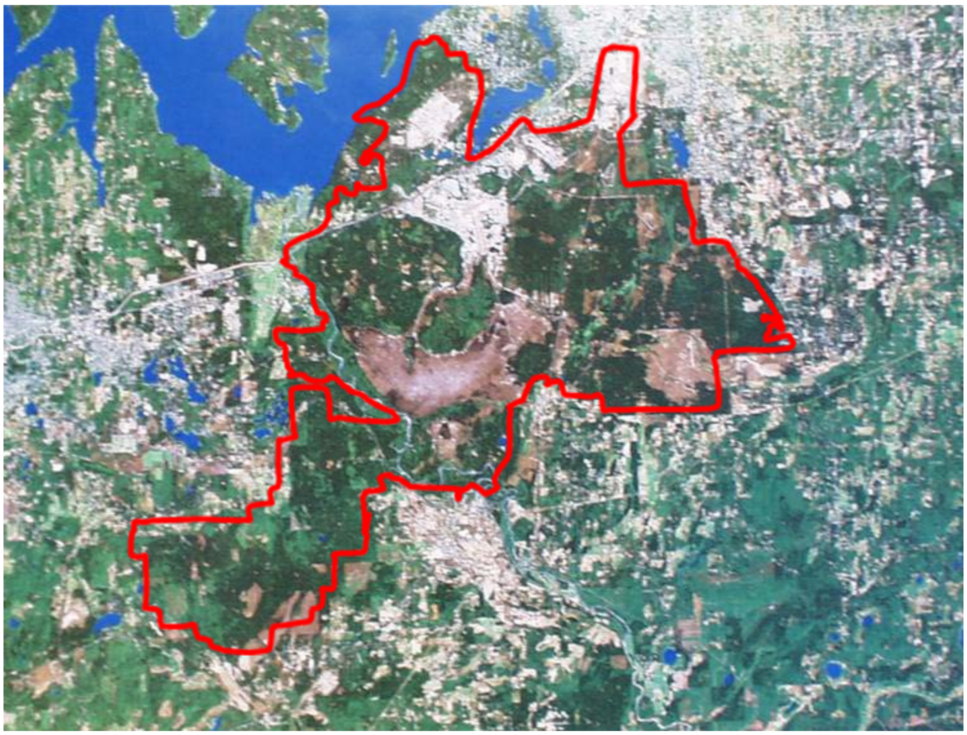
Biological Evaluation and Essential Fish Habitat Assessment for Issuance of NPDES Permit #WAS-026638 For Discharges from the Joint Base Lewis-McChord Municipal Separate Storm Sewer System (MS4)



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Prepared by:
US EPA Region 10
Office of Water and Watersheds

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Acronyms

AKART	All Known Available and Reasonable Methods of Treatment, Prevention and Control
ASDM	2008 Aviation Stormwater Design Manual
BE	Biological Evaluation
B-IBI	Benthic Index of Biological Integrity
BMPs	Best Management Practices
CWA	Clean Water Act
CFR	Code of Federal Regulations
CFS	Cubic Feet per Second
DPS	Distinct Population Status
EFH	Essential Fish Habitat
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FMP	Fishery Management Plans
FR	Federal Register
In/hr	Inches per hour
ID	Identification Number
JBLM	Joint Base Lewis-McChord
LID	Low Impact Development
MEP	Maximum Extent Practicable
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
MSGP	NPDES Multi-Sector General Permit for Stormwater Discharges Associated with Industrial Activities for Federal Operators in Washington State, Permit #WAR-05-000F
MS4	Municipal Separate Storm Sewer System
NMFS	National Oceanic and Atmospheric Administration, National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
OF	Outfall
OWS	Oil-Water Separator
PCE	Primary Constituent Element
RCW	Revised Code of Washington
SW	Stormwater
SWMP	Stormwater Management Program
TMDL	Total Maximum Daily Load
USFWS	U.S. Fish and Wildlife Service
WAC	Washington Administrative Code
WQS	Water Quality Standards
WWHM	Western Washington Hydrology Model

1.0 INTRODUCTION

The U.S. Environmental Protection Agency (EPA) has evaluated the potential impacts to federally-listed endangered or threatened species that could result from the issuance of a National Pollutant Discharge Elimination System permit #WAS-026638 (NPDES permit or Permit) to the Joint Base Lewis-McChord (JBLM) for discharges from their municipal separate storm sewer system (MS4).

Receiving waters for the MS4 discharges within the developed areas of JBLM include Murray Creek; Clover Creek; American Lake; other associated lakes, wetlands, and tributaries; and Puget Sound. Developed areas of JBLM are referred to in this document as "the cantonment areas."

EPA's NPDES permitting program is authorized by Section 402 of the Clean Water Act (CWA, or the Act) and implemented by regulations appearing in Title 40 of the Code of Federal Regulations (CFR), Parts 122, 123 and 124.

The Permit also covers the JBLM military training areas, which include portions of the Nisqually River and its tributary, Muck Creek; however, these military training areas are largely undeveloped. No MS4 infrastructure is known to exist within the training areas in the vicinity of either Nisqually River or Muck Creek; the extent of any existing MS4 infrastructure has not yet been assessed. MS4 discharges from the training areas into the Nisqually River and Muck Creek are presumed to be minimal or nonexistent, due to the U.S. Army's restricted use designations for these areas, the lack of impervious areas which could generate surface runoff, and the presence of soil types well suited for infiltration of any surface flow.

Designated uses for the receiving waters within the JBLM boundary are established by the Washington Department of Ecology (Ecology) in the State of Washington's Water Quality Standards (WQS), as summarized in Table 1.

Table 1. Surface Water Quality Standards/Beneficial Uses for JBLM MS4 Receiving Waters

Designated Uses	Clover Creek &tributaries(surface freshwaters)	Murray Creek & tributaries, wetlands, American Lake (surface freshwaters)	Puget Sound (marinewater)
Salmonid spawning, rearing & migration	X	X	
Core summer salmonid habitat			
Primary contact recreation	X		X
Domestic, industrial, agricultural water supply	X	X	
Stock Watering	X	X	
Aquatic Life Uses (extraordinary)			X
Shellfish Harvest			X
Wildlife Habitat	X	X	X
Harvesting, Commerce and Navigation	X	X	X
Boating	X	X	X
Aesthetic values	X	X	X

Source: Washington Administrative Code (WAC)-173-201A, Tables 602, 610 and 612.

Section 7 of the Endangered Species Act (ESA) requires that federal agencies consult with the U.S. Fish and Wildlife Service (USFWS) and National Oceanic and Atmospheric Administration National Marine Fisheries Service (NMFS) (collectively the Services) to ensure that any action it authorizes is not likely to jeopardize the continued existence of any species listed under ESA or result in the destruction or adverse modification of critical habitat required by a listed species.

The Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) established regional Fishery Management Councils and mandated that Fishery Management Plans (FMPs) be developed to responsibly manage exploited fish and invertebrate species in federal waters of the United States. MSFCMA, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), charged the National Marine Fisheries Service (NMFS) with designating and conserving Essential Fish Habitat (EFH) for species managed under existing FMPs. This requirement is intended to minimize, to the extent practicable, any adverse effects on habitat caused by fishing or non-fishing activities, and to identify other actions to encourage the conservation and enhancement of such habitat.

EPA has developed this Biological Evaluation and EFH Assessment (collectively referred to in this document as the BE) to assist with consultations for the permit action as required under Section 7 of the ESA and Section 305(b) of the MSFCMA.

The BE describes the receiving environment and potential effects (direct and indirect) of the proposed NPDES permit action to ESA listed fish, wildlife and designated critical habitat that may be present in the vicinity of the Action Area. The BE evaluates the species and critical habitat under the jurisdiction of both USFWS and NMFS. The BE also evaluates the potential for adverse effect on EFH resulting from issuance of the NPDES permit.

The federal action discussed in this BE is the issuance of the NPDES permit #WAS-026638 to JBLM for stormwater discharges from the MS4 located within the exterior boundaries of the military installation. The geographic Action Area in Figure 1 depicts the exterior boundary of JBLM in red; the populated and developed subareas, known as the "cantonment" areas, are outlined in green. Subsequent sections of this BE describe these areas – known as JBLM-Main, JBLM-North, and JBLM-McChord Field- in greater detail. All remaining land at JBLM is largely undeveloped and is used for military training.

Figure 1. Action Area for EPA's NPDES Permit #WAS-026638 for Discharges from the Municipal Separate Storm Sewer System (MS4) Operated by Joint Base Lewis-McChord
(Source: JBLM-DPW, 2012b.)

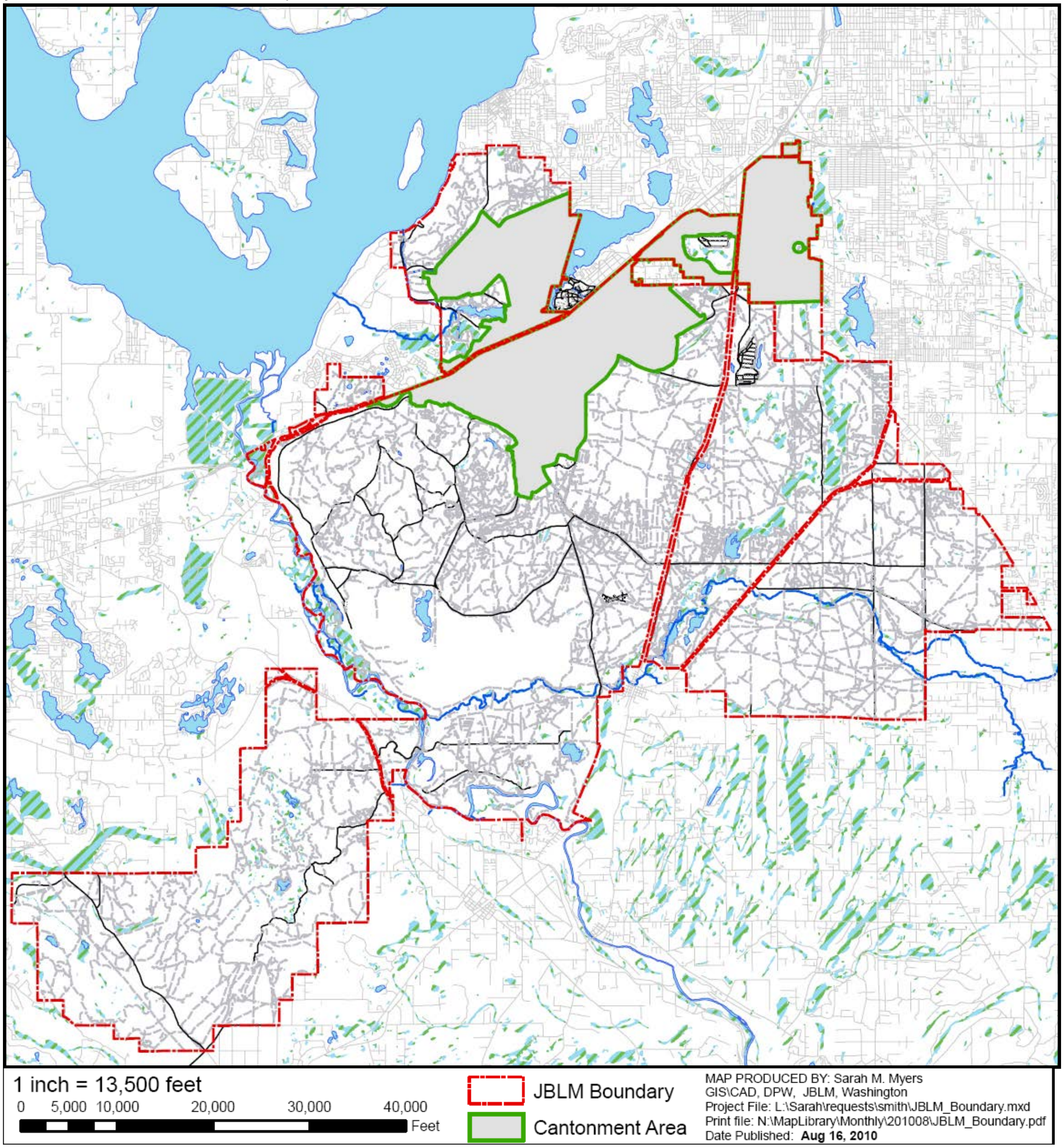
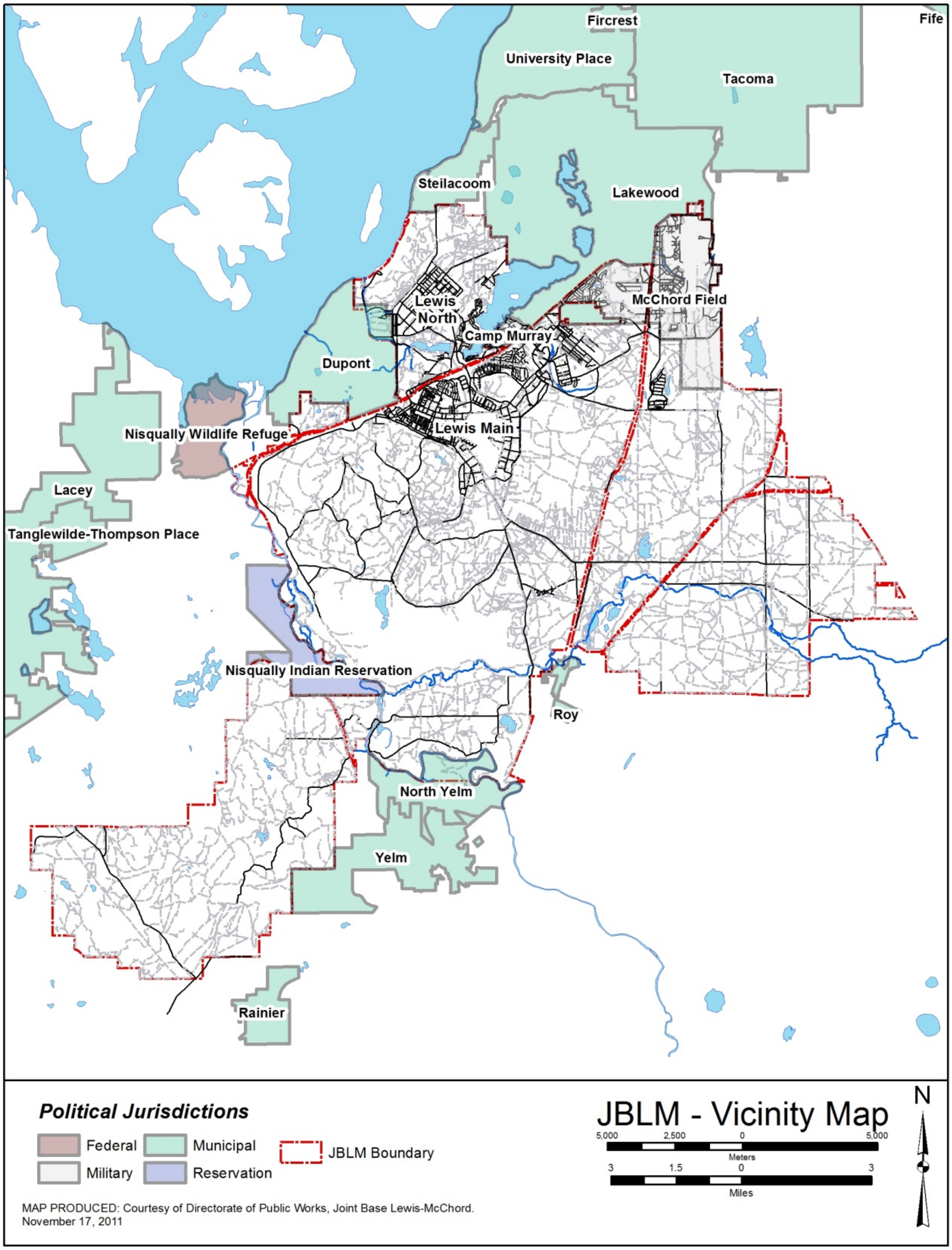


Figure 2. Joint Base Lewis-McChord and Surrounding Vicinity
(Source: JBLM-DPW-2012b.)



2.0 DESCRIPTION OF THE ACTION AREA AND THE ACTION

2.1 Action Area

The ESA implementing regulations define an "Action Area" as all areas to be affected directly or indirectly by the federal action (50 CFR Section 402.02).

The Action Area for this BE includes the 142-square mile military installation located within Pierce and Thurston Counties of Washington (Figure 1), the water bodies within the installation, and water bodies adjacent to the installation which may be affected by the JBLM MS4 discharges.

The following receiving waters are part of the Action Area: Puget Sound, near the JBLM Canal outfall at Solo Point; Murray Creek; American Lake; American Lake Pond; Lynn Lake; Kennedy, Bell, Hamer, Elliot, and McKay Marshes (and associated wetland areas within the JBLM cantonment area); Clover Creek; Carter Lake; and wetlands near JBLM-McChord Field.

The Nisqually River and Muck Creek are also considered part of the Action Area for this BE; however, as described below, based upon EPA's understanding of the extent of existing MS4 infrastructure, all stormwater discharge from the training areas is presumed to entirely infiltrate to ground, and therefore does not discharge directly to the Nisqually River or Muck Creek. In order to confirm the presence or absence of MS4 infrastructure, EPA has included a permit requirement to further assess the area , as described in Sections 2.2.1.3 and 2.2.2.2.3 of this BE.

2.2 Purpose and Objectives

In compliance with the CWA, the purpose of EPA's action to issue the NPDES permit is to authorize the discharge of stormwater runoff from the MS4 owned and operated by JBLM. NPDES permits must address the Act's requirements for technology-based limits which protect water quality as required by CWA Section 301. All NPDES permits must also include effluent limits at least as stringent as the applicable technology-based limits regardless of the discharge's impact on water quality. NPDES permits also implement the Act's "fishable/swimmable" goal (CWA Section 101(a)(2)) by including water quality-based limits that may be more stringent than technology-based limits. Water quality-based effluent limits are required by Section 301(b)(1)(C) of the Act and protect the aquatic life, human health, and recreation uses of the nation's waters.

2.2.1 Statutory Background of the NPDES Stormwater Permit Program

Clean Water Act Section 402(p) requires implementation of a comprehensive national program for addressing discharges from certain types of stormwater discharges, as listed under CWA Section 402(p)(2).

Subsequent regulations promulgated by the EPA in 1990 comprise the "Phase 1" NPDES stormwater program requirements, and address permit requirements for SW discharges from various categories of industry, and from "large" and "medium" sized municipal separate storm sewer systems (ie, those serving populations >100,00 people based on the 1990 Census). Pursuant to CWA Section 402(p)(6), EPA's 1999 "Phase II" stormwater requirements expanded the types of SW discharges to be permitted, and includes (among others) discharges from "small municipal separate storm sewer systems " located within Bureau of Census-defined Urbanized Areas and which are owned or operated by the United States.[1] The JBLM MS4 Permit is developed in accordance with these "Phase II" stormwater regulations.

2.2.1.1 Permitting Objectives for Discharges From Municipal Separate Storm Sewer Systems

CWA Section 402(p)(3)establishes the NPDES permit requirements for discharges from industrial and municipal separate storm sewer systems. NPDES permits for stormwater discharge associated with industrial activity must meet all applicable NPDES provisions and ensure that applicable state water quality standards are met through the use of technology based effluent limits and/or water quality based effluent limits as required by CWA Section 301(b)(2).

In contrast, Section 402(p)(3)(B) specifies that NPDES permits for discharges from MS4s:

". (i) *may be issued on a system- or jurisdiction-wide basis; …*
(ii) shall include a requirement to effectively prohibit non-stormwater discharges into the storm sewers, and
*(iii) shall require controls to reduce the discharge of pollutants to the **maximum extent practicable**, including management practices, control techniques, and system, design and engineering methods, and such other provisions as the Administrator or the State determines appropriate for the control of such pollutan*ts."
[emphasis added]

Maximum extent practicable (MEP) is therefore the statutory standard that establishes the level of pollutant reduction that regulated MS4 operators must achieve. EPA considers narrative effluent limitations requiring the implementation of Best Management Practices (BMPs) to be the most appropriate form of effluent limitations for MS4s, and provided the rationale for this national stormwater permitting policy as follows:

> "*….EPA determines that pollutants from wet weather discharges are most appropriately controlled through management measures rather than end-of-pipe numeric effluent limitations. …EPA believes that the currently available methodology for derivation of numeric water quality-based effluent limitations is significantly complicated when applied to wet weather discharges from MS4s (compared to continuous or periodic batch discharges from most other types of discharge). Wet weather discharges from MS4s introduce a high degree of variability in the inputs to the models currently available for derivation of water quality based effluent limitations, including assumptions about in-stream and discharge flow rates, as well as effluent characterization…*[2]

[1] See: 40 CFR §122.30-37. A "Municipal Separate Storm Sewer" is defined at 40 CFR 122.26(b)(8) as "*a conveyance or system of conveyances (…roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains): (i) Owned or operated by a State, city, town, borough, county, parish, district, association, or other public body (created by or pursuant to State law) having jurisdiction over disposal of sewage, industrial wastes, stormwater, or other wastes, including special districts under State law such as a sewer district, flood control district or drainage district, or similar entity, or an Indian tribe or an authorized Indian tribal organization, or a designated and approved management agency under Section 208 of the CWA that discharges to waters of the United States; (ii) Designed or used for collecting or conveying stormwater; (iii) Which is not a combined sewer; and (iv) Which is not part of a Publicly Owned Treatment Works (POTW) as defined at 40 CFR §122.2.*"
The term "Small Municipal Separate Storm Sewer Systems" is defined at 40 CFR 122.26(b)(16) to include, but not limited to, separate storm sewers owned or operated by the United States, and "*systems similar to separate storm sewer systems in municipalities, such as systems at military bases, large hospital or prison complexes, and highways and other thoroughfares but does not include storm sewers in very discrete areas, such as individual buildings*."

[2] USEPA 1996 and 1999a.

EPA further elaborates on implementation of CWA Section 402(p)(3)(B)(iii) through NPDES permits for regulated MS4s as follows:

> *"….In the first two to three rounds of permit issuance, EPA envisions that a BMP-based storm water management program that implements the six minimum measures will be the extent of the NPDES permit requirements for the large majority of regulated small MS4s. …..if properly implemented, EPA anticipates that a permit for a regulated small MS4 operator implementing BMPs to satisfy the six minimum control measures will be sufficiently stringent to protect water quality, including water quality standards, so that additional, more stringent and/or more prescriptive water quality based effluent limitations will be unnecessary………"*
>
> *[yet], "….If the permitting authority (rather than the regulated small MS4 operator) needs to impose additional or more specific measures to protect water quality, then that action will most likely be the result of an assessment based on a TMDL or equivalent analysis that determines sources and allocations of pollutant(s) of concern. EPA believes that the small MS4's additional requirements, if any, should be guided by its equitable share based on a variety of considerations, such as cost effectiveness, proportionate contribution of pollutants, and ability to reasonably achieve wasteload reductions. Narrative effluent limitations in the form of BMPs may still be the best means of achieving those reductions. "*
>
> *……"EPA's interpretation of CWA section 402(p)(3)(B)(iii) was ….reviewed by the Ninth Circuit in Defenders of Wildlife, et al v. Browner, No. 98–71080 (September 15, 1999). The Court upheld the Agency's action in issuing five MS4 permits that included water quality based effluent limitations. The Court did, however, disagree with EPA's interpretation of the relationship between CWA sections 301 and 402(p). The Court reasoned that MS4s are not compelled by section 301(b)(1)(C) to meet all State water quality standards, but rather that the Administrator or the State may rely on section 402(p)(3)(B)(iii) to require such controls. Accordingly, the Defenders of Wildlife decision is consistent with the Agency's 1996 ''Interim Permitting Policy for Water Quality-Based Effluent Limitations in Storm Water Permits."*
>
> *…………..EPA has intentionally not provided a precise definition of MEP to allow maximum flexibility in MS4 permitting. MS4s need the flexibility to optimize reductions in storm water pollutants on a location-by-location basis. EPA envisions that this evaluative process will consider such factors as conditions of receiving waters, specific local concerns, and other aspects included in a comprehensive watershed plan. Other factors may include MS4 size, climate, implementation schedules, current ability to finance the program, beneficial uses of receiving water, hydrology, geology, and capacity to perform operation and maintenance. The pollutant reductions that represent MEP may be different for each small MS4, given the unique local hydrologic and geologic concerns that may exist and the differing possible pollutant control strategies. Therefore, each permittee will determine appropriate BMPs to satisfy each of the six minimum control measures through an evaluative process. Permit writers may evaluate small MS4 operator's proposed storm water management controls to determine whether reduction of pollutants to the MEP can be achieved with the identified BMPs."* [3]

EPA's Permit for discharges from the JBLM MS4 establishes narrative effluent limitations, prohibitions, required practices, and other conditions intended to reduce the discharge of pollutants from the MS4 to waters of the United States. The Permit contains narrative water quality based effluent limits to address discharges to waters which currently do not meet existing WQS. As is the case with all NPDES permits,

[3] *Ibid.* "Six minimum measures" refers to mandatory stormwater management program control measures which must be addressed, implemented and enforced by each operator of a regulated MS4. Each SWMP must incorporate public education, public involvement, illicit discharge detection and elimination, construction site runoff control, post construction stormwater runoff control, and pollution prevention/good housekeeping for municipal operations. These broad control measures are outlined in 40 CFR 122.32, and explained in further detail in Section 2.3.2 of this document. NPDES permits for MS4 discharges must contain prescriptive requirements detailing the explicit expectations for each minimum control measure.

the Permit will be effective for a term of five years from its effective date. EPA's Fact Sheet for the Permit is included as Appendix 1 of this BE, and details EPA's basis for the permit requirements and conditions, including further explanation of federal and state requirements which have influenced the Permit's content.

2.3 Description of the MS4 Owned and Operated By JBLM

2.3.1 MS4 Characteristics and Associated Receiving Waters

The MS4 owned and operated by JBLM drains precipitation-related surface runoff from the developed areas of the 142-square mile military installation.

Located in Pierce and Thurston Counties, Washington, JBLM is cooperatively operated by the U.S. Army and Air Force to support war fighting units, their families, and the extended military community. According to the Year 2010 Census, JBLM's population is estimated to be approximately 95,000, which includes all military personnel, military dependents living on base, civilian employees and visitors. Through directorates and agencies the Joint Base Garrison provides a full range of city services and quality of life functions for this population, including facility maintenance, recreation, family programs, training support, and emergency services.

JBLM's MS4 consists of curbs, gutters, ditches, storm drains, lift stations, treatment systems, infiltration areas and structures, drainage canals, and the associated outfalls, which discharge into both surface and ground waters. The JBLM MS4 receives surface runoff from the populated developed areas within JBLM, which are collectively referred to as the "cantonment area." The cantonment area serves as the center for most installation activities apart from military field training. Land uses in the cantonment area include residential housing for family and troops; administrative and commercial areas (i.e., offices, shops and medical services); industrial areas (i.e., maintenance, logistics, and transportation activities); and open space (maintained as green belts and recreational areas).[4] In contrast, remaining areas of the installation are used exclusively for military training operations. These training areas have limited, if any, development and are not known to support any existing MS4 infrastructure discharging to receiving waters.

The geographic subareas which drain surface runoff through the MS4 are described In Sections 2.3.1.1 through 2.3.1.3 below.

2.3.1.1 JBLM-Main and JBLM-North Cantonment Areas

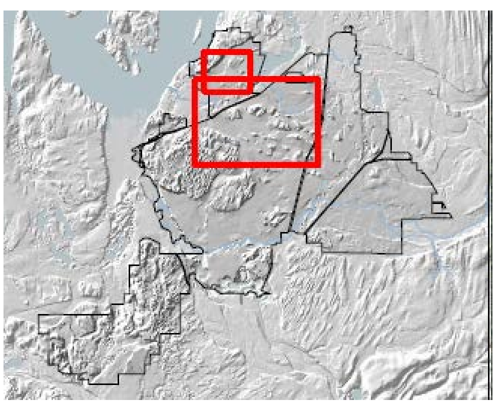


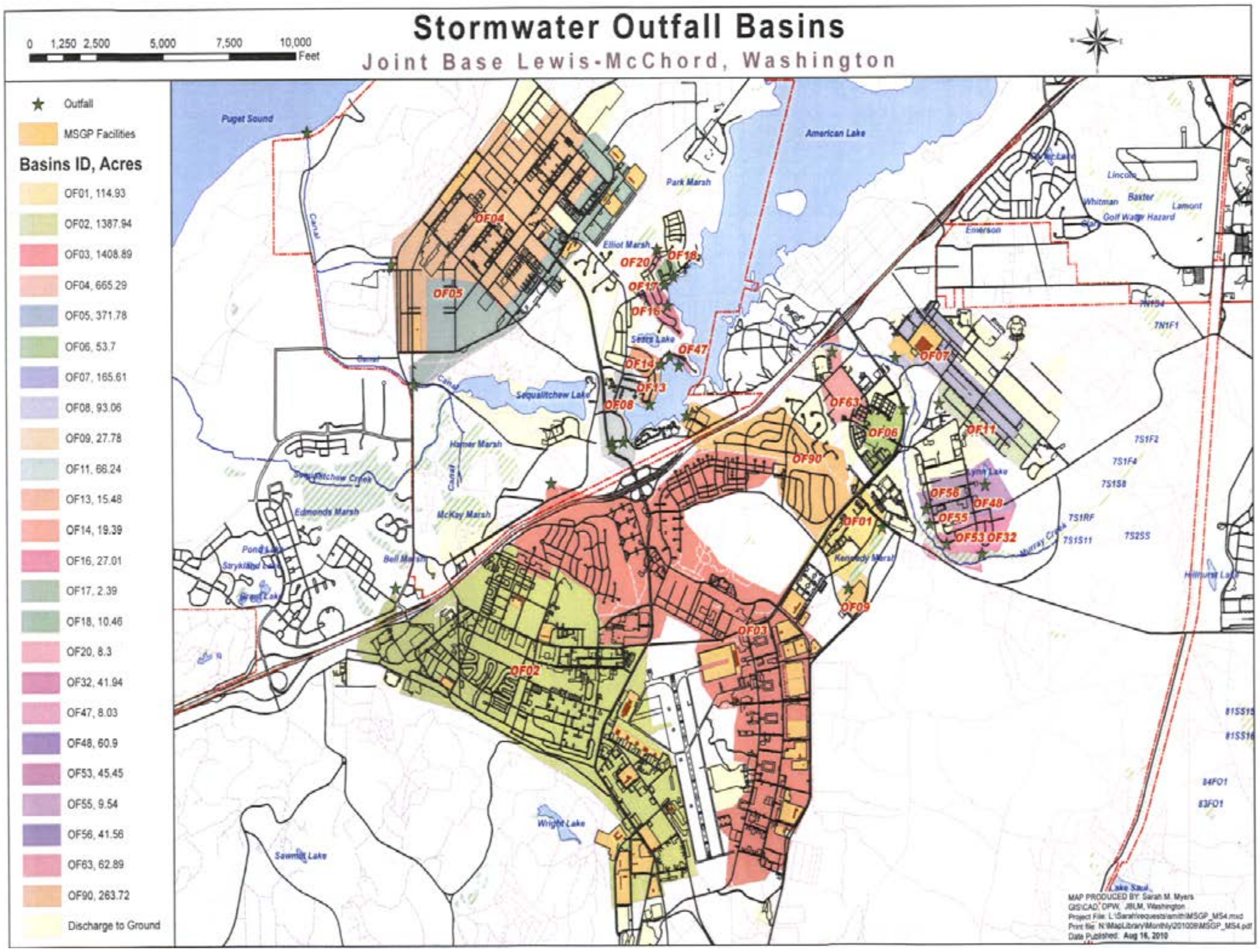
Figure 3. Locator Map for Cantonment Areas known as JBLM-Main and JBLM-North (*indicated by the rectangular and square outlines, respectively*).
(Source: JBLM-DPW 2012b.)

