2014 STREAM HABITAT AND FISH BASELINE REPORT

Pacific International Terminals Property

Whatcom County, Washington

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Project No. 091515338C

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PREFACE

Pacific International Terminals, Inc. (PI Terminals), proposes to develop the Gateway Pacific Terminal (the “Terminal”), a multimodal terminal for transfer of dry bulk commodities, at Cherry Point in Whatcom County, Washington. Construction and operation of the Terminal and associated facilities require the approval of local, state, and federal agencies. Agency decision makers are to be informed of the potential environmental impacts of the proposed project by preparation of two environmental impact statements (EISs) under guidelines of the National Environmental Policy Act (NEPA) and under the State Environmental Policy Act (SEPA).

This report is one of several technical reports prepared on behalf of PI Terminals that provides scientific technical information about the existing conditions of the proposed project site and, in some cases, the projected effects of Terminal operations and mitigation for those effects. This report is provided to Whatcom County and the Department of Ecology for their use in preparation of a SEPA EIS. It is also provided to the U.S. Army Corps of Engineers (USACE) for its use in preparation of a NEPA EIS. This report has also been prepared to support specific permit applications and as part of the consultation process with resource agencies and affected Indian Nations.

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EXECUTIVE SUMMARY

AMEC Environment & Infrastructure, Inc. (AMEC), conducted an assessment of streams and fish habitat at the Pacific International Terminals, Inc. (PI Terminals), property. The stream assessment included an inventory of freshwater streams and drainages, characterization of the streams and drainages with respect to suitable fish habitat, and a baseline assessment of fish presence or absence in streams with the highest habitat potential. All 23 watercourses on the property were characterized, including natural and modified streams and ditches. The results of studies conducted by AMEC at the property related to stream habitat and fish distribution are presented in the *Freshwater Streams Baseline Inventory Report* (AMEC 2012a) and in this *2014 Stream Habitat and Fish Baseline Report*.

Habitat surveys focusing on Stream 1 and its tributaries were conducted in 2008 and 2010 to collect data on fish habitat potential and ecological condition, and to make general observations regarding barriers to fish passage and flow regimes. According to guidance provided by NOAA Fisheries' Matrix of Pathways and Indicators (NOAA Fisheries 1996), habitat in the Stream 1 sub-watershed was properly functioning with regard to large woody debris accumulation and channel condition, and not properly functioning with regard to habitat access, substrate composition, and overall watershed conditions as indicated by riparian reserves. Habitat provided by roadside streams 4, 5, and 6, and roadside drainages 1, 3, and 5, was characterized as not properly functioning. This information was presented in an earlier report (AMEC 2012a).

Habitat surveys focusing on Stream 2 and its tributaries were conducted in 2014 following purchase of the Parcel 15 property by PI Terminals. The methods used for the surveys and functional evaluation were similar to those used on Stream 1. These data are presented in this report. The Stream 2 watershed is considered functionally at risk with respect to channel condition and overall watershed conditions, and not properly functioning with regard to habitat access, substrate composition, and large woody debris accumulation.

Based on habitat information and the location of migration barriers, fish surveys were conducted in 2011 in the lower portions of Stream 1 and Stream 2, and in Stream 4. Juvenile coho and chum salmon were documented in the lower reach of Stream 1. Three-spined sticklebacks were found in the lower reach of Stream 1 and in the coastal lagoon. No fish were found in Reach 2 of Stream 1 (upstream of the Henry Road culvert), in reaches 1 and 2 of Stream 2, or in Stream 4. These results were presented in a prior report (AMEC 2012a). Because salmonids were observed only in Reach 1 of Stream 1, a salmonid spawner survey and a more detailed salmonid spawning substrate survey were conducted in this reach. The spawner survey took place biweekly during the 2011/2012 and 2012/2013 spawning seasons, but no spawners were observed. The survey of the distribution and abundance of potential spawning substrates was conducted in 2013 and found that spawning gravel in Stream 1 was limited (35 percent of the streambed) and usually embedded in finer substrates.

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ACRONYMS AND ABBREVIATIONS

BFD	bankfull depth
BFW	bankfull width
BNSF	BNSF Railway Company
cm	centimeter
Ecology	Washington State Department of Ecology
EIS	environmental impact statement
EMAP	Environmental Monitoring and Assessment Program
GPS	global positioning system
HGM	hydrogeomorphic
LWD	large woody debris
m	meter
mm	millimeter
MPI	Matrix of Pathways and Indicators
NEPA	National Environmental Policy Act
NOAA	National Oceanographic and Atmospheric Administration
NOAA Fisheries	NOAA National Marine Fisheries Service
PEM	palustrine emergent
PFC	proper functioning condition
PFO	palustrine forested
PI Terminals	Pacific International Terminals, Inc.
POW	palustrine open water
PSS	palustrine scrub-shrub
RPW	relatively permanent waterways
SEPA	State Environmental Policy Act
Terminal	Gateway Pacific Terminal
TFW	Timber, Fish and Wildlife
TNW	traditional navigable water
USACE	U.S. Army Corps of Engineers
WAC	Washington Administrative Code
WCC	Whatcom County Code
WDFW	Washington Department of Fish and Wildlife
WDNR	Washington Department of Natural Resources
WFPB	Washington Forest Practices Board
WRIA	Water Resources Inventory Area
WW	wetted width

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2014 STREAM HABITAT AND FISH BASELINE REPORT

Pacific International Terminals Property
Whatcom County, Washington

1.0 INTRODUCTION

Pacific International Terminals, Inc. (PI Terminals), is proposing to develop the Gateway Pacific Terminal (the "Terminal") at the PI Terminals property located at Cherry Point in Whatcom County, Washington. This report is intended to provide information regarding existing conditions at the site to be used in preparation of two Environmental Impact Statements (EISs) under guidelines of the National Environmental Policy Act (NEPA) and under the State Environmental Policy Act (SEPA).

The purposes of this report are threefold: (1) to present an inventory of freshwater streams and drainages on the PI Terminals property, (2) to characterize these streams and drainages with respect to suitable fish habitat, and (3) to provide a baseline assessment of fish presence or absence in streams.

Extensive field studies have been conducted on the PI Terminals property to characterize stream habitat and the presence of fish. Results of field activities conducted from 2008 to 2012 were reported in detail in an earlier report (AMEC 2012a), which focused primarily on the Stream 1 watershed. This report focuses primarily on, and consequently provides greater detail for, new information that has been gathered since that earlier report. This new information relates primarily to the Stream 2 watershed. Nevertheless, so as to provide a comprehensive report on streams and fish at the PI Terminals property, this report also includes either a summary or reference to the earlier information reported previously.

The description of the physical and environmental setting presented in Section 2 of this report has been updated from the version presented in the earlier report to reflect PI Terminals' acquisition of Parcel 15. Table 1 presents a summary of stream habitat and fish-related data collection activities at the PI Terminals property, and indicates where the resulting data were first reported.

1.1 Project Description

PI Terminals proposes to construct and operate a deep-water, multimodal terminal for the export of dry bulk commodities. The Terminal would have a 3,000-foot, deep-water wharf and storage and transfer areas. The storage and transfer area would be serviced by rail and support facilities. The wharf would accommodate large ocean-going vessels, including Capesize and Panamax vessels. The Terminal would handle a variety of dry bulk commodities throughout its lifetime.

Table 1 Summary of Fish and Stream Habitat Data Collection Activities

Watercourse(s)	Survey Type	Method[a]	Year	Previously Reported?
Stream 1	Habitat characterization	Properly Functioning Condition (PFC)	2008	Yes (AMEC 2012a)
Streams 4, 5, 6, and Drainages 1, 3, 5	Habitat characterization	Modified PFC	2010	Yes (AMEC 2012a)
Stream 1, 2, and 4	Fish survey	Backpack electrofishing Hand netting	2011	Yes (AMEC 2012a)
Stream 1	Habitat characterization	Salmonid Spawning Habitat Availability (Timber, Fish, and Wildlife [TFW] program)	2013	No
Stream 2, 2A, 2B	Habitat characterization	PFC	2014	No
Stream 1	Spawner survey	Visual survey	2011/2012 2012/2013	Yes (AMEC 2012a) No

a. Methods are described in detail in Section 3, or in prior reports.

Dry bulk commodities would be transferred to the Terminal by rail. Rail access would be provided by the BNSF Railway Company (BNSF) main line via new connections from the Terminal to the existing Custer Spur industrial rail line. Modern commodities-handling equipment would be installed and appropriate management practices enforced to protect the environment during Terminal operations. A detailed description of the project is described in the *Project Alternatives Report* (PI Terminals 2014).

2.0 PHYSICAL AND ENVIRONMENTAL SETTING

The site has been characterized extensively as a result of proposed development projects over the past 30 years (Parametrix, Inc., et al. 1981; Shapiro 1984, 1994; Whatcom County Department of Public Works 1993; Huckell/Weinman Associates et al. 1996, 1997); but streams and freshwater fish habitat have not been documented in detail until the past decade.

Recent studies relating to the hydrology of the site provide much of the basis for the following description of the property. These studies include 2008 and 2013 wetland determination and delineation reports (AMEC 2008, 2013), the *Hydrologic and Hydrogeologic Investigation Report* (AMEC 2012b), the *Draft Conceptual Compensatory Wetland Mitigation Plan* (AMEC 2014a), and the *Draft Conceptual Stormwater Management Plan* (AMEC 2014b).

2.1 Property Description

The 1,566-acre property is located at Cherry Point on the Strait of Georgia. Cherry Point is a small promontory of land on the south side of Point Whitehorn and south of Birch Bay. The area is located approximately 5 miles west of the City of Ferndale, approximately 18 miles northwest of the City of Bellingham, and approximately 17 miles south of the Canadian border (**Figure 1**). The property covers portions of Sections 17, 18, 19, and 20 of Township 39 North, Range 1 East, all in unincorporated Whatcom County.

The area is zoned for heavy-impact Industrial use, is located within unincorporated Whatcom County, and is in Whatcom County's designated Cherry Point Industrial Urban Growth Area 9 (Whatcom County 2006b). The wharf and trestle would be located in the Strait of Georgia between the BP Cherry Point Refinery pier and the ALCOA Intalco Works pier.

The BP Cherry Point Refinery borders the property to the north and west. The ALCOA Intalco Works (aluminum plant) borders the property to the southeast. The Strait of Georgia lies to the southwest. The nearest residential areas are located on Kickerville Road, adjacent to the eastern edge of the project site. The Lake Terrell Wildlife Refuge, owned by the Washington Department of Natural Resources (WDNR), is located approximately 0.25 mile east of the site beyond Kickerville Road.

Roads, pipelines, power-line corridors, and railroads further define the area. The BNSF Railway's Custer Spur and a Bonneville Power Administration transmission line run north-south in the eastern portion of the property. A north/south-trending gas line doglegs through the area from the BP Cherry Point Refinery toward the southeast, and other pipelines run parallel to the western boundary.

The area consists primarily of pasture and secondary forest stands. All wetlands and watercourses eventually drain to the Strait of Georgia.

2.2 Topography and Geology

The property is located in the Puget Trough Ecoregion (Camp and Gamon 2011) along the Strait of Georgia. The terrain is characterized by generally flat to gently rolling slopes. Elevations range from sea level to 220 feet above mean sea level. The highest elevation occurs nearest the eastern project site boundary, with site elevation gradually decreasing to the west and southwest toward the shoreline (**Figure 2**). Moderate slopes and steep bluffs border the westernmost and easternmost stretches of shoreline within the project area. Unstable slopes are not present on the site other than in the vicinity of the shoreline bluffs.

The retreat of the Vashon-Stade glacier approximately 13,000 years before present left the project area at least partially submerged below sea level. The glacier deposited glacial debris, gravel, sand, and rock, forming depositional units up to several hundreds of feet thick (Goldin 1992). Over time, waves reworked and redeposited the uppermost geologic layer. More recently, the land rebounded from glacial compaction while sea level dropped, producing today's shoreline and nearshore areas.

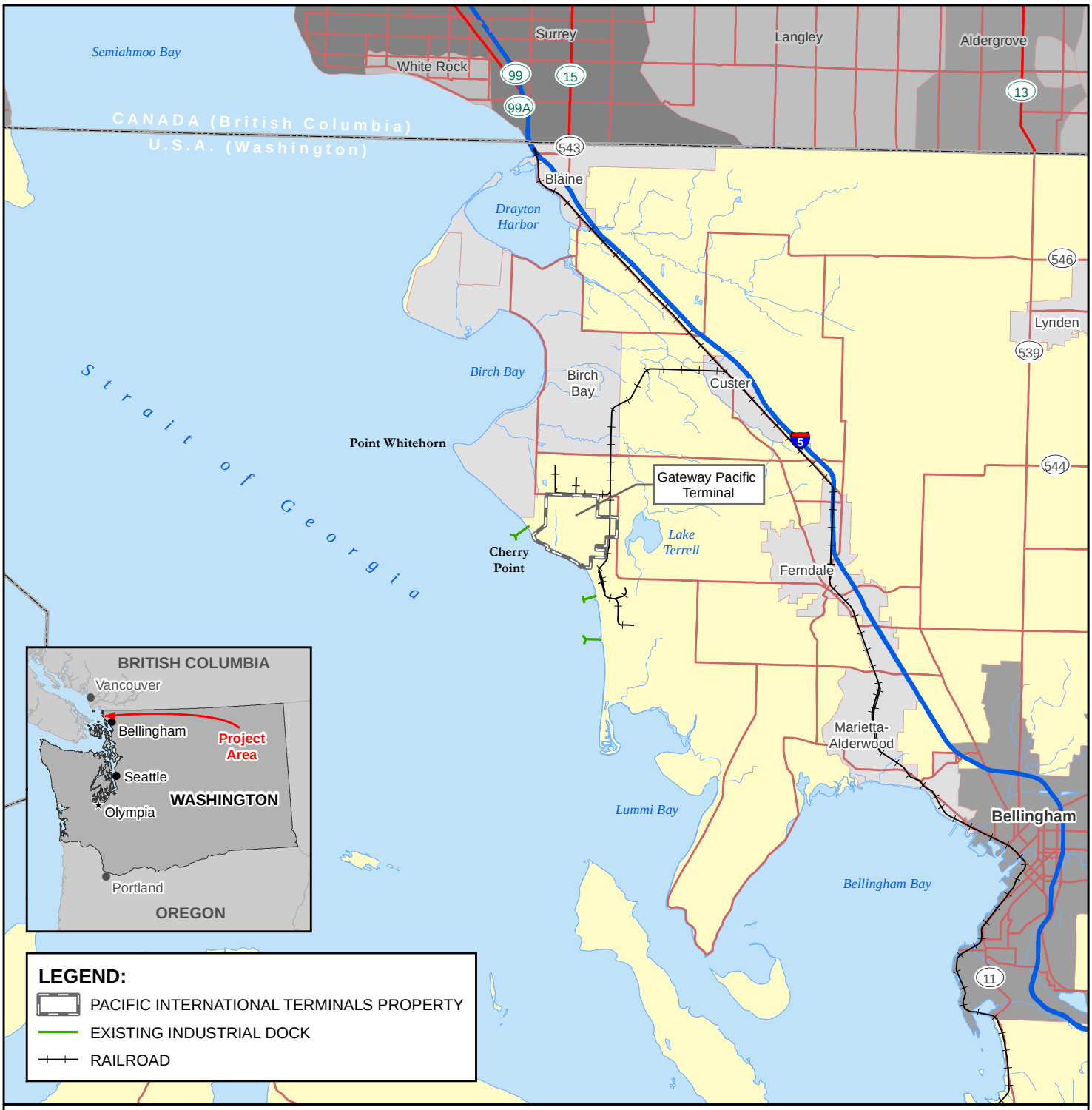
2.3 Site Hydrology

Wetlands, streams, and ditches occur throughout the property. The area is drained primarily by Stream 1 and Stream 2, with several roadside drainages that are tributary to these two stream corridors. Both Streams 1 and 2 gain water from groundwater and surface water inputs (AMEC 2012b). Stream 1 drains the north, central, and western portions of the property, while Stream 2 drains the southeastern portion (**Figure 3 and Figure 4**). Both Stream 1 and Stream 2 are typically dry in the summer and early fall each year.

