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**Internet Resources:**

*<http://www.washington.edu/uwired/outreach/cspn/curforest/documents.html>*

*NOAA Fisheries Website. ESA Listing Maps. Available at URL =  
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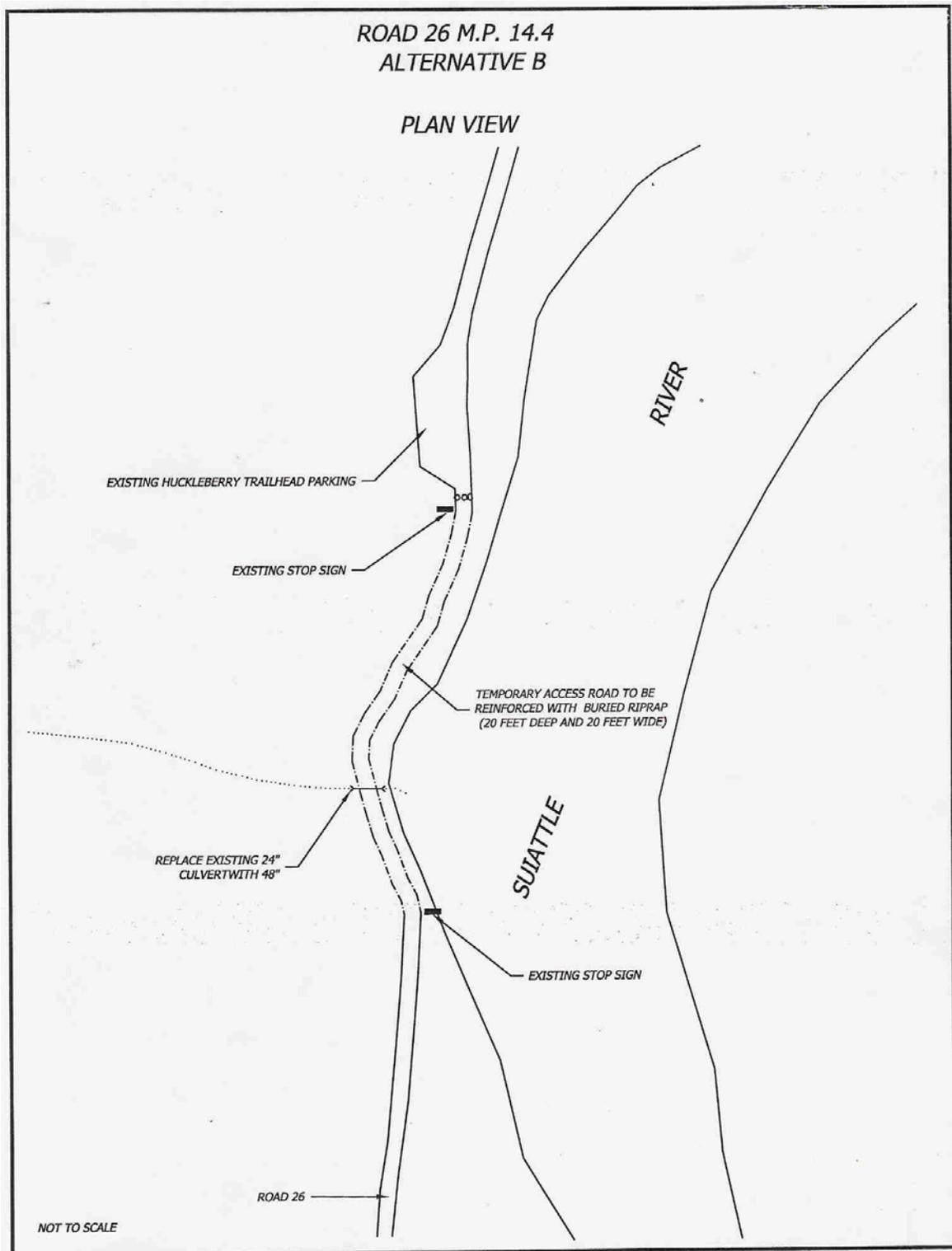
*USFWS. 2004. Skagit Eagle Website. <http://www.skagiteagle.org/>*