JBLM-Main and JBLM-North encompass approximately 10,603 acres. Approximately half of this combined area (~4,972 acres) drains directly into the MS4 infrastructure, and discharges to Murray Creek, American Lake, Puget Sound (via the conveyance known as the JBLM Stormwater Canal), and

[4] JBLM-DPW 2010.

associated wetlands. The remaining 5,000 acres of this combined area drains directly to the ground. Figures 4 and 5 illustrate the surface flow direction for these two areas. Summary inventory tables of the MS4 outfalls are provided in Tables 2 and 3.

Figure 4. Graphic of Drainage Areas & Outfall Inventory- JBLM-Main & JBLM-North
***Note location of the JBLM Stormwater Canal and Discharge location into Puget Sound*.**
(*Source: JBLM-DPW, 2010.)*



JBLM-Main. The northern-most portion of JBLM-Main, located east of Exit 122 on Interstate 5, includes the JBLM Logistics Center, and Madigan Army Medical Center.

Figures 5 and 6 provides a detailed view of the main MS4 discharge locations along Murray Creek, and the estimated drainage area associated with each outfall. The MS4 in this portion of JBLM-Main predominately drains through eight primary outfalls [Outfalls (OF) 32, 53, 55, 56, 11, 06, 07, and 63]. Murray Creek flows northwest into American Lake. Portions of the MS4 in the JBLM-Main area discharge into Kennedy Marsh through OF 01 and OF 09; the MS4 in this area also discharges directly to American Lake through OF 90.

Figure 5. Overview Map of the Northern Portion of JBLM-Main Area.
(Source: JBLM- DPW 2012b*, Excerpt from* *Stormwater Wallmap 2012.pdf, dated March 2012*)

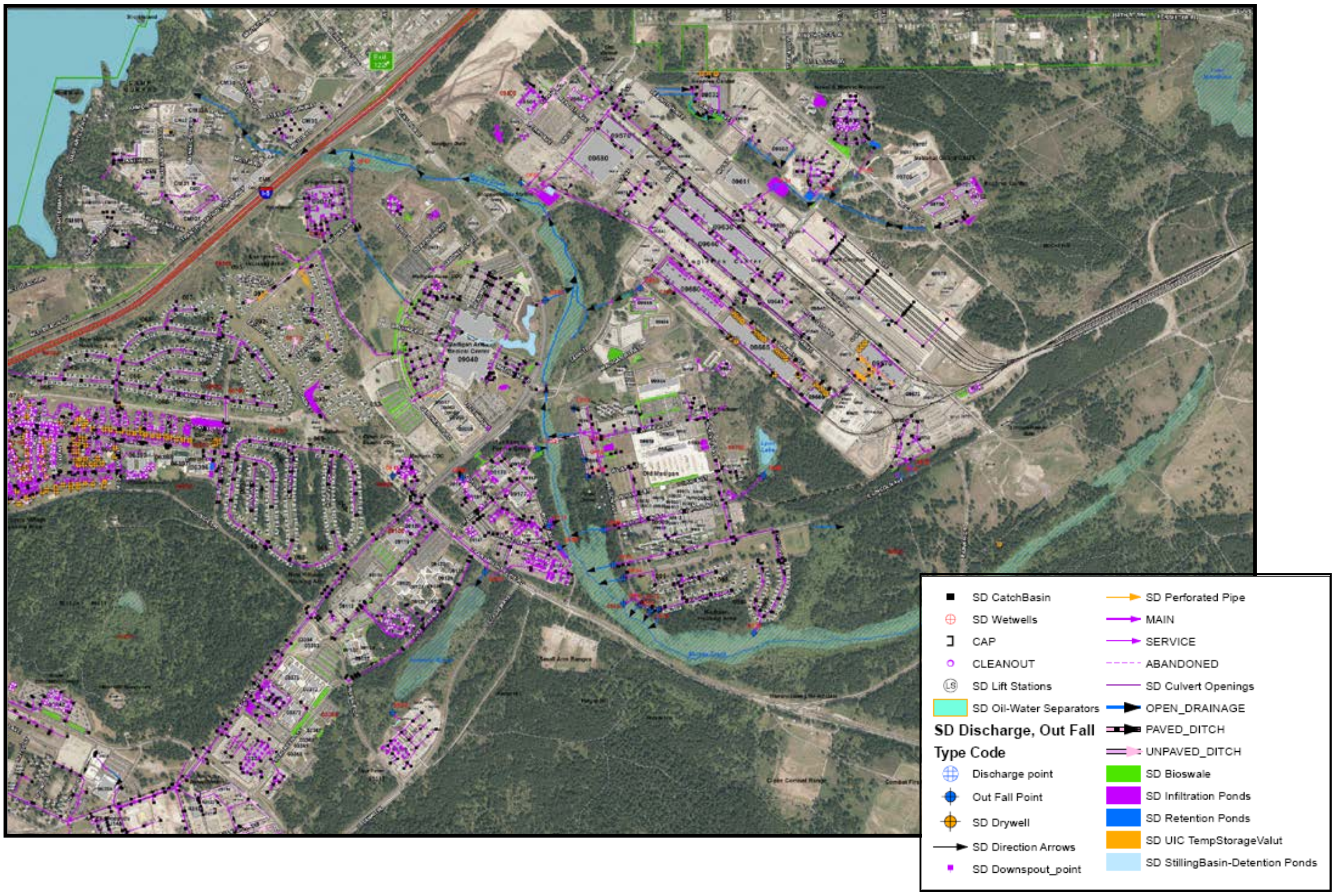
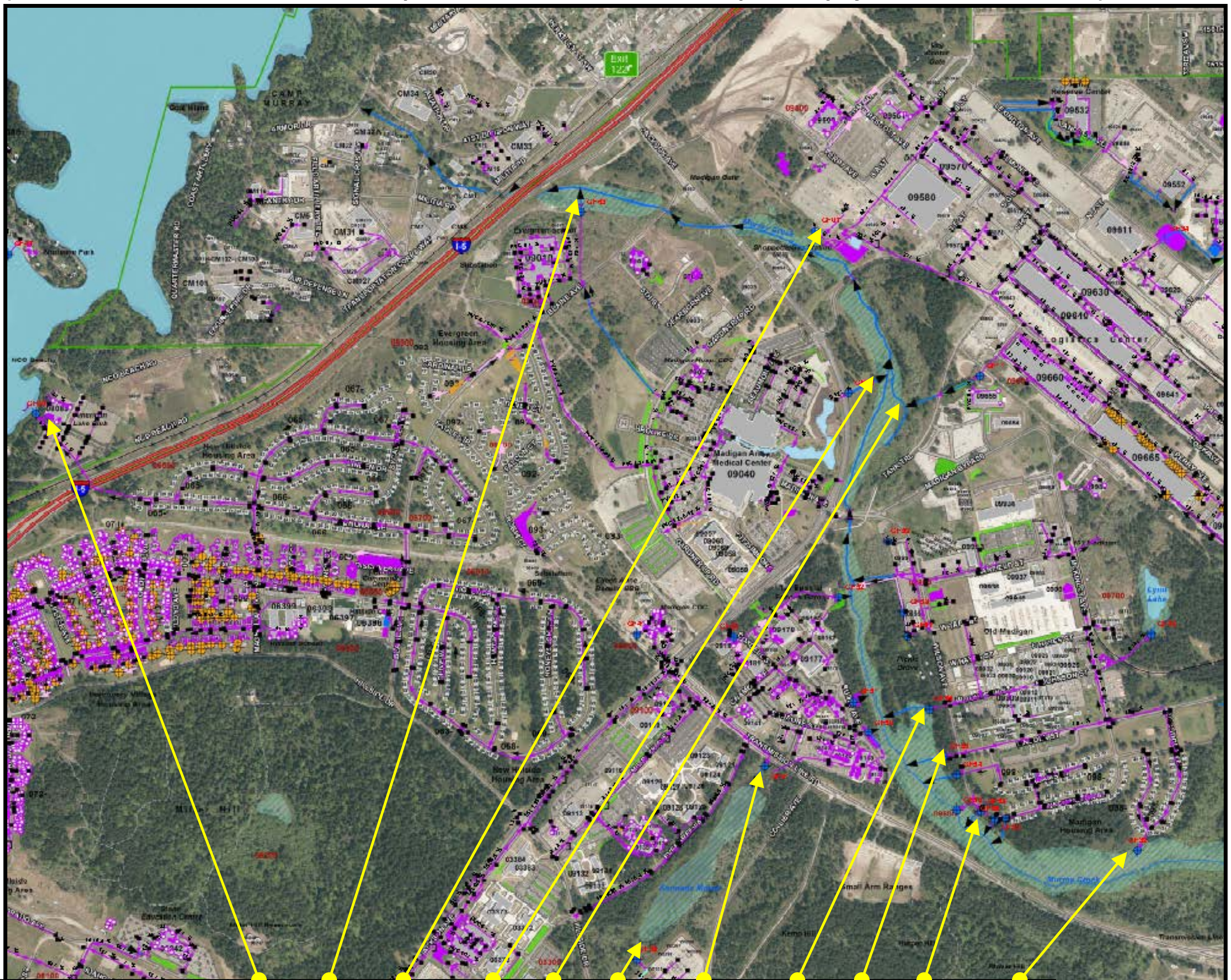


Figure 6. Detail Map of the Northern Portion of the JBLM-Main & MS4 Outfall Locations (Source: JBLM- DPW 2012b, Excerpt from *Stormwater Wallmap 2012.pdf, dated March 2012*)



Outfall ID#	90	63	07	06	11	09	01	56	55	53	32
Estimated Acres	263	62	165	54	66	27.8	115	41.5	9.5	45.5	41.9

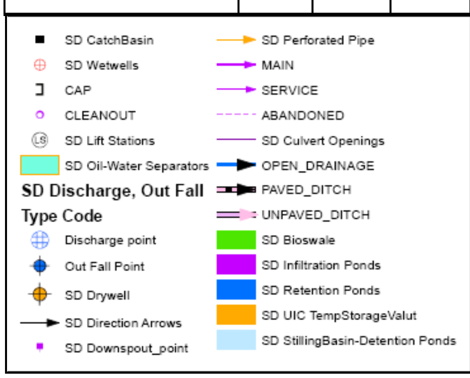


Figure 7 provides an overview of the southern-most portion of JBLM-Main, which includes the Main Gate area and the Gray Army Airfield east of the Main Gate at Exit 120 from Interstate 5. The map also shows portions the JBLM-North area, which is discussed in the next section.

Figure 7. Overview Map of the Southern Portion of the JBLM-Main Area (Source: JBLM- DPW 2012b, Excerpt from *Stormwater Wallmap 2012.pdf, dated March 2012*)

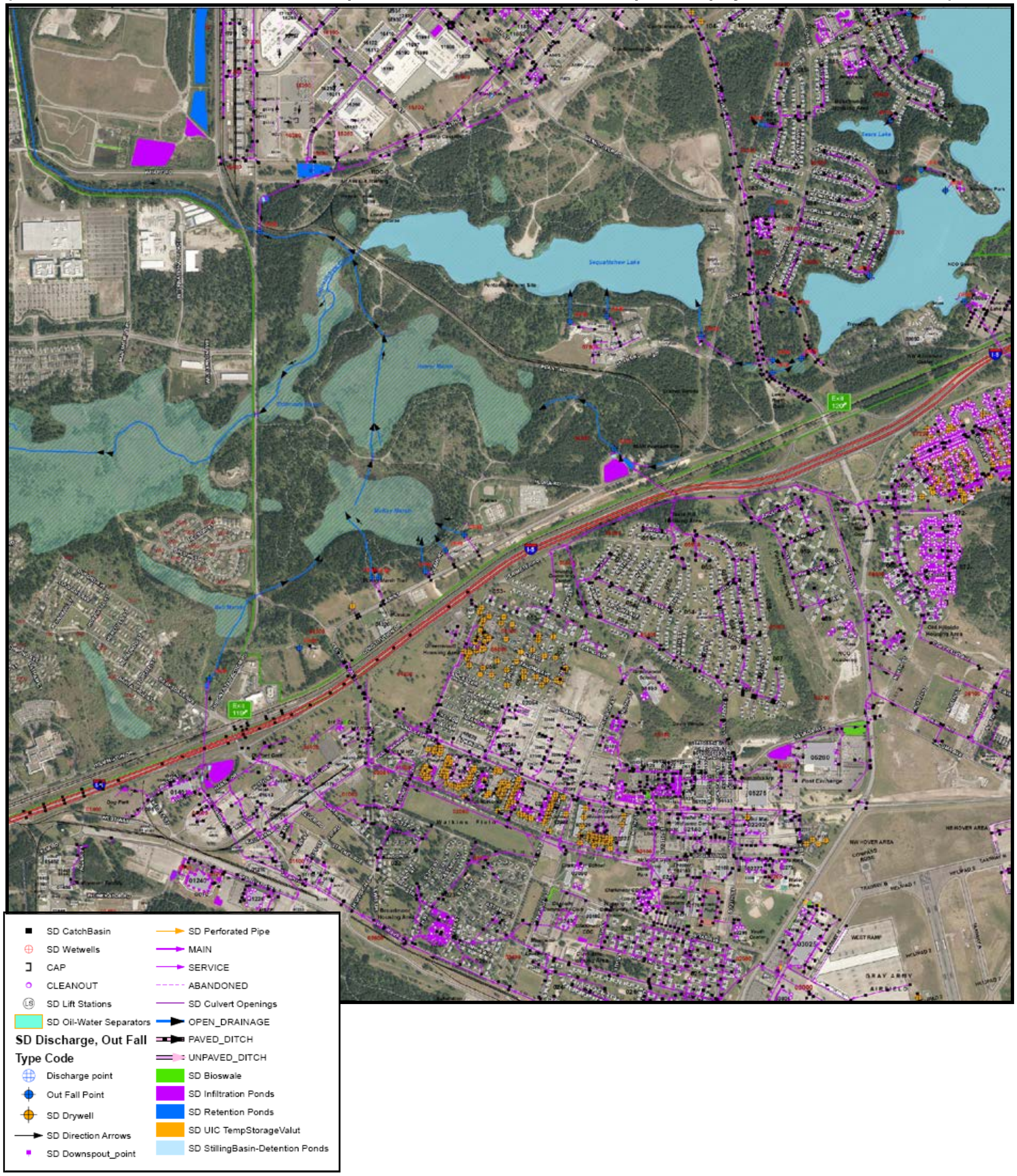
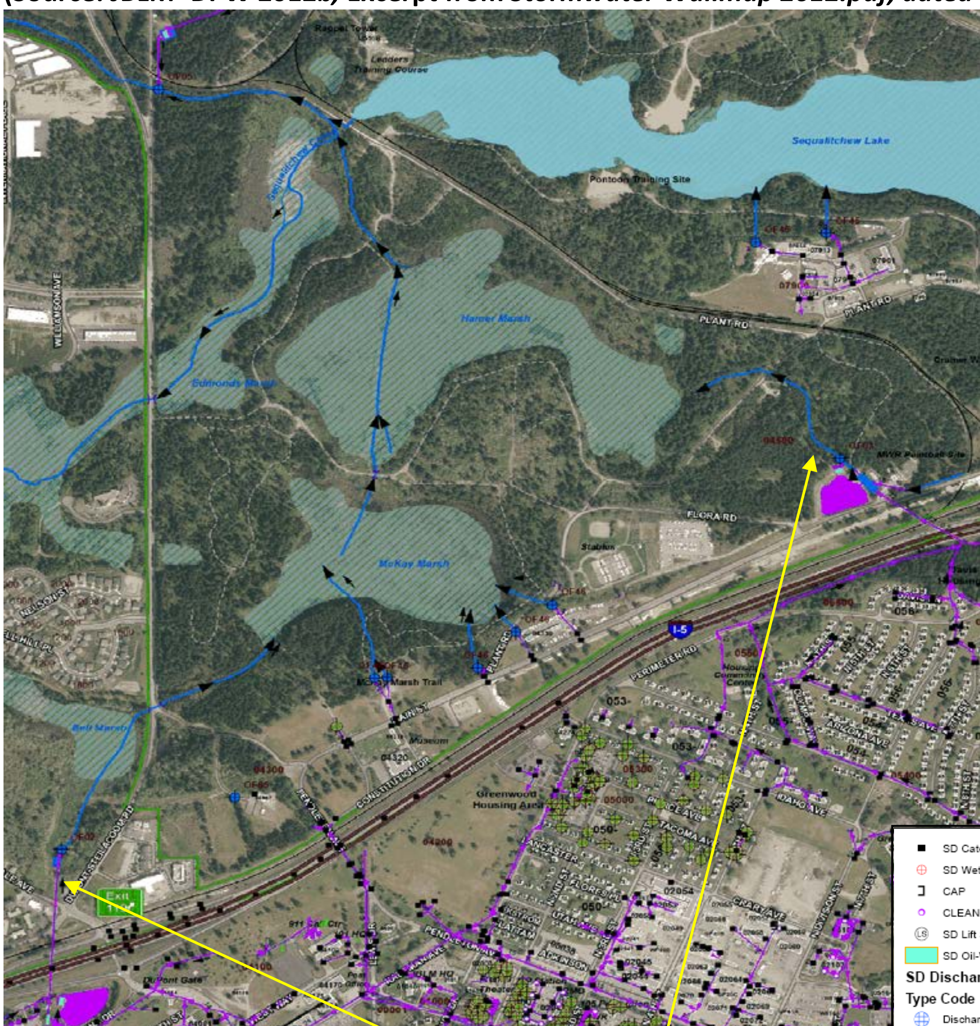
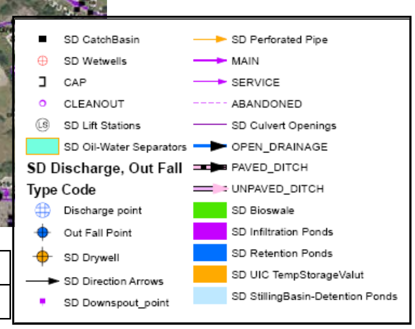


Figure 8 provides a detailed view of the MS4 outfall locations for this southern portion of JBLM-Main. Approximately 2,795 acres of this portion of JBLM-Main drains from the west of Interstate-5 through to the east side of the interstate towards either OF 02 or OF 03. Prior to reaching these outfalls, the runoff first flows through settling ponds, then into large infiltration ponds; water is then treated through oil-water separators (#OW002 near Dupont Gate and #OW082, near Flora Road, respectively) each having an operating capacity of approximately 24,000 gallons. The stormwater facilities associated with OF 02 and OF 03 are designed to treat the six month, 24-hour storm event, in accordance with the Washington Department of Ecology's water quality treatment requirement and results in treating 91% of the annual run-off volume. Runoff can by-pass the infiltration basins and oil-water separators after consecutive days of rainfall which exceeds this design storm.

Figure 8. Detail of Southern Portion of JBLM-Main and Locations of Outfalls 02 and 03 (Source: JBLM- DPW 2012b, Excerpt from *Stormwater Wallmap 2012.pdf, dated March 2012*)





Outfall ID#	02	03
Estimated Acres Drained	1387.9	1408.9

The large infiltration ponds that infiltrate and treat runoff prior to OF 02 and OF 03 are indicated by the purple shaded areas in Figure 7 in the lower left and mid-right areas of the map. If these infiltration ponds overflow, discharges pass through oil-water separators then are conveyed in open canals that lead to Bell March (OF 02) and Hammer Marsh (OF 03). Significant water storage and additional treatment of this overflow is provided by these marshes. Overflow for OF 02 into Bell Marsh then flows to McKay Marsh; which subsequently flows into Hamer Marsh. Subsequent overflow from Hamer Marsh travels through an open canal and then is routed, via a pipe intentionally designed bypass beneath Sequalitchew Creek, into the JBLM Canal. The Canal, which includes water diverted from Sequalitchew Lake, subsequently discharges into Puget Sound near Solo Point.

JBLM-North is located northwest of the JBLM-Main Gate at I-5 Exit 120 (See Figure 9). Land use within JBLM-North consists primarily of industrial and commercial activities. Figure 10 shows the drainage areas and relative locations of the primary outfalls (OF 04 and OF 05) and various smaller outfalls into Elliot Marsh, American Lake Pond, and American Lake. The total drainage area discharging to OF 04 and OF 05 is approximately 1,038 acres.

In 2010, JBLM built a large stormwater treatment facility for the OF 04 drainage area (approximately 571 acres, of which 324 acres are impervious), which consists of an oil-water separator (# OW122), a large detention pond, and an infiltration basin (indicated by the blue and purple areas in lower left portion of Figure 9). The detention pond was designed to treat the six month, 24-hour storm event, in accordance with the Washington Department of Ecology's water quality treatment requirement and results in treating 91% of the annual run-off volume. Combined with the infiltration basin, JBLM staff confirmed to EPA that discharges from OF 04 basin have been effectively been eliminated.[5]

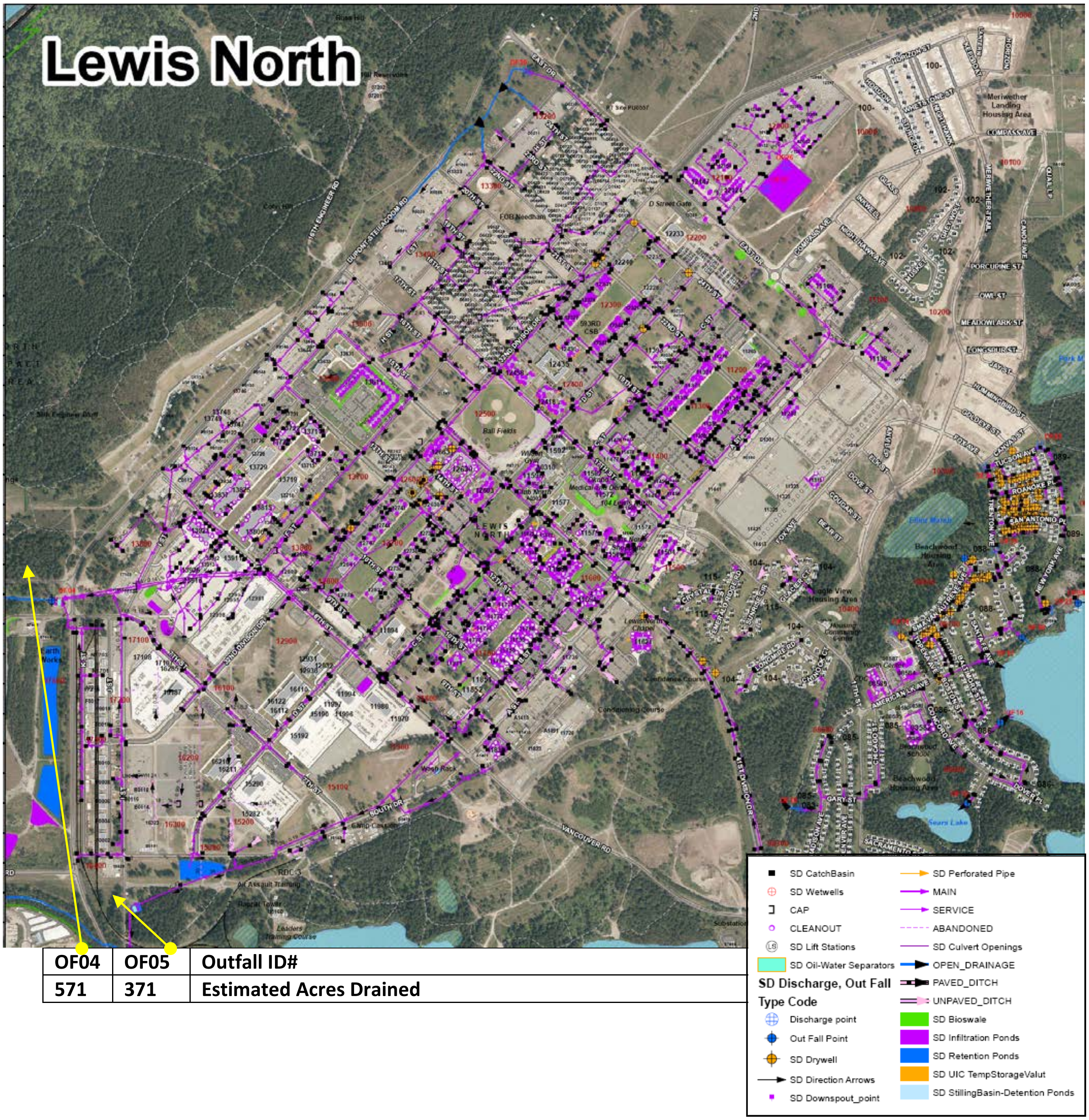
Stormwater runoff draining from the remaining 371 acres of JBLM-North is directed into a detention facility, and is treated through an oil-water separator (#OW121); see Figure 9. Treated stormwater is then conveyed through OF 05 into the JBLM Canal.

Runoff from the JBLM-North residential areas discharges through the MS4 into Elliot Marsh, American Lake Pond, and/or American Lake.

Discharges through the JBLM Canal. As discussed in detail in Section 4.1 of this BE, outflow from Sequalitchew Lake generally forms the majority of flow into the JBLM Canal, except during the few days per year with high peak runoff due to cumulative rain events. Stormwater discharges from OF 02 and OF 03 (after traveling through open canals and marshes), and discharges from OF 05, can enter into the JBLM Canal. Stormwater discharges into American Lake do not enter into the JBLM Canal. The JBLM Canal extends for approximately 2.5 miles, and then discharges into the Puget Sound nearshore in the vicinity of the Solo Point Wastewater Treatment Plant. See Figure 10 for the location of the JBLM Canal, and Figure 11 for the JBLM Canal discharge location

[5] JBLM 2011.

Figure 9. Overview of Drainage Pathways and Locations of MS4 Outfalls 04 and 05 within JBLM-North (Source: JBLM- DPW 2012b, Excerpt from *Stormwater Wallmap 2012.pdf, dated March 2012*)



OF04	OF05	Outfall ID#
571	371	Estimated Acres Drained

Figure 10. Graphic of the Subbasin Drainage Basins within JBLM-North, and Locations of MS4 OF 04 and OF 05, into Puget Sound via the JBLM Canal. ***(Source: JBLM-DPW, 2010)***

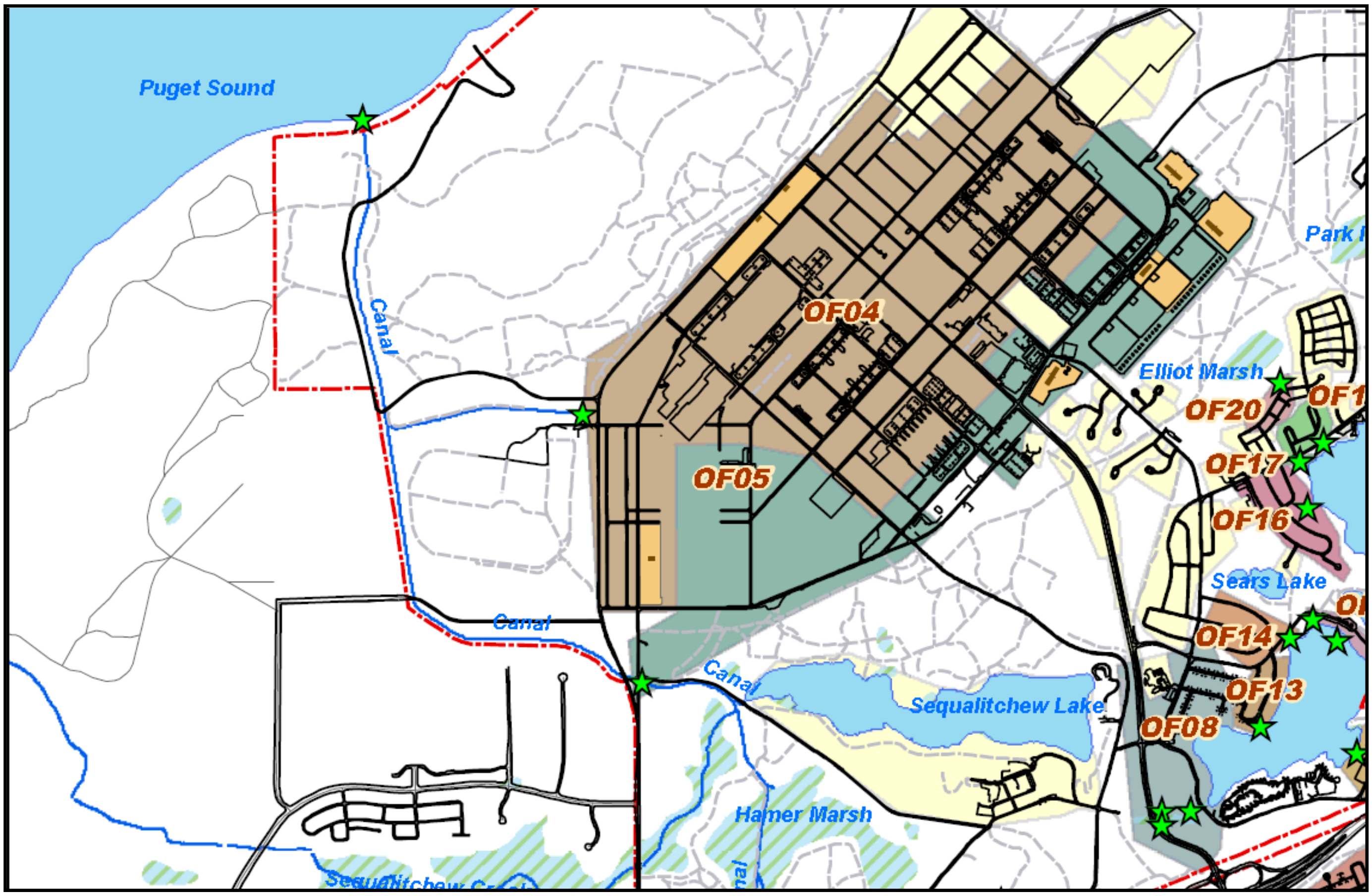


Figure 11. Satellite Image Depicting the Discharge Location of the JBLM Canal into Puget Sound. (*Source: Google Earth, downloaded November 2012*)

2.3.1.1.1 **NPDES-Permitted Industrial (Non-MS4) Stormwater Discharges From the JBLM Cantonment Areas**

This BE describes EPA's action to issue a permit for discharges from the MS4 draining stormwater runoff from the non-industrial activity areas of JBLM. This BE references, but does not assess, the NPDES-regulated industrial stormwater discharges from JBLM area.

