NATIONAL MARINE FISHERIES SERVICE
ENDANGERED SPECIES ACT SECTION 7 CONSULTATION
BIOLOGICAL AND CONFERENCE OPINION

Agency: U.S. Environmental Protection Agency

Activities Considered: Issuance of the Multi-Sector General Permit for Stormwater Discharges Associated with Industrial Activity, Pursuant to the National Pollution Elimination System

Consultation Conducted by: Endangered Species Act Interagency Cooperation Division of the Office of Protected Resources, National Marine Fisheries Service.

Public Consultation Tracking System # FPR-2014-9094

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Acronyms

ACE – Ashepoo, Combahee, and Edisto River Basins
BE – Biological Evaluation
BCF – Bioconcentration factor
BOD – Biochemical Oxygen Demand
BMP – Best Management Practice
BPT/BAT/BCT – Best Practicable Control Technology Currently Available (BPT) /Best Conventional Pollutant Control Technology (BCT) /Best Available Technology Economically Achievable (BAT)
CCC - Central California Coast
CFR – Code of Federal Regulations
COD – Chemical Oxygen Demand
CEWAF - Chemically-dispersed fraction
DDT – Dichlorodiphenyltrichloroethane
DPS – Distinct Population Segment
ECHO – Enforcement Compliance History Online database
ECOTOX – ECOTOXicology database
ELG(s) – Effluent Limitation Guideline(s)
eNOI – Electronic Notice of Intent to seek coverage under the permit
ESA – Endangered Species Act
EPA – Environmental Protection Agency
ESU – Evolutionarily Significant Unit
GOM – Gulf of Maine
HUC – Hydrological Unit Code
ICBTRT – Interior Columbia Basin Technical Review Team
ICIS – Integrated Compliance Information System
IPCC – Intergovernmental Panel on Climate Change
ITS – Incidental take statement
IUU – Illegal, Unregulated or Unreported
LCR – Lower Columbia River
MSGP – Multi-Sector General Permit
NARS – National Aquatic Resource Surveys
NMFS – National Marine Fisheries Service
NOAA – National Oceanic and Atmospheric Administration
NOI – Notice of Intent to seek coverage under the permit
NOT – Notice Of Termination of coverage
NPDES – National Pollutant Discharge Elimination System

NYB – New York Bight
PCB – Polychlorinated biphenyls
PCEs – Primary Constituent Elements
PCTS – Public Consulting Tracking System
SIC – Standard Industrial Class Code
SWPPP – Stormwater Pollution Prevention Plan
THC – Total hydrocarbon content
TMDL – Total Maximum Daily Load
TSS – Total suspended solids
UCR – Upper Columbia River
USFWS – United States Fish and Wildlife Service
WAF – Water accommodated fraction

1 INTRODUCTION

The Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et seq.) establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat they depend on. Section 7 (a)(2) of the ESA requires Federal agencies to consult with the United States Fish and Wildlife Service (USFWS), NMFS, or both, to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or adversely modify or destroy their designated critical habitat. Section 7 (b)(3) requires that at the conclusion of consultation, the Service provide an opinion stating how the agencies' actions will affect ESA-listed species and their designated critical habitat. Section 7 (b)(4) requires the consulting agency to provide an incidental take statement (ITS) that specifies the impact of any incidental taking and includes reasonable and prudent measures to minimize such impacts.

When a Federal agency's action "may affect" a protected species, that agency is required to consult formally with NMFS or the USFWS[1], depending upon the endangered species, threatened species, or designated critical habitat that may be affected by the action (50 CFR §402.14(a)). Federal agencies are exempt from this general requirement if they have concluded that an action "may affect, but is not likely to adversely affect" endangered species, threatened species, or designated critical habitat and NMFS or the USFWS concurs with that conclusion (50 CFR §402.14(b)). Although the MSGP refers to both NMFS and USFWS, this is NMFS' biological opinion (Opinion) and so applies only to NMFS' species and critical habitat.

The action agency for this consultation is the Environmental Protection Agency (EPA).

This biological opinion (Opinion) and incidental take statement were prepared by NMFS Endangered Species Act Interagency Cooperation Division in accordance with section 7 (b) of the ESA and implementing regulations at 50 CFR §402. However, consistent with the decision in Gifford Pinchot Task Force v. USFWS, 378 F.3d 1059 (Ninth Cir. 2004), we did not apply the regulatory definition of "destruction or adverse modification of critical habitat" at 50 CFR §402.02. Instead, we relied on the statutory provisions of the ESA to complete our analysis of the effects of the action on designated critical habitat. This document represents NMFS' final biological opinion on the effects of these actions on endangered and threatened species and designated critical habitat that has been designated for those species.

This Opinion complies with the Data Quality Act (44 U.S.C. 3504(d)(1) et seq.) and underwent pre-dissemination review.

We evaluate whether the EPA's proposed action is likely to jeopardize endangered and threatened species or destroy or adversely modify designated critical habitat. The continued

[1] Generally, NMFS has ESA responsibility for marine and anadromous species, and USFWS has responsibility for terrestrial and freshwater species.

existence of a population is determined by the fate of the individuals within it and the continued existence of a species is determined by the fate of its populations. Populations grow or decline as its individuals live, die, grow, mature, migrate, and reproduce, or fail to do so. Critical habitat contains physical and biological features that are essential to the conservation of the species are physical and biological features including, but not limited to: (1) space for individual and population growth, and for normal behavior; (2) food, water, air, light, minerals, or other nutritional or physiological requirements; (3) cover or shelter; (4) sites for breeding, reproduction, rearing of offspring, germination, or seed dispersal; and (5) habitats that are protected from disturbance or are representative of the historic geographic and ecological distributions of a species (ESA §3(5)(A)(i), 50 CFR §424.12(b)).

1.1 Consultation on EPA's 2015 Multi-Sector General Permit

The EPA proposes to authorize stormwater discharges and certain non-stormwater discharges from facilities belonging 30 industrial sector classifications into waters of the United States under the 2015 Multi-Sector General Permit (MSGP). After determining in the BE that discharges to be authorized by its proposed MSGP may adversely affect protected species, the EPA requested formal consultation with NMFS.

The EPA's statutory authority for the MSGP is the National Pollution Discharge Elimination System (NPDES) of the Clean Water Act (the Clean Water Act 33 USC §§ 1342 et seq.). The purpose of the proposed general permit is to satisfy the goals and policies of the Clean Water Act (33 USC §§1251). The Clean Water Act establishes the basic structure for regulating discharges of pollutants into and regulating quality standards for the waters of the United States

The Clean Water Act made it unlawful to discharge any pollutant from a point source into navigable waters, unless a permit was obtained. EPA's NPDES permit program controls discharges. Point sources are discrete conveyances such as pipes or man-made ditches. Individual homes that are connected to a municipal system, use a septic system, or do not have a surface discharge do not need an NPDES permit; however, industrial, municipal, and other facilities must obtain permits if their discharges go directly to surface waters.

Section 402 of the Clean Water Act directed EPA to develop a phased approach to regulate stormwater discharges under the NPDES program, and EPA published a final regulation on the first phase of this program in November 1990. It was at this time that EPA established permit application requirements for stormwater discharges associated with industrial activity.

1.2 Consultation History

- On July 27, 2012 EPA shared with the NMFS its proposed changes to the 2015 MSGP and began pre-consultation discussions.
- On September 17, 2012, EPA and NMFS began meeting to discuss the development of the 2015 MSGP and the BE for that action.

- On September 18, 2012, NMFS provided geographic data to EPA on the names and locations of threatened and endangered species under NMFS' jurisdiction and any designated critical habitat that has been designated for those species.
- On September 20, 2012, EPA provided an outline of their proposed compliance study to evaluate the effectiveness of their Endangered Species Act review procedures for the 2015 MSGP to inform the development of their BE. NMFS provided comments to EPA on September 27th 2012.
- On December 10, 2012, EPA provided a draft BE outline to NMFS for review and NMFS provided comments to EPA on December 21st 2012.
- On December 10, 2012, NMFS provided EPA a consultation plan that included the types of analysis we perform during formal consultations under the Endangered Species Act.
- On March 18, 2013 EPA provided NMFS with its Draft EPA MSGP ESA Criterion Evaluation and MSGP ESA SWPPP Evaluation Checklist.
- On July 24, 2013, EPA provided NMFS with a draft BE. NMFS provided comments on that draft BE on September 30th 2013.
- On January 27, 2014, EPA provided its final BE and requested formal consultation under section 7(a)(2) of the Endangered Species Act.
- On February 28, 2014 NMFS notified EPA that it had not provided all of the information necessary to initiate formal consultation under section 7 of the Endangered Species Act.
- On March 12, EPA provided all of the remaining information necessary, and NMFS initiated formal consultation under section 7 of the Endangered Species Act.
- Between March 12, 2014 and July 10, 2014, EPA and NMFS engaged in formal Endangered Species Act section 7 consultation and held multiple meetings and calls.
- On July 10, 2014, NMFS concluded formal consultation.
- On August 29, 2014, NMFS requested and EPA agreed to an extension of the MSGP Biological Opinion deadline.

2 DESCRIPTION OF THE PROPOSED ACTION

Under the MSGP, EPA proposes to authorize stormwater discharges associated with activity from 30 industrial sectors into waters of the United States over the MSGP period from 2015 to 2020.

The purpose of the MSGP is to authorize discharges of pollutants to the waters of the United States in an efficient manner for industrial facilities to secure authorization for discharging stormwater (and specified non-stormwater) to waters of the U.S. Those facilities that do not qualify for coverage under the MSGP must receive either an individual NPDES permit or qualify for coverage under another general permit in order to discharge pollutants. In its permit, EPA reserved the right to modify or revoke and reissue this permit under 40 CFR 122.62 and 63.

The MSGP would provide NPDES permit coverage for stormwater discharges, certain allowable non-stormwater discharges, and discharge-associated activities for facilities where EPA is the NPDES permitting authority and has made the MSGP available for coverage, including four States (Idaho, Massachusetts, New Hampshire, and New Mexico), the District of Columbia, Puerto Rico, the Pacific Territories (i.e., American Samoa, Baker Island, Guam, Howland Island, Jarvis Island, Johnston Atoll, Midway Atoll, Navassa Island, the Commonwealth of the Northern Mariana Islands, Palmyra Atoll, and Wake Island), designated areas in Oklahoma and Texas*, Federally operated facilities in Colorado, Delaware, Vermont, and Washington, and Indian country[2] lands in 23 states. While EPA has permitting authority for Indian Country lands in EPA's Region 4 (i.e., North Carolina, South Carolina, Georgia, Florida, Alabama and Mississippi), EPA has determined that, since there are so few facilities in these areas, they would be covered under individual permits.

The EPA estimates that the 2015 MSGP will reauthorize discharges from approximately 2,365 existing facilities and that an average of approximately 52 additional facilities will seek coverage under the MSGP each year totaling approximately 250 new facilities over the life of the 5-year permit (i.e., permit cycle).

2 The term "Indian country" means: (a) all land within the limits of any Indian reservation under the jurisdiction of the United States Government, notwithstanding the issuance of any patent, and, including rights-of-way running through the reservation; (b) all dependent Indian communities within the borders of the United States whether within the original or subsequently acquired territory thereof, and whether within or without the limits of a state; and(c) all Indian allotments, the Indian titles to which have not been extinguished, including rights-of-way running through the same (18 USC 1151).

2.1 Requests for Coverage under the Multi-Sector General Permit

To be authorized to discharge under the MSGP a facility must[3]:

- Be located in a state, territory, or Indian country, or be a federal operator identified in Appendix C of the MSGP where EPA is the permitting authority;
- Meet the eligibility requirements described in permit;
- Select, design, install, and implement control measures in accordance with the permit to meet numeric and non-numeric effluent limits;
- Develop a Stormwater Pollution Prevention Plan (SWPPP) according to the requirements in Part 5 of the MSGP or update the existing SWPPP consistent with Part; and
- Submit a complete and accurate Notice of Intent (NOI) to seek coverage under the MSGP after developing the SWPPP.

The NOI serves as the facility operator's certification that that the discharges are eligible for coverage according to the requirements of the MSGP. The NOI includes basic information about the facility and also requires that a URL to the SWPPP be included, or that the following information from the SWPPP be described:

- Industrial activities and associated discharges for the subject facility;
- Onsite industrial activities exposed to stormwater, including potential spill and leak areas;
- Pollutants or pollutant constituents associated with each industrial activity exposed to stormwater that could be discharged in stormwater and/or any authorized non-stormwater;
- Stormwater control measures facility operators employ to comply with the non-numeric technology- based effluent limits, and any other measures taken to comply with the requirements in MSGP Part 2.2 (Water Quality -Based Effluent Limitations); and
- Schedule for good housekeeping and maintenance and schedule for all required inspections.

The following sections summarize the proposed permit and pertinent details embedded in the permit fact sheets and appendices. More detailed information on implementation of the proposed permit can be found in the permit, the BE and addenda, and is in the administrative record for this Opinion. A copy of the draft permit submitted for consultation was provided as an attachment to the BE, and is appended to this Opinion (see Appendix D of the MSGP). In some instances, the information from the sections below was taken directly from the permit language and/or the BE in the interest of clarity.

2.1.1 Types of Facilities Covered by the MSGP

EPA proposes to cover 10 broad categories of industrial activities under the MSGP, which have been categorized into 30 sectors and associated subsectors (MSGP, attached as Appendix A). The broad categories include:

[3] *Section 1.2.1 of the permit*

- Category One (i) : Facilities subject to federal stormwater effluent discharge standards in 40 CFR Parts 405-471
- Category Two (ii) : Heavy manufacturing (e.g., paper mills, chemical plants, petroleum refineries, and steel mills and foundries)
- Category Three (iii) : Coal and mineral mining and oil and gas exploration and processing
- Category Four (iv) : Hazardous waste treatment, storage, or disposal facilities
- Category Five (v) : Landfills, land application sites, and open dumps with industrial wastes
- Category Six (vi) : Metal scrapyards, salvage yards, automobile junkyards, and battery reclaimers
- Category Seven (vii) : Steam electric power generating plants
- Category Eight (viii) : Transportation facilities that have vehicle maintenance, equipment cleaning, or airport deicing operations
- Category Nine (ix) : Treatment works treating domestic sewage with a design flow of 1 million gallons a day or more
- Category Eleven (xi) : Light manufacturing (e.g., food processing, printing and publishing, electronic and other electrical equipment manufacturing, and public warehousing and storage).

EPA reserves discretion to designate other industrial activities as eligible for coverage under the MSGP under Sector AD: Non-classified facilities[4.] Examples of facilities that have been covered under sector AD include aircraft services, a resource recovery facility, a coal loading facility, a Naval support facility, a National Park Service maintenance facility, U.S. Postal Service facilities. Some industrial facilities are covered under multiple sector or subsector categories, and these are identified by the facilities' Standard Industrial Classification (SIC) code(s) referenced when facilities seek coverage under the MSGP.

Table 1. Primary industrial sectors eligible for coverage under the Multi Sector General Permit (MSGP).

Primary Industrial Sector	
Sector A: Timber products	Sector P: Land transportation and warehousing
Sector B: Paper and allied products	Sector Q: Water transportation
Sector C: Chemicals and allied products	Sector R: Ship and boat building and repairing yards
Sector D: Asphalt paving and roofing materials and lubricants	Sector S: Air transportation facilities
Sector E: Glass, clay, cement, concrete, and gypsum products	Sector T: Treatment works
Sector F: Primary metals	Sector U: Food and kindred products
Sector G: Metal mining (ore mining and dressing)	Sector V: Textile mills, apparel, and other fabric product manufacturing; leather and leather products

[4] *Section1.1.1 of the permit.*

Primary Industrial Sector	
Sector H: Coal mines and coal mining-related facilities	Sector W: Furniture and fixtures
Sector I: Oil and gas extraction and refining	Sector X: Printing and publishing
Sector J: Mineral mining and dressing	Sector Y: Rubber, miscellaneous plastic products, and miscellaneous manufacturing industries
Sector K: Hazardous waste treatment, storage, or disposal facilities	Sector Z: Leather tanning and finishing
Sector L: Landfills, land application sites, and open dumps	Sector AA: Fabricated metal products
Sector M: Automobile salvage yards	Sector AB: Transportation equipment, industrial or commercial machinery
Sector N: Scrap recycling facilities	Sector AC: Electronic, electrical, photographic, and optical goods
Sector O: Steam electric generating facilities	Sector AD: Non-classified facilities

[a]Subsector activities are identified in Appendix D of the MSGP

2.1.2 Types of Activities Covered by the MSGP

The MSGP covers three main categories of activities that could result in potential effects to species listed as threatened or endangered under the ESA and their designated critical habitat: (1) stormwater discharges, (2) certain allowable non-stormwater discharges, and (3) discharge-related activities[5]. These activities are described in the following sections.

2.1.3 Allowable Stormwater Discharges

The MSGP is primarily intended to cover stormwater discharges from the industrial sectors listed above (Table 1) into the Nation's receiving waters in locations and for facilities where EPA has retained permitting jurisdiction and has made the MSGP available for coverage. The receiving waters are defined as the first waters of the U.S. that are discharged into, or, for discharges that enter a storm sewer system or other water body prior to discharge, the first waters of the U.S. discharged to by the storm sewer system or water body. To minimize the discharge of pollutants in stormwater from industrial activity into receiving waters, there are certain requirements that apply to the discharges. The following stormwater discharges will be authorized under the permit:

- Stormwater discharges associated with industrial activity for any primary industrial activities and co-located industrial activities (as defined in the permit);
- Discharges designated by EPA as needing a stormwater permit as provided in sector AD of the MSGP;
- Discharges that are not otherwise required to obtain an NPDES permit but are comingled with MSGP-authorized discharges (e.g., condensate from air conditioners); and
- Discharges subject to the national stormwater-specific effluent limitations guidelines6 (discussed later in this section).

[5] *Sections 1.1.2 and 1.1.3 of the MSGP*

[6] *Table 1-1 in the MSGP*

2.1.4 Allowable Non-Stormwater Discharges[7]

Certain non-stormwater discharges are authorized under the MSGP, if all discharges comply with the effluent limitations as described at Part 2 of the MSGP, *Control Measures and Effluent Limits*. The allowable non-stormwater discharges are:

- Discharges from fire-fighting activities;
- Fire hydrant flushings;
- Potable water, including water line flushings;
- Uncontaminated condensate from air conditioners, coolers, and other compressors and from the outside storage of refrigerated gases or liquids;
- Irrigation drainage;
- Landscape watering provided all pesticides, herbicides, and fertilizers have been applied in accordance with the approved labeling;
- Pavement wash waters where no detergents or hazardous cleaning products are used (e.g., bleach, hydrofluoric acid, muriatic acid, sodium hydroxide, nonylphenols), and the wash waters do not come into contact with oil and grease deposits or any other toxic or hazardous materials (unless cleaned up using dry clean-up methods);
- Routine external building washdown / power washwater that does not use detergents or hazardous cleaning products, (such as those containing bleach, hydrofluoric acid, muriatic acid, sodium hydroxide, nonylphenols);
- Uncontaminated ground water or spring water;
- Foundation or footing drains where flows are not contaminated with process materials;
- Incidental windblown mist from cooling towers that collects on rooftops or adjacent portions of the facility, but not intentional discharges from the cooling tower (e.g., "piped" cooling tower blowdown or drains); and
- Discharges from the spray down of lumber and wood product storage yards where no chemical additives are used in the spray-down waters and no chemicals are applied to the wood during storage (applicable only to Sector A facilities provided the non- stormwater component of the discharge is in compliance with the non-numeric effluent limits requirements in the permit at *Part 2.1.2 Non-Numeric Technology-Based Effluent Limits (*Best Practicable Control Technology Currently Available (BPT) /Best Conventional Pollutant Control Technology (BCT) /Best Available Technology Economically Achievable (BAT) : *BPT/BAT/BCT)*).

Allowable discharges (both stormwater and non-stormwater discharges) commingled with a discharge authorized by a different NPDES permit and/or a discharge that does not require NPDES permit authorization are also authorized under the MSGP.

2.1.4.1 Discharge-Related Activities[8]

Discharge-related activities are any activities that cause, contribute to, or result in stormwater and allowable non-stormwater point source discharges, and measures such as the siting, construction, and operation of stormwater controls to control, reduce, or prevent pollutants from being discharged. The majority of the facilities that are anticipated to seek coverage under the MSGP are not expected to propose discharge-related activities, as many of the facilities are existing facilities with ongoing discharges covered under the 2008 or previous MSGP permit cycles. However, new facilities, facilities seeking new or expanded coverage, or a limited number of existing facilities may plan to install new controls or engage in other discharge-related activities. Thus, this category of activities is also included in the MSGP.

2.1.5 Activities not Covered by the MSGP

Any discharges not expressly authorized as summarized above[9] are not within the scope of the pollutants addressed by the MSGP and are not included as part of the proposed action. To provide greater clarity, the EPA has also defined activities and discharges that are explicitly not covered by the MSGP. Some of these activities may require an individual permit or other form of alternative permit, or, in some cases, no permit would be required. These activities are not part of the proposed action.

2.2 Procedures for Addressing ESA-listed species and Designated critical habitat in Permit Coverage Requests[10]

As noted above, coverage under the MSGP is available only for stormwater discharges, allowable non-stormwater discharges, and stormwater discharge-related activities. The MSGP specifies that only discharges that are not likely to adversely affect any species that are federally listed as endangered or threatened ("listed") under the ESA and are not likely to adversely modify habitat that is federally designated as "designated critical habitat" under the ESA are eligible for coverage.[11] Facilities can qualify for coverage by establishing that their facility discharges do not overlap with listed resources, that discharges are covered under another operator's permit coverage, or that effects of the allowable discharges and discharge-associated activities have previously been the subject of an ESA section 7 consultation or an ESA Section 10 permit. To demonstrate that the facility is eligible for coverage under the MSGP, a facility operator must determine which of 5 ESA criteria applies to the facility's discharge(s), allowable non-

8 See Part 1.1.4.5 of the MSGP.

9 Described in detail in parts 1.1.2 through 1.1.4 of the MSGP

10 Section 1.1.4.5 of the permit

11 Designated critical habitat includes specific areas within the geographical area occupied by the species on which are found those physical or biological features that are essential to the conservation of the species and which may require special management considerations or protection; and specific areas outside the geographical area occupied by the species essential for its conservation of the species. ESA §3 (5) (A).

stormwater discharge(s), and/or discharge-related activities. The facility operator must then submit an NOI to apply for coverage under the MSGP. The following sections describe the five ESA Eligibility Criteria and the proposed process for facility operators to select an appropriate criterion while seeking coverage under the 2015 MSGP.

2.3 ESA Eligibility Criteria

The facility operators are directed to demonstrate their eligibility under one of the ESA Criteria by following instructions outlined in Appendix E of the MSGP: *Procedures Relating to Endangered Species Protection,* which includes a *Criterion Selection Worksheet.* The 2015 MSGP permit is provided as Appendix A of this Opinion. The worksheet guides a permit applicant in selecting the most appropriate eligibility criterion their facility meets or will meet based on information such as existing documentation, facility location, and overlap of ESA-listed species /designated critical habitat with the area of potential effects (or "action area") of their discharge(s)(and discharge-related activities, where proposed). In addition to this worksheet, those permit applicants certifying under *Eligibility Criterion C* are required to complete a *Criterion C Eligibility Form.* The Eligibility Criteria for Endangered Species Protection are shown in Table 2.

Table 2. Endangered Species Act (ESA) criteria from the Multi Sector General Permit (MSGP)(Note: Reproduced from Appendix E of the draft permit, but reorganized into table format for clarity in the Opinion.)

Criterion	Additional Considerations
A: No federally-ESA-listed species or their designated critical habitat(s) are likely to occur in the "action area" as defined in Appendix A of the MSGP.	To certify eligibility under this criterion, the permit applicant must use the E.4 Criterion Selection worksheet. The permit applicant must also provide a description of the basis for the criterion the permit applicant selected on the NOI form and provide documentation supporting the eligibility determination in the SWPPP.
B: The industrial activity's discharges and discharge-related activities were already addressed in another operator's valid certification of eligibility for the action area under this permit and there is no reason to believe that federally-listed species or federally-designated critical habitat not considered in the prior certification may be present or located in the "action area" (e.g., due to a new species listing or designated critical habitat designation).	To certify eligibility under this criterion, there must be no lapse of NPDES permit coverage in the other operator's certification. The permit applicant must also comply with any terms and conditions imposed under the other operator's valid certification of eligibility to ensure that the discharges and discharge-related activities are protective of ESA-listed species and/or designated critical habitat. To certify eligibility under this criterion, the permit applicant must use the E.4 Criterion Selection worksheet. The NOI must include the NPDES ID from the other operator's notification of authorization under this permit, and a description of the basis for the criterion selected on the NOI form, including the eligibility criterion selected by the other operator's certification. The permit applicant must also provide any documentation in the SWPPP that supports the other operator's eligibility determination, as well as any terms and conditions imposed under the eligibility requirements that applied under the prior certification.
C: Federally-ESA-listed species or their designated critical habitat(s) are likely to occur in or near the facility's "action area," and the industrial activity's discharges and discharge-	To certify eligibility under this criterion, the permit applicant must use the E.4 Criterion Selection worksheet. At least 30 days prior to filing an NOI for permit coverage, the permit applicant must submit to EPA a completed *Criterion C Eligibility Form*. After evaluation of this worksheet, EPA may require additional controls that the permit applicant must implement to avoid or eliminate

Criterion	Additional Considerations
related activities are not likely to adversely affect listed threatened or endangered species or designated critical habitat.	adverse effects on ESA-listed species and designated critical habitat from discharges and discharge-related activities. The permit applicant may submit a NOI for permit coverage 30 days after submitting the completed *Criterion C Eligibility Form*. The permit applicant must provide a description of the basis for the criterion the permit applicant selected on the NOI form and provide documentation supporting the applicant's eligibility determination in the SWPPP.
D: Consultation between a Federal Agency and the U.S. Fish and Wildlife Service and/or the National Marine Fisheries Service under section 7 of the ESA has been concluded.	Consultations can be either formal or informal, and would have occurred only as a result of a separate federal action (e.g., during application for an individual wastewater discharge permit or the issuance of a wetlands dredge and fill permit), and consultation must have addressed the effects of the industrial activity's discharges and discharge-related activities on all federally-listed threatened or endangered species and all federally-designated critical habitat. The result of this consultation must be one of the following: (i) A biological opinion that concludes that the action in question (taking into account the effects of the facility's discharges and discharge-related activities) is not likely to jeopardize the continued existence of ESA-listed species, nor result in the destruction or adverse modification of designated critical habitat; (ii) a biological opinion that concludes that the action is likely to jeopardize ESA-listed species or to result in the destruction or adverse modification of designated critical habitat with recommended reasonable and prudent alternatives that the facility is implementing; or (iii) written concurrence from the applicable Service(s) with a finding that the facility's discharges and discharge-related activities are not likely to adversely affect federally-listed species or federally-designated critical habitat. To certify eligibility under this criterion, the permit applicant must use the E.4 Criterion Selection worksheet. The permit applicant must verify that the consultation remains valid, in accordance with 50 CFR §402.16. If reinitiation of consultation is required, in order to be eligible under this Criterion the permit applicant must ensure the consultation is reinitiated and the result of the consultation must be consistent with (i), (ii), or (iii) above. If eligible, the permit applicant must also provide supporting documentation for this determination in the NOI and SWPPP, including the Opinion (or Public Consulting Tracking System, PCTS, tracking number) or concurrence letter.
E: Industrial activities are authorized through the issuance of a permit under section 10 of the ESA, and this authorization addresses the effects of the facility's discharges and discharge-related activities on federally-listed species and federally-designated critical habitat.	To certify eligibility under this criterion, the permit applicant must use the E.4 Criterion Selection worksheet. The permit applicant must also provide supporting documentation for the determination in the NOI and SWPPP, including a copy of the permit from the Services.

[a] *Criteria have been relabeled from previous permit cycles: 2015 B (2008 F); 2015 C (2008 D & E); 2015 D (2008 B), and 2015 E (2008 C). Criterion A remains the same in both past and proposed permit cycles.*

2.4 Eligibility Criteria Selection Procedure

As the facility operators prepare to seek coverage under the MSGP, they must use the Criterion Selection Worksheet to guide them in determining which ESA criterion most appropriately applies to their facility. The criterion selection process directs facility operators to consider first whether the facility is eligible for MSGP coverage under Criterion B, Criterion D, or Criterion E, as described above. When considering these criteria, the operator must ensure that the facility's stormwater discharges (and associated pollutants) were adequately addressed in the analyses associated with each of these criteria. For example, if a facility is selecting Criterion D based on an earlier, separate federal nexus with a completed ESA section 7 consultation for construction of a facility, the operator must confirm that effects of the stormwater discharge were considered during that section 7 consultation. If stormwater discharges were not considered in the suite of effects evaluated in the section 7 consultation, selection of Criterion D would not be appropriate. If an operator can demonstrate that the facility is eligible for coverage under Criterion B, D, or E, the operator can proceed with submittal of an NOI. If the eligibility was made possible through the agreement (or another operator's agreement if eligible under Criterion B) to include certain measures or prerequisite actions, or implement certain terms and conditions, facility operators must comply with all such agreed-upon requirements to maintain eligibility under the MSGP.

Should the applicant be unable to meet either of Criteria B, D, or E, the operator must then determine whether Criteria A or C would apply to the facility. To do so, the applicant must first determine the extent of the action area of the facility to evaluate whether effects from the proposed activities overlap with endangered or threatened species or their designated critical habitat. The action area of the facility includes all areas potentially affected directly or indirectly by the stormwater discharges, allowable non-stormwater discharges, and any proposed discharge-related activities[12] and not merely the immediate area (e.g., mixing zone) involved in the action. This area includes all waterbodies or downstream/down-current reaches within waterbodies that are reasonably expected to receive pollutants from these sources as well as species and species habitat affected by loss of prey resulting from the authorized discharges. Once the extent of the action area is determined for the facility, the applicant must request a species list of threatened and/or endangered species and designated critical habitat from NMFS and the USFWS, as described in the MSGP. If the species and designated critical habitat list indicates no ESA-listed species and designated critical habitat are present in the action area of the facility, the operator may then select Criterion A, and proceed with submittal of an NOI.

If the applicant is unable to certify there is no overlap between their action area and any threatened or endangered species or their designated critical habitat (i.e., if facility discharges are not eligible under Criterion A), the applicant must complete the *Criterion C Eligibility Form* and submit it to EPA. This worksheet is a tool that is used to assist the operator in making a preliminary determination of whether ESA-listed species or designated critical habitat may be

12 e.g., upland areas associated with installation of and operation of stormwater control measures

exposed to discharges and/or discharge-related activities, and whether such exposures would be likely to adversely affect ESA-listed species or their designated critical habitat. If the applicant determines that the ESA-listed species and designated critical habitat may be exposed to discharge pollutants, the worksheet requires the applicant to evaluate discharge effects and verify that facility operators will implement controls and other measures to avoid adverse effects.

If an operator determines that facility is likely to be eligible under Criterion C, the completed worksheet must be submitted to EPA at least 30 days prior to the submission of a NOI. Once the worksheet has been received, EPA will review it for completeness and forward to the appropriate Service(s) Regional or Field Office[13] for consideration. If NMFS requests additional time or information to complete review of the proposal, EPA will temporarily stop the clock and notify the operator of any additional information requests or requirements, as needed, when they are identified. For example, in some cases, a NMFS reviewer may request a SWPPP (or link to a SWPPP, as available) to supplement review of the worksheet.

For *Criterion C Eligibility Form*s submitted to NMFS Regional Offices, reviewers will be provided 25 days (plus a time extension, if requested) to respond if they have additional information needs, or if they have concerns that a proposal for coverage has not demonstrated sufficient measures in their *Criterion C Eligibility Form* or SWPPP (if requested) to avoid adverse effects to ESA-listed species or their designated critical habitat. Eligibility for Criterion C requires NMFS concurrence that the controls and other measures to avoid adverse effects support a not likely to adversely affect determination. If NMFS does not respond or request additional review time within the 30-day time period, this does not constitute an approval of the discharge under the MSGP. NMFS will communicate its approval in writing. NMFS may raise questions or concerns about the effects of discharges to ESA-listed species and designated critical habitat until the end of the NOI review period, as described below.

NMFS expects that the EPA will rely on NMFS' determinations when determining whether to allow permit coverage, whether to require additional conditions or whether to withhold authorization under the general permit.

Permittees must comply with any applicable terms, conditions, or other requirements developed in the process of meeting these Eligibility Criteria to remain eligible for coverage under the MSGP. The *Criterion C Eligibility Form* and any additional documentation related to these requirements must be kept onsite as part of the SWPPP. The operator may proceed with submittal of an NOI 30 days after submitting the *Criterion C Eligibility Form*.

13 Contact information for each Service Regional or Field Office has been forwarded to EPA to insure timely electronic submission of the Criteria C worksheets.

2.5 Submitting a Notice of Intent (NOI) [14]

As of the date of this Opinion, the EPA is currently in the process of transitioning their NOI submission system to a fully on-line system, called the NPDES eReporting Tool (NeT), which is connected to EPA's existing Integrated Compliance Information System, or ICIS, using electronic NOIs (eNOIs). EPA anticipates the use of this system for the MSGP will improve and streamline the coverage application process, as well as providing for better oversight capabilities for EPA. To be considered complete, the eNOI must contain all the required information supporting the selected ESA criterion (as well as other non-ESA information required for the permit). A sample copy of the eNOI form is included within the draft permit in Appendix A of this Opinion. The NOI serves as the facility operator's certification that that the discharges are eligible for coverage according to the requirements of the MSGP. The NOI includes basic information about the facility and also requires that a URL to the SWPPP be included, or that the following information from the SWPPP be described:

- Industrial activities and associated discharges for the subject facility;
- Onsite industrial activities exposed to stormwater, including potential spill and leak areas;
- Pollutants or pollutant constituents associated with each industrial activity exposed to stormwater that could be discharged in stormwater and/or any authorized non-stormwater;
- Stormwater control measures facility operators employ to comply with the non-numeric technology- based effluent limits, and any other measures taken to comply with the requirements in MSGP Part 2.2 (Water Quality -Based Effluent Limitations); and
- Schedule for good housekeeping and maintenance and schedule for all required inspections.

2.6 Development of a SWPPP

Prior to submitting the eNOI for coverage under the MSGP, the facility operators must develop a SWPPP[15] or update their existing SWPPP. If facility operators choose to post the SWPPP on the Internet according to Part 5.4.1of the permit, the URL must be included on the eNOI form and this URL must directly link to the SWPPP (not just the corporate or facility homepage). If the SWPPP is not posted online, additional facility information from the SWPPP must be entered into the NOI. Once the SWPPP is complete and all other permit eligibility requirements are met, a complete and accurate eNOI may be submitted to EPA. NOIs for coverage under the MSGP must be submitted by the appropriate deadline described below. Discharges are not authorized if the eNOI is incomplete or inaccurate or if the facility was never eligible for permit coverage.

2.6.1 Timelines for Seeking Coverage under the New Permit

All facilities seeking coverage under the 2015 permit are required to submit their eNOIs according to an established timeframe, with separate deadlines for existing and new dischargers. Existing dischargers that were authorized for coverage under the 2008 MSGP must submit their

14 Part 1.2.1.1 and 1.2.1.3 of the permit.

15 Detailed information on development of the SWPPP and all information to be included therein are described in the permit.

NOIs no later than 90 days after the MSGP is issued (projected to be spring of 2015). New dischargers and existing dischargers that were not authorized for coverage under the 2008 MSGP must submit NOIs at least 30 days prior to commencing a discharge New owners/operators of an existing MSGP permitted facility where the discharge is authorized under the 2015 MSGP must submit an eNOI at least 30 days prior to the date of the transfer of ownership/operations. Finally, other eligible facilities (i.e., facilities that commenced discharging prior to the issuance of the 2015 MSGP but that are/were not covered by any type of NPDES permit) must submit their eNOIs immediately per EPA's permit to minimize the time that unauthorized discharges would occur. In each of these cases, coverage would begin 30 days after EPA notifies the applicant that a complete eNOI has been received (unless EPA notifies that applicant that authorization has been denied or delayed). A timeline integrating the ESA criterion certification process and the NOI submission process is provided in Figure 1.

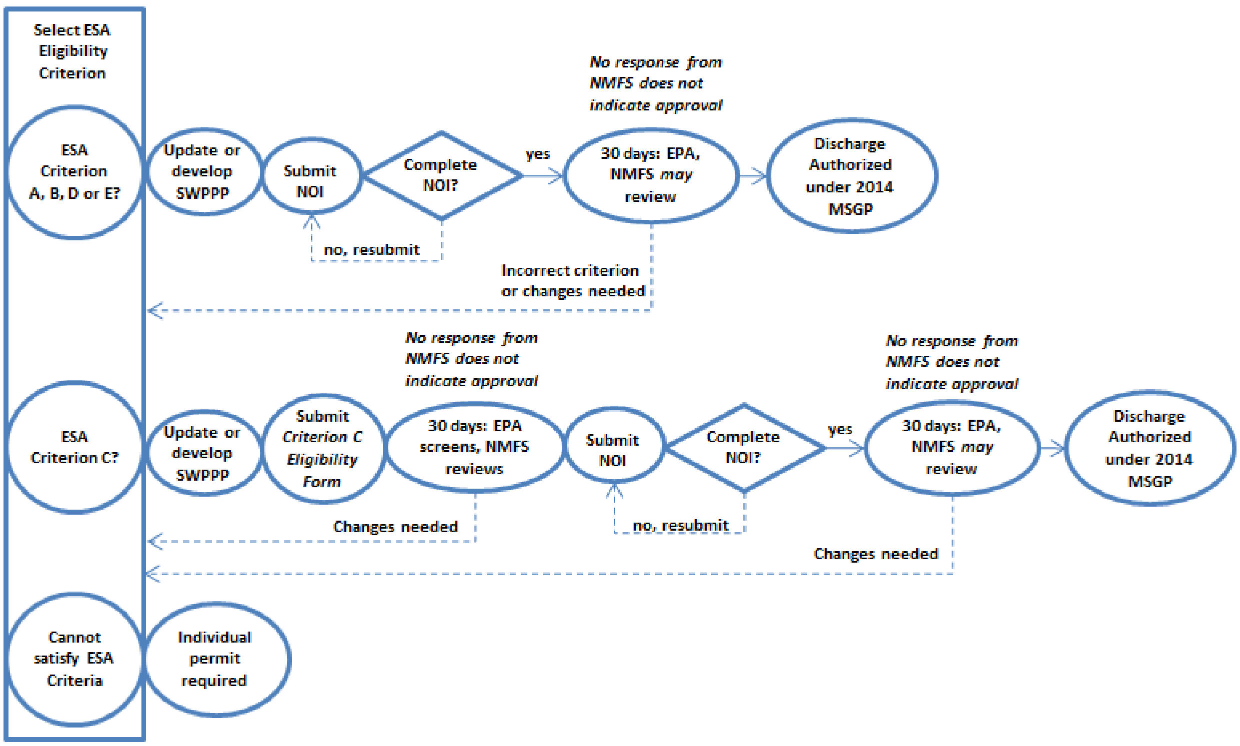

Figure 1. Preparation, submittal, and approval sequence for documents required for coverage under the 2015 MSGP.

The majority of the facilities anticipated to seek coverage under the 2015 MSGP are existing dischargers; thus, most of the requests for coverage (i.e., via eNOI submissions) are expected to occur within the first 3 months after issuance of the MSGP, and are administratively covered under the 2008 permit during this time in accordance with the Administrative Procedure Act and 40 CFR 122.6. EPA may take enforcement action for any unpermitted discharges that occur between the commencement of discharging and discharge authorization.

After submission of the eNOI, the operator will receive notice that their discharges are authorized unless EPA provides notice that coverage has been delayed or denied. EPA may choose to interrupt or postpone initiation of coverage during this timeframe for a number of reasons, including, but not limited to: requests to the operator for additional information, requirements for additional measures or controls, and suggested and/or recommended changes in permit type (e.g., to an individual or other alternative permit), as applicable. As noted above, the NMFS will have the opportunity to provide input to the request for coverage until the end of the 30-day eNOI review period. As eNOIs are submitted to EPA, notification of submittals will be automatically forwarded to NMFS Regional Offices that have requested the opportunity to review the NOIs. This automated notification process will also allow Regional Offices the opportunity to review NOIs that are seeking coverage under other criteria besides Criterion C.

Control Measures and Effluent Limits[16] Facility operators must select, design, install, and implement control measures (including but not limited to best management practices) to minimize effects to water quality and adverse effects to ESA-listed species and designated critical habitat. In the technology-based limits included in the MSGP, the term "minimize" means reduce and/or eliminate to the extent achievable using control measures (including best management practices) that are technologically available and economically practicable and achievable in light of best industry practice.

There are additional considerations for new dischargers under the MSGP. A new discharger is defined as a facility: 1) from which there is a discharge, 2) that did not commence the discharge at a particular site prior to August 13, 1979, 3) which is not a new source, and 4) which has never received a final effective NPDES permit for discharges at that site. The MSGP places additional limitations on new discharges to receiving waters that are identified as impaired or of high water quality.

New dischargers are not eligible for coverage if EPA determines the discharges will not meet any applicable water quality standard prior to authorizing under this permit. In such cases, EPA may notify the facility that an individual permit application is necessary. However, EPA may authorize coverage under the MSGP if the facility includes appropriate controls and implementation procedures designed to ensure the discharge will meet water quality standards. In the absence of information demonstrating otherwise, EPA expects that compliance with the stormwater control requirements of this permit, including the requirements applicable to such discharges, will meet applicable water quality standards.

2.6.2 Water Quality Standards

Water Quality Standards define the goals for a waterbody by designating its uses, setting numeric and narrative criteria to protect those uses, and establishing provisions such as antidegradation policies to protect waterbodies from pollutants. EPA expects that if receiving

16 Part 2.0 of the permit

waters continue to meet Water Quality Standards, exposures of ESA-listed species and designated critical habitat to hazardous concentrations of stormwater pollutants will have been avoided or limited. To this end, the MSGP employs water quality based effluent limits and water quality benchmark monitoring, and requires the development and implementation of SWPPPs to prevent stormwater and permitted non-stormwater discharges from creating conditions which do not meet Water Quality Standards. Water quality benchmarks are based on national recommended water quality criteria, and are a level of concern at which a stormwater discharge could potentially cause or contribute to an impairment of water quality standards.

A facility's discharge must be controlled as necessary to meet applicable water quality standards. EPA expects that compliance with the conditions in this permit will control discharges as necessary to meet this goal. If, at any time, a facility operator becomes aware, or EPA determines, that the discharge does not meet applicable water quality standards, the facility operator must take corrective action (described in a subsequent section) and document the corrective actions taken. The facility must also comply with any additional requirements that the state or tribe requires (per Part 9 of the MSGP).

2.6.3 Water Quality-Based Effluent Limitations[17]

The MSGP includes a narrative water quality-based effluent limitation that discharges must be "controlled as necessary to meet applicable water quality standards." EPA may also impose additional water quality-based limitations on a site-specific basis, or require the facility to obtain coverage under an individual permit, if information in the NOI, required reports, or from other sources indicates that the discharges are not controlled as necessary to meet applicable water quality standards.

2.6.4 Discharges to Water Quality-Impaired Waters[18]

A facility will be considered to discharge to an impaired water if the first water of the U.S. discharged to is identified by a state, tribe, or EPA pursuant to Section 303(d) of the Clean Water Act as not meeting an applicable water quality standard, or is included in an EPA-approved or established total maximum daily load (TMDL). For discharges that enter a storm sewer system prior to discharge, the first water of the U.S. discharged to is the waterbody that receives the stormwater discharge from the storm sewer system.

If a facility discharges to an impaired water with an EPA approved or established TMDL, EPA will inform the facility operators if any additional limits or controls are necessary for the discharge to be consistent with the assumptions of any available wasteload allocation in the TMDL, or if coverage under an individual permit is necessary. If a facility discharges to an impaired water without an EPA approved or established TMDL, facility operators are still required to comply with Part 2.2.1 of the permit, and must comply with the corresponding

17 Part 2.2 of the permit

18 Part 2.2.2 of the permit

monitoring requirements. This provision also applies to situations where EPA determines that the discharge is not controlled sufficiently to meet water quality standards in a downstream water segment, even if the discharge is to a receiving waterbody that is not specifically identified on a Section 303(d) list.

If the authorization to discharge under this permit relied on Part 1.1.4.8 for a new discharge to an impaired water, facility operators must implement and maintain any control measures or conditions on the site that enabled the facility to become eligible under Part 1.1.4.8, and modify such measures or conditions as necessary pursuant to any corresponding corrective actions. The facility is also required to comply with Part 2.2.1 and the monitoring requirements of Parts 6.2.4.

The MSGP states that in some cases, a new discharger discharging to an impaired receiving waterbody[19] is eligible for coverage under the permit. In these cases, the discharger must either: prevent all exposure to stormwater of the pollutant(s) for which the waterbody is impaired; demonstrate that the pollutant(s) for which the waterbody is impaired is not present at the site; or demonstrate to EPA that the facility's discharge is expected to meet applicable water quality standards. A facility is eligible if the EPA Regional Office fails to respond within 30 days of data submission or provides an affirmative determination that the discharge will meet applicable water quality standards. Both the supporting documentation for the facility's rationale and the EPA's determination (if provided) must be maintained onsite with the SWPPP.

2.6.5 Discharges to Tier 2 or Tier 2.5 Waters

If the facility is a new discharger, or an existing discharger required to notify EPA of an increased discharge consistent with Part 7.7 (i.e., a "planned changes" report), and discharges directly to waters designated by a state or tribe as Tier 2 or Tier 2.5 for antidegradation purposes under 40 CFR 131.12(a), in the absence of information demonstrating otherwise, EPA expects that compliance with the stormwater control requirements of this permit will result in discharges that will not lower the water quality of the applicable water. However, EPA may notify facility operators that additional analyses, control measures, or other permit conditions are necessary to comply with the applicable antidegradation requirements, or that an individual permit application is necessary.

New dischargers are authorized to discharge to Tier 2[20] or Tier 2.5 waters provided the discharge does not lower the water quality of the receiving water. New dischargers are not eligible to

19 A facility will be considered to discharge to an impaired water if the receiving water has been identified by a state, tribe, or EPA pursuant to Section 303(d) of the Clean Water Act as not meeting an applicable water quality standard, or is included in an EPA-approved or established TMDL.

20 Tier 2 waters are characterized as having water quality that exceeds the levels necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water. Tier 2.5 waters are those waters designated by States or Tribes as requiring a level of protection equal to and above that given to Tier 2 waters, but less than that given Tier 3 waters. States have special requirements for these waters. Tier 3 waters are identified by states as having high quality waters constituting an Outstanding Natural Resource Water (ONRW), such as waters of National Parks and State Parks, wildlife refuges, and waters of exceptional recreational or ecological significance.

discharge to Tier 3 waters. A list of Tier 2, Tier 2.5 and Tier 3 waters is provided in Appendix L of the MSGP. These waters are identified for antidegradation purposes, pursuant to 40 CFR 131.12(a).

2.7 Control Measures[21]

The MSGP directs facilities to evaluate selection and design considerations when determining appropriate controls[22] for the facility's discharges, as well as to meet the specified limits described in the permit (i.e., non-numeric technology-based effluent limits, applicable numeric effluent limitations guidelines, and water quality-based effluent limitations). If control measures are not achieving their intended effect of minimizing pollutant discharges, facility operators must modify the control measures for their facilities in accordance with specified corrective action requirements describe d in the permit. In particular, facility operators are directed to consider a variety of measures, which include but are not limited to:

- measures that prevent exposure to contaminants
- combinations of controls
- minimization of impervious surfaces
- good housekeeping practices
- maintenance of control measures
- spill prevention and response measures
- erosion and sediment controls

Additionally, all employees who work in areas where industrial materials or activities are exposed to stormwater, or who are responsible for implementing activities necessary to meet the conditions of this permit must be provided appropriate training. For additional measures, see Part 8 of the MSGP; EPA also provides facts sheets for the applicants that clarify sector-specific controls. Additional details related to consideration and implementation of controls are found in the permit.

2.7.1 Sector Specific Requirements

The MSGP outlines a number of sector-specific requirements with which facility operators must comply that are associated with the facility's primary industrial activity and any co-located industrial activities. These requirements are in addition to any requirements specified elsewhere in the MSGP. Part 8 is organized by individual sectors to allow permit applicants to focus on only those requirements that apply to their facility.

21 Part 2.1 of the MSGP

22 Sector and pollutant source-specific control measures were developed by EPA for the 2008 MSGP. These are found at http://cfpub1.epa.gov/npdes/stormwater/swsectors.cfm.

2.7.2 Numeric Effluent Limitations Based on Effluent Limitations Guidelines[23]

If a facility is in an industrial category subject to one of the effluent limitations guidelines identified in the permit, facility discharges must meet the corresponding effluent limits as described in the permit. These effluent limits apply to the following regulated activities:

- Discharges resulting from spray down or intentional wetting of logs at wet deck storage areas
- Runoff from phosphate fertilizer manufacturing facilities that comes into contact with any raw materials, finished product, by-products or waste products
- Runoff from asphalt emulsion facilities
- Runoff from material storage piles at cement manufacturing facilities
- Mine dewatering discharges at crushed stone, construction sand and gravel, or industrial sand mining facilities
- Runoff from hazardous waste landfills
- Runoff from non-hazardous waste landfills
- Runoff from coal storage piles at steam electric generating facilities
- Existing and new primary airports with 1,000 or more annual jet departures that discharge wastewater associated with airfield pavement deicing that contains urea commingled with stormwater

2.8 Inspections and Monitoring Requirements

The MSGP outlines specific inspection and monitoring requirements that facilities must follow once coverage has been granted. These requirements are specified in the permit, and are summarized below (see the permit and Appendix B of the permit for more detail).

2.8.1 Inspections

The MSGP requires facility operators to conduct quarterly inspections of the facility during normal facility operating hours by qualified personnel. Inspections are intended to ensure that exposure to pollutants is avoided or corrected, and focuses on locations of potential exposure (e.g., storage locations, discharge points) as well as areas where previous spills or leaks have been observed. Some facilities may be required to inspect more frequently based on the use of certain types of equipment, processes and/or stormwater control measures, or where areas of the facility may have significant activities and/or materials exposed to stormwater.

The permit notes that at least one of the routine inspections must be conducted during a period when a stormwater discharge is occurring. Inspectors must consider the results of visual and analytical monitoring (if any) for the past year when planning and conducting inspections.

Inspections should focus on and document instances where contaminants (e.g., industrial materials, residue or trash) may have or could come into contact with stormwater, leaks or spills have occurred, and offsite tracking of materials or sediment has occurred. Inspections should also document any control measures needing replacement, maintenance or repair. Control

23 Part 2.1.3 of the MSGP

measures should also be inspected to determine whether the facility is complying with effluent limits. At least one inspection must be conducted during a stormwater discharge to ensure control measures are functioning correctly. Discharge points must also be observed during the inspection. If such discharge locations are inaccessible, the permit notes that nearby downstream locations must be inspected.

The MSGP allows for certain exceptions to routine inspections. For example, routine inspections are not required at facilities that are inactive and unstaffed as long as there are no industrial materials or activities exposed to stormwater. S uch facilities are only required to conduct an annual site inspection. If the facility is already covered under the permit and the facility has changed from active to inactive and unstaffed, facility operators must modify the NOI to reflect the changed status, and the facility must maintain a statement to this effect in the SWPPP. If circumstances change and industrial materials or activities become exposed to stormwater or the facility becomes active and/or staffed, this exception no longer applies, and the permit requires that facility operators must immediately resume routine facility inspections.

Additionally inactive and unstaffed facilities covered under Sectors G (Metal Mining), H (Coal Mines and Coal Mining-Related Facilities), and J (Non-Metallic Mineral Mining and Dressing), are not required to meet the "no industrial materials or activities exposed to stormwater" standard to be eligible for this exception from routine inspections.

Facility operators must document the findings of the facility inspections and maintain this report with the SWPPP. Facilities are not required to submit the routine facility inspection report to EPA, unless the facility is specifically requested to do so. However, findings must be documented and summarized in the *Annual Report* that is submitted to EPA.

2.8.2 Quarterly Visual Assessments

With a few exceptions, all facilities covered by the MSGP are required to conduct quarterly visual assessments of discharges covered under the permit. A stormwater sample from each outfall must be collected and visually assessed once each quarter for the entire permit term. The MSGP notes that these samples should be collected in such a manner that the samples are representative of the stormwater discharge, and on-line guidance on how to conduct monitoring is provided on EPA's website (http://water.epa.gov/polwaste/npdes/stormwater/EPA-Multi-Sector-General-Permit-MSGP.cfm). The MSGP notes that samples should be taken within the first 30 minutes of an actual discharge from a storm event (or as soon as practicable), and should note any water quality characteristics indicative of stormwater pollution (e.g., color, odor, clarity, foam, oil sheen, and floating, settled, or suspended solids). Additional details on how the visual assessment should be conducted are available in in the permit. Whenever the visual assessment shows obvious signs of stormwater pollution, facility operators must initiate the corrective action procedures described in the permit.

Facility operators must document the results of the visual assessments and maintain this documentation onsite with the SWPPP. Facility operators are not required to submit visual assessment findings to EPA, unless the facility is specifically requested to do so, although findings should be noted in the *Annual Report*.

The MSGP notes several exceptions to requirements for visual assessments. In some cases, adverse weather conditions prevent the safe or practical collection of samples, and the MSGP requires substitute samples during the next qualifying storm event. In other cases, the MSGP allows for variation of the assessment schedule, such as in areas subject to longer-term snow accumulation or in arid/semi-arid areas where limited rainfall occurs. Other exceptions are provided for inactive and unstaffed sites, or where a facility has two or more outfalls that would most likely discharge substantially identical effluents ("substantially identical outfalls"). For each of these cases, the MSGP outlines appropriate procedures for inspections and reporting

2.8.3 Monitoring

All required monitoring must be performed in response to a storm event that results in an actual discharge from the site ("measurable storm event") that follows the preceding measurable storm event by at least 72 hours (3 days). This storm interval does not apply if facility operators are able to document that a shorter interval is representative for local storm events during the sampling period. In the case of snowmelt, the monitoring must be performed at a time when a measurable discharge occurs at the site.

For each monitoring event (except snowmelt monitoring), facility operators must identify the date and duration of the rainfall event, rainfall total for that rainfall event, and time since the previous measurable storm event. For snowmelt monitoring, operators must identify the date of the sampling event.

Facility operators must take required samples from a discharge resulting from a measurable storm event as described above. Samples must be collected within the first 30 minutes of a measurable storm event. If it is not possible to collect the sample within the first 30 minutes of a measurable storm event, the sample must be collected as soon as practicable after the first 30 minutes and documentation must be kept with the SWPPP explaining why it was not possible to take samples within the first 30 minutes. In the case of snowmelt, samples must be taken during a period with a measurable discharge. When adverse weather conditions[24] prevent the collection of samples according to the relevant monitoring schedule, a substitute sample must be taken during the next qualifying storm event. Operators must report any failure to monitor indicating the basis for not sampling during the usual reporting period.

If the facility is located in areas where limited rainfall occurs during parts of the year (e.g., arid or semi-arid climates) or in areas where freezing conditions exist that prevent runoff from occurring

24 Adverse weather does not exempt facility operators from having to file a benchmark monitoring report in accordance with the sampling schedule.

for extended periods, required monitoring events may be distributed during seasons when precipitation occurs, or when snowmelt results in a measurable discharge from the site. Facility operators must still collect the required number of samples.

Monitoring requirements as specified in the MSGP begin in the first full quarter following either 90 days after the permit issuance or the date of discharge authorization, whichever date comes later. If the monitoring is required on a quarterly basis (e.g., benchmark monitoring), monitoring must occur at least once in each of the following 3-month intervals:

- January 1 – March 31;
- April 1 – June 30;
- July 1 – September 30; and
- October 1 – December 31.

This monitoring schedule may be modified by the facility if the revised schedule is documented with the SWPPP and provided to EPA with the first monitoring report.

2.8.3.1 Analytical Monitoring

Facility operators must collect and analyze stormwater samples[25] and document all monitoring activities consistent with the procedures described in the MSGP including any additional sector-specific or state/tribal-specific requirements that are applicable to their facility. Applicable monitoring requirements apply to each outfall authorized by this permit, except as otherwise exempt from monitoring (e.g., as with a substantially identical outfalls[26]). The permit includes five types of required analytical monitoring, one or more of which may apply to the discharge(s) :

- Quarterly benchmark monitoring
- Annual effluent limitations guidelines monitoring
- State- or tribal-specific monitoring
- Impaired waters monitoring
- Other monitoring as required by EPA

When more than one type of monitoring for the same parameter[27] at the same outfall applies (e.g., total suspended solids once per year for an effluent limit and once per quarter for benchmark monitoring at a given outfall), facility operators may use a single sample to satisfy both monitoring requirements (i.e., one sample satisfying both the annual effluent limit sample and one of the four quarterly benchmark monitoring samples). All required monitoring must be conducted in accordance with the procedures described in Appendix B, Subsection 10.D of the MSGP.

25 Facility operators are only required to monitor allowable non-stormwater discharges when they are co-mingled with stormwater discharges associated with industrial activity.
26 Facility operators are required to monitor each outfall covered by a numeric effluent limit
27 The term parameter refers to the pollutant or water quality characteristic (e.g., pH, dissolved oxygen) that is measured in the discharge.

2.8.4 Benchmark Monitoring

The MSGP specifies pollutant benchmark concentrations that are applicable to certain sectors/subsectors. Benchmark monitoring data are primarily to determine the overall effectiveness of the control measures and to assist facility operators in knowing when additional corrective action(s) may be necessary to comply with the effluent limitations in Part 2 of the MSGP. The benchmark concentrations are not effluent limitations; a benchmark exceedance, therefore, is not a permit violation. However, if corrective action is required as a result of a benchmark exceedance, failure to conduct required corrective action is a permit violation.

Facility operators must monitor for any benchmark parameters specified for the industrial sector(s), both primary industrial activity and any co-located industrial activities, applicable to the discharge. Industry-specific benchmark concentrations are listed in the sector-specific sections of Part 8 of the MSGP. If the facility is in one of the industrial sectors subject to benchmark concentrations that are hardness-dependent, facility operators are required to submit a hardness value with the NOI that is representative of the receiving water by following the procedures in Appendix J of the MSGP. Samples must be analyzed consistent with 40 CFR Part 136 analytical methods and using test procedures with quantitation limits at or below benchmark values for all benchmark parameters for which the facility is required to sample.

Benchmark monitoring must be conducted quarterly for the first four full quarters of permit coverage commencing no earlier than 90 days after permit issuance. As noted earlier, facilities in climates with irregular stormwater runoff may modify this quarterly schedule provided that this revised schedule is reported to EPA when the first benchmark sample is collected and reported, and that this revised schedule is kept with the facility's SWPPP. When conditions prevent obtaining four samples in four consecutive quarters, facility operators must continue monitoring until obtaining the four samples required for calculating the benchmark monitoring average. At the operator's discretion, more than four samples may be taken during separate runoff events and used to determine the average benchmark parameter concentration for facility discharges.

After collection of four quarterly samples, if the average of the four monitoring values for any parameter does not exceed the benchmark, the facility has fulfilled the monitoring requirements for that parameter for the permit term. However, if the average of the four monitoring values for any parameter exceeds the benchmark, facility operators must review the selection, design, installation, and implementation of the control measures to determine if modifications are necessary to meet the effluent limits in this permit, and either:

- Make the necessary modifications and continue quarterly monitoring until four additional quarters of monitoring are completed for which the average does not exceed the benchmark; or
- Make a determination that no further pollutant reductions are technologically available and economically practicable and achievable in light of best industry practice to meet the technology-based effluent limits or are necessary to meet the water-quality-based effluent

limitations in the MSGP, in which case monitoring must continue once per year. The facility operator must also document the rationale for concluding that no further pollutant reductions are achievable, and retain all records related to this documentation with the SWPPP.

Facility operators must review the control measures and perform any required corrective action immediately (or document why no corrective action is required), without waiting for the full four quarters of monitoring data, if an exceedance of the four-quarter average is mathematically certain. If after modifying the control measures and conducting four additional quarters of monitoring, the average still exceeds the benchmark (or if an exceedance of the benchmark by the four quarter average is mathematically certain prior to conducting the full four additional quarters of monitoring), operators must again review the control measures and take one of the two actions above.

Following the first four quarters of benchmark monitoring (or sooner if the exceedance is triggered by less than four quarters of data, as noted above), if the average concentration of a pollutant exceeds a benchmark value, and the facility operator determines that exceedance of the benchmark is attributable solely to the presence of that pollutant in the natural background, the operator is not required to perform corrective action or additional benchmark monitoring provided that:

- The average concentration of the benchmark monitoring results is less than or equal to the concentration of that pollutant in the natural background;
- The operator documents and maintains with the SWPPP the supporting rationale for concluding that benchmark exceedances are in fact attributable solely to natural background pollutant levels. Any data previously collected by the facility and others must be included in the supporting rationale (including literature studies) that describe the levels of natural background pollutants in the stormwater discharge; and
- The operator notifies EPA on the final quarterly benchmark monitoring report that the benchmark exceedances are attributable solely to natural background pollutant levels.

Natural background pollutants include those substances that are naturally occurring in soils or ground water. Natural background pollutants do not include legacy pollutants from earlier activity on the site, or pollutants in run-on from neighboring sources that are not naturally occurring, such as other industrial sites or roadways. However, facilities may be eligible to discontinue monitoring for pollutants that occur solely from run-on sources, and operators are advised in the permit to consult the appropriate EPA Regional Office for related guidance.

The requirement for benchmark monitoring does not apply at a facility that is inactive and unstaffed, as long as there are no industrial materials or activities exposed to stormwater. This exception has different requirements for Sectors G, H, and J. To invoke this exception, a facility operator must maintain a statement with the SWPPP stating that the site is inactive and unstaffed, and that there are no industrial materials or activities exposed to stormwater in accordance with the substantive requirements in 40 CFR 122.26(g), and then sign and certify the corresponding statement as described in the MSGP. If circumstances change and industrial materials or activities become exposed to stormwater or the facility becomes active and/or staffed, this exception no longer applies and the facility must immediately begin complying with the applicable benchmark monitoring requirements as if the facility were in the first year of permit coverage. If the facility is not qualified for this exception at the time discharges are authorized under the MSGP, but during the permit term the facility becomes qualified because the facility is inactive and unstaffed, and there are no industrial materials or activities that are exposed to stormwater, then the facility operator must notify EPA of this change in the next benchmark monitoring report. The facility operator may discontinue benchmark monitoring once EPA has been notified, and has prepared and signed the certification statement described above concerning the facility's qualification for this special exception.

2.8.5 Effluent Limitations Monitoring

As noted above, certain stormwater discharges subject to effluent limitation guidelines (ELGs) that are authorized for coverage under the MSGP. Beginning in the first full quarter following 90 days after permit issuance or the date of discharge authorization, whichever date comes later, facility operators must monitor once per year at each outfall containing the discharges identified in the sector-specific section of Part 8 applicable to each regulated activity.

Facility operators must monitor each outfall discharging runoff from any of the applicable regulated activities. The substantially identical outfall monitoring provisions are not available for numeric effluent limits monitoring. Facility Operators must conduct follow- up monitoring within 30 calendar days (or during the next qualifying runoff event, should none occur within 30 days) of implementing corrective action(s) taken in response to an exceedance of a numeric effluent limit contained in this permit. The MSGP also outlines specific monitoring requirements applicable to individual states or tribes. Monitoring must be performed for any pollutant(s) that exceeds the effluent limit. If this follow-up monitoring exceeds the applicable effluent limitation, Facility Operators must 1) submit an Exceedance Report no later than 30 days after receiving the lab result; and 2) continue to monitor, at least quarterly, until the discharge is in compliance with the effluent limit or until EPA waives the requirement for additional monitoring.

Facility Operators must comply with any state or tribal monitoring requirements applicable to the facility's location. If a monitoring frequency is not specified for an applicable requirement, Facility Operators must monitor once per year for the entire permit term.

If a facility discharges to an impaired waterbody, facility operators must monitor all pollutants for which the waterbody is impaired and for which a standard analytical method exists. If the pollutant of concern for the impaired waterbody is suspended solids, turbidity or sediment/sedimentation, facility operators must monitor for Total Suspended Solids (TSS). If a pollutant of concern is expressed in the form of an indicator or surrogate pollutant, facility operators must monitor for that indicator or surrogate pollutant. No monitoring is required when a waterbody's biological communities are impaired but no pollutant, including indicator or surrogate pollutants, is specified as causing the impairment, or when a waterbody's impairment is related to hydrologic modifications, impaired hydrology, or other non-pollutant. Facility operators are directed to consult the appropriate EPA Regional Office for any available guidance regarding required monitoring parameters under this part. If the EPA's Discharge Mapping Tool does not provide the needed information, facility operators may consult the appropriate EPA Regional Office for guidance regarding required monitoring parameters under this part.

Stormwater discharges to impaired waters without an applicable EPA-approved or established TMDL wasteload allocation must be monitored once per year at each outfall (except substantially identical outfalls) beginning in the first full quarter following 90 days after permit issuance or the date of discharge authorization, whichever date comes later. This monitoring requirement no longer applies once the pollutant of concern is not detected above natural background levels in the stormwater monitoring results, and facility operators document this pollutant is not expected to be present above natural background levels in the discharge.

If the pollutant of concern is not present and not expected to be present in the discharge, or it is present but facility operators have determined that its presence is caused solely by natural background sources, facility operators must include a notification to this effect in the first monitoring report, after which facility operators may discontinue monitoring. To support a determination that the pollutant's presence is caused solely by natural background sources, facility operators must document and maintain with the SWPPP:

- An explanation of why facility operators believe that the presence of the pollutant of concern in the discharge is not related to the activities or materials at the facility; and
- Data and/or studies that tie the presence of the pollutant of concern in the discharge to natural background sources in the watershed.

Stormwater discharges to waters for which there is an EPA approved or established TMDL wasteload allocation are not required to be monitored for the pollutant for which the TMDL was written unless EPA informs facility operators, upon examination of the applicable TMDL and/or wasteload allocation, that facility operators are subject to such a requirement consistent with the assumptions of the applicable TMDL and/or wasteload allocation. EPA's notice will include specifications on which pollutant to monitor and the required monitoring frequency. Facility operators must consult the appropriate EPA Regional Office for guidance regarding required monitoring under this part.

2.8.6 Additional Monitoring Required by EPA.

EPA may notify facility operators of additional discharge monitoring requirements. Any such notice will briefly state the reasons for the monitoring, locations, and parameters to be monitored, frequency and period of monitoring, sample types, and reporting requirements.

2.9 Corrective Actions

The MSGP outlines a number of corrective actions that may be required during the 5-year permit cycle and describes how and when these actions should be undertaken and reported to EPA. Although SWPPPs are intended to address anticipated conditions at covered facilities, EPA recognizes that unforeseen conditions or other factors may sometimes require the need for corrective actions at a facility. Where corrective actions are needed based on inspections, monitoring, or other observations, or when notified by the EPA, or local, state or tribal entity, operators are required to review their SWPPP to determine if and where revisions may need to be made to eliminate the condition, prevent its reoccurrence, and ensure that effluent limits are met. Corrective measures may be required to address the following:

- An unauthorized release or discharge (e.g., spill, leak, or discharge of non-stormwater not authorized by this or another NPDES permit) occurs at the facility.
- A discharge violates a numeric effluent limit.
- Control measures are not stringent enough for the discharge to meet applicable water quality standards or the non-numeric effluent limits in this permit.
- A required control measure was never installed, was installed incorrectly, or not in accordance with Parts 2 and/or 8, or is not being properly operated or maintained.
- Visual assessments indicate obvious signs of stormwater pollution (e.g., color, odor, floating solids, settled solids, suspended solids, foam, sheen, etc.).
- The average of four quarterly sampling results exceeds an applicable benchmark. If less than four benchmark samples have been taken, but the results are such that an exceedance of the four quarter average is mathematically certain (i.e., if the sum of quarterly sample results to date is more than four times the benchmark level) this is considered a benchmark exceedance, triggering a review.
- Construction or a change in design, operation, or maintenance at the facility that significantly changes the nature of pollutants discharged in stormwater from the facility, or significantly increases the quantity of pollutants discharged.

The MSGP states that in all circumstances, facility operators must immediately take all reasonable steps necessary to minimize or prevent the discharge of pollutants until a permanent solution is installed and made operational, including cleaning up any contaminated surfaces so that the material will not discharge in subsequent storm events. In this context, the term "immediately" requires action on the same day it is discovered that a control measure needs to be replaced or repaired, and that all reasonable steps must be taken to minimize or prevent the discharge of pollutants until a permanent solution is installed and made operational. However, if a problem is identified at a time in the workday when it is too late to take action, the initiation of action must begin on the following workday.

If a facility operator determines that additional changes are necessary beyond those implemented, the operator must install a new or modified control and make it operational, or complete the repair, before the next storm event if possible, and within 14 calendar days from the time of discovery. If it is infeasible to complete the installation or repair within 14 calendar days, the operator must document why it is infeasible to complete the installation or repair within the 14- day timeframe. The facility operator must also identify the schedule for completing the work, which must be done as soon as practicable after the 14-day timeframe but no longer than 45 days after discovery. Where the corrective actions result in changes to any of the controls or procedures documented in the SWPPP, the operator must modify the SWPPP accordingly within 14 calendar days of completing corrective action work.

