EXAMPLES OF REACH BREAK METHODS

Pierce County Report:

APPENDIX B
GEOMORPHIC REACH DESCRIPTION
INTRODUCTION

Key elements of our CMZ analysis include identifying the geomorphic processes operating throughout the project area, and evaluating the affects of those processes on channel migration. For the purposes of our evaluation, we divided each river channel into geomorphic reaches based on the presence and continuity of specific physical features, geomorphic characteristics and channel conditions. Physical features and geomorphic characteristics used in the delineation include the following:

- Valley and floodplain configuration,
- Dominant channel pattern (meander, braided, straight channel),
- Average channel gradient,
- Size and abundance of sand and gravel bars,
- Rate and continuity of lateral channel movement,
- Floodplain features indicative of historic/ancient channel activity (abandoned channels, oxbow lakes)

The features and characteristics summarized above were identified from aerial photographs, topographic maps, geologic maps and field reconnaissance. Reach delineations are shown on Plate 1and included in the GIS CD, both of which accompany this report.

In order to be consistent with river mile stationing convention, the reaches are numbered in the upstream direction, with Reach 1 located at the downstream end of the channel. However, to better evaluate the influence of fluvial and bedload transport on channel migration, all reach descriptions are provided in the downstream direction, beginning at the upstream end of the project area. The descriptions generally focus on a single reach. However, wherever applicable, two or more successive reaches are combined in a description. Tributary channels are not included in this evaluation.

Each of the following descriptions contains three sections: Existing Geomorphic Character, Historic Information Review, and Erosion Potential. The Existing Geomorphic Character section describes the current condition of the reach based on review of 1998 orthophotographs and other information from the last decade. The Historic Information Review section summarizes the history of the reach from the pre-confined to the post-confined condition. The Erosion Potential section briefly describes channel and floodplain soils with regard to sediment production, sensitivity to erosion, and migration.

Specific characteristics used to describe and interpret the condition of the reaches are provided in Appendix B-1. The reach descriptions begin with Puyallup River, followed by the Carbon and White Rivers.

PUYALLUP RIVER CORRIDOR

Introduction

The Puyallup River project area extends from the confluence with the White River at P-RM 10.3 to P-RM 28.6. We identified 18 geomorphic reaches throughout the project area.

PUYALLUP REACH 18

Existing Geomorphic Character

Reach 18 extends roughly 9,100 feet through a steep trough-shaped valley with steep walls. Discontinuous levees and revetments, and the valley walls confine the channel corridor. Within the high flow channel corridor the river transitions from a system of complexly braided channels to a system of one to two straight channels bounded by continuous mid- and side-channel gravel bars. The braided section is situated in the upper portion of the reach, where active channels shift around large bars and woody debris.

Throughout this reach, the channel gradient decreases abruptly from 4.0 percent, just upstream of the project area, to about 1.3 percent in the middle of the reach. The pronounced decrease in channel gradient identifies an area prone to significant sediment deposition. Within the high flow channel corridor, the channel floor and bar deposits consist of boulders up to 5 feet in diameter, large cobbles, gravel, and trace amounts of sand. The right valley wall is composed of Fraser continental drift. The left valley-wall is composed of andesitic bedrock. Flood terrace deposits situated outside high flow high flow channel corridor consist of alluvial gravel and/or cohesive Electron mudflow deposits.

Existing levees, revetments and a railroad embankment are generally composed of quarry riprap and angular quarry spall.

The results of our aerial photograph evaluation indicate that bedload entering Reach 18 is supplied primarily from upstream source areas and Fox Creek, a small tributary entering the main stem from the right. The creek, which drains a portion of the steep valley wall, is likely transporting moderate to large volumes of sediment to the valley floor where it is entrained into Puyallup River bedload during high stage flows. The creek presently occupies an abandoned Puyallup River channel and joins with the main stem at P-RM 27.9.

The upper one-half of the reach was partially confined by levees and revetments in 1965. Confinement was completed throughout the reach by 1978. The revetments effectively decreased the width of the high flow channel from an average of 800 feet in 1931 to about 300 feet in 1978.