*USGS. 2004. Sauk River Flow Data <http://waterdata.usgs.gov/nwis/uv/>*

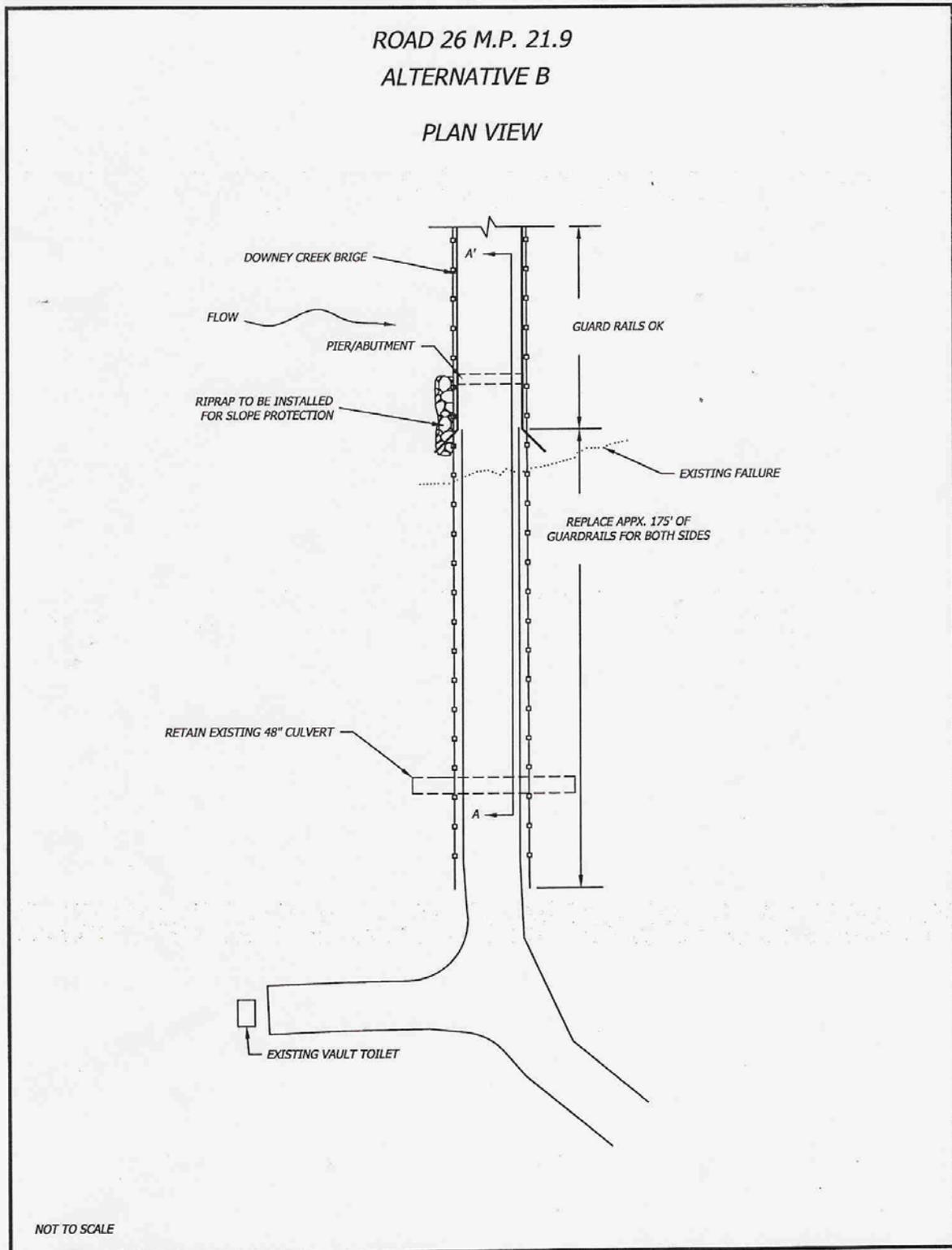
# Appendix B

## Damage Sites and Repairs

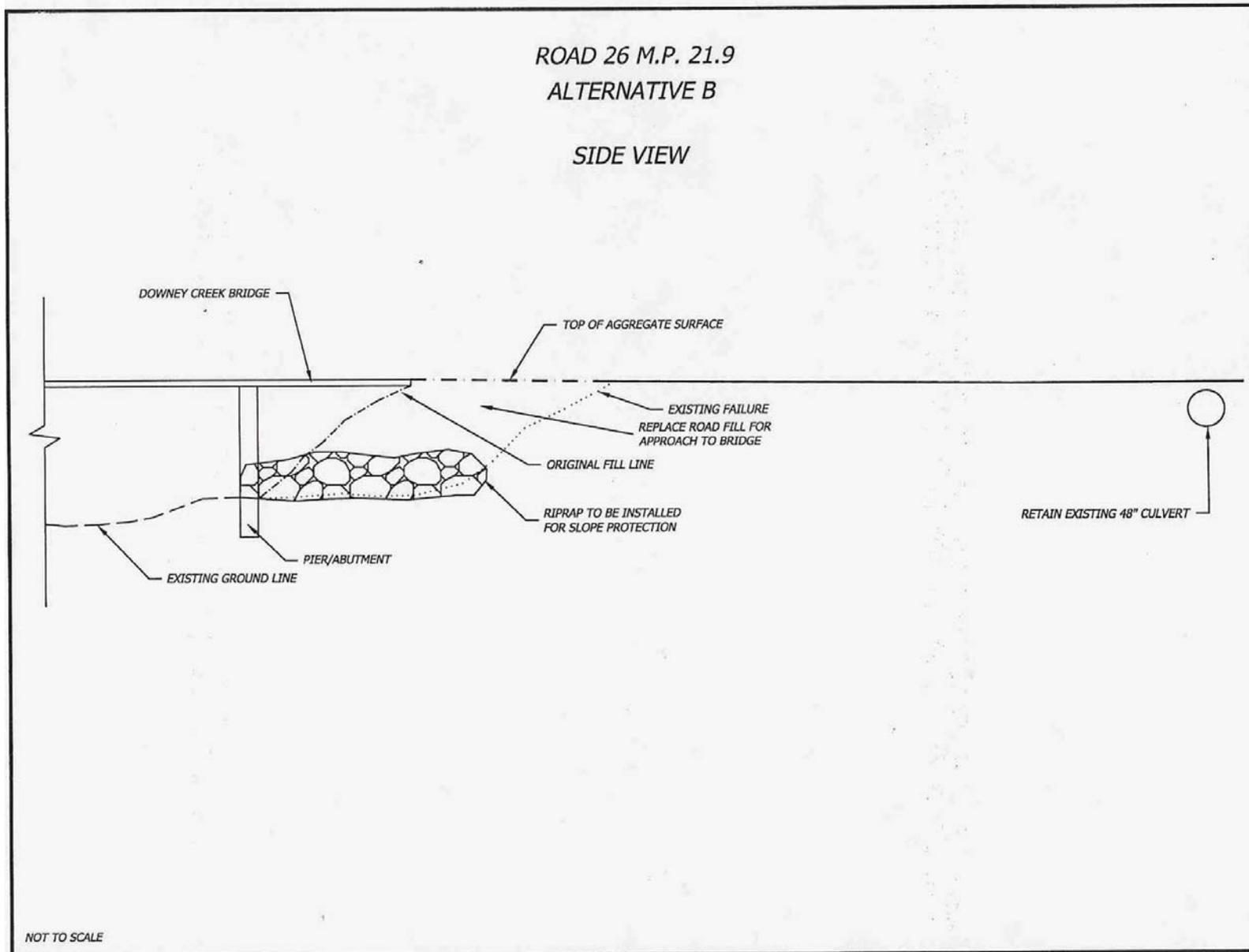
Appendix Figure 1: Line Drawing, Alternative B Site #1 Proposed Repair