Areas where JBLM conducts NPDES-regulated "industrial activity" within the JBLM-Main and JBLM-North cantonment areas and discharge stormwater do so exclusively through the outfalls as indicated by the acronym "MSGP" in the outfall inventory within Table 2.

Regulated industrial stormwater discharges from these areas, as well as regulated industrial stormwater discharges at McChord Field, are authorized under a separate NPDES general permit issued by EPA, the *NPDES Multi-Sector General Permit for Stormwater Associated with Industrial Activities (*otherwise known as the *MSGP*). Stormwater associated with industrial activities occurring within JBLM-Main and JBLM-North is authorized under the MSGP as NPDES Permit # WAR05-B82F. Stormwater associated with industrial activities occurring within the JBLM-McChord Field area in compliance with the MSGP is discussed in Section 2.3.1.2.1. EPA Region 10 and the Services separately completed informal consultation related to these discharges within JBLM-Main and JBLM North in 2009. These informal consultations determined that stormwater discharges from regulated industrial activities at JBLM will not adversely affect endangered species or critical habitat. See also Section 4.1.2.4 of this BE for discussion of the stormwater discharge monitoring and other data collected at JBLM-McChord Field in compliance with the MSGP.

2.3.1.1.2 **Discharges to Ground**

The State of Washington Department of Ecology considers ground water as waters of the State, and allows Underground Injection Control (UIC) permits for certain types of discharges disposed directly to ground. To meet applicable groundwater quality standards, Ecology requires that all UICs be situated at least 3 feet above the high ground water level. JBLM currently has more than 1,000 UICs registered with the Department of Ecology; JBLM's existing design requirements for UICs are more stringent than state requirements, and direct that UICs be structured and designed to provide at least 5 feet between the UIC and the known high groundwater level. Locations of UIC disposal dry wells are indicated in the JBLM drainage overview maps in Figures 5 through 9.

Table 2. Outfall Inventory for JBLM-Main and JBLM-North Cantonment Areas (*Source: JBLM –DPW, 2010*)

JBLM - LEWIS OUTFALLS					
Receiving Water Body	**Outfall ID Number**	**Outfall**	**Nearest Bldg**	**Land Use**	**MS4 or MSGP**
American Lake	OF13-01	Atlanta Ave	08241	Residential	MS4
American Lake	OF14-01	Shoreline Beach Rd/Atlanta Ave	08496	Residential	MS4
American Lake	OF47-01	Shoreline Beach #1	08278	Residential	MS4
American Lake	OF47-02	Shoreline Beach #2	08274	Residential	MS4
American Lake	OF16-01	Boston St.	08664	Residential	MS4
American Lake	OF17-01	Sante Fe Ave	08753	Residential	MS4
American Lake	OF18-01	Saint Paul Ave.	08755	Residential	MS4
American Lake	OF90	American Lake Community Center	08085	Residential / Parking	MS4
American Lake Pond	OF08-01	San Francisco Ave #1	08012	Residential / Roadways	MS4
American Lake Pond	OF08-02	41st Division # 1	08066	Roadway	MS4
American Lake Pond	OF08-03	42nd Division # 2	08066	Roadway	MS4
Bell Marsh	OF02	Barksdale Ave/Dupont-Steilacoom Rd	01407	All types	MS4/MSGP
Elliot Marsh	OF20-01	SMA Van Autreve Ave	G8836	Residential	MS4
Kennedy Marsh	OF01-01	Transmission Line Road # 1	09144	Roadway	MS4
Kennedy Marsh	OF09	Hillside Dr	3390	Industrial / Parking	MS4/MSGP
Lynn Lake	OF48-01	Old Madigan	09793	Roadways	MS4
Murray Creek	OF32-01	Coolidge Ave	09825	Residential	MS4
Murray Creek	OF53-01	Washington Street # 1	09871	Residential	MS4
Murray Creek	OF55-01	Washington Street # 6	09907	Residential	MS4
Murray Creek	OF56-01	Wilson Ave/Johnson St	09999	Residential	MS4
Murray Creek	OF06-01	Madigan Moat	09040	Madigan / Roadway	MS4
Murray Creek	OF63-01	Blaine Ave	09011	Madigan	MS4
Murray Creek	OF11-01	Madigan Bypass/Tank Trail	09660	Light Industrial/ Commercial Roadways	MS4
Murray Creek	OF07	S. "F" St / DOL	09586	Industrial / Light Industrial / Commercial / Roadways / Parking	MS4/MSGP
McKay Marsh	OF03	Flora Rd/Main St	04535	All types	MS4/MSGP
Puget Sound	OF04	Plant Rd/Dupont-Steilacoom Rd	17240	All types	MS4/MSGP
Puget Sound	OF05	"I" St	17240	All types	MS4/MSGP

Table 3. Oil-Water Separator Inventory for JBLM-Main and JBLM-North Cantonment Areas (*Source: JBLM-DPW, 2012b*)

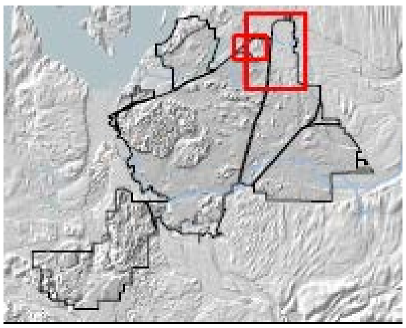
Bldg. #	Description	Unit type	ID #	Estimated Operating Capacity (gallons)	Est. Hold Capacity of used oil compartment or tank (gal)	Current Status	Where Does It Discharge To?	Estimated Cleaning Frequencies
				STORMWATER – ACTIVE [i]				
C0112	C-Block (North Fort) Stormwater Facility	OWS-sump only?	OW152	250	N/A	Active	Stormwater	Semi-Annual
C0120	C-Block (North Fort) Stormwater	OWS-CP	OW157	1,900	N/A	Active	Stormwater	Annual
1407	Dupont Gate Stormwater Treatment (OF 2)	OWS-CP	OW002	24,000	16,000 (part of structure)	Active	Stormwater	Annual
3036	GAAF-SOAR (not found in GIS)	OWS-API	OW160	4,200	N/A	Active	Stormwater	Annual
3041	Public Works	OWS-API	OW008	4,200	N/A	Active	Stormwater	Annual
3076	POL Storage	OWS-API	OW010	2,100	N/A	Active	Stormwater	Annual
3394 (3390)	Kennedy March SW Treatment OF 9)	OWS-API	OW032	38,000	500 (below ground)	Active	Stormwater	Annual
3052 (3053)	4-6 Cav	OWS-API	OW009	3,600	N/A	Active	Stormwater	Annual
3916A	Skookum Vehicle Maintenance (5-20 IN Motor Pool	OWS-API	OWS061	185,000?	500	Active	Stormwater (onsite)	Annual
3932A	DOL Oil Storage Building	OWS-API	OW065	800	N/A	Active	Stormwater	Semi-Annual
3932B	DOL Oil Storage Building	OWS-API	OW066	750	N/A	Active	Stormwater	Semi-Annual
3960B	DOL Veh. Maint Shed	OWS-CP	OW073	6,000	N/A	Active	Stormwater	Annual
3960C	DOL Veh. Maint Shed	OWS-CP	OW074	6,000	N/A	Active	Stormwater	Annual
4535	Flora Rd Stormwater Treatment (OF 03)	OWS-CP	OW082	24,000	16,000 (part of structure)	Active	Stormwater	Annual
9157A	HHC 1st SFG Adm & Supply	OWS-API	OW099	5,200	N/A	Active	Stormwater	Annual
9157B	HHC 1st SFG Adm & Supply	OWS-CP	OW100	5,200	N/A	Active	Stormwater	Annual
9586A	Logistic Center Stormwater Treatment – DOL	OWS-API	OW104	6,700	N/A	Active	Stormwater	Annual
9586B	Logistic Center Stormwater Treatment - DOL	OWS-CP	OW105	7,200	N/A-Skimmers not working or needed	Active	Stormwater	Annual
9660 (9671)	DRMO – Stormwater Filter Vaults (OF 11)	OWS-3 filter vaults + 3 filter CBs	OW144	2 @600** 1@900** 3@495** Total 33 filter cartridges (to be replaced annually)	N/A	Active	Stormwater	Semi-Annual
9691	Marine and Navy Reserve Training Center/80th consolidated Battalion	OWS-CP	OW159	1,000?	N/A	Active	Stormwater	Semi-Annual
11248 (E1304)	Marines 4th LSV Vehicle Maintenance	OWS–API	OW147	1,000	N/a	Active	Stormwater	Semi-Annual
11566	Burger King-North Fort	OWS-Baysavers (2)	OW118	2 – 2,300**	N/A	Active	Stormwater	Annual
15492	I Street SW Treatment (OF 5)	OWS-CP	OW121	100,000?	7,000	Active	Stormwater	Annual
17240	Solo Point Road SW Treatment (OF 4)	OWS-CP	OW122	100,000?	7,000	Active	Stormwater	Annual

**Operating capacity evaluated by CHPPM, Sept. 2007. **Estimated from construction details.*

2.3.1.2 JBLM-McChord Field Cantonment Area

The JBLM-McChord Field cantonment area is comprised of the airfield, supporting airfield infrastructure, and small residential areas. This cantonment area is located within the red border of the map Figure 12.

Figure 12. Locator Map for the Area known as JBLM-McChord Field



The MS4 serving the JBLM-McChord Field cantonment area drains approximately 415 acres of airfield and residential areas, and discharges through approximately 36 outfalls into Clover Creek, Carter Lake, Emerson Wetland, and other wetlands. Figure 13 provides an overview of the JBLM-McChord Field area; Figure 14 depicts the primary drainage basins and outfall locations. Table 4 summarizes the inventory of MS4 outfall locations and drainage basins; Table 5 provides the inventory of oil/water separator treatment devices for the JBLM-McChord Field area.

In general, Clover Creek flows towards Puget Sound from east to west through the JBLM-McChord Field; approximately 5,760 feet of the Creek was diverted into culverts beneath the airfield at the time McChord Field was constructed in the 1940s; Clover Creek then daylights and continues through the area (as depicted in Figure 14), and ultimately exits the installation to empty into Lake Steilacoom, near the City of Lakewood.

Figure 13. Overview of the JBLM-McChord Field Cantonment Area (including Residential Areas) (Source: JBLM-DPW, 2012b. ***StormwaterwallmapMCF.pdf, dated March 2012)***

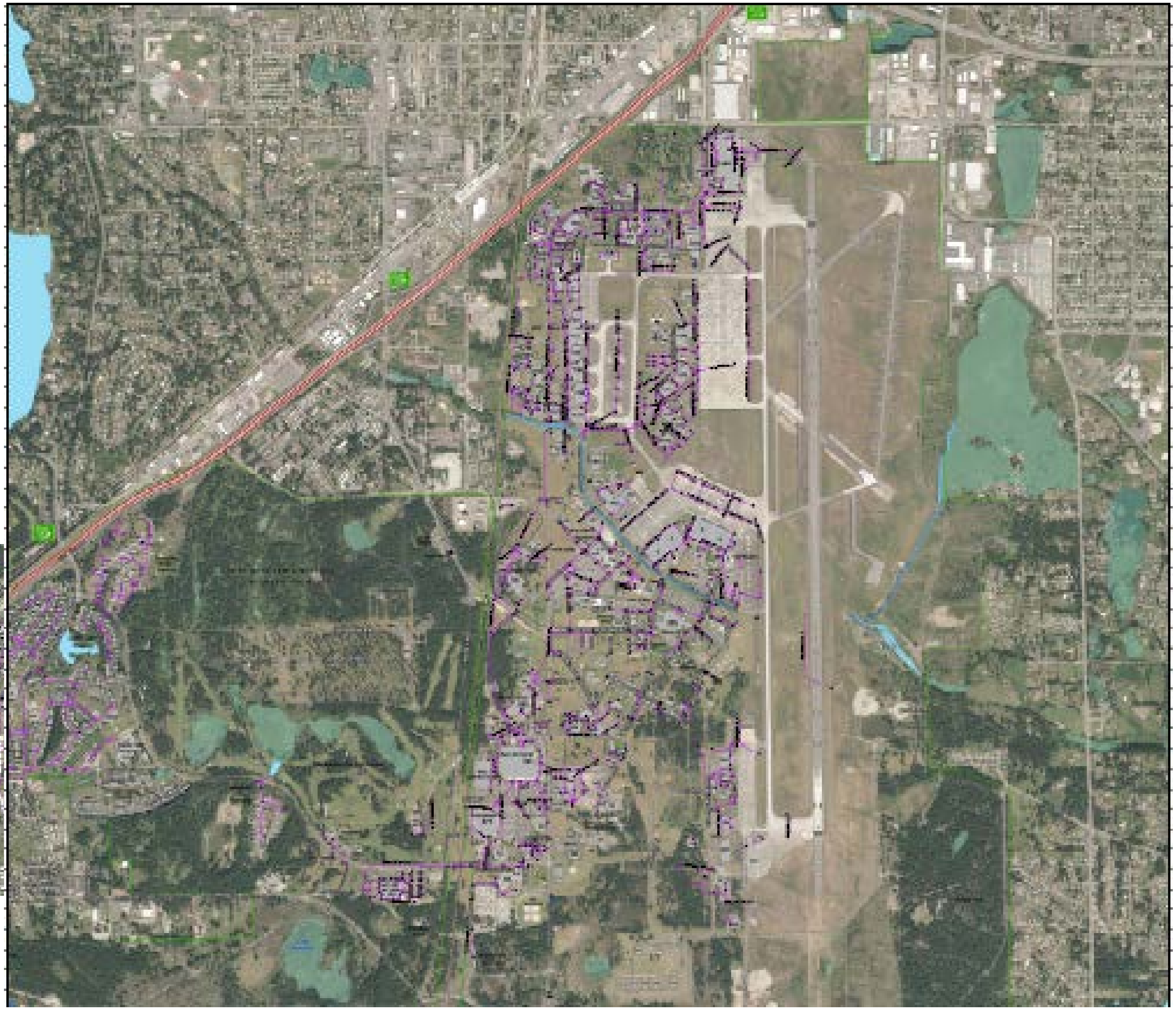


Figure 14. Detail of JBLM-McChord Field (Airfield Subarea) Drainage Basins and MS4 Outfall Locations into Clover Creek (*Source: JBLM-DPW, 2010*)

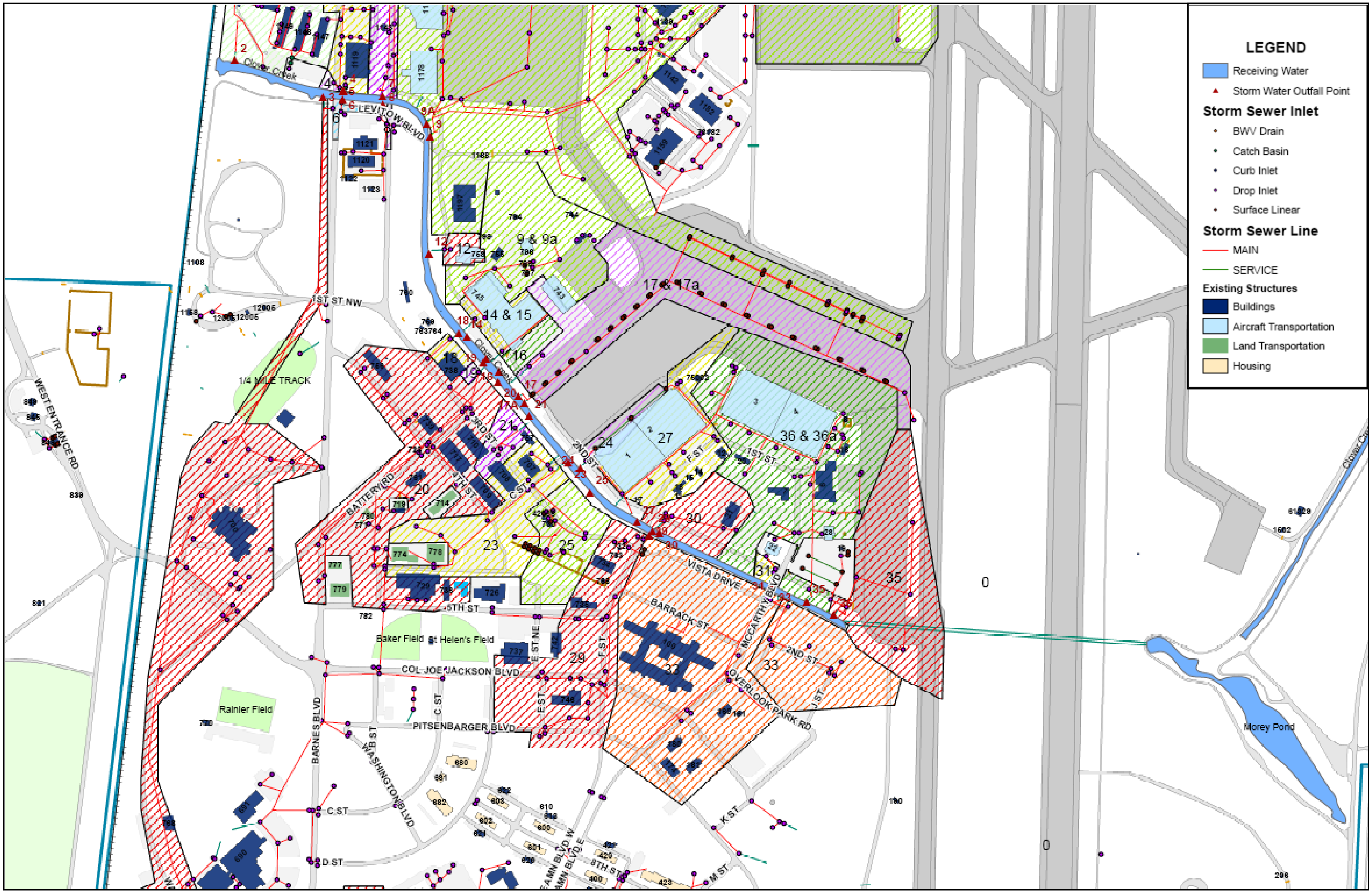


Table 4. Outfall Inventory for the JBLM–McChord Field Cantonment Area
(Source: JBLM-DPW, 2012b)

Drainage Area	Outfall ID	Latitude - N	Longitude - W	Receiving Waters	Bank Location	Acres Drained MS4	Acres Drained MSGP	Description
1	1	47.14425	-122.49644	Clover Creek	North		163.3	3' Diameter Concrete (Skimmer 1)
2	2	47.14288	-122.49629	Clover Creek	North	11.2		1' Diameter Concrete w/ steel grate
3	3	47.14232	-122.49419	Clover Creek	South	90.1		3.5' Diameter Concrete w/ steel grate
4	4	47.14243	-122.49370	Clover Creek	North	0.2		1' Diameter PVC
5	5	47.14242	-122.49373	Clover Creek	North	10.9		0.5' Diameter Concrete
6	6	47.14230	-122.49372	Clover Creek	South	0.4		1' Diameter Concrete
7	7	47.14237	-122.49279	Clover Creek	South	6.9		1.5' Diameter Metal Flap Gate
8	8	47.14224	-122.49278	Clover Creek	North	0.4		1.5' Diameter Concrete
9 & 9a	9	47.14173	-122.49164	Clover Creek	North		182.5	1.66'Diameter Concrete (Skimmer 2)
9 & 9a	9a	47.14194	-122.49173	Clover Creek	North		Overflow	4' Diameter Rubber Bladder type (2) Skimmer 2 bypass
none	10	47.14214	-122.49196	Clover Creek	North	Inactive		3' Diameter concrete (steam line base)
none	11	47.14211	-122.49186	Clover Creek	North	Inactive		0.75' Diameter Concrete
12	12	47.13985	-122.49160	Clover Creek	North	0.9		0.75' Diameter Concrete
none	13	47.13865	-122.49076	Clover Creek	North	Inactive		0.75' Diameter Terra Cotta
14 & 15	14	47.13854	-122.49066	Clover Creek	North	2.8		0.75' Diameter Concrete
14 & 15	15	47.13819	-122.49019	Clover Creek	North	See Above		0.75' Diameter Terra Cotta
16	16	47.13798	-122.48988	Clover Creek	North	1.1		1.33' Diameter Concrete
17 & 17a	17	47.13759	-122.48941	Clover Creek	North		18.3	1.5' Diameter Concrete (Skimmer 4)
17 & 17a	17a	47.13748	-122.48926	Clover Creek	North		Overflow	2' Diameter Metal Flap Gate (Skimmer 4 bypass)
18	18	47.13859	-122.49085	Clover Creek	South	0.9		0.75' Diameter Concrete
19	19	47.13812	-122.49026	Clover Creek	South	0.2		0.75' Diameter Concrete
20	20	47.13782	-122.48990	Clover Creek	South	23.1		1.5' Diameter Concrete
21	21	47.13728	-122.48915	Clover Creek	South	1.7		1' Diameter Concrete
none	22	47.13668	-122.48883	Clover Creek	South	Inactive		0.75' Diameter Concrete

Table 4. Outfall Inventory for the JBLM–McChord Field Cantonment Area (continued)

Drainage Area	Outfall ID	Latitude - N	Longitude - W	Receiving Waters	Bank Location	Acres Drained MS4	Acres Drained MSGP	Description
23	23	47.13655	-122.48820	Clover Creek	South	9.6		2' Diameter Concrete
24	24	47.13646	-122.48791	Clover Creek	North	1.4		0.5' Diameter Concrete
25	25	47.13608	-122.48767	Clover Creek	South	5.5		1' Diameter Concrete
none	26	47.13593	-122.48716	Clover Creek	North	Inactive		3' Diameter Metal Flap Gate
27	27	47.13562	-122.48654	Clover Creek	North	8.8		1' Diameter Concrete
28	28	47.13549	-122.48618	Clover Creek	North	0.2		0.75' Diameter Concrete
29	29	47.13541	-122.48625	Clover Creek	South	13.3		0.75' Diameter Concrete
30	30	47.13545	-122.48601	Clover Creek	North	4.2		0.5' Diameter Concrete
31	31	47.13466.	-122.48336	Clover Creek	North	3.3		0.75 Diameter Concrete
none	32	47.13454	-122.48346	Clover Creek	South	Inactive		1' Diameter Concrete
33	33	47.13448	-122.48317	Clover Creek	South	33.4		2.5' Diameter Concrete
none	34	47.13442	-122.48292	Clover Creek	South	Inactive		1' Diameter Concrete
35	35	47.13441	-122.48250	Clover Creek	North	13.5		1' Diameter Concrete
36 & 36a	36	47.13421	-122.48186	Clover Creek	North		26.6	1' Diameter Concrete (Skimmer 6)
36 & 36a	36a	47.13421	-122.48186	Clover Creek	North		Overflow	2' Diameter Metal Flap Gate (Skimmer 6 bypass)
	37	47.13442	-122.48146	Clover Creek	North	Inactive		3' Diameter Concrete w/ Steel Plate
Housing 50 & 51	50	47.12660	-122.53367	Emerson Wetland	NA	306.4		3.5' Diameter Carter Lake Overflow from 52-56
Housing 50 & 51	51	47.12731	-122.53530	Emerson Wetland	NA	See 50 Above		3' Diameter
Housing See 50	52	47.13172	-122.52669	Carter Lake	NA	See 50		1.75' Diameter
Housing See 50	53	47.13320	-122.52408	Carter Lake	NA	See 50		0.75' Diameter
Housing See 50	54	47.13321	-122.52363	Carter Lake	NA	See 50		3.5' Diameter
Housing See 50	55	47.13170	-122.52394	Carter Lake	NA	See 50		0.75' Diameter
Housing See 50	56	47.13154	-122.52718	Carter Lake	NA	See 50		1.25' Diameter
Wescott Hills Housing	60	47.12660	-122.51259	Golf Course Pond & Wetland	NA	12.8		New 2010 Installation As-Built Drawings Pending

Table 5. Oil-Water Separator Inventory for the JBLM–McChord Field Cantonment Area *(Source: JBLM-DPW, 2012b)*

OWS NO.	LOCATION	TYPE	Water Source	TANK SIZE	DISCHARGE METHOD/ Associated ***NPDES Permit***	REMARKS
1	South of Bldg 1204. FAC 82037	**TYPE A -** A/G Separator W/Belt & Coalescing Plates (1970)	Storm water runoff from approx. 70 acres of buildings and pavements of the north side of base. Runoff discharges to Clover Creek.	1000 gal. vaulted tank	Outfall #1/ ***MSGP***	AKA Skimmer #1. Capacity is ~ 53,100 gal.
2	SE corner of Bldg. 1178. FAC 82038	**TYPE A -** A/G Separator W/Belt & Coalescing Plates (1970)	Storm water runoff from approx. 103 acres of pavements used for aircraft parking. Discharges to Clover Creek.	1000 gal. vaulted tank	Outfall #9/***MSGP***	Skimmer #2. Capacity is ~. 52,500 gal.
4	South of Bldg. 745. FAC 82039	**TYPE A -** A/G Separator W/Belt & Coalescing Plates (1970)	Storm water runoff from approximately 30.7 acres of pavement used for aircraft parking. (Area north of Hangers 1,2,3, and 4). Discharges to Clover Creek;	1000 gal. vaulted tank	Outfall #17/***MSGP***	Skimmer #4. Capacity is approx 9,950 gal.
6	West end of creek culverts under runway. FAC 82050	**TYPE A -** A/G Separator W/Belt & Coalescing Plates (1970)	Storm water runoff from approx. 4.5 acres of D Ramp and H Taxiway. Discharges into Clover Creek.	1000 gal vaulted tank	Outfall #36***/MSGP***	Skimmer #6. Capacity is approx. 5,950 gal.
9	West of Bldg. 1178. FAC 82050.	**TYPE B1 -** B/G Separator with Coalescing Plates (1987)	Storm water runoff from approx 5 acres of buildings and pavements. Discharges to Clover Creek.	1000 gal vaulted tank	Outfall #8/***MS4***	Capacity is approx. 6,400 gal.
10	South of Bldg. 305. FAC 82032	**TYPE B3 -** B/G Separator with Coalescing Plates (1983)	Storm water runoff from aircraft parking. Discharges to open swale.	1000 gal tank	Vegetated swale	Capacity is approx 5,050 gal.
11	South of Bldg. 328 (across Lincoln Blvd.). FAC 83022	**TYPE B3 -** B/G Separator with Coalescing Plates (1982)	Storm water runoff from aircraft parking. Discharges to open swale.	1000 gal tank	Vegetated swale	Capacity is approx. 5,500 gal
15	West of Bldg. 343. FAC 82049	**TYPE B3 -** B/G Separator with Coalescing Plates	Runoff from adjacent vehicle and equipment parking areas.	1000 gal tank	Vegetated swale	Capacity is approx. 5,500 gal.
27	East of Bldg 1121 (hobby shop)	**TYPE C -** Manhole type separator with single chamber (1976)	Runoff from approx. 1.5 acres paved parking and roads. Discharges to Clover Creek.	1000 gal. tank	Outfall #7/***MS4***	
43	Off NW corner of Bldg. 345	**TYPE C -** Manhole type separator with single chamber (1986)	Runoff from adjacent building roof and parking lot.	No tank	Vegetated swale	Capacity is approx. 200 gal.
44	SW corner of bldg 345	**TYPE C -** Manhole type Separator with single chamber	Runoff from bldg 345 west side parking lot	No tank	Vegetated swale	
47	NW corner of Bldg 1197 Parking Lot	**TYPE C -** Manhole Type Separator with single chamber	Runoff from bldg parking lot	No tank	Clover Creek	**DECOMMISSIONED**
52	Northwest of Bldg. 369	**TYPE B4 -** B/G Separator (1988)	Runoff from adjacent building roof and parking lot.	No tank	Open Swale	

Table 5. JBLM–McChord Field Oil-Water Separator Inventory (continued)

OWS NO.	LOCATION	TYPE	Water Source	TANK SIZE	DISCHARGE METHOD/ Associated ***NPDES Permit***	REMARKS
56	Adjacent to Bldg. 569	**TYPE C -** B/G collection tank. This is actually a concrete tank not a separator unit.	Bldg 569 storage area floor drains.	1100 gal. tank	Closed Sump	**Not a separator - sump**
57	Corner of Vista and G St. (old clinic)	**TYPE B1 -** B/G Separator with Coalescing Plates (1993)	Storm drains on McCarthey Street and Clinic parking area (approx. 6.3 acres). Discharges to Clover Creek; Outfall #27.	500 gal. tank	Outfall #27 /***MS4***	
58	Vista St. Between G St. and Skimmer #6	**TYPE B1 -** B/G Separator with Coelescing Plates(1993)	Storm water runoff from east and south of Hanger 4, Bldg. 16 and Bldg. 6 area (approx. 17.7 acres). Discharges to Clover Creek; Outfall #28.	500 gal. tank	Outfall #35 / **MS4**	
60	SW Corner of Hanger 1, across from lift station 17	**TYPE B1 -** B/G Separator (1993)	Runoff from parking areas and exterior troughs around Hangers 1 & 2. Discharges to Clover Creek; Outfall #23	500 gal. tank	Outfall #23	**DECOMMISSIONED**
61	At Northeast end of Bldg 702.	**TYPE B1 -** B/G Separator with Coalescing Plates (1993)	Runoff from parking area and Trns Motor Pool area around Bldg 778 (~3.1 acres) discharges to Clover Creek.	500 gal tank	Outfall #22	
63	West of Bldg 21	**TYPE B2 -** B/G Separator with Coalescing Plates (1994)	Runoff from concrete pad near Bldg 21	No tank	Outfall #30	**DECOMMISSIONED**
66	West of Barnes Boulevard across st from Bldg 1120 hobby shop in field	**TYPE B1 -** B/G Separator (1998) Grit chamber/one main body/lift station and coelescing plates	Runoff from parking area along Barnes Boulevard	500 gal tank	Outfall # 3 /***MS4***	
67	S. W. end of Bldg 1150. In field west end of parking lot.	**TYPE B1 -** B/G Separator (1998) Grit chamber/one main body/lift station and coelescing plates	Runoff from dorm area north of 1st St. parking. Discharges to Clover Creek	500 gal tank	Outfall # 2 **/MS4**	

Approximately twenty-four (24) active MS4 outfalls drain the non-industrial land use areas within the JBLM-McChord Field area; all of these MS4 outfalls discharge into Clover Creek. Six outfalls (namely, Outfalls # 2, 3, 7, 8, 27, and 35) are equipped with oil-water separator treatment devices treating runoff from approximately 130 acres, slightly more than 50% of the 240 acre total area draining into Clover Creek. The remaining 18 outfalls in this ld area discharge into Clover Creek and drain approximately 114 acres of non-industrial administrative land use area; these smaller catchment areas range in size from 0.2 acres to 33.4 acres.

Seven (7) MS4 outfalls drain the approximately 318 acres of JBLM-McChord Field residential area discharge stormwater into Carter Lake, Emerson Wetland, the Golf Course Pond, and/or other nearby wetlands.

2.3.1.2.1 **Industrial Stormwater Discharges in the JBLM-McChord Field Cantonment Area**

As previously noted in Section 2.3.1.1.1*,* this BE describes EPA's action to issue a permit for discharges from the MS4 draining stormwater from the non-industrial activity areas of JBLM. This BE references, but does not assess, the NPDES-regulated industrial stormwater discharges from JBLM areas.

