Germany Creek Photo Points and Channel Stability Evaluation: 1990 – 2000

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INTRODUCTION AND PURPOSE

Germany Creek is located in Cowlitz County, Washington, and is a tributary to the Columbia River west of Longview (Figure 1). The upper watershed of the creek is managed for forest products. Unstable terrain coupled with extensive forest harvest in the 1960's through 1980's led to accelerated mass wasting and channel impacts. In 1990 a process was set up to begin addressing these impacts and to begin recovery of the channel. At that time photo points along the channel system were set up and channel stability conditions were evaluated. These same photo points and channel evaluations were redone in 2000. This report summarizes findings from the ten-year interval and provides the photos, photo point locations and stability evaluation data, and locations in a manner that will allow repeatability in the future.

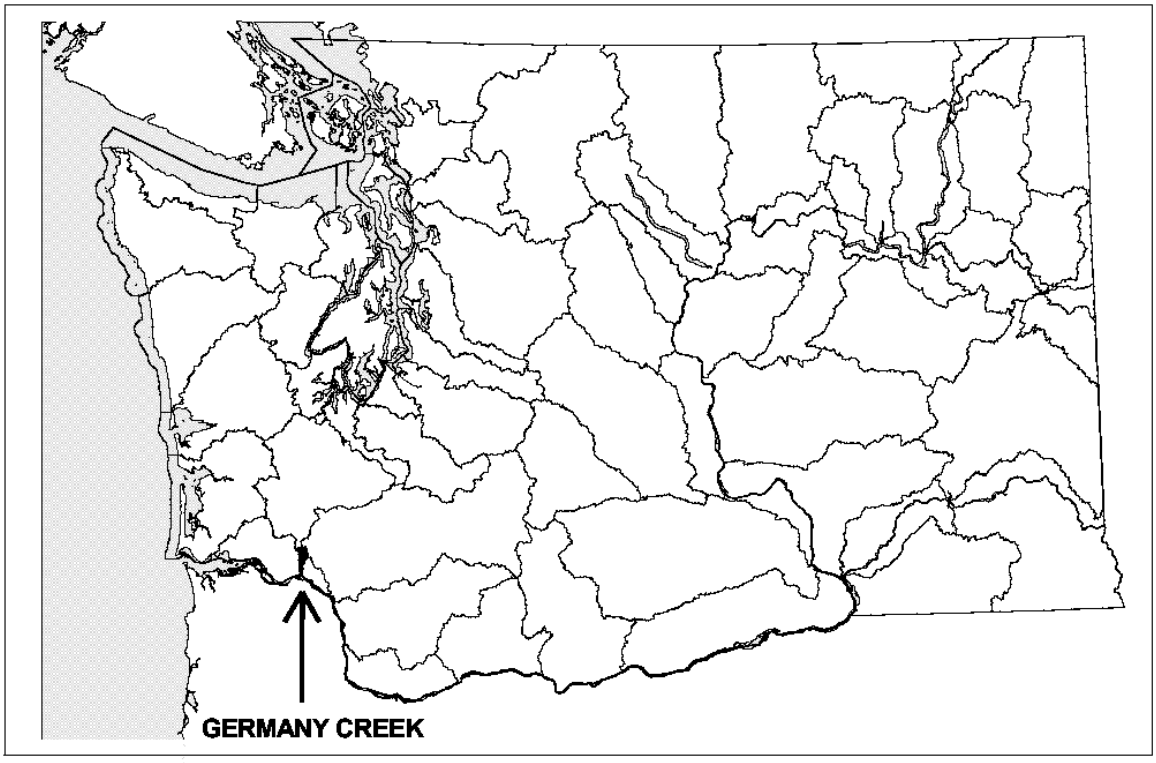

Figure 1. The location of Germany Creek in Washington State.

BACKGROUND

In 1990 the Washington State Forest Practices Board placed Germany Creek in a Category of Concern for imminent damage to public resources. Germany Creek issues were: soil erosion, water quality, channel stability and wildlife biological diversity. Items to address in applications for operations in Germany Creek were: seral stages for drainage (hydrology); state soil survey; geology-rehabilitation of mass failure; will operations accelerate failures?; degree of sedimentation; green tree retention or recruitment; what is happening within 100 feet of type 1->5 waters; and, channel integrity (Handlos 1990). Washington Department of Natural Resources (DNR) divided the basin into an upstream area where holdings were by four large timber landowners and the downstream area with diverse holdings and land-uses. Upstream practices would have basin-wide information developed with assistance from the landowners; this would be followed by a basin-wide interdisciplinary team review. International Paper Company was the

largest upstream landowner with 89 percent ownership of the 10,834 total acres. Downstream forest practices would be viewed on a case by case situation based on potential impacts for the entire drainage (Bannon, B. 1990). In June 1990 DNR began deferring upper basin forest practice applications until the upper basin interdisciplinary team (ID team) review could be held (Bannon 1991a). The ID team review was held in October 1990. As a result, DNR notified upstream landowners in January 1991 that additional information would be needed before future activities could begin.