EPA does not consider these time intervals to be grace periods; they are instead schedules that are considered reasonable for documenting the findings and for making repairs and improvements. The time intervals are included in the permit to ensure that the conditions prompting the need for these repairs and improvements are not allowed to persist indefinitely.

If the event triggering corrective action is linked to an outfall that represents other substantially identical outfalls, the review must assess the need for corrective action for each outfall represented by the outfall that triggered the review. Any necessary changes to control measures that affect these other outfalls must also be made before the next storm event if possible, or as soon as practicable following that storm event. Any corrective actions must be conducted within the timeframes set forth in the permit.

Facility operators must document the existence of any of the conditions listed requiring corrective action within 24 hours of becoming aware of such condition. Facility operators must also document the corrective actions taken that occurred as a result of the conditions within 14 days from the time of discovery of any of those conditions. If applicable, facility operators must also document why it is infeasible to complete necessary installations or repairs within the 14-day timeframe and document the schedule for installing the controls and making them operational as soon as practicable after the 14-day timeframe. Operators are required to submit to EPA a summary of any corrective action taken from the previous year of permit coverage in their *Annual Report*.

If the event triggering the review is a permit violation (e.g., non-compliance with an effluent limit), correcting it does not remove the original violation. Additionally, failing to take corrective action in accordance with this section is an additional permit violation. EPA will consider the appropriateness and promptness of corrective action in determining enforcement responses to permit violations.

Any noncompliance with any of the requirements of the MSGP constitutes a violation of the permit, issued under the Clean Water Act. The MSGP states that failure to take any required corrective actions constitutes an independent, additional violation of this permit, in addition to any original violation that triggered the need for corrective action. As such, any actions and time periods specified for remedying noncompliance do not absolve parties of the initial underlying noncompliance. However, where corrective action is triggered by an event that does not itself constitute permit noncompliance, such as an exceedance of an applicable benchmark, there is no permit violation provided the facility operators takes the required corrective action within the relevant deadlines established in Part 4.2.

2.10 Reporting and Recordkeeping

The EPA requires that facility operators submit all NOIs, NOTs, No Exposure Certifications, *Annual Reports*, *Discharge Monitoring Reports*, and other reporting information as appropriate electronically, unless a waiver was received from the relevant EPA Regional Office. Waivers are only granted for a one-time use for a single information submittal (i.e., an initial waiver does not apply for the entire term of the permit). All required information to be submitted under the permit will be submitted via EPA's eNOI system unless the permit states otherwise or unless a waiver has been granted. Thus, the NOI, *Discharge Monitoring Reports* and *Annual Reports*, along with any no exposure certifications or NOTs would be submitted electronically (or by hard copy if granted a waiver by EPA).

Facility operators must submit an *Annual Report* to EPA electronically, per Part 7.2, by January 30th for each year of permit coverage containing information generated from the past calendar year. The *Annual Report* must include the following information:

- The results or a summary of the past year's routine facility inspection documentation required and quarterly visual assessment documentation;
- Information copied or summarized from the corrective action documentation required (if applicable). If corrective action is not yet completed at the time of submission of this *Annual Report*, facility operators must describe the status of any outstanding corrective action(s);
- Regarding benchmark monitoring resulting in four quarter average exceedances, the rationale for why facility operators believe that no further pollutant reductions are achievable (i.e., technologically available and economically practicable and achievable in light of best industry practices); and
- Any incidents of noncompliance observed or, if there is no noncompliance, a signed certification signed stating the facility is in compliance with this permit.

For benchmark monitoring, note that facility operators are required to submit sampling results to EPA no later than 30 days after receiving laboratory results for each quarter that operators are required to collect benchmark samples, in accordance with Part 6.2.1.2. If operators collect multiple samples in a single quarter (e.g., due to adverse weather conditions, climates with irregular stormwater runoff, or areas subject to snow), facility operators are required to submit all sampling results to EPA within 30 days of receiving the laboratory results.

If follow-up monitoring exceeds a numeric effluent limit, facility operators must submit an Exceedance Report to the appropriate EPA Regional Office no later than 30 days after receiving the lab results. The report must include the following:

- NPDES ID;

- Facility name, physical address and location;
- Name of receiving water;
- Monitoring data from this and the preceding monitoring event(s);
- An explanation of the situation; what facility operators have done and intend to do (should the corrective actions not yet be complete) to correct the violation; and
- An appropriate contact name and phone number.

In addition to the reporting requirements described above, facility operators are also subject to standard permit reporting provisions of the MSGP. These are described in the Appendix B of the permit.

2.10.1 Additional Measures Taken by EPA to Protect Endangered and Threatened Species

Over the course of the consultation, EPA has changed its action to incorporate measures to protect ESA endangered and threatened species through their implementation of the MSGP.

2.10.2 Compliance Check on Facilities Certifying ESA Eligibility under Criterion A

One of the high priority concerns involves proposed dischargers who may incorrectly choose Criterion A (i.e., no federally-ESA-listed species or their designated critical habitat(s) are likely to occur in the "action area"). To address this concern, EPA stated in an e-mail dated July 28, 2014 that it would like to amend the project description for the MSGP reissuance to include the following additional EPA action:

> *"After the permit is issued, EPA intends to do a "compliance check" on a subset of facilities who have selected Criterion A on their Notice of Intent (NOI) for coverage under the MSGP during the 30 day waiting period. EPA envisions that the compliance check would consist of a GIS analysis to determine if the facility's action area is within designated critical habitat or within the range of a threatened or endangered species. For any incorrect Criterion A determinations, EPA would place the NOI on hold, and require the facility to submit a Criterion C worksheet for coverage under Criterion C."*

EPA will work with the NMFS to identify the Criterion A sample, perhaps based on priority watersheds for threatened and endangered species and/or designated critical habitat protection. EPA envisions that this focused Criterion A compliance check would occur in the 6 months following the permit reissuance (when the majority of facilities will be submitting NOIs for permit coverage). EPA envisions that the focused Criterion A compliance check would look at no greater than 100 separate facility NOIs.

2.10.3 Protocol for EPA's Completeness Review of Criterion C Eligibility Forms

To avoid submitting incomplete forms or forms with inadequate information to NMFS, EPA has established a protocol for completeness review of *Criterion C Eligibility Forms* which directs reviewers to:

- Confirm that the entire form is filled out (no fields blank and all appropriate boxes are checked).
- Confirm there is both a map (can be hand drawn) and a written description of the action area. The map of the action area must extend beyond the footprint of the facility to include the receiving water(s).
- Confirm that a species list is included (could be a list for FWS species only, a list for NMFS species only, or a list of both FWS species and NMFS species). If a species list for only one Service office is listed, the form should include a statement confirming there are no ESA-listed species and/or designated critical habitat for the other Service.

Confirm that those facilities that have checked the box indicating any past exceedances of benchmarks or effluent limitations under prior MSGP coverage have provided a description of all actions that will be implemented to ensure that pollutants in the discharges will not result in likely adverse effects from future exceedances. If, during review of a Criterion C Eligibility Form, a Service reviewer responds in writing that the information submitted in the review package may not support the rationale for coverage under Criterion C for listed species under the Service's jurisdiction, EPA will coordinate with the relevant Service field office to identify the appropriate controls or other additional measures in the facility's SWPPP that are sufficient to support a "may affect, not likely to adversely affect" call for the facility's activities that would be covered by the permit. In deciding whether to provide authorization to discharge under the MSGP, EPA will ensure one of the following is met:

i. Additional information is provided that addresses the Service's concerns and the Service subsequently agrees that coverage under Criterion C is appropriate;

ii. Additional measures are included in the SWPPP that would address the concerns raised during Service review;

iii. Changes to the facility's proposal are made to address the Service's concerns; or

iv. The Service subsequently determines no changes are necessary to support a "may affect, not likely to adversely affect" call.

In making the eligibility determination, EPA will rely on the Services' expertise.

3 APPROACH TO THE ASSESSMENT

Section 7(a)(2) of the ESA of 1973, as amended, requires federal agencies, in consultation with and with the assistance of the NMFS, to insure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of endangered or threatened species, and is not likely to destroy or adversely modify designated critical habitat that has been designated for these species (16 U.S.C. 1536(a)(2)). Endangered species are at risk of extinction throughout all or a significant portion of their range; threatened species are not yet at risk of extinction but are likely to become so in the foreseeable future. Designated critical habitat is defined as the specific areas within the geographical area occupied by the species, at the time it is listed, on which are found those physical or biological features that are essential to the conservation of the species, and which may require special management considerations or protection. Designated critical habitat can also include specific areas outside the geographical area occupied by the species at the time it is listed that are determined by the Secretary to be essential for the conservation of the species. Sections 3(a)(5), (a)(6) and (a)(20), 16 U.S.C. 1532(a)(5), (a)(6) and (a)(20). During consultations on specific actions, NMFS fulfills its obligations using an assessment framework that begins by identifying the physical, chemical, or biotic components of proposed actions that are likely to have individual, interactive, or cumulative direct and indirect effects on the environment (we use the term "potential stressors" for these components of an action); we then determine whether ESA-listed species or designated critical habitat are likely to be exposed to those potential stressors; we estimate how ESA-listed species or designated critical habitat are likely to respond to any exposure; then we conclude by estimating the risks those responses pose to the individuals, populations, and species or designated critical habitat that are likely to be exposed.

General permits authorized by Federal agencies apply to activities over large geographic areas occurring over long periods of time, with substantial uncertainty about the number, location, timing, frequency, and intensity of specific activities those programs authorize, fund, or carry out. Our traditional approaches to section 7 consultations, which focus on the specific effects of a specific proposal, are not designed to address the spatial and temporal scales and level of uncertainty that is typical of consultations on general permits.

Instead of trying to adapt the traditional approach to programmatic consultations, we developed an assessment framework that allows us to help Federal agencies insure that their programs comply with the requirements of section 7(a)(2) of the ESA Our assessment framework for general permits first assesses whether the actions a general permit authorizes are likely to adversely affect ESA-listed species or designated critical habitats. We do this by estimating exposure and response to the stressors these actions contribute, just as described above for traditional consultations. If ESA-listed species and designated critical habitats are likely to be adversely affected, we then examine the general permit's structure and decision-making processes to determine whether they are likely to insure that the actions the agency authorizes collectively comply with the requirements of section 7(a)(2).

The steps followed for this programmatic assessment are described in detail below.

3.1 The Proposed Action

In reviewing the proposed action and BE, the NMFS examined the activities that would be authorized by the proposed MSGP. This step of our analyses identifies spatial and temporal patterns associated with each category of activity: specifically (a) the geographic distribution of the different activities; (b) the number of activities; (c) the types and amounts of pollutants that are likely to be discharged; and (d) the rate and other characteristics of discharges.

Our analysis will evaluate the direct and indirect effects of all discharges of likely industrial stormwater pollutants and allowable non-stormwater discharges to waters of the U.S. incidental to the normal operation of the facility sectors that would be covered by the MSGP. In addition, the NMFS must consider the effects of interrelated and interdependent actions of the proposed action. Interdependent actions are actions having no independent utility apart from the proposed action (50 CFR 402-021). They are typically a consequence of the proposed action. For example, if our consultation were evaluating the effects of building a road, an interdependent action would be the planned construction of homes and other structures that would not be accessible without the presence of that road. Interrelated actions are actions that are part of a larger action and depend on the larger action for their justification (50 CFR 402-02[28]). They are actions that are typically associated with the proposed action. For this consultation, NMFS determined that there were no interrelated or interdependent actions that required consideration.

In this consultation, NMFS will address the potential effects of the proposed action for marine, coastal, estuarine, or anadromous endangered species, threatened species, and designated critical habitat that has been designated for those species in those ecosystems under its jurisdiction;

3.2 Action Area

We determine the degree of geographic and temporal overlap between the activities that would be authorized by the proposed MSGP and endangered and threatened species and designated critical habitat.

3.3 Effects Analysis

Before assessing an agency's decision-making process (as described above), NMFS will first establish whether the proposed action could expose ESA-listed species and designated critical habitat to potentially harmful stressors and whether ESA-listed species and designated critical habitats are likely to be adversely affected. If exposure to stressors and adverse effects are not likely to occur, we do not assess the agency's decision-making process.

We determine whether adverse effects are likely to occur though a review of the BE supplemented with additional information on the physical, physiological, behavioral, social, and ecological responses of endangered or threatened species or features of designated critical habitat

28 See: http://cfr.vlex.com/vid/402-02-definitions-19895209

given exposure to harmful discharges into waters of the US or to the effects of those discharges and the activities associated with those activities on the ecology of the watersheds in which they occur (that is, effects resulting from changes in populations of prey, predators, competitors, symbionts, etc.). Rather than discuss the literature for each species, we organize the data using species groups (for example, Pacific Salmon; Sturgeon; Sea Turtles; etc.). We summarize the probable consequences of the identified responses for individuals and populations of endangered and threatened species and features of designated critical habitat.

3.4 Treatment of Aggregate Impacts

To address the question of whether activities authorized by the proposed MSGP that may individually have minor direct and indirect effects on the environment but collectively may have large effects, we explicitly consider those impacts of the proposed permits in an Aggregate Impacts section of the Effects of the Action chapter of this Opinion.

3.5 Programmatic Assessment Risk Analyses

The continued existence of a species is determined by the fate of the populations it is comprised of and the continued existence of a population is determined by the fate of individual members of that population. Populations grow or decline as its members live, die, grow, mature, migrate, and reproduce, or fail to do so.

Our general permit assessments focus on whether or to what degree an Agency’s program is likely to insure that the direct or indirect effects of actions the program would authorize are not likely to reduce the fitness of listed individuals to a degree that would be sufficient to reduce the viability of the population(s) those individuals represent and jeopardize the survival and recovery of the species. In particular, the programmatic assessment focuses on whether and to what degree the EPA structured the program in ways that would prevent or minimize endangered or threatened species or designated critical habitat that has been designated for those species from being exposed to harmful discharges of pollutants into waters of the United States and other harmful activities because such exposures can trigger adverse responses.. . For that reason, our assessment focuses on whether and to what degree the program prevents or minimizes endangered and threatened species and designated critical habitat from being exposed to harmful discharges and other harmful activities that would be authorized by the proposed MSGP.

Our consideration of how well an Agency’s program avoids likely adverse effects to designated critical habitat focuses on the value of the physical, chemical, or biotic phenomena of the designated critical habitat for the conservation of the endangered and threatened species for which the designated critical habitat was designated. Our general permit assessments focus on whether or to what degree an Agency’s program insures that the direct or indirect effects of actions the program would authorize are not likely to appreciably reduce the value of the physical, chemical, or biotic phenomena of the designated critical habitat for the conservation of ESA-listed species.

3.6 Application of this Approach in this Consultation

As we have already discussed, we treat the issuance of the proposed MSGP as a permitting "program" that would authorize discharges of pollutants over a five-year period. The specific questions we ask about the proposed MSGP as a permitting program are:

1. Scope

Has the general permit been structured to reliably estimate the probable number, location and timing of the discharges that would be authorized by the program?

2. Stressors

Has the general permit been structured to reliably estimate the physical, chemical, or biotic stressors that are likely to be produced as a direct or indirect result of the discharges that would be authorized (that is, the stressors produced by the actual discharges to waters of the U.S.) ?

3. Overlap

Has the general permit been structured to reliably estimate whether or to what degree specific endangered or threatened species or designated critical habitat are likely to be exposed to potentially harmful impacts that the proposed permit would authorize?

4. Monitoring/Feedback

Has the general permit been structured to identify, collect, and analyze information about authorized actions that may have exposed endangered or threatened species or designated critical habitat to stressors at concentrations, intensities, durations, or frequencies that are known or suspected to produce physical, physiological, behavioral, or ecological responses that have potential individual or cumulative adverse consequences for individual organisms or physical or biological features of designated critical habitat?

5. Responses of Listed Resources

Does the general permit incorporate an analytical methodology that considers:

- Status and trends of endangered or threatened species or designated critical habitat;
- Demographic and ecological status of populations and individuals of those species given their exposure to pre-existing stressors in different drainages and watersheds;
- Direct and indirect pathways by which endangered or threatened species or designated critical habitat might be exposed to the discharges to waters of the United States; and
- Physical, physiological, behavior, sociobiological, and ecological consequences of exposing endangered or threatened species or designated critical habitat to stressors from discharges at concentrations, intensities, durations, or frequencies that could produce physical,

physiological, behavioral, or ecological responses, given their pre-existing demographic and ecological condition?

6. Compliance

Does the general permit have a mechanism to reliably determine whether or to what degree operators have complied with the conditions, restrictions or mitigation measures the proposed permit requires when they discharge to waters of the United States?

7. Adequacy of Controls

Does the general permit have a mechanism to change the action to prevent or minimize endangered or threatened species or designated critical habitat from being exposed to stressors from discharges at concentration, durations or frequencies that have adverse effects to individual listed organisms, populations or species or physical or biological features of designated critical habitat?

3.7 Evidence Available for the Consultation

For all of the above analyses, NMFS relied on two bodies of evidence for this consultation. For the first body of evidence, to assess baseline conditions and the effects of the authorized discharges, we used information from:

- EPA's BE,
- open, peer reviewed literature identified through literature searches using the Web of Science and National Center for Biotechnology Information,
- National Research Council's Urban Stormwater Management in the United States report,
- International Stormwater Best Management Practices (BMP) database[29],
- Reports on the status and trends of water quality, and
- Various state and federal spatial datasets.

Literature searches focused on identifying recent information on the biology, ecology, distribution, status, and trends of the threatened and endangered species considered in this consultation. We will consider the results of these searches based on the quality of their study design, sample sizes and study results. Studies that relied on large sample sizes with small variances will be generally ranked higher than studies that relied on small sample sizes or large variances. We will use the first body of evidence to determine whether or to what degree the proposed general permits can insure that discharges and discharge-related activities into or near waters of the United States are not likely to jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of designated critical habitat that has been designated for those species.

29 http://www.bmpdatabase.org/

The second body of evidence relates to the programmatic analysis. To build this body of evidence, we will search for, gather, and analyze published and unpublished sources that examine the effectiveness of previous programs, and whether or to what degree the program has had: (1) adverse consequences for species that have been listed as endangered or threatened that have some dependency on the quality of waters of the United States, or (2) adverse consequences for the habitats on which those species depend. In particular, we considered information contained in EPA's ESA compliance study and the benchmark monitoring database provided by EPA. We also considered ESA Section 7 consultations on other EPA general Permits, species status reviews, listing documents, recovery plans, along with past and current research.

4 Action Area

The Action Area for this consultation consists of all waters of the U.S. in states, territories, and possessions receiving stormwater discharges, certain allowable non-stormwater discharges, and discharge-associated activities authorized by EPA under the MSGP. EPA retains NPDES permitting authority for four States (Idaho*, Massachusetts*, New Hampshire*, and New Mexico), the District of Columbia*, Puerto Rico*, the Pacific Territories* (i.e., American Samoa, Baker Island, Guam, Howland Island, Jarvis Island, Johnston Atoll, Midway Atoll, Navassa Island, the Commonwealth of the Northern Mariana Islands, Palmyra Atoll, and Wake Island), designated areas in Oklahoma and Texas*, Federally operated facilities in Colorado, Delaware*, Vermont, and Washington*, and Indian country[30] lands in 23 states (Table 3).

Table 3. States in which Federal-operated industrial facilities are included in the action area.

Alaska*	Kansas	Nevada	Texas*
Arizona	Louisiana*	North Dakota	Utah
California*	Michigan	Oklahoma	Washington*
Colorado	Minnesota	Oregon*	Wisconsin
Connecticut*	Montana	Rhode Island*	Wyoming
Iowa	Nebraska	South Dakota	

Because NMFS only has jurisdiction over marine, estuarine, and anadromous endangered and threatened species and designated critical habitat that has been designated for those species, this Opinion addresses the potential effects of MSGP-authorized discharges occurring in coastal areas (identified with an asterisk). While EPA also has permitting authority for Indian country lands in Alabama, Florida, Mississippi and North Carolina (i.e., EPA's Region 4), there are so few industrial stormwater discharges in these areas, EPA has determined that they will be covered under individual permits and not the MSGP. In summary, the areas covered in this Opinion include waters of the U.S. within the entire states of Massachusetts, New Hampshire, and Idaho, the District of Columbia, Puerto Rico, the Pacific territories, federally operated facilities in Washington and Delaware, Indian country lands in the states of Alaska, California, Connecticut, Louisiana, Oregon, Texas, and Washington, and oil and gas facilities in Texas. Waters of the U.S. (as defined in 40 CFR 122.2) are:

30 The term "Indian country" means: (a) all land within the limits of any Indian reservation under the jurisdiction of the United States Government, notwithstanding the issuance of any patent, and, including rights-of-way running through the reservation; (b) all dependent Indian communities within the borders of the United States whether within the original or subsequently acquired territory thereof, and whether within or without the limits of a state; and(c) all Indian allotments, the Indian titles to which have not been extinguished, including rights-of-way running through the same (18 USC 1151).

- All waters which are currently used, were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide;
- All interstate waters, including interstate "wetlands;"
- All other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, "wetlands," sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds the use, degradation, or destruction of which would affect or could affect interstate or foreign commerce including any such waters:
- Which are or could be used by interstate or foreign travelers for recreational or other purposes;
- From which fish or shellfish are or could be taken and sold in interstate or foreign commerce; or
- Which are used or could be used for industrial purposes by industries in interstate commerce;
- All impoundments of waters otherwise defined as waters of the United States under this definition;
- Tributaries of those waters described above;
- The territorial sea; and
- "Wetlands" adjacent to waters (other than waters that are themselves wetlands).

Waters of the U.S. extend to the outer reach of the three mile territorial sea, defined in section 502(8) of the Clean Water Act as the belt of the seas measured from the line of ordinary low water along that portion of the coast which is in direct contact with the open sea and the line marking the seaward limit of inland waters, and extending seaward a distance of three miles.

While EPA has permitting authority on Federal and Indian lands in certain states, some of these areas have been excluded from designated critical habitat designations for reasons of national defense or in support of United States-Tribal relationships. Effects within these areas are included in the action area for this Opinion with respect to jeopardy determinations (i.e., effects to the species), but cannot be considered in adverse modification determinations for designated critical habitat. However, the effects of discharges originating from excluded areas on *adjacent* designated critical habitat are considered in adverse modification determinations. For example, EPA has NPDES permitting authority for Indian country lands in California. Designated critical habitat for the southern Distinct Population Segment (DPS) of Pacific eulachon occurs on the Klamath River in California (76 FR 65323, October 20, 2011). The portion of the Klamath River which flows through the Yurok Reservation is excluded from the designated critical habitat. Accordingly, jeopardy determinations would consider effects of hypothetical MSGP discharges to the species over the extent of the Klamath River while adverse modification determinations would only consider effects to designated critical habitat elements essential to the conservation of the species on that portion of the Klamath River designated as designated critical habitat (i.e., not within the Yurok Reservation).

4.1 Spatial extent of the Action Area

The action area encompasses 3,927 sub-watersheds (Hydrological Unit Code 12 - HUC12) within 362 thousand square kilometers (approximately 140 thousand square miles) dispersed over 17 states and territories. Among these, 170 sub watersheds discharge directly to bays or the ocean where marine species under NMFS Jurisdiction may occur.

Table 4 Extent of the Action Area where EPA has Permitting Authority for the MSGP.

	All Watersheds			Coastal Watersheds		
State or Territory	**# HUC12 watersheds**	**Acres**	**Km²**	**# HUC12 watersheds**	**Acres**	**Km²**
East Coast						
Connecticut Indian Country Lands	2	35,363	143	1	17,182	70
District of Columbia	6	161,124	652			
Delaware Federally Operated Facilities	9	185,536	751	5	119,489	484
Massachusetts	226	5,205,997	21,079	26	544,455	2,204
Maine Indian Country Lands	13	329,342	1,333	2	87,435	354
New Hampshire	334	7,390,815	29,910	9	241,779	978
Puerto Rico						
Puerto Rico	219	2,206,073	8,928	52	433,246	1,753
Gulf Coast States						
Louisiana Indian Country Lands	2	63,348	256	1	35,248	143
Texas Indian Country Lands	2	66,057	267			
Texas Oil and Gas Facilities	477	19,901,547	80,539	27	5,022,965	20,327
West Coast						
Alaska Indian Country Lands	7	317,423	1,285	6	307,605	1,245
California Indian Country Lands	201	6,349,845	25,697	11	478,323	1,936
Idaho	2,573	56,696,234	229,446	5	89,294	361
Oregon Indan Country Lands	77	1,695,526	6,862	1	6,816	28
Washington Indian Country Lands and Federally Operated Facilities	246	8,162,553	33,033	27	576,597	2,331
Pacific Territories						
American Samoa	4	317,694	1,286	2	48,393	196
Guam	10	364,856	1,477	9	134,470	544
Northern Marianas	5	152,049	615	4	29,451	119

The distribution of HUC 12 watersheds on the Continental U.S. that are subject to MSGP discharges are illustrated in Figure 2, 3, and 4**Error! Reference source not found.** for the East, Gulf, and West Coasts, respectively. The entire extent of Puerto Rico and the Pacific Territories are potentially subject to MSGP discharges. According to the National Atlas, Indian Country Lands in Alaska include only the Annette Islands off South East Alaska.

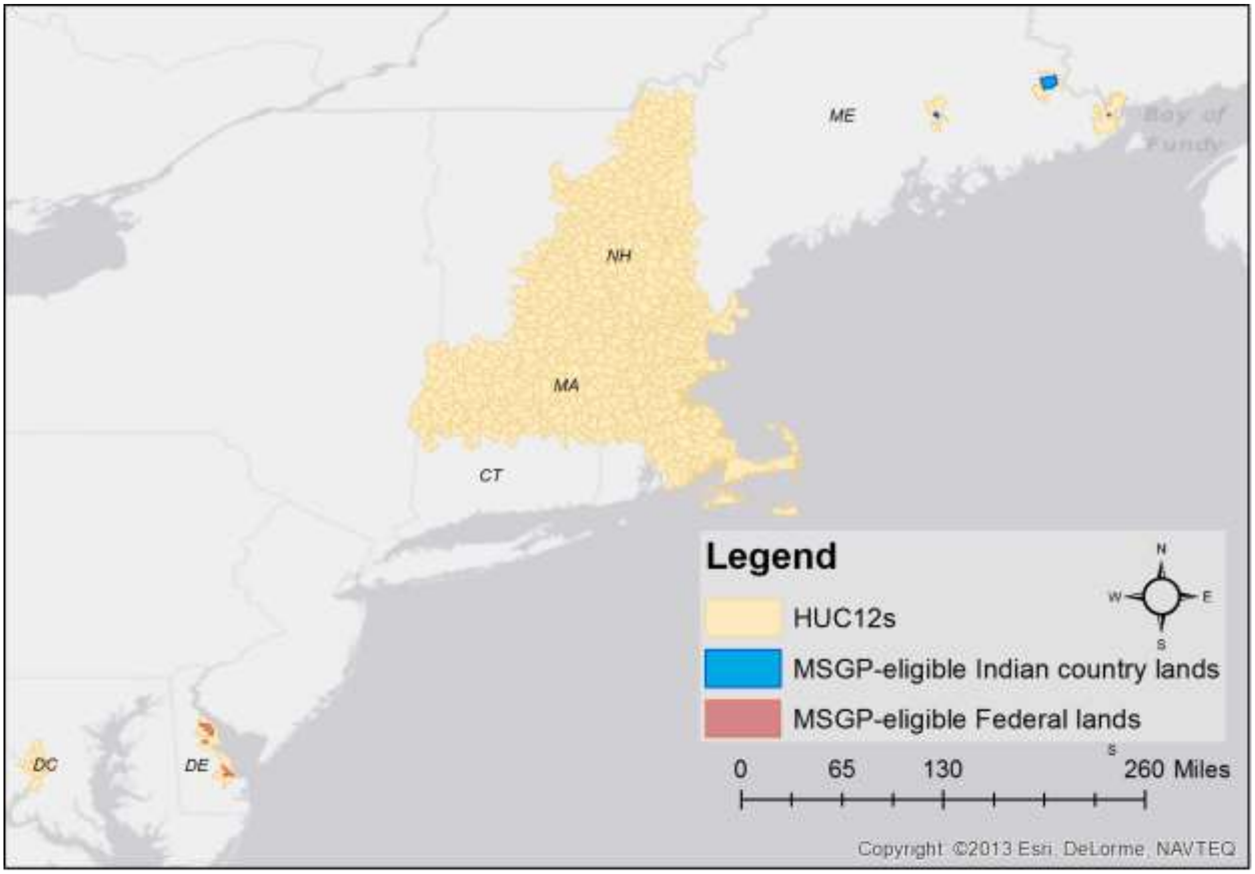

Figure 2 Map of East Coast HUC 12 watersheds potentially subject to MSGP discharges: Facilities in the District of Columbia (DC), Massachusetts (MA), or New Hampshire (NH), on Indian country lands in Maine (ME) or Connecticut (CT), or on Federal lands in Delaware (DE).

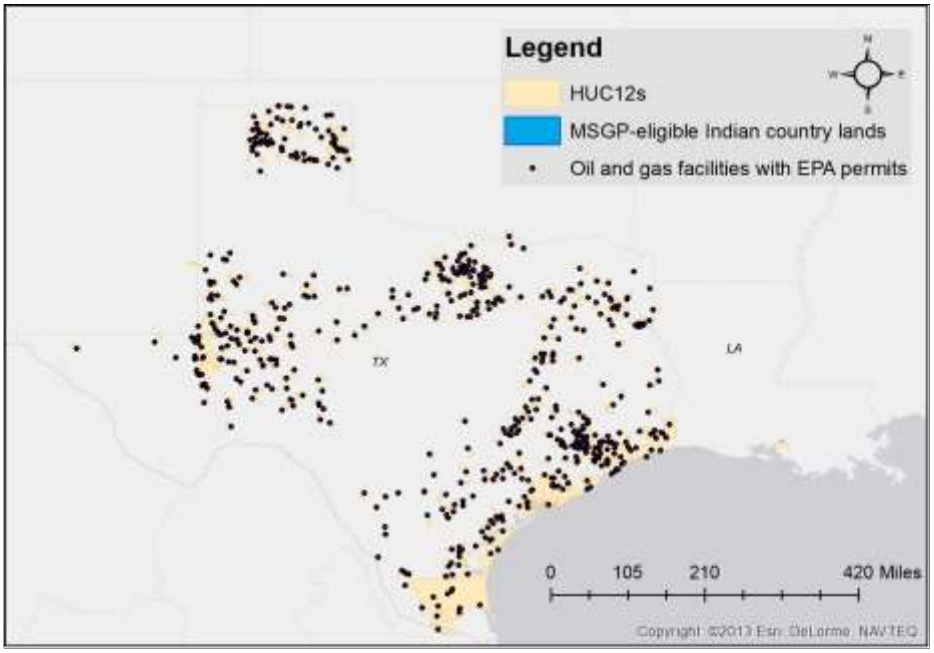

Figure 3 Map of Gulf Coast HUC 12 watersheds potentially subject to MSGP discharges: Facilities engaged in Oil and Gas activities in Texas (TX) or located on Indian country lands in Texas or Louisiana (LA).

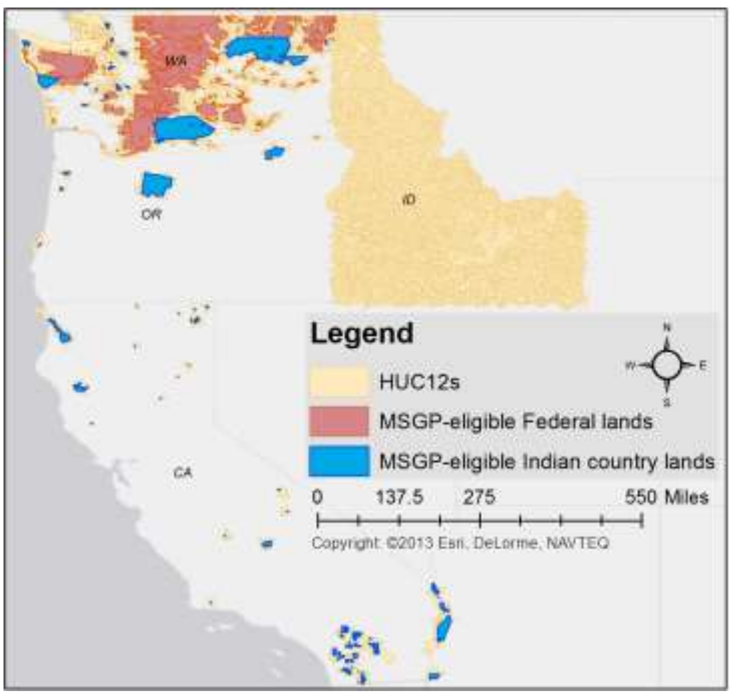

Figure 4 Map of West Coast HUC 12 watersheds subject to MSGP discharges: Facilities located in Idaho, on Indian country lands in California (CA), Oregon (OR), or Washington (WA), or located on Federal lands in Washington.

5 STATUS OF THE SPECIES AND DESIGNATED CRITICAL HABITAT

As described in the *Approach to the Assessment*, during the consultation we identify those endangered or threatened species[31] or designated critical habitat that may be affected by the proposed action. In order for a proposed action to be determined to not likely adversely affect species or designated critical habitat, all of the effects of that action must be expected to be discountable, insignificant or completely beneficial. Discountable effects are those that are extremely unlikely to occur. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Beneficial effects are contemporaneous positive effects without any adverse effects to the species or designated critical habitat.

The stormwater discharges authorized under the MSGP are influenced by the effectiveness of location-specific controls, are episodic in nature, and are variable in magnitude, duration, and constituent make up. Because the toxicity and physical intensity of exposures to stormwater stressors cannot be predicted, any species which co-occur with MSGP discharges are potentially adversely affected.

However, the effects of the MSGP are discountable for those threatened and endangered species and designated critical habitat that do not co-occur with the stressors of the action because they are extremely unlikely to be exposed to MSGP discharges. The MSGP is therefore not likely to adversely affect such species. These species include; 1) those with entirely foreign populations, 2) marine species which do not frequent shallow coastal waters, and 3) species with ranges or designated critical habitat PCEs and essential elements which do not occur along the coast or inland waters of states, territories, or other areas which may be affected by MSGP discharges. Accordingly, we have determined that the following species and designated critical habitat "are not likely to be adversely affected" by EPA's proposed MSGP because they and, where applicable, their associated designated critical habitat, do not co-occur with the stressors of the action. The effects of the MSGP are insignificant for those threatened and endangered species which will not experience significant exposures to stormwater discharges due to the extent to which they interact with shallow coastal waters. The species which are not considered further in this assessment due to discountable or insignificant effects are listed in Table 5.

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31 We use the word "species" as it has been defined in section 3 of the Endangered Species Act, which include "species, subspecies, and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature (16 U.S.C. 1533) ". Pacific salmon that have been listed as endangered or threatened were listed as "evolutionarily significant units (ESU) " which NMFS uses to identify distinct population segments (DPS) of Pacific salmon. Any ESU or DPS is a "species" for the purposes of the Endangered Species Act.

Table 5. Endangered and threatened species under NMFS jurisdiction and designated critical habitat which are extremely unlikely to be exposed to discharges authorized by the MSGP.

Reason	Common Name	Status*
Species with entirely foreign populations (discountable)	dolphin, Chinese River / baiji *(Lipotes vexillifer)*	Endangered
	dolphin, Indus River *(Platanista minor)*	Endangered
	porpoise, Gulf of California harbor / vaquita *(Phocoena sinus)*	Endangered
	whale, gray (*Eschrichtius robustus*)	Endangered
	whale, Southern right whale *(Eubalaena australis)*	Endangered
	seal, Mediterranean monk *(Monachus monachus)*	Threatened and Endangered populations
	seal, spotted (*Phoca largha*)	Threatened
	sturgeon, Adriatic (*Acipenser naccarii*)	Endangered
	sturgeon, Chinese (*Acipenser sinensis*)	Endangered
	sturgeon, European (*Acipenser sturio*)	Endangered
	sturgeon, Kaluga (Huso dauricus)	Endangered
	sturgeon, Sakhalin (*Acipenser mikadoi*)	Endangered
	totoaba (*Totoaba macdonaldi*)	Endangered
	largetooth sawfish (*Pristis pristis*)	Endangered
	sawfish, dwarf (*Pristis clavata*)	Proposed Endangered
	sawfish, green (*Pristis zijsron*)	Proposed Endangered
	sawfish, narrow (*Anoxypristis cuspidata*)	Proposed Endangered
Species which do not frequent shallow coastal waters and are therefore not likely to experience stormwater discharges (discountable)	blue whale (*Balaenoptera musculus*)	Endangered
	false killer whale (*Pseudorca crassidens*)	Endangered
	fin whale (*Balaenoptera physalus*)	Endangered
	sei whale (*Balaenoptera borealis*)	Endangered
	sperm whale (*Physeter macrocephalus*)	Endangered
Threatened or endangered species range and designated critical habitat does not occur along the coast or within inland waters of a state, territory, or other area which may be affected by EPA-MSGP authorized discharges (discountable)	smalltooth sawfish (*Pristis pectinata*)	Endangered
	Cook Inlet beluga whale (*Delphinapterus leucas*)	Endangered*
	bowhead whale (*Balaena mysticetus*)	Endangered
	bearded seal (*Erignathus barbatus*) Beringia	Proposed Threatened
	Guadalupe fur seal (*Arctocephalus townsendi*)	Threatened
	Hawaiian monk seal (*Monachus schauinslandi*)	Endangered*
	ringed seal (*Phoca hispida*)	Proposed Threatened
	Steller sea lion (*Eumetopias jubatus*) Western population	Endangered*
	Johnson's seagrass (*Halophila johnsonii*) *	Threatened
Species which would experience only insignificant exposures to stormwater discharges (insignificant)	Humpback Whale (*Megaptera novaeangliae*)	Endangered
	North Atlantic Right Whale (*Eubalaena glacialis*)*	Endangered

* Denotes species with designated critical habitat

The species listed in Table 5 are not considered further in this Opinion because they will not be directly or indirectly affected by actions authorized under the MSGP.

In addition, NMFS and the U.S. Fish and Wildlife Service have joint jurisdiction over sea turtles, gulf sturgeon and Atlantic salmon. To avoid redundancy, the U.S. Fish and Wildlife Service is generally responsible for endangered and threatened sea turtles above mean high water (when they are on their nesting beaches as opposed to when they are in or beyond the surf zone) and for Gulf sturgeon and Atlantic salmon when they are in fresh water (as opposed to when they are in estuarine or marine water). The EPA is the permitting authority on Indian Country lands within range of Gulf sturgeon but Indian Country lands within Gulf coast states are inland. While Gulf sturgeon may be affected by MSGP authorized actions within these states, the species is not considered further in this Opinion because any exposures would occur in freshwaters where NMFS does not have jurisdiction, coastal waters of Louisiana where EPA is not the NPDES permitting authority, or Region 4 states which are not covered under the MSGP.

5.1 Species and Designated critical habitat Likely to be Adversely Affected by the Proposed Action

In this section we describe the distribution, life history, status and designated critical habitat of the threatened and endangered species and designated critical habitat which occur within the action area and may be exposed to the stressors associated with stormwater discharges and experience direct or indirect effects of those exposures (Table 6).

Table 6. NMFS endangered and threatened species and designated critical habitat considered in this Opinion.

Species	ESA Status	Designated critical habitat	Recovery Plan
Non-Salmonid Anadromous Species			
Shortnose sturgeon (*Acipenser brevirostrum*)	E – 32 FR 4001	-- --	63 FR 69613
Gulf sturgeon (Page: 46 *Acipenser oxyrinchus desotoi*)	T – 56 FR 49653	68 FR 13370	Recovery Plan
Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*)			
- Gulf of Maine DPS	T – 77 FR 5880	-- --	-- --
- New York Bight DPS	E - 77 FR 5880	-- --	-- --
- Chesapeake Bay DPS	E - 77 FR 5880	-- --	-- --
- Carolina DPS	E – 77 FR 5914	-- --	-- --
- South Atlantic DPS	E – 77 FR 5914	-- --	-- --
Eulachon (*Thaleichthys pacificus*)	T – 75 FR 13012	76 FR 65323	-- --
Salmonids			
Atlantic Salmon – Gulf of Maine DPS	E – 74 FR 29344	74 FR 29300	70 FR 75473
salmon, Chinook (*Oncorhynchus tshawytscha*)			
- California coastal	T – 64 FR 50393	70 FR 52488	-- --
- Central Valley spring-run	T – 64 FR 50393	70 FR 52488	79 FR 42504
- Lower Columbia River	T – 64 FR 14308	70 FR 52630	78 FR 41911

Species	ESA Status	Designated critical habitat	Recovery Plan
- Upper Columbia River spring-run	E – 64 FR 14308	70 FR 52630	72 FR 57303
- Puget Sound	T – 64 FR 14308	70 FR 52630	72 FR 2493
- Sacramento River winter-run	E – 59 FR 440	58 FR 33212	79 FR 42504
- Snake River fall-run	T – 59 FR 42529	58 FR 68543	-- --
- Snake River spring/summer-run	T – 59 FR 42529	64 FR 57399	-- --
- Upper Willamette River	T – 64 FR 14308	70 FR 52630	76 FR 52317b
salmon, chum (*Oncorhynchus keta*)			
- Columbia River	T – 64 FR 14507	70 FR 52630	78 FR 41911
- Hood Canal summer-run	T – 64 FR 14507	70 FR 52630	72 FR 29121
salmon, coho (*Oncorhynchus kisutch*)			
- Central California coast	E – 61 FR 56138	65 FR 7764	-- --
- Oregon coast	T – 63 FR 42587	64 FR 24049	78 FR 41911
- Southern Oregon & Northern California coasts	T – 62 FR 24588		
- Lower Columbia River	T – 70 FR 37160	78 FR 2725 (proposed)	78 FR 41911
salmon, sockeye (*Oncorhynchus nerka*)			
- Ozette Lake	T – 64 FR 14528	70 FR 52630	74 FR 24706
- Snake River	E – 56 FR 58619	58 FR 68543	-- --
trout, steelhead (*Oncorhynchus mykiss*)			
- California Central Valley	T – 71 FR 834	70 FR 52488	79 FR 42504
- Central California coast	T – 71 FR 834	70 FR 52488	-- --
- South-Central California coast	T – 71 FR 834	70 FR 52488	-- --
- Southern California	E – 71 FR 834	70 FR 52488	-- --
- Northern California	T – 71 FR 834	70 FR 52488	-- --
- Lower Columbia River	T – 71 FR 834	70 FR 52630	74 FR 50165
- Middle Columbia River	T – 71 FR 834	70 FR 52630	-- --
- Upper Columbia River	T – 74 FR 42605	70 FR 52630	72 FR 57303
- Upper Willamette River	T – 71 FR 834	70 FR 52630	76 FR 52317b
- Snake River Basin	T – 71 FR 834	70 FR 52630	-- --
- Puget Sound	T – 72 FR 26722	78 FR 2725 (proposed)	-- --
Corals			
Elkhorn Coral (*Acropora palmata*)	T – 71 FR 26852	-- --	-- --
Staghorn Coral (*Acropora cervicornis*)	T – 71 FR 26852	-- --	-- --
Mycetophyllia ferox	T – 79 FR 54122	-- --	-- --
Pillar Coral (*Dendrogyra cylindrus)*	T – 79 FR 54122	-- --	-- --
Orbicella annularis	T – 79 FR 54122	-- --	-- --
Mountainous Star Coral (*Orbicella faveolata)*	T – 79 FR 54122	-- --	-- --
Boulder Star Coral (*Orbicella franksi)*	T – 79 FR 54122	-- --	-- --
Lobed Star Coral (*Acropora globiceps)*	T – 79 FR 54122	-- --	-- --

Species	ESA Status	Designated critical habitat	Recovery Plan
Acropora jacquelineae	T – 79 FR 54122	-- --	-- --
Acropora lokani	T – 79 FR 54122	-- --	-- --
Acropora pharaonis	T – 79 FR 54122	-- --	-- --
Acropora retusa	T – 79 FR 54122	-- --	-- --
Acropora rudis	T – 79 FR 54122	-- --	-- --
Acropora speciose	T – 79 FR 54122	-- --	-- --
Acropora tenella	T – 79 FR 54122	-- --	-- --
Anacropora spinosa	T – 79 FR 54122	-- --	-- --
Euphyllia paradivisa	T – 79 FR 54122	-- --	-- --
Isopora crateriformis	T – 79 FR 54122	-- --	-- --
Montipora australiensis	T – 79 FR 54122	-- --	-- --
Pavona diffluens	T – 79 FR 54122	-- --	-- --
Porites napopora	T – 79 FR 54122	-- --	-- --
Seriatopora aculeate	T – 79 FR 54122	-- --	-- --
Abalone			
White Abalone (Haliotis sorenseni)	E – 66 FR 29046	Not prudent	73 FR 62257
Black Abalone (Haliotis cracherodii)	E – 74 FR 1937	76 FR 66806	-- --
Marine Mammals – Cetaceans			
*Southern Resident Killer Whale (*Orcinus orca*)*	E – 70 FR 69903	71 FR 69054	73 FR 4176
Sea Turtles			
*Green Turtle (*Chelonia mydas*)*	E – 43 FR 32800	63 FR 46693	63 FR 28359
*Hawksbill Turtle (*Eretmochelys imbricata)	E – 35 FR 8491	63 FR 46693	57 FR 38818
*Kemp's Ridley Turtle (*Lepidochelys kempii*)*	E – 35 FR 18319	-- --	75 FR 12496
Olive Ridley Turtle (*Lepidochelys olivacea*) Pacific Coast of Mexico breeding populations *all other populations*	E – 43 FR 32800 T – 43 FR 32800	-- --	63 FR 28359
Leatherback Turtle (*Dermochelys coriacea*)	E – 61 FR 17	44 FR 17710	63 FR 28359
Loggerhead Turtle (*Caretta caretta*) – Northwest Atlantic DPS North Pacific DPS	E – 76 FR 58868	-- --	63 FR 28359

Species	ESA Status	Designated critical habitat	Recovery Plan
	Marine Fish		
Bocaccio *(Sebastes paucispinis)*	E – 75 FR 22276	78 FR 47635 (proposed)	-- --
Canary Rockfish (*Sebastes pinniger*)	T – 75 FR 22276	78 FR 47635 (proposed)	-- --
Yellow Eye Rockfish (*Sebastes ruberrimus*)	T – 75 FR 22276	78 FR 47635 (proposed)	-- --
Scalloped Hammerhead (*Sphyrna lewini*)		-- --	-- --
Easter Pacific DPS	E – 79 FR 38213		
Central and Southwest Atlantic DPS	T – 79 FR 38213		

5.1.1 Cetaceans

5.1.1.1 Southern Resident Killer Whale

Killer whales (or orcas) are distributed worldwide, but populations are isolated by region and ecotype (i.e., different morphology, ecology, and behavior). Southern Resident killer whales occur in the inland waterways of Puget Sound, Strait of Juan de Fuca, and Southern Georgia Strait during the spring, summer and fall. During the winter, they move to coastal waters primarily off Oregon, Washington, California, and British Columbia. The EPA has NPDES permitting authority for Federally operated facilities and tribal lands within the state of Washington, and for tribal lands in Oregon and California.

The DPS was listed as endangered under the ESA on November 18, 2005 (70 FR 69903). We used information available in the final rule, the 2012 Status Review (NMFS 2013b) (NMFS 2012) and the 2011 Stock Assessment Report (NMFS 2014) to summarize the status of this species, as follows.

Life history

Southern Resident killer whales are geographically, matrilineally, and behaviorally distinct from other killer whale populations (70 FR 69903). The DPS includes three large, stable pods (J, K, and L), which occasionally interact (Parsons et al. 2009). Most mating occurs outside natal pods, during temporary associations of pods, or as a result of the temporary dispersal of males (Pilot et al. 2010). Males become sexually mature at 10 – 17 years of age. Females reach maturity at 12 – 16 years of age and produce an average of 5.4 surviving calves during a reproductive life span of approximately 25 years. Mothers and offspring maintain highly stable, life-long social bonds, and this natal relationship is the basis for a matrilineal social structure. They prey upon salmonids, especially Chinook salmon (Hanson et al. 2010).

Population dynamics

The most recent abundance estimate for the Southern Resident DPS is 87 whales in 2012. This represents an average increase of 0.4 percent annually since 1982 when there were 78 whales. Population abundance has fluctuated during this time with a maximum of approximately 100 whales in 1995 (NMFS 2013b). As compared to stable or growing populations, the DPS reflects a smaller percentage of juveniles and lower fecundity (NMFS 2014) and has demonstrated weak growth in recent decades.

Status

The Southern Resident killer whale DPS was listed as endangered in 2005 in response to the population decline from 1996 to 2001, small population size, and reproductive limitations (i.e., few reproductive males and delayed calving). Current threats to its survival and recovery include: contaminants, vessel traffic, and reduction in prey availability. Chinook salmon populations have declined due to degradation of habitat, hydrology issues, harvest, and hatchery introgression; such reductions may require an increase in foraging effort. In addition, these prey contain environmental pollutants (e.g., flame retardants; Polychlorinated biphenyls - PCBs; and dichlorodiphenyltrichloroethane - DDT). These contaminants become concentrated at higher trophic levels and may lead to immune suppression or reproductive impairment (70 FR 69903). The inland waters of Washington and British Columbia support a large whale watch industry, commercial shipping, and recreational boating; these activities generate underwater noise, which may mask whales' communication or interrupt foraging. The factors that originally endangered the species persist throughout its habitat: contaminants, vessel traffic, and reduced prey. The DPS's resilience to future perturbation is reduced as a result of its small population size (N = 86); however, it has demonstrated the ability to recover from smaller population sizes in the past and has shown an increasing trend over the last several years. NMFS is currently conducting a status review prompted by a petition to delist the DPS based on new information, which indicates that there may be more paternal gene flow among populations than originally detected (Pilot et al. 2010).

Designated critical habitat

On November 29, 2006, NMFS designated critical habitat for the Southern Resident killer whale (71 FR 69054). The designated critical habitat consists of approximately 6,630 km^2 in three areas: the Summer Core Area in Haro Strait and waters around the San Juan Islands; Puget Sound; and the Strait of Juan de Fuca. It provides the following physical and biological features: water quality to support growth and development; prey species of sufficient quantity, quality and availability to support individual growth, reproduction and development, as well as overall population growth; and inter-area passage conditions to allow for migration, resting, and foraging.

5.1.2 Salmonids

The action area for this consultation contains designated critical habitat for anadromous salmonids. NMFS has identified PCEs of designated critical habitat for each life stage (e.g., migration, spawning, rearing, and estuary) common for each species. To fully understand the conservation role of these habitats, specific physical and biological habitat features (e.g., water temperature, water quality, forage, natural cover, etc.) were identified for each life stage. Specifically, during all freshwater life stages, salmonids require cool water that is free of contaminants. During the juvenile life stage, salmonids also require stream habitat that provides excess forage (i.e., prey abundance). Besides potential toxicity, water free of contaminants is important as contaminants can disrupt normal behavior necessary for successful migration, spawning, and juvenile rearing. Sufficient forage is necessary for juveniles to maintain growth that reduces freshwater predation mortality, increases overwintering success, initiates smoltification, and increases ocean survival. Natural cover such as submerged and overhanging large wood and aquatic vegetation provides shelter from predators, shades freshwater to prevent increase in water temperature, and creates important side channels. A description of the past, ongoing, and continuing activities that threaten the functional condition of PCEs and their attributes are described in the Environmental Baseline section of this Opinion. NMFS has identified six common PCEs for 7 California listed Chinook salmon and steelhead (70 FR 52488, Sept. 2, 2005), 12 ESUs of Oregon, Washington, and Idaho salmon (chum, sockeye, Chinook) and steelhead (70 FR 52630, Sept. 2, 2005), and for the Oregon Coast coho salmon (73 FR 7816, Feb. 11, 2008). They are:

(1) Freshwater spawning sites with water quantity and quality, and suitable substrate size as attributes necessary to support spawning, incubation and larval development;

(2) Freshwater rearing sites with the following attributes: (i) Water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; (ii) Water quality and forage supporting juvenile development; and (iii) Natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.

(3) Freshwater migration corridors free of obstruction and excessive predation with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival.

(4) Estuarine areas free of obstruction and excessive predation with:

(i) Water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater; (ii) Natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels; and (iii)

Juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation.

(5) Nearshore marine areas free of obstruction and excessive predation with:

(i) Water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and (ii) Natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels.

(6) Offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation.

NMFS similarly developed the following list of species habitat requirements and PCEs for coho salmon ESUs (64 FR 24049, May 5, 1999). They are:

1. Juvenile summer and winter rearing areas,

2. Juvenile migration corridors,

3. Areas for growth and development to adulthood,

4. Adult migration corridors, and

5. Spawning areas. Within these areas, essential habitat attributes of coho salmon designated critical habitat include adequate: (1) substrate, (2) water quality, (3) water quantity, (4) water temperatures, (5) water velocity, (6) cover/shelter, (7) food, (8) riparian vegetation, (9) space, and (10) safe passage conditions. Riparian vegetation refers to its role in providing essential habitat for coho salmon such as instream woody debris and submerged vegetation for holding and shelter, low water temperature through shading, functional channel bottom substrate for development of eggs and alevins by stabilizing stream banks and capturing fine sediment in runoff, and food by providing nutrients to streams and production of terrestrial insects.

5.1.2.1 Protective regulations for threatened salmonid species

Since 1997 NMFS promulgated a total of 29 limits to the ESA section 9(a) take prohibitions for 21 threatened Pacific salmon and steelhead Evolutionarily Significant Units (ESUs) or Distinct Populations Segments (DPSs)(62 FR 38479, July 18, 1997; 65 FR 42422, July 10, 2000; 65 FR 42485, July 10, 2000; 67 FR 1116, January 9, 2002; 73 FR 7816, February 11, 2008). On June 28, 2005, as part of the final listing determinations for 16 ESUs of West Coast salmon, NMFS amended and streamlined the 4(d) protective regulations for threatened salmon and steelhead (70 FR 37160). NMFS took this action to provide appropriate flexibility to ensure that fisheries and artificial propagation programs are managed consistently with the conservation needs of threatened salmon and steelhead. Under this change, the section 4(d) protections apply to natural and hatchery fish with an intact adipose fin, but not to listed hatchery fish that have had their adipose fin removed prior to release into the wild. Throughout this section discussing listed salmonids, we use the word "species" to apply to distinct population segments, DPSs, and evolutionary significant units, ESUs.

5.1.2.2 Atlantic salmon, Gulf of Maine DPS

The three generally recognized groups of Atlantic salmon (North American, European, and Baltic) range from northeastern North America through portions of the North Atlantic Ocean to Europe and northwestern Russia in both fresh and saltwater habitats. The North American group historically ranged from northern Quebec southeast to Newfoundland and southwest to Long Island Sound. It included Canadian populations and U.S. populations, including the listed Gulf of Maine (GOM) DPS. The GOM DPS was first listed as endangered by the USFWS and NMFS on November 17, 2000 (65 FR 69459). The listing was refined by the Services on June 19, 2009 (74 FR 29344;) to include all anadromous Atlantic salmon whose freshwater range occurs in the watersheds from the Androscoggin River northward along the Maine coast to the Dennys River, and wherever these fish occur in the estuarine and marine environment. EPA has NPDES permitting authority on tribal lands within Maine. The FWS has jurisdiction over this species in freshwater, so the NMFS jurisdiction is limited to potential MSGP-authorized discharges from the coastal lands belonging to the Passamoquoddy Tribe at Pleasant Point. We used information available in the 2006 Status Review (Fay et al. 2006) and the Final Rule to List the Expanded Gulf of Maine DPS as Endangered Under the ESA (74 FR 29344) to summarize the status of the GOM DPS, as follows.

Life history

Adult Atlantic salmon typically spawn in early November and juveniles spend approximately two years feeding on small invertebrates and occasionally small vertebrates in freshwater until they weigh approximately two ounces and are six inches in length. Smoltification (the physiological and behavioral changes required for the transition to salt water) usually occurs at age two for the GOM DPS. The GOM DPS migrates more than 4,000 km in the open ocean to reach feeding areas in the Davis Strait between Labrador and Greenland. Adult salmon feed opportunistically and their diet is composed primarily of other fish. The majority of GOM DPS salmon (about 90 percent) spend two winters at sea before reaching maturity and returning to their natal rivers, with the remainder spending one or three winters at sea. At maturity, GOM DPS salmon typically weigh between 8 to 15 pounds and average 30 inches in length.

Population dynamics

Historically, the GOM DPS population was several orders of magnitude larger than contemporary populations. Foster and Atkins (Foster and Atkins 1869) estimated that roughly 100,000 adult salmon returned to the Penobscot River alone before the river was dammed, whereas estimates of abundance for the entire GOM DPS exceeded 5,000 individuals in only four years from 1967 to 2007. From 2001 to 2007, abundance has been estimated between 819 (in 2002) and 1,416 (in 2004) individuals. Abundance was estimated at 1,014 individuals in 2007, the most recent year for which abundance records are available.

Status

The GOM DPS of Atlantic salmon was listed as endangered in 2000 in response to population decline caused by many factors, including overexploitation, degradation of water quality, and damming of rivers, all of which remain persistent threats. Atlantic salmon in the GOM DPS currently exhibit critically low spawner abundance, poor marine survival, and are still confronted with a variety of threats, including: poor water quality, land and water use practices, habitat loss, predation, incidental capture and poaching, genetic threats from hatchery programs, and climate change. The abundance of Atlantic salmon in the GOM DPS has been low and, in general, has been in decline over the past several decades. The proportion of fish of natural origin to hatchery-reared fish is very small (approximately 10%) and is continuing to decline. The conservation hatchery program has assisted in slowing the decline and helping to stabilize populations at low levels, but has not contributed to an increase in the overall abundance of salmon and has not been able to halt the decline of the naturally reared component of the GOM DPS. The 2006 status review reports an estimated extinction risk of 19% to 75% within the next 100 years for the GOM DPS, even when current levels of hatchery supplementation are considered. Even with current conservation efforts, returns of adult Atlantic salmon to the GOM DPS rivers remain extremely low. Based on the information above, the species would likely have a low resilience to additional perturbations.

Designated critical habitat

On June 19, 2009, NMFS and the USFWS defined designated critical habitat for Atlantic salmon (74 FR 29300). The designated critical habitat includes all anadromous Atlantic salmon streams whose freshwater range occurs in watersheds from the Androscoggin River northward along the Maine coast northeastward to the Dennys River, and wherever these fish occur in the estuarine and marine environment. PCEs were identified within freshwater and estuarine habitats of the occupied range of the GOM DPS and include sites for spawning and incubation, juvenile rearing, and migration. Designated critical habitat and PCEs were not designated within marine environments because of the limited of the physical and biological features that the species uses during the marine phase of its life.

5.1.2.3 Chinook salmon (9 ESUs)

We used information available in the 2005 West Coast salmon and steelhead status review (Good et al. 2005), various salmon Evolutionarily Significant Unit (ESU) listing documents, and biological opinions (NMFS 2008a, b, 2012a) to summarize the status of the species.

Chinook salmon are the largest of the Pacific salmon and historically ranged from the Ventura River in California to Point Hope, Alaska in North America, and in northeastern Asia from Hokkaido, Japan to the Anadyr River in Russia in both fresh and saltwater habitats (Healey

1991). This range encompasses the coast and inland waters of Washington State, Oregon, northern California and Idaho in the action area where EPA has NPDES permitting authority. In freshwater, Chinook salmon prefer streams that are deeper and larger than those used by other Pacific salmon species.

Life history

Chinook salmon exhibit varied and complex life history strategies and can generally be described as one of two types: “stream-type” or “ocean type”. Stream-type Chinook salmon ESUs reside in freshwater for a year or more following emergence before migrating to salt water; ocean-type Chinook salmon ESUs migrate to the ocean within their first year and typifies populations north of 56ºN (Healey 1991). Stream-type ESUs normally return in late winter and early spring (spring-run) as immature adults and reside in deep pools during summer before spawning in fall. Ocean-type ESUs migrate to the ocean within their first year (sub-yearlings) and usually return as full mature adults in fall (fall-run) and spawn soon after river entry. Temperature and stream flow can significantly influence the timing of migrations and spawning, as well as the selection of spawning habitat (Geist et al. 2008, Hatten et al. 2009). All Chinook salmon are semelparous (i.e. they die after spawning).

The timing of return to fresh water, and ultimately spawning, often provides a temporal isolating mechanism for populations with different life histories. Return timing is often related to spawning location. Thus, differences in the timing of spawning migration also serve as a geographic isolating mechanism. Fall-run Chinook salmon generally spawn in the mainstem of larger rivers and are less dependent on flow, although early autumn rains and a drop in water temperature often provide cues for movements to spawning areas. Spring-run Chinook salmon take advantage of high flows from snowmelt to access the upper reaches of rivers.

Generally, Chinook salmon outmigrants (smolts) are about 2 to 5 inches long when they enter saline (often brackish) waters. The process of smoltification enables salmon to adapt to the ocean environment. Several factors can affect smoltification process, not only at the interface between fresh water and salt water, but higher in the watershed as the process of transformation begins long before fish enter salt waters. These factors include exposure to chemicals such as heavy metals and elevated water temperatures (Wedemeyer et al. 1980).

Chinook salmon feed on a variety of prey organisms depending upon life stage. In freshwater and brackish waters Chinook salmon primarily feed on small invertebrates and vertebrates. The diet of adult oceanic Chinook salmon is comprised primarily of fish.

Designated critical habitat

Areas designated as designated critical habitat are important for the species’ overall conservation by protecting quality growth, reproduction, and feeding. At the time of designation, PCEs are identified and include sites necessary to support one or more Chinook salmon life stage(s). These

PCEs will be identified for each ESU below, but in general they may include freshwater spawning sites, freshwater rearing sites, freshwater migration corridors, nearshore marine habitat, and estuarine areas. Physical or biological features that characterize these sites will also be discussed for each ESU separately, but they may include water quality and quantity, natural cover, forage, adequate passage conditions, and floodplain connectivity. The designated critical habitat designation identified for each ESU contains additional details on the areas included as part of the designation, and the areas that were excluded from designation.

5.1.2.4 Chum salmon (2 ESUs)

We used information available in status reviews (NMFS 1999, Good et al. 2005), various listing documents, and biological opinions (NMFS 2012a) to summarize the status of the species.

Because their range extends farther along the shores of the Arctic Ocean than other Pacific salmonid, chum salmon have the widest natural geographic and spawning distribution of the Pacific salmonids. Chum salmon have been documented to spawn from Korea and the Japanese island of Honshu, east around the rim of the North Pacific Ocean to Monterey Bay, California. This range encompasses the coast and inland waters of Alaska, Washington State, Oregon, and northern California of the action area where EPA has NPDES permitting authority.

Historically, chum salmon were distributed throughout the coastal regions of western Canada and the U.S. Presently, major spawning populations occur as far south as Tillamook Bay on the northern Oregon coast.

Life history

In general, North American chum salmon migrate north along the coast in a narrow coastal band that broadens in southeastern Alaska. Chum salmon usually spawn in the lower reaches of rivers during summer and fall. Redds are dug in the mainstem or in side channels of rivers from just above tidal influence to nearly 100 km from the sea. The time to hatching and emergence from the gravel redds are influenced by dissolved oxygen, gravel size, salinity, nutritional conditions, behavior of alevins in the gravel, and incubation temperature (Bakkala 1970, Schroder and Duher 1977, Salo 1991). Chum salmon juveniles use shallow, low flow habitats for rearing that include inundated mudflats, tidal wetlands and their channels, and sloughs. The duration of estuarine residence for chum salmon juveniles are known for only a few estuaries. Observed residence time ranged from 4 to 32 days, with about 24 days as the most common.

Immature salmon distribute themselves widely over the North Pacific Ocean and maturing adults return to the home streams at various ages, usually at two to five years of age, and in some cases up to seven years (Bigler 1985). This ocean-type migratory behavior contrasts with the stream-type behavior of some other species in the genus *Oncorhynchus* (e.g., steelhead, coho, and most types of Chinook and sockeye salmon). Stream-type salmonids usually migrate to sea at a larger size, after months or years of freshwater rearing. Thus, survival and growth for juvenile chum salmon depend less on freshwater conditions than on favorable estuarine conditions. Another behavioral difference between chum salmon and other salmonid species is that chum salmon form schools. Presumably, this behavior reduces predation (Pitcher 1986) especially if fish movements are synchronized to swamp predators (Miller and Brannon 1982). All chum salmon are semelparous (i.e., they die after spawning) and exhibit obligatory anadromy (i.e., there are no recorded landlocked or naturalized freshwater populations; they must spend portions of their lives in both salt and freshwater habitats).

Chum salmon feed on a variety of prey organisms depending upon life stage and size. In freshwater Chum salmon feed primarily on small invertebrates; in saltwater, their diet consists of copepods, tunicates, mollusks, and fish.

Designated critical habitat

Areas designated as designated critical habitat are important for the species' overall conservation by protecting quality growth, reproduction, and feeding. At the time of designation, PCEs are identified and include sites necessary to support one or more chum salmon life stage(s). For both ESUs discussed below, PCEs include freshwater spawning, rearing, and migration areas; estuarine and nearshore marine areas free of obstructions; and offshore marine areas with good water quality. The physical or biological features that characterize these sites include water quality and quantity, natural cover, forage, adequate passage conditions, and floodplain connectivity. The designated critical habitat designation identified for each ESU contains additional details on the areas included as part of the designation, and the areas that were excluded from designation.

5.1.2.5 Coho salmon (4 ESUs)

We used information available in status reviews (Good et al. 2005, NMFS 2011a, b, c), various listing documents, and biological opinions (NMFS 2012a) to summarize the status of the species.The species was historically distributed throughout the North Pacific Ocean from central California to Point Hope, Alaska, through the Aleutian Islands, and from the Anadyr River, Russia, south to Hokkaido, Japan. This range encompasses the coast and inland waters of Alaska, Washington State, Oregon, and northern California of the action area where EPA has NPDES permitting authority.

Life history

Coho salmon exhibit a stream-type life history. Most coho salmon enter rivers between September and February. In many systems, coho salmon wait to enter until fall rainstorms have provided the river with sufficiently strong flows and depth. Coho salmon spawn from November to January, and occasionally into February and March. Some spawning occurs in third-order streams, but most spawning activity occurs in fourth- and fifth-order streams with gradients of 3% or less. After fry emerge in spring, they disperse upstream and downstream to establish and defend territories weak water currents such as backwaters and shallow areas near stream banks. Juveniles rear in these areas during the spring and summer. In early fall juveniles move to river margins, backwater, and pools. During winter juveniles typically reduce feeding activity and growth rates slow down or stop. By March of their second spring, juveniles feed heavily on insects and crustaceans and grow rapidly before smoltification and outmigration (Olegario 2006). Relative to species such as chum salmon, Chinook salmon, and steelhead, coho salmon smolts usually spend a short time (one to three days) in the estuary with little feeding (Thorpe 1994, Miller and Sadro 2003). After entering the ocean, immature coho salmon initially remain in nearshore waters close to the parent stream. North American coho salmon will migrate north along the coast in a narrow coastal band that broadens in southeastern Alaska. During this migration, juvenile coho salmon tend to occur in both coastal and offshore waters.

Along the Oregon/California coast, coho salmon primarily return to rivers to spawn as three-year olds, having spent approximately 18 months rearing in fresh water and 18 months in salt water. In some streams, a smaller proportion of males may return as two-year olds. The presence of two-year old males can allow for substantial genetic exchange between brood years. The relatively fixed three-year life cycle exhibited by female coho salmon limits demographic interactions between brood years. This makes coho salmon more vulnerable to environmental perturbations than other salmonids that exhibit overlapping generations, i.e., the loss of a coho salmon brood year in a stream is less likely than for other Pacific salmon to be reestablished by females from other brood years. All coho salmon are semelparous and anadromous.

Coho salmon feed on a variety of prey organisms depending upon life stage and size. While at sea, coho salmon tend to eat fish including herring, sand lance, sticklebacks, sardines, shrimp and surf smelt. While in estuaries and in fresh water coho salmon are significant predators of Chinook, pink, and chum salmon, as well as aquatic and terrestrial insects. Smaller fish, such as fry, eat chironomids, plecoptera and other larval insects, and typically use visual cues to find their prey.

5.1.2.6 Sockeye salmon (2 ESUs)

We used information available in the status review (Good et al. 2005), various listing documents, and biological opinions (NMFS 2012a) to summarize the status of the species.Sockeye salmon occur in the North Pacific and Arctic oceans and associated freshwater systems. In North America, the species ranges north from the Klamath River in California to Bathurst Inlet in the Canadian Arctic. In Asia sockeye salmon range from northern Hokkaido in Japan north to the Anadyr River in Siberia. The largest populations occur north of the Columbia River.

Life history

Most sockeye salmon exhibit a lake-type life history (i.e., they spawn and rear in or near lakes), though some salmon exhibit a river-type life history. Spawning generally occurs in late summer and fall, but timing can vary greatly among populations. In lakes, salmon commonly spawn along “beaches” where underground seepage provides fresh oxygenated water. Incubation is a function of water temperature, but generally lasts between 100 to 200 days (Burgner 1991).