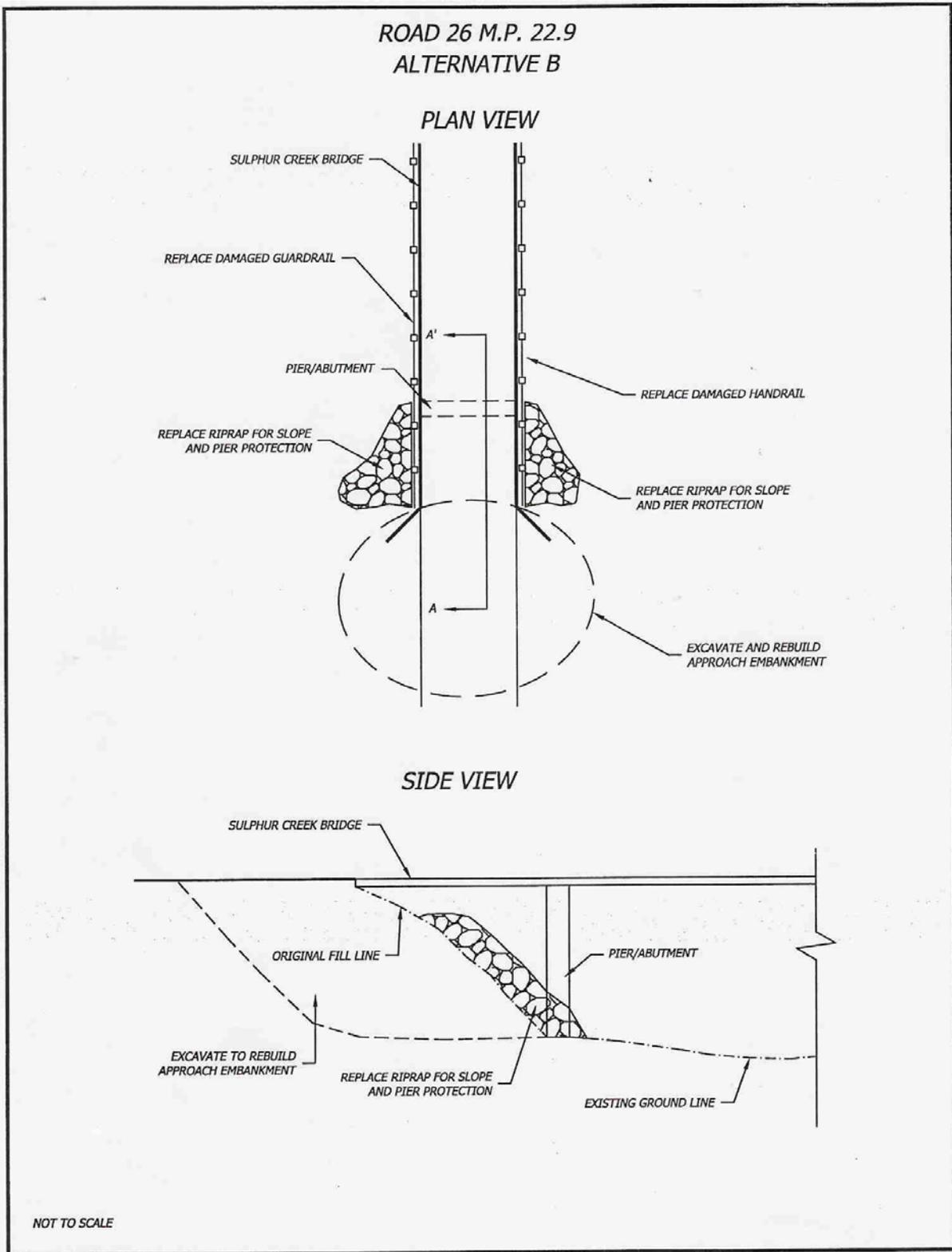
Appendix Figure 2: Line Drawing, Alternative B Site #2 Proposed Repair