Within the JBLM-McChord Field area, the NPDES regulated industrial activity areas discharge stormwater exclusively through Outfalls #1, 9, 17 and 36, as indicated in the column entitled "Acres Drained MSGP" in Table 4.

Stormwater discharges associated with industrial activities from the JBLM-McChord Field area is authorized to discharge under MSGP NPDES Permit #WAR05-B83F.

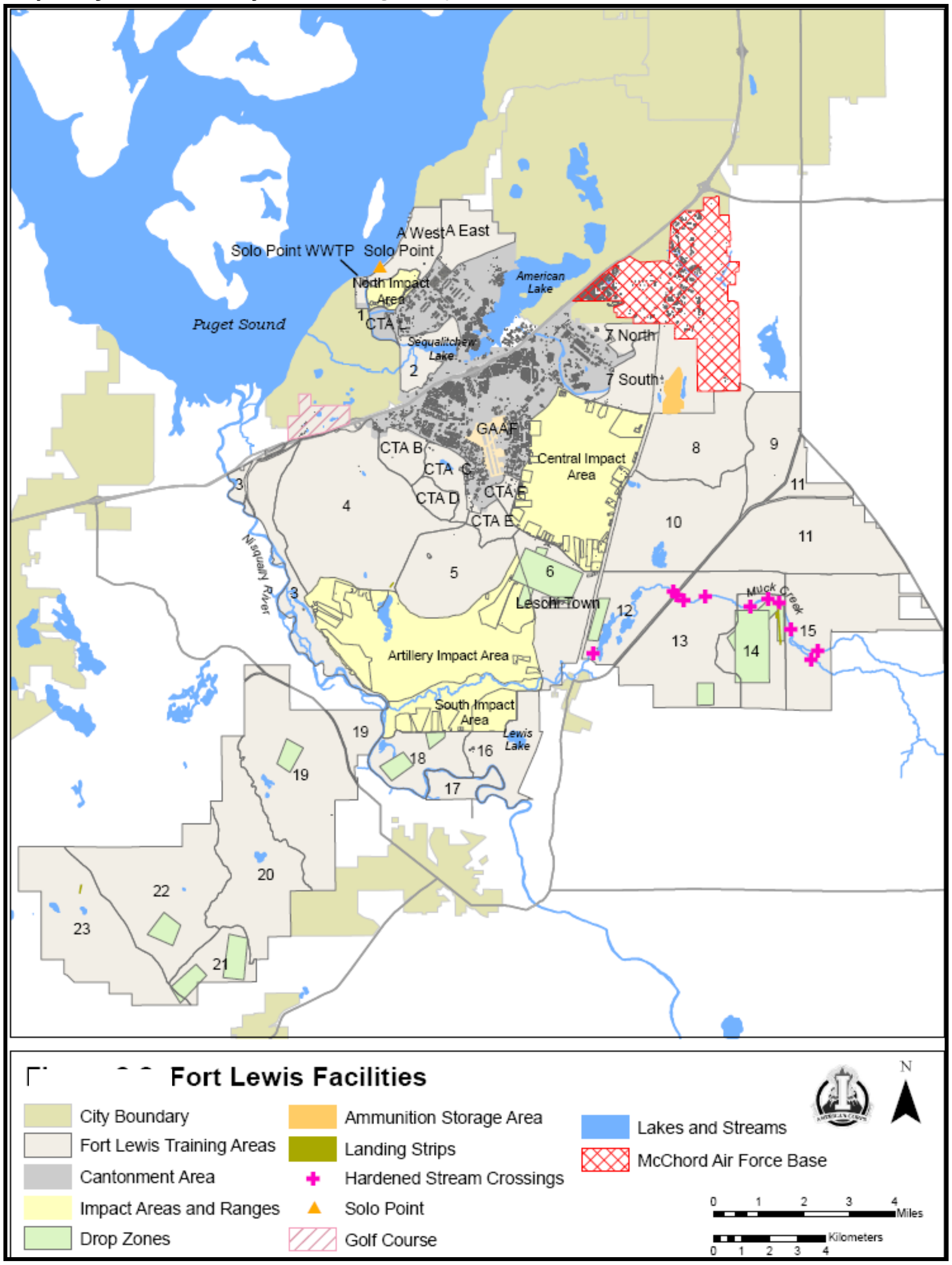
EPA Region 10 and the Services separately completed informal ESA consultation on EPA's MSGP permit action for #WAR05-B83F in 2010. EPA determined that stormwater discharges from regulated industrial activities at JBLM-McChord Field do not adversely affect endangered species or critical habitat. As a condition of obtaining the Services concurrence for this no effect determination, EPA required added additional monitoring provisions to the MSGP for JBLM-McChord Field, specifically to collect additional stormwater outfall data for total copper and total zinc to better characterize these discharges to Clover Creek.

See Section 4.1.2.4 of this BE for discussion of the stormwater discharge monitoring results and other data collected by JBLM.

2.3.1.3 JBLM-Military Training Areas.

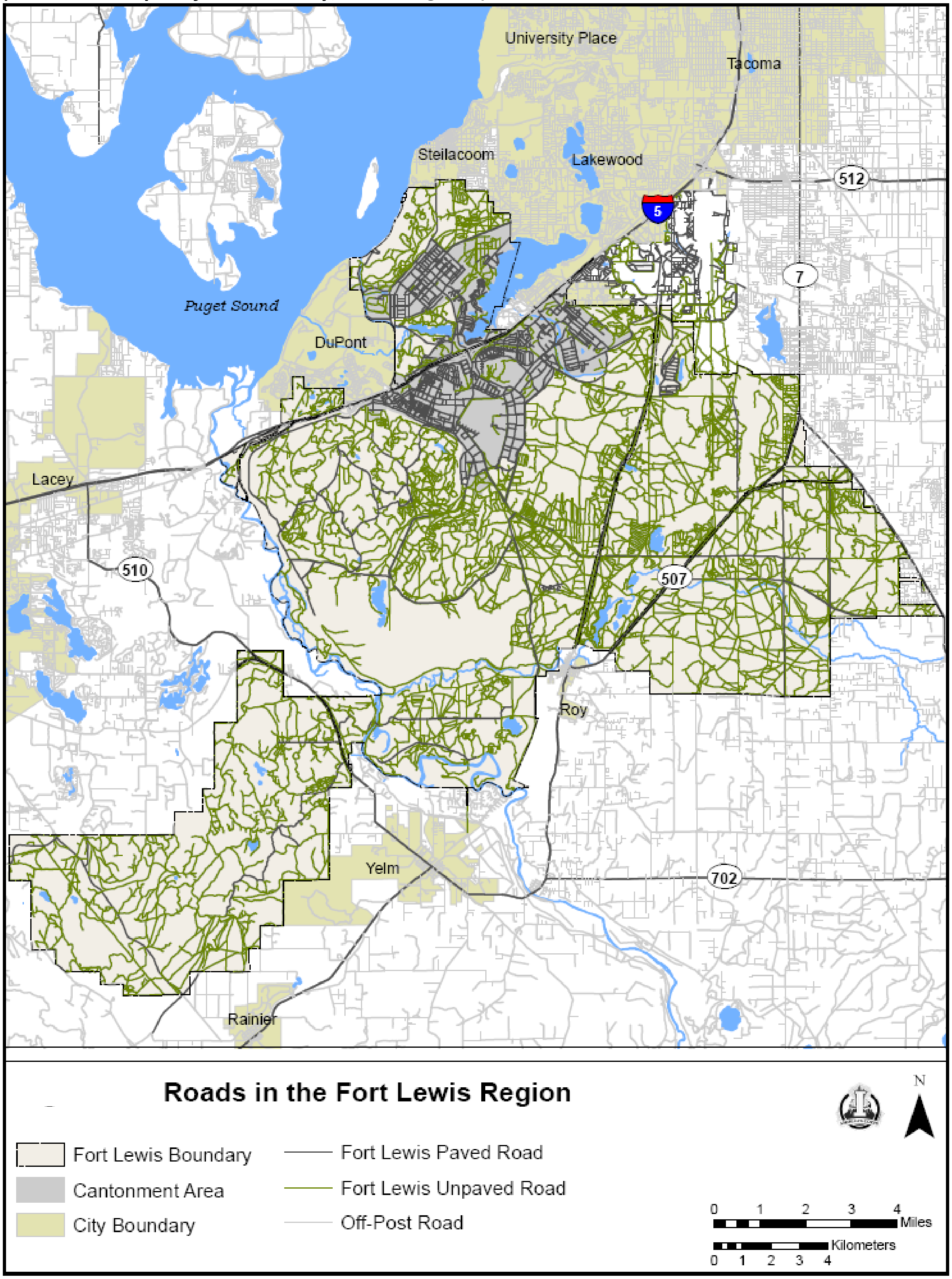
Military training areas at JBLM include forest, wetland, prairie, brush, and marine environments, and comprise approximately 75,570 acres outside of the JBLM cantonment areas (See Figures 1, 15 and/or 16). Training areas consist of ranges, impact areas, drop zones, and maneuver areas, are used 325 days per year, and support military training. The training areas include direct and indirect fire ranges located in four impact areas. Additionally, training areas include ammunition storage areas, urban combat areas, landing strips, and amphibious training sites. They are available for off-road vehicle movement, gunnery practice, digging (vehicle positions and foxholes), unit assembly areas, and unit deployment exercises. Dense forest covering much of the installation is ideal for light infantry maneuvers, which are primarily conducted on foot. Open areas in grassland habitats provide adequate space for vehicle maneuver training. These areas are accessed primarily through an extensive network of unpaved roads. See Figure 15. Specific portions of the training areas are controlled with military specific land use designations, restrictions, and other regulations as imposed by the U.S. Army to dictate the types of activities authorized in various locations; most designated zones in the training areas are environmentally sensitive areas, such as wetlands, streams and their associated buffers, cultural sites, and buffers for ESA-listed species Detailed descriptions of the JBLM training areas and their designations is available in the *Final Biological and Essential Fish Habitat Assessment- Army Growth and Force Structure Realignment (Grow the Army or GTA) at Fort Lewis and Yakima Training Center, Washington*.[6]

Figure 15. Depiction of JBLM Training Areas, Indicating Land Use Designations
(Source: Excerpted from US Army, 2010; Page 2-4)



6 US Army 2010, pages 2-3 through 2-32.

Figure 16. Depiction of Road Network within JBLM Cantonment and Training Areas
(Source: Excerpted from US Army, 2010. Page 2-5)



Based on the areas' designated purposes, the JBLM training are not presumed to have any significant MS4 infrastructure beyond that associated with roadside ditches along unpaved roads. Based on the type of soils within these areas, the roadside ditches likely act as infiltration swales. There is no existing inventory or assessment of any significant structural MS4 conveyance network, as found within the JBLM cantonment area. Because the of the training areas' long term intended use is preserved for active military training, future development within the JBLM training areas is not expected to occur. Stormwater from unpaved roads leading into or from these training areas presumed to largely, if not completely, infiltrate to ground. Based on the topography and geology of the training areas, any quantity of stormwater runoff which could discharge into nearby receiving waters is presumed to be very minimal.

JBLM has not yet evaluated the extent of any MS4 infrastructure which may exist outside of the cantonment area. Therefore, EPA's Permit requires JBLM to maintain maps and assessment information for MS4 infrastructure within the cantonment areas, and to begin assessment and mapping of any existing MS4 within the training areas on a prioritized basis. (See also Section 2.3.2.2.3). Starting with the training area located adjacent to Muck Creek, EPA's Permit requires JBLM to assess and map the presence of any existing MS4 infrastructure in the training area nearest Muck Creek prior to the expiration date of the Permit.

2.3.2 Description of the Permit's Narrative Effluent Limitations

EPA's Permit establishes narrative conditions, prohibitions and management practices for discharges of storm water from the MS4 owned or operated by JBLM as discussed below, and summarized in Table 4. Additional detail regarding these effluent limitations may be found in the final draft Permit and supporting Fact Sheet contained in Appendices 1 and 2 of this document, respectively.

Consistent with Clean Water Act Section 402(p)(3), NPDES regulations, Washington State administrative code, and other applicable Department of Ecology requirements, JBLM must implement a jurisdiction-wide municipal Storm Water Management Program (SWMP) designed to address the minimum controls required by federal regulation and summarized in Table 4 below. Documentation of the SWMP as required by the Permit must be compiled during the five year Permit term. Parts II.B and II.C of the Permit (included in this document as Appendix 2) collectively address the types of practices expected to be implemented through the SWMP that is implemented by JBLM. Many of these activities are already being conducted by JBLM. The Permit prescriptively describes in narrative format the expected content and activity associated with each mandatory minimum control measures. In compliance with EPA regulations, the installation-wide SWMP that JBLM implements must effectively prohibit the discharge of non-stormwater into the storm sewer system, and require controls to reduce pollutants in urban storm water discharges through the MS4 to the maximum extent practicable (MEP).[7] EPA has added both monitoring and retrofit planning requirements, See Sections 2.3.2.3 and 2.3.2.4.

[7] See also Appendix 1(EPA Fact Sheet), Pages 50 through 52 of 81).

Table 6: Summary of the JBLM MS4 Permit's Narrative Effluent Limits

Permit Part (see also Appendix 2)	Summary of Item/Action
I.C.	**Discharge prohibitions include:** • Discharge of non-stormwater from the MS4 is prohibited, except under certain specified conditions, (i.e., *allowable non-stormwater flows, such as flows in compliance with other NPDES permits, landscape irrigation water and/or uncontaminated pumped groundwater, may discharge through the MS4 provided that JBLM appropriately ensures that pollutant levels in these specified flows appropriately managed See Appendix 2, pages 3-5 for specific discharges and associated conditions.)* • Discharges that cause or contribute to exceedance of WA water quality standards [ie, WAC 173-201A (surface water, 173-204(sediment management) and/or 173-200 (groundwater)], are prohibited. • Discharges of snow and snow melt to surface waters, or to MS4, is prohibited, unless consistent with operational BMPs required elsewhere by the permit. • Discharges of otherwise regulated stormwater are allowed into the MS4, provided those discharges are authorized via an alternative NPDES permit.
II.A	**Implement comprehensive SWMP**- as directed through Part II.B - designed to control discharges of pollutants from the MS4 to the MEP; Document, track and maintain summary information about all SWMP activities
II.B.1	**Public Education and Outreach**
II.B.2	**Public Involvement and Participation**
II.B.3	**Illicit Discharge Detection and Elimination** – e.g, MS4 mapping; use of JBLM regulations/other authorities to prohibit non-stormwater discharges into MS4; field assessment activities; procedures to address and remove illicit discharges as necessary; program assessment; public education and employee training.
II.B.4	**Construction site stormwater runoff control program** – includes construction oversight, ordinance/regulation; enforcement; BMPs; appropriate contract language in Requests for Proposals which address construction related requirements as necessary; preconstruction site plan review and approval; construction site inspections, employee training
II.B.5	**Stormwater management for Areas of New Development and Redevelopment** – Site planning procedures, site plans, source control, design to minimize impervious areas, preserve vegetation, and preserve natural drainage systems to the maximum extent feasible; hydrologic performance requirements for onsite stormwater management and flow control; runoff treatment, wetland protection, inspections, proper operation and maintenance of SW facilities; employee training.
II.B.6	**Pollution Prevention and Good Housekeeping;** includes maintenance standards & practices; inspection requirements for catch basins, other facilities; spot check inspections; land management; pollution prevention plans for equipment maintenance/material storage yards.
II.C	**Stormwater Retrofit Plan to Reduce Discharges** to American Lake, Clover and Murray Creeks.
II.D	**Required Response to Violations of WQS**
II.E, F, & G	**Update of SWMP; Transfer of Ownership; SWMP Resources**
IV.	**Monitoring and Reporting**
V, VI	**Standard NPDES Permit Conditions**

2.3.2.1 Minimum Control Measures

2.3.2.1.1 *Federal Requirements*

Federal regulations at 40 CFR §122.32(b) require regulated MS4 operators to ensure that a comprehensive Stormwater Management Program is fully implemented throughout their jurisdiction. At a minimum, a comprehensive SWMP must address the following control measures: public education and outreach; public involvement; illicit (i.e., non-stormwater) discharge detection and elimination; construction site runoff control; post construction runoff control; and good housekeeping for municipal operations.

EPA's MS4 program regulations were developed with storm sewer systems serving city or county government areas in mind; however, in its Phase II stormwater program EPA acknowledges that a MS4 operated by a federal entity possesses unique characteristics which set them apart from any local government municipal counterparts. Federal MS4s often serve a diverse, specialized, and sometimes more transient, population. The illicit discharge detection and elimination, construction site runoff control and post construction runoff control program activities require the MS4 operator to impose enforceable controls on third party activities. EPA recognizes that federal MS4 operators (like JBLM) have limited regulatory responsibility over third parties operating within their boundaries, compared to the enforcement oriented ordinances enacted by local governments. EPA expects regulated federal MS4 operators to use all available authorities and mechanisms they possess to prohibit non-stormwater discharges from the MS4. JBLM has enforceable control of pollutants throughout its jurisdiction, which will improve through implementation of the SWMP activities specified in the NPDES Permit.[8]

The mandatory SWMP is influenced by both federal NPDES regulations and the stormwater management requirements for discharges to waters of the State established through the Washington Water Pollution Control Act (Revised Code of Washington [RCW] 90.48.010); the state water quality standards for surface waters (Washington Administrative Code [WAC] 173-201A); the state sediment management standards (WAC 173-204); national requirements for toxics control (57 FR 60-848-60923 [December 22, 1992]); and state groundwater standards (WAC 173-200).

2.3.2.1.2 *State Requirements*

On August 1, 2012, the Washington Department of Ecology (Ecology) revised its *Stormwater Management Manual for Western Washington* (2012 Ecology Manual), a technical guidance of measures to control stormwater runoff quantity and quality from construction, new development and redevelopment project sites. Using controls as specified in the 2012 Ecology Manual is necessary to achieve compliance with Washington State water quality standards, and help protect the beneficial uses of both surface and ground waters of the State. Stormwater management techniques applied in accordance with the 2012 Ecology Manual are presumed by Ecology to meet the technology-based treatment requirements established by Washington State law, to provide all known available and reasonable methods of treatment, prevention and control (also known as AKART; see Revised Code of Washington (RCW) 90.52.040 and RCW 90.48.010).

EPA's Permit specifies quantitative hydrologic performance requirements for onsite stormwater management and flow control requirements for discharges from new or redevelopment sites where stormwater volumes cannot be 100% managed onsite. Details are discussed in Section 2.2.2.2.5 below.

[8] USEPA1999 (see Pages 68749 and 68768); and USEPA 2000b.

The term "Low Impact Development" (LID) refers to developing land and managing resulting stormwater runoff in a manner that imitates the natural hydrology (or movement of water) at the project site. In general, LID techniques and practices attempt to manage surface water runoff as near to its source as possible. EPA's Permit requires LID practices appropriate for Western Washington. EPA incorporates into the Permit by reference the specifications outlined in the 2012 Ecology Manual, the 2012 *Low Impact Development Technical Guidance Manual for Puget Sound (2012 LID Manual),*[9] and the *Aviation Stormwater Design Manual - Managing Wildlife Hazards Near Airports (2008 ASDM).* [10]

2.3.2.2 Description of the Minimum Control Measures

Actual text of the EPA permit provisions are contained in Appendix 2 of this document.

2.3.2.2.1 *Public Education and Outreach*[11]

Part II.B.1 of the Permit requires JBLM to implement an education program to increase public understanding of the impacts of stormwater discharges on water quality and steps the public can take to reduce pollutants in stormwater runoff. Educating both the public and employees leads to greater overall compliance with the SWMP, as the public is made aware of personal responsibilities and individual actions that substantively protect or improve water quality in their area.

2.3.2.2.2 *Public Involvement and Participation*[12]

EPA believes that the public can provide valuable input and should be given opportunities to play an active role in SWMP implementation. Part II. B. 2 of the Permit requires that any public participation efforts comply with the applicable federal, state and/or local law. As an active military base, JBLM must focus on coordination within its internal organizations to achieve the SWMP program objectives, and must use regular internal meetings with affected JBLM organizations, and/or engage the broader JBLM "public" through a regularly convened Water Council. Annual reports and SWMP documentation must be available to the public, and at least once per year JBLM must coordinate at least one volunteer activity to engage base residents and personnel.

2.3.2.2.3 *Illicit Discharge Detection and Elimination*[13]

Part II.B.3 of the EPA Permit requires JBLM to use its existing regulations or other authorities to effectively prohibit non-stormwater discharges into MS4; however, as previously noted. Certain exceptions to this prohibition can be allowed under specific circumstances. JBLM must maintain a comprehensive map of its existing MS4 within the cantonment areas, and must update these maps as necessary. To confirm whether MS4 infrastructure drains from the military training areas, EPA's permit requires JBLM to assess and document the presence of any MS4 infrastructure in the portion of the training area draining to Muck Creek and or its tributaries; JBLM must complete this assessment, and produce a preliminary map of any existing MS4 drainage structures no later than the permit expiration date. JBLM must also update and maintain its ongoing program to locate and address/remove non-stormwater discharges, spills and illicit connections into the MS4, which includes field assessment; procedures to remove/disconnect any illicit discharges as quickly as possible; program assessment; public education; and employee training.

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[9] WSU & PSP 2012.

[10] WSDOT & FAA 2008.

[11] See 40 CFR § 122.34(b)(1); Appendix 2 (Permit)-pages 23-24, & Appendix 1 (Fact Sheet)-pages 6-8 of 81.

[12] See 40 CFR §122.34(b)(2); Appendix 2(Permit)-pages 24-25; & Appendix 1 (Fact Sheet)-page 8 of 81.

[13] See 40 CFR §122.34(b)(3); Appendix 2 (Permit)-pages 8-13; & Appendix 1 (Fact Sheet)pages 25-27 of 81.

2.3.2.2.4 *Construction Site Stormwater Runoff Control Program* [14]

Part II.B.4 of the EPA Permit requires JBLM to control stormwater runoff from all construction activities disturbing 5,000 square feet or more, by ensuring sufficient oversight of individual contractors hired to carry out specific construction projects; specifying requirements through ordinance or regulation for erosion/sediment controls and onsite materials management sufficient to protect surface and ground water quality; including appropriate contract language in Requests for Proposals to include such construction related requirements as necessary; reviewing and approving preconstruction site plan to ensure appropriate controls are used; prioritizing construction sites and conducting site inspections; ; and ensuring employees are properly trained to accomplish these objectives.

2.3.2.2.5 *Stormwater Management for Areas of New Development and Redevelopment*[15]

The permit requires JBLM to manage stormwater from developed areas in a manner that preserves and restores the area's predevelopment hydrology. To accomplish this, JBLM must:

- Require through ordinance or other regulatory mechanism that runoff from all public and private new development project sites which will cause land disturbance of 5,000 square feet or more to be designed in a manner that protects water quality and reduces the discharge of pollutants to the maximum extent practicable;
- Require designers of new development or redevelopment sites to use site planning procedures as outlined in the 2012 Ecology Manual, the 2012 LID Manual, and the 2008 ASDM, as appropriate;
- Require source control practices in accordance with the 2012 Ecology Manual;
- Ensure that projects are designed to minimize impervious surfaces, retain vegetation, restore native vegetation, and preserve natural drainage systems to the maximum extent feasible;
- Require onsite stormwater management to infiltrate, disperse, retain, and/or harvest and reuse stormwater runoff to the maximum extent technically feasible (Section 2.3.2.2.5.1 below discusses this requirement);
- Ensure certain types of projects are designed to meet a hydrologic performance requirement for flow control, including: sites which create $\geq$ 10,000 square feet of effective impervious surface area; sites converting ¾ acres or more from native vegetation to lawn/landscaping and from which there is a discharge to a natural or manmade conveyance system; and, sites converting 2.5 acres of native vegetation to pasture from which there is surface discharge to natural or manmade conveyance system (Section2.3.2.2.5.1 below discusses this requirement);
- Ensure proper construction of all runoff treatment facilities;
- Ensure discharges to wetlands maintain the conditions and characteristics necessary to support designated wetland uses;
- Conduct inspections to ensure that all runoff management practices are properly installed and operating as required; and
- Ensure that responsible staff members are adequately trained to conduct site plan review, hydrologic modeling, inspections and enforcement activities.

[14] See 40 CFR §122.34(b)(4); Appendix 2 (Permit)- pages 13-15; & Appendix 1 (Fact Sheet)-pages 28-30 of 81.
[15] See 40 CFR §122.34(b)(5); Appendix 2 (Permit)-pages 15-20; & Appendix 1 (Fact Sheet)-pages 30-41, 70-81.

2.3.2.2.5.1 Hydrologic Performance Requirements for Onsite Stormwater Management and Flow Control

To protect water quality to the maximum extent practicable, it is necessary that any new development and redevelopment sites within the contributing watersheds be planned, designed, and constructed in a manner that all development mimics natural hydrology, thereby minimizing the negative impacts of urbanization on the aquatic environment.[16] In EPA's permit, JBLM must require project sites which will disturb 5,000 square feet or more to incorporate onsite stormwater management practices to the maximum extent technically feasible by designing sites in the following manner:

- All lawn and landscaped areas must use native and/or amended soils as specified in the 2012 Ecology Manual, 2012 LID Manual and/or the 2008 ASDM, in order to restore sufficient stormwater treatment and storage functions; this is necessary because such areas can be degraded during development through removal or compaction;

- Project sites disturbing 5,000 square feet or more (and which will create or replace between 2,000-4,999 square feet of hard surface) must be designed to use dispersion and infiltration practices consistent with the 2012 Ecology Manual, the 2012 LID Manual, and/or the 2008 ASDM. Such techniques include rain gardens, bioretention areas, downspout dispersion, and permeable pavement. As discussed in Section 4.1, soils within JBLM are particularly well suited for infiltration, and for drainage from relatively small impervious areas.

- Project sites disturbing 5,000 square feet or more (and which will create or replace >5,000 square feet of hard surfaces) must be designed to retain on-site the volume of stormwater produced from the 95th percentile rainfall event. This performance standard provides a design objective that is quantitative and easily calculable, and which restores site hydrology towards its natural Puget Sound lowland condition. The volume of stormwater to be retained on the developed project site will therefore closely match the volume that would be retained under the site's undeveloped condition. Sites designed to attain this performance standard will mitigate the runoff from the most frequent Western Washington storm events, storms which currently contribute the bulk of pollutant loads and of discharge volumes into nearby receiving waters.

The onsite stormwater management standard is consistent with Ecology's approach to require LID, where feasible, through its comparable NPDES permits issued to other MS4s regulated by Ecology in Western Washington. Ecology 's comparable LID hydrologic performance standard in its recently issued Western Washington Phase II Municipal Stormwater Permit requires that local ordinances dictate a site's post-development stormwater discharge flows be designed to match the site's pre-development discharge flows, for the range from 8% of the 2-year peak flow to 50% of the 2-year peak flow.[17] Using continuous simulation modeling, and assuming soils with high infiltration rates of greater than 0.2 in/hr (such as those that exist throughout the JBLM area), EPA has calculated that the performance standard as expressed in EPA Permit requiring retention onsite of the volume associated with the 95th percentile rain event is functionally equivalent to Ecology's LID hydrologic performance standard as it is expressed in the Western Washington Phase II Municipal Stormwater Permit (effective August 2013 – July 2018), and the 2012 Ecology Manual.[18]

[16] See also Appendix 1 (Fact Sheet for Permit), pages 31-32 of 81.
[17] WDOE 2012a, 2012b.
[18] WDOE 2012a, 2012b; and Appendix 1 (Fact Sheet for Permit)-page70 of 81.

2.3.2.2.5.2 Exemptions from Onsite Stormwater Management

JBLM may exempt a specific project from managing all of the calculated volume onsite, if JBLM determines that compliance with the performance standard is not technically feasible. JBLM must use all reasonably available SW management techniques, and must document their rationale and supporting engineering or like analysis, and must quantify the total runoff volume that can successfully be managed onsite compared to the remaining annual runoff volume which must otherwise be discharged. Examples of site conditions which may prevent retention of 100% of the required may include, for example, areas with low soil infiltration capacity; areas with high groundwater; and/ or sites with contaminated soils.

Because the geologic and soil conditions at JBLM are favorable to runoff infiltration, EPA expects that only in rare instances will it be technically infeasible for JBLM to comply with the onsite management requirement.

2.3.2.2.5.3 Hydrologic Performance Requirement for Flow Control

For certain large development or redevelopment sites which cannot effectively manage all of the stormwater onsite, the permit requires that JBLM impose site design requirements to control flows by limiting discharges to receiving waters. To do this, sites must be designed using the Western Washington Hydrology Model (WWHM) or other approved continuous runoff model such that the post-development discharge flow does not exceed the pre-development discharge flow over the range of 50% of the 2-year peak flow to 100% of the 50-year peak flow.

The predevelopment hydrologic flow condition to be used in the modeling must be “forested land cover” (unless historic information indicates the site was originally “prairie”). This flow control standard applies to two types of sites: 1) sites which create or replace 10,000 square feet or more of effective impervious surface area; and 2) sites from which there is a surface discharge to a natural or manmade conveyance system, and which convert ¾ acres or more from native vegetation to lawn/landscaping, or will convert 2.5 acres or more of native vegetation to pasture.

Controlling flow rates is necessary to eliminate accelerated stream channel erosion which causes bedload sediment movement in Puget Sound lowlands.[19] This flow control standard significantly reduces alteration to the natural hydrology, and thus reduces impacts on the beneficial uses and biological communities which are dependent on that hydrology.[20] The flow control standard is an important component of an overall watershed strategy to preserve and restore high quality aquatic resources such as salmonid species as well as other ecologically, commercially, and culturally important fish species.

2.3.2.2.5.4 Exemptions from the Flow Control Requirement

JBLM may choose that a site cannot meet the flow control standard in only two scenarios:

- The first scenario exempts flow control for any future project sites designed to discharge stormwater through OF 04 or OF 05 to the JBLM Canal. The JBLM Canal is a man made

[19] Booth 1997.
[20] DeGaspari, et al. 2009.

conveyance, draining directly to Puget Sound; it is therefore unnecessary to prevent stream channel erosion within the JBLM Canal and/or into Puget Sound.[21]

- The flow control standard does not need to be fully met based on a determination that managing 100% of the calculated flow volume from the development will result in severe economic costs. This exemption is outlined in Permit Appendix C.[22] JBLM must manage as much of the calculated flow volume as possible, and document the specific circumstances of the determination in writing via letter to EPA within 15 days of the determination. The costs to provide temporary storage for runoff volumes at a development project site are not prohibitive, based on cost information available from other MS4s regulated in Western Washington; therefore, EPA does not expect that JBLM to have a basis for exempting project sites from the flow control requirement due to severe economic costs.[23]

2.3.2.2.6 *Good Housekeeping for Municipal Operations*

The permit requires JBLM to implement an operation and maintenance program to prevent or reduce pollutant runoff from the MS4 and other activities conducted by the JBLM. Proper and timely maintenance of stormwater management facilities helps to avoid repair costs from damage caused by age and neglect, and ultimately protects receiving water quality.