Sockeye salmon fry primarily rear in lakes; river-emerged and stream-emerged fry migrate into lakes to rear. Juvenile sockeye salmon generally rear in lakes from one to three years after emergence, though some river-spawned salmon may migrate to sea in their first year. Juvenile sockeye salmon feeding behaviors change as they transition through life stages after emergence to the time of smoltification. In the early fry stage from spring to early summer, juveniles forage exclusively in the warmer littoral (i.e., shoreline) zone where they depend mostly on fly larvae and pupae, copepods, and water fleas. In summer, underyearling sockeye salmon move from the littoral habitat to a pelagic (i.e., open water) existence where they feed on larger zooplankton; however, flies may still make up a substantial portion of their diet. Older and larger fish may also prey on fish larvae. Distribution in lakes and prey preference is a dynamic process that changes daily and yearly depending on many factors, including: water temperature; prey abundance; presence of predators and competitors; and size of the juvenile. Peak emigration to the ocean occurs in mid-April to early May in southern sockeye populations (<52ºN latitude) and as late as early July in northern populations (62ºN latitude) (Burgner 1991). Adult sockeye salmon return to their natal lakes to spawn after spending one to four years at sea. The diet of adult salmon consists of amphipods, copepods, squid, and other fish.

Certain populations of *O. nerka* become resident in the lake environment and are referred to as "kokanee". Kokanee and sockeye often co-occur in many interior lakes, where access to the sea is possible but energetically costly; kokanee are rarely found in coastal lakes, where the migration to sea is relatively short and energetic costs are minimal. In some cases a single population will give rise to both the anadromous and freshwater life history form. Both sockeye and kokanee are semelparous.

5.1.2.7 Steelhead trout (11 DPSs)

We used information available in the 2005 West Coast salmon and steelhead status review (Good et al. 2005), various salmon ESU listing documents, and biological opinions (NMFS 2012a) to summarize the status of the species.Steelhead is the common name of the anadromous form of O. mykiss. They are a Pacific salmonid with freshwater habitats that include streams extending from northwestern Mexico to Alaska in North America to the Kamchatka peninsula in Russia. Non-anadromous O. mykiss do not migrate to the ocean and remain in freshwater all their lives. These fish are commonly called rainbow trout.

Life history

Steelhead have a longer run time than other Pacific salmonids and do not tend to travel in large schools. They can be divided into two basic run-types: the stream-maturing type (summer steelhead) and the ocean-maturing type (winter steelhead). Summer steelhead enter fresh water as sexually immature adults between May and October (Nickelson et al. 1992, Busby et al. 1996) and hold in cool, deep pools during summer and fall before moving to spawning sites as mature adults in January and February (Barnhart 1986, Nickelson et al. 1992). Winter steelhead return to fresh water between November and April as sexually mature adults and spawn shortly after river entry (Nickelson et al. 1992, Busby et al. 1996). Steelhead typically spawn in small tributaries rather than large, mainstem rivers and spawning distribution often overlaps with coho salmon, though steelhead tend to prefer higher gradients (generally two to seven percent, but up to 12 percent or more) and their distributions tend to extend further upstream than coho salmon. Summer steelhead commonly spawn higher in a watershed than do winter steelhead, sometimes even using ephemeral streams from which juveniles are forced to emigrate as flows diminish. Fry usually inhabit shallow water along banks and stream margins of streams (Nickelson et al. 1992) and move to faster flowing water such as riffles as they grow. Some older juveniles move downstream to rear in larger tributaries and mainstem rivers (Nickelson et al. 1992). In Oregon and California, steelhead may enter estuaries where sand bars create low salinity lagoons. Migration of juvenile steelhead to these lagoons occurs throughout the year, but is concentrated in the late spring/early summer and in the late fall/early winter periods (Shapovalov and Taft 1954, Zedonis 1992). Juveniles rear in fresh water for one to four years, then smolt and migrate to the ocean in March and April (Barnhart 1986). Steelhead typically reside in marine waters for two or three years prior to returning to their natal streams to spawn as four or five-year olds. Unlike Pacific salmon, steelhead are iteroparous, or capable of spawning more than once before death (Busby et al. 1996). Females spawn more than once more commonly than males, but rarely more than twice before dying (Nickelson et al. 1992). Iteroparity is also more common among southern steelhead populations than northern populations (Busby et al. 1996).

Steelhead feed on a variety of prey organisms depending upon life stage, season, and prey availability. In freshwater juveniles feed on common aquatic stream insects such as caddisflies, mayflies, and stoneflies but also other insects (especially chironomid pupae), zooplankton, and benthic organisms (Pert 1993 , Merz 2002). Older juveniles sometimes prey on emerging fry, other fish larvae, crayfish, and even small mammals, though these are not a major food source (Merz 2002). The diet of adult oceanic steelhead is comprised primarily of fish and squid (Light 1985, Burgner et al. 1992).

Designated critical habitat

NMFS designated critical habitat for all but one of the listed steelhead DPSs on September 2, 2005 (70 FR 52488). Proposed designation of designated critical habitat for the Puget Sound steelhead will be discussed separately in Section 6.6.5. Areas designated as designated critical habitat are important for the species’ overall conservation by protecting quality growth, reproduction, and feeding. At the time of designation, PCEs are identified and include sites necessary to support one or more steelhead life stage(s). PCEs in steelhead designated habitat include freshwater spawning and rearing sites, freshwater migration corridors, nearshore marine habitat, and estuarine areas. The physical or biological features that characterize these sites include water quality and quantity, natural cover, forage, adequate passage conditions, and floodplain connectivity. The designated critical habitat section for each listed DPS below identifies the areas included as part of the designation and discusses the current status of designated critical habitat.

5.1.3 Non-salmonid Anadromous fish

5.1.3.1 Southern Pacific eulachon

The southern population of Pacific eulachon was listed as threatened on March 18, 2010 (75 FR 13012). Eulachon are small smelt native to eastern North Pacific waters from the Bering Sea to Monterey Bay, California, or from 61º N to 31º N (Hart and McHugh 1944, Eschmeyer et al. 1983, Minckley et al. 1986, Hay and McCarter 2000). Eulachon that spawn in rivers south of the Nass River of British Columbia to the Mad River of California comprise the southern population of Pacific eulachon. EPA has NPDES permitting authority for Tribal lands in Alaska, Washington, Oregon and California and for Federally operated facilities in Washington. This species is designated based upon timing of runs and genetic distinctions (Hart and McHugh 1944, McLean et al. 1999, Hay and McCarter 2000, McLean and Taylor 2001, Beacham et al. 2005).

Life history

Adult eulachon are found in coastal and offshore marine habitats (Allen et al. 1988, Hay and McCarter 2000, Willson et al. 2006). Larval and post larval eulachon prey upon phytoplankton, copepods, copepod eggs, mysids, barnacle larvae, worm larvae, and other eulachon larvae until they reach adult size (WDFW and ODFW 2001). The primary prey of adult eulachon are copepods and euphausiids, malacos tracans and cumaceans (Smith and Saalfeld 1955, Barraclough 1964, Drake and Wilson 1991, Sturdevant et al. 1999, Hay and McCarter 2000).

Although primarily marine, eulachon return to freshwater to spawn. Adult eulachon have been observed in several rivers along the west coast (Odemar 1964, Minckley et al. 1986, Emmett et al. 1991, Jennings 1996, Wright 1999, Hay and McCarter 2000, Larson and Belchik 2000, Musick et al. 2000, WDFW and ODFW 2001, Moyle 2002). For the southern population of Pacific eulachon, most spawning is believed to occur in the Columbia River and its tributaries as well as in other Oregonian and Washingtonian rivers (Emmett et al. 1991, Musick et al. 2000, WDFW and ODFW 2001). Eulachon take less time to mature and generally spawn earlier in southern portions of their range than do eulachon from more northerly rivers (Clarke et al. 2007).

Spawning is strongly influenced by water temperatures, so the timing of spawning depends upon the river system involved (Willson et al. 2006). In the Columbia River and further south, spawning occurs from late January to March, although river entry occurs as early as December (Hay and McCarter 2000). Further north, the peak of eulachon runs in Washington State is from February through March while Alaskan runs occur in May and river entry may extend into June (Hay and McCarter 2000). Females lay eggs over sand, course gravel or detritial substrate. Eggs attach to gravel or sand and incubate for 30 to 40 days after which larvae drift to estuaries and coastal marine waters (Wydoski and Whitney 1979).

Eulachon generally die following spawning (Scott and Crossman 1973). The maximum known lifespan is 9 years of age, but 20 to 30% of individuals live to 4 years and most individuals survive to 3 years of age, although spawning has been noted as early as 2 years of age (Wydoski and Whitney 1979, Barrett et al. 1984, Hugg 1996, Hay and McCarter 2000, WDFW and ODFW 2001). The age distribution of spawners varies between river and from year-to-year (Willson et al. 2006).

Population dynamics

The southern population of Pacific eulachon was listed as threatened on March 18, 2010 (75 FR 13012). It is considered to be at moderate risk of extinction throughout its range because of a variety of factors, including predation, commercial and recreational fishing pressure (directed and bycatch), and loss of habitat. Further population decline is anticipated to continue as a result of climate change and bycatch in commercial fisheries. However, because of their fecundity, eulachon are assumed to have the ability to recover quickly if given the opportunity (Bailey and Houde 1989).

Eulachon formerly experienced widespread, abundant runs and have been a staple of Native American diets for centuries along the northwest coast. However, such runs that were formerly present in several California rivers as late as the 1960s and 1970s (i.e., Klamath River, Mad River and Redwood Creek) no longer occur (Larson and Belchik 2000). This decline likely began in the 1970s and continued until, in 1988 and 1989, the last reported sizeable run occurred in the Klamath River and no fish were found in 1996, although a moderate run was noted in 1999 (Larson and Belchik 2000, Moyle 2002). Eulachon have not been identified in the Mad River and Redwood Creek since the mid-1990s (Moyle 2002).

Designated critical habitat

Designated critical habitat has been designated for the southern population of Pacific eulachon (76 FR 65323). The designated areas are a combination of freshwater creeks and rivers and their associated estuaries, comprising approximately 539 km (335 mi) of habitat. The physical or biological features essential to the conservation of the DPS include:

(1) Freshwater spawning and incubation sites with water flow, quality and temperature conditions and substrate supporting spawning and incubation, and with migratory access for adults and juveniles. These features are essential to conservation because without them the species cannot successfully spawn and produce offspring.

(2) Freshwater and estuarine migration corridors associated with spawning and incubation sites that are free of obstruction and with water flow, quality and temperature conditions supporting larval and adult mobility, and with abundant prey items supporting larval feeding after the yolk sac is depleted. These features are essential to conservation because they allow adult fish to swim upstream to reach spawning areas and they allow larval fish to proceed downstream and reach the ocean.

(3) Nearshore and offshore marine foraging habitat with water quality and available prey, supporting juveniles and adult survival. Eulachon prey on a wide variety of species including crustaceans such as copepods and euphausiids (Hay and McCarter 2000, WDFW and ODFW 2001), unidentified malacostracans (Sturdevant et al. 1999), cumaceans (Smith and Saalfeld 1955)mysids, barnacle larvae, and worm larvae (WDFW and ODFW 2001). These features are essential to conservation because they allow juvenile fish to survive, grow, and reach maturity, and they allow adult fish to survive and return to freshwater systems to spawn.

5.1.3.2 Shortnose Sturgeon

Shortnose sturgeon were listed as endangered throughout its range on March 11, 1967 pursuant to the Endangered Species Preservation Act of 1966. Shortnose sturgeon remained on the list as endangered with enactment of the ESA in 1973.

Shortnose sturgeon occur along the Atlantic Coast of North America, from the Saint John River in Canada to the Saint Johns River in Florida. The Shortnose Sturgeon Recovery Plan describes 19 shortnose sturgeon populations that are managed separately in the wild. Two additional geographically separated populations occur behind dams in the Connecticut River (above the Holyoke Dam) and in Lake Marion on the Santee-Cooper River system in South Carolina (above the Wilson and Pinopolis Dams). While shortnose sturgeon spawning has been documented in several rivers across its range (including but not limited to: Kennebec River, ME, Connecticut River, Hudson River, Delaware River, Pee Dee River, SC, Savannah, Ogeechee, and Altamaha rivers, GA), status for many other rivers remain unknown. EPA has NPDES permitting authority throughout New Hampshire, Massachusetts, the District of Columbia, Federally operated facilities in Delaware and Tribal lands in Connecticut, Rhode Island, New York, North Carolina, and Florida.

We used information available in the Shortnose Sturgeon Recovery Plan (NMFS 1998), the 2010 NMFS Biological Assessment (SNS BA 2010), and the listing document (32 FR 4001) to summarize the status of the species, as follows.

Life history

Sturgeon are a long-lived species, taking years to reach sexual maturity. Male shortnose sturgeon tend to sexually mature earlier than females, and sturgeon residing in more northern latitudes reach maturity later than those at southerly latitudes. Sturgeon are broadcast spawners, with females laying adhesive eggs on hard bottom, rocky substrate at upstream, freshwater sites. When the males arrive at the spawning site, they broadcast sperm into the water column to fertilize the eggs. Despite their high fecundity, sturgeon have low recruitment.

Spawning periodicity varies by species and sex, but there can be anywhere from 1 to 5 years between spawning, as individuals need to rebuild gonadal material. There is difficulty in definitively assessing where and how reliably spawning occurs. Presence of eggs, age-1 juveniles and capture of "ripe" adults moving upstream (i.e., likely on a spawning run) serve as strong indicators, but due to their life history and the impacts sturgeon populations have taken, there are additional hurdles to successful spawning. Because sturgeon are iteroparous, and populations in some areas so depleted, eggs deposited at the spawning grounds may not be fertilized if males do not arrive at the spawning grounds that year.

Hatching occurs approximately 94-140 hrs after egg deposition, and larvae assume a bottom-dwelling existence. The yolksac larval stage is completed in about 8-12 days, during which time larvae move downstream to rearing grounds over a 6 – 12 day period. Size of larvae at hatching and at the juvenile stage varies by species. During the daytime, larvae use benthic structure (e.g., gravel matrix) as refugia. Juvenile sturgeon continue to move further downstream into brackish waters, and eventually become residents in estuarine waters for months or years.

Generally, sturgeon are benthic omnivores, feeding on benthic invertebrates that are abundant in the substrate in that area. Shortnose sturgeon forage over sandy bottom, and eat benthic invertebrates like amphipods.

Juvenile shortnose generally move upstream during spring and summer and downstream for fall and winter; however, these movements usually occur above the salt- and freshwater interface. During summer and winter, adult shortnose sturgeon inhabit freshwater reaches of rivers and streams influenced by tides. During summer, at the southern end of its range, shortnose sturgeon congregate in cool, deep, areas of rivers taking refuge from high temperatures. Adult shortnose sturgeon prefer deep, downstream areas with soft substrate and vegetated bottoms, if present. Because they rarely leave their natal rivers, shortnose sturgeon are considered to be freshwater amphidromous (i.e. adults spawn in freshwater but regularly enter saltwater habitats during their life).

Population dynamics

Currently, there is no range-wide population estimate for shortnose sturgeon, although many individual river systems have been studied and population estimates have been generated for several rivers. Some rivers have been more intensely studied than others, allowing for multiple estimates. Rivers with the largest shortnose sturgeon population estimates are the Hudson (ranging up to 61,000), Delaware (about 12,000), and Altamaha (6,320).

Despite the life span of adult sturgeon, the viability of sturgeon populations is highly sensitive to juvenile mortality resulting in lower numbers of sub-adults recruiting into the adult breeding population. This relationship caused Secor et al. (2002) to conclude sturgeon populations can be grouped into two demographic categories: populations having reliable (albeit periodic) natural recruitment and those that do not. The shortnose sturgeon populations without reliable natural recruitment are at more risk. Several authors have also demonstrated that sturgeon populations generally, and shortnose sturgeon populations in particular, are much more sensitive to adult mortality than other species of fish. Sturgeon populations cannot survive fishing related mortalities exceeding five percent of an adult spawning run and they are vulnerable to declines and local extinction if juveniles die from fishing related mortalities (Secor et al. 2002).

The shortnose sturgeon is endangered, and much remains unknown about the population status in many rivers throughout its range. Commercial harvest of shortnose sturgeon at the beginning of the 20th century is a principal cause for population decline. Harvest peaked in the 1880s, with 7 million pounds of shortnose sturgeon landed in 1890; landings later dropped off dramatically, to only 22,000 pounds landed in 1920. Shortnose sturgeon populations are at risk from incidental bycatch, loss of habitat, dams, dredging and pollution. These threats are likely to continue into the future. We conclude that the shortnose sturgeon's resilience to further perturbation is low.

Designated critical habitat

No critical habitat has been designated for shortnose sturgeon.

5.1.3.3 Atlantic sturgeon (5 DPSs)

We evaluate the effects of the action by considering the distribution, life history, population dynamics, status, and designated critical habitats of the five species separately; however, because listed Atlantic sturgeon species are virtually indistinguishable in the wild and comprise the same biological species, we begin this section describing characteristics common across DPSs. We used information available in the 2007 Atlantic Sturgeon Status Review (2007), and the listing documents (77 FR 5880, 77 FR 5914) to summarize the status of the species.

Species description and distribution

The range of Atlantic sturgeon includes the St. John River in Canada, to St. Johns River in Florida. EPA has NPDES permitting authority throughout New Hampshire, Massachusetts, the District of Columbia, Federally operated facilities in Delaware and Tribal lands in Connecticut, Rhode Island, New York, North Carolina, and Florida. Five DPSs of Atlantic sturgeon were designated and listed under the ESA on February 6, 2012 (Gulf of Maine, New York Bight, Chesapeake Bay, Carolina, and South Atlantic)(77 FR 5880, 77 FR 5914).

Life history

Although the Atlantic sturgeon DPSs are genetically distinct, their life history characteristics are the same and are discussed together below.

As Acipensieriformes, Atlantic sturgeon are anadromous and iteroparus. Like shortnose sturgeon, male Atlantic sturgeon tend to sexually mature earlier than females, and sturgeon residing in more northern latitudes reach maturity later than those at southerly latitudes. Evidence of Atlantic sturgeon spawning has been found in many of the same rivers as shortnose sturgeon (see discussion above). Atlantic sturgeon eggs are between 2.5-3.0mm, and larvae are about 7mm long upon hatching. Generally, sturgeon are benthic omnivores, feeding on benthic invertebrates that are abundant in the substrate in that area. Atlantic sturgeon commonly eat polychaetes and isopods.

As juveniles, Atlantic sturgeon migrate downstream from the spawning grounds into brackish water. Unlike shortnose sturgeon, subadult Atlantic sturgeon (76-92cm) may move out of the estuaries and into coastal waters where they can undergo long range migrations. At this stage in the coastal waters, individual subadult and adult Atlantic sturgeon originating from different DPSs will mix, but adults return to their natal river to spawn.

Population dynamics

Subadult and adult Atlantic sturgeon spend time in oceanic waters during coastal migrations. Using bycatch data and the USFWS sturgeon tagging database, NMFS Northeast Fisheries Science Center estimated mean abundance of oceanic Atlantic sturgeon for 2006-2011 to be 417,934 (95% CI: 165,381-744,597); this estimate did not include Atlantic sturgeon residing year-round in rivers (Dias-Teixeira et al. 2013). However, evaluating the status of the species depends on the status of the smaller extant populations because maintaining those populations maintains genetic heterogeneity and having a broad range prevents a single catastrophic event from causing their extinction.

Designated critical habitat

No designated critical habitat has been designated for any Atlantic sturgeon DPS.

5.1.3.4 Green sturgeon

The Southern DPS of green sturgeon is listed as threatened (71 FR 17757; April 7, 2006). The Southern DPS consists of populations south of the Eel River (Humboldt, CA), coastal and Central Valley populations, and the spawning population in the Sacramento River, CA. This range encompasses the coast and inland waters of Washington State, Oregon, northern California and Idaho in the action area where EPA has NPDES permitting authority. On June 2, 2010, NMFS issued a 4(d) Rule for the Southern DPS, applying certain take prohibitions (75 FR 30714).

Green sturgeon occur in coastal Pacific waters from San Francisco Bay to Canada. The Southern DPS of green sturgeon includes populations south of (and exclusive of) the Eel River (Adams et al. 2007). We used information available in the 2002 Status Review and 2005 Status Review Update (GSSR 2002, 2005), and the proposed and final listing rules (70 FR 17836; 71 FR 17757) to summarize the status of the species, as follows.

Life history

As members of the family Acipenseridae, green sturgeon share similar reproductive strategies and life history patterns with other sturgeon species; see discussion for shortnose sturgeon above.

The Sacramento River is the location of the single, known spawning population for the green sturgeon Southern DPS (Adams et al. 2007). Green sturgeon have relatively large eggs compared to other sturgeon species (4.34mm) and grow rapidly, reaching 66mm in three weeks. Generally, sturgeon are benthic omnivores, feeding on benthic invertebrates that are abundant in the substrate in that area. Little is known specifically about green sturgeon foraging habits; generally, adults feed upon invertebrates like shrimp, mollusks, amphipods and even small fish, while juveniles eat opossum shrimp and amphipods. Juvenile green sturgeon spend 1-3 years in freshwater, disperse widely in the ocean, and return to freshwater as adults to spawn (about age 15 for males, age 17 for females).

Population dynamics

Trend data for green sturgeon is severely limited. Available information comes from two predominant sources, fisheries and tagging. Only three data sets were considered useful for the population time series analyses by NMFS' biological review team: the Klamath Yurok Tribal fishery catch, a San Pablo sport fishery tag returns, and Columbia River commercial landings. Using San Pablo sport fishery tag recovery data, the California Department of Fish and Game produced a population time series estimate for the southern DPS. San Pablo data suggest that green sturgeon abundance may be increasing, but the data showed no significant trend. The data set is not particularly convincing, however, as it suffers from inconsistent effort and since it is unclear whether summer concentrations of green sturgeon provide a strong indicator of population performance. Although there is not sufficient information available to estimate the current population size of southern green sturgeon, catch of juveniles during state and federal salvage operations in the Sacramento delta are low in comparison to catch levels before the mid-1980s.

The 5 Year Status Review for the Southern DPS was initiated in 2012 (77 FR 64959). Loss of spawning habitat and bycatch in the white sturgeon commercial fishery are two major causes for the species decline. Current threats to the Southern DPS include reduction in spawning habitat (mostly from impoundments), entrainment by water projects, contaminants, incidental bycatch and poaching. Given the small population size, the species' life history traits (e.g., slow to reach sexual maturity), and that the threats to the population are likely to continue into the future, we conclude that the Southern DPS is not resilient to further perturbations.

Designated critical habitat

Green sturgeon designated critical habitat for the Southern DPS was designated on October 9, 2009 (74 FR 52300), including coastal U.S. marine waters within 60 fathoms deep from Monterey Bay, CA to Cape Flattery, WA, including the Strait of Juan de Fuca, and numerous coastal rivers and estuaries: see the Final Rule for a complete description (74 FR 52300). Food resources were identified as a PCE.

5.1.4 Marine Fish

5.1.4.1 Cartilaginous fish: Scalloped Hammerhead Eastern Pacific DPS, Central & Southwest Atlantic DPS

The scalloped hammerhead shark is a circumglobal species that lives in coastal warm temperate and tropical seas. It occurs over continental and insular shelves, as well as adjacent deep waters, but is seldom found in waters cooler than 22° C (Compagno 1984, Schulze-Hangen and Kohler 2003). EPA has permitting authority for Puerto Rico and Tribal lands in the state of California. The Eastern Pacific Scalloped Hammerhead ranges from southern California and Gulf of California to Panama, Ecuador and possibly northern Peru (Compagno in prep). The Central and Southwest Atlantic DPS range from the Bahamas to Buenos Aires, Argentina. The species was listed as endangered effective September 2, 2014 (79 FR 38213 July 3, 2014). This is a coastal and semi-oceanic pelagic shark, ranging from the intertidal and surface to depths of up to 450-512 m (Sanches 1991, Klimley 1993), with occasional dives to even deeper waters (Jorgensen et al. 2009). It has also been documented entering enclosed bays and estuaries (Compagno 1984). The pups of this species tend to stay in coastal zones, near the bottom, occurring at high concentrations during summer in estuaries and bays (Clarke 1971, (Bass 1975), Castro 1983). They have been observed to be highly faithful to particular diurnal core areas (Holland et al. 1993) and sometimes form large schools which migrate to higher latitudes in summer (Stevens and Lyle 1989).

Life history

The scalloped hammerhead shark is viviparous (i.e., give birth to live young), with a gestation period of 9-12 months (Branstetter 1987, Stevens and Lyle 1989), which may be followed by a one-year resting period (Liu and Chen 1999). Females attain maturity around 200-250 cm (TL) while males reach maturity at smaller sizes (range 128-200 cm (TL); Table 1); however, the age at maturity differs by region. For example, in the Gulf of Mexico, Branstettter (1987) estimated that females mature at about 15 years of age and males at around 9-10 years of age. In north eastern Taiwan, Chen et al. (1990) calculated age at maturity to be 4 years for females and 3.8 years for males. On the east coast of South Africa, age at sexual maturity for females was estimated at 11 years (Dudley and Simpfendorfer 2006).

While it appears that maturity, age, and growth estimates vary by region, it is unclear whether these differences are truly biological or a result of differences in band interpretations in aging methodology approaches (Piercy et al. 2007). Parturition, however, does not appear to vary by region and may be partially seasonal (Harry et al. 2011), with neonates present year round but with abundance peaking during the spring and summer months (Duncan and Holland 2006) Adams and Paperno 2007, Bejarano-Alvarez et al. 2011, (Harry et al. 2011, Noriega et al. 2011). Females move inshore to birth, with litter sizes anywhere between 1 and 4 live pups.

Population dynamics

Information regarding the population dynamics of this DPS is lacking.

Status

There are few good abundance data from the Eastern Pacific region. Diver sightings reports from 1992 - 2004 reveal declines of 71% in populations of *S. lewini* in Cocos Island National Park (Myers et al. no date). Using fishing mortality estimates calculated from 1997 and 1998 catches, INP (2006) estimated that the scalloped hammerhead population in the Gulf of Tehuantepac is currently decreasing by 6% per year. Substantial fishing by artisanal fishermen on *S. lewini* juveniles and neonates, as well as reports of large harvests of sharks by Illegal, Unregulated or Unreported (IUU) vessels, suggests significant decreases in abundance and probability for surviving environmental variation and catastrophes, especially in the foreseeable future. From an evolutionary standpoint, Nance et al. (2011) calculated that this DPS has undergone significant declines (1-3 orders of magnitude) from its ancestral population, with the onset of decline occurring - 3600 to 12,000 years ago. Given the high artisanal fishing pressure as well as the frequent reports of IUU, abundance levels may be at a level that contributes significantly to the DPS 's risk of extinction in the face of environmental and anthropogenic disturbances now and in the foreseeable future.

Designated critical habitat

No critical habitat has been designated for this species.

5.1.4.2 Rockfish

Bocaccio range from Punta Blanca, Baja California, to the Gulf of Alaska off Krozoff and Kodiak Islands. They are most common between Oregon and northern Baja California. In Puget Sound, most bocaccio are found south of Tacoma Narrows. Canary rockfish range between Punta Colnett, Baja California, and the Western Gulf of Alaska. Within this range, canary rockfish are most common off the coast of central Oregon. Yelloweye rockfish range from northern Baja California to the Aleutian Islands, Alaska, but are most common from central California northward to the Gulf of Alaska. These ranges encompass the coastal portion of the action area of Alaska and western United States where EPA has NPDES permitting authority for tribal lands and, in Washington, for Federally operated facilities.

Bocaccio Puget Sound/Georgia Basin DPS

Georgia Basin bocaccio were listed as endangered on April 28, 2010 (75 FR 22276).

Distribution

The bocaccio that occur in the Georgia Basin are listed as an endangered “species,” which, in this case, refers to a distinct segment of a vertebrate population (75 FR 22276). The listing includes bocaccio throughout Puget Sound, which encompasses all waters south of a line connecting Point Wilson on the Olympic Peninsula and Partridge on Whidbey Island; West Point on Whidbey Island, Deception Island, and Rosario Head on Fidalgo Island; and the southern end of Swinomish Channel between Fidalgo Island and McGlinn Island (U.S. Geological Survey 1979), and the Strait of Georgia, which encompasses the waters inland of Vancouver Island, the Gulf Islands, and the mainland coast of British Columbia.

Life history

Preferred bocaccio habitat is largely dependent upon the life stage of an individual. Larvae and young juveniles tend to be found in deeper offshore regions (1-148 km offshore), but associated with the surface and occasionally with floating kelp mats (Hartmann 1987, Love et al. 2002, Emery et al. 2006). As individuals mature into older juveniles and adults, they transition into shallow waters and settle to the bottom, preferring algae-covered rocky, eelgrass, or sand habitats and aggregating into schools (Eschmeyer et al. 1983, Love et al. 1991). After a few weeks, fish move into slightly deeper waters of 18-30 m and occupy rocky reefs (Feder et al. 1974, Carr 1983, Eschmeyer et al. 1983, Johnson 2006, Love and Yoklavich 2008). As adults, bocaccio may be found in depths of 12-478 m, but tend to remain in shallow waters on the continental shelf (20-250 m), still associating mostly with reefs or other hard substrate, but may move over mud flats (Feder et al. 1974, Kramer and O'Connell 1995, Love et al. 2002, Love et al. 2005, Love and York 2005, Love et al. 2006). Artificial habitats, such as platform structures, also appear to be suitable habitat for bocaccio (Love and York 2006). Adults may occupy territories of 200-400 hectares, but can venture outside of this territory (Hartmann 1987). Adults tend to occupy deeper waters in the southern population compared to the northern population (Love et al. 2002). Adults are not as benthic as juveniles and may occur as much as 30 m above the bottom and move 100 m vertically during the course of a day as they move between different areas (Starr 1998, Love et al. 2002). Prior to severe population reductions, bocaccio appeared to frequent the Tacoma Narrows in Washington State (DeLacy et al. 1964, Haw and Buckley 1971, Miller and Borton 1980).

Bocaccio are live-bearers with internal fertilization. Once females become mature (at 54-61 cm total length), they produce 20,000-2.3 million eggs annually, with the number increasing as females age and grow larger (Hart 1973, Echeverria 1987, Love et al. 2002). However, either sex has been known to attain sexual maturity as small as 35 cm or 3 years of age and, in recent years as populations have declined, average age at sexual maturity may have declined as well (Hart 1973, Echeverria 1987, Love et al. 2002, MacCall 2002). Mating occurs between August and November, with larvae born between January and April (Lyubimova 1965, Moser 1967, Westrheim 1975, Echeverria 1987, Love et al. 2002, MacCall and He 2002).

Upon birth, bocaccio larvae measure 4-5 mm in length. These larvae move into pelagic waters as juveniles when they are 1.5-3 cm and remain in oceanic waters from 3.5-5.5 months after birth (usually until early June), where they grow at ~0.5-1 mm per day (Moser 1967) (Matarese et al. 1989) (Woodbury and Ralston 1991, Love et al. 2002, MacCall and He 2002, MacCall 2003).

However, growth can vary from year-to-year (Woodbury and Ralston 1991). Once individuals are 3-4 cm in length, they return to nearshore waters, where they settle into bottom habitats. Females tend to grow faster than males, but fish may take 5 years to reach sexual maturity (MacCall 2003). Individuals continue to grow until they reach maximum sizes of 91 cm, or 9.6 kg, at an estimated maximum age of 50 years (Eschmeyer et al. 1983, Halstead et al. 1990, Ralston and Ianelli 1998, Love et al. 2002, Andrews et al. 2005, Piner et al. 2006). However, individuals tend to grow larger in more northerly regions (Dark et al. 1983).

Prey of bocaccio vary with fish age, with bocaccio larvae starting with larval krill, diatoms, and dinoflagellates (Love et al. 2002). Pelagic juveniles consume fish larvae, copepods, and krill, while older, nearshore juveniles and adults prey upon rockfishes, hake, sablefish, anchovies, lanternfish, and squid (Reilly et al. 1992, Love et al. 2002).

Status

From 1975 through 1979, bocaccio were reported as representing an average of 4.63% of the total rockfish catch. From 1980–1989, they represented about 0.24% of the rockfish identified, and from 1996 to 2007, bocaccio were not reported in a sample of 2,238 rockfish captured in recreational fisheries (in a sample of that size, there was a 99.5% probability of observing at least one bocaccio, assuming their relative frequency was the same as it had been in the 1980s). Bocaccio have always been rare in recreational fisheries that occur in North Puget Sound and the Strait of Georgia; however, there have been no confirmed reports of bocaccio in Georgia Basin for several years. NMFS proposed critical habitat designation of approximately 1,185 mi^2 of marine habitat for bocaccio in Puget Sound, Washington, on August 6, 2013 (78 FR 47635)[32].

Although their abundance cannot be estimated directly, NMFS' BRT estimated that the populations of bocaccio, canary rockfish and yelloweye rockfish are small in size, probably numbering fewer than 10,000 individuals in Georgia Basin and fewer than 1,000 total individuals in Puget Sound (74 FR 18532) (Drake et al. 2010). Georgia Basin bocaccio are most common at depths between 50 and 250 meters (160 and 820 feet).

Critical Habitat

Critical habitat was designated for bocaccio on November 13, 2014 (79 FR 68042). Physical or biological features essential to adult bocaccio include the benthic habitats or sites deeper than 30m (98ft) that possess or are adjacent to areas of complex bathymetry consisting of rock and or highly rugose habitat are essential to conservation because these features support growth, survival, reproduction, and feeding opportunities by providing the structure for rockfish to avoid predation, seek food and persist for decades. Several attributes of these sites determine the quality of the habitat and are useful in considering the conservation value of the associated feature, and whether the feature may require special management considerations or protection.

[32] See http://www.nmfs.noaa.gov/pr/species/fish/bocaccio.htm for more information.

These attributes are also relevant in the evaluation of the effects of a proposed action in a section 7 consultation if the specific area containing the site is designated as critical habitat. These attributes include: (1) Quantity, quality and availability of prey species to support individual growth, survival, reproduction, and feeding opportunities, (2) water quality and sufficient levels of dissolved oxygen to support growth, survival, reproduction, and feeding opportunities, and (3) the type and amount of structure and rugosity that supports feeding opportunities and predator avoidance.

Physical or biological features essential to juvenile bocaccio conservation include settlement habitats located in the nearshore with substrates such as sand, rock or cobble compositions that also support kelp because these features enable forage opportunities and refuge from predators and enable behavioral and physiological changes needed for juveniles to occupy deeper adult habitats. Several attributes of these sites determine the quality of the area and are useful in considering the conservation value of the associated feature and, in determining whether the feature may require special management considerations or protection. These attributes include: (1) Quantity, quality, and availability of prey species to support individual growth, survival, reproduction, and feeding opportunities; and (2) water quality and sufficient levels of dissolved oxygen to support growth, survival, reproduction, and feeding opportunities.

Rockfish, Canary (Puget Sound/Georgia Basin)

Georgia Basin canary rockfish were listed as threatened under the ESA on April 28, 2010 (75 FR 22276).

Distribution

Georgia Basin canary rockfish occur throughout Puget Sound, which encompasses all waters south of a line connecting Point Wilson on the Olympic Peninsula and Partridge on Whidbey Island; West Point on Whidbey Island, Deception Island, and Rosario Head on Fidalgo Island; and the southern end of Swinomish Channel between Fidalgo Island and McGlinn Island and the Strait of Georgia, which encompasses the waters inland of Vancouver Island, the Gulf Islands, and the mainland coast of British Columbia.

Life history

Canary rockfish occupy a variety of habitats based upon their life stage. Larvae and younger juveniles tend to occupy shallow waters at the beginning of their lives, but generally remain in the upper 100 m of the water column (Love et al. 2002). Juveniles initially settle into tide pools and rocky reefs (Miller and Geibel 1973) (Love et al. 1991, Cailliet et al. 2000, Love et al. 2002). Juveniles have also been observed in diurnal movements, occurring near sand-rock interfaces in groups by day and moving over sandy areas at night (Love et al. 2002). After as much as 3 years, juveniles move into deeper rocky reefs, forming loose schools, rarely on but generally near the bottom (Phillips 1960, Boehlert 1980, Lamb and Edgell 1986, Rosenthal et al. 1998, Starr 1998, Cailliet et al. 2000, Johnson et al. 2003, Methot and Stewart 2005, Tissot et al. 2007). Adults may be found in waters of up to 400 m, but tend to be most common in the 80-200 m range, or even shallower (Moser 1996b, Methot and Stewart 2005, Tissot et al. 2007). Mid shelf locations seem to have the highest concentrations of canary rockfish off Washington and Oregon (Weinberg 1994). Adults tend to occur in shallow areas in higher latitudes than their southern counterparts, although adults do appear to move into progressively deeper waters as they age (Vetter and Lynn 1997, Methot and Stewart 2005). It is believed that, within Puget Sound, canary rockfish were most common in the 1960's and 1970's in Tacoma Narrows, Hood Canal, San Juan Islands, Bellingham, and Appletree Cove (Delacy et al. 1972, Miller and Borton 1980). A latitudinal gradient may be present by age class, with older and larger individuals preferably occupying more northerly habitat (Dark et al. 1983).

Individual canary rockfish can range widely (up to 700 km over several years), although patterns of residency have been observed (Gascon and Miller 1981, DeMott 1983)Casillas et al. 1998, (Lea et al. 1999, Love et al. 2002). In addition, seasonal movements have been found, with individuals moving from 160-210 m depths in late winter to 100-170 m in late summer (COSEWIC in press).

Canary rockfish develop their young internally before giving birth to live young as larvae. During each annual spawning event, a female can produce 260,000 to 1.9 million eggs, depending upon her size and age (Guillemot et al. 1985, NMFS 2008c). Unlike some other rockfish, there does not appear to be a latitudinal or geographic gradient associated with number of eggs produced (Gunderson et al. 1980, Love et al. 2002). Birth takes place in Oregonian and Washingtonian waters between September through March, with a peak in December and January. The peak in British Columbian waters is slightly later (February) (Hart 1973, Westrheim and Harling 1975, Echeverria 1987, Barss 1989.).

When born, larvae are 3.6-4.0 mm in length and take from 1-4 months to develop into juveniles (Waldron 1968, Richardson and Laroche 1979a, Richardson and Laroche 1979b, Stahl-Johnson 1985, Moser 1996a, Krigsman 2000, Love et al. 2002). As with other rockfish, females seem grow more quickly than do males, with females reaching sexual maturity at 7-9 years of age (35-45 cm in length) versus males at 7-12 years (~41 cm in length) off Oregon (Westrheim and Harling 1975, Boehlert and Kappenman 1980, Lenarz and Echeverria 1991, STAT 1999). Mean length at sexual maturity off Vancouver Island is 41 cm for females and 48 cm for males (Westrheim and Harling 1975). Canary rockfish are known to frequently reach 60-75 years of age and have been found to be as old as 84 years (Cailliet et al. 2000, Cailliet et al. 2001, Andrews et al. 2007). Maximum reported sizes are 76 cm and 4.5 kg (Boehlert 1980, IGFA 1991, Williams et al. 1999, Love et al. 2002, Methot and Stewart 2005).

Canary rockfish prey upon different species as they age. Larvae are planktivores, consuming invertebrate eggs, copepods, and nauplii (Moser and Boehlert 1991, Love et al. 2002). Juveniles feed upon zooplankton, including crustaceans, juvenile polychaetes barnacle cyprids, and euphasiid eggs and larvae (Gaines and Roughgarden 1987, Love et al. 1991). However, adults move into a carnivorous lifestyle as well as eating euphasiids and other crustaceans. Adults consume other fishes such as shortbelly rockfish, mytophids and stomiatiods (Cailliet et al. 2000, Love et al. 2002). However, oceanographic and climactic shifts can alter foraging such that canary rockfish feed on other available species (Lee and Sampson 2009).

Status

The frequency of canary rockfish in Puget Sound appears to have been highly variable; frequencies were less than 1% in the 1960s and 1980s and about 3% in the 1970s and 1990s. In North Puget Sound, however, the frequency of canary rockfish has been estimated to have declined from a high of greater than 2% in the 1970s to about 0.76% by the late 1990s. This decline combined with their low intrinsic growth potential, threats from bycatch in commercial and recreational fisheries, loss of nearshore rearing habitat, chemical contamination, and the proportion of coastal areas with low dissolved oxygen levels led to this species' listing as threatened under the ESA.

Although their abundance cannot be estimated directly, NMFS' BRT estimated that the populations of bocaccio, canary rockfish and yelloweye rockfish are small in size, probably numbering fewer than 10,000 individuals in Georgia Basin and fewer than 1,000 total individuals in Puget Sound (74 FR 18532)(Drake et al. 2010).

Georgia Basin canary rockfish are most common at depths between 50 and 250 meters (160 and 820 feet) and may occur at depths of 425 meters (1,400 feet). Larval rockfish occur over areas that extend several hundred miles offshore where they are passively dispersed by ocean currents and remain in larval form and as small juveniles for several months (Moser and Boehlert 1991, Auth and Brodeur 2006). They appear to concentrate over the continental shelf and slope, but have been captured more than 250 nautical miles offshore of the Oregon coast (Moser and Boehlert 1991). Larval rockfish have been reported to be uniformly distributed at depths of 13, 37 and 117 meters below the surface. Larval canary rockfish were captured at all three depths, but their densities were highest at the 37- and 177-meter depths (Lenarz and Echeverria 1991).

At these depths, canary rockfish are not likely to be exposed to the direct or indirect effects of most of the activities that would be authorized by the Nationwide Permits. However, both adult and larval canary rockfish may be exposed to water-based renewable energy generation pilot projects, such as one that is being considered for Admiralty Inlet in northern Puget Sound that would be authorized by Nationwide Permit 52.

Critical Habitat

Critical habitat was designated for canary rockfish on November 13, 2014 (79 FR 68042). Physical or biological features essential to the conservation of juvenile canary rockfish are the same as for juvenile bocaccio. Physical or biological features essential to the conservation of adult canary rockfish are the same as for adult bocaccio.

Rockfish, Yelloweye (Puget Sound/Georgia Basin)

Georgia Basin yelloweye rockfish were listed as threatened under the ESA on April 28, 2010 (75 FR 22276).

Distribution

Georgia Basin yelloweye rockfish occur through Puget Sound, which encompasses all waters south of a line connecting Point Wilson on the Olympic Peninsula and Partridge on Whidbey Island; West Point on Whidbey Island, Deception Island, and Rosario Head on Fidalgo Island; and the southern end of Swinomish Channel between Fidalgo Island and McGlinn Island (U.S. Geological Survey 1979), and the Strait of Georgia, which encompasses the waters inland of Vancouver Island, the Gulf Islands, and the mainland coast of British Columbia.

Life history

As with other rockfishes, yelloweye habitat varies based upon life stage. Larvae maintain a pelagic existence but as juveniles, move into shallow high relief rocky or sponge garden habitats (Eschmeyer et al. 1983, Richards et al. 1985, Love et al. 1991). Juveniles may also associate with floating debris or pilings (Lamb and Edgell 1986). As adults, yelloweye rockfish move in to deeper habitats. Individuals have been found in waters as deep as 549 m, but are generally found in waters of less than 180 m (Eschmeyer et al. 1983, Love et al. 2002). However, adults continue to associate with rocky, high relief habitats, particularly with caves and crevices, pinnacles, and boulder fields (Carlson and Straty 1981, Richards 1986, Love et al. 1991, O'Connell and Carlisle 1993, Yoklavich et al. 2000). Yelloweyes generally occur as individuals, with loose, residential aggregations infrequently found (Coombs 1979, DeMott 1983, Love et al. 2002). In the Puget Sound region, sport catch records from the 1970's indicate that Sucia Island and other islands of the San Juans as well as Bellingham Bay had the highest concentrations of catches (Delacy et al. 1972, Miller and Borton 1980).

Yelloweye rockfish are live bearers with internal fertilization. Copulation occurs between September and April, with fertilization taking place later as latitude increases (Hitz 1962, DeLacy et al. 1964, Westrheim 1975, Echeverria 1987, O'Connell 1987, Lea et al. 1999). Puget Sound yelloweyes mate between winter and summer, giving birth from spring to late summer (Washington et al. 1978). Gestation lasts roughly 30 days (Eldridge et al. 2002). Although yelloweye rockfish were once believed to reproduce annually, evidence exists that indicate the potential for multiple births per year (MacGregor 1970, Washington et al. 1978). Females produce more eggs as they grow older and larger, with each individual producing roughly 300 eggs per year per gram of body weight (1.2-2.7 million eggs per year) (MacGregor 1970, Hart 1973). In addition, older females of several rockfish species may be capable of provisioning their offspring better than their younger counterparts, meaning that they may be more a more influential component in a given year's recruitment success (Sogard et al. 2008).

Larvae are born at 4-5 mm in length and maintain a pelagic existence for the first 2 months of life, before moving to nearshore habitats and settling into rocky reef habitat at about 25 mm in length (DeLacy et al. 1964, Matarese et al. 1989, Moser 1996a, Love et al. 2002). Yelloweye growth is thought to vary by latitudinal gradient, with individuals in more northerly regions growing faster and larger. Year class strength appears to be most strongly linked to survival of the larval stage (Laidig et al. 2007). In general, sexual maturity appears to be reached by 50% of individuals by 15-20 years of age and 40-50 cm in length (Yamanaka and Kronlund 1997). As with other rockfish, yelloweyes can be long-lived (reported oldest age is 118 years) (Munk 2001). Maximum size has been reported as 910 cm, but assymptotic size in Alaskan waters for both males and females was estimated to be 690 cm and 659-676 mm along British Columbia (Clemens and Wilby 1961, Westrheim and Harling 1975, Rosenthal et al. 1982, Love et al. 2005, Yamanaka et al. 2006).

Individuals shift to deeper habitats as they age. Juveniles tend to begin life in shallow rocky reefs and graduate to deeper rocky habitats as adults. Once adult habitat is established, individuals tend to remain at a particular site (Love 1978, Coombs 1979, DeMott 1983).

As with other rockfish species, yelloweye rockfish prey upon different species and size classes throughout their development. Larval and juvenile rockfish prey upon phyto- and zooplankton (Lee and Sampson 2009). Adult yelloweyes eat other rockfish (including members of their own species), sand lance, gadids, flatfishes, shrimp, crabs, and gastropods (Love et al. 2005, Yamanaka et al. 2006).

Status

The frequency of yelloweye rockfish in collections from Puget Sound appears to have been highly variable; frequencies were less than 1% in the 1960s and 1980s and about 3% in the 1970s and 1990s. In North Puget Sound, however, the frequency of yelloweye rockfish has been estimated to have declined from a high of greater than 3% in the 1970s to about 0.65% in more recent samples. This decline combined with their low intrinsic growth potential, threats from bycatch in commercial and recreational fisheries, loss of nearshore rearing habitat, chemical contamination, and the proportion of coastal areas with low dissolved oxygen levels led to this species' listing as threatened under the ESA.

Although their abundance cannot be estimated directly, NMFS' BRT estimated that the populations of bocaccio, yelloweye rockfish and canary rockfish are small in size, probably numbering fewer than 10,000 individuals in Georgia Basin and fewer than 1,000 total individuals in Puget Sound (74 FR 18532) (Drake *et al.* 2010).

Georgia Basin yelloweye rockfish are most common at depths between 91 and 180 meters (300 to 580 feet), although they may occur in waters 50 to 475 meters (160 and 1,400 feet) deep. Larval rockfish occur over areas that extend several hundred miles offshore where they are passively dispersed by ocean currents and remain in larval form and as small juveniles for several months (Auth and Brodeur 2006, Moser and Boehlert 1991). They appear to concentrate over the continental shelf and slope, but have been captured more than 250 nautical miles offshore of the Oregon coast (Richardson and Laroche 1979a, Moser and Boehlert 1991). Larval rockfish have been reported to be uniformly distributed at depths of 13, 37 and 117 meters below surface. Like the other rockfish we have discussed, larval yelloweye rockfish were captured at all three depths, but their densities were highest at the 37- and 177-meter depths (Lenarz *et al.* 1991).

Critical Habitat

Critical habitat was designated for yelloweye rockfish on November 13, 2014 (79 FR 68042). Physical or biological features essential to the conservation of both adult and juvenile yelloweye rockfish are the same as for adult bocaccio and adult canary rockfish.

5.1.4.3 Nassau Grouper

The Nassau grouper (*Epinephelus striatus*) is primarily a shallow-water, insular fish species found from inshore to about 330 feet (100m) depth. The species is distributed throughout the islands of the western Atlantic including Bermuda, the Bahamas, southern Florida and along the coasts of central and northern South America. It is not known from the Gulf of Mexico except at Campeche Bank off the coast of the Yucatan Peninsula, at Tortugas, and off Key West. Adults are generally found near coral reefs and rocky bottoms while juveniles are found in shallower waters in and around coral clumps covered with macroalgae (*Laurencia* spp.) and over seagrass beds. Their diet is mostly fishes and crabs, with diet varying by age/size. Juveniles feed mostly on crustaceans, while adults (>30 cm; 11.8 in) forage mainly on fish. The Nassau grouper usually forages alone and is not a specialized forager.

The Nassau grouper has been designated a candidate species since 1991. NMFS began a status review on the species in 1993 and identified research that needed to be conducted to fill some of the gaps in the information concerning the species biology, genetics and habitat requirements. Under the authority of the Magnuson-Stevens Fisheries Act, NMFS classified the Nassau grouper as "overfished" in its October 1998 "Report to Congress on the status of Fisheries and Identification of overfished Stocks." The species was proposed for listing as a threatened species under the ESA September 2, 2014 (79 FR 51929).

Life History

Nassau grouper exhibit no sexual dimorphism in body shape or color. The species passes through a juvenile bisexual phase, with gonads consisting of both immature spermatogenic and immature ovarian tissue, before maturing directly as male or female. The minimum age at sexual maturity is between four and eight years when reaching a size of 400-500 mm standard length (Olsen and LaPlace 1979, Bush et al. 2006). The major determinant of maturity appears to be size rather than age, as fish raised in captivity reached maturity at 27-28 months (Tucker and Woodward 1994).

Nassau grouper reproduce in site-specific spawning aggregations. Spawning aggregations, of a few dozen up to perhaps thousands of individuals have been reported from the Bahamas, Jamaica, Cayman Islands, Belize, and the Virgin Islands. These aggregations occur in depths of 20-40 m (65.6-131.2 ft) at specific locations of the outer reef shelf edge. Spawning takes place in December and January, around the time of the full moon, in waters 25-26 degrees C (77-78.8 degrees F).

Threats

Because Nassau grouper spawn in aggregations at historic areas and at very specific times, they are easily targeted during reproduction. Because Nassau grouper mature relatively late (4-8 years), many juveniles may be taken by the fishery before they have a chance to reproduce.

Designated critical habitat

Critical habitat is not designated for species proposed for listing as Endangered or Threatened under the ESA.

5.1.5 Sea Turtles

5.1.5.1 Leatherback Sea Turtle

The leatherback sea turtle is unique among sea turtles for its large size, wide distribution (due to thermoregulatory systems and behavior), and lack of a hard, bony carapace. It ranges from tropical to subpolar latitudes, worldwide. The range for this species encompasses the entire coastal portion of the action area where EPA has NPDES permitting authority as well as the Pacific Territories. The species was first listed under the Endangered Species Conservation Act (35 FR 8491) and listed as endangered under the ESA since 1973. We used information available in the 5-year review (NMFS and USFWS 2007c) and the designated critical habitat designation (77 FR 61573) to summarize the status of the species, as follows.

Life history

Age at maturity remains elusive, with estimates ranging from 5 to 29 years (Spotila et al. 1996, Avens et al. 2009). Females lay up to seven clutches per season, with more than 65 eggs per clutch and eggs weighing >80 g (Reina et al. 2002, Wallace et al. 2007). The number of leatherback hatchlings that make it out of the nest on to the beach (i.e., emergent success) is approximately 50% worldwide (Eckert et al. 2012). Females nest every 1 to 7 years. Natal homing, at least within an ocean basin, results in reproductive isolation between five broad geographic regions: eastern and western Pacific, eastern and western Atlantic, and Indian Ocean.

Leatherback sea turtles migrate long, transoceanic distances between their tropical nesting beaches and the highly productive temperate waters where they forage, primarily on jellyfish and tunicates. These gelatinous prey are relatively nutrient-poor, such that leatherbacks must consume large quantities to support their body weight. Leatherbacks weigh about 33 percent more on their foraging grounds than at nesting, indicating that they probably catabolize fat reserves to fuel migration and subsequent reproduction (James et al. 2005, Wallace et al. 2006). Sea turtles must meet an energy threshold before returning to nesting beaches (Rivalan et al. 2005, Sherrill-Mix and James 2008, Casey et al. 2010). Therefore, their remigration intervals (the time between nesting) are dependent upon foraging success and duration (Hays 2000, Price et al. 2004).

Population dynamics

The global population of adult females has declined over 70 percent in less than one generation, from an estimated 115,000 adult females in 1980 to 34,500 adult females in 1995 (Pritchard 1982, Spotila et al. 1996). There may be as many as 34,000 – 94,000 adult leather backs in the North Atlantic, alone (TEWG 2007), but dramatic reductions (> 80 percent) have occurred in several populations in the Pacific, which was once considered the stronghold of the species (Sarti Martinez 2000).

Status

The leatherback sea turtle is an endangered species whose once large nesting populations have experienced steep declines in recent decades. The primary threats to leatherback sea turtles include: fisheries bycatch, harvest of nesting females, and egg harvesting. As a result of these threats, once large rookeries are now functionally extinct, and there have been range-wide reductions in population abundance. Other threats include loss of nesting habitat due to development, tourism, and sand extraction. Lights on or adjacent to nesting beaches alter nesting adult behavior and are often fatal to emerging hatchlings as they are drawn to light sources and away from the sea. Plastic ingestion is common in leatherbacks and can block gastrointestinal tracts leading to death. Climate change may alter sex ratios (as temperature determines hatchling sex), range (through changes in foraging habitat), and habitat (through the loss of nesting beaches, as a result of sea-level rise. The species' resilience to additional perturbation is low.

Designated critical habitat

On March 23, 1979, leatherback designated critical habitat was identified adjacent to Sandy Point, St. Croix, Virgin Islands from the 183 m isobath to mean high tide level between 17° 42'12" N and 65°50'00" W (44 FR 17710). This habitat is essential for nesting, which has been increasingly threatened since 1979, when tourism increased significantly, bringing nesting habitat and people into close and frequent proximity; however, studies do not support significant designated critical habitat deterioration.

On January 20, 2012, NMFS issued a final rule to designate additional designated critical habitat for the leatherback sea turtle (50 CFR 226). This designation includes approximately 43,798 km2 stretching along the California coast from Point Arena to Point Arguello east of the 3000 m depth contour; and 64,760 km^2 stretching from Cape Flattery, Washington to Cape Blanco, Oregon east of the 2,000 m depth contour (Fig. 5). The designated areas comprise approximately 108558 km2 of marine habitat and include waters from the ocean surface down to a maximum depth of 80 m. They were designated specifically because of the occurrence of prey species, primarily scyphomedusae of the order Semaeostomeae (i.e., jellyfish), of sufficient condition, distribution, diversity, abundance and density necessary to support individual as well as population growth, reproduction, and development of leatherbacks.

5.1.5.2 Hawksbill Sea Turtle

The hawksbill sea turtle has a sharp, curved, beak-like mouth. It has a circumglobal distribution throughout tropical and, to a lesser extent, subtropical oceans. The range for this species encompasses that portion of the action area where EPA has NPDES permitting authority along the Eastern and Gulf Coast of the continental United States and the Pacific territories. The species was first listed under the Endangered Species Conservation Act (35 FR 8491) and listed as endangered under the ESA since 1973. We used information available in the 5-year reviews (NMFS and USFWS 2007b, NMFS 2013a) to summarize the status of the species, as follows.

Life history

Hawksbill sea turtles reach sexual maturity at 20 to 40 years of age. Females return to their natal beaches every 2 to 5 years to nest (an average of 3 to 5 times per season). Clutch sizes are large (up to 250 eggs). Sex determination is temperature dependent, with warmer incubation producing more females. Hatchlings migrate to and remain in pelagic habitats until they reach approximately 22 to 25 cm in straight carapace length. As juveniles, they take up residency in coastal waters to forage and grow. As adults, hawksbills use their sharp beak-like mouths to feed on sponges and corals.

Population dynamics

Surveys at 88 nesting sites worldwide indicate that 22,004 to 29,035 females nest annually (NMFS 2013a). In general, hawksbills are doing better in the Atlantic and Indian Ocean than in the Pacific Ocean, where despite greater overall abundance, a greater proportion of the nesting sites are declining.

Status

Long-term data on the hawksbill sea turtle indicate that 63 sites have declined over the past 20 to 100 years (historic trends are unknown for the remaining 25 sites). Recently, 28 sites (68 percent) have experienced nesting declines, 10 have experienced increases, three have remained stable, and 47 have unknown trends. The greatest threats to hawksbill sea turtles are overharvesting of turtles and eggs, degradation of nesting habitat, and fisheries interactions. Adult hawksbills are harvested for their meat and carapace, which is sold as tortoiseshell. Eggs are taken at high levels, especially in Southeast Asia where collection approaches 100 percent in some areas. In addition, lights on or adjacent to nesting beaches are often fatal to emerging hatchlings and alters the behavior of nesting adults. The species' resilience to additional perturbation is low.

Terrestrial threats to marine turtle species include loss or degradation of nesting habitat resulting from erosion control through beach nourishment and armoring, beachfront development, artificial lighting, and non-native vegetation. Beach armoring intended to control erosion from stormwater (e.g., bulkheads, seawalls, soil retaining walls, rock revetments, sandbags, and geotextile tubes) can impede a turtle's access to upper regions of the beach/dune system, thereby limiting the amount of available nesting habitat. Impacts also can occur if structures are installed during the nesting season. For example, unmarked nests can be crushed or uncovered by heavy equipment, nesting turtles and hatchlings can get caught in construction debris or excavations, and hatchlings can get trapped in holes or crevices of exposed riprap and geotextile tubes.

Designated critical habitat

On September 2, 1998, NMFS established designated critical habitat for hawksbill sea turtles around Mona and Monito Islands, Puerto Rico (63 FR 46693). Aspects of these areas that are important for hawksbill sea turtle survival and recovery include important natal development habitat, refuge from predation, shelter between foraging periods, and food for hawksbill sea turtle prey.

5.1.5.3 Kemp's Ridley Sea Turtle

The Kemp's ridley is the smallest of all sea turtle species and considered to be the most endangered sea turtle, internationally (Zwinenberg 1977, Groombridge 1982, TEWG 2000). Its range extends over a portion of the action area where EPA has NPDES permitting authority, from the Gulf of Mexico to the Atlantic coast, with nesting beaches limited to a few sites in Mexico and Texas. The species was first listed under the Endangered Species Conservation Act (35 FR 8491) and listed as endangered under the ESA since 1973. We used information available in the revised recovery plan (NMFS et al. 2010) to summarize the status of the species, as follows.

Life history

Adult Kemp's ridley sea turtles have an average straight carapace length of 2.1 ft (65 cm). Females mature at 12 years of age. The average remigration is 2 years. Nesting occurs from April to July in large arribadas, primarily at Rancho Nuevo, Mexico. Females lay an average of 2.5 clutches per season. The annual average clutch size is 97 – 100 eggs per nest. The nesting location may be particularly important because hatchlings can more easily migrate to foraging grounds in deeper oceanic waters, where they remain for approximately 2 years before returning to nearshore coastal habitats. Juvenile Kemp's ridley sea turtles use these nearshore coastal habitats from April through November, but move towards more suitable overwintering habitat in deeper offshore waters (or more southern waters along the Atlantic coast) as water temperature drops. Adult habitat largely consists of sandy and muddy areas in shallow, nearshore waters less than 120 ft (37 m) deep, although they can also be found in deeper offshore waters. As adults, Kemp's ridleys forage on swimming crabs, fish, jellyfish, mollusks, and tunicates.

Population dynamics

Of the seven species of sea turtles in the world, the Kemp's ridley sea turtle is the most geographically restricted species, with nesting primarily at a single location (Rancho Nuevo, Mexico). were estimated at 40,000 females in 1947. By the mid-1980s, the population had declined to an estimated 300 nesting females. From 1980 to 2003, the number of nests increased 15 percent annually. In 2009, an estimated 8,000 nesting females produced over 20,000 nests. In addition, a total of 911 nests were recorded on the Texas coast from 2002 – 2010. The number of nests declined significantly to approximately 13,000 in 2010. While nesting rebounded to 2009 levels in 2011 and 2012, the number of nests again declined in 2013 and 2014 (Schroeder 2015).

Status

Greater numbers of Kemp's ridley sea turtle nesting, over levels in the 1980s, is likely due to a combination of management measures including elimination of direct harvest, nest protection, the use of TEDs, reduced trawling effort in Mexico and the United States, and possibly other changes in vital rates (TEWG 1998, 2000). While these results are encouraging, the species' limited range, the recent change in population recovery ratealong low global abundance makes the species particularly vulnerable to new sources of mortality as well as demographic and environmental randomness

Terrestrial threats to marine turtle species include loss or degradation of nesting habitat resulting from erosion control through beach nourishment and armoring, beachfront development, artificial lighting, and non-native vegetation. Beach armoring intended to control erosion from stormwater (e.g., bulkheads, seawalls, soil retaining walls, rock revetments, sandbags, and geotextile tubes) can impede a turtle's access to upper regions of the beach/dune system, thereby limiting the amount of available nesting habitat. Impacts also can occur if structures are installed during the nesting season. For example, unmarked nests can be crushed or uncovered by heavy equipment, nesting turtles and hatchlings can get caught in construction debris or excavations, and hatchlings can get trapped in holes or crevices of exposed riprap and geotextile tubes.

5.1.5.4 Olive Ridley Sea Turtle

The olive ridley sea turtle is a small, mainly pelagic, sea turtle with a circumtropical distribution. The species was listed under the ESA on July 28, 1978 (43 FR 32800). The species was separated into two listing designations: endangered for breeding populations on the Pacific coast of Mexico, and threatened wherever found except where listed as endangered (i.e., in all other areas throughout its range). The species range encompasses Puerto Rico, California, and the Pacific territories portion of action area where EPA has NPDES permitting authority. We used information available in the 5-year review (NMFS and USFWS 2007d) to summarize the status of each population, as follows.

Life history

Olive ridley females mature at 10 to 18 years of age. They lay an average of two clutches per season (3-6 months in duration). The annual average clutch size is 100 to 110 eggs per nest. Olive ridleys commonly nest in successive years. Females nest in solitary or in arribadas, large aggregations coming ashore at the same time and location. As adults, olive ridleys forage on crustaceans, fish, mollusks, and tunicates, primarily in pelagic habitats.

Mexico's Pacific coast breeding colonies population dynamics

The eastern Pacific lineage is genetically and geographically isolated from other olive ridley lineages.

Mexico's Pacific coast breeding colonies status

Prior to 1950, abundance was conservatively estimated to be 10 million adults. Years of adult harvest reduced the population to just over one million adults by 1969. Shipboard transects along the Mexico and Central American coasts between 1992 and 2006 indicate an estimated 1.39 million adults. Based on the number of olive ridleys nesting in Mexico, populations appear to be increasing in one location (La Escobilla: from 50,000 nests in 1988 to more than one million in 2000) and stable at all others. Harvest prohibitions and the closure of a nearshore turtle fishery resulted in a partial recovery; however, remaining threats include current bycatch in longline and trawl fisheries and the illegal harvest of eggs and turtles. Given its large population size, it is somewhat resilient to future perturbation.

Olive ridley sea turtle in all other areas population dynamics

Threatened olive ridley sea turtles nest in arribadas at a few beaches in the eastern Pacific, western Atlantic, and northern Indian Oceans. Solitary nesting is observed on many tropical beaches throughout the Atlantic, Pacific, and Indian Oceans. Arribadas now range in size from 335 to 2,000 nests in the western Atlantic, from 1,300 to 200,000 turtles in the eastern Pacific, and from 1,000 to 200,000 in the Indian Ocean.

Status

It is likely that solitary nesting locations once hosted large arribadas; since the 1960s, populations have experienced declines in abundance of 50 – 80 %. Many populations continue to decline. Olive ridley sea turtles continue to be harvested as eggs and adults, legally in some areas, and illegally in others. Incidental capture in fisheries is also a major threat. The olive ridley sea turtle is the most abundant sea turtle in the world; however, several populations are declining as a result of continued harvest and fisheries bycatch. Its large population size, however, allows some resilience to future perturbation.

Terrestrial threats to marine turtle species include loss or degradation of nesting habitat resulting from erosion control through beach nourishment and armoring, beachfront development, artificial lighting, and non-native vegetation. Beach armoring intended to control erosion from stormwater (e.g., bulkheads, seawalls, soil retaining walls, rock revetments, sandbags, and geotextile tubes) can impede a turtle's access to upper regions of the beach/dune system, thereby limiting the amount of available nesting habitat. Impacts also can occur if structures are installed during the nesting season. For example, unmarked nests can be crushed or uncovered by heavy equipment, nesting turtles and hatchlings can get caught in construction debris or excavations, and hatchlings can get trapped in holes or crevices of exposed riprap and geotextile tubes.

5.1.5.5 Loggerhead Sea Turtle

The loggerhead sea turtle is distinguished from other turtles by its large head and powerful jaws. The North Pacific Ocean DPS ranges throughout tropical to temperate waters in the North Pacific. The species was first listed as threatened under the ESA in 1978 (43 FR 32800). In 2011, the North Pacific Ocean DPS was listed as endangered under the ESA (76 FR 58868). In 2011, the Northwest Atlantic Ocean DPS was listed as threatened under the ESA (76 FR 58868). The range for this species encompasses the coastline of the continental United States, Puerto Rico and the Pacific Territories where EPA has NPDES permitting authority. We used information available in the 2009 Status Review (Conant et al. 2009) and the final listing rule (76 FR 58868) to summarize the status of the species, as follows.

North Pacific Ocean Loggerhead sea turtle DPS life history

Mean age at first reproduction for female loggerhead sea turtles is 30 years (SD = 5). Females lay an average of three clutches per season. The annual average clutch size is 112 eggs per nest. The average remigration interval is 2.7 years. Nesting occurs primarily on Japanese beaches, where warm, humid sand temperatures incubate the eggs. Temperature determines the sex of the turtle during the middle of the incubation period. Turtles spend the post-hatchling stage in pelagic waters. The juvenile stage is spent first in the oceanic zone (Kuroshio Extension Bifurcation Region) and later in the neritic zone (i.e., coastal waters) in the eastern and central Pacific. Coastal waters in the eastern and western North Pacific provide important foraging habitat, inter-nesting habitat, and migratory habitat for adult loggerheads.

North Pacific Ocean Loggerhead sea turtle DPS population dynamics

There are nine loggerhead DPSs, which are geographically separated and genetically isolated, as indicated by genetic, tagging, and telemetry data. The North Pacific DPS has a small nesting population. An 18-year time series of nesting data in Japan indicates a decline in the North Pacific population from 6,638 nests in 1990 to 2,064 nests in 1997. Since then, nesting has gradually increased to 7,000 – 8,000 nests, based on estimates taken in 2009).

North Pacific Ocean Loggerhead sea turtle DPS status

In the loggerhead sea turtle North Pacific Ocean DPS, historical evidence from Kamouda Beach indicates a substantial overall decline (50 – 90 percent) since 1950. Furthermore, population modeling in 2009 indicated that the North Pacific Ocean DPS appears to be declining, is at risk, and is thus likely to decline in the foreseeable future (Conant et al. 2009). The decline is a result of incidental capture in fishing gear, directed harvest, coastal development, increased human use of nesting beaches, and pollution. Coastal fisheries in Japan, the South China Sea, and Baja California, Mexico are the biggest threat to the species. Drift gillnet fisheries in California and Oregon and the Hawaii-based longline fishery once took large numbers of loggerheads; however, seasonal and take-based closures have minimized the impact of these fisheries. The DPS remains at risk for extinction and its resilience to future perturbations is low.

Northwest Atlantic Ocean Loggerhead sea turtle DPS life history

Adult loggerhead sea turtles have a mean straight carapace length of 3 ft (92 cm). Mean age at first reproduction for female loggerhead sea turtles is 30 years (SD = 5). Mating occurs in the spring, and eggs are laid throughout the summer. Northwest Atlantic females lay an average of five clutches per season. The annual average clutch size is 115 eggs per nest. The average remigration interval is 3.7 years (Tucker 2010). Nesting occurs primarily on beaches along the Southeastern Coast of the United States, from southern Virginia to Alabama. Additional nesting occurs on beaches throughout the Gulf of Mexico and Caribbean Sea. Temperature determines the sex of the turtle during the middle of the incubation period. Post- hatchling loggerheads from southeast U.S. nesting beaches may linger for months in waters just off the nesting beach or become transported by ocean currents within the Gulf of Mexico and North Atlantic, where they become associated with Sargassum habitats, driftlines, and other convergence zones. The juvenile stage is spent first in the oceanic zone (e.g., waters around the Azores, Madeira, Morocco, and the Grand Banks off Newfoundland) and later in the neritic zone (i.e., continental shelf waters) from Cape Cod Bay, Massachusetts, south through Florida, the Caribbean, and the Gulf of Mexico. Neritic stage juveniles often inhabit relatively enclosed, shallow water estuarine habitats with limited ocean access. Juveniles are omnivorous and forage on crabs, mollusks, jellyfish and vegetation at or near the surface (Dodd 1988). Adults inhabit shallow water habitats with large expanses of open ocean access, as well as continental shelf waters. Sub-adult and adult loggerheads prey on benthic invertebrates such as mollusks and decapod crustaceans in hard bottom, coastal habitats.