A total of 23 watercourses occur within the project area. Of these, 10 are streams (Streams 1 through 7, plus Streams 1A, 2A, and 2B) and 13 are drainages adjacent to existing roads or railroads (**Figure 4**). Streams 1, 1A, 2, 2A, and 2B occur in natural stream channels, whereas Stream 3 through Stream 7 occur as roadside ditches.

2.4 Wetlands

Field investigations from 2006 through 2013 resulted in the delineation of approximately 609 acres of wetlands within the property boundaries (AMEC 2008, 2013) (**Figure 4**). Delineated wetlands were classified as riverine, slope, and depressional type wetlands according to the hydrogeomorphic (HGM) classification system (Brinson 1993). Palustrine forested (PFO), palustrine scrub-shrub (PSS), palustrine emergent (PEM), and palustrine open water (POW) wetland habitat types were identified in accordance with the Cowardin classification system (Cowardin et al. 1979).



AMEC 11810 North Creek Parkway N Bothell, WA 98011	amec	Pacific International Terminals	CLIENT: PACIFIC INTERNATIONAL TERMINALS, INC.

PROJECT: 2014 STREAM REPORT	DWN BY: SD	DATUM: NAD83	DATE: AUGUST 2014
TITLE: VICINITY MAP	CHK'D BY: TS	REV. NO.: -	PROJECT NO.: 091515338C-04-09
	PROJECTION: WA SP North, Ft.	SCALE: 1 inch=3 miles	FIGURE NO.: FIGURE 1

K:\AMEC US OFFICES\KIRKLAND\15338-0\15338C\T-04-04 - Fish and Stream Report\dwg_Revised_July_2014\Figure 1 - Vicinity Map.mxd

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NOTE: Current Elevation Contours data derived from National Elevation Dataset product:
http://ned.usgs.gov/

Pacific International Terminals
A Carrix Enterprise

CLIENT: PACIFIC INTERNATIONAL TERMINALS, INC.

AMEC
11810 North Creek Parkway N
Bothell, WA 98011

amec

DWN BY:	SD
CHK'D BY:	TS
DATUM:	NAD83
PROJECTION:	WA SP North, Ft.
SCALE:	1 inch = 1,500 feet

PROJECT: 2014 STREAM REPORT

TITLE: SITE TOPOGRAPHY

DATE:	AUGUST 2014
PROJECT NO.:	091515338C-04-09
REV. NO.:	-
FIGURE NO.:	FIGURE 2

K:\AMEC US OFFICES\KIRKLAND\15338-0\15338C\T-04-04 - Fish and Stream Report\dwg_Revised_July_2014\Figure 2 - Site Topography.mxd

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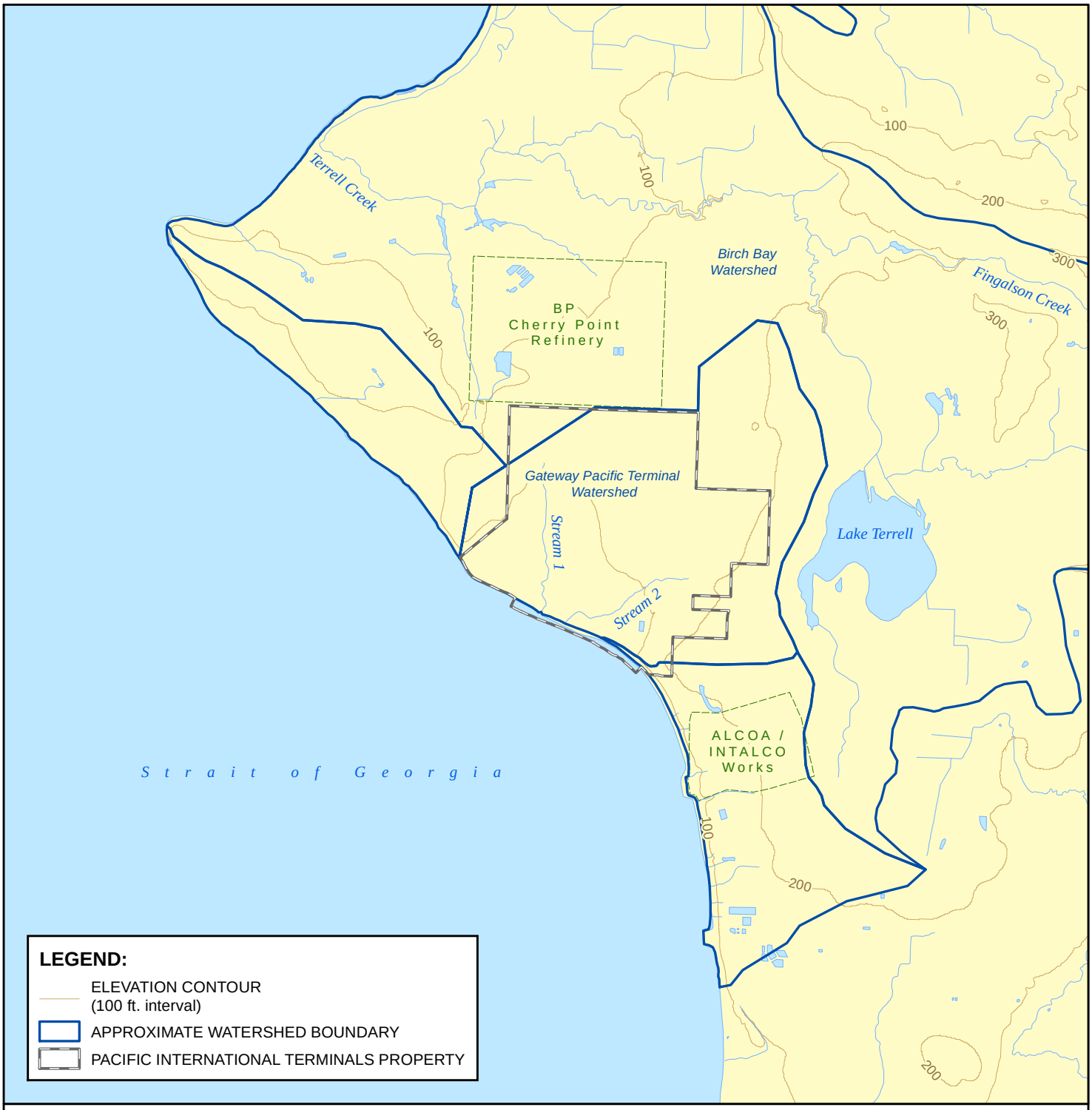

Source:
Elevation Contours from Whatcom County:
http://www.co.whatcom.wa.us/pds/planning/gis/gisdata.jsp
Hydrology Data from the U.S. Geological Survey
National Hydrography Dataset :
http://nhd.usgs.gov/data.html

0 0.5 1 2 Miles

N

AMEC 11810 North Creek Parkway N Bothell, WA 98011	amec	Pacific International Terminals	CLIENT: PACIFIC INTERNATIONAL TERMINALS, INC.

PROJECT: 2014 STREAM REPORT	DWN BY: SD	DATUM: NAD83	DATE: AUGUST 2014
TITLE: WATERSHED BOUNDARIES	CHK'D BY: TS	REV. NO.: -	PROJECT NO.: 091515338C-04-09
	PROJECTION: WA SP North, Ft.	SCALE: 1 inch=1 mile	FIGURE NO.: FIGURE 3

K:\AMEC US OFFICES\KIRKLAND\15338-0\15338C\T-04-04 - Fish and Stream Report\dwg_Revised_July_2014\Figure 3 - Watershed Boundaries.mxd

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NOTE: Streams regulated by WDFW under the Hydraulic Code (RCW 77.55 and WAC 220-110):
Stream 1 (Reaches 1, 2, and 3), 2, 2A, 2B, 4, 6 & 7.

Streams regulated by Whatcom County per Critical Areas Ordinance Maps: Streams 1, 2, 2A, 2B, 3, 4, 5, 6, and 7 .

Pacific International Terminals
A Carrix Enterprise

CLIENT: PACIFIC INTERNATIONAL TERMINALS, INC.

AMEC
11810 North Creek Parkway N
Bothell, WA 98011

amec

DWN BY:	SD
CHK'D BY:	TS
DATUM:	NAD83
PROJECTION:	WA SP North, Ft.
SCALE:	1 inch = 1,200 feet

PROJECT: 2014 STREAM REPORT

TITLE: WETLANDS & WATERCOURSES IN THE PROJECT AREA

DATE:	AUGUST 2014
PROJECT NO.:	091515338C-04-09
REV. NO.:	-
FIGURE NO.:	FIGURE 4

K:\AMEC US OFFICES\KIRKLAND\15338-0\15338C\T-04-04 - Fish and Stream Report\dwg_Revised_July_2014\Figure 4 - Wetlands and Watercourses in the Project Area.mxd

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Approximately 402 acres of PFO wetlands are present on the PI Terminals property. Many of the PFO wetlands lack defined outlets, which results in the detention of surface water and infiltration to groundwater. Approximately 144 acres of PEM wetlands occur in wet pastures, hayfields, and mowed utility easements. Approximately 59 acres of PSS wetlands occur in areas of abandoned pastures, and in linear strips at the boundaries between forest and emergent wetland areas or forest and roadways. Approximately 3.3 acres of POW wetlands occur as farm ponds or other impoundments.

Wetlands on the site drain to roadside ditches and streams, natural stream courses, and groundwater. Wetlands drain via several main pathways: (1) surface discharge from small channels within forested wetlands, (2) sheetflow, and (3) shallow groundwater throughflow that discharges through seeps on slopes. Baseflow in the streams and ditches is supported by water detention in wetland areas as precipitation is captured and released through surface and groundwater discharges.

One particular wetland of note is an 11.2-acre coastal lagoon (Wetland 012) that abuts the Strait of Georgia shoreline west of Gulf Road (**Figure 4**). This coastal lagoon wetland lies between the marine shoreline and upland slopes and riparian communities. The lagoon is separated from the sea by a barrier beach with two outlets. Both Stream 1 and Stream 2 supply fresh water to this area. The lagoon also receives inputs of saltwater through the porous sediments of the beach and over the beach during severe storm events (AMEC 2012a).

2.5 Watersheds and Streams

The area includes portions of two coastal watersheds that drain to the Strait of Georgia: (1) the Birch Bay watershed; and (2) an unnamed coastal watershed designated the Gateway Pacific Terminal watershed for purposes of the Terminal project. Approximately 1,422 acres of the PI Terminals property lie within the Gateway Pacific Terminal watershed, while approximately 68 acres of the PI Terminals property drains instead to the Birch Bay watershed[1] (**Figure 3**). Of the 10 streams and 13 drainages identified, only Stream 3 is located within the Birch Bay watershed. All other streams and roadside drainages are located within the Gateway Pacific Terminal watershed.

For planning purposes, the Washington State Department of Ecology (Ecology) grouped several small coastal watersheds into the Water Resources Inventory Area (WRIA) 1 watershed, including the Stream 1 and Stream 2 watersheds. Ecology designated Stream 1 as Stream 01.0100, and Stream 2 as Stream 01.0101 (Ecology 2013). These watersheds drain directly to marine waters, have no hydrologic connection to interior mountain drainages, and are therefore considered independent coastal watersheds.

[1] An additional 76 acres are tidelands, bringing the total acreage to 1,566 acres.

2.5.1 Birch Bay Watershed

The northwest corner of the project area (approximately 68 acres) lies within the 31-square-mile Birch Bay watershed. The Birch Bay coastal watershed lies to the north and east of the project area and supports a variety of land uses, including heavy industry, residential, recreational, open space, and farming. The watershed includes the BP Cherry Point Refinery and associated industries lying immediately north, and Lake Terrell and its surrounding natural areas lying due east of the project area. Both the BP Refinery and Lake Terrell are notable features in the project vicinity.

The portion of the Birch Bay watershed within the project area includes 44 acres of wetlands (Wetland 01) that drain to Stream 3 (**Figure 4**). Stream 3 is located on BP property adjacent to the northern perimeter of the PI Terminal property, and flows west intermittently in a deep ditch along the north side of Aldergrove Road. This stream connects downstream with the industrial tributary to Terrell Creek, which drains the western and northwestern portions of BP's property. This industrial tributary flows north to Terrell Creek and ultimately discharges to Birch Bay.

A single 6-inch culvert identified beneath Aldergrove Road provides surface water connection between Wetland 01 and Stream 3 during high-flow periods (AMEC 2008). However, based on topographic gradients, Wetland 01 likely also has subsurface hydrologic connectivity through the Aldergrove roadbed.