Documentation on forest age classes was provided by John Gross of International Paper Company for the team. The Ecology (Schuett-Hames 1991) ID team report included: forest age class considerations; channel stability reviews; stream temperature information; and mass wasting considerations. At the time of the ID team, 32 percent of the basin was in a stand age of less than 6 years old and 17 percent was 6 to 10 years old making 49 percent of the upper basin less than 10 years old. Overall 78 percent of the basin was less than 30 years old. The extent of these young age classes was of concern due to:

(1) Root strength loss and subsequent increased potential for mass wasting;
(2) Increased volumes of water being delivered to the soil, ground water, and streams with potential for higher peak flows, greater sediment transport capability, and increased risk of mass wasting.

Channel stability review and photo points were set up at this time by Washington Department of Ecology to develop information for the ID team and for expected future monitoring needs. Germany Creek within the review area was documented as follows: unstable; debris flood affected; low channel capacity; poor habitat for aquatic biota due to unstable rubble substrate; low volume of LOD; extensive aggradation – some areas scoured to bedrock; extensive bedrock channel walls along mainstem; good hardwood riparian zones along the mainstem, but lack of sufficient conifer for future recruitment; and, roads within riparian zones – in several cases adjoining the stream bank.

Stream temperature data from 1988 showed exceedences of the state water temperature criteria of 18.3°C in July, August, and September (Sullivan et. al. 1990).

DNR specified results from the ID team as follows: "*The technical experts have documented material damage in the basin, primarily from sedimentation caused by mass wasting events in the upper drainage. There has been a loss of habitat for snag dependant species, and the stream may be temperature sensitive."* (Bannon 1991a).

Landowners were notified that existing applications awaiting approval were disapproved *"pending completion of road maintenance, abandonment, and other activities to prevent further damage to public resources in upper Germany Creek."* Specifications for road maintenance plans were listed; stream temperature sensitivity determination would be made; and future road construction or timber harvest applications would not be accepted until the road maintenance and abandonment requirements were completed.

In 1991 International Paper (whose land in Germany Creek is now owned by Hampton Tree Farms) implemented a road maintenance and abandonment plan. They also aerial seeded for erosion control on slumps and slides (Bannon 1991b).

METHODS

Photo Points

Photos were taken from the same locations in 1990 and 2000. These locations were set up to be easily relocated and were either bridge crossings of the river or its tributaries, or tributary junctions. Photos from 1990 were taken into the field in 2000 to compare with current conditions and to facilitate assurance that photos would be comparable. Photos and site conditions were evaluated for any noticeable changes in riparian, bank, or bed conditions.

Channel Stability Evaluations

These evaluations were done according to U.S. Forest Service (1978) modified by Rickert et. al. (1978). The index rates a stream's capability to maintain stable channel characteristics under the flow and sediment regime it is subject to. Numerical values are given to 15 physical characteristics of the stream bank and channel bottom relating to stream bank erosion and stability of bottom materials. A representative channel cross-section is measured to obtain the channel capacity rating.

RESULTS

Photo Points

Photo points were originally set-up August 10, 1990. They were revisited March 30, 2000. Photo point locations are shown in Figures 2 – 5. Table 1 describes photo point locations and comparative results from 1990 to 2000. Photo Plates 1 – 11 include the photos from both years and are primarily organized with 1990 photos on the left of the page and corresponding year 2000 photos on the right side of the page. Photos were typically taken both upstream and downstream at a particular point, and are labeled by site and as "u" for and upstream view, and "d" for a downstream view. Six mainstem Germany Creek locations and two tributaries are included in the photo points. Three of the mainstem sites are also at channel stability evaluation reaches. All locations are in the upper portion of the watershed that is managed for timber production. April, pre-leaf out timing was found to allow better view into the channel, and distance-wise up the channel. Overviews of information on sediment, large woody debris, and channel morphology are included below.

Coarse sediment and channel bars.— In 2000, photos and the site visit showed the loss of channel bars evident in 1990. Some bars were also seen to be stabilized in 2000 by alders with 8 to 10 plus year growth.

Fine sediment.—Notable in the upper reaches surveyed were the extensive golden colored sediment deposits that appear to be from a new landslide located above tributary site H.

Large woody debris in the channel.—Little evident in 1990 or 2000.

Channel morphology.—Germany Creek in the areas reviewed functions as a transport reach. It appears much sediment has been transported through since 1990. Tributary site F photos show coarse large rubble that filled the channel in 1990 has been sorted creating a distinguishable step-pool morphology in 2000.

Channel Stability Evaluations

There are three stability index sites set up; their locations are shown in Figures 2, 3, and 5. Table 2 includes factor data as well as the site score and rating for 1990 and 2000 along with reach field note summaries.

