to munitions constituents and chem/bio simulants. Currently these effects are considered to be insignificant. NSWCDL will continue to coordinate with the USFWS, NMFS, MDNR, and researchers to stay abreast of information on shortnose and Atlantic sturgeon in the Potomac River, inclusive of unexpected developments, in order to determine whether any conservation measures are necessary and should be implemented.

The potential direct and indirect effects on sea turtles are limited to exposure to munitions constituents and chem/bio simulants comparable to background levels and range vessels using the LDZ. Currently these effects are considered to be insignificant. NSWCDL will continue to coordinate with NMFS, MDNR, and researchers to stay abreast of information on sea turtles in the Potomac River, inclusive of unexpected developments, in order to determine whether any conservation measures are necessary and should be implemented.

THIS PAGE INTENTIONALLY LEFT BLANK

6 Conclusions

6.1 Shortnose and Atlantic Sturgeon

Shortnose and Atlantic sturgeon have been captured in the PRTR (Figure 4-2 and 4-3), where the proposed action would be implemented. Shortnose sturgeon capture and tracking data from the Potomac River indicate that a limited number of adult shortnose sturgeon are present in the upriver portion of the PRTR, generally in less saline water (Kynard et al., 2009). Shortnose sturgeon are found at an extremely low density in the Potomac River, and much of their time appears to be spent in the freshwater and less-saline regions of the river, upstream of the PRTR, where they are unlikely to be directly affected by the proposed action. No shortnose sturgeon spawning has been documented in the Potomac River to date; however, if spawning were to occur, it would likely take place well upriver of the proposed action, near Little Falls.

Atlantic sturgeon are more commonly found in the Potomac River than shortnose sturgeon, but the number of individuals found in the PRTR is still quite limited. Atlantic sturgeon spend much more of their lives in marine waters than do shortnose sturgeon and are found primarily in the lower, more saline portion of the Potomac River based on capture records. There are no records of Atlantic sturgeon spawning in the Potomac River; however, if Atlantic spawning were to occur, it would likely take place well upriver of the proposed action, between Little Falls and Great Falls.

Potential direct effects on the shortnose and Atlantic sturgeon include physical injury or death, disruption of migration or reproduction, and direct alteration of habitat. Under the proposed action, the number of large-caliber projectiles fired into the PRTR would not increase from current levels. Given the small number of live projectiles detonating underwater, the small area that would be encompassed by a projectile detonating close to the surface of the water, the large target area of munitions firing (diffuse zone), the intermittent nature of the testing, and the small number of shortnose and Atlantic sturgeon in the Potomac River (with even fewer present in target areas), the probability of a migrating or resident sturgeon's being hit by a projectile or by an associated shockwave is discountable.

No direct effects from EM energy or HE lasers are anticipated, as the work done outdoors by NSWCDL would involve little-if-any interaction with the Potomac River. Further, EM energy and laser beams that breach the water surface would be absorbed, scattered, or reflected off of organic and inorganic molecules, rapidly dissipating the energy and resulting in insignificant potential effects.

There would be no direct effects of chem/simulant testing on sturgeon as this testing would occur above the water surface with only low concentrations of simulants entering the water.

The proposed increase in RDT&E activities would increase the number of hours NSWCDL's test-related vessels are on the Potomac River. However, all other vessel traffic would decrease during testing because public access would be restricted. Locations that support large ports and have relatively narrow waterways have reported strikes of Atlantic sturgeon by deep draft vessels (which are very rarely used during RDT&E activities). Incidental vessel strikes, which may also occur during adult sturgeon breaching behavior, are not expected to occur during proposed action activities because of the low number of shortnose and Atlantic sturgeon found in the Potomac River and the limited number of breaching occurrences. The likelihood of direct effects from increased vessel traffic associated with the proposed action is considered discountable.

Potential indirect effects on the shortnose and Atlantic sturgeon from implementation of the proposed action include increases in suspended sediment, decreases in water quality, and habitat disturbance. Indirect effects based on modeled concentrations of munitions constituents in water, sediments, and fish tissue would be well below levels associated with adverse effects. Indirect effects on concentrations of suspended sediments, migration, and habitat as a food source are also considered to be insignificant.

No indirect effects from EM energy or HE lasers are anticipated, as any EM energy and laser beams that breach the water surface would be absorbed, scattered, or reflected off of organic and inorganic molecules, rapidly dissipating the energy and minimizing the effect on biological organisms in the water.

Testing of chem/bio simulants would deposit minimal concentrations of simulants on the water surface. All exposure concentrations were more than an order of magnitude below the lowest aquatic toxicity value found. Based on the low concentrations deposited, the low chemical toxicity, the rapid dilution of simulants, and the widespread presence in the environment of the BSL-1 organisms used for biological testing, no indirect effects would result from chem/bio simulant RDT&E.

Given the existing vessel traffic on the Potomac River and the fact that vessel traffic would be reduced during RDT&E activities (because of public access restrictions during testing), the increase in number of hours that the PRTR may be used for activities under the proposed action would have insignificant effects on water and sediment quality.

As potential direct and indirect effects on the shortnose and Atlantic sturgeon discussed in this BA are considered to be discountable, no specific conservation measures aside from the coordination discussed in Section 5.4 are required for their protection.

The proposed action may affect, but is not likely to adversely affect, the shortnose and Atlantic sturgeon.

6.2 Sea Turtles

Three sea turtle species – loggerhead, Kemp’s ridley, and green – are known to occur in the lower Potomac River based on reported stranding and/or incidental capture incidents (Figures 4-4 and 4-5). The range of these turtles does not extend upriver to the part of the PRTR where NSWCDL’s RDT&E activities could directly impact them. Most of NSWCDL’s activities and vessel use on the PRTR take place in the MDZ (Figure 1-1), and this would remain the case under the proposed action. NSWCDL uses the LDZ much less frequently than the MDZ and for only limited types of activities, primarily in the upper LDZ.

The proposed action activities evaluated in this report would be well removed from the lower portion of the LDZ, where sea turtles are known to occur. Projectile testing would occur more than 7 NM (13 km) upriver of where sea turtles may be present and there would be no possibility of a sea turtle being in the vicinity of a detonation. The only potential spatial overlap is the use of range boats, barges, and occasionally larger vessels in the lower LDZ. The probability of any of these vessels coming into contact with a sea turtle is the same as any other vessel near the mouth of the Potomac River and is anticipated to be extremely low. Therefore, no direct effects on sea turtles are expected from any RDT&E activities included in the proposed action.

The potential indirect effects on sea turtles from implementation of the proposed action include increases in suspended sediment, decreases in water quality, habitat disturbance, and disturbance of sea turtles. As discussed for the sturgeon, indirect effects of munitions constituents in water, sediments, and fish tissue would be well below levels associated with adverse effects.

No indirect effects on sea turtles from EM energy or HE laser are anticipated, as any EM energy and laser beams that breach the water surface would be absorbed, scattered, or reflected off of organic and inorganic molecules, rapidly dissipating the energy and minimizing the effect on biological organisms in the water.

Concentrations of chem/bio simulants used in RDT&E would also be far below levels associated with adverse effects. Indirect effects on concentrations of suspended sediments, migration, and habitat as a food source are also considered to be insignificant.

The change in vessel traffic on the Potomac River would be minimal, resulting in insignificant, if any, effects on water and sediment quality.

As sea turtles would not be directly affected by the proposed action and indirect effects are insignificant, no specific conservation measures aside from the coordination discussed in Section 5.4 are required for their protection.

The proposed action will have no effect on sea turtles in the Potomac River.

THIS PAGE INTENTIONALLY LEFT BLANK

7 References

American National Standards Institute (ANSI). 2007. Z136.1, Safe Use of Lasers and Z136.6 Safe Use of Lasers Outdoors.

Atlantic Sturgeon Status Review Team (ASSRT). 2007. *Status Review of Atlantic sturgeon* (*Acipenser oxyrinchus oxyrinchus*). Report to National Marine Fisheries Service, Northeast Regional Office. 174 pp. February 23, 2007.

Babin, M. and D. Stramski. 2002. “Light Absorption by Aquatic Particles in the Near-Infrared Spectral Region”. *Limnology and Oceanography* 47(3):911-915.

Bai, J., J. Liu, Y. Huang, Y. Liu, L. Sun, D. Liu, and E.S. Fry. 2007. Investigations of the attenuation coefficient of a narrow-bandwidth pulsed laser beam in water. *Applied Optics* 46(27):6804-6808.

Bai, J., J. Shi, M. Ouyang, X. Chen, W. Gong, H. Jing, J. Liu, and D. Liu. 2008. Method for measuring the threshold value of stimulated Brillouin scattering in water. *Optics Letters* 33(13):1539-1541.

Bain, M.B. 1997. Atlantic and shortnose sturgeons of the Hudson River: Common and divergent life history attributes. *Environmental Biology of Fishes* 48:347–358.

Bemis, W.E. and B. Kynard. 1997. Sturgeon rivers: An introduction to Acipenseriform biogeography and life history. *Environmental Biology of Fishes* 48(1/4):167-183.

Blankenship, P. 2007. James River survey turns up 175 sturgeon, including a spawning male. Bay News, Volume 17, Number 6. [website] Accessed on 25 January 2011 and 1 September 2011. Available from <http://www.bayjournal.com/article.cfm?article=3153>.

Blum, Megan. 2009. Personal communication by Email with Megan Blum, Maryland Transport Authority, June 19, 2009.

Boulnois, J.L. 1986. Photophysical Processes in Recent Medical Laser Developments: a Review. *Lasers in Medical Science* 1:47-66.

Brown, J.J. and G.W. Murphy. 2010. Atlantic Sturgeon Vessel-Strike Mortalities in the Delaware Estuary. *Fisheries* 35(2):72-83.

Buckley, J., and B. Kynard. 1981. Spawning and rearing of shortnose sturgeon from the Connecticut River. *Progress in Fish Culture* 43:74–76. As cited in NMFS, 1998.

Calamari, D., G.F. Gaggino, and G. Pacchetti. 1982. Toxicokinetics of low levels of Cd, Cr, Ni and their mixture in long-term treatment on *Salmo gairdneri Rich*. *Chemosphere* 11: 59-70.

Carter, V., N.B. Rybicki, J.M. Landwehr, J.T. Reel, and H.A. Ruhl. 1998. Correlations among Seasonal Water Quality, Discharge, Weather, and Coverage by Submersed Aquatic Vegetation in the Tidal Potomac River and Potomac Estuary, 1983-96. United States Geological Survey, Reston, Virginia. Open-File Report 98-657.

Center for Research Information, Inc. 2004. Health Effects of Project Shad Biological Agent: *Bacillus Globigii [Bacillus licheniformis] [Bacillus subtilis var. niger] [Bacillus atrophaeus]*. Prepared for the National Academies. [website]. Available from <http://www.iom.edu/Object.File/Master/43/432/BACILLUS%20GLOBIGII.pdf>.

Coleman, R.L and J.E. Cearley. 1974. Silver toxicity and accumulation in largemouth bass and bluegill. *Bulletin of Environmental Contamination and Toxicology* 12:53–61.

Coles, W.C. 1999. Aspects of the Biology of Sea Turtles in the Mid-Atlantic Bight. Ph.D dissertation, School of Marine Science, College of William and Mary, Virginia. [website] Available from <http://web.vims.edu/library/Theses/Coles99.pdf>.

Cosby, E.B., Assistant Executive Secretary, Potomac River Fisheries Commission. February 25, 2009. Email to Jessica G. Joyce, Scientist, AECOM.

Crance, J.H. 1986. Habitat suitability index models and instream flow suitability curves: shortnose sturgeon. Biological Report 82 (10.129). United States Fish and Wildlife Service, Washington, DC.

Dadswell, M.J. 1979. Biology and population characteristics of the shortnose sturgeon, *Acipenser brevirostrum* LeSueur, 1818 (Osteichthyes: Acipenseridae), in the Saint John River estuary, New Brunswick, Canada. *Canadian Journal of Zoology* 57: 2186-2210.

Dadswell, M.J., B.D. Taubert, T.S. Squiers, D. Marchette, and J. Buckley. 1984. Synopsis of Biological Data on Shortnose Sturgeon, *Acipenser brevirostrum* LeSueur 1818. National Oceanic and Atmospheric Administration (NOAA) Technical Report NMFS 14, National Marine Fisheries Service, Washington, D.C.

Dailey, Aimee S. June 3 and 4, 2010. Planner III, Charles County Department of Planning and Growth Management. Emails to and telephone conversation with Vic Frankenthaler, Senior Scientist, AECOM.

Dean, B. 1894. Recent experiments in sturgeon hatching on the Delaware River. *U.S. Fish Commission Bulletin.* (1893) 13:335-339.

De Giacomo, A., M. Dell'Aglio, O. De Pascale, and M. Capitelli. 2007. Spectroscopic investigation of laser-water interaction beyond the breakdown threshold energy. *Spectrochimica Acta Part B* 62:87-93.

Degregorio, Jen. 2006. "U.S. Steel's Swan Point Project Moving Forward". *The Daily Record (Baltimore)*. October 10, 2006.

Dodd, C.K., Jr. 1988. Synopsis of the biological data on the loggerhead sea turtle *Caretta caretta* (Linnaeus 1758). US Fish and Wildlife Service Biological Report 88(14). 110 pages.

Dolgaev, S.I., A.V. Simakin, and G.A. Shafeev. 2003. Laser beam propagation in opaque liquids. In *Laser Processing of Advanced Materials and Laser Microtechnologies,* Friedrich H. Dausinger, Vitali I. Konov, Vladimir Yu. Baranov, Vladislav Ya. Panchenko, (eds.). Proceedings of SPIE. Vol. 5121.

Dovel, W.L. 1981. The endangered shortnose sturgeon of the Hudson estuary: Its life history and vulnerability to the activities of man. Final Report to the Federal Energy Regulatory Commission by the Oceanic Society, 139 pp. As cited in NMFS, 1998.

Dow Chemical Company. 2008. *Safety Data Sheet: Dimethyl Adipate Pure.* Revision Date: 2008/11/08, Print Date: 7 February 2008. Available from http://www.dow.com/PublishedLiterature/dh_014d/0901b8038014d8fa.pdf?filepath=custproc/pdfs/noreg/114-00074.pdf&fromPage=GetDoc.

Ehrhardt, L.M. and R.G. Yoder. Marine Turtles of Merritt Island National Wildlife Refuge, Kennedy Space Center, Florida. Pages 25-30 in Henderson, G.E. (editor.) Proceedings of the Florida and Interregional Conference on Sea Turtles. Florida Research Publication Number 33. As cited in NMFS and USFWS, 2008.

Epperly, S. P., J. Braun and A. J. Chester. 1995a. Aerial surveys for sea turtles in North Carolina inshore waters. *Fishery Bulletin* 93:254-261.

Epperly, S. P., J. Braun and A. Veishlow. 1995b. Sea turtles in North Carolina waters. *Conservation Biology* 9(2):384-394.

Eyler, Sheila. January 11, 2011. United States Fish and Wildlife Service, Maryland Fishery Resources Office. Shortnose and Atlantic Sturgeon Data Request for the Potomac River. Email and data sent to Helen Chernoff, Senior Scientist, AECOM.

Eyler, Sheila and Mike Mangold. January 11, 2011. United States Fish and Wildlife Service, Maryland Fishery Resources Office. Email to Helen Chernoff, Senior Scientist, AECOM.

Farmer, G.J., D. Ashfield, and H.S. Samant. 1979. Effects of zinc on juvenile Atlantic salmon *Salmo salar*: Acute toxicity, food intake, growth and bioaccumulation. *Environmental Pollution* 19:103–117.

Fischer Scientific Company. 2008. *Material Safety Data Sheet: Acetic Acid. MSDS Creation* Date: 21 July 1999. Revision #14 Date: 30 September 2008. [website] Accessed on 1 July 2009 and 1 September 2011. Available from <http://fscimage.fishersci.com/msds/00120.htm>.

Frick, M.G., C.A. Quinn, and C.K. Slay. 1999. *Dermochelys coriacea* (leatherback sea turtle), *Lepidochelys kempi* (Kemp's ridley sea turtle), and *Caretta caretta* (loggerhead sea turtle) Pelagic feeding. *Herpetological Review* 30 (3): 165.

Gore, J.A. 1979. Patterns of initial benthic recolonization of a reclaimed coal strip-mined river channel. *Canadian Journal of Zoology* 57:2429-39.

Greene, K. E., J. L. Zimmerman, R. W. Laney, and J. C. Thomas-Blate. 2009. Atlantic coast diadromous fish habitat: A review of utilization, threats, recommendations for conservation, and research needs. Atlantic States Marine Fisheries Commission Habitat Management Series No. 9, Washington, D.C. Chapter 8, Atlantic Sturgeon. [website]. Accessed on 26 January 2011. Available from <http://www.asmfc.org/diadromousSpeciesDocument.htm>.

Haley, N., and M. Bain. 1997. Habitat and food partitioning between two co- occurring sturgeons in the Hudson River estuary. Paper presentation at the Estuarine Research Federation Meeting, Providence, Rhode Island, October 14, 1997. As cited in ASSRT, 2007.

Heppell, S.S., D.T. Crouse, L.B. Crowder, S.P. Epperly, W. Gabriel, T. Henwood, R. Marquez, and N.B. Thompson. 2005. A population model to estimate recovery time, population size, and management impacts on Kemp's ridley sea turtles. *Chelonian Conservation and Biology* 4(4):767-773. As cited in NMFS, USFWS, and SEMARNAT, 2010.

Hogarth, W.T. 2001. Testimony of William T. Hogarth, Ph.D., Assistant Administrator for Fisheries, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, United States Department of Commerce, on the Effects of Washington Aqueduct Discharges on the Endangered Shortnose Sturgeon, before the Subcommittee on National Parks, Recreation, and Public Lands, Committee on Resources, United States House of Representatives. October 30, 2001. [website]. Accessed on 28 May 2009. Available from <http://www.ogc.doc.gov/ogc/legreg/testimon/107f/hogarth1030.htm>.

Holcombe, G.W., D.A. Benoit, E.N. Leonard, J.M. McKim. 1976. Long-term effects of lead exposure on three generations of brook trout (*Salvelinus fontinalis*). *Journal of the Fisheries Research Board of Canada* 33:1731–1741. As cited in Jarvinen, and Ankley, 1999.

James River Association. 2011. New Sturgeon Spawning Reef in the Lower James. [website] Accessed on 1 September 2011. <http://www.jamesriverassociation.org/what-we-do/sturgeon-reef>.

Jarvinen, A.W. and G.T. Ankley. 1999. Linkage of Effects to Tissue Residues: Development of a Comprehensive Database for Aquatic Organisms Exposed to Inorganic and Organic Chemicals. SETAC Press, Pensacola, Florida.

Jezierska, B. and P. Sarnowski. 2002. The effect of mercury, copper and cadmium during single and combined exposure on oxygen consumption of *Oncorhynchus Mykiss Wal.* and *Cyprinus carpio L*. larvae. *Archives of Polish Fisheries* 10: 15-22.

Kahnle, A. W. and K. A. Hattala Bottom trawl survey of juvenile fishes in the Hudson River estuary. Summary Report for 1981-1986. New York State Department of Environmental Conservation. Albany, NY, USA. As cited in ASSRT, 2007.

Keinath, J.A. 1993. Movements and behavior of wild and head-started sea turtles. Ph.D. Dissertation. Virginia Institute of Marine Science, College of William and Mary, Gloucester Point, VA, 206 pp.

Ketten, D.R. and S.M. Bartol. 2006. Functional measures of sea turtle hearing. ONR Award Number N00014-02-1-0510 Prepared for the Office of Naval Research, Arlington, Virginia by Woods Hole Oceanographic Institution, Woods Hole, Massachusetts.

Knebel, H.J., Martin, E.A., Glenn, J.L., Needell, S.W. 1981. *Sedimentary Framework of the Potomac River Estuary*, Maryland in *Geological Society of America Bulletin* 92(1):578-589. August.

Kieffer, M. and B. Kynard. 1993. Annual movements of shortnose and Atlantic sturgeons in the Merrimack River, Massachusetts. *Transactions of the American Fisheries Society* 122: 1088-1103.

Kimmel, T.L. 2004. *Sea Turtle Tagging and Health Assessment Study in Maryland's Chesapeake Bay and Summary of Sea Turtle Strandings in Maryland, 1999-2003*. Maryland Department of

Natural Resources, Oxford Cooperative Laboratory. Submitted to National Marine Fisheries Service. March.

Kimmel, T.L. 2007. *Sea Turtle Tagging and Health Assessment Study in the Maryland Portion of Chesapeake Bay*. Maryland Department of Natural Resources, Oxford Cooperative Laboratory. Submitted to NOAA Fisheries Office of Protected Resources.

Kynard, B. 1997. Life history, latitudinal patterns, and status of the shortnose sturgeon. *Environmental Biology of Fishes* 48: 319-334.

Kynard, B., and M. Horgan. 2002. Ontogenetic behavior and migration of Atlantic sturgeon, *Acipenser oxyrinchus oxyrinchus*, and shortnose sturgeon, *A. brevirostrum*, with notes on social behavior. *Environmental Biology of Fishes* 63:137–150.

Kynard, B., M. Atcheson, M. Breece, M. Kieffer, and M. Mangold. 2007. Status of shortnose sturgeon in the Potomac River: Part 1- Field Studies. Final Report, National Park Service, National Capital Region, Washington, D.C. July 20, 2007.

Kynard, B., M. Breece, M. Atcheson, M. Kieffer, and M. Mangold. 2009. Life history and status of shortnose sturgeon (*Acipenser brevirostrum*) in the Potomac River. *Journal of Applied Ichthyology* 25(2):34-38.

Landwehr, J.M., J.T. Reel, N.B. Rybicki, H.A. Ruhl, and V. Carter. 1999. Chesapeake Bay Habitat Criteria Scores and the Distribution of Submersed Aquatic Vegetation in the Tidal Potomac River and Potomac Estuary, 1983-1997. United States Geological Survey, Reston Virginia, Open-File Report 99-219.

Lannin, Christopher. July 27, 2010. Brookfield Homes Corporation. Email to Penny Douglas, Project Manager, AECOM.

Li, J.C., D.R. Alexander, H.F. Zhang, U. Parali, D.W. Doerr, J.C. Bruce III, H. Wang. 2007. "Propagation of ultrashort laser pulses through water". *Optics Express* 15(4): 1939-1945.

Lipcius, R. N., and W. T. Stockhausen. 2002. Concurrent Decline of the Spawning Stock, Recruitment, Larval Abundance, and Size of the Blue Crab *Callinectes Sapidus* in Chesapeake Bay. *Marine Ecology-Progress Series* 226: 45-61. As cited in Seney, 2003.

Lippson, A.J., M.S. Haire, A.F. Holland, F. Jacobs, J. Jensen, R.L. Moran-Johnson, T.T. Polgar, and W.A. Richkus. 1981. Environmental Atlas of the Potomac Estuary. Baltimore and London: Johns Hopkins University Press.

Litwiler, T. 2001. Conservation Plan for Sea Turtles, Marine Mammals and the Shortnose Sturgeon in Maryland; Technical Report: FS-SCOL-01-2. Prepared by Fish and Wildlife Health Program, Sarbanes Cooperative Oxford Laboratory. November 2001.

Long, E.R. and L.G. Morgan. 1990. The potential for biological effects of sediment-sorbed contaminants tested in the National Status and Trends Program. NOAA Technical Memorandum, NOS OMA 64. Seattle: National Oceanic and Atmospheric Administration.

Lubatschowski H. and A. Heisterkamp. 2004. "Interaction with biological tissue". *Femtosecond* Technology *for Technical and Medical Applications, Topics in Applied Physics*. F. Dausinger, F. Lichtner, H. Lubatschowski, (eds.). Vol. 96: 91-105. Springer-Verlag Berlin Heidelberg.

Lutcavage, M., and J.A. Musick. 1985. Aspects of the biology of sea turtles in Virginia. *Copeia* (2): 449-456.

Mangin, E. 1964. Croissance en Longueur de Trois Esturgeons d'Amerique du Nord: *Acipenser oxyrhynchus,* Mitchill, *Acipenser fulvescens,* Rafinesque, et *Acipenser brevirostris* LeSueur. *Verhandlungen der Internationalen Vereinigung für Theoretische und Angewandte Limnologie* 15: 968-974. As cited in ASSRT, 2007.

Mansfield, K.L., Seney, E.E., and Musick, J.A. 2002a. An evaluation of sea turtle abundances, mortalities and fisheries interactions in the Chesapeake Bay, Virginia, 2001. Final Report to NMFS Northeast Regional Office, Gloucester, MA. Contract Number 43EANF110773, April 2002, 104p.

Mansfield, K.L., Seney, E.E., Fagan, M.A., Musick, J.A., Frisch, K.L., and Knowles, A.E. 2002b. An evaluation of interactions between sea turtles and pound net leaders in the Chesapeake Bay, Virginia. Final Report to NMFS Northeast Regional Office, Gloucester, MA. Contract Number EA133002SE0075, October 2002, 120 pp.

Mansfield, C.J. 2006. Sources of mortality, movement and behavior of sea turtles in Virginia. Ph.D dissertation, College of William and Mary, Virginia, 367p. [website]. Available from <http://www.sefsc.noaa.gov/seaturtledissertations.jsp>.

Marquez, M.R., ed. 1994. Synopsis of Biological Data on the Kemp's Ridley Turtle, *Lepidochelys kempi* (Garman, 1880). NOAA Technical Memorandum NMFS-SEFSC-343. 91 pp.

Maryland Department of Natural Resources (MDNR). Maryland Department of Natural Resources (MDNR). 2010. Fixed Station Monthly Monitoring. [website] Accessed June 2010. Available from <http://mddnr.chesapeakebay.net/bay_cond/index.cfm>.

Maryland Department of Natural Resources (MDNR). 2008. *Oyster bar data*. [website] Accessed August 2008. Available from <http://dnrweb.dnr.state.md.us/gis/data/>.

Maryland Department of Natural Resources (MDNR). 2009. Natural Heritage Program. [website] Accessed on 9 February 2011 and 1 September 2011. Available from <http://dnr.maryland.gov/wildlife/plants_wildlife/rte/rtesnsturgeon.asp>.

Maryland Department of Natural Resources (MDNR). 2011. *Sea Turtle Pound Net Tagging and Health Assessment Study in Maryland's Chesapeake Bay.* [website] Accessed on 1 September 2011. Available from <http://www.dnr.state.md.us/fisheries/oxford/research/fwh/taggingstudy/index.html>.

Maryland Department of the Environment (MDE). 2009. Facts About... Swan Point Wastewater Treatment Plant. [website]. Accessed in August 2009. Available from <http://www.mde.state.md.us/assets/document/enr/Swan_Point.pdf>.

Maryland Transportation Authority (MdTA). 2008. Biological Assessment for the Shortnose Sturgeon. Governor Harry W. Nice Memorial Bridge Improvement Project. July 2008.

Maryland Transportation Authority (MdTA). 2009. Environmental Assessment / Draft Section 4(f) Evaluation, Governor Harry W. Nice Memorial Bridge Improvement Project. Submitted by the MTA for the US Department of Transportation – Federal Highway Administration, and in cooperation with the US Army Corps of Engineers, the US Environmental Protection Agency, and the Virginia Department of Transportation. July 30, 2009.

Maryland Transportation Authority (MdTA). 2010. *Modified Alternate 7 Preferred Alternate / Conceptual Mitigation, Nice Bridge Improvement Project, Charles County, Maryland and King George County, Virginia.* MdTA Division of Capital Planning, Baltimore, Maryland. Draft, May 19, 2010.

McConaty, Nancy Bromley. October 2007. "Some Still Upset at Swan Point Plan". *Southern Maryland Newspapers Online*. [website]. Accessed August 2009. <http://www.somdnews.com/stories/101007/indymor91118_32134.shtml>. October 10, 2007.

Meehan, W.E. 1910. Experiments in sturgeon culture. *Transactions of the American Fisheries Society* 39:85-91. As cited in Crance, 1986.

Mirant Mid-Atlantic, LLC. 2010. Environmental Analysis, Application for CPCN Authorizing Modification of the Morgantown Generating Station. Prepared by Golder Associates Inc. for Mirant Mid-Atlantic, LLC. March 2010.

Morreale, S.J. and E.A. Standora. 2005.Western North Atlantic Waters: crucial developmental habitat for Kemp's ridley and loggerhead sea turtles. *Chelonian Conservation and Biology* 4(4):872-882.

Moser, M.L. and S.W. Roth. 1995. Habitat use and movements of shortnose and Atlantic sturgeon in the Lower Cape Fear River, North Carolina. *Transactions of the American Fisheries Society* 124:225-234. As cited in Litwiler, 2001.

Murawski, S. A. and A. L. Pacheco. 1977. Biological and fisheries data on Atlantic Sturgeon, *Acipenser oxyrhynchus* (Mitchill). National Marine Fisheries Service Technical Series Report 10: 1-69. As cited in ASSRT, 2007.

Musick, J.A. 2005. Essential Fish Habitat of Atlantic Sturgeon *Acipenser oxyrinchus* in Southern Chesapeake Bay. VIMS Special Scientific Report #145. The Virginia Institute of Marine Science, College of William and Mary. November 5, 2005.

National Marine Fisheries Service (NMFS). 1998. Final Recovery Plan for the Shortnose Sturgeon (*Acipenser brevirostrum*). Prepared by the Shortnose Sturgeon Recovery Team for the NMFS, Silver Spring, Maryland. 104 pages.

National Marine Fisheries Service and U.S. Fish and Wildlife Service (NMFS and USFWS). 1991. Recovery Plan for the U.S. Population of the Atlantic Green Turtle (*Chelonia mydas*). USFWS, Southeast Region, Atlanta, Georgia and NMFS, Washington, D.C.

National Marine Fisheries Service and U.S. Fish and Wildlife Service (NMFS and USFWS). 2007. Green Turtle (*Chelonia mydas*). 5-Year Review: Summary and Evaluation. NMFS, Office of Protected Resources, Silver Spring, MD and USWFS, Southeast Region, Jacksonville, Florida.

National Marine Fisheries Service and U.S. Fish and Wildlife Service (NMFS and USFWS). 2008. Recovery Plan for the Northwest Atlantic Population of the Loggerhead Sea Turtle (*Caretta caretta*), Second Revision. National Marine Fisheries Service, Silver Spring, MD.

National Marine Fisheries Service, U.S. Fish and Wildlife Service, and Secretary of Environment and Natural Resources, Mexico (NMFS, USFWS, and SEMARNAT). 2010. Bi-National Recovery Plan for the Kemp's Ridley Sea Turtle (*Lepidochelys kempii*), Second Revision. National Marine Fisheries Service. Silver Spring, Maryland.

National Oceanic and Atmospheric Administration (NOAA). 2011a. *estuaries.gov*. [website] Accessed October 10, 2011. Available from <http://www.estuaries.gov>. NOAA Office of Ocean and Coastal Resource Management.

National Oceanic and Atmospheric Administration (NOAA). 2011b. Tides & Currents. [website] Accessed October 10, 2011. Available from <http://tidesandcurrents.noaa.gov/index.shtml>.

National Oceanic and Atmospheric Administration (NOAA). March 2008. Screening Quick Reference Tables. [website] Accessed on 19 March 2009. Available from <http://response.restoration.noaa.gov/book_shelf/122_NEW-SQuiRTs.pdf>. .

National Oceanic and Atmospheric Administration (NOAA). 2009. Database of Hazardous Materials. [website] Accessed on 24 February 2009. Available from <http://cameochemicals.noaa.gov/>.

National Oceanic and Atmospheric Administration (NOAA) Fisheries Service (NFS). 2011. NOAA Fisheries: Office of Protected Resources. *[*website] Accessed on 24 January 2011. Available from <http://www.nmfs.noaa.gov/pr/. >.

National Research Council (NRC). 2010. Assessment of Sea-Turtle Status and Trends: Integrating Demography and Abundance. NRC, Committee on Sea Turtle Population Assessment Methods. National Academies Press, Washington, DC.

Naval Facilities Engineering Command (NAVFAC). 2000. Toxicity of Marine Sediments and Pore Waters Spiked with Ordnance Compounds. Conducted by R.S. Carr, United States Geological Survey Marine Ecotoxicology Research Station and M. Nipper, Texas A&M University-Corpus Christi Center for Coastal Studies. NFESC Contract Report CR 01-001-ENV. August 2000.

Naval Surface Weapons Center (NSWC). 1978. Explosion Effects and Properties II – Explosion Effects in Water. Edited by M.M. Swisdak, Jr., Research and Technology Department, Dahlgren, Virginia and Silver Spring, Maryland. NSWC/WOL TR76-116. February 1978.

Naval Surface Warfare Center, Dahlgren Division (NSWCDD). 2003. *Final Environmental Assessment, Infrared Sensor Testing at Naval Surface Warfare Center Dahlgren, Dahlgren, Virginia*. Prepared by TAMS Consultants, Inc. for Naval Surface Warfare Center, Dahlgren Site. United States Navy, Naval Surface Warfare Center, Dahlgren Laboratory. May 2003.

Naval Surface Warfare Center, Dahlgren Laboratory (NSWCDL). 2004. *Over-water Simulant Release Testing for the Joint Services Lightweight Standoff Chemical Agent Detector (JSLSCAD). Dahlgren, Virginia*. Prepared by D. Driscoll, B. Patrick, G. Johnson, K. Patton-Hall, G.M. Turman, M. Cornwell, B. Stelmok, and R. Kinter for Naval Surface Warfare Center, Dahlgren Laboratory. United States Navy, Naval Surface Warfare Center Dahlgren Laboratory. October 2004.

Naval Surface Warfare Center, Dahlgren Laboratory (NSWCDL). 2005. *Over Water Testing of Standoff Chemical Agent Detection Systems.* Prepared by D.C. Driscoll and R. Neil for Naval Surface Warfare Center, Dahlgren Laboratory. United States Navy, Naval Surface Warfare Center, Dahlgren Laboratory. August 15, 2005.

Naval Surface Warfare Center, Dahlgren Laboratory (NSWCDL). 2008. E-mail from William Goss, Safety and Environmental Office, NSWCDL, to Lane Willson, Environmental Program Manager, AECOM, October 29.

Naval Surface Warfare Center Dahlgren (NSWCDL). 2009. Subj: Over Water Testing of Standoff Chemical Agent Detection Systems. SOP No.: XSC-OSC-003-09. Effective Date: 15 July 2009.

Naval Surface Warfare Center, Dahlgren Laboratory (NSWCDL). In preparation. *Draft Environmental Impact Statement Outdoor Research, Development, Test & Evaluation Activities, Naval Surface Warfare Center, Dahlgren Laboratory, Dahlgren, Virginia*.

Netzeva T.I., A.O. Aptula, E. Benfenati, M.T.D. Cronin, G. Gini, I. Lessigiarska, U. Maran M.Vračko, and G. Schürmann. 2005. "Description of the electronic structure of organic chemicals using semiempirical and *ab initio* methods for development of toxicological QSARs". *Journal of Chemical Information and Modeling* 45: 106-114.

New Scientist. 2006. "Dive! Dive!" February18, 2006. [website] Accessed on 29 May 2009 and 1 September 2011. Available from <http://www.newscientist.com/article/mg18925392.400-dive-dive.html?page=1>.

Niemi, G.J., P. DeVore, N. Detenbeck, D. Taylor, J.D. Yount, A. Lima, J. Pastor, and R.J. Naiman. 1990. Overview of case studies on recovery of aquatic systems from disturbance. *Environmental Management* 14: 571-88.

Nyden, M.R., J.C. Yang, and J.D. Mather. 2000. *Screening of Candidate Fire Suppressants. National Institute of Standards and Technology.* Available from <http://www.fire.nist.gov/bfrlpubs/fire00/PDF/f00126.pdf>.

OceanLink. 2011. An Ocean of Sound!! An Exploration of Underwater Acoustics. [website] Accessed on 10 February 2011. http://oceanlink.island.net/oinfo/acoustics/acoustics.html.

Orth, R.J. and K.A. Moore. 1984. Distribution and abundance of submerged aquatic vegetation in Chesapeake Bay: An historical perspective. *Estuarie*s 7:531-540.

Orth, R.J., D.J. Wilcox, J.R. Whiting, L.S. Nagey, A.L. Owens, and .K. Kenne. 2011. 2010 Distribution of Submerged Aquatic Vegetation in the Chesapeake Bay and Coastal Bays. Virginia Institute of Marine Science, College of William and Mary. Special Scientific Report #153. October 2011. Accessed on 10 November 2011. Available from <http://web.vims.edu/bio/sav/sav10/index.html>

Patteson, M.G. August 4, 2008. Naval Surface Warfare Center Dahlgren Division (NSWCDD), Email to W.E. Goss NSWCDD.

Pascoe D. and D.L. Mattey. 1977. Studies on the toxicity of cadmium to the three-spined stickleback *Gasterosteus aculeatus* L. *Journal of Fisheries Biology* 11:207–215.Pelton, T. 2010. The Last, Rocky Refuge of the Dinosaur Fish that Saved America. [website] Accessed on 28 January 2011. Available from <http://cbf.typepad.com/bay_daily/2010/12/i-was-in-a-boat-in-virginias-james-river-recently-cruising-past-plantation-houses-and-feeling-the-currents-of-history-i.html>.

Polovina, J.J., E. Howell, D.M. Parker, and G.H. Balazs. 2003. Dive-depth distribution of loggerhead (*Caretta caretta*) and olive ridley (*Lepidochelys olivacea*) sea turtles in the central North Pacific: Might deep longline sets catch fewer turtles? *Fishery Bulletin* 101 (1): 189-193.

Ridgway, S.H., E.G. Wever, J.G. McCormick, J. Palin, and J.H. Anderson. 1969. Hearing in the giant sea turtle, *Chelonia mydas*. Proceedings of the National Academy of Sciences of the United States of America 64:884-890.

Roberts, C.M. 2007. The Unnatural History of the Sea. Island Press, Washington, D.C. [website] Accessed on 24 January 2011. Available from <http://books.google.com/books?id=kPUdwlxmda0C&pg=PA48&lpg=PA48&dq=Jamestown+Colony+sturgeon&source=bl&ots=A70FLdDYbr&sig=9KjP7RutOeP0vLLGYHpO1FceYFk&hl=en&ei=EGs8Tb3fD83HswbK-r3zBg&sa=X&oi=book_result&ct=result&resnum=5&ved=0CDAQ6AEwBA#v=onepage&q=Jamestown%20Colony%20sturgeon&f=false>.

Ruhl, H.A., N.B. Rybicki, J.T. Reel, and V. Carter. 1999. Distribution and Abundance of Submersed Aquatic Vegetation in the Tidal Potomac River and Upper Potomac Estuary, Maryland, Virginia, and the District of Columbia, 1993-1998. US Geological Survey, Reston, Virginia. Open-File Report 99-233.