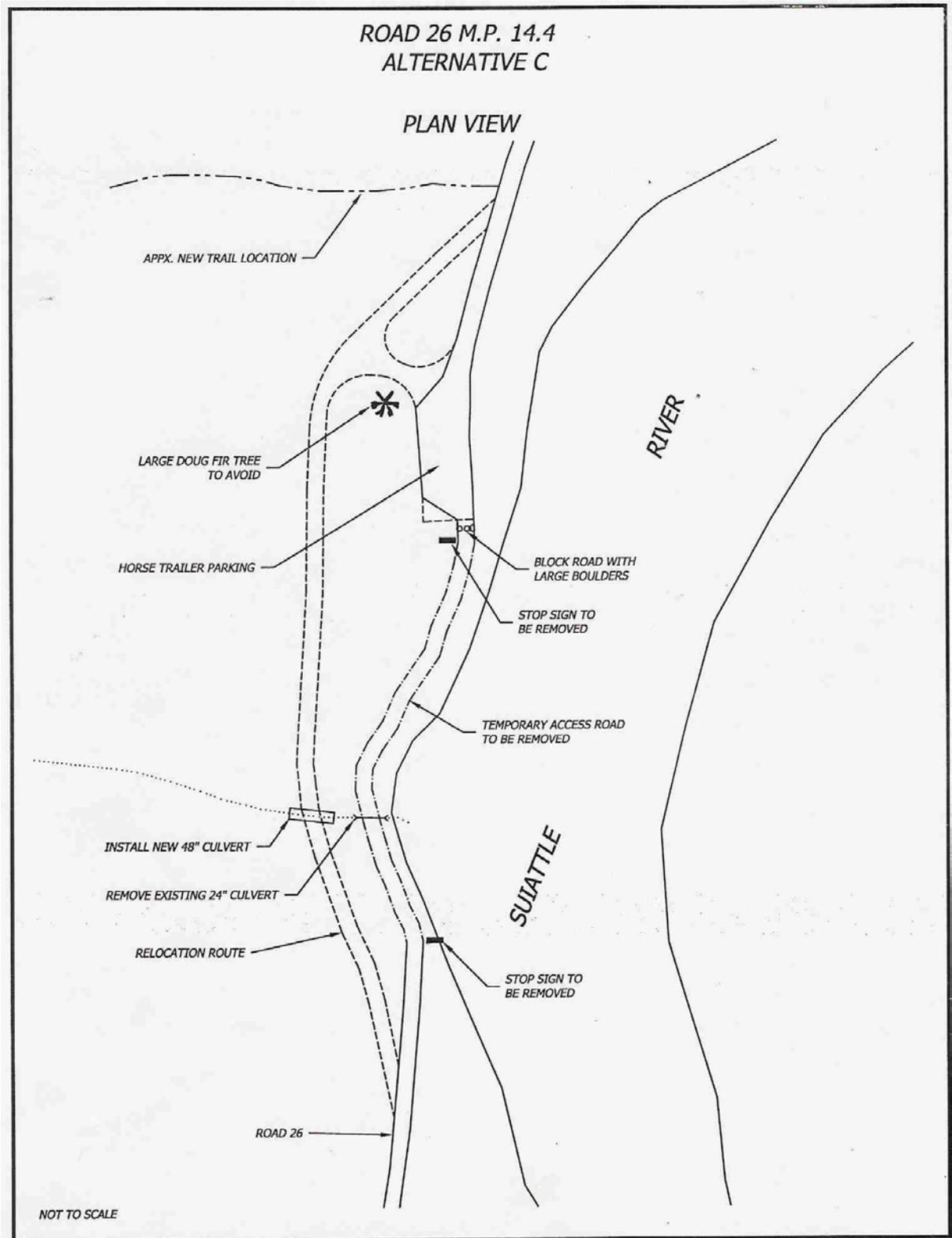
Appendix Figure 3: Line Drawing, Alternative B Site # 2 Proposed Repair