As seen in the photo points, the stability evaluation also indicates an extensive shift in channel characteristics between 1990 and 2000. Overall ratings for all three sites are unstable in 1990 with scores of 107, 104, and 111 (site numbers 1, 2, and 3 respectively). Ratings for 2000 are 68, 74, and 100 (again site numbers 1, 2, and 3 respectively). Of these year 2000 ratings the first two sites classify as stable, and the third as moderately unstable. These general ratings classes of stable, moderately unstable, and unstable are from Rickert et al. (1978). Of the 2000 scores, site #3 was substantially higher due to the extensive deposition of fine sediments from a recent landslide near photo point H.

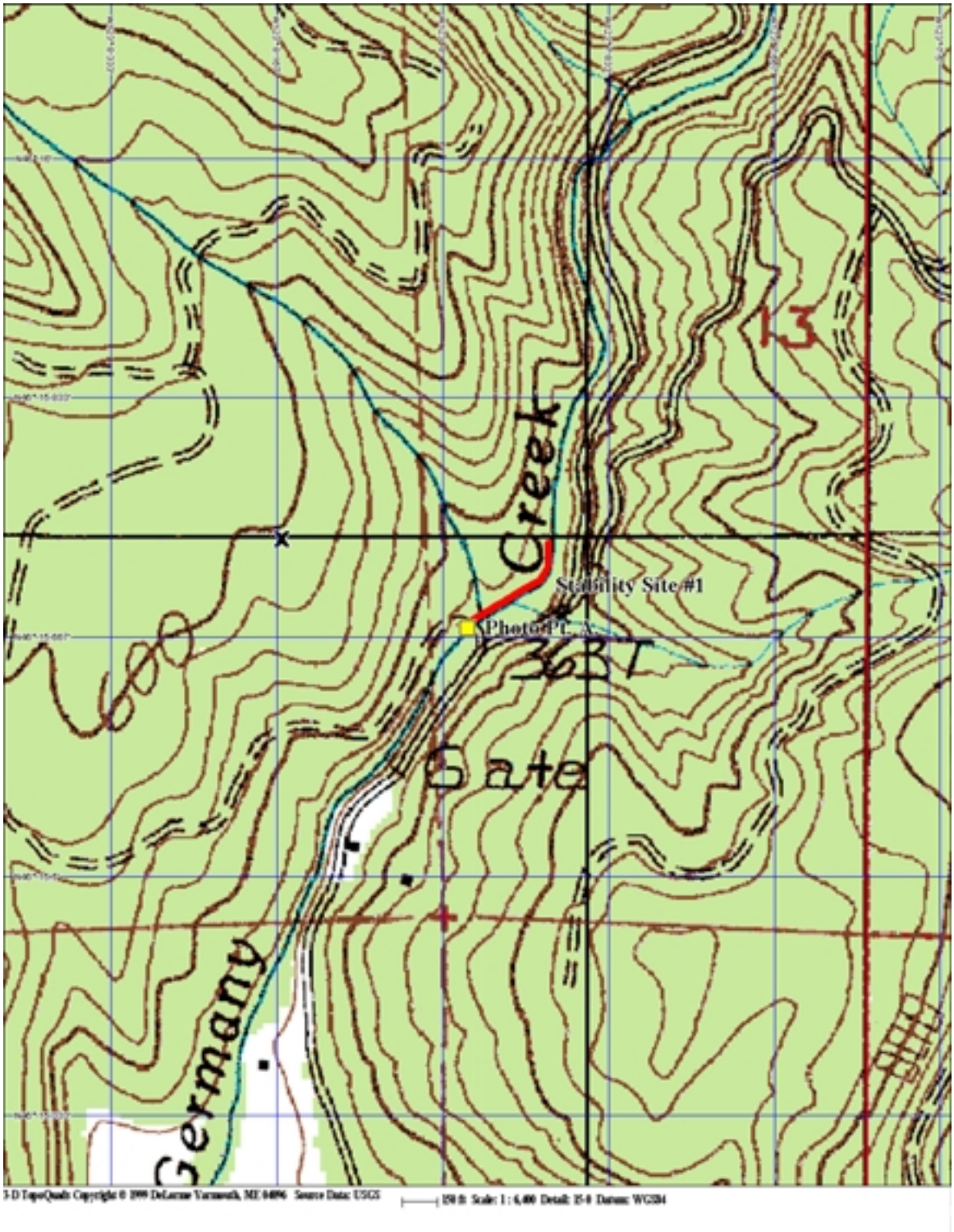

Figure 2. Germany Creek photo point A and channel stability site #1.