Northwest Atlantic Ocean Loggerhead sea turtle DPS population dynamics

There are nine loggerhead DPSs, which are geographically separated and genetically isolated, as indicated by genetic, tagging, and telemetry data. The Northwest Atlantic Ocean DPS is further divided into five recovery units or nesting subpopulations: Northern, Peninsular Florida, Dry Tortugas, Northern Gulf of Mexico, and Greater Caribbean. Using a stage/age demographic model, the adult female population size of the DPS is estimated at 20,000 – 40,000 females (TEWG 2009). Peninsular Florida hosts more than 10,000 females nesting annually, which constitutes 87 percent of all nesting effort in the DPS. A 23 percent increase in nest counts from 1989 until 1998 was followed by a sharp decline in the subsequent decade (http://myfwc.com/research/wildlife/sea-turtles/nesting/loggerhead-trends/); large fluctuations in population size often indicate the loss of resilience and susceptibility to population collapse (Dai et al. 2012, Scheffer et al. 2012). Nesting aggregations from Georgia to North Carolina host 1,000 to 9,999 females nesting annually. The other recovery units are much smaller but are still considered essential to the continued existence of the species.

Northwest Atlantic Ocean Loggerhead sea turtle DPS status

The loggerhead sea turtle Northwest Atlantic Ocean DPS was listed as threatened under the ESA. Bycatch remains the most significant threat in the ocean, however turtle excluder devices on shrimp trawlers and the use of circle hooks in the longline fishery have reduced bycatch significantly.

Terrestrial threats to marine turtle species include loss or degradation of nesting habitat resulting from erosion control through beach nourishment and armoring, beachfront development, artificial lighting, and non-native vegetation. Beach armoring intended to control erosion from stormwater (e.g., bulkheads, seawalls, soil retaining walls, rock revetments, sandbags, and geotextile tubes) can impede a turtle's access to upper regions of the beach/dune system, thereby limiting the amount of available nesting habitat. Impacts also can occur if structures are installed during the nesting season. For example, unmarked nests can be crushed or uncovered by heavy equipment, nesting turtles and hatchlings can get caught in construction debris or excavations, and hatchlings can get trapped in holes or crevices of exposed riprap and geotextile tubes. The rangewide nesting trend of the DPS from 1989 until 2010 is slightly negative but not significantly different from zero. NMFS concluded that, as a result of its relatively large abundance (20,000 – 40,000 females), the DPS is not currently at risk of extinction; however, its large fluctuations in population size indicates loss of resilience, such that it is likely to become endangered within the foreseeable future.

Northwest Atlantic Ocean Loggerhead sea turtle DPS designated critical habitat

The final designated critical habitat for the Northwest Atlantic Ocean loggerhead DPS within the Atlantic Ocean and the Gulf of Mexico includes 36 occupied marine areas within the range of the Northwest Atlantic Ocean DPS (79 FR 39855). These areas contain one or a combination of nearshore reproductive habitat, winter area, breeding areas, and migratory corridors.

5.1.5.6 Green sea turtle

The green sea turtle is the largest of the hardshell marine turtles, growing to a weight of 350 lb (159 kg) and a straight carapace length of greater than 3.3 ft (1 m). It has a circumglobal distribution, occurring throughout nearshore tropical, subtropical, and, to a lesser extent, temperate waters. The species was listed under the ESA on July 28, 1978 (43 FR 32800). The species was separated into two listing designations: endangered for breeding populations in Florida and the Pacific coast of Mexico, and threatened in all other areas throughout its range. On August 1, 2012, NMFS found that a petition to identify the Hawaiian population of green turtle as a DPS, and to delist the DPS, may be warranted (77 FR 45571). With the exception of Alaska, the range for this species encompasses the entire coastal portion of the action area where EPA has NPDES permitting authority. We used information available in the 2007 5-Year Review (NMFS and USFWS 2007a) to summarize the status of the species, as follows.

Life history throughout range

Age at first reproduction for females is 20 - 40 years. They lay an average of three nests per season with an average of 100 eggs per nest. The remigration interval (i.e., return to natal beaches) is 2 – 5 years. Nesting occurs primarily on beaches with intact dune structure, native vegetation, and appropriate incubation temperatures during summer months. After emerging from the nest, hatchlings swim to offshore areas and go through a post-hatchling pelagic stage where they are believed to live for several years. During this life stage, green sea turtles feed close to the surface on a variety of marine algae and other life associated with drift lines and debris. Adult turtles exhibit site fidelity and migrate hundreds to thousands of kilometers from nesting beaches to foraging areas. Green sea turtles spend the majority of their lives in coastal foraging grounds, which include open coastlines and protected bays and lagoons. Adult green turtles feed primarily on seagrasses and algae, although they also eat jellyfish, sponges, and other invertebrate prey.

Population dynamics throughout range

Nesting data at 46 sites from 1990-2006 indicate that 108,761 to 150,521 females nest each year. At the 23 sites for which nesting trend data are available, ten are increasing, nine are stable, and four are decreasing. Where long term data (≥ 20 years) are available (nine sites), nesting populations are stable or increasing in abundance. Nesting populations are doing relatively well in the Pacific, Western Atlantic, and Central Atlantic Ocean; whereas, populations are doing poorly in Southeast Asia, Eastern Indian Ocean, and Mediterranean.

Status

Once abundant in tropical and subtropical waters, globally, green sea turtles exist at a fraction of their historical abundance, as a result of over-exploitation. Egg harvest, the harvest of females on nesting beaches, and directed hunting of turtles in foraging areas remain the three greatest threats to their recovery. In addition, bycatch in drift-net, long-line, set-net, pound-net, and trawl fisheries kill thousands of green sea turtles annually. Apparent increases in recent years are optimistic but must be viewed cautiously, as the datasets represent a fraction of a green sea turtle generation, up to 50 years. While the threats of harvest, coastal development, and fisheries bycatch continue, the species appears to be somewhat resilient to future perturbations.

Terrestrial threats to marine turtle species include loss or degradation of nesting habitat resulting from erosion control through beach nourishment and armoring, beachfront development, artificial lighting, and non-native vegetation. Beach armoring intended to control erosion from stormwater (e.g., bulkheads, seawalls, soil retaining walls, rock revetments, sandbags, and geotextile tubes) can impede a turtle's access to upper regions of the beach/dune system, thereby limiting the amount of available nesting habitat. Impacts also can occur if structures are installed during the nesting season. For example, unmarked nests can be crushed or uncovered by heavy equipment, nesting turtles and hatchlings can get caught in construction debris or excavations, and hatchlings can get trapped in holes or crevices of exposed riprap and geotextile tubes.

Designated critical habitat

On September 2, 1998, NMFS designated critical habitat for green sea turtles (63 FR 46694), which include coastal waters surrounding Culebra Island, Puerto Rico. Seagrass beds surrounding Culebra provide important foraging resources for juvenile, subadult, and adult green sea turtles. Additionally, coral reefs surrounding the island provide resting shelter and protection from predators. This area provides important developmental habitat for the species.

Life history of Florida and Mexico's Pacific coast breeding colonies

Life history for the Florida coast breeding colony differs slightly from other populations in that their nests contain an average of 136 eggs and the average remigration interval is 2 years. In addition to nesting on Florida beaches, green sea turtles are found in coastal waters throughout the state. Important neritic habitats include: Mosquito and Indian River Lagoons, Port Canaveral, St. Lucie Inlet, and Biscayne Bay.

Population dynamics of Florida and Mexico's Pacific coast breeding colonies

Along the central and southeast coast of Florida, an estimated 200 – 1,100 females nest each year (Meylan et al. 1994, Weishampel et al. 2003). According to data collected from Florida's index nesting beach survey from 1989-2012, green sea turtle nest counts across Florida have increased approximately ten-fold from a low of 267 in the early 1990s to a high of 10,701 in 2011. In the Pacific Mexico, surveys from 2000 to 2006 indicate an average of 6,050 nests, and a 25-year dataset reveals an increasing trend for the largest nesting site (Colola).

Status of Florida and Mexico's Pacific coast breeding colonies

The historic and current threats for the Florida and Mexico's Pacific coast breeding populations are the same as described above for all other areas. Recent increases in nesting on Florida beaches are likely a result of a Florida statute prohibiting the killing of green sea turtles, ESA listing, the 1994 Florida State ban on gillnets and other entangling nets, CITES Appendix I listing, and turtle protections in other nations. Recent increases in the Mexican breeding populations are likely the result of nesting beach protection (1979) and a 1990 presidential decree protecting all sea turtles. However, the threats of harvest, coastal development, and fisheries bycatch continue. The populations' resilience to future perturbations is low but increasing with population size increases.

5.1.6 Abalone

5.1.6.1 White abalone

The white abalone is a large marine gastropod mollusk found in deep (20 – 60 m), rocky habitats interspersed with sand channels, from Point Conception, California to Punta Abreojos, Baja California, Mexico. The range of this species encompasses the Southern California portion of the action area where EPA is the NPDES permitting authority on tribal lands The species was listed as endangered under the ESA on May 29, 2001 (66 FR 29046). We used information available in the status review report (Hobday and Tegner 2000)and the recovery plan (NMFS 2008c) to summarize the status of the species, as follows.

Life history

White abalone are "broadcast" spawners, releasing gametes in synchrony during the winter. Fertilization is reliant upon dense adult aggregations and high gamete density. Fertilized eggs sink and hatch into free-swimming larvae. After one or two weeks, larvae settle and become increasingly sedentary with age. They mature at 4 – 6 years of age and can live 35 – 40 years. Females release hundreds of thousands to millions of eggs each year. White abalone are herbivorous, feeding on attached or drifting algae.

Population dynamics

Surveys conducted in 2002 and 2003 resulted in population estimates of 12,818 (± 3,582) and 7,365 (± 5,340) individuals on two banks in southern California. These estimates are larger than the estimate of total abundance (600 – 1,600 individuals) in the late 1990s. Though current abundance remains unknown, it is likely less than one percent of pre-exploitation population size

Status

Surveys conducted between 1972 and 1997 indicate that the density of white abalone declined by four orders of magnitude (99 percent). Furthermore, juvenile shells are rarely observed, indicating a lack of recruitment. The species is endangered as a result of overharvest by commercial and recreational fisheries. The Californian commercial fishery began in 1968 and peaked at 144,000 lbs (86,000 individuals) in 1972. By 1978, white abalone catch had declined dramatically, such that individuals were rarely landed (< 1000 lbs annually). The Californian recreational fishery peaked in 1975, at ~35,000 individuals. The commercial and recreational fisheries were closed in 1996. White abalone were also harvested in Baja California, Mexico, although catch numbers are not available. Its continued existence is threatened by illegal poaching and low recruitment (the current density of white abalone limits the success rate of fertilization and recruitment). Therefore, species' resilience to future perturbations is low.

Designated critical habitat

Designated critical habitat has not been designated because it was determined to be "not prudent," due to concern that disclosure of white abalone whereabouts would increase the threat of poaching (66 FR 29048).

5.1.6.2 Black abalone

Black abalone is a large marine gastropod mollusk found in shallow (< 6 m) rocky intertidal and subtidal habitats, from Point Arena, California to Bahia Tortugas and Isla Guadalupe, Baja California, Mexico. The range of this species encompasses the Southern California portion of the action area where EPA is the NPDES permitting authority on tribal lands. The species was listed as endangered under the ESA on January 14, 2009 (74 FR 1937). We used information available in the status review report (NMFS 2009) to summarize the status of the species, as follows.

Life history

Black abalone are "broadcast" spawners, releasing gametes in synchrony during the spring and summer. Fertilization is reliant upon dense adult aggregations, high gamete density. Within days, fertilized eggs sink and hatch into free-swimming larvae. After 4 – 10 days, larvae settle and become increasingly sedentary with age. They mature at ~3 years of age and can live for 30 years. Small females release a hundred thousand eggs each year, but larger individuals release millions of eggs annually. Black abalone are herbivorous, feeding on attached or drifting algal material.

Population dynamics

Fisheries data indicate that black abalone populations have declined > 95% in recent decades, such that the species now exhibits a patchy distribution along the coasts of California and northern Baja California. The populations appear to be reproductively isolated by distance, emphasizing the importance of local spawning and recruitment.

Status

Long-term monitoring sites from most of the geographical range of black abalone in the United States indicate that black abalone have become locally extinct at 11 of the 32 study locations (34%), have declined between 90–99% in abundance at an additional 10 (31%) study locations, and have declined between 80–89% at 2 sites (Neuman et al. 2010). At 8 northern sites (25%), there have been no instances of declines, and average abundance has increased by 56% (Neuman et al. 2010). Thus, significant declines (>80%) have occurred at the majority (72%) of study sites, including all sites in southern California (Neuman et al. 2010). There is evidence of recent recruitment in northern Baja California. Black abalone are endangered as a result of overharvest and disease. The Californian commercial fishery peaked at 1,860 metric tons in 1879, reached 868 metric tons in 1973, and fell to <20 metric tons in 1993, when the commercial and recreational fisheries were closed. Between 1972 and 1981, over 3.5 million individuals were harvested. The Mexican commercial fishery peaked in 1990 with 28 metric tons and declined to < 0.5 metric tons by 2003. The severe declines were caused primarily by withering syndrome. Withering syndrome is a disease caused by bacteria that prevents assimilation of nutrients in the digestive system. The first appearance along mainland California occurred in 1988, when approximately 85% of the resident black abalone in Diablo Cove died as a result of the disease and warm-water effluent from a nuclear power facility. Previous overharvest, continued poaching, and withering syndrome have resulted in extremely low population densities, which further reduce the potential for fertilization and recruitment and limit the recovery potential of the species. Its resilience to future perturbations is extremely low.

Designated critical habitat

On October 27, 2011, the NMFS designated critical habitat for black abalone as follows: rocky areas from mean high water to six meters water depth in the Farallon, Channel, and Año Nuevo islands; the California coastline from Del Mar Ecological Reserve south to Government Point (excluding some stretches, such as in Monterey Bay and between Cayucos and Montaña de Oros State Park); and between the Palos Verdes and Torrance border south to Los Angeles Harbor. These areas include PCEs required by black abalone, such as: rocky substrates, food resources, juvenile settlement habitat, suitable water quality, and suitable nearshore circulation patterns.

5.1.7 Corals

There are currently 22 coral species listed as threatened under the ESA, 16 of which occur in the action area (Table 7). Elkhorn and staghorn coral were listed as threatened under the ESA on May 9, 2006 (71 FR 26852). Both species were proposed as endangered on December 7, 2012 (77 FR 73219) along with listing proposals for 66 other coral species. On September 10, 2014 a final listing rule was published listing 22 coral species, including elkhorn and staghorn coral, as threatened (79 FR 53852). Information from the proposed listings (77 FR 73219 and 79 FR 53852) and status reports (ABRT 2005) were used to summarize the status of these species

Table 7: Threatened coral species occurring in the MSGP action area

Threatened Corals	Currently Known in These U.S. Geographic Areas
Caribbean Waters: Puerto Rico	
Acropora cervicornis (Staghorn)*and designated critical habitat*	X

Acropora palmata (Elkhorn) *and designated critical habitat*	X			
Mycetophyllia ferox	X			
Dendrogyra cylindrus	X			
Orbicella annularis	X			
Orbicella faveolata	X			
Orbicella franksi	X			
Pacific Waters				
	Guam	**Commonwealth of Northern Mariana Islands**	**Pacific Remote Island Areas**	**American Samoa**
Acropora globiceps	X	X	X	X
Acropora jacquelineae				X
Acropora retusa	X		X	X
Acropora rudis				X
Acropora speciosa			X	X
Euphyllia paradivisa				X
Isopora crateriformis				X
Pavona diffluens	X	X		X
Seriatopora aculeata	X			

Life history

The threatened coral species include true stony corals (class Anthozoa, order Scleractinia), the blue coral (class Anthozoa, order Helioporacea), and fire corals (class Hydrozoa, order Milleporina). All threatened species are reef-building corals, because they secrete massive calcium carbonate skeletons that form the physical structure of coral reefs.

Reef-building coral species are capable of rapid calcification rates because of their symbiotic relationship with single-celled dinoflagellate algae, zooxanthellae, which occur in great numbers within the host coral tissues. Zooxanthellae photosynthesize during the daytime, producing an abundant source of energy for the host coral that enables rapid growth. At night, polyps extend their tentacles to filter-feed on microscopic particles in the water column such as zooplankton, providing additional nutrients for the host coral. In this way, reef-building corals obtain nutrients autotrophically (i.e., via photosynthesis) during the day, and heterotrophically (i.e., via predation) at night.

Most coral species use both sexual and asexual propagation. Sexual reproduction in corals is primarily through gametogenesis (i.e., development of eggs and sperm within the polyps near the base). Some coral species have separate sexes (gonochoric), while others are hermaphroditic. Strategies for fertilization are by either “brooding” or “broadcast spawning” (i.e., internal or external fertilization, respectively). Brooding is relatively more common in the Caribbean, where nearly 50 percent of the species are brooders, compared to less than 20 percent of species in the Indo-Pacific. Asexual reproduction in coral species most commonly involves fragmentation, where colony pieces or fragments are dislodged from larger colonies to establish new colonies, although the budding of new polyps within a colony can also be considered asexual reproduction. In many species of branching corals, fragmentation is a common and sometimes dominant means of propagation.

Reef-building corals do not thrive outside of an area characterized by a fairly narrow mean temperature range (typically 25 °C-30 °C). Two other important factors influencing suitability of habitat are light and water quality.

Threats

Massive mortality events from disease conditions of corals and the keystone grazing urchin Diadema antillarum have precipitated widespread and dramatic changes in reef community structure. Large-scale coral bleaching reduces population viability. In addition, continuing coral mortality from periodic acute events such as hurricanes, disease outbreaks, and bleaching events from ocean warming have added to the poor state of coral populations and yielded a remnant coral community with increased dominance by weedy brooding species, decreased overall coral cover, and increased macroalgal cover. Additionally, iron enrichment may predispose the basin to algal growth. Further, coral growth rates in many areas have been declining over decades. Such reductions prevent successful recruitment as a result of reduced density. Finally, climate change is likely to result in the endangerment of many species as a result of temperature increases (and resultant bleaching), sea level rises, and ocean acidification.

Designated critical habitat

On November 26, 2008, NMFS designated critical habitat for elkhorn and staghorn coral. They designated marine habitat in four specific areas: Florida (1,329 square miles), Puerto Rico (1,383 square miles), St. John/St. Thomas (121 square miles), and St. Croix (126 square miles). These areas support the following physical or biological features that are essential to the conservation of the species: substrate of suitable quality and availability to support successful larval settlement and recruitment and reattachment and recruitment of fragments.

6 ENVIRONMENTAL BASELINE

The "Environmental Baseline" is defined as: "the past and present impacts of all Federal, State, or private actions and other human activities in an action area, the anticipated impacts of all proposed Federal projects in an action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process" (50 CFR 402.02). This includes discharges and activities authorized by the administratively continued MSGP, and other activities authorized by the EPA (e.g., NPDES permits, cooling water intake, air emissions, and the cleanup and management of hazardous waste). The key purpose of the Environmental Baseline is to describe the condition of the ESA-listed species and designated critical habitat in the action area and the consequences of that condition without the action.

In some cases, the deterioration of water quality has led to the endangerment of aquatic species; in all cases, activities that threaten water quality also threaten species under the jurisdiction of NMFS. The decline in these species' populations leave them vulnerable to a multitude of threats. Because of reduced abundance, low or highly variable growth capacity, and the loss of essential habitat, these species are less resilient to additional disturbances. In larger populations, stressors that affect only a limited number of individuals could once be tolerated by the species without resulting in population level impacts, whereas in smaller populations, the same stressors are more likely to reduce the likelihood of survival. It is with this understanding of the environmental baseline that we consider the effects of the proposed action, including the likely effect that the MSGP will have on endangered and threatened species and their designated critical habitat.

Since the action area for this consultation is national in scope, involving greater than 2,000 existing discharge sources plus unknown future discharge sources, it is not practical to describe the environmental baseline and assess risk for each specific site where the MSGP may authorize discharges and activities, nor is it practical evaluate effects to each ESA-listed species potentially exposed to these discharges. Accordingly, this Opinion approaches the Environmental Baseline more generally by describing activities, conditions and stressors which degrade water quality and affect ESA-listed species and designated critical habitat: land use, water use, climate change (Section 6.1.3 below), aquatic invasive species, injury and competition due to fisheries, and environmental pollutants, including stormwater pollutants. The Environmental Baseline then integrates the activities and conditions that degrade water quality by closing with a summary of the major causes and sources for aquatic impairments identified under section 303(d) within the Action Area, making special note of those impairments associated with stormwater. In discussing aquatic impairments, we acknowledge that other water bodies may have impaired water quality but not yet be identified by a state for inclusion in its section 303(d) list. However, evaluation of identified impairments provides an accurate background for purposes of the baseline description. This information is organized at a regional scale for the east coast, Gulf coast, west coast, and Pacific island territories.

6.1 Activities, Conditions, and Stressors which Degrade Water Quality

A variety of activities and conditions, contribute to the degradation of water quality. These include conversion of unbroken, natural lands, withdrawals of water and subsequent effluent discharges, the progression of climate change, the introduction of nonnative invasive species, species inherent vulnerabilities, region-specific vulnerabilities, and introduction of contaminants.

6.1.1 Land Use

In 2013, the U.S. Census Bureau estimated the U.S. population to be more than 315 million people. Increases in population growth and density over the last 100 years have resulted in dramatic changes to the natural landscape of the U.S. Most modern metropolitan areas encompass many different land covers and uses (Hart 1991), Land-use changes due to human activities represent a major factor in terms of habitat and water quality changes that, in turn, influence plant and animal abundance and distribution (Mac et al. 1998). Flather C.H. et al. (1998) identified habitat loss and alien species as the two most widespread threats to endangered species, affecting more than 95% and 35% of listed species, respectively. Localized anthropogenic effects within small watersheds may lead to cumulative changes which influence estuarine and coastal waters. For example, nutrient runoff from farmland and input by wastewater treatment plants to a large river system could influence the natural dissolved oxygen regime in an entire estuary. Changes in land use over the past few centuries have increased the occurrence and significance of water quality problems, particularly stormwater runoff from non-point source pollution and hydrological modification.

By the mid-1990s, at least 27 types of ecosystems, including those used by anadromous species under NMFS jurisdiction, had declined by more than 98 percent (Noss et al. 1995) due to land use changes. Aquatic and semi-aquatic ecosystems have not fared much better than terrestrial ecosystems. Many of our nation's rivers and streams have been altered by dams, stream channelization, and dredging to stabilize water levels in rivers or lakes. When examining the impacts of large dams alone, it is estimated that 75,000 large dams have modified at least 600,000 miles of rivers across the country (IWSRCC 2011). For example, more than 400 dams exist in the Columbia River Basin alone (CBT 2012). Wetland habitats have been drained to make land available for agriculture, filled to make land available for residential housing, commerce, and industry, diked to control mosquitoes, or flooded for water supply. The net effect of human-altered hydrology (1) creates conditions which increase stormwater runoff, transporting land based pollutants into surface waters (2) reduces the filtration of stormwater runoff through wetlands prior to reaching surface waters (3) has reduced the spatial extent and quality of available habitat and (3) has reduced the connectivity among rivers and streams which is necessary for anadromous species to complete their migratory lifecycles.

In estuaries of the Pacific northwest for example, diking and filling activities have reduced the tidal prism and eliminated emergent and forested wetlands and floodplain habitats. These changes likely have reduced estuaries' salmon-rearing capacity. Restoration of estuarine habitats, particularly diked emergent and forested wetlands, reduction of avian predation by terns, and flow manipulations to restore historical flow patterns may have begun to enhance the estuary's productive capacity for salmon, although historical changes in population structure and salmon life histories may prevent salmon from making full use of the productive capacity of estuarine habitats. For example, in estuaries that support salmon, changes in habitat and food-web dynamics have altered their capacity to support juvenile salmon (LCFRB 2004, Bottom et al. 2005, Fresh et al. 2005, NMFS 2006).

Between the 1780s and 1980s, 30% of the nation's wetlands had been destroyed, including 74% of the wetlands in Connecticut, 73% of the wetlands in Maryland, 52% of the wetlands in Texas, and 91% of all wetlands in California, including 94% of all inland wetlands (Dahl 1990), and, declines have continued. From 1982 to 1987, the wetland area throughout the conterminous U.S. declined by 1.1 percent. Between 2006 and 2009, approximately 13,800 acres of wetlands were lost per year (Dahl 2011). While this loss is significantly less than that experienced in the previous decades (Figure 5), based on historical estimates, about 72% of U.S wetlands have already been lost (Dahl 2011).

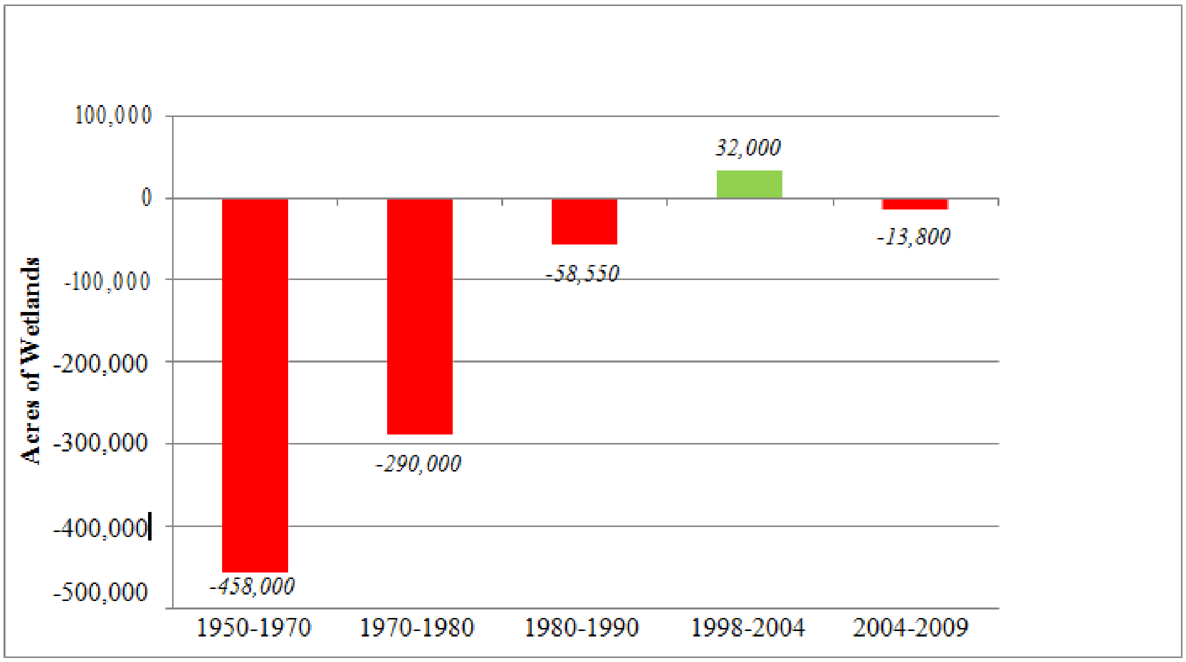

Figure 5 Average annual net wetland acreage loss and gain estimates for the conterminous U.S. (Taken from Dahl 2011)

Efforts to create and restore wetlands and other aquatic habitats by agencies of Federal, State, and local governments, non- governmental organizations, and private individuals have dramatically reduced the rate at which these ecosystems have been destroyed or degraded, but many aquatic habitats continue to be lost each year. The expansion of urban/suburban metropolitan areas accounted for 48% of wetland decline (Brady and Flather 1994). Urban land use increased from 1.3 percent (29 million acres) in 1964 to 2.9 percent (66 million acres) in

1997 (Lubowski et al. 2006). The type of land use in a stream catchment and along the stream margins substantially influences that waterbody's physical, chemical, and biological quality (Diana et al. 2006). Urban land use adversely affects stream and water quality, especially when present in critical amounts and close to the stream channel (Diana et al. 2006). Increased impervious surface area increases surface runoff, one of the major concerns of urban land use, and commonly causes degradation in channel morphology (Konrad et al. 2005), water quality, macroinvertebrates, and fish (Deacon et al. 2005, Kennen et al. 2005, Walters et al. 2005, Stranko et al. 2008). In fact, many studies have identified impervious surface as a quantifiable attribute of land use that is clearly linked to (i.e., actually causes) water quality, aquatic habitat degradation, and adverse impacts to biota (Stranko et al. 2008, Magee 2009).

In addition to the impacts resulting from increased impervious surfaces, urban and suburban development also often result in direct waterbody modification, including channelization, channel armoring, creating dams and impoundments, and stream piping and burial. Additionally, removing vegetated riparian buffers leads to increased sediment, increased water temperature, increased nitrogen, and changes in channel morphology. Physical habitat degradation like this can significantly change the fish assemblage present in a stream (Diana et al. 2006). In general, as channel morphology and aquatic habitat become less diverse, nutrient and pollutant levels in streams increase, and macroinvertebrate and fish communities shift from species that require high quality water to species that can survive in degraded water quality and habitat conditions (Magee 2009).

Urban and suburban areas concentrate wastewater inputs to waterbodies. Common wastewater inputs include effluents (from both wastewater treatment plants and industrial discharges), stormwater runoff, sewer overflows, and septic systems. These wastewaters can result in increased nutrients, pathogens, metals, pharmaceuticals and personal care products, toxics, and dissolved solids. They also increase stream discharge and water temperature and decrease dissolved oxygen.

6.1.2 Water Use

The U.S., like many world regions, is experiencing increasing demand for fresh, clean water. Increasing population growth and increasing agricultural needs frequently conflict with availability. The twentieth century saw increased dam construction, increased irrigation practices for agriculture, increased recreational use of waterbodies, and increased use of waterways for waste disposal, both sanitary and industrial. The results of these water use changes include[33]:

- Increased water withdrawal for consumption and irrigation
- Increased habitat loss and fragmentation
- Altered flow regimes

33 After Schilling and J. Smythe 1987, McDonald and D. 1988, Waterstone and Burt 1988, Johnson and Viessman 1989, Moore 1989.

- Altered patterns of sediment transport and deposition
- Increased water temperature, and
- Decreased water quality resulting from chemical and pathogenic contamination.

These changes nearly always adversely affect aquatic and aquatic-dependent species, either by forcing their relocation or extirpating them. There remains a need to balance human water use with aquatic species' requirements. Water use in the western U.S. presents a particular concern, because the western states are characterized by low precipitation. Moreover, agricultural uses dominate the water needs in these states (Anderson and Woosley 2008). Although the western states contain the headwaters of some of the continent's major river systems, these water sources have been utilized to the point that there are few undeveloped resources to draw upon to satisfy new demands or to restore depleted rivers and aquifers (USACE and CBI 2012). Groundwater has become an increasingly important source of water as surface water resources have been depleted. Water remains a finite resource, however, and there are consequences to pumping ground water. These consequences include depleting aquifer storage, supplying poorer quality water to wells, diminishing flow to springs and streams, and land subsidence (Anderson and Woosley 2008).

6.1.3 Climate Change

The Intergovernmental Panel on Climate Change (IPCC) estimated that average global land and sea surface temperature has increased by 0.85°C (± 0.2) since the late 1800s, with most of the change occurring since the mid-1900s (IPCC 2013). This temperature increase is greater than what would be expected given the range of natural climatic variability recorded over the past 1,000 years (Crowley and Berner 2001). The IPCC estimates that the last 30 years were likely the warmest 30-year period of the last 1,400 years, and that global mean surface temperature change will likely increase in the range of 0.3 to 0.7°C by about 2033.

All species discussed in this Opinion are or are likely to be threatened by the direct and indirect effects of global climatic change. Global climate change stressors, including consequent changes in land use, are major drivers of ecosystem alterations (USEPA 2008). Climate change is projected to have substantial direct effects on individuals, populations, species, and the community structure and function of marine, coastal, and terrestrial ecosystems in the foreseeable future (McCarty 2001, IPCC 2002, Parry et al. 2007, IPCC 2013). Increasing atmospheric temperatures have already contributed to changes in the quality of freshwater, coastal, and marine ecosystems and have contributed to the decline of populations of endangered and threatened species (Mantua et al. 1997, Karl et al. 2009, Littell et al. 2009).

Warming water temperatures attributed to climate change can have significant effects on survival, reproduction, and growth rates of aquatic organisms (Staudinger et al. 2012). For example, warmer water temperatures have been identified as a factor in the decline and disappearance of mussel and barnacle beds in the Northwest (Harley 2011). Increasing surface water temperatures can cause the latitudinal distribution of freshwater and marine fish species to change: as water temperatures rise, cold and warm water species will spread northward (Hiddink and ter Hofstede 2008, Britton et al. 2010). Cold water fish species and their habitat will begin to be displaced by the warm water species (Hiddink and ter Hofstede 2008, Britton et al. 2010). Fish species are expected to shift latitudes and depths in the water column, and the increasing temperatures may also result in expedited life cycles and decreased growth (Perry et al. 2005). Shifts in migration timing of pink salmon (*Oncorhynchus gorbuscha*), which may lead to high pre-spawning mortality, have also been tied to warmer water temperatures (Taylor 2008). Climate-mediated changes in the global distribution and abundance of marine species are expected to reduce the productivity of the oceans by affecting keystone prey species in marine ecosystems such as phytoplankton, krill, and cephalopods. For example, climate change may reduce recruitment in krill by degrading the quality of areas used for reproduction (Walther et al. 2002).

Warmer water also stimulates biological processes which can lead to environmental hypoxia. Oxygen depletion in aquatic ecosystems can result in anaerobic metabolism increasing, thus leading to an increase in metals and other pollutants being released into the water column (Staudinger et al. 2012). In addition to these changes, climate change may affect agriculture and other land development as rainfall and temperature patterns shift. Aquatic nuisance species invasions are also likely to change over time, as oceans warm and ecosystems become less resilient to disturbances (USEPA 2008). If water temperatures warm in marine ecosystems, native species may shift poleward to cooler habitats, opening ecological niches that can be occupied by invasive species introduced via ships' ballast water or other sources (Ruiz et al. 1999, Philippart et al. 2011). Invasive species that are better adapted to warmer water temperatures could outcompete native species that are physiologically geared towards lower water temperatures; such a situation currently occurs along central and northern California (Lockwood and Somero 2011).

Climate change is also expected to impact the timing and intensity of stream seasonal flows (Staudinger et al. 2012). Warmer temperatures are expected to reduce snow accumulation and increase stream flows during the winter, cause spring snowmelt to occur earlier in the year, and reduced summer stream flows in rivers that depend on snow melt. As a result, seasonal stream flow timing will likely shift significantly in sensitive watersheds (Littell et al. 2009). Warmer temperatures may also have the effect of increasing water use in agriculture, both for existing fields and the establishment of new ones in once unprofitable areas (ISAB 2007). This means that streams, rivers, and lakes will experience additional withdrawal of water for irrigation and increasing contaminant loads from returning effluent. Changes in stream flow due to use changes and seasonal run-off patterns may alter predator-prey interactions and change species assemblages in aquatic habitats. For example, a study conducted in an Arizona stream documented the complete loss of some macroinvertebrate species as the duration of low stream flows increased (Sponseller et al. 2010). As it is likely that intensity and frequency of droughts will increase across the southwest (Karl et al. 2009), similar changes in aquatic species composition in the region is likely to occur.

Ocean acidification, as a result of increased atmospheric carbon dioxide, can interfere with numerous biological processes in corals including: fertilization, larval development, settlement success, and secretion of skeletons (Albright et al. 2010). Over the past 200 years, the oceans have absorbed about half of the CO2 produced by fossil fuel burning and other human activities. This increase in CO2 has led to a reduction of the pH of surface seawater of 0.1 units, equivalent to a 30 percent increase in the concentration of hydrogen ions in the ocean. If global emissions of CO2 from human activities continue to increase, the average pH of the oceans is projected to fall by 0.5 units by the year 2100 (RoyalSocietyofLondon 2005). In addition to global warming, acidification poses another significant threat to oceans because many major biological functions respond negatively to increased acidity of seawater. Photosynthesis, respiration rate, growth rates, calcification rates, reproduction, and recruitment may be negatively impacted with increased ocean acidity (RoyalSocietyofLondon 2005). Kroeker et al (Kroeker et al. 2010) reviewed 139 studies that quantified the effect of ocean acidification on survival, calcification, photosynthesis, growth, and reproduction. Their analysis determined that the effects were variable depending on species, but effects were generally negative, with calcification being one of the most sensitive processes. Their meta-analysis was not able to show significant negative effects to photosynthesis. Although the scale of acidification changes would vary regionally, the resulting pH could be lower than the oceans have experienced over at least the past 420,000 years and the rate of change is probably one hundred times greater than the oceans have experienced at any time over that time interval. Aquatic species, especially marine species, already experience stress related to the impacts of rising temperature. Corals, in particular, demonstrate extreme sensitivity to even small temperature increases. When sea temperatures increase beyond a coral's limit, the coral "bleaches" by expelling the symbiotic organisms that not only give coral its color, but provide food for the coral through their photosynthetic capabilities. According to (Hoegh-Guldberg 2010), bleaching events have steadily increased in frequency since the 1980s.

In summary, the direct effects of climate change include increases in atmospheric temperatures, decreases in sea ice, and changes in sea surface temperatures, patterns of precipitation, and sea level. Indirect effects of climate change include altered reproductive seasons/locations, shifts in migration patterns, reduced distribution and abundance of prey, and changes in the abundance of competitors and/or predators. Climate change is most likely to have its most pronounced effects on species whose populations are already in tenuous positions (Williams et al. 2008).

6.1.4 Vessel Strikes

Ship strikes and entanglement in fishing gear pose significant threats to populations of endangered whales along the Atlantic seaboard, particularly North Atlantic right whales. Based on the records available, large whales have been struck by ships off almost every coastal state in the United States, although ship strikes are most common along the Atlantic Coast. From 2006 to 2010, Henry et al. (2012) reported a total of 500 large whale interactions including ship strikes, entanglements and strandings due to unknown causes. The number of entanglements (206) far outweighed the number of vessel strikes (58). Among the entanglements 24 (12%) caused the deaths of the individuals and 28 (48%) of the vessel strikes caused the deaths of the animals. Thirty-three (16%) of the entanglements were serious enough to result in death of the animal while only1 of the vessel strikes resulted in a serious injury. Humpback whales had the greatest number of entanglement mortalities (n=9), the highest number of serious injury events resulting from entanglements (n=20); and the greatest number of vessel strike mortalities (n=10); and right whales had the only serious injury (n=1) from vessel strikes.

Atlantic sturgeon are also susceptible to vessel collisions. Out of a total of 28 mortalities reported in the Delaware estuary between 2005 and 2008, 14 resulted from vessel strike (Brown and Murphy 2007). Further, the authors determined that a mortality rate of more than 2.5% of the females within a population could result in population declines. Similarly, in the James River in Virginia, 34 out of a total of 39 Atlantic sturgeon had injuries consistent with vessel strikes (Brown and Murphy 2007, Balazik et al. 2012). The actual number of vessel strikes in both of these river systems in unknown, however, Balazik et al. (2012) estimated up to 80 sturgeon were killed between 2007 and 2010.

For sea turtles, vessels also present risks for injury and death. For example, out of a total of 109 stranded, dead sea turtles found in the Delaware River estuary from 1994-1999, 30 had been struck and killed by vessels (Stetzar 2002). Numbers of vessel struck sea turtles would be elevated above those mentioned here in the southern part of their ranges where sea turtle abundance is greater.

6.1.5 Fisheries

The shrimp trawl fisheries conducted off the southeast United States (from North Carolina to the Atlantic coast of Florida) and Gulf of Mexico (from the Gulf coast of Florida to Texas) are one of the fisheries that have the most significant demographic effect on sea turtles. Participants in these fisheries are required to use Turtle Exclusion Devices (TEDs), which are estimated to reduce the number of shrimp trawl related mortality by as much as 94% for loggerheads and 97% for leatherbacks. Even with TED measures in place, in 2002, NMFS (2002) expected these fisheries to capture about 323,600 sea turtles each year and kill about 5,600 of the turtles captured. Loggerhead sea turtles account for most of this total: 163,000 captured, killing almost 4,000 of them. Kemp’s ridleys account for the second-most interactions: 155,503 captures with 4,200 of them dying. These are followed by green sea turtles: about 18,700 captured with more than 500 of them dying as a result of their capture. Leatherback sea turtle interactions were estimated at 3,090 captures with 80 of them dying as a result (NMFS 2002). Since 2002, however, effort in the Atlantic shrimp fisheries has declined from a high of 25,320 trips in 2002 to approximately 13,464 trips in 2009. Since sea turtle takes are directly linked to fishery effort, these takes are expected to decrease but are still expected to result in at least hundreds and possibly in the low thousands of sea turtle interactions annually, of which hundreds are expected to be lethal (NMFS 2012b).

Portions of the Atlantic pelagic fisheries for swordfish, tuna, shark, and billfish capture and kill the second highest numbers of sea turtles along the Atlantic coast. These fisheries, which operate off the coast of South Carolina and Georgia (with the exception of waters off Florida and southernmost Georgia that are closed to the longline component of these fisheries) and the Gulf of Mexico, include purse seine fisheries for tuna, harpoon fisheries for tuna and swordfish, commercial and recreational rod and reel fisheries, gillnet fisheries for shark, driftnet fisheries, pelagic longline fisheries, and bottom longline fisheries.

Between 1986 and 1995, this fishery captured and killed 1 northern right whale, 2 humpback whales, and two sperm whales. Between 1992 and 1998, the longline components of these fisheries are estimated to have captured more than 10,000 sea turtles (4,585 leatherback sea turtles and 5,280 loggerhead sea turtles), killing 168 of these sea turtles in the process. The latter estimate does not include sea turtles that might have died after being released (Johnson et al. 1999, Yeung 1999). Since then, all components of these fisheries are estimated to capture about 2,381 sea turtles each year, killing 781 sea turtles in the process.

Portions of the Atlantic sea scallop fisheries and capture and kill the third highest numbers of sea turtles along the Atlantic coast. These fisheries are expected to capture about 129 loggerhead sea turtles in 2012 but 49 loggerheads are estimated captured and killed in 2013 and beyond. Although these fisheries are only expected to capture 2 green, leatherback, and Kemp's ridley sea turtles each year, all of these turtles might die as a result of their capture. In addition, sea turtles are captured and killed in several other Federal fisheries that operate along the Atlantic coast, although most of these fisheries capture and kill fewer sea turtles than the fisheries discussed in the preceding narratives. Of all the factors that influenced NMFS' decision to list sea turtles as threatened or endangered, the most significant sources of injury or mortality of juvenile, subadult, and adult sea turtles are those associated with commercial fishing. The fisheries discussed in this section of this Opinion are expected to continue into the foreseeable future at levels of effort that are roughly equivalent to current levels. As a result, we expect the number of sea turtles that are captured and killed in these fisheries to continue for the foreseeable future.

6.1.6 Aquatic Invasive Species

Aquatic invasive species are aquatic organisms that are introduced into new habitats and subsequently produce harmful impacts on the natural resources in and human uses of these ecosystems (http://www.anstaskforce.gov). Not all non-native (also called alien or nonindigenous) species are considered invasive. Over 250 nonindigenous species of invertebrates, algae, and microorganisms have established themselves in the coastal marine ecosystems of California, whose waters have been the subject of most in-depth analyses of aquatic invasions in the U.S. Over 175 invasive species are reportedly established in San Francisco Bay alone. More than 180 invaders have been detected and described in the Great Lakes, which are among the best-studied freshwater systems in the world. Overall, there have been 374 documented invasive species in U.S. waters, 150 of which have arrived since 1970 (Pew 2003).

In 2003, the Director of the U.S. FWS called invasive species "the biggest environmental threat to this country..it's something everyone needs to take very, very seriously." Introduced aquatic invasive species are one of the main sources of risk to ESA-listed species, second only to habitat loss (Wilcove and Chen 1998). They have been implicated in the endangerment of 48% of the species listed under ESA (Czech and Krausman 1997). The U.S. Fish and Wildlife Service considers invasive species to be a significant contributing factor in determining the “threatened” or “endangered” status of many native species (OTA 1993, Ruiz et al. 1997). Invasive species impact aquatic environments in many different ways. They can reduce native species abundance and distribution, and reduce local biodiversity by out-competing native species for food and habitat. They may displace food items preferred by native predators, disrupting the natural food web. They may alter ecosystem functions. For example, (Callaway and Josselyn 1992) found that invasive species changed shorebird foraging habitat and increased competition, adversely impacting native shorebirds. Additionally, invasive species can cause significant damage to human infrastructure and systems, as in the case of zebra mussel in the Great Lakes. Exotic plants can clog channels and interfere with recreational fishing and swimming. Introduced non-native algal species combined with nutrient overloading may increase the intensity and frequency of algal blooms. An overabundance of algae can lead to depleted dissolved oxygen. Oxygen depletion can result in “dead zones,” murky water, seagrass and coral habitat degradation, and large-scale fish kills (Deegan and Buchsbaum 2005).

6.1.7 Salmonid Natural Mortality Factors

Available data indicate high natural mortality rates for salmonids, especially in the open ocean/marine environment. According to (Bradford et al. 1997), salmonid mortality rates range from 90 to 99%, depending on the species, the size at ocean entry, and the length of time spent in the ocean. In freshwater rearing habitats, the natural mortality rate averages about 70% for all salmonid species (Bradford et al. 1997). Past studies in the Pacific Northwest suggest that the average freshwater survival rate (from egg to smolt) is 2 to 3% throughout the region (Marshall and Britton 1990, Bradford et al. 1997). A number of suspected causes contributing to natural mortality include parasites and/or disease, predation, water temperature, low water flow, wildland fire, and oceanographic features and climatic variability. The cumulative mortality in young animals can reach 90 to 95%. Most young fish are highly susceptible to disease during the first two months of life. Disease outbreaks may occur when water quality is diminished and fish are stressed from crowding and diminished flows (Spence et al.1996, (Guillen 2003). Young coho salmon or other salmonid species may become stressed and lose their resistance in higher temperatures (Spence et al. 1996). Consequently, diseased fish become more susceptible to predation and are less able to perform essential functions, such as feeding, swimming, and defending territories (McCullough 1999).

Salmonids are exposed to high rates of natural predation, during freshwater rearing and migration stages, as well as during ocean migration. Salmon along the U.S. west coast are prey for marine mammals, birds, sharks, and other fishes. In the Pacific Northwest, the increasing size of tern, seal, and sea lion populations may have reduced the survival of some salmon ESUs/DPSs (Gustafson et al. 1997, Pearcy 1997, NMFS 2008d). Large numbers of fry and juveniles are eaten by birds such as mergansers (*Mergus* spp.), common murre (*Uria aalage*), gulls (*Larus* spp.), and belted kingfishers *(Megaceryle alcyon*). Avian predators of adult salmonids include bald eagles (*Haliaeetus leucocephalus*) and osprey (*Pandion haliaetus*) (Pearcy 1997). Caspian terns (*Sterna caspia*) and cormorants (*Phalacrocorax* spp.) may be responsible for the mortality of up to 6% of the outmigrating stream-type juveniles in the Columbia River basin (Roby et al. 2006, Collis and et al. 2007). Pikeminnows (*Ptychocheilus oregonensis*) are significant predators of yearling juvenile migrants (Friesen and Ward 1999). Chinook salmon were 29% of the prey of northern pikeminnows in lower Columbia reservoirs, 49% in the lower Snake River, and 64% downstream of Bonneville Dam. Sockeye smolts comprise a very small fraction of the overall number of migrating smolts (Ferguson 2006) in any given year. The significance of fish predation on juvenile chum is unknown. There is little direct evidence that piscivorous fish in the Columbia River consume juvenile sockeye salmon. The primary fish predators in estuaries are probably adult salmonids or juvenile salmonids which emigrate at older and larger sizes than others. Outside estuaries, many large non-salmonid populations reside just offshore and may consume large numbers of smolts (Beamish et al. 1992, Pearcy 1992, Beamish and Neville 1995)

6.1.8 Wildland Fire (west coast)

Wildland fires that are allowed to burn naturally in riparian or upland areas may benefit or harm aquatic species, depending on the degree of departure from natural fire regimes. Although most fires are small in size, large size fires increase the chances of adverse effects on aquatic species. Large fires that burn near the shores of streams and rivers can have biologically significant short-term effects. They include increased water temperatures, ash, nutrients, pH, sediment, toxic chemicals, and loss of large woody debris (Rinne 2004, Buchwalter et al. 2004). Nevertheless, fire is also one of the dominant habitat-forming processes in mountain streams (Bisson et al. 2003). As a result, many large fires burning near streams can result in fish kills with the survivors actively moving downstream to avoid poor water quality conditions (Rinne 2004, Greswell 1999). The patchy, mosaic pattern burned by fires provides a refuge for those fish and invertebrates that leave a burning area or simply spares some fish that were in a different location at the time of the fire (USFS 2000). Small fires or fires that burn entirely in upland areas also cause ash to enter rivers and increase smoke in the atmosphere, contributing to ammonia concentrations in rivers as the smoke adsorbs into the water (Greswell 1999).

The presence of ash also has indirect effects on aquatic species depending on the amount of ash entry into the water. All ESA-listed salmonids rely on macroinvertebrates as a food source for at least a portion of their life histories. When small amounts of ash enter the water, there are usually no noticeable changes to the macroinvertebrate community or the water quality (Bowman and Minshall 2000). When significant amounts of ash are deposited into rivers, the macroinvertebrate community density and composition may be moderately to drastically reduced for a full year with long-term effects lasting 10 years or more (Buchwalter et al. 2003, Buchwalter et al. 2004, Minshall et al. 2001). Larger fires can also indirectly affect fish by altering water quality. Ash and smoke contribute to elevated ammonium, nitrate, phosphorous, potassium, and pH, which can remain elevated for up to four months after forest fires (Buchwalter et al. 2003).

6.1.9 Pollutants

In addition to direct loss and alteration of aquatic habitat, many aquatic ecosystems have been impacted by various contaminants and pollutants. Accumulation of naturally occurring high background concentrations of environmental contaminants at harmful concentrations occurs primarily when human activities such as agriculture, mining, logging, and dredging accelerate rates of natural processes. Industrial stormwater discharges authorized by the MSGP may contain inorganics, organics, nutrients, and unusual values for some general water quality parameters (i.e., pH, measured of sediment, etc.). In addition to industrial inputs, these contaminants are already present in the environment from multiple sources and pathways including atmospheric deposition, agriculture, mining, and urbanization.

In 2008, the Heinz Center for Science, Economics and the Environment (Heinz Center 2008) published a comprehensive report on the condition of our nation's ecosystems noting the following:

- From 1992 to 2001, benchmarks for the protection of aquatic life were exceeded in 50% of streams tested nationwide—83% of streams in urbanized areas—and 94% of streambed sediments.
- Contaminants were detected in approximately 80% of sampled freshwater fish and most of these detected contaminants exceeded wildlife benchmarks (1992–2001 data) (Gilliom et al. 2006).
- Nearly all saltwater fish tested had at least five contaminants at detectable levels, and concentrations exceeded benchmarks for the protection of human health in one-third of fish tissue samples—most commonly DDT, PCBs, polycyclic aromatic hydrocarbons, and mercury (USEPA 2007)

Toxic contaminants, as noted above have, been documented in the Lower Columbia River and its tributaries (LCREP 2007). More than 41,000 waters are listed as impaired by pollutants that include mercury, pathogens, sediment, other metals, nutrient, and oxygen depletion, and other causes (USEPA 2013b). Pennsylvania reported the greatest number of impaired waters (6,957), followed by Washington (2,420), Michigan (2,352), and Florida (2,292). These figures likely underestimate the true number of impaired waterbodies in the U.S. For example, EPA's National Aquatic Resource Surveys (NARS) is a probability based survey that provides a national assessment of the nation's waters and is used to track changes in water quality over time. Through this method, EPA estimates that 50% of the nation's streams (approximately 300,000 miles) and 45% of the nation's lakes (approximately seven million acres) are in fair to poor condition for nitrogen or phosphorus levels relative to reference condition waters (USEPA 2013a). However, data submitted by the States indicates that only about half of the NARS estimate (155,000 miles of rivers and streams and about four million acres of lakes) have been identified on EPA's 303(d) impaired waters list for nutrient related causes (USEPA 2013a).

While provisions of the Clean Water Act have helped significantly improve the quality of aquatic ecosystems, nonpoint sources of water pollution, which are believed to be responsible for the majority of modern water quality problems in the United States, are not subject to Clean Water Act NPDES permit and regulatory requirements. Instead, nonpoint sources of pollution are regulated by programs overseen by the States. Water quality problems, particularly the problem of non-point sources of pollution, have resulted from changes humans have imposed on the landscapes of the United States over the past 100 to 200 years. The mosaic of land uses associated with urban and suburban centers has been cited as the primary cause of declining environmental conditions in the United States (Flather C.H. et al. 1998) and other areas of the world (Houghton 1994). Most land areas covered by natural vegetation are highly porous and have very little sheet flow; precipitation falling on these landscapes infiltrates the soil, is transpired by the vegetative cover or evaporates. The increased transformation of the landscapes of the United States into a mosaic of urban and suburban land uses has increased the area of impervious surfaces such as roads, rooftops, parking lots, driveways, sidewalks, etc., in those landscapes. Precipitation that would normally infiltrate soils in forests, grasslands and wetlands falls on and flows over impervious surfaces. That runoff is then channeled into storm sewers and released directly into surface waters (rivers and streams), which changes the magnitude and variability of water velocity and volume in those receiving waters. Inputs of sediments into aquatic ecosystems can result from erosion resulting from high velocity flows (Gosselink and Lee 1989, Beechie et al. 2010). As water moves through a watershed it carries sediments and pollutants to streams (e.g., (Paul and Meyer 2001, Allan 2004, Dudgeon 2005) and wetlands (e.g., (Zedler and Kercher 2005, Wright et al. 2006).

Increases in polluted runoff have been linked to a loss of aquatic species diversity and abundance, including many important commercial and recreational fish species. Nonpoint source pollution has also contributed to coral reef degradation, fish kills, seagrass bed declines and algal blooms, including blooms of toxic algae (NOAA 2013). In addition, many shellfish bed and swimming beach closures can be attributed to polluted runoff. As discussed in EPA's latest National Coastal Condition Report nonpoint sources have been identified as one of the stressors contributing to coastal water pollution (USEPA 2012). Since 2001, EPA has periodically released these reports detailing condition of the nation's costal bays and estuaries and assessing trends in water quality in coastal areas. The latest National Coastal Condition Report indicates that coastal water conditions have remained "fair" and the trend assessment demonstrates no significant change in the water quality of U.S. coastal waters since the publication of the second National Coastal Condition Report in 2004 (USEPA 2012).

In many estuaries, agricultural activities are major source of nutrients and a contributor to the harmful algal blooms in summer, although according to (McMahon and Woodside 1997)– nearly one-third of the total nitrogen inputs and one-fourth of the total phosphorus input to the estuary are from atmospheric sources. The National Estuary Program Condition Report found that nationally, 37% of national estuary program estuaries are in poor condition (http://water.epa.gov/type/oceb/nep/nepccr-factsheet.cfm). Throughout the 20th century, mining, agriculture, paper and pulp mills, and municipalities contributed large quantities of pollutants to many estuaries. For example, the Roanoke River and the Albemarle-Pamlico Estuarine Complex receives water and associated pollutant loads from 43 counties in North Carolina and 38 counties and cities in Virginia. This estuarine system supports an array of ecological and economic functions that are of regional and national importance. Both the lands and waters of the estuarine system support rich natural resources that are intertwined with regional industries including forestry, agriculture, commercial and recreational fishing, tourism, mining, energy development, and others. The critical importance of sustaining the estuarine system was reflected in its Congressional designation as an estuary of national significance in 1987. Even so, today the Albemarle-Pamlico Estuarine Complex is rated in good to fair condition in the National Estuary Program Coastal Condition Report despite that over the past 40-year period data indicate some noticeable changes in the estuary, including increased dissolved oxygen levels, increased pH, decreased levels of suspended solids, and increased chlorophyll *a* levels (USEPA 2006).

Since 1993, EPA has compiled information on locally issued fish advisories and safe eating guidelines. This information is provided to the public to limit or avoid eating certain fish due to contamination of chemical pollutants. EPA's 2010 National Listing of Fish Advisories database indicates that 98% of the advisories are due (in order of importance) to: mercury, PCBs, chlordane, dioxins, and DDT (USEPA 2010). Fish advisories have been issued for 36% of the total river miles (approximately 1.3 million river miles) and 100% of the Great Lakes and connecting waterways (USEPA 2010). Fish advisories have been steadily increasing over the National Listing of Fish Advisories period of record (1993-2010), but EPA interprets these increases to reflect the increase in the number of waterbodies being monitored by States and advances in analytical methods rather than an increase in levels of problematic chemicals (USEPA 2010).

Water quality concerns related to urban development include providing adequate sewage treatment and disposal, transporting contaminants to streams by storm runoff, and preserving stream corridors. Water availability has been, and will continue to be, a major, long-term issue in many areas. It is now widely recognized that ground-water withdrawals can deplete streamflows

(Morgan and Jones 1999), and one of the increasing demands for surface water is the need to maintain instream flows for fish and other aquatic biota.

6.1.10 Stressors of the Action in the Baseline: Stormwater Pollutants

There is a great deal of variability in constituent make up, flow rate and quantity of stormwater discharges. Heavier pollutant loads can result from rain on snow because both soluble and particulate pollutants accumulated in snow are flushed from the snowpack simultaneously in the rain and melting snow. The addition of rain to snowmelt can also flush pollutants that have accumulated on various surfaces such as roads, parking lots, roofs, and saturated soil surfaces over the winter. The intensity of runoff from a rain-on-snow event can be greater than a summer thunderstorm because the ground is saturated or frozen and the rapidly melting snowpack provides added runoff volume (Oberts et al. 2000).

The 2008 National Research Council publication *"Urban Stormwater Management in the United States"* reviews stormwater effects on water quality in urbanized areas. The document includes a review of the distinct nature of industrial stormwater discharges. This review is supplemented with information from current literature and the updated 2011 National Stormwater Quality Database. The 2008 National Stormwater Quality Database summary ((CWP and Pitt 2008, Pitt et al. 2008)for version 3) reported that the median metal concentrations in stormwater discharges from industrial areas were about three times the median concentrations observed in open-space and residential areas. The activities performed and materials present at industrial facilities create "hotspots" for stormwater runoff, containing pollutant loadings greater than that of "normal" runoff (Bannerman et al. 1993, Pitt et al. 1995, Claytor and Schueler 1996). The first comprehensive monitoring of stormwater, dry weather base flows, and snowmelt runoff in an industrial area was conducted by Pitt and McLean in 1986. The mass discharges of heavy metals, total phosphorus, and COD from industrial stormwater were three to six times that of mixed residential and commercial areas (Pitt and McLean 1986).

The extensive rooftops of industrial areas can be a significant pollutant source. Researchers have investigated the effects of industrial runoff on receiving waters and biota. Bailey et al. (1999)investigated the toxicity to juvenile rainbow trout of runoff from British Columbia sawmills and found that much of the toxicity may have been a result of divalent cations on the industrial site, especially zinc from galvanized roofs. Tobisewski and colleagues (Tobiszewski et al. 2010)characterized pollutant concentrations in rooftop runoff resulting from "first flush", steady state, and snowmelt stormwater. Total chrysene and PAHs concentrations in first flush of rain events were 10 orders of magnitude greater than steady state, while zinc concentrations were hundreds of orders of magnitude higher. Polycyclic aromatic hydrocarbon concentrations increased as snowmelt progressed. The particulate-bound PAHs which had accumulated as combustion particulates over the winter were mobilized more rapidly overtime because release rates increase as a snow pack decreases in volume (Tobiszewski et al. 2010).

While runoff concentrations may be dynamic, Good (1993) reports that dissolved metals' concentrations and toxicity remained high in roof runoff samples, especially from rusty galvanized metal roofs during both first flush and several hours after a rain has started, indicating that metal leaching continued throughout the events and for many years (Good 1993). During pilot-scale tests of roof panels exposed to rains over a two-year period, zinc runoff concentrations from traditional galvanized metal panels were 5 to 30 mg/L throughout monitoring period while factory-painted aluminum–zinc alloy panels had runoff zinc levels less than 250 µg/L. To place these discharges in context of stormwater from nonindustrial areas and toxicity potential for aquatic organisms: The median stormwater values reported in the National Stormwater Quality Database for different land uses is 60 to 300 µg/L and EPA's acute zinc water quality criterion for aquatic life is 120 µg/L for water with a hardness of 100 mg $CaCO_3$/L. In the same study, copper runoff from newly treated wood panels exceeded 5 mg/L for the first nine months of exposure and continued to be released at levels high enough to exceed aquatic life criteria for long periods after installation. To place these copper discharges in context of stormwater from nonindustrial areas and potential toxicity to exposed organisms: The National Stormwater Quality Database reports median stormwater copper concentrations of about 10 to 40 µg/L for several land uses and the acute copper aquatic life criteria, which is determined by the influence of water chemistry on bioavailability, may be as low as 0.5 µg/L in soft water with low dissolved organic carbon at pH 6.5. This work also suggested the release of nutrients from many of the materials tested, possibly due to phosphate washes and binders used in manufacturing or natural degradation (Clark et al. 2008).

The metal form (i.e., dissolved versus total metal) in runoff is influenced by the pH of the rainwater striking the surface and the buffering capacity of the surface. Pennington and Webster-Brown (2008) reported that copper clad roofs generated runoff with concentrations of up to 7,690 µg Cu/L, predominantly present as dissolved, free Cu^{2+} owing to the low pH of 6.4 of rainwater. Meanwhile concrete tile roof with Cu guttering generated up to 590 µg Cu/L, and the portion of dissolved and free Cu^{2+} was less, due to the pH buffering effect of the cement-based roofing material, which increased rainwater pH from 5.8 to 7.8 in rooftop runoff (Pennington and Webster-Brown 2008).

Pavement surfaces can also have a strong influence on stormwater runoff quality. For example, concrete is often mixed with industrial waste sludges as a way of disposing of the wastes. However, this can lead to stormwater discharges high in toxic compounds, either due to the additives themselves or due to the mobilization of compounds via the additives. Salaita and Tate (1998) showed that high levels of aluminum, iron, calcium, magnesium, silicon, and sodium occurred in cement-waste samples. Using the Microtox assay, Pitt et al. (1995) found high toxicity in concrete yard runoff from many source areas. The toxicity was likely due to the high pH of the discharge, which was about 11 in the discharge due to lime dust washing off from the site.

In addition to the bitumens and asphalts, other compounds are added to paving (and asphaltic roofing) materials. The long-term environmental effects of all of the chemical modifiers and fillers used in asphalts are unknown. Rogge et al. (1997) found that the components of asphalt elutable organic mass consisted of n-alkanes, carboxylic acids, and benzoic acids. PAHs and thiaarenes were 7.9 percent of the identifiable mass. In addition, heterocyclic aromatic hydrocarbons containing sulfur (S-PAH), such as dibenzothiophene, were identified at concentration levels similar to that of phenanthrene. S-PAHs are potentially mutagenic (similar to other PAHs), but due to their slightly increased polarity, they are more soluble in water and more prone to aquatic bioaccumulation.

Brantley and Townsend (1999) performed a series of leaching tests and analyzed the leachate for a variety of organics and heavy metals. Only lead from asphalt pavements reclaimed from older roadways was found to be elevated in the leachate. Stormwater quality from asphalt-paved surfaces seems to vary with time. Fish kills have been reported when rains occur shortly after asphalt has been installed in parking areas near ponds or streams (Anonymous 2000, Perez-Rivas 2000, Kline 2002). It is expected that these effects are associated with losses of the more volatile and toxic hydrocarbons that are present on new surfaces. It is likely that the concentrations of these materials in runoff decrease as the pavement ages. Toxicity tests conducted on pavements several years old have not indicated any significant detrimental effects, except for those associated with activities conducted on the surface (such as maintenance and storage of heavy equipment; (Pitt et al. 1995, Pitt et al. 1999). However, pavement maintenance used to “renew” the asphalt surfaces has been shown to cause significant problems.

Coal-tar sealants commonly used to “restore” asphalt parking lots and storage areas are a significant source of PAHs in the Austin, Texas area. Mahler et al. (2005) found that small particles of sealcoat that flake off due to abrasion by vehicle tires have PAH concentrations about 65 times higher than for particles washed off parking lots that are not seal coated. Unsealed parking lots receive PAHs from the same urban sources as do sealed parking lots (e.g., tire particles, leaking motor oil, vehicle exhaust, and atmospheric fallout), and yet the average yield of PAHs from the sealed parking lots was found to be 50 times greater than that from the control lots. The authors concluded that sealed parking lots could be the dominant source of PAHs in watersheds that have seal-coated surfaces, such as many industrial, commercial, and residential areas. Consequently, the City of Austin has restricted the use of parking lot coal-tar sealants, as have several Wisconsin communities.

Although roofing and pavement materials make up a large fraction of the total surface covers and can have significant effects on stormwater quality, leaching of rain through stored materials may also be a significant pollutant source at industrial sites. Exposed metals in scrap yards can result in very high concentrations of heavy metals. Metals are largely associated small particles (<20 µm in diameter), and relatively little is associated with the filterable fraction. These metals concentrations (especially zinc, copper, and lead) are also very high compared to that of most outfall industrial stormwater. For example, concentrations up to 3.8 mg/L were observed for copper, 1.7 mg/L for lead, 8 mg/L for zinc, and 70 mg/L for aluminum (Clark 2000). Investigation of stormwater runoff from logging yards indicated a strong correlation between total suspended solids and concentrations of metals and some organic and inorganic compounds, suggesting that strategies that effectively remove total suspended solids would control these discharges (Kaczala et al. 2011).

Factors such as amount of dry deposition, storm intensity, rain acidity, inter-storm period, seasonality, and the physical properties and material composition of the surfaces contributing pollutants to the runoff event determine the constituents and their concentrations within the discharge. Add to this the variability contributed by the receiving water and other stormwater sources and land uses within the watershed. This variability is shown in the broad concentrations ranges in monitoring data from the National Stormwater Quality Database (accessed March 24, 2013) and quarterly benchmark monitoring data reported under the 2008 MSGP (Table 8).

Table 8: Summary of industrial stormwater monitoring data from the National Stormwater Quality Monitoring Database and Quarterly Benchmark Monitoring under the 2008 MSGP.

Analyte, form (units)	National Stormwater Quality Monitoring Database – data to 2011 geometric mean detected (range)	Quarterly Monitoring data under the 2008 MSGP geometric mean detected (range)
Ammonia		2.2 (0.003-50.8)
BOD, Total (mg/L)	7.9 (1.42-83)	284.4 (0.5-2,100)
Chemical oxygen demand (COD), Total (mg/L)	49.85 (7.2-559)	404.2 (1-25,000)
pH SU	6.89 (5.4-9.02)	6.6 (2.6-11.9)
Total Suspended Solids (mg/L)	57.1 (0.1-2,870)	230.7 (0.04-83,000)
Turbidity NTU	32.98 (5.95-1,033)	162.6 (0.39-1,360)
Nitrogen, Nitrite + Nitrate N, Total (mg/L)	0.48 (0.02-14)	1.3 (0.01-79)
Phosphorus as P, Total (mg/L)	0.22 (0.01-6.4)	1.1 (0.012-19.6)
Oil and Grease (mg/L)	2.39 (0.4-7.8)	
Aluminum, Total (mg/L)	0.9 (0.05-36.4)	4.6 (0.02-1,037)
Antimony, Total (mg/L)	0.003 (0.002-0.009)	0.1 (0.002-3)
Arsenic, Total (mg/L)	0.003 (0.001-0.01)	0.02 (0.001-1)
Beryllium, Total (mg/L)	0.001 (0.001-0.001)	0.001 (0.001-0.003)
Cadmium, Total (mg/L)	0.013 (0-0.2)	0.001 (0.0001-0.018)
Chromium, Total (mg/L)	0.048 (0.002-0.365)	
Copper, Total (mg/L)	0.02 (0.001-0.39)	0.4 (0.001-12)
Cyanide, Total (mg/L)	0.013 (0.005-0.045)	0.002 (0.0004-0.005)
Fluoride mg/L	0.29 (0.12-0.528)	
Iron, Total (mg/L)	2.427 (0.1-57)	47.6 (0.002-56,000)
Lead, Total (mg/L)	0.042 (0.001-2.4)	0.3 (0.001-34.2)
Magnesium, Total (mg/L)	1.233 (0.7-4)	4.5 (0.47-13.1)
Mercury, Total (mg/L)	0.001 (0-0.003)	0.0001 (0.00005-0.001)
Nickel, Total (mg/L)	0.096 (0.004-0.2)	0.015 (0.005-0.047)
Selenium, Total (mg/L)	0.003 (0.002-0.006)	0.004 (0.0002-0.02)
Silver, Total (mg/L)	0.002 (0.001-0.002)	0.003 (0.001-0.005)

Analyte, form (units)	National Stormwater Quality Monitoring Database – data to 2011 geometric mean detected (range)	Quarterly Monitoring data under the 2008 MSGP geometric mean detected (range)
Zinc, Total (mg/L)	0.082 (0.005-5.46)	0.5 (0.002-34)

6.2 Baseline Water Quality Conditions within the Action Area

Having discussed the activities, conditions, and stressors which degrade water quality, we now review the extent of degraded water quality within the action area for the MSGP. The following paragraphs describe the aquatic impairments and their sources identified pursuant to the Clean Water Act sections 303(d) and 305(b) [34], making special note of stormwater-associated impairments. These summaries are supplemented with data from EPA's Enforcement Compliance History Online database (ECHO) [35] on potential pollutant sources, including NPDES discharges, Clean Air act-permitted releases, and Resource Conservation and Recovery Act permitted sites. Information on compliance rates is provided is to identify conditions which may contribute to water quality degradation. These action area-specific baseline descriptions are summarized by regions for East Coast, Puerto Rico, the Gulf Coast states of Texas and Louisiana, the West Coast, and the Pacific Territories. This portion of the Environmental Baseline Section:

- Describes the relative extent of impaired waters within the action area
- Identifies principal causes of impairment (i.e., top five), and
- Describes permitted pollutant sources within the action area, including:
- The number of permitted direct discharges to waters of the U.S. (i.e., NPDES permits) within subwatersheds with impaired waters.
- The number of dischargers in noncompliance or significant noncompliance with permitted direct discharges to waters of the U.S.