2.5.2 Gateway Pacific Terminal Watershed

The Gateway Pacific Terminal watershed is a small, approximately 2,000-acre coastal watershed that drains to the Strait of Georgia. Approximately 1,422 acres (95 percent) of the property is located within this watershed, and the property occupies approximately 71 percent of the watershed. Land cover includes a mix of forest, pasture, hayfields, abandoned fields, and roadways.

The watershed drains via only Stream 1 and Stream 2. These two streams have continuous flow for approximately 9 to 10 months of the year, with an annual dry period occurring during the summer and early fall. Both streams terminate in a coastal lagoon (Wetland 012) before discharging into the Strait of Georgia.

Streams 1 and 1A

Stream 1 is approximately 2.4 miles long and drains a total of approximately 800 acres. Stream 1 originates north of Aldergrove Road, flows as a roadside ditch on the north side of Aldergrove Road, and then turns south entering the project area near the intersection of Gulf Road and Aldergrove Road (**Figure 4**). From there, Stream 1 flows into Wetland 03, a large pasture in the northern portion of the project area. The stream flows southwest through the pasture as a ditch and through forested wetlands (Wetland 02) until it reaches its ravine approximately 2,000 feet downstream from where it entered the property.

Stream 1 is fed by surface flow through excavated roadside ditches and isolated channels within wetlands and, in some places, by surface sheet flow. Groundwater seeps appear to be important for base flow support in the lower reaches. Stream 1 is dry during the summer months, as precipitation and groundwater inputs no longer support stream flows (AMEC 2012b).

Stream 1A is tributary to Stream 1, with its confluence approximately 150 feet north of Henry Road. Stream 1A originates in Wetland 07A and is approximately 700 feet long. Additionally, Streams 4, 5, 6, and 7, along with Drainages 1 through 9, are all tributaries to Stream 1.

Streams 2, 2A, and 2B

Stream 2 is approximately 1 mile long and is fed by two tributaries: Streams 2A and 2B (**Figure 4**). Stream 2 drains the southeastern portion of the Gateway Pacific Terminal watershed and generally flows from east to west. It originates off-property east of the BNSF Railway tracks, and partially receives flows from Drainages 12 and 13. It flows west through a forested riparian corridor towards its confluence with Stream 2B. Stream 2 flows into a ravine downstream of this confluence. After the ravine, a concrete weir and earthen dam slow the stream flow and create an impoundment with an emergent wetland and open-water complex (Wetland 10B).

The concrete structure at the base of the dam has not been maintained and no longer functions to discharge to the lower streambed. As a result, the impounded water breaches the southern edge of the dam during the wet season. This overflow water partially returns to the Stream 2 streambed below the dam through an erosional side channel. The overflow water that does not return to the Stream 2 streambed flows over the surface in multiple shallow braided channels through a young alder-forested wetland (Wetland 22) south of the dam, drains south to a shrub wetland (Wetland 23) adjacent to the north side of Gulf Road, and then drains through a culvert onto the beach along the shoreline of the Strait of Georgia.

Below the earthen dam, Stream 2 flows west, joins with Stream 2A approximately 500 feet east of Gulf Road, and flows into the coastal lagoon (Wetland 012) through a culvert beneath Gulf Road. Stream 2 is dry during the summer months when flows are no longer supported by surface water input and groundwater discharges.

Stream 2A flows seasonally through an upland forest and receives stormwater discharges from the partially constructed industrial development abandoned in 1992-1993. Stream 2A baseflow is supported by groundwater discharges and adjacent wetlands that discharge directly to the channel. The channel alternates between low-gradient areas, with unconsolidated fine sediment and emergent vegetation, and higher gradient areas, with a more confined channel and patches of gravel substrates.

Stream 2B flows in a straight, man-made ditch constructed to drain the surrounding agricultural fields. It is flanked by a narrow riparian corridor, consisting of young red alder (*Alnus rubra*), salmonberry (*Rubus spectabilis*), and Himalayan blackberry (*Rubus discolor*), that traverses through a hayfield. Stream 2B drops approximately 10 feet where it doglegs sharply to the north adjacent to the stock ponds (Wetlands 17, 18, and 19) and again at the confluence with Stream 2.

2.6 Stream Types and Regulatory Authority

Stream types are defined by law and can be determined based on a combination of factors, such as the size of the stream or waterbody, seasonality of flow, and fish presence. The stream's official type often determines which federal, state, or local agencies have regulatory authority over it, and can be an indicator of its ecological significance. These determinations have been used, in part, to plan the stream habitat assessments and scale the level of effort given to each of the streams and watercourses on the property.

An earlier report (AMEC 2012a) presented a description of the Stream Types used by the Washington Department of Fish and Wildlife (WDFW) and Ecology as defined under Washington Administrative Code (WAC) 222-16-030 and by Whatcom County as defined under Whatcom County Code (WCC) 16.16.700. In summary, WDFW determined that Streams 1 (Reaches 1, 2, and 3 only), 2, 2A, 2B, 4, 6, and 7 are watercourses regulated under the Hydraulic Code (WAC 220-110); Whatcom County has regulatory authority over Stream 1, 2, 2A, 2B, 3, 4, 5, 6, and 7, but has indicated that Stream 1 is the only presumed fish-bearing stream on the property, and Stream 2 is the only presumed potential/historic fish-bearing stream (Whatcom County 2006a).

On November 12, 2013, the U.S. Army Corps of Engineers (USACE) issued a Determination indicating Federal jurisdiction for all wetlands and watercourses on the property because they either abut or are adjacent to unnamed tributaries of the Strait of Georgia, which has been identified as a traditional navigable water (TNW) used for interstate and foreign commerce (See Appendix A). The USACE also confirmed the extent and location of delineated wetlands on the property at that time. As documented in the Jurisdictional Determination, Stream 1 through Stream 7 (including Streams 1A, 2A, and 2B) and Drainages 1, 3, 4, 7, 8, 9, 11, 12, and 13 have continuous flow for at least 3 months of the year, and thus are considered relatively permanent waterways (RPWs). All other drainages were determined to be non-RPWs (See Appendix A).

3.0 METHODS

Stream assessment protocols to characterize the general habitat quality and function of watercourses are widely available. In 2014, habitat conditions of Streams 2, 2A, and 2B were characterized using protocols (described below) to measure key indicators that could be evaluated relative to the National Oceanographic and Atmospheric Administration (NOAA), National Marine Fisheries Service's (NOAA Fisheries) definition of "Properly Functioning Condition" (PFC) for salmon habitat (NOAA Fisheries 1996, 1999). These methods were used, in part, to maintain consistency with data collected for Stream 1 and other drainages on the property (AMEC 2012a). Methods used to collect additional information relating to Stream 1, namely the spawning substrate survey and the spawner survey, are also described below. Fish survey methods used in the 2011 survey are described briefly, but are available in greater detail in a prior report (AMEC 2012a).

3.1 Stream Habitat Characterization

Stream and riparian habitat was surveyed using a set of standard field protocols developed by federal, state, and local resource agencies (Barbour et al. 1999; Kaufmann et al. 1999; King County 2002). Each stream was walked in its entirety, and observations were recorded about the stream corridor, dominant riparian vegetation, surrounding land use, potential migration barriers, and apparent gains/losses of surface water from the reach. Quantitative data were gathered at transects, or cross-sections perpendicular to flow, which were established approximately 300 feet apart in areas found to be characteristic of the entire reach. Parameters of interest included channel morphology, substrate, riparian canopy and in-channel cover, large woody debris, and obvious human disturbance.

Stream 2 was assessed on May 28 and 29, 2014; Streams 2A and 2B were assessed on June 10 and 11, 2014 (**Figure 5**). Similar data for Stream 1 and its tributaries were collected on November 24 and 25, 2008, and are presented in prior project reports (AMEC 2012a).

3.1.1 Channel Morphology

Bank geometry measurements were recorded to characterize the basic shape of the channel at each cross-section. Measurements included wetted width (WW), thalweg depth, the estimated width and depth of the channel at bankfull stage, the bank slope angles, and the longitudinal slope of the channel. Bankfull width (BFW) is the width between each top of bank. Bankfull depth (BFD) is the depth of water at bankfull stage. These parameters are useful indicators of channel stability during flood flows, long-term channel down-cutting, and fish concealment features, such as undercut banks.

3.1.2 Substrate

Particle size and embeddedness were recorded at each transect using a method similar to the Environmental Monitoring and Assessment Program (EMAP) protocol (Kaufmann and Robison 1998). The dominant substrate size for each cross-section was assessed visually at five locations

established at equidistant points between the banks: left bank, left of center, center, right of center, and right bank. At each point, substrate was assigned to one of the following categories:

Category	Particle Size (millimeters [mm])
RS Bedrock (Smooth)	> 4000
RR Bedrock (Rough)	> 4000
HP Hardpan	> 4000
BL Boulders	> 250 to 4000
CB Cobbles	> 64 to 250
GC Gravel (Coarse)	> 16 to 64
GF Gravel (Fine)	> 2 to 16
SA Sand	> 0.06 to 2
FN Silt, clay, muck	0.06
WD Wood	Regardless of Size
OT Other	Regardless of Size

Embeddedness is described according to the portion of a particle's surface that is surrounded by (embedded in) fine sediments on the stream bottom. Sand and finer substrates are defined as 100 percent embedded (Kaufmann et al. 1999).

3.1.3 Riparian and In-stream Cover

The riparian canopy throughout the surveyed reaches was assessed using three techniques: (1) at each transect, several measurements were taken with a densiometer to quantify the total percent cover of riparian vegetation; (2) visual estimates were made of the relative amount of cover provided by trees, understory shrubs, and ground cover; and (3) dominant plant species were listed.

Densiometer measurements were taken separately in four directions positioned at the center of the stream, and on each bank facing upstream. These measurements were averaged and used to represent the total percentage canopy cover over the channel and within the riparian corridor.

The type, size, and density of vegetation along each stream bank were used to evaluate the potential for shade and input of large woody debris (LWD) to the stream. The overstory and understory canopies were described as deciduous, coniferous, broadleaf evergreen, or mixed. Layers were considered "mixed" if more than 10 percent of its areal coverage was made up of an alternate vegetation type. Percentage cover within each of the three vegetation layers was estimated and classified into one of four categories: "0" (absent: zero cover), "1" (sparse: less than 10 percent cover), "2" (moderate: 10 to 40 percent cover), "3" (heavy: 40 to 75 percent cover), and "4" (very heavy: greater than 75 percent cover) (Kaufmann et al. 1999).

NOTE:

PFC = PROPERLY FUNCTIONING CONDITIONS (NOAA FISHERIES, 1996)

TFW = TIMBER FIAH AND WILDLIFE (SCHUETT - HAMES ET AL. 1999)

Pacific International Terminals
A Carrix Enterprise

CLIENT: PACIFIC INTERNATIONAL TERMINALS, INC.

AMEC
11810 North Creek Parkway N
Bothell, WA 98011

amec

DWN BY:	SD
CHK'D BY:	TS
DATUM:	NAD83
PROJECTION:	WA SP North, Ft.
SCALE:	1 inch = 1,200 feet

PROJECT: 2014 STREAM REPORT

TITLE: HABITAT SURVEY EXTENT

DATE:	AUGUST 2014
PROJECT NO.:	091515338C-04-09
REV. NO.:	-
FIGURE NO.:	FIGURE 5

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A list of dominant plant species was recorded at each transect to describe vegetation along the surveyed stream reaches and to document nonnative species.

3.1.4 Large Woody Debris

Methods to assess the abundance of LWD followed a simplified adaptation of methods described by Robison and Beschta (1990), which are also used in the EMAP methods (Kaufmann et al. 1999). All LWD was categorized according to location in the channel, and then separated into size classes based on length and diameter using visual estimates.

LWD is defined as woody material with a diameter of at least 10 centimeters (cm) (4 inches) and length of at least 1.5 meters (m) (5 feet). At each cross section, the length and diameter of each piece of LWD identified within 15 feet upstream and downstream (30 linear feet per cross section) were recorded. LWD was assigned to the following diameter classes:

- 0.1 m to less than 0.3 m;
- 0.3 m to less than 0.6 m;
- 0.6 m to less than 0.8 m; and
- greater than 0.8 m.

The length classes were defined as (Kaufmann et al. 1999):

- 1.5 m to less than 5.0 m;
- 5.0 m to less than 15 m; and
- greater than 15 m.

LWD smaller than 1.5 m in length or 10 cm in diameter at the large end were not recorded.

The number of pieces in each reach was divided by 30 feet, the linear distance investigated at each cross section, to calculate the number of pieces of LWD per linear foot. Density of LWD was then averaged across all transects in a reach. The average LWD density for each reach was used to compare the abundance of LWD between stream reaches, and to evaluate the abundance of LWD in each reach relative to “properly functioning” condition (NOAA Fisheries 1996).

3.2 Properly Functioning Condition

Habitat conditions were evaluated following the PFC concept developed by NOAA Fisheries (1996, 1999). NOAA Fisheries defines PFC as “the sustained presence of natural habitat-forming processes in a watershed (e.g., riparian community succession, bedload transport, precipitation runoff pattern,

channel migration) that are necessary for the long-term survival of the species through the full range of environmental variation" (NOAA Fisheries 1999). PFC therefore incorporates the habitat component of the species' biological requirements. Using the PFC framework, baseline environmental conditions are described as (1) functioning, (2) at risk, or (3) not properly functioning. To aid in consistently describing freshwater habitat conditions and determining factors limiting salmon production within the PFC framework, NOAA Fisheries (1996) developed a methodology known as the Matrix of Pathways and Indicators (MPI). As part of the habitat characterization to assess the functioning condition of streams and roadside ditches, AMEC evaluated several indicators included in the NOAA Fisheries MPI:

- Channel condition was evaluated by measuring the bankfull width to bankfull depth ratio.
- Habitat elements were indicated by substrate and the presence of LWD.
- Watershed conditions were assessed using riparian vegetation as an indicator.
- Habitat access was evaluated by assessing the physical barriers present within a waterway.

Stream channel morphology is influenced by overland and channel flow, drainage systems and channel networks, stream discharge and basin area, and stream erosion. Stream morphology, or channel condition, can be evaluated quantitatively as the bankfull width to bankfull depth ratio. Streams that are plagued by either a high sediment load or that do not have enough flow to transport fine sediments generally have a high bankfull width to bankfull depth ratio. Alternatively, incised streams have a very low bankfull width to bankfull depth ratio. The NOAA Fisheries (1996) criterion for properly functioning channel condition is a bankfull width to bankfull depth ratio of less than 10.