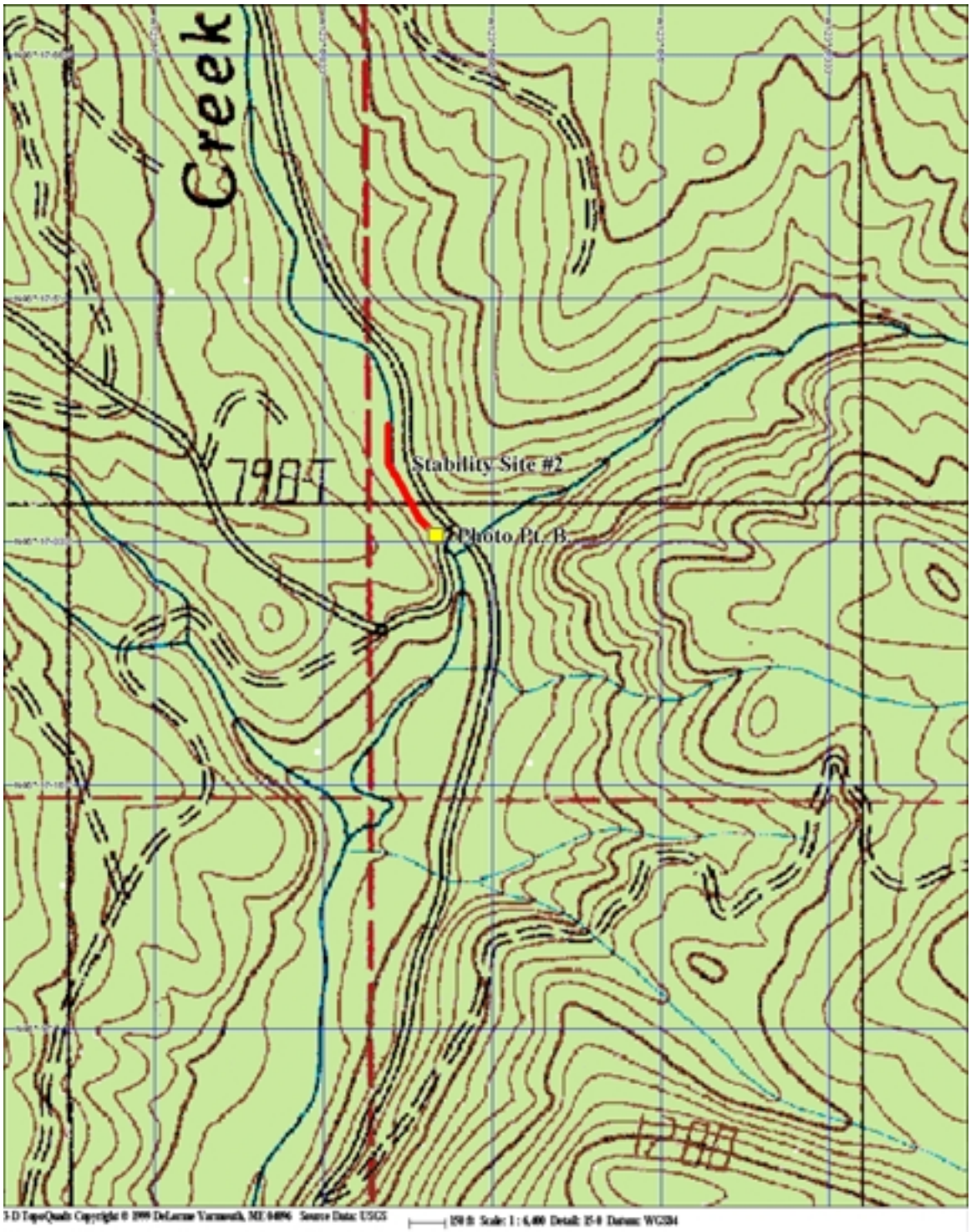

Figure 3. Germany Creek photo point B and channel stability site #2.