Rybicki, N.B., S.H. Yoon, E.R. Schenk, and J.B. Baldizar. 2007. The Distribution of Submersed Aquatic Vegetation in the Fresh and Oligohaline Tidal Potomac River, 2004. United States Geological Survey, Reston VA, Open-Fi1e Report 2007-1198, 27 pp.

Sample, B.E., D.M. Opresko, and G.W. Suter, II. 1996. Toxicological benchmarks for wildlife: 1996 revision. ES/ER/TM-86/RS. Prepared for the US Department of Energy, Office of Environmental Management. Oak Ridge National Laboratory, Risk Assessment Program, Health Sciences Research Division, Oak Ridge, Tennessee.

Schofield, Jamie. December 4, 2009. Sea Turtle & Marine Mammal Stranding Coordinator, Maryland Department of Natural Resources, Cooperative Oxford Laboratory. Sea Turtle Standing Data Request for Counties Surrounding the Potomac River. MDNR, Personal communication by Email with Helen Chernoff, Senior Scientist, AECOM.

Testa, Jamie. January 11, 2011. Sea Turtle & Marine Mammal Stranding Coordinator, Maryland Department of Natural Resources, Cooperative Oxford Laboratory. Sea Turtle Standing Data Request for Counties Surrounding the Potomac River. Personal communication by Email with Helen Chernoff, Senior Scientist, AECOM.

Seney, E.E. 2003. Historical diet analysis of loggerhead (*Caretta caretta*) and Kemp's ridley (*Lepidochelys kempi*) sea turtles in Virginia. Unpublished Master of Science thesis. College of William and Mary, Williamsburg, Virginia. 123 pages.

Shazili, N.A.M. 1995. Effects of salinity and pre-exposure on acute cadmium toxicity to seabass, *Lates calcarifer. Bulletin of Environmental Contamination and Toxicology* 54:22–28.

Smith, J.S. 1624. *The Generall Historie of Virginia, New England & the Summer Isles: Together with The True Travels, Adventures and Observations, and a Sea Grammar*, third book of the five volumes. London. The Settlement of Jamestown - 1607. [website] Accessed on September 1, 2011. Available from <http://www.nationalcenter.org/SettlementofJamestown.html>.

Smith, T. I. J. 1985. The fishery, biology, and management of Atlantic sturgeon, *Acipenser oxyrhynchus*, in North America. *Environmental Biology of Fishes* 14(1): 61-72.

Smith, H.M. and B.A. Bean. 1899. List of fishes known to inhabit the waters of the District of Columbia and vicinity. *Bulletin of the U.S. Bureau of Commercial Fisheries* 18:179-187. As cited in NMFS, 1998.

Smith, T. I. J. and J. P. Clugston. 1997. Status and management of Atlantic sturgeon, *Acipenser oxyrinchus*, in North America. *Environmental Biology of Fishes* 48: 335-346.

Stevenson, J. T. and D. H. Secor. 1999. Age determination and growth of Hudson River Atlantic sturgeon, *Acipenser oxyrinchus*. *Fishery Bulletin* 97: 153-166.

Talmage, S.S., D.M. Opresko, C.J. Maxwell, C.J. Welsh, F.M. Cretella, P.H. Reno, and E.B. Daniel. 1999. “Nitroaromatic munition compounds: environmental effects and screening values”. *Reviews of Environmental Contamination and Toxicity* 161:1-156. As cited in US Navy, 2002.

The Good Scents Company. 2011. *Material Safety Data Sheet, Methyl Salicylate.* [website] Accessed September 1, 2011. Available from <http://www.thegoodscentscompany.com/msds/md101455.html>.

Thurman, Harold V. 1994. Introductory Oceanography, Seventh Edition. New York: Macmillan.

Trapani, Christina. January 11, 2011. Virginia Aquarium Stranding Response Program, Assistant Stranding Response Coordinator. Sea Turtle Standing Data Request for Counties Surrounding the Potomac River. Personal communication by Email with Helen Chernoff, Senior Scientist, AECOM.

Tulipani, Diane. March 4, 2009. Sea Turtle Standing Data Request for Counties Surrounding the Potomac River. Virginia Institute of Marine Science, Fisheries Science Department. Personal communication by Email with Jessica Joyce, Senior Scientist, AECOM.

Tulipani, Diane. January 7, 2010. Virginia Institute of Marine Science, Fisheries Science Department. Sea Turtle Standing Data Request for Counties Surrounding the Potomac River. Personal communication by Email with Helen Chernoff, Senior Scientist, AECOM.

Turtle Expert Working Group (TEWG). 2000. *Assessment Update for the Kemp’s Ridley and Loggerhead Sea Turtle Populations in the Western North Atlantic*. NOAA Technical Memorandum NMFS-SEFSC-444, Southeast Fisheries Science Center, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, Miami, Florida.

Uhler, P.R. and O. Lugger. 1876. List of fishes of Maryland. Rept. Comm. Fish. Md. 1876:67-176 as cited in NMFS, 1998.

United Nations Environmental Program (UNEP). 1998. Triethylphosphate CAS N°: 78-40-0. Organisation for Economic Co-operation and Development, Screening Information Data Set

High Production Volume Chemicals. Available from <http://www.inchem.org/documents/sids/sids/78400.pdf>.

United States Environmental Protection Agency (USEPA). 1997. Attachment I –Final Risk Assessment of *Bacillus subtilis*. February 1997. Available from http://www.epa.gov/biotech_rule/pubs/pdf/fra009.pdf

United States Environmental Protection Agency (USEPA). 1999. Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities. EPA/530/D-99/001A. Peer Review Draft. August 1999.

United States Environmental Protection Agency (USEPA). 2003. Technical Support Document for Identification of Chesapeake Bay Designated Uses and Attainability. USEPA Region III, Chesapeake Bay Program Office, EPA 903-R-03-004. October 2003.

United States Environmental Protection Agency (USEPA). 2009. National Recommended Water Quality Criteria. Available from < http://water.epa.gov/scitech/swguidance/standards/current/>.

United States Environmental Protection Agency (USEPA). 2008. Target Compounds and Analytes. [website] Accessed on February 19, 2009Available from <http://www.epa.gov/superfund/programs/clp/target.htm>.

United States Fish and Wildlife Service (USFWS). 2001. *Green Sea Turtle* (*Chelonia mydas*). North Florida Field Office. Content updated July 2001. [website] Accessed on October 26, 2011. Available from <http://www.fws.gov/northflorida/SeaTurtles/Turtle%20Factsheets/PDF/Green-Sea-Turtle.pdf>.

United States Fish and Wildlife Service (USFWS). 2011. Listed Animals. [website] USFWS Environmental Conservation Online System, Species Reports. Last updated October 26, 2011. Accessed on October 26, 2011. Available from <http://ecos.fws.gov/tess_public/pub/listedAnimals.jsp>.

United States Fish and Wildlife Service, Chesapeake Bay Field Office (USFWS Chesapeake Bay). 2011. Atlantic Sturgeon (*Acipenser oxyrinchus*). [website] Accessed on 1 February 2011. Available from <http://www.fws.gov/chesapeakebay/sturgeon.html>.

United States Navy (US Navy). 2002. *Environmental Effects of Underwater Ordnance*. Internal Draft. Naval Facilities Engineering Service Center.

Van Den Avyle, M.J. 1984. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates. U.S. Fish and Wildlife Service. FWS/OBS-82/11. U.S. Army Corps of Engineers, TR EL-82-4.

Van Eenennaam, J.P., Doroshov, S.I., Moberg, G.P., Watson, J.D., Moore, D.S. and Linares, J., 1996. Reproductive conditions of Atlantic sturgeon (*Acipenser oxyrinchus*) in the Hudson River. Estuaries 19(4):769-777.

Virginia Commonwealth University. 2010. VCU Rice Center Part of Effort to Restore Atlantic Sturgeon to the James River. [website] Accessed on 1 February 2010. Available from

<http://www.news.vcu.edu/news/VCU_Rice_Center_Part_of_Effort_to_Restore_Atlantic_Sturgeon_to>.

Virginia Department of Game and Inland Fisheries (VDGIF). 2011. Special Legal Status Faunal Species in Virginia. Available from <http://www.dgif.state.va.us/wildlife/virginiatescspecies.pdf >.

Witherington, B. E. and Ehrhart, L. M. 1989. Hypothermic stunning and mortality of marine turtles in the Indian River Lagoon System, Florida. *Copeia*: 696-703.

Wetzel, RG. 2001. *Limnology: Lake and River Ecosystems*. San Diego, California: Academic Press.

Wilson, R.E. 1977. A model of dynamics in the Lower Potomac River Estuary. *Chesapeake Science* 18 (2):177-187 (June 1977).

Youngkin, D.A. 2001. A long-term dietary analysis of loggerhead sea turtles (*Caretta caretta*) based on strandings from Cumberland Island, Georgia. Unpublished Master of Science thesis. Florida Atlantic University, Boca Raton, Florida. 65 pages. As cited in NMFS and USFWS, 2008.

THIS PAGE INTENTIONALLY LEFT BLANK

8 LIST OF PREPARERS AND REVIEWERS

Navy Technical Representative for the preparation of this BA is:

Ms. Carolyn Woods
Naval Facilities Engineering Command, Washington
Washington Navy Yard
1314 Harwood Street, SE
Washington, DC 20374-5018

The contractor responsible for the preparation of this BA for the US Navy is:

AECOM

675 North Washington Street, Suite 300
Alexandria, VA 22314

Key personnel who prepared or reviewed the BA include:

Naval Surface Warfare Center, Dahlgren Laboratory, Dahlgren Division

Capt. Michael H. Smith, Commanding Officer

Ann Swope, Chief of Staff

Jennifer Boyd, Project Manager

Vanessa Lovejoy, Safety and Environmental Office Manager

Naval Support Activity South Potomac, Naval Support Facility Dahlgren

Thomas Wray, Natural Resources Manager, Project Review

DTI Sector of Kratos Defense & Security Solutions

William Goss, Project Review

Richard Neil, Project Review

AECOM

Lane Willson, Environmental Program Manager (Captain, US Navy, Retired): 34 years of active duty experience afloat in cruisers and destroyers, and ashore in environmental compliance and program management. Auburn University, BS, Marketing and Transportation; Marymount University, MBA.

Penelope Douglas, BA Project Manager: 41 years of experience in environmental and natural resource planning and environmental impact assessment. University of Michigan, BS, Natural Resource Planning; University of Maryland, MA, Geography/Environmental Analysis.

Helen Chernoff, Principal Investigator: 26 years of experience performing ecological and human health risk assessments, environmental impact analyses, biological assessments, natural resource evaluations, and hazardous waste investigations (CERCLA/RCRA). State University of New York, Binghamton, BS, Biology; Florida State University, MS, Biology.

Andrew Foley, Ecologist/Environmental Planner: 10 years of experience in ecology; 3 years of experience in environmental planning. Eastern Michigan University, BS, Aquatic and Terrestrial Ecology; Eastern Michigan University, MS, Ecology and Organismal Biology.

Victor P. Frankenthaler, Senior Environmental Planner: 30 years of experience as an environmental planner specializing in the preparation of environmental impact studies, water and coastal resource planning, and field investigations. Cook College, Rutgers University, BS, Environmental Planning and Design; Rutgers University, MS, Geography.

Jessica Joyce, Environmental Planner: 6 years of experience in environmental planning. University of Miami, BA, Marine Policy; University of Miami, Rosenstiel School of Marine and Atmospheric Science, MA, Marine Policy.

Anne Lewis-Russ, PhD, Principal Geochemist: 26 years of experience in design and interpretation of geochemical, hydrogeological and geological studies, evaluation of contaminant fate and transport in soil, groundwater, and sediments; determination of background concentrations; evaluation of geochemical barriers and soil attenuation. South Dakota School of Mines and Technology, BS, Geological Engineering; Colorado School of Mines, PhD, Geochemistry.

Brendan V. McGuinness, Senior Geologist: 25 years of experience in environmental geological work, site assessment, remedial investigation, feasibility studies and risk assessment. Tennessee Registered Professional Geologist. State University of New York, BS, Geosciences.

Serkan Mahmutoglu, Water Resources Engineer: 13 years of experience in hydrologic, hydraulic, water-quality and sediment-transport modeling. Connecticut and Maine Registered Professional Engineer. Istanbul Technical University, BS, Environmental Engineering; University of New Hampshire, MS, Ocean Engineering.

Mark Moese, Senior Environmental Scientist: 30 years of experience specializing in environmental impact assessments and statements, environmental and social soundness assessments, EIS/EIA training seminars, hazardous materials investigations, dredging impact analyses, environmental permits, and site-selection studies. Fairleigh Dickinson University, BS, Biology; MS, Marine Biology; New York University, PhD, Environmental Toxicology/Biology.

Katherine Weber, GIS/Cartography: 6 years of experience in mapping using GIS, ArcView, ArcGIS, and PGS. Mary Washington College, BA, Geography.

DEPARTMENT OF THE NAVY
NAVAL SURFACE WARFARE CENTER
DAHLGREN DIVISION
6149 WELSH ROAD, SUITE 203
DAHLGREN, VIRGINIA 22448-5130

IN REPLY REFER TO

5090
Ser XDC8/016
10 Apr 08

Ms. Patricia A. Kurkul
Regional Administrator
National Marine Fisheries Service
Northeast Region
One Blackburn Drive
Gloucester, MA 01930-2298

Dear Ms. Kurkul,

SUBJECT: NSWCDL RDT&E EIS TECHNICAL ASSISTANCE

The Naval Surface Warfare Center, Dahlgren Site (NSWCDL), a tenant on Naval Support Facility Dahlgren, Dahlgren, Virginia, is preparing an environmental impact statement (EIS) to evaluate the potential environmental consequences of expanding our research, development, test and evaluation (RDT&E) activities taking place outdoors on the Potomac River Test Range (PRTR) Complex. We request technical assistance from your office concerning the proposed action on the lower Potomac River. RDT&E activities are conducted in support of NSWCDL's mission requirements in surface warfare, surface ship combat systems, strategic systems, ordnance, and special warfare systems. These activities include outdoor operations using ordnance, lasers, electromagnetic fields, and chemical and biological simulants. Enclosed are five fact sheets that describe our operations and support the EIS. We foresee evaluating the impacts of three alternatives as described in the in the EIS.

To help us describe existing conditions and evaluate the impacts of the proposed action, we ask that your agency:

a. Clarify what listed, proposed, and candidate species may be in the action area (the PRTR) by concurring with or revising our list of species (details provided in the enclosed PRTR Species Summary);

b. Clarify whether and, if so, what designated or proposed critical habitats may be in the action area;

c. Provide points of contact for those having information on these species or critical habitats; and

d. Provide preliminary indication of whether a survey of the action area will be needed.

For further information, please contact Dr. Thomas Wray II at (540) 653-4186 (thomas.wray@navy.mil). Thank you in advance for your assistance.

Sincerely,

ANN G. SWOPE
Head, Safety & Environmental Office
By direction of the Commander

Enclosures:
1. Environmental Impact Statement Fact Sheet
2. Test Range Operations Fact Sheet
3. Chemical & Biological Sensor Tests Fact Sheet
4. Dahlgren: A Unique National Asset Fact Sheet
5. Dahlgren: A Vital Mission Fact Sheet
6. Potomac River Test Range Species Summary

Copy to (w/encl):
Commander
Naval Sea Systems Command
Ms. Vicki Writt (SEA 04RE)
1333 Isaac Hull Avenue SE
Washington Navy Yard, DC 20376

Commander
Naval Surface Warfare Center
Ms. Tanya Robinson
1333 Isaac Hull Avenue SE, Bldg 197
Washington Navy Yard, DC 20376

Copy to: (w/encl) (Cont'd)
Chief of Naval Operations
Ms. Elizabeth Phelps (N45)
2511 Jefferson Davis Highway
NC-1, Suite 2000
Arlington, VA 22202

Ms. Christine Porter
Commander, Navy Region, Mid-Atlantic
Regional Environmental Programs (N45)
1510 Gilbert St.
Norfolk, VA 23511-2737

Mr. Lane Willson
Earth Tech
675 N. Washington Street
Suite 300
Alexandria, VA 22314

Blind copy to (w/encl):

NAVFAC (Wray)
XDC8 (Goss)
XDC809

POTOMAC RIVER TEST RANGE SPECIES SUMMARY

The Naval Surface Warfare Center, Dahlgren Site's (NSWCDL) Potomac River Test Range (PRTR) (Figure 1) extends over a 169-square-nautical-mile area along the lower 51 miles of the Potomac River. The range is divided into three areas identified on nautical charts as the Upper, Middle, and Lower Danger Zones. For many years, NSWCDL's guns have fired projectiles primarily into the Middle Danger Zone. The Lower and Upper Danger Zones are used for other types of testing, such as boat or aircraft maneuvers, but rarely for gunnery. Figure 2 shows the main gunnery target area within the Middle Danger Zone.

As the Navy's research, development, test and evaluation (RDT&E) center for chemical and biological protection and detection systems, NSWCDL has been conducting tests of chemical sensors on the river range the last few years. We coordinated with National Marine Fisheries Service (NMFS) in 2002 during preparation of the Environmental Assessment, Infrared Sensor Testing at Naval Surface Warfare Center Dahlgren. The benign chemicals used in the tests are chemical simulants that were dispersed into the air to mimic the dangerous ones that terrorists might use. Future work covered by the environmental impact statement (EIS) would involve similar and different chemical simulants and an increase in the annual number of tests. Outdoor testing of biological sensors using benign simulants would be new at NSWCDL; such testing is now being conducted in an indoor laboratory, but sensors must eventually be tested over water to ensure shipboard protection of our sailors.

As the Navy's center for developing integrated warfare systems and for directed energy systems RDT&E, NSWCDL conducts RDT&E activities using electromagnetic energy transmitted through the air, including lasers, microwaves, and radar. These types of RDT&E activities, which we propose to increase, are expected to have no negative effects on biota in the river. Lasers, microwaves, and radar would be used in the air above the river and any electromagnetic energy entering the water would be of low enough intensity that the energy would be immediately absorbed and dissipated.

Our initial research indicates that several species protected under the Endangered Species Act (ESA), the Marine Mammal Protection Act (MMPA), and the Magnuson-Stevens Fishery Conservation and Management Act occur in the PRTR. We welcome

ENCLOSURE (6)

any further information you may have on their occurrence and abundance in the lower 51 miles of the Potomac River.

STURGEON

Both the shortnose sturgeon (listed as endangered under the ESA) and the Atlantic sturgeon occur in the Potomac River. Of the 19 Distinct Population Segments identified in the NMFS Final Recovery Plan for the Shortnose Sturgeon, the Chesapeake Bay segment includes those that occur in the Potomac River in Maryland and in tributaries to the Potomac River in Virginia. The Atlantic sturgeon was listed as a candidate species on October 17, 2006.

While the distribution and abundance of shortnose sturgeon in the Chesapeake Bay are not well known, the Atlantic Sturgeon and Shortnose Sturgeon Reward Program being carried out by the United States Fish and Wildlife Service (USFWS), in cooperation with the Chesapeake Bay Program and the Maryland Department of Natural Resources (as reported in United States Army Corps of Engineers (USACE), 2007), provides some useful information. From 1996 through May 2007, eight shortnose sturgeon were captured in fishermen's gill nets and pound nets in the Potomac River as part of the reward program. The most recent capture, in March 2006, was at the mouth of Popes Creek, along the PRTR Middle Danger Zone (Westmoreland County). Four fish were documented at: the mouth of the Potomac River near Ophelia, Virginia (Northumberland County in the Lower Danger Zone near the mouth of the river) (May 3, 2000; March 26, 2001; December 10, 2004; and May 22, 2005); one at the mouth of the Saint Mary's River (St. Mary's County on the Lower Danger Zone) (April 12, 1998); and three at the mouth of Potomac Creek (about five miles upriver from the NSWCDL Upper Danger Zone) (May 17, 1996 and March 8, 2002).

The USFWS sturgeon reward program, (USACE, 2007), recorded the capture of 225 Atlantic sturgeon in the Potomac River from February 1996 through April 2007. Captures in the first four years were sporadic but have grown substantially since, culminating in the capture of 70 Atlantic sturgeon during the month of April 2007. Most sturgeon were caught in the spring.

The sturgeon captures appeared to be concentrated in and around the PRTR Middle Danger Zone, the upper part of the PRTR Lower Danger Zone, and around Ophelia, Virginia, near the mouth of the Potomac River (Northumberland County).

SEA TURTLES

Anecdotally, people living along the PRTR Lower Danger Zone report seeing sea turtles in this part of the river. Three species of sea turtles are regularly sighted in the Chesapeake Bay: loggerhead, Kemp's Ridley, and to a lesser extent, leatherback sea turtles (Litwiler, 2001). All of these species are listed as threatened or endangered under the ESA, and in accordance with the ESA, recovery plans were completed for these species in 1991 and 1992. The recovery plans for the loggerhead and Kemp's Ridley sea turtles are currently being revised.

The Virginia Institute of Marine Science (VIMS) recorded strandings of three species of sea turtles in St. Mary's and Northumberland counties from 2000 through May 2006: loggerhead, green, and Kemp's Ridley (VIMS Stranding Data, 2006). (Note that these counties front both the Potomac River and the Chesapeake Bay, so strandings could have occurred in either body of water). While green turtles are rarely found in the bay, an incidental take was recorded in St. Mary's County in 2001.

MARINE MAMMALS

The only marine mammal regularly sighted in the Potomac River is the bottlenose dolphin. The Western North Atlantic coastal migratory stock, of which dolphins in the Chesapeake Bay form a part, is considered depleted under the MMPA. In Virginia, bottlenose dolphins occur along the entire coast, within one mile of shore, and in the Chesapeake Bay and its tributaries from late spring into the winter (Blaylock, 1985). Since 1995, approximately ten bottlenose dolphin strandings have been reported in the Potomac River and the Chesapeake Bay near the mouth of the Potomac (NMFS Stranding Data, 2007).

While little is known about their distribution in the Chesapeake Bay and its tributaries, there are two relatively recent records of harbor porpoise strandings in the Potomac

River: (1) in 1999, a harbor porpoise stranded near Leonardtown, Maryland (within the PRTR Lower Danger Zone in St. Mary's County), and (2) in 2003, a harbor porpoise stranded near Scotland, Maryland (within the PRTR Lower Danger Zone near the entrance to the bay in St. Mary's County) (NMFS Stranding Data, 2007).

Several other species of marine mammals have stranded in the Potomac River, but they are primarily coastal offshore species and likely are not regular visitors to the river. In 2002, a Risso's dolphin stranded in Charles County (in either the Middle or Upper Danger Zone). In 1995, a minke whale stranded in the Potomac River near Piney Point, Maryland (within the PRTR Lower Danger Zone in St. Mary's County) (NMFS Stranding Data, 2007). These species are not ESA-listed, nor are they considered depleted under the MMPA.

Other marine mammals that have stranded in the Chesapeake Bay include a humpback whale, a sei whale, and other species of dolphins. These are thought to be rare occurrences, as these species are not considered to be inhabitants of or regular visitors to the bay.

ESSENTIAL FISH HABITAT

Seven species of fish and three species of skate have designated essential fish habitat in the lower Potomac River: bluefish, red drum, summer flounder, windowpane flounder, king mackerel, Spanish mackerel, cobia, winter skate, little skate, and clearnose skate. We would appreciate any information you may have on the abundance and distribution of these species in the area of the PRTR.

REFERENCES

Blaylock, R.A. 1985. *The Marine Mammals of Virginia*. Virginia Institute of Marine Science. VSG-85-05. July 1985.

Litwiler, T. 2001. *Conservation Plan for Sea Turtles, Marine Mammals, and the Shortnose Sturgeon in Maryland. Maryland Department of Natural Resources and Sarbanes Cooperative Oxford Laboratory, Oxford, Maryland*. Technical Report FS-SCOL-01-2. November 2001.

NMFS. 2007. National Marine Mammal Stranding Database. June 11, 2007 query.

U.S. Army Corps of Engineers, Baltimore District. 2007. *Biological Assessment on the Potential Impacts of Dredging and Dredged Material Placement Operations on Shortnose Sturgeon in the Chesapeake Bay*. August 2007.

Virginia Institute of Marine Science. 2006. VIMS Sea Turtle Stranding Program. March 15, 2006 query.

Potomac River Test Range Complex

Potomac River Test Range Complex

Naval Support Facility Dahlgren

7 0 7 Miles

11 0 11 Kilometers

Figure 1

NSWCDL EIS

Source: NSWCDL GIS; Danger Zones defined in CFP 33, Part 33.230.

Potomac River Test Range Primary Gunnery Target Area

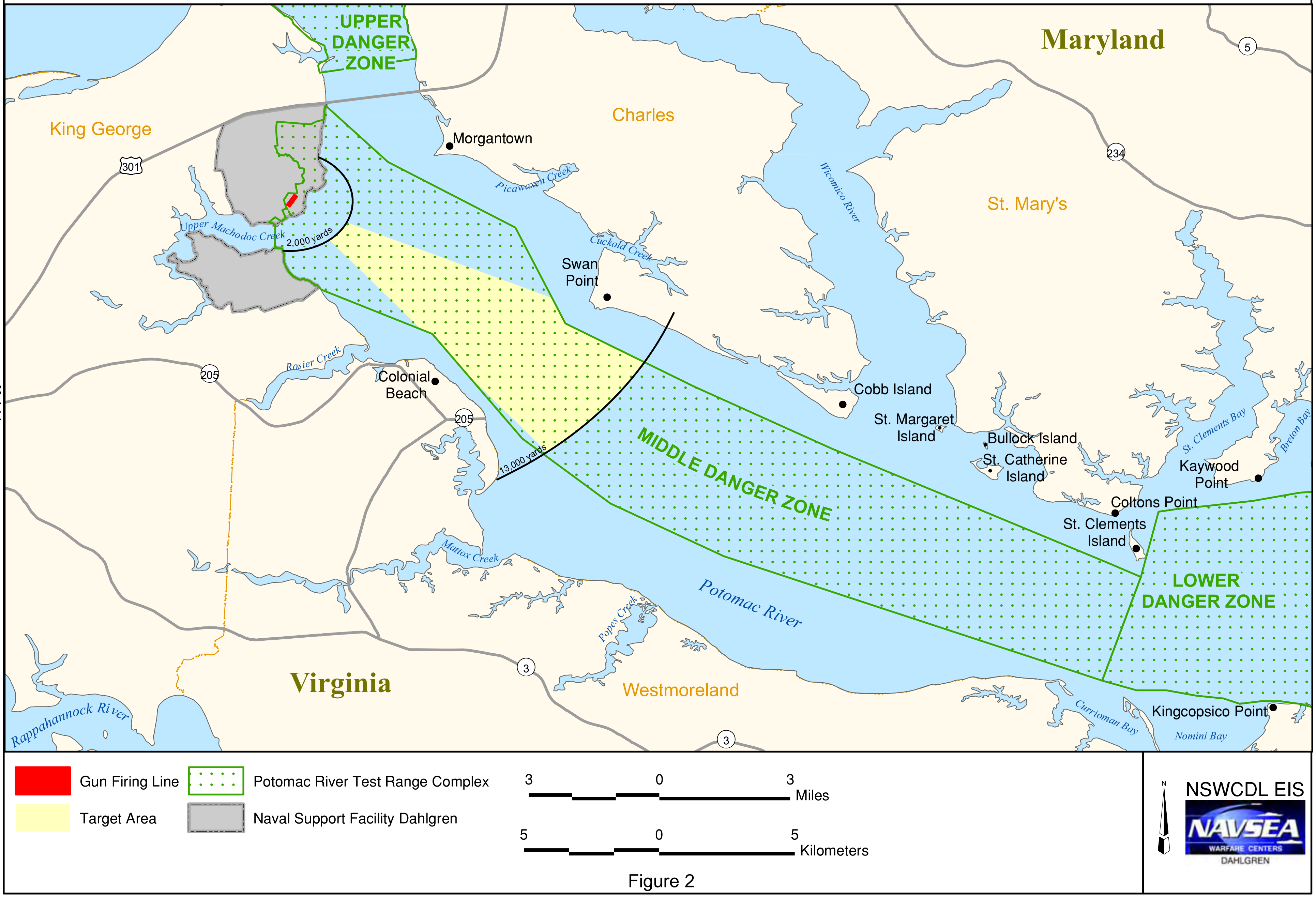


Figure 2

NAVSEA WARFARE CENTERS
DAHLGREN

Dahlgren: A Unique National Asset

A Dahlgren Public Affairs Fact Sheet

Four characteristics that make Dahlgren a unique national asset:

1. Coastal environment and varied climate
2. Fully instrumented over-the-water range
3. On-site expertise and equipment for complete development process
4. Proximity to other key military and government installations

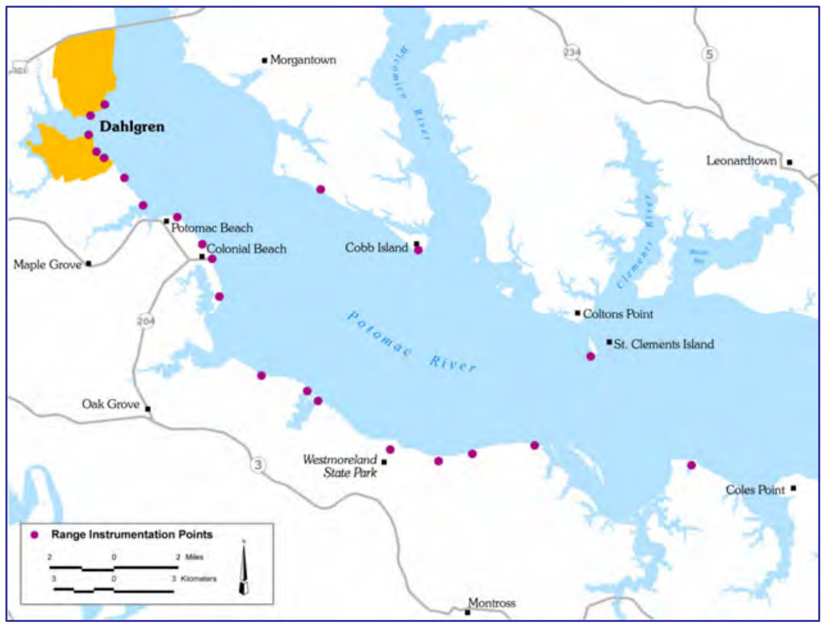
For information on Dahlgren, please visit:

General Web site: www.nswc.navy.mil

Range Web site: www.nswc.navy.mil/RANGE/

Dahlgren has been at the core of US Naval strength for nearly a century. Today, it also supports other branches of the military, the joint forces of our allies, and the Department of Homeland Security. From surface combat systems and advanced weapons to strategic strike capabilities and homeland protection, Dahlgren provides overwhelming technological advantage to our nation and our troops. The nation is very fortunate to have this unique research, development, testing and evaluation (RDT&E) facility. Four characteristics make Dahlgren invaluable to our nation:

Coastal Environment and Varied Climate



Because weapon systems and sensors function differently over water than over land, it is necessary to test them in a coastal environment that blends land, air, and water with varying weather conditions.

At Dahlgren, we can test and evaluate weapons and equipment in a riverine location that is similar to the coastal environments around the world where many of today's conflicts occur. Dahlgren is one of the few Navy locations that can provide a coastal environment for RTD&E supporting military preparedness.

Fully Instrumented Over-the-Water Range

Dahlgren has a multitude of test facilities that support its RDT&E activities. Among them are the Potomac River Test Range (PRTR) complex and the Explosives Experimental Area (EEA) range complex (see map on back page). Dahlgren's PRTR is the nation's largest fully-instrumented over-the-water gun firing range. It allows the Navy to efficiently conduct testing in a realistic, controlled environment. Using the PRTR together with our other RDT&E facilities, we can interact in real time with actual operating forces of the Navy or other branches of the military to test how well they operate together and how well weapon system components are working. This not only provides the Navy with a cost-effective method of developing new weapons and systems, but also speeds the development process.

Dahlgren and the Potomac River

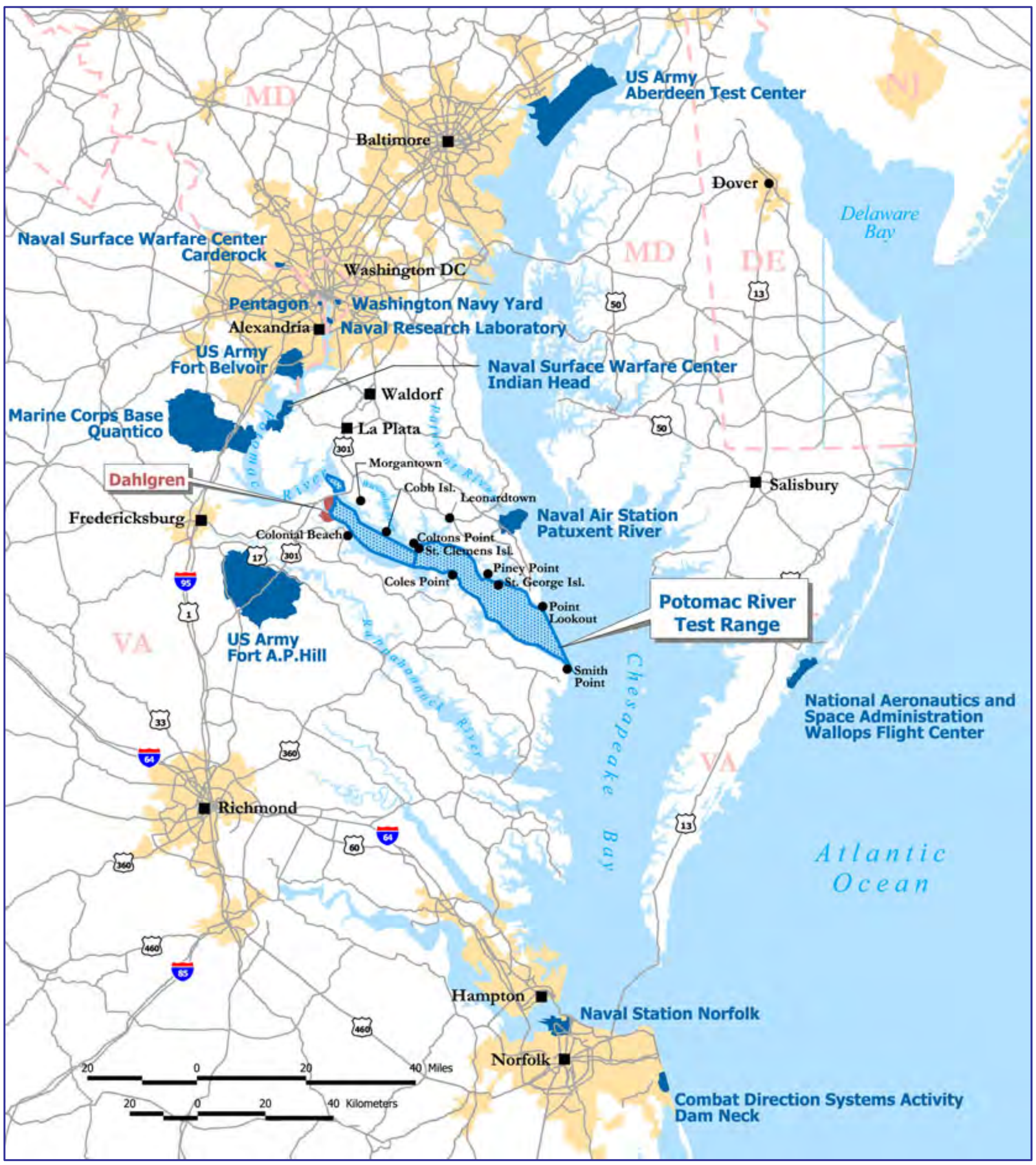
On-site Expertise and Equipment for Complete Development Process

With our extraordinary team of scientists and engineers, extensive and cutting-edge equipment, and fully integrated RDT&E capabilities, we can take entire projects from idea to prototype to deployment right here at Dahlgren.

These assets also enable us to respond quickly and effectively to ever-changing situations. One example of rapid response is the recent need by the Marines in Iraq for improved armor plating and windshield material. Many of the military's transportation vehicles have minimal armor protection against attacks by small arms fire, improvised explosive devices (IEDs), and rocket-propelled grenades. The Marines came to Dahlgren urgently requesting assistance. In response, Dahlgren's engineers and scientists worked 24/7 to develop – in just a few weeks' time – improved shielding. In addition to being protective, the new armor had to be lightweight, and more than a dozen materials were tested. The final product is protection that can literally be sprayed onto the vehicles in layers, providing added security and flexibility. Another advantage is that this process can be performed on equipment in place, precluding the need for vehicles to be removed from the field for upgrade.

Proximity to Key Military Installations and Government Agencies

Finally, the proximity of Dahlgren and its resident scientists and engineers to the seat of government and numerous military installations (from the Pentagon to Naval Station Norfolk) fosters scientific, technical, and operational collaboration across services and government agencies. The combination of our outstanding RDT&E capabilities, our testing facilities, and our physical location makes us a hub within this important network of military installations and government agencies.



NAVSEA WARFARE CENTERS DAHLGREN

Dahlgren: A Vital Mission

A Dahlgren Public Affairs Fact Sheet

Research, development, test, and evaluation for:

- Military safety testing
- Integrated warfare systems
- Weapons and ammunition
- Sensors and directed energy
- Homeland and force (military personnel and equipment) protection

For information on Dahlgren, please visit:

General Web site: www.nswc.navy.mil

Range Web site: www.nswc.navy.mil/RANGE/

The mission of the Naval Surface Warfare Center at Dahlgren focuses on research, development, test, and evaluation (RDT&E) in the fields of military safety testing, integrated warfare systems, weapons and ammunition, sensors and directed energy, and homeland and force (military personnel and equipment) protection.

Military Safety Testing


Drop test facilities

When aboard ship, sailors literally sleep adjacent to ammunition and their weapons. Therefore, it is important to ensure that all weapons and every lot of ammunition that goes to the fleet are tested for stability and safety under a variety of conditions. For example, if sailors accidentally drop a projectile they are handling, an explosion could occur, potentially resulting in serious damage, injury, or loss of life. To help design projectiles that will not explode if dropped, we test their stability by dropping them from a height of 40 feet.

Other tests are conducted to ensure that weapons and ammunition will withstand a range of environmental conditions, including extreme heat, cold, and humidity; shock; vibrations; and electromagnetic energy (such as radio and cell phone signals). For instance, Dahlgren is an advanced RDT&E center for determining the adverse effects that electromagnetic energy can have on ammunition or electro-explosive devices. Such effects include premature firing and failure to fire. Test programs in this field are a growing activity at Dahlgren.