Descriptions of water quality impairments are expressed in terms of percentage of spatial area or linear extent of the assessed waters. States differ in their assessment classification methodologies and some states have submitted water quality impairment data more recently than others, so these data can reflect different assessment approaches and represent a different snapshot in time for different states. In addition to pollutants, many of the nation's streams, lakes, and estuaries also suffer from fundamental changes in their flow regime, energy cycles, and aquatic habitats.

34 Data were collected from state water quality assessment reports for those states and territories covered by this Opinion (i.e., MA, NH, DC, PR, and ID) and for areas where EPA has permitting authority for Federally Operated Facilities and/or Indian country lands, but the information of interest could be reasonably inferred from state water quality assessment reports (see Texas and Washington Action Areas illustrated in Figure 3 and Figure 4). For Louisiana, Oregon, and California, aquatic impairment data for the specific affected sub watersheds of interest was collected from EPA's National Geospatial Dataset (http://water.epa.gov/scitech/datait/tools/waters/data/downloads.cfm).

35 Publically available at: https://echo.epa.gov/. For states and territories where EPA has permitting authority for Indian country lands and/or Federally Operated Facilities, spatial associations between ECHO data and the appropriate action area HUCs were accomplished using ArcMap 10.2.

The resulting ecological consequences, alterations in habitat, biological interactions, and community structure are not easily measured via pollutant concentrations. Such waters may be impaired, but not listed on a state 303(d) list when there is no corresponding water quality standard that would indicate such conditions (NRC, 2008). For example, not all states have biocriteria, which are expressions of the presence, condition and numbers of types of fish, insects, algae, plants, and other organisms that is characteristic of a healthy aquatic ecosystem (i.e., reference condition). Biological assessments identify whether an aquatic habitat is impaired by indicating differences from the expected reference condition.

With respect to this Opinion, the sources of impairment stressors that are related to nonpoint and stormwater discharges are of special interest because the stormwater sources likely include discharges from industrial sources. Water quality assessments rarely apportion stormwater sources by land use (e.g., industrial, residential, agricultural). Impairment sources associated with non-point, stormwater type discharges are therefore considered an indicator of stormwater-mediated impairments which may include contributions from industrial properties.

6.2.1 East Coast

The east coast portion of the action area includes the states of Massachusetts and New Hampshire, the District of Columbia, Indian country lands in Maine, Connecticut, and Rhode Island, and federally operated facilities in Vermont and Delaware. However, the National Map (http://nationalmap.gov/) does not identify any Indian country lands in the state of Rhode Island. Species under NMFS jurisdiction whose range occurs along the coastline and inland waters include the North Atlantic right whale, Atlantic salmon, Atlantic and shortnose sturgeon, and green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles. All but the Atlantic salmon range as far southward as the mid-Atlantic.

All waters in New Hampshire were assessed in 2010. While stormwater runoff-associated sources are listed among the top five contributors to water quality impairments, their contribution is minor relative to impairments due to atmospheric mercury. All waters in the state were found to be impaired by mercury contamination in fish tissue, with the source being atmospheric deposition. A high proportion (75%) of lakes, reservoirs, and ponds are listed as pH-impaired while 20% of New Hampshire's rivers and streams are listed for pH impairments. New Hampshire's bays and estuaries are listed as impaired by dioxins and PCBs of unknown/legacy origin. A final notable aquatic impairment is the presence of nonnative aquatic plants in 38% of the assessed lakes, reservoirs, and ponds. Aside from atmospheric deposition sources of pH and mercury impairments, unknown sources contribute to water quality degradation in 25% of impaired rivers and streams, 59% of impaired lakes, reservoirs and ponds, and all bays and estuaries. By comparison, the various stormwater runoff sources identified are relatively minor. These include highways, bridges and roads, urbanized areas, and wet weather discharges. Violation rates among EPA- permitted pollutant sources is relatively low in New Hampshire. A total of 386 (1.7%) of 23,192 permitted facilities are in violation of their permits, and 58 (0.25%)

of these violations are classified as a significant noncompliance. Of the 254 NPDES permits in New Hampshire, 28 currently have effluent violations and five of these are classified as significant.

Table 9 Principal causes and sources of aquatic impairments in New Hampshire (reporting year 2010)

Aquatic habitat and extent of assessed aquatic resource	Principal (top 5) causes and sources of impairment	% of assessed waters
Rivers and Streams	**Principal causes of impairment**	
Assessed 100% of 16,896 miles	Mercury	100%
	pH	20%
	Escherichia coli	7%
	dissolved oxygen	4%
	dissolved oxygen saturation	3%
	Principal sources of impairment causes	
	atmospheric deposition – toxics	100%
	source unknown	25%
	municipal (urbanized high density area)	0.4%
	municipal point source discharges	0.4%
	highway/road/bridge runoff (non-construction related)	0.3%
Lakes, Reservoirs, and Ponds	**Principal causes of impairment**	
Assessed 100% of 185,272 acres	Mercury	100%
	pH	75%
	non-native aquatic plants	38%
	dissolved oxygen saturation	17%
	dissolved oxygen	15%
	Principal sources of impairment causes	
	atmospheric deposition – toxics	100%
	atmospheric deposition - acidity	75%
	source unknown	59%
	naturally occurring organic acids	10%
	highways, roads, bridges, infrastructure (new construction)	2%
Bays and Estuaries	**Principal causes of impairment**	
Assessed 100% of 99.3 square miles	Mercury	100%
	dioxin (Including 2,3,7,8-TCDD)	100%
	PCBs	100%
	impaired estuarine biological assemblages	15%
	total nitrogen	14%
	Principal sources of impairment causes	
	atmospheric deposition – toxics	100%
	source unknown	100%
	wet weather discharges (point source and stormwater)	2.6%
	combined sewer overflows	1.0%
	animal feeding operations	0.5%

In 2012, Massachusetts assessed the condition of 2,816 miles (28%) of its rivers and streams and found 63% of assessed miles to be impaired. Assessment of 151,173 (57%) acres of its lakes, reservoirs and ponds found 97% of those to be impaired. Nearly the entire spatial area of Massachusetts' bays and estuaries were assessed, 98% of 248 square miles, with 87% of assessed waters found to be impaired. The distribution of impairment causes and probable sources suggest that eutrophication is a factor in rivers and stream impairments (Table 10). Four out of the top five impairment causes for rivers and streams are attributed to pathogens and nutrients. The probable sources for these impaired waters include unknown sources, municipal discharges and unspecified urban stormwater. PCBs in fish tissue from legacy sediment contamination is identified as a contributing factor in 14% of assessed river or stream miles. Both invasive species and atmospheric mercury deposition are major contributors to impairments of lakes, reservoirs and ponds. Fecal coliform contamination from municipal discharges impair the entire extent of assessed bays and estuaries. PCBs in fish tissue are also a significant factor, occurring in 36% of assessed waters. The impairment classification “other cause” is identified in 27% of estuaries and bays. This reporting category is used for dissolved gases, floating debris and foam, leachate, stormwater pollutants, and many other uncommon causes lumped together. Among sources for pollutants, stormwater as a major factor for estuaries and bays is suggested: three of the top five identified sources of impairments are discharges from municipal separate storm sewer systems (53% of impaired area), wet weather discharges (27%) and unspecified urban stormwater (25%). While violation rates among all EPA-permitted sources is relatively low in Massachusetts, effluent violation rates for NPDES permits is about 10%. Among the 29,788 discharge-permitted facilities located in Massachusetts, 956 (3%) are in violation, with 115 (0.39%) of these violations classified as a significant noncompliance. NPDES permits are held by 833 of these facilities. Effluent violations are identified at 77 of these facilities, with 33 violations classified as in significant noncompliance.

Table 10 Principal causes and sources of aquatic impairments in Massachusetts (reporting year 2012).

Aquatic habitat and extent of assessed aquatic resource	Principal (top 5) causes and sources of impairment	% of assessed waters
Rivers and Streams	**Principal causes of impairment**	
Assessed 2,816 of 9,962 miles (28%)	Fecal coliform	23%
	Escherichia coli	19%
	PCB(s) in Fish Tissue	14%
	Phosphorus, Total	13%
	Dissolved Oxygen	13%
	Principal sources of impairment causes	
	Source Unknown	48%
	Municipal Point Source Discharges	14%
	Unspecified Urban Stormwater	14%
	Introduction of Non-Native Organisms	9%
	Contaminated Sediments	8%
Lakes, Reservoirs, and Ponds	**Principal causes of impairment**	
Assessed 86,228 of 151,173 acres (57%)	Non-Native Aquatic Plants	69%
	Mercury in Fish Tissue	61%
	Eurasian Water Milfoil	20%
	Dissolved Oxygen	12%
	Excess Algal Growth	7%
	Principal sources of impairment causes	
	Introduction of Non-Native Organisms	73%

Aquatic habitat and extent of assessed aquatic resource	Principal (top 5) causes and sources of impairment	% of assessed waters
	Atmospheric Deposition – Toxics	56%
	Source Unknown	33%
	Internal Nutrient Recycling	2%
	Superfund Sites	1%
Bays and Estuaries	**Principal causes of impairment**	
Assessed 243 of 248.5 square miles (98%)	Fecal Coliform	100%
	PCB(s) in Fish Tissue	36%
	Other Cause	27%
	Estuarine Bioassessments	17%
	Total nitrogen	16%
	Principal sources of impairment causes	
	Source Unknown	62%
	Municipal Separate Storm Sewer Systems (MS4)	53%
	Contaminated Sediments legacy	30%
	Wet Weather Discharges	27%
	Unspecified Urban Stormwater	25%

The District of Columbia assessed the condition of 38 out of 39 miles of its rivers and streams, all 238 acres of lakes, reservoirs, and ponds, and 6 square miles of bays and estuaries. The most frequent aquatic impairment cause for these waters is “unknown.” This reporting category is used when degraded conditions have been detected, but no specific details about those conditions or the pollutants present is reported. The most frequent impairment was impaired biological assemblages, found in 81% of assessed rivers and streams, followed by embeddedness (i.e., particles clogging the interstitial areas of stream gravel and cobble), and alterations in flow. Residential districts are identified as the source for 72% of river and stream impairments. Impairment sources data suggest significant stormwater contributions, with two of the top five sources associated with wet weather discharges, while residential districts and yard maintenance sources suggest stormwater or washwater runoff from these areas. Lakes, reservoirs, ponds, bays and estuaries had few identified causes of impairment; these included organic enrichment, trash and pH/caustic conditions. There are 2,729 facilities with pollutant-source permits in the District of Columbia. Forty eight permits (1.8%) are in violation, with three in serious noncompliance. Again, NPDES effluent violation rates are higher. Among the twenty eight NPDES permits in the District of Columbia, two had effluent violations (7%), but none of the effluent violation are classified as a significant noncompliance.

Table 11 Principal causes and sources of aquatic impairments in the District of Columbia (reporting year 2010)

Aquatic habitat and extent of assessed aquatic resource	Principal (top 5) causes and sources of impairment	% of assessed waters
Rivers and Streams	**Principal causes of impairment**	
Assessed 38 of 39 miles (98%)	Cause Unknown	100%
	Combination Benthic/Fishes Bioassessments	81%
	Particle Distribution (Embeddedness)	65%
	Other Flow Regime Alterations	43%
	Debris/Floatables/Trash	35%
	Principal sources of impairment causes	
	Residential Districts	
	Wet Weather Discharges (Point Source And Combination	
	Of Stormwater, sanitary sewer or combined sewer	72%
	overflow)	44%
	Wet Weather Discharges (Non-Point Source)	44%
	Hydrostructure Impacts On Fish Passage	36%
	Yard Maintenance	36%
Lakes, Reservoirs, and Ponds	**Principal causes of impairment**	
Assessed 238 acres (100%)	Cause Unknown	100%
	pH	57%
	Dissolved Oxygen Saturation	43%
	Principal sources of impairment causes	
	not identified	
Bays and Estuaries	**Principal causes of impairment**	
Assessed 5.9 of 6 square miles (99%)	Cause Unknown	95%
	Debris/Floatables/Trash	14%
	Biochemical Oxygen Demand (BOD)	5%
	Principal sources of impairment causes	
	not identified	

The remaining east coast portion of the action area is very small. It includes 24 subwatersheds distributed among Maine, Vermont, Connecticut, and Delaware. Although 13 of these are in Maine, few river and stream aquatic impairments are reported in this state (8 out of 250 total assessed water bodies are impaired). Impairment causes in Maine are identified as low dissolved oxygen and dioxins. Microbial pollution of rivers and streams are indicated as major impairment causes in Vermont, Connecticut and Delaware, accounting for nearly 60% of the impaired river and stream miles among these states. Mercury and arsenic pollution and "unknown" are also among the top impairment causes for rivers and streams. Maine did not have impairments listed for lakes, reservoirs, or ponds within the action area. Mercury, from atmospheric deposition, is the cause of greater than 60% of impairments within Connecticut lakes, reservoirs and ponds while indicators for nutrient pollution and euthrophication accounted for the remaining causes. The only lake, reservoir, or pond impairment identified in Vermont is for pH. Lake, reservoir, and pond impairment causes in Delaware included arsenic and bacteria. The 35 federally operated permitted facilities in Delaware and Vermont and the 6 facilities on Indian country land in Connecticut do not have permit violations. The 9 facilities located in Maine include 5 with violations, 4 of which are classified as a significant noncompliance. There are no NPDES permits recorded in ECHO for action area sub-watersheds of Maine or Vermont, the single NPDES permitted facility in the Delaware portion of the action area is currently in compliance with its permit.

6.2.2 Puerto Rico

The waters along the coast of Puerto Rico include the range and designated critical habitat for staghorn and elkhorn corals, humpback whale, scalloped hammerhead, and the green, hawksbill, Kemp's ridley, olive ridley, leatherback, and loggerhead sea turtles. In 2012 Puerto Rico assessed the condition of 5,188 of its 5,394 miles of rivers and streams (96.2%), 8,441 out of 12,146 acres of lakes, ponds, and reservoirs (70%), 425 out of 550 miles of coastal shoreline (77%) and 6.3 square miles of the surrounding bays and estuaries. The findings indicate 96% of rivers and streams, all lakes, ponds and reservoirs, 98 % of the assessed extent of estuaries and bays, and 64% of the coastline are impaired. Pathogens (e.g., fecal coliform, total coliform, enterococcus) and pathogen sources dominate the impairment profiles for all three types of assessed waters. These include onsite waste water systems, agriculture, concentrated animal feeding operations, and major municipal point sources. Urban runoff is also a significant contributor of pollutants and is reasonably the expected source of freshwater habitat impairments by arsenic (66% of rivers and streams and 41% of lakes reservoirs and ponds), cyanide (56% of rivers and streams), and copper (24% of lakes, reservoirs and ponds). In addition, about a quarter of assessed lakes, reservoirs and ponds are impaired by pesticides. Other important contributors to river and stream impairments include arsenic, cyanide, and turbidity while arsenic, pesticides and copper are important impairment causes for lakes, reservoirs, and ponds. Coastline impairment causes include pH, turbidity and Enterococcus bacteria. Many of these impairments are attributed to sewage and urban-related stormwater runoff. Rates of noncompliance among EPA-permitted pollution sources are fairly high. Among the 10,077 facilities located in Puerto Rico, 5,919 (59%) are in violation of at least one permit. Further, all but one of these violations are classified as a significant noncompliance. There are 522 facilities with NPDES permits and 84 (16%) of these are currently are classified as in significant violation of permit effluent limits.

Table 12 Principal causes and sources of aquatic impairments in Puerto Rico (reporting year 2012)

Aquatic habitat and extent of assessed aquatic resource	Principal (top 5) causes and sources of impairment	% of assessed waters
Rivers and Streams	**Principal causes of impairment**	
Assessed 5,188 of 5,394 miles (96%)	Fecal Coliform	83%
	Arsenic	66%
	Cyanide	56%
	Turbidity	55%
	Dissolved Oxygen	34%
	Principal sources of impairment causes	
	Onsite Wastewater Systems (Septic Tanks)	95%
	Confined Animal Feeding Operations	65%

Aquatic habitat and extent of assessed aquatic resource	Principal (top 5) causes and sources of impairment	% of assessed waters
	Urban Runoff/Storm Sewers	59%
	Minor Industrial Point Sources	50%
	Sewage Collection System Failure	47%
Lakes, Reservoirs, and Ponds	**Principal causes of impairment**	
Assessed 8,442 of 12,146 acres (70%)	Dissolved Oxygen	96%
	Fecal Coliform	56%
	Arsenic	41%
	Pesticides	25%
	Copper	24%
	Principal sources of impairment causes	
	Onsite Wastewater Systems (Septic Tanks)	91%
	Agriculture	55%
	Confined Animal Feeding Operations	43%
	Urban Runoff/Storm Sewers	33%
	Minor Industrial Point Sources	28%
Bays and Estuaries	**Principal causes of impairment**	
Assessed 6.3 square miles	Fecal Coliform	94%
	Dissolved Oxygen	78%
	Surfactants	75%
	Turbidity	65%
	Total Coliform	63%
	Principal sources of impairment causes	
	Onsite Wastewater Systems (Septic Tanks)	94%
	Urban Runoff/Storm Sewers	75%
	Collection System Failure	68%
	Confined Animal Feeding Operations	67%
	Landfills	11%
Coastline	**Principal causes of impairment**	
Assessed 425 of 550 miles (77%)	Dissolved Oxygen	48%
	Turbidity	35%
	pH	32%
	Enterococcus Bacteria	23%
	Fecal Coliform	20%
	Principal sources of impairment causes	
	Onsite Wastewater Systems (Septic Tanks)	56%
	Urban Runoff/Storm Sewers	56%
	Upstream Impoundment	25%
	Major Industrial Point Sources	20%
	Major Municipal Point Sources	16%

6.2.3 Gulf Coast

The MSGP Indian country action area in the Gulf Coast states includes a total of four subwatersheds, two each in Texas and Louisiana. Within the Louisiana portion of the action area, water quality was assessed in 2010 for the Bayou Choupique-Frontal Intercoastal Waterway and Yellow Bayou-Bayou Teche. There are no water quality impairments recorded for these waterbodies. Data for water quality assessments within Texas Indian country lands are not found in EPA's database. However, there are two fully compliant Resource Conservation Recovery Act-permitted facilities located on Texas Indian country lands. Meanwhile, Louisiana Indian country lands include 52 permitted facilities, three of which are in noncompliance with their permits, with one in significant noncompliance. There are no NPDES permits among these sites.

EPA also has permitting authority for activities associated with the exploration, development, or production of oil or gas or geothermal resources, including transportation of crude oil or natural gas by pipeline. The Texas portion of the action area is broadly distributed throughout Texas and includes much of the coastline (Figure 6).

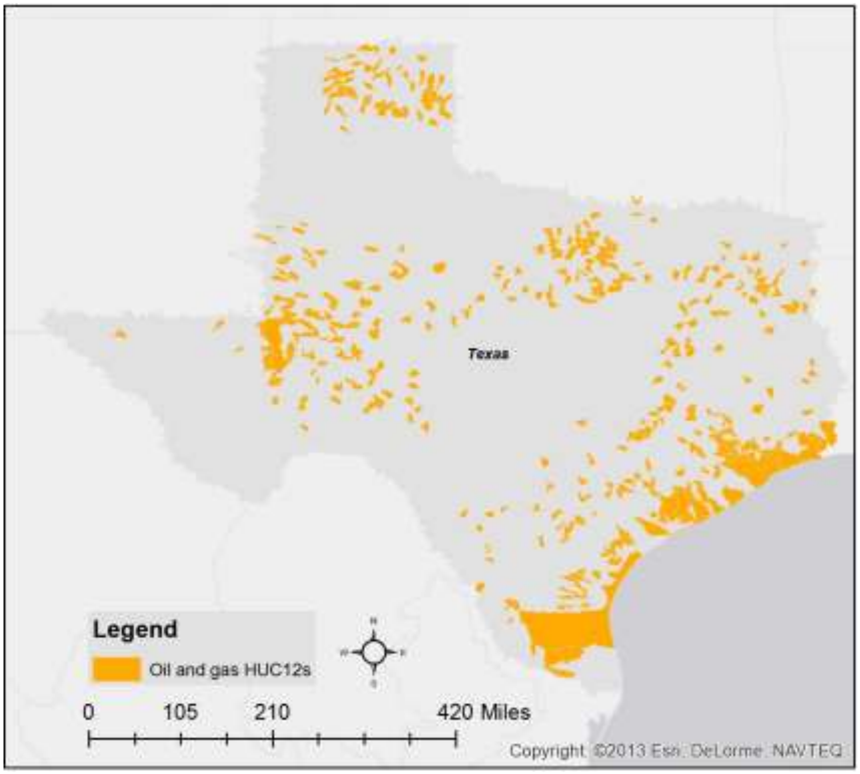

Figure 6 Distribution of HUC 12 watersheds with oil and gas facilities within the state of Texas

We assessed baseline conditions along the Texas coastline using the 2010 water quality assessments for 6,011 square miles of estuaries and bays, 388 miles of coastal shoreline, and 74 square miles ocean and near coast waters. Impairment rates are lowest among assessed bays and estuaries, at 28% of the assessed waters. Impairment rates are much higher for coastal shoreline, at 100% of assessed waters, and for ocean and near coastal waters at 91%.

Table 13 Principal causes and sources of aquatic impairments in Texas (reporting year 2010)

Aquatic habitat and extent of assessed aquatic resource	Principal (top 5) causes and sources of impairment	% of assessed waters
Bays and Estuaries	**Principal causes of impairment**	
Assessed 6,010 square miles	Dissolved Oxygen	10%
	PCB(s) in Fish Tissue	9%
	Dioxin (Including 2,3,7,8-TCDD)	9%

Aquatic habitat and extent of assessed aquatic resource	Principal (top 5) causes and sources of impairment	% of assessed waters
	Bacteria (Oyster Waters)	8%
	Bacteria	2%
	Principal sources of impairment causes	
	Source Unknown	18%
	Non-Point Source	17%
	Upstream Source	10%
	Industrial Point Source Discharge	9%
	Urban Runoff/Storm Sewers	6%
Coastline Shoreline	**Principal causes of impairment**	
Assessed 388.2 miles	Mercury in Fish Tissue	100%
	Bacteria	7%
	Principal sources of impairment causes	
	Source Unknown	100%
	Atmospheric Deposition – Toxic	100%
Ocean and Near Coastal	**Principal causes of impairment**	
Assessed 74.9 square miles	Mercury in Fish Tissue	91%
	Principal sources of impairment causes	
	Source Unknown	91%
	Atmospheric Deposition – Toxic	91%

Three of the top five causes of impairments in assessed bays and estuaries are associated with eutrophic conditions (e.g., low dissolved oxygen, bacteria) and two are toxics (i.e., PCBs in fish tissue and Dioxin). Other than industrial point source discharges contributing to impairments in 9% of assessed waters, prominent sources for aquatic impairments in these waters are primarily nonpoint in nature, including unknown, upstream sources, and urban runoff. Mercury in fish tissue is the principle cause of impairments to the entire assessed coastal shoreline and 91% of assessed ocean and near coastal waters. The source of these impairments is atmospheric deposition and unknown sources. Among the 1,243 facilities located in HUC 12s where Texas oil and gas extraction facilities occur, a total of 120 (10%) facilities are in violation, with 59 (5%) of these violations classified as a significant noncompliance. This includes 200 SIC 13 NPDES permits, 21 of with effluent violations and three with significant effluent violations.

6.2.4 West Coast

Endangered and threatened species under NMFS jurisdiction within the west coast portion of the action area include humpback whale, southern resident killer whale, north Pacific right whale, the green, leatherback, loggerhead, and olive ridley sea turtles, eulachon, the Puget sound rockfish, and the pacific salmonids. EPA has permitting authority within the entire state of Idaho and is permitting authority for Indian country lands in California, Oregon, Washington and Alaska.

In 2010 Idaho assessed 64% of its 96,391 miles of rivers and streams and 60% of its 475,457 acres of lakes, reservoirs, and ponds. The report indicates that 55% of rivers and streams to be impaired while 92% of lakes, reservoirs, and ponds are impaired. Water temperature and sedimentation are the two most important causes of impairments, affecting 29% and 27% of assessed waters, respectively (Table 14). Other causes included phosphorous, impaired aquatic assemblages, and flow regime alteration. The sources for impairments of the assessed waters are all various expressions of livestock activity within the assessed watersheds, e.g., grazing, including grazing on riparian shorelines and rangeland. Sources for impairments of the assessed lakes, reservoirs and ponds are not identified in Idaho's report, the causes of impairments could be associated with livestock or agricultural activities (e.g.,. phosphorous, sediment, low dissolved oxygen). Mercury, which is typically associated with atmospheric deposition in the east, is among the top five causes of impairments to these streams. However, mercury also occurs in Idaho's waters due to historic mining practices[36].

Table 14 Principal causes and sources of aquatic impairments in Idaho (reporting year 2010)

Aquatic habitat and extent of assessed aquatic resource	Principal (top 5) causes and sources of impairment	% of assessed waters
Rivers and Streams	**Principal causes of impairment**	
Assessed 61,926 of 96,391 miles (64%)	temperature, water	29%
	sedimentation/siltation	27%
	phosphorus, total	9%
	impaired biological assemblages	8%
	other flow regime alterations	6%
	Principal sources of impairment causes	
	grazing in riparian or shoreline zones	4%
	rangeland grazing	3%
	livestock (grazing or feeding operations)	2%
	loss of riparian habitat	1%
	source unknown	1%
Lakes, Reservoirs, and Ponds	**Principal causes of impairment**	
	phosphorus, total	52%
	mercury	42%
	other flow regime alterations	30%
	sedimentation/siltation	29%
	dissolved oxygen	23%
	Principal sources of impairment causes	
	not reported	

Among the 10,715 EPA-permitted facilities located in Idaho, a total of 761 (7%) are in noncompliance with their permits and with 144 (1%) of these violations classified as a significant noncompliance. Among the 6,413 NPDES permits in this group, only 20 have effluent violations and none of these are classified as significant.

Subwatersheds associated with Washington State federal lands where MSGP eligible activities may occur (e.g., Department of Defense, Bureau of Land Management, Bureau of Reclamation)

36 https://www.deq.idaho.gov/water-quality/surface-water/mercury.aspx

or Indian country lands, are distributed throughout the state and along the coast line (Figure 7), so information from the 2008 state water quality assessment report for the entire state is used to infer conditions within the action area.

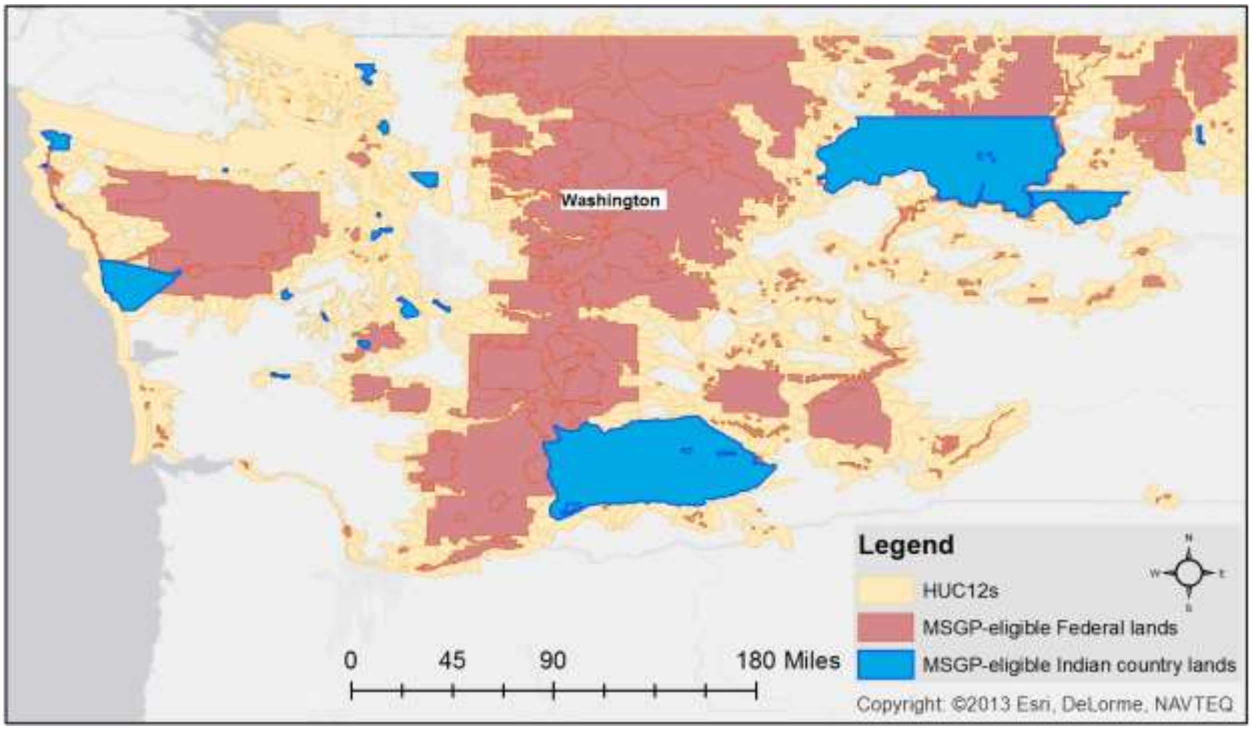

Figure 7 MSGP eligible Federal and Indian country lands within Washington.

For the 2008 reporting year, the state of Washington assessed 1,997 miles of rivers and streams, 434,530 acres of lakes, reservoirs, and ponds, and 376 square miles of ocean and near coastal waters. Among assessed waters, 80% of rivers and streams, 68% of lakes, reservoirs, and ponds, and 53% of ocean and near coastal waters are impaired. Washington does not, however, identify any sources for these impairments. Temperature, for 39% of assessed waters, and fecal coliform, for 32% of assessed waters, are prominent causes of impairments. These are followed by low dissolved oxygen in 19% of assessed waters, pH in 9% of assessed waters, and instream flow impairments within 2% of assessed rivers and streams. Impairment causes within lakes, reservoirs and streams include toxics are more evenly distributed with the top five causes impairing between 11% and 16% of assessed waters. These include the toxicants PCBs and dioxins, invasive exotic species, water temperature and total dissolved gases. Ocean and near coastal impairment causes include fecal coliform in 17% of assessed waters, followed by low dissolved oxygen in 12% of these waters. The remaining contributors are invasive exotic species, sediment toxicity, and PCBs.

Table 15 Principal causes of aquatic impairments in Washington (reporting year 2008, sources of impairment causes not identified)

Aquatic habitat and extent of assessed aquatic resource	Principal (top 5) causes and sources of impairment	% of assessed waters
Rivers and Streams	**Principal causes of impairment**	
Assessed 1,997 of 70,439 miles (3%)	temperature	39%
	fecal coliform	32%
	dissolved oxygen	19%
	pH	9%
	instream flow	2%
Lakes, Reservoirs, and Ponds	**Principal causes of impairment**	
Assessed 464,530 acres	PCBs	%16%
	invasive exotic species	14%
	temperature	13%
	total dissolved gas	11%
	dioxin (Including 2,3,7,8-TCDD)	11%
Ocean and near coastal	**Principal causes of impairment**	
Assessed 376 square miles	fecal coliform	17%
	dissolved oxygen	12%
	invasive exotic species	9%
	sediment bioassay	7%
	PCBs	4%

Among the 485 facilities located within Washington's Indian country land, 67 are in violation of their permits, with 7 of these violations classified as a significant noncompliance. There are 349 NPDES permits within the area, but only two of these facilities have effluent violations. There are no violations reported for the 11 EPA permitted facilities within the watersheds associated with federally operated facilities in Washington. Three of these permits are NPDES permits.

EPA has permitting authority for Indian country lands in Oregon, and associated watershed area accounts for only 1.5% of the action area. Direct examination of these areas using EPA's geospatial databases[37] 2006 indicate 80% of the 376 km of rivers and streams assessed are impaired by elevated iron. While the source of the iron in is not identified, iron contamination can result from acid mine drainage. Eleven out of the 13 assessed lakes, reservoirs, and ponds in subwatersheds associated with these lands are impaired, with causes listed as temperature and fecal coliform bacteria (reporting year 2006). This amounts to impairment of 93% of the assessed area. Sources of impairments are not supplied with the 2006 data.

EPA also has permitting authority for Indian country lands in California. The watersheds associated with these lands account for about 6% of the total action area, but are dispersed widely and make up a very small fraction of the watersheds within the state, so generalizations about water quality in these areas should not be made from the 2010 statewide water quality assessment report. Rather, information for the relevant watersheds was extracted from EPA Geospatial databases and analyzed. Seventy nine percent of the assessed rivers and streams are

37 http://water.epa.gov/scitech/datait/tools/waters/data/downloads.cfm

impaired by nutrients, aluminum, arsenic, temperature, and chlordane. Stressor sources are attributed to unknown sources, municipal point discharges, agriculture, natural background, and loss of riparian habitat. High impairment rates, at 93%, are also found for assessed lakes, reservoirs and ponds. The predominant impairment for these waters is arsenic, affecting 45% of assessed waters, while mercury is a factor in about 9% of assessed waters. Arsenic is also the identified cause of impairment in 97% of assessed bays and estuaries. Among the 204 facilities located in the California action area, a total of 25 facilities are in violation of their NPDES, Clean Air Act, or Resource Conservation and Recovery Act permit, with 2 of these violations classified as a significant noncompliance. The single NPDES permit listed among these permits is in compliance.

According to the National Atlas, the Annette Islands reservation is the only Indian country land in Alaska, and there are no indications of water quality assessments being performed in this area. The ECHO, however indicates 316 facilities located in Alaska Indian country lands. Sixty eight of these facilities are in violation of their permit, with 26 of these violations classified as a significant noncompliance. Three of the permitted facilities have NPDES permits that are in compliance. These facilities are distributed mainly along the coast. A very small portion, less than 0.2%, of the state's extensive waters were assessed for the 2010 report. Among the waters assessed, impairments are found among 74 % of the rivers and streams, 43% of the lakes, reservoirs, and ponds, two percent of bays and estuaries, and all assessed coastline, which is 17.6 miles. The relative proportion of assessed waters to existing waters in Alaska, taken with the diverse environments ranging from arctic to the temperate rainforest of Southeast Alaska, excludes use of the state monitoring report to make generalizations about water quality conditions within the action area.

6.2.5 U.S. Pacific Islands

EPA has NPDES permitting authority in Pacific islands of Guam, the Northern Marianas, and American Samoa. Endangered and threatened species with range and designated critical habitat among the Pacific territories, include the humpback whale, the green, hawksbill, leatherback, olive ridley, and loggerhead sea turtles, and recently listed coral species. Because these species are strictly marine and do not occur in freshwaters or wetlands, this discussion will focus on water quality conditions reported for coastal shoreline and saltwater habitats.

Table 16 Principal causes and sources of aquatic impairments in the Pacific island territories (reporting year 2010).

American Samoa

Island and aquatic habitat	Impairment Cause	% of assessed waters	Sources of impairment causes	% of assessed waters
Coastal Shoreline	Enterococcus Bacteria	50%		
	Undetermined Nonpoint Source	26%	Sanitary Sewer Overflows	50%
	Stressors	6%	Animal Feeding Operations	50%
	Arsenic	6%	Multiple Non-Point Sources	26%
	Mercury	6%	Contaminated Sediments	6%

	PCBs			

Guam

Island and aquatic habitat	Impairment Cause	% of assessed waters	Sources of impairment causes	% of assessed waters
Bays and Estuaries	PCB(s) in Fish Tissue	33%	No sources listed	
	Dieldrin	6%		
	Trichloroethylene	6%		
	Antimony	6%		
	Tetrachloroethylene	6%		
Coastal Shoreline	Enterococcus Bacteria	96%		
	PCB(s) in Fish Tissue	4%		

Northern Marianas

Island and aquatic habitat	Impairment Cause	% of assessed waters	Sources of impairment causes	% of assessed waters
Coastal Shoreline	Phosphate	36%	Sediments	15%
	Enterococcus bacteria	22%	Source unknown	13%
	Dissolved oxygen saturation	16%	On-site treatment systems	12%
	Biological criteria	15%	Urban runoff/storm sewers	12%
	Mercury in fish tissue	1%	Livestock Grazing or Feeding Operations	7%

Eighty four percent of American Samoa's 159 mile long coastline was assessed in 2010 and 60% of the assessed waters were found to be impaired (Table 16). Enterococcus is identified as causing impairments along 50% of the coastline evaluated while 26% of assessed coastline had nonpoint source pollutants contributing to impairments. Sources of impairment stressors included sanitary sewer overflows and animal feeding operations, each implicated for 50% of the waters assessed. Multiple nonpoint sources is identified as a stressor source for 26% of assessed waters while contaminated sediments contributed to the impairments in 6% of assessed waters. Among the 204 facilities with pollutant permits, a total of 21 facilities are in violation, with 17 of these violations classified as a significant noncompliance. Of the six facilities with NDPES permits, two have violated effluent limits, one of which is considered to be in significant violation.

Guam assessed 3% of its 915 acres of bays and estuaries and 14% of its 117 mile long coastline. Impairments are identified in 42% of assessed bays and estuaries and the entire extent of assessed coastline. Causes of impairments in 33% of assessed Bays and estuaries included PCBs in fish tissue, followed by antimony, dieldrin, tetrachloroethylene, and trichloroethylene, each listed as causing impairments to 6% of assessed waters. In contrast, Enterococcus is implicated as a cause of impairment in nearly all of the assessed waters (96%). PCBs contamination of fish tissue is a minor contributor, listed as a cause of impairment in 4% of assessed waters. Guam did not identify sources of impairment causes. Among the 403 NPDES, Clean Air act, or Resource Conservation and Recovery Act EPA-permitted facilities located in Guam, a total of 23 facilities are in violation, with 13 of these violations classified as a significant noncompliance. NPDES permits are held by 19 facilities. Six of these have effluent violations classified as significant noncompliances.

In the Northern Marianas, 36% of the 235.5 miles of assessed shoreline were found to be impaired. Phosphate is listed as a cause for all of these impairments. Other causes identified among the impaired stretches of shoreline include enterococcus bacteria (22%), dissolved oxygen saturation levels (16%), and mercury in fish tissue (1%). In addition 15% of the assessed waters had impaired biological assemblages. Sources of impairments included sediments (15%), unknown sources (13%), on-site septic treatment systems (12%), urban runoff (12%), and livestock operations (7%). Query of the ECHO did not identify any permitted facilities in the Norther Marianas.

6.3 Summary

Many native ecosystems exist as small isolated fragments surrounded by expanses of urban and suburban landscapes or "natural" areas that are dominated by non-native species. As a result, many of the native plant and animal species that inhabited those ecosystems have become extinct, endangered, or threatened over the past 200 years. Anthropogenic stressors are present to some degree in all water bodies of the United States and are the result of many different impacts. These stressors often lead to long-term environmental degradation associated with lowered biodiversity, reduced primary and secondary production, and a lowered capacity or resiliency of the ecosystem to recover to its original state in response to natural perturbations(Rapport and Whitford 1999). Federal, State, and local governments, as well as non-governmental organizations and private individuals, have established a wide variety of programs to protect or restore our nation's wetlands, estuaries, rivers, lakes, and streams. Those programs have helped slow--and, for many ecosystems, reverse—species decline. Despite these efforts impaired water quality, particularly due to nonpoint sources, extends throughout the action area for this Opinion. Water quality is important to all listed resources. Activities that threaten water quality also threaten these listed resources. Endangered and threatened species have experienced population declines that leave them vulnerable. Because of reduced abundance, variable growth capacity, and the loss of essential habitat, these species are less resilient to additional disturbances. For example, stressors that were once tolerated with little impact could now reduce population viability. It is with this understanding of the environmental baseline that we consider the effects of the proposed action, including the likely effects that pollutants will have on endangered and threatened species and their designated critical habitat.

7 EFFECTS OF THE ACTION

The *Effects of the Action* section analyzes the pathway tracing components of the Proposed Action, or stressors of the action, to effects on threatened and endangered species and designated critical habitat. Since this is a Programmatic Opinion, if this analysis indicates that the agency's action may result in exposure of ESA-listed species and designated critical habitats to hazardous levels of stressors of the action, we then apply a Programmatic Approach which examines the structure and decision-making processes of the proposed action to determine whether measures are in place to prevent those exposures.

In this Opinion, we first describe and evaluate the decisions made by EPA in selecting the data used for the effects analysis in EPA's BE. We then review and supplement the assessment in EPA's Biological Evaluation. We first identify the *Stressors of the Action* and the mechanisms by which they exert effects. *Stressors of the Action* are the physical, chemical, and biological stressors associated with activities authorized under the MSGP. We use data supplied by the Action Agency along with the best available scientific and commercial data on the activities to be authorized under the proposed action. The *Stressors of the Action* is followed by the *Exposure Analysis*, where we evaluate the likelihood of exposing endangered and threatened species and their designated critical habitat to these stressors by integrating our own knowledge of their spatial distribution, seasonal movements, and behaviors with the spatial extent of the action area and the anticipated distribution and intensities of the stressors of the action. Finally, we evaluate the consequences of these exposures in the *Effects Analysis* through review of the best available scientific and commercial information regarding the effects of the stressors of the action.

The effects of the action include both the direct and indirect effects of stressors on the species or designated critical habitat, together with the effects of other activities that are interrelated and interdependent with that action. Direct effects are responses that occur in individuals as a result of exposures to the stressors of the proposed action. Indirect effects are those that are caused by the stressors of the proposed action and are later in time, but are still reasonably certain to occur, such as cascading effects of pollutants on community structure and prey availability or the accumulation or persistent pollutants in prey species to toxic levels for ESA-listed species. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. For example, if the action is the construction of a marina, the interdependent actions include the infrastructure (e.g., roads, power lines, fuel and septic services etc.) necessary for the access to and use of the marina.

In determining whether an action is likely to jeopardize ESA-listed species, we consider the effects of the action in conjunction with the environmental baseline. Our discussion of the effects of the stormwater pollutant discharges the MSGP will authorize reviews and, where necessary, supplements the analysis provided in the BE. In particular, EPA's analysis relied heavily on comparing the results of screened laboratory toxicity tests from ECOTOX[38] (EPA's Ecotoxicology Database) with benchmarks or ELGs. While EPA's analysis of ECOTOX-screened laboratory data is thorough, not all toxicity information relevant to NMFS jurisdictional species and designated critical habitat is included in that database. NMFS has supplemented EPA's work with additional toxicity data and information on field studies of the effects of stormwater in industrialized and urbanized areas. Further the structure of this Opinion differs from the BE in that pollutant classes are discussed together when effects to species are addressed, because stormwater exposures occur as mixtures of inorganic, organic and conventional pollutants, not as exposures to single stressors or stressor classes.

7.1 Programmatic Approach

As indicated in the Approach to the Assessment, the scope of the MSGP is nationwide, may affect many species, and involves an unpredictable frequency and intensity of stormwater pollutant discharges into waters of the U.S. where species and designated critical habitat under NMFS jurisdiction occur. Under these circumstances, it is not feasible to conduct site specific and species specific effects analysis or to predict the effects of each pollutant on each species and designated critical habitat given the multitude of possible scenarios of exposure. Rather, if we find in our effects analysis that there is potential for harmful exposures, we consider the processes and responsibilities for new and existing facility owners to remain eligible for and in compliance with the MSGP.

Accordingly, the effects analysis concludes with the *Programmatic Summary*. This begins with an evaluation of the permit's ability to avoid or minimize likely adverse effects due to stressors of the action to ESA-listed species and their designated critical habitats from discharges and discharge-related activities authorized under the proposed MSGP. Our analysis of effects is based, in part, on the assumption that all covered facilities must comply with the MSGP as expressed in the description of the action and the draft permit this consultation is based upon, or seek an individual permit. As such, analysis of the effects of this action includes an evaluation of the full extent of impacts to ESA-listed species that will occur when facilities are in compliance with their permit. We identify the range of representative responses and consequences we would expect given exposure to industrial discharges authorized by EPA's MSGP.

In our Programmatic approach, we assess whether EPA has structured the permit and supporting documentation (i.e., sector specific fact sheets) to enable EPA to fulfill the following criteria: (1) understand the scope of its action; (2) reliably estimate the physical, chemical, or biotic stressors that are likely to be produced as a direct or indirect result of their action; (3) minimize adverse effects of such activities on ESA-listed species and designated critical habitat; (4) identify, inform, encourage, and screen applicants for potential eligibility under or participation in the permitting activity; (5) continuously monitor and evaluate likely adverse effects on ESA-listed species and designated critical habitat; (6) monitor and enforce permit compliance; and (7)

38 http://cfpub.epa.gov/ecotox/

modify its action if new information (including inadequate protection for species or low levels of compliance) becomes available.

We assess EPA's compliance with the provisions of section 7(a)(2) of the ESA by evaluating the extent to which the MSGP and supporting documentation establishes processes to require EPA, the owner or operator, and the Director, to collectively implement the MSGP in a manner that ensures effects to ESA-listed species and designated critical habitat will be minimized and thereby avoid likely jeopardy and likely destruction or adverse modification of designated critical habitat, consistent with section 7(a)(2) of the ESA. Therefore, we focus primarily on the required aspects of the MSGP and EPA's commitment to overseeing the implementation of the MSGP.

7.2 Data Used in the Effects Analysis

EPA expects that compliance with the stormwater control requirements of this permit, including the requirements applicable to such discharges, will meet applicable water quality standards. To minimize the discharge of pollutants in stormwater from industrial activity into receiving waters, there are certain requirements that apply to the discharges. Facility operators must select, design, install, and implement control measures (including but not limited to best management practices) to minimize effects to water quality and adverse effects to ESA-listed species and designated critical habitat. In the technology-based limits included in the MSGP, the term "minimize" means reduce and/or eliminate to the extent achievable using control measures (including best management practices) that are technologically available and economically practicable and achievable in light of best industry practice (MSGP part 2.0).

> The effects analyses in the BE and this Opinion first evaluates the discharge limits used in the MSGP. Potential effects are then placed in context of the ESA-protective safeguards to prevent or minimize exposures to discharges that were built into obtaining authorization and complying with the 2015 MSGP.

The effects analyses in the BE and this Opinion first evaluates the discharge limits used in the MSGP. Potential effects for each stressor group are then placed in context of the ESA-protective safeguards to prevent or minimize exposures to discharges that were built into obtaining authorization and complying with the 2015 MSGP.

Those stormwater constituents subject to quantitative evaluation through quarterly benchmark monitoring and effluent limitation guidelines were selected using industry-supplied stormwater discharge data to determine which pollutants were high enough, on average, to be of concern for the given industries. These pollutants are the stressors of the action which species are most likely to be exposed to and affected by. Estimating exposure concentrations and identifying stressor concentrations at which species are likely to be affected for the BE and this Opinion is described below.

7.2.1 MSGP Benchmark and ELG Concentrations as Surrogate Estimates of In Stream Pollutant Exposures

Given the unknown intensity and constituent make up of stormwater discharges and the widespread and variability of receiving waters within the action area for the MSGP, the data necessary to evaluate in-stream concentrations of pollutants discharged under the permit is not available. To address this in its BE risk analysis, EPA used the stressor/pollutant concentration limits specified in the MSGP as surrogates for in stream exposure concentrations (Table 17). However, different industrial sectors have different ELG concentration limits and some sectors have, for the same stressor, both ELGs and benchmark concentrations for evaluating quarterly benchmark monitoring data. EPA's BE used the lowest benchmark or ELG concentration limit as the MSGP-based exposure estimate for each stressor. By selecting the lowest benchmark or ELG concentration to estimate in-stream exposures, the analysis is less likely to identify exposures which exceed concentrations at which species would be affected. The analysis in this Opinion used the highest benchmark or ELG concentration as the MSGP-based exposure estimate, where more than one MSGP concentration limit is available, to see if a more protective approach resulted in a different conclusion than reached in EPA's BE (see Table 17). The implications of EPA's decision to use the lowest MSGP benchmark or ELG concentration resulted in BE exposure estimates 3 to 47 times lower than the highest benchmark or ELG concentrations for BOD, oil and grease, ammonia, total suspended solids, arsenic, silver, and zinc.

Table 17 Benchmarks and ELGs in the 2015 MSGP and values used as exposure estimates.

Stressor, form (units)	MSGP Benchmarks[1]	MSGP ELGs[2] Daily Maximum	MSGP ELGs[2] Monthly Average	Benchmark or ELG concentration used for exposure estimate: EPA BE	Benchmark or ELG concentration used for exposure estimate: NMFS BiOp
BOD, Total (mg/L)	30	140-220	37-56	30	220
Chemical oxygen demand (COD), Total (mg/L)	120	No ELG		120	120
pH SU	6 - 9 su	6 - 9 su	6 - 9 su	6 - 9 su	
Total Suspended Solids (mg/L)	100	23-88	15-27	23	100
Turbidity (NTU)	50	No ELGs		50	50
Nitrogen, Nitrite + Nitrate N, Total (mg/L)	0.68	No ELGs		0.68	0.68
Ammonia, form not specified (mg/L) _	2.14	10	4.9	2.14	10
Phosphorus as P, Total (mg/L)	2	105	35	2	105
Oil and Grease (mg/L)	No benchmark	15	10	15	15
Aluminum, Total (mg/L)	0.75	No ELGs		0.75	0.75

Stressor, form (units)	MSGP Benchmarks[1]	MSGP ELGs[2] Daily Maximum	MSGP ELGs[2] Monthly Average	Benchmark or ELG concentration used for exposure estimate: EPA BE	Benchmark or ELG concentration used for exposure estimate: NMFS BiOp
Antimony, Total (mg/L)	0.64			0.64	0.64
Arsenic, Total (mg/L)	0.15	1	0.54	0.15	1
Beryllium, Total (mg/L)	0.13	No ELGs	0.13	0.13	
Cadmium, Total (mg/L)	FW 0.0005-0.0053 SW 0.04			FW 0.0008 SW 0.04	FW 0.0008 SW 0.04
Chromium, Total (mg/L)	No benchmark	1.1	0.46	1.1	1.1
Copper, Total (mg/L)	FW 0.0038-0.032 SW 0.0048-0.014	No ELGs		FW 0.0056 SW 0.0048	FW 0.0056 SW 0.014
Cyanide, Total (mg/L)	0.022			0.022	0.022
Fluoride mg/L	No benchmark	75	25	25	75
Iron, Total (mg/L)	1			1	1
Lead, Total (mg/L)	FW 0.014-0.262 SW 0.21	No ELGs		FW 0.023 SW 0.21	FW 0.023 SW 0.21
Magnesium, Total (mg/L)	0.064			0.064	0.064
Mercury, Total (mg/L)	0.0014			0.0014	0.0014
Nickel, Total (mg/L)	FW 0.15-1.02 SW 0.074			FW 0.2 SW 0.074	FW 0. 2 SW 0.074
Selenium, Total (mg/L)	0.005			0.005	0.005
Silver, Total (mg/L)	FW 0.0007-0.0183 SW 0.0019-0.09			FW 0.0007 SW 0.0019	FW 0.0007 SW 0.09
Zinc, Total (mg/L)	FW 0.04-0.26 SW 0.09	0.2-0.535	0.11-0.296	FW 0.05 SW 0.09	0.535
Alpha Terpineol (mg/L)	No benchmarks	0.033-0.042	0.016-0.019	0.033	0.042
Aniline (mg/L)		0.024	0.015	0.024	0.024
Benzoic acid (mg/L)		0.119-0.12	0.071-0.073	0.119	0.12
Napthalene (mg/L)		0.059	0.022	0.059	0.059
p-Cresol (mg/L)		0.022-0.024	0.014-0.015	0.022	0.024
Phenol (mg/L)		0.026-0.048	0.015-0.029	0.026	0.048
Pyridine (mg/L)		0.072	0.025	0.072	0.072

[1] Ranges indicate hardness dependent criteria to adjust for biological availability. FW= freshwater,

SW=saltwater.

[2]Ranges indicate differing ELGs for BOD, TSS and zinc due to the technological capacity for different sectors to reduce pollutant concentrations in stormwater discharges.

The BE analysis addressed the hardness-dependent freshwater national water quality criteria for cadmium, copper, lead, nickel, silver and zinc by selecting guideline concentrations assuming a water hardness of 50 mg/L as calcium carbonate (CaCO3). Metals with hardness-dependent toxicity are less toxic at higher hardness values (i.e., higher concentrations of CaCO3) because ions as calcium contributing to water hardness bind to metals, making them unavailable for uptake (Table 18). While 50 mg/L is relatively soft water in a general sense, and portions of the action area may have softer water (Figure 8), so the use exposure estimates based on a water hardness of 50 mg/L is expected to be sufficiently protective.

Table 18 MSGP quarterly benchmark monitoring thresholds for metals (based on EPA's hardness dependent water quality guidelines).

Freshwater Hardness ($CaCO_3$) Range	Hardness based water quality guideline concentration (mg dissolved metal/L)					
	Copper	Zinc	Lead	Cadmium	Nickel	Silver
0-24.99 mg/L	0.0038	0.04	0.014	0.0005	0.15	0.0007
25-49.99 mg/L	0.0056	0.05	0.023	0.0008	0.2	0.0007
50-74.99 mg/L	0.009	0.08	0.045	0.0013	0.32	0.0017
75-99.99 mg/L	0.0123	0.11	0.069	0.0018	0.42	0.003
100-124.99 mg/L	0.0156	0.13	0.095	0.0023	0.52	0.0046
125-149.99 mg/L	0.0189	0.16	0.122	0.0029	0.61	0.0065
150-174.99 mg/L	0.0221	0.18	0.151	0.0034	0.71	0.0087
175-199.99 mg/L	0.0253	0.2	0.182	0.0039	0.8	0.0112
200-224.99 mg/L	0.0285	0.23	0.213	0.0045	0.89	0.0138
225-249.99 mg/L	0.0316	0.25	0.246	0.005	0.98	0.0168
250+ mg/L	0.0332	0.26	0.262	0.0053	1.02	0.0183

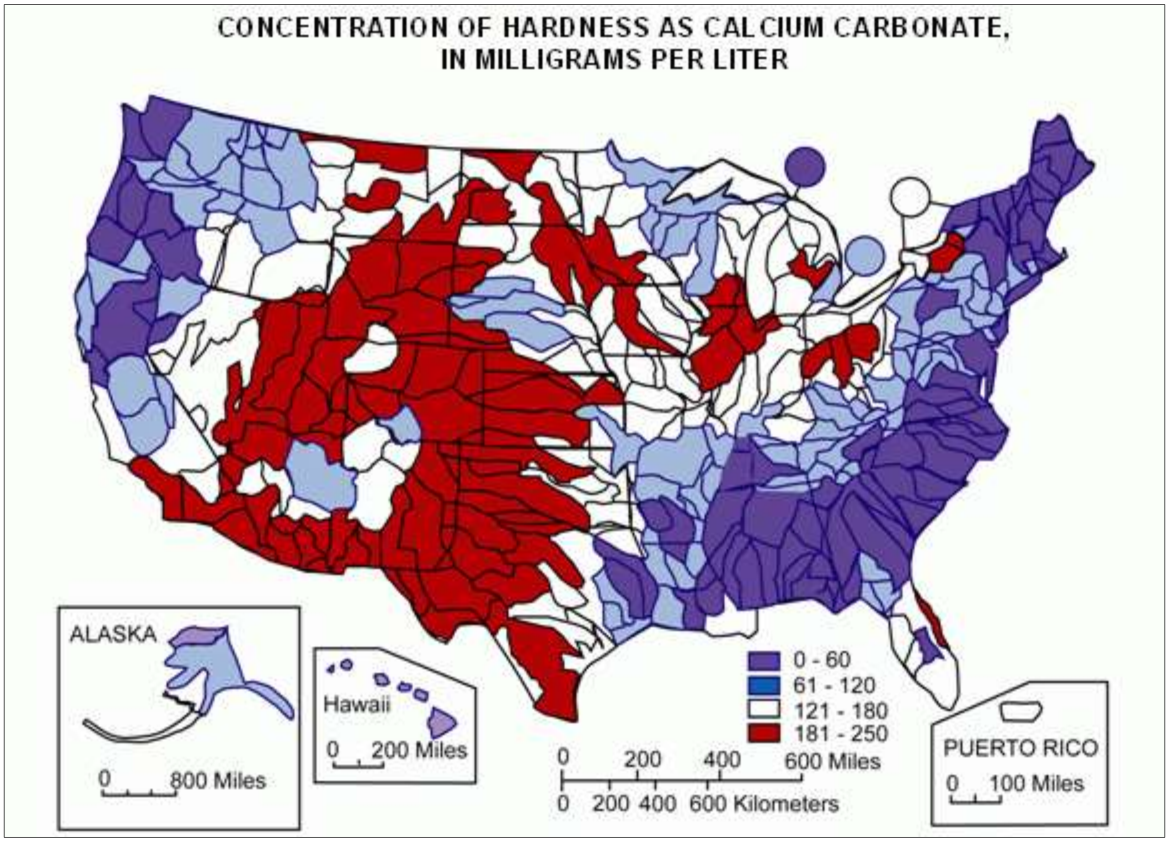

Figure 8 General calcium carbonate water hardness throughout the United States.

EPA strengthens its argument that the analysis is conservative because it did not account for the expected significant dilution of pollutants in receiving waterbodies and the intermittent and often short- term nature of discharges authorized under the permit. However, stormwater discharges from large rain events into shallow back water habitats used by juvenile salmonids would be one exception to this expectation. The BE did acknowledge such cases in its discussion of uncertainties in the analysis.

The analysis in the BE did not account for the additional protections for ESA-listed species and designated critical habitat that are built into the proposed 2015 MSGP eligibility requirements (see Section 6.2.1 of the BE and Appendix E of the proposed MSGP). Under the MSGP eligibility requirement procedure, facilities that have ESA-listed species and/or designated critical habitat in their action areas either (1) have addressed ESA concerns through measures identified during preexisting individual consultations or permitting and certify their eligibility for MSGP coverage under criteria B, D, or E, or, (2) define the measures the facility will undertake to prevent harmful exposures in the *Criterion C Eligiblity Form* in order to certify eligibility under Criterion C, working with EPA and NMFS as necessary to revise such measures to minimize exposures to concentrations below which effects would occur, irrespective of limits specified in the MSGP.

While the decisions made by EPA in designing its analysis did not choose the most conservative (i.e., highest) in-stream exposure estimate, NMFS understands that, due to dilution, in most cases the concentrations presented in their BE are higher (more conservative) than actual in-stream concentrations that ESA-listed species and designated critical habitats will likely be exposed to from stormwater discharges as authorized under the MSGP. To the extent that their analysis shows their exposure concentrations exceed concentrations which would result in effects, EPA stated that it expects that any toxic exposure of ESA-listed species or their designated critical habitats will be extremely limited due to the ESA-listed species and designated critical habitat protections implemented in the proposed permit. EPA acknowledged in its discussion of uncertainties that there may be rare scenarios in which exposure may be a higher risk due to factors such as larger and more frequent storm events, lower assimilative capacity of the receiving stream, aggregate sources, etc.

7.2.2 Acute Toxicity Data Availability and the Use of Surrogate Species Data

Acute toxicity data are based on an organism's exposure to a potential toxin up to 96-hours (h), while chronic exposures occur over longer time frames. The MSGP action regulates industrial stormwater discharges which, by the very nature of storm events, are episodic and short-term. EPA selected acute toxicity data for their analysis because long-term (>96-h) chronic exposure is not a likely exposure scenario under the proposed action. Toxicity data were used for continuous single stressor laboratory exposures lasting between 48- and 96-h. While actual durations of these discharges will vary and are not predictable exposures to discharges of industrial stormwater are thought to be less than 48-h.

EPA also notes that acute effects data were not readily available for some of the stormwater toxicant-stressors. EPA's ECOTOX database did not contain any toxicity data for some stressors, including many of the organic toxicants which potentially bioaccumulate or cause narcosis, and internet searches were not fruitful in providing adequate toxicity data for evaluation of these stressors in the BE or this Opinion. Toxicological data for the representative species were presented in the BE, when available. However in many cases, toxicity information for individual ESA-listed species was lacking or limited, so other species within the same species group (i.e., surrogates: another non-salmonid fish instead of the representative species) were used to determine potential effects on ESA-listed species. When toxicity data were not available for a specific stressors and species group, a qualitative analysis of the potential effects is presented.

In addition, many stressor pollutants monitored by some facilities under the MSGP, such as nutrients and debris, do not elicit toxic effects per se or are not as amenable to identifying a concentration at which species would be affected. Therefore, direct and indirect effects were evaluated qualitatively in the BE for these pollutants.

EPA derived direct effects data for the stressors of concern from published literature detailing the toxicity of stormwater toxic stressors within each stressor type (i.e., toxicants, nutrients, excursions in pH, sediment, etc.). When acute toxicity data for a specific stressor were available for the representative species, a quantitative comparison of the toxicity data to the quarterly benchmark/ELG requirement for that stressor in each sector was performed. Indirect effects were qualitatively evaluated in the BE using ecological information for each group of ESA-listed species selected for analysis. EPA assumed that the potential impact of indirect effects on water quality, shelter, prey/forage items, etc. is proportional to the direct effects, following the logic that the greater the risk of a potential direct effect of a pollutant on a ESA-listed species ’ food source or its habitat, the greater the likelihood of potential indirect effects on the species. Effects on designated critical habitat were evaluated after the indirect effects analysis for each stressor type and species group, where applicable.

7.3 Stressors of the Action: Pollutants authorized for discharge under the MSGP

This section of the *Effects of the Action* identifies the stressors which may affect ESA-listed species and provides a general overview of the mechanism(s) by which of these stressors affect animals and the environment. The many pollutants that may be present in industrial stormwater discharges are detailed in the sector specific fact sheets developed by EPA for the 2008 MSGP. The MSGP itself does not require monitoring of each and every potential discharge constituent. Those constituents subject quantitative evaluation through quarterly benchmark monitoring and effluent limitation guidelines were selected using industry-supplied stormwater discharge data to determine which pollutants were high enough, on average, to be of concern for the given industries. Different sectors have different monitoring requirements. We must also consider that not all sectors are required to monitor for all analytes, and 11 sectors are not required to monitor for benchmarks or ELGs at all. Among benchmarks and ELGs, the most commonly required measurement is TSS.

Table 19 Sector specific pollutants which require quarterly benchmark and effluent limitations guideline monitoring.

Sector	Measured for Quarterly Benchmark Monitoring	Effluent Limitation Guidelines Monitoring
A: Timber Products	COD, TSS, Arsenic, Copper, Zinc	pH, woody debris
AA: Fabricated metal products	Aluminum, Iron, Nitrate plus Nitrite Nitrogen, Zinc	no ELGs
AB: Transportation equipment, industrial or chommercial machinery facilities	no benchmarks	no ELGs
AC: Electronic and electrical equipment and components, photographic and optical goods	no benchmarks	no ELGs
AD: Stormwater discharges designated by the director as requiring permits	no benchmarks	no ELGs
B: Paper and Allied products	COD	no ELGs
C: Chemical and Allied products manufacturing and refining	Aluminum, Iron, Lead, Nitrate plus Nitrite Nitrogen, Phosphorous, Zinc	Phosphrous, Floride

Sector	Measured for Quarterly Benchmark Monitoring	Effluent Limitation Guidelines Monitoring
D: Asphalt paving and roofing materials and lubricant manufacturing	TSS	pH, TSS, Oil and Grease
E: Glass, clay, cement, concrete, and gypsum products	TSS, Aluminum, Iron	pH, TSS
F: Primary metals	TSS, Aluminum, Copper, Zinc	no ELGs
G: Metal mining	COD, TSS, Turbidity, pH, Hardness, Antimony, Arsenic, Beryllium, Cadmium, Copper, Iron, Lead, Mercury, Nickel, Nitrate plus Nitrite Nitrogen, Selenium, Silver, Zinc	no ELGs
H: Coal Mines and coal mining-related facilities	TSS, Aluminum, Iron	no ELGs
I: Oil and gas extraction	no benchmarks	no ELGs
J: Non-metalic mineral mining and dressing	TSS, Nitrate plus Nitrite Nitrogen	pH, TSS
K: Hazardous waste treatment, storage, or disposal facility	COD, Ammonia, Arsenic, Cadmium, Cyanide, Lead, Magnesium, Mercury, Selenium, Silver	pH, TSS, BOD, Ammonia, Alpha Terpineol, Aniline, Benzoic acid, Napthalene, p-Cresol, Phenol, Pyridine, Arsenic, Chromium, Zinc
L: Landfills, land application sites, and open dumps	TSS, Iron	pH, TSS, BOD, Ammonia, Alpha Terpineol, Benzoic acid, p-Cresol, Phenol, Zinc
M: Automobile salvage yards	TSS, Aluminum, Iron, Lead	no ELGs
N: Scrap recycling and waste recycling facilities	COD, TSS, Aluminium, Copper, Iron, Lead, Zinc	no ELGs
O: Steam electric generating facilities	Iron	pH, TSS
P: Land transportation and warehousing	no benchmarks	no ELGs
Q: Water transportation	Aluminum, Iron, Lead, Zinc	no ELGs
R: Ship and boat building and repair yards	no benchmarks	no ELGs
S: Air transportation	COD, BOD, pH, Ammonia	Ammonia
T: Treatment works	no benchmarks	no ELGs
U: Food and kindred products	COD, BOD, TSS, Nitrate plus Nitrite Nitrogen	no ELGs
V: Textile mills, apparel, and other fabric products	no benchmarks	no ELGs
W: Furniture and fixtures	no benchmarks	no ELGs
X: Printing and publishing	no benchmarks	no ELGs
Y: Rubber, miscellaneous plastic products, and miscellaneous manufacturing	Zinc	no ELGs
Z: Leather tanning and finishing	no benchmarks	no ELGs

7.3.1 Toxicants

Differing inorganic and organic compounds exhibit differing mechanisms of toxicity. Some compounds pass through the system unchanged, and simply are excreted. Others are metabolized without ill effect to the organism. Some are transformed to a more toxic form inside the body. Still others (such as hydrogen or sodium cyanide) are immediately and dramatically toxic. The mechanism of toxicity for a given toxicant typically is similar among similar organisms, but an individual species will exhibit greater or lesser sensitivity to a toxic substance compared to other species, depending on its individual physiology, ecological traits, protective mechanisms, and evolutionary adaptations.

7.3.1.1 Inorganic Toxicants

The inorganic pollutants in stormwater discharges covered under the MSGP consist of metals, metalloids, and non-metals. These include aluminum, antimony, beryllium, cadmium, chromium, copper, iron, lead, magnesium, mercury, nickel, silver, zinc, the metalloids arsenic and selenium; a potentially toxic ion (fluoride); and two potentially toxic non-metal compounds (ammonia and cyanide). Many of the metals are essential to life at low nutrient-scale concentrations, but are also toxic at higher concentrations. There is often a narrow window between the amount of a heavy metal that is essential for life and that which is toxic.

Factors affecting whether or not an organism will experience adverse effects from a given inorganic substance include:

- the chemical form of the inorganic substance released in the industrial stormwater and its stability in the aquatic environment;
- the medium to which the inorganic substance preferentially partitions (e.g., air, water, or sediment);
- the chemical form and amount of the inorganic substance to which the organism is exposed;
- the amount of the inorganic substance that actually enters the organism;
- whether the substance is retained and increases in concentration within the body, (bioaccumulates); and
- the toxicity of the inorganic substance in the organism, with or without bioaccumulation.

The net effect of chemical form and partitioning determine environmental behavior and exposure potential. With the exception of iron and magnesium, these are summarized from the BE in Table 20.

Table 20 Summary of environmental behavior and bioaccumulation potential for inorganic pollutants of concern under the MSGP.

Element	Environmental behavior	Bioaccumulation
Aluminum	Sparingly soluble in water between pH 6 and 8	Low likelihood
Antimony	Partitions to sediment, but low levels found in water	Low likelihood
Arsenic	Highly dependent on chemical form	Accumulates in organisms
Beryllium	Typically partitions to sediment	Low likelihood
Cadmium	Partitions to sediment, but low levels found in water	Accumulates at all levels of the food chain, in plants and animals

Element	Environmental behavior	Bioaccumulation
Chromium	Partitions to sediment, but low levels found in water	Low likelihood
Copper	Partitions to sediment, but low levels found in water	Low likelihood in fish; higher likelihood in mollusks
Lead	Highly dependent upon pH, hardness, salinity, and presence of humic (organic) material. Most soluble in soft, acidic water	Accumulates at all levels of the food chain, in both plants and animals, but does not biomagnify.
Mercury	Highly dependent upon chemical form	Accumulates and magnifies at all levels of the aquatic food chain
Nickel	Partitions to suspended particles in water	Low likelihood
Selenium	Dependent upon chemical form, but can be found in the sediment and in the water column	Accumulates in the aquatic food chain
Silver	Can be found in the sediment and the water column; partitioning coefficients are fn	Accumulates to a limited extent in algae, mussels, clams, and other aquatic organisms
Zinc	Partitions to suspended particles in water, some will exist in aqueous phase	Low likelihood
Fluoride	Strongly binds to aluminum in sediment and water	Accumulates in some plants and in the skeletal systems of terrestrial animals
Cyanide	Soluble, but transforms to hydrogen cyanide and evaporates to air	None
Ammonia	Highly soluble, but as part of the nitrogen cycle, found in all environmental compartments	None

As stated above, depending upon the chemical form discharged, and physicochemical properties of the aqueous environment to which it is discharged (especially pH), the heavy metal compounds present in the aqueous environment will be more or less soluble in water. Inorganics generally are very mobile in the environment. Depending upon the pH, hardness, salinity, oxidation state of the element, soil saturation, and other factors, inorganics are readily soluble, if in an ionic form. Less soluble compounds typically precipitate and either settle to sediment, adsorb onto suspended particulate matter, or are transported downstream as particulate matter. More soluble compounds dissolve in the water column. Dissolved compounds typically will be transported the greatest distances, but will be significantly diluted during transport. Insoluble compounds of sufficient density will be deposited on the substrate closest to the source of the discharge. Suspended particulates will settle to the bottom at an intermediate distance.