Salmon require substrates dominated by gravel and cobble for spawning and rearing. An abundance of fines and sand can suffocate salmon embryos. According to the NOAA Fisheries MPI, substrates dominated by sand, silt, or small gravel are considered "not properly functioning."

LWD functions to dissipate energy, protect stream banks, stabilize stream beds, store sediment, and provide in-stream cover and habitat diversity (Keller and Swanson 1979; Bilby 1984; Harmon et al. 1986; Bisson et al. 1987; Gregory et al. 1991). Several studies have described normal LWD frequencies in natural streams in the Pacific Northwest as 150 to 670 pieces per kilometer (0.046 to 0.205 pieces per linear foot) (Ralph et al. 1994; Murphy and Koski 1989; Beechie and Sibley 1997). An additional measure of LWD is the presence of "key pieces." The Washington Forest Practices Board (WFPB) *Standard Methodology for Conducting Watershed Analysis* (WFPB 1996) suggests that a properly functioning stream channel must contain a few larger pieces of wood that provide stability and function in unison with smaller pieces. These pieces of LWD have been termed "key pieces" by WFPB and NOAA Fisheries. NOAA Fisheries (1996) defines *properly functioning condition*

as more than 50 pieces per kilometer of LWD greater than 0.6 m (24 inches) in diameter and greater than 15 m (50 feet) long.

NOAA Fisheries (1996) specifies that a properly functioning stream should have a riparian zone with "greater than 80 percent intact canopy cover to provide stream shading, aquatic insect recruitment, and an adequate source of LWD."

Habitat access was determined by walking the stream reaches and inspecting any culverts, natural or anthropogenic drops, and other potential barriers.

3.3 Availability of Salmonid Spawning Habitat

Substrate in Reach 1 of Stream 1, from the mouth upstream to Henry Road, was surveyed according to the WDNR's manual for *Salmonid Spawning Habitat Availability Surveys* (Schuett-Hames et al. 1999). The extent of the survey was limited to this reach because this reach corresponded with the spawner and redd survey (see Section 3.4). The protocol describes two alternative strategies: the transect method and the patch method. The transect method was chosen for several reasons:

- The transect method provides an efficient way to assess the maximum amount and distribution of suitable habitat available throughout the survey reach.
- The transect method focuses solely on substrate size between the stream banks, which remains relatively stable across a wide range of flows.
- The patch method relies on multiple habitat parameters, such as surface velocity and water depth, that can change due to varying flow conditions and by season.

Salmonid spawning habitat availability in Stream 1 was evaluated by sampling 16 transects, established perpendicular to the main flow direction of the stream, every 150 feet (46 m) along the 2,310-feet-long (704-meters-long) reach. A tape measure was laid along each transect to measure the BFW and wetted width of the channel. BFW was defined based on observations of channel morphology, vegetation, and wrack lines. Within the BFW at each transect, the stream bed was examined to identify the dominant substrate size classes. For the salmon habitat availability survey, substrate was assigned to one of six size classes:

1	<8 millimeter (mm)	Silt/Sand
2	8-64 mm	Small Spawning Gravel
3	64-128 mm	Large Spawning Gravel
4	>128 mm	Boulders
5	>1 square m	Bedrock
6	>0.5 m	Other (LWD, Clay, Peat, etc.)

The boundaries of each substrate size class were identified on the tape measure in the field to calculate the width, and the width of each size class was recorded on field data sheets. The coverage (width) of each substrate size class within and among transects was summed and converted to a percentage to describe the availability of suitable spawning habitat in the surveyed reach of Stream 1. Suitable spawning habitat is characterized as size classes 2 (8-64 mm) and 3 (64-128 mm) depending on species.

Note that this protocol uses size classes that differ from those used in the EMAP protocol (Kaufmann and Robison 1998) described above and used to determine PFC. In this protocol, spawning gravels (small and large) were defined as having a diameter of between 8 and 128 mm, whereas the EMAP criterion for gravels (fine and coarse) was smaller – between 2 and 64 mm. Substrate size data was classified in the field according to categories that were consistent with whichever protocol was being applied. Therefore, it is not possible to re-classify substrate sizes *ex post facto* to make them comparable to each other.

3.4 Spawner Surveys

Salmonid spawner surveys were conducted in Stream 1 during the 2011/2012 and 2012/2013 spawning season to determine whether salmonids spawn in the lower reach of Stream 1 and, if so, to record the location, timing, and species. Two biologists conducted biweekly visual surveys of the total number of live and dead adult salmonids and their locations in Stream 1 for the duration of the spawning period. Surveys during the 2011/2012 spawning season were conducted on October 19, November 2, November 16, November 30, December 21, January 4, and February 2. During the 2012/2013 spawning season, surveys were conducted on November 8, November 28, December 11, December 21, January 3, and January 17. The investigation was limited to the downstream segment of Stream 1 below the fish passage barrier (culvert) at Henry Road.

For the purposes of quantifying the spatial extent of the distribution of each salmon species, the stream was divided into 100-m (328-feet) segments using a hand-held global positioning system (GPS) unit and flagged in the field. For each 100-m (328-feet) segment, the total number of live and dead spawners of each species was enumerated using hand-held tally counters. The upper extent of each species within the stream was defined by the 100-m (328-feet) segment above which no live or dead fish were observed for a distance of at least 200 m (656 feet). The locations of spawning

salmonids, as well as any identified redds, were mapped based on reference to the marked 100-m (328-feet) stream sections or using GPS.

The survey on each survey date began at the mouth of Stream 1 at the Strait of Georgia, and ended at the fish passage barrier at Henry Road. If fish were observed during the spawner surveys, WDFW was notified by AMEC staff to inform them of fish presence in the stream.

3.5 Fish Surveys

A survey to document the presence of juvenile salmonids or other resident fish species was conducted in May, 2011, on Stream 1 (reaches 1 and 2), Stream 2 (reaches 1 and 2), Stream 4, and in the coastal lagoon. Electrofishing techniques were used in the freshwater stream habitats and hand netting was used in the brackish coastal lagoon. Detailed methods are described in an earlier report (AMEC 2012a).

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4.0 RESULTS

This section presents the results of stream habitat and fish surveys conducted at the PI Terminals property from 2008 through June 2014. As noted in Section 1.0, this report focuses primarily on results of investigations conducted since 2012 related primarily to Stream 2. Complete results of studies conducted through 2012 were presented in an earlier report (AMEC 2012a) and are summarized only briefly here.

4.1 Stream 1 Habitat Characterization

Habitat conditions in Stream 1 and the roadside streams and drainages that are tributary to Stream 1 were characterized following the PFC method (AMEC 2012a). In summary, the lower three reaches of Stream 1, where it occurs in a natural channel, appear to provide limited fish habitat; however, a barrier culvert impedes access to Reaches 2 and 3. As a whole, Stream 1 was considered properly functioning with regard to LWD accumulation and channel condition, but not properly functioning with regard to habitat access or watershed conditions as indicated by the riparian corridor.[2] Reaches 4 and 5 are characterized as agricultural or roadside ditches, having low-functioning habitat. Habitat was characterized as not properly functioning in roadside streams 4, 5, and 6, and roadside drainages 1, 3, and 5, which are all tributaries to Stream 1.

4.2 Stream 2 Habitat Characterization

Stream 2 was divided into four reaches based on differences in habitat and potential fish barriers (Table 2). Reaches 1 and 2 are located in the low-gradient area between the mouth and the earthen dam. Reach 3 comprises the pond created by the dam and was excluded from the survey because stream-based metrics were not relevant to the pond habitat. Reach 4 extends from the weir upstream of the pond to the end of Stream 2 near the property boundary. Streams 2A and 2B were also surveyed, but not divided into multiple reaches due to their shorter lengths.

The following sections summarize and contextualize the habitat data that were collected in Streams 2, 2A, and 2B. Complete details regarding the measurements taken at each transect are provided in Appendix B.

[2] The Stream 1 habitat survey was conducted in November 2008, when deciduous trees had lost their leaves; therefore, measurements of canopy cover are likely underestimated and are not comparable to more recent measurements made in the Stream 2 watershed.

Table 2 Summary of Stream 2 Conditions by Reach

Stream-Reach Number	Length (linear feet)	Description (see Figure 4)	Characteristics
2-1	570	Stream mouth, where it flows into the coastal lagoon, to Gulf Road	Low-gradient (1% slope), unconfined depositional area feeding into the coastal lagoon. Unconsolidated fine sediment in channel and on the floodplain. Braided shallow channels (<1 foot BFD) and areas of sheet flow during periods of high flow. Canopy of red alder and black cottonwood (*Populus trichocarpa)* with a dense shrub understory dominated by willow (*Salix spp.*), vine maple (*Acer circinatum*), salmonberry, and skunk cabbage (*Lysichiton americanus*) (Figure 6).
2-2	990	Gulf Road to earthen dam	Low-gradient (1%), depositional area with shallow channel (1 foot BFD). Streambed dominated by fine sediment. In-line and off-channel riverine wetlands. Some gravels at the upper end of the reach near the base of the dam where gradient increases. Evidence of anthropogenic alterations, such as a breached berm and buried culvert. Riparian community characterized by a canopy of red alder and black cottonwood with dense shrub understory, including salmonberry, vine maple, and skunk cabbage (Figure 7).
2-3	460	Earthen dam to weir	Farm pond impounded by dam. Red alder fringe along shoreline. LWD below surface and on banks. Small wetland area at inlet with a poorly defined channel, and extra fine substrates dominated by reed canary grass (*Phalaris arundinacea*). Not a stream and not surveyed for stream habitat conditions.
2-4	4,800	Weir to property boundary	Narrower valley with more defined, higher gradient channel (2-5%) and more frequent patches of fine gravel than in lower reaches (Figures 8 and 9). Gradual decrease in channel width and depth higher in the watershed (from approximately 7.0 feet to 4.5 feet BFW and from approximately 0.8 feet to ~0.3 feet BFD). Red alder dominant in riparian area canopy.
2A	2,830	Confluence to origin at Wetland 3	Confluence 775 feet from mouth of Stream 2. Stream channel alternates between low-gradient (1% slope) depositional areas and higher gradient (6-7% slope) sub-reaches with a defined channel and coarser substrates. Red alder and salmonberry are the dominant riparian species, with dense Himalayan blackberry in the upper section. Surface flows originate from Wetland 3 (Figures 10 and 11).
2B	1,420	Confluence to stream end	Confluence 3,140 feet from mouth of Stream 2. Channelized/ditched stream that skirts farm ponds and runs in a narrow riparian zone between hayfields. Red alder, salmonberry, and Himalayan blackberry dominant in riparian zone (Figure 12). Likely constructed to drain surrounding hayfields.

Figure 6 **May 28, 2014. Reach 1 of Stream 2 Near the Mouth with Deciduous Canopy and Understory**

Figure 7 **May 28, 2014. Reach 2 of Stream 2, with Red Alder and Salmonberry Dominated Riparian Zone**

Figure 8 **May 28, 2014. Reach 4 of Stream 2, with Typical Fine Substrate and Small Woody Debris**

Figure 9 **May 28, 2014. Reach 4 of Stream 2, with Fine Substrate, Small Woody Debris, and High Bankfull Width-To-Depth Ratio**

Figure 10 **June 11, 2014. Upper End of Stream 2A Where a Defined Channel is Lacking**

Figure 11 **June 11, 2014. Stream 2A Riparian Zone with Red Alder Dominant Forest and Occasional Evergreen**

Figure 12 June 11, 2014. Stream 2B Channelization and Red Alder/ Blackberry Riparian Zone

4.2.1 Channel Condition

Table 3 presents the average BFW to BFD ratios for each of the evaluated reaches of Streams 2, 2A, and 2B. Channel cross-sectional geometry in Stream 2 was variable, and the process for selecting transects captured some of that variability. In places the stream was confined within a narrow valley with slopes steep enough to maintain a defined, functional channel. In other locations, either with lower gradient, behind debris jams, or higher in the watershed with less stream power, the channel was shallow with silty substrate. In pools and other places where backwater flow occurred, the BFW was typically much wider than in riffle/run areas. Very few undercut banks were observed.

The bankfull width-to-depth ratio in Reach 2-1 was 4.2, indicating PFC (less than 10.0 is considered properly functioning); however, this ratio was based on only one transect. The average bankfull width-to-depth ratio in Reach 2-2 was 11.8, but was based on only three transects. The average ratio in Reach 2-4, a much longer reach, was 12.0, indicating not properly functioning conditions, although clear differences were noted between the upstream and downstream portions of the reach. The first six transects (from 300 to 1,800 feet upstream of the mouth) had an average ratio of 8.4, whereas the last 10 transects (from 2,100 to 4,800 feet upstream) had an average ratio of 14.1 (see details in Appendix B). The average for all transects in the lower portion of Stream 2, downstream of the

earthen dam, is 9.9, very close to the threshold for properly function condition. Overall the average BFW to BFD ratio for all of Stream 2 was 11.6.

The average BFW to BFD ratio for Streams 2A and 2B were 9.8 and 9.9, respectively, very close to the established threshold for PFC (Table 3).

Table 3 Bankfull Width-to-Depth Ratios for Stream 2

Reach	Average BFW (feet)	Average BFD (feet)	Average BFW:BFD Ratio[a]	Variance
Reference[b]			*10.0*	
2-1	3.8	0.9	4.2	NA
2-2	10.6	0.9	11.8	55.7
2-4	5.8	0.5	12.0	25.0
2A	4.0	0.5	9.8	31.0
2B	4.3	0.5	9.9	10.9

a. Average BFW:BFD Ratio is calculated as the arithmetic mean of the BFW:BFD ratios for each transect within a reach and is not necessarily equal to the ratio of the average BFW: average BFD.

b. The NOAA Fisheries matrix categorizes streams with a bankfull width to depth ratio of less than 10:1 as properly functioning (NOAA Fisheries 1996).

4.2.2 Substrate

Fines (FN, see Section 3.1.2 for definition) were the dominant substrate size class within the surveyed reaches of Stream 2 (Figure 13); therefore, all reaches are considered not properly functioning with respect to substrate. In Reach 2-1 and Reach 2-2, substrate consisted almost exclusively of fine silt and sand (FN and SA). Reach 2-4 had almost 20 percent gravels (GF and GC), which occurred predominantly in the lower half of the reach. Stream 2A also contained approximately 20 percent gravels (GF and GC), whereas Stream 2B consisted of only 5 percent fine gravel (GF) and lacked any coarse gravel.