Prior to confinement, the upstream end of the reach was a complexly braided river consisting of shallow, multi-thread channels separated by numerous gravel bars. Aerial photographs from 1931 to 1978 clearly show that gravel bars and channels shifted frequently, indicating that the channel floor was aggrading. The dominant migration style observed consisted of rapid lateral and downstream shifting of channels through braid bars within the high flow

corridor, and lateral migration of channels into adjacent floodplains and terraces. Aerial photographs also indicate the occurrence of periodic channel abandonment and reoccupation (avulsion) within heavily braided sections. Ancient abandoned channels and channel traces are observable in alluvial floodplain deposit on both sides of the channel corridor, not including the Electron mudflow deposits, suggesting that the Electron Mudflow impeded migration of the braided channels.

Since confinement was completed in the 1970s, several levee sections have been destroyed during flood events. Portions of levees in upper reach areas were destroyed by 1978. Portions of the levees in the lower reach were destroyed or damaged in the 1996 floods. A likely cause of the damage is the high rate of channel aggradation, which has greatly reduced the flow capacity of the channel.

Erosion Potential

Erosion potential within Reach 18 varies with levee and revetment materials, native soils comprising valley walls, and the composition of gravel bars. Alluvial gravel bars inside the confined corridor are highly susceptible to erosion. The maximum distance of lateral migration measured through an alluvial deposit between 1931 and 1965 is 460 feet (at P-RM 27.2). Portions of the left valley wall composed of hard sedimentary and andesitic bedrock are very resistant to erosion and therefore represent a barrier to migration. The right valley wall consists of Fraser continental drift, generally considered to be moderately resistant to erosion. Several sections of the levies on both sides of the channel are composed of quarry spall and small riprap, and have been subject to frequent damage. Field observations indicate the quarry rock and riprap comprising the levees is subject to downstream transport and, therefore, cannot be expected to prevent erosion. Remnants of Electron mudflow deposits, located in the floodplains landward of existing levees and revetments, are moderately resistant to erosion.

GEOMORPHIC REACH DESCRIPTIONS: Puyallup

Reaches:	Puyallup18	Puyallup17	Puyallup16	Puyallup15	Puyallup14	Puyallup13
River Miles:	27.0-28.6	25.3-27.0	25.2-25.3	23.6-25.2	23.1-23.6	22.5-23.1
Length: (Feet)	9,117	8,353	1,336	9,173	2,916	3,281
Gradient:(%)	1.14	1.08	0.88	0.83	0.85	0.75
Valley configuration:	The river flows into a trough-like valley, 2,500 to 3,000 feet wide valley floor. Puyallup River runs on the east-side, Kapowsin Creek occupies the west-side.	Valley narrows slightly, 2,500-1,800' wide. River cross valley floor and hugs the west side.	Valley narrows to 300 feet due to a bedrock outcrop.	Valley widens (1300-2000'). River remains in the center.	Valley walls narrow to 1,400- 3,500'; river hugs the west side of the valley.	Valley opens (3500-6500'). River flows of the left half of the valley.
Floodplain and Terraces: (presence, and character)	Large, discontinuous floodplains on both sides of channel, a young mudflow terrace in the middle of the valley floor.	Large continuous floodplains on both sides of channel upstream of confluence with Kapowsin Creek. Downstream there is a moderate floodplain on the right.	No floodplains	Moderate floodplains (discontinuous, on both sides) with young terrace on the right.	Floodplains (continuous, on river right) with young terrace on the right.	Floodplains (narrow, discontinuous, both sides) young terrace on the right
Floodplain Features:	Ancient channel scars on left floodplain	Ancient channel swales on the right	None	Oxbows (left flood plain) and ancient channel scars (both) on floodplains	Oxbows (right) and ancient channel scars on both floodplains.	Oxbows (right) and ancient channel scars (both) on floodplains
Dominant Channel Pattern:	Historically: braided, Existing: single and multiple braided threads.	Historically: braided Existing: transitional and straight single thread.	Historically: single threaded Existing: single threaded.	Historically: braided, multiple-threads Existing: transitional meander/braided	Historically: braided multiple-threads Existing: straight single-thread with side bars.	Historically: braided multiple-threads Existing: transitional meander/braided.
Measured Maximum Migration Rate: (feet/year)	13.5	13.5	0.0	81.1	36.2	43.9
Width of Observed Active Channel to High Flow Channel:	15-33%	25-40%	50-95%	20-60%	40-60%	30-50%
Gravel Bar Character (within the Channel Corridor):	Large, abundant, active mid-channel and side bars	Large, abundant, active side bars	Small, discontinuous, stable bars Large, abundant, and active mid-channel and side bars	Moderately large, abundant, stable side bars	Large abundant, and active mid-channel and side bars	
Tributaries: Name, confluence location (side of the river it enters)	Fox Creek, RM 27.9 (right)	Kapowsin Creek, RM 26.1 (left); Fiske Creek, RM 25.4 (right)	None Unnamed creek/swamp, RM 25.0 (left);	Mint Creek, RM 23.7 (left)	None	None
Primary Bank Soil:	Alluvial gravel bars overbank deposits cohesive mudflow deposit andesitic bedrock	Alluvial gravels cohesive mudflow deposit bedrock, shale and andesite	Alluvial gravel overbank deposits andesite bedrock	Alluvial sand and gravel bars overbank deposits cohesive mudflow deposit	Alluvial sand and gravels bars overbank deposits bedrock shale and andesite	Alluvial sand and gravels cohesive mudflow deposit