JBLM is responsible for all structural stormwater facilities located within the installation; for the purposes of the Permit, EPA defines the term "Stormwater Facility" as:

> .."*a constructed component of a stormwater drainage system, designed or constructed to perform a particular function or multiple functions. Stormwater facilities include, but are not limited to, pipes, swales, ditches, culverts, street gutters, detention basins, retention basins, constructed wetlands, infiltration devices, catch basins, oil/water separators, sediment basins, and modular pavement."*

In particular, JBLM's ongoing and regular maintenance of the treatment and infiltration facilities located in the JBLM-North and JBLM-Main cantonment areas is a crucial stormwater management practice which prevents adverse runoff related impacts and protects the aquatic habitat and species. As cited previously, the treatment and infiltration facilities receive most of the runoff draining from approximately 5,000 combined acres of the JBLM cantonment area. Operation of the JBLM stormwater management facilities, implementation of the new and redevelopment sites design standards, and other SWMP activities, provide important stormwater treatment and flow management which is protective of species within the Action Area.

The Permit requires JBLM to:

- adopt maintenance standards to determine when maintenance of a specific function or location is necessary;

[21] All other narrative effluent limitations within the Permit pertaining to the Stormwater Management for Areas of New Development and Redevelopment, including the onsite stormwater management requirements, apply to any project site that meets the site size thresholds and which may discharge to the Canal discharge through OF 04 or OF 05 in JBLM-North.
[22] See Appendix 2 (Permit)-page 62.
[23] WDOE 2012c.

- conduct annual inspections of permanent stormwater facilities, and spot checks of potentially damaged facilities after major storm events;[24]
- inspect (and clean as necessary) all catch basins and inlets prior to the permit expiration date of the permit;
- dispose of decant water and solids in an appropriate manner;
- use practices that reduce pollutants in runoff from right of ways, maintenance yards, and associated JBLM street/road maintenance activities, as well as reducing impacts from land management activities;
- ensure training for JBLM staff and contractors whose job functions may impact stormwater quality;
- manage runoff from any heavy equipment maintenance, or material storage areas that are not already addressed under the MSGP; and
- document all summary information for inspections, maintenance and repair activity, and submit summary information in each Annual Report.

2.3.2.3 Retrofits to Reduce Discharges to Receiving Waters

Physically disconnecting conveyances which allow runoff from impervious areas to discharge to surface waters prevents pollutants from entering water bodies and eliminates the physical impacts of runoff which compromises channel integrity, allowing for greater groundwater recharge. Opportunities to redevelop existing sites makes it possible to make capital improvements at the site level which improve water quality and aquatic habitat and correct the negative impacts of urbanization on receiving waters. JBLM must begin a retrofit planning process to identify feasible structural retrofit project sites; these retrofit projects must reduce runoff flow volumes and associated pollutants currently causing impairment (i.e., phosphorus, and pH) in waters which are known to not currently meet the Washington WQS, and to reduce discharge volumes,. Within three years of the permit effective date, JBLM must develop a prioritized list of retrofit projects that, if completed, would reduce stormwater discharge/flow volumes into Clover Creek, Murray Creek, and Puget Sound through the use of LID or other site based stormwater management practices. Prior to the permit expiration date, JBLM must initiate or complete one or more retrofit project sufficient to disconnect and infiltrate discharges from the effective hard surfaces equal to five impervious acres cumulative area. A retrofit implementation status report must be submitted with the 5th Year Annual Report.

2.3.2.4 Required Response to Violations of Washington Water Quality Standards

The Permit includes a corrective action, or adaptive management, provision, through which JBLM must identify to EPA any noncompliance with the permit requirements and subsequently may identify response actions upon notification from EPA. EPA reserves its enforcement authority to respond to a violation of water quality standards even if JBLM conducts the adaptive management response activities.

[24] "Major storm event" is defined in EPA's final draft Permit to mean a 24-hour, 10-year recurrence interval rainfall or snow melt event. (Appendix 2, page 47 of 64).

2.3.2.5 Monitoring, Recordkeeping and Reporting

2.3.2.5.1 *Monitoring*

The Permit requires JBLM to conduct monitoring of stormwater discharges, ambient surface water, and biologic indicators. In general, monitoring information collected by the JBLM will be used to evaluate the overall success of the SWMP and to define adjustments to Permit requirements as necessary in future permit terms. The purpose of the monitoring is to: 1) broadly estimate pollutant loading from the MS4 into Clover Creek, Murray Creek and Puget Sound and 2) determine the effectiveness of the JBLM stormwater management program activities.

American Lake is listed by the State of Washington as impaired for phosphorus; EPA is not aware of any existing monitoring data or information regarding the quality and quantity of the JBLM MS4 discharges into either the Lake or the Canal. Monitoring of direct stormwater discharges to American Lake and the JBLM Canal is required to further characterize pollutant loadings into both these receiving waters. It is also necessary to define the proportional contribution of stormwater overflow discharging via the Canal into Puget Sound.

Surface water monitoring in Murray Creek is required to better understand a possible source of phosphorus loadings to American Lake, as Murray Creek is tributary to the lake.

Clover Creek is listed by the State of Washington as impaired for pH, fecal coliform and dissolved oxygen. To better assess sources of pollutants in Clover Creek between JBLM -McChord Field and the fence line border of the installation, the MS4 Permit requires JBLM to establish or continue an in-stream water quality monitoring station at a location at/near the property line where the Creek leaves the JBLM installation.[25]

JBLM must also conduct biological monitoring twice during the permit term in Clover Creek and Murray Creek, to augment other regionally available information regarding overall stream health.
Benthic macroinvertebrate sampling is recommended through the Puget Sound Partnership's Ecosystem Recovery Targets for the Puget Sound basin, stating that: "*By 2020, 100% of Puget Sound lowland stream drainage areas monitored with baseline Benthic Index of Biological Integrity (B-IBI) scores of 42-46 or better retain these excellent scores, and mean B-IBI scores of 30 Puget Sound Lowland drainage areas improve from 'fair' to 'good.'* " The B-IBI is used as an indicator of the effects of development and stormwater runoff on watershed health, and is considered appropriate monitoring for Puget Sound lowland streams.[26] Local governments conduct stream health monitoring using similar macroinvertebrate sampling protocols, and analyze/score samples according to the Puget Sound Lowlands B-IBI, as reflected at Puget Sound Stream Benthos website (www.pugetsoundbenthos.org).

[25] Limited stormwater monitoring data exists, which characterizes industrial stormwater discharges from JBLM-McChord Field into the Clover Creek and collected as a result of the separate ESA consultation for industrial stormwater discharges authorized under the MSGP. Through this effort, JBLM also voluntarily collected in-stream monitoring data for Clover Creek since late 2010 (See Figure 26).
[26]Karr, et al. 1997; PSP 2011; and Pierce County 2011.

2.3.2.5.2 *Recordkeeping and Reporting*

JBLM must keep records required by this permit for a period of at least five years. Records must be submitted only when requested by EPA. JBLM's SWMP materials must also be available to the public. The Permit requires that JBLM submit Annual Reports, pursuant to 40 CFR §122.34(g)(3). The Annual Reports must contain an evaluation of the SWMP for compliance with the terms of the permit, including progress towards achieving the measurable goals, a summary of any information collected and analyzed, including data and discharge monitoring reports. The Annual Report should summarize SWMP statistics for the reporting period, including the number of new development or redevelopment projects initiated and completed using the hydrologic performance standards, etc.

3.0 STATUS OF SPECIES, CRITICAL HABITAT and ESSENTIAL FISH HABITAT

3.1 Species List

In a meeting between EPA, USFWS and NMFS staff on June 5, 2012, the following endangered, threatened, and candidate listed species, their associated critical habitat, and Essential Fish Habitat were identified as potentially present within the Action Area:

Endangered, Threatened, and Candidate Listed Species Potentially Present in the Action Area	Critical Habitat in the Action Area	Essential Fish Habitat in the Action Area
Chinook salmon *(Oncorhynchus tshawytscha) – ESA Threatened*	**Yes**	**Yes**
Puget Sound Steelhead trout (*Oncorhynchus mykiss*) – ESA *Threatened*	No	N/A
Bull Trout (*Salvelinus confluentus)* – ESA *Threatened*	**Yes**	N/A
Coho salmon (*Oncorhynchus kisutch*)- EFH	N/A	**Yes**
Pink salmon *(Oncorhynchus gorbuscha)* - EFH	**No**	**Yes**
Marbled murrelet (*Brachyramphus marmoratus marmoratus*)	No	N/A
Streaked Horned Lark (*Eremophila alpstris strigata*)	No	N/A
Northern Spotted Owl (*Strix occidentalis caurina*)	No	N/A
Taylor's Checkerspot Butterfly (*Euphydryas editha taylori*)-	No	N/A
Mardon Skipper (*Polites mardon*)	No	N/A
Water howellia (*Howellia aquatilis)*	No	N/A
Marsh sandwort *(Arenaria paludicola)*	No	N/A
Golden paintbrush *(Castillija levisecta)*	No	N/A
Canada lynx (*Lynx canadensis)*	No	N/A
Gray wolf *(Canis lupus)*	No	N/A
Grizzly bears *(Ursus arctos)*	No	N/A
Mazama Pocket Gopher (Thomomys mazama)	No	N/A
Southern resident killer whale (*Orcinus orca*)	No	N/A

3.2 Species Which This Action Results in "No Effect"

EPA has concluded the following ESA listed candidate, threatened and/or endangered species will not be affected by the EPA permit action within the Action Area, and therefore is not consulting with the Services on these species or their habitats: Marbled Murrelet; Streaked Horned Lark; Northern Spotted Owl; Taylor's Checkerspot Butterfly; Mardon Skipper Butterfly; Water Howellia; Marsh Sandwort, Golden Paintbrush, Canada Lynx, Gray wolf, Grizzly Bear, Mazama Pocket Gopher, and Southern Resident Killer Whale.

3.3 Status of ESA Species and Critical Habitat in the Action Area

This section describes the ESA-listed species in the Action Area that may be potentially affected by the Action specifically: Puget Sound Chinook salmon; Puget Sound Steelhead Trout; and Bull Trout. A discussion of the life history, habitat use, and habitat concerns of each species is outlined below. This section also describes designated critical habitat in the Action Area for Puget Sound Chinook and Bull Trout.

3.3.1 Puget Sound Chinook Salmon [27]

3.3.1.1 Puget Sound Chinook Status and Distribution

The Evolutionarily Significant Unit (ESU) of Puget Sound Chinook salmon was listed as threatened on March 24, 1999.[28] The boundaries of the Puget Sound Chinook salmon ESU correspond with the Puget Lowland Ecoregion. This ESU encompasses all runs of Chinook salmon in the Puget Sound region from the North Fork Nooksack River to the Elwha River on the Olympic Peninsula. Hatchery fish are known to spawn in the wild in the Elwha and Dungeness river basins and are not considered discrete stocks from the wild fish.[29]

NMFS initially designated critical habitat for Puget Sound Chinook on February 16, 2000, and revised the designation on September 2, 2005. Critical habitat consists of the water, substrate, and the adjacent riparian zone of accessible estuarine and riverine reaches.[30]

3.3.1.2 Puget Sound Chinook Presence & Critical Habitat in the Action Area

Puget Sound Chinook salmon may be present in the area of Puget Sound near the JBLM Canal outfall; life stage presence may include adult Chinook migrating to freshwater systems, and foraging juveniles and subadults. However, the location of the JBLM Canal outfall is an area which is not known to have any particular high use by Puget Sound Chinook salmon because it is not near any stream or river entrance; in addition, the area is not particularly suited for foraging, due to extensive shoreline armoring and other existing nearshore impacts.[31]

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[27] USEPA 2012, NMFS 2005a, 2005b.
[28] NMFS 1999a.
[29] WDFW 1992/1994.
[30] NMFS 2000, 2005a.
[31] NMFS 2005a, 2005b.

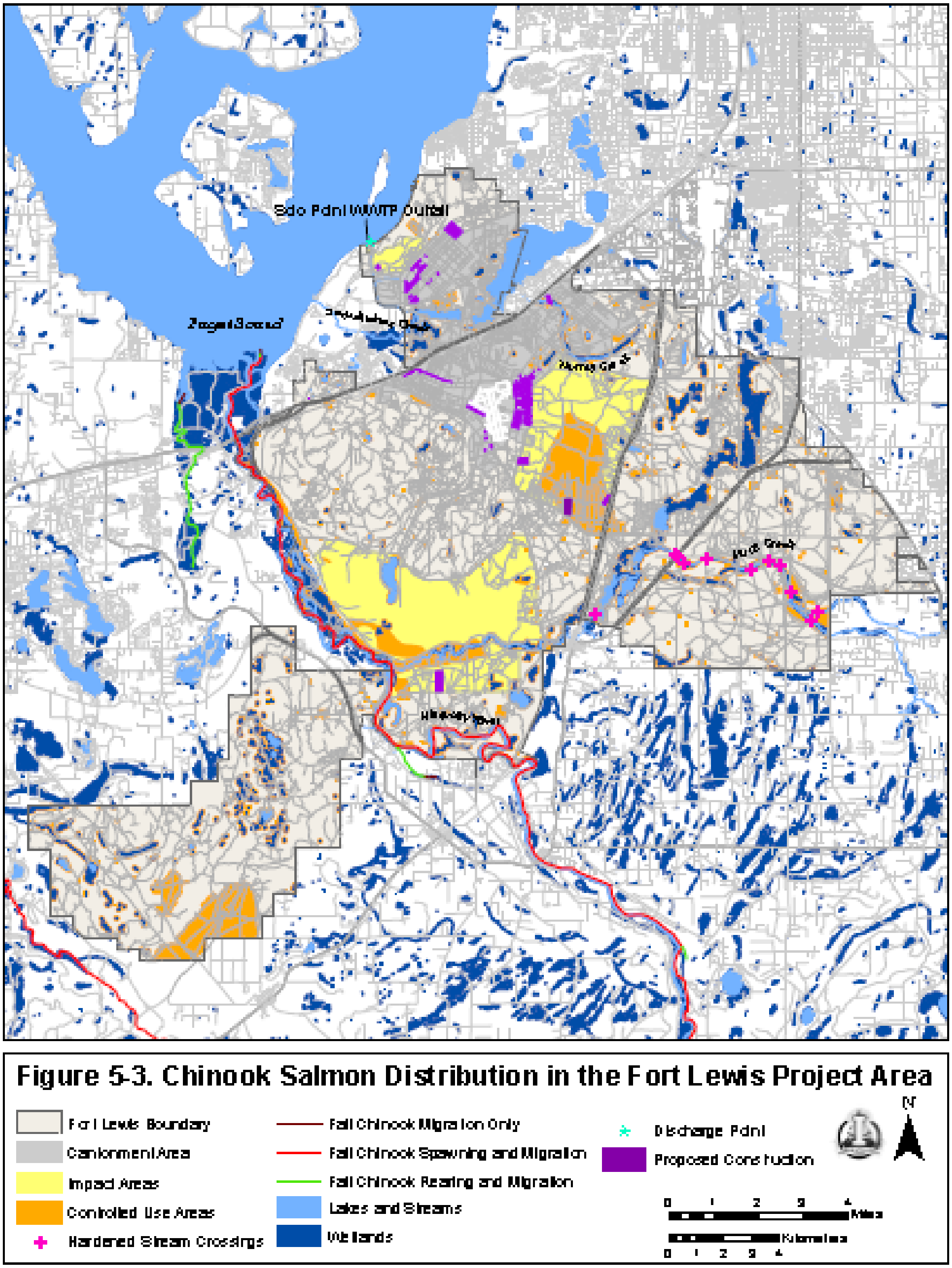
Figures 18 and 19 depict river areas used by Puget Sound Chinook salmon near JBLM.[32] Fall Chinook migrate and spawn in the Nisqually River, which as previously noted is presumed to be unaffected by discharges from the JBLM MS4. Puget Sound Chinook are likely present in the lower reaches of Chambers Creek, which is downstream and outside the Action Area.

Puget Sound Chinook are not known to be present in Clover Creek, which is the only upstream tributary of Chambers Creek located within the Action Area where MS4 discharges from JBLM-McChord Field occur. Puget Sound Chinook salmon are not known to be present in Sequalitchew Lake, Murray Creek, American Lake, or other water bodies on JBLM.

The only Puget Sound Chinook critical habitat designated in the Action Area that may potentially be affected by the Action is the area of Puget Sound near the JBLM Stormwater Canal outfall. As noted above, the location of the JBLM Canal outfall is an area which is not known to have any particular high use by Puget Sound Chinook salmon, and is not particularly suited for foraging due to extensive shoreline armoring and other existing nearshore impacts.[33]

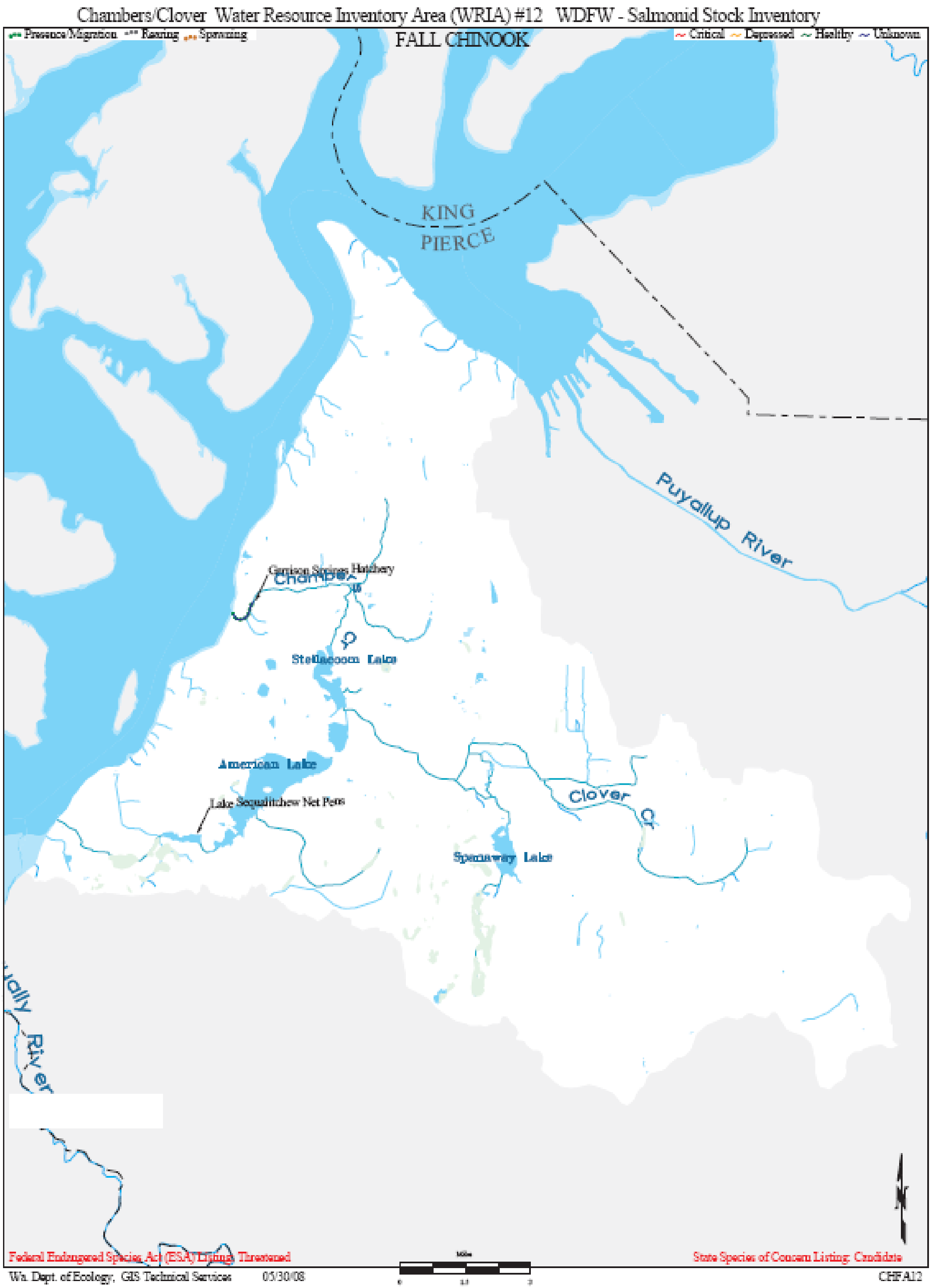
[32] Army 2010 Page 5-14.
[33] NMFS 2005a, 2005b, 2012c.

Figure 18. Puget Sound Chinook Distribution in the JBLM Cantonment and Training Areas (*Source: US Army, 2010, page 5-8*)



Source: Stream Net 2009

Figure 19. Puget Sound Chinook Salmon Presence and Distribution Near the Action Area within the Chambers/Clover Creek Watershed (*Source: WDFW, 2008*)



3.3.1.3 Puget Sound Chinook Life History

Puget Sound Chinook salmon spawn and rear in the mainstem of rivers and larger streams.[34] Puget Chinook salmon all exhibit an ocean-type life history where adults return to freshwater with developed gonads and migrate a relatively short distance in freshwater before reaching their spawning grounds. Although the incubation period is determined by water temperatures, fry typically hatch in about eight weeks.[35]After emergence, Puget Sound juvenile Chinook salmon migrate to the marine environment during their first year. Although some spring-run Chinook salmon populations in the Puget Sound ESU have a high proportion of yearling smolt emigrants, the proportion varies substantially from year to year and appears to be environmentally mediated rather than genetically determined. Puget Sound stocks all tend to mature at 3 to 4 years old and exhibit similar, coastally-oriented, ocean migration patterns.[36]

Rearing and development to adulthood occurs primarily in estuarine and coastal waters.[37] The amount of time juvenile Puget Sound Chinook spend in estuarine areas depends upon their size at downstream migration and rate of growth. While residing in upper estuaries, juvenile prey mainly on benthic and epibenthic organisms, such as amphipods, mysids, and crustaceans. Juveniles typically move into deeper waters when they reach approximately 65-75 mm in fork length. As the juveniles grow and move to deeper waters with higher salinities, their main prey changes to pelagic organisms such as decapod larvae, larval and juvenile fish, drift insects, and euphausids.[38]

3.3.1.4 Puget Sound Chinook Reasons for Decline

The abundance of Chinook salmon in this ESU has declined compared to historic levels. The reasons for the decline include widespread stream blockages which have reduced available spawning habitat. Release of hatchery fish from limited stocks has increased the risks of loss of genetic diversity and fitness of natural populations. In addition, the large number of hatchery releases masks natural population trends and makes it difficult to determine the sustainability of the natural populations. Forestry practices, farming and urbanization have also blocked or degraded fresh water habitat.[39]

3.3.1.5 Puget Sound Chinook Research and Recovery

The NMFS adopted the Recovery Plan for the Puget Sound Chinook Salmon ESU on January 19, 2007. The Recovery Plan consists of two documents: the Puget Sound Salmon Recovery Plan prepared by the Shared Strategy for Puget Sound and NMFS' Final Supplement to the Shared Strategy Plan.[40] The Recovery Plan recognizes that recovery actions must be implemented at both the regional and watershed levels, and it proposes both types of site specific actions. Watershed-level actions are detailed in the individual watershed plans contained in Volume II of the Shared Strategy Plan, and regional actions are described in Volume I. The Recovery Plan states that recovery will depend on integrating actions that address habitat (including hydropower effects), harvest, and hatchery operations. The Shared Strategy Plan provides cost estimates to carry out specific recovery actions for the first 10 years of plan implementation, as well as cost estimates for programs that span multiple

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[34] Healey 1991.
[35] Wydoski 1979; Healey 1991.
[36] Myers 1998.
[37] Myers 1998.
[38] Simenstad,et al. 1982.
[39] Myers 1998.
[40] Shared Strategy for Puget Sound 2007; NOAA 2006b.

watersheds: hatchery improvements, nearshore and marine habitat protection and restoration, and incentive programs for habitat restoration and conservation on farm and small forest lands.

3.3.2 Puget Sound Steelhead Trout[41]

3.3.2.1 Puget Sound Steelhead Trout Status and Distribution

The Puget Sound Steelhead Trout's Distinct Population Status (DPS) was listed as threatened on May 11, 2007. This DPS includes all naturally spawned anadromous winter-run and summer-run steelhead populations, in streams in the 18 river basins of the Strait of Juan de Fuca, Puget Sound, and Hood Canal, Washington, bounded to the west by the Elwha River (inclusive) and to the north by the Nooksack River and Dakota Creek (inclusive), as well as the Green River natural and Hamma Hamma winter-run steelhead hatchery stocks. [42]

There is no critical habitat designated for Puget Sound Steelhead trout.[43]

3.3.2.2 Puget Sound Steelhead Trout Presence & Critical Habitat in the Action Area

Puget Sound Steelhead may be present in the south Puget Sound area near the JBLM Canal outfall. Life stage presence may include adult migrating to freshwater systems and foraging juveniles and sub-adults. However, the outfall is located in an area which is not known to have any particular high use by steelhead, because it is not located at a stream or river entrance, and the specific area is not well suited for foraging due to existing shoreline armoring and other nearshore impacts. Critical habitat is not designated in the nearshore marine areas of Puget Sound, due to information indicating that steelhead do not favor migration along shorelines. [44]

Figures 20, 21, and 22 depict Steelhead presence in fresh water bodies near JBLM. Puget Sound Steelhead are present in Chambers Creek (downstream and outside the Action Area); the WDFW winter steelhead distribution map indicates that no steelhead trout are known to be present in Clover Creek, the only upstream tributary of Chambers Creek which is located within the Action Area where MS4 discharges occur, and in Nisqually River (which, as previously noted, is presumed to be unaffected by the JBLM MS4 discharges). Winter steelhead are known to rear and migrate in Muck Creek (which is also presumed to be unaffected by the JBLM MS4 discharges). Approximately 161 miles of occupied riverine habitat in Nisqually River subbasin is currently proposed as critical habitat; however, NMFS proposes to exempt freshwater bodies occupied by steelhead within the boundaries of JBLM because these areas are subject to an Integrated Natural Resource Management Plan (INRMP) , which includes beneficial actions to protect steelhead (including such actions as eliminating fish passage barriers, controlling erosion, protecting riparian zones, increasing stream habitat complexity, and monitoring listed species and their habitats). [45]

[41] NMFS 2005a, 2007; PSMFC 1998.
[42] NMFS 2007, 2013.
[43] NMFS 2012b, 2012c, 2013.
[44]NMFS 2012, 2013.
[45] NMFS 2005; 2013.

Figure 20 – Winter Steelhead Distribution in the JBLM Cantonment and Training Areas (Excerpted from the US Army 2010*, page 5-10*)

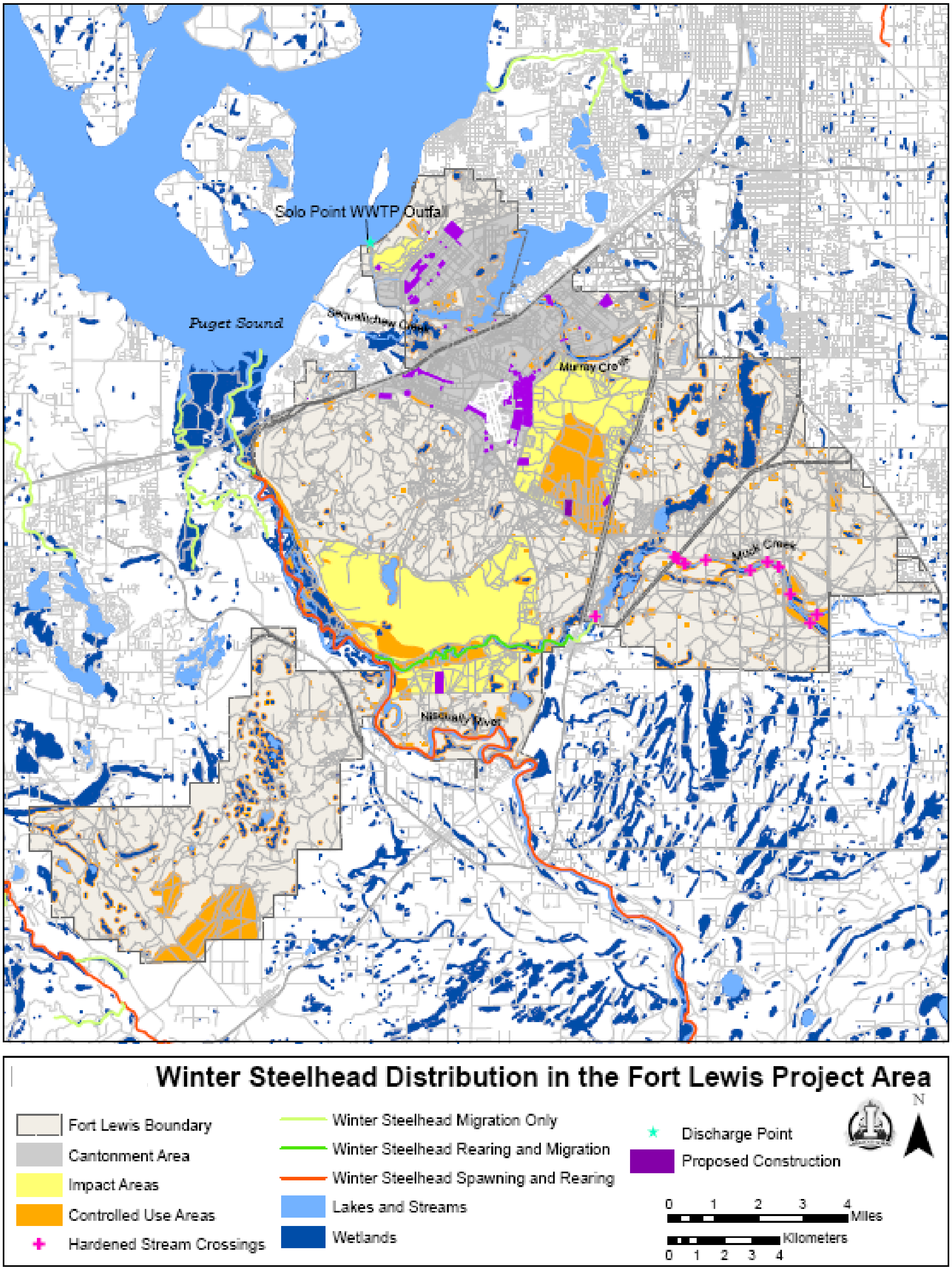


Figure 21 – Summer Steelhead Distribution in the JBLM Cantonment and Training Areas (Excerpted from the US Army 2010, page 5-9)