The abundance of fines (FN) is most likely due to seasonal low flow volumes and low streamflow velocities, and less due to excessive erosion in the watershed. Low stream flows limit the stream's ability to transport sediment and leads to increased fine sediment deposition throughout the channel. Excessive erosion does not appear to be occurring in Stream 2, 2A, or 2B, as incised stream banks and excessive scouring of the stream channel were not observed.

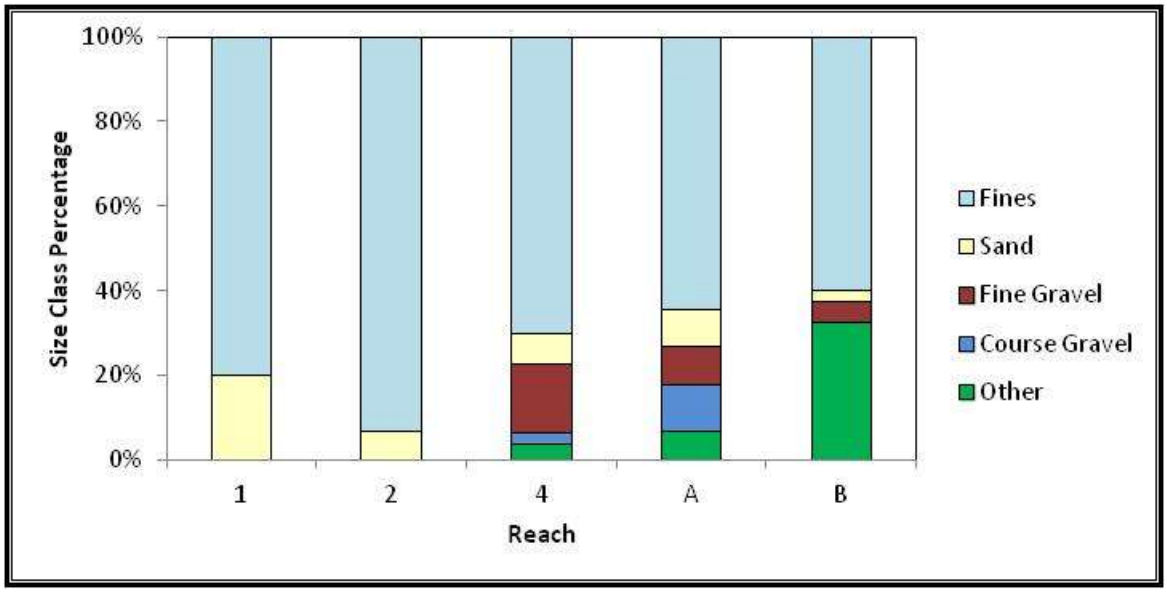

Figure 13 Substrate Size Class Distribution in Stream 2

4.2.3 Riparian Conditions

The riparian corridor along Stream 2 is continuous but with varying width. Dominant overstory species are deciduous (Table 4), primarily young, relatively small-diameter red alder, with some black cottonwood and bigleaf maple (*Acer macrophyllum*). The Stream 2 survey, conducted in late May and June 2014, measured dense canopy (87 percent covered, on average) throughout the stream corridor due to the peak season for deciduous foliage. However, because the dominant species are deciduous, this cover is not present year-round, and much of the stream would be exposed to direct solar radiation during the late fall, winter, and early spring. Stream temperatures are not typically a problem during those seasons.

As a source of habitat-forming LWD, alder and other deciduous species are not ideal because they decay relatively quickly once fallen. Conifers are typically more resistant to decay and provide more stable habitat features. Over time, an alder-dominated riparian community would be expected to be replaced by conifers; however, very few coniferous saplings were observed during the survey, and this process may take several decades.

Despite the high percentage of intact canopy cover, the species composition of the riparian forest limits its ability to provide year-round shade and persistent LWD; therefore, all reaches of the Stream 2 watershed are considered “at-risk.”

Table 4 Riparian Cover on Stream 2

Reach Number	Canopy Cover (%)		Understory Cover (%)		Ground Cover (%)		
	Deciduous	Mixed	Woody shrubs/saplings	Nonwoody herbs, grasses, and forbs	Woody shrubs	Non-woody	Bare dirt
2-1	40-75	0	>75	40-75	10-40	>75	<10
2-2	>75	0	>75	10-40	10-40	10-40	<10
2-4	>75	<10	40-75	10-40	10-40	10-40	10-40
2A	>75	<10	40-75	10-40	10-40	10-40	10-40
2B	>75	<10	40-75	<10	10-40	<10	10-40

4.2.4 Large Woody Debris

All surveyed reaches of Stream 2 contain a density of LWD comparable to published values for functioning streams; however, very few pieces were large enough to be considered key pieces (Table 5). Therefore, LWD densities do not meet NOAA Fisheries' criterion and are considered "not properly functioning."

The small size of LWD pieces reflects the character of the riparian forest which serves as the source for woody debris—a young alder riparian zone, with scattered larger-diameter cottonwoods. During the survey, we observed several large old stumps of western red cedar (*Thuja plicata*) in the upper part of the watershed adjacent to the stream channel. Like most western Washington riparian areas, western red cedar trees were historically more abundant in the riparian area than they are currently.

Table 5 Frequency and Characteristics of LWD in Stream 2

Reach	Pieces LWD per Linear foot	Key pieces of LWD per Linear foot
Reference[a]	*0.046*	*0.015*
2-1	0.100	0.000
2-2	0.089	0.000
2-4	0.115	0.002
2A	0.067	0.000
2B	0.054	0.000

a. The NOAA Fisheries matrix categorizes streams as properly functioning when they possess at least these quantities of LWD (NOAA Fisheries 1996).

4.2.5 Habitat Access

The earthen dam is an absolute barrier to upstream fish migration. Thus, reaches 3 and 4 in Stream 2, and Stream 2B are not properly functioning with respect to habitat access. Shallow water depths in the braided channels near the mouth of the stream are likely to impair fish migration during all but the highest flows. Thus, Reach 2-2 and Stream 2A are considered "at risk" for habitat access.

Only Reach 2-1 is considered properly functioning because of its direct connection to the coastal lagoon and the absence of any man-made barriers.

4.2.6 Summary of Properly Functioning Condition

Table 6 presents the condition of all surveyed reaches of Stream 2 for each of the five main NOAA Fisheries indicators. Overall conditions for Stream 2 in its entirety are then presented in Table 7. The three functional categories of the NOAA Fisheries MPI are: (1) functioning, (2) at risk, and (3) not properly functioning. Of the five indicators measured in Stream 2, most were either at risk or not properly functioning. Only the BFW to BFD ratio in Reach 1, Stream 2A, and Stream 2B, and the absence of man-made physical barriers in Reach 1, indicate PFC.

Table 6 Pathways and Indicators Relative to Properly Functioning Conditions in the Stream 2 Watershed

Pathway	Indicator	Properly Functioning	At Risk	Not Properly Functioning
Reach 1				
Habitat Access	Physical Barriers	X		
Habitat Elements	Substrate			X
Habitat Elements	Large Woody Debris			X
Channel Condition	Width/Depth Ratio	X		
Watershed Conditions	Riparian Reserves		X	
Reach 2				
Habitat Access	Physical Barriers		X	
Habitat Elements	Substrate			X
Habitat Elements	Large Woody Debris			X
Channel Condition	Width/Depth Ratio		X	
Watershed Conditions	Riparian Reserves		X	
Reach 4				
Habitat Access	Physical Barriers			X
Habitat Elements	Substrate			X
Habitat Elements	Large Woody Debris			X
Channel Condition	Width/Depth Ratio		X	
Watershed Conditions	Riparian Reserves		X	
Stream 2A				
Habitat Access	Physical Barriers		X	
Habitat Elements	Substrate			X
Habitat Elements	Large Woody Debris			X
Channel Condition	Width/Depth Ratio	X		

Table 6 Pathways and Indicators Relative to Properly Functioning Conditions in the Stream 2 Watershed

Pathway	Indicator	Properly Functioning	At Risk	Not Properly Functioning
Watershed Conditions	Riparian Reserves		X	
Stream 2B				
Habitat Access	Physical Barriers			X
Habitat Elements	Substrate			X
Habitat Elements	Large Woody Debris			X
Channel Condition	Width/Depth Ratio	X		
Watershed Conditions	Riparian Reserves		X	

Table 7 Summary of NOAA Fisheries Matrix of Pathways and Indicators Evaluated for Stream 2

Pathway	Indicator	Properly Functioning	At Risk	Not Properly Functioning
Habitat Access	Physical Barriers			X
Habitat Elements	Substrate			X
Habitat Elements	Large Woody Debris			X
Channel Condition	Width/Depth Ratio		X	
Watershed Conditions	Riparian Reserves		X	

4.3 Stream 1 Spawning Habitat Availability

Substrate data for Stream 1, Reach 1 was collected using the Timber, Fish and Wildlife (TFW) methodology (Schuett-Hames et al. 1999) on January 17, 2013, when moderate surface flow was continuous along Stream 1, and wetted width ranged between 6.0 and 19.1 feet (1.8 and 5.8 m).

Silt and sand (size class 1) made up 62 percent of the total available substrate, spawning gravel (size class 2 and 3) made up 35 percent, and a small percentage (3 percent) consisted of LWD and wrack. Areas of sand and silt were common throughout the entire reach, but in general the substrate became coarser upstream as the channel gradient increased from 1 to approximately 3-5 percent. The lower portion of the reach near the mouth was almost exclusively fine sediment (size class 1). Small spawning gravels were first recorded 600 feet (183 m) upstream from the mouth and were patchily distributed throughout the rest of the reach. Large spawning gravels were largely absent except at the upper end of the reach, 2,100 feet (640 m) upstream from the mouth. Transect 13 (1,800 feet [549 m] upstream from the mouth) had the highest proportion of gravel in the spawning gravel size classes (Table 8).

Table 8 Distribution of Salmonid Spawning Substrate in Stream 1, Reach 1, on January 17, 2013

				Substrate Class (%)					
				1	2	3	4	5	6
Transect	Distance Upstream (feet)	BFW (feet)	WW (feet)	Silt/ sand	Small spawning gravel	Large spawning gravel	Boulder	Bedrock	Other (wood, etc.)
1	0 (mouth)	19.5	14.8	100.0	0.0	0.0	0.0	0.0	0.0
2	150	8.1	7.0	100.0	0.0	0.0	0.0	0.0	0.0
3	300	10.4	7.6	100.0	0.0	0.0	0.0	0.0	0.0
4	450	9.3	6.0	100.0	0.0	0.0	0.0	0.0	0.0
5	600	12.3	8.5	42.3	57.7	0.0	0.0	0.0	0.0
6	750	11.9	9.1	81.5	18.5	0.0	0.0	0.0	0.0
7	900	24.3	18.1	86.8	0.0	0.0	0.0	0.0	13.2
8	1,050	11.3	10.8	45.1	54.9	0.0	0.0	0.0	0.0
9	1,200	17.8	11.2	43.3	56.7	0.0	0.0	0.0	0.0
10	1,350	12.2	8.7	39.3	60.7	0.0	0.0	0.0	0.0
11	1,500	12.0	9.5	100.0	0.0	0.0	0.0	0.0	0.0
12	1,650	12.3	7.9	35.8	64.2	0.0	0.0	0.0	0.0
13	1,800	15.8	12.8	19.0	81.0	0.0	0.0	0.0	0.0
14	1,950	20.8	10.5	71.6	28.4	0.0	0.0	0.0	0.0
15	2,100	18.4	13.0	18.5	23.9	48.9	0.0	0.0	8.7
16	2,250	37.0	19.1	49.2	27.6	12.7	0.0	0.0	10.5

BFW = bankfull width
WW = wetted width

High proportions of fine sediments were common throughout the reach in depositional areas, particularly where the stream gradient was low or where pools had formed. At many of the locations where spawning gravels were present at or near the water level surface, the coarser particles were highly embedded in sand and silt (approximately 50 to 90 percent embedded). Often the gravels were present in a thin layer that served to armor the underlying sand and silt. These embedded surface gravels make it difficult for salmonids to excavate their nest (redd), and as a consequence do not necessarily provide optimal spawning/incubation habitat to support fry emergence in the spring. Therefore, the amount of suitable habitat for spawning salmonids may be over-estimated because the level of gravel embeddedness was not a measured habitat parameter.

Evidence of abandoned side channels, flooded overbank areas, and bank erosion indicate that this small stream is dynamic, as segments occasionally change alignment throughout the wet season and from year to year. Thus, the result of this spawning habitat survey, as is true for many surveys, represents a “snapshot” of conditions at the time the survey was conducted. For comparison, a previous survey to quantify substrate size classes in Reach 1 of Stream 1 was conducted in 2008 using EMAP size classes (see Section 3.1.2) and found gravels (between 2 and 64 mm in diameter)

made up only 9 percent of the streambed, with fines and sand (less than 2 mm in diameter) making up the remaining 91 percent (AMEC 2012a).

4.4 Stream 1 Salmon Spawner Surveys

No spawning salmonids, either alive or dead, or salmon redds, were identified in Stream 1 over the two spawning seasons surveyed for this report.

Adult coho salmon (*Oncorhynchus kisutch*) were observed in Stream 1 during the last two weeks of November and throughout December ten years ago (Shapiro and Associates, unpublished data). During those weeks, both dead and live male and female coho adults were observed during a visual stream survey and it was estimated that in total approximately 100 fish had migrated to Stream 1 that year. Numbers of fish reported on each survey date are provided in Table 9. Observations were made, but no fish were reported upstream of the Henry Road culvert in 2004.