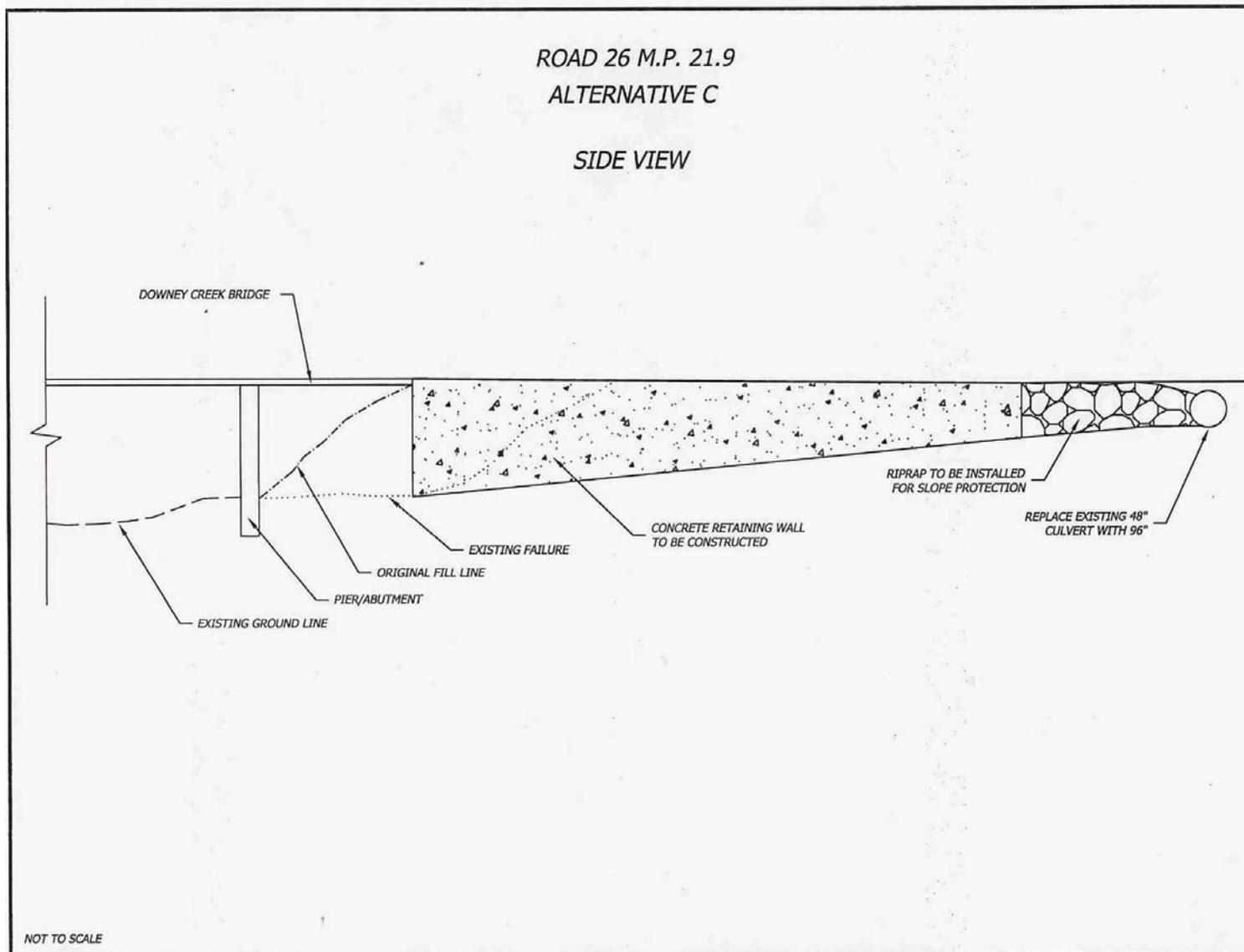
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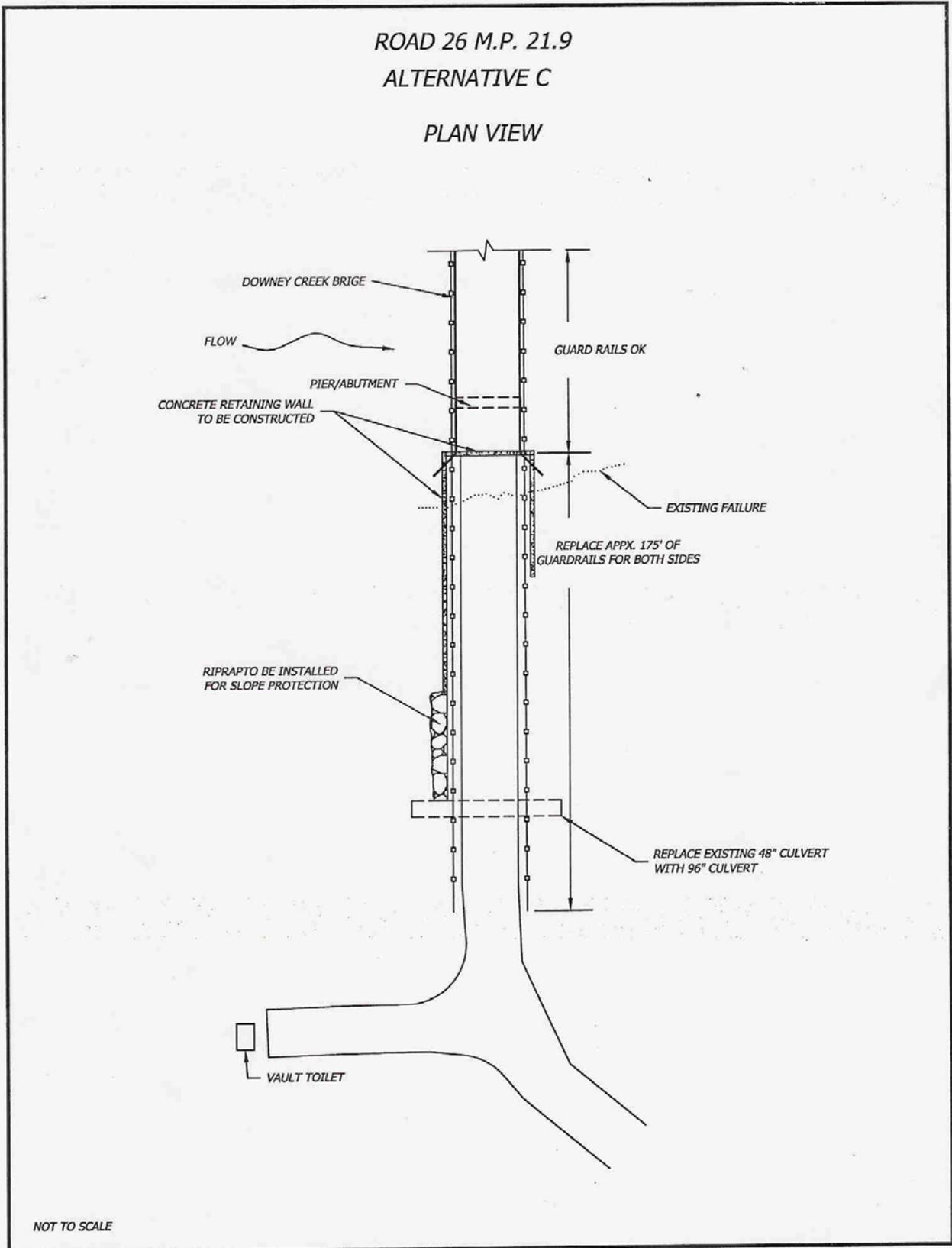
Appendix Figure 5: Line Drawing, Alternative C Site #1 Proposed Repair