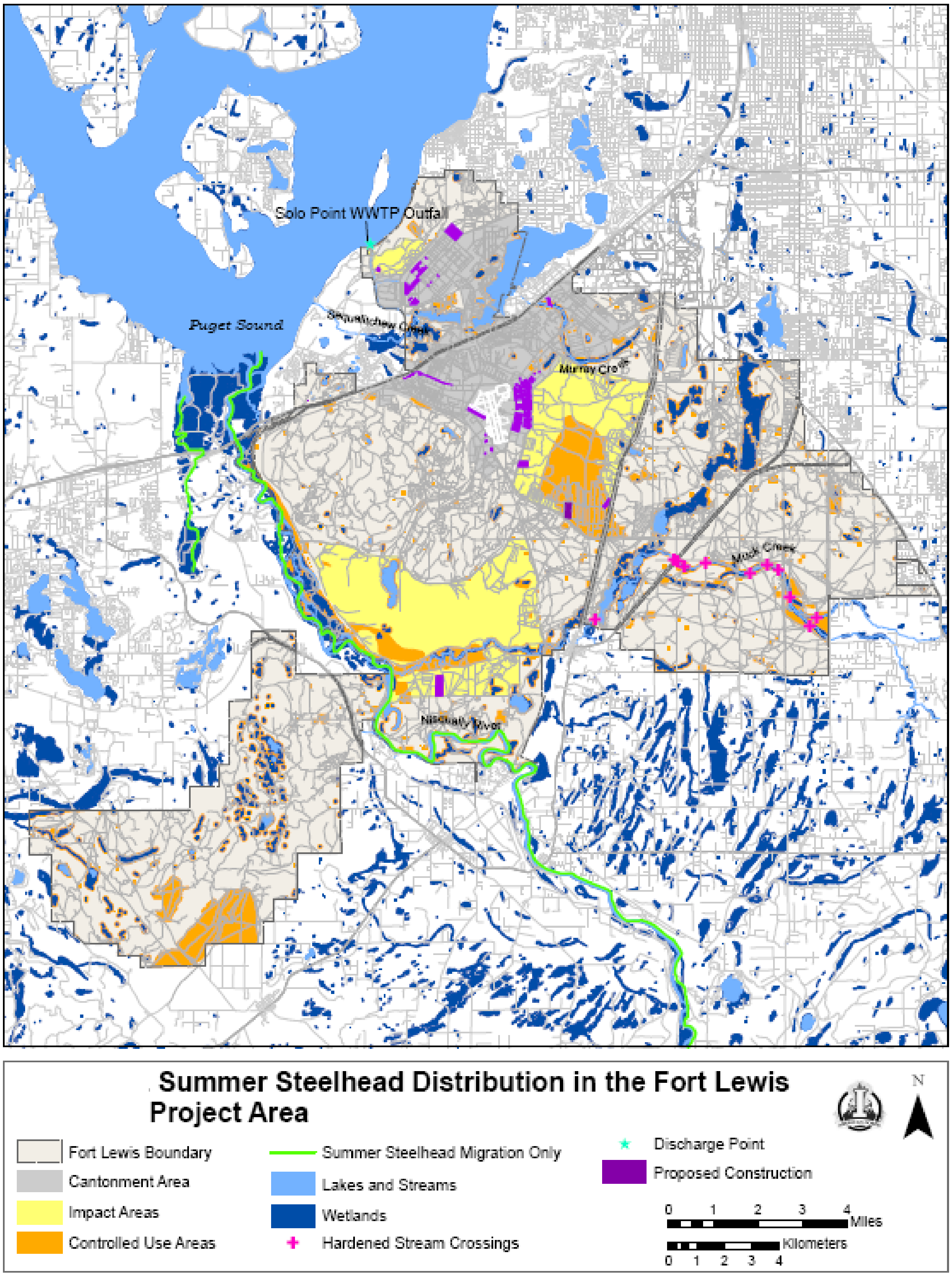
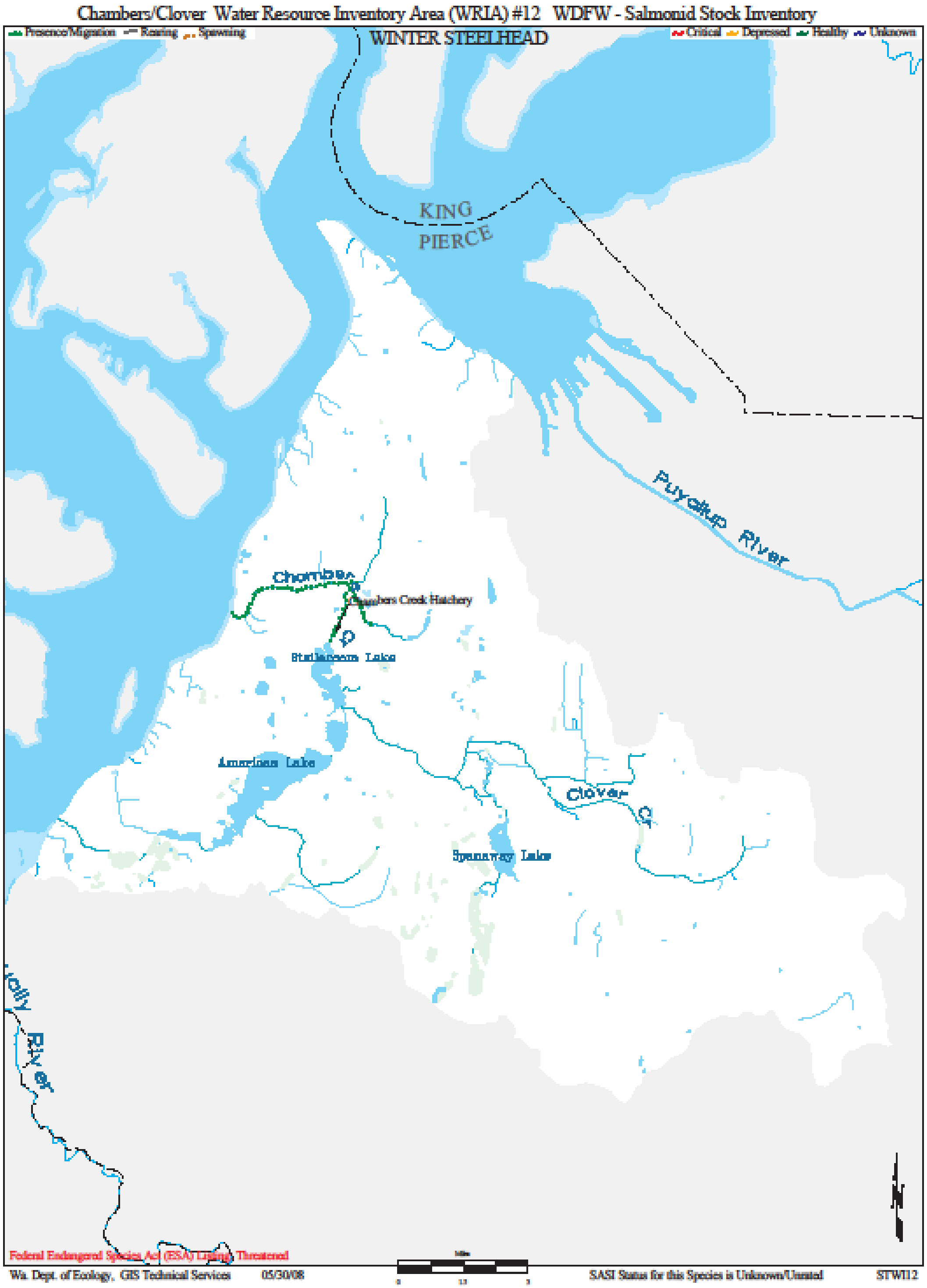


Figure 22- Winter Steelhead Distribution Near the Action Area within the Chambers/Clover Creek Watershed (WDFW2008)



3.3.2.3 Puget Sound Steelhead Life History[46]

Puget Sound Steelhead populations can be divided into two basic reproductive ecotypes, based on the state of sexual maturity at the time of river entry (summer or winter) and duration of spawning migration. Stream-maturing steelhead, also called summer-run steelhead, enter fresh water at an early stage of maturation, usually from May to October. These summer-run fish migrate to headwater areas and hold for several months before spawning in the spring. Ocean-maturing steelhead, also called winter-run steelhead, enter fresh water from December to April at an advanced stage of maturation and spawn from March through June. While there is some temporal overlap in spawn timing between these forms, in basins where both winter- and summer run steelhead are present, summer-run steelhead spawn farther upstream, often above a partially impassable barrier. In many cases it appears that the summer migration timing evolved to access areas above falls or cascades that present velocity barriers to migration during high winter flow months, but are passable during low summer flows. Winter-run steelhead trout are predominant in Puget Sound, in part because there are relatively few basins in the Puget Sound DPS with the geomorphological and hydrological characteristics necessary to establish the summer-run life history. Summer-run steelhead stocks within this DPS are all small and occupy limited habitat.

Puget Sound Steelhead eggs incubate from one to four months (depending on water temperature) before hatching, generally between February and June. After emerging from the gravel, fry commonly occupy the margins of streams and side channels, seeking cover to make them less vulnerable to predation). Juvenile steelhead forage for one to four years before emigrating to sea as smolts. Smoltification and seaward migration occur principally from April to mid-May. The nearshore migration pattern of Puget Sound steelhead is not well understood, but it is generally thought that smolts move quickly offshore, bypassing the extended estuary transition stage which many other salmonids need. Steelhead oceanic migration patterns are also poorly understood. Evidence from tagging and genetic studies indicates that Puget Sound steelhead travel to the central North Pacific Ocean. Puget Sound steelhead feed in the ocean for one to three years before returning to their natal stream to spawn. They typically spend two years in the ocean, although, notably, Deer Creek summer-run Steelhead spend only a single year in the ocean before spawning. In contrast with other species of Pacific salmonids, Steelhead are iteroparous, capable of repeat spawning. While winter steelhead spawn shortly after returning to fresh water, adult summer steelhead rely on ‘‘holding habitat’’—typically prior to spawning. Adults tend to spawn in moderate to high-gradient sections of streams. In contrast to semelparous Pacific salmon, Steelhead females do not guard their redds, or nests, but return to the ocean following spawning. Spawned-out fish that return to the sea are referred to as ‘‘kelts.”

3.3.2.4 Puget Sound Steelhead Trout Reasons for Decline[47]

Salmonid species on the west coast of the United States have experienced dramatic declines in abundance during the past several decades as a result of human-induced and natural factors. As with the Chinook salmon, declines in Puget Sound Steelhead population levels in the last century are attributed to the modification of stream flow regimes, withdrawal of water from streams, pollution from mining, agriculture, logging, urban development, recreation, increased temperatures in streams, reduced spawning habitat, obstructions to upstream and downstream migration, overfishing, climatic change, and competition and interbreeding with hatchery fish. Habitat utilization by Puget Sound Steelhead has been most dramatically affected by a number of large dams in basins to Puget Sound. In

[46] Information in this Section is taken entirely from NMFS 2013- pages 2734-2735.
[47] USEPA 2012, page 19.

addition to eliminating accessibility to habitat, dams affect habitat quality through changes in river hydrology, temperature profile, downstream gravel recruitment, and the movement of large woody debris.

Many of the lower reaches of rivers and their tributaries in Puget Sound have been dramatically altered by urban development. Urbanization and suburbanization have resulted in the loss of historical land cover in exchange for large areas of imperious surface. The loss of wetland and riparian habitat has dramatically changed the hydrology of many urban streams, with increases in flood frequency and peak flow during storm events and decreases in groundwater driven summer flows. Flood events result in gravel scour, bank erosion, and sediment deposition. Land development for agricultural purposes has also altered the historical land cover; however, because much of this development took place in river floodplains, there has been a direct impact on river morphology.

3.3.2.5 Puget Sound Steelhead Trout Research and Recovery[48]

Recovery planning in Puget Sound is proceeding as a collaborative effort between NMFS and numerous tribal, state, and local governments and interested stakeholders. The Puget Sound Partnership is the entity responsible for working with NMFS to recover the listed Puget Sound Chinook salmon DPS. The Hood Canal Coordinating Council is the regional board implementing the recovery plan for the Hood Canal summer chum salmon DPS. There is a good deal of overlap between the geographical area occupied by Puget Sound Steelhead and these two salmon DPSs, both of which had critical habitat designated on September 2, 2005. [49] A Technical Recovery Team was convened in 2008 to identify the historically independent spawning populations of steelhead within, and viability criteria for, the Puget Sound steelhead DPS. In 2011 the NMFS Technical Recovery Team (TRT) completed an initial draft assessment and has begun work on viability criteria for this DPS.[50] Upon completion of the technical work from the TRT, NMFS will develop a recovery plan for Puget Sound steelhead and will work directly with the two regional boards to augment implementation plans to include measures to recover Puget Sound steelhead. During the critical habitat designation process for Puget Sound steelhead currently underway, NMFS intends to continue to review and incorporate as appropriate the information from these regional recovery plans as well as the ongoing population work by the TRT. [51]

3.3.3 Bull Trout

3.3.3.1 Bull Trout Status and Distribution

The Coastal/Puget Sound (PS) Bull Trout DPS encompasses all Pacific coast drainages north of the Columbia River within Washington, including Puget Sound and Olympic Peninsula. This DPS was designated as threatened on June 10, 1998.[52] This DPS is comprised of 34 populations which are segregated from other DPS by the Pacific Ocean and the Cascade Mountains. Within this area, Bull Trout often occur with Dolly Varden (*S. malma malma*) is another native char species extremely similar in appearance to Bull Trout but distinct genetically. Because these species are virtually indistinguishable, USFWS currently manages them together as “native char.” The Puget Sound DPS is significant because it

[48] USEPA 2012, pages 19-20.
[49] NMFS 2005.
[50] Puget Sound Steelhead Technical Recovery Team, 2011.
[51] NMFS 2013, page 2735.
[52] USFWS 1998.

is thought to contain the only anadromous forms of Bull Trout in the coterminous United States.[53] The coastal Bull Trout subpopulations occur in five river basins: Chehalis River, Grays Harbor, Coastal Plains, Quinault River, Queets River, Hoh River, and Quillayute River. While most of the northwest coast subpopulations occur within Olympic National Park with relatively undisturbed habitats, subpopulations in the southwestern coastal area are in relatively low abundance.

Critical habitat for Bull Trout was initially designated in 2005, and was revised by USFWS in 2010.[54] Nine PCEs are deemed necessary for the conservation of the species. Critical habitat for Bull Trout includes approximately 31,750.8 km (19,729.0 mi) of streams (which includes 1,213.2 km (754.0 mi) of marine shoreline) and are designating a total of 197,589.2 ha (488,251.7 ac) of reservoirs and lakes. The areas designated as critical habitat are located in the States of Washington, Oregon, Nevada, Idaho, and Montana. The Puget Sound Critical Habitat Unit extends across Whatcom, Skagit, Snohomish, King, Pierce, Thurston, and Island Counties in Washington.

3.3.3.2 Bull Trout Presence & Critical Habitat In the Action Area

Bull Trout may be present in the south Puget Sound area near the JBLM Stormwater Canal outfall. The JBLM Stormwater Canal discharge outfall is located in an area of Puget Sound that, due to extensive shoreline armoring, has little foraging area or other available habitat suitable for Bull Trout.[55]
Bull Trout are not known to be present in streams within the JBLM Action Area (Clover and Murray Creek).[56]

USFWS determined that approximately 27.5 km (17 mi) of habitat within JBLM are exempt from critical habitat designation under section 4(a)(3) of the Act, because JBLM has an approved Integrated Natural Resource Management Plan which describes conservation efforts which have previously been determined by USFWS to provide a benefit to Bull Trout in habitats within or adjacent to JBLM.[57] Therefore, the only Bull Trout critical habitat designated in JBLM Action Area with MS4 discharges is the area of Puget Sound near the JBLM Canal outfall. As noted above, the location of the JBLM Canal outfall is an area which does not have high quality foraging habitat for Bull Trout due to extensive shoreline armoring and other existing nearshore impacts.

3.3.3.3 Bull Trout Life History[58]

Bull Trout exhibit both resident and migratory life history strategies. Both resident and migratory forms may be found together, and either form may produce offspring exhibiting either resident or migratory behavior. Resident Bull Trout complete their entire life cycle in the tributary (or nearby) streams in which they spawn and rear. The resident form tends to be smaller than the migratory form at maturity and also produces fewer eggs. Migratory Bull Trout spawn in tributary streams and juveniles rear one to four years before migrating to either a lake (adfluvial form), river (fluvial form), or saltwater (anadromous form) to rear as subadults or to live as adults.

[53] USFWS, 1999.
[54] USFWS2005; USFWS, 2010a.
[55] USFWS 2010b.

[56] Runge, et al, 2003.
[57] USFWS 2010a
[58] Info in this section quoted from USFWS 2004.

Bull Trout normally reach sexual maturity in four to seven years and may live longer than 12 years. They are iteroparous (i.e. able spawn more than once in a lifetime). Bull Trout typically spawn from August to November during periods of decreasing water temperatures. Preferred spawning habitat consists of low gradient stream reaches with loose, clean gravel. Fry normally emerge from early April through May. Migratory forms of Bull Trout appear to develop when habitat conditions allow movement between spawning and rearing streams and larger rivers or lakes where foraging opportunities may be enhanced. The migratory life history is beneficial to the long-term survival of Bull Trout populations as it allows for greater growth in the more productive waters of larger streams and lakes. Larger more mobile fish have a greater fecundity resulting in increased reproductive potential, and dispersing the population across space and time so that spawning streams may be re-colonized should local populations suffer a catastrophic loss.

Growth varies depending upon life-history strategy. Resident adults range from 150 to 300 millimeters (6 to 12 inches) total length, and migratory adults commonly reach 600 millimeters (24 inches) or more. Bull Trout are opportunistic feeders, with food habits primarily a function of size and life-history strategy. Resident and juvenile migratory Bull Trout prey on terrestrial and aquatic insects, macrozooplankton, and small fish. Adult migratory Bull Trout feed on various fish species. In coastal areas of western Washington, Bull Trout feed on Pacific herring (*Clupea pallasi*), Pacific sand lance (*Ammodytes hexapterus*), and surf smelt (*Hypomesus pretiosus*) in the ocean.

Migratory Bull Trout begin growing rapidly once they move to waters with abundant forage that includes fish. As they mature and increase in body mass, Bull Trout are able to travel greater distances in search of prey species of larger size and in greater abundance. Migration allows Bull Trout to access optimal foraging areas and exploit a wider variety of prey resources. In the Skagit River system, anadromous Bull Trout make migrations as long as 121 miles between marine foraging areas in Puget Sound and headwater spawning grounds. Anadromous Bull Trout also use marine waters as migratory corridors to reach seasonal habitats in non-natal watersheds to forage and possibly overwinter.

Freshwater habitat components that influence Bull Trout distribution and abundance include water temperature, cover, channel form and stability, valley form, spawning and rearing substrate, and migratory corridors. Cold water temperatures play an important role in determining Bull Trout habitat, as these fish are primarily found in colder streams (< 15 °C), and spawning habitats are generally characterized by temperatures that drop below 9 °C. Thermal requirements for Bull Trout appear to differ at different life stages. Spawning areas are often associated with cold-water springs, groundwater infiltration, and the coldest streams in a given watershed. Optimum incubation temperatures for Bull Trout eggs range from 2 to 4 °C whereas optimum water temperatures for rearing range from about 8 to 10 °C. Although Bull Trout are found primarily in cold streams, occasionally these fish are found in larger, warmer river systems throughout the Columbia River basin). Factors that can influence Bull Trout ability to survive in warmer rivers include availability and proximity of cold water refugia and food productivity. All freshwater life history stages of Bull Trout are associated with complex forms of cover, including large woody debris, undercut banks, boulders, and maintaining Bull Trout habitat requires stability of stream channels and maintenance of natural flow patterns. Juvenile and adult Bull Trout frequently inhabit side channels, stream margins, and pools with suitable cover. [57]

[57] USFWS, 2004.Page 3-9.

3.3.3.4 Bull Trout Reasons for Decline

The Coastal-Puget Sound Bull Trout are vulnerable to hybridization and competition with non-native brook trout, brown trout and lake trout, degradation of spawning and rearing habitat, and isolation of local populations from dams, diversions [58](and road crossing structures.

Due to their need for very cold waters and long incubation time, Bull Trout are more sensitive to increased water temperatures, poor water quality and degraded stream habitat than many other salmonids. In many areas, continued survival of the species is threatened by a combination of factors rather than one major problem. For example, past and continuing land management activities have degraded stream habitat, especially along larger river systems and streams located in valley bottoms. Degraded conditions have severely reduced or eliminated migratory Bull Trout as water temperature, stream flow and other water quality parameters fall below the range of conditions which these fish can tolerate. In many watersheds, remaining Bull Trout populations consist of smaller, resident fish that are isolated in headwater streams. Brook trout (*S. fontinalis*), introduced throughout much of the range of Bull Trout, easily hybridize with them, producing sterile offspring. Brook trout also reproduce earlier and at a higher rate than Bull Trout so Bull Trout populations are often supplanted by these non-natives. Dams and other in-stream structures affect Bull Trout by blocking migration routes, altering water temperatures, and causing mortality as they attempt to pass through and over dams or are trapped in irrigation and other diversion structures. The iteroparous (multiple spawning) as well as migratory nature of Bull Trout has important repercussions for the management of this species. Bull Trout require two-way passage up and downstream, not only for repeat spawning but also for foraging. Most fish ladders, however, were designed specifically for upstream passage of anadromous semelparous (single spawning) salmonids. Therefore even dams or other barriers with fish passage facilities may be a factor in isolating Bull Trout populations if they do not provide a downstream passage route.

Altered stream flow in the fall may disrupt Bull Trout during the spawning period, and channel instability may decrease survival of eggs and young juveniles in the gravel from winter through spring. Increases in fine sediment reduce egg survival and emergence. [59]

3.3.3.5 Bull Trout Research and Recovery

The 2004 USFWS recovery plan for the coastal-Puget Sound Bull Trout DPS includes the following recommendations for recovering Bull Trout:

- Protect, restore, and maintain suitable habitat conditions for Bull Trout.
- Prevent and reduce negative effects of nonnative fishes and other nonnative taxa on Bull Trout.
- Establish fisheries management goals and objectives for compatibility with Bull Trout recovery, and implement practices to achieve goals.
- Characterize, conserve, and monitor genetic diversity and gene flow among local populations of Bull Trout.

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[58] USFWS 2004.
[59] USFWS 2004. Pages 9-10.

- Conduct research and monitoring to implement and evaluate Bull Trout recovery activities, consistent with an adaptive management approach using feedback from implemented, site-specific recovery tasks.
- Use all available conservation programs and regulations to protect and conserve Bull Trout and Bull Trout habitat.
- Assess the implementation of Bull Trout recovery by management units and revise management unit plans based on evaluations.

Research needs identified in the plan include the need to acquire more complete information on Bull Trout use of and distribution in estuarine and marine waters of Puget Sound. [60]

3.4 Essential Fish Habitat Potentially In the Action Area[61]

The 1999 Magnuson-Stevens Fishery Conservation and Management Act requires EPA to consult with the NOAA-Fisheries when a proposed discharge has the potential to adversely affect (reduce quality and/or quantity of) Essential Fish Habitat (EFH). Adverse affects may include direct (e.g., contamination or physical disruption), indirect (e.g., loss of prey), site-specific, or habitat-wide impacts. EFH is defined in the NMFS' 1997 interim final rule as: "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." [62]

For the Pacific Coast (excluding Alaska), the Pacific Fishery Management Council (Pacific Council) manages federal fisheries for Washington, Oregon, Idaho, and California under three Fishery Management Plans. These Fishery Management Plans are the Pacific Coast Groundfish Management Plan (82 species), the Coastal Pelagic Species Fishery Management Plan (5 species), and the Pacific Coast Salmon Plan (3 species: Chinook, coho (*Oncorhynchus kisutch*), and Puget Sound pink salmon (*Oncorhynchus gorbuscha*)).

Three salmon species (Chinook, Coho, and Pink Salmon) have designated EFH in the Action Area that may potentially be affected by the action. The 82 managed groundfish species do not occur within the Action Area of EPA's permit for MS4 discharges, and are not included in this EFH. Pelagic species occupy deeper ocean waters, and therefore are also not included in this EFH.

For the Pacific Coast salmon fishery, EFH includes those waters and substrates that are necessary for salmon production, and that are capable of supporting a long-term, sustainable salmon fishery and salmon contributions to a healthy ecosystem. To achieve this level of production, EFH includes all streams, lakes, ponds, wetlands, and other viable water bodies that are accessible to salmon, as well as most of the habitat that was historically accessible (excluding areas upstream of longstanding naturally impassable barriers) in Washington, Oregon, Idaho, and California. In estuarine and marine areas, salmon EFH extends out from the nearshore and tidal submerged environments within state territorial waters, to the full extent of the Exclusive Economic Zone offshore of Washington, Oregon, and California, north of Point Conception.[63]

[60] USFWS 2004 - pages 237-273.
[61] Information for Section 3.4- EFH Assessment, in its entirety, was compiled from US Army, 2010-Chapter 6.
[62] NMFS, 1997.
[63] PFMC 1999; US Army 2010-Chapter 6.

Designated essential fish habitat within the Action Area that may potentially be affected by JBLM MS4 discharges include: 1) EFH for chinook, coho, and pink salmon in the Puget Sound area near the JBLM canal outfall; and 2) EFH for coho in Clover Creek.

3.4.1 Habitat Requirements of Salmonids in Streams

Adult Pacific salmon typically migrate upstream at temperatures between 37 and 68° F (3 and 20° C), inwater depths between 7 and 9.5 inches (18 and 24 cm).[64] Salmon may spawn within this temperature range, although spawning typically occurs between 39 and 52° F (4 and 11° C).[65]

Once spawning is complete, water temperature affects the timing of salmonid egg incubation.[66] Newly hatched and juvenile salmonids are variable with regard to their temperature requirements, although as parrs most species are at risk when water temperatures exceed 77° F (25° C). Although juvenile salmonids may briefly tolerate such high temperatures, they are mostly lethal.

Embryos and alevins are very susceptible to low dissolved oxygen (DO) levels, and require oxygen levels greater than 8 parts per million to survive.[67] Upon hatching, however, alevins in the gravel are able to detect oxygen gradients and move to areas with more suitable DO levels. Salmon, when rearing in freshwater, require DO levels of 6.5 to 7.0 parts per million. They may survive when DO concentrations are lower (< 5 parts per million), but growth, food conversion efficiency, and swimming performance may be adversely affected.

Riparian vegetation provides shade, shelters salmon from predation, moderates water temperature of a stream, stabilizes banks, and controls soil erosion and sedimentation. Furthermore, this vegetation provides nutrients to the stream, food for juvenile salmon, and may contribute large woody debris (LWD), which in turn increases channel complexity, creates backwater habitats, and increases the water depth of pools. Studies have shown a correlation between the amount of LWD and salmon production.[68]

Adult salmonids can successfully migrate any stream reach of reasonable length if the water depth is greater than 5 inches (12.7 cm) where substrate particles average larger than 3 inches (8 cm) in diameter, or if the depth is greater than 3.5 inches (9 cm) where particles are less than 3 inches (7.6 cm;).[69] Adult salmonids, upon reaching spawning beds, typically deposit eggs within a range of water depths and velocities that minimize the risk of desiccation over the coming incubation period. These depths and velocities vary depending on species and run of population (i.e., spring, summer, or fall runs). However, studies suggest that a depth of 7 inches (18 cm) and a velocity of 0.98 feet per second (ft/s; 0.03 meters per second [m/s]) meet the minimum criteria.[70]

Upon emerging from the substrate, fry between 0.7 and 1.4 inches (1.8 and 3.6 cm) long require water

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[64] Bjornn and Reiser, 1991.
[65] Bell, 1986.
[66] Laufle et al., 1986; Healey, 1991; Sandercock, 1991; Spence et al., 1996; NMFS, 1999b.
[67] Phillips and Campbell, 1961.
[68] Dolloff, 1983; House and Boehne, 1986.
[69] Bjornn and Reiser, 1991.
[70] Thompson, 1972; Neilson and Banford, 1983; Bjornn and Reiser 1991; Healy 1991; Heard 1991.

velocities of less than 0.32 ft/s (0.01 m/s), whereas juvenile salmon between 1.6 and 7 inches (4.1 and 18 cm) long usually occupy sites with velocities of up to 1.3 ft/s (0.04 m/s).[71] When rearing in freshwater, juvenile salmon seek out slower velocity areas adjacent to faster water for feeding, resting, and growing. Overall, velocities required and used by juvenile salmonids vary with the size of the fish, and may change seasonally. By occupying slow velocity areas, salmon are likely to use less energy. Invertebrate drift abundance increases with velocity across a stream. Therefore, darting into the stream to feed and then resuming position in slower waters may provide a potential energy benefit for fish. Salmon use less energy maintaining their position in slow velocities while at the same time benefiting from the increased food abundance provided by faster velocities.

Within the stream channel, salmon require sufficient clean and appropriately sized cobbles and gravel (ranging from 0.5 to 4 inches [1.3 to 10 cm]) for spawning and incubation.[72] Furthermore, riffles, rapids, pools, and floodplain connectivity with the stream are important for production, rearing, cover, and aeration.

3.4.2 Habitat Requirements of Salmonids in the Marine Environments

The marine environment can be subdivided into three general regions: estuary, coastal/nearshore, and ocean. Smoltification, the transition from fresh- to saltwater, marks a critical phase in the life history of anadromous salmonids. The emigration from freshwater to the ocean is preceded by rapid physiological, morphological, and behavioral transformations that pre-adapt fish for the marine environment. Once entering estuaries, juvenile salmon that have undergone smoltification (smolts) must acclimate to the new ecological conditions rapidly, including an immediate shift in diet, introduction to new predators, and a significantly different environment.

Utilization of marine habitats may vary both among and within salmon species. For pink and ocean-type Chinook salmon, smoltification occurs from within days to within a few months of life, whereas coho and stream-type Chinook salmon may reside in freshwater systems for an extended period then migrate to saltwater in their second year (or third year, more so in the case of coho salmon). Rivers with well-developed estuaries, like the Nisqually Reach, are able to sustain larger ocean-type populations than those without.[73] Brackish water areas in estuaries moderate the physiological stress during the parr-smolt transition. A longer estuarine residence exhibited by ocean-type Chinook salmon makes them more susceptible to changes in the productivity of the marine environment than stream-type Chinook salmon or coho salmon. This possible change in productivity, combined with the loss in coastal wetlands, may directly impact ocean-type populations.

Salmon, such as ocean-type Chinook salmon fry (as opposed to stream-type Chinook) prefer protected estuarine habitats with lower salinity, moving from the edges of marshes during low tide to protected tidal channels and creeks during high tides. Ocean-type Chinook remain in estuaries for several months before migrating to marine waters, whereas stream-type Chinook spend little time in the estuary of their natal stream before their migration. As the salmonids grow, they move to higher-salinity waters and increasingly less protected habitats (within the estuary) before entering into the strictly marine areas. Chinook salmon can reside in the ocean between 2 and 5 years before returning to natal streams to spawn.[74] They are typically distributed throughout the Bering Sea.

[71] Bjornn and Reiser,1991.
[72] Spence et al., 1996.
[73] Levy and Northcote, 1982.
[74] Healey, 1991.

Coho salmon are thought to remain in estuarine areas for several days to several weeks, as opposed to more northern populations that remain in these areas for several months. In estuaries, smolts often occur in intertidal and pelagic habitats, with deep, marine-influenced habitats.[75] When reaching the marine environment, coho salmon exhibit two dispersal patterns. Some juveniles spend weeks in estuaries before migrating to offshore waters, while others remain in coastal waters for at least the first summer before moving offshore.[76] Due to the increase in food availability, growth of smolts is very rapid once smolts reach the estuarine area.[77] Juvenile coho feed mostly on marine invertebrates but also prey upon chum and pink fry.[78] Most coho remain at sea for about 18 months, moving northwest and south along the West Coast before returning to coastal areas and entering freshwater to spawn.[79] In Washington, adults typically enter freshwater habitat from October through November. In general, larger river basins have a wider range of river entry times than do smaller systems, with river entry occurring later the farther south a river is situated.