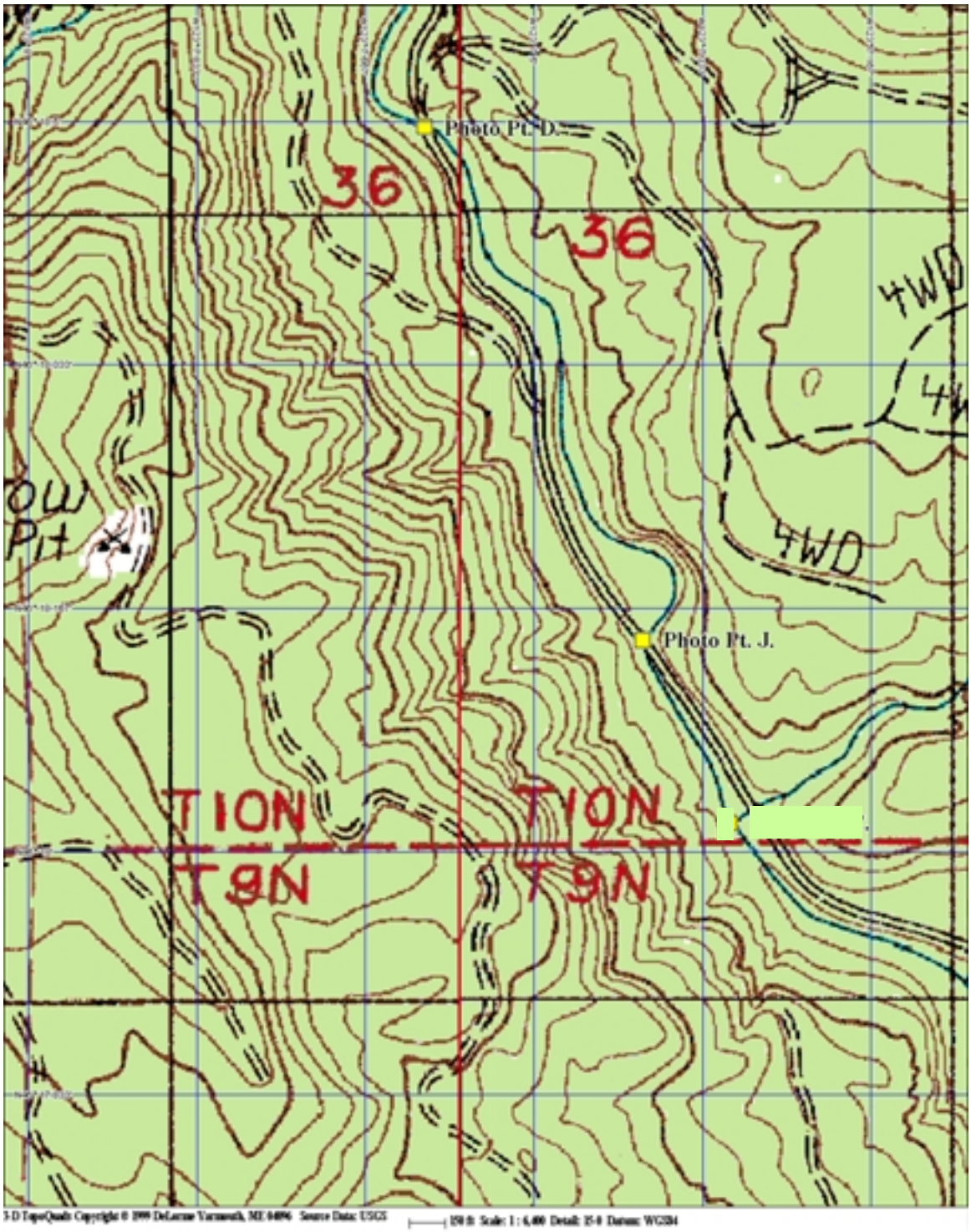

Figure 4. Germany Creek photo points J and D.