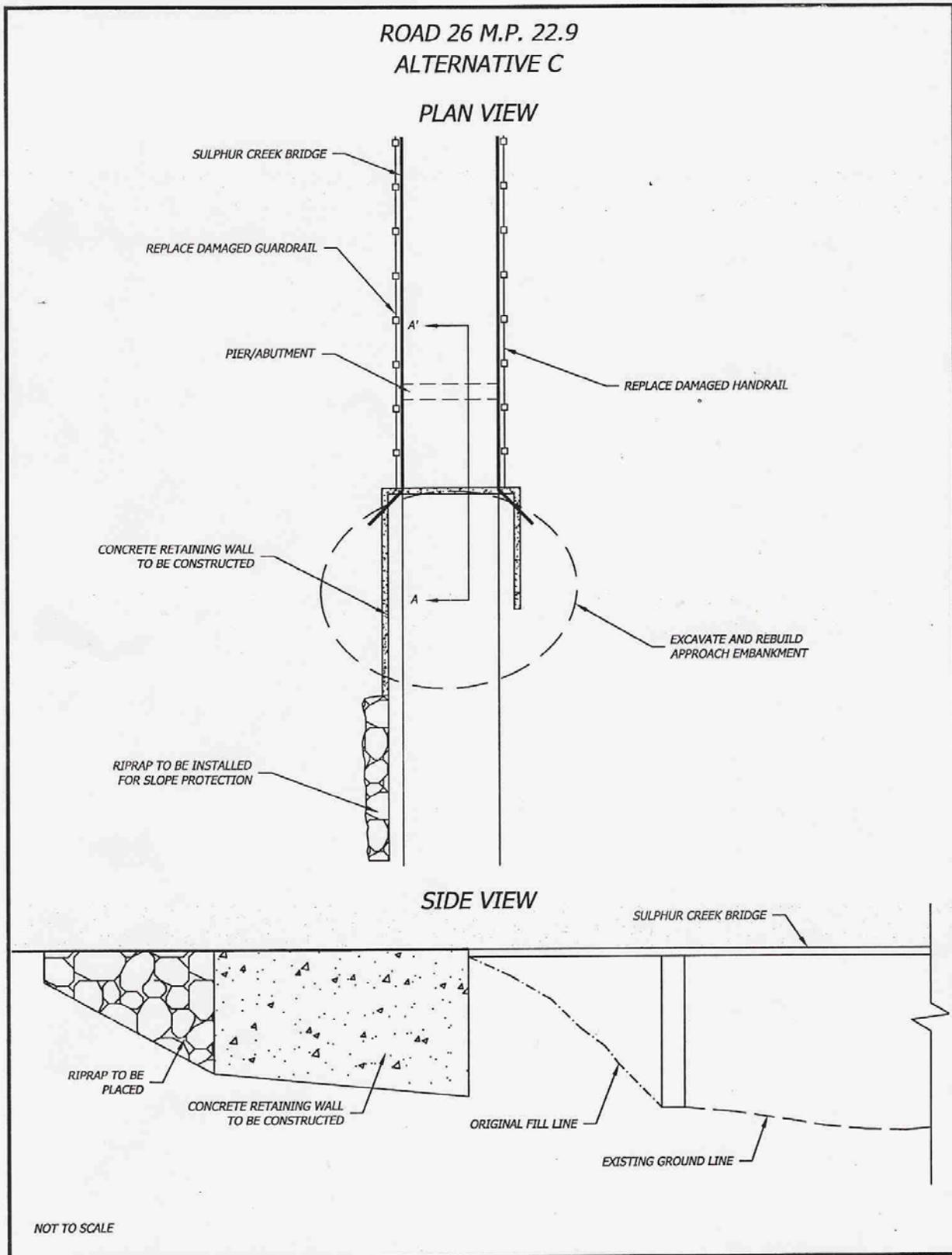
Appendix Figure 6: Line Drawing, Alternative C Site #2 Proposed Repair



Appendix Figure 7: Line Drawing, Alternative C Site #2 Proposed Repair



Appendix Figure 8: Line Drawing, Alternative C Site #3 Proposed Repair



## Flood Damage Photos

Photo- 1 Temporary Road at Site #1, MP 14.4.



Photo- 2 Damage at Site #2, Downey Creek Bridge



Photo- 3 Damage at Site #3, Sulphur Creek Bridge



## Historical Flood Damage Sites on Road 26

The following table displays the flood history on the Road 26 as recorded in the Forest's Roads-Flood Damage Database. This database contains 934 records of sites damaged by one or more of the 14 EFRO-Floods (1974, 1977, 1979, 1980, 1982, 1984, 1989, 1990, 1991, 1994, 1995, 1996, 1999, and 2003). These sites qualified and received FHWA-ERFO funding for repair. When comparing damage across all the flood event years to determine the failure history of a particular site, caution must be used due to the accuracy of the site location. Site location definition is limited by one-tenth of a mile in accuracy as recorded on the FHWA-ERFO Damage Site Report (DSR) form. Over this 30-year flood history on the Forest, there has been milepost odometer reading variability. Based on this, this review is assuming that, when comparing across the various flood event years, any site within a .20 of a mile of another listed site should be considered the same site, unless local knowledge dictates these are truly separate sites.