Pink salmon generally begin migration immediately upon emergence from the gravel. Upon entering the marine environment (around March – April), pink salmon appear to utilize the nearshore extensively for early rearing.[80] The use of estuaries by pink salmon varies widely, from passing directly through en route to the nearshore areas to residing in estuaries for 1 to 2 months.[81] In general, most pink salmon prefer nearshore habitats over estuaries for their initial rapid growth. Rearing of pink salmon is typically 2 to 3 months, but may be as long as 4 months in the Puget Sound before juveniles move into the ocean.[82] At approximately 2 to 3 inches (5 to 7.6 cm) in length, pink salmon move from the nearshore to colder, deeper water to begin their ocean migration.[83] For populations in the Puget Sound, this movement begins in July and lasts through October as fish migrate out of the Puget Sound into the Pacific Ocean. Research shows that pink salmon from the Puget Sound migrate rapidly northward along the coasts of British Columbia and southeastern Alaska.[84] Pink salmon is one of the fastest growing salmonid species.[85]

4.0 ENVIRONMENTAL BASELINE

4.1 Description of the Environmental Baseline

The environmental baseline includes the past and present impacts of all Federal, state, or private actions and other human activities in the Action Area, the anticipated impacts of all proposed Federal projects in the Action Area that have already undergone formal or early ESA Section 7 consultation, and the

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[75] Pearce et al.,1982.
[76] Pearce et al., 1982; Pearcy, 1992
[77] Sandercock ,1991.
[78] Slaney et al., 1985.
[79] Sandercock, 1991.
[80] Hard et al., 1996.
[81] Heard, 1991.
[82] Heard, 1991; Hard, et al., 1996.
[83] Healey, 1980.
[84] Hartt and Dell, 1986.
[85] Heard, 1991.

impact of state or private actions which are contemporaneous with the consultation in process (50 CFR 402.02).

The discussion below discusses the environmental baseline for the following primary water bodies receiving MS4 discharges in the Action Area: the Murray/Sequalitchew Watershed (including the Puget Sound Nearshore near the JBLM Stormwater Canal Outfall; and the Clover Creek portion of the Chambers-Clover Creek Watershed. The Puget Sound, near the JBLM Canal discharge, and Clover Creek are the two waterbodies that contain ESA or EFH listed salmonid species that may be affected by the JBLM MS4 discharges.

As noted earlier, MS4 discharges from the JBLM training areas are presumed to be minimal or nonexistent based on the physical characteristics of the area. Any precipitation related surface runoff occurring within JBLM training areas likely discharges to ground, and are not discharged via the MS4 into Nisqually River and/or its tributary, Muck Creek.

4.1.1 Murray/Sequalitchew Watershed, including the Puget Sound Nearshore

The portion of the Murray/Sequalitchew watershed located within JBLM boundaries and the Action Area subject to EPA's permit includes Murray Creek, American Lake, Sequalitchew Lake, the headwaters of Sequalitchew Creek, and associated wetlands/marshes. This watershed area also includes an engineered conveyance, called the JBLM Stormwater Canal; the JBLM Canal conveys combined overflows from adjacent wetlands, Sequalitchew Lake, and treated stormwater from JBLM-North, and then discharges the combined flows into Puget Sound near Solo Point.

4.1.1.1 Physical Description of Murray/Sequalitchew Creek Watershed within the Action Area

This watershed is bounded on the west by Puget Sound, and to the north is bounded by the JBLM-North area, the City of Lakewood and Gravelly Lake. The watershed's eastern boundary is the JBLM-McChord Field, and the Burlington Northern Santa Fe Railway tracks; the southern boundary is the portion of JBLM-Main encompassing Gray Army Airfield.

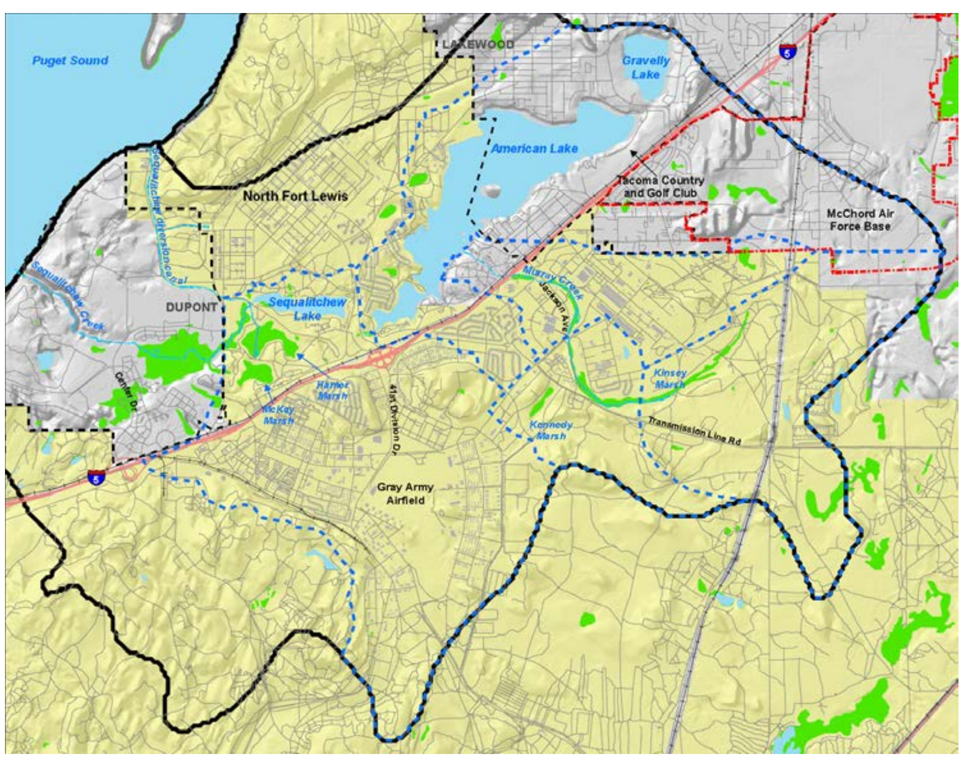

Figure 23. Murray/Sequalitchew Creek Watershed within the Action Area (Source: Herrera, 2007)

The landscape is characterized by western-sloping plains with several kettles (depressions) created by glacial processes. Some of these kettles formed lakes, while others became marshes or wetlands. The elevation above mean sea level (MSL) ranges between 400 feet near the headwater hills, to 236 feet around American Lake, 216 feet around Sequalitchew Lake, and down to sea level off the JBLM installation where the mouth of Sequalitchew Creek meets Puget Sound. Very little natural erosion occurs because of the relatively level topography and permeable, coarse-textured soils.[86]

Soils of the Murray/Sequalitchew Creek Watershed within the Action Area largely consist of the Spanaway and the Everett series (classified by U.S. Geological Survey as outwash soils having high infiltration rates. Other soil series present, to a lesser extent, include the Nisqually, DuPont, and McKenna series. The Nisqually series is loamy sand found in several locations along Murray Creek. It formed in sandy glacial outwash under grassland in the JBLM-Main area. It is relatively flat (less than 6 percent slope) and has rapid permeability.[87]

Murray Creek originates from springs and seeps at the toe of the slope areas along the upper reaches near Kinsey Marsh. Throughout much of the creek there is high hydraulic connectivity with groundwater. Base flow is strongly influenced by the amount of groundwater seepage into and out of the creek. [88] Murray Creek discharges to American Lake.

American Lake has a surface area of approximately 1,100 acres, 12 miles of shoreline, and an average depth of 53 feet. The annual inflow to American Lake is estimated at approximately 25,451 acre-feet, consisting of 65% groundwater, 15% precipitation, and 20% streamflow. Approximately 90% of the outflow from American Lake is through seepage into the aquifer along the western shoreline, with evaporation accounting for the remainder of waterloss from the lake. American Lake had no surface water outlet prior to the 1960s, when an overflow to Sequalitchew Lake was constructed; the overflow consists of a weir constructed and managed by Pierce County, which overflows to a channel connected via a culvert to an unnamed stream that flows into the southeast corner of Sequalitchew Lake if the level of American Lake rises significantly. Despite the presence of the channel, there are no current reports of surface water inputs to Sequalitchew Lake from American Lake.

Sequalitchew Lake has a surface area of approximately 75 acres. The primary inflow to the Lake is from Sequalitchew Springs, and the lake is highly influenced by groundwater. Historically, the sole outflow from the Lake's western end fed Sequalitchew Creek. An outlet diversion weir at the west end of the Sequalitchew Lake diverts overflow from the Lake into an engineered canal, called the JBLM Stormwater Canal. A backflow prevention weir at the upper end of the Lake prevents lake water from submerging Sequalitchew Springs, which is a primary source of drinking water for JBLM during the winter months.

The JBLM MS4 does not discharge to Sequalitchew Creek, however a small portion of the Creek's headwaters are physically located at the southend of Sequalitchew Lake and is included in this discussion based on its physical location near the Action Area. Sequalitchew Creek flows through Edmond Marsh, a 130-acre wetland bordering JBLM and DuPont, then approximately 3.25 miles through a steep canyon, supplemented by a spring and several seeps, into a salt marsh, and finally through a culvert under a railroad dike into the Puget Sound.[89]

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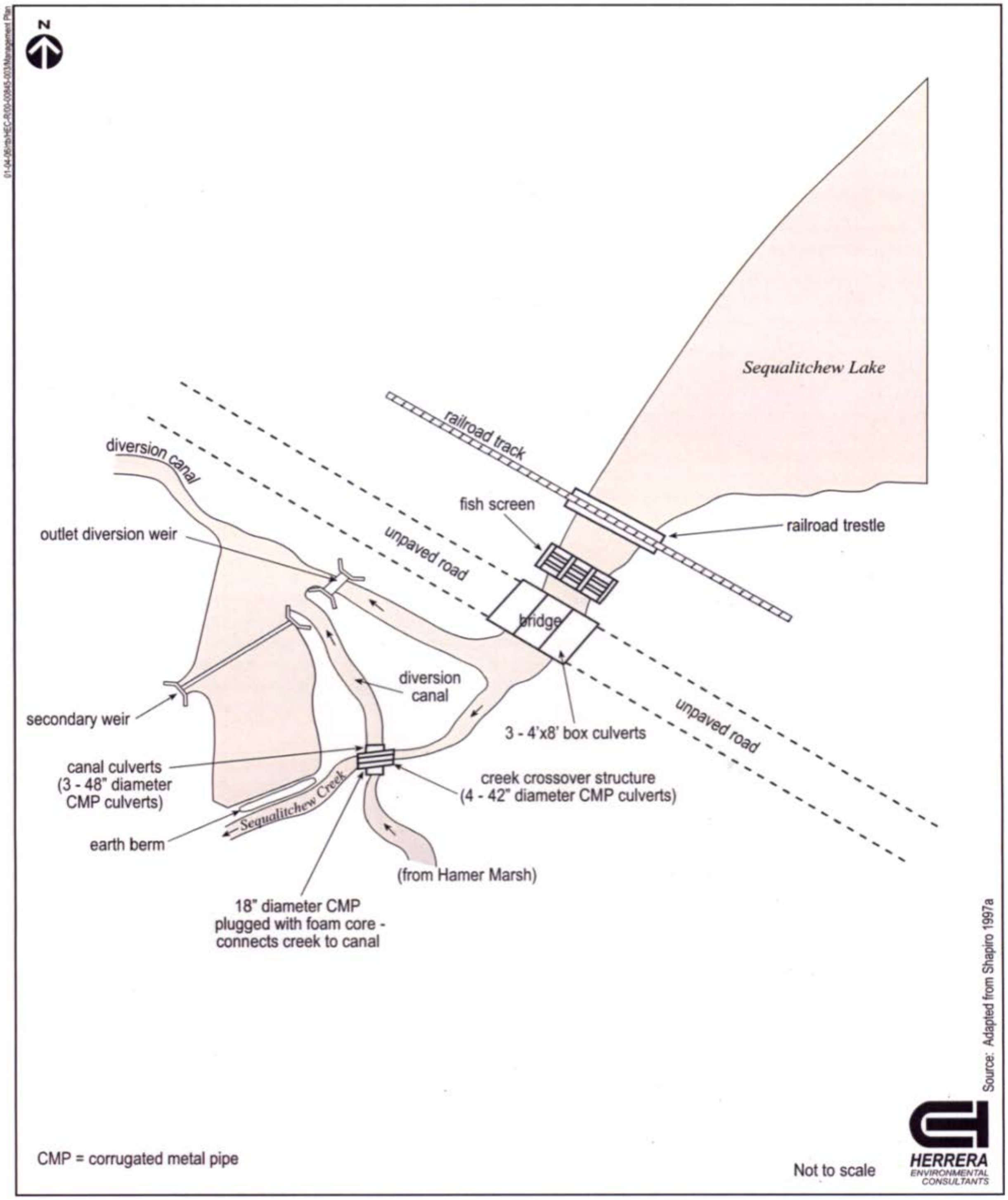
[86] Herrera, 2007; page3-1.
[87] Herrera, 2007; page 3-3 through 3-4.
[88] Herrera, 2007; page 3-30.
[89] Herrera, 2007; AHBL Inc & NW Hydraulic Consultants, 2007; Anchor QEA, 2012.

The JBLM Canal was built in the 1950's to avoid sending excess stormwater into Sequalitchew Creek. The outlet of Sequalitchew Lake is regulated by a weir to prevent the lake from rising to an elevation that could back up to Sequalitchew Springs and affect the installation's drinking water supplies. Due to beaver dams in Sequalitchew Creek that back up flow, most of the outflow from Sequalitchew Lake enters the Canal, not the Creek. The Canal begins at Hamer Marsh, south of Sequalitchew Lake and east of Sequalitchew Creek. The JBLM Canal flows north from the marsh, crossing below Sequalitchew Creek in three 48-inch diameter culverts (See Figure 24). Water discharging from Sequalitchew Lake over the weir flows into the Canal downstream of these culverts. The JBLM Canal then continues to the northwest and discharges into Puget Sound near Solo Point.

Figure 24. Diagram of Sequalitchew Lake Diversion Weir **(Source: Herrera, 2007)**



4.1.1.2 Water Quality Information for the Murray/Sequalitchew Watershed

Limited water quality data is available for Murray Creek, American Lake, Sequaltichew Lake, or the Edmonds/Hamer/McKay Marshes. The latest known available dataset for Murray Creek indicated that, in general, the Creek met the applicable WQS for temperature, turbidity, fecal coliform bacteria, and dissolved oxygen; at the time, the observed nitrate-nitrogen concentrations were high enough to support algal blooms where phosphate concentrations also were adequate for algal growth. However, phosphate concentrations were low, limiting algal bloom potential at that time. [90]

Prior studies of American Lake found the lake was phosphorus-limited for algae growth, based on total inorganic nitrogen to orthophosphate-phosphorus ratio greater than 10. A study of Sequalitchew Lake found that the lake generally exhibited good water quality, and was phosphorus-limited for algae growth based on total inorganic nitrogen to orthophosphate phosphorus ratio greater than 10. Fecal coliform bacteria concentrations at the Sequalitchew Lake outlet met the WQS for a Class A stream. [91]

4.1.1.3 Water Quantity and Quality Information for the JBLM Canal

For the majority of the year, the water in the JBLM Canal and discharging into Puget Sound is primarily comprised of lake water from Sequalitchew Lake. Stormwater from the JBLM MS4 enters into the canal from Hamer Marsh (after passing through the treatment/infiltration facilities for OF 02 and OF 03 and open canals and wetlands) and OF 05 (after detention and oil/water separator treatment).See additional discussion in Section 2.3.1.1. During the summer and fall months, the JBLM canal flow is the 5- 10 cfs range, with very little flow from the JBLM MS4 via Hamer March and OF 05. During the wet season (November through June), flow in the Canal is in the 10-20 cfs range, with a few short duration spikes that can reach 60-70 cfs. During the wet season, flow from Hamer Marsh normally constitutes about 10-20% of Canal flow, but during the spikes when the flow reaches 60-70 cfs, Hamer Marsh outflow contributes about 70% of the Canal flow.[92] It is unknown what percentage of the Hamer Marsh outflow is stormwater exiting the MS4 through OF 02 and OF 03, but during such events most of the outflow is likely from the MS4 with some contribution from rainfall on the marshes and groundwater flow into the marshes. These flow summaries are based on flow measurements recorded during 2005 and 2006.

EPA could not locate any data to characterize the water quality of the JBLM Stormwater Canal that discharges into the Puget Sound. However, EPA has deduced the following:

- During the summer and fall months, the water quality in the JBLM Canal and discharging into the Puget Sound is likely to be of good quality with low level of contaminants because flow during this timeframe is almost exclusively comprised of Sequalitchew Lake water, which is believed to be of good quality. During rain events that can occur in the summer and fall, the infiltration ponds associated with OF 02 and OF 03 generally infiltrate the associated runoff and the detention pond and oil/water separator associated with OF 05 provides adequate treatment prior to discharge.

  During the majority of the wet season, the quality of the flow in the JBLM Canal discharging into Puget Sound is also likely to be of good quality with minimal level of contaminants for several

[90] Herrera, 2007; page 3-31.
[91] Herrera, 2007; pages 3-29 to 3-40.
[92] Washington Engineering Inc. 2001.

reasons. First, during most of the wet season, good quality Sequalitchew Lake water comprises most of the Canal flow (80-90%). Second, any stormwater discharge into the JBLM Canal from Hamer Marsh and OF 05 has passed through treatment facilities described in Section 2.3.1.1. Third, the available stormwater and instream sampling data of stormwater runoff from the industrial activity areas of JBLM-McChord Field into Clover Creek shows that overall instream pollutant levels are low as a result of existing stormwater management and source control efforts. See additional discussion in Section 4.1.2.2. EPA views these data as representative of the stormwater runoff quality from the JBLM MS4 and the associated in-stream concentration for waters receiving MS4 discharges.

- During the infrequent storm events when JBLM Canal flows exceeds 30 cubic feet per second (cfs), EPA assumes there is likely to be elevated levels of pollutants associated with stormwater runoff, but it is unlikely that pollutant levels exceed water quality standards or reach levels that cause adverse effects. During multiple day rainfall events which produce storm volumes in excess of the 6 month, 24 hour storm event, stormwater runoff from OF 02 and OF 03 is no longer fully infiltrated and treated prior to discharge. By design this is in accordance with Ecology's stormwater treatment standard. Additionally, runoff associated with larger storms also can exceed the detention capacity of available facilities prior to discharge through OF 05. Thus, during high rainfall events, a significant portion of the flow is untreated. However, the excess untreated stormwater is largely associated with the mid-to-later part of a multi-day rain event and does not contain the "first flush" of pollutants, because the first 24-hours of stormwater associated with a multi-day rain event is treated/managed through the existing stormwater facilities. EPA presumes that the remaining volume of rain during these events, combined with overflow from Lake Sequalitchew, likely dilutes any pollutant concentrations. Thus, it is reasonable to assume that pollutant loadings are not occurring at concentrations that would cause adverse effects to species or habitat when excess stormwater flow enters the JBLM Canal and discharges into the Puget Sound during these infrequent high rainfall events.

4.1.1.4 Habitat Condition of the Puget Sound Nearshore Adjacent to the JBLM Canal Outfall

The JBLM Canal outfall discharges into an area where the shoreline is extensively armored and therefore is considered poor salmon rearing habitat. The railroad track along this shoreline area effectively eliminates contributions from feeder bluffs, resulting in significant impacts to natural beach forming processes. Armoring the shoreline has interfered with natural erosion of the upland material (organic and inorganic debris) onto the beach and into the intertidal area, caused beach scouring, and resulted in changes in population structure of epibenthic and benthic organisms. Natural recruitment of beach-forming material was curtailed by the historical placement of fill for the rail line in the upper intertidal area. The dearth of fine-grained material in the intertidal zone as a result of shoreline armoring significantly reduces forage fish spawning in the nearshore. In addition, the rock seawall that supports and protects the railroad fill promotes greater erosion of the shoreline by deflecting wave energy, and reduces the amount of shallow water habitat that juvenile salmonids rely upon by creating a deeper water vertical shoreline.[93]

According to the Washington Department of Natural History Shore Zone Inventory, kelp is present in this vicinity of the Action Area for EPA's permit. The nearest eelgrass beds are almost three miles south at

[93] USFWS 2010 page 7.

Nisqually Reach. The shoreline configuration in this vicinity of the Action Area near the JBLM Canal outfall is relatively straight with no pocket beaches or sheltered embayments to reduce water velocity and facilitate development of vegetation beds.[94]

4.1.2 Clover Creek Watershed

4.1.2.1 Physical Description of the Clover Creek Sub-Watershed within the Action Area[95]

Only a portion of the Chambers-Clover Creek Watershed is located within the Action Area. The entire watershed covers 144 square miles and includes approximately 2,020 acres of lakes, extensive wetlands, as well as Chambers and Clover Creeks.

The Chambers-Clover Creek drainage originates from spring and groundwater springs and seeps in the northeast corner of the watershed. The ground-water discharge forms the headwaters of Clover Creek, outside the Action Area to the east in the vicinity of the City of Puyallup, WA. The Creek flows through the center of the watershed, flowing from east to northwest, for approximately 13.8 miles through the City of Parkland.

Clover Creek enters the Action Area on the east side of JBLM-McChord Field. After McChord Air Force Base was dedicated as a military installation in the 1940s, sections of Clover Creek were extensively dredged, channelized, and diked. Within the Action Area, Clover Creek now flows through 12-foot-deep channels before entering two 12-foot diameter CMP culverts, each over 2,500 feet long, positioned under the JBLM-McChord Field runway.[96] Clover Creek exits the JBLM boundary on the east side of I-5, and ends immediately west of Interstate 5 near the City of Lakewood, WA. Clover Creek enters Steilacoom Lake at river mile (RM) 5.8.

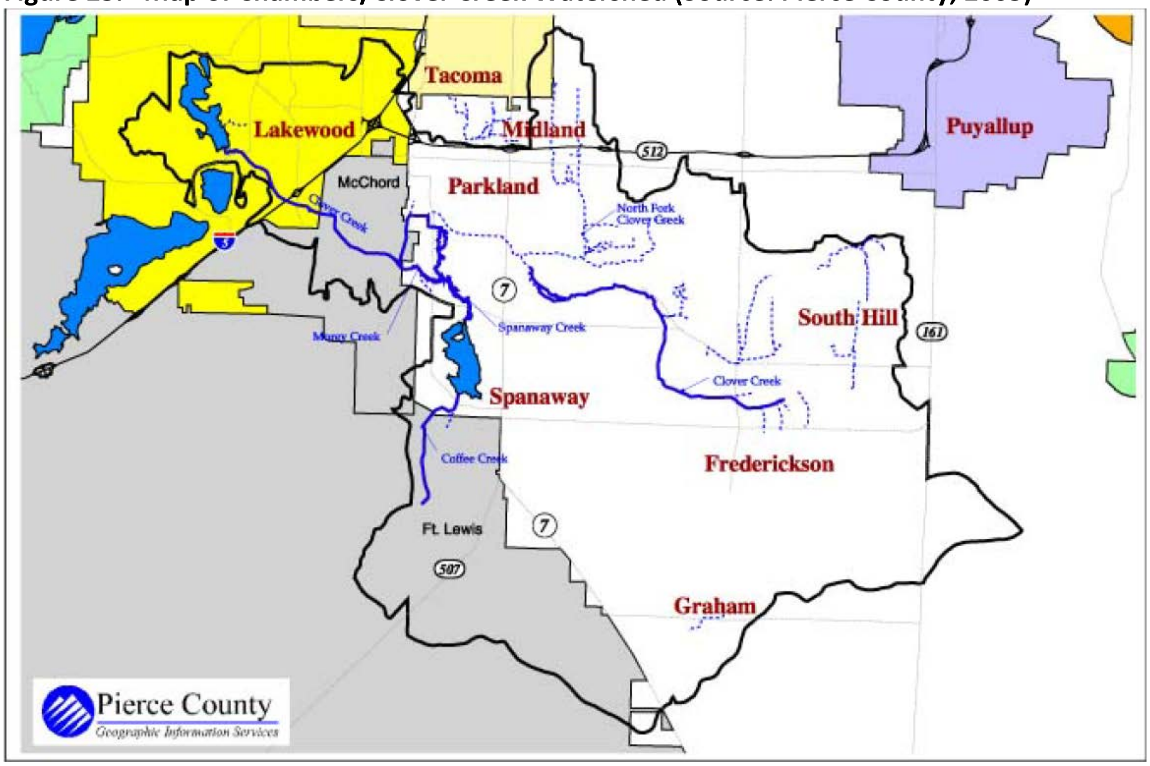
Chambers Creek is formed from the outlet of Steilacoom Lake flowing 4.0 miles north and west down a narrow ravine where it is joined by Flett and Leach Creeks before it discharges to Puget Sound through Chambers Bay. See Figure 25.The Lower Clover Creek drainage is underlain by the highly permeable Steilacoom gravels and coarse sandy till soils, notably the Spanaway soils, which largely consists of sand, loess, aggregated silts, and is characterized by rapid infiltration.[97]

Baseline conditions of Clover Creek from the east side of McChord-Field area to Lake Steilacoom are described below, separated into three reaches. The JBLM MS4 discharges into Reach 1; Reaches and 2 and 3 are immediately downstream of JBLM but are part of the Action Area. Reach 1 is approximately 16,000 feet in length, and is within McChord-Field area. Approximately 2,500 feet of the reach is within culvert pipes beneath the airfield and other JBLM structures. The uppermost portion of this reach is wetland. Reach 2 is approximately 6500 feet in length and the riparian and bank condition is not uniform over its length. Substrate and aquatic habitat are relatively uniform. The lower approximately 2000 feet has concrete banks and ornamental non-native plantings in the riparian zone. This section flows through residential development outside of the JBLM boundary.

[94] USFWS 2010 page 12.
[95] Information in this section was compiled from Pierce County 2005.
[96] Pierce County 2005, p 4-33
[97] Pierce County, 2005- p 4-28, 4-29, Figure 4-1.

Reach 3 of Clover Creek ends at the entrance to Lake Steilacoom is approximately 2100 feet in length and is surrounded by residential development. There are several weirs present, of which three weirs are approximately 6 feet high. Fish ladders have been placed at the three highest weirs. The fish ladders are estimated to convey approximately 10-20% of the creek flow with entrances 12” in width. The creek is generally shaded in this reach because there are numerous trees within 100 feet of the bank. However, all understory vegetation is composed of ornamental non-native species, mostly grass. Essentially no riparian zone is present and the majority of the banks are hardened with riprap, concrete or other unnatural materials. The dominant substrate material is sand and silts. There are no connections to off-channel habitats or wetlands and no woody debris was observed in this reach. No pools are present and all habitat is either riffle or run. Bankfull width is estimated at 15 feet.

Figure 25. Map of Chambers/Clover Creek Watershed (Source: Pierce County, 2005)



4.1.2.2 Water Quality Information for Clover Creek

In October 2010, EPA and NMFS concluded informal consultation on EPA’s action to authorize regulated industrial stormwater discharges from air land transportation/vehicle maintenance activities at JBLM-McChord Field into Clover Creek, under the NPDES Permit #WAR05B83F, concluding that industrial stormwater discharges were not likely to adversely affect listed species.

As a condition of obtaining NMFS’ concurrence that there are no adverse effects to listed Puget Sound Steelhead or Chinook salmon potentially present in the Clover/Chamber Creek watershed, EPA exercised its discretion to require JBLM-McChord to conduct additional monthly stormwater discharge monitoring for both zinc and copper at JBLM-McChord Field OFs 01, 09, 17 and 36. Consistent with provisions of the MSGP, EPA established “benchmark concentrations” for both total zinc and total copper, above which the JBLM must employ additional control measures on pollutant sources within the drainage areas in order to further reduce pollutants discharged from the regulated industrial activity.

It is important to note that such benchmarks are not effluent limitations, but instead are indicator levels intended to be used as an adaptive management tool for the permittee to better control pollutants so as not to exceed applicable water quality standards. EPA established benchmarks for both total zinc and total copper of 50 µg/L and 5.6 µg/L, respectively. These benchmarks are each based upon EPA's water quality criteria for freshwater, assuming a water hardness level of 25-50 (which is generally typical for Western Washington waters).[98]

JBLM-McChord Field began monthly stormwater outfall sampling during storm events in October 2010. This monitoring data indicates that average total copper concentrations in stormwater from the industrial activities discharging to Clover Creek are consistently below the 5.6 µg/l benchmark, ranging from 1.1 µg/l to 4.5 µg/l. Total zinc concentrations ranged from 8.9 µg/l to 220 µg/l. Monitoring results above the benchmark direct that mandatory source control corrective actions must be taken at the site. Recent monthly sampling data, collected between January 2012 –June2012 at Outfall #1 at McChord Field to Clover Creek, show average concentration of total zinc at 42.8 µg/l (average water hardness = 47). While this stormwater outfall monitoring data is not intended to directly characterize the MS4 discharges from JBLM-McChord, EPA believes the data serves as a broad indicator for stormwater runoff quality and the impact of dedicated source control efforts at areas within the JBLM boundaries.