Integrated Warfare Systems


Aegis Combat Information Center

As recently as Desert Storm (early 1990s), the different branches of the armed forces could not communicate or operate effectively with one another. Waste and unnecessary loss of life were the unfortunate result. Technology has changed this, by allowing the weapons and communications systems of all branches of the armed forces to work together. This is called integrated warfare and has become absolutely critical to military effectiveness.

The first-ever integrated warfare system was Dahlgren's Aegis. It remains the most successful. Today, Dahlgren tests, upgrades, and ensures the seamless functioning of multiple integrated warfare systems.

Weapons and Ammunition

Dahlgren uses its resources to conduct a variety of tests to ensure the safety and effectiveness of our military's inventory of naval guns, ammunition, and barrels. Almost every naval gun barrel comes to Dahlgren for testing before going to the fleet. We inspect them and test them by firing rounds of ammunition under conditions that ensure their proper functioning in the field. All forms of naval fuzes (detonating devices) are likewise thoroughly tested at Dahlgren, as it is essential that fuzes work as intended under all conditions. Finally, random samples of each lot of ammunition purchased by the Navy are sent to Dahlgren for testing and evaluation.

We also develop and test new forms of weapons and ammunition, such as long-range projectiles. Long-range projectiles will allow Naval ships to stay well offshore in hostile areas and bombard targets farther inland than is possible using current Naval guns and projectiles.

57-mm gun

Sensors and Directed Energy

Passive and active sensors are critical in modern warfare and homeland protection. Both kinds of sensors are tested at Dahlgren.

Passive sensors pick up signals from targets without emitting any potentially detectable energy. Examples include nighttime vision devices that amplify existing light, infrared detectors that sense heat emitted by targets, and surveillance television cameras. Active sensors, such as radar, send out their own signals in order to identify and track a given target or threat. Most active sensors involve the use of directed energy. Lasers and high-powered microwaves such as radars are forms of directed energy. With sufficient energy and technical design, directed energy can also be developed into weapons. RDT&E of directed energy devices is a dynamic field at Dahlgren.

Laser research at Dahlgren

Sensors allow our military to respond effectively to a wide range of threats, both conventional and unconventional, and help provide real-time situational awareness of the battlefield. For instance, sensors can be used for all-weather night and day surveillance; precision targeting; detection and tracking of moving targets such as cruise missiles; and detection of mines and submarines.

Homeland and Force (Military Personnel and Equipment) Protection

Ship air filter

Dahlgren's homeland and force protection RDT&E activities draw on the full range of expertise available on base. Examples include:

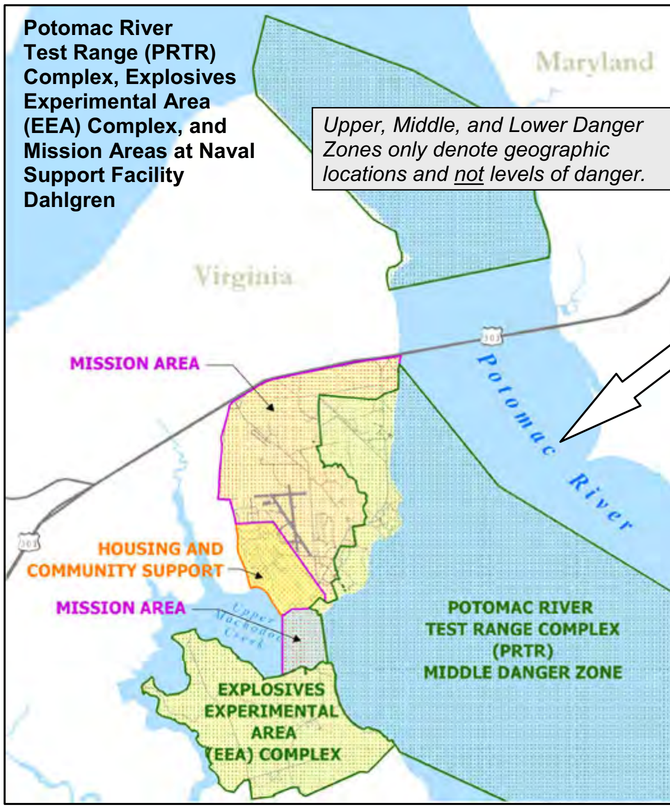
- Rapid prototyping of troop-protection devices.
- Chemical/biological/radiological defense, including contamination avoidance, individual and collective protection, and decontamination.
- Testing of air filters used onboard ships.
- Gear-entanglement systems that can stop small high-speed boats by launching a mesh of rope or similar material to entangle the boat or its propulsion system.
- Infrastructure Assurance Program, which identifies and finds ways to protect critical United States technology and intellectual capital, particularly in the areas of national defense .

Environmental Impact Statement

NAVSEA WARFARE CENTERS
DAHLGREN

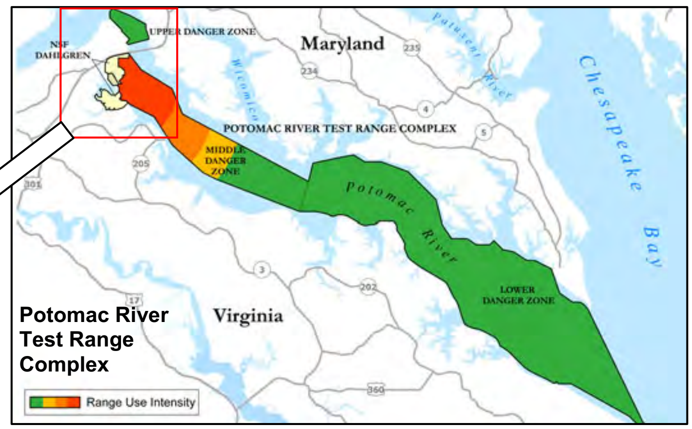
A Dahlgren Public Affairs Fact Sheet

Under the National Environmental Policy Act (NEPA), any federal action that may have an impact on the human or natural environment must have an environmental impact analysis prepared to identify potential impacts and to identify ways such impacts can be lessened. Future work here at Dahlgren is considered a federal action under NEPA, so we are preparing an environmental impact statement (EIS) that will cover current and future research, development, testing, and evaluation (RDT&E) activities conducted outdoors on our two test range complexes – the Explosives Experimental Area (EEA) Complex and the Potomac River Test Range (PRTR) Complex – in the adjoining Mission Areas, and in our Special Use Airspace.



In this EIS we will evaluate the impacts of increasing our RDT&E activities in four program areas that are critical to national defense:

- **Warfare Systems Elements** entails testing the functionality of a warfare component such as a gun or other type of weapon.
- **Military Standards Testing** involves checking the safety of a warfare component by simulating transport and shipboard handling and storage in normal and emergency conditions.
- **Chemical & Biological Defense** entails testing the ability to rapidly and accurately detect or defend against chemical or biological agents.
- **Warfare Systems Integration** involves testing any or all of the above components once they are integrated into a larger system, such as an unmanned vehicle, ship, or complete strike group.



Not only do we plan to increase the number of activities annually in these key program areas, but we also need to conduct some of the tests under conditions in which we do not now normally run tests, such as at night and in bad weather.

The EIS will focus on RDT&E activities that take place **outdoors**, and could therefore have an impact on the environment. Much of our research and development takes place inside laboratories and will not be analyzed in this EIS.

We are aiming for this EIS to cover activities that we can reasonably foresee taking place within the next seven to fifteen years. During this period, we foresee enhancing existing technologies by expanding our existing RDT&E capabilities rather than developing new ones, so:

The Proposed Action for this EIS is to expand Dahlgren's outdoor RDT&E capabilities within the EEA and PRTR ranges, the Mission Areas, and the Special Use Airspace.

ACTIVITY	NO ACTION ALTERNATIVE	ALTERNATIVE 1	ALTERNATIVE 2 (PREFERRED)	CHANGE
Laser Operations (Class 3 & 4)	60 Events	125 Events	145 Events	↑
Electromagnetic Operations	103 Events	210 Events	240 Events	↑
Guns/Projectile Tests *	4,700 Projectiles	4,700 Projectiles	4,700 Projectiles	—
Small Arms Tests *	6,000 Bullets	6,000 Bullets	6,000 Bullets	—
Detonations *	192 Events	200 Events	230 Events	↑
Chemical & Biological Sensor Tests	54 Events	324 Events	372 Events	↑
* Noise Production	Steady	Steady	Steady	—
Potomac River Test Range Use	750 Hours	770 Hours	890 Hours	↑

EIS Alternatives

Part of any EIS process is to determine what is presently happening in order to be able to look at possible future activity and analyze the impacts that activity may have. Over three years, we collected data and interviewed more than 75 Dahlgren program managers. This process helped us accurately describe existing conditions, analyze what will be needed in the future, and develop two possible alternatives for future levels of activity, as shown in the EIS Alternatives Table.

- Under the No Action Alternative, the annual level of outdoor RDT&E activities taking place on the PRTR, EEA, Mission Areas, and Special Use Airspace would remain constant; there would be no expansion of Dahlgren's outdoor RDT&E capabilities. This alternative addresses past and current mission activities.

- Under Alternative 1, which would include existing baseline activities, Dahlgren's outdoor RDT&E capabilities would increase (with the exception of Gun/Projectile and Small Arms tests) over approximately the next seven years to accommodate known workload requirements.

- Under Alternative 2, the preferred alternative, Dahlgren would gain the greatest flexibility to adapt to program changes in the future. This alternative includes existing baseline activities, the increased activities under Alternative 1, plus projected increases in test activities over approximately the next 15 years. The alternative generally provides for a 15 percent increase in mission activities above Alternative 1 levels plus new applications of existing technology.

Future Activities Covered under the EIS

Here's what we anticipate for the future at NSWCDL, as shown in the EIS Alternatives table:

- Overall, *Warfare Systems Elements* RDT&E will increase. Specifically, we anticipate a transition from explosive projectiles launched with explosive powder to high-energy and electric weapons. While testing of new, longer range conventional guns and projectiles will occur, the frequency of testing of existing guns may decline. Hence, on average, the number of firings of large-caliber weapons is expected to remain constant, but the percentage of live ordnance will drop because modeling of tests will continue to increase. We expect testing of high-energy weapons such as lasers, rail guns, reactive materials, and directed energy projects to increase significantly over the next seven to fifteen years.

- Under Military Standards Testing, the requirement to subject all modified and new ordnance and systems to stressful transport and shipboard conditions, such as fire, will remain critical, and we expect the tempo to slightly increase.

- The emerging threat of Chemical and Biological agents against American military and civilian populations will require increases in the testing of viable and accurate sensors using various chemical and biological substitutes. See the fact sheet on Chemical and Biological Sensor Tests for information on the substitutes used to mimic dangerous chemicals and biological organisms. We expect baseline chemical and biological sensor testing to see a marked increase overall.

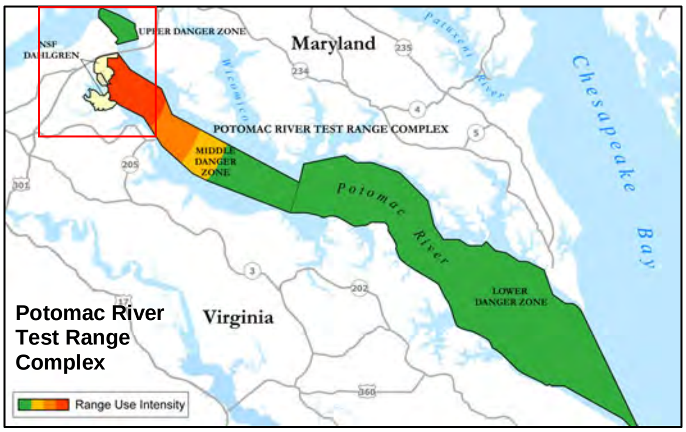
- Under the fourth program area, Warfare Systems Integration, Dahlgren combines component technologies from the other three operations areas into integrated systems. For example, the Department of Homeland Security may have an urgent need to be able to detect a chemical that may be used against our troops or citizens. In response, Dahlgren could take several sensors developed under our chemical and biological defense program and integrate them onto an existing unmanned aerial system, along with cameras and communications equipment, and test the new device under a range of environmental conditions. Merging technologies is a major area of growth anticipated at Dahlgren, as the Navy's Integration Center of Excellence. Overall, Warfare Systems Integration will experience substantial growth in the future.

Test Range Operations

NAVSEA WARFARE CENTERS DAHLGREN

A Dahlgren Public Affairs Fact Sheet

Since 1918 Dahlgren has been an important national resource for the testing of naval guns and ammunition as well as for a wide variety of military testing and training efforts utilizing explosive and non-explosive ordnance. Highlights of Dahlgren's ordnance work include test-firing every type of naval gun and its ammunition, and conducting a variety of short-term programs, such as serving as a bombing range for military pilot training during World War II. Dahlgren has two range complexes where most ordnance is tested: the Potomac River Test Range (PRTR) and the Explosives Experimental Area (EEA).

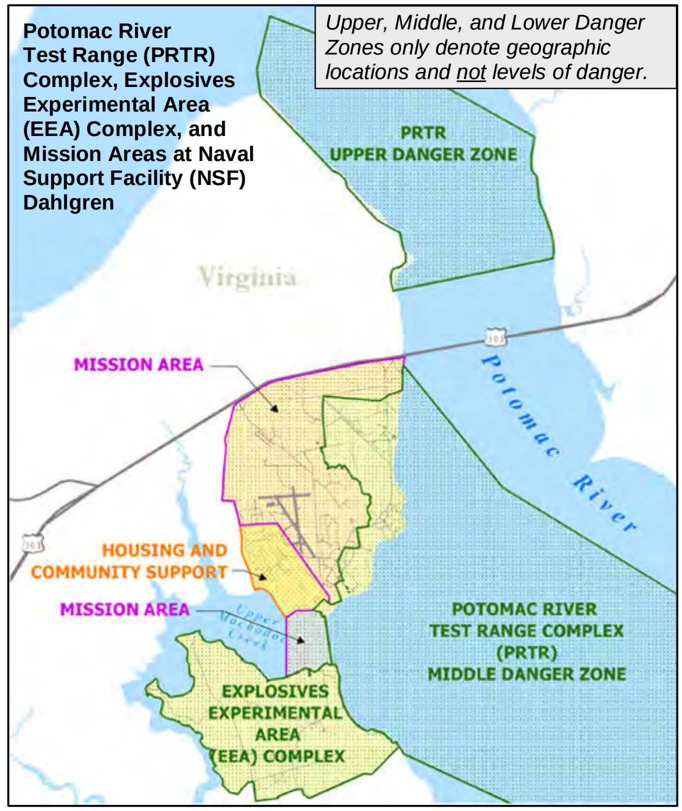


Potomac River Test Range (PRTR)

The PRTR Complex consists of a 715-acre land area and a 169-square-nautical-mile water area that stretches along the lower 51 miles of the Potomac River. Three geographic zones are defined on nautical charts – the Upper, Middle, and Lower Danger Zones – so called to alert mariners that access to the areas may be restricted when test activities are taking place. The Middle Danger Zone receives the heaviest use. Restricted airspace zones extend to 60,000 feet above the river surface. Danger zones and airspace restrictions are only in effect during test operations.

Explosives Experimental Area (EEA)

The 1,641-acre EEA Complex is a land range used to test ordnance performance, lethality, and safety. One of Dahlgren's missions is to perform testing and evaluation to certify that ordnance items and weapons systems are safe for fleet use. This testing occurs on the EEA. A restricted airspace zone 7,000 feet in altitude in is effect over the EEA during testing.



Test Range Safety

During test operations on the PRTR or the EEA, range safety considerations may require restrictions on river traffic. In order to ensure that such testing does not endanger watercraft, range boats (painted international orange with a white hull) patrol areas rendered hazardous by the test operations. It is the responsibility of these boats to ensure that no watercraft are endangered by the test operation. Normally, these boats are stationed near Lower Cedar Point, Maryland; near Swan Point, Maryland; offshore at Colonial Beach, Virginia; and at the mouth of Upper Machodoc Creek, Virginia.

During test operations, range boats fly red flags, warning watercraft not to enter an area without having obtained permission from the nearest range patrol boat. Depending on the type of operation, traffic can frequently be safely rerouted around the test area. Range control personnel carefully minimize delays to both commercial and recreational boat traffic.

Dahlgren's Range Control Communications Center can be reached at 1-540-653-8791. Range Control monitors marine ship-to-shore channels 14 and 16 and will respond to requests for information. More specific information on the danger zone and on tests scheduled for a particular day can be found on the Web at http://www.nswc.navy.mil/RANGE.

Frequency of Testing

Dahlgren typically conducts operations Monday through Friday between 9 am and 5 pm. Operations outside these times are infrequent. In recent years, an average of about 4,700 rounds have been fired annually from large-caliber guns on the PRTR. Guns shoot multiple bursts or intermittent single rounds. An average of 192 detonations take place every year, primarily on the EEA. Detonations usually are heard as booms or rumbles. Because Dahlgren is able to model test firings on computers, the number of rounds fired annually has dropped by 80 percent since the 1960s.

Scheduled operations are listed on our range website at http://www.nswc.navy.mil/RANGE or accessed by calling our toll-free number at 1-877-845-5656.

Ammunition in the Potomac River

Over Dahlgren's more than eight decades of operations, millions of rounds of ammunition have been fired or launched within the bounds of the PRTR. Most of the ammunition fired on Dahlgren's ranges has been inert, composed of a steel case surrounding an inert filler material, such as cement. The cement replicates the weight of a live projectile. Spent projectiles typically become embedded in river sediments.

When there is a requirement to test-fire explosive ammunition, the filler in the projectile is composed of explosive materials designed to detonate just above the water or upon impact with the water. As the very nature of Dahlgren's mission is to develop and test weapons and ammunition in order to develop more effective systems, some tests fail. A small percentage of live ammunition fired over the years has failed to detonate. Such ammunition is called unexploded ordnance or UXO.

Unexploded Ordnance (UXO)

UXO still contains explosives, chemicals, or propellants after firing or use because the ordnance did not explode. On the PRTR, unexploded projectiles rapidly sink to the bottom of the river and are covered with sediment and silt.

The broad variety of research, development, testing, evaluation, and training activities conducted on Dahlgren's ranges have resulted in four different types of UXO: naval gun ammunition; small explosives such as grenades; aircraft bombs; and small rockets.

If disturbed, UXO can explode and injure people handling it. In the event that UXO or potential UXO is located by the public in shallow water, or is found washed ashore following a storm, Dahlgren responds immediately to secure the item and safely remove it.

If you find a projectile:

1. DO NOT TOUCH OR ATTEMPT TO MOVE THE ITEM.
2. Treat any suspected UXO as if it IS UXO – Dahlgren will provide experts who will identify and if necessary remove and properly treat the item.
3. Phone the Dahlgren base operator – (540) 653-8531 – and give your name, address, phone number, and location of the suspect item.
4. Mark the area (avoid direct contact with the suspect item).
5. If possible, take a digital picture of the suspect item to email to the Explosives Ordnance Disposal (EOD) response team after they contact you.

The base operator will contact the EOD response team – on call 24 hours a day – who will follow up with you.

Chemical & Biological Sensor Tests

NAVSEA WARFARE CENTERS
DAHLGREN

A Dahlgren Public Affairs Fact Sheet

The possibility that weapons of mass destruction might be used against us has become all too real in today's world. It is far easier and cheaper for potential adversaries to make and deliver chemical or biological weapons than nuclear weapons, and the potential for harm is very high. The 1995 sarin nerve gas chemical attack on the Tokyo subway system and the 2001 anthrax biological attack through the Washington, DC postal service demonstrate the need to focus significant efforts to protect our homeland and our troops.

Chemical and biological weapons are very difficult to detect, and the key to surviving an attack is early detection and warning. As the primary Navy laboratory for the Department of Defense (DoD) chemical and biological defense program, Dahlgren has been working with other DoD agencies, the Department of Homeland Security, and civilian industry to develop rapid and accurate methods for detecting, or sensing, chemical agents outdoors in the coastal environment. Efforts will soon be expanding into the detection of biological agents or combinations of chemical and biological agents outdoors.

Because actual chemical and biological agents are dangerous, Dahlgren will conduct outdoor tests using only non-hazardous chemical and biological substitutes for the real, dangerous agents that terrorists might use.

Press Conference on Detection of Chemical and Biological Agents

Non-hazardous Chemical and Biological Substitute Agents Used in Testing

For outdoor tests of chemical and biological sensors, Dahlgren will use benign chemical compounds or biological materials, many of which are in common everyday use. These compounds simulate or mimic chemical or biological agents that might be used in a terrorist attack, and therefore are crucial in allowing us to determine whether the sensors we are testing could detect actual agents. In order to mimic the real chemical or biological agents effectively, these substitute materials must have the same characteristics – such as size, density, and aerosol behavior – as the real agents would have, but must also carry minimum risk, so that they can be used safely in outdoor tests.

Acetic acid and methyl salicylate are two examples of chemicals that are similar to dangerous chemical agents in physical characteristics. Both are common in everyday life. Common vinegar is actually diluted acetic acid, and methyl salicylate is a non-toxic chemical better known as oil of wintergreen. *Bacillus globigii* is an example of a substitute for biological agents that is used to mimic anthrax in tests. *Bacillus globigii* is commonly found in decomposing organic material, and some strains are used to make antibiotics.

Safety When Using Non-hazardous Chemical and Biological Substitute Agents

The substitute chemical compounds and biological materials that Dahlgren will use are specifically designed to pose minimum risk to humans and the environment. In fact, the types of chemicals that people use every day in cleaning their homes and killing bugs and weeds in their gardens are far more dangerous than anything that Dahlgren will use in its tests. However, to ensure safety, our scientists will use caution in handling these chemical and biological substitute agents, just as people use caution when handling chemicals in their homes.

As an example, vinegar – a dilute version of one chemical agent substitute – is an excellent disinfectant and cleaning solution in the home, and is much safer than most of the other chemicals available in the grocery store. Although you can use vinegar to dress a salad or rinse your hair, it is still an acid, and can hurt your eyes and irritate your lungs if sprayed near your face. Therefore, when Dahlgren scientists and engineers conduct tests that involve releasing chemical subtitute agents outdoors, they wear appropriate protective gear. However, once airborne, the chemical mist quickly dilutes and dissipates, so that no protective gear is required beyond the immediate release point.

Household dust, mold spores that emerge from digging in the garden, pollen in the spring and summer, or leaf dust raked up in the fall are examples of biological substances that often cause us more problems when inhaled than the biological substitute agents Dahlgren will use. The Centers for Disease Control, for example, considers *Bacillus globigii*, the biological substitute agent previously mentioned, safe to be around. It is very common and we inhale it almost everywhere. Nevertheless, at Dahlgren we will only use *Bacillus globigii* spores under strict safety guidelines, as inhaling too many live spores can still cause respiratory distress to sensitized individuals and anyone with severe respiratory ailments. Just as you would not want to breathe in or get in your eyes perfectly safe substances such as flour dust, Dahlgren scientists will wear protective gear to avoid inhaling large amounts of substitute biological agents. Again, the concentration of substitute bioligical materials used in tests will quickly decrease, and protective gear will only be required near the release point.

What will Dahlgren do with these Non-hazardous Chemical and Biological Substitute Agents?

The Navy and the DoD need to know whether the detection methods under development actually work, and – of particular importance to the Navy – whether and how well they work in a maritime environment. Dahlgren scientists and engineers will use various chemical and biological substitute agents to test both our sensor methods and our equipment.

We at Dahlgren are on the cutting edge of technology, using the electromagnetic spectrum to develop unique sensors. Our scientists will use electromagnetic frequencies and sophisticated computer software to analyze substitute chemical and bilogical agents as they develop effective methods for rapidly identifying the presence of real chemical or biological agents – in a matter of seconds or minutes, rather than the hours and sometimes days it currently takes. Accuracy is equally important: sensors must correctly identify the relevant agents and not give false alarms. Using a variety of safe chemical and biological substitute agents in sensor testing will help ensure that we achieve the required accuracy.

In addition to sensor development, Dahlgren scientists and engineers will use these chemical and biological subsititue agents for two other important applications:

1. To develop ways of protecting personnel from contact with real chemical and biological agents, such as through the use of protective clothing and equipment.

2. To develop ways of both handling and decontaminating people and equipment exposed to real chemical and biological agents while minimizing danger to others.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
NORTHEAST REGION
One Blackburn Drive
Gloucester, MA 01930-2298

JUN 20 2008

Ms. Ann G. Swope
Head, Safety & Environmental Office
Department of the Navy
Naval Surface Warfare Center, Dahlgren Division
6149 Welsh Road, Suite 203
Dahlgren, VA 22448-5130

JUN 27

Re: NSWCDL RDT&E EIS Technical Assistance

Dear Ms. Swope:

This is in response to your letter dated April 10, 2008 requesting information on the presence of any species listed as threatened or endangered under the Endangered Species Act of 1973 (ESA), as amended, in the vicinity of the Potomac River Test Range (PRTR) Complex. The Naval Surface Warfare Center, Dahlgren Site (NSWCDL) is preparing an environmental impact statement (EIS) to evaluate the potential environmental consequences of expanding the research, development, test and evaluation (RDT&E) activities taking place outdoors on the PRTR. These activities include use of ordnance, lasers, electromagnetic fields, and chemical and biological simulants. Your letter included fact sheets about the activities conducted at the PRTR, as well as a summary of protected species known to occur in the Potomac River in the vicinity of the PRTR, and requested concurrence with the species list and any further information regarding endangered and threatened species that could assist in preparation of the EIS.

The PRTR Species Summary enclosed with your letter identified the presence of ESA-listed shortnose sturgeon (*Acipenser brevirostrum*), loggerhead sea turtles (*Caretta caretta*), Kemp's ridley sea turtles (*Lepidochelys kempii*), green sea turtles (*Chelonia mydas*), and leatherback sea turtles (*Dermochelys coriacea*) in the vicinity of the PRTR. NMFS concurs with this species list. Although ESA-listed whales are known to transit past the mouth of Chesapeake Bay, large whale species would be considered rare transients within the Bay and are not likely to occur within the Potomac River. There is no designated or proposed critical habitat in the action area.

Sea turtles are generally present in the Chesapeake Bay from April 1-November 30 each year, when water temperatures are relatively warm. An estimated 3,000 - 10,000 loggerhead turtles and 500 Kemp's ridley sea turtles are found in the Chesapeake Bay annually. In the Chesapeake Bay, Kemp's ridleys frequently forage in shallow embayments, particularly in areas supporting submerged aquatic vegetation and on tidal flats. Approximately 95 percent of the loggerheads found in the Chesapeake Bay are juveniles; these turtles are found most commonly from the mouth of the Bay to the Potomac River while foraging along channel edges. Leatherback sea turtles are predominantly pelagic but are also seasonally present in the Chesapeake Bay. As noted in the summary provided by your office, sea turtles are more likely to be found in the

Lower Danger Zone in areas closer to the mouth of the river. For more information about sea turtles in the Chesapeake Bay, please contact Carrie Upite at (978) 281-9300, ext. 6525, or Carrie.Upite@noaa.gov.

The federally endangered shortnose sturgeon is known to be present in the Chesapeake Bay. During the 1996-2005 time period, the incidental capture of seventy-two different shortnose sturgeon in the Chesapeake Bay and its tributaries had been reported via the US Fish and Wildlife Service's Atlantic sturgeon reward program. This number includes eight shortnose sturgeon captured incidentally in fishing gear in the Potomac River. As your letter indicates, several of these captures were within the PRTR. Additionally, researchers conducting a survey for shortnose sturgeon in the river captured one mature egg bearing female in September 2005 and an additional mature egg bearing female in the same location in March 2006. Both fish have been outfitted with sonic tags and are being actively tracked by researchers. Information available to date indicates that these fish have remained within the Potomac River since they were tagged. The female caught in September overwintered in the Potomac River near Mattawoman Creek. One of the females was documented at the presumed spawning grounds near Little Falls in the spring of 2006. The occurrence of pre-spawning females in the Potomac River suggests that a spawning population of shortnose sturgeon continues to exist in this river system. Although the two tagged sturgeon appeared to spend most of their time in areas upriver of the PRTR, one was captured at rkm 63 in 2006, which is within the Middle Danger Zone of the PRTR. For further information about shortnose sturgeon in the Potomac River, please contact Mike Mangold, US Fish and Wildlife Service, at (410) 573-4509.

Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) are distributed along the entire East Coast of the United States and have been designated a Candidate Species by NMFS. Atlantic sturgeon are known to be present in the Chesapeake Bay and its tributaries, including the Potomac River. As a candidate species, Atlantic sturgeon receive no substantive or procedural protection under the ESA; however, NMFS recommends that project proponents consider implementing conservation actions to limit the potential for adverse effects on Atlantic sturgeon from any proposed project. Many populations, including those found in the Chesapeake Bay, have undergone drastic declines in abundance since the late 1800s. In 2006, NMFS initiated a status review for this species to determine if listing as threatened or endangered under the ESA is warranted. NMFS is currently reviewing the findings of the Status Review team. If the species is proposed for listing, the conference provisions of Section 7 become applicable (see 50 CFR §402.10) and the consultation requirement becomes applicable if the species is listed. The Status Review report is available at: *http://www.nero.noaa.gov/prot_res/CandidateSpeciesProgram/AtlSturgeonStatusReviewReport.pdf.*

Sturgeon and sea turtles may be impacted by the types of activities proposed in the PRTR, including direct impacts from the use of explosives as well as impacts to habitat from expended ordnance or chemical and biological simulants. As you know, Section 7(a)(2) of the ESA states that each Federal agency shall, in consultation with the Secretary, insure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat. As listed shortnose sturgeon and sea turtles are known to be present in the vicinity of the PRTR and effects to listed species may result from the activities taking place on the PRTR, NMFS recommends that the Navy initiate consultation pursuant to section 7 of the ESA.

To initiate section 7 consultation for this action, the Navy should submit a complete project description along with a determination of effects and justification for the determination (i.e., a Biological Assessment) and a request for concurrence to NMFS. We do not anticipate requiring any site surveys to assess the distribution of listed species in the action area; however, NMFS does expect a complete and accurate assessment of shortnose sturgeon and sea turtle presence in the vicinity of project activities based on the best available data, as well as a thorough assessment of the potential impacts of the RDT&E activities on listed species in the PRTR.

While not protected under the ESA, several other species of marine mammals may occur in the Chesapeake Bay and its tributaries. All marine mammals are protected under the Marine Mammal Protection Act of 1972 (MMPA). If it is felt that this project has the potential to take marine mammals through injury, harassment, or mortality, then the Navy is responsible for obtaining an incidental take permit from NMFS. For more information about the permitting process, please visit http://www.nmfs.noaa.gov/pr/permits/.

Consultation for Essential Fish Habitat (EFH) under the Magnuson-Stevens Fishery Conservation and Management Act (MSA) may be necessary for this project due to the presence of federally managed species in the project area. If EFH may be adversely affected, the Navy must submit an EFH Assessment to NMFS analyzing the effects of the action on EFH and federally managed species. A guide to essential fish habitat designations in the Northeastern United States is located on the Habitat Conservation Division web site at http://www.nero.noaa.gov/hcd/webintro.html. Questions concerning EFH in Maryland and Virginia can be directed to John Nichols at (410)267-5675.

My staff looks forward to working with you on the conservation of listed species in the Chesapeake Bay and is available to further discuss protected resources in this area that may be affected by the proposed project. Please contact Kristen Koyama of my staff at (978) 281-9300 x6531 or by e-mail (Kristen.Koyama@noaa.gov) if you would like to discuss these comments or the procedures for initiating consultation.

Sincerely,

Mary A. Colligan
Assistant Regional Administrator
for Protected Resources

Cc: Nichols, Colosi - F/NER4

File Code: Sec 7 tech assist 2008 – Navy Potomac River Test Range RDT&E
PCTS: T/NER/2008/03640

THIS PAGE INTENTIONALLY LEFT BLANK

DEPARTMENT OF THE NAVY
NAVAL SURFACE WARFARE CENTER
DAHLGREN DIVISION
6149 WELSH ROAD, SUITE 203
DAHLGREN, VIRGINIA 22448-5130

IN REPLY REFER TO

5090
Ser XDC8/028
24 Jun 08

Ms. Karen Mayne, Supervisor
Virginia Field Office
U.S. Fish and Wildlife Service
6669 Short Lane
Gloucester, VA 23061

Dear Ms. Mayne,

SUBJECT: TECHNICAL ASSISTANCE FOR NSWCDL OUTDOOR RESEARCH, DEVELOPMENT, TESTING & EVALUATION ACTIVITIES ENVIRONMENTAL IMPACT STATEMENT

The Naval Surface Warfare Center, Dahlgren Site (NSWCDL), a tenant on Naval Support Facility (NSF) Dahlgren, Virginia, is preparing an environmental impact statement (EIS) to evaluate the potential environmental consequences of expanding our research, development, test and evaluation (RDT&E) activities taking place outdoors on the Potomac River Test Range (PRTR) Complex, the Explosives Experimental Area (EEA) Complex, mission areas, and in special use airspace over the ranges. RDT&E activities are conducted in support of NSWCDL's mission requirements in surface warfare, surface ship combat systems, strategic systems, ordnance, and special warfare systems. These activities include outdoor operations using ordnance, lasers, electromagnetic energy, and chemical and biological simulants.

The project areas for the proposed action are our ranges and mission areas (Figures 1 and 2), which include:

a. The PRTR Complex, which consists of a 715-acre land area and a 169-square-nautical-mile water area that stretches along the lower 51 miles of the Potomac River. Three geographic zones are defined on nautical charts - the Upper, Middle, and Lower Danger Zones - so called to alert mariners that access to the areas may be restricted when test activities are taking place. The areas of interest in the PRTR Complex are subdivided into land ranges, Upper Danger Zone, Middle Danger Zone, and

Lower Danger Zone. The Middle Danger Zone is the focus of most outdoor RDT&E activities. Figure 3 shows the main gunnery target area in the PRTR.

b. The counties surrounding the PRTR include King George, Westmoreland and Northumberland counties in Virginia and Charles and St. Mary's counties in Maryland. The geographic coordinates of the danger zones may be found at http://edocket.access.gpo.gov/cfr_2007/julqtr/pdf/33cfr334.230.pdf. The PRTR is shown on parts of the following US Geological Survey quadrangle maps: Mathias Point, MD-VA; King George, VA-MD; Dahlgren, VA-MD; Colonial Beach North, VA-MD; Colonial Beach South, VA-MD; Port Royal, VA; Rollins Fork, VA; Stratford Hall, VA-MD; St. Clements Island, MD-VA; Piney Point, MD-VA; Machodoc, VA; and Kinsale, VA-MD.

c. The 1,641-acre EEA Complex, which is bordered by Upper Machodoc Creek to the north and west and the Potomac River to the east (Figure 2).

d. NSWCDL's Mission Areas, which include a 1,593-acre land area on NSF Dahlgren and a 164-acre water area (see Figure 2). The water area lies on Upper Machodoc Creek, immediately north of the EEA and south and west of the PRTR land complex. The land area lies immediately north and west of the PRTR land ranges.

Enclosed are seven fact sheets that describe our operations and support the EIS. We foresee evaluating the impact of three alternatives in the EIS as described in the EIS Fact Sheet. Further information on the EIS may be obtained from our website: http://www.nswc.navy.mil/EIS/index.html.

To help us describe existing conditions and evaluate the impacts of the proposed action, we request that your agency provide a list of endangered, threatened, and proposed species and designated and proposed critical habitats that may be present in the project areas. Please note that we are also sending coordination letters to the US Fish & Wildlife Service's

Chesapeake Bay Field Office, the National Marine Fisheries Service's Northeast Regional Office, the Virginia Department of Game and Inland Fisheries, the Virginia Department of Conservation and Recreation-Division of Natural Heritage, and the Maryland Department of Natural Resources-Wildlife and Heritage Service.

For further information, please contact Dr. Thomas Wray II, at (540) 653-4186 (Thomas.Wray@navy.mil). Thank you in advance for your assistance.

Sincerely,

ANN G. SWOPE
Head, Safety and Environmental Office
By direction of the Commander

Enclosures:
1. Figure 1. Potomac River Test Range Complex
2. Figure 2. Dahlgren's Ranges and Mission Areas
3. Figure 3. Potomac River Test Range Primary Gunnery Target Area
4. Environmental Impact Statement
5. Test Range Operations
6. Chemical and Biological Sensor Tests
7. Laser Technology
8. Electromagnetic Energy
9. Dahlgren: A Unique National Asset
10. Dahlgren: A Vital Mission

THIS PAGE INTENTIONALLY LEFT BLANK

DEPARTMENT OF THE NAVY
NAVAL SURFACE WARFARE CENTER
DAHLGREN DIVISION
6149 WELSH ROAD, SUITE 203
DAHLGREN, VIRGINIA 22448-5130

IN REPLY REFER TO

5090
Ser XDC8/026
24 Jun 08

Mr. John Wolflin
Chesapeake Bay Field Office
U.S. Fish and Wildlife Service
177 Admiral Cochrane Dr.
Annapolis, MD 21401

Dear Mr. Wolflin,

SUBJECT: TECHNICAL ASSISTANCE REQUEST FOR NSWCDL OUTDOOR RESEARCH, DEVELOPMENT, TESTING AND EVALUATION ACTIVITIES ENVIRONMENTAL IMPACT STATEMENT

The Naval Surface Warfare Center, Dahlgren Site (NSWCDL), a tenant on Naval Support Facility (NSF) Dahlgren, Virginia, is preparing an environmental impact statement (EIS) to evaluate the potential environmental consequences of expanding our research, development, test and evaluation (RDT&E) activities taking place outdoors on the Potomac River Test Range (PRTR) Complex, the Explosives Experimental Area (EEA) Complex, mission areas, and in special use airspace over the ranges. RDT&E activities are conducted in support of NSWCDL's mission requirements in surface warfare, surface ship combat systems, strategic systems, ordnance, and special warfare systems. These activities include outdoor operations using ordnance, lasers, electromagnetic energy, and chemical and biological simulants.

The project areas for the proposed action are our ranges and mission areas (Figures 1 and 2), which include:

a. The PRTR Complex, consisting of a 715-acre land area and a 169-square-nautical-mile water area that stretches along the lower 51 miles of the Potomac River. Three geographic zones are defined on nautical charts - the Upper, Middle, and Lower Danger Zones - so called to alert mariners that access to the areas may be restricted when test activities are taking place. The areas of interest in the PRTR Complex are subdivided into land ranges, Upper Danger Zone, Middle Danger Zone, and Lower Danger Zone.