**Table 1 Historical ERFO Flood Damage Sites on the Road 26 Arterial**

Flood Year	Mile post	Damage Description	Repair Needed	Quantities Lost (cu yds)	Costs \$(M)
1980	22.4	Bridge approach damaged	Repair or replace approach	700	10.000
1990	4.1	Bridge approach damaged	Repair or replace approach	1100	171.000
1990	7.8	Bridge approach damaged	Repair or replace approach	200	5.152
1990	3.0	Bridge approach damaged	Increase span length of bridge	0	321.000
1974	6.8	Cut-slope and fill slope failure	Remove debris, Replace fill	370	2.580
1996	3.37	Ditchline failure	Replace road fill	180	4.890
1996	5.5	Ditchline failure	Replace road fill	60	12.000
1974	2.3	Cut-slope and fill slope failure	Replace road fill	1170	6.000
1974	3.0	Cut-slope and fill slope failure	Replace road fill	160	4.160
1996	3.05	Plugged culvert, fill failure	Clean culvert	0	3.260
1996	1.3	Plugged culvert, fill failure	Clean culvert, fix ditchline	0	2.170
1996	12.6	Plugged culvert, fill failure	Replace culvert w/fish passage culvert	0	33.000
1996	15.8	Plugged culvert, fill failure	Replace culvert w/box culvert	0	15.000
1989	1.0	Plugged culvert, ditchline failure	Clean culvert	550	6.000
1989	2.0	Plugged culvert, ditchline failure	Clean culvert	500	5.000
1996	3.94	Plugged culvert, ditchline failure	Replace w/larger culvert	1500	94.750
1974	2.5	Plugged culvert, road prism failure	Replace w/larger culvert	1500	18.500
1979	2.8	Plugged culvert, road prism failure	Replace w/larger culvert	150	5.200
1979	2.85	Plugged culvert, road prism failure	Replace w/larger culvert	2000	25.700
1979	2.92	Plugged culvert, road prism failure	Replace w/larger culvert	500	11.110
1979	3.01	Plugged culvert, road prism failure	Replace w/larger culvert	950	12.375
1979	10.1	Plugged culvert, road prism failure	Replace w/larger culvert	400	3.450
1980	3.0	Plugged culvert, road prism failure	Replace w/larger culvert	500	5.690
1989	3.5	Plugged culvert, road prism failure	Clean culvert, fix ditchline	50	1.700
1989	4.2	Plugged culvert, road prism failure	Clean culvert, fix ditchline	50	1.700
1989	5.0	Plugged culvert, road prism failure	Clean culvert, fix ditchline	50	1.700
1990	3.7	Plugged culvert, road prism failure	Replace w/larger culvert	500	73.675
1990	4.7	Plugged culvert, road prism failure	Replace culvert w/concrete ford	800	271.540
1990	10.2	Plugged culvert, road prism failure	Replace w/larger culvert	80	7.320
1990	12.6	Plugged culvert, road prism failure	Clean culvert, fix ditchline	80	6.660
1996	2.7	Plugged culvert, road prism failure	Replace culvert w/concrete ford	3000	221.827
1996	10.2	Plugged culvert, road prism failure	Replace w/larger culvert	250	20.480
1996	12.5	Channel and road encroachment	Replace fill, enforce toe of slope	3000	66.420
1980	12.7	Channel and road encroachment	Replace fill, enforce toe of slope	2500	50.230
1980	13.1	Channel and road encroachment	Replace fill, enforce toe of slope	1560	20.660
1990	13.0	Channel and road encroachment	Replace fill, enforce toe of slope	800	60.160
2003	21.9	Bridge approach damage	Repair / replace approach /abutment	2600	86.940
2003	22.9	Bridge approach damage	Repair / replace approach /abutment	200	14.739
2003	14.4	Channel and road encroachment	Reroute road segment	200	49.964

## Appendix C-Cumulative Effects Review Process

Cumulative Impact is the impact on the environment, which results from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor or collectively significant actions taking place over a period of time (40 CFR 1508.7).

### Analysis

Refer to each resource discussion in Chapter 3 for the estimated cumulative effects.

To complete the analysis of cumulative effects for the Suiattle Road Repair project, the Interdisciplinary Team (ID Team) first considered the direct and indirect effects on the environment that are expected or likely to result from the proposed action and the alternatives to the proposed action. Once these effects had been determined, the ID Team then assessed the residual (or still on-going) effects of past actions that are, in the judgment of the resource specialists, relevant and useful: there is the possibility they could add to the direct and indirect effects of the proposed Suiattle Road Repairs alternatives.

The team then assessed the spatial extent of the effects of the alternatives, resource by resource, to determine if they would add to modify or mitigate the on-going effects of the past actions/expected future actions. For each resource, an “Area of Potential Effect” (APE) was determined for each subject; see project files. The resource specialists then determined if any potential, existing, or residual effects were present from the other identified projects. If there was no overlap in time (e.g. no remaining effects from past projects) *AND* in space (extent of effects), there was no cumulative effect.

The initial area is centered on the upper Suiattle River Watershed. The geographic area was bounded by the ridges above the Suiattle River.

The following table lists all of the past, present, or reasonably foreseeable actions within the Suiattle Watershed that analyzed for potentially spatially and temporally overlap with the effects of the Suiattle Road repair, and where cumulative effects could occur.