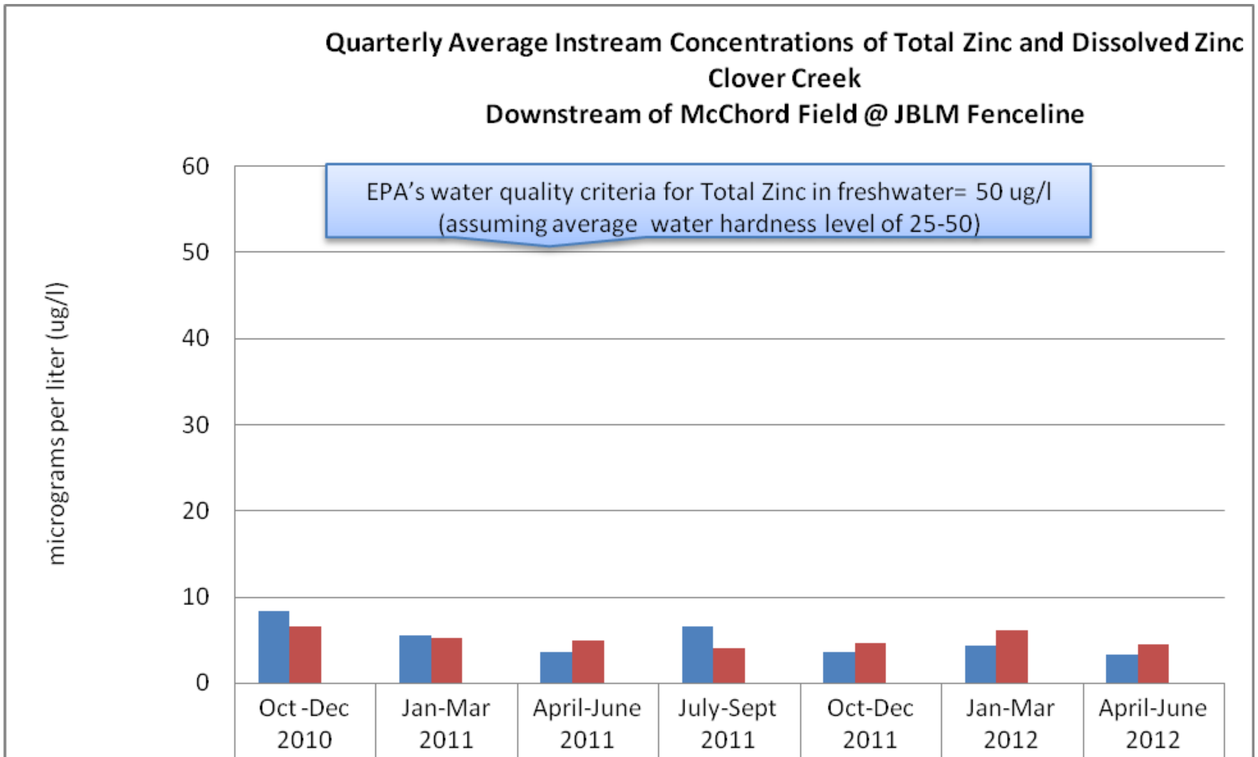
JBLM-McChord Field staff also independently collected in-stream water quality sampling of Clover Creek for zinc (total and dissolved), and copper (total and dissolved) at the western-most location downstream from McChord Field that is still within the JBLM fence line. See Figures 26 and 27. These data represent in-stream conditions, which are influenced by both the MS4 discharges and the MSGP-authorized flows discharged into Clover Creek immediately upstream of the sampling point. Average in-stream concentrations for both total zinc and total copper are considerably lower than the EPA established water quality criteria levels. As noted earlier, twenty four (24) active MS4 outfalls drain into Clover Creek from the JBLM-McChord Field. Six of the outfalls drain approximately 54% of the Clover Creek MS4 drainage area, which is comprised of light industrial and commercial land use, and are equipped to treat resulting flows using oil/water separators prior to discharge. The in-stream monitoring data in Figures 26 and 27 reflect total and dissolved zinc and copper concentrations resulting from storm water discharge from all 28 JBLM-McChord outfalls which drain into Clover Creek, and does not indicate that in-stream pollutant levels are a cause of harm or significant habitat impairment in Clover Creek.

Runoff from the 24 MS4 outfalls may contribute excess flows to Clover Creek, which can impact the Creek due to stream channel scouring and associated impacts to the benthic community. The extent of such existing impacts is currently unknown. However, the majority of the banks are hardened with riprap, concrete or other unnatural materials, therefore erosion occurring due to excess flow is unlikely. EPA believes the relatively high soil infiltration rates in the JBLM-McChord area likely serve to reduce both the frequency and magnitude of the MS4 discharge volumes ultimately reaching Clover Creek as noted above.

From the above information, EPA concludes there may be minor impact to habitat quality in Clover Creek from the existing JBLM MS4 discharges.

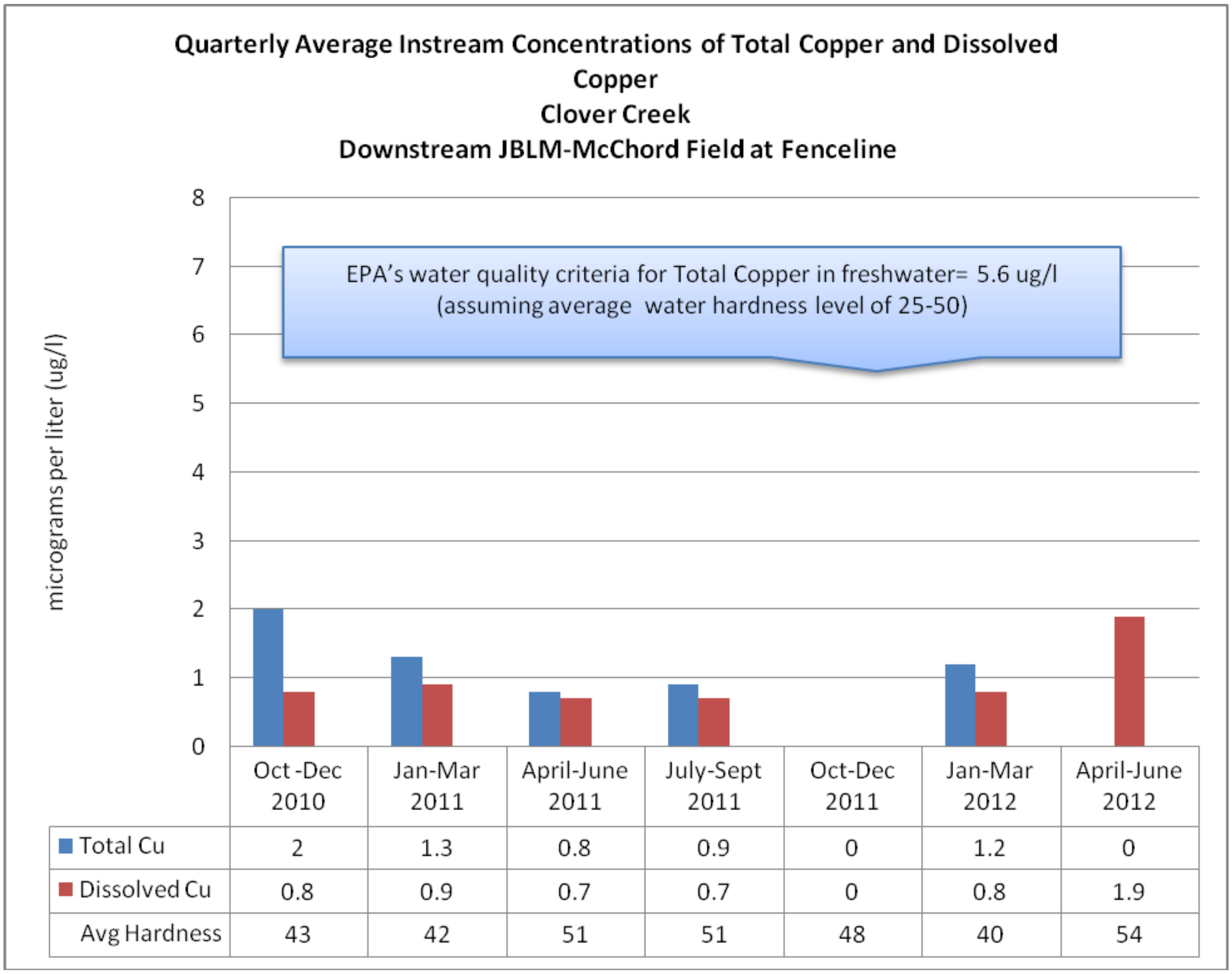
[98] USEPA 2009, 2010.

Figure 26. In-stream Zinc Concentrations, Clover Creek –Downstream of McChord-Field, at JBLM Fence Line



	Oct -Dec 2010	Jan-Mar 2011	April-June 2011	July-Sept 2011	Oct-Dec 2011	Jan-Mar 2012	April-June 2012
Total Zn	8.4	5.5	3.6	6.6	3.6	4.4	3.3
Dissolved Zn	6.6	5.3	5	4	4.6	6.1	4.5
Avg Hardness	43	42	51	51	48	40	54

Figure 27. Instream Copper Concentrations, Clover Creek – Downstream of McChord Field, at JBLM Fenceline



	Oct -Dec 2010	Jan-Mar 2011	April-June 2011	July-Sept 2011	Oct-Dec 2011	Jan-Mar 2012	April-June 2012
Total Cu	2	1.3	0.8	0.9	0	1.2	0
Dissolved Cu	0.8	0.9	0.7	0.7	0	0.8	1.9
Avg Hardness	43	42	51	51	48	40	54

4.2 Effectiveness of Stormwater Management BMPs

Section 2 of this BE described the variety of MS4 infrastructure and stormwater management practices used by JBLM to control pollutants in stormwater runoff from the developed cantonment areas. The structural practices employed by JBLM to manage stormwater runoff include detention ponds, infiltration ponds, retention ponds, bioswales, and wetland basins. JBLM also uses site planning and site design to direct surface runoff into the ground via infiltration or bioretention; underground injection control devices such as drywells are also used in certain circumstances. These practices control pollutants and excess runoff volumes, and peak flows. Source control measures (such as street sweeping or spill prevention activities, enforceable prohibitions, and other "non-structural" practices) also reduce pollutants and prevent flow impacts to receiving waters. When appropriately designed, operated and maintained, the accumulative benefit of using both structural and nonstructural BMPs is broadly recognized to result in significant water quality improvement.[99]

National analyses of pollutant removal efficiency for specific stormwater management facilities show that, on average, practices such as bioretention, detention basins, retention ponds and wetland basins, each significantly reduce Total Suspended Solids (TSS) concentrations, and result in median effluent concentrations ranging from 10 - 25 mg/l.[100]

Bioretention, detention basins, retention ponds and wetland basins can also effectively reduce total and dissolved metals, such as copper, zinc, lead, nickel and chromium. For example, these practices can individually result in median effluent concentrations ranging from approximately 4 -11 µg/l for total copper, and 4.2-7.9µg/l for dissolved copper; and approximately 15-30 µg/l for total zinc and 8 - 25 µg/l for dissolved zinc.[101] Retention ponds, wetland basins, and detention basins are similarly recognized to reduce total phosphorus concentrations, with median effluent concentrations reported as ranging from approximately 0.08 to 0.22 mg/l.[102]

Bioretention can also be used as an effective approach for reducing runoff frequencies, peak flow rates and total flow volumes during frequently occurring storm events.[103]

To address bacteria pollutants such as fecal coliform or *e. Coli*, available research suggests that BMP designs that can reduce bacteria concentrations in the water column are those which maximize exposure to sunlight, provide habitat enable predation by other microbes, provide surfaces for sorption, provide filtration, and/or allow sedimentation. Practices that infiltrate stormwater and avoid discharge to surface water will also reduce bacteria loading by reducing the volume component of the load. Practices that infiltrate stormwater also typically provide treatment processes enabling sorption and filtration.[104]

Volume reduction refers to the volume which enters a structural stormwater management device or facility and does not discharge to surface water. Instead, the water infiltrates into the bottom and sides of the BMP and percolates to groundwater or shallow interflow pathways; evaporates or evapotranspirates to the atmosphere; or can be available for re-use, generally either for irrigation or other non-potable use such as toilet flushing. Bioretention is an effective volume reduction technique which reduces runoff frequencies, peak flow rates and overall volumes during frequently occurring storm events.

Oil/water separators are also used by JBLM at various locations; see inventories in Tables 3 and 5. Typical devices include gravity separators (including American Petroleum Institute [API] separators and separation vaults), coalescing plate separators, and cartridge filters added to such oil/water separator devices. Factors affecting separator performance include the quantity of oil, oil density, oil droplet size, water temperature and other waste stream characteristics. Studies show that separators can produce effluents down to 30 ppm, routinely at 30-150 ppm, with occasional concentrations above 150 ppm,

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[99] USEPA 1999.
[100] Geosyntec/WWE, 2011a.
[101] Geosyntec/WWE, 2011b.
[102] Geosyntec/WWE 2010a.
[103] Geosyntec/WWE 2012b.
[104] Geosyntec/WWE 2010b.

depending upon the flow rate. CPI separators have been found to remove droplets down to 30 to 60 pm size, and have been found to produce effluent concentrations in the range of 10 to 20 ppm.[105]

Estimates of long term cumulative pollutant removal efficiencies have been calculated for stormwater BMPs designed and sized using WWHM (as used for development site design by JBLM in recent years) , assuming the BMPs are sized and maintained in accordance with Washington State requirements.[106] These analyses examined the following six stormwater BMPs: surface infiltration practices (e.g., infiltration basins); subsurface infiltration systems (e.g., infiltration trenches); gravel wetland systems; bioretention systems; porous pavement systems; , and wet ponds. These analyses generated long-term cumulative performance estimates, expressed as performance curves; for each of the six BMPs, performance curves were developed for five different land uses and three water quality pollutants.[107]

For all of the BMPs analyzed through this effort, cumulative pollutant removal performance (expressed as % removed) was plotted against the corresponding BMP size. The range of modeled pollutant removal efficiencies for TSS, TP, and Zn from the six types of BMPs appear to confirm the results of the cumulative national BMP studies cited above. Assuming BMPs sized to manage the impervious runoff volume associated with the 95th percentile storm event for the Seattle, WA area and the Olympia, WA areas (1.0 inches and 1.3 inches, respectively), [108] and soil infiltration rates of 0.17 in/hour or more (as is generally present within the Action Area); and assuming a national average annual pollutant loading from all land use types, the predicted pollutant removal efficiency curves show that it is reasonable to expect improved stormwater quality through the use of appropriately designed, properly sized and maintained stormwater management BMPs such as those which are required by EPA's Permit within the Action Area.

5.0 EFFECTS OF THE ACTION

The ESA Section 7 implementing regulations (50 CFR 402.02) define "effects of the action" as:

> "*The direct and indirect effects of an action on the species or critical habitat together with the effects of other activities interrelated or interdependent with that action, that will be added to the environmental baseline. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the Action Area, the anticipated impacts of all proposed Federal projects in the 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. Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur (50 CFR 402.02).*"

EPA's action is the proposed issuance of an NPDES Permit for discharge from the MS4 owned and operated by JBLM. The primary effects analyzed in this BE are the effects to species and habitat in water bodies that receive discharges from the JBLM MS4 as authorized by EPA's permit.

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[105] USEPA 1999b, pages 62-71.
[106] Tetra Tech, 2010.
[107] Tetra Tech, 2010. The modeled land uses consist of Commercial, Industrial, High-Density Residential, Medium-Density Residential, and Low-Density Residential; the modelled water quality constituents consist of total phosphorous (TP), total suspend solids (TSS), and Zinc (Zn).
[108] Calculation of the 95th percentile storm event from the available rainfall record is described in detail within various sources; in particular. See: USEPA 2009; Hirschman & Kosco, 2008.

5.1 Description of How the Environmental Baseline Would Be Affected

EPA's action to issue the Permit to authorize discharges from the JBLM MS4, and JBLM's subsequent implementation of the required stormwater management actions, will improve the overall quality and quantity of MS4 discharges into surface waters by reducing pollutant loading and excess flow to the receiving waters. The Permit prescribes implementation of actions to prohibit, prevent and respond to illicit non-stormwater discharges into the MS4. Examples include the prevention and response to petroleum spills, investigation and elimination of dry weather discharge through the MS4, and ongoing training for personnel and residents regarding appropriate disposal of hazardous materials at the base. The Permit requires regular inspection and ongoing maintenance of the MS4 infrastructure, which is intended to remove sediments and accumulated pollutants from the MS4 and eliminate pollutant discharge of those solids into receiving waters. Runoff from all new development sites will be minimal as a result of the Permit's prescriptive stormwater treatment requirements and hydrologic performance standards for onsite stormwater management and flow control. As existing impervious areas are redeveloped the quality and quantity of the stormwater runoff from the redeveloped sites will significantly improve due to the Permit's treatment and hydrologic performance standards for onsite stormwater management. Retrofit planning and associated actions will result in site level projects that further mitigate and/or eliminate stormwater flows from existing developed areas within JBLM. These activities and prescriptive performance standards as required by the Permit will improve the environmental baseline conditions within the Action Area.

5.2 Water Bodies That May Be Affected by JBLM MS4 Discharges

As previously discussed in Sections 2, 3 and 4 of this BE, the two water bodies with ESA listed species, ESA critical habitat and/or EFH that may be affected by the JBLM MS4 discharges are: 1) the Puget Sound nearshore, in the vicinity of the JBLM Canal outfall; and 2) Clover Creek, from the JBLM-McChord Field to Lake Steilacoom. The discussion below describes EPA's effect analysis and conclusions for the ESA listed species and designated habitat that occurs (or may occur) in both of these water bodies. Though EPA considers the Nisqually River and Muck Creek to part of the Action Area, the JBLM MS4 is not known to discharge into either Nisqually River or Muck Creek.

5.2.1 Puget Sound Nearshore, in the Vicinity of the JBLM Canal Outfall

As described in Section 3, the ESA listed species which may occur in the vicinity of the discharge from the JBLM Canal outfall are Puget Sound Chinook Salmon, Puget Sound Steelhead, and Bull Trout.

EPA concludes that issuance of the JBLM MS4 permit is not likely to adversely affect ESA listed Puget Sound Chinook Salmon, Puget Sound Steelhead, or Bull Trout in the Action Area for the following reasons:

1) *The current discharge from the JBLM Canal outfall into the Puget Sound nearshore is not expected to contain contaminants at concentrations that adversely affect salmonids.*

As described in Sections 4.1.1.3 and 4.1.1.4, flows into and through the JBLM Canal primarily consist of overflow from Sequalitchew Lake, a spring-fed water body which is unlikely to contain elevated pollutant concentrations. Lake water comprises 90% or more of the flow within JBLM Canal during the summer and fall months, and approximately 80% during the winter and spring months (except for a few days of heavy rainfall per year). As outlined in Section 2.3.1.1, discharges from the JBLM

MS4 can enter the JBLM Canal via Outfalls 02 and 03 (from JBLM-Main) and Outfalls 04 and 05 (from JBLM-North). However, stormwater treatment and flow facilities co-located ahead of each outfall serve to effectively manage flow and treat pollutants in the runoff (except during the infrequent very large storm events). Further, the stormwater detention and infiltration facility adjacent to OF 04 has effectively eliminated discharges to Puget Sound from OF 04. MS4 discharges from Outfalls 02 and 03 receive additional treatment via settling and biological processes through Hamer Marsh. Therefore, considering all of these factors, EPA concludes that the JBLM MS4 discharge into Puget Sound is unlikely to contain pollutants at concentrations that would harm salmonids. This conclusion is further supported by available sampling data collected by JBLM for Clover Creek which shows that industrial stormwater outfall discharges and in-stream concentrations for total copper and total zinc are generally well below EPA's target benchmarks and water quality criteria.

As previously discussed in Section 4.1.1.3, EPA is less certain about pollutant concentrations during the infrequent multi-day storm events when the stormwater runoff from the JBLM MS4 exceeds the design capacities of the facilities at OF 02, OF 03, and OF 05. During these events, JBLM stormwater runoff comprises a larger portion of the flow into the JBLM Canal and much of the runoff is not treated prior to entering the Canal. However, the runoff that is by-passing the facilities at OF 02, OF 03, and OF 05 is comprised of runoff from the later part of an infrequent multi-day rain event and is significantly diluted due the high rainfall.

2) *There is likely to be very low numbers of individual rearing Puget Sound Chinook salmon, Puget Sound Steelhead, and migrating Bull Trout in the vicinity of the JBLM Canal outfall, and any use by these species is likely to be infrequent due to the existing degraded shoreline habitat.*

The habitat near the vicinity of the JBLM Canal outfall is of poor physical quality due extensive shoreline armoring. USFWS has stated there are no habitat features (such as forage fish or aquatic vegetation) along this portion of the nearshore Puget Sound shoreline that would cause Bull Trout to linger in the vicinity of the JBLM Canal outfall. It is unlikely that Bull Trout will be exposed to or to encounter the discharges from the JBLM Canal because there are very few Bull Trout in the marine environment near the location of JBLM Canal outfall south of Ketron Island off Solo Point in south Puget Sound.[109] The location of the JBLM Canal outfall into Puget Sound is similarly not known for any particular high use by Puget Sound Chinook salmon or Puget Sound Steelhead, because the outfall is not located near any stream or river entrance, and as stated above, the nearshore area is not particularly suited for foraging due to extensive shoreline armoring and other existing nearshore impacts.[110]

3) *The Permit requirements will further improve the water quality of the JBLM MS4 discharge to Puget Sound over the five year permit term.*

As discussed in Section 2 and summarized in Section 5.1, EPA's issuance of the Permit is expected to improve the quality of and reduce the quantity of MS4 discharges through the JBLM Canal into Puget Sound. JBLM's stormwater management activities as specified in the Permit are imposed across the entire JBLM installation. Receiving water quality is expected to incrementally improve as a result of JBLM's continued investigation and elimination of illicit discharges. Ongoing pollutant

[109] USFWS 2010a,2010b.
[110] USFWS 2010b, NMFS 2012c.

source control efforts, combined with dedicated maintenance of the MS4 infrastructure, will improve and maintain water quality over the long term. Retrofit planning will redesign additional acreage too infiltrate and/or treat MS4 discharges; and advanced design of re-development projects will improve treatment and flow control of surface runoff over current conditions. In most cases, improved control of surface runoff from future development sites at JBLM will be accomplished by avoiding or eliminating anticipated discharges through infiltration; when combined, these actions will restore natural hydrologic processes to the extent practicable and impose no additional impact to the Puget Sound.

ESA critical habitat is designated in the Puget Sound nearshore vicinity of the JBLM Canal outfall for Puget Sound Chinook and for Bull Trout. Essential Fish Habitat is designated in the the Puget Sound nearshore vicinity of the JBLM Canal outfall for Puget Sound Chinook, Coho Salmon, and Pink Salmon.

EPA concludes that issuance of the JBLM MS4 Permit is not likely to adversely affect designated critical habitat for either Puget Sound Chinook or Bull Trout, and does not have the potential to cause substantial adverse effects on Chinook, Coho, and Pink Salmon EFH in this area, for the following reasons:

1) *Salmonid habitat near the JBLM Canal outfall is currently of low physical quality, and the nearshore area does not appear to be significantly degraded by the current JBLM Canal discharge.*

Although the Puget Sound nearshore in the vicinity of JBLM Canal outfall is considered critical habitat and/or EFH for the salmonid species listed above due to the broad nature of those habitat designations, the current physical habitat quality in this area is considered poor due to existing shoreline armoring and lack of habitat features to support salmonid rearing and foraging. As a result, very little salmonid rearing and migration use is known to occur in this area.[111]

Of the six Primary Constituent Elements (PCEs) identified by NMFS as essential critical habitat features for Puget Sound Chinook, only PCE #5 is applicable to the Action at this nearshore location:

> *PCE #5: Nearshore marine areas free of obstruction with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels.*[112]

With respect to this PCE for Puget Sound Chinook, water quality conditions to support juvenile development may be affected by the combined discharge from the JBLM Canal, however, as discussed in detail in Section 4.1.1.4 and previously in this section, the discharge is not likely to degrade the water quality conditions and habitat conditions necessary to support juvenile rearing and growth are not present in the vicinity of the JBLM Canal outfall area; further, the Canal discharge does not contribute to the currently degraded physical condition of the nearshore area.

USFWS has identified nine PCEs for Bull Trout; four of the nine (PCEs #2, 3, 4, and 8) are applicable to the Action at the Puget Sound nearshore location for the JBLM Canal outfall:

[111] USFWS 2010b, NMFS 2012c.
[112] NMFS 2005b, Page 52665.

PCE#2: Migration habitats with minimal physical, biological or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats, including but not limited to permanent , partial, intermittent or seasonal barriers.

PCE #3: An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.

PCE #4: Complex river, stream, lake, reservoir, and marine shoreline aquatic environments, and processes that establish and maintain these aquatic environments, with features such as large wood, side channels, pools, undercut banks and unembedded substrates, to provide a variety of depths, gradients, velocities, and structure.

PCE # 8: Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited. [113]

The physical habitat conditions associated with the PCEs #2, 3 and 4 to support juvenile spawning, rearing and foraging are not present in the vicinity of the JBLM Canal outfall and the existing discharge does not contribute to the current degraded physical condition. Similar to the PCE for Chinook, the water quality conditions to support Bull Trout rearing and growth have the potential to be affected by the by JBLM Canal discharge, however, as noted above, EPA is not aware of evidence that the discharge from the JBLM Canal degrades the existing water quality conditions in the vicinity. EPA reaches the same basic conclusions for the effects to Chinook, Coho and Pink Salmon EFH. Water quality is an important part of EFH to ensure proper growth and development of young salmon. As discussed in Section 4.1.1.3 and 4.1.1.4, the discharge from the JBLM Canal outfall does not appear to degrade the water quality conditions in the vicinity of the outfall. Physical habitat conditions integral to proper functioning EFH and which support juvenile salmonid rearing and growth are not present in the vicinity of the JBLM Canal outfall and the Canal outfall discharge does not contribute to the currently degraded physical habitat conditions.

2) *The Permit requirements will further improve the water quality of the JBLM MS4 discharge over the five year permit term thereby only serving to improve the habitat in the vicinity of the JBLM discharge.*

EPA's issuance of the Permit is expected to improve the quality of and reduce the quantity of MS4 discharges through the JBLM Canal into Puget Sound. JBLM's stormwater management activities as specified in the Permit are imposed across the entire JBLM installation. Receiving water quality is expected to incrementally improve as a result of JBLM's continued investigation and elimination of illicit discharges. Ongoing pollutant source control efforts, combined with dedicated maintenance of the MS4 infrastructure, will improve and maintain water quality over the long term. Retrofit planning will redesign additional acreage too infiltrate and/or treat MS4 discharges; and advanced design of re-development projects will improve treatment and flow control of surface runoff over current conditions. In most cases, improved control of surface runoff from future development sites at JBLM will be accomplished by avoiding or eliminating anticipated discharges through infiltration; when combined, these actions will restore hydrologic processes to the extent practicable and impose no additional impact to the Puget Sound.

[113] USFWS 2010. Pages 63931-63932.

5.2.2 Clover Creek, from JBLM-McChord Field to Lake Steilacoom

As discussed in Sections 3.3and 3.4, no ESA listed species occur in this stretch of Clover Creek, and the only designated habitat within this reach is EFH for Coho salmon.

EPA concludes that issuance of the JBLM MS4 permit does not have the potential to cause substantial adverse effects on Coho EFH in this area for the following reasons:

1) *The current water quality and quantity impacts to Clover Creek from the JBLM MS4 discharges appear to be modest.*

As discussed in Sections 2.3.1.2 and 4.1.2, there 24 MS4 outfalls that discharge into Clover Creek from about 240 acres of residential and commercial land. Runoff from about half this land area is currently treated with oil/water separators at six outfalls. Existing discharges from these 24 MS4 outfalls likely contribute some pollutants and excess flow into Clover Creek. However, ambient monitoring data suggests the in-stream concentrations associated with the combined industrial stormwater and MS4 discharges are unlikely to be causing adverse water quality conditions. The magnitude of flow impacts from the MS4 discharges on in-stream channel habitat is not quantified, but is generally considered to be modest given that the channel is stable in many locations due to channelization and bank armoring.

2) *EPA's issuance of the Permit is expected to improve the quality and reduce the quantity of the MS4 discharges into Clover Creek.*

Improvements are expected from the continued investigation and elimination of illicit discharges; ongoing source control efforts; dedicated maintenance of the MS4 infrastructure; retrofit planning to redesign additional acreage to infiltrate and/or treat MS4 discharges; and re-development projects that will improve both the treatment and flow control of surface runoff compared to current conditions. In most cases this improved control of surface runoff will be accomplished by eliminating existing discharges through use of additional infiltration facilities. Additionally, new development will be designed to restore hydrologic processes to the extent practicable and will impose no additional negative impact to Clover Creek. EPA anticipates these improvements will lead to reduced impacts such that the effects of the MS4 discharge will be insignificant.

5.2.3 Nisqually River and Muck Creek

As noted throughout this BE, the JBLM MS4 is not known to discharge into the Nisqually River or into Muck Creek. These water bodies flow through the southern portion of the JBLM installation, and are viewed by EPA as part of the Action Area. Therefore, EPA has concluded that the EPA Action to issue a NPDES permit for MS4 discharges is not likely to adversely affect the ESA listed Puget Sound Chinook, Bull Trout, or Puget Sound Steelhead; ESA designated critical habitat for Puget Sound Chinook or Bull Trout; or EFH for Puget Sound Chinook, Coho, and Pink Salmon.

6.0 RELATED JBLM ACTIONS

This section discusses plans and strategies currently implemented by JBLM that are related to the protection and Endangered Species and reduction of stormwater discharges.

Integrated Natural Resource Management Plans and Endangered Species Management Plans[114]

JBLM has recently updated their Integrated Natural Resource Management Plan and Endangered Species Management Plans, which serves to govern JBLM's ongoing use and management of areas important to endangered, threatened, and candidate species. Habitat restoration activities are ongoing and actively coordinated through its Army Compatible Use Buffer (ACUB) program and other JBLM actions. These planned and ongoing actions have been deemed by NMFS and USFWS to be beneficial to the recovery of target species located within JBLM boundaries. Endangered Species Management Plans (ESMPs) have been prepared for Chinook salmon, Puget Sound Steelhead, and Bull Trout. The management objectives of these ESMPs are focused on the protection and enhancement of these listed species.

Department of Army's Net Zero Water Strategy[115]

JBLM's goal under the Army's Net Zero plan is to reduce the annual discharge from the developed areas of 5.0 Billion gallons to Zero by 2020. As of 2012, approximately 62 % of the developed JBLM area is already converted to on-site (i.e., on-installation) stormwater management. In addition to EPA's Permit requirements to help attain this goal, the Army has already begun incorporating onsite stormwater management into its new construction project sites, and including LID stormwater facilities to treat stormwater for groundwater recharge; such actions serve to restore natural site hydrology. JBLM is also incorporating ways to re-direct flow from existing outfalls to increase onsite infiltration/injection/reuse. For example, JBLM may increase its use of rainwater capture and reuse systems, by incorporating such practices into new site projects; JBLM is also considering diverting rainwater to the installation's industrial users.

[114] NMFS 2013, USFWS 2013; 2010; 2005a.
[115] JBLM-DPW 2012a.

7.0 CONCLUSION AND SUMMARY EFFECT DETERMINATIONS FOR LISTED SPECIES, CRITICAL HABITAT AND ESSENTIAL FISH HABITAT

This BE summarizes the effects on ESA-listed species, ESA designated critical habitat, and Essential Fish Habitat associated with EPA's action to issue a NPDES permit for discharges from the MS4 owned and operated by Joint Base Lewis-McChord. After analysis of the baseline condition and potential effects of the action, as discussed in Sections 4 and 5 of this BE, EPA has made the following ESA and EFH determinations:

7.1 ESA Effect Determinations

EPA determines that the issuance of NPDES Permit # WAS-026638 may affect, but is not likely to adversely affect, ESA-listed Puget Sound Chinook salmon, Puget Sound Steelhead, and Bull Trout.

7.2 ESA Critical Habitat Effect Determinations

EPA determines that the issuance of NPDES Permit # WAS-026638 may affect, but is not likely to adversely affect, ESA-designated critical habitat for Puget Sound Chinook and Bull Trout.

7.3 Essential Fish Habitat Determinations

EPA determines that the issuance of NPDES Permit # WAS-026638 may adversely affect EFH for Puget Sound Chinook, Coho, and Pink Salmon, but does not have the potential to cause substantial adverse effects on EFH for these species.

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9.0 APPENDICES

Appendix 1 – EPA Fact Sheet, dated January 26, 2012 (Available as a separate document).
Appendix 2 – EPA Final Draft Permit dated April 2013 (Available as a separate document).