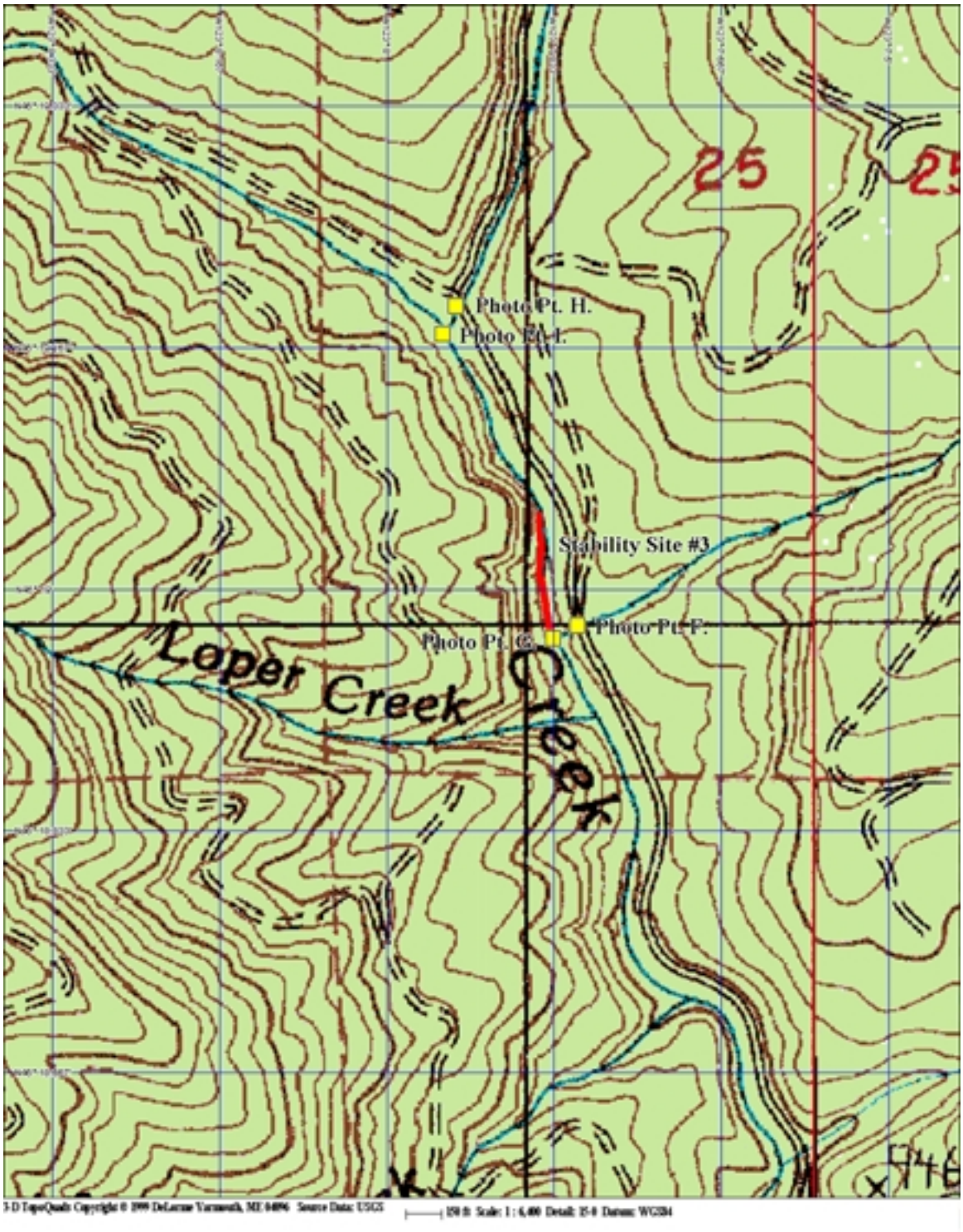

Figure 5. Germany Creek photo points F, G, H, I and channel stability site #3.

Table 1. Germany Creek photo point locations and 1990 to 2000 results.

Location	**Latitude / Longitude, Elevation**	**Photo Point**	**Notes and Comparative Results 1990 - 2000**
Bridge crossing of Germany Creek. Bridge located at mile 5.2 from start of Germany Creek Road at Highway, and 0.1 mile from the Hampton Tree Farm gate to the upper watershed. *Note that the 500 ft. reach upstream of this bridge is channel stability evaluation site #1.*	Latitude N46º15.676' Longitude W123º7.964' Elevation 348 ft.	A upstream A downstream *Both taken from top of bridge.*	Both photos show no large wood in channel. Lower banks look more mossy and vegetated in 2000. It appears in upstream photo that large in-channel gravel bar has downgraded in 2000 photo. Site is a transport reach.
Bridge crossing of Germany Creek. This crossing is 3 miles by road from photo point A. *Note that the 500 ft. reach upstream of this bridge is channel stability evaluation site #2.*	Latitude N46º17.343' Longitude W123º6.725' Elevation 604 ft.	B upstream	Mid-channel bar comprised of large rubble-sized particles in 1990 is gone in 2000 photos with channel appearing deepened. Channel now is flanked along right bank with a lateral bar. Nice pool under bridge.
		B downstream *One set of photos taken from on top of bridge; one set from below bridge.*	Left bank lateral bar is gone in 2000. Steelhead redd on pool tail-out below bridge (2000).
Mainline crossing of Germany Creek.	Latitude N46º18.146' Longitude W123º7.392' Elevation 723 ft.	J upstream	Appears that some gravel deposition shown in 1990 has lessened in 2000.
		J downstream	Photos look quite similar.
Road crossing of mainstem Germany Creek.	Latitude N46º18.498' Longitude W123º7.610' Elevation 740 ft.	D upstream D downstream *Photos taken from on top of bridge.*	2000 photos: note mid-channel gravel bar with approximately 8 year-old alders. Sediment wedge is being stabilized in-channel at this location. No photos available for 1990.

Location	Latitude / Longitude, Elevation	Photo Point	Notes and Comparative Results 1990 - 2000
Road crossing of tributary to Germany Creek.	Latitude N46º18.975' Longitude W123º7.806' Elevation 860 ft.	F upstream	2000: step-pools are forming both upstream and downstream at 20 ft. intervals. Right bank erosion occurring approximately 75 ft. upstream. Downstream alluvial fan with alders. Channel mouth now about 30 ft. further upstream from that of 1990.
		F downstream *Photos taken from on top of bridge. (See also G trib.)*	
Germany Creek at tributary junction. Also note G tributary is same tributary as in photo point F but the view is from its mouth with Germany Creek. *Note that the 500 ft. reach upstream of the mouth of the creek is channel stability evaluation site #3.*	Latitude N46º18.968' Longitude W123º7.836' Elevation 863 ft.	G upstream	2000: viewing upstream primary change at site appears to be change in tributary location. Riparian has remained stable.
		G downstream	2000: lateral bar has shifted from right side of channel to left side.
		G tributary *All views are from in channel near mouth of tributary.*	The change shown in the tributary characteristics is distinctive. 1990 shows an unsorted large rubble morphology. 2000 shows distinctive sorting and start of step-pool morphology.
Road crossing of tributary to Germany Creek.	Latitude N46º19.198' Longitude W123º7.929' Elevation 914 ft.	H upstream	1990 notes describe this tributary as having been sluiced to bedrock with loose sediment on top. 2000 photos (especially upstream) and site visit show the extensive golden colored sand deposition from the new, year 1999 or 2000 landslide that is about 100 to 300 ft. upstream, right side.
		H downstream	
Germany Creek at tributary junction. Also note I tributary is same tributary as in photo point H.	Latitude N46º19.176' Longitude W123º7.944' Elevation 910 ft.	I upstream	Boulders and rubble seen in right side of channel in 1990 photos are gone in 2000 with exposed bedrock showing.
		I downstream	Lateral bar on left side of channel in 1990 photo is gone in year 2000 photos.
		I tributary	Year 2000 photo shows extensive sediment deposition.