The Middle Danger Zone is the focus of most outdoor RDT&E activities. Figure 3 shows the main gunnery target area in the PRTR.

b. The counties surrounding the PRTR include King George, Westmoreland and Northumberland counties in Virginia and Charles and St. Mary's counties in Maryland. The geographic coordinates of the danger zones may be found at http://edocket.access.gpo.gov/cfr_2007/julqtr/pdf/33cfr334.230.pdf. The PRTR is shown on parts of the following US Geological Survey quadrangle maps: Nanjemoy, MD; Popes Creek, MD; Charlotte Hall, MD; Mechanicsville, MD; Rock Point, MD; Leonardtown, MD; Hollywood, MD; Mathias Point, MD-VA; King George, VA-MD; Dahlgren, VA-MD; Colonial Beach North, VA-MD; Port Royal, VA; Rollins Fork, VA; Colonial Beach South, VA-MD; Stratford Hall, VA-MD; St. Clements Island, MD-VA; Piney Point, MD-VA; Machodoc, VA; and Kinsale, VA-MD.

c. The 1,641-acre EEA Complex, bordered by Upper Machodoc Creek to the north and west and the Potomac River to the east (Figure 2).

d. NSWCDL's Mission Areas, including a 1,593-acre land area on NSF Dahlgren and a 164-acre water area (see Figure 2). The water area lies on Upper Machodoc Creek, immediately north of the EEA Complex and south and west of the PRTR land complex. The land area lies immediately north and west of the PRTR land ranges.

Enclosed are seven fact sheets that describe our operations and support the EIS. We foresee evaluating the impact of three alternatives in the EIS as described in the EIS Fact Sheet. Further information on the EIS may be obtained from our website: http://www.nswc.navy.mil/EIS/index.html.

To help us describe existing conditions and evaluate the impacts of the proposed action, we request that your agency provide a list of endangered, threatened, and proposed species and designated and proposed critical habitats that may be present in the project areas. Please note that we are also sending coordination letters to the US Fish & Wildlife Service's Virginia Field Office, the National Marine Fisheries Service's Northeast Regional Office, the Virginia Department of Game and Inland Fisheries, the Virginia Department of Conservation and Recreation-Division of Natural Heritage, and the Maryland Department of Natural Resources-Wildlife and Heritage Service.

For further information, please contact Dr. Thomas Wray II, at (540) 653-4186 (thomas.wray@navy.mil). Thank you in advance for your assistance.

Sincerely,

Ann G. Swope

ANN G. SWOPE
Head, Safety and Environmental Office
By direction of the Commander

Enclosures:
1. Figure 1. Potomac River Test Range Complex
2. Figure 2. Dahlgren's Ranges and Mission Areas
3. Figure 3. Potomac River Test Range Primary Gunnery Target Area
4. Environmental Impact Statement
5. Test Range Operations
6. Chemical & Biological Sensor Tests
7. Laser Technology
8. Electromagnetic Energy
9. Dahlgren: A Unique National Asset
10. Dahlgren: A Vital Mission

Copy to: (w/encl)
Commander
Naval Sea Systems Command
Ms Vicki Writt (SEA 04RE)
1333 Isaac Hull Avenue SE
Washington Navy Yard, DC 20376

Copy to: (w/encl) (Cont'd)
Commander
Ms. Tanya Robinson
1333 Isaac Hull Avenue SE, Bldg 197
Washington Navy Yard, DC 20376

Chief of Naval Operations
Ms. Elizabeth Phelps (N45)
2511 Jefferson Davis Highway
NC-1, Suite 2000
Arlington, VA 22202

Ms. Christine Porter
Commander, Navy Region, Mid-Atlantic
Regional Environmental Programs (N45)
Norfolk, VA 23511-2737

Mr. Lane Willson
Earth Tech
675 N. Washington Street
Suite 300
Alexandria, VA 22314

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
NORTHEAST REGION
55 Great Republic Drive
Gloucester, MA 01930-2276

JAN 11 2012

Jeffrey C. Bossart
Director, Environmental Division
Department of the Navy
Naval Support Activity South Potomac
6509 Sampson Rd, Suite 217
Dahlgren, Virginia 22448

Re: Naval Surface Warfare Center, Dahlgren Division, Research, Development, Test, and Evaluation

Dear Mr. Bossart,

Your letter, dated November 23, 2011, requesting consultation with us regarding a proposal by the Navy for the Naval Surface Warfare Center, Dahlgren Division at Dahlgren (NSWCDD) to expand its research, development, test, and evaluation activities. These activities would take place outdoors on the Potomac River Test Range (PRTR) and Explosives Experimental Area (EEA) Range Complexes, the adjoining Mission Area, and the special-use airspace (SUA) at Naval Support Facility (NSF) Dahlgren, Virginia. The PRTR is 51 nautical miles (NM) long and covers 169 square NMs, and is divided into areas designated on nautical charts as the Upper, Middle, and Lower Danger Zones (UDZ, MDZ, LDZ, respectively). The Navy has made the preliminary determination that the proposed project is not likely to adversely affect any species listed as threatened or endangered under the jurisdiction of NOAA's National Marine Fisheries Service (NMFS). We concur with this determination and justification for this determination follows. This consultation has been conducted in accordance with Section 7 of the ESA of 1973, as amended, and is based on information provided to NMFS on November 25, 2011.

Proposed Project
The proposed project will enable NSWCDL to meet current and future mission-related warfare and force protection requirements by providing research, development, test, and evaluation of surface ship combat systems, ordnance, lasers and directed energy, force-level warfare, and homeland and force protection. The proposed action will expand NSWCDD's research, development, test, and evaluation activities within the PRTR and EEA Range complexes, the adjoining Mission Area, and SUA. These activities include outdoor activities that require the use of ordnance, electromagnetic (EM) energy, high-energy lasers and chemical and biological simulants.

Ordnance

NSWCDD will be firing large and small-caliber projectiles up to 4,000 yards downriver from the Main Range located on the land just north of Upper Machodoc Creek. Most of the gunfire is directed at target areas in the MDZ, but target areas in the upper part of the LDZ may be used on occasion. Large-caliber projectiles can be live (explosive) or inert (non-explosive). Between 1995 and 2009, 74 percent of the projectiles fired into the Potomac River have been inert. The component most often being tested on inert projectiles is the fuze or detonator which contains a few ounces of non-explosive talcum-like powder to produce a puff of smoke to indicate that the fuze has been successfully triggered. Twenty-six percent of the projectiles have been live, explosive projectiles. The largest explosive projectiles fired are 5", which contain approximately 6 to 10 pounds of explosives. NSWCDD also occasionally fires a 6.1" howitzer. Very rarely, NSWCDD fires an 8" gun loaded with a canister filled with electronics equipment to test the capability of the equipment to withstand high G-forces, but explosive projectiles are not used. Both the fuzes and the live projectiles are programmed to detonate above the water. Those that enter the water generally do not detonate, although a few may have a slight delay and detonate shortly after entering the water. It is estimated that two percent of live projectiles tested detonate underwater, generally within the upper 6 feet of the water column. Twenty-six percent of the projectiles fired are live and of those less than 2 percent detonate underwater, resulting in an estimate of 24 projectiles detonating underwater each year. Historically, 99.7 percent of large-caliber projectiles were fired into the MDZ and 0.3 percent into the LDZ. NSWCDD fired an average of 4,700 projectiles in the particularly active years and will not expect the number of projectiles fired to increase above 4,700 in the foreseeable future. Long range guns would fire into a target area up to 40,000 yards in the upper LDZ approximately 10 days a year.

The number of small-arms firing would increase from historic levels of 6,000 bullets per year to 30,000 bullets per year. Approximately 90 percent of this increase would be on land, with the remaining 10 percent potentially entering the water, mainly within 1,000 yards of the shoreline.

Electromagnetic Energy

The proposed project will emit EM energy in a frequency range that includes radio waves or radio frequency, microwaves, infrared light, visible light, and ultraviolet light. The devices that will be used operate at frequencies ranging from 300 kilohertz to 300 gigahertz and at average powers ranging from 10 watts to more than 500 megawatts. NSWCDD directs EM energy at targets on the PRTR and from special facilities on one land range to another across the entrance to Upper Machodoc Creek. Operation of EM sensors and directed energy equipment mainly take place in the UDZ and LDZ. Waves of EM energy do not move easily through water. The only EM activity that the NSWCDD would conduct in waters of the PRTR uses modified sonobuoys to receive, but not send, sound. The sonobuoys are small floating devices from which tiny attached microphones drop down to a fixed depth of water to detect submarines. Any sounds that are picked up are amplified by the sonobuoy and are converted into EM waves in the air and transmitted to a receiver where the sounds can be analyzed. The number of annual EM energy events would increase from the current 490 to 680. The majority of these events take place on the land ranges.

Lasers

Lasers are categorized into four classes according to the power of light they emit, expressed in watts. Class 1 & 2 lasers are not considered to be hazardous to the environment according to existing standard operating procedures. Therefore class 1 & 2 lasers will have no effect on ESA-listed species. Lasers using power levels from less than 5 milliwatts (Class 3) to 500 kilowatts (Class 4) are considered high energy lasers and have the capability to adversely affect ESA-listed species. In the proposed action over water Class 3 and 4 laser operations will be conducted along three corridors that cross over the waters of Upper Machodoc Creek and the Potomac River. The lasers will be tested outdoors firing slightly downwards into a target with a backstop lined with absorbent material. There would be 145 high energy laser operation events per year, which is an increase from previous levels of 60 events per year. All lasers would be directed to targets at, or above the surface of the water, not into the water.

Chemical Simulants

Chemical simulants are chosen for their low toxicity, low environmental impacts, and ability to closely simulate the actual agent the sensor is designed to detect. Prior to use, all simulants would be approved by the NSWCDD Safety and Environmental Office in consultation with NSF Dahlgren personnel as applicable. Simulants will only be approved for use after considering toxicity data relative to the intended quantity and concentration of the simulant to be used. Chemical simulants are dispersed into the air as a vapor on the Potomac River to test various kinds of chemical agent detection equipment. The test would be conducted over one or more weeks and one or two tests can be conducted per day. Over water operations would be conducted on the MDZ and would involve a vapor or chemical simulant released from a vessel in a variety of weather conditions. Sensors are mounted on and operated from vessels and/or on shore and would be aimed upriver or downriver to detect the simulant vapor against a sky/water background. The release for each operational test would take about 2 minutes, and the resulting vapor would dissipate in less than 10 minutes. A typical test would involve the release of approximately 10 gallons of simulant, but the amount could vary from a few ounces up to 20 gallons.

Biological Simulants

The test of biological simulants would be very similar to chemical detector operations using chemical simulants. Biological simulants are microorganisms that exhibit a quality similar to that of an actual biological threat agent. NSWCDD would use only Biosafety Level 1 simulants which are suitable for work involving well characterized agents not known to consistently cause disease in healthy adult humans, and of minimal potential hazard to laboratory personnel and the environment. Prior to use, all simulants would be approved by the NSWCDD Safety and Environmental Office in consultation with NSF Dahlgren personnel as applicable. Simulants will only be approved for use after considering Bio safety level data relative to the intended use of the simulant and purpose of the test. Operations will likely be conducted over a two-week period, with up to two tests per day, for a maximum of up to 20 releases in a two-week test period.

Vessel Traffic
Several range control boats will be on river whenever public access to the part of the PRTR being used is restricted. The range boats would be on the water for about 1,000 hours a year and would primarily be limited to the perimeter of the range to restrict access during testing. Activities may employ vessels and/or unmanned systems to perform a variety of tasks in the action area (e.g., serve as platforms for operations, tow targets, test sensors). NSWCDD maintains a group of small watercraft in Upper Machodoc Creek that will be used during the proposed action. Additionally, larger Navy or Coast Guard vessels may occasionally come up the river to participate in operations.

NMFS listed species in Project Area
The proposed project is located in the lower Potomac River. The action area is defined as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 CFR§402.02). For this project, the action area includes the project footprint as well as the underwater area where effects of the action will be experienced. As vessels involved in the test program will be transiting to and from the test location, the action area also includes the routes transited by project vessels while conducting the test program within the Potomac River. This area is expected to encompass all effects of the proposed action.

Although ESA-listed whales are known to transit past the mouth of Chesapeake Bay, large whale species would be considered rare transients within the Bay and are not likely to occur within the Potomac River.

Sea turtles are generally present in the Chesapeake Bay from April 1 – November 30 each year, when water temperatures are relatively warm. An estimated 3,000 – 10,000 loggerhead turtles and 500 Kemp's ridley sea turtles are found in Chesapeake Bay annually. In the Chesapeake Bay, Kemp's ridleys frequently forage in shallow embayments, particularly in areas supporting submerged aquatic vegetation and on tidal flats. Approximately 95 percent of the loggerheads found in Chesapeake Bay are juveniles; these turtles are found most commonly from the mouth of the Bay to the Potomac River while foraging along channel edges. Leatherback sea turtles are predominantly pelagic but are also seasonally present in the Chesapeake Bay. Loggerhead, Kemp's ridley, green, and leatherback sea turtles may occasionally be present in the lower Potomac River during warmer months of the year, but have not been recorded farther upstream than Piney Point, Maryland/Sandy Point, Virginia in the lower LDZ. Based on data, these occurrences are infrequent, and sea turtles are considered to be to be restricted to the lower part of the Potomac River.

The federally endangered shortnose sturgeon (*Acipenser brevirostrum*) is known to be present in the Potomac River. Fifteen shortnose sturgeon have been captured in the Potomac River between 1996 and 2010. The fifteen shortnose sturgeon captured in the Potomac River and reported via the USFWS Atlantic Sturgeon Reward Program, as well as other research, were documented in the following locations: four at the mouth of the river (May 3, 2000, March 26, 2001, December 10, 2004, May 22, 2005); one at the mouth of the Saint Mary's River (April 21, 1998); three at the mouth of Potomac Creek (May 17, 1996, two on March 8, 2002); one near Craney Island (September 20, 2005); one near the mouth of Popes Creek (March 22, 2006); three captures around Cobb Bar (one of which was a fish that was captured twice within a few days (December 23, 2007, March 14 and 17, 2008); one near Colonial Beach (March 13, 2009); and one near Cole's Point (April 9, 2009). It is important to note that the presence of shortnose sturgeon in the Potomac River is not limited to these capture locations. Based on tagging information (see below), the range of shortnose sturgeon in the Potomac River extends from the Little Falls to the confluence with the Chesapeake Bay. Use of discrete areas of the Potomac River is seasonal and is described below.

An ongoing tagging and telemetry study of shortnose sturgeon in the Potomac River began in 2004 (Kynard *et al.* 2007). Three shortnose sturgeon (the 9/20/05, 3/22/06 and 3/14/08 fish mentioned above) have been tagged with CART tags (Combined Acoustic and Radio Transmitting). While the sex and reproductive status of the 2008 fish is unknown, the 2005 and 2006 fish were both females with late stage eggs. The occurrence of pre-spawning females in the Potomac River combined with documented habitat that is consistent with preferred shortnose sturgeon spawning habitat suggests that a spawning population of shortnose sturgeon continues to exist in this river system. The 2005 female migrated upstream in spring 2006 to a 2-km reach (river km 187–185) containing habitat determined to be suitable for spawning (Kynard *et al.* 2007). The fish tagged in 2008 has not been detected by the telemetry array that is within the Potomac River. This suggests that the fish either shed the tag or that the fish has left the Potomac River. Information available to date from this study is summarized below.

While an extensive study of shortnose sturgeon in the Potomac River has not been conducted, the data resulting from the tracking of the two females by Kynard *et al.* (2007, 2009) provides valuable information on habitat use and the likely distribution of the species within the river. The two tracked fish have been concentrated in a 124 km stretch of the river, from rkm 187 (Little Falls/Chain Bridge) to rkm 63 (just downstream of the confluence with the Port Tobacco River). Within this reach, a summering-wintering concentration area was identified from rkm 63-141 (Kynard *et a*l. 2009). The researchers also indicate that not much change would be expected in the size of the foraging-overwintering concentration area even with a larger sample size of tracked adults. The type of habitat used did not change based on season, with the majority of time spent in the channel or channel edge and in locations with substrate comprised primarily with mud. The range of water depth used was 4.1 – 21.3 meters. The limited use of areas outside of the deep water channel is likely due to the lack of forage items in those habitats, which is supported by evidence of limited shortnose sturgeon forage items in the River (Kynard *et al.* 2007). As shortnose sturgeon use similar habitats in other rivers throughout their range, it is possible to make some conclusions regarding the likelihood of shortnose sturgeon to occur in a particular location in the Potomac. Shortnose sturgeon are typically found in the deepest areas (i.e., greater than 3 meters) with suitable dissolved oxygen (i.e., greater than 5 parts per million); often this type of habitat occurs in deepwater navigation channels. While foraging, shortnose sturgeon can also be found in shallower water over mudflats of shellfish beds with submerged aquatic vegetation. During the winter or during the summer, while seeking out thermal refugia, shortnose sturgeon are known to occur in deep holes. These statements regarding shortnose sturgeon distribution are well supported by Kynard *et al.* (2007).

Based on the best available scientific information, the action area, located in the lower Potomac River, is likely to be used as a migratory corridor to and from potential spawning grounds (i.e., approximately rkm 187–185) as well as a possible summering area (i.e., one shortnose sturgeon detected in vicinity of action area in June 2007; Kynard *et al.* 2009). Due to the distance from the spawning grounds (i.e., greater than 55 km downstream), shortnose sturgeon eggs or larvae, whose occurrence is limited to the waters near the spawning grounds, are not likely to occur within the action area.

Effects of the Action

SEA TURTLES

Sea turtles are known to occasionally occur in the lower LDZ; however the proposed action activities will take place outside of the lower LDZ. The only potential overlap is the use of range boats, barges and occasionally larger vessels in the lower LDZ. The probability of any one of these vessels coming into contact with a sea turtle is the same as any other vessel near the mouth of the Potomac River and is anticipated to be extremely low. Therefore, no direct effects on sea turtles are expected from the proposed action.

SHORTNOSE STURGEON

Ordnance

Shortnose sturgeon are known to occur in the area where the ordnance will be tested. The large caliber projectiles (inert and live) are all programmed to detonate above the surface of the water, and it is estimated that approximately 98% of them will. Above water detonations are not expected to affect shortnose sturgeon as the air-water interface would reflect most of the energy from the shock wave outward and upward. Less than 2% of the live rounds are expected to detonate underwater, although near the surface. Live projectiles that detonate underwater may directly strike a sturgeon or the pressure pulses generated by the detonation may injure or kill a sturgeon. However, as noted above, shortnose sturgeon are found in the deepest areas of the river channel, approximately one meter from the bottom. Shock waves attenuate exponentially away from the point of detonation and a substantial portion of its energy is expected to dissipate before reaching a sturgeon near the bottom. Additionally, the expanding bubble that contains the gaseous products would break the water surface quickly, allowing a significant portion of the energy to escape into the less dense air, thus reducing the peak pressure.

Given the small number of projectiles detonating underwater annually (24), the small area that would be encompassed by a projectile detonating close to the surface of the water, the large area where almost all projectiles are fired (31 sq NM), the intermittent nature of the testing, and the small number of sturgeon in the Potomac River overall, the effect of large-caliber projectiles on shortnose sturgeon is expected to be insignificant and discountable.

The small caliber projectiles (bullets) have the potential to hit a shortnose sturgeon. However, the bullets will be entering the water at an angle of less than 5 to 7 degrees, which causes them to bounce along the water because of the surface tension, losing momentum, and entering the water with less velocity than when hitting the water at angles greater than seven degrees. Small caliber bullets may also shatter upon impact with the water. Given the extent of the MDZ (38.8 sq NM), the size of the small-caliber bullets (20 mm or less), and the angle at which the bullets hit the water, the effect of small-caliber bullets on shortnose sturgeon is expected to be insignificant and discountable.

Gunfire may destroy or damage physical targets on the Potomac River. The environmental impacts of fragmenting these targets are minimized by removing hazardous materials to the extent possible prior to destroying or damaging them. After a target is impacted and the test completed, all remaining debris and waste remaining on the surface is cleaned up. For these reasons, impacts from target debris are considered insignificant and discountable.

Electromagnetic energy
Almost all EM energy being tested in the proposed action would occur above the surface of the water and would have no contact with any ESA-listed species or their habitat. EM that does reach the surface would be rapidly absorbed, scattered, or reflected off of organic and inorganic molecules. Any incidental EM energy that reaches the water surface would be reflected at the air-water boundary or quickly dissipated by the water molecules, and a negligible amount of energy would enter the water, which is not expected to effect shortnose sturgeon. Therefore, the effect of EM energy on shortnose sturgeon is expected to be insignificant and discountable.

Lasers
The lasers being tested in the proposed action are extremely accurate and the likelihood of missing a target is small. In the event the laser light hits the water, the amount and intensity of the energy would be immediately decreased as a result of the attenuation and propagation of the laser beam. Laser beams are not expected to enter the water and in the unlikely event that they do, the beam would be immediately reduced. Further, the surface area of the PRTR is massive in comparison to the surface area of a sturgeon and the small cross section of a laser beam, and therefore, the likelihood of a laser beam striking a sturgeon is discountable.

Chemical and biological simulants
Chemical and biological simulants deposited on the surface of the water have the potential to affect shortnose sturgeon. There would be limited deposition of chem/bio simulants on the water surface during the testing events. Many of the biological simulants that may be used are ubiquitous and often found in high concentrations in nature, including in water. Based on water testing conducted by NSWCDD immediately after chemical sensor tests on the PRTR, concentrations of chemical and biological simulants would be diluted down to barely detectable levels by the time they reach the river bottom where sturgeon are found. Therefore, the effect of chemical and biological simulants on shortnose sturgeon is expected to be insignificant and discountable.

Vessel Traffic
As shortnose sturgeon are known to occur in the action area, there is a potential for vessels to interact with shortnose sturgeon; however, the overall vessel traffic on the PRTR would decrease during operations, as public assess would be restricted. At such times, approximately 3 range boats would be stationed along the perimeter of the range, and barges or vessels associated with testing, would be present on the restricted part of the range. Given that the proposed action

would reduce overall vessel traffic on the river during testing, and shortnose sturgeon are generally found in the deepest areas of the river channel, it is extremely unlikely that an interaction between an individual shortnose sturgeon and a vessel will occur as vessels will not be operating within one meter or closer to the river bottom where shortnose sturgeon are likely to occur. Based on the best available information, NMFS is able to conclude that the interaction of a shortnose sturgeon with a vessel is discountable.

Alteration of Habitat

As described above, shortnose sturgeon are found in the deepest areas of the river channel and migrate along the river channel to other areas of the river, depending on season, to reach spawning, overwintering, and foraging grounds. Based on the above analysis of ordnance, EM energy, lasers, chemical/biological simulants and vessel traffic effects on shortnose sturgeon, the proposed action is not expected to alter the habitat or create any barriers that would disrupt or prevent the continuation of these essential behaviors (e.g., migrating and foraging) of shortnose sturgeon. Based on this information, the effects of the proposed action on shortnose sturgeon migration and foraging are expected to be insignificant and discountable

Conclusions

Based on the analysis that any effects to listed sea turtles and shortnose sturgeon will be insignificant or discountable, NMFS is able to concur with the determination that the proposed action by the Navy is not likely to adversely affect any listed species under NMFS jurisdiction. Therefore, no further consultation pursuant to section 7 of the ESA is required. Reinitiation of consultation is required and shall be requested by the Federal agency or by the Service, where discretionary Federal involvement or control over the action has been retained or is authorized by law and: (a) If new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered in the consultation; (b) If the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the consultation; or (c) If a new species is listed or critical habitat designated that may be affected by the identified action.

Technical Assistance for Proposed Species

On October 6, 2010, NMFS published two proposed rules to list five distinct population segments (DPS) of Atlantic sturgeon under the ESA. NMFS is proposing to list four DPSs as endangered (New York Bight, Chesapeake Bay, Carolina and South Atlantic) and one DPS of Atlantic sturgeon as threatened (Gulf of Maine DPS). Once a species is proposed for listing, as either endangered or threatened, the conference provisions of the ESA may apply (see 50 CFR 402.10 and ESA Section 7(a)(4)). As stated at 50 CFR 402.10, "Federal agencies are required to confer with NMFS on any action which is likely to jeopardize the continued existence of any proposed species or result in the destruction or adverse modification of proposed critical habitat."

NMFS has reviewed the proposed action in order to provide guidance to the Navy as to whether a conference is required in this case. Atlantic sturgeon are known to occur in the Potomac River and may be present in the action area. If present in the action area during the proposed action, NMFS anticipates that effects to Atlantic sturgeon would be similar to those described for shortnose sturgeon above. As such, all effects resulting from the test program are expected to be insignificant and discountable. As all effects of the proposed action are likely to be insignificant and discountable and the proposed action is not likely to result in the injury, mortality, or reduction in the reproduction, numbers, and distribution of any Atlantic sturgeon, the action is not likely to appreciably reduce the survival and recovery of any DPS of Atlantic sturgeon and therefore it is not reasonable to anticipate that this action would be likely to jeopardize the continued existence of any DPS of Atlantic sturgeon. As such, NMFS concludes that a conference is not required at this time for Atlantic sturgeon. Should project plans change, NMFS recommends that the Navy discuss the potential need for conference with NMFS.

Should you have any questions about this correspondence please contact Dan Marrone at (978) 282-8465 or by e-mail (Daniel.Marrone@Noaa.gov).

Sincerely,

Daniel S. Morris
Acting Regional Administrator

References

Kynard, B., M. Breece, M. Atcheson, M. Kieffer, and M. Mangold. 2007. Status of Shortnose Sturgeon in the Potomac River, Part I – Field Studies. USGS Natural Resources Preservation Project: E 2002-7.

Kynard, B., M. Breece, M. Atcheson, M. Kieffer, and M. Mangold. 2009. Life History and Status of Shortnose Sturgeon *(Acipenser brevirostrum)* in the Potomac River. J. Appl. Ichthyol: 1-5.

Ec: Marrone, NMFS/PRD
Wray, Navy

File Code: Navy Surface Warfare Center, Dahlgreen Division
PCTS: I/NER/2011/06208
H:\H2.0\Section 7\Non-Fisheries\Navy\Informal\2011\Navy Surface Warfare Center, Dahlgreen Division

APPENDIX I

FEDERAL COASTAL CONSISTENCY DETERMINATIONS

THIS PAGE INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

Section **Page**

THIS PAGE INTENTIONALLY LEFT BLANK

Introduction to Federal Coastal Consistency Determinations for Virginia and Maryland

The following Federal Coastal Consistency Determinations for proposed research, development, test, and evaluation (RDT&E) activities of Naval Surface Warfare Center, Dahlgren Division (NSWCDD) at Naval Support Facility (NSF) Dahlgren, Virginia are draft documents prepared by the Navy for submission to the Virginia Department of Environmental Quality (VDEQ) and the Maryland Department of the Environment (MDE). They will be submitted to the VDEQ and MDE for review when the Draft Environmental Impact Statement (DEIS) is published and becomes a public document. The Federal Coastal Consistency Determinations will provide the Commonwealth of Virginia and the State of Maryland, respectively, with the Navy's Consistency Determination under Coastal Zone Management Act (CZMA) Section 307(c)(1) and 15 CFR Part 930, Sub-part C, for the action proposed in the DEIS.

The CZMA (16 U.S.C. §1451 *et seq*.) was enacted in 1972 to protect coastal resources from growing demands associated with commercial, residential, recreational and industrial uses. The CZMA allows coastal states to develop a Coastal Zone Management Plan (CZMP) whereby they designate permissible land and water use within the state's coastal zone. States then have the opportunity to review and comment on federal agency activities that could affect the state's coastal zone or its resources.

Federal agency activities potentially affecting a state's coastal zone must be consistent, to the maximum extent practicable, with the enforceable policies of the state's coastal management program. The enforceable policies of a state's coastal management program for purposes of federal consistency consist of management programs adopted by a coastal state in accordance with the provisions of sections 305 and 306 of the CZMA and approved by the Assistant Administrator for the Ocean Services and Coastal Zone Management, National Oceanic and Atmospheric Administration (NOAA), US Department of Commerce. In addition, the enforceable policies of a state must be legally binding through constitutional provisions, laws, regulations, land use plans, ordinances or judicial or administrative decisions, by which a state exerts control over private and public land and water uses and natural resources in the coastal zone and which are incorporated in a management program as approved by the Office of Ocean and Coastal Resource Management, NOAA, either as part of the program approval described above or as a program change in accordance with the procedures detailed in 16 U.S.C. §1455(e). Typically, a state's coastal zone management program will focus on the protection of physical, biological, and socioeconomic resources.

Review of federal agency activities is conducted through the submittal of a Consistency Determination or a Negative Determination. A federal agency shall submit a Consistency Determination when it determines that its activity may have either a direct or an indirect effect on a state's coastal zone or resources. In accordance with 15 CFR § 930.39, the consistency determination shall include a brief statement indicating whether the proposed activity will be undertaken in a manner consistent to the maximum extent practicable with the enforceable policies of the management program and should be based upon an evaluation of the relevant enforceable policies of the management program.

Pursuant to 15 CFR § 930.41, each state has 60 days from the receipt of the Consistency Determination in which to concur with or object to the Consistency Determination, or to request an extension under 15 CFR § 930.41(b). Federal agencies shall approve one request for an extension period of 15 days or less.

VIRGINIA

THIS PAGE INTENTIONALLY LEFT BLANK

FEDERAL COASTAL CONSISTENCY DETERMINATION FOR OUTDOOR RESEARCH, DEVELOPMENT, TEST AND EVALUATION ACTIVITIES NAVAL SURFACE WARFARE CENTER, DAHLGREN LABORATORY DAHLGREN, VIRGINIA

This document provides the Commonwealth of Virginia with the Navy's Consistency Determination under Coastal Zone Management Act (CZMA) Section 307(c)(1) and 15 CFR Part 930, Subpart C, for the following proposed action:

FEDERAL AGENCY ACTION

The Department of the Navy proposes to expand Naval Surface Warfare Center, Dahlgren Division's (NSWCDD) outdoor research, development, test, and evaluation (RDT&E) activities within the Potomac River Test Range (PRTR) and Explosives Experimental Area (EEA) Range complexes, Land and Water Mission Areas, and Special-Use Airspace (SUA) at Naval Support Facility (NSF) Dahlgren, in King George County, Virginia. NSWCDD is the principal Naval RDT&E center for surface warfare analysis, surface ship combat systems, strategic systems and special warfare systems. The Navy has prepared a Draft Environmental Impact Statement (DEIS) for this Proposed Action, which is being submitted for review simultaneously with this consistency determination. The information provided below is summarized from the DEIS.

The outdoor RDT&E activities that are the subject of the Proposed Action are activities that require the use of the following (a more detailed description is provided in Chapter 1, Section 1.5 of the DEIS):

- **Ordnance.** Since its beginnings in 1918 as the US Naval Proving Ground, NSWCDD has been doing proof testing, lot acceptance, safety testing, and RDT&E for large-caliber guns, small arms, and many other types of ordnance, some of which result in detonations. Today, NSWCDD is the Navy's primary center for such work.

- **Electromagnetic Energy.** Electromagnetic (EM) energy is naturally occurring and man-made energy created by the interaction of fluctuating electrical and magnetic forces that travel through space at the speed of light. The equipment used outdoors at NSWCDD emits EM energy in a frequency range that includes radio waves or radio frequency, microwaves, and infrared, visible, and ultraviolet light. The 2005 Defense Base Realignment and Closure Commission (BRAC), which reviewed the work of all Department of Defense (DoD) installations, identified NSWCDD as a center of excellence for weapon systems integration, which involves RDT&E for communications and sensors that use EM energy. NSWCDD is also the Navy's lead laboratory for the RDT&E of issues surrounding EM environmental effects.

- **Lasers.** A laser is a device that emits a coherent beam of light. While lasers are a form of EM energy, they have unique properties that create different types of hazards from other EM sources. NSWCDD has been recognized by the Navy as a center of excellence for laser RDT&E with expertise that includes RDT&E of sensors, rangefinders, target designators, guidance systems, simulators, communications equipment, and weapons.

- **Chemical and Biological (Chem/Bio) Simulants.** The threat of terrorist attacks has prompted DoD to step up RDT&E to counter chem/bio terrorism. Chem/bio agents are very difficult to detect, and the key to minimizing the effects of an attack is early detection and warning. As the Navy's center for RDT&E on chemical and biological warfare sensors and protection systems, NSWCDD uses chemical simulants, rather than dangerous chemical agents, in the open air to test detection and protection systems. Simulants are substances – many in common, everyday use, such as acetic acid (strong vinegar) and oil of wintergreen – that mimic chemical and biological agents but do not have the agents' adverse health and environmental effects. Biological simulants are not currently used but would be introduced under the Proposed Action. They would be species of bacteria, fungi, and proteins (Bio-Safety Level [BSL-1 organisms]) that are naturally found in the environment in large concentrations, some of which are commonly used for teaching in college laboratories.

NSWCDD's outdoor RDT&E activities do and would continue to take place on the range complexes and Mission Area at NSF Dahlgren (more detailed descriptions are provided in Chapter 1, Section 1.4 of the DEIS):

- **PRTR Complex.** Shown on Figures 1-3 and 1-4 of the DEIS, the PRTR Complex consists of land and water test areas that support RDT&E principally for ordnance, but also for lasers, EM energy, and chemical simulants. The PRTR allows the Navy to conduct testing in a realistic, controlled environment – it effectively operates as a "ship on shore," collecting real-time data from a number of instrument stations. The water portion of the range is 51 nautical miles (NM) long, covers 169 square nm (sq NM), and is divided into areas designated on nautical charts as the Upper, Middle, and Lower Danger Zones (UDZ, MDZ, and LDZ, respectively). Most testing takes place within the MDZ. Public use of the danger zones is restricted during test events. Live fire can be performed up to 40,000 yards or approximately 20 NM down range. The 725 acres (ac) of land ranges that are part of the PRTR (Figure 1-4) include the Main Range, AA Fuze Range, Missile Test Range, Machine Gun Range, and Terminal Range, all located along the eastern shore of NSF Dahlgren.

- **EEA Range Complex**. The 1,641-ac EEA Range Complex (Figure 1-4) supports performance, lethality, safety, and insensitive munitions testing on full-scale weapon systems and components containing explosives, propellants, and inert materials. Although the EEA mainly supports RDT&E and safety testing for ordnance weapon systems, such as rocket-propelled grenades, rockets, and restrained missile launchers, this complex also supports RDT&E of lasers, EM energy, and chem/bio simulants. Two ranges – Churchill and Harris – are located within the EEA, as are two EM energy testing facilities.

- **Mission Area**. The 1,593-ac Mission Area (Figure 1-4) consists of property adjacent to but not designated as part of the PRTR Complex. This area supports a myriad of outdoor RDT&E activities for NSF Dahlgren and its tenants but excludes destructive ordnance testing (allowed on military ranges including the PRTR and EEA). Facilities in this area include the NSF Dahlgren Airfield, the Maginot Open Air Test Site (MOATS), the Chemical/Biological Defense (CBD) Facility, and the Electromagnetic Environmental Effects (E3) facilities – Me MOATS, ground planes, airfield hangars, and the abandoned and main runways.

- **Special-Use Airspace (SUA)**. SUA areas have been established by the Federal Aviation Administration (FAA) to prevent hazards to aircraft from NSWCDD's RDT&E activities (Figure 1-6 of DEIS). The maximum altitudes are 40,000 feet (ft) for R-6611A and R-6613A, and 60,000 ft for R-6611B and R-6613B. Additionally, a small restricted airspace – R-6612 – lies directly over the EEA, and extends to 7,000 ft.

PURPOSE AND NEED

The purpose of the Proposed Action is to enable NSWCDD to meet current and future mission-related warfare and force-protection requirements by providing RDT&E of surface ship combat systems, ordnance, lasers and directed energy, force-level warfare, and homeland and force protection. The need for the Proposed Action is to enable the Navy and other stakeholders to successfully meet current and future national and global defense challenges by developing a robust capability to carry out assigned RDT&E activities on range complexes, in the Mission Area, and in SUA at NSF Dahlgren.

ALTERNATIVES

The Navy is considering three alternatives:

- **No Action Alternative.** This would be a continuation of NSWCDD's existing outdoor activities (baseline activities) that have the potential to affect the human environment, namely, those involving ordnance, high-power EM energy and lasers, and chemical simulants.
- **Alternative 1.** This alternative includes the baseline activities plus the increase in activities that are necessary to meet the minimum workload requirements in the reasonably foreseeable future; it amounts overall to an approximate doubling of current activities, with the exception of large-caliber gun activities, which would remain at baseline levels.
- **Alternative 2.** This alternative, which is the Preferred Alternative, would provide an increase in activities of 15 percent above Alternative 1 levels. This alternative satisfies current baseline requirements; includes the growth necessary to meet minimum workload requirements for the reasonably foreseeable future; and includes a margin of growth for the most actively evolving programs, for which the number of future annual operational events is harder to predict.

A detailed description of the alternatives is provided in Chapter 2 of the DEIS.

ENFORCEABLE POLICIES

The Commonwealth of Virginia has developed and implemented a federally approved Coastal Resources Management Program (CRMP) encompassing nine enforceable policies for the coastal area pertaining to:

- Fisheries management.
- Subaqueous lands management.
- Wetlands management.
- Dunes management.
- Non-point source pollution control.
- Point source pollution control.
- Shoreline sanitation.
- Air pollution control.
- Coastal lands management.

A summary analysis of how the Proposed Action would affect each of the enforceable policies follows. It is based on the more detailed analyses presented in the DEIS, as noted.

FISHERIES MANAGEMENT. *This program stresses the conservation and enhancement of finfish and shellfish resources and the promotion of commercial and recreational fisheries to maximize food production and recreational opportunities*.

The Proposed Action is not expected to have a significant adverse impact on the conservation and enhancement of finfish and shellfish resources or the promotion of commercial or recreational fisheries.

Effects on Potomac River Fish Species and Essential Fish Habitat

The following summary impact analysis is organized by type of activity and focuses on the MDZ, where the large majority of activities occur. For all activities, impacts outside this area would be substantially less or nil.

There are approximately 90 species of fish that are known to occur in the PRTR section of the Potomac River (these species are described in Chapter 3, Section 3.11.1.4 of the DEIS). Essential Fish Habitat (EFH) has been identified in the Potomac River for one or more life stages of bluefish, Spanish mackerel, red drum, windowpane flounder, and summer flounder (see Chapter 3, Section 3.11.1.4). EFH in the PRTR is as follows:

- UDZ – juvenile bluefish and summer flounder
- MDZ – juvenile bluefish and summer flounder
- LDZ – juvenile and adult bluefish, summer flounder

Both the species with EFH in the MDZ are seasonally present. Juvenile bluefish are found in mid-Atlantic estuaries from May through October. Adult and juvenile summer flounder generally inhabit shallow coastal and estuarine waters during the warmer months of the year and remain offshore during the fall and winter. EFH for juvenile summer flounder consists of demersal waters, muddy substrate, and sand. EFH for bluefish includes pelagic waters.