Table 9 2004 Salmon Spawning Survey at Stream 1

	Coho				Chinook[1]				
	Male		Female		Female	Unidentified		Total	
Date	Live	Dead	Live	Dead	Live	Live*	Dead	Salmon	Comment
10/25/2004	0	0	0	0	0	0	0	0	
11/11/2004	0	0	0	0	0	1	0	1	
11/18/2004	3	0	2	0	0	2	0	7	Low turbidity
12/3/2004	14	3	0	0	0	1	0	18	Moderate flow turbidity
12/10/2004	0	0	0	0	0	0	0	0	Extreme flows high turbidity
12/17/2004	13	0	6	1	1	0	0	21	Moderate flow and turbidity
12/23/2004	10	9	2	6	0	0	0	27	Moderate flow and turbidity
12/29/2004	0	12	0	1	0	1	0	14	Moderate flow and turbidity
Totals	**40**	**24**	**10**	**8**	**1**	**5**	**0**	**88**	

Notes: [1] Tentative identification only * Most Likely coho

During 2004, spawning in Stream 1 was assumed based on the condition of several fish carcasses examined, but no redds were reported. One live female Chinook salmon was tentatively identified but was not observed to have spawned, and was not seen alive or dead on subsequent survey dates. High turbidity and or flows prevented complete observations on some survey dates.

The presence of adult coho in 2004, in addition to the documented presence of juvenile coho and chum salmon (*Oncorhynchus keta*) in 2011 (AMEC 2012a), strongly suggests that Stream 1 may be used by salmon periodically for spawning; however, the conditions or factors that determine whether

Stream 1 is used for spawning in any particular year are unknown. Note that during the 2011/2012 spawner survey, Stream 1 did not have continuous surface flow until late November, precluding the ability of coho or other salmonids to migrate upstream. However rainfall patterns were more typical in the fall of 2012, with surface flows returned to the lower reach of Stream 1 by October; however, again spawning salmonids were not observed. Therefore, it does not appear that stream flow is the sole factor in determining whether spawning occurs in Stream 1.

4.5 Fish Surveys

Detailed results of the fish surveys are described in an earlier report (AMEC 2012a). In summary, 47 juvenile coho (up to 175 mm) were found in Reach 1 of Stream 1, concentrated near the mouth and within 400 feet (122 m) of the culvert at Henry Road. Two juvenile chum salmon (36 and 45 mm), and 3 three-spined stickleback (*Gasterosteus aculeatus*) (20 – 50 mm) were found at the mouth of Stream 1. Three-spined stickleback were also found in the coastal lagoon. No fish were encountered in Stream 1 above the Henry Road culvert (reaches 2 and 3), or in Stream 2 and Stream 4.

5.0 CONCLUSIONS

This report presents comprehensive habitat data for Streams 2, 2A, and 2B to document baseline conditions. According to the guidance provided by NOAA Fisheries' Matrix of Pathways and Indicators (NOAA Fisheries 1996), Stream 2 is not properly functioning with regard to the following indicators:

- Habitat access, due to intermittent flow and several barriers;
- Substrate composition, due to a very high proportion of fine sediments; and
- Large woody debris accumulation, based on the lack of key members.

Stream 2 is functionally at risk with respect to channel condition, having a relatively high BFW to BFD ratio, and to overall watershed condition, because the riparian reserves are almost exclusively young deciduous trees. Streams 2A and 2B are in a condition similar to Stream 2 overall, although in both tributary streams the average BFW to BFD ratio is below the threshold of 10.0 and thus they are considered to be properly functioning with respect to channel condition. This measure may be misleading, however, particularly for Stream 2B, considering the channel geometry has been highly altered by human activities and is not strictly the product of geomorphic processes.

Fish habitat conditions in Stream 1 have been described in prior reports as properly functioning with regard to LWD accumulation and channel condition, and not properly functioning with regard to habitat access, substrate composition, and overall watershed conditions as indicated by riparian reserves. Habitat provided by Stream 1 tributaries (roadside streams 4, 5, and 6, and roadside drainages 1, 3, and 5) was characterized as not properly functioning (AMEC 2012a).

Salmonid spawning substrates in Reach 1 of Stream 1 were limited when surveyed in 2013, with fine and coarse gravels comprising only 35 percent of the streambed. Spawner and redd surveys, conducted during the 2011/20012 and 2012/2013 spawning seasons, indicate that Stream 1 did not function as spawning habitat in those years. A report of coho during the late fall of 2004 along with the documented presence in 2011 of juvenile coho and chum salmon in the lower reach of Stream 1 indicates Stream 1 may be used sporadically by coho and chum salmon for spawning and is currently used as juvenile habitat. No adult or juvenile fish have been observed using Stream 2 or its tributaries.

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APPENDIX A

Agency Correspondence

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Gray, Jeff

From: Williams, Brian W (DFW) [Brian.Williams@dfw.wa.gov]
Sent: Monday, February 04, 2013 9:37 AM
To: Gray, Jeff
Subject: RE: Watercourse Designations for GPT and Parcel 15 in Whatcom County
Attachments: Kamps.parcel 15.doc; Figure 1 - Regulated Streams.pdf

Jeff,
Sorry it took so long to get back to you.

The watercourses in Figure 1 that are highlighted in yellow correctly illustrate the watercourses on site that are regulated by WDFW through the Hydraulic Code. Figure 1 could be improved if the yellow highlighting for Stream 1 was more prominent.

I have attached a communication and map from Jeff Kamps to Melinda Gray where the figure clearly illustrates Jeff's determination for Stream 2B. The description in this communication is essentially similar to that in Jeff's letter dated August 9, 2012.

Call if you have additional questions.

From: Gray, Jeff [mailto:jeff.gray@amec.com]
Sent: Wednesday, January 30, 2013 4:06 PM
To: Williams, Brian W (DFW)
Subject: Watercourse Designations for GPT and Parcel 15 in Whatcom County

Hi Brian,

Thanks for returning my call this afternoon. Attached to this email are three items:

1) Your email sent to Kristie Dunkin on April 27, 2011, including attachment (map), regarding WDFW watercourse designations for the GPT project;
2) WDFW's letter to Mr. Steinberg dated August 9, 2012, regarding WDFW watercourse classifications for the adjacent parcel (Parcel 15), including attachment (map)
3) Figure 1 – An illustration of the watercourses regulated under the Hydraulic Code on GPT and Parcel 15 combined

Does WDFW agree that the watercourses highlighted in yellow on Figure 1 are the only watercourses regulated under the jurisdiction of the State's Hydraulic Code?

For clarification purposes, the map included with the August 9, 2012 letter is scanned here in black and white, but shows Streams 1 (Reaches 1,2, and 3), 2, 4, 6, and 7 on GPT, and Streams 2, 2A, and 2B on Parcel 15.

Regards,
Jeff Gray

Jeff Gray | Wetland Scientist
AMEC | 11810 North Creek Parkway North, Bothell, Washington 98011
Direct: 425 368-0955 | Office: 425 368-1000 | jeff.gray@amec.com

DEPARTMENT OF THE ARMY
SEATTLE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 3755
SEATTLE, WASHINGTON 98124-3755

REPLY TO
ATTENTION OF

NOV 1 2 2013

Regulatory Branch

Mr. Skip Sahlin
Pacific International Terminals
1131 Southwest Klickitat Way
Seattle, Washington 98134

Reference: NWS-2008-260
Pacific International
Terminals

Dear Mr. Sahlin:

During May and June of 2013, Mr. Randel Perry conducted site visits in response to your request for a jurisdictional determination for wetlands and streams on property located near Ferndale, Whatcom County, Washington. The information provided by your agent, AMEC Earth and Environmental, Inc., included a wetland delineation for an additional portion of the property (Parcel 15) and revisions to the previous delineation of wetlands and tributaries on the Gateway Pacific Terminal project site as verified in our jurisdictional determination letter, dated November 20, 2012.

We have confirmed that waters of the U.S. including wetlands and streams exist on your property. After reviewing the submitted information and our office resources and after visiting the site, we have determined the all delineated on-site wetlands shown on the enclosed drawings, dated September 2013 abut or are adjacent to tributaries of the Strait of Georgia, a navigable waterway used for interstate and foreign commerce. These wetlands have a significant nexus to downstream traditional navigable waters (the Strait of Georgia) and, as such, are regulated by the U.S. Army Corps of Engineers (Corps) as waters of the U.S. under Section 404 of the Clean Water Act. We have also confirmed that all other waterbodies identified as "Streams," "Drainages," and "Ditches" on the enclosed drawings, dated September 2013, are tributaries to downstream navigable waters (the Strait of Georgia) and/or have a significant nexus to downstream traditional navigable waters. These tributaries are waters of the U.S. and are regulated by the Corps under Section 404 of the Clean Water Act.

During the site visit Mr. Perry observed a pond and two ditches in the northwest corner of Parcel 15 that were reportedly constructed as stormwater facilities associated with the abandoned industrial development. These features were installed in 1992-1993. While the ditches and the retention pond were man-made stormwater facilities, the project they were intended to serve was

never completed. The stormwater system does not currently provide water quality treatment functions and is not used to treat municipal or industrial effluent. Therefore, per Seattle District policy, the pond is not considered a "waste treatment systems" as described under 33 Code of Federal Regulations (CFR), Part 328.3(a)(8). It appears that the stormwater pond and ditches may have been created in dry land. However, the pond and ditches have a surface hydrological connection to downstream water of the United States. These features have the potential to convey pollutants to downstream waters of the United States. In accordance with Seattle District policy based on the 9th Circuit Court's *Headwaters, Inc. v. Talent Irrigation District* decision, the stormwater pond and ditches conveying water to it are considered tributaries and are jurisdictional waters of the United States. In addition, both the pond, identified as Wetland SW on the enclosed drawings, and ditches, identified as Ditch SW1 and SW 2 have a significant nexus to the downstream waters of the Strait of Georgia. We consider these aquatic features as jurisdictional tributaries and wetlands

This approved jurisdictional determination is valid for a period of 5 years from the date of this letter unless new information warrants revisions of the determination. A copy of this jurisdictional determination can be found on our website at: http://www.nws.usace.army.mil/ click on "Regulatory Branch, Permit Information," and then "Jurisdictional Determinations." If you object to this determination, you may request an administrative appeal under our regulations 33 CFR, Part 331 as described in the enclosed *Appeal Process Fact Sheet* and the *Notification of Administrative Appeal Options and Process and Request for Appeal* form.

A copy of this correspondence with enclosures will be furnished to Ms. Kristie Dunkin of AMEC Earth and Environmental, Inc., located at 11810 North Creek Parkway North, Bothell, Washington 98011. Because Department of the Army authorization may be necessary for work in these waters of the U.S., including wetlands and drainages, do not commence construction before written authorization is received. If you have any questions, please contact Mr. Randel Perry at (360) 734-3156 or at randel.j.perry@usace.army.mil.

Sincerely,

Kristina G. Tong

Kristina G. Tong, Senior Scientist
Regulatory Branch

Enclosures

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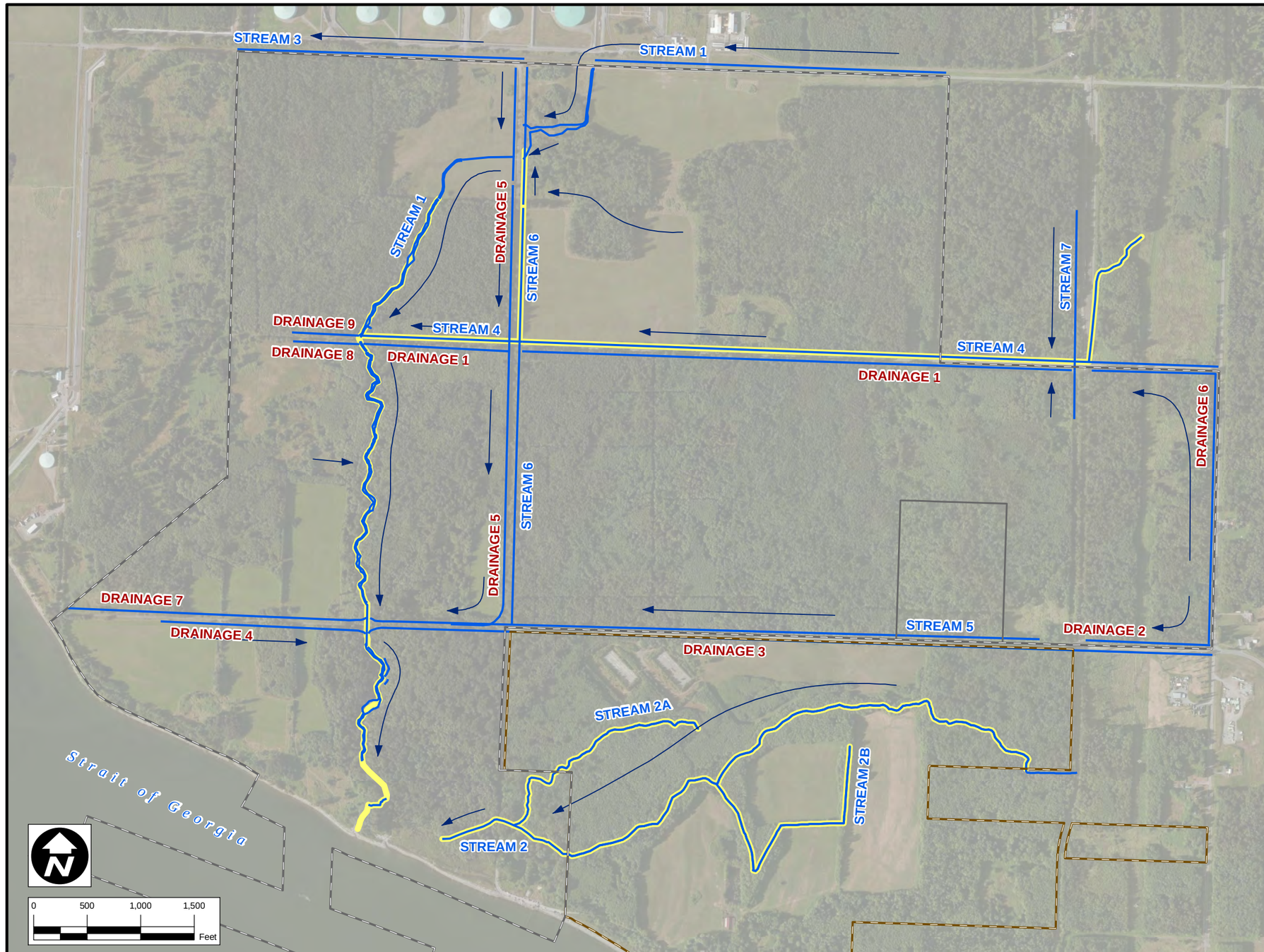

LEGEND

- OTHER WATERCOURSE (ROADSIDE STREAMS & DITCHES)
- STREAM REGULATED UNDER THE STATE HYDRAULIC CODE (PER WDFW)
- STREAM AND DRAINAGE FLOW DIRECTION
- PARCEL 15 PROPERTY BOUNDARY
- PROPERTY BOUNDARY
- PROJECT AREA BOUNDARY

NOTE: Streams regulated by WDFW under the Hydraulic Code (RCW 77.55 and WAC 220-110): Stream 1 (Reaches 1, 2, and 3), Stream 2, 4, 6 & 7.