Photo Point Au – 1990.

Photo Point Au – 2000.

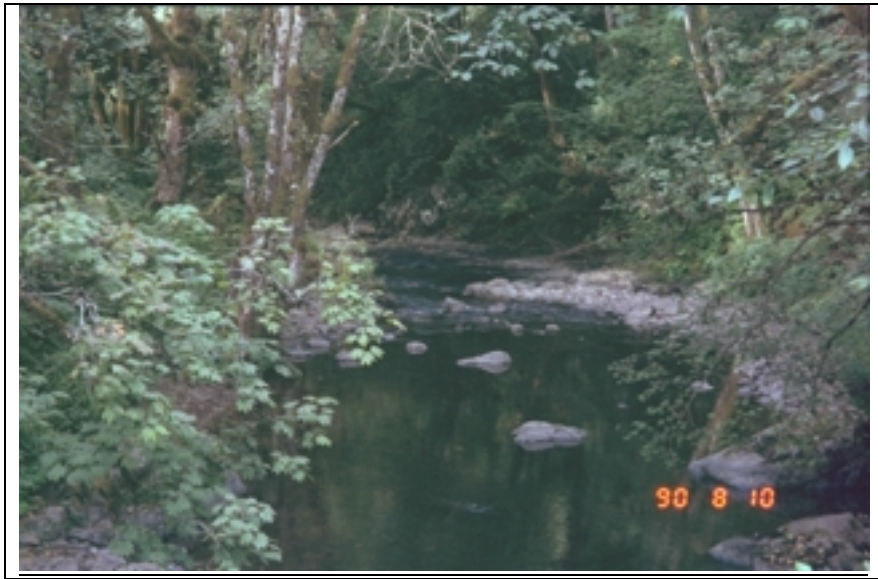

Photo Point Ad – 1990.

Photo Point Ad – 2000.

Photo Point Bu (top bridge) – 1990.

Photo Point Bu (top bridge) – 2000.

Photo Point Bu (stream level) – 1990.

Photo Point Bu (stream level) – 2000.

Photo Point Bd (top bridge) – 1990.

Photo Point Bd (top bridge) – 2000.

Photo Point Bd (stream level) – 1990.

Photo Point Bd (stream level) – 2000.

Photo Point Cu – 1990.

Photo Point Cu – 2000.

Photo Point Cd – 1990.

Photo Point Cd – 2000.

Photo Point Ju – 1990.

Photo Point Ju – 2000.

Photo Point Jd – 1990.

Photo Point Jd – 2000.

	
Photo Point Du Panorama – 2000.	Photo Point Du Panorama – 2000.
	
Photo Point Dd – 2000.	No Photo.

Photo Point Fu – 1990.

Photo Point Fu – 2000.

Photo Point Fd – 1990.

Photo Point Fd – 2000.

Photo Point Gu – 1990.

Photo Point Gu – 2000.

Photo Point Gd – 1990.

Photo Point Gd – 2000.

Photo Point G (tributary) – 1990.

Photo Point G (tributary) – 2000.

Photo Point Hu – 1990.

Photo Point Hu – 2000.

Photo Point Hd – 1990.

Photo Point Hd – 2000.

Photo Point Iu – 1990.

Photo Point Iu – 2000.

Photo Point Id – 1990.

Photo Point Id – 2000.

Photo Point I (tributary) – 1990.

Photo Point I (tributary) – 2000.

Table 2. Germany Creek stream channel stability scores for 1990 and 2000 with attached field note summary. (Note that if printed in color, colors of individual ratings relate as follows: green – excellent; blue – good; dark red – fair; red – poor.)