While the benchmarks and ELGs in the MSGP are specified for total metals, water quality guidelines are expressed as dissolved metals. The total recoverable metals in stormwater in the dissolved phase is that which is filtered through a 0.45 micrometer filter. One study conducted by Washington Department of Ecology evaluated three storm events from a small industrial site (Golding 2006). The study monitored hourly concentrations of total and dissolved zinc and copper over the course of 24-49 hours. Dissolved metal concentrations, as a percentage of total metal, ranged from 51 to 99 percent for copper and from 72 to over 100 percent for zinc. Another study on stormwater runoff from roads found the vast majority of copper was in the dissolved fraction as well; particulate bound copper accounted for less than 20 % of total (Hwang et al.

2006). This contrasts with the work of Nason et al. (2012) who analyzed copper concentrations in various stormwater samples and report the vast majority (>99.9%) of the total dissolved copper in composite samples was complexed by organic ligands in stormwater. Regardless of form, ligand bound metals in stormwater discharges contribute to the net load and existing legacy metals resident in sediments. Kalnejais et al. (2010) quantified the potential release of dissolved metals from Boston Harbor sediments due to resuspension and determined that 2-5% of sediment bound copper when sediments were retained in suspension for 90 hours.

From the time following discharge, an inorganic compound may be transformed from its initial form to another that can be either more or less toxic than the original. Some transformations may occur rapidly, resulting in an organism being exposed to a different form of the stressor than the one released. In particular, inorganic compounds susceptible to rapid hydrolysis will undergo transformation quickly upon release into the aquatic environment. The pH of both the discharge and the receiving water likely will affect both transformation rates and results. Despite being exposed to a particular compound, an organism may not take up that compound. Plants may not be able to absorb some compounds through their root structures. Still, other compounds may be sequestered by an organism. For example, arsenic typically partitions to sediments, resulting in greater arsenic concentrations in sediment than surface water. Consequently, aquatic bottom feeders experience greater exposure to higher arsenic concentrations than do pelagic species (Merciai et al. 2014). The toxic effects of chromium are primarilyfound at the lower trophic levels. Chromium exposure reduces the growth of freshwater fish fingerlings (USEPA 1980a).

Inorganics that tend to bioaccumulate (some of the heavy metals, including cadmium, chromium, and mercury) do so by binding to phosphate and sulfide groups of various proteins. When the sulfhydryl groups of enzymes are bound, the enzyme activity is inhibited and results in a general decline in fish health. At high enough concentrations, osmoregulatory and hormonal systems cease to function (Heath 1995). Toxicity of most inorganics is dependent upon water quality, and is amplified with increased temperature, increased pH, decreased hardness, and decreased dissolved oxygen.

7.3.1.2 Organic Toxicants

The organics of concern in stormwater discharges covered under the MSGP include alpha terpineol, benzoic acid, aniline, pyridine, naphthalene, p-cresol, and phenol. Like the inorganics discussed earlier, these organic compounds also are found in natural substances. However, none of the organics are essential. In fact, all are toxic to humans to some degree and may exhibit toxicity toward other species. Table 6-6 summarizes relevant physical and chemical properties of each of the organics, describes the natural sources of them, and presents known toxic effects.

Factors affecting whether or not an organism or designated critical habitat will experience adverse effects to a given organic substance released to the environment include:

- the chemical released and its physical form at the time of release (solid, liquid, or vapor) and its solubility in water;
- the chemical's affinity for lipids (log K_{ow}) or organic carbon (K_{oc}) relative to water;
- the chemical's ability to volatilize from water (Henry's Law Constant);
- the chemical's likelihood of concentrating in aquatic organisms (Bioconcentration Factor, the ratio of a contaminant concentration in an organism to the contaminant concentration in its environment);
- the chemical's toxicity in the organism; and
- the exposure of the species or designated critical habitat to the chemical.

The form and physical properties of organic pollutants influence the degree to which it may bioconcentrate. Bioconcentration factors, adapted from table 6-6 in the BE, are summarized in Table 21. The bioconcentration factor (BCF) is a measure of the tendency of a compound to accumulate in organisms, especially fish. This value helps illustrate the potential for an organism's predators to be exposed to the compound by ingestion. BCFs for the organic compounds of concern range from less than ten to 168 and depend on the organism tested. Substances which bioconcentrate may accumulate in an organism's body to toxic levels for the organism, or for predators consuming the organisms. In general, benzoic acid, aniline, p-cresol, and phenol are not expected to bioaccumulate in fish. Alpha-terpineol, naphthalene, and pyridine are more likely to bioaccumulate.

Table 21 Bioconcentration factors for organic pollutants of concern in the MSGP (adapted from Table 6.6 of the BE)

Organic	Bioconcentration Factor
α-terpineol	43 (estimated)
Benzoic acid	5 in fish
Aniline	<10 in 3 species of fish
Pyridine	88 in guppies
Naphthalene	23-168 in fish
p-cresol	6 (estimated)
Phenol	20 (Goldorfe) 1.9 (Carassius auratus) 17 (fish, unspecified) 1.7 (fish, unspecified) 39 (Salmo gairdneri)

Aquatic organisms can be expected to experience greater exposure to more soluble substances. Naphthalene is the least soluble in water, followed in order of increasing solubility by benzoic acid, alpha terpineol, p-cresol, aniline, phenol, and pyridine, which is considered miscible (capable of mixing fully). The PubChem Compound Database provides estimates for the amount of time required for each chemical to volatilize completely from a modeled river or lake. Benzoic acid is not expected to volatilize at all; it is expected to remain dissolved in water. On the other hand, naphthalene is expected to volatilize from a modeled river in four hours or from a modeled lake in five days.

Other factors also affect the likelihood of an organism's exposure to the organic compounds of concern, including environmental degradation and biodegradation. Aniline, naphthalene, and phenol may undergo degradation through photolysis in a time-frame corresponding with the acute toxicity window of ≤ 96-hs, but photolysis is only likely under conditions of strong sunlight, and will only affect the portion of the water that sunlight reaches. Only pyridine and phenol may biodegrade (under optimal conditions) in the time frame considered here.

Most of the organic chemicals of concern in the MSGP are skin and mucous membrane irritants. As such, depending on the level of exposure, they can affect fishes, mammals, reptiles, birds, bivalves, and abalone, but the degree of affect is uncertain. It is uncertain how or if these irritants will affect benthic macroinvertebrates or plants. Two of the chemicals affect the blood (aniline and naphthalene) and can be expected to impact any of the higher animals (reptiles, fish, mammals, birds). Benzoic acid sequesters coenzyme A, affecting the tricarboxylic acid cycle and therefore energy production in animals and higher plants. Consequently, benzoic acid is expected to exhibit some level of toxicity toward all the organisms considered here, although the level of toxicity will likely vary by organism and is uncertain. Depending upon the exact mechanism of toxicity, it is likely that all of the organics are toxic toward all of the species evaluated. Of the seven organics of concern in discharges covered under the MSGP, toxicity data for alpha terpineol and benzoic acid are not available for any of the ESA-listed species groups. The other five organics–aniline, pyridine, naphthalene, p-cresol, and phenol have limited toxicity data available. There are no available aquatic toxicity data for covered organics for reptiles, abalone, coral, sturgeon, rockfish, and eulachon.

7.3.1.3 Oil and Grease

Oil and grease are a known component of uncontrolled urban stormwater runoff and accidental industrial spills with potentially harmful impacts to humans and to aquatic life. Oil constituents can be highly toxic and carcinogenic, and may inhibit reproduction and cause organ damage or even mortality (Howarth 1989). Both petroleum and non-petroleum oils (e.g. vegetable oils, grease) have similar properties that can harm wildlife when spilled into the environment (USEPA 1999). While deleterious effects of oil via spills are well-known, this situation is not relevant to discharges covered under the MSGP, which are prohibited discharging oil from spills. The effects of petroleum oils on many species of fish have been investigated extensively (Howarth 1989, USEPA 1999). Commonly reported individual effects of petroleum oils in fish include: impaired reproduction and growth, blood disorders, liver disorders, kidney disorders, malformations, altered respiration or heart rate, altered endocrine function in fish, altered behavior, increased gill cells, fin erosion, and death. Oils can also act on the epithelial surfaces of fish, accumulate on gills, and prevent respiration (Howarth 1989, USEPA 1999). In addition, secondary effects have been observed. Oil coating surface waters can interfere with natural processes of re-aeration and increase BOD, depleting the water of oxygen.

Both petroleum and non-petroleum oils have similar physical properties that can harm wildlife (USEPA 1999) such as sticking to fur and feathers and reducing their insulative properties. Oil weathered to state of a tar ball is generally considered less acutely toxic than crude oil or refined petroleum because the water soluble hydrocarbons have dissipated. Exposures to oil and grease discharged under the MSGP would be through surface coating or direct ingestion of material with food items or ingestion of oil and grease constituents incorporated into food items through the food web.

7.3.2 Excursions in Water Quality Parameters

Excursions in water quality parameters are deviations from normal conditions that raise concern. Water quality parameters covered under the MSGP subject to excursions include the sediment regime parameters erosivity, turbidity and total suspended solids, debris, the water chemistry metrics of pH, hardness, and biological and COD. These analyses are all measurable characteristics describing water quality. It was not possible for EPA to precisely evaluate the potential effects from authorized discharges of these parameters on ESA-listed species so their BE included a general discussion of their effects on the ecosystem. This discussion is summarized and supplemented in the paragraphs below.

7.3.2.1 Erosivity, turbidity, and total suspended solids

Excess sediment is considered a major pollutant of streams in the U.S., which can have adverse consequences for ESA-listed species and other special status species. Erosion is a natural occurrence in aquatic systems where the flow or movement of water scours loose sediment from stream banks and shorelines. However, stream bank erosion can be exacerbated by anthropogenic sources which disturb soils or alter hydrology (e.g., logging, construction, paving) and is commonly correlated with urbanization and high percentages of impervious surfaces in watersheds. Impervious surfaces in a watershed increase the natural flow and volume of water during rain events causing increased scouring and sediment transport potential in streams and rivers. Specific land use factors of the watershed also play a role in erosion intensity. For example, construction sites can be susceptible to excessive sediment erosion during storm events as the un-vegetated soils are easily scoured and transported to watershed streams and rivers. Stormwater erosion directly contributes to spikes in total suspended solids, turbidity, and nutrient concentrations in the water column, as well as causing indirect water chemistry changes.

During high flow events, eroded sediment is transported as suspended solids until it reaches low flow areas where it settles out of solution and sinks to the bottom, at least temporarily (Cover et al. 2008) in the watershed from surface erosion and landslides. In watersheds with excessive erosion, the particulate sediment can cover the natural substrate causing direct and indirect biological effects. Total suspended solids is considered to be one of the major pollutants that contributes to the deterioration of water quality, contributing to higher costs for water treatment, decreases in fish resources, and the general aesthetics of the water (Bilotta and Brazier 2008).

Excessive sediment loads introduced into receiving waterbodies can pose significant environmental health risks; sediment can cause smothering and disruption of aquatic habitats, reduce light penetration and transport many other potentially harmful pollutants (e.g. hydrocarbons, heavy metals, phosphorus) (Duncan et al. 1999). Direct effects of suspended materials on invertebrates and fish are complex, ranging from behavioral to physiological to toxicological. Suspended sediments have been documented to have a negative effect on the survival of fish, freshwater mussels, and other benthic organisms. In a frequently cited review paper prepared by Newcombe and Jensen (Newcombe and Jensen 1996), sublethal effects (e.g. increased respiration rate) were observed in eggs and larvae of fish when exposed to TSS concentrations as low as 55 mg/L for one hour. Excess sediment smothers benthic organisms and the surface layer of the benthos can be heavily impacted and altered. Increased turbidity associated with suspended sediments can reduce primary productivity of algae as well as growth and reproduction of submerged vegetation (Jha and Swietlik 2003). In addition, once in the system, resuspension and deposition can “recycle” sediments so that they exert water column and benthic effects repeatedly over time and in multiple locations.

TSS can influence macrophytes and algae, primarily through affecting the amount of light penetrating through the water column (Bilotta and Brazier 2008). The reduction in light penetration through the water column will restrict the rate at which periphyton and emergent and submersed macrophytes can assimilate energy through photosynthesis, which could impact primary consumers. Certain waterbody types are capable of recovering more quickly from events causing excess suspended sediment and turbidity (e.g., high energy streams), whereas others may retain accumulated sediments for years (e.g., lakes and wetlands) (USEPA 2009). Short-term increases in suspended sediment and turbidity levels can naturally occur during spring thaws, storms, and other high flow events. Naturally occurring inputs of sediment are considered to be small and nondestructive to stream habitat and biota. However, anthropogenic sources such as uncontrolled stormwater discharges and runoff can change natural sediment and turbidity dynamics by elevating sediment and turbidity levels significantly beyond those associated with natural events, for longer periods of time, and at times when an aquatic ecosystem and its organisms are unaccustomed to receiving such inflows (e.g., late summer low flow periods).

Jones et al. (1999) noted significant reductions in overall fish abundance with an increased sediment load. Deforestation and the resulting increase in erosion and fine particles caused critical fish habitats to become filled with fine particles and altered the population dynamics of several streams in the Little Tennessee River drainage (Jones et al. 1999). Studies have also shown that benthic macroinvertebrate communities are negatively affected from fine sediment accumulation in riffle and pool areas of streams and rivers. For example, Vasconcelos and Melo

(2008), observed significant changes in macroinvertebrate abundance and community structure with additions of various size sand particles to their habitat.

Observed impacts to ESA-listed species from elevated sediment and turbidity levels fall into several broad categories such as avoidance or behavioral responses, feeding and hunting, breeding and egg survival, habitat loss, juvenile survival and physical damage. The potential cumulative effect of these impacts includes reduced disease and parasite resistance, reduced growth, and degraded health of individual organisms in the fish community. Population reductions can take place both through direct mortality in the short term and reduced reproductive success in the long term. Suspended sediment is associated with negative effects on the spawning, growth, and reproduction of salmonids (Bash and Ryan 2002). Effects on salmonids will differ based on their developmental stage by altering their physiology, behavior, and habitat, all of which may lead to physiological stress and reduced survival rates.

7.3.2.2 pH

The pH of water affects the normal physiological functions of aquatic organisms, including the exchange of ions with the water and respiration. Such important physiological processes operate normally in most aquatic biota under a relatively wide pH range (e.g., 6-8.5 pH units). There is no definitive pH range within which all freshwater aquatic life is unharmed and outside which adverse impacts occur. Rather, there is a gradual "deterioration" in acceptability as pH values become further removed from the normal range (EIFAC 1969, AFS 1979, Alabaster and Lloyd 1980). The acceptable range of pH to aquatic life, particularly fish, depends on numerous other factors, including prior pH acclimatization, water temperature, dissolved oxygen concentration, and the concentrations and ratios of various cations and anions (McKee and Wolf 1963).

Aquatic communities have low species richness at pH levels below 6 or above 8.5 units (Kalif 2002). At high (alkaline) pH levels, LC_{50} (lethal concentration) values for salmonids fall in the 9-10 pH unit range. Few fish survive even short-term exposures to pH levels less than 4 or greater than 11 (Alabaster and Lloyd 1980). Some aquatic plants are also sensitive to pH changes (e.g., some studies of the genus *Potamogeton* have shown it to be very sensitive to water column pH changes) (USFWS 1998). Low species richness at high or low pH levels can be attributable, in some cases, to other factors working in concert with altered pH levels. These factors can include increased metal toxicity (e.g., aluminum), high salt levels, and high water temperature.

In response to acid rain problems occurring in the eastern United States, the physiological effects of acid stress on fish and other aquatic life have been well documented. A number of researchers have proposed that the toxic action of hydrogen ions on fish under acidic conditions involves production of mucus on the gill epithelium, which interferes with the exchange of respiratory gasses and ions across the gill; precipitation of proteins within the epithelial cells; and/or acidosis of the blood (also affecting oxygen uptake) (Ellis 1937, Westfall 1945, AFS

1979, Boyd 1990). Hence, respiratory distress and osmotic imbalance are the primary physiological symptoms of acid stress in fish. In addition, primary productivity of freshwater aquatic ecosystems is reduced considerably below pH of 5.0, which in turn, reduces the food supply for higher organisms. Thus, fish that remain present would likely experience reduced numbers or growth rates (Alabaster and Lloyd 1980).

The physiological effects on aquatic life induced by high pH (>9) have been studied less than those at low pH. This is likely because high pH waters are less common (Doudoroff and M. 1950, Alabaster and Lloyd 1980). Several researchers concluded that the toxic mode of action of hydroxyl ions (i.e., high pH values) is hypertrophy of mucus cells at the base of the gill filaments and destruction of gill and skin epithelium, with effects on the eye lens and cornea (Alabaster and Lloyd 1980, Boyd 1990).

7.3.2.3 Hardness

Heavy metals are more toxic to invertebrate and fish species in soft water than in hard water because they occur in a more ionic dissolved state in soft water, and it is known that the dissolved forms of heavy metals are the active toxic agents (Rathore and Khangarot 2003). Decreasing metal toxicity to fish with increasing water hardness has been shown throughout the literature. Mebane et al.(Mebane et al. 2010)found that fish incubated in the higher hardness water were about two times more resistant than fish incubated in the extremely soft water.

Water hardness has been shown to have a direct effect on the swelling of newly fertilized eggs, which is an important process during the early development of teleost eggs (Spade and Bristow 1999). Typically, egg swelling increases when water hardness decreases because low water hardness usually means low osmotic concentration. Other ions, both mono and multivalent, also play a role in egg swelling. The greater the valence of the ions, the greater the egg swelling is reduced (Eddy and Talbot 1983). Spade and Bristow ((Spade and Bristow 1999) examined the effects of increasing water hardness on egg diameter and hatch rates of striped bass (*Morone saxatilis*) eggs. They found that increased water hardness of the incubation water reduced swelling (egg volume), which in turn stopped the eggs from rupturing and reduced buoyancy.

In higher hardness streams, freshwater fish can accumulate calcium directly from the water by absorption across the gills (Simkiss 1974, Milhaud et al. 1977, Mayer-Gostan et al. 1983), and in at least some species of fish this mode of calcium accumulation is sufficient to maintain normal growth, even when the fish are fed a calcium-deficient diet (Ogino and Takeda 1976, 1978, Watanabe et al. 1980, Ichii and Mugiya 1983). In fact, even when calcium is supplied with the food, direct absorption of calcium from the water *via* the gills prevails (Berg 1968).

7.3.2.4 Biochemical oxygen demand (BOD) and chemical oxygen demand (COD)

Oxygen is essential in aerobic organisms for the electron transport system of mitochondria. Oxygen insufficiency at the mitochondria results in reduction in cellular energy and a subsequent loss of ion balance in cellular and circulatory fluids (USEPA 2000a). If oxygen insufficiency persists, death will ultimately occur, although some aerobic animals also possess anaerobic metabolic pathways, which can delay lethality for short time periods (minutes to days). Anaerobiosis is well developed in some benthic animals, such as bivalve molluscs and polychaetes, but not in other groups, like fish and crustaceans (Hammen 1976).

Elevated loadings of organic material can increase levels of oxygen-demanding substances (e.g., as measured by BOD and COD in receiving waters thus lowering dissolved oxygen in the water. COD is a measure of the oxygen-consuming capacity of inorganic and organic matter present in wastewater. Microbes aerobically break down the organic compounds. Elevated oxygen demand can lower dissolved oxygen levels in surface water, leading to several of the impacts associated with nutrient- derived or organic chemical caused oxygen depletion discussed previously. If dissolved oxygen concentrations are reduced sufficiently, pollutants such as phosphorus, aluminum and iron are released from sediments in the streambed (Kim et al. 2003). Excess phosphorus in the water column can cause algal blooms, developing an oxygen-depleting cycle that can cause harm to fish. Aluminum, iron and other metals in the water column may be toxic to fish under certain concentrations.

7.3.2.5 Debris

An ELG for debris is Debris is only listed for sector A, Timber Products. Much of the literature regarding debris effects in aquatic systems concerns the habitat component of large woody debris in streams (Naiman et al. 1999, Hyatt and Naiman 2001, Latterell and Naiman 2007, Naiman et al. 2008, Naiman et al. 2010). Effects reported include bank erosion, downstream sediment movement, and the formation and loss of structural elements such as pools and riffles (May and Gresswell 2003). Debris from the timber products industry includes treated and untreated wood fragments. Discharge limits of woody imposed by the MSGP prevent discharges and accumulations which would be harmful to receiving waters. Nutrients

Sources of these nutrients include point source discharges from municipal and industrial sources, and non-point source discharges from land runoff and atmospheric deposition. Nutrient loadings in the form of nitrogen and phosphorus to waterbodies impact water quality by stimulating plant and algae growth which subsequently may result in depletion of dissolved oxygen, degradation of habitat, development of harmful algal blooms, impairment of the waterbody’s designated use, and impairment of drinking water sources. In general, nitrogen is most often the limiting nutrient in estuarine waters, and phosphorus is more often limiting in freshwater systems. This means that the growth of phytoplankton is substantially controlled by the concentration and availability of phosphorus in freshwater systems. Increased nutrients can lead to changes in composition of flora and fauna present, increased eutrophication of a water body, rates of ecosystem functioning, nutrient uptake, recycling rates of the ecosystem, and decomposition rates (Spatharis et al. 2007, Herbert and Fourqurean 2008, Armitage and Fourqurean 2009, Armitage et al. 2011). Determining risk to aquatic life from excess nutrients (e.g.,eutrophication) is complicated because nitrogen and phosphorus are essential for primary production in aquatic ecosystems, and over-enrichment problems involve multiple interrelated variables. The most visible symptom of eutrophication is the excessive algal growth that reduces water clarity. Eutrophication can also significantly affect phytoplankton community structure resulting in a greater abundance of less desirable taxa such as blue-green algae (Zhu et al. 2010, Hall et al. 2013). These changes in the phytoplankton community can have cascading effects on higher trophic levels and the eventual transfer of organic carbon from the primary producers to less desired species – for example, the replacement of seagrasses with less desirable vegetation types (Herbert and Fourqurean 2008, Herbert and Fourqurean 2009).

7.3.2.6 Nutrient Enrichment

Under natural conditions, essential nutrients contribute to the proper structure and function of healthy ecosystems. However, in excessive quantities, nutrients can have adverse effects on ecosystems, and nutrient enrichment, which leads to eutrophication, often ranks as one of the top causes of water resource impairment (Bricker et al. 2008, USEPA 2014). Because it was not possible for EPA to precisely evaluate the potential effects from authorized discharges, the BE included a general discussion of the effects of excess nutrients on ecosystems.

There are two major pathways by which eutrophication can indirectly affect ESA-listed species and other special status aquatic plants, invertebrates, amphibians, mammals, and fish. These are: 1) competition, in which excess nutrients lead to replacement of native taxa by nuisance/harmful species, many of which produce toxins; and 2) productivity, in which nutrients lead to increased organic matter loading by increasing productivity, which can then result in visible cyanobacterial or algal blooms, surface scums, floating plant mats and excess benthic macrophytes.

Eutrophication alters the composition and species diversity of aquatic communities through intensifying competition by those species, native or invasive, that are better adapted to eutrophic environments ((Nordin 1985, Welch et al. 1988, Carpenter et al. 1998, Smith 1998, Smith et al. 1999) – after (USEPA 2000b). In some cases, it may result in ESA-listed species experiencing increased mortality from competitors. Thus, eutrophication can have cascading effects that change ecosystem structure at numerous trophic levels. Nuisance levels of algae and other aquatic vegetation (macrophytes) can develop rapidly in freshwater and marine habitats in response to nutrient enrichment when other factors (e.g., light, temperature) are not limiting. The relationship between nuisance algal growth and nutrient enrichment has been well-documented (e.g., (Welch et al. 1992, VanNieuwenhuyse and Jones 1996, Dodds et al. 1997, Chetelat et al. 1999). In addition to outcompeting native aquatic plants for space and light, the proliferation of nuisance algae can lead to the occurrence of harmful algal blooms (e.g., brown tides, toxic *Pfiesteria piscida* outbreaks, some types of red tides) which contain microalgae that produce potent toxins. Symptoms from toxin exposure range from neurological impairment to gastrointestinal upset to respiratory irritation, and sometimes result in severe illness and death (Lopez et al. 2008). Eutrophication is believed to be a likely contributor to the increased occurrence of harmful algal blooms (Heisler et al. 2008). In addition to its association with harmful algal blooms and algal toxins, eutrophication has also been linked to increases in bacteria biomass (Carr et al. 2005). Bacteria have been associated with mortality among fish, turtles, and alligators (Shotts et al. 1972). In marine systems, algal toxins have caused massive fish kills, along with deaths of whales, sea lions, dolphins, manatees, sea turtles, birds, and wild and cultured fish and invertebrates (Landsberg 2002, Shumway et al. 2003). There has been an increase in the number of unusual marine mammal mortality events reported in the U.S. and this is believed to be associated with the increasing occurrence of harmful algal blooms. The timing of the blooms and strandings of marine mammals suggests that species that forage both inshore and offshore can be affected. NOAA's Marine Mammal Health and Stranding Response Program is finding more mammal stranding events to be linked to biotoxins (Gulland and Hall 2007, de la Riva et al. 2009).

The accumulation of this biomass through excessive productivity can reduce available habitat, and the decay of this organic matter may lead to reductions in dissolved oxygen in the water, which in turn can cause problems such as fish kills and release of toxic substances or phosphates that were previously bound to oxidized sediments (Chorus and Bartram 1999). High biomass blooms of toxic and nontoxic algae resulting from excess nutrients or eutrophication is a common type of event that can cause hypoxia or anoxia (low or no dissolved oxygen), which suffocates fish and bottom- dwelling organisms and can sometimes lead to hydrogen sulfide poisoning (Lopez et al. 2008). Hypoxia can cause habitat loss, long-term weakening of species, change in species dynamics and even fish kills. Because hypoxia often occurs in estuaries or near shore areas where the water is poorly mixed, nursery habitat for fish and shellfish is often affected. Without nursery grounds the young animals cannot find the food or habitat they need to reach adulthood. This causes years of weak recruitment to adult populations and can result in an overall reduction or destabilization of important stocks. High biomass blooms can also directly inhibit growth of beneficial vegetation by blocking sunlight penetration into the water column (Onuf 1996). For example, an excessive accumulation of filamentous benthic algae or other macrophytes during the peak summer growing season can alter stream flow as well as the availability of benthic habitat for stream invertebrates and vertebrates (Welch et al. 1989, Chessman et al. 1992). Macroalgal blooms reduce sunlight penetration and can overgrow or displace seagrasses and corals as well as foul beaches (Valiela et al. 1997). The decay of excess organic matter from high biomass blooms will also lead to reductions in dissolved oxygen in the water, which in turn can cause problems like fish kills and release of toxic substances or phosphates that were previously bound to oxidized sediments (Chorus and Bartram 1999). Bloom-inflicted mortalities can degrade habitat quality indirectly through altered food webs or hypoxic events caused by the decay of dead animals (Lopez et al. 2008).

7.4 Effects Analysis for Threatened and Endangered Species

The following section reviews the BE assessment of effects to threatened and endangered species and, where applicable, their designated critical habitat. It was not possible to discuss each analyte for each species, both due to the existence of data gaps contributing to the uncertainty in the analysis and the breadth of analytes and species to be considered. Rather than discuss the literature for each species, we organize the data using species groups (e.g., Anadromous fish, Corals, etc.). We base these groups on their similar biology and ecological needs which result in similar stress pathways and responses to stressors of the action.

In its analysis, the BE compared the lowest exposure concentrations resulting in acute mortality in salmonid test species to the most stringent benchmark or ELG to determine if the limits placed in the MSGP are sufficient to protect threatened and endangered salmonid species and their designated critical habitat. NMFS examined data for additional effects on olfaction and behavior and compared these toxicity data, and the toxicity data used by EPA, with the *least* stringent MSGP benchmark or ELG. That is to say this Opinion applied the highest MSGP benchmark or ELG as an MSGP-based exposure estimate to produce a more conservative analysis. In cases where the selected toxicity threshold is higher than the MSGP-based exposure estimate, the proposed permit terms, in the absence of measures required for ESA Eligibility Criteria certification, are considered sufficiently protective for single stressor exposures.

7.4.1 Cetaceans

While the Southern Resident Killer Whale is not expected to be directly exposed to industrial stormwater discharges, these discharges may destroy or adversely modify their Critical Habitat. Critical habitat for this species which includes prey species of sufficient quantity, quality and availability to support individual growth, reproduction and development, as well as overall population growth. Southern resident Killer Whales prefer Chinook salmon to the more abundant Pink and Sockeye in Puget Sound. Effects to Chinook salmon, described in section 7.4.2 below, would therefore, influence this species.

7.4.2 Salmonid and Non-salmonid Anadromous Fish

The anadromous salmon, sturgeon, and eulachon under NMFS' jurisdiction are particularly vulnerable to the effects of discharges authorized under the MSGP because the freshwater inland habitats they use for spawning and rearing allow for more immediate exposures to stormwater pollutants at lower dilution volumes relative to exposures occurring in bays and estuaries. These species are treated together in this Opinion due to their shared vulnerability and the colocation of the Pacific salmonids, eulachon and green sturgeon ranges and designated critical habitat on the West coast and of Atlantic salmon and shortnose and Atlantic sturgeon ranges on the East coast. The analysis uses Chinook salmon as the representative species for all Pacific salmon and shortnose sturgeon as the representative species for all sturgeon. Atlantic salmon and eulachon were analyzed separately, using surrogate data where necessary.

A great body of literature exists on the effects of urbanization and pollutants on the Pacific salmonids in comparison to less literature for Atlantic salmon, eulachon, and the sturgeon species. Stormwater pollutant exposures are, of course, mixtures and there are numerous field investigations describing the adverse effects of stormwater on aquatic environments. These all suggest causes of existing ecological conditions which have integrated the temporary and long term effects of toxicants, physical disturbance, habitat alteration, and physical and chemical water quality parameters due to storm water originating from multiple land uses and point source discharges such as NPDES permitted waste water treatment facilities and industrial dischargers. Feist et al (Feist et al. 2011) conducted a series of spatial analyses to identify correlations between land use and land cover (roadways, impervious surfaces, forests, etc.) and the magnitude of coho mortality in six streams with different drainage basin characteristics. Coho return to small coastal stream networks to spawn each fall. Entry into freshwater is triggered by early autumn rainfall and rising stream flows. Surveys conducted over several decades indicate that many coho salmon were dying in newly-accessible stream reaches before they were able to spawn. Female carcasses were found in good condition (ocean bright colors) with skeins (membrane or sac that contains the eggs within the fish) filled with unspawned eggs (McCarthy et al. 2008). They found that the strength of the association with spawner mortality was greatest for impervious surfaces, local roads, and commercial property. The authors conclude that this association supports the hypothesis that these coho are being killed by as-yet unidentified toxic chemical contaminants that originate from these types of surfaces. While the land uses implicated are consistent with characteristics of industrial areas (e.g., impervious surfaces, commercial property), analysis of watersheds with respect to MSGP permitted discharger density would be required to definitively determine the influence of industrial sources of stormwater on spawner mortality in this case.

7.4.2.1 Inorganic Pollutants:
Copper in stormwater discharges is a particular concern for salmonids due to the potential to affect chemoreception. In aquatic systems, chemoreception is one of oldest and most important sensory systems used by animals to collect information on their environment and generate behaviors involved in growth, reproduction, and survival (Pyle and Mirza 2007). These behaviors include recognition of conspecifics, mates and predators, food search, defense, schooling, spawning and migration. Stimuli are perceived by sensory structures and converted to electrical signals that are conducted to the central nervous system where the information is integrated and appropriate behavioral responses are generated (Baatrup 1991). Detection of chemical signals involves not only recognition of a spectrum of unique compounds or mixtures but also their spatial and temporal distribution in the medium (Atema 1995). Sensory receptors are in direct contact with the environment, and therefore pollutants may disrupt normal chemosensory function by masking or counteracting biologically relevant chemical signals or by causing direct morphological and physiological damage to the receptors (Baatrup 1991).

Salmon experience adverse chemoreception effects at concentrations as low as 0.002 mg/L dissolved copper in soft water (i.e., <25 mg/L $CaCO_3$) (Sprague et al. 1965). Copper interferes with fish sensory systems and important behaviors that underlie predator avoidance, juvenile growth, mating and migratory. Reduced olfaction, increased avoidance behavior and compromised alarm response occurred after exposure durations ranging from 20 minutes to three hours at concentrations at or below 0.002 mg/L (Sprague et al. 1965, Hansen et al. 1999a, Hansen et al. 1999b, Sandahl et al. 2007). Salmonids avoid concentrations of copper below ≤0.005 ug/L (Brown et al. 1982), which can block upstream swimming during spawning migration (Saunders & Sprague, 1967). Sandahl et al. (2007) demonstrated a significant difference in the ability of Coho salmon to respond to the presence of a predator after exposure for 3 h to copper levels as low as 0.002 mg/L. Reduced courting behaviors in brown trout have been reported, but the only exposures tested were the control and 0.1 mg/L Cu (Jaensson and Olsen 2010). Baldwin et al. (2011) demonstrated that olfactory function was reduced 45-60% in coho salmon after 3 hours exposure to 0.005 mg/L copper, the lowest copper exposure tested. Greater than 80 percent reduced olfaction occurred at concentrations of 0.02 mg/L. McIntyre et al. (2012) reported impaired predator avoidance after 3 hours exposure to 0.005 mg Cu/L, the lowest exposure concentration tested.

The MSGP benchmark monitoring would flag discharges as a concern only if the average of four quarterly samples exceed the benchmark. The MSGP benchmark for copper under the soft water conditions used in these studies is 0.0038 mg/L, so multiple discharge events at or below this level to a shallow, low volume receiving water, such as the shallow backwaters used by juvenile salmonids, could result in olfactory effects, but would not raise concern under the permit. Further, a single event exceeding EPA's benchmark by four fold (i.e., 0.0152 mg/L) would not raise concern if copper was not reported in any other sample. While toxic effects of copper will be reversible, with physiological recovery taking place over the course of several hours following low-dose exposures (Baldwin et al. 2003), at concentrations sufficient to trigger cell death in the sensory epithelium, i.e., 0.025 µg/L (Hansen et al. 1999b), the regeneration may take place over days or weeks. Salmon will avoid copper originating from point sources with defined environmental gradients (Hansen et al. 1999a). However, pulsed exposures due to storm events can create a recurrent toxicity-recovery cycle, the effects of which have yet to be investigated.

We must also take into consideration that the MSGP copper benchmark monitoring applies EPA's older hardness-based water quality guidelines. The guideline for copper was updated in 2007 to apply the biotic ligand model. The updated guideline adjusts for multiple water chemistry factors influencing copper bioavailability: dissolved organic carbon, pH, and water hardness. A ligand is an ion or molecule that attaches to a metal. Dissolved organic carbon acts as a ligand and binds copper, preventing copper from binding to a biological ligand (i.e., gill tissue or olfactory receptor). Dissolved organic carbon is a very important determinant of copper toxicity. Kennedy et al. (2012) demonstrated that the presence of dissolved organic carbon at concentrations as low as 5 mg/L reduced olfactory impairment seven fold during acute copper exposures and four fold during chronic copper exposures. Recent work by Meyer and Adams (2010) examined whether the biotic ligand-based or hardness-based copper guidelines were protective of olfaction impairments reported in previous studies. They found that the hardness-based guidelines can be considerably under protective for olfactory and avoidance responses relative to the biotic ligand guidelines. The hardness based values were only more protective than the biotic ligand when calculated for exposures with organic carbon concentrations greater than 4 mg/L. A comparison of the biotic ligand guidelines with the MSGP copper benchmarks approaches is provided in Table 22. Instances where the biotic ligand guideline is more protective than the MSGP benchmark are indicated with an asterisk. In a majority of cases shown in Table 22 (>80%), the biotic ligand-based criteria are more protective.

Table 22 Comparison of calculated biotic ligand-based guidelines with MSGP hardness-based benchmarks for copper.

Hardness (mg/L $CaCO_3$)	Dissolved Organic Carbon (mg/L)	pH 6.5	pH 7	pH 7.5	pH 8.0	MSGP Hardness-based Benchmark
40	2	**0.0005***	**0.0012***	**0.0025***	**0.0043***	0.0056 mg/L at 25-49.99 mg/L hardness
	4	**0.001***	**0.0025***	**0.0049***	**0.0086**	
	8	**0.0021***	**0.0051***	0.0101	0.0173	
	16	**0.0044***	**0.0107**	0.0209	0.0357	
80	2	**0.0006***	**0.0014***	**0.0027***	**0.0048***	0.0123 mg/L at 75-99.99 mg/L hardness
	4	**0.0012***	**0.0027***	**0.0054***	**0.0095***	
	8	**0.0024***	**0.0056***	**0.011***	0.0191	
	16	**0.005***	**0.0115***	0.0225	0.0389	
159	2	**0.0007***	**0.0016***	**0.0031***	**0.0056***	0.0221 mg/L at 150-174.99 mg/L hardness
	4	**0.0014***	**0.0032***	**0.0062***	**0.011***	
	8	**0.0029***	**0.0064***	**0.0126***	**0.0218***	
	16	**0.0059***	**0.0132***	0.0256	0.0441	
317	2	**0.0009***	**0.0019***	**0.0037***	**0.0067***	0.0332 mg/L at 250+ mg/L hardness
	4	**0.0017***	**0.0039***	**0.0074***	**0.0129***	
	8	**0.0035***	**0.0077***	**0.0148***	**0.0256***	
	16	**0.0072***	**0.0157***	**0.0301***	0.0513	

* Bold indicates biotic ligand-based guidelines that are more protective than MSGP hardness-based benchmark

In addition to the sensory effects of copper, impaired disease resistance, hyperactivity, impaired respiration, disrupted osmoregulation, pathology of kidneys, liver, and gills, impaired function of olfactory organs and brain, altered blood chemistry, and enzyme activity have been documented in fish, with effects thresholds as low as 0.1 ug/L (Eisler 1988a). Like olfactory effects, other sublethal effects may manifest quickly and persist after exposure ceases. For example, Munoz et al. (1991) observed rapid elevations of plasma cortisol, an indicator of stress, in rainbow trout after a 1-hour exposure to approximately 0.2 μg/L of copper at a hardness of 12 mg/L. The elevated plasma cortisol levels were maintained throughout the experiment's duration of 21 days. Elevated plasma cortisol levels are indicative of stress, and potentially represent a diversion of energy from normal physiological processes that may render salmonids more vulnerable to disease.

Zinc is also an element of special concern for salmonids. Altered behavior, blood and serum chemistry, impaired reproduction, and reduced growth have been reported for zinc concentrations as low as 0.0053 mg/L dissolved Zn in soft water (Sprague et al. 1965), whereas the hardness-based benchmarks to be applied in the MSGP range from 0.04 to 0.26 mg/L total zinc. As discussed previously, metals in stormwater are typically in dissolved form, which is not surprising given that rain water is soft. However, we must also consider that the hardness of stormwater runoff will change as it is conveyed over land and through control structures to a receiving water and that the constituent hardness of the receiving water itself will influence the biological availability of metals contributed by the stormwater. These conditions of course would be highly site and storm specific and could not possibly be estimated at the resolution of a national programmatic assessment such as EPA's BE or this Opinion.

Among the other inorganic stressors, EPA's BE reports that fish exposed to chromium may experience chromosomal aberrations, reduced disease resistance, and morphological changes (USEPA 1980a). Sensitive fish species are highly susceptible to cyanide exposure, exhibiting lethal effects at concentrations as low as 20 to 76 g/L (Eisler 1991). Sub-lethal effects include reduced reproductive capacity (decreased egg number and viability, and reduced embryo and larval survival), impaired swimming ability, altered growth, and hepatic necrosis (dead liver tissue) (Eisler 1991). Fish exposed to high levels of lead exhibit a wide-range of effects, including muscular and neurological degeneration and destruction, growth inhibition, mortality, reproductive problems, and paralysis (USEPA 1980b, Eisler 1988b). Mercury toxicity is greatly influenced by mercury form, with organic forms (i.e., methyl mercury, phenyl mercury) being more toxic than inorganic mercury due to the greater biological availability of organic forms (Sorensen 1991). Multigenerational exposures of early life stage brook trout to methyl mercuric chloride at concentrations as low as 0.96 ug/L resulted in absence of spawning in second generation fish. Other reported effects include deformities and expression of neurological effects as muscle twitching (McKim et al. 1976). Exposure to inorganic mercury at concentrations as low as 20 ug/L resulted in reduced hatchability, increased deformities and embryo death (Heisinger and Green 1975, Weis and Weis 1977). Mercury also adversely effects growth, behavior, metabolism, blood chemistry, osmoregulation, and oxygen exchange (Weis and Khan 1990, Sorensen 1991). Juveniles are more susceptible than adults. Exposing larval or juvenile fish to elevated concentrations of mercury can cause larval mortality, developmental abnormalities, and reduced larval growth in fish. Mercury also exhibits a high potential for bioaccumulation and biomagnification, with reported mercury concentrations in fish up to 100,000 times the ambient water concentrations (Sorensen 1991).

The sensitivity of Pacific salmon and trout species to the toxic effects of inorganic pollutants is well documented in laboratory toxicity tests. EPA's ECOTOX database contains toxicity data for all inorganics for the genera *Oncorhynchus* and *Salvelinus*. Pacific salmon and trout acute sensitivities to inorganics vary greatly, ranging from 0.29 µg/L for cadmium (at hardness of 89.3 as $CaCO_3$ (USEPA 2001) to 367,600 µg/L for magnesium (Birge et al. 1981). Other inorganics to which Pacific salmon are sensitive, based on the available data, include aluminum (96-h LC_{50} = 90 µg/L), copper (96-h LC_{20} = 2.4 µg/L, at hardness of 37.7 mg/L as $CaCO_3$), iron (96-h LC_{50} = 400 µg/L), nickel (96-h LC_{50} = 60 µg/L, at hardness of 174 mg/L as $CaCO_3$), and zinc (96-h LC_{50} = 40 µg/L, at hardness of 31.2 mg/L as $CaCO_3$). Cardwell et al. (1976) reported a 96-h LC_{50} of >5,090 µg/L beryllium for the brook trout (*Salvelinus fontinalis*), a potential surrogate species for the Atlantic salmon.

Nitrogen in the form of un-ionized ammonia has the potential to be toxic to fish. Among fish, Chinook salmon are moderately sensitive to ammonia; ranking ninth among 27 freshwater fish genera tested (i.e., top 1/3). Servizi and Gordon (1990) found the 96-h LC_{50} for fingerling Chinook salmon weighing from one to seven grams to be 25.98 mg/L total ammonia nitrogen at pH 8; whereas Thurston and Meyn (1984) found larger juvenile Chinook salmon weighing from 14.4 to 18.1 grams to be more sensitive to ammonia, with the 96-h LC_{50} for ranging from 14.50 to 19.53 mg/L. The toxicity of ammonia is primarily attributable to the un-ionized form (NH_3), as opposed to the ionized form (NH_4^+). Percent NH_3 increases with temperature and pH; however, NH_3 toxicity depends much more on pH than temperature. An increase of one pH unit may increase the NH_3 concentration about 10-fold (USEPA 1985).

Several studies have documented negative changes in behavior (Israeli-Weinstein and Kimmel 1998, Richardson et al. 2001, Craig and Laming 2004, Tudorache et al. 2008) that occur at sublethal concentrations of un-ionized ammonia as low as 0.002 mg/L(Richardson et al. 2001). These sublethal concentrations of ammonia can cause malformation of trout embryos and histopathological changes as well as a reduction in their feeding (Israeli-Weinstein and Kimmel 1998) and thereby a reduction in their growth and survival (Linton et al. 1998).

There is much less toxicity data available for sturgeon than is available for salmonids, so surrogate species data were required in the analysis. A 96-h LC_{50} value of 80 µg/L has been reported for copper in the shortnose sturgeon at a hardness of 160 -180 mg/L as $CaCO_3$ (Dwyer et al. 2005). Shi et al. (2009) reported a LC_{50} for 96-h exposure of long-nosed Siberian sturgeon (*Acipenser baerii*) to sodium fluoride at 125,000 µg/L. Shortnose sturgeon are less sensitive to ammonia relative to other fish species, ranking 19th among 27 freshwater fish genera. The 96-h LC_{50} for fingerling shortnose sturgeon exposed to total ammonia is 36.49 mg/L at pH 8 (Fontenot et al. 1998).

In its BE, EPA tabulated toxicity data for potential surrogate species to represent the shortnose sturgeon. These data are found in Table 23. Decker and Menendez (1974) reported a 96-h LC_{50} of 3,600 µg/L aluminum for the brook trout, a surrogate species for the shortnose sturgeon. The 96-h LC_{50} for exposures of fathead minnow to antimony was reported at 21,900 µg/L (Kimble manuscript referenced in EPA's 1980 Ambient Water Quality Criteria for Antimony). Johnson and Finley (1980) reported a 96-h LC_{50} value of 1,921 µg/L for bluegill exposed to arsenic. Slonim and Slonim (1973) reported a 96-h LC_{50} value of 130 µg/L beryllium for the guppy.

Stratus 1999 (in (USEPA 2001) reported a 96-h LC_{50} value of 0.38 µg/L cadmium for the rainbow trout. Pickering and Henderson (1966) reported a 96-h LC_{50} value of 3,330 µg/L chromium for the guppy. Kovacs (1979), and Kovacs and Leduc (1982) (1982b) reported a 96-h LC_{50} of 40 µg/L cyanide for the rainbow trout. Data compiled by EPA USEPA (1980b) reported a 96-h LC_{50} value of 1,170 µg/L lead for the rainbow trout (Goettl 1972, Davies and Everhart 1973, Davies and al. 1976). Lind, et al. (manuscript reference, 1986 Ambient Water Quality Criteria for Nickel) reported a 96-h LC_{50} value of 2,480 µg/L nickel for the rock bass. Palawski et al. (1985) reported a 96-h LC_{50} value of 1,325 µg/L selenium for the striped bass. Goettl and Davies (1978) reported a 96-h LC_{50} value of 3.9 µg/L silver for the striped bass.

NMFS identified additional data for sturgeon that had not been captured by the ECOTOX. Fontenot et al. (1998) reported the 96-h median-lethal concentrations total ammonia nitrogen (ammonia-N) to fingerling shortnose sturgeon at 149.8 +/- 55.20 mg/L. The calculated 96-h LC50 for un-ionized ammonia-N was 0.58 +/-0.213 mg/L. While the extremely broad standard deviations on these data may have resulted in their exclusion from the ECOTOX, the values reported are not out of scale with other data: the upper bound of the concentration interval for this estimate falls between the values reported for Chinook and Atlantic salmon. NMFS acknowledges that these data provide imperfect evidence for effects relative to the rigorous standards of the ECOTOX. However, taken in context of uncertainties presented by interspecies and lab to field extrapolation and considering that the MSGP benchmark and ELG for ammonia are an order of magnitude greater, it is not unreasonable to expect adverse effects to sturgeon from exposures that would be authorized under the MSGP.

The use of surrogate species for sturgeon toxicity analyses should be pursued cautiously as the differences between species within this genus with respect to metals toxicity and uptake patterns appear to vary greatly. White sturgeon *(Acipenser transmontanus*), particularly the early life stages, appear to be highly sensitive to copper, with LC20 response thresholds falling within the range of concentrations causing sensory effects in salmonids, as described by Hecht 2007(Vardy et al. 2011, Little et al. 2012). Current work (Vardy et al. 2014) compared sensitivity of white sturgeon exposed to metals dissolved in river water and laboratory water to determine whether laboratory conditions contributed to the observed sensitivities. While their results demonstrated lower toxicity in river water, the difference could not be attributed strictly to differences in water chemistry parameters (e.g., dissolved organic carbon, Ca^{+}, Mg^{+}). They hypothesized that differing concentrations of calcium in the waters tested resulted in differences in acquired sensitivity of the sturgeon to the metal exposures. The work of De Riu et al. (2014) suggests that white sturgeon are actually less sensitive to selenium than the threatened green sturgeon and may therefore may not be an appropriate surrogate. Significant mortality occurred after 2 weeks in green sturgeon (*Acipenser medirostris*), but not white sturgeon consuming a diet containing 200 mg/kg Se. By six weeks, significant mortality occurred in those consuming 100 mg Se/kg diet. After 8 weeks, green sturgeon exhibited growth depression at the 50 mg/Kg diet exposure while white sturgeon did not. At 100 mg selenium/Kg diet per day, the green sturgeon mean growth was not only reduced over controls and lower Se diet treatments, mean growth was half that of the white sturgeon. However, the standard deviation for these data are high, and trending higher for exposures to greater concentrations of selenium and longer duration exposures. Physiological indicators in green sturgeon consuming the 100 and 200 mg/Kg diets were consistent with patterns expected in the exhaustion stage of stress adaptation. The trend in increased variance, taken with these indicators suggests individual divergence as they enter physiological adaptation states progressing towards exhaustion. A possible mechanism for the differences in toxicity may lie in how green sturgeon digest their food. De Riu noted that the green sturgeon selenium accumulation did not follow the expected dose-duration dependent relationship exhibited by the white sturgeon. One mechanism which may contribute to greater sensitivity is the reported atypical intestinal absorption rate in green sturgeon. In this species absorption efficiency increases in the distal portion of the gut relative to the stomach and proximate portion of the gut while the opposite is true for other fish and mammalian species (Bakke et al. 2010). Essentially absorption efficiency in the green sturgeon increases as a bolus is churned and broken down though the gastrointestinal tract.

Many surrogate species data were required in the BE for assessing risks to eulachon as there are no data for any eulachon in the ECOTOX. The surrogate species used ranged broadly. USEPA (1988) reported a 96-h LC_{50} value of >6200 µg/L antimony for the sheepshead minnow. Cardin (1980) reported a 96-h LC_{50} value of 14,953 µg/L arsenic for the fourspine stickleback, a 96-h LC_{50} value of 577 µg/L cadmium for the Atlantic silverside, a 96-h LC_{50} value of 11.9 µg/L copper for the summer flounder. Gardner and Berry (1981) reported a 96-h LC_{50} value of 59 µg/L cyanide for the Atlantic silverside. Dorfman (1977) reported a 96-h LC_{50} value of 315 µg/L lead for the mummichog. Lind et al. (1986) reported a 96-h LC_{50} value of 2480 µg/L nickel for the rock bass. U.S. EPA aquatic life water quality criteria documents report a 96-h LC_{50} value of 12,400 µg/L chromium for the Atlantic silverside (USEPA 1980a) and 96-h LC_{50} values of 599 µg/L selenium (USEPA 2004) and 4.7 µg/L silver (USEPA 1987) for the haddock. Hansen (1983) reported a 96-h LC_{50} value of 36 µg/L mercury for the juvenile spot. NMFS investigated the availability of additional data for toxic effects of inorganics to species within the taxonomic family Osmeridae (smelts), to which eulachon belong. The only data found were for ammonia effects. Chronic data for ammonia toxicity for delta smelt indicate a LC50 of 13 mg/L for 4-day exposure of 57-day old juveniles to total ammonium (Connon et al. 2011). This is a chronic exposure effect concentration that is an order of magnitude above the acute effects concentrations for other anadromous species, yet is still below both the benchmark values and ELGs posed in the MSGP. Had the chronic value been well above those thresholds, it would not be unreasonable to expect adverse effects would not occur due to discharges authorized under the MSGP. However, since this is not the case, the potential for effects due to ammonia exposures remains uncertain.

MSGP-based exposure estimates and toxicity data discussed above are summarized in Table 23 below. Among anadromous species, Pacific salmon are the most likely to respond adversely to single stressor exposures at benchmark or ELGs specified for inorganics in the MSGP. The toxicity data for this species indicated response values at concentrations lower than MSGP-based exposure estimates for 7 out of 18 stressors for which there were available data in ECOTOX. These stressors were aluminum, ammonia, cadmium, copper, iron, nickel, and zinc. This is the same conclusion reached by the analysis using the lower exposure estimates applied in the BE.

It was necessary to use surrogate species data to assess risk to Atlantic salmon for aluminum, cadmium, copper, cyanide, and lead. The analysis included data from the genus *Salmo*, *Microterpes*, and *Oncorhynchus*: brown trout, largemouth bass, and rainbow trout. Toxic responses occurred at concentrations lower than the highest MSGP-based exposure estimate for five out of the 18 inorganic stressors evaluated. The stressors identified as posing a risk to Atlantic salmon included those flagged for Pacific salmon, with the exception of copper and iron. For this species, MSGP-based exposure estimates for aluminum, ammonia, cadmium, nickel, and zinc exceed concentrations at which toxic effects occurred in laboratory tests. On a stressor-by stressor basis, Pacific salmon were more sensitive to aluminum and cadmium than Atlantic salmon and Atlantic salmon were more sensitive to ammonia. The same response concentrations for fluoride, nickel and zinc were used for analyzing risk to these species. Meanwhile comparison of sturgeon toxicity data with the highest MSGP benchmark or ELG indicated that two out of the 13 stressors for which there were data may not be protective of sturgeon. These analytes were beryllium and cadmium. Using surrogate species, EPA was only able to identify thresholds for 10 inorganic analytes. Repeating the analysis using the least protective MSGP benchmark or ELG did not identify any analytes that would pose a risk to eulachon. However, the uncertainty associated with extrapolating toxicity data from surrogate species is substantial given taxonomic distances involved.

Table 23 Toxic concentrations of inorganics for anadromous fish with exposure estimates based on MSGP benchmarks and ELGs (units in ug/L, asterisks indicate toxicity occurs at concentration below MSGP-based exposure estimate).

Stressor	Exposure Estimate (ug/L)	Salmonids				Sturgeon		Eulachon	
		Chinook Salmon (ug/L)		Atlantic Salmon		Shortnose Sturgeon		Pacific Eulachon	
Aluminum	750	90*	a	584*	s	3600	ab	-	
Ammonia	10000	3709*	b	170*	t	580*	as	-	
		2*	au	2*	au				
Antimony	640	37000	c	25700	u	21900	ac	6200	am
Arsenic	1000	10800	d	10800	d	1921	ad	14953	an
Beryllium	130	59300	e	5090	e	130*	ae	-	
Cadmium	0.8	0.29	f	1	v	0.38*	f	577	an
Chromium	1100	4400	g	11200	w	3330	af	12400	ao
Copper	5.6	2.4*	h	125	x	80	ag	12	an
		2-5*	at	2-5*	at				
Cyanide	22	28	i	90	y	40	i	59	ap

Stressor	Exposure Estimate (ug/L)	Salmonids				Sturgeon		Eulachon	
		Chinook Salmon (ug/L)		Atlantic Salmon		Shortnose Sturgeon		Pacific Eulachon	
Fluoride	75000	51000*	j	51000*	j	125000	ah	-	
Iron	1000	400	k	28000	z	-		-	
Lead	23	600	l	700	aa	1170	ai	315	aq
Magnesium	64	367600	m	367600	m	-		-	
Mercury	1.4	5	n	5	n	-		-	
Nickel	200	60*	m	60*	m	2480	aj	2480	aj
Selenium	5	11500	p	11500	p	1325	ak	599	ar
Silver	0.7	2	q	6	p	4	al	5	ar
Zinc	535	40*	r	40*	r	-		-	
		5.3*	at	5.3*	at				

a – Heming and Blumhagen, 1988
b – Water Pollution Research Board, 1968
c – Doe et al., 1987
d – Hale, 1977
e – Cardwell et al., 1976
f – Stratus Consulting, Inc., 1999
g – Stevens and Chapman, 1984
h – Welsh, et al., 1998
i – Kovacs and Leduc, 1982
j – Pimentel and Bulkley, 1983
k – Decker and Menendez, 1975
l – Chapman, 1975
m – Birge et al., 1981
n – Birge et al., 1979
p – Goettl et al., 1976
q – Karen et al., 1999
r – British Columbia Research, 1976
s – Hamilton and Haines, 1995
t – Hazel and Huggins, 1982
u – Brooke et al., 1986
v – Goettl and Davies, 1975
w – Bills et al., 1977
x – Wilson, 1972
y – Tryland and Grande, 1983
z – Dalzell et al., 1999
aa – Grande and Anderson, 1983
ab – Decker and Menendez, 1974
am – USEPA, 1978
an – Cardin, 1982
ao – USEPA, 1980b
ap – Gardner and Berry, 1981
aq – Doriman, 1977
aj – Lind et al, manuscript
ar – USEPA, 1980a
as – Fontenot et al. 1998
at – Sublethal data:

- *Sprague et al., 1965; Brown et al,,*
- *1982, and others (see discussion on Cu and Zn)*

au – Sublethal data:

- *Richardson et al. and others (see discussion on ammonia)*

This analysis indicates that, in the absence of measures taken in order to certify under the ESA Eligibility Criteria, the MSGP would apply controls, benchmarks, and ELGs for inorganic pollutants which are not protective of salmonids or sturgeon. The stressors for which there were no toxicity data for sturgeon in ECOTOX (ammonia, iron, magnesium, mercury, and zinc) presented an unknown risk in the BE and may affect ESA-listed species. NMFS evaluation of more recent data for ammonia suggests that exposure to this analyte at MSGP-authorized discharge concentrations may result in adverse effects.

The geographic distribution of stormwater discharges with inorganic constituents varies across the nation, with different sectors dominating in different parts of the country. On the East coast where Atlantic salmon and Atlantic and shortnose sturgeon occur, the majority of currently covered industrial subsectors[39] discharging stormwater with inorganic constituents are located in Massachusetts (n=550). There are 240 in New Hampshire, 24 in the District of Columbia, three in Vermont and one in Delaware. Among the Massachusetts and New Hampshire facilities with discharge data from the 2008 MSGP permit cycle, only 31 discharged to HUC12 watersheds identified as accessible to Atlantic sturgeon (2013 draft GIS data from NMFS). It is reasonable to expect that these watersheds would be accessible to Atlantic salmon and shortnose sturgeon as well. A total of 161 MSGP-permitted dischargers within the coastal zone of Massachusetts may affect species under NMFS jurisdiction. On the West coast, where the ranges of eulachon, green sturgeon and the Pacific sturgeon occur, most currently covered industrial subsectors discharging metals are in Idaho (n=176). There are 30 in Washington, two in Oregon, and four in California.

EPA concluded that although the MSGP-based exposure estimates exceeded concentrations at which lethal effects would occur in some species for some stressors, exposures to inorganic toxicants in MSGP discharges were not likely to raise population-level concerns given the transitory nature of the discharges and safeguards built into obtaining and complying with 2015 MSGP. Yet EPA further stated that potential effects to Pacific salmon, Atlantic salmon, Atlantic sturgeon, green sturgeon, and shortnose sturgeon would be limited to areas where inorganic parameters are discharged.

7.4.2.2 Organic Pollutants

Only two sectors are required to monitor for organic pollutants as ELGs: sector F, Hazardous waste treatment, storage, or disposal facility and sector G, Landfills, land application sites, and open dumps. The sensitivity of Pacific salmon and trout species to some of the organics of interest is well documented. The ECOTOX database contained toxicity data for all the organics for the genus *Oncorhynchus* with the exception of alpha terpineol and benzoic acid. It did not contain data for Chinook salmon. Reported LC_{50} values for rainbow trout (*Oncorhynchus mykiss*), a surrogate species, include a 96-h LC_{50} of 10,600 µg/L for aniline (Abram and Sims 1982), a 48-h LC_{50} 5,000 µg/L for p-cresol, and a 48-h LC_{50} of 560,000 µg/L for pyridine (Shumway and Palensky 1973, Slooff et al. 1983). Pink salmon (*Oncorhynchus gorbuscha*) exhibited a 96-h LC_{50} of 1,240 µg/L for and 3,730 µg/L for phenol (Korn et al. 1979, Korn et al. 1985). The BE applied these same data to the effects analysis for Atlantic salmon.

The BE identified the most sensitive toxicity data for the organics of concern for anadromous species and compared these values to the ELG to determine if the limits placed in the MSGP are sufficient to protect threatened and endangered species and their designated critical habitat. NMFS supplemented this analysis with data found in ECOTOX, but not included in the BE‘s assessment. The analysis required the use of surrogate species for both Pacific and Atlantic

39 Facilities may be subject to more than one industrial sector and/or subsector. Therefore, this total is not reflective of total number of separate industrial facilities with the parameters of concern, but rather, the total number of permitted sectors with the parameters of concern.

salmon. There were no data for the organics of concern that could be used for sturgeon and eulachon.

The concentration at which effects were observed after exposures to five of the organics of concern (i.e., aniline, pyridine, naphthalene, p-cresol and phenol) were orders of magnitude greater than the ELGs for these chemicals. EPA did not report any data from ECOTOX for alpha terpineol, p-cresol and benzoic acid. NMFS query of the ECOTOX identified data for Coho salmon and Rainbow trout exposed to alpha-terpineol (Stroh et al. 1998). The reported 24 hour LC50s for these species were 6,800 and 6,700 ug alpha-terpineol/L, respectively. Again, these toxicity values are orders of magnitude higher than the ELGs in the MSGP. NMFS looked for but did not find additional data for p-cresol and benzoic acid through literature searches or the ECOTOX.

This analysis indicates that the MSGP will apply benchmarks and ELGs for inorganic pollutants that appear to be protective of salmonids. There were no data for MSGP organic pollutants of concern that could be used to assess risks to sturgeon or eulachon. Interspecies extrapolation using data applied in the BE for salmonids exposed to aniline, pyridine, naphthalene, p-cresol and phenol would include the attendant uncertainties. The magnitude of differences between these effects concentrations and MGP ELGs and that toxicity data for more taxonomically distant species (i.e., crustaceans, flowering plants, snails, amphibians, and other nonsalmonid fish) are also orders of magnitude greater than the ELGs, suggest that the MSGP limits may be protective for sturgeon and eulachon as well.

The geographic distribution of stormwater discharges with inorganic constituents for sectors F and G is concentrated on the West coast in Idaho, with 45 subsectors, 39 of which are metal mining sites. This eliminates the risk of exposure for green sturgeon, Gulf sturgeon and eulachon. Atlantic salmon and Atlantic and shortnose sturgeon occur within the inland waters and along the coasts of Massachusetts and New Hampshire. The 62 subsectors within these two states which must monitor for organic constituents are in sector F, primary metals.

EPA concluded that the discharges authorized under the MSGP were not likely to adversely affect these species due to the differences between the ELGs and effects concentrations. With respect to uncertain risks due to the unavailability of data for assessing risks to sturgeon and eulachon, EPA concluded that the discharges would not likely adversely affect ESA-listed species due to the intermittent nature of these exposures and additional stringent requirements placed on facilities discharging to waters where threatened and endangered species and their designated critical habitat occur.

7.4.2.3 Oil and Grease

The type and concentration of toxic constituents in oil and grease is dependent on the source, original form, age, and weathering prior to discharge. Toxicity data for the soluble chemical constituents of petroleum are available for standard lab fish species, such as the fathead minnow.

Marchini et al. (1992) reported a 96-h LC_{50} of 24.6 mg/L for benzene in juvenile fathead minnow, and 15.6 mg/L in larvae. Geiger et al. (1986) reported a 96-h LC_{50} of 9.09 mg/L for ethylbenzene in juvenile fathead minnow. Marchini et al. (1992) reported a 96-h LC_{50} of 36.2 mg/L for toluene in juvenile fathead minnow, and 17.0 mg/L in larvae. For xylene, Geiger et al. (1986) reported a 96-h LC_{50} of 16.0 mg/L for juvenile fathead minnow. In addition effects have been observed from oil-related derivatives such as PAHs. For example, Oris and Giesy (1987) reported a LT_{50} (lethal time to 50 percent mortality) of 5.6 μg/L for benzo(a) pyrene (BaP) in larval fathead minnow. DeGraeve et al. (1982) reported a 96-h LC_{50} of 7.9 mg/L for naphthalene. Hence, listed minnow species could be adversely affected if exposed to high levels of oil and grease containing these organic materials.

There is limited toxicity data describing the sensitivity of salmon species to petroleum hydrocarbons and for other hydrocarbons, including animal fat-based hydrocarbons (grease). One study examined the toxic action of the water accommodated fraction (WAF) and chemically-dispersed fraction (CEWAF) of crude oil on smolts of Chinook salmon (Tjeerdema et al. 2007). The results of this study showed that, based on total hydrocarbon content (THC), the mean LC_{50} of the WAF tests (LC_{50} = 7.46 mg/L THC) was approximately 20 fold lower than that of the CEWAF tests (LC_{50} = 155.93 mg/L THC). This suggests that although there were much higher concentrations of total hydrocarbons present in the CEWAF solutions, hydrocarbon bioavailability to salmon smolts was lower under dispersed conditions. Several studies performed by researchers at Northwest Fisheries Science Center demonstrated the sensitivity of salmon species to PAHs; effects ranging from subcellular effects to changes in immune function and growth (Johnson et al. 2008, Carls and Meador 2009, Johnson et al. 2009, Bravo et al. 2011, Curtis et al. 2011, Collier et al. 2014). Another study determined that PAH levels as low as 1 ppb can be lethal to embryos of both pink salmon and Pacific herring (Heintz 1999). In addition, feeding of juvenile salmon can be interrupted by exposure to PAHs. Purdy (1989) exposed Coho salmon to a mixture of seven hydrocarbons at two concentrations. At the lowest level, 0.08 percent, feeding was reduced. At the highest level, 0.15 percent, feeding was completely inhibited and fish would not feed for three days after exposure.

Several characteristics of short-nose sturgeon (i.e., long lifespan, extended residence in estuarine habitats, benthic predator) predispose the species to long-term and repeated exposure to surface water and sediment contamination from oil and oil-related derivatives (PAHs). Kocan et al. (1996) investigated the survival of sturgeon eggs and larvae exposed to sediment. Coal-tar contaminated sediment produced approximately 95 percent embryo-larval mortality after 18 days of exposure. Toxicity appeared to be via direct contact of the embryos with contaminated whole sediment, as opposed to water soluble extracts of the sediment (elutriate). For example, the concentration of low molecular weight PAHs (LPAHs; water soluble) that resulted in embryo and larval mortality was $\geq$ 0.47 mg/L, which is higher than would occur naturally. The authors report that no decrease in petroleum hydrocarbon was observed in Connecticut River whole sediment exposed to flowing water for 14 d, supporting the conclusion that soluble hydrocarbons were not responsible for the observed toxicity in short-nose sturgeon embryos in whole sediment laboratory exposures.

EPA concluded in the BE that the requirementsof the MSGP will ensure that oil and grease discharges are minimized from all facilities covered under the permit, and also ensure any adverse effects to listed species and critical habitat from oil and grease are minimized.

7.4.2.4 Sediment

In its BE, the EPA stated that it was not possible to precisely evaluate the potential effects from authorized discharges of water quality parameters on ESA-listed species. These parameters include TSS and turbidity, which are measures of sediment in stormwater, and biochemical and chemical oxygen demand, which influence dissolved oxygen in surface water. The BE included a general discussion of the effects of excess water quality parameters on the ecosystem, but did not address whether these requirements of the MSGP were protective of species.

The MSGP includes benchmark of 100 mg/L for TSS for 11 sectors, more sectors than any other benchmark. A single turbidity benchmark of 50 NTU is required for Sector G, metal mining. In addition to these, four sectors have a TSS ELG of 23.0 mg/L daily maximum and 15.0 mg/L maximum monthly average, and two others have an ELG of 88 mg/L daily maximum and 27 mg/L maximum monthly average. ELGGs are considered technologically feasible guidelines. Turbidity and bedded sediment preferences vary from species to species. For example, some species like sturgeon are soft bottom feeders while fish like salmon require gravel substrate for spawning. Newcombe and Jensen (1996) developed a model which synthesizes effects data to provide severity-of-ill-effect scores for juvenile and adult salmonids. According to the model, one hour exposures to TSS concentrations between 55 and 148 mg/L would lead to abandonment of cover and avoidance, at three hours, feeding rates would be reduced, and seven hours of elevated TSS would result in minor to moderate physiological stress (model spreadsheet provided by Walter Berry, USEPA, personal communication). The ranges of the modeled effects data overlap with benchmarks and ELGs, suggesting that, if these MSGP limits were taken to represent surrogate instream constituent exposure concentration, these limits are not protective of effects to species and designated critical habitat (i.e., physical habitat sediment characteristics) for species under NMFS Jurisdiction. The majority of subsectors required to monitor for TSS or turbidity on the West coast (n=425) are in Idaho (n=408) and 240 of these are within Sector J, Non-metallic Mineral Mining and Dressing. There are 633 subsectors which must monitor for TSS on the east coast, 411 of which are in Massachusetts.