Streams regulated by Whatcom County per Critical Areas Ordinance Maps: Streams 1, 2, 3, 4, 5, 6, and 7 .

All streams and drainages are regulated under the Federal Clean Water Act.

Pacific International Terminals
A Cermix Enterprise

CLIENT: PACIFIC INTERNATIONAL TERMINALS, INC.

AMEC
11810 North Creek Parkway N
Bothell, WA 98011

amec

DWN BY:	SD
CHK'D BY:	MG
DATUM:	NAD83
PROJECTION:	WA SP North, Ft.
SCALE:	1 inch = 1,000 feet

PROJECT: GATEWAY PACIFIC TERMINAL

TITLE: REGULATED STREAMS

DATE:	JULY 2012
PROJECT NO.:	091515338C-01-01
REV. NO.:	-
FIGURE NO.:	FIGURE 1

K:\AMEC US OFFICES\KIRKLAND\15338-0\15338C\T-01-01 - Stream Assessment\dwg\Figure 1 - Regulated Streams.mxd

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APPENDIX B

Stream 2 Habitat Characterization Field Data

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Project:	Date:
Stream:	Transect:
Reach:	Personnel:

Geometry

Wetted Width		Left bank slope	
Thalweg Depth		Right bank slope	
Bankfull Width		Channel slope	
Bankfull Depth		Undercut banks	

Substrate

Station	Dist from L	Water depth	Size code	Embedd. (0-100%)
L				
LC				
C				
RC				
R				

RS = Bedrock (Smooth) - (Larger than a car)
RR = Bedrock (Rough) - (Larger than a car)
BL = Boulder (250 to 4000 mm) - (Basketball to car)
CB = Cobble (64 to 250 mm) - (Tennis ball to basketball)
GC = Course Gravel (16 to 64mm) - (Marble to tennis ball)
GF = Fine Gravel (2 to 16 mm) - (Ladybug to Marble)

SA = Sand (0.06 to 2mm) - (Gritty up to ladybug size)
FN = Silt/Clay/Muck - (Not Gritty)
HP = Hard Pan - (Firm, consolidated fine substrate)
WD = Wood - (Any size)
OT = Other J (Comment)

Canopy Cover

Densiometer (0-24 max)

		Flag
Stream Ctr - Up		
Stream Ctr - Down		
Stream Ctr - Left		
Stream Ctr - Right		

		Flag
OHWM - Left Bank		
OHWM - Right Bank		

Flag Codes: K = no meaurement made; U = suspect measurement; F1, F2, ect. = misc. flags assigned by each field crew. Explain all flags in comments section on the reverse side on the form.

Large Woody Debris (≥ 10 cm Small End Diameter; ≥ 1.5 m Length)
Tally Each Piece

Diameter Large End	Pieces All/Part in Bankfull Channel			Pieces Bridge Above Bankfull Channel		
	Length 1.5 - 5 m	5 - 15 m	> 15 m	Length 1.5 - 5 m	5 - 15 m	> 15 m
0.1 to < 0.3 m						
0.3 - 0.6 m						
0.6 - 0.8 m						
> 0.8 m						

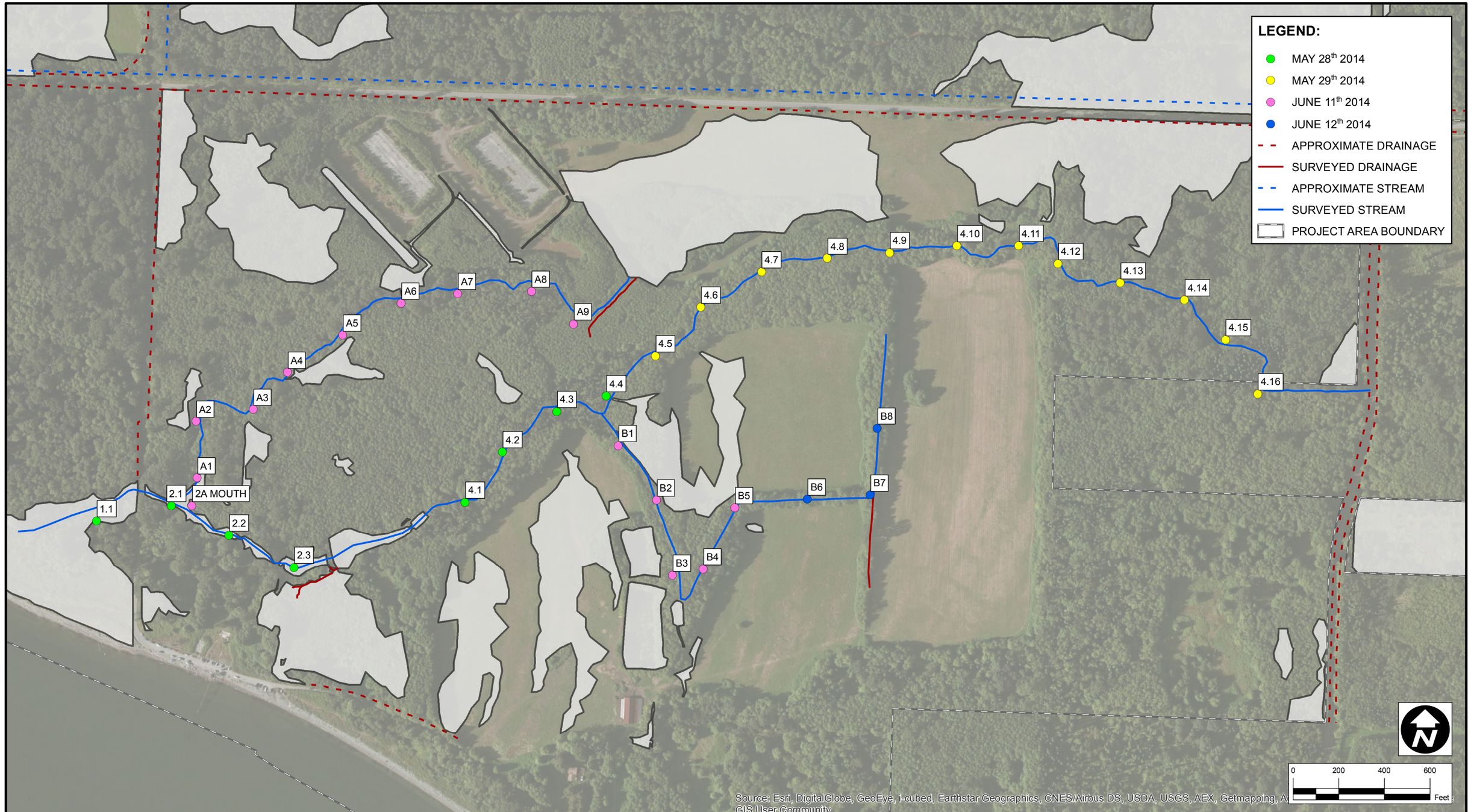
Riparian

V. Visual Riparian Estimates	Left Bank					Right Bank					Flag
Riparian Vegetation Cover	0 = Absent		0%			D = Deciduous					
	1 = Spare		<10%			C = Coniferous					
	2 = Moderate		10-40%			E = Broadleaf Evergreen					
	3 = Heavy		40-75%			M = Mixed					
	4 = Very Heavy		>75%			N = None					
Canopy (> 5m high)	D	C	E	M	N	D	C	E	M	N	Flag
Vegetation Type (D,C,M, or N)											
	0	1	2	3	4	0	1	2	3	4	Flag
Big Trees (Trunk > 0.3m DBH)											
Small Trees (Trunk < 0.3m DBH)											
Understory (0.5 to 5 m high)	D	C	E	M	N	D	C	E	M	N	Flag
Vegetation Type (D,C,M, or N)											
	0	1	2	3	4	0	1	2	3	4	Flag
Woody shrubs & saplings											
Non-woody herbs, grasses, & forbs											
Ground cover (< 0.5 m high)	0	1	2	3	4	0	1	2	3	4	Flag
Woody shrubs & seedlings											
Non-woody herbs, grasses, & forbs											
Barren, Bare dirt or Duff											
Human Influence	O = Not Present,					P = > 10 m					Flag
	C = Within 10 m,					B = On Bank					
	O	P	C	B		O	P	C	B		
Wall/Dike/Revetment/Riprap/Dam											
Buildings											
Pavement											
Road/Railroad											
Pipes (Inlet/outlet)											
Landfill/Trash											
Park/Lawn											
Row Crops											
Pasture/Range/Hay Field											
Logging Operations											
Mining Activity											

In-Channel Cover

	0	1	2	3	4	Flag
Filamentous Algae						
Macrophytes						
Woody Debris > 0.3 m (Big)						
Brush/ Woody Debris <0.3 m (Small)						
Overhanging Veg. ≤ 1 m of surface						
Undercut Banks						
Boulders						
Artificial Structures						

0 = Absent	0%
1 = Sparse	<10%
2 = Moderate	10-40%
3 = Heavy	40-75%
4 = Very Heav	>75%



Pacific International Terminals
A Carrix Enterprise

CLIENT:
PACIFIC INTERNATIONAL TERMINALS, INC.

AMEC
11810 North Creek Parkway N
Bothell, WA 98011

amec

DWN BY: SD
CHK'D BY: TS
DATUM: NAD83
PROJECTION: WA SP North, Ft.
SCALE: 1 inch = 400 feet

PROJECT:
PROPOSED GATEWAY PACIFIC TERMINAL

TITLE:
APPENDIX B
STREAM HABITAT SURVEY STRANSECT LOCATIONS

DATE: JULY 2014
PROJECT NO.: 091515338C-04-09
REV. NO.: -
FIGURE NO.: FIGURE B1

K:\AMEC US OFFICES\KIRKLAND\15338-0\15338C\T-04-04 - Fish and Stream Report\dwg_Revised_July_2014\Figure B1 - Stream Habitat Survey Transect Locations .mxd

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					Geometry									Substrate					Canopy Cover							LWD			
Stream	**Reach**	**Transect**	**Distance upstream (from beginning of reach)**	**MAP ID**	**BFW**	**BFD**	**BFW:BFD**	**WW**	**TD**	**Left Bank slope angle (degrees)**	**Right Bank slope angle (degrees)**	**Channel slope (%)**	**Undercut Banks**	Left Bank	Left-Center	Center	Right-Center	Right Bank	Facing Upstream	Facing Downstream	Facing Left	Facing Right	On Left Bank	On Right Bank	Avg	Total No. pieces	Key pieces (>.6m diam)	Density (pieces/lf)	Density (pieces/km)
2	1	1	300	1.1	3.8	0.90	4.2	2.3	0.36	45	45	1	no	FN	FN	SA	FN	FN	20	23	22	22	19	20	87	3	0	0.100	327
2	2	1	150	2.1	7.3	1.10	6.6	5.7	0.82	46	22	1	no	FN	FN	FN	FN	FN	19	23	22	20	21	20	87	2	0	0.067	218
2	2	2	450	2.2	6.7	0.80	8.4	3.6	0.34	28	18	1	no	FN	FN	FN	FN	FN	19	19	21	22	21	13	80	3	0	0.100	327
2	2	3	750	2.3	17.9	0.88	20.3	6.8	0.32	<5	9	1	no	FN	FN	SA	FN	FN	20	21	23	23	23	24	93	3	0	0.100	327
2	4	1	300	4.1	9.3	0.85	10.9	7.7	0.14	78	56	3	no	FN	GF	FN	WD	FN	20	19	22	20	20	18	83	3	0	0.100	327
2	4	2	600	4.2	6.7	0.77	8.7	3.6	0.25	23	22	2	no	GF	GF	GC	SA	GF	23	23	22	20	21	23	92	3	0	0.100	327
2	4	3	900	4.3	7.7	0.90	8.6	5.5	0.30	52	44	5	no	HP	FN	GF	GF	FN	21	22	23	24	24	19	92	5	0	0.167	546
2	4	4	1200	4.4	5.8	0.65	8.9	4.4	0.11	55	42	5	no	FN	GF	GF	SA	FN	18	23	21	23	19	18	85	6	0	0.200	655
2	4	5	1500	4.5	3.6	0.77	4.7	2.9	0.29	61	41	4	no	FN	GC	GF	SA	FN	22	21	22	21	20	22	89	2	0	0.067	218
2	4	6	1800	4.6	4.2	0.50	8.4	2.6	0.15	40	21	3	no	FN	SA	GF	GF	FN	20	22	21	22	23	19	88	6	0	0.200	655
2	4	7	2100	4.7	9.6	0.61	15.7	3.4	0.29	11	27	4	no	FN	FN	FN	FN	FN	21	22	23	21	22	22	91	4	0	0.133	436
2	4	8	2400	4.8	8.8	0.66	13.3	4.4	0.29	19	21	3	no	FN	GF	FN	FN	FN	18	19	20	17	18	17	76	5	0	0.167	546
2	4	9	2700	4.9	5.3	0.29	18.3	1.4	0.11	13	11	2.5	no	FN	SA	GF	FN	FN	23	23	22	21	22	20	91	0	0	0.000	0
2	4	10	3000	4.10	2.6	0.36	7.2	1.2	0.06	14	29	4	no	FN	FN	FN	FN	FN	20	20	21	19	17	20	81	6	1	0.200	655
2	4	11	3300	4.11	6.0	0.27	22.2	2.3	0.05	15	11	3	no	FN	FN	SA	FN	WD	20	21	20	22	20	21	86	4	0	0.133	436
2	4	12	3600	4.12	3.4	0.24	14.2	1.4	0.07	36	20	3	no	FN	FN	FN	FN	FN	21	23	20	22	20	22	89	1	0	0.033	109
2	4	13	3900	4.13	3.2	0.62	5.2	0.0	0.00	9	29	1	no	FN	FN	FN	FN	FN	22	23	21	23	22	21	92	4	0	0.133	436
2	4	14	4200	4.14	6.0	0.37	16.2	1.4	0.10	18	8	2	no	FN	FN	FN	FN	FN	23	21	22	23	24	23	94	1	0	0.033	109
2	4	15	4500	4.15	5.2	0.31	16.8	0.0	0.00	7	8	5	no	FN	FN	FN	FN	FN	21	22	20	22	21	21	88	2	0	0.067	218
2	4	16	4800	4.16	5.2	0.42	12.4	0.0	0.00	11	21	1	no	FN	FN	FN	FN	FN	12	21	19	20	17	22	77	3	0	0.100	327
2A		1	150	A1	3.7	0.47	7.9	2.1	0.22	37	19	1	no	FN	FN	FN	FN	FN	21	19	23	20	19	21	85	1	0	0.033	109
2A		2	450	A2	3.8	0.64	5.9	0.0	0.00	72	29	6	no	FN	GF	GC	GF	FN	21	22	23	23	22	21	92	4	0	0.133	436
2A		3	750	A3	4.6	0.57	8.1	1.3	0.15	26	31	7	nearby	FN	GC	GC	GC	FN	16	19	20	19	18	18	76	2	0	0.067	218
2A		4	1050	A4	3.9	0.58	6.7	1.3	0.11	42	52	K	nearby	FN	FN	GC	WD	FN	21	15	22	16	19	23	80	3	0	0.100	327
2A		5	1350	A5	3.6	0.64	5.6	0.0	0.00	34	49	6	nearby	FN	SA	GF	WD	FN	23	22	22	21	22	23	92	1	0	0.033	109
2A		6	1650	A6	2.8	0.52	5.4	1.2	0.14	31	21	2	no	FN	FN	FN	FN	WD	21	21	21	20	22	21	87	2	0	0.067	218
2A		7	1950	A7	6.4	0.29	22.1	0.0	0.00	9	31	2	no	FN	FN	SA	SA	FN	21	23	22	23	20	21	90	2	0	0.067	218
2A		8	2250	A8	3.9	0.34	11.5	0.0	0.00	36	51	2.5	nearby	FN	FN	FN	FN	FN	19	22	21	19	20	22	85	2	0	0.067	218
2A		9	2550	A9	3.6	0.24	15.0	0.0	0.00	29	24	1.5	no	FN	FN	GF	SA	FN	15	16	16	18	20	16	70	1	0	0.033	109
2B		1	150	B1	3.3	0.62	5.3	2.1	0.23	22	56	2	no	FN	FN	FN	GF	FN	21	19	20	19	20	21	83	1	0	0.033	109
2B		2	450	B2	6.5	0.80	8.1	4.8	0.39	42	73	1	no	OT	OT	OT	OT	OT	18	17	20	18	18	23	79	3	0	0.100	327
2B		3	750	B3	5.2	0.66	7.9	1.3	0.38	12	33	2	no	FN	FN	FN	FN	FN	21	21	23	21	20	22	89	0	0	0.000	0
2B		4	1050	B4	3.4	0.31	11.0	0.0	0.00	28	30	2	no	FN	FN	FN	FN	WD	19	21	20	20	19	20	83	0	0	0.000	0
2B		5	1350	B5	3.7	0.24	15.4	1.2	0.11	19	39	2	no	FN	SA	FN	WD	FN	21	20	19	18	20	21	83	1	0	0.033	109
2B		6	1650	B6	3.6	0.46	7.8	2.1	0.16	28	26	3	no	FN	WD	WD	WD	FN	21	23	20	20	21	21	87	3	0	0.100	327
2B		7	1950	B7	4.4	0.43	10.2	0.0	0.00	21	34	2	no	FN	FN	GF	FN	WD	18	18	22	19	19	21	81	4	0	0.133	436
2B		8	2250	B8	4.4	0.33	13.3	0.0	0.00	10	28	1	nearby	WD	FN	FN	FN	WD	22	23	23	20	21	23	92	1	0	0.033	109