Ordnance Activities

Under all alternatives, approximately 4,700 large-gun projectiles (an average based on particularly active years since 1995) would enter the PRTR portion of the Potomac River in particularly active years and be propelled into the sediments on the river bottom, typically to a depth of 6-8 feet (ft) or more, which could affect fish (about 10 percent of small-arm projectiles, i.e., bullets, also are fired into the river but because bullets lose energy quickly in water, this impact can be considered negligible). Adverse effects to fish or EFH could result from physical impact or from exposure, direct or indirect, to the metal and explosive constituents introduced in the water column or sediments by the projectiles entering the river.

Inert projectiles and dud live projectiles (about 3 percent of all live projectiles, or about 37 projectiles in a particularly active year) would penetrate the water and sediments propelled by their forward momentum and may potentially hit a fish[1]. However, the probability of such a hit is low and the adverse effect may be considered negligible, especially in the deeper waters where most projectiles would touch down. Live projectiles are designed to detonate above the water surface and only fragments enter the river. Here also, the odds of a direct hit are low and the potential impacts negligible. Less than two percent of the live projectiles (about 24 in a particularly active year) can be expected to accidentally detonate underwater. In this case, impacts could result from the pressure wave generated by the detonation. This could affect fish in the vicinity and the potential damage would depend on a number of factors, including the size and physiology of the fish, the depth of explosion, the weight of the explosive charge, the local bathymetry, and the distance of the fish to the explosion. Adverse effects could include death, damage to swimbladders and blood vessels, tearing of tissues, and rupturing of various organs. However, because of the small number of projectiles that would detonate underwater and likely shallow depth of the detonation, overall adverse impacts on fish populations would be minimal. Indeed, the resulting fish mortality can be expected to be much less than that resulting from recreational or commercial fishing.

As detailed in Appendix F of the DEIS, the concentration of munitions constituents (metals and explosives) in the water and sediments of the areas of the PRTR that have historically been most intensively used were modeled based on a 90-year average of 3,820 rounds a year since the Navy began using the PRTR in 1918. These estimates were compared to water and sediment quality criteria and guidelines recommended by federal and state agencies to determine whether adverse effects to fish are likely. The modeled concentrations of both metals and explosives were found to be orders of magnitude below the concentrations that could be expected to result in adverse effects. The DEIS also compared predicted concentrations of metals in fish tissues to the lowest concentration levels causing adverse effects. Again, the predicted concentrations were well below levels known to result in adverse impacts. A similar comparison could not be conducted with respect to explosives because of a lack of relevant studies. However, the low concentrations

[1] Inert projectiles contain inert material such as concrete rather than explosives. Live projectiles contain explosives that detonate at the target. Duds are live projectiles that fail to detonate at the target. In the years 1995 to 2009, 74 percent of the projectiles NSWCDD fired were inert.

of explosives in water and sediments strongly suggest that explosives are not present in sufficient quantity to significantly affect fish species. Because of the low concentrations of metals and explosives in the waters and sediments of the most intensely used water portion of the PRTR, continuation of the ordnance activities under Alternatives 1 and 2 is not expected to result in significant impacts.

Electromagnetic Energy Activities

The number of EM energy events would range from 490 a year under the No Action Alternative to 590 a year under Alternative 2. While under all alternatives some activities would involve beaming EM energy within the water part of the PRTR and across Upper Machodoc Creek, such activities would take place above the water surface. Any breach of the surface by concentrated EM energy would be accidental and rare. In such cases, the energy would be quickly absorbed, scattered, or reflected off. The intensity of the beam would quickly decrease and any potential impact to fish or EFH would be minimal. Also under all alternatives, some underwater EM sensor testing would be conducted involving the occasional deployment of passive (receives signals but does not emit them) sonobuoys. This would not generate any additional sound or EM waves in the water and the buoys would be recovered at the conclusion of the test. The initial deployment of the sonobuoys may scare away any fish present in the area, but they could and would return soon after.

Laser Activities

The number of annual laser events would range from 60 under the No Action Alternative to 145 under Alternative 2. Under all alternatives, laser activities would be conducted above the surface within the PRTR or the Water Mission Area. Like all NSWCDD activities, laser activities are tightly controlled and the odds of a laser beam hitting the water surface are extremely low. If it happened, the energy would quickly be absorbed, scattered, or reflected off, with no potential impact to fish or EFH.

Chemical and Biological Defense Activities

Only chemical defense activities would take place under the No Action Alternative (12 events a year). Alternatives 1 and 2 include both chemical and biological activities (60 and 70 events a year, respectively). In all cases, the activities would involve the use of simulants only – simulants are low-toxicity chemicals in common use or bacteria, bacteriophages, fungi, and proteins commonly found in the environment. As described in Chapter 4, Section 4.11.1.4 of the DEIS, a model was develop to estimate the concentration of chemical simulants that would be deposited on surface water and these estimates were compared to the lowest known aquatic toxicity thresholds. All exposure concentrations were found to be an order of magnitude below the lowest aquatic toxicity value, indicating that chemical simulant testing would have no adverse effects on aquatic life, including fish and EFH.

While no modeling was performed for biological simulants, the bacteria, bacteriophages, fungi, and proteins that would be used are ubiquitous and often found in high concentrations in nature, including in water. There are no published reports of disease associated with these organism/substances in aquatic plants or animals and they are not considered to be disease-causing agents. The small concentrations of these organisms/substances deposited on the water would not cause any significant increase in the resident bacterial or fungal populations. No adverse effects are anticipated.

Effects on Potomac River Biological Resources Other than Fish

The DEIS also considered the potential impacts of the Proposed Action on aquatic vegetation, phytoplankton and zooplankton, and invertebrates (including species of economic interest such as blue crab and oyster) that live in the Potomac River (Chapter 4, Section 4.11). For the same reasons as those summarized above with respect to potential impacts to fish species, none of the activities that would take place within the PRTR or Mission Area are expected to result in significant adverse impacts to these aquatic biological resources.

Effects on Commercial Fishing

Under all alternatives, access to the stretch of the Potomac River underlying the water portion of the PRTR would be restricted while activities are underway. The annual total of restricted hours would range from 750 under the No Action Alternative to 1000 under Alternative 2. Restrictions would mostly affect the MDZ, and often only a part of the MDZ is restricted. Under Alternatives 1 and 2, greater use would be made of the UDZ and LDZ than under the No Action Alternative. Under Alternatives 1 and 2, access to some or all of the UDZ may be restricted up to 2 days a year. Access to the upper part of the LDZ to 40,000 yds downrange may be restricted up to 10 days a year, and to some or all of the LDZ for up to two days a year. NSWCDD's Range Control Center works with commercial fishermen to allow them to cross the range during lulls in testing to minimize delays, so that the maximum delay is one-half hour, with 10 minutes being the typical delay.

The DEIS considered the potential impact of the Proposed Action and projected range closures on commercial fishing activity in the area (Chapter 4, Section 4.2). Commercial fishing in the Potomac River involves fishing, crabbing, and less frequently, oystering. The occupational category of Farming, Fishing and Forestry in the five counties surrounding the PRTR (King George, Westmoreland, and Northumberland in Virginia, Charles and St. Mary's in Maryland) accounted for 1,300 jobs, providing an idea of the scale of commercial fishing employment in the region. Data from the Potomac River Fisheries Commission (PRFC) indicate that 85 percent of finfish as well as 60 percent of crabs are obtained in the lower reaches of the river from Colton's Point, the lower limit of the MDZ, down to the mouth of the river. While 77 percent of oysters are obtained within the MDZ, volumes are small. PRFC issues 1,300 commercial finfish licenses annually, but many fishermen hold multiple licenses, so that an estimated 800 commercial fisherman fish the Potomac from its mouth to Mosspoint, MD. Efforts to survey fishermen met with few responses, but those that did respond indicated no issues with NSWCDD's activities, presumably because most fishing activity takes place in the LDZ, which has and would continue to have relatively few testing activities compared to the MDZ. Fishermen are usually able to work around activities in the MDZ. Thus, no significant adverse impacts are expected.

SUBAQUEOUS LANDS MANAGEMENT. *The management program for subaqueous lands establishes conditions for granting or denying permits to use state-owned bottomlands.*

The Proposed Action would not involve any encroachment in, on or over state-owned subaqueous lands.

WETLANDS MANAGEMENT. *The purpose of the wetlands management program is to preserve tidal wetlands, prevent their despoliation, and accommodate economic development in a manner consistent with wetlands preservation.*

The Proposed Action under any alternative would not have any significant adverse effects on tidal wetlands. No construction or other ground-disturbing activities that could result in the filling of, or other significant physical alterations to, wetlands either on NSF Dahlgren or outside the installation are involved in the Proposed Action. As explained in the DEIS, Chapter 4, Section 4.10.2, while residue from ordnance activities could enter wetlands, the concentrations involved would be so low as to be virtually undetectable (a quantitative modeling of the munitions component concentrations that can be expected to be present in the water and sediments of the PRTR as a result of NSWCDD's activities is presented in Appendix G of the DEIS). EM and laser activities would involve beaming energy above ground only. Chemical and biological defense activities would involve relatively harmless simulants with low concentrations of simulants deposited over land or water.

DUNES MANAGEMENT. *Dune protection is carried out pursuant to the Coastal Primary Sand Dune Protection Act and is intended to prevent destruction or alteration of primary dunes.*

The Proposed Action would not affect any primary sand dunes. There are no sand dunes on NSF Dahlgren or within the vicinity of the PRTR.

NON-POINT SOURCE POLLUTION CONTROL. *Virginia's Erosion and Sediment Control Law requires soil-disturbing projects to be designed to reduce soil erosion and to decrease inputs of chemical nutrients and sediments to the Chesapeake Bay, its tributaries, and other rivers and waters of the Commonwealth*.

The Proposed Action does not involve any ground-disturbing activities or new construction that could result in an increase in the quantity, or a degradation of the quality, of stormwater runoff on or outside NSF Dahlgren.

POINT SOURCE POLLUTION CONTROL. *The point source program is administered by the State Water Control Board pursuant to Code of Virginia § 62.1-44.15. Point source pollution control is accomplished through the implementation of the National Pollutant Discharge Elimination System permit program established pursuant to Section 402 of the federal Clean Water Act and administered in Virginia as the Virginia Pollutant Discharge Elimination System permit program.*

The Proposed Action would have no effect on point source pollution control. It would not impact NSF Dahlgren's Virginia Pollutant Discharge Elimination System program permit. The Navy-owned sewage treatment plant located on the installation would continue to operate as at present.

SHORELINE SANITATION. *The purpose of this program is to regulate the installation of septic tanks, set standards concerning soil types suitable for septic tanks, and specify minimum distances that tanks must be placed away from streams, rivers, and other waters of the Commonwealth.*

The Proposed Action would not require the installation of septic systems.

AIR POLLUTION CONTROL. *The program implements the federal Clean Air Act to provide a legally enforceable State Implementation Plan for the attainment and maintenance of the National Ambient Air Quality Standards.*

Because NSF Dahlgren's annual emissions levels do not exceed the Title V major source threshold of 100 tons per year of any criteria pollutants, the installation is operating under a state minor synthetic operating permit (Registration No. 40307) instead of a major-source Title V permit.

As part of the DEIS, a chemical simulant dispersion modeling analysis was conducted to evaluate the potential impact on air quality of proposed chemical defense activities (no modeling was conducted for biological simulants because, as noted above, only entirely harmless, bio-level 1 bacteria would be used). For each simulant considered, the most sensitive toxicological value found in the literature was used as a toxicity endpoint (toxic effect level) for comparison to the modeled air concentrations. A detailed account of the modeling procedures and results is provided in Chapter 4, Section 4.4.1.2 of the DEIS (See also Appendix J). The model shows that no significant adverse impacts would result from the proposed activities. The only individuals potentially exposed to the highest modeled concentrations, some of which exceed target toxicity levels, would be NSWCDD personnel working on the operation near the release point on the land or water ranges, all of whom would be equipped with respirators and protective clothing. Outside the near vicinity of the release point, there would be no exposure to elevated simulant concentrations.

COASTAL LANDS MANAGEMENT. *This program is a state-local cooperative program administered by the Chesapeake Bay Local Assistance Department and 84 localities in Tidewater, Virginia established pursuant to the Chesapeake Bay Preservation Act (CBPA); Code of Virginia § 10.1-2100 thru § 10.1-2114 and Chesapeake Bay Preservation Area Designation and Management Regulations; Virginia Administrative Code 9 VAC 10-20-10 et seq.*

The Proposed Action includes no development within the designated state coastal zone resource protection areas or resource management areas. Therefore, there would be no direct impacts to these habitats. Indirect impacts from the migration of detonation residues, EM energy activities, laser activities, and chemical/biological defense activities would be minimal, for the reasons stated above.

CONCLUSION

Based on these and other findings of the DEIS, the Navy finds that the Proposed Action under any of the alternatives considered would result in no or minimal adverse impacts to the coastal zone resources of Virginia. The Proposed Action, which would be implemented in accordance with the mitigation and protective measures listed in Chapter 6 of the DEIS, is consistent to the maximum extent practicable with the enforceable policies of the Virginia Coastal Zone Management Plan.

MARYLAND

THIS PAGE INTENTIONALLY LEFT BLANK

FEDERAL COASTAL CONSISTENCY DETERMINATION FOR OUTDOOR RESEARCH, DEVELOPMENT, TEST AND EVALUATION ACTIVITIES NAVAL SURFACE WARFARE CENTER, DAHLGREN LABORATORY DAHLGREN, VIRGINIA

This document provides the State of Maryland with the Navy's Consistency Determination under Coastal Zone Management Act (CZMA) Section 307(c)(1) and 15 CFR Part 930, Subpart C, for the following proposed action:

FEDERAL AGENCY ACTION

The Department of the Navy proposes to expand Naval Surface Warfare Center, Dahlgren Division's (NSWCDD) outdoor research, development, test, and evaluation (RDT&E) activities within the Potomac River Test Range (PRTR) and Explosives Experimental Area (EEA) Range complexes, the Mission Area, and Special-Use Airspace (SUA) at Naval Support Facility (NSF) Dahlgren, in King George County, Virginia. NSWCDD is the principal Naval RDT&E center for surface warfare analysis, surface ship combat systems, strategic systems and special warfare systems. The Navy has prepared a Draft Environmental Impact Statement (EIS) for this Proposed Action, which is being submitted for review simultaneously with this consistency determination. The information provided below is summarized from the DEIS.

The outdoor RDT&E activities that are the subject of the Proposed Action are activities that require the use of the following (a more detailed description is provided in Chapter 1, Section 1.5 of the DEIS):

- **Ordnance.** Since its beginnings in 1918 as the US Naval Proving Ground, NSWCDD has been doing proof testing, lot acceptance, safety testing, and RDT&E for large-caliber guns, small arms, and many other types of ordnance, some of which result in detonations. Today, NSWCDD is the Navy's primary center for such work.

- **Electromagnetic Energy.** Electromagnetic (EM) energy is naturally occurring and man-made energy created by the interaction of fluctuating electrical and magnetic forces that travel through space at the speed of light. The equipment used outdoors at NSWCDD emits EM energy in a frequency range that includes radio waves or radio frequency, microwaves, and infrared, visible, and ultraviolet light. The 2005 Defense Base Realignment and Closure Commission (BRAC), which reviewed the work of all Department of Defense (DoD) installations, identified NSWCDD as a center of excellence for weapon systems integration, which involves RDT&E for communications and sensors that use EM energy. NSWCDD is also the Navy's lead laboratory for the RDT&E of issues surrounding EM environmental effects.

- **Lasers.** A laser is a device that emits a coherent beam of light. While lasers are a form of EM energy, they have unique properties that create different types of hazards from other EM sources. NSWCDD has been recognized by the Navy as a center of excellence for laser RDT&E with expertise that includes RDT&E of sensors, rangefinders, target designators, guidance systems, simulators, communications equipment, and weapons.

- **Chemical and Biological (Chem/Bio) Simulants.** The threat of terrorist attacks has prompted DoD to step up RDT&E to counter chem/bio terrorism. Chem/bio agents are very difficult to detect, and the key to minimizing the effects of an attack is early detection and warning. As the Navy's center for RDT&E on chemical and biological warfare sensors and protection systems, NSWCDD uses chemical simulants, rather than dangerous chemical agents, in the open air to test detection and protection systems. Simulants are substances – many in common, everyday use, such as acetic acid (strong vinegar) and oil of wintergreen – that mimic chemical and biological agents but do not have the agents' adverse health and environmental effects. Biological simulants are not currently used but would be introduced under the Proposed Action. They would be species of bacteria, fungi, and proteins (Bio-Safety Level [BSL-1 organisms]) that are naturally found in the environment in large concentrations, some of which are commonly used for teaching in college laboratories.

NSWCDD's outdoor RDT&E activities do and would continue to take place on the range complexes and mission areas at NSF Dahlgren (more detailed descriptions are provided in Chapter 1, Section 1.4 of the DEIS):

- **PRTR Complex.** Shown on Figures 1-3 and 1-4 of the DEIS, the PRTR Complex consists of land and water test areas that support RDT&E principally for ordnance, but also for lasers, EM energy, and chemical simulants. The PRTR allows the Navy to conduct testing in a realistic, controlled environment – it effectively operates as a "ship on shore," collecting real-time data from a number of instrument stations. The water portion of the range is 51 nautical miles (NM) long, covers 169 square nm (sq NM), and is divided into areas designated on nautical charts as the Upper, Middle, and Lower Danger Zones (UDZ, MDZ, and LDZ, respectively). Most testing takes place within the MDZ. Public use of the danger zones is restricted during test events. Live fire can be performed up to 40,000 yards or approximately 20 NM down range. The 725 acres (ac) of land ranges that are part of the PRTR (Figure 1-4) include the Main Range, AA Fuze Range, Missile Test Range, Machine Gun Range, and Terminal Range, all located along the eastern shore of NSF Dahlgren.

- **EEA Range Complex**. The 1,641-ac EEA Range Complex (Figure 1-4) supports performance, lethality, safety, and insensitive munitions testing on full-scale weapon systems and components containing explosives, propellants, and inert materials. Although the EEA mainly supports RDT&E and safety testing for ordnance weapon systems, such as rocket-propelled grenades, rockets, and restrained missile launchers, this complex also supports RDT&E of lasers, EM energy, and chem/bio simulants. Two ranges – Churchill and Harris – are located within the EEA, as are two EM energy testing facilities.

- **Mission Area**. The 1,593-ac Mission Area (Figure 1-4) consists of property adjacent to but not designated as part of the PRTR Complex. This area supports a myriad of outdoor RDT&E activities for NSF Dahlgren and its tenants but excludes destructive ordnance testing (allowed on military ranges including the PRTR and EEA). Facilities in this area include the NSF Dahlgren Airfield, the Maginot Open Air Test Site (MOATS), the Chemical/Biological Defense (CBD) Facility, and the Electromagnetic Environmental Effects (E3) facilities – Me MOATS, ground planes, airfield hangars, and the abandoned and main runways.

- **Special-Use Airspace (SUA)**. SUA areas have been established by the Federal Aviation Administration (FAA) to prevent hazards to aircraft from NSWCDD's RDT&E activities (Figure 1-5). The maximum altitudes are 40,000 feet (ft) for R-6611A and R-6613A, and 60,000 ft for R-6611B and R-6613B. Additionally, a small restricted airspace – R-6612 – lies directly over the EEA, and extends to 7,000 ft.

PURPOSE AND NEED

The purpose of the Proposed Action is to enable NSWCDD to meet current and future mission-related warfare and force-protection requirements by providing RDT&E of surface ship combat systems, ordnance, lasers and directed energy, force-level warfare, and homeland and force protection. The need for the Proposed Action is to enable the Navy and other stakeholders to successfully meet current and future national and global defense challenges by developing a robust capability to carry out assigned RDT&E activities on range complexes, in mission areas, and in SUA at NSF Dahlgren.

ALTERNATIVES

The Navy is considering three alternatives:

- **No Action Alternative.** This would be a continuation of NSWCDD's existing outdoor activities (baseline activities) that have the potential to affect the human environment, namely, those involving ordnance, high-power EM energy and lasers, and chemical simulants.
- **Alternative 1.** This alternative includes the baseline activities plus the increase in activities that are necessary to meet the minimum workload requirements in the reasonably foreseeable future; it amounts overall to an approximate doubling of current activities, with the exception of large-caliber gun activities, which would remain at baseline levels.
- **Alternative 2.** This alternative, which is the Preferred Alternative, would provide an increase in activities of 15 percent above Alternative 1 levels. This alternative satisfies current baseline requirements; includes the growth necessary to meet minimum workload requirements for the reasonably foreseeable future; and includes a margin of growth for the most actively evolving programs, for which the number of future annual operational events is harder to predict.

A detailed description of the alternatives is provided in Chapter 2 of the DEIS.

ENFORCEABLE POLICIES

The State of Maryland has developed and implemented a federally approved Coastal Resources Management Program (CRMP) encompassing enforceable policies for the coastal area pertaining to:

General Policies
- Core policies.
- Water quality.
- Flood hazards.

Coastal Resources
- The Chesapeake and Atlantic Coastal Bays Critical Area.
- Tidal wetlands.
- Non-tidal wetlands.
- Forests.
- Historical and archaeological sites.
- Living aquatic resources.

Coastal Uses
- Mineral extraction.
- Electrical generation and transmission.
- Tidal shore erosion control.
- Oil and natural gas facilities.
- Dredging and disposal of dredged material.
- Navigation.
- Transportation.
- Agriculture.
- Development.
- Sewage treatment.

The Proposed Action has the potential to affect the Potomac River and the adjacent portions of Charles and St. Mary's counties in Maryland, which are located in Maryland's designated coastal zone. Table H-1 summarizes the applicability of each of the Maryland enforceable policies and the Proposed Action's consistency with the applicable policies. A summary analysis of how the Proposed Action would affect each of the applicable enforceable policies follows. It is based on the more detailed analyses presented in the DEIS, as noted.

Core Policies

Policy A.1.1 – *This policy provides for the maintenance of air quality to protect the health, general welfare, and property of the people of the state.*

As part of the DEIS, a chemical simulant dispersion modeling analysis was conducted to evaluate the potential impact on air quality of proposed chemical defense activities (no modeling was conducted for biological simulants because, as noted above, only biosafety level-1 bacteria would be used). For each simulant considered, the most sensitive toxicological value found in the literature was used as a toxicity endpoint (toxic effect level) for comparison to the modeled air concentrations. A detailed account of the modeling procedures and results is provided in Chapter 4, Section 4.4.1.2 of the DEIS (See also Appendix J). The model shows that no significant adverse impacts would result from the proposed activities. The only individuals potentially exposed to the highest modeled concentrations, some of which exceed target toxicity levels when concentrated, would be NSWCDD personnel working on the operation near the release point on the land or water ranges, all of whom would be equipped with respirators and protective clothing. Outside the near vicinity of the release point, there would be no exposure to elevated simulant concentrations.

Policy A.1.2 – *This policy provides for the control of noise that may jeopardize health, general welfare, or property, or which degrades the quality of life.*

Continuous noise (as opposed to sporadic gun firing noise) from aircraft/helicopter/UAV activities is considered negligible due to the low number of flights. Modeling was used to develop installation-wide noise contours for large-gun firing and explosive detonations, as described in Chapter 3, Section 3.5.4 of the DEIS. Additionally, noise measurements were taken in November 2009 at six historic structures located along the PRTR, as detailed in Appendix D of the DEIS. The noise measurements at historic structures confirmed that the model-predicted peak noise contours reasonably represent worst-case gun firing peak noise conditions around the PRTR and that the model-predicted peak noise levels can be considered conservative, particularly at on-land receiving sites. The noise modeling shows that no significant adverse impacts would result from the proposed activities. In addition, implementation of NSWCDD's outdoor noise management process, provided in Appendix C of the DEIS, is expected to minimize noise impacts resulting from NSWCDD outdoor RDT&E activities.

The 2009 noise measurement program also included airborne and ground borne vibration monitoring. Based on the low vibration levels measured over the two-day firing and monitoring period, it is unlikely that the largest gun firing at NSWCDD would result in vibration impacts to structures near the PRTR significant enough to cause any structural damage.

Policy A.1.3 – *This policy provides for the protection of the unique ecological, geological, scenic, and contemplative aspects of State wild lands from effects that would jeopardize the future use and enjoyment of those lands as wild.*

Two designated wildlands in the Maryland Wildlands Preservation System are located within the Maryland counties that are adjacent to the PRTR. Both wildlands are distant from NSF Dahlgren and from the PRTR. A 1,605-ac wildland is located in Charles County in Mattawoman Natural Environment Area, near Indian Head, Maryland, upriver of the UDZ. A 1,445-ac wildland is located in St. Mary's County in St. Mary's River State Park, south of Leonardtown, Maryland northeast of the LDZ.

The impacts of the Proposed Action to ecological and geological resources would be restricted to NSF Dahlgren and the PRTR, particularly to the immediate vicinity of NSWCDD RDT&E activities, as discussed in Chapter 4, Sections 4.9 and Sections 4.11 through 4.14 of the DEIS. As the Proposed Action would not result in new construction or development, no impacts to scenic resources would occur. No significant adverse affects on the contemplative aspects of State wildlands would result from the Proposed Action due to noise-generating RDT&E activities on NSF Dahlgren and the PRTR.

Continuous noise (as opposed to sporadic gun firing noise) from aircraft/helicopter/UAV activities is considered negligible due to the low number of flights. Modeling was used to develop installation-wide noise contours for large-gun firing and explosive detonations, as described in Chapter 3, Section 3.5.4 of the DEIS. Additionally, noise measurements were taken in November 2009 at six historic structures located along the PRTR, as detailed in Appendix D of the DEIS. The noise measurements at historic structures confirmed that the model-predicted peak noise contours reasonably represent worst-case gun firing peak noise conditions around the PRTR and that the model-predicted peak noise levels can be considered conservative, particularly at on-land receiving sites. The noise modeling shows that no significant adverse impacts would result from the proposed activities. In addition, implementation of NSWCDD's outdoor noise management process, discussed in Section 3.5.3.5 and provided in Appendix C of the DEIS, is expected to minimize noise impacts resulting from NSWCD outdoor RDT&E activities.

Policy A.1.4 – *This policy provides for the protection of the safety, order, and natural beauty of State parks and forests, State reserves, scenic preserves, parkways, historical monuments, and recreational areas.*

Under the Proposed Action, health and safety activities would continue to be an integral part of NSWCDD's mission and continue to follow the NSWCDD Occupational Safety and Health Policy. All outdoor activities associated with RDT&E activities would continue to comply with all applicable federal and state, Department of Defense, Navy, and installation-level occupational and environmental safety requirements. The development and rigorous implementation of risk hazard assessments, standard operating procedures (SOPs), or general operating procedures (GOPs) with associated operation procedures supplements (OPSs) described in Chapter 3, Section 3.8 of the DEIS would continue for all RDT&E activities, as would the safety measures specific to each type of operation, as detailed in Section 3.8.

Policies and SOPs/GOPs/OPSs include, but are not limited to, very specific operating parameters for range clearance and scheduling, safety controls, environmental preservation, materials-handling safety procedures, and control hazard briefings. Additionally, the dedicated technical facilities and equipment at NSF Dahlgren have features specifically designed to support safety requirements for the activities covered in this DEIS.

As a result, no adverse affect on the safety of State parks and forests, State reserves, scenic preserves, parkways, historical monuments, and recreational areas would result from the Proposed Action. Additionally, as the Proposed Action would not result in new construction or development, no impacts to the natural beauty of State lands would occur.

Policy A.1.11 – *This policy provides for the prevention of soil erosion.*

No new building or facility construction that would disturb soils is included in the Proposed Action. Munitions detonations may displace or alter the soil structure immediately surrounding the detonations. Any localized soil displaced by detonations or fill placed over detonations of 200 lbs net explosive weight or greater is regraded and the range is maintained according to the NSWCDD Range Management Plan. No significant adverse effects are expected, as described in Chapter 4, Section 4.9 of the DEIS.

Policy A.1.12 – *This policy addresses the management of controlled hazardous substances.*

NSF Dahlgren and NSWCDD have in place a number of programs, plans, and processes to safely use, transport, handle, store, and dispose of hazardous material (HM) and hazardous waste (HW), as described in Chapter 3, Section 3.7.3 of the DEIS. HW accumulation areas must have contingency plans designed to minimize hazards to human health and the environment. Additionally, the operational ranges at NSF Dahlgren are managed under several military directives, policies, and programs—described in Section 3.7 of the DEIS—that require range maintenance and clearance activities. The NSWCDD Range Management Plan and specific post-operation cleanup procedures documented in standard operating procedures prepared for each operation ensure that all range wastes, such as ordnance casings and residues, are managed as required by all applicable regulations and directives.

NSF Dahlgren and NSWCDD programs, plans, and processes ensure the safe use, transportation, handling, storage, and disposal of HM, HW, and explosive HW. The findings of the Range Condition Assessment for land-based NSWCDD operational ranges at NSF Dahlgren completed in September 2010, documented in Section 3.7.6 of the DEIS, indicate that NSWCDD’s operational ranges are in compliance with all applicable HM and HW (inclusive of explosive HW) regulations.

Water Quality

Policies A.2.1, A.2.2, and A.2.3 – *Policy A.2.1 requires State authorization to add, introduce, leak, spill, or emit any substance that will pollute any waters of the State. Policy A.2.2 requires the protection of all waters of the State for water contact recreation, fish, and other aquatic life and wildlife, and additional protection for shellfish harvesting and recreational trout waters, and waters worthy of protection because of their unspoiled character. Policy A.2.3 prohibits the discharge of any pollutant which will accumulate to toxic amounts during the expected life of aquatic organisms or produce deleterious behavioral effects on aquatic organisms.*

Residues from the land-based firing of munitions and detonation of explosives that remain on land after operational range surface clearance could enter surface waters indirectly via surface water or soil runoff and shallow groundwater discharge. Drainage from land ranges at NSF Dahlgren flows into the Potomac River, as well as tributaries to the river, via surface runoff and groundwater discharge. Although some residues likely would migrate into surface waters, they are expected to occur at concentrations below standard detection levels. As discussed in Chapter 3, Section 3.7.6 of the DEIS, a Range Condition Assessment (RCA) was completed for NSWCDD land-based operational ranges in September of 2010. The RCA concluded that the Navy is already investigating, and in most cases has already addressed, areas where there is a potential for an off-range release of munitions constituents from land-based operational areas through the Environmental Restoration Program at NSF Dahlgren and permitting requirements.

Further, the RCA concluded that there is no need to investigate any areas for potential off-range releases beyond planned investigations.

On the PRTR, environmental impacts of fragmenting targets are minimized by removing hazardous materials such as batteries, oil, gasoline, and antifreeze to the extent possible prior to destroying or damaging them. After the target is impacted and the test completed, all remaining debris and any waste is cleaned up. As there is potential at the PRTR for interaction between the munitions fired into the Potomac River and human and ecological receptors, range-specific screening-level risk assessments (RSSRAs) were performed, as described in Sections 4.8, 4.11, 4.12, and 4.13 of the DEIS, based on sediment and water concentrations predicted for the areas of heaviest use (see Appendix F of the DEIS). The results of the ecological and human health RSSRAs indicate that input of munitions constituents of potential concern from munitions testing in the PRTR are orders of magnitude – hundreds to billions of times – below concentrations that could cause adverse effects to human health or the environment. Therefore, no further analyses are required at this time and continued use of the PRTR for ordnance activities is expected to have negligible impacts on surface water.

The Chesapeake and Atlantic Coastal Bays Critical Area

Maryland's Critical Area Program was created by the passage of the Critical Area Act in 1984. It is a comprehensive program to protect the natural resources of the Chesapeake Bay and its tidal shorelines. The Critical Area includes all lands within 1,000 feet of the mean high water line of tidal waters or the landward edge of tidal wetlands of the Chesapeake and Coastal Bays and their tidal tributaries. Development within the Critical Area is regulated and must meet specific standards pertaining to land use classification; 100-foot buffer; habitat protection areas; shore erosion protection; and forest and woodland protection.

The Proposed Action does not include any construction or development. Nor would it indirectly induce development within the coastal zone of Maryland. Therefore, the Proposed Action has no potential to result in adverse effects to the areas protected under the Critical Area Program.

Potential indirect impacts to wetlands are considered in Chapter 4, Section 4.10.2 of the DEIS. No significant adverse effects are expected.

Policy B.1.1 – *This policy prohibits disturbing colonial water bird nesting sites in the Critical Area during breeding season.*

Colonial water bird nesting sites are located on land in the vicinity of the Potomac River shoreline or tributaries, as described in Chapter 3, Section 3.12 of the DEIS. Ordnance activities on NSF Dahlgren and on the PRTR and range boat activities on the waters of the PRTR, Upper Machodoc Creek, and other waterways in the vicinity of NSF Dahlgren routinely occur without long-term adverse impacts. As discussed in Section 4.12 of the DEIS, under Alternatives 1 and 2, ordnance activities and PRTR use at increased levels would have negligible impacts on Potomac River nesting birds, as there would be no increase in large-caliber gun firings and only minor increases in detonations, range boat traffic, or other activities that could disturb them.

Policy B.1.4 – *This policy prohibits the installation or introduction of concrete riprap or other artificial surfaces onto the bottom of natural streams in the Critical Area—defined in Code of Maryland Regulations 27.01.09.05 as those streams that are tributary to the Chesapeake Bay where spawning of anadromous species of fish occurs or has occurred—unless water quality and fisheries habitat will be improved.*

The locations of anadromous fishes spawning in the Potomac River are summarized in Chapter 3, Section 3.11.4.2 of the DEIS. Spawning of threespine stickleback (*Gasterosteus aculeatus aculeatus*), alewife (*Alosa pseudoharengus*) or blueback herring (*Alosa aestivalis*), and striped bass (*Morone saxatilis*) has been documented in the PRTR.

As described in Section 4.9 of the DEIS, large-caliber inert projectiles and duds, and most bullets fired in the river are immediately buried intact in the soft, Potomac River bottom sediments. Any ordnance not propelled into the sediment would be rapidly covered by sediment. Burial isolates munitions from movement and potential exposure pathways, thereby limiting contaminant release into surface water. As there is potential at the PRTR for interaction between the munitions fired into the Potomac River and human and ecological receptors, RSSRAs were performed, as described in Sections 4.8, 4.11, 4.12, and 4.13 of the DEIS, based on sediment and water concentrations predicted for the areas of heaviest use (see Appendix F of the DEIS). The results of the ecological and human health RSSRAs indicate that input of munitions constituents of potential concern from munitions testing in the PRTR are orders of magnitude – hundreds to billions of times – below concentrations that could cause adverse effects to human health or the environment. Therefore, no further analyses are required at this time and continued use of the PRTR for ordnance activities is expected to have negligible impacts on surface water.

Policy B.1.13 – *This policy allows water-dependent research facilities or activities in the buffer providing associated nonwater-dependent structures or facilities are, to the extent possible, located outside the buffer.*

All of the NSWCDD RDT&E activities, described in Chapter 1, Section 1.6 of the DEIS, that would occur in the buffer are water-dependent activities. The Proposed Action would not result in new construction or development, either in or outside the buffer.

Policy B.1.19 – *This policy prohibits the cutting or clearing of trees within the buffer, except the commercial harvesting of trees under specified conditions.*

NSF Dahlgren forested areas are managed for the production of timber. Foliage is removed and ground vegetation is cut where necessary to achieve a clear line of sight for EM energy and laser activities.

Tidal Wetlands

Policy B.2.1 – *This policy requires that any action which alters the natural character in, on, or over tidal wetlands and tidal waters of Chesapeake Bay tributaries, as well as other specified tidal waters, avoid dredging and filling, be water dependent, and provide appropriate mitigation.*

As described in Section 4.9 of the DEIS, large-caliber inert projectiles and duds, and most bullets fired in the river are immediately buried intact in the soft, Potomac River bottom sediments. Any ordnance not propelled into the sediment would be rapidly covered by sediment. Burial isolates munitions from movement and potential exposure pathways, thereby limiting contaminant release into surface water. As there is potential at the PRTR for interaction between the munitions fired into the Potomac River and human and ecological receptors, RSSRAs were performed, as described in Sections 4.8, 4.11, 4.12, and 4.13 of the DEIS, based on sediment and water concentrations predicted for the areas of heaviest use (see Appendix F of the DEIS). The results of the ecological and human health RSSRAs indicate that input of munitions constituents of potential concern from munitions testing in the PRTR are orders of magnitude – hundreds to billions of times – below concentrations that could cause adverse effects to human health or the environment. Therefore, no further analyses are required at this time and continued use of the PRTR for ordnance activities is expected to have negligible impacts on surface water.

Historical and Archaeological Sites

Policy B.5.1 – *This policy prohibits activities that excavate, remove, destroy, injure, deface, or disturb submerged archaeological historic property unless permission is granted by the Maryland Historical Trust.*

NSWCDD RDT&E activities would have no direct or indirect impacts on previously identified submerged archaeological resources and are not expected to affect unknown resources within the Archaeological Area of Potential Effect (APE), as described in Chapter 4, Section 4.6.1 of the DEIS. In accordance with Section 106 of the National Historic Preservation Act, the Proposed Action is not expected to have an adverse effect on submerged archaeological resources within the Archaeological APE, contingent on consultation with the State Historic Preservation Officers.

Policy B.5.2 – *This policy prohibits activities that excavate, remove, destroy, injure, deface, or disturb cave features or archaeological sites unless permission is granted by the Maryland Historical Trust.*

As described in Chapter 4, Section 4.6.2 of the DEIS, NSWCDD RDT&E activities would have no direct or indirect impacts on National Register-listed or -eligible resources within the Historic Architectural APE with the exception of those on NSF Dahlgren, where noise levels can exceed 134 decibels, the level at which minor damage to old structures can occur. In accordance with Section 106 of the National Historic Preservation Act, ordnance noise and vibration modeling—summarized in Chapter 3, Section 3.6.2.2 of the DEIS and detailed in Chapter 3, Sections 3.5.4 and 3.5.5, and Appendix D of the DEIS—indicates no adverse effect (with conditions to include plaster patching and window repairs as necessary) to either the National Register-eligible Dahlgren Residential Historic District or the three proposed districts on NSF Dahlgren—see Chapter 3, Section 3.6.8.2 for information regarding the four districts.

Living Aquatic Resources

Policy B.6.1 – *This policy prohibits taking a State-listed endangered or threatened species of fish or wildlife unless authorized by an Incidental Take Permit.*

One State-listed endangered fish species, the shortnose sturgeon (*Acipenser brevirostrum*), and two federally-listed endangered species, the shortnose sturgeon and Atlantic sturgeon (*A. oxyrhynchus*), are found in the PRTR portion of the Potomac River. Three State-listed endangered or threatened species of sea turtles are known to occur in the lower Potomac River based on reported stranding incidents: loggerhead (*Caretta caretta*), Kemp's ridley (*Lepidochelys kempii*), and, to a lesser extent, the green turtle (*Chelonia mydas*). As detailed in Chapter 4, Section 4.14 and Appendix H of the DEIS, the NSWCDD RDT&E activities conducted on the PRTR under the Proposed Action are predicted to have discountable effects on shortnose and Atlantic sturgeon and, because there would be minimal spatial overlap between RDT&E activities conducted on the PRTR and sea turtles using the lower Potomac River, the Proposed Action would have no effect on sea turtles in the Potomac River.