**Table 2 Past, Present, or Reasonably Foreseeable Actions**

<b>Activity</b>	<b>Extent/Description</b>	<b>Comment</b>	<b>Road Miles from Project</b>
<b>Boundary Bridge Repair</b>	Add another bridge to span new channel on north side.	Construct in 2007. Some downstream sedimentation estimated	MP 9.9 on Road 26 so 4 miles downstream
<b>Suiattle Trail Repairs</b>	Trail relocation along first 2 miles of trail 784.	Construct in 2006. Minor short-term sediment, blasting, no habitat removal	1 mile east of MP 22.9
<b>Suiattle River Trail Bridge Replace</b>	Replace trail bridge across Suiattle River at beginning of Milk Creek Trail 790	Construct in 2006. Minor short-term sediment, use helicopters.	0.5 miles east of MP 22.9
<b>Road 25 Closure/Storage</b>	2.5 miles of waterbars and culvert removals	Completed in 2002. Minor short-term sediment with improved local hydrology.	Across Suiattle River from MP14.4
<b>Road 26 Captain Creek Culvert Replacements</b>	Fish passage improvement at Captain and other creeks	Completed 1998. Increased access to spawn/rearing habitat for coho. Short-term sediment with improved local hydrology.	1 mile west of MP 14.4 on Road 26.
<b>Instream treatments</b>	Structures and off-channel projects for spawning and rearing habitats in multiple streams, including Sulphur Creek.	Completed mid-1980s into early 1990s. Many have suffered effects from flooding events. Increased spawning and rearing. Short-term sediment and bedload.	0 at Sulphur; up to 16 miles west on Road 26.
<b>Road Repairs</b>	Multiple fixes from past floods in 1974, 79, 80, 89, 90 96. Replace fill and riprap, clear and replace with larger culverts along Roads 25, 26, other roads.	Short-term sediment with improved local hydrology and fish passage.	Road 26 MP 10.2, 12.6, 13.0, 15.8, 22.4, 22.9 (same as Site #3)
<b>Road Maintenance</b>	Routine road maintenance on Road 26 is brush every 3 years and grade/blade 2 times yearly.	Short-term sediment with maintained ditches.	Road 26 to end
<b>Forest Service Timber Harvest</b>	7810 acres total in WA – 2450 acres 1980 to 1995, 5360 acres 1930 to 1979 mostly by clearcut	Sedimentation, changes in hydrology, removal of riparian vegetation and old growth habitat, reduction of instream wood	
<b>Private Land</b>	12,979 acres in WA	Primary activity is timber harvest, mostly in lower part of WA	Mostly below/west of MP 10, Jimmy Price 80 ac parcel MP19.3.

## Appendix D Glossary of Commonly Used Terms

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**Activity center:** The core of an owl's territory and the focal point of protection measures. Most frequently located in or near the highest concentration of remaining suitable habitat.

**Aggradation:** Deposition in one place of material eroded from another. Aggradation raises the elevation of streambeds, flood plains, and the bottom of other water bodies.

**Alluvial:** Originate through the transport and deposition from running water.

**Alluvial fan:** A low, outspread mass of loose materials and/or rock material, commonly with gentle slopes, shaped like an open fan or a segment of a cone, deposited by a stream at the place where it issues from a narrow mountain valley upon a plain or broad valley, or where a tributary stream is at its junction with the main stream. It is steepest near the mouth of the valley where its apex points upstream. Moreover, it slopes gently and convexly outward with decreasing gradient.

**Anadromous fish:** Fish that are hatched and rear in freshwater, move to the ocean to grow and mature, and return to freshwater to reproduce. Salmon and steelhead are examples.

**Carrying capacity:** The maximum number of organisms that can be supported in a given area of habitat at a given time.

**Closed road:** A road that remains part of the transportation system, but motorized use has been eliminated, prohibited, or restricted during all or certain times of the year.

**Concern species:** Species whose populations are of concern to biologists on the Mt. Baker-Snoqualmie National Forest. An informal designation.

**Critical habitat:** (Endangered Species Act) defined as an area occupied by a species listed as threatened or endangered within which are found physical or geographical features essential to the conservation of the species, or an area not currently occupied by the species, which is itself essential to the conservation of the species. As defined in the ESA "conservation" means any and all methods and procedures, and the use of those, needed to bring a species to recovery—the point at which the protections of the ESA are no longer needed.

**Cumulative effect:** The effect on the environment that results from the incremental effect of the action, when added to the effects of other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes the other actions and regardless of land ownership on which the other actions occur. An individual action when considered alone may not have a significant effect, but when its effects are considered in sum with the effects of other past, present, and reasonably foreseeable future actions, the effects may be significant. They can occur when small, incremental amounts of habitat are lost over time through a variety of management activities across a landscape.

**Debris avalanche:** A rapid moving mass of rock fragments, soil, and mud of various sizes not reaching a stream channel.

**Debris fans:** A gently sloping fan shaped mass of deritus formed as a result of upslope or upstream erosional events.

**Debris flow:** A rapid moving mass of rock fragments, soil, and mud with more than half the particles being larger than sand size.

**Debris flows:** (Lahar) a flowing mixture of water-saturated rock debris that forms on the slopes of a volcano, and moves downslope under the force of gravity, sometimes referred to as a mudflow.

**Decommissioned road:** On the MBSNF, a road that no longer is serving a current or planned future access need and has been removed from the transportation system maps and database. The ground occupied by the road corridor is managed according to the land allocation in which it is located.

**Degradation:** Erosional removal of materials from one place to another. Degradation lowers the elevation of streambeds and floodplains.

**Depressed stock:** A stock of fish whose production is below expected levels based on available habitat and natural variations in survival rates, but above the level where permanent damage to the stock is likely.

**Discharge:** Volume of water flowing past reference point per unit time (usually expressed as cubic meter/second).

**Early seral (Regional Ecological Assessment Program [REAP]):** An