					In-Channel Cover								Riparian - Left Bank									Riparian - Right Bank								
Stream	**Reach**	**Transect**	**Distance upstream (from beginning of reach)**	**MAP ID**	Filamentous Algae	Macrophytes	Woody Debris Big	Woody Debris Small	Overhanging Veg	Undercut Banks	Boulders	Artificial Structures	Canopy Type	Big trees	Small trees	Understory Type	Woody shrubs & saplings	Non-woody herbs, grasses, forbs	Ground cover - woody	Ground cover - non-woody	Ground cover - bare	Canopy Type	Big trees	Small trees	Understory Type	Woody shrubs & saplings	Non-woody herbs, grasses, forbs	Ground cover - woody	Ground cover - non-woody	Ground cover - bare
2	1	1	300	1.1	0	0	0	1	2	0	0	0	D	2	3	D	4	3	2	4	1	D	2	2	D	4	3	2	4	1
2	2	1	150	2.1	0	0	0	1	2	0	0	0	D	4	2	D	4	1	2	3	1	D	4	2	D	4	2	2	3	1
2	2	2	450	2.2	0	0	1	2	3	0	0	0	D	3	1	D	4	2	1	1	1	D	3	1	D	4	2	1	1	1
2	2	3	750	2.3	0	0	0	2	2	0	0	0	D	4	3	D	4	1	2	1	2	D	4	3	D	4	1	2	1	2
2	4	1	300	4.1	0	0	0	2	2	0	0	0	M	4	2	D	3	3	2	2	1	M	4	2	D	3	3	2	2	1
2	4	2	600	4.2	0	0	1	2	2	0	0	0	M	4	2	D	3	2	2	2	1	M	4	2	D	3	2	2	2	1
2	4	3	900	4.3	0	0	2	2	2	0	0	0	M	4	1	D	3	1	2	3	2	M	4	1	D	3	1	2	3	2
2	4	4	1200	4.4	0	0	1	2	2	0	0	0	M	4	2	M	3	1	1	1	4	M	4	2	M	3	1	1	1	4
2	4	5	1500	4.5	0	0	0	2	3	0	0	0	M	4	4	D	4	1	2	3	2	M	4	4	D	4	2	2	3	2
2	4	6	1800	4.6	0	0	1	2	2	0	1	0	D	4	3	D	2	1	1	3	2	D	4	3	D	2	1	1	3	2
2	4	7	2100	4.7	0	0	1	2	1	0	0	0	M	3	3	D	2	1	1	1	4	M	3	3	D	2	1	1	1	4
2	4	8	2400	4.8	0	0	1	4	3	0	1	0	D	4	1	D	4	1	3	2	1	D	4	1	D	4	1	3	2	1
2	4	9	2700	4.9	0	0	0	2	1	0	1	0	D	3	3	D	4	1	2	1	4	D	3	3	D	4	1	2	1	4
2	4	10	3000	4.10	0	0	1	2	4	0	0	0	D	4	2	D	4	1	2	1	3	M	4	2	D	4	1	2	1	3
2	4	11	3300	4.11	0	0	1	3	4	0	1	0	D	3	3	M	3	1	3	1	4	D	3	3	D	4	1	3	1	4
2	4	12	3600	4.12	0	0	0	4	3	0	0	0	D	4	3	D	3	2	na	3	2	D	3	3	D	3	2	na	3	2
2	4	13	3900	4.13	0	0	0	3	2	0	0	0	D	4	3	D	2	3	2	3	3	D	4	3	D	2	3	2	3	3
2	4	14	4200	4.14	0	0	0	3	2	0	0	0	D	4	3	D	3	2	1	2	2	D	4	3	D	3	2	1	2	2
2	4	15	4500	4.15	0	0	1	3	3	0	1	0	M	4	2	D	3	2	na	2	2	M	4	2	D	3	2	na	2	2
2	4	16	4800	4.16	0	0	1	4	4	0	1	0	M	4	2	D	4	3	1	2	2	M	4	2	D	4	3	1	2	2
2A		1	150	A1	0	0	0	1	3	0	0	0	M	4	3	D	3	2	1	2	2	M	4	3	D	3	2	1	2	2
2A		2	450	A2	0	0	1	2	3	1	0	0	M	4	1	D	2	2	2	2	2	D	4	1	D	4	2	1	1	3
2A		3	750	A3	0	0	1	3	3	1	0	0	D	4	1	D	4	3	2	2	1	D	4	1	D	4	3	2	2	1
2A		4	1050	A4	0	0	1	3	4	1	1	0	D	4	1	D	4	2	2	2	2	D	4	1	D	4	2	2	2	2
2A		5	1350	A5	0	0	1	3	2	1	1	0	D	4	1	D	4	1	1	2	2	D	4	1	D	4	1	1	2	2
2A		6	1650	A6	0	0	1	3	4	0	0	0	D	3	1	D	4	2	2	2	2	D	3	3	D	4	2	2	2	2
2A		7	1950	A7	0	0	1	2	2	0	0	0	M	4	2	D	2	2	2	2	3	M	4	2	D	2	2	2	2	3
2A		8	2250	A8	0	0	1	3	3	1	0	0	M	4	2	D	2	1	2	2	3	M	4	2	D	3	1	2	2	3
2A		9	2550	A9	0	0	0	2	2	0	0	0	D	1	4	D	4	3	2	2	2	D	1	4	D	3	1	1	1	3
2B		1	150	B1	0	0	0	2	2	0	0	0	D	1	4	D	2	1	2	1	2	D	2	3	D	2	1	2	1	2
2B		2	450	B2	0	0	0	2	3	0	0	0	D	4	1	D	2	1	1	2	3	D	4	1	D	2	1	1	2	3
2B		3	750	B3	0	0	0	2	2	0	0	0	D	1	3	D	2	1	2	2	2	D	1	3	D	3	2	2	2	2
2B		4	1050	B4	0	0	0	2	2	0	1	0	M	4	1	D	1	1	2	2	3	D	2	3	M	2	1	2	2	2
2B		5	1350	B5	0	0	0	3	4	0	0	0	D	1	3	D	3	1	2	1	2	D	3	2	D	3	1	2	1	2
2B		6	1650	B6	0	0	0	4	2	0	0	0	D	1	3	D	4	1	1	1	3	D	1	3	D	4	1	1	1	3
2B		7	1950	B7	0	0	1	4	3	0	0	0	D	3	1	D	4	1	2	1	2	D	3	1	D	4	1	2	1	2
2B		8	2250	B8	0	0	1	4	3	1	0	0	D	2	3	M	3	1	1	1	2	D	2	3	M	3	0	1	0	3

					Human Influence - Left Bank											Human Influence - Right Bank										
Stream	**Reach**	**Transect**	**Distance upstream (from beginning of reach)**	**MAP ID**	Wall/Dike/Dam	Buildings	Pavement	Road/Rail	Pipes	Landfill/Trash	Park/Lawn	Row Crops	Pasture/Hay Field	Logging	Mining	Wall/Dike/Dam	Buildings	Pavement	Road/Rail	Pipes	Landfill/Trash	Park/Lawn	Row Crops	Pasture/Hay Field	Logging	Mining
2	1	1	300	1.1	O	O	O	O	P	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
2	2	1	150	2.1	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
2	2	2	450	2.2	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
2	2	3	750	2.3	P	O	O	O	P	O	O	O	O	O	O	P	O	O	O	P	O	O	O	O	O	O
2	4	1	300	4.1	P	O	O	O	O	O	O	O	O	O	O	P	O	O	O	O	O	O	O	O	O	O
2	4	2	600	4.2	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
2	4	3	900	4.3	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
2	4	4	1200	4.4	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
2	4	5	1500	4.5	O	O	O	O	O	O	O	O	P	O	O	O	O	O	O	O	O	O	O	O	O	O
2	4	6	1800	4.6	O	O	O	O	O	O	O	O	P	O	O	O	O	O	O	O	O	O	O	O	O	O
2	4	7	2100	4.7	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
2	4	8	2400	4.8	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
2	4	9	2700	4.9	O	O	O	O	O	O	O	O	P	O	O	O	O	O	O	O	O	O	O	O	O	O
2	4	10	3000	4.10	O	O	O	O	O	O	O	O	P	O	O	O	O	O	O	O	O	O	O	O	O	O
2	4	11	3300	4.11	O	O	O	O	O	O	O	O	P	O	O	O	O	O	O	O	O	O	O	P	O	O
2	4	12	3600	4.12	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
2	4	13	3900	4.13	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
2	4	14	4200	4.14	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
2	4	15	4500	4.15	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
2	4	16	4800	4.16	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
2A		1	150	A1	O	O	O	P	O	O	O	O	O	O	O	O	O	O	P	O	O	O	O	O	O	O
2A		2	450	A2	O	O	O	P	O	O	O	O	O	O	O	O	O	O	P	O	O	O	O	O	O	O
2A		3	750	A3	O	O	O	P	O	O	O	O	O	O	O	O	O	O	P	O	O	O	O	O	O	O
2A		4	1050	A4	O	O	O	P	O	O	O	O	O	O	O	O	O	O	P	O	O	O	O	O	O	O
2A		5	1350	A5	O	O	O	P	O	O	O	O	O	O	O	O	O	O	P	O	O	O	O	O	O	O
2A		6	1650	A6	O	O	O	O	O	O	O	O	O	O	O	O	O	O	P	O	O	O	O	O	O	O
2A		7	1950	A7	O	O	O	O	O	O	O	O	O	O	O	O	O	P	P	O	O	O	O	O	O	O
2A		8	2250	A8	O	O	O	O	O	O	O	O	O	O	O	O	O	P	P	O	O	O	O	O	O	O
2A		9	2550	A9	O	O	O	O	O	O	O	O	O	O	O	O	O	P	O	O	O	O	O	O	O	O
2B		1	150	B1	O	O	O	O	O	O	O	O	P	O	O	O	O	O	O	O	O	O	O	O	O	O
2B		2	450	B2	O	O	O	O	O	O	O	O	P	O	O	O	O	O	O	O	O	O	O	O	O	O
2B		3	750	B3	O	O	O	O	O	O	O	O	P	O	O	O	O	O	O	O	O	O	O	P	O	O
2B		4	1050	B4	O	O	O	O	O	O	O	O	P	O	O	O	O	O	O	O	O	O	O	O	O	O
2B		5	1350	B5	O	O	O	O	O	O	O	O	P	O	O	B	O	O	O	O	O	O	O	O	O	O
2B		6	1650	B6	O	O	O	O	O	O	O	O	P	O	O	O	O	O	O	O	O	O	O	P	O	O
2B		7	1950	B7	O	O	O	O	O	O	O	O	P	O	O	O	O	O	O	O	O	O	O	P	O	O
2B		8	2250	B8	O	O	O	O	O	O	O	O	P	O	O	O	O	O	O	O	O	O	O	P	O	O