Five State-listed endangered or threatened species of birds are found, or potentially found, on or in the vicinity of NSF Dahlgren or within the PRTR: loggerhead shrike (*Lanius ludovicianus*), black rail (*Laterallus jamaicensis*), upland sandpiper (*Bartramia longicauda*), least tern (*Sterna antillarum*), and sedge wren (*Cistothorus platensis*). The often patchy distribution of birds, NSWCDD's clearing the range of waterfowl on the water surface before events begin, and the resulting low probability that birds would occur at the exact target location at the time a projectile would detonate diminishes the likelihood of direct impacts. Although individuals could be hit by projectiles, the total number of birds affected would be too small to cause population-level impacts. A range-specific screening-level ecological risk assessment was performed, as described in Sections 4.11, 4.12, and 4.13 of the DEIS, to determine if concentrations of metals and explosives in water and sediments from ordnance fired into the PRTR are present at concentrations that could cause adverse effects on avian and mammalian wildlife. One representative receptor modeled was the great blue heron. The results of the ecological risk assessment indicate that none of the constituents entering into the Potomac River by munitions activities are released at concentrations high enough to cause adverse effects in the great blue heron, which was selected to represent Potomac River birds.

Impacts to birds during operation of EM energy emitters would be negligible for two reasons. First, range areas used for EM energy activities are checked for the presence of birds before testing begins; and if they are present, they are either scared away or tests are paused until they leave. Second, even if birds are present in the area, the high electric or magnetic field levels experienced within test areas quickly dissipate and return to background levels outside the test areas. Birds flying above EM energy test facilities are unlikely to be exposed to high electric or magnetic fields, as exposure levels rapidly dissipate with distance.

The impact to birds from HE laser activities would be negligible to minor because, before an event begins, NSWCDD personnel would clear the test areas of visible wildlife and the event would be stopped if people or wildlife approach the laser corridor during the event. The probability of adversely affecting a bird that may fly into or along the laser beam during an event would be very low due to the short duration of the laser emissions and the small area that would be used for testing. The odds of a bird's flying into the beam during emission would be very low, particularly as most birds spend the majority of their time in activities other than flying – e.g., resting or feeding.

Navigation

Policy C.6.6 – *This policy requires that vessels operated on State waters not exceed a noise level of 90 decibels.*

According to the 2000 *Reference Guide to State Boating Laws, Sixth Edition*, among the 31 states that have a maximum noise level for motor boats, the standards range from 75 to 90 decibels, typically measured at a distance of 50 feet. It is anticipated that marine manufacturers generally build engines and vessels for commercial use that comply with these standards, particularly Maryland's 90-decibel standard as it is at the high end of the range.

Noise from vessel operations likely is rarely an issue of concern to residents and visitors along the PRTR because the sound of passing boats and ships is common, familiar, and expected. NSWCDD would continue to routinely maintain its vessels in good operating condition and to operate the vessels typically at low speeds, except during unusual events. Therefore, it is anticipated that NSWCDD vessel activities in the PRTR would be indistinguishable from current vessel activity, inclusive of non-Navy, commercial, industrial, and recreational activity, and the ambient noise environment.

Sewage Treatment

Policy C.10.1 – *This policy requires that the quality of State waters be protected, maintained, and improved for public supplies, propagation of wildlife, fish, and aquatic life, and domestic, agricultural, industrial, recreational, and other legitimate beneficial uses.*

Residues from the land-based firing of munitions and detonation of explosives that remain on land after operational range surface clearance could enter surface waters indirectly via surface water or soil runoff and shallow groundwater discharge. Drainage from land ranges at NSF Dahlgren flows into the Potomac River, as well as tributaries to the river, via surface runoff and groundwater discharge. Although some residues likely would migrate into surface waters, they are expected to occur at concentrations below standard detection levels. As discussed in Chapter 3, Section 3.7.6 of the DEIS, a Range Condition Assessment (RCA) was completed for NSWCDD land-based operational ranges in September of 2010. The RCA concluded that the Navy is already investigating, and in most cases has already addressed, areas where there is a potential for an off-range release of munitions constituents from land-based operational areas through the Environmental Restoration Program at NSF Dahlgren and permitting requirements. Further, the RCA concluded that there is no need to investigate any areas for potential off-range releases beyond planned investigations.

On the PRTR, environmental impacts of fragmenting targets are minimized by removing hazardous materials such as batteries, oil, gasoline, and antifreeze to the extent possible prior to destroying or damaging them. After the target is impacted and the test completed, all remaining debris and any waste is cleaned up. As there is potential at the PRTR for interaction between the munitions fired into the Potomac River and human and ecological receptors, RSSRAs were performed, as described in Sections 4.8, 4.11, 4.12, and 4.13 of the DEIS, based on sediment and water concentrations predicted for the areas of heaviest use (see Appendix F of the DEIS). The results of the ecological and human health RSSRAs indicate that input of munitions constituents of potential concern from munitions testing in the PRTR are orders of magnitude – hundreds to billions of times – below concentrations that could cause adverse effects to human health or the environment. Therefore, no further analyses are required at this time and continued use of the PRTR for ordnance activities is expected to have negligible impacts on surface water.

CONCLUSION

Based on these and other findings of the DEIS, the Navy finds that the Proposed Action under any of the alternatives considered would result in no or minimal adverse impacts to the coastal zone resources of Maryland. The Proposed Action, which would be implemented in accordance with the mitigation and protective measures listed in Chapter 6 of the DEIS, is consistent to the maximum extent practicable with the enforceable policies of Maryland's coastal zone management program.

Table H-1
Maryland Enforceable Policies

Code	Policy	Policy References[1]	Applicability or Consistency[2]
A	General Policies		
A.1	Core Policies		
A.1.1	It is State policy to maintain that degree of purity of air resources which will protect the health, general welfare, and property of the people of the State.	MDE (C9) Md. Code Ann., Envir. §§ 2-102 to -103	Consistent
A.1.2	The environment shall be free from noise which may jeopardize health, general welfare, or property, or which degrades the quality of life.	MDE (C9) COMAR 26.02.03.02	Consistent
A.1.3	The unique ecological, geological, scenic, and contemplative aspects of State wild lands shall not be affected in a manner that would jeopardize the future use and enjoyment of those lands as wild.	DNR (C7) Md. Code Ann., Nat. Res. §§ 5-1201, -1203	Consistent
A.1.4	The safety, order, and natural beauty of State parks and forests, State reserves, scenic preserves, parkways, historical monuments and recreational area shall be preserved.	DNR (B1) Md. Code. Ann., Nat. Res. § 5-209	Consistent
A.1.5	Any water appropriation must be reasonable in relation to the anticipated level of use and may not have an unreasonable adverse impact on water resources or other users of the waters of the State.	MDE (C9) COMAR 26.17.06.02	Not Applicable
A.1.6	The natural character and scenic value of a river or waterway must be given full consideration before the development of any water or related land resources including construction of improvements, diversions, roadways, crossings, or channelization.	MDE/DNR (C7) Md. Code Ann., Nat. Res. § 8-405 COMAR 26.17.04.11	Not Applicable
A.1.7	A dam or other structure that impedes the natural flow of a scenic or wild river may not be constructed, operated, or maintained, and channelization may not be undertaken, until the applicant considers alternatives less harmful to the scenic and wild resource. Construction of an impoundment upon a scenic or wild river is contrary to the public interest, if that project floods an area of unusual beauty, blocks the access to the public of a view previously enjoyed, or alters the stream's wild qualities.	MDE/DNR (C7) Md. Code Ann., Nat. Res. § 8-406 COMAR 26.17.04.11	Not Applicable
A.1.8	Permanent structures that do not have a clear environmental benefit are prohibited east of the dune line along the Atlantic Coast.	MDE/DNR (B1) Md. Code Ann., Nat. Res. § 8-1102	Not Applicable
A.1.9	Activities which will adversely affect the integrity and natural character of Assateague Island will be inconsistent with the State's Coastal Management Program, and will be prohibited.	MDE/DNR (B1) Md. Code. Ann., Nat. Res. §§ 5-209, 8-1102	Not Applicable
A.1.10	An opportunity for a public hearing shall be provided for projects in non-tidal waters that dredge, fill, bulkhead, or change the shoreline; construct or reconstruct a dam; or create a waterway, except in emergency situations.	MDE (A3) COMAR 26.17.04.13A	Not Applicable
A.1.11	Soil erosion shall be prevented to preserve natural resources and wildlife; control floods; prevent impairment of dams and reservoirs; maintain the navigability of rivers and harbors; protect the tax base, the public lands, and the health, safety and general welfare of the people of the State, and to enhance their living environment.	MDA (C4) Md. Code Ann., Agric. § 8-102(d)	Consistent

Code	Policy	Policy References[1]	Applicability or Consistency[2]
A.1.12	Controlled hazardous substances may not be stored, treated, dumped, discharged, abandoned, or otherwise disposed anywhere other than a permitted controlled hazardous substance facility or a facility that provides an equivalent level of environmental protection.	MDE (D4) Md. Code Ann., Envir. § 7-265(a)	Consistent
A.1.13	A person may not introduce in the Port of Baltimore any hazardous materials, unless the cargo is properly classed, described, packaged, marked, labeled, placarded, and approved for highway, rail, or water transportation.	MDOT (D3) COMAR 11.05.02.04A	Not Applicable
A.1.14	Operations on the Outer Continental Shelf must be conducted in a safe manner by well-trained personnel using technology, precautions, and techniques sufficient to prevent or minimize the likelihood of blowouts, loss of well control, fires, spillages, physical obstruction to other users of the waters or subsoil and seabed, or other occurrences which may cause damage to the environment or property, or which may endanger life or health.	(B2) Md. Code Ann., Envir. §§ 17-101 to -403 COMAR 26.24.01.01 COMAR 26.24.02.01, .03 COMAR 26.24.05.01	Not Applicable
A.2	Water Quality		
A.2.1	No one may add, introduce, leak, spill, or emit any liquid, gaseous, solid, or other substance that will pollute any waters of the State without State authorization.	MDE (A5) Md. Code Ann., Envir. §§ 4-402, 9-101, 9-322	Consistent
A.2.2	All waters of the State shall be protected for water contact recreation, fish, and other aquatic life and wildlife. Shellfish harvesting and recreational trout waters and waters worthy of protection because of their unspoiled character shall receive additional protection.	MDE (A1) COMAR 26.08.02.02	Consistent
A.2.3	The discharge of any pollutant which will accumulate to toxic amounts during the expected life of aquatic organisms or produce deleterious behavioral effects on aquatic organisms is prohibited.	MDE (A4) COMAR 26.08.03.01	Consistent
A.2.4	Before constructing, installing, modifying, extending, or altering an outlet or establishment that could cause or increase the discharge of pollutants into the waters of the State, the proponent must hold a discharge permit issued by the Department of the Environment or provide an equivalent level of water quality protection.	MDE (D6) Md. Code Ann., Envir. § 9-323(a)	Not Applicable
A.2.5	The use of best available technology is required for all permitted discharges into State waters, but if this is insufficient to comply with the established water quality standards, additional treatment shall be required and based on waste load allocation.	MDE (D4) COMAR 26.08.03.01C	Not Applicable
A.2.6	Thermal discharges shall be controlled so that the temperature outside the mixing zone (50 feet radially from the point of discharge) meets the applicable water quality criteria or discharges comply with the thermal mixing zone criteria.	MDE (D4) COMAR 26.08.03.03C	Not Applicable
A.2.7	Pesticides shall be stored in an area located at least 50 feet from any water well or stored in secondary containment approved by the Department of the Environment.	MDA (C4) COMAR 15.05.01.06	Not Applicable
A.2.8	Any development or redevelopment of land for residential, commercial, industrial, or institutional purposes shall use small-scale non-structural stormwater management practices and site planning that mimics natural hydrologic conditions, to the maximum extent practicable. Development or redevelopment will be consistent with this policy when channel stability and 100 percent of the average annual predevelopment groundwater recharge are maintained, nonpoint source pollution is minimized, and structural stormwater management practices are used only if determined to be absolutely necessary.	MDE (C9) Md. Code Ann., Envir. § 4-203 COMAR 26.17.02.01, .06	Not Applicable

Code	Policy	Policy References[1]	Applicability or Consistency[2]
A.2.9	Unless otherwise permitted, used oil may not be dumped into sewers, drainage systems, or any waters of the State or onto any public or private land.	MDE (D4) Md. Code Ann., Envir. § 5-1001(f)	Not Applicable
A.2.10	If material being dumped into Maryland waters or waters off Maryland's coastline has demonstrated actual toxicity or potential for being toxic, the discharger must perform biological or chemical monitoring to test for toxicity in the water.	MDE (A5) COMAR 26.08.03.07(D) COMAR 26.08.04.01	Not Applicable
A.2.11	Public meetings and citizen education shall be encouraged as a necessary function of water quality regulation.	MDE (A2) COMAR 26.08.01.02E(3)	Not Applicable
A.3	Flood Hazards		
A.3.1	Projects in coastal tidal and non-tidal flood plains which would create additional flooding upstream or downstream, or which would have an adverse impact upon water quality or other environmental factors, are contrary to State policy.	MDE (C2) Md. Code Ann., Envir. § 5-803 COMAR 26.17.05.04A	Not Applicable
A.3.2	The following policies apply to projects in non-tidal waters and non-tidal floodplains, but not non-tidal wetlands. ▪ Proposed floodplain encroachments, except for roadways, culverts, and bridges, shall be designed to provide a minimum of 1 foot of freeboard above the elevation of the 100-year frequency flood event. In addition, the elevation of the lowest floor of all new or substantially improved residential, commercial, or industrial structures shall also be at least 1 foot above the elevation of the 100-year frequency flood event. ▪ Proposed unlined earth channels may not change the tractive force associated with the 2-year and the 10-year frequency flood events, by more than 10 percent, throughout their length unless it can be demonstrated that the stream channel will remain stable. ▪ Proposed lined channels may not change the tractive force associated with the 2-year and the 10-year frequency flood events, by more than 10 percent, at their downstream terminus unless it can be demonstrated that the stream channel will remain stable. ▪ Category II, III, or IV dams may not be built or allowed to impound water in any location where a failure is likely to result in the loss of human life or severe damage to streets, major roads, public utilities, or other high value property. ▪ Projects that increase the risk of flooding to other property owners are generally prohibited, unless the area subject to additional risk of flooding is purchased, placed in designated flood easement, or protected by other means acceptable to the Maryland Department of the Environment. ▪ The construction or substantial improvement of any residential, commercial, or industrial structures in the 100-year frequency floodplain and below the water surface elevation of the 100-year frequency flood may not be permitted. Minor maintenance and repair may be permitted. The modifications of existing structures for flood-proofing purposes may be permitted. Flood-proofing modifications shall be designed and constructed in accordance with specifications approved by the Maryland Department of the Environment. ▪ Channelization shall be the least favored flood control technique.	MDE (C2) COMAR 26.17.04.01, .07, .11	Not Applicable

Code	Policy	Policy References[1]	Applicability or Consistency[2]
	▪ Multiple purpose use shall be preferred over single purpose use, the proposed project shall achieve the purposes intended, and, at a minimum, project shall provide for a 50 percent reduction of the average annual flood damages.		
A.3.3	Development may not increase the downstream peak discharge for the 100-year frequency storm event in the following watersheds and all their tributaries: ▪ Gwynns Falls in Baltimore City and Baltimore County; and ▪ Jones Falls in Baltimore City and Baltimore County.	MDE (C2) COMAR 26.17.02.07	Not Applicable
B	Coastal Resources		
B.1	The Chesapeake and Atlantic Coastal Bays Critical Area		
	In addition to the policies in this section, the laws approved by NOAA implementing the Chesapeake and Atlantic Coastal Bays Critical Area Protection Program are enforceable policies.		Consistent
B.1.1	Colonial water bird nesting sites in the Critical Area may not be disturbed during breeding season.	CAC (C9) COMAR 27.01.09.04	Consistent
B.1.2	New facilities in the Critical Area shall not interfere with historic waterfowl concentration and staging areas.	CAC (C9) COMAR 27.01.09.04	Not Applicable
B.1.3	Physical alterations to streams in the Critical Area shall not affect the movement of fish.	CAC (C9) COMAR 27.01.09.05	Not Applicable
B.1.4	The installation or introduction of concrete riprap or other artificial surfaces onto the bottom of natural streams in the Critical Area is prohibited unless water quality and fisheries habitat will be improved.	CAC (C9) COMAR 27.01.09.05	Consistent
B.1.5	The construction or placement of dams or other structures in the Critical Area that would interfere with or prevent the movement of spawning fish or larval forms in streams is prohibited.	CAC (C9) COMAR 27.01.09.05	Not Applicable
B.1.6	Development may not cross or affect a stream in the Critical Area, unless there is no feasible alternative and the design and construction of the development prevents increases in flood frequency and severity that are attributable to development; retains tree canopy and maintains stream water temperature within normal variation; provides a natural substrate for affected streambeds; and minimizes adverse water quality and quantity impacts of stormwater.	CAC (C9) COMAR 27.01.02.04	Not Applicable
B.1.7	The construction, repair, or maintenance activities associated with bridges or other stream crossings or with utilities and roads, which involve disturbance within the buffer or which occur in stream are prohibited between March 1 and May 15.	CAC (C9) COMAR 27.01.09.05	Not Applicable
B.1.8	Roads, bridges, or utilities may not be constructed in any areas designated to protect habitat, including buffers, in the Critical Area, unless there is no feasible alternative and the road, bridge, or utility is located, designed, constructed, and maintained in a manner that maximizes erosion protection; minimizes negative impacts to wildlife, aquatic life, and their habitats; and maintains hydrologic processes and water quality.	CAC (C9) COMAR 27.01.02.03C, .04C, .05C	Not Applicable

Code	Policy	Policy References[1]	Applicability or Consistency[2]
B.1.9	In the Critical Area, a minimum 100-foot vegetated buffer shall be maintained landward from the mean high water line of tidal waters, the edge of each bank of tributary streams, and the upland boundary of tidal wetlands. The buffer shall be expanded in sensitive areas in accordance with standards adopted by the Critical Area Commission. The buffer is not required for agricultural drainage ditches if the adjacent agricultural land has in place best management practices that protect water quality. The buffer is not required if existing patterns of development prevent the buffer from protecting ecological quality and functions, in which case, alternative means of protecting ecological quality and functions are required.	CAC (C9) COMAR 27.01.09.01, .01-5, .01-7	Not Applicable
B.1.10	Disturbance to a buffer in the Critical Area is only authorized for a shore erosion control measure, new development, or redevelopment that is: water-dependent; meets a recognized private right or public need; minimizes the adverse effects on water quality and fish, plant, and wildlife habitat; and, insofar as possible, locates nonwater-dependent structures or operations associated with water-dependent projects or activities outside the buffer. Mitigation of impacts to the buffer and a buffer management plan must be developed in accordance with standards adopted by the Critical Area Commission when a development or redevelopment activity occurs within the buffer.	CAC (C9) COMAR 27.01.03.03 COMAR 27.01.09.01, .01-2, .01-3	Not Applicable
B.1.11	If a development or redevelopment activity occurs on a lot or parcel that includes a buffer or if issuance of a permit, variance, or approval would disturb the buffer, the proponents of that activity must develop a buffer management plan that clearly indicates that all applicable planting standards developed by the Critical Area Commission will be met and that appropriate measures are in place for the long-term protection and maintenance of the buffer.	CAC (C9) COMAR 27.01.09.01-1, .01-3	Not Applicable
B.1.12	Public beaches or other public water-oriented recreation or education areas including, but not limited to, publicly owned boat launching and docking facilities and fishing piers may be permitted in the buffer in portions of the Critical Area not designated as intensely developed areas only if adequate sanitary facilities exist; service facilities are, to the extent possible, located outside the Buffer; permeable surfaces are used to the extent practicable, if no degradation of ground water would result; and disturbance to natural vegetation is minimized.	CAC (C9) COMAR 27.01.03.08	Not Applicable
B.1.13	Water-dependent research facilities or activities may be permitted in the buffer, if nonwater-dependent structures or facilities associated with these projects are, to the extent possible, located outside the buffer.	CAC (C9) COMAR 27.01.03.09	Consistent
B.1.14	Industrial and port-related facilities may only be sited in the portions of areas of intense development that are exempted from buffer designation.	CAC (C9) COMAR 27.01.03.05	Not Applicable
B.1.15	Agricultural activities are permitted in the buffer, if, as a minimum best management practice, a 25-foot vegetated filter strip measured landward from the mean high water line of tidal waters or tributary streams (excluding drainage ditches), or from the edge of tidal wetlands, whichever is further inland, is established in trees with a dense ground cover or a thick sod of grass.	CAC (C4) COMAR 27.01.09.01-5	Not Applicable
B.1.16	The feeding or watering of livestock is not permitted within 50 feet of the mean high water line of tidal waters and tributaries.	CAC (C4) COMAR 27.01.09.01-5	Not Applicable
B.1.17	In the Critical Area, the creation of new agricultural lands shall not be accomplished by diking, draining, or filling of nontidal wetlands; by clearing of forests or woodland on soils with a slope greater than 15 percent or on soils with a "K" value greater than 0.35 and slope greater than 5 percent; by clearing that will adversely affect water quality or will destroy plant and wildlife habitat; or by clearing existing natural vegetation within the 100-foot buffer.	CAC (C4) COMAR 27.01.06.02C	Not Applicable

Code	Policy	Policy References[1]	Applicability or Consistency[2]
B.1.18	Agricultural activity permitted within the Critical Area shall use best management practices in accordance with a soil conservation and water quality plan approved or reviewed by the local soil conservation district.	CAC (C4) COMAR 27.01.06.02G	Not Applicable
B.1.19	Cutting or clearing of trees within the buffer is prohibited except that commercial harvesting of trees by selection or by the clearcutting of loblolly pine and tulip poplar may be permitted to within 50 feet of the landward edge of the mean high water line of tidal waters and perennial tributary streams, or the edge of tidal wetlands if the buffer is not subject to additional habitat protection. Commercial harvests must be in compliance with a buffer management plan that is prepared by a registered professional forester and is approved by the Department of Natural Resources.	CAC (C5) Md. Code Ann., Nat. Res. § 8-1808.7 COMAR 27.01.09.01-6	Consistent
B.1.20	Commercial tree harvesting in the buffer may not involve the creation of logging roads and skid trails within the buffer and must avoid disturbing stream banks and shorelines as well as include replanting or allowing regeneration of the areas disturbed or cut in a manner that assures the availability of cover and breeding sites for wildlife and reestablishes the wildlife corridor function of the buffer.	CAC (C5) Md. Code Ann., Nat. Res. § 8-1808.7 COMAR 27.01.09.01-6	Not Applicable
B.1.21	Solid or hazardous waste collection or disposal facilities and sanitary landfills are not permitted in the Critical Area unless no environmentally acceptable alternative exists outside the Critical Area, and these facilities are needed in order to correct an existing water quality or wastewater management problem.	CAC (C9) COMAR 27.01.02.02	Not Applicable
B.1.22	All available measures must be taken to protect the Critical Area from all sources of pollution from surface mining operations, including but not limited to sedimentation and siltation, chemical and petrochemical use and spillage, and storage or disposal of wastes, dusts, and spoils.	CAC (D5) COMAR 27.01.07.02A	Not Applicable
B.1.23	In the Critical Area, mining must be conducted in a way that allows the reclamation of the site as soon as possible and to the extent possible.	CAC (D5) COMAR 27.01.07.02B	Not Applicable
B.1.24	Sand and gravel operations shall not occur within 100 feet of the mean high water line of tidal waters or the edge of streams or in areas with scientific value, important natural resources such as threatened and endangered species, rare assemblages of species, or highly erodible soils. Sand and gravel operations also may not occur where the use of renewable resource lands would result in the substantial loss of forest and agricultural productivity for 25 years or more or would result in a degrading of water quality or a loss of vital habitat.	CAC (D5) COMAR 27.01.07.03D	Not Applicable
B.1.25	Wash plants including ponds, spoil piles, and equipment may not be located in the 100-foot buffer.	CAC (D5) COMAR 27.01.07.03E	Not Applicable
B.1.26	A soil erosion and sedimentation control plan shall be required whenever development within the Critical Area will involve any clearing, grading, transporting, or other form of disturbance to land by the movement of earth. This plan shall be appropriately designed to reduce adverse water quality impacts.	CAC (C9) COMAR 27.01.02.04	Not Applicable
B.1.27	All stormwater storage facilities shall be designed with sufficient capacity to eliminate all runoff caused by the development in excess of that which would have come from the site if it were in its predevelopment state.	CAC (C9) COMAR 27.01.02.04	Not Applicable
B.1.28	Intense development should be directed outside the Critical Area. Future intense development activities, when proposed in the Critical Area, shall be directed towards the intensely developed areas.	CAC (D1) Md. Code Ann., Natural Res. § 8-1807(b) COMAR 27.01.02.02B	Not Applicable

Code	Policy	Policy References[1]	Applicability or Consistency[2]
B.1.29	The following development activities and facilities are not permitted in the Critical Area except in intensely developed areas and only after the activity or facility has demonstrated that there will be a net improvement in water quality to the adjacent body of water. ▪ Nonmaritime heavy industry ▪ Transportation facilities and utility transmission facilities, except those necessary to serve permitted uses, or where regional or interstate facilities must cross tidal waters ▪ Permanent sludge handling, storage, and disposal facilities, other than those associated with wastewater treatment facilities. However, agricultural or horticultural use of sludge when applied by an approved method at approved application rates may be permitted in the Critical Area, but not in the 100-foot Buffer	CAC (C9) COMAR 27.01.02.02	Not Applicable
B.1.30	The following policies apply in those areas of the Critical Area that are determined to be areas of intense development. ▪ To the extent possible, fish, wildlife, and plant habitats, should be conserved. ▪ Development and redevelopment shall improve the quality of runoff from developed areas that enters the Chesapeake or Atlantic Coastal Bays or their tributary streams. ▪ At the time of development or redevelopment, appropriate actions must be taken to reduce stormwater pollution by 10%. Retrofitting measures are encouraged to address existing water quality and water quantity problems from stormwater. ▪ Development activities may cross or affect a stream only if there is no feasible alternative, and those activities must be constructed to prevent increases in flood frequency and severity attributable to development, retain tree canopy, maintain stream water temperatures within normal variation, and provide a natural substrate for affected streambeds. ▪ If practicable, permeable areas shall be established in vegetation. ▪ Areas of public access to the shoreline, such as foot paths, scenic drives, and other public recreational facilities, shall be maintained and, if possible, are encouraged to be established. ▪ Ports and industries which use water for transportation and derive economic benefits from shore access, shall be located near existing port facilities or in areas identified by local jurisdictions for planned future port facility development and use if this use will provide significant economic benefit to the State or local jurisdiction. ▪ To the extent practicable, development shall be clustered to reduce lot coverage and maximize areas of natural vegetation. ▪ Development shall minimize the destruction of forest and woodland vegetation.	CAC (C9) COMAR 27.01.02.03	Not Applicable
B.1.31	The following policies apply in those portions of the Critical Area that are not areas of intense development. ▪ Development shall maintain, and if possible, improve the quality of runoff and ground water entering the Chesapeake and Coastal Bays. ▪ To the extent practicable, development shall maintain existing levels of natural habitat.	CAC (C9) COMAR 27.01.02.04	Not Applicable

Code	Policy	Policy References[1]	Applicability or Consistency[2]
	▪ All development sites shall incorporate a wildlife corridor system that connects undeveloped vegetated tracts onsite with undeveloped vegetated tracts offsite. ▪ All forests that are cleared or developed shall be replaced on not less than an equal area basis. ▪ If there are no forests on a proposed development site, the site shall be planted to provide a forest or developed woodland cover of at least 15 percent. ▪ Development on slopes equal to or greater than 15 percent, as measured before development, shall be prohibited unless the project is the only effective way to maintain the slope and is consistent with other policies. ▪ To the extent practicable, development shall be clustered to reduce lot coverage and maximize areas of natural vegetation. ▪ Lot coverage is limited to 15 percent of the site.		
B.2	Tidal Wetlands		
B.2.1	Any action which alters the natural character in, on, or over tidal wetlands; tidal marshes; and tidal waters of Chesapeake Bay and its tributaries, the coastal bays adjacent to Maryland's coastal barrier islands, and the Atlantic Ocean shall avoid dredging and filling, be water-dependent, and provide appropriate mitigation for any necessary and unavoidable adverse impacts on these areas or the resources associated with these areas. A proponent of an action described above shall explain the actions impact on: ▪ Habitat for finfish, crustaceans, mollusks, and wildlife of significant economic or ecologic value; ▪ Potential habitat areas such as historic spawning and nursery grounds for anadromous and semi-anadromous fisheries species and shallow water areas suitable to support populations of submerged aquatic vegetation; ▪ Marine commerce; ▪ Recreation, and aesthetic enjoyment; ▪ Flooding; ▪ Siltation; ▪ Natural water flow, water temperature, water quality, and natural tidal circulation; ▪ Littoral drift; ▪ Local, regional, and State economic conditions; ▪ Historic property; ▪ Storm water runoff; ▪ Disposal of sanitary waste; ▪ Sea level rise and other determinable and periodically recurring natural hazards; ▪ Navigational safety;	MDE (B2) COMAR 26.24.01.01 COMAR 26.24.02.01, .03 COMAR 26.24.05.01.	Consistent

Code	Policy	Policy References[1]	Applicability or Consistency[2]
	▪ Shore erosion; ▪ Access to beaches and waters of the State; ▪ Scenic and wild qualities of a designated State scenic or wild river; and ▪ Historic waterfowl staging areas and colonial bird-nesting sites.		
B.3	Non-Tidal Wetlands		
B.3.1	Removal, excavation, grading, dredging, dumping, or discharging of, or filling a non-tidal wetland with materials of any kind, including the driving of piles and placing of obstructions; changing existing drainage characteristics, sedimentation patterns, flow patterns, or flood retention characteristics; disturbing the water level or water table; or removing or destroying plant life that would alter the character of a non-tidal wetland is prohibited unless: ▪ The proposed project has no practicable alternative; ▪ Adverse impacts are first avoided and then minimized based on consideration of existing topography, vegetation, fish and wildlife resources, and hydrological conditions; ▪ Comprehensive watershed management plans are considered; and ▪ The proposed project does not cause or contribute to an individual or cumulative effect that degrades: o Aquatic ecosystem diversity, productivity, and stability, o Plankton, fish, shellfish, and wildlife, o Recreational and economic values, and o Public welfare; o Surface water quality; or o Ground water quality. Mitigation measures are required to replace the ecological values associated with non-tidal wetlands that are impaired by activities described above.	MDE (C3) COMAR 26.23.01.01 COMAR 26.23.02.04, .06 COMAR 26.23.04.02	Not Applicable
B.4	Forests		
B.4.1	The Forest Conservation Act and its implementing regulations, as approved by NOAA, are enforceable policies. Generally, before developing an area greater than 40,000 square feet, forested and environmentally sensitive areas must be identified and preserved whenever possible. If these areas cannot be preserved, reforestation or other mitigation is required to replace the values associated with them. This policy does not apply in the Critical Area.	DNR (C5) Md. Code Ann., Nat. Res. §§ 5-1601 to -1613 COMAR 08.19.01-.06	Not Applicable
B.4.2	Forestry activities shall provide for adequate restocking, after cutting, of trees of desirable species and condition; provide for reserving, for growth and subsequent cutting, a sufficient growing stock of thrifty trees of desirable species to keep the land reasonably productive; and prevent clear-cutting, or limit the size of a tract to be clear-cut in areas where clear-cutting will seriously interfere with protection of a watershed.	DNR (C5) Md. Code Ann., Nat. Res. § 5-606	Not Applicable

Code	Policy	Policy References[1]	Applicability or Consistency[2]
B.4.3	When any timber is cut for commercial purposes from five acres or more of land on which loblolly pine, shortleaf pine, or pond pine, singly or together occur and constitute 25 percent or more of the live trees on each acre, the person conducting the cutting or the landowner shall leave uncut and uninjured at least eight well distributed, cone-bearing, healthy, windfirm, loblolly, shortleaf, or pond pine trees on each acre cut for the purpose of reseeding.	DNR (C5) Md. Code Ann., Nat. Res. §§ 5-501, -504	Not Applicable
B.4.4	Any highway construction project may only cut or clear the minimum amount of trees and other woody plants necessary to be consistent with sound design principles. If over an acre of forest is lost as a result of the project, an equivalent area of publicly owned property shall be reforested.	DNR/MDOT (C5) Md. Code Ann., Nat. Res. § 5-103	Not Applicable
B.4.5	Roadside trees should not be cut down, trimmed, mutilated, or injured unless the activity will eliminate a hazard to property, public safety, or health; improve or prevent tree deterioration; or improve the general aesthetic appearance of the right-of-way.	DNR (C5) COMAR 08.07.02.05	Not Applicable
B.4.6	A person conducting a forestry activity in non-tidal wetlands shall develop and implement a sediment and erosion control plan.	MDE (C3) COMAR 26.23.05.02	Not Applicable
B.5	Historical and Archaeological Sites		
B.5.1	Unless permission is granted by the Maryland Historical Trust, activities that excavate, remove, destroy, injure, deface, or disturb submerged archaeological historic property are generally prohibited.	MDP (C8) Md. Code Ann., State Fin. & Proc. §§ 5A-341, -333	Consistent
B.5.2	Unless permission is granted by the Maryland Historical Trust, activities that excavate, remove, destroy, injure, deface, or disturb cave features or archeological sites under State control are generally prohibited.	MDP (C8) Md. Code Ann., State Fin. & Proc. §§ 5A-342 to -343	Consistent
B.5.3	Neither human remains nor funerary objects may be removed from a burial site or cemetery, unless permission is granted by the local State's Attorney. Funerary objects may not be willfully destroyed, damaged, or defaced.	MDP (C8) Md. Code Ann., Crim. Law §§ 10-401 to -404	Not Applicable
B.6	Living Aquatic Resources		
B.6.1	Unless authorized by an Incidental Take Permit, no one may take a State listed endangered or threatened species of fish or wildlife.	DNR (A4) Md. Code Ann., Nat. Res. §§ 4-2A-01 to -09 Md. Code Ann., Nat. Res. §§ 10-2A-01 to -09	Consistent
B.6.2	Fisheries shall be sustainably harvested.	DNR (A4) Md. Code Ann., Nat. Res. § 4-215	Not Applicable
B.6.3	Any land or water resource acquired by the State to protect, propagate, or manage fish shall not be damaged.	DNR (A4) Md. Code Ann., Nat. Res. § 4-410	Not Applicable
B.6.4	No activity will be permitted that impedes or prevents the free passage of any finfish, migratory or resident, up or down stream.	DNR (A4) Md. Code Ann., Nat. Res. § 4-501 to -502	Not Applicable

Code	Policy	Policy References[1]	Applicability or Consistency[2]
B.6.5	All in-stream construction in non-tidal waters is prohibited from October through April, inclusive, for natural trout waters and from March through May, inclusive, for recreational trout waters. In addition, the construction of proposed projects, which may adversely affect anadromous fish spawning areas, shall be prohibited in non-tidal waters from March 15 through June 15, inclusive.	MDE (C2) COMAR 26.17.04.11B(5)	Not Applicable
B.6.6	Riparian forest buffers adjacent to waters that are suitable for the growth and propagation of self-sustaining trout populations shall be retained whenever possible.	MDE (C5) COMAR 26.08.02.03-3F	Not Applicable
B.6.7	Projects in or adjacent to non-tidal waters shall not adversely affect aquatic or terrestrial habitat unless there is no reasonable alternative and mitigation is provided.	MDE (C2) COMAR 26.17.04.11B(5)	Not Applicable
B.6.8	The harvest, cutting, or other removal or eradication of submerged aquatic vegetation may only occur in a strip up to 60 feet wide surrounding a pier, dock, ramp, utility crossing, or boat slip to point of ingress in a marina, otherwise the activity must receive the approval of the Department of Natural Resources. No chemical may be used for this purpose, and the timing and method of the activity shall minimize the adverse impact on water quality and on the growth and proliferation of fish and aquatic grasses.	MDE (A4) Md. Code Ann., Nat. Res. § 4-213	Not Applicable
B.6.9	Natural oyster bars in the Chesapeake Bay shall not be destroyed, damaged, or injured.	DNR (A4) Md. Code Ann., Nat. Res. § 4-1118.1	Not Applicable
B.6.10	A person, other than the leaseholder, may not willfully and without authority catch oysters on any aquaculture or submerged land lease area, or willfully destroy or transfer oysters on this land in any manner.	DNR (A4) Md. Code Ann., Nat. Res. § 4-11A-15(a)	Not Applicable
B.6.11	An organism into which genetic material from another organism has been experimentally transferred so that the host acquires the genetic traits of the transferred genes may not be introduced into State waters.	DNR (A4) COMAR 08.02.19.03	Not Applicable
B.6.12	Vectors for the introduction of nonnative aquatic organisms must be appropriately controlled to prevent adverse impacts on aquatic ecosystems.	DNR (A4) Md. Code Ann., Nat. Res. § 4-205.1	Not Applicable
B.6.13	Except as authorized by federal law, any live snakehead fish or viable eggs of snakehead fish of the Family Channidae may not be imported, transported, or introduced into the State.	DNR (A4) COMAR 08.02.19.06	Not Applicable
B.6.14	Nonnative oysters may not be introduced into State waters.	DNR (A4) Md. Code Ann., Nat. Res. § 4-1008	Not Applicable
C	Coastal Uses		
C.1	Mineral Extraction		
C.1.1	Habitats of unique value for fish, wildlife, and other related environmental values shall be identified prior to commencing coal prospecting activities and shall be protected during those activities.	MDE (D5) COMAR 26.20.08.04	Not Applicable
C.1.2	Surface mining activities must be conducted in a manner that protects birds and wildlife; decreases soil erosion; prevents pollution of rivers, streams, and lakes; prevents loss or waste of valuable mineral resources; and prevents and eliminates hazards to health.	MDE (D5) Md. Code Ann., Envir. §§ 15-802, -807(d), -822(c), -828(b)	Not Applicable

Code	Policy	Policy References[1]	Applicability or Consistency[2]
C.1.3	Surface mining activities must not have an unduly adverse effect on wildlife or freshwater, estuarine, or marine fisheries; constitute a substantial physical hazard to a neighboring house, school, church, hospital, commercial or industrial building, public road, or other public or private property in existence at the time of application for the permit; or significantly adversely affect the uses of a publicly owned park, forest, or recreation area in existence at the time of application for the permit.	MDE (D5) Md. Code Ann., Envir. §§ 15-802(a), -810(b)	Not Applicable
C.1.4	Surface coal mining activities shall use the best available technology to minimize disturbances and adverse impacts on fish, wildlife, and related environmental values, and shall achieve enhancement of the resources when practicable.	MDE (D5) COMAR 26.20.23.02A	Not Applicable
C.1.5	A surface coal mining activity may not be conducted in a way that is likely to jeopardize the continued existence of endangered or threatened species listed by the federal or state government.	MDE (D5) COMAR 26.20.23.02B	Not Applicable
C.1.6	Coal mining operations shall be conducted to minimize water pollution, and, where necessary, treatment methods shall be used to control water pollution.	MDE (D5) COMAR 26.20.13.05B COMAR 26.20.21.01	Not Applicable
C.1.7	Coal mining may not adversely affect any publicly owned park or place recorded in the National Register of Historic Sites without approval from the appropriate agency and is prohibited in the Youghiogheny River scenic corridor; within 100 feet of a cemetery, a perennial or intermittent stream, or the outside right-of-way line of any public road; and in areas designated unsuitable for certain types of surface coal mining.	MDE (D5) Md. Code Ann., Envir. §§ 15-505(b), -506(e) COMAR 26.20.20.03	Not Applicable
C.1.8	Underground coal mining activities may not be conducted beneath or adjacent to any perennial stream or impoundment having a storage volume of 20 acre-feet or more. Underground coal mining activities beneath any aquifer that serves as a significant source of water supply to any public water system shall be conducted so as to avoid disruption of the aquifer and consequent exchange of ground water between the aquifer and other strata.	MDE (D5) COMAR 26.20.13.10	Not Applicable
C.1.9	Surface mining shall not occur within 25 feet of any property line or 100 feet of any scenic or wild river or its tributaries or any parcel of land that has been designated an area of critical State concern.	MDE (D5) COMAR 26.21.01.17	Not Applicable
C.1.10	Coal prospect pits may not be more than 1 acre in size or affect more than 10 acres and shall be backfilled, seeded, and mulched within 30 days after it is opened.	MDE (D5) COMAR 26.20.08.04	Not Applicable
C.1.11	Coal project proponents must draft a mining and reclamation plan, including a description of the natural resources, geology, and cultural and historical resources within the proposed permit and adjacent areas and the methods for road construction, removing topsoil, controlling drainage, backfilling, and revegetating the affected area, as well as identify baseline hydrologic information and determine the probable hydrologic consequences of the mining and reclamation operations upon surface and ground waters on and off the permit area and plan remedial and reclamation activities.	MDE (D5) Md. Code Ann., Envir. §§ 15-505(c), -822 COMAR 26.20.02.05-.09 COMAR 26.20.02.14	Not Applicable
C.1.12	A mining and reclamation plan for a mineral extraction activity must outline mining methods, intended reclamation practices, land uses before and after mining, areas to be affected by the mining, and measures to protect other uses and the environment.	MDE (D5) Md. Code Ann., Envir. §§ 15-807(d), -808(d), -822, -828(b)	Not Applicable

Code	Policy	Policy References[1]	Applicability or Consistency[2]
C.1.13	Prior to the commencement of a mineral extraction activity, the appropriate county must issue a written statement that the proposed land use conforms to all applicable county zoning and land use requirements.	MDE (D5) Md. Code Ann., Envir. § 15-810(c)	Not Applicable
C.1.14	If the probable hydrologic consequences of the proposed coal mining operation are contamination, diminution, or interruption of an underground or surface source of water that is used for domestic, agricultural, industrial, or other legitimate purpose, the project proponent shall analyze the availability of water and alternative water sources.	MDE (D5) COMAR 26.20.02.08	Not Applicable
C.1.15	Underground coal mining activities shall be planned and conducted so as to prevent subsidence from causing material damage to the extent technologically and economically feasible.	MDE (D5) COMAR 26.20.13.07A	Not Applicable
C.1.16	Sediment control measures shall be designed, constructed, and maintained using the best technology currently available to prevent additional contributions of sediment to stream flow or runoff outside an area where coal mining is permitted.	MDE (D5) COMAR 26.20.21.05A	Not Applicable
C.1.17	Diversions shall be designed, constructed, and maintained to minimize adverse impacts, including preventing the contribution of suspended solids to stream flow and runoff outside an area where coal mining permitted, to the extent possible using the best technology currently available.	MDE (D5) COMAR 26.20.21.03	Not Applicable
C.1.18	Pits, cuts, and other mine excavations or disturbances for coal mining shall be located, designed, constructed, and utilized in such a manner as to prevent adverse impacts, including the discharge of acid, toxic, or otherwise harmful mine drainage waters into ground water systems.	MDE (D5) COMAR 26.20.20.01B	Not Applicable
C.1.19	Transportation facilities constructed for surface coal mining purposes shall be located, designed, constructed or reconstructed, and maintained, and the area restored, in a manner that prevents damage to fish, wildlife, or their habitat and related environmental values; prevents additional contributions of suspended solids to stream flow or runoff outside the permit area; minimizes diminution or degradation of water quality and quantity; minimizes erosion, siltation, and attendant air pollution; and prevents damage to public and private property.	MDE (D8) COMAR 26.20.19.01D, .08	Not Applicable
C.1.20	The removal of vegetation, topsoil, and overburden before surface mining must be minimized, and erosion and sediment control devices must be constructed and maintained.	MDE (D5) COMAR 26.21.01.10	Not Applicable
C.1.21	An area exposed for surface coal mining shall be protected and stabilized to effectively control erosion and air pollution attendant to erosion.	MDE (D5) COMAR 26.20.23.01A	Not Applicable
C.1.22	During surface mining, topsoil shall be removed, segregated, and stockpiled on-site for reclamation and protected by a vegetative cover or by other methods demonstrated to provide protection.	MDE (D5) COMAR 26.21.01.11	Not Applicable
C.1.23	The discharge of water from coal mining areas shall be conducted so as to reduce erosion, prevent deepening or enlargement of stream channels, and minimize disturbance of the hydrologic balance.	MDE (D5) COMAR 26.20.21.07	Not Applicable
C.1.24	All surface drainage from coal mining and discharge of water from underground coal mining to surface waters shall be passed through a sedimentation pond, a series of sedimentation ponds, or a treatment facility before leaving the permit area.	MDE (D5) COMAR 26.20.13.06	Not Applicable
C.1.25	Storage piles of overburden, mine waste, and rock from surface mining must be stabilized and may not restrict any natural drainage without an approved diversion.	MDE (D5) COMAR 26.21.01.12	Not Applicable
C.1.26	An ephemeral, intermittent, or perennial stream may not be diverted during coal prospecting activities. Overland flow of water shall be diverted only in a manner that prevents erosion and, to the extent possible using best available technology, additional contributions of suspended solids to streamflow or runoff outside the prospecting area.	MDE (D5) COMAR 26.20.08.04	Not Applicable

Code	Policy	Policy References[1]	Applicability or Consistency[2]
C.1.27	During any coal mining activities, changes in the depth to ground water, in water quality and quantity, and in the location of surface water drainage channels shall be minimized.	MDE (D5) COMAR 26.20.21.01	Not Applicable
C.1.28	The operator of a coal mine shall replace the water supply of an owner of interest in real property who obtains all or part of the owner's supply of water for domestic, agricultural, industrial, or other legitimate use from an underground or surface source where the supply has been affected by contamination, diminution, or interruption proximately resulting from the mining operations.	MDE (D5) Md. Code Ann., Envir. §§ 15-524(b), -608(b) COMAR 26.20.13.05D COMAR 26.20.20.11	Not Applicable
C.1.29	If water is pumped out of a pit located in karst terrain in Baltimore, Carroll, Frederick, and Washington counties, the project proponent shall replace a water supply if it fails as a result of declining ground water levels and pay compensation for property damage from land subsidence.	MDE (D5) Md. Code Ann., Envir. § 15-813	Not Applicable
C.1.30	Surface coal mining activities and restoration efforts shall be conducted so as to maintain the recharge capacity of surface mining areas and support the approved post mining land use, minimizes disturbances to the hydrologic balance in the mine plan area and in adjacent areas, and provides a rate of recharge that approximates the pre-mining recharge rate.	MDE (D5) COMAR 26.0.20.02 COMAR 26.20.21.01A	Not Applicable
C.1.31	Promptly after coal prospecting activities are completed, all areas disturbed during prospecting operations, including roads, shall be returned to the approximate original contour.	MDE (D5) COMAR 26.20.08.04	Not Applicable
C.1.32	Mined land must be properly reclaimed, including rehabilitating settling ponds; restoring or establishing stream channels and stream banks to a condition that minimizes erosion, siltation, and other pollution; and creating final slopes in all excavations at an angle that minimizes the possibility of slides and is consistent with the future use of the land.	MDE (D5) Md. Code Ann., Envir. §§ 15-802(a), -807(d), -822, -828(b)	Not Applicable
C.1.33	The placement of backfilled materials shall be done in a way that minimizes contamination and other adverse effects of coal mining on ground water systems outside the permit area and supports approved post-mining land uses.	MDE (D5) COMAR 26.20.20.01A	Not Applicable
C.1.34	Vegetative cover shall be established on all areas disturbed by surface coal mining in a manner that is compatible with the approved post-mining land use.	MDE (D5) COMAR 26.20.29.01A	Not Applicable
C.1.35	Surface mining reclamation shall be completed in accordance with the mining and reclamation plan within 2 years after mineral extraction has terminated.	MDE (D5) COMAR 26.21.01.16	Not Applicable
C.2	Electrical Generation and Transmission		
C.2.1	Power plants shall be sited, constructed, and operated in a manner which minimizes their impacts on tidal wetlands, aquatic resources, terrestrial resources, significant wildlife habitat, public open space, recreational, and natural areas, air and water quality, and the public health, safety, and welfare.	DNR/PSC (D2) Md. Code Ann., Nat. Res. §§ 1-302, 3-303, 3-304, 3-306 Md. Code Ann., Pub. Util. Cos. § 7-208	Not Applicable
C.2.2	Proposals for new power plants and transmission lines must account for their impact on the physical, biological, aesthetic, and cultural features of the site and adjacent areas; identify contributions to air and water pollution; recommend mitigation opportunities; and adequately consider recommendations of local government.	PSC (D2) Md. Code Ann., Pub. Util. Cos. § 7-207(e) COMAR 20.79.03.02(B) COMAR 20.79.04.04	Not Applicable
C.2.3	Proposals for new transmission lines must estimate the capital and annual operating costs of each alternative route considered and explain why each alternative route was rejected.	PSC (D2) COMAR 20.79.04.03	Not Applicable

Code	Policy	Policy References[1]	Applicability or Consistency[2]
C.2.4	Utilities shall maintain the vertical clearances of overhead electric supply lines that cross water surfaces suitable for sailing.	PSC (D2) COMAR 20.50.02.05(B)	Not Applicable
C.2.5	The location, design, construction, and capacity of cooling water intake structures shall reflect the best technology available for minimizing adverse environmental impact, specifically impingement and entrainment losses.	MDE (D4) COMAR 26.08.03.05	Not Applicable
C.3	Tidal Shore Erosion Control		
C.3.1	Structural erosion control measures shall be designed to use materials such as stone or broken concrete, wood, metal, plastic, or other similar materials that are of adequate size, weight, and strength to function as intended; free of protruding objects; and selected because they minimize impacts to water quality and plant, fish, and wildlife habitat.	MDE (C1) COMAR 26.24.04.01	Not Applicable
C.3.2	Tidal shore erosion control projects shall not use junk, metal, tree stumps, logs, or other unsuitable materials for backfill.	MDE (C1) COMAR 26.24.04.01	Not Applicable
C.3.3	Beach nourishment projects shall meet the following requirements: ▪ The fill material grain size shall be equal to or greater in grain size and character to the existing beach material, or determined otherwise to be compatible with existing site conditions and acceptable to the Department; ▪ The fill material shall be relatively free of organic material, floating debris, or other objects; ▪ Silt and clay fills that change the sandy nature of the existing beach materials are not acceptable; ▪ Gravel fill may be acceptable, if particle sizes are equal to or greater than the existing beach materials; and ▪ Fill material shall be placed above the mean high water line before final grading to achieve the desired beach profile, unless site conditions prohibit the placement of fill material above the mean high water line and specific measures are designed to prevent material from washing away from the site.	MDE (C1) COMAR 26.24.03.06D	Not Applicable
C.3.4	Improvements to protect property bounding on navigable water against erosion shall consist of nonstructural shoreline stabilization measures that preserve the natural environment, such as marsh creation, except in areas designated by Department of the Environment as appropriate for structural shoreline stabilization measures, including areas of excessive erosion, areas subject to heavy tides, and areas too narrow for effective use of nonstructural shoreline stabilization measures.	MDE (C1) Md. Code Ann., Envir. § 16-201	Not Applicable
C.3.5	Encroachment into state tidal wetlands for shore erosion control shall be limited to that which is structurally necessary. Bulkheads that encroach into tidal wetlands in excess of 3 feet beyond the mean high water line are prohibited, unless a design report verifies the necessity for the encroachment, and that other structural and nonstructural alternatives have been considered and determined to be impractical. The design report shall distinguish between shore erosion and bank stabilization requirements.	MDE (C1) COMAR 26.24.04.01	Not Applicable
C.3.6	Tidal shore erosion control measures are listed below beginning with measures that are most consistent with State policy and ending with measures that are least consistent with State policy. ▪ No action and relocation of structure	MDE (C1) COMAR 26.24.04.01C	Not Applicable

Code	Policy	Policy References[1]	Applicability or Consistency[2]
	▪ Nonstructural shoreline stabilization, including beach nourishment, marsh creation, and other measures that encourage the preservation of the natural environment ▪ Shoreline revetments, breakwaters, groins, and similar structures designed to ensure the establishment and long-term viability of nonstructural shoreline stabilization projects ▪ Shoreline revetments ▪ Breakwaters ▪ Groins ▪ Bulkheads		
C.3.7	Tidal shore erosion control projects shall not occur when: ▪ There is no evidence of erosion; ▪ Existing tidal wetlands are adequately serving as a buffer against erosion; ▪ Adjacent properties may be adversely affected by the proposed method of erosion control; ▪ Navigation may be adversely affected by the project and the applicant has not made provisions to offset these impacts; ▪ Threatened or endangered species, species in need of conservation, or significant historic or archaeological resources may be adversely affected by the project; or ▪ Natural oyster bars or private oyster leases may be adversely affected by the project.	MDE (C1) COMAR 26.24.04.01	Not Applicable
C.4	Oil and Natural Gas Facilities		
C.4.1	The Coastal Facilities Review Act (CFRA) and its implementing regulations, as approved by NOAA, are enforceable policies.		Not Applicable
C.4.2	To detect and control oil spills, all private tank vessels transporting oil in the State must either be equipped with a cargo level monitoring system, have double hulls, have a plan for inspecting load lines approved by the Department of the Environment, or be accompanied by an all-weather escort vessel for the purpose of continuously checking for evidence of an oil discharge from the escorted tank vessel.	MDE (A2) Md. Code Ann., Envir. § 4-405 (b)(1) COMAR 26.10.01.23B	Not Applicable
C.4.3	Through bond or other form of security, the operator of a private tank vessel transporting more than 25 barrels of oil as cargo must be able to prove the financial ability to cover the cost of oil spill cleanup and recovery before entering waters of the State.	MDE (A2) COMAR 26.10.01.24A	Not Applicable
C.4.4	No person may discharge oil in any manner, including through bilge and ballast water, or deposit it in an area where it may enter waters of the State.	MDE (A2) Md. Code Ann., Envir. § 4-410(a) COMAR 26.10.01.02B	Not Applicable
C.4.5	Above-ground oil storage sites shall prevent movement of oil into the waters of the State.	MDE (D1) COMAR 26.10.01.12B(1)	Not Applicable
C.4.6	The construction of above-ground oil storage tanks, dikes, or walls within the tidal wetlands or within the 100-year flood plain is prohibited without first obtaining a State Wetlands Permit or providing an equivalent level of environmental protection.	MDE (D1) COMAR 26.10.01.12B(3)	Not Applicable

Code	Policy	Policy References[1]	Applicability or Consistency[2]
C.5	Dredging and Disposal of Dredged Material		
C.5.1	A person may not dredge for projects that are non-water-dependent unless there is no practicable alternative.	MDE (A3) Md. Code Ann., Envir. § 5-907(a) COMAR 26.24.03.02D	Not Applicable
C.5.2	Dredging for sand, gravel, or fill material, including material for beach nourishment, is prohibited unless an environmental analysis determines that there will be no adverse impact on the environment and no alternative material is available.	MDE (A3) COMAR 26.24.03.02C	Not Applicable
C.5.3	Dredging of channels, canals, and boat basins shall be designed to provide adequate flushing and elimination of stagnant water pockets, and channel alignment shall make maximum use of natural or existing channels and bottom contours.	MDE (B2) COMAR 26.24.03.02	Not Applicable
C.5.4	The alignment of a channel shall first avoid and then minimize impacts to shellfish beds, submerged aquatic vegetation, and vegetated tidal wetlands. When feasible, the alignment shall be located the maximum distance feasible from shellfish beds, submerged aquatic vegetation, and other vegetated tidal wetlands.	MDE (C6) COMAR 26.24.03.02	Not Applicable
C.5.5	Dredging is prohibited from February 15 through June 15 in areas where yellow perch have been documented to spawn and from March 1 through June 15 in areas where other important finfish species have been documented to spawn.	MDE (A3) COMAR 26.24.02.06G	Not Applicable
C.5.6	Dredging is prohibited within 500 yards of submerged aquatic vegetation from April 15 through October 15.	MDE (A3) COMAR 26.24.02.06H	Not Applicable
C.5.7	Within 500 yards of shellfish areas, mechanical and hydraulic dredging is prohibited from June 1 through September 30 and mechanical dredging is also prohibited from December 16 through March 14.	MDE (A3) COMAR 26.24.02.06E	Not Applicable
C.5.8	New disposal sites for dredged material shall be selected based on the following hierarchy of criteria: (i) beneficial use and innovative reuse of dredged material; (ii) upland sites and other environmentally sound confined capacity; (iii) expansion of existing dredged material disposal capacity other than the Hart-Miller Island Dredged Material Containment Facility and areas collectively known as Pooles Island.	MDE (A3) Md. Code Ann., Envir. § 5-1104.2(d)	Not Applicable
C.5.9	Disposal facilities for dredged material shall be designed to have the least impact on public safety, adjacent properties, and the environment.	MDE (A3) COMAR 26.24.03.04A	Not Applicable
C.5.10	Prior to disposing of dredged material on upland areas, a sediment and erosion control plan must be developed and approved by the local soil conservation district or the Department of the Environment and the methods for protecting water quality and quantity must be identified in detail.	MDE (A3) COMAR 26.24.03.03B	Not Applicable
C.5.11	A person may not redeposit in an unconfined manner dredged material into or onto any portion of the water or bottomland of the Chesapeake Bay or of the tidewater portion of any of the Chesapeake Bay's tributaries except when the project is undertaken to restore islands or underwater grasses, stabilize eroding shorelines, or create or restore wetlands or fish and shellfish habitats.	MDE (A3) Md. Code Ann., Envir. § 5-1101(a), 5-1102	Not Applicable
C.5.12	A person may not redeposit in an unconfined manner dredged material into or onto any portion of the bottomlands or waters of the Chesapeake Bay known as the deep trough.	MDE (A3) Md. Code Ann., Envir. §§ 5-1101(a), -1102	Not Applicable

Code	Policy	Policy References[1]	Applicability or Consistency[2]
C.5.13	No material dredged from Baltimore Harbor shall be disposed of in an unconfined manner in the open water portion of Chesapeake Bay, or the tidal portions of its tributaries outside of Baltimore Harbor.	MDE (A3) Md. Code Ann., Envir. § 5-1102(a)	Not Applicable
C.6	Navigation		
C.6.1	Navigational access projects shall when possible be designed to use piers to reach deep waters rather than dredging.	MDE (B2) COMAR 26.24.03.02	Not Applicable
C.6.2	Navigational access channels to serve individual or small groups of riparian landowners shall be designed to prevent unnecessary channels**.** A central access channel with short spur channels shall be considered over separate access channels for each landowner.	MDE (B2) COMAR 26.24.03.02	Not Applicable
C.6.3	Navigational access channels shall be designed to minimize alteration of tidal wetlands and underwater topography.	MDE (B2) COMAR 26.24.03.02	Not Applicable
C.6.4	New or expanded facilities for the mooring, docking, or storing of more than ten vessels on tidal navigable waters shall be located on waters with strong flushing characteristics and may not be located in areas where the natural depth is 4.5 feet or less at mean low water, and any of the following will be adversely affected: aquatic vegetation, productive macroinvertebrate communities, shellfish beds, fish spawning or nursery areas, rare, threatened, or endangered species, species in need of conservation, or historic waterfowl staging areas. Expansion of existing facilities is favored over new development.	MDE (A1) COMAR 26.24.04.03	Not Applicable
C.6.5	The location of buoys for the mooring of boats shall not be located in designated private or public shellfish areas, cable-crossing areas, navigational channels, in other places in where general navigation would be impeded or obstructed, or public ship anchorage. The location of mooring buoys should not obstruct the riparian access of adjacent property owners or hinder the orderly access to or use of the waterways by the general public.	DNR (A1) COMAR 08.04.13.02	Not Applicable
C.6.6	Vessels operated on state waters should not exceed a noise level of 90dB(a).	DNR (A1) COMAR 08.18.03.03	Consistent
C.7	Transportation		
C.7.1	The social, economic, and environmental effects of proposed transportation facilities projects must be identified and alternative courses of action must be considered.	MDOT (D8) COMAR 11.01.06.02B	Not Applicable
C.7.2	The public must be involved throughout the process of planning transportation projects.	MDOT (D8) Md. Code Ann., Transp. § 7-304(a) COMAR 11.01.06.02B	Not Applicable
C.7.3	Transportation development and improvement projects must support the integrated nature of the transportation system, including removing impediments to the free movement of individuals from one mode of transportation to another.	MDOT (D8) Md. Code Ann., Transp. § 2-602	Not Applicable
C.7.4	Private transit facilities must be operated in such a manner as to supplement facilities owned or controlled by the State to provide a unified and coordinated regional transit system without unnecessary duplication or competing service.	MDOT (D8) Md. Code Ann., Transp. § 7-102.1(b)	Not Applicable

Code	Policy	Policy References[1]	Applicability or Consistency[2]
C.7.5	Access to and use of transportation facilities by pedestrians and bicycle riders must be enhanced by any transportation development or improvement project, and best engineering practices regarding the needs of bicycle riders and pedestrians shall be employed in all phases of transportation planning.	MDOT (D8) Md. Code Ann., Transp. § 2-602	Not Applicable
C.8	Agriculture		
C.8.1	Agricultural land management practices may not add, introduce, leak, spill, or otherwise emit soil or sediment into waters of the State unless a plan is being implemented on the property that is designed to conserve soil and protect water quality.	MDA (C4) Md. Code Ann., Envir. § 4-213	Not Applicable
C.8.2	A person conducting an agricultural activity shall implement best management practices to protect non-tidal wetlands.	MDE (C3) COMAR 26.23.05.02	Not Applicable
C.8.3	Animal feeding operations shall use best management practices designed and approved by a local soil conservation district to limit livestock access to surface water.	MDA (C4) COMAR 26.08.03.09	Not Applicable
C.8.4	An agricultural operation with $2500 a year in gross income or more than 8000 pounds of livestock that uses chemical fertilizers, sludge, or animal manure shall use these nutrients in a way that minimizes impacts on water quality.	MDA (C4) Md. Code Ann., Agric. § 8-803.1	Not Applicable
C.8.5	Agricultural drainage projects shall provide substantial agricultural benefits, prevent direct over bank flow into the ditch, be truncated as far upstream as possible, minimize adverse environmental impacts, and implement and maintain approved soil conservation district conservation plans.	MDE (C3) COMAR 26.17.04.11	Not Applicable
C.9	Development		
C.9.1	Any development shall be designed to minimize erosion and keep sediment onsite.	MDE (C4) COMAR 26.17.01.08	Not Applicable
C.9.2	Development must avoid and then minimize the alteration or impairment of tidal and nontidal wetlands; minimize damage to water quality and natural habitats; minimize the cutting or clearing of trees and other woody plants; and preserve sites and structures of historical, archeological, and architectural significance and their appurtenances and environmental settings.	MDE/DNR/CAC (D6) Md. Code Ann., Envir. §§ 4-402, 5-907(a), 16-102(b) Md. Code Ann., Nat. Res. §§ 5-1606(c), 8-1801(a) Md. Code Ann., Article 66B § 8.01(b) COMAR 26.24.01.01(A)	Not Applicable
C.9.3	Any proposed development may only be located where the water supply system, sewerage system, or solid waste acceptance facility is adequate to serve the proposed construction, taking into account all existing and approved developments in the service area and any water supply system, sewerage system, or solid waste acceptance facility described in the application and will not overload any present facility for conveying, pumping, storing, or treating water, sewage, or solid waste.	MDE (C9) Md. Code Ann., Envir. § 9-512	Not Applicable

Code	Policy	Policy References[1]	Applicability or Consistency[2]
C.9.4	A proposed construction project must have an allocation of water and wastewater from the county whose facilities would be affected or, in the alternative, prove access to an acceptable well and on-site sewage disposal system. The water supply system, sewerage system, and solid waste acceptance facility on which the building or development would rely must be capable of handling the needs of the proposed project in addition to those of existing and approved developments.	MDE (D6) Md. Code Ann., Envir. § 9-512	Not Applicable
C.9.5	Any residence or commercial establishment that is served or will be served by an on-site sewage disposal system or private water system must demonstrate that the system or systems are capable of handling the existing and reasonably foreseeable sewage flows or water demand prior to construction or alteration of the residence or commercial establishment.	MDE (D6) COMAR 26.04.02.02D	Not Applicable
C.9.6	Proponents of grading or building in the Severn River Watershed must create a development plan and have it approved by the soil conservation district. The plan shall include a strategy for controlling silt and erosion and must demonstrate that any septic or private sewer facility will not contribute to the pollution of the Severn River.	MDE (D4) Md. Code Ann., Envir. § 4-308(a)	Not Applicable
C.9.7	Industrial facilities must be sited and planned to insure compatibility with other legitimate beneficial water uses, constraints imposed due to standards of air, noise and water quality, and provision or availability of adequate water supply and waste water treatment facilities.	MDE (D4) Md. Code Ann., Envir. §§ 2-102, 4-402, 9-224(b), 9-512(b) COMAR 26.02.03.02 COMAR 26.11.02.02B	Not Applicable
C.9.8	Local citizens shall be active partners in planning and implementation of development.	MDP (D6) Md. Code Ann., State Fin. & Proc. §§ 5-7A-01 to -02	Not Applicable
C.9.9	Development shall protect existing community character and be concentrated in existing population and business centers, growth areas adjacent to these centers, or strategically selected new centers.	MDP (D6) Md. Code Ann., State Fin. & Proc. §§ 5-7A-01 to -02	Not Applicable
C.9.10	Development shall be located near available or planned transit options.	MDP (D6) Md. Code Ann., State Fin. & Proc. §§ 5-7A-01 to -02	Not Applicable
C.9.11	Whenever possible, communities shall be designed to be compact, contain a mixture of land uses, and be walkable.	MDP (D6) Md. Code Ann., State Fin. & Proc. §§ 5-7A-01 to -02	Not Applicable
C.9.12	To meet the needs of existing and future development, communities must identify adequate drinking water and water resources and suitable receiving waters and land areas for stormwater management and wastewater treatment and disposal.	MDE (D6) Md. Code Ann., Article 66B § 3.05	Not Applicable
C.10	Sewage Treatment		

Code	Policy	Policy References[1]	Applicability or Consistency[2]
C.10.1	The quality of state waters shall be protected, maintained, and improved for public supplies, propagation of wildlife, fish and aquatic life, and domestic, agricultural, industrial, recreational, and other legitimate beneficial uses.	MDE (D7) Md. Code Ann., Envir. §§ 4-402, 9-302(b), 9-323(a)	Consistent
C.10.2	No waste shall be discharged into any waters of the State without first receiving necessary treatment or other corrective action to protect the legitimate beneficial uses of the State's waters.	MDE (D7) Md. Code Ann., Envir. §§ 9-302(b), -323(a)	Not Applicable
C.10.3	Unless permitted by Maryland law, sewage or sewage effluent, treated or non-treated, or industrial wastes may not be disposed of in any manner that will create a nuisance or cause contamination of potable water supply systems, the waters of the State, or the ground surface.	MDE (D7) COMAR 26.04.02.02	Not Applicable
C.10.4	A person may not discharge raw sewage or any other waste into the Patuxent River, the Severn River, or any of their tributaries.	MDE (D7) Md. Code Ann., Envir. § 4-307	Not Applicable
C.10.5	A person may not dump, deposit, scatter, or release sewage sludge by any means, including discharge from a sewer or pipe, into or onto any portion of the water or bottomland of the Chesapeake Bay or of the tidewater portions of any of the Chesapeake Bay's tributaries within 5 miles of the Hart-Miller-Pleasure Island chain in Baltimore County.	MDE (D7) Md. Code Ann., Envir. § 5-1102(e)	Not Applicable
C.10.6	Before constructing, installing, modifying, extending, altering, or operating a sewage treatment facility that could cause or increase the discharge of pollutants into the waters of the State, the proponent must hold a discharge permit issued by the Department of the Environment or provide an equivalent level of water quality protection.	MDE (D7) Md. Code Ann., Envir. § 9-323(a)	Not Applicable
C.10.7	Before attempting to construct or alter an on-site sewage disposal system or cause it to receive any increase in flow, the proponent must receive a permit from the Department of the Environment or provide an equivalent level of water quality protection.	MDE (D7) COMAR 26.04.02.02	Not Applicable
C.10.8	New sewage treatment plants shall be constructed so as to meet the State effluent water quality standards, including those for bacteriological values, dissolved oxygen, pH, and temperature conditions, which may require advanced waste treatment.	MDE (D7) Md. Code Ann., Envir. § 4-303	Not Applicable
C.10.9	Secondary treatment is required as a minimum for sewage treatment works discharging into any waters of the State.	MDE (D7) COMAR 26.08.04.04C	Not Applicable
C.10.10	If compliance with the established water quality standards or nutrient control requirements cannot be achieved through secondary treatment for all sewage discharges within a specific river segment or water region, the sewage treatment facilities are subject to additional restrictions.	MDE (D7) COMAR 26.08.01.02C	Not Applicable
C.10.11	Advanced waste treatment is required for all sewage treatment works with a design capacity exceeding 1 million gallons per day and discharging into water quality limited waters. Advanced waste treatment may also be required for smaller sewage treatment works where the Department of the Environment determines that this level of treatment is necessary.	MDE (D7) COMAR 26.08.04.04C	Not Applicable
C.10.12	An effluent limitation of 2 milligrams/liter total phosphorus is required for all facilities discharging more than: 500,000 gallons per day to the Chesapeake Bay and its tributaries above the Baltimore Harbor and 10 million gallons per day in the vicinity of Baltimore Harbor to the Bay Bridge.	MDE (D7) COMAR 26.08.04.04C	Not Applicable
C.10.13	If discharging into shellfish harvesting waters, sewage treatment must be sufficient to protect shellfish harvesting, potentially requiring advanced waste treatment, and the treatment plant must have a bypass control system, including a minimum 24-hour emergency holding facility.	MDE (D7) COMAR 26.08.04.04C	Not Applicable

Code	Policy	Policy References[1]	Applicability or Consistency[2]
C.10.14	Holding tanks shall be watertight and sized to hold at least 7 days effluent from a septic tank.	MDE (D7) COMAR 26.04.02.03C	Not Applicable
C.10.15	Sewerage systems must conform to the county plan or revision or amendment of the county plan.	MDE (D7) Md. Code Ann., Envir. § 9-511	Not Applicable
C.10.16	Unless sewage sludge is disposed of in a manner that precludes potential health hazards due to the presence of pathogens, all sewage sludge shall be treated by a process to significantly reduce pathogens or a process to further reduce pathogens.	MDE (D7) COMAR 26.04.06.08A	Not Applicable
C.10.17	Sewage sludge utilization is prohibited if it cannot be done without causing an undue risk to the environment or public health, safety, or welfare or if the sewage sludge was generated in a state that does not apply sewage sludge to land.	MDE (D7) Md. Code Ann., Envir. § 9-245 COMAR 26.04.06.10A	Not Applicable
C.10.18	Prior to utilizing sewage sludge in Maryland, a person shall obtain a sewage sludge utilization permit from the Maryland Department of the Environment or provide an equivalent level of environmental protection.	MDE (D7) Md. Code Ann., Envir. § 9-231	Not Applicable
C.10.19	A user of sewage sludge may not interfere with any inspection of a sewage sludge utilization site, including prohibiting access to any representative of the Department of the Environment, to a local health official, or to the local health official's designee who requests access to insure compliance with the appropriate rules and regulations.	MDE (D7) Md. Code Ann., Envir. § 9-243 COMAR 26.04.06.06	Not Applicable
C.10.20	Sewage sludge composting or storage facilities must meet all zoning and land use requirements of the county in which the facility is to be located.	MDE (D7) Md. Code Ann., Envir. § 9-233	Not Applicable
C.10.21	The public shall be given an opportunity to present its views prior to any final decision being made on the siting of sewage sludge or a sewage sludge storage or distribution facility.	MDE (D7) Md. Code Ann., Envir. §§ 9-234, -238(c) COMAR 26.04.06.05	Not Applicable
C.10.22	On-site sewage disposal systems are prohibited: ▪ If they may pollute well water supplies, water supply reservoirs, shellfish growing waters, bathing beaches, lakes, or tidewater areas, including within 25 feet of drainage and spring seeps, flood plain soils, gullies, rock outcroppings, or slopes in excess of 25 percent; 50 feet from water well systems in confined aquifers; ▪ 100 feet from water well systems in unconfined aquifers, water bodies not serving as potable water supplies, and a stream bank when further than 3,000 feet upstream of an intake for a potable water supply; and ▪ 200 feet from a stream bank when closer than 3,000 feet upstream of such an intake.	MDE (D7) COMAR 26.04.02.04	Not Applicable
C.10.23	Facilities capable of berthing vessels 22 feet or larger with more than 10 slips must have a wastewater collection and treatment system and an on-site pump-out station adequate to handle existing and increased flow and increased sewage capacity, respectively.	MDE (D7) Md. Code Ann., Env. § 9-333	Not Applicable

Code	Policy	Policy References[1]	Applicability or Consistency[2]
C.10.24	A vessel 65 feet in length and under with an installed toilet shall have a Type I, II, or III marine sanitation device. A vessel over 65 feet in length with an installed toilet shall have a Type II or III marine sanitation device. While in Maryland waters, all means of overboard discharge from a vessel with a Type III marine sanitation device must be blocked or secured so as to prevent discharge. Marine Sanitation Devices: ▪ A Type I marine sanitation device produces an effluent having a fecal coliform bacteria count not greater than 1,000 per 100 milliliters and no visible floating solids. ▪ A Type II marine sanitation device produces an effluent having a fecal coliform bacteria count not greater than 200 per 100 milliliters and suspended solids not greater than 150 milligrams per liter. ▪ A Type III marine sanitation device does not discharge effluent.	DNR/MDE (A1) Md. Code Ann., Natural Res. § 8-741	Not Applicable

Source:
State of Maryland. 2011. *Maryland's Enforceable Coastal Policies*. Effective April 8, 2011.

Notes:
1. Initial reference expressions indicates the implementing agency followed a parenthetical citation to the section where the policy can be found in the Chart of Proposed Changes included in the original Maryland Coastal Management Program document, *Routine Program Change, Update and Clarification of Maryland Coastal Management Program Enforceable Policies, Request for Concurrence* (Maryland Department of Natural Resources, November 2010). Subsequent expressions indicate statutory or regulatory references.
2. "Consistent" indicates consistent, to the maximum extent practicable.

Implementing Agency:

CAC – Critical Area Commission for the Chesapeake and Atlantic Coastal Bays.
DNR – Maryland Department of Natural Resources.
MDA – Maryland Department of Agriculture.
MDE – Maryland Department of the Environment.
MDOT – Maryland Department of Transportation.
MDP – Maryland Department of Planning.
PSC – Public Service Commission.

Regulatory and Statutory Reference:

§ – Section.
§§ – Sections.
Agric. – Agriculture Article.
COMAR – Code of Maryland Regulations.
Crim. Law – Criminal Law Article.
Envir. – Environment Article.
Fin. & Proc. – Finance and Procurement Article.
Md. Code Ann. – Maryland Code Annotated.
Nat. Res. – Natural Resources Article.
Pub. Util. Cos. – Public Utilities Article.
Transp. – Transportation Article.

APPENDIX J

CHEMICAL SIMULANT MODELING

THIS PAGE INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

SECTION **Page**

TABLE

FIGURE

THIS PAGE INTENTIONALLY LEFT BLANK

J.1 Chemical Simulant Modeling

As described in Section 4.4, atmospheric dispersion of a set of chemical simulants was modeled based on established testing methods and protocols used at Naval Surface Warfare Center, Dahlgren Division (NSWCDD). The analysis used the Department of Defense (DoD)-approved Vapor, Liquid, and Solid Tracking Model (VLSTRACK: Version 3.2.3) to calculate the concentration and deposition levels resulting from the proposed testing. Using this model, the simulant concentration at various points in time and distance from the release point were predicted (Tables I-1 to I-6) along with deposition rates on water or land ranges areas (Table I-7). The modeling used a range of inputs for each parameter, as shown in the columns of the following tables, which present a summary of all modeling results.

Figure I-1 (Diethyl Malonate Run on the PRTR) provides a visual example of the dispersion of chemical simulants after release. In this scenario (Run 027, see Table I-1), 1.5 gallons of diethyl malonate (DEM) has been released at a height of 6 feet, a droplet mass median diameter (MMD) of 7 microns (to simulate maximum vapor concentrations), a wind speed of 10 miles per hour (mph), and a temperature of 65°F. The maximum concentration of 2,640 mg/m^3 would be reached almost immediately upon release, within the first 33 feet (10 meters) of the release point. The total area where the concentration of DEM would reach a maximum concentration of ≥ 100 mg/m^3 is less than 0.002 acres (7.33 E-06 km^2). This concentration would drop rapidly within the first 2 minutes, reaching a concentration of almost 0 mg/m^3 within 4 minutes.

Other combinations of parameters (Run 028, see Table I-1) would result in a maximum concentration of DEM of up to 20,200 mg/m within the first 33 feet (10 meters) of the release point. This run is based on 1.5 gallons of DEM has been released at a height of 6 feet, a droplet MMD of 7 microns, a wind speed of 1 mph, and a temperature of 85°F. The maximum concentration would be reached within 0.5 minute, with concentrations falling rapidly within the first 1,640 feet (50 meters).