Factors Rated	Site #1		Site #2		Site #3	
	1990	2000	1990	2000	1990	2000
Landform Slope	4	2	4	2	4	2
Mass Wasting	6	6	3	3	6	9
Debris Jam Potential	2	4	2	2	2	4
Vegetative Bank Protection	9	3	9	6	9	9
Channel Capacity (Width/Depth)	4(93)	4(34)	4(74)	3(24)	4(42)	4(26)
Bank Rock Content	2	2	2	4	2	4
Obstructions, Flow Deflectors, Sediment Traps	8	4	6	2	6	4
Cutting	4	8	4	8	8	10
Deposition	16	4	16	12	16	16
Rock Angularity	2	2	2	2	2	2
Brightness	3	1	3	2	3	2
Consolidation (Packing)	6	2	6	2	6	4
Bottom Size Distribution & Stable Material	14	12	16	12	16	16
Scouring and Deposition	24	12	24	12	24	12
Clinging Aquatic Vegetation	3	2	3	2	3	2
Score	**107**	**68**	**104**	**74**	**111**	**100**
Rating*	**U**	**S**	**U**	**S**	**U**	**M**
*From Rickert et al. (1978), Stable (S) = < 79; Moderately Unstable (M) = 79-102; Unstable (U) = >102.						
Field Notes						
Site #1.						
1990. Reach debris flood affected; loss of channel capacity; unstable rubble substrate; no large woody debris; riparian zone of alder and maple, no conifer. Trout, kingfisher and dipper seen.						
2000. Two older large rock sediment plugs in reach; small rocks are being transported through segment but larger are not; channel hardened; nice density of moss above bankfull; no large woody debris; riparian zone of large alder and maple, no conifer. Poor spawning habitat; one 10-98 chinook redd flag; saw sculpin and dipper.						
Site #2.						
1990. Reach debris flood affected; no bank erosion – gravel is deposited up to top of the bank; some locations aggraded and others scoured to bedrock; one deep pool 3 to 4 ft. deep; riparian zone of alder.						
2000. Bedload appears to have moved downstream; high fines – likely from new mass wasting event upstream; very little spawning gravel; excellent bedrock pools; narrow riparian zone primarily of older alder. Saw kingfisher, steelhead redd, and what appeared to be several beaver musk piles.						
Site #3.						
1990. Debris flood rubble substrate; aggradation fills stream; bedrock sides; road within the riparian zone – portions of road edge rip-rapped. Depositional area along tributary restabilizing with 3 year-old alder. Trout and dippers seen.						
2000. Overall substrate is coarse; bed is stable. However, large volumes of fines behind every roughness element in the stream with fines 2 to 4 in. deep along channel margins; all appear to be recent deposition from new slide within ½ mile upstream. Section of plastic road culvert is on lateral bar at edge of channel. Riparian zone is narrow strip of mature alder with dying tops; mainline runs along left side of channel - there are areas where brush has been clipped impacting further the RMZ. Saw dipper, turkey vultures, and elk.						

In 1990 most factors at the three sites rated either fair or poor. In 2000 this had shifted to most ratings falling into excellent or good categories. Those remaining in fair or poor categories were primarily driven by the fine sediment delivery from upstream landslides or width to depth ratios that have lessened but still receive poor or fair ratings. In 1990 site #1 had a width to depth ratio of 93; in 2000 it was 34. Likewise in 1990 site #2 was 74 compared to 24 in 2000. Site #3's ratio was 42 in 1990 and 26 in 2000. These ratios are based on field measurements, but just one per reach and are not necessarily taken in the same location in subsequent years. Nonetheless, the documented shift in ratios at all sites is important to note.

DISCUSSION

Both methods used, photo points and channel stability evaluation are qualitative assessments. However, taken together they do tell us valuable information about change in the upper reaches of Germany Creek over the last decade. In 1990 the mainstem was affected by debris floods and by receiving large amounts of unsorted coarse sediments from upper basin landslides. This is reflected in high width/depth ratios as well as other characteristics documented. Tributary reaches also had debris floods and similarly were either scoured to bedrock or comprised of unsorted coarse sediments. By 2000 the photos and stability ratings indicate that coarse material levels being delivered to the mainstem have been substantially abated and much depositional sediment has now been transported out of this upper watershed area. Important now is a continuance of landslide prevention through road maintenance and prevention and mediation through other actions.

For the upper watershed this shows important recovery progress. However, fish habitat is currently poor in the reaches reviewed due especially to lack of wood and poor availability of spawning gravels. The creek is listed on the 1998 Clean Water Act Section 303(d) list for high water temperature and exceedences of the state criteria. Next stages of recovery for restoration of fish habitat are needed. If hydrology conditions in the upper basin are acceptable, large wood placement would be worthwhile to consider to assist with holding spawning size gravels and otherwise developing channel complexity.

Unfortunately, according to Darin Houpt (personal communication) the lower Germany Creek watershed is now facing serious flooding issues from what appears to be arrival to the lower watershed of sediment transported from upstream. This further highlights the long-term importance of diligence in maintaining the recovery trajectory for the upper watershed.

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