7.4.2.5 Oxygen Demand

Translation of oxygen demand to effects data, which is expressed in terms of dissolved oxygen, is complicated by the need to know baseline oxygen saturation from which the “oxygen demand” is taken, and therefore must be considered generally since it is not possible to compare response thresholds with MSGP benchmarks for oxygen demand. Chinook salmon are stressed by oxygen depletion. NMFS (2007) cites reduced water quality in the form of changes to dissolved oxygen, temperature, chemical contaminant, nutrients, and suspended sediment/turbidity as a potential threat to Chinook salmon. For example, the dissolved oxygen requirements of Chinook salmon embryos are unclear, but Alderdice et al. (1958) observed an increase in oxygen demand by chum salmon embryos as they neared hatching. The effects of dissolved oxygen concentrations below the saturation level on salmonids include delayed or premature hatching (depending on the timing of low dissolved oxygen in the egg development process); abnormal embryo development; reduced size and strength at hatching; reduced growth, feeding, and swimming ability; and increased susceptibility to disease, predation, and toxic contaminants (Davis 1975, Allen and Hassler 1986). Migrating adult Chinook salmon in the San Joaquin River exhibited an avoidance response when dissolved oxygen was below 4.2 mg/L, and most Chinook waited to migrate until dissolved oxygen levels were at 5 mg/L or higher (Hallock et al. 1970). Salmonid mortality begins to occur when dissolved oxygen concentrations are below 3 mg/L for periods longer than 3.5 days (USEPA 1986).

Reported effects of low dissolved oxygen on abalone species include mortality, immune suppression, and reduced growth rate (Cheng et al. 2004b, Kim et al. 2013). Holding conditions specified in the recovery plan for this species require dissolved oxygen levels to be maintained at or within 10% of saturation. However, intertidal species like black abalone are tolerant to extremes in environmental conditions such as fluctuations in dissolved oxygen (Bowen et al. 2014). Searches of the open literature and the NMFS status review for coral species did not identify issues with depletion of dissolved oxygen or BOD.

Intergravel dissolved oxygen concentrations for survival of embryo and larval salmonids need to be at least 8 mg/L dissolved oxygen, which requires dissolved oxygen levels of 11 mg/L in overlying water. Other salmonid lifestages require 8 mg/L in the water column, with impairments to productivity occurring when levels decline to 6 mg/L or lower (WDOE 2002, Carter 2005). Sturgeon basal metabolism, growth, consumption and survival are all very sensitive to changes in oxygen levels, which may indicate their relatively poor ability to oxyregulate. Based on bioenergetics and behavioral responses of young of the year juveniles aged 30 to 200 days, productivity losses occurred at oxygen saturation levels below 60 percent, which corresponds to 5 mg/liter at 25^{o}C (Secor and NiMitschek 2001, Niklitschek and Secor 2010). Accordingly, dissolved oxygen levels of 5 mg/L and above are also considered protective of sturgeon (Kahn and Mohead 2010).

Jenkins et al. (1993) found that juvenile shortnose sturgeon experienced relatively high mortality (86 percent) when exposed to dissolved oxygen concentrations of 2.5 mg/L. Older sturgeon (>100 days) could tolerate dissolved oxygen concentrations of 2.5 mg/L with <20 percent mortality, indicating an increased tolerance for lowered oxygen levels by older fish. Similarly, Campbell and Goodman (2004) reported a 24 h LC_{50} of 2.7 mg/L for 77-d old fish tested at 2 ppt salinity and 25° C; an estimated LC_{50} of 2.2 mg/L was obtained for 134-d old fish tested at 4.5 ppt and 26° C. According to this latter study, shortnose sturgeon may be more tolerant of low dissolved oxygen levels in high ambient water temperatures. A test with 100-d old fish at 2 ppt and a temperature of 30° C yielded a 24 h LC_{50} of 3.1 mg/L. The opposite trend was reported by Flournoy et al. (1992) where shortnose sturgeon were less tolerant of low dissolved oxygen levels in high ambient water temperatures and show signs of stress in water temperatures higher than 28° C. The acute and chronic dissolved oxygen thresholds for some of the expected prey items of shortnose sturgeon (*Americamysis bahia, Ampelisca abdita, Callinectes sapidus, Hyalella azteca*) range from 0.7 to 3.0 mg/L (Sprague 1963, Poucher 1997, USEPA 2000a, Bell and Eggleston 2005).

7.4.2.6 Indirect Effects

Potential indirect effects to Pacific salmon and green sturgeon would include loss of prey items when those prey items are more sensitive to toxicants, and potential loss of habitat either due to consequences of toxicants or sedimentation. Effects to forage species not be expected to affect eulachon, which are plankton-feeders, chiefly eating crustaceans such as copepods and euphausiids (Barraclough 1964, Hay and McCarter 2000). Effects to these forage species specifically due to industrial stormwater that would translate to effects to eulachon populations are unlikely due to the scale of dilution in the open ocean where eulachon feed. EPA concluded that for Pacific salmon, discharges of inorganics in industrial stormwater authorized under the MSGP may cause indirect effects, but these effects are likely to be insignificant, "given the stringent species/habitat protections in the permitting structure and considering the transitory nature of MSGP-authorized discharges."

Indirect effects related to the discharge of organic toxicants would be similar to those noted for discharges of inorganic toxicants in that toxicity presents the risk of potential loss of prey and structural habitat if toxicants affect aquatic vegetation used for cover. The presence of organic constituents can also affect the dissolved oxygen in water due to oxygen consumed in the breakdown of the constituent molecules, or if mortality results from the organic toxicants, increased oxygen consumption due to the decay of dead organisms.

Unlike toxic response thresholds for inorganic toxicants, the toxic response thresholds for organic toxicants are orders of magnitude greater than the ELGs set forth in the MSGP for a broad variety of species, including plants, crustaceans, amphibians, and fish. For this reason NMFS does not expect toxic effects organic pollutants in MSGP-authorized discharges to result in significant indirect effects. Given the breadth of uncertainty for those inorganic and organic toxicants that could not be evaluated, it is plausible that adverse indirect effects may occur.

7.4.2.7 Designated critical habitat

Designated critical habitat designation for Chinook salmon, the Pacific salmon species used as a representative species in the BE, includes PCEs with respect to habitat, water quality, and food abundance in freshwater, estuarine, and marine habitats. EPA assumed that physical habitat would not be adversely affected due to the discharge of inorganic or organic pollutants in industrial stormwater. Effects to physical habitat would be associated with the physical disturbance and contribution of physical pollutants (i.e., sediment, oil and grease, and debris). However, discharges of toxicants in industrial stormwater may impact water quality and food abundance of both forage fish and the invertebrates (McCarthy et al. 2008, Johnson et al. 2013) in the critical areas used by Chinook salmon.

The Status of the Species and Designated critical habitat section describes the common PCEs for 7 California listed Chinook salmon and steelhead (70 FR 52488, Sept. 2, 2005), 12 ESUs of Oregon, Washington, and Idaho salmon (chum, sockeye, Chinook) and steelhead (70 FR 52630, Sept. 2, 2005), and for the Oregon Coast coho salmon (73 FR 7816, Feb. 11, 2008). Among these, the biological and substrate PCEs which may be affected by MSGP discharges include water quality and substrate attributes necessary to support spawning, incubation and larval development; water quality and forage to support juvenile development; and natural cover including vegetation in in water courses used during rearing, migration, and freshwater-marine transition; juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation in estuarine, and nearshore areas. Habitat requirements and PCEs for coho salmon ESUs, which are less detailed (64 FR 24049, May 5, 1999), were also summarized in in the Status of the Species and Designated critical habitat section of this Opinion. Essential attributes of coho salmon designated critical habitat which may be affected by MSGP discharges include substrate, water quality, cover/shelter, food, and riparian vegetation. Sediment, oil and grease, and debris discharges may infiltrate and embed spawning gravels and cobble, making the substrate unsuitable for nesting or reducing the survival of any eggs or newly hatched larvae present. Erosive flows may also dislodge and redistribute substrates. NMFS must acknowledge that EPA’s analysis of discharge monitoring results for the 2008 permit period indicate high frequencies of discharges exceeding benchmarks and some discharges exceeding ELGs. Discharges of toxicants at toxic levels in industrial stormwater may impact water quality and food abundance of both forage fish and the invertebrates (McCarthy et al. 2008, Johnson et al. 2013) in the critical areas used by Chinook salmon. The MSGP-authorized discharges are expected to be well below toxic levels.

Critical habitat for shortnose sturgeon has not been designated but other species in the sturgeon species group, including and Gulf and green sturgeon, do have designated critical habitat. The PCEs of the designated critical habitat for Gulf sturgeon include water and sediment quality, sediment substrate, flow regime, prey quality and abundance, as well as clear migratory pathways. The PCEs for green sturgeon designated critical habitat include abundant prey items for larval, juvenile, subadult, and adult life stages, suitable water flow and physical substrate for spawning and water and sediment of sufficient quality for normal behavior, growth, and viability of all life stages. Physical habitat features of the PCEs, including sediment substrate, flow regime, and clear migratory pathways, are not expected to be adversely affected from the discharge of inorganic and organic pollutants in industrial stormwater, but will be affected by TSS and turbidity. Impacts to the dietary component of the designated critical habitats designated for salmonids and green sturgeon, that is to say, invertebrate populations, are highly location and discharge specific and are accompanied by substantial amounts of uncertainty.

Given that the toxic response thresholds for organic toxicants are orders of magnitude greater than the ELGs set forth in the MSGP for a broad variety of species, including plants, crustaceans, amphibians and fish, NMFS does not expect toxic effects of MSGP-authorized organic discharges to adversely modify designated critical habitat for anadromous species. However, given the breadth of uncertainty for those inorganic and organic toxicants that could not be evaluated, it is plausible that discharges may adversely modify designated critical habitat under certain conditions.

7.4.3 Marine fish: Nassau Grouper and Rockfish

The Nassau Grouper belongs to the species Serranidae. Search of the ECOTOX for acute toxicity data for this family returned only data for rockcod exposed to lead: the LC50s over 24, 48, 72, and 96 hour exposures were 42,500, 22,500, 19,000 and 17,000 ug lead/L, respectively(Siammai and Chiayvareesajja 1988). Acute toxicity data for exposures of cadmium, mercury, or zinc to *Sebastes schlegeli* are available. *Sebastes schlegeli* was exposed to mercury chloride for up to 96-h and resulted in 48-h, 72-h, and 96-h LC_{50}s of less than 100 µg/L (Choi and Kinae 1994). Choi and Kinae (1994) also reported 96-h LC_{50} for *Sebastes sp.* exposure to cadmium chloride of approximately 30,000 µg/L and a 72-h LC_{50} for exposure to zinc of greater than 10,000 µg/L. Toxicity data for other potential species were use to represent the rockfish in the BE are also used to represent Nassau grouper. USEPA (1988) reported a 96-h LC_{50} value of >6200 µg/L antimony for the sheepshead minnow. Cardin (1982) reported a 96-h LC_{50} value of 14,953 µg/L arsenic for the fourspine stickleback and a 96-h LC_{50} value of 11.9 µg/L copper for the summer flounder. Gardner and Berry (1981) reported a 96 hour LC50 value of 59 µg/L cyanide for the Atlantic silverside. Dorfman (1977) reported a 96-h LC_{50} value of 315 µg/L lead for the mummichog. Lind et al. (1986) reported a 96-h LC_{50} value of 2480 µg/L nickel for the rock bass. U.S. EPA aquatic life water quality criteria documents report a 96-h LC_{50} value of 12,400 µg/L chromium for the Atlantic silverside (USEPA 1980a) and 96-h LC_{50} values of 599 µg/L selenium (USEPA 2004) and 4.7 µg/L silver (USEPA 1987) for the haddock. Hansen (1983) reported a 96-h LC_{50} value of 36 µg/L mercury for the juvenile spot. Data for the toxic effects of exposure to organics of concern (i.e., alpha terpineol, aniline, pyridine, naphthalene, p-cresol, phenol, and benzoic acid) to Nassau grouper and rockfish are not available. It can be inferred, based on observed effects in other non-salmonid fish, that organic pollutants could lead to decreased growth, alterations of metabolic functions, and reduced recruitment.

Table 24 Toxic concentrations of inorganics for marine fish with exposure estimates based on MSGP benchmarks and ELGs (units in ug/L, asterisks indicate toxicity occurs at concentration below MSGP-based exposure estimate).

Stressor	Exposure Estimate (ug/L)	Marine fish LC_{50}

Arsenic	1000	14,953	Cardin, 1982
Cadmium	0.8	30,000	Choi and Kinae, 1994
Chromium	1100	12,400	USEPA, 1980a
Copper	5.6	11.9	Cardin, 1982
Cyanide	22	59	Gardner and Berry, 1981
Lead	23	315	Dorfman, 1977 (mummichog)
		17,000	Siammai, 1988 (rock cod)
Mercury	1.4	<100 ug/L	Choi and Kinae, 1994
Nickel	200	2,480	Lind et al, 1986
Selenium	5	599	USEPA, 2004
Silver	0.7	4.7	USEPA, 1987
Zinc	535	>10,000	Choi and Kinae, 1994

The concentration levels deemed toxic to rockfish for 12 of the inorganics of concern (i.e., antimony, arsenic, cadmium, chromium, copper, cyanide, lead, mercury, nickel, selenium, silver and zinc), exceeded the MSGP-based exposure estimates used in the BE. The same conclusion is reached in this Opinion. Data were not available for aluminum, ammonia, beryllium, fluoride, iron, and magnesium, so it is uncertain whether the discharge limits within the MSGP for these substnces are protective of marine fish.

With respect to Nassau grouper within the MSGP action area, there are approximately 129 currently covered industrial sectors with inorganic stressors of concern in Puerto Rico. Based on table 4-2 in the BE, among the sectors monitoring for organic toxicants, there is currently only one existing permitted sector in Puerto Rico. EPA lists 23 currently covered industrial sectors with inorganic stressors of concern that have listed rockfish in Oregon and Washington. There are 4 currently covered industrial sectors with organic stressors of concern in Washington.

7.4.3.1 Indirect Effects

As a reef dependent species, direct effects described for corals in section 7.4.6 constitute indirect effects on Nassau Grouper. Potential indirect effects of organics as described for anadromous fish are applicable for rockfish, including the potential loss of prey and loss of habitat.

7.4.3.2 Designated critical habitat

Designated critical habitat has not been proposed for Nassau Grouper, as their listing status is yet to be determined. Designated critical habitat has been proposed but not designated for rockfish in the Puget Sound in Washington. Although designated critical habitat has been proposed, PCEs have not been defined. Based on the review of other non-salmonid fish and their applicable PCEs, it can be assumed that physical habitat elements will not be affected by the discharge of inorganics, but impacts on water quality and prey quality and abundance may be affected.

7.4.4 Sea Turtles

EPA concluded that Sea Turtles are unlikely to be exposed to the direct discharge of constituents addressed in the MSGP based on their marine habitat and the expectation of substantial dilution in marine and estuarine environments. Most sectors covered under the MSGP discharge to inland or coastal waters; both direct and indirect effects are therefore highly unlikely because concentrations of any constituents would be extremely low in the ocean habitat where these species occur. However, NMFS considers the use of MSGP benchmark values and ELGs as surrogate exposure concentrations is not appropriate for these habitats, in most cases. The facility specific measures required under Appendix E of the permit would determine whether significant exposures may occur and need to be addressed for these species.

Further while there are abundant data on the concentrations of inorganic and organic contaminants in the tissues of sea turtles, actual response data to which exposures could be compared are lacking. Some studies have associated metals levels with physiological parameters and body condition (Keller et al. 2004, Day et al. 2007, Labrada-Martagon et al. 2011, Yu et al. 2012, Camacho et al. 2013), but extrapolations of such effects to adverse implications on the fitness of individuals has not been attempted. Among the limited data available, EPA reported the results of studies of persistent organic contaminants exposure on long-lived freshwater turtles and alligators. Abnormal production of vitellogenin, precursor to egg yolk, has been reported in male turtles. Exposure of turtles to organic toxicants have also resulted in deformities of the reproductive tract; and decreased hatching/reproduction. Other reptiles may experience sex hormone disruption, reduced phallus size, testicular abnormalities, reduced clutch viability resulting from fertilization failure and embryo mortality, and decreased post-hatch survival (CHEMTrust 2008). However, the primary avenue of exposure of these reptilian receptors to these organics is through dietary uptake, rather than exposure to ambient pollutants, as would be the case for stormwater.

7.4.4.1 Indirect Effects

Indirect effects of stormwater discharges are more likely for sea turtles. Hawksbill sea turtles are dependent on coral reefs for food and shelter while green sea turtles require seagrass beds for foraging (63 FR 170 – 46693-46701). As discussed previously in *Erosivity, turbidity, and total suspended solids*, sediment loads in stormwater discharges (i.e., TSS and turbidity) adversely affect the quality of these habitats.

7.4.4.2 Effects to Designated critical habitat

Critical habitat designated for green and hawksbill turtles and the St. Croix population of leatherback turtles does not specify PCEs, rather activities requiring species management are identified for these areas. These include coastal construction and point and nonpoint pollution, such as that contributed through sotrmwater. Critical habitat for west coast leatherback sea turtles and gulf coast loggerhead turtle include marine forage species, which are not likely to be affected by industrial stormwater dischareges.

7.4.5 Abalone

There are limited data on toxic effects of organic and inorganic toxicants to abalone. Harrison (1985) reported 96-h LC_{50} for *Haliotis sp.* of 30 µg/L copper, while Liao et al. (2002) indicated *Haliotis diversicolor* was less sensitive to zinc (LC_{50} = 1100 µg/L). Cheng et al. (2004a) reported

96-h LC_{50} of ammonia for *Haliotis diversicolor* of 2,550 µg/L. Toxicity data for other potential species was tabulated for potential use to represent the abalone. Cheng et al. (2004a) reported an LC_{50} value of 2,550 µg/L ammonia. Nelson et al. (1976) reported an LC_{50} value of 3,490 µg/L arsenic for the Bay scallop. Evola-Maltese (1957) reported an effect of abnormal embryonic development at 9,010 µg/L beryllium for the sea urchin, *Paracentrofus Ilvidis*. Gorski and Nugegoda (2006) reported an LC_{50} of 3,700 µg/L cadmium; an LC_{50} of 5,111 µg/L iron; an LC_{50} of 4,102 µg/L lead; and an LC_{50} of 173 µg/L mercury for the blacklip abalone. Calabrese et al. (1973) reported an LC_{50} of 10,300 µg/L chromium for the American oyster. Harrison (1985) reported a 96-h LC_{50} value of 30 µg/L copper for the abalone. While EPA concluded that, after comparing toxicity data to the lowest MSGP benchmark or ELG, twelve of the inorganics of concern (i.e., arsenic, beryllium, cadmium, chromium, copper, iron, lead, mercury, nickel, selenium, silver, and zinc), the concentration levels deemed toxic to abalone exceed MSGP-based exposure estimates used by EPA. Using the higher MSGP-based exposure estimates indicated in Table 17, NMFS searched for additional information and, after reviewing the literature, found that this conclusion was acceptable for all but ammonia. The LC_{50} value of 2,550 µg/L for ammonia is well below the daily maximum ELG of 10,000 ug/L.

Data for the toxic effects of exposure to organics of concern (i.e., alpha terpineol, aniline, pyridine, naphthalene, p-cresol, phenol, and benzoic acid) and for sediment exposure (i.e., TSS, turbidity) to abalone are not available. It can be inferred, based on observed effects in other non-salmonid fish, that organic pollutants could lead to decreased growth, alterations of metabolic functions, and reduced recruitment.

The range for abalone occurs along the coast of California, where the MSGP action area is quite limited and much of it is inland. Within these areas, very few facilities discharge pollutants which require monitoring. Four existing MSGP-permitted facilities are required to monitor nitrates and TSS or turbidity (eNOI database accessed 11/4/2014). Recall that monitoring requirements are based on sector-specific discharge data that EPA used to identify which pollutants may prove problematic and therefore require monitoring.

7.4.5.1 Indirect Effects

Indirect effects to abalone of inorganics discharged in industrial stormwater would be primarily due to the potential disruption of the food chain by the potential impacts to primary producers which make up the food source for abalone. Effects on marine algae may result in indirect effects to abalone.

7.4.5.2 Designated critical habitat

Black abalone have designated critical habitat off the California coast that includes a requirement for rocky intertidal and subtidal habitats. Biological designated critical habitat PCEs which might be affected by toxic discharges include the bacterial and diatom films, crustose coralline algae (especially kelp), and a source of detrital macroalgae, which are required for growth and survival of all life stages of black abalone. The extreme sediment loads that would change a rocky tidal habitat into a non-rocky substrate are not expected in these areas from discharges to be authorized under the 2015 MSGP.

7.4.6 Corals

At the time of writing for the BE, NMFS had two species of coral listed. The effects evaluated these species in EPA's BE expected to be similar for the additional species listed since finalizing the BE. Our analysis below integrates and updates that of the BE.

7.4.6.1 Inorganic Toxicants

Uptake of heavy metals such as iron and mercury by coral has been detected in reef ecosystems (Goreau 1977, Shen and Boyle 1988, Guzmán-Espinal and Jiménez-Centeno 1992). Some heavy metals, including iron, zinc, copper, lead, and nickel, may cause physiological stress, reduced reproductive success, and mortality in some invertebrates depending on the level of exposure (Peters et al. 1997). Bao et al. (2011) reported a copper 24-h LC_{10} of 5.8 µg/L for *Acropora tumida*. Elevated levels of heavy metals in the marine environment also could lead to sub-lethal effects in coral, including changes in physiology, tissues, biochemistry, behavior and reproduction. Evola-Maltese (1957) reported an effect of abnormal embryonic development at 9,010 µg/L beryllium for the sea urchin, *Paracentrofus ilvidis*, a potential surrogate species for the elkhorn coral in the absence of data for cnidarians. Comparison of the limited amount of available toxicity data for coral exposures to inorganics reveals that, for beryllium, the concentration level deemed toxic to corals exceeds the most stringent benchmark target or numeric effluent limit. Toxicity data are not available for representative or surrogate species for coral, so the remaining inorganic pollutants authorized for discharge under the MSGP may affect coral species.

7.4.6.2 Organic Toxicants

Data for the toxic effects of exposure to organics of concern (i.e., alpha terpineol, aniline, pyridine, naphthalene, p-cresol, phenol, and benzoic acid) to coral are not available. Based on observed effects in other species, it can be inferred that organic pollutants could lead to decreased growth, alterations of metabolic functions, and reduced recruitment.

7.4.6.3 Sediment

While there are no available sediment criteria or effects thresholds for coral species at this time, sediment discharges under the MSGP are a concern for corals.

Figure 9 Sediment plume washing over elkhorn coral reef. (http://sero.nmfs.noaa.gov/protected_resources/coral/elkhorn_coral/).

There can be substantial natural variability in turbidity/suspended sediment among coral reef environments due to tides, storms, and river input (e.g. Figure 9) and sediment tolerance varies among coral species (reviewed in (Harmelin-Vivien 1994, Anthony et al. 2004, Orpin et al. 2004, Storlazzi et al. 2004, Jouon et al. 2008, Erftemeijer et al. 2012). Light attenuation from sediment concentrations above tolerated levels impairs photosynthesis by zooanthellae symbionts, reducing the energy available to the host coral. In addition to effects on energy supplied by the zooanthellae, sediment blanketing of coral poses additional energetic costs through impaired feeding, increased polyp cilliary activity and stimulation of mucous production, to clear the sediment (Figure 10) (Peters and Pilson 1985, Riegl and Bloomer 1995, Riegl and Branch 1995). The structure of many coral species maximizes surface area and geometric arrangement such that the capture of light and food particles carried by the current is optimized. Certain morphologies are prone to collect more sediment from the water column than the coral species is able to clear (Hubbard and Pocock 1972, Bak and Elgershuizen 1976, Dodge 1977, Rogers 1990, Stafford-Smith 1993, Sanders and Baron-Szabo 2005). The consequences of these photo-physiological responses include increased susceptibility to disease and reduced coral growth, calcification, and regeneration rates. Sediment blanketing substrate also inhibits settlement of larval corals and reduces recruitment. At high sediment stress levels, individual-scale responses compound to colony and reef scale effects manifested as changes in coloration, bleaching and necrosis. Sustained sediment stress can lead to widespread mortality and changes in community structure.

Figure 10 Sediment from land-based sources of pollution covers coral near a wharf in Kanakakai, HI. Photo Credit: Kathy Chaston (http://coralreef.noaa.gov/aboutcrcp/strategy/reprioritization/wgroups/resources/lbsp/welcome.html)

Organisms vary in their ability to tolerate and recover from exposure to sediment or turbidity. The proportion of organisms able to tolerate (or escape) periods of elevated sediment and turbidity levels can increase in impacted surface waters, while the proportion of sensitive species may decline. However, even organisms adapted to sediment or turbidity influx (whether episodic or constant) can be harmed if input levels rise excessively or if their resiliency is taxed by other stressors. The potential further decline of ESA-listed species or designated critical habitat is particularly important because these species are already rare and at risk of irreversible decline. Given the broad range of sensitivity and resilience among coral species and habitats, the effects of MSGP authorized sediment discharges will therefore be very location and species specific

7.4.6.4 pH

Corals can also be affected by changes in seawater pH that may accompany stormwater discharges. Decreases in sea surface pH and carbonate ion concentration have a negative effect on calcification in hermatypic corals and other calcifying organisms (Schneider and Erez 2006). Marubini and Atkinson (1999) indicated that corals growing in seawater at a reduced pH of 7.2 calcified at half the rate of control corals at pH 8.0. Changes to effects from seawater pH from MSGP discharges are generally not expected to be significant.

7.4.6.5 Nutrient Enrichment

In addition, high nutrient levels can result in decreased rates of growth and calcification of corals (Ferrier-Pages et al. 2000) and may negatively impact coral reproduction (Ward and Harrison 2000). This might shift the balance enough to result in species replacement (McCook 2001, McCook et al. 2001). Exposure to nitrogen negatively affected species in the genus *Acropora* by decreasing the size and number of eggs (Ward and Harrison 2000).

There are approximately 129 currently covered industrial sectors with inorganic stressors of concern in Puerto Rico, where seven ESA-listed species occur so potential effects to corals from inorganic stressors of concern to be limited to this territory. An additional nine coral species are listed among the Pacific Territories, where there are 17 sectors identified that monitor for inorganic pollutants. Based on table 4-2 in the BE, among the sectors monitoring for organic toxicants, there is only one existing permitted sector in Puerto Rico.

7.4.6.6 Indirect Effects

Indirect effects to corals from toxicants, sediment, and pH, and nutrient enrichment include responses by other organisms that profoundly affect health and abundance of corals, including organisms that facilitate coral settlement, alter the structural strength of the reef substratum, compete for space with corals, infect corals with diseases, and prey on corals (Fabricius 2005). Dissolved inorganics can reduce coral calcification and fertilization rates and increase macroalgal abundances, but measurements in the field indicate that dissolved inorganic nutrients disappear relatively quickly (Fabricius 2005).

7.4.6.7 Designated critical habitat

Designated critical habitat designated for elkhorn and staghorn coral required certain substrate. The discharge of inorganic or organic pollutants in industrial stormwater will not affect the substrate necessary for the designated critical habitat of these species. Elkhorn and staghorn coral have designated critical habitat in the tropical western Atlantic ocean that includes reef rubble, reef crests, reef flats, spur and groove reefs and transitional reefs. The only PCEs for the elkhorn coral was suitable substrate. Given the density of 2008 MSGP-authorized facilities on Puerto Rico, extreme sediment loads that would alter these habitats may occur in the absence of controls for the protection of ESA-listed species under the 2015 MSGP.

7.4.7 Conclusion

Sections 7.4.1 through 7.4.6 discuss the effects of exposures to MSGP discharges at ELG or benchmark thresholds on ESA-listeds pecies and designated critical habitat. While this analysis indicates adverse effects would occur at MSGP authorized discharge levels, information gained through consultation with EPA during the development of this Opinion, taken with the programmatic analyses within this Opinion (see section 7.5 below), leads NMFS to conclude that successful implementation of the ESA Eligibility Criterion Procedure in the 2015 MSGP ensures that measures have been or will be put in place that minimize risk posed by MSGP-authorized discharges to ESA listed species and designated critical habitat. Key to this conclusion are the benchmark monitoring requirements specified in the MSGP and the corrective measures required in response to problems indicated by the monitoring.

7.5 Programmatic Summary

It is the programmatic analysis of this Opinion that determines whether the 2015 MSGP is structured such that risk to ESA-listed species and designated critical habitat is minimized. This analysis specifically evaluates measures in the 2015 MSGP which will improve discharge compliance and criterion selection validity, given the poor performance under the 2008 MSGP in these areas. Key to this analysis are the MSGP's monitoring and reporting requirements.

In our Programmatic approach, we examine whether and to what degree EPA has structured their MSGP to ensure that implementation of the permit is not likely to jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of designated critical habitat. In this evaluation, we assess whether EPA has structured the permit and supporting documentation (i.e., sector specific fact sheets) to enable EPA to fulfill the following criteria: (1) understand the scope of its action; (2) reliably estimate the physical, chemical, or biotic stressors that are likely to be produced as a direct or indirect result of their action; (3) minimize adverse effects of such activities on ESA-listed species and designated critical habitat; (4) identify, inform, encourage, and screen applicants for potential eligibility under or participation in the permitting activity; (5) continuously monitor and evaluate likely adverse effects on ESA-listed species and designated critical habitat; (6) monitor and enforce permit compliance; and (7) modify its action if new information (including inadequate protection for species or low levels of compliance) becomes available.

7.5.1 (1) Scope

In this section, we ask whether EPA is aware of the scope of their Action. Section 7 regulations define an action as "all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies in the United States or upon the high seas." It defines effects of the action as the "direct and indirect effects of an action on the species or designated critical habitat, together with the effects of other activities that are interrelated or interdependent with that action that will be added to the environmental baseline. Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration."

The scope of the action includes all aspects of EPA's issuance and implementation of the MSGPs, including the monitoring of discharges authorized by the permits and compliance with required reporting, effluent limitations, and where necessary, corrective measures. As discussed in the description of the action, EPA defines the requirements for authorization under the MSGP (MSGP sections 1.2.1) allowable stormwater discharges, specific allowable non-stormwater discharges, and discharge-related activities that may be authorized under the permit (MSGP sections 1.2 and 1.3). EPA defines receiving waters for these discharges as the first waters of the U.S. that are discharged into, or, for discharges that enter a storm sewer system or other water body prior to discharge, the first waters of the U.S. discharged to by the storm sewer system or water body. Special conditions apply for facilities discharging to impaired waters or Tier 2 and Tier 3 waters.

To reliably estimate the probable individual or cumulative effects to ESA-listed species or designated critical habitat, EPA would need to know or reliably estimate the frequency, intensity and locations of discharges that it would authorize. Since the timing and number of stormwater events cannot be precisely predicted we also ask whether EPA has structured their general permits to reliably estimate the probable number and locations of discharges that would be authorized by the MSGP with respect to the locations of threatened and endangered species and designated critical habitat.

The MSGP specifies that facilities seeking coverage must ensure that the effects of the discharges are not likely to adversely affect any species that are federally listed as endangered or threatened ("listed") under the ESA and are not likely to adversely affect designated critical habitat (MSGP section 1.1.4.5). The facility operators are directed to demonstrate their eligibility under one of the ESA Criteria by following instructions outlined in Appendix E: *Procedures Relating to Endangered Species Protection* prior to submitting their NOI. Facilities unable to certify eligibility for MSGP coverage based on existing documentation of measures to protect endangered species (see descriptions for Criteria B, D, and E) must then determine whether the spatial extent of the effects of their discharge (i.e., their action area) overlaps with threatened or endangered species or their designated critical habitat. EPA explicitly defines the action area in the permit to include all areas potentially affected directly or indirectly by the stormwater discharges, allowable non-stormwater discharges, and any proposed discharge-related activities[40] and not merely the immediate area (e.g., mixing zone) involved in the action, including all waterbodies or downstream/down-current reaches within waterbodies that are reasonably expected to receive pollutants from these sources.

During consultation EPA noted that they intended to improve the clarity of their SWPPP documentation requirements to improve criterion selection for the protection of endangered and threatened species. In March of 2013 EPA provided NMFS with a draft *EPA MSGP ESA Criterion Evaluation* that examined the quality of the supporting documentation used to support criteria selection of permitted facilities. Supporting documentation for 77 of the 117 evaluated facilities were found to be unsatisfactory (i.e., no ESA documentation or explanation of compliance) or below satisfactory (i.e., minimal explanation of compliance; most or all ESA documentation missing). The instructions outlined in the 2013 Criteria Eligibility Worksheet, provides a template for a permittee to fill out and include in the SWPPP. This new approach for the MSGP is intended to ensure improved consistency and quality of ESA eligibility criterion selection and documentation in the SWPPP.

40 e.g., upland areas associated with installation of and operation of stormwater control measures

Another common finding was the incorrect selection of eligibility Criterion A: no species present. After the permit is issued, EPA intends to do a "compliance check" on a subset of facilities who have selected Criterion A on their NOI for coverage under the MSGP during the 30 day waiting period. EPA envisions that the compliance check would consist of a GIS analysis to determine if the facility's action area is within designated critical habitat or within the range of a threatened or endangered species. For any incorrect Criterion A determinations, EPA would place the NOI on hold, and require the facility to submit a *Criterion C Eligibility Form* for coverage under Criterion C. EPA intends to work with NMFS to identify the Criterion A sample for this effort. EPA envisions that this focused Criterion A compliance check would occur in the 6 months following the permit reissuance (when the majority of facilities will be submitting NOIs for permit coverage).

EPA expects that compliance with the stormwater control requirements of this permit, including the requirements applicable to such discharges, will meet applicable water quality standards. To minimize the discharge of pollutants in stormwater from industrial activity into receiving waters, there are certain requirements that apply to the discharges. Facility operators must select, design, install, and implement control measures (including but not limited to best management practices) to minimize effects to water quality and adverse effects to ESA-listed species and designated critical habitat. In the technology-based limits included in the MSGP, the term "minimize" means reduce and/or eliminate to the extent achievable using control measures (including best management practices) that are technologically available and economically practicable and achievable in light of best industry practice (MSGP part 2.0).

The EPA estimates that the 2015 MSGP will reauthorize discharges from approximately 2,365 existing facilities and that an average of approximately 52 additional facilities will seek coverage under the MSGP each year totaling approximately 250 new facilities over the life of the 5-year permit. EPA is in the process of codifying an electronic reporting rule and is requiring MSGP applicants to file their NOI and any discharge monitoring reports electronically. Further applicants are encouraged to make their SWPP available on-line or provide additional details regarding the SWPPP content in the NOI. Electronic submission of NOI and discharge monitoring reports is expected to increase the efficiency and accuracy of permit implementation.

Information gained through consultation with EPA during the development of this Opinion, taken with this programmatic analyses, leads NMFS to conclude that successful implementation of the ESA Eligibility Criterion Procedure in the 2015 MSGP ensures that measures have been or will be put in place that minimize risk posed by MSGP-authorized discharges to ESA listed species and designated critical habitat. Key to this conclusion are the benchmark monitoring requirements specified in the MSGP and the corrective measures required in response to problems indicated by the monitoring. Specifically, we conclude that EPA is aware of the number and locations of existing facilities with MSGP permits and has provided this information to NMFS. EPA has also assessed the performance of its 2008 permit and has made adjustments based on this assessment for the 2015 MSGP. EPA is aware of the scope of their Action, and has used its existing permitting information to estimate the probable number of new discharges that it would authorize under the MSGP. Further EPA plans to put additional measures in place to address the issue of incorrect selection of ESA Eligibility Criteria.

7.5.2 (2) Stressors

Here we ask whether the EPA has reliably estimated the physical, chemical or biotic stressors that are likely to be produced as a direct or indirect result of the discharges that would be authorized by the MSGP. We also ask whether the EPA would know or be able to reliably estimate whether those discharges have occurred in concentrations, frequencies, or for durations that violate the terms of the MSGP.

Requirements to monitor for discharge concentrations above water quality based benchmarks are included for those pollutants determined by EPA, based upon discharge data and other information submitted to EPA by covered facilities, to be of potential concern in stormwater discharges on a sector-by-sector basis. The analytes of concern for each sector were identified during the earliest iterations of the MSGP based on information concerning the specific types of operations which are present at the different types of industrial facilities, potential sources of pollutants at the facilities, industry-specific BMPs which are available, and monitoring data provided by the different types of facilities. Using this information, EPA developed SWPPP requirements for the MSGP which consisted of the generic requirements of the baseline permit plus industry-specific requirements developed from the group application information. For example, monitoring requirements of the 1995 MSGP were developed using the monitoring data submitted with the group applications rather than EPA’s best professional judgment.

Based on monitoring submitted by each industry sector or subsector, EPA identified those pollutants discharged at a median concentration higher than the benchmark level (i.e., generally the ambient water quality criteria) as pollutants of concern for that sector. EPA then analyzed the list of potential pollutants against the list of significant materials exposed and industrial activities which occur within each industry sector or subsector. Where EPA could identify a source of a potential pollutant directly related to activities of the industry sector or subsector, EPA included a benchmark monitoring requirement in the permit. EPA included benchmark monitoring requirements for Sector S (air transportation) and K (hazardous waste treatment, storage, or disposal) facilities due to the high potential for contamination of stormwater discharges at these facilities, and not based strictly on pollutant discharge data submitted to the Agency from the covered facilities.

EPA acknowledged that there are potential pollutants sources associated with each industrial sector that are not required to be monitored under the permit, but does not believe these other pollutants pose a risk to water quality, and that these pollutants will be sufficiently controlled through the implementation of the control measures requirements and visual assessment and inspection requirements in the permit without needing analytic monitoring oversight. These pollutants, and measures to control them, are identified in sector specific fact sheets[41] with the types of specific stormwater control measures that will minimize the discharge of those pollutants.

EPA included in its BE an analysis of benchmark monitoring data submitted by facilities covered under the 2008 MSGP which did not include the newer protective measures that will be part of the 2015 MSGP. The data indicate that for many pollutants, the benchmark concentration required in the permit is met the majority of the time. The majority (greater than 50 percent) of annual benchmark averages of data submitted for aluminum, BOD, COD, lead, nitrate + nitrite, and total suspended solids met the benchmark. The majority of annual benchmark averages for copper, iron, pH, and zinc, were not met. For certain pollutants (i.e., ammonia, arsenic, cadmium, cyanide, magnesium, mercury, phosphorus, selenium, silver), data were very limited, and therefore, it was not possible to make observations about existing facilities' abilities to meet all benchmarks. NMFS expects that, given successful implementation, the safeguards built into obtaining and complying with 2015 MSGP will result in necessary compliance among facilities discharging to areas where ESA-listed species, species proposed for listing under the ESA, and designated critical habitat and habitat that is proposed for designation as designated critical habitat.

Unfortunately, the report does not indicate the severity of these exceedances. EPA provided the raw data used in the analysis in March of 2004 with the caveat that the database contained many unusable data. Examination of the data suggests that copper and zinc concentrations in stormwater discharges are particularly problematic in Massachusetts and New Hampshire. These facilities are located along the Connecticut, Taunton, Merrimack, and Deerfield rivers, which have been identified as important to sturgeon by NMFS and within accessible watersheds for Atlantic sturgeon (Draft data, NMFS 2014). While many facilities either lack benchmark data or have no reported benchmark exceedances, nearly 60 percent of those facilities reporting metals discharges exceeded benchmarks and among those facilities reporting copper in stormwater discharges, greater than 80% exceeded the benchmark. The median reported annual average value for copper was 45 times the hardness dependent benchmark, while the median reported zinc annual average observation was 5 times hardness dependent benchmarks. Benchmark exceedances for copper cannot trigger an instance of permit noncompliance because there are no ELGs for copper. However, discharges that potentially result in exposures of ESA-listed species should have been taken into consideration through a valid ESA eligibility certification. Regardless of water hardness, a five-fold benchmark exceedance for zinc exceeds the daily maximum ELG for Sector L facilities, landfills, land application sites and dumps and, at a water hardness of 50 mg $CaCO_3$/L and above, a five-fold exceedance of the benchmark exceeds the monthly average maximum ELG for Sector K, hazardous waste treatment. storage or disposal facilities. These exceedances underscore the need for the stringent eligibility criterion

41 http://water.epa.gov/polwaste/npdes/stormwater/Industrial-Fact-Sheet-Series-for-Activities-Covered-by-EPAs-MSGP.cfm

certification procedure under the 2015 MSGP, in particular, the more explicit instructions for facilities for defining the action area, screening of Criterion A certificatons, and NMFS review of proposed stormwater authorizations among those facilities certifying eligibility under Criterion C. NMFS reviews will consider all potential sources and pollutants from an individual MSGP applicant along with the density of MSGP authorized discharges within the watershed.

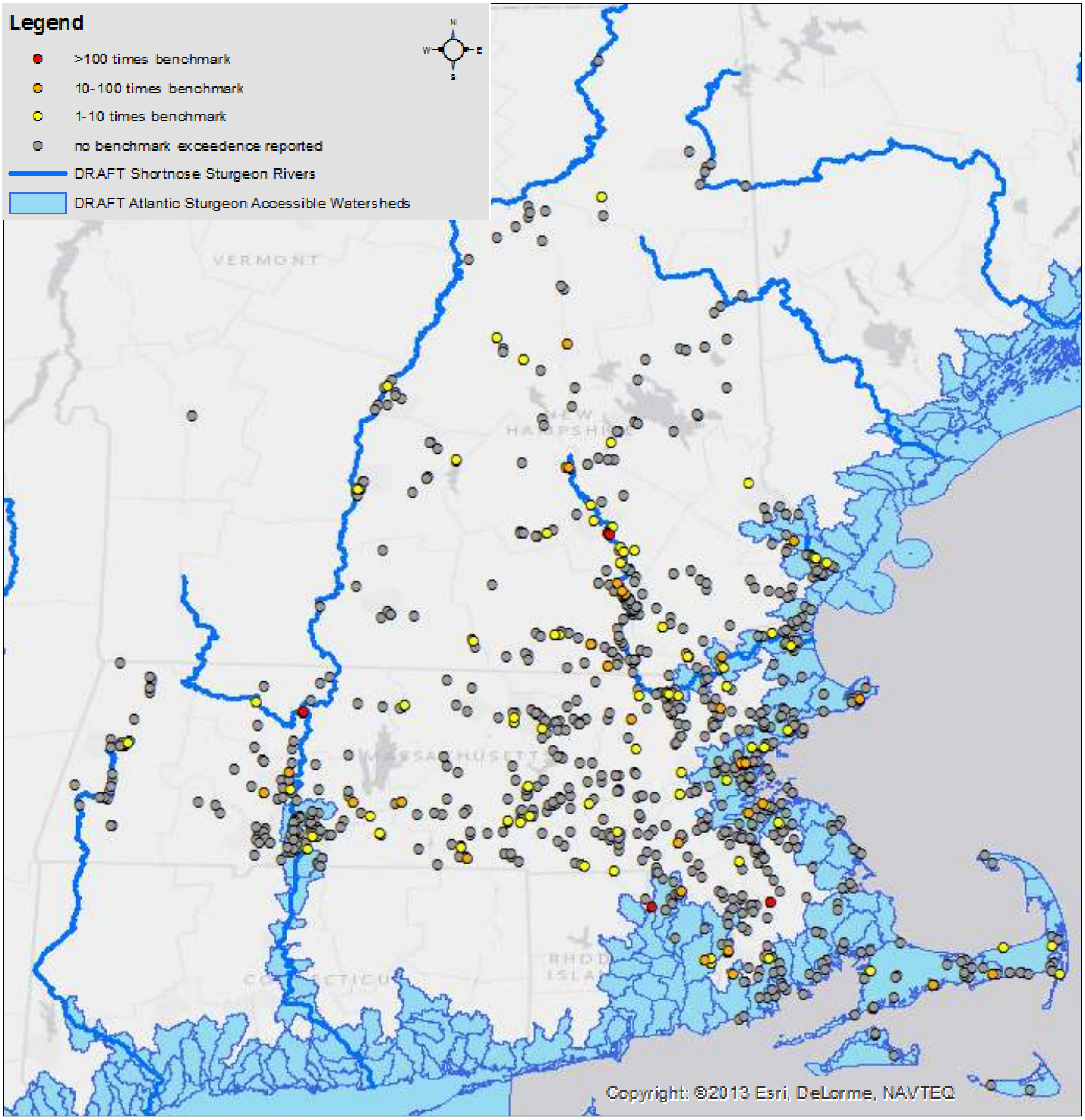

Figure 11 Locations of facilities with exceedances relative to major shortnose sturgeon rivers and Atlantic sturgeon accessible watersheds (NMFS DRAFT data).

Due to incomplete reporting and unusable data, these results are not representative of the entire action area of the permit. The vast majority of usable observations in the supplied data are for facilities in Massachusetts (n=114) and New Hampshire (n=53)() with only six facilities from Puerto Rico, and ten from Idaho. Among these, only 29 facilities reported annual averages for all pollutants measured to be below benchmark concentrations. In the BE, EPA stated that the improved electronic discharge monitoring report system will better enable EPA, the public, and other stakeholders to review and analyze monitoring data from facilities covered under the 2015 MSGP. EPA has revised the NOI form to provide adequate information to determine whether additional water quality-based requirements are necessary, and to enable EPA to inform the operator of its specific monitoring requirements. Operators now need to include more specific information regarding the classification of the receiving water(s) into which they discharge and information about any impairments and TMDLs specific to that waterbody, as well as general information from their SWPPP if the SWPPP is not posted online. The operator must also include basic information to allow the Agency to determine the applicability of effluent limits and clarification of the basis for eligibility under criteria related to protection of ESA-listed species and designated critical habitat. EPA has also strengthened many of the non-numeric BMP-based effluent limitations to minimize stormwater pollutants loads by making them more specific and enforceable. EPA has clarified which conditions require a SWPPP review, modified the deadlines to further specify EPA's expectations for what actions must be taken by the deadlines, and rewritten and clarified the reporting requirements for reporting following corrective actions.

NMFS concludes that EPA has used industry-supplied data from the early years of stormwater permitting to systematically estimate the physical, chemical or biotic stressors that are likely to be produced as a direct or indirect result of the discharges that would be authorized by the MSGP. Other pollutants which may be associated with these sectors and control measures to address them are identified in sector specific fact sheets.

EPA's assessment of the performance of the 2008 MSGP for only a limited number of facilities, data not representative of the entire permitted population and indicated that some benchmarks, particularly copper and zinc, were consistently exceeded by large margins.

Development of the 2015 MSGP considered the implications of these results. Information gained through consultation with EPA during the development of this Opinion, taken with this programmatic analyses, leads NMFS to conclude that successful implementation of the ESA Eligibility Criterion Procedure in the 2015 MSGP ensures that measures have been or will be put in place that minimize risk posed by MSGP-authorized discharges to ESA listed species and designated critical habitat. Key to this conclusion are the benchmark monitoring requirements specified in the MSGP and the corrective measures required in response to problems indicated by the monitoring. Specifically, in the 2015 MSGP, permit applicants are required to better characterize their receiving waters and stormwater management plans to enable EPA and NMFS to better assess whether ESA-listed species or designated critical habitat may be affected. EPA has clarified which conditions require a SWPPP review, modified the deadlines to further specify EPA's expectations for what actions must be taken by the deadlines, and rewritten and clarified the reporting requirements for reporting following corrective actions. Permit holders are now required to file discharge monitoring reports, *Annual Report*s and other permit documentation electronically. NMFS concludes that, for the 2015 MSGP, electronic reporting of discharge monitoring reports should allow EPA to readily identify discharges that exceed benchmarks and ELGs.

7.5.3 (3) Exposure to potentially harmful impacts

In this section, we ask whether EPA has reliably estimated whether and to what degree ESA-listed species and designated critical habitat are likely to be exposed to potentially harmful impacts of discharges authorized by the permit. EPA identified uncertainties in their effects analysis that could potentially limit the interpretation of results and conclusions. In order to address whether EPA has demonstrated sufficient knowledge of the exposures resulting from discharges authorized by the MSGP, we must first review these uncertainties acknowledged by EPA for the BE's assessment. EPA's BE provided detailed and thorough review of the uncertainties associated with assessing the potential effects of stormwater discharges on threatened and endangered species and designated critical habitat.

7.5.3.1 EPA's Assessment of Uncertainty: Use of Permits Limits as Surrogate Exposure Estimates

EPA used the MSGP quarterly benchmarks or ELGs as surrogates for in-stream exposure concentrations. This is likely to overestimate actual exposure potential because such an approach ignores dilution in the receiving water. Thus, potential adverse effects identified in the BE may be unlikely due to dilution of chemical constituents well below known acute effect levels. EPA acknowledges that past monitoring data showed benchmark exceedances, which are not permit violations[42], are likely to occur for some of the discharges that obtain coverage under the permit. However, EPA expects that the dilution of pollutants and intermittent and short-term nature of stormwater discharges, end-of-pipe benchmark exceedences do not necessarily indicate that water quality standards will not be met in the receiving waterbody. EPA also acknowledged that, depending on how much a given constituent is above the quarterly benchmark during a given storm event, potential effects could be underestimated in the effects analysis in the BE. Another uncertainty related to pollutant exposure concentrations could be possible effects from pollutants that are not required to be monitored under the permit. However, the permit's current monitoring requirements include all of the significant potential pollutants of concern for a given industrial

42 Benchmark monitoring is intended to evaluate performance of control measures in meeting effluent limitations contained in the permit and to assist the facility in understanding when corrective action(s) are necessary.

sector based on more than a decade of monitoring. Furthermore, other requirements in the permit are generally expected to be sufficient to control other pollutants not identified in the permit (e.g., through required control measures and quarterly visual assessments).

7.5.3.2 EPA's Assessment of Uncertainty: Indirect Trophic Effects and Exposures

EPA acknowledged uncertainties regarding effects on several species groups and their designated critical habitats, because direct effects data are limited and indirect effects via aquatic pathways are complex. The latter account for potential food web effects (e.g., biomagnification), as well as effects on potential food items, which are also not well-known in many cases. In addition, the exposure of mobile species to constituents of concern in industrial stormwater is likely to be limited due to the ability of these species to avoid pollutants associated with storm events. Nonmobile species, however, cannot avoid stormwater discharges but may reduce feeding rates or employ other mechanisms such as mucous production by corals to reduce pollutant uptake. EPA expects that using the quarterly benchmark or numeric ELG as the potential exposure concentration is likely to overestimate pollutant exposure to species groups for which the dominant exposure pathway is via the diet (i.e., data for reptile exposures to organic toxicants). The degree to which an adverse effect on birds, mammals, and other non-fish vertebrates is likely due to dietary pathways via bioaccumulation and biomagnification is difficult to discern. Stormwater discharges represent short-term pulses of exposure whereas most of the literature and models evaluating trophic food web effects assume a continuous exposure of the contaminant. Of the constituents monitored under the MSGP, a few are known to be bioaccumulative, including lead, mercury, selenium, and certain constituents in oil and grease (i.e., some PAHs). This might be a potential concern for contaminants that tend to partition to sediments such as certain organic chemicals of concern. The likelihood of this happening will depend on the particular discharge characteristics, sediment particle size downstream of the discharge, the average life expectancy of the species, and species mobility (e.g., size of its foraging or habitat area). Those species that are relatively long-lived, feed or live in fine-grained sediments, and are relatively restricted in terms of home range during its life time (e.g., some bivalves, plants), or species that feed on benthic organisms, might be expected to be more vulnerable to effects of bioaccumulative chemicals in stormwater discharge events over time.

7.5.3.3 EPA's Assessment of Uncertainty: Use of Representative Species

In evaluating effects on all aquatic and aquatic-dependent species in the action area, it was not feasible to determine the actual exposure potential for each ESA-listed species. Instead, upon advice from the Services, EPA analyzed risk for representative species from each species group. Effects of each stressor on a representative species or other genus of the group were extrapolated based on general taxonomic similarities; e.g., if a given chemical was likely to elicit an effect on the Rio Grande silvery minnow (a non-salmonid fish), then all listed non-salmonid fish species were assumed to have that finding as well. Toxicity data presented in the BE are for the representative species or another species within the genus within its group. Implicit in the use of the lowest toxicity values for the most sensitive species is the presumption that these toxicity values afford protection not only for the surrogate species but for closely related ESA-listed species of concern as well. Despite the conservative nature of this approach, and the diversity of representative species selected for in-depth analysis, there is uncertainty associated with the extent to which the most sensitive test species is representative of the sensitivity of listed aquatic and aquatic-dependent species and designated critical habitats to pollutants of concern.

7.5.3.4 EPA's Assessment of Uncertainty: Stormwater Exposures are Mixtures

An additional source of uncertainty in assessing effects of permitted industrial stormwater discharges is the potential impact of multiple constituents on aquatic or aquatic-dependent organisms. EPA does not routinely include an evaluation of mixtures of chemicals in its water quality criteria. Possible interactions among chemicals include independent, additive, antagonistic, or synergistic effects. The variety of chemical interactions presented in the available literature suggests that the interaction can be a function of many factors including but not limited to: (1) the type of species tested, (2) co-contaminants in the mixture, (3) the ratio of pollutant concentrations in the mixture, (4) differences in the duration of exposure among contaminants, and (5) the differential effects of other physical/chemical characteristics of the receiving waters (e.g., organic matter present in sediment and suspended water).

EPA stated that quantitatively predicting the combined effects of mixtures to a given species with confidence was considered beyond the scope of the available data. However, potential effects due to the co-occurrence of different constituents are perhaps possible under the MSGP. For example, certain industrial sectors may discharge several metals of concern simultaneously. Since some of these metals may have a similar mode of action in certain types of species (e.g., divalent metals and effects on fish), additive toxicity effects of metals might be possible in some cases even though the concentration of each individual metal is below levels of concern. A similar situation could occur for stormwater discharges containing several PAHs. Another type of interaction that introduces uncertainty in the effects analysis is the co-occurrence of certain constituents in a stormwater discharge with other environmental factors, resulting in greater potential adverse effects on ESA-listed species. For example, the effects analysis in the BE discusses potential effects of excess nutrients in conjunction with high water temperature. A combination of excess nutrients and warm water could result in high biological respiration rates and low dissolved oxygen. Species such as sturgeon and salmonids that are sensitive to low dissolved oxygen could be adversely affected by such discharge conditions.

7.5.3.5 EPA's Assessment of Uncertainty: Aggregate Industrial Stormwater Sources

A third type of condition identified by EPA that would introduce uncertainties is the co-occurrence of different industrial stormwater discharges in a particular location, or the co-occurrence of an industrial stormwater discharge and other point or nonpoint source discharges. In these cases, multiple contaminants may be present during a stormwater event with toxic properties that are not readily predictable based on individual discharge constituents. To the extent that a given site has multiple discharges under the MSGP, or an MSGP discharge co-occurs with other types of discharges, such aggregate mixture effects may be possible. However, this situation is most likely to occur in highly urbanized or industrial areas where ESA-listed species or their designated critical habitat are less likely to occur. Even in circumstances where multiple facilities covered under the MSGP are discharging in close proximity, because each individual facility is required to individually assess its eligibility for permit coverage with regard to the protection of ESA-listed species and their designated critical habitats, and because EPA and NMFS have the opportunity to review the Notices of Intent and information about the facility prior to the authorization of coverage, concerns about effects resulting from the co-occurrences of facilities will be addressed when EPA or NMFS review documentation and determine that a facility's discharge needs further controls. Additionally, most facilities that will be covered under the permit are already in existence, and according to EPA are not known to cause adverse effects to ESA-listed species or designated critical habitat in the MSGP action area. For these reasons, EPA does not expect significant adverse impacts to ESA-listed species and/or designated critical habitats from the co-occurrence of dischargers. EPA's conclusion that MSGP discharges are not known to cause adverse effects on a programmatic level is weakened by the evidence suggesting the potential for adverse effects based on findings of their *EPA MSGP ESA Criterion Evaluation* study and the benchmark monitoring data. The MSGP implementation requires valid eligibility criterion selection and the application of adequate controls to prevent adverse exposures in areas where ESA-listed species occur.

7.5.3.6 EPA's Assessment of Uncertainty: Chronic Effects

It is EPA's expectation that, due to the episodic nature of the discharge covered under the proposed MSGP, chronic water column exposure of endangered species to pollutants of concern is not expected. The toxicity data presented in the Effects Assessment account for continuous exposure periods of no less than 48 hours, and for most toxicant stressors, a 96-h endpoint was evaluated. These acute exposure periods represent exposure periods that are thought to be longer than typical stormwater discharges under the proposed MSGP. Even with prolonged storm events, pollutant concentrations are likely to fluctuate throughout the exposure and not remain constantly high. Thus, EPA considers 96-h continuous exposure to overestimate exposure in terms of this permit action.

While chronic water column exposures are unlikely to be an issue of concern for stormwater discharges under this permit, EPA acknowledged that certain pollutants discharged in authorized stormwater may become bound to sediment particles and persist in the downstream receiving water. In addition, to the extent that a stormwater discharge occurs frequently and contains bioaccumulative pollutants, a species may be exposed to chronic pollutant effects based on water exposures only. While chronic adverse effects may occur to ESA-listed species or designated critical habitat, EPA does not believe that chronic effects will cause population-level concerns. EPA expects that stringent species protections (i.e., eligibility requirements) and stringent control measures applicable to all industrial sectors will minimize discharges of all pollutants in stormwater, including pollutants that could lead to chronic effects, to levels that are protective of water quality and aquatic life.

7.5.3.7 EPA's Assessment of Uncertainty: Sediment-Bound Pollutants

The concentrations of pollutants that may be adsorbed to particles, settle in depositional zones, and persist as sediment-associated contaminants is an uncertainty in the BE. EPA acknowledged that certain pollutants that may be found in industrial stormwater discharges may persist in sediments downstream of the stormwater discharge, especially in fine sediments such as silts and clay that are known to adsorb pollutants much more than sand or gravels. The direct effects that these sediment-bound pollutants may have on benthic organisms (including, but not limited to, invertebrates and fish), as well as the indirect effects that may impact species that forage on sediment dwelling organisms, are uncertain. However, given the controls required to prevent these types of pollutants from being discharged in the first place, EPA does not expect pollutants in stormwater authorized under the MSGP will be a significant source of sediment- bound contaminants, and these stressors are not expected to raise population-level concerns.

7.5.3.8 EPA's Assessment of Uncertainty: Flow, Assimilative Capacity

EPA stated that the toxicity evaluation presented in the BE discounted potential dilution or potential assimilative capacity of the receiving water may overestimate the actual pollutant exposure concentrations and therefore potential risks to ESA-listed species or designated critical habitat. However, EPA also acknowledged that it is not known whether multiple stormwater pulses of such contaminants would in fact elicit adverse effects over time to ESA-listed species. Stormwater discharges to small headwater streams, for example, may be more likely to have potential effects on aquatic or aquatic-dependent ESA-listed species due to the lack of available upstream dilution and therefore reduced assimilative capacity available. Other factors that will affect receiving water assimilative capacity and therefore, likelihood of effects, are the frequency and duration of stormwater discharges. The more frequent the discharges, and/or the longer they last, the more likely that certain pollutant concentrations may remain elevated in the waterbody, thereby reducing assimilative capacity. EPA expects that downstream dilution is likely to be high and likely to occur relatively rapidly (i.e., over a relatively short distance), thus decreasing the concentration of pollutants in the receiving water below levels of concern.

It was not possible for EPA to account for the assimilative capacity of the receiving waters when determining the potential risk to ESA-listed species and designated critical habitat under the proposed permit. Using the quarterly benchmarks and numeric effluent limitations as the exposure concentration in the effects analysis of the BE, the affordance of any assimilative capacity that the receiving water has would only lessen the exposure concentration of pollutants to ESA-listed species. If the receiving waterbody was not able to assimilate any of the pollutant discharged, then the quarterly benchmark and effluent limitation would represent the exposure concentration. EPA concluded that not considering assimilative capacity increases the conservativeness of the effects analysis in the BE.

7.5.3.9 EPA's Assessment of Uncertainty: Species sensitivity, developmental stage, and recovery time of ESA-listed species and prey

EPA noted that the sensitivity of the representative species may not reflect the sensitivities of all ESA-listed species in that group. Other ESA-listed species may be more or less sensitive to specific stressors, which would over- or underestimate the risk based on the extrapolation of effects to all ESA-listed species. In cases where toxicity information is not available, other species in the same genus were used as the representative species, or another genus in the group was used that had available toxicity data. Therefore, since toxicity data specific to ESA-listed species are not readily available in many cases, the sensitivity of these species may not be completely understood. Toxicity data for other taxonomically related species would be the way to limit, but not eliminate, this uncertainty. For many species, one developmental stage may be more sensitive to certain contaminants than other stages. For the ESA-listed species that could potentially be affected by the proposed permit action, the developmental stage most closely tested in aquatic toxicity tests is what was used to determine whether effects are likely to cause impairment. Non-salmonid fish acute toxicity tests are typically conducted with juvenile fish; thus, that life stage was what was evaluated for many pollutants in the BE. EPA acknowledged that for some ESA-listed species, the developmental life stage evaluated may not be the most sensitive. This is an uncertainty that may underestimate the effects to ESA-listed species.

7.5.3.10 NMFS Assessment of Uncertainty in the Exposure Analysis

NMFS' assessment of uncertainty builds on EPA's detailed and thorough uncertainty analysis. EPA acknowledges past monitoring data that showed benchmark exceedances but expects that, due to the dilution of pollutants and intermittent and short-term nature of stormwater discharges, end-of-pipe benchmark exceedences do not necessarily indicate that water quality standards will not be met in the receiving waterbody. EPA also acknowledged that, depending on how much a given constituent is above the quarterly benchmark during a given storm event, potential effects could be underestimated in the effects analysis in the BE. NMFS would like to note that the discharge monitoring data provided by EPA indicate some severe copper exceedances, with the median observed concentration exceeding EPA's benchmark by 45 times. Concern regarding these exceedances is strengthened when considering that greater than 80% of observed annual averages for copper exceeded the benchmark values and the copper benchmarks applied by EPA are not consistent with current EPA water quality guidelines for the protection of aquatic life. Copper discharges into waters where ESA-listed species occur will require careful scrutiny if these species are to be protected from extreme exceedences.

EPA also acknowledged that discharges to headwater streams would not provide the dilution required to allow the receiving water achieve water quality standards. NMFS would like to note that headwaters and low volume backwaters with small dilution volumes are important rearing habitats for juvenile fish and discharges to such waters within designated critical habitat would raise substantial concern. It is particularly important that EPA understand that stormwater discharges to receiving waters may be combining with an existing pollutant load, regardless of stormwater inputs. While the permit has provisions for discharges to 303(d) listed impaired waters, not all waters have been recently assessed and some receiving waters may have emerging impairments. Identification of receiving waters that are at risk of developing an impairment is a highly location specific task which would require local knowledge of surrounding land uses and water regime.

Again, Information gained through consultation with EPA during the development of this Opinion, taken with this programmatic analyses, leads NMFS to conclude that successful implementation of the ESA Eligibility Criterion Procedure in the 2015 MSGP ensures that measures have been or will be put in place that minimize risk posed by MSGP-authorized discharges to ESA listed species and designated critical habitat. Key to this conclusion are the benchmark monitoring requirements specified in the MSGP and the corrective measures required in response to problems indicated by the monitoring.Specifically, NMFS concludes that EPA will be able to reliably estimate whether and to what degree ESA-listed species and designated critical habitat are likely to be exposed to potentially harmful impacts of discharges authorized by the permit by virtue of the exposure assessments that would be performed in context of consultations or implementation of technical guidance from NMFS associated with Eligibility Criteria B, D or E or successful implementation of the *Criterion C Eligibility Form* procedure. The *Criterion C Eligibility Form* procedure requires NMFS regional biologists to review applicant-supplied data and determine whether and to what degree ESA listed species and designated critical habitat will potentially experience harmful impacts of discharges from the permitted facility. If harmful impacts are anticipated, NMFS regional biologists will identify measures to prevent them.

7.5.4 (4) Monitoring/Feedback

In this section, we ask whether EPA proposes to identify, collect, and analyze information about its authorized discharges that may expose ESA-listed species and designated critical habitat to harmful stressors. We view the monitoring and reporting requirements of the MSGP as key to our ability to conclude that the action is not likely to jeopardize listed species or destroy or adversely momdify designated criticald habitat.

Requirements specified in the MSGP include quarterly inspections of the facility pollutant sources and control measures, one of which must occur during a storm event, to ensure that exposure to pollutants are avoided or corrected. Quarterly visual inspections of stormwater discharges for indicators of pollutants (e.g., color, odor, clarity, foam, oil sheen, and floating, settled, or suspended solids) are also required. Some facilities are required to conduct quarterly benchmark monitoring, annual effluent limitations guidelines monitoring, State- or tribal-specific monitoring, and impaired waters monitoring. The permit specifies the conditions under which inspections and monitoring will identify the need for additional control measures and states that facility operators must immediately take all reasonable steps necessary to minimize or prevent the discharge of pollutants until corrective control measures are established.

The MSGP outlines a number of sector-specific control and monitoring requirements with which facility operators must comply that are associated with the facility's primary industrial activity and any co-located industrial activities (MSGP Part 2.3.1). The sectors-specific control measures include additional inspection requirements and technology based effluent limits such as good housekeeping measures, employee training, preventative maintenance, and measures to control or divert stormwater and sediments. Sector-specific monitoring requirements include quarterly aquatic life benchmark monitoring and technology based ELGs for stormwater constituents expected to be present in the discharges. EPA included an analysis of benchmark monitoring data submitted by facilities covered under the 2008 MSGP with its BE. EPA's electronic reporting system will facilitate the receipt and analysis of future discharge monitoring reports. The 2015 MSGP requires electronic reporting, making it possible for EPA to obtain better quality data and a more representative sample of data, if not data for the entire MSGP-permitted population.

Information gained through consultation with EPA during the development of this Opinion, taken with this programmatic analyses, leads NMFS to conclude that successful implementation of the ESA Eligibility Criterion Procedure in the 2015 MSGP ensures that measures have been or will be put in place that minimize risk posed by MSGP-authorized discharges to ESA listed species and designated critical habitat. Key to this conclusion are the benchmark monitoring requirements specified in the MSGP and the corrective measures required in response to problems indicated by the monitoring.Specifically, NMFS concludes that, given successful implementation of the electronic reporting system and permitee compliance with the requirement to submit discharge monitoring reports electronically, EPA will have a mechanism for monitoring and feedback enabling it to identify, collect, and analyze information about its authorized discharges that may expose ESA-listed species and designated critical habitat to harmful stressors.

7.5.5 (5) Effects on Listed Resources

Here we ask whether EPA, in its implementation of the MSGP, will use analytical methodology that considers:

- the status and trends of endangered or threatened species or designated critical habitat;
- the demographic and ecological status of populations and individuals of those species given their exposure to pre-existing stressors in different drainages and watersheds;
- the direct and indirect pathways by which endangered or threatened species or designated critical habitat might be exposed to the discharges to waters of the United States; and
- the physical, physiological, behavior, sociobiological, and ecological consequences of exposing endangered or threatened species or designated critical habitat to stressors from discharges at concentrations, intensities, durations, or frequencies that could produce physical, physiological, behavioral, or ecological responses, given their pre-existing demographic and ecological condition.

The primary feature that minimizes the potential for adverse effects to ESA-listed species and designated critical habitat from facilities covered under the MSGP are the ESA-listed species and designated critical habitat eligibility requirements that all operators must meet prior to applying for permit coverage. The MSGP is structured to ensure that only facilities that have completed a separate ESA section 7 consultation, have received an ESA section 10 permit for their stormwater discharges, allowable non-stormwater discharges, and stormwater discharge-related activities, or facilities that are not likely to adversely affect any species that are federally-listed as endangered or threatened ("listed") and are not likely to adversely affect designated critical habitat, are eligible for coverage under the MSGP. Limiting eligibility in this manner will ensure that ESA-listed species and designated critical habitats are protected from discharges and discharge-related activities covered under the MSGP. In the event that a discharger does cause adverse effects to ESA-listed species and designated critical habitat (and provided that facility did not complete a separate ESA section 7 consultation or receive an ESA section 10 permit), EPA would view that facility to be in violation of the permit.

The specific listed resource Eligibility Criteria are listed in Part 1.1.4.5 of the proposed MSGP. The procedures that operators must meet in order to determine which criterion they are eligible under, if any, are found in Appendix E of the proposed MSGP. Based on information from currently covered facilities, EPA estimated that the vast majority of facilities (approximately 76 percent) that will seek coverage under the MSGP will meet criterion A, and therefore will have no effect on ESA-listed species or designated critical habitat. An additional approximate seven percent will have already addressed any possible effects to ESA-listed species and designated critical habitat because another operator already covered by the MSGP has established eligibility with regard to the protection of ESA-listed species and designated critical habitat under the permit for the operator's discharges and discharge-related activities or through a separate ESA section 7 consultation or a section 10 permit (criteria B, D, and E). Only approximately 19 percent of facilities will have possible adverse effects to ESA-listed species and designated critical habitat and may need additional scrutiny by EPA and NMFS to ensure that they will have no adverse effects and are therefore eligible for permit coverage under criterion C. Based on data from the 2008 MSGP, out of the approximate 2,365 facilities expected to seek coverage under the new MSGP, only approximately 400 of those facilities are expected to fall under the Part 1.1.4.5 eligibility criterion C in the new proposed permit, which are the facilities that have listed the potential to cause adverse effects due to overlap with ESA-listed species and/or designated critical habitat and may have been required to implement additional controls to prevent adverse effects to listed resources. Most facilities that sought coverage under the permit (approximately 76 percent) certified that there were no ESA-listed species or designated critical habitat in their action area (criterion A). The remaining facilities that will seek coverage will be eligible another operator has already made a valid eligibility determination (criterion B), or because a separate Section 7 consultation has been completed (criterion D), or because a Section 10 permit has been issued (criterion E), and therefore, these facilities will have addressed any concerns regarding the protection of ESA-listed species and designated critical habitat prior to obtaining coverage under the permit (Table 25).