Table J-1 - Diethyl Malonate Model Runs

Parameters							Max. Conc. (mg/m^3)	Distance (meters)	Time (min)	Ten Min. Max Conc. (mg/m^3)	Ten Min. Distance (meters)
Simulant	Run Number	Height of Release (ft)	Fill Weight (gal)	MMD (microns)	Wind Speed (mph)	Air Temp (°F)					
DEM	run025	6.00	1.50	7.00	1	65	1.84E+04	10	0.5	8.78E-01	50
DEM	run026	6.00	1.50	7.00	5	65	4.32E+03	10	1.4	5.59E+00	1110
DEM	run027	6.00	1.50	7.00	10	65	2.64E+03	10	2.0	1.33E+03	10
DEM	run028	6.00	1.50	7.00	1	85	2.02E+04	10	0.5	8.78E-01	50
DEM	run029	6.00	1.50	7.00	5	85	4.88E+03	10	1.2	5.59E+00	1110
DEM	run030	6.00	1.50	7.00	10	85	2.73E+03	10	1.0	1.34E+03	10
DEM	run031	6.00	1.50	72.00	1	65	1.32E+04	10	1.8	7.71E+00	10
DEM	run032	6.00	1.50	72.00	5	65	2.58E+03	10	1.8	8.25E+00	30
DEM	run033	6.00	1.50	72.00	10	65	1.83E+03	10	2.0	4.51E+00	40
DEM	run034	6.00	1.50	72.00	1	85	1.38E+04	10	1.8	2.39E+00	10
DEM	run035	6.00	1.50	72.00	5	85	2.68E+03	40	2.1	8.34E+00	30
DEM	run036	6.00	1.50	72.00	10	85	1.87E+03	10	2.0	7.65E-01	10
DEM	run061	40.00	5.00	7.00	1	65	1.99E+02	290	10.8	1.80E+02	280
DEM	run062	40.00	5.00	7.00	5	65	7.84E+01	420	3.9	1.75E+01	1150
DEM	run063	40.00	5.00	7.00	10	65	4.19E+01	470	2.7	0.00E+00	0
DEM	run064	40.00	5.00	7.00	1	85	1.99E+02	290	10.8	1.80E+02	280
DEM	run065	40.00	5.00	7.00	5	85	7.84E+01	420	3.9	1.75E+01	1150
DEM	run066	40.00	5.00	7.00	10	85	4.19E+01	470	2.7	0.00E+00	0
DEM	run067	40.00	5.00	72.00	1	65	9.47E+01	170	11.8	9.00E+01	140
DEM	run068	40.00	5.00	72.00	5	65	1.10E+02	360	3.1	1.79E+01	1150
DEM	run069	40.00	5.00	72.00	10	65	5.82E+01	400	2.4	2.51E-04	240
DEM	run070	40.00	5.00	72.00	1	85	1.32E+02	280	10.0	1.32E+02	280
DEM	run071	40.00	5.00	72.00	5	85	8.99E+01	400	3.5	1.77E+01	1150
DEM	run072	40.00	5.00	72.00	10	85	4.79E+01	450	2.6	0.00E+00	0
DEM	run097	40.00	10.00	7.00	1	65	3.98E+02	290	10.8	3.60E+02	280
DEM	run098	40.00	10.00	7.00	5	65	1.57E+02	420	3.6	3.50E+01	1150
DEM	run099	40.00	10.00	7.00	10	65	8.38E+01	470	2.7	0.00E+00	0
DEM	run100	40.00	10.00	7.00	1	85	3.98E+02	290	10.8	3.60E+02	280
DEM	run101	40.00	10.00	7.00	5	85	1.57E+02	420	3.6	3.50E+01	1150

Parameters							Max. Conc. (mg/m³)	Distance (meters)	Time (min)	Ten Min. Max Conc. (mg/m³)	Ten Min. Distance (meters)
Simulant	Run Number	Height of Release (ft)	Fill Weight (gal)	MMD (microns)	Wind Speed (mph)	Air Temp (°F)					
DEM	run102	40.00	10.00	7.00	10	85	8.38E+01	470	2.7	0.00E+00	0
DEM	run103	40.00	10.00	72.00	1	65	2.17E+02	70	11.0	6.12E+01	150
DEM	run104	40.00	10.00	72.00	5	65	2.32E+02	350	3.9	3.59E+01	1150
DEM	run105	40.00	10.00	72.00	10	65	1.17E+02	400	2.4	6.54E-04	240
DEM	run106	40.00	10.00	72.00	1	85	1.05E+02	170	6.7	1.01E+02	200
DEM	run107	40.00	10.00	72.00	5	85	1.80E+02	400	3.4	3.54E+01	1150
DEM	run108	40.00	10.00	72.00	10	85	9.59E+01	450	2.6	0.00E+00	0
DEM	run133	40.00	20.00	7.00	1	65	7.96E+02	290	10.8	7.19E+02	280
DEM	run134	40.00	20.00	7.00	5	65	3.14E+02	420	3.9	7.00E+01	1150
DEM	run135	40.00	20.00	7.00	10	65	1.68E+02	470	2.6	0.00E+00	0
DEM	run136	40.00	20.00	7.00	1	85	7.96E+02	290	10.8	7.19E+02	280
DEM	run137	40.00	20.00	7.00	5	85	3.14E+02	420	3.9	7.00E+01	1150
DEM	run138	40.00	20.00	7.00	10	85	1.68E+02	470	2.6	0.00E+00	0
DEM	run139	40.00	20.00	72.00	1	65	7.98E+03	50	1.9	7.77E+01	100
DEM	run140	40.00	20.00	72.00	5	65	5.12E+02	330	4.1	7.34E+01	1140
DEM	run141	40.00	20.00	72.00	10	65	2.47E+02	390	2.4	1.57E-03	190
DEM	run142	40.00	20.00	72.00	1	85	1.43E+03	60	11.0	2.60E+02	140
DEM	run143	40.00	20.00	72.00	5	85	3.67E+02	390	3.7	7.09E+01	1150
DEM	run144	40.00	20.00	72.00	10	85	1.92E+02	450	2.6	0.00E+00	0
Maximum							2.02E+04	4.70E+02	1.18E+01	1.34E+03	1.15E+03
Minimum							4.19E+01	1.00E+01	4.67E-01	0.00E+00	0.00E+00
Average							2.21E+03	2.67E+02	4.39E+00	1.34E+02	4.09E+02

Notes: DEM = dimethyl malonate; MMD = mass median diameter of droplet.
All runs done are shown, numbering is not sequential.
Runs used the Vapor, Liquid, and Solid Tracking (VLSTRACK) computer model version 3.2.3.

Table J-2 - Dimethyl Adipate Modeling Runs

Parameters												
Simulant	Run Number	Height of Release (ft)	Fill Wt. (gal)	MMD (microns)	Wind Speed (mph)	Air Temp (°F)	Max. Conc. (mg/m^3)	Distance (meters)	Time (min)	Ten Min. Max Conc. (mg/m^3)	Ten Min. Distance (meters)
DMA	run025	6.00	1.50	7.00	1	65	5.02E+03	10	1.8	3.19E-02	10
DMA	run026	6.00	1.50	7.00	5	65	7.77E+02	40	0.4	4.04E+00	1090
DMA	run027	6.00	1.50	7.00	10	65	6.42E+02	10	1.0	8.89E-03	10
DMA	run028	6.00	1.50	7.00	1	85	1.20E+04	10	1.8	8.01E-02	10
DMA	run029	6.00	1.50	7.00	5	85	2.03E+03	40	0.4	4.04E+00	1090
DMA	run030	6.00	1.50	7.00	10	85	1.03E+03	50	0.3	1.29E-02	10
DMA	run031	6.00	1.50	72.00	1	65	1.33E+03	10	1.8	1.54E-01	10
DMA	run032	6.00	1.50	72.00	5	65	4.84E+02	10	0.2	3.06E+00	1010
DMA	run033	6.00	1.50	72.00	10	65	6.21E+02	10	1.0	4.45E-02	10
DMA	run034	6.00	1.50	72.00	1	85	3.87E+03	10	1.8	4.99E-01	10
DMA	run035	6.00	1.50	72.00	5	85	1.33E+03	10	0.2	4.33E+00	1070
DMA	run036	6.00	1.50	72.00	10	85	8.80E+02	10	2.0	1.41E-01	40
DMA	run061	40.00	5.00	7.00	1	65	2.13E+02	280	10	2.13E+02	280
DMA	run062	40.00	5.00	7.00	5	65	6.66E+01	430	4.5	1.62E+01	1140
DMA	run063	40.00	5.00	7.00	10	65	3.31E+01	480	2.7	3.31E+01	480
DMA	run064	40.00	5.00	7.00	1	85	2.13E+02	280	10	2.13E+02	280
DMA	run065	40.00	5.00	7.00	5	85	6.66E+01	430	4.5	1.62E+01	1140
DMA	run066	40.00	5.00	7.00	10	85	3.31E+01	480	2.7	3.31E+01	480
DMA	run067	40.00	5.00	72.00	1	65	7.95E+02	10	9.3	1.09E+02	10
DMA	run068	40.00	5.00	72.00	5	65	6.66E+01	270	2.4	1.11E+01	1040
DMA	run069	40.00	5.00	72.00	10	65	1.33E+01	410	2.3	2.35E-01	290
DMA	run070	40.00	5.00	72.00	1	85	1.24E+03	10	7.3	2.39E+02	10
DMA	run071	40.00	5.00	72.00	5	85	1.62E+02	270	2.4	1.72E+01	1100
DMA	run072	40.00	5.00	72.00	10	85	3.34E+01	420	2.7	4.35E-01	290
DMA	run097	40.00	20.00	7.00	1	65	8.51E+02	280	10	8.51E+02	280
DMA	run098	40.00	20.00	7.00	5	65	2.66E+02	430	4.5	6.47E+01	1140
DMA	run099	40.00	20.00	7.00	10	65	1.32E+02	480	2.7	1.32E+02	480
DMA	run100	40.00	20.00	7.00	1	85	8.51E+02	280	10	8.51E+02	280

Parameters							Max. Conc. (mg/m^3)	Distance (meters)	Time (min)	Ten Min. Max Conc. (mg/m^3)	Ten Min. Distance (meters)
Simulant	Run Number	Height of Release (ft)	Fill Wt. (gal)	MMD (microns)	Wind Speed (mph)	Air Temp (°F)					
DMA	run101	40.00	20.00	7.00	5	85	2.66E+02	430	4.5	6.47E+01	1140
DMA	run102	40.00	20.00	7.00	10	85	1.32E+02	480	2.7	1.32E+02	480
DMA	run103	40.00	20.00	72.00	1	65	3.28E+03	10	9.3	3.45E+02	10
DMA	run104	40.00	20.00	72.00	5	65	2.69E+02	260	2.3	4.33E+01	1030
DMA	run105	40.00	20.00	72.00	10	65	5.00E+01	400	2.2	5.44E-01	390
DMA	run106	40.00	20.00	72.00	1	85	7.35E+03	10	7.3	7.69E+02	10
DMA	run107	40.00	20.00	72.00	5	85	6.86E+02	270	2.3	6.52E+01	1100
DMA	run108	40.00	20.00	72.00	10	85	1.33E+02	400	2.2	1.34E+00	390
Maximum							1.20E+04	480	10.00	8.51E+02	1.14E+03
Minimum							1.33E+01	10	0.17	8.89E-03	1.00E+01
Average							1.31E+03	214	3.71	1.18E+02	4.90E+02

Notes: DMA = dimethyl adipate; MMD = mass median diameter of droplet.
All runs done are shown, numbering is not sequential.
Runs used the Vapor, Liquid, and Solid Tracking (VLSTRACK) computer model version 3.2.3.

Table J-3- Dimethyl Methylphosphonate Modeling Runs

Parameters							Max. Conc. (mg/m^3)	Distance (meters)	Time (min)	Ten Min. Max Conc. (mg/m^3)	Ten Min. Distance (meters)
Simulant	Run Number	Height of Release (ft)	Fill Weight (gal)	MMD (microns)	Wind Speed (mph)	Air Temp (°F)					
DMMP	run025	40.00	5.00	7.00	1	65	2.22E+02	290	10.8	2.00E+02	280
DMMP	run026	40.00	5.00	7.00	5	65	8.74E+01	420	3.9	1.95E+01	1150
DMMP	run027	40.00	5.00	7.00	10	65	4.67E+01	470	2.7	0.00E+00	0
DMMP	run028	40.00	5.00	7.00	1	85	2.22E+02	290	10.8	2.00E+02	280
DMMP	run029	40.00	5.00	7.00	5	85	8.74E+01	420	3.9	1.95E+01	1150
DMMP	run030	40.00	5.00	7.00	10	85	4.67E+01	470	2.7	0.00E+00	0
DMMP	run031	40.00	5.00	72.00	1	65	6.25E+01	180	6.9	5.86E+01	240
DMMP	run032	40.00	5.00	72.00	5	65	1.05E+02	390	3.3	1.98E+01	1150
DMMP	run033	40.00	5.00	72.00	10	65	5.61E+01	440	2.6	0.00E+00	0
DMMP	run034	40.00	5.00	72.00	1	85	1.97E+02	240	9	1.48E+02	290
DMMP	run035	40.00	5.00	72.00	5	85	9.45E+01	410	3.5	1.96E+01	1150
DMMP	run036	40.00	5.00	72.00	10	85	5.04E+01	460	2.6	0.00E+00	0
DMMP	run061	40.00	10.00	7.00	1	65	4.44E+02	290	10.8	4.01E+02	280
DMMP	run062	40.00	10.00	7.00	5	65	1.75E+02	420	3.6	3.90E+01	1150
DMMP	run063	40.00	10.00	7.00	10	65	9.34E+01	470	2.7	0.00E+00	0
DMMP	run064	40.00	10.00	7.00	1	85	4.44E+02	290	10.8	4.01E+02	280
DMMP	run065	40.00	10.00	7.00	5	85	1.75E+02	420	3.6	3.90E+01	1150
DMMP	run066	40.00	10.00	7.00	10	85	9.34E+01	470	2.7	0.00E+00	0
DMMP	run067	40.00	10.00	72.00	1	65	3.34E+02	150	10.27	3.32E+02	140
DMMP	run068	40.00	10.00	72.00	5	65	2.12E+02	390	3.3	3.96E+01	1150
DMMP	run069	40.00	10.00	72.00	10	65	1.12E+02	440	2.5	0.00E+00	0
DMMP	run070	40.00	10.00	72.00	1	85	1.41E+02	200	7.5	1.25E+02	280
DMMP	run071	40.00	10.00	72.00	5	85	1.89E+02	410	3.5	3.93E+01	1150
DMMP	run072	40.00	10.00	72.00	10	85	1.01E+02	460	2.6	0.00E+00	0
DMMP	run097	40.00	20.00	7.00	1	65	8.87E+02	290	10.8	8.01E+02	280
DMMP	run098	40.00	20.00	7.00	5	65	3.50E+02	420	4.0	7.80E+01	1150
DMMP	run099	40.00	20.00	7.00	10	65	1.87E+02	470	2.6	0.00E+00	0
DMMP	run100	40.00	20.00	7.00	1	85	8.87E+02	290	10.8	8.01E+02	280
DMMP	run101	40.00	20.00	7.00	5	85	3.50E+02	420	4.0	7.80E+01	1150

Parameters							Max. Conc. (mg/m^3)	Distance (meters)	Time (min)	Ten Min. Max Conc. (mg/m^3)	Ten Min. Distance (meters)
Simulant	**Run Number**	**Height of Release (ft)**	**Fill Weight (gal)**	**MMD (microns)**	**Wind Speed (mph)**	**Air Temp (°F)**					
DMMP	run102	40.00	20.00	7.00	10	85	1.87E+02	470	2.6	0.00E+00	0
DMMP	run103	40.00	20.00	72.00	1	65	2.78E+03	40	2.2	8.96E+01	140
DMMP	run104	40.00	20.00	72.00	5	65	4.37E+02	380	4.4	7.93E+01	1150
DMMP	run105	40.00	20.00	72.00	10	65	2.26E+02	440	2.6	0.00E+00	0
DMMP	run106	40.00	20.00	72.00	1	85	5.38E+02	160	12	4.97E+02	150
DMMP	run107	40.00	20.00	72.00	5	85	3.82E+02	410	4.6	7.86E+01	1150
DMMP	run108	40.00	20.00	72.00	10	85	2.02E+02	460	2.6	0.00E+00	0
Maximum							2.78E+03	470	12.00	8.01E+02	1.15E+03
Minimum							4.67E+01	40	2.17	0.00E+00	0.00E+00
Average							3.11E+02	365	5.27	1.28E+02	4.64E+02

Notes: DMMP = dimethyl methylphosphonate; MMD = mass median diameter of droplet.
All runs done are shown, numbering is not sequential.
Runs used the Vapor, Liquid, and Solid Tracking (VLSTRACK) computer model version 3.2.3.

Table J-4- Glacial Acetic Acid Modeling Runs

Parameters											
Simulant	Run Number	Height of Release (ft)	Fill Weight (gal)	MMD (microns)	Wind Speed (mph)	Air Temp (°F)	Max. Conc. (mg/m^3)	Distance (meters)	Time (min)	Ten Min. Max Conc. (mg/m^3)	Ten Min. Distance (meters)
GAA	run025	40.00	5.00	7.00	1	65	1.99E+02	290	10.8	1.80E+02	280
GAA	run026	40.00	5.00	7.00	5	65	7.84E+01	420	3.9	1.75E+01	1150
GAA	run027	40.00	5.00	7.00	10	65	4.19E+01	470	2.6	0.00E+00	0
GAA	run028	40.00	5.00	7.00	1	85	1.99E+02	290	10.8	1.80E+02	280
GAA	run029	40.00	5.00	7.00	5	85	7.84E+01	420	4	1.75E+01	1150
GAA	run030	40.00	5.00	7.00	10	85	4.19E+01	470	2.6	0.00E+00	0
GAA	run031	40.00	5.00	72.00	1	65	7.05E+02	60	11	1.44E+01	70
GAA	run032	40.00	5.00	72.00	5	65	6.74E+01	260	3.2	1.16E+01	1030
GAA	run033	40.00	5.00	72.00	10	65	1.34E+01	400	3.3	1.61E-01	340
GAA	run034	40.00	5.00	72.00	1	85	9.02E+02	60	11	5.11E+01	70
GAA	run035	40.00	5.00	72.00	5	85	2.01E+02	270	2.5	1.90E+01	1110
GAA	run036	40.00	5.00	72.00	10	85	4.23E+01	400	3.3	3.85E-01	340
GAA	run061	40.00	10.00	7.00	1	65	3.98E+02	290	10.8	3.60E+02	280
GAA	run062	40.00	10.00	7.00	5	65	1.57E+02	420	3.8	3.50E+01	1150
GAA	run063	40.00	10.00	7.00	10	65	8.38E+01	470	2.7	0.00E+00	0
GAA	run064	40.00	10.00	7.00	1	85	3.98E+02	290	10.8	3.60E+02	280
GAA	run065	40.00	10.00	7.00	5	85	1.57E+02	420	3.6	3.50E+01	1150
GAA	run066	40.00	10.00	7.00	10	85	8.38E+01	470	2.7	0.00E+00	0
GAA	run067	40.00	10.00	72.00	1	65	1.34E+03	60	11	2.64E+01	70
GAA	run068	40.00	10.00	72.00	5	65	1.34E+02	260	3.3	2.32E+01	1030
GAA	run069	40.00	10.00	72.00	10	65	2.57E+01	400	3.3	2.16E-01	390
GAA	run070	40.00	10.00	72.00	1	85	2.25E+03	60	11	1.10E+02	70
GAA	run071	40.00	10.00	72.00	5	85	4.12E+02	260	2.8	3.80E+01	1110
GAA	run072	40.00	10.00	72.00	10	85	8.51E+01	400	3.3	7.85E-01	340
GAA	run097	40.00	20.00	7.00	1	65	7.10E+02	290	10.8	5.65E+02	290
GAA	run098	40.00	20.00	7.00	5	65	3.14E+02	420	4.0	7.00E+01	1150
GAA	run099	40.00	20.00	7.00	10	65	1.68E+02	470	2.6	0.00E+00	0
GAA	run100	40.00	20.00	7.00	1	85	7.96E+02	290	10.8	7.19E+02	280
GAA	run101	40.00	20.00	7.00	5	85	3.14E+02	420	3.9	7.00E+01	1150

Parameters							Max. Conc. (mg/m^3)	Distance (meters)	Time (min)	Ten Min. Max Conc. (mg/m^3)	Ten Min. Distance (meters)
Simulant	Run Number	Height of Release (ft)	Fill Weight (gal)	MMD (microns)	Wind Speed (mph)	Air Temp (°F)					
GAA	run102	40.00	20.00	7.00	10	85	1.68E+02	470	2.6	0.00E+00	0
GAA	run103	40.00	20.00	72.00	1	65	2.33E+03	60	11	3.71E+01	70
GAA	run104	40.00	20.00	72.00	5	65	2.60E+02	260	3.7	4.62E+01	1030
GAA	run105	40.00	20.00	72.00	10	65	5.01E+01	380	3.2	2.51E-01	1510
GAA	run106	40.00	20.00	72.00	1	85	4.94E+03	60	11	1.04E+02	70
GAA	run107	40.00	20.00	72.00	5	85	8.45E+02	260	2.3	7.55E+01	1110
GAA	run108	40.00	20.00	72.00	10	85	1.70E+02	380	2.8	9.11E-01	390
Maximum							4.94E+03	470	11.00	7.19E+02	1.51E+03
Minimum							1.34E+01	60	2.33	0.00E+00	0.00E+00
Average							5.32E+02	316	5.75	8.80E+01	5.21E+02

Notes: GAA = glacial acetic acid; MMD = mass median diameter of droplet.
All runs done are shown, numbering is not sequential.
Runs used the Vapor, Liquid, and Solid Tracking (VLSTRACK) computer model version 3.2.3.

Table J-5 - Methyl Salicylate Modeling Runs

Parameters							Max. Conc. (mg/m^3)	Distance (meters)	Time (min)	Ten Min. Max Conc. (mg/m^3)	Ten Min. Distance (meters)
Simulant	Run Number	Ht. of Release (ft)	Fill Weight (gal)	MMD (microns)	Wind Speed (mph)	Air Temp (°F)					
MeS	run025	6.00	1.50	7.00	1	65	1.43E+04	10	1.8	9.86E-01	50
MeS	run026	6.00	1.50	7.00	5	65	4.60E+03	30	2.1	6.28E+00	1110
MeS	run027	6.00	1.50	7.00	10	65	2.38E+03	30	0.2	1.29E-03	10
MeS	run028	6.00	1.50	7.00	1	85	1.93E+04	10	0.5	9.86E-01	50
MeS	run029	6.00	1.50	7.00	5	85	4.81E+03	20	1.0	6.28E+00	1110
MeS	run030	6.00	1.50	7.00	10	85	2.63E+03	10	2.0	1.21E+03	10
MeS	run031	6.00	1.50	72.00	1	65	8.06E+03	10	1.8	8.12E+00	10
MeS	run032	6.00	1.50	72.00	5	65	2.32E+03	10	1.4	7.27E+00	30
MeS	run033	6.00	1.50	72.00	10	65	1.65E+03	10	2.0	4.21E+00	40
MeS	run034	6.00	1.50	72.00	1	85	1.35E+04	10	1.8	9.70E+00	10
MeS	run035	6.00	1.50	72.00	5	85	2.36E+03	10	2.0	1.10E+01	30
MeS	run036	6.00	1.50	72.00	10	85	1.67E+03	10	2.0	5.94E+00	40
MeS	run061	40.00	5.00	7.00	1	65	2.24E+02	290	10.8	2.02E+02	280
MeS	run062	40.00	5.00	7.00	5	65	8.81E+01	420	3.9	1.97E+01	1150
MeS	run063	40.00	5.00	7.00	10	65	4.71E+01	470	2.7	0.00E+00	0
MeS	run064	40.00	5.00	7.00	1	85	2.24E+02	290	10.8	2.02E+02	280
MeS	run065	40.00	5.00	7.00	5	85	8.81E+01	420	3.9	1.97E+01	1150
MeS	run066	40.00	5.00	7.00	10	85	4.71E+01	470	2.7	0.00E+00	0
MeS	run067	40.00	5.00	72.00	1	65	2.32E+03	50	2.1	2.99E+01	80
MeS	run068	40.00	5.00	72.00	5	65	3.47E+02	240	3.6	2.13E+01	1130
MeS	run069	40.00	5.00	72.00	10	65	8.61E+01	380	3.3	2.10E+00	290
MeS	run070	40.00	5.00	72.00	1	85	3.04E+02	60	11	7.46E+01	160
MeS	run071	40.00	5.00	72.00	5	85	1.36E+02	340	4.0	2.02E+01	1150
MeS	run072	40.00	5.00	72.00	10	85	7.17E+01	380	2.3	7.07E-04	190
MeS	run097	40.00	10.00	7.00	1	65	4.47E+02	290	10.8	4.04E+02	280
MeS	run098	40.00	10.00	7.00	5	65	1.76E+02	420	3.9	3.93E+01	1150
MeS	run099	40.00	10.00	7.00	10	65	9.42E+01	470	2.7	0.00E+00	0
MeS	run100	40.00	10.00	7.00	1	85	4.47E+02	290	10.8	4.04E+02	280
MeS	run101	40.00	10.00	7.00	5	85	1.76E+02	420	3.9	3.93E+01	1150

Parameters							Max. Conc. (mg/m^3)	Distance (meters)	Time (min)	Ten Min. Max Conc. (mg/m^3)	Ten Min. Distance (meters)
Simulant	Run Number	Ht. of Release (ft)	Fill Weight (gal)	MMD (microns)	Wind Speed (mph)	Air Temp (°F)					
MeS	run102	40.00	10.00	7.00	10	85	9.42E+01	470	2.7	0.00E+00	0
MeS	run103	40.00	10.00	72.00	1	65	4.31E+03	40	2.2	7.71E+01	70
MeS	run104	40.00	10.00	72.00	5	65	7.67E+02	240	3.6	4.29E+01	1130
MeS	run105	40.00	10.00	72.00	10	65	1.88E+02	370	3.2	5.06E+00	290
MeS	run106	40.00	10.00	72.00	1	85	3.53E+03	40	2.2	3.84E+01	150
MeS	run107	40.00	10.00	72.00	5	85	2.93E+02	330	4	4.13E+01	1140
MeS	run108	40.00	10.00	72.00	10	85	1.44E+02	380	2.3	1.46E-03	190
MeS	run133	40.00	20.00	7.00	1	65	8.95E+02	290	10.8	8.08E+02	280
MeS	run134	40.00	20.00	7.00	5	65	3.53E+02	420	3.6	7.87E+01	1150
MeS	run135	40.00	20.00	7.00	10	65	1.88E+02	470	2.7	0.00E+00	0
MeS	run136	40.00	20.00	7.00	1	85	8.95E+02	290	10.8	8.08E+02	280
MeS	run137	40.00	20.00	7.00	5	85	3.53E+02	420	3.6	7.87E+01	1150
MeS	run138	40.00	20.00	7.00	10	85	1.88E+02	470	2.7	0.00E+00	0
MeS	run139	40.00	20.00	72.00	1	65	6.59E+03	40	2.2	1.33E+02	70
MeS	run140	40.00	20.00	72.00	5	65	1.77E+03	240	3.6	8.63E+01	1130
MeS	run141	40.00	20.00	72.00	10	65	3.98E+02	370	3.2	1.12E+01	290
MeS	run142	40.00	20.00	72.00	1	85	1.29E+04	50	2.1	8.94E+01	70
MeS	run143	40.00	20.00	72.00	5	85	7.40E+02	290	2.4	8.36E+01	1130
MeS	run144	40.00	20.00	72.00	10	85	3.13E+02	370	3.2	4.96E-03	190
Maximum							1.93E+04	4.70E+02	1.10E+01	1.21E+03	1.15E+03
Minimum							4.71E+01	1.00E+01	2.33E-01	0.00E+00	0.00E+00
Average							2.45E+03	2.39E+02	3.81E+00	1.07E+02	4.15E+02

Notes: MeS = methyl salicylate; MMD = mass median diameter of droplet.
All runs done are shown, numbering is not sequential.
Runs used the Vapor, Liquid, and Solid Tracking (VLSTRACK) computer model version 3.2.3.

Table J-6- Triethyl Phosphate Modeling Runs

Parameters							Max. Conc. (mg/m^3)	Distance (meters)	Time (min)	Ten Min. Max Conc. (mg/m^3)	Ten Min. Distance (meters)
Simulant	Run Number	Height of Release (ft)	Fill Weight (gal)	MMD (microns)	Wind Speed (mph)	Air Temp (°F)					
TEP	run025	40.00	5.00	7.00	1.00	65.00	2.01E+02	290	10.8	1.81E+02	280
TEP	run026	40.00	5.00	7.00	5.00	65.00	7.92E+01	420	3.9	1.77E+01	1150
TEP	run027	40.00	5.00	7.00	10.00	65.00	4.23E+01	470	2.7	0.00E+00	0
TEP	run028	40.00	5.00	7.00	1.00	85.00	2.01E+02	290	10.8	1.81E+02	280
TEP	run029	40.00	5.00	7.00	5.00	85.00	7.92E+01	420	3.9	1.77E+01	1150
TEP	run030	40.00	5.00	7.00	10.00	85.00	4.23E+01	470	2.7	0.00E+00	0
TEP	run031	40.00	5.00	72.00	1.00	65.00	4.96E+01	230	10.2	4.57E+01	210
TEP	run032	40.00	5.00	72.00	5.00	65.00	9.98E+01	380	3.3	1.80E+01	1150
TEP	run033	40.00	5.00	72.00	10.00	65.00	5.30E+01	430	2.5	0.00E+00	0
TEP	run034	40.00	5.00	72.00	1.00	85.00	1.52E+02	260	9.5	1.46E+02	280
TEP	run035	40.00	5.00	72.00	5.00	85.00	8.76E+01	400	3.5	1.78E+01	1150
TEP	run036	40.00	5.00	72.00	10.00	85.00	4.67E+01	450	2.6	0.00E+00	0
TEP	run061	40.00	10.00	7.00	1.00	65.00	4.02E+02	290	10.8	3.63E+02	280
TEP	run062	40.00	10.00	7.00	5.00	65.00	1.58E+02	420	3.6	3.53E+01	1150
TEP	run063	40.00	10.00	7.00	10.00	65.00	8.46E+01	470	2.7	0.00E+00	0
TEP	run064	40.00	10.00	7.00	1.00	85.00	4.02E+02	290	10.8	3.63E+02	280
TEP	run065	40.00	10.00	7.00	5.00	85.00	1.58E+02	420	3.6	3.53E+01	1150
TEP	run066	40.00	10.00	7.00	10.00	85.00	8.46E+01	470	2.7	0.00E+00	0
TEP	run067	40.00	10.00	72.00	1.00	65.00	5.14E+02	70	11.0	1.52E+02	140
TEP	run068	40.00	10.00	72.00	5.00	65.00	2.08E+02	370	3.2	3.60E+01	1150
TEP	run069	40.00	10.00	72.00	10.00	65.00	1.06E+02	420	2.5	0.00E+00	0
TEP	run070	40.00	10.00	72.00	1.00	85.00	1.19E+02	180	6.7	1.11E+02	220
TEP	run071	40.00	10.00	72.00	5.00	85.00	1.75E+02	400	3.4	3.57E+01	1150
TEP	run072	40.00	10.00	72.00	10.00	85.00	9.35E+01	450	2.6	0.00E+00	0
TEP	run097	40.00	20.00	7.00	1.00	65.00	8.04E+02	290	10.8	7.26E+02	280
TEP	run098	40.00	20.00	7.00	5.00	65.00	3.17E+02	420	3.6	7.07E+01	1150
TEP	run099	40.00	20.00	7.00	10.00	65.00	1.69E+02	470	2.6	0.00E+00	0
TEP	run100	40.00	20.00	7.00	1.00	85.00	8.04E+02	290	10.8	7.26E+02	280
TEP	run101	40.00	20.00	7.00	5.00	85.00	3.17E+02	420	3.6	7.07E+01	1150

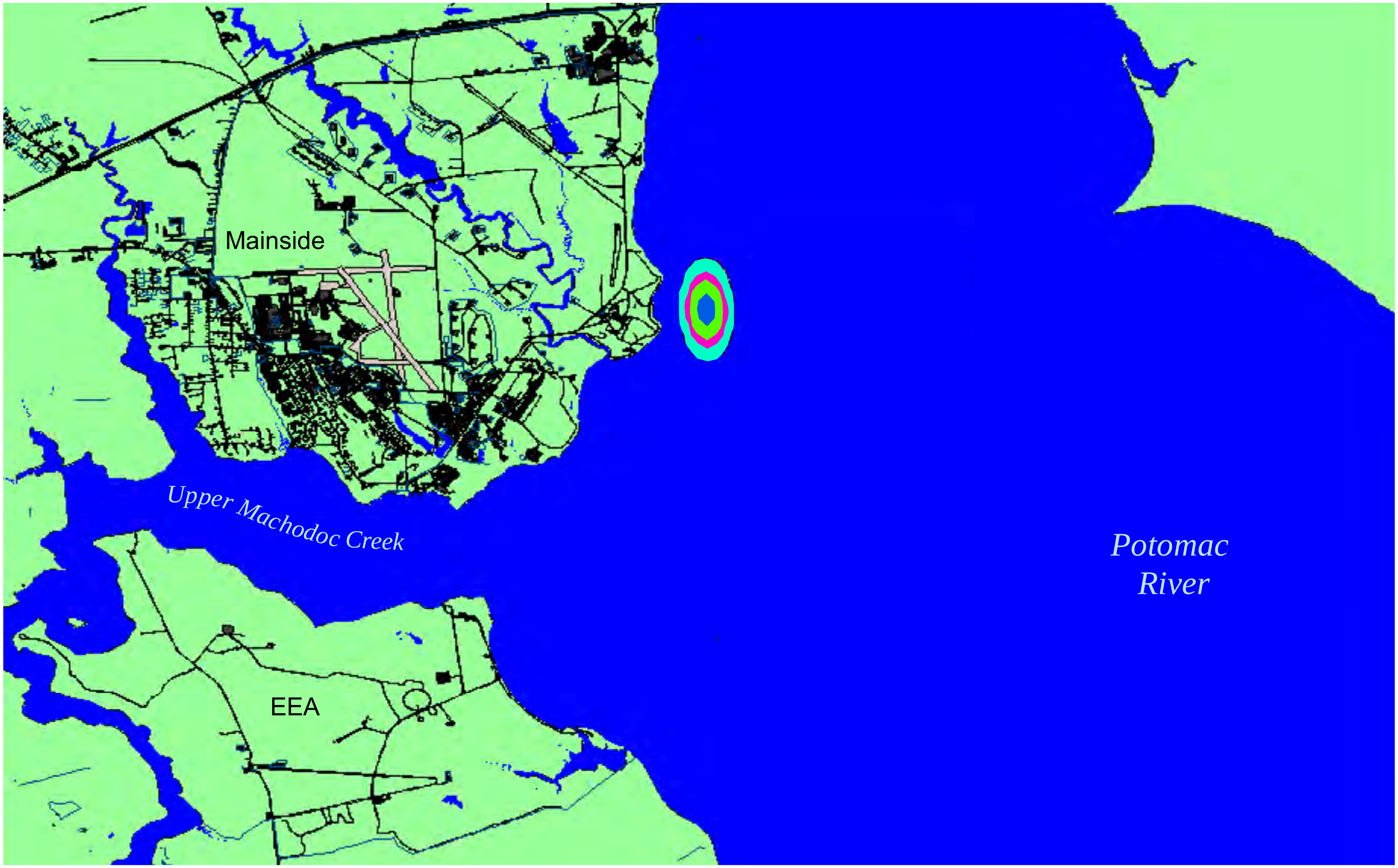
Parameters							Max. Conc. (mg/m³)	Distance (meters)	Time (min)	Ten Min. Max Conc. (mg/m³)	Ten Min. Distance (meters)
Simulant	Run Number	Height of Release (ft)	Fill Weight (gal)	MMD (microns)	Wind Speed (mph)	Air Temp (°F)					
TEP	run102	40.00	20.00	7.00	10.00	85.00	1.69E+02	470	2.6	0.00E+00	0
TEP	run103	40.00	20.00	72.00	1.00	65.00	5.06E+03	50	1.9	8.09E+01	110
TEP	run104	40.00	20.00	72.00	5.00	65.00	4.53E+02	360	4.0	7.25E+01	1150
TEP	run105	40.00	20.00	72.00	10.00	65.00	2.22E+02	420	2.5	0.00E+00	0
TEP	run106	40.00	20.00	72.00	1.00	85.00	7.75E+02	70	11.0	3.09E+02	140
TEP	run107	40.00	20.00	72.00	5.00	85.00	3.57E+02	400	3.8	7.14E+01	1150
TEP	run108	40.00	20.00	72.00	10.00	85.00	1.87E+02	450	2.6	0.00E+00	0
Maximum							5.06E+03	470	11.00	7.26E+02	1.15E+03
Minimum							4.23E+01	50	1.93	0.00E+00	0.00E+00
Average							3.69E+02	358	5.28	1.08E+02	4.61E+02

Notes: TEP = triethyl phosphate; MMD = mass median diameter of droplet.
All runs done are shown, numbering is not sequential.
Runs used the Vapor, Liquid, and Solid Tracking (VLSTRACK) computer model version 3.2.3.

Table J-7 - Maximum Deposition of Chemical Simulants

Chemical Simulant	Maximum Deposition Level (mg/m^2)	Maximum Total Mass Deposition (kg)	Maximum Surface Area for level 0.01 mg/m^2 (km^2)	Maximum time to fall below 0.01 mg/m^2 (min)
DEM	3.57E+04	2.6	4.30E-03	1040
DMA	1.19E+05	75.85	2.34E-01	1440
DMMP	2.82E+01	3.0E-03	6.79E-04	20
GAA	9.94E+04	76.7	2.57E-01	1440
MeS	8.32E+04	59.9	3.71E-02	1410
TEP	2.81E-01	4.0E-04	1.45E-03	10

Diethyl Malonate (Run 027) - PRTR



Concentration of DEM and Area Covered

Concentration	Area Covered
≥ 0.01 mg/m³	1.26 E-04km²
≥ 1.0 mg/m³	7.08 E-05km²
≥ 10 mg/m³	4.15 E-05km²
≥ 100 mg/m³	7.33 E-06km²

N

NSWCDD EIS

NAVSEA WARFARE CENTERS DAHLGREN

Note: Maximum concentrations shown

Figure J-1

THIS PAGE INTENTIONALLY LEFT BLANK