Bedload: listed order of observed composition	Cobbles and gravel with boulders and sand	Cobbles and gravel with boulders and sand	Cobbles and gravel with sand	Cobbles and gravel with sand	Cobbles and gravel with sand	Cobbles and gravel with sand
Sediment Source Area	Primarily upstream mass wasting and glacial run-off. Mass-wasting of in-reach valley wall sediments.	Upstream, tributaries, in-reach mass wasting of valley wall	Upstream	Upstream, tributaries, banks	Upstream and banks	Upstream
Existing Infrastructure:	Champion Bridge (RM 28.6) Railroad alignment and private timber road (left) Orville Road E (left)	Abandoned Railroad Alignment and Neadham Road (right) Orville Road E (left)	Abandoned Railroad Alignment and Orville Road E (right) Orville Road High Bridge	Abandoned Railroad Alignment and Orville Road E (right)	Abandoned Railroad Alignment and Orville Road E (right)	None
Revetments and Levees: (presences)	Left side is reveted (riprap is incorporated into the bedload)	1960's era levee/revetment remains in spots.	Engineered riprap embankment Remains of the abandon railroad grade	1960's era levee/revetment remains in spots. Set-back levee is constructed along the right side.	1960's era levee/revetment remains in place. Set-back levee is constructed along the right side.	1960's era levee/revetment remains in place. Set-back levee is constructed along the right side.

REACH SUBDIVISIONS: Naches River CMZ

For the CMZ study, the study area was divided into six reaches, with Reach 1 at the upstream end of the study area and Reach 6 at the downstream end (Figure 3-2). Boundaries between reaches were defined at breakpoints in slope of the longitudinal channel profile, at notable changes in channel planform or other channel characteristics, or where the reach lengths created are manageable in scale for analysis.

River gradient, floodplain width, and active and primary channel widths were plotted for each reach (see Figures 3-3 through 3-5). Average gradients and widths are listed by reach in Table 3-3; data is provided in Appendix B. Generally, and as should be expected, channel width and floodplain width increase in the downstream direction. The average channel gradient between reaches remains fairly constant around 0.6 percent. Figures 3-6 through 3-8 show transect ratios (the ratio of active channel width to floodplain width) for 1984-2000, 1927-1972, and 1927-2000.

TABLE 3-3.: CHARACTERISTICS OF THE NACHES RIVER REACHES

Reach Number	Channel Gradient (feet/foot)	Active Channel Width (feet)	Primary Channel Width (feet)	Floodplain Width (feet)
1	0.006	240	109	1490
2	0.0057	275	98	2613
3	0.0068	661	107	3158
4	0.0053	405	100	2562
5	0.0053	655	126	2156
6	0.0056	893	115	4685