Table 25 Distribution of endangered species eligibility criteria for facilities covered under the 2008 MSGP.

ESA Criterion	Total	Percent of Total Permittees
A	1808	76.4%
B	75	3.1%
C	18	0.7%
D	52	2.1%
E	351	14.8%
F	61	2.5%

In order to become eligible under criterion C under the 2015 MSGP, operators must submit a completed *Criterion C Eligibility Form* for review a minimum of 30 days prior to submitting their NOIs for permit coverage. The *Criterion C Eligibility Form* requires the discharger to analyze and document potential effects to threatened and endangered species and/or designated critical habitat from their discharges and discharge-related activities. The information on the *Criterion C Eligibility Form* allows EPA and NMFS to assess the likelihood of adverse effects to ESA-listed species and designated critical habitat and to determine if additional controls are necessary to ensure no adverse effects on ESA-listed species and designated critical habitat on a facility-by-facility basis. The *Criterion C Eligibility Form* requires identification of receiving waters, discharges and discharge related activities, pollutants and specific controls to avoid adverse effects to ESA-listed species and designated critical habitat, and identification of any past monitoring exceedances from the facility under the 2008 MSGP. EPA believes that this process will ensure that the small minority of facilities with potential effects on ESA-listed species and designated critical habitat will have no likely adverse effects prior to being authorized under the permit.

All permit applicants seeking coverage under the MSGP must certify their eligibility with regard to ESA-listed species and designated critical habitat protections when they submit their NOIs for coverage under the MSGP. On the proposed NOI form for the MSGP, permit applicants are required to provide a brief summary of the basis for the eligibility criterion they selected. Depending on which criterion is selected, there may be additional information that the permit applicant would be required to provide on the NOI form. For example:

- Permit applicants certifying under eligibility criterion B must provide the NPDES ID (i.e., permit tracking number) from the other operator's NOI authorized under the permit.
- Permit applicants certifying under eligibility criterion C must list the federally ESA-listed species or federally designated critical habitat located in the "action area" and must list any

controls or management practices required by EPA, in coordination with the NMFS, to ensure that discharges and discharge-related activities are not likely to adversely affect ESA-listed species and their designated critical habitats.
- Permit applicants certifying under criterion D or E must attach copies of any letters or other communications with, or permits granted from, NMFS.

This required information provides EPA and NMFS a greater ability to oversee and verify that applicants are making accurate eligibility determinations with regard to the protection of ESA-listed species and designated critical habitat. If a facility falsely certifies its eligibility, EPA considers the facility to be discharging without a permit, and would be subject to penalties under the Clean Water Act. Facilities are also required to include in their SWPPP information to support their eligibility criterion (i.e., their completed worksheet and any additional documentation). EPA can request to review this information at any time during an on-site inspection or through a Clean Water Act section 308 request for information.

EPA's permit authorization process also provides that all NOIs submitted for coverage under the MSGP undergo a 30-day review period before they are authorized to discharge. During this 30-day review period, EPA may place a hold on the authorization to address potential concerns to ESA-listed species and designated critical habitat from the facility's discharges and/or discharge-related activities. NMFS will be able to review all NOIs during this period and EPA will place a hold on any activity that NMFS requests. Once a hold has been placed, EPA may require more information or additional controls before authorizing the discharge, or may decide that coverage under an individual NPDES permit is required. This post- NOI submittal review period provides additional assurance that potential adverse effects associated with the issuance of the MSGP will be minimized.

EPA also notes that many of the proposed eligibility requirements regarding ESA-listed species and designated critical habitat are new requirements and are more stringent than the previous 2008 MSGP. For example, the procedures in Appendix E that all permittees must follow to determine their eligibility criterion are more rigorous and require more stringent analyses by the permit applicant. The *Criterion C Eligibility Form* is a brand new addition to the permit that requires a detailed information about the facility's action area, ESA-listed species and designated critical habitat, and the facility's discharges and discharge-related activities to enable EPA and NMFS to assess whether discharges may pose a concern. Also new is the requirement that *Criterion C Eligibility Form*s provide information about their facility (through the submission of the *Criterion C Eligibility Form*) *prior* to the submittal of the NOI. In addition, EPA has made the Part 1.1.4.5 ESA-listed species and designated critical habitat criteria more stringent. EPA has proposed the following enhancements to the Part 1.1.4.5 criteria:

- For a facility certifying its eligibility under criterion B (i.e., another operator has already established eligibility for the facility's discharges and discharge-related activities), the facility may only select this criterion if the other operator has established eligibility under the newly issued MSGP (i.e., the facility can't rely on another's certification of eligibility under the 2008 or a previous MSGP). This is to ensure that all eligibility determinations are made consistent with the new ESA-listed species and designated critical habitat protections built into the proposed MSGP.

- For a facility certifying its eligibility under criterion C (i.e., the facility is not likely to adversely affect ESA-listed species and/or designated critical habitat in the action area), the facility must fill out a detailed worksheet that documents information about the discharges and discharge-related activities, and must submit the worksheet a minimum of 30 days *prior* to the date the facility intends to file a NOI for permit coverage. During a 30-day review period, EPA and NMFS have the opportunity to review the information on the worksheet to assess the likelihood of adverse effects to ESA-listed species and designated critical habitat and to determine if additional controls are necessary to ensure that there are no likely adverse effects. When submitting the NOI for permit coverage, the facility must also list the federally-listed species or designated critical habitat located in the action area and describe any controls and/or management practices that it will implement to ensure no likely adverse effects on ESA-listed species and designated critical habitat.
- For a facility certifying its eligibility under criterion D (i.e., a separate ESA section 7 consultation has been concluded), the facility must verify that the consultation remains valid, that the consultation addressed the stormwater discharges, and must reinitiate consultation if required. The facility must also include supporting documentation with its NOI.
- When filling out the NOI for permit coverage, all facilities must provide a description of the basis for the eligibility criterion they selected.

These additional protections were added to the permit in consultation with us, and EPA believes they will provide greater assurance that the issuance of the new MSGP will be protective of ESA-listed species and designated critical habitat.

The approach described above does not formally use analytical methodology that considers:

- the status and trends of endangered or threatened species or designated critical habitat;
- the demographic and ecological status of populations and individuals of those species given their exposure to pre-existing stressors in different drainages and watersheds;
- the direct and indirect pathways by which endangered or threatened species or designated critical habitat might be exposed to the discharges to waters of the United States; and
- the physical, physiological, behavior, sociobiological, and ecological consequences of exposing endangered or threatened species or designated critical habitat to stressors from discharges at concentrations, intensities, durations, or frequencies that could produce physical, physiological, behavioral, or ecological responses, given their pre-existing demographic and ecological condition.

Rather, where species occur in the action area of an individual dischargers (i.e., not eligible for Criterion A), such methodology would be incorporated into the individual implemented technical guidance or consultations (Criterion D), certifications of collocated operators (Criterion B), a permit issued under section 10 of the ESA (Criterion E), or the permit applicant has identified and addressed discharge-related activities which would potentially adversely affect listed threatened or endangered species or designated critical habitat (Criterion C) through completing the Criterion C procedure, which is screened for completeness by EPA, then sent to the applicable NMFS Region for review and recommendations. It is the review and implementation of any recommendations made by NMFS which integrates the requirements listed above into a permit applicant's Criterion C eligibility certification.

EPA determined, in its draft study examining the quality of the supporting documentation used to support criteria selection of permitted facilities, that many applicants incorrectly certified for eligibility under Criterion A. On July 28, 2014, EPA notified NMFS that they would like to amend its action to include a "compliance check" on a subset of facilities who have selected Criterion A on their NOI for coverage under the MSGP during the 30 day waiting period. For any incorrect Criterion A determinations, EPA would place the NOI on hold, and require the facility to submit a *Criterion C Eligibility Form* for coverage under Criterion C. EPA intends to work with NMFS to identify the Criterion A sample for this effort.

Information gained through consultation with EPA during the development of this Opinion, taken with this programmatic analyses, leads NMFS to conclude that successful implementation of the ESA Eligibility Criterion Procedure in the 2015 MSGP ensures that measures have been or will be put in place that minimize risk posed by MSGP-authorized discharges to ESA listed species and designated critical habitat. Key to this conclusion are the benchmark monitoring requirements specified in the MSGP and the corrective measures required in response to problems indicated by the monitoring.Specifically, the procedures described above satisfy NMFS requirements of EPA to address effects to ESA-listed species and designated critical habitat when implementing its MSGP, provided that permit applicants make valid eligibility certifications and issues identified in the process of seeking eligibility under Criterion C are successfully resolved or the permit applicant is referred to an individual permit and formal ESA Section 7 consultation.

7.5.6 (6) Compliance

Here we ask whether EPA has a mechanism to reliably determine whether and to what degree operators have complied with the conditions, restrictions, or mitigation measures required of the MSGP.

EPA's new electronic reporting requirements and modernized ECHO database will result in a comprehensive centralized database of compliance and enforcement data for permits issued under the Clean Water Act, the Clean Air Act and the Resource Conservation and Recovery Act. The 2015 MSGP now requires permit applicants to submit discharge monitoring reports, *Annual Report*s and other required information electronically through ECHO. For example, part 7.5 of the permit requires all permittees to submit an *Annual Report* to EPA electronically that contains information generated from the past calendar year. The *Annual Report* must include the results or a summary of the past year's routine facility inspections, information about any corrective actions, and information about any incidents of noncompliance observed. EPA states in its BE that the electronically submitted *Annual Report* enhances permittee accountability and EPA's ability to oversee the facility. Electronic reporting contrasts with the former paper copy reports because it allows EPA to efficiently screen all reports submitted and flag those which may need closer scrutiny. Further, by making the information entered into ECHO publically available, EPA has enhanced permittee accountability though enhancing the credible risk that a noncompliant facility will face a civil suit[43]. The BE further states that EPA can use the information submitted through the *Annual Report* to provide a basis on which to judge permittee performance. Facilities may opt out of the electronic reporting requirement if they receive a waiver granted by the EPA. However, permittees would not be in a position to use waivers as a means to avoid scrutiny by EPA or the public. Waivers are only issued because of a demonstrated technical incapacity to submit an electronic report and a new waiver must be obtained from EPA for each individual information submittal requirement.

EPA will verify compliance with reporting requirements and assess discharge monitoring limits by examining information submitted, or not submitted, electronically. While the ECHO is not yet up to date for all permits and states, current data suggest expected compliance rates for general permits in states and territories where EPA is the permitting authority (i.e. Idaho, Massachusetts, New Hampshire, New Mexico, District of Columbia, Puerto Rico, and the Pacific Islands) [44]. ECHO identified 2,045 EPA-general permits for these places. Six percent (n=125) have current violations and 13% (n=280) were subject to formal enforcement actions within the past five years. Among current violations, 22% (n=28) of these are effluent violations and six of the 28 facilities with effluent violations are classified as "in significant noncompliance". In sum, 1.3% of EPA-permitted facilities with general permits are in noncompliance with respect to their discharge limitations at the time of this writing.

Assessing compliance in terms of effluent violation frequencies is a straightforward task, but does not take into account compliance with all control measures required under a permit. Verification of compliance with physical control measures requires inspection. However, inspection rates for facilities with general permits are much lower than for facilities with individual permits: in the past three years 71% of facilities with individual permits were inspected but only 23% of facilities holding general permits were inspected. Inspected facilities appear to be more likely to be found in noncompliance with their permit than uninspected facilities because inspections evaluate operations logs, training certificates and the condition of control measures whereas the only evidence for noncompliance at uninspected operations are the availability and content of discharge monitoring reports. Unfortunately, the modernized ECHO

43 Section 505 (a) of the Clean Water Act authorizes any citizen to commence a civil action in federal court to enforce the Clean Water Act.
44 echo.epa.gov, accessed 08/07/2014

does not identify the type of inspections conducted, so we cannot distinguish between compliance rates of facilities receiving routine random inspections and those inspected for cause due to complaints or difficulties with reporting and compliance schedules.

Information gained through consultation with EPA during the development of this Opinion, taken with this programmatic analyses, leads NMFS to conclude that successful implementation of the ESA Eligibility Criterion Procedure in the 2015 MSGP ensures that measures have been or will be put in place that minimize risk posed by MSGP-authorized discharges to ESA listed species and designated critical habitat. Key to this conclusion are the benchmark monitoring requirements specified in the MSGP and the corrective measures required in response to problems indicated by the monitoring. The modernized ECHO, ESA eligibility process, and electronic reporting requirements under the MSGP provides EPA with a mechanism that should allow them to reliably determine whether and to what degree operators have complied with the conditions, restrictions, or mitigation measures required of the MSGP where ESA-listed species occur. Inspections are EPA's mechanism to directly verify compliance with control measures, but this mechanism cannot be employed as effectively for stormwater discharges. EPA must rely on self-inspections, reporting and record keeping due to the sporadic and variable nature of stormwater discharges. Information provided in the *Annual Report*, taken with compliance with discharge limits, provides the necessary indication of compliance with permit control measures.

7.5.7 (7) Adequacy of Controls

Finally, we ask whether EPA has a mechanism to prevent or minimize listed resources' exposure to stressors in discharges if (1) EPA finds that these stressors occur at concentrations, durations, or frequencies that are potentially harmful to individual listed organisms, populations, or species; or (2) EPA identifies that the discharges lead directly or indirectly to ecological consequences that are potentially harmful to individual listed organisms, populations, species or PCEs of designated critical habitat.

This requirement pertains to corrective actions (part 4 of the MSGP) put in place in the event a problem has been detected. In order for NMFS to conclude that EPA has a mechanism to prevent or minimize exposure of ESA-listed species or elements of designated critical habitat to stressors at potentially harmful intensities, NMFS must first conclude that the need for a corrective action will be triggered prior to or very soon after harmful exposure intensities occur. Under the MSGP, corrective actions are triggered when:

- An unauthorized release or discharge (e.g., spill, leak, or discharge of non-stormwater not authorized by this or another NPDES permit) occurs.
- A discharge violates a numeric effluent limit.
- Control measures are not stringent enough for the discharge to meet applicable water quality standards or the non-numeric effluent limits in this permit.

- A required control measure was never installed, was installed incorrectly, or not in accordance with the permit or is not being properly operated or maintained.
- Visual assessments indicate obvious signs of stormwater pollution (e.g., color, odor, floating solids, settled solids, suspended solids, and foam).
- The average of four quarterly sampling results exceeds an applicable benchmark. If less than four benchmark samples have been taken, but the results are such that an exceedance of the four quarter average is mathematically certain (i.e., if the sum of quarterly sample results to date is more than four times the benchmark level) this is considered a benchmark exceedance, triggering this review.
- Construction or a change in design, operation, or maintenance at your facility that significantly changes the nature of pollutants discharged in stormwater from your facility, or significantly increases the quantity of pollutants discharged.

Benchmark monitoring, water quality standards and non-numeric standards stated in the permit are the corrective action triggers that NMFS must consider when deciding whether EPA has an appropriate mechanism to minimize or prevent exposures at harmful intensities. The first portion of the effects section of this Opinion found that several of the benchmarks are not protective of ESA-listed species and designated critical habitat or there is insufficient information to determine whether the benchmarks are protective. Further, EPA will not be assessing the ecological consequences of its authorized discharges, and therefore will not be able to identify whether discharges lead directly or indirectly to potentially harmful consequences for individual listed organisms, populations, species or PCEs of designated critical habitat.

Information gained through consultation with EPA during the development of this Opinion, taken with this programmatic analyses, leads NMFS to conclude that successful implementation of the ESA Eligibility Criterion Procedure in the 2015 MSGP ensures that measures have been or will be put in place that minimize risk posed by MSGP-authorized discharges to ESA listed species and designated critical habitat. Key to this conclusion are the benchmark monitoring requirements specified in the MSGP and the corrective measures required in response to problems indicated by the monitoring. EPA’s ability to prevent or minimize listed resources’ exposure to harmful stressor intensities relies on valid certification under Criterion A, any protective measures associated with Eligibility Criteria B, D or E or successful implementation of the *Criterion C Eligibility Form* procedure. Further, EPA is authorized to inspect permitted facilities and will pursue enforcement for noncompliance. Permit compliance is further motivated by the public availability of discharge and compliance data through ECHO, which has implications for public relations and citizen suits. Given the transparent permitting data provided through ECHO, permitted facilities have the added incentive to comply with permit terms in order to maintain a positive public image and avoid citizen suits.

7.5.8 Aggregate Effects

Up to this point we have discussed the implications of discharges from individual facilities as authorized under the MSGP. This opinion must also consider the aggregate effects of MSGP-authorized discharges to determine whether, taken together, these present industrial stormwater "hot spots" affecting watersheds where species and designated critical habitat under NMFS jurisdiction occur. Aggregate impacts include: (1) time-crowded perturbations or perturbations (i.e., repeated occurrence of one type of impact in the same area) that are so close in time that the effects of one perturbation do not dissipate before a subsequent perturbation occurs; (2) space-crowded perturbations (i.e., a concentration of a number of different impacts in the same area) or perturbations that are so close in space that their effects overlap; (3) interactions or perturbations that have qualitatively and quantitatively different consequences for the ecosystems, ecological communities, populations, or individuals exposed to them because of synergism (when stressors produce fundamentally different effects in combination than they do individually), additivity, magnification (when a combination of stressors have effects that are more than additive), or antagonism (i.e., when two or more stressors have less effect in combination than they do individually); and (4) nibbling (i.e., the gradual disturbance and loss of land and habitat) or incremental and decremental effects are often, but not always, involved in each of the preceding three categories (NRC 1986). Stormwater and snowmelt discharges are, by nature, time crowded, and concurrent discharges within a watershed shared by MSGP facilities. These discharges are mixtures of pollutants, not all of which are monitored under the MSGP, but should be minimized by the sector species control measures required by the MSGP. Further these discharges may physically disturb aquatic systems, through introduction of warmer water, and due to erosivity, redistributing bedded sediments and increasing turbidity. Stormwater events are episodic, with variable intensity and frequency which cannot be predicted at the resolution of stormwater events, however general expectations may be possible based on seasonal expectations for rain events. Snowmelt events are more tractable and could be modeled on a location by location basis using information on snowpack mass and expected thaw rates. The only fixed aggregate effects information that can be assessed at a national scale is the density of existing permits.

The 2,365 existing MSGP-permitted facilities are distributed among 543 sub-watersheds, so a detailed analysis on a watershed-by-watershed basis is not feasible for this Opinion. The greatest densities of MSGP permitted facilities occur in Puerto Rico and the east coast. The number of dischargers ranges from one to 31 facilities within in a single sub-watershed with densities of nearly 7 facilities per 10 square kilometers (~3.9 square miles), as found in the Cienaga de las Cucharillas drainage. By contrast, the densities of MSGP-permitted facilities on the west coast range up to just over one operation per 10 square kilometers (Table 26).

Table 26 Distribution and relative densities of existing MSGP-permitted facilities.

State	# sub-watersheds with MSGP permits	# MSGP Permits	Average density of facilities per 10 km^2	Minimum density per 10 km^2	Maximum density per 10 km^2
East Coast					
Massachusetts	165	777	0.43	0.06	2.28
New Hampshire	92	219	0.29	0.06	1.99
Vermont	3	4	0.16	0.1	0.24
District of Columbia	4	35	0.85	0.32	1.47
Delaware	1	1	0.09	0.09	0.09
Puerto Rico					
Puerto Rico	98	350	0.74	0.07	6.78
Gulf Coast States					
Texas	10	11	0.11	0.01	0.18
West Coast					
California	2	3	0.12	0.08	0.15
Idaho	139	269	0.19	0.01	1.38
Oregon	2	2	0.06	0.05	0.07
Washington	13	15	0.13	0.01	0.28
Pacific Island Territories					
American Samoa	1	1	0.07	0.07	0.07
Guam	5	9	0.44	0.11	1.24
Northern Marianas	1	1	0.24	0.24	0.24

Previously this Opinion described the distribution of facilities with metals exceedances among rivers and watersheds potentially used by Atlantic and shortnose sturgeon (Figure 12). Placing the locations of existing MSGP facilities with latitude- longitude data in context of NMFS designated critical habitat indicates substantial aggregation of facilities along waters potentially used by Atlantic and shortnose sturgeon (Figure 12), no overlap for Gulf sturgeon (Figure 13), and aggregates of facilities along coastline of Puerto Rico's *Acropora* designated critical habitat (Figure 14). The location data placing some Puerto Rico facilities in the ocean suggests that some location data may need correction. The greatest concentrations of MSGP-permitted facilities occur at Clarkston Idaho along the Idaho-Washington Border (six facilities) and along Clearwater River near Nezperce (four facilities, Figure 15). A total of 11 facilities are located in the Puget Sound area. There is only a single facility with location data in Southern California and it is not located near designated critical habitat for steelhead or abalone.

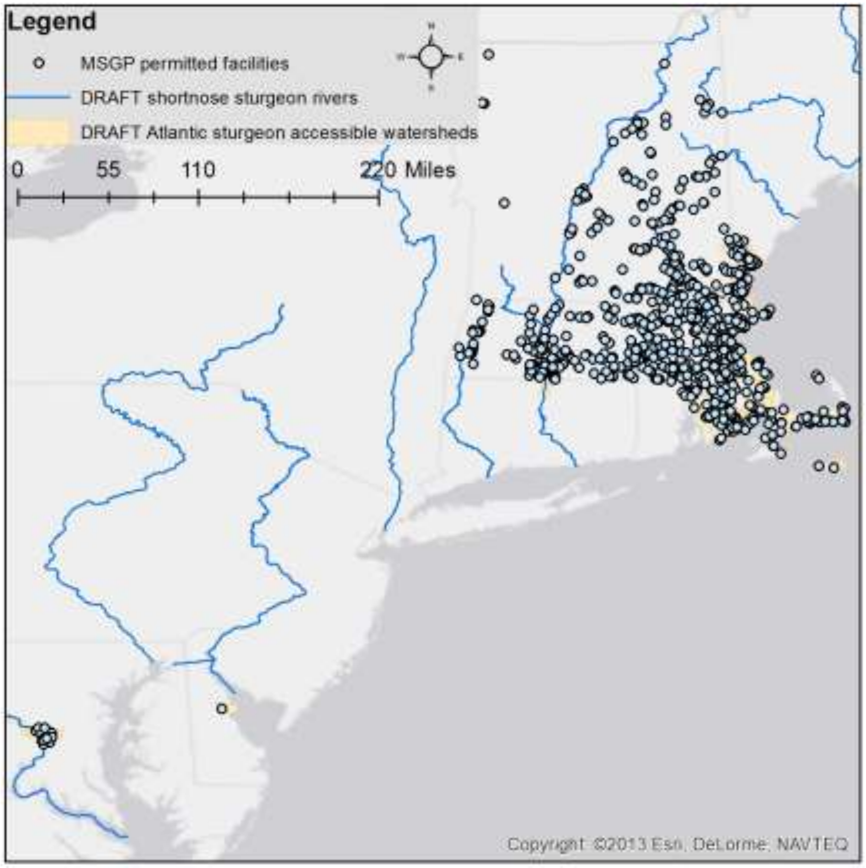

Figure 12 Distribution of MSGP facilities relative to areas potentially used by Atlantic and shortnose sturgeon (DRAFT).

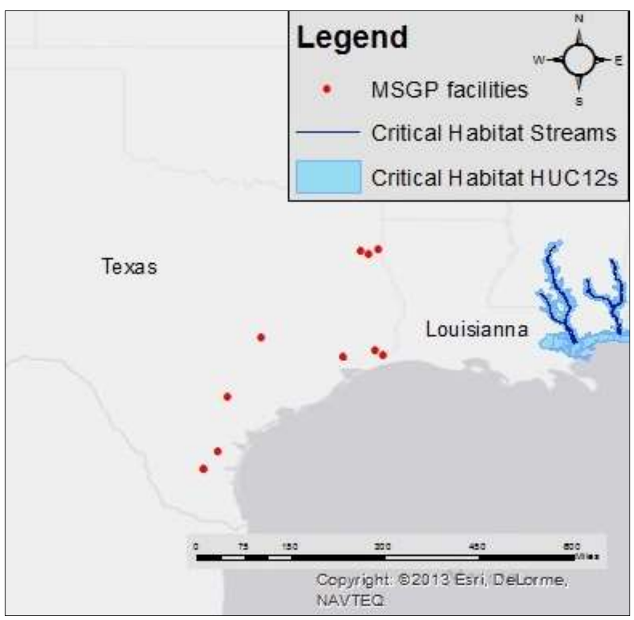

Figure 13 Distribution of MSGP facilities relative to designated critical habitat of the Gulf sturgeon.

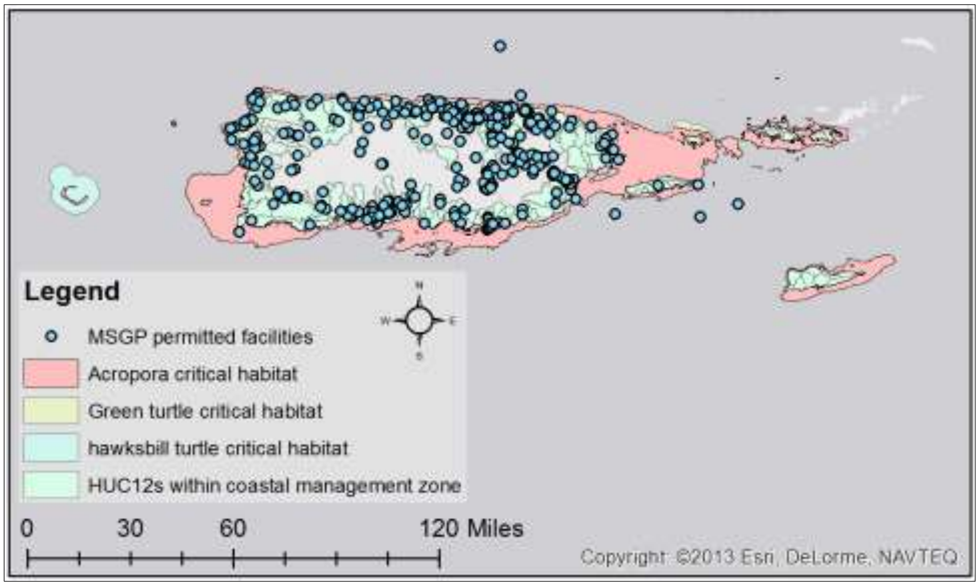

Figure 14 Distribution of MSGP facilities in Puerto Rico Relative to designated critical habitat for *Acropora*, hawksbill sea turtle, and green turtle (note: some inaccurate spatial data).

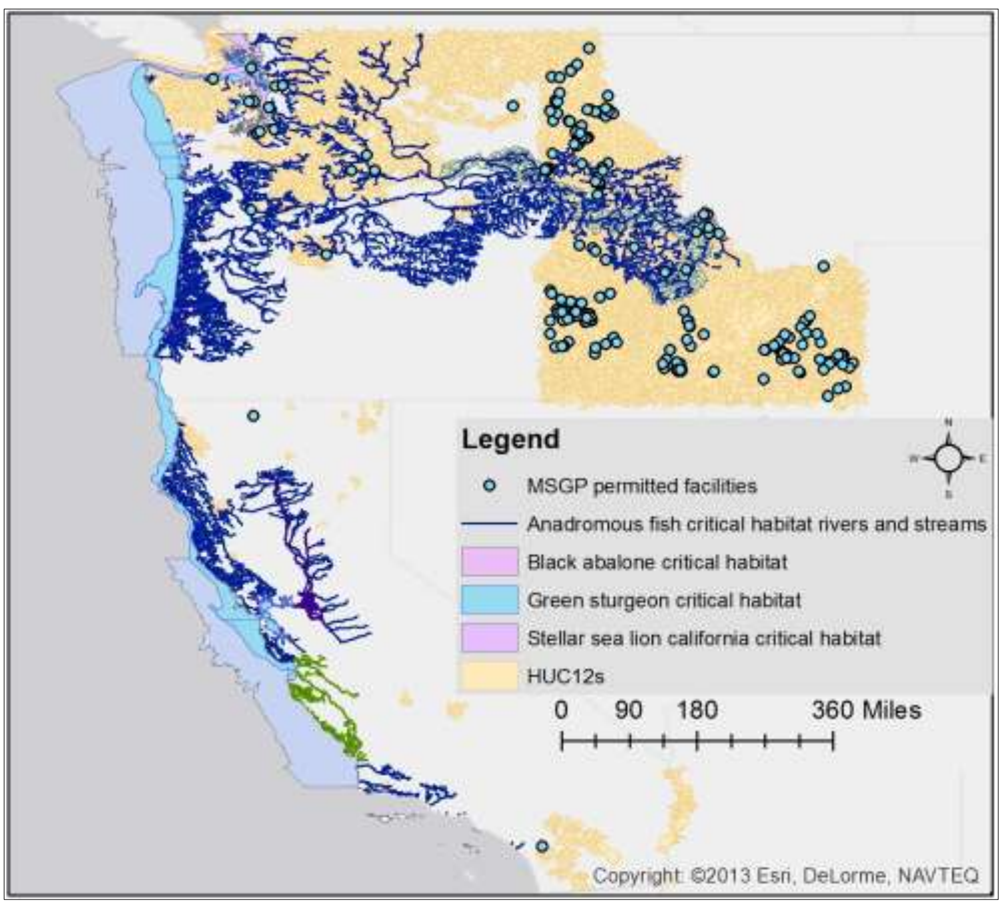

Figure 15 Distribution of MSGP facilities relative to designated critical habitat for Pacific salmonids, the green sturgeon, leatherback turtle, southern resident killer whale, eulachon, and proposed Puget sound rockfish.

It is reasonable to expect that new MSGP-permitted facilities will most likely be concentrated in the areas of industrial activity where other MSGP-permitted facilities are located. Note that, when considering potential effects to threatened and endangered species and their designated critical habitat, NMFS regional biologists reviewing a *Criterion C Eligibility Form* or conducting MSGP-related technical assistance or consultation will consider the individual discharge source in context of all stressor sources present within a watershed, not simply the pollutant load from the facility or the facility and neighboring MSGP-permitted sources.

7.6 Integration and Synthesis of Effects

EPA proposes to reissue the MSGP for Stormwater Discharges Associated with Industrial Activity. Through this permit, EPA would authorize stormwater discharges associated with industrial activity from 30 sectors into waters of the United States over the permit period from 2015 to 2020. The EPA estimates that the 2015 MSGP will reauthorize discharges from approximately 2,365 existing facilities and that an average of approximately 52 additional facilities will seek coverage under the MSGP each year totaling approximately 250 new facilities over the life of the 5-year permit. The proposed action, in the absence of successful implementation of the ESA eligibility criterion process, is likely to adversely affect species and designated critical habitats listed in Table 4.2. Here, we integrate information presented in this Opinion to summarize the action in its entirety and EPA's planned implementation of the permit.

Our Programmatic Effects Analysis assesses whether, and to what degree, EPA structured its permit to establish processes that addresses adverse effects to ESA-listed species, and ensures that authorized discharges are not likely to jeopardize the continued existence of endangered or threatened species or destroy or adversely modify designated critical habitat. We addressed this issue by answering seven questions:

First, we concluded that EPA is aware of the number and locations of existing facilities with MSGP permits and has provided this information to NMFS. EPA has also assessed the performance of its 2008 permit and has made adjustments based on this assessment for the 2015 MSGP. EPA is aware of the scope of their Action, and has used its existing permitting information to estimate the probable number of new discharges that it would authorize under the MSGP. Further, EPA plans to put additional measures in place to address the issue of incorrect selection of ESA Eligibility Criteria.

Second, we concluded that EPA has identified the physical, chemical or biotic stressors that are likely to be produced as a direct or indirect result of the discharges that would be authorized by the MSGP using data supplied by industry sources in the early years of industrial stormwater permitting. EPA has issued sector specific fact sheets identifying other pollutants which may be associated with these sectors and control measures to address them. We also concluded that, through improved reporting tools, EPA would know or be able to reliably estimate whether those discharges have occurred in concentrations, frequencies, or for durations that violate the terms of the MSGP.

EPA has demonstrated its prior ability to identify whether discharges have occurred in concentrations, frequencies, or for durations that violate the terms of the MSGP by sharing its assessment of the performance of the 2008 MSGP with respect to stressor concentrations in stormwater discharges. While the 2008 example indicated incomplete reporting and benchmark exceedances, NMFS concludes that changes made in the 2015 MSGP are expected to remedy these shortcomings. Specifically, permit holders are now required to file discharge monitoring reports, *Annual Report*s and other permit documentation electronically. The electronic reporting of discharge monitoring reports should allow EPA to readily identify discharges that exceed benchmarks and ELGs.

Third, NMFS concludes that EPA will be able to reliably estimate whether and to what degree ESA-listed species and designated critical habitat are likely to be exposed to potentially harmful impacts of discharges authorized by the permit by virtue of the exposure assessments that would be performed in context of consultations associated with Eligibility Criteria B, D or E or successful implementation of the *Criterion C Eligibility Form* procedure. The *Criterion C Eligibility Form* procedure requires that NMFS regional biologists review *Criterion C Eligibility Form*s and estimate whether and to what degree ESA-listed species and designated critical habitat are likely to be exposed to potentially harmful impacts of discharges authorized by the permit.

Fourth, NMFS concluded that, given successful implementation of the electronic reporting system and permittee compliance with the requirement to submit discharge monitoring reports, *Annual Report*s and other permit documentation electronically, EPA will have a mechanism for monitoring and feedback enabling it to identify, collect, and analyze information about its authorized discharges that may expose ESA-listed species and designated critical habitat to harmful stressors.

Fifth, NMFS concludes that the MSGP Eligibility Criteria selection procedure developed by EPA in consultation with us satisfy requirements of EPA to identify effects to ESA-listed species and designated critical habitat when implementing its MSGP. This requires that permit applicants make valid eligibility certifications and any issues identified in the process of seeking eligibility under Criterion C are successfully resolved or the permit applicant is referred to an individual permit and ESA consultation.

Sixth, NMFS concludes that EPA has a mechanism that will allow them to reliably determine whether and to what degree operators have complied with the conditions, restrictions, or mitigation measures required of the MSGP. The modernized ECHO and electronic reporting requirements under the MSGP will make this a straight forward task with respect to discharge monitoring and reporting compliance. Inspections are EPA's mechanism to directly verify compliance with control measures, but this mechanism is not easily employed for stormwater discharges, which are episodic in nature. Information provided in the *Annual Report*, taken with compliance with discharge limits, provides an indirect indication of compliance with permit control measures (i.e., installation and maintenance of BMPs etc.

Seventh, in the absence of additional measures that would be identified in the course of satisfying the ESA Eligibility Criteria (i.e., measures required for Eligibility Criteria B, D, and E, *Criterion C Eligibility Form* content), NMFS would not be able to conclude that EPA's MSGP has a mechanism to prevent or minimize listed resources' exposure to stressors in discharges if (1) EPA finds that these stressors occur at concentrations, durations, or frequencies that are potentially harmful to individual listed organisms, populations, or species; or (2) EPA identifies that the discharges lead directly or indirectly to ecological consequences that are potentially harmful to individual listed organisms, populations, species or PCEs of designated critical habitat. As stated when evaluating EPA's ability to assess exposures of listed resources, EPA's ability to prevent or minimize listed resources' exposure to harmful stressor intensities relies on the valid certification under Criterion A and the measures associated with Eligibility Criteria B, D or E or successful implementation of the *Criterion C Eligibility Form* procedure.

The analyses in this Opinion establish that in the absence of the ESA Eligibility Criteria procedure, exposures of ESA-listed species and designated critical habitat to stressors at concentrations resulting in adverse effects may occur under the MSGP. Our programmatic analysis of the 2015 MSGP measures to minimize risks to ESA-listed species and designated critical habitat through the ESA Eligibility Criterion procedure indicates that successful implementation required to ensure that measures have been or will be put in place that minimize any risk posed by MSGP-authorized discharges to ESA-listed species and their designated critical habitat. We rely particularly on the monitoring and reporting that EPA will conduct pursuant to the MSGP.

7.7 Cumulative Effects

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this Opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

During this consultation, NMFS searched for information on future State, tribal, local or private actions that were reasonably certain to occur in the action area. NMFS conducted electronic searches of business journals, trade journals and newspapers using electronic search engines. Those searches produced no evidence of future private action in the action area that would not require Federal authorization or funding and is reasonably certain to occur. As a result, at the spatial and temporal scale of this programmatic action, NMFS is not aware of any specific actions of this kind that are likely to occur in the action area during the near future.

While specific actions were not identified, the collective impact of ongoing activities contribute to climate change and associated effects on the distribution, frequency, and intensity of precipitation events resulting in stormwater and snowmelt discharges. Climate change is expected to impact the timing and intensity of stream seasonal flows (Staudinger et al. 2012). Warmer temperatures are expected to reduce snow accumulation and increase stream flows during the winter, cause spring snowmelt to occur earlier in the year, and reduced summer stream flows in rivers that depend on snow melt. As a result, seasonal stream flow timing will likely shift significantly in sensitive watersheds (Littell et al. 2009).

Climate change is projected to have substantial direct effects on individuals, populations, species, and the community structure and function of marine, coastal, and terrestrial ecosystems in the foreseeable future (McCarty 2001, IPCC 2002, Parry et al. 2007, IPCC 2013). Warming water temperatures attributed to climate change can have significant effects on survival, reproduction, and growth rates of aquatic organisms (Staudinger et al. 2012). Changes in stream flow due to use changes and seasonal run-off patterns may alter predator-prey interactions and change species assemblages in aquatic habitats. Climate-mediated changes in the global distribution and abundance of marine species are expected to reduce the productivity of the oceans by affecting keystone prey species in marine ecosystems such as phytoplankton, krill, and cephalopods. For example, climate change may reduce recruitment in krill by degrading the quality of areas used for reproduction (Walther et al. 2002). Warmer water also stimulates biological processes which can lead to environmental hypoxia. Oxygen depletion in aquatic ecosystems can result in anaerobic metabolism increasing, thus leading to an increase in metals and other pollutants being released into the water column (Staudinger et al. 2012).

In summary, the direct effects of climate change include increases in atmospheric temperatures, decreases in sea ice, and changes in sea surface temperatures, patterns of precipitation, and sea level. Indirect effects of climate change include altered reproductive seasons/locations, shifts in migration patterns, reduced distribution and abundance of prey, and changes in the abundance of competitors and/or predators. Climate change is most likely to have its most pronounced effects on species whose populations are already in tenuous positions (Williams et al. 2008).

8 Conclusion

After placing the current status of ESA-listed and proposed to be listed species, the environmental baseline, the potential effects of the action, and the cumulative effects of concurrent and future nonfederal actions in context of the controls, monitoring, and feedback loops and integration of NMFS expertise through the ESA Eligibility Criteria Procedure, it is our biological and conference opinion that EPA has insured that its action is not likely to jeopardize any listed or proposed species under NMFS' jurisdiction.

After placing the current status of the designated critical habitat, critical habitat proposed for designation listing under the ESA, the environmental baseline, the potential effects of the action, and the cumulative effects of concurrent and future nonfederal actions in context of the controls monitoring and feedback loops, and integration of NMFS expertise through the ESA Eligibility Criteria Procedure, it is our biological opinion that EPA has insured that its action, as described in this Opinion, is not likely to destroy or adversely modify designated critical habitat.

9 Incidental Take Statement

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption (see below). Take is defined as to: "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct." Harm is further defined by NMFS to include significant habitat modification or degradation that results in death or injury to ESA-listed species by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The basis for take of ESA-listed species anticipated under MSGP authorized actions has been set forth in the effects section of this Opinion, and NMFS has provided a detailed explanation of the conditions under which stormwater discharges, even when in compliance with MSGP benchmarks, result in take. However, NMFS believes that incidental take is still possible. The benchmarks applied in the MSGP are based on EPA's Guidelines for the Protection of Aquatic life, which have not been evaluated by NMFS for protectiveness of ESA listed species under NMFS jurisdiction. Engagement of NMFS expertise through the MSGP ESA Eligibility Criteria procedure and the terms and conditions listed below is expected to eliminate or minimize take. Given the scope, complexity, wide geographic reach and uncertainty of the type, frequency, location and intensity of stormwater events, NMFS, however, is unable to specify an amount or extent of take in terms of numbers of individuals or units of habitat for the entire extent of individual permit authorizations made under the MSGP permitting program. Any take is identified through the MSGP ESA Eligibility Criteria procedure with which proposed dischargers are required to comply. Take of a threatened or endangered species resulting from discharges or discharge-related activities under the MSGP is only authorized when:

(1) Take has been authorized under the ESA of 1973, as amended, through a separate permit pursuant to ESA section 10(a)(1)(A)(a permit for research or to enhance the survival or propagation of an endangered or threatened species), ESA section and 10(a)(1)(B)(a permit exempting incidental "take" of endangered species or threatened species), both cases certifying under MSGP eligibility criterion E,

(2) Take is exempted through an Incidental Take Statement included in an Opinion for a specific MSGP-permitted facility (i.e., certifying eligibility through criteria B or D). Where a discharger proposes to discharge under the MSGP and the discharge may cause the take of a ESA-listed species, permitees must either be in compliance with section 7 and the exemption of take in a previously issued incidental take statement for facilities certifying eligibility under criterions B or D, or must submit a *Criterion C Eligibility Form* for review by EPA and NMFS at least 30 days prior to filing the NOI for permit coverage and must implement any additional controls identified by NMFS to avoid or eliminate adverse effects on ESA-listed species and critical habitat before the discharge is authorized.

Accordingly, the amount or extent of any incidental take has been or will be more fully developed for those individual existing and new dischargers certifying under the MSGP's ESA Eligibility Criteria procedure that section 7 consultation has been completed (i.e., Eligibility Criteria B or D).

This programmatic consultation focuses on whether the EPA has insured that their issuance of the general permit is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of designated critical habitat of such species. It does not address specific actions that the general permit would authorize. We focus instead on whether EPA's program functions sufficiently to prevent or minimize take resulting from individual discharges. .

In addition to any incidental take authorized in documentation supporting individual facility certifications under ESA eligibility criteria B and D, NMFS identifies the following as a surrogate for the allowable extent of take for the MSGP program as a whole: the ability to proceed without any adverse incident as defined in the MSGP to ESA-listed species or designated critical habitat attributable to any stormwater discharged in accordance with the general permit in the range of listed endangered or threatened species under NMFS' jurisdiction. An adverse incident is considered attributable to stormwater discharged in accordance with the general permit if the stormwater is known to have been discharged prior to, and near or upstream of the adverse incident and there is evidence that the stormwater caused the adverse incident (e.g. bank incision, erosion, sedimentation, elevated pollutants).

The RPMs described below are designed to ensure the successful implementation of the ESA Eligibility Criteria procedure and benchmark monitoring which NMFS believes will reduce or in most cases prevent the exposure of endangered or threatened species under NMFS' jurisdiction to stressors resulting from MSGP-authorized discharges.

Reasonable and Prudent Measures (RPMs)

The measures to avoid or minimize take described below are non-discretionary and must be undertaken by the EPA so that they become a binding condition of the EPA's MSGP implementation and oversight responsibilities, as appropriate, for the exemption in section 7(a)(2) to apply. The EPA has a continuing duty to regulate the activities it authorizes which are covered by this incidental take statement. The protective coverage of section 7(a)(2) may lapse if the EPA fails to assume and implement the terms and conditions. In order to monitor the impact of incidental take, the EPA must report the progress of the action to NMFS Office of Protected Resources consistent with Term & Condition 2 as specified in the incidental take statement (50 CFR§402.14(i)(3)). The reporting requirements are established in accordance with 50 CFR 220.45 and 228.5.

The RPMs, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the action and subsequent monitoring, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The Federal agency must immediately provide an explanation of the causes of the taking and review with NMFS the need for possible modification of the RPMs.

NMFS believes all measures described as part of the proposed action, together with the RPMs described below, are necessary and appropriate to minimize the likelihood of incidental take of ESA-listed species due to implementation of the proposed action.

1) EPA must gather information on the activities authorized by the MSGP including any corrective actions reported on the permittees' Annual Reports. EPA will report this information to NMFS.

2) To ensure compliance with the MSGP, EPA must monitor the effectiveness of the MSGP provisions for the protection of endangered and threatened species and designated critical habitat and report this information to NMFS.

Terms and Conditions

To be exempt from the prohibitions of section 9 of the ESA, the EPA must comply with the following terms and conditions. These terms and conditions implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary to allow the exemption to apply.

1) The EPA will compile and provide to NMFS an annual report that will include the data from EPA's ICIS summarizing the covered facilities as well as reporting and monitoring data submitted by the facilities to EPA pursuant to the MSGP. (This annual report should not be confused with the annual reports provided to EPA from the covered facilities.) The report should include, at minimum, the following data:
   a) Locations of facilities covered under the MSGP by selected criterion (these should be provided in an electronic spreadsheet including at minimum: facility sector/subsector, name, ESA criterion selection, state, and geographic point data for the facilities and their outfall locations).
   b) All instances of facilities covered under any ESA criteria that exceeded benchmarks and numeric ELGs for their subsector(s) during one or more quarterly monitoring efforts and data associated with these exceedences.
   c) All instances where an operator (or EPA) determined there was a need to consider corrective actions at facilities covered under any criteria. This listing should also include, if available, the trigger for corrective actions (e.g., spill, lack of required control, etc.) and the outcome (e.g., any actions taken or implemented to correct the problem).
   d) Any observed/reported impacts to ESA-listed species or designated critical habitat as documented by facilities during or between the required inspection and/or monitoring efforts conducted at the facility[45].
   e) For facilities certifying under Criterion C, a brief description of any instances of coverage provided under the MSGP where the reviewing Service field office initially noted, in writing, that the facility's proposal did not appear to support coverage under the permit. The description shall include how the Service's concerns were addressed, and will specify whether the reviewing Service field office provided confirmation that any additional information and/or changes to the proposal (including but not limited to additional BMPs) were sufficient to address the Service's concerns.
   f) All data in bullets 1 a-e above should be provided to NMFS Headquarter Office (see accompanying cover letter) along with a brief summary, and:
      i) If possible, data should be submitted in a format that is sortable (such as an electronic spreadsheet that can be sorted by sector/subsector, state, county, receiving waters, and parameter measured/exceeded at minimum).

45 While we recognize that the ICIS system does not specifically request this information, if such information is provided in the narrative section of the report, EPA should forward this to NMFS as part of their annual report of implementation of the MSGP.

   ii) The data should be clearly linked to sector type, geographic location (e.g., point data) to enable efficient review by NMFS that can be linked to the data specified in 1a above (e.g., to facility ID and location to allow for review by receiving water).

2) The first annual report should be submitted to NMFS no later than 3 months after the deadline for submitting results from the fourth quarterly inspection after issuance of the permit, as described by the MSGP.
   a) Subsequent annual reports to NMFS should be submitted at 12-month intervals after this date.
   b) For the first monitoring report to NMFS, EPA may request a 3-month extension to the report submission deadline to address unforeseen challenges with querying and compiling information from the new reporting system.
3) NMFS will meet with EPA to discuss the results and determine if modifications to the MSGP's implementation may need to be considered.
4) A preliminary report listing facility locations should be submitted to NMFS no later than 12 months after the issuance of the permit.
5) The EPA shall include the following instructions requiring reporting of adverse incidents to ESA-listed species online:

*"*NOTICE: Under section 9 (a)(1)(B) of the Endangered Species Act, with respect to any endangered species of fish or wildlife listed pursuant to section 4 of this Act, it is unlawful for any person subject to the jurisdiction of the United States to take any such species within the United States or the territorial sea of the United States. To ensure consistency with the conditional take exemption associated with the MSGP, MSGP-authorized dischargers shall notify the nearest National Marine Fisheries Service (NMFS) Regional Office within three days upon finding any dead, injured, or sick, specimen, nest, and/or egg(s) of endangered or threatened species under NMFS jurisdiction that appears to have been harmed by MSGP-authorized discharges into Waters of the United States. In addition, notify the National Marine Fisheries Service, Office of Protected Resources at (301) 427-8400 and EPA at msgpesa@epa.gov.

Include the date, time, and precise location of the injured animal, carcass, nest, and/or egg and any other pertinent information in your notification. Leave the plant or animal alone, make note of any circumstances likely causing the death or injury, note the location and number of individuals involved and, if possible, take photographs. The finder may be asked to carry out instructions provided by NMFS to collect specimens or take other measures to ensure that evidence intrinsic to the specimen is preserved. Care should be taken in handling sick or injured specimens to preserve biological materials in the best possible state for later analysis of cause of death, if that occurs.*"*

All such instances should also be documented in the *Annual Report* from EPA.

Terms and Conditions to implement RPM 2:

Possible errors were made by proposed dischargers in previous iterations of the MSGP was the incorrect assessment that threatened or endangered species or their designated critical habitat do not overlap with the facilities' action area. That is to say, they incorrectly certify that they are eligible to discharge under ESA eligibility criterion A. EPA has added an addendum to its action that it will review a subset of facilities certifying under Criterion A, identified through coordination with NMFS, to ensure that they have made a correct certification.

NMFS is adding the following terms and conditions to fully address RPM 2:

6) EPA will post on their website maps that show ranges of NMFS' ESA-listed species and designated critical habitat.

7) As stated in its project description, EPA will review a subset of the Criterion A certifications to determine whether those certifications are valid, including verifying that the discharge locations identified are correct.

8) EPA will provide future information and/or coordination regarding unexpected developments once a facility is provided coverage under the MSGP if the reviewing NMFS regional office requests it. For example, NMFS may want to review post event control measures for a facility that has experienced a flood, fire, or some other event potentially affecting stormwater control measures and stormwater constituents.

10 CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on ESA-listed species or designated critical habitat, to help implement recovery plans, or to develop information.

The following conservation recommendations would provide information for future consultation involving EPA's issuance and implementation of the MSGP:

- Review and update the contents of the Sector Specific Fact Sheets to ensure that the pollutants listed and recommended BMPs are up to date. The fact sheets should systematically and clearly identify measures with similar level of detail.
- Develop additional tools to assist facility operators with further measures and considerations that will improve both the EPA's and the facilities' efforts to consistently avoid, reduce, or minimize effects to ESA-listed species and designated critical habitat associated with the MSGP.
- Maintain a list of receiving waters where Criterion A has been selected in error in previous permit cycles and crosscheck requests for coverage under Criterion A against this list to avoid inadvertent errors in criterion selection as NOIs are submitted. As additional receiving

waters are identified where ESA-listed species and/or designated critical habitat are likely to occur either through notification by NMFS or through other means (e.g., the EPA's proposed review of a subsample of Criterion A facilities), the list and crosscheck should be expanded accordingly. For example, facilities discharging to the following receiving waters should generally not be allowed to proceed with coverage under Criterion A:
  - Puerto Rico coastal management zone
  - Washington: Puget Sound; tributaries to eastern Puget Sound, from the Puyallup River north; mainstem Columbia River; and certain tributaries to the Upper and Lower Yakima River
  - New England: Watersheds accessible to anadromous species
- Encourage facilities to describe and ensure control maintenance schedules are clearly defined and adhered to as part of their SWPPP, and that these activities are addressed both in the eNOIs, and, where applicable, in *Criterion C Eligibility Form*. For example, facilities that include settling ponds or other controls that allow contaminants to settle out prior to discharge into the receiving waters should specify the maintenance schedule for removing contaminants and confirm such maintenance was performed in *Annual Report*ing. This would be of particular concern in dry areas (such as portions of the desert Southwest), where contaminants that are successfully filtered out during a storm event may be resuspended and discharged in future storm events occurring many months later.
- Begin informal ESA Section 7 consultation ("preconsultation") during the development of the next draft MSGP permit in the Federal Register for public comment. This will allow EPA to incorporate recommended actions designed to protect ESA-listed species and designated critical habitat into its permits at an early stage and receive public comment on these actions.
- Maintain informal dialogue with NMFS on the events and observations for MSGP performance over the course of the permit term.

In order to keep NMFS' Endangered Species Division informed of actions minimizing or avoiding adverse effects, or benefiting ESA-listed species or their habitats, the U.S. Environmental Protection Agency should notify the NMFS Office of Protected Resources of any conservation recommendations they implement in their final action by contacting the Service's Headquarters Office at the address listed on the cover letter to this document.

11 Reinitiation Notice

This concludes formal consultation on the U.S. Environmental Protection Agency's issuance of the Multi-Sector General Permit. As provided in 50 CFR 402.16, Reinitiation of formal 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 the amount or extent of taking specified in the incidental take statement is exceeded;

(b) If new information reveals effects of the action that may affect ESA-listed species or designated critical habitat in a manner or to an extent not previously considered;

(c) If the effluent limits in the permit are revised to be less stringent

(d) If the identified action is subsequently modified in a manner that causes an effect to the ESA-listed species or designated critical habitat that was not considered in the biological opinion; or

(e) If a new species is listed or critical habitat is designated that may be affected by the identified action.

(f) Eligibility certifications for Criteria B and D-certifying facilities are found to be invalid due to consultations that did not actually occur, are out of date, have exceed specified take, or with Opinions that have unimplemented RPAs

(g) Unsuccessful implementation of the Criterion C eligibility procedure as specified according to the procedures outlined in the description of the action,

(h) Invalid Criterion A certifications (i.e. incorrectly claiming species are not present in the action area) that are not referred to the Criterion C procedure or an individual permit,

(i) Invalid criterion E certifications. For those facilities with ESA Eligibility Certifications based on an existing formal consultation, any instance where the amount or extent of take specified in the incidental take statement is exceeded requires that the U.S. Environmental Protection Agency must immediately request reinitiation of Section 7 consultation.

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APPENDIX A: DRAFT MULTISECTOR GENERAL PERMIT

APPENDIX B: DEFINITIONS

Action – all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies in the United States or upon the high seas. Examples include, but are not limited to: (a) actions intended to conserve ESA-listed species or their habitat; (b) the promulgation of regulations;(c) the granting of licenses, contracts, leases, easements, rightsof–way, permits, or grants–in–aid; or (d) actions directly or indirectly causing modifications to the land, water, or air. [50 CFR §402.02]

Action area – 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]

In the MSGP, the **action area** is defined explicitly to include, for the purposes of the permit and for application of Endangered Species Act requirements, the following:

The areas where stormwater discharges originate and flow from the industrial facility to the point of discharge into receiving waters. (Example: Where stormwater flows into a ditch, swale, or gully that leads to receiving waters and where ESA-listed species (such as listed amphibians) are found in the ditch, swale, or gully.)

The areas where stormwater from industrial activities discharge into receiving waters and the areas in the immediate vicinity of the point of discharge. (Example: Where stormwater from industrial activities discharges into a stream segment that is known to harbor listed aquatic species.)

The areas where stormwater controls will be constructed and operated, including any areas where stormwater flows to and from the stormwater controls. (Example: Where a stormwater retention pond would be built.)

The areas upstream and/or downstream from the stormwater discharge into a stream segment that may be affected by these discharges. (Example: Where sediment discharged to a receiving stream settles downstream and impacts a breeding area of a listed aquatic species.)

Control(s)

In the MSGP, the term ***Control Measures*** refers to any stormwater control or other method (including narrative effluent limitations) used to prevent or reduce the discharge of pollutants to waters of the United States.

In the Biological Opinion, the term ***Adequacy of Controls*** refers to the adequacy of mechanisms to prevent or minimize listed resources' exposure to stressors in discharges if (1) EPA finds that these stressors occur at concentrations, durations, or frequencies that are potentially harmful to individual listed organisms, populations, or species; or (2) EPA identifies that the discharges lead directly or indirectly to ecological consequences that are potentially harmful to individual listed organisms, populations, species or PCEs of designated critical habitat. Mechanisms to prevent exposure include the ESA Eligibility Criterion process through which ESA concerns regarding the proposed discharge are addressed.

Corrective Action – for the purposes of the MSGP, any action taken, or required to be taken, to (1) repair, modify, or replace any stormwater control used at the site; (2) clean up and dispose of spills, releases, or other deposits found on the site; and (3) remedy a permit violation.

Discharge – when used without qualification, means the "discharge of a pollutant." See 40 CFR 122.2.

Discharge of a Pollutant – any addition of any “pollutant” or combination of pollutants to “waters of the United States” from any “point source,” or any addition of any pollutant or combination of pollutants to the waters of the “contiguous zone” or the ocean from any point source other than a vessel or other floating craft which is being used as a means of transportation. This includes additions of pollutants into waters of the United States from: surface runoff which is collected or channeled by man; discharges through pipes, sewers, or other conveyances, leading into privately owned treatment works. See 40 CFR 122.2.

Discharge Point – for the purposes of this permit, the location where collected and concentrated stormwater flows are discharged from the facility.

Discharge–Related Activity – activities that cause, contribute to, or result in stormwater and allowable non–stormwater point source discharges, and measures such as the siting,

Discharge to an Impaired Water – for the purposes of this permit, a discharge to an impaired water occurs if the first water of the U.S. to which you discharge is identified by a State, Tribe, or EPA pursuant to Section 303(d) of the Clean Water Act as not meeting an applicable water quality standard, or is included in an EPA–approved or established total maximum daily load (TMDL). For discharges that enter a storm sewer system prior to discharge, the water of the U.S. to which you discharge is the first water of the U.S. that receives the stormwater discharge from the storm sewer system.

Effective Operating Condition – for the purposes of this permit, a stormwater control is kept in effective operating condition if it has been implemented and maintained in such a manner that it is working as designed to minimize pollutant discharges.

Effluent Limitations – for the purposes of the MSGP, any of the Part 2 or Part 3 requirements.

Effluent Limitations Guideline (ELG) – defined in 40 CFR § 122.2 as a regulation published by the Administrator under section 304(b) of CWA to adopt or revise effluent limitations.

Electronic Notice of Intent (eNOI) – EPA's online system for submitting electronic Multi–Sector General Permit forms.

Eligible – for the purposes of the MSGP, refers to stormwater and allowable non–stormwater discharges that are authorized for coverage under this general permit.

Existing Discharger – an operator applying for coverage under the MSGP for discharges authorized previously under an NPDES general or individual permit.

Facility or Activity – any NPDES "point source" (including land or appurtenances thereto) that is subject to regulation under the NPDES program. See 40 CFR 122.2.

Federal Operator – an entity that meets the definition of "Operator" in the MSGP and is either any department, agency or instrumentality of the executive, legislative, and judicial branches of the Federal government of the United States, or another entity, such as a private contractor, operating for any such department, agency, or instrumentality.

Hazardous Materials or Hazardous Substances or Hazardous or Toxic Waste – for the purposes of the MSGP, any liquid, solid, or contained gas that contain properties that are dangerous or potentially harmful to human health or the environment. See also 40 CFR §261.2.

Impaired Water (or "Water Quality Impaired Water" or "Water Quality Limited Segment") – for the purposes of the MSGP, waters identified as impaired on the CWA Section 303(d) list, or waters with an EPA–approved or established TMDL. Your industrial facility will be considered to discharge to an impaired water if the first water of the U.S. to which you discharge is identified by a state, tribe, or EPA pursuant to Section 303(d) of the CWA as not meeting an applicable water quality standard, or is included in an EPA–approved or established total maximum daily load (TMDL). For discharges that enter a storm sewer system prior to discharge, the first water of the U.S. to which you discharge is the waterbody that receives the stormwater discharge from the storm sewer system.

Indian Country or Indian Country Lands – defined at 40 CFR 122.2 as:

(a) All land within the limits of any Indian reservation under the jurisdiction of the United States Government, notwithstanding the issuance of any patent, and including rights–of–way running through the reservation;
(b) All dependent Indian communities within the borders of the United States, whether within the original or subsequently acquired territory thereof, and whether within or without the limits of a State: and

(c) All Indian allotments, the Indian titles to which have not been extinguished, including rights–of–way running through the same. This definition includes all land held in trust for an Indian tribe. (18 U.S.C. 1151)

Industrial Activity – the 10 categories of industrial activities included in the definition of "stormwater discharges associated with industrial activity" as defined in 40 CFR 122.26(b)(14)(i) –(ix) and (xi).

Industrial Stormwater – stormwater runoff from industrial activity.

Minimize – to reduce and/or eliminate to the extent achievable using control measures that are technologically available and economically practicable and achievable in light of best industry practices.

National Pollutant Discharge Elimination System (NPDES) – defined at 40 CFR §122.2 as the national program for issuing, modifying, revoking and reissuing, terminating, monitoring and enforcing permits, and imposing and enforcing pretreatment requirements, under sections 307, 402, 318, and 405 of CWA. The term includes an 'approved program.'

New Discharger – a facility from which there is a discharge, that did not commence the discharge at a particular site prior to August 13, 1979, which is not a new source, and which has never received a finally effective NPDES permit for discharges at that site. See 40 CFR 122.2.

New Source – any building, structure, facility, or installation from which there is or may be a "discharge of pollutants," the construction of which commenced:

- after promulgation of standards of performance under section 306 of the CWA which are applicable to such source, or
- after proposal of standards of performance in accordance with section 306 of the CWA which are applicable to such source, but only if the standards are promulgated in accordance with section 306 within 120 days of their proposal. See 40 CFR 122.2.

New Source Performance Standards (NSPS) – technology–based standards for facilities that qualify as new sources under 40 CFR 122.2 and 40 CFR 122.29.

No Exposure – all industrial materials or activities protected by a storm–resistant shelter to prevent exposure to rain, snow, snowmelt, and/or runoff. See 40 CFR 122.26(g).

Non–Stormwater Discharges – discharges that do not originate from storm events. They can include, but are not limited to, discharges of process water, air conditioner condensate, non–contact cooling water, pavement wash water, external building washdown, irrigation water, or uncontaminated ground water or spring water.

Notice of Intent (NOI) – the form (electronic or paper) required for authorization of coverage under the Multi–Sector General Permit.

Notice of Termination (NOT) – the form (electronic or paper) required for terminating coverage under the Multi–Sector General Permit.

Operator – any entity with a stormwater discharge associated with industrial activity that meets either of the following two criteria:

The entity has operational control over industrial activities, including the ability to make modifications to those activities; or

The entity has day–to–day operational control of activities at a facility necessary to ensure compliance with the permit (e.g., the entity is authorized to direct workers at a facility to carry out activities required by the permit).

Permitting Authority – for the purposes of the MSGP, EPA, a Regional Administrator of EPA, or an authorized representative.

Point Source – any discernible, confined, and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, landfill leachate collection system, vessel, or other floating craft from which pollutants are or may be discharged. This term does not include return flows from irrigated agriculture or agricultural stormwater runoff. See 40 CFR 122.2.

Pollutant – defined at 40 CFR §122.2. A partial listing from this definition includes: dredged spoil, solid waste, incinerator residue, filter backwash, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt, and industrial, municipal and agricultural waste discharged into water. See 40 CFR 122.2.

Pollutant of Concern – a pollutant which causes or contributes to a violation of a water quality standard, including a pollutant which is identified as causing an impairment in a state's 303(d) list.

Primary Industrial Activity – includes any activities performed on–site which are (1) identified by the facility’s primary SIC code and included in the descriptions of 122.26(b)(14)(ii), (iii), (vi), and (viii); or (2) included in the narrative descriptions of 122.26(b)(14)(i), (iv), (v), or (vii), and (ix). [For co–located activities covered by multiple SIC codes, it is recommended that the primary industrial determination be based on the value of receipts or revenues or, if such information is not available for a particular facility, the number of employees or production rate for each process may be compared. The operation that generates the most revenue or employs the most personnel is the operation in which the facility is primarily engaged. In situations where the vast majority of on–site activity falls within one SIC code, that activity may be the primary industrial activity.] Narrative descriptions in 40 CFR 122.26(b)(14) identified above include: (i) activities subject to stormwater effluent limitations guidelines, new source performance standards, or toxic pollutant effluent standards; (iv) hazardous waste treatment storage, or disposal facilities including those that are operating under interim status or a permit under subtitle C of the Resource Conservation and Recovery Act (RCRA); (v) landfills, land application sites and open dumps that receive or have received industrial wastes; (vii) steam electric power generating facilities; and (ix) sewage treatment works with a design flow of 1.0 mgd or more.

Programmatic consultation – consultation addressing an agency's multiple actions on a program, regional or other basis. [Clarification of usage]

Qualified Personnel – qualified personnel are those who possess the knowledge and skills to assess conditions and activities that could impact stormwater quality at your facility, and who can also evaluate the effectiveness of control measures.

Reportable Quantity Release – a release of a hazardous substance at or above the established legal threshold that requires emergency notification. Refer to 40 CFR Parts 110, 117, and 302 for complete definitions and reportable quantities for which notification is required.

Run–On – sources of stormwater that drain from land located upslope or upstream from the regulated facily in question.

Significant Materials – includes, but is not limited to: raw materials; fuels; materials such as solvents, detergents, and plastic pellets; finished materials such as metallic products; raw materials used in food processing or production; hazardous substances designated under section 101(14) of CERCLA; any chemical the facility is required to report pursuant to section 313 of Title III of SARA; fertilizers; pesticides; and waste products such as ashes, slag and sludge that have the potential to be released with stormwater discharges. See 40 CFR 122.26(b)(12).

Stormwater Discharges Associated with Industrial Activity – the discharge from any conveyance that is used for collecting and conveying stormwater and that is directly related to manufacturing, processing or raw materials storage areas at an industrial plant. The term does not include discharges from facilities or activities excluded from the NPDES program under Part 122. For the categories of industries identified in this section, the term includes, but is not limited to, stormwater discharges from industrial plant yards; immediate access roads and rail lines used or traveled by carriers of raw materials, manufactured products, waste material, or by–products used or created by the facility; material handling sites; refuse sites; sites used for the application or disposal of process waste waters (as defined at part 401 of this chapter); sites used for the storage and maintenance of material handling equipment; sites used for residual treatment, storage, or disposal; shipping and receiving areas; manufacturing buildings; storage areas (including tank farms) for raw materials, and intermediate and final products; and areas where industrial activity has taken place in the past and significant materials remain and are exposed to stormwater. For the purposes of this paragraph, material handling activities include storage, loading and unloading, transportation, or conveyance of any raw material, intermediate product, final product, by–product or waste product. The term excludes areas located on plant lands separate from the plant's industrial activities, such as office buildings and accompanying parking lots as long as the drainage from the excluded areas is not mixed with stormwater drained from the above described areas. Industrial facilities include those that are federally, State, or municipally owned or operated that meet the description of the facilities listed in 40 CFR 122.26(b)(14). The term also includes those facilities designated under the provisions of 40 CFR 122.26(a)(1)(v). See 40 CFR 122.26(b)(14).

Tier 2 Waters – For antidegradation purposes, pursuant to 40 CFR 131.12(a)(2), Tier 2 waters are characterized as having water quality that exceeds the levels necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water.

Tier 2.5 Waters – For antidegradation purposes, Tier 2.5 waters are those waters designated by States or Tribes as requiring a level of protection equal to and above that given to Tier 2 waters, but less than that given Tier 3 waters.States have special requirements for these waters.

Tier 3 Waters – For antidegradation purposes, pursuant to 40 CFR 131.12(a)(3), Tier 3 waters are identified by states as having high quality waters constituting an Outstanding Natural Resource Water (ONRW), such as waters of National Parks and State Parks, wildlife refuges, and waters of exceptional recreational or ecological significance.

Total Maximum Daily Loads (TMDLs) – The sum of the individual wasteload allocations (WLAs) for point sources and load allocations (LAs) for nonpoint sources and natural background. If receiving water has only one point source discharger, the TMDL is the sum of that point source WLA plus the LAs for any nonpoint sources of pollution and natural background sources, tributaries, or adjacent segments. TMDLs can be expressed in terms of either mass per time, toxicity, or other appropriate measure. (See section 303(d) of the Clean Water Act and 40 CFR 130.2 and 130.7).

Upset – Upset means an exceptional incident in which there is unintentional and temporary noncompliance with technology based permit effluent limitations because of factors beyond your reasonable control. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation. See 40 CFR 122.41(n)(1).

Water Quality Standards – defined in 40 CFR § 131.3, and are provisions of State or Federal law which consist of a designated use or uses for the waters of the United States, water quality criteria for such waters based upon such uses, and an antidegradation policy to protect high–quality waters. Water quality standards protect the public health or welfare, enhance the quality of water and serve the purposes of the Act.

Waters of the United States – defined at 40 CFR §122.2 as:

1. All waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide;
2. All interstate waters, including interstate wetlands;
3. All other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds the use, degradation, or destruction of which would affect or could affect interstate or foreign commerce including any such waters:
   (d) Which are or could be used by interstate or foreign travelers for recreational or other purposes;
   (e) From which fish or shellfish are or could be taken and sold in interstate or foreign commerce; or
   (f) Which are used or could be used or could be used for industrial purposes by industries in interstate commerce;
4. All impoundments of waters otherwise defined as waters of the United States under this definition;
5. Tributaries of waters identified in paragraphs (1) through (4) of this definition;
6. The territorial sea; and
7. Wetlands adjacent to waters (other than waters that are themselves wetlands) identified in paragraphs (1) through (6) of this definition.

Waste treatment systems, including treatment ponds or lagoons designed to meet the requirements of CWA (other than cooling ponds as defined in 40 CFR 423.11(m) which also meet the criteria of this definition) are not waters of the United States. This exclusion applies only to manmade bodies of water which neither were originally created in waters of the United States (such as disposal area in wetlands) nor resulted from the impoundment of waters of the United States. Waters of the United States do not include prior converted cropland. Notwithstanding the determination of an area's status as prior converted cropland by any other federal agency, for the purposes of the Clean Water Act, the final authority regarding Clean Water Act jurisdiction remains with EPA.

In applying this definition, EPA will consider applicable Court cases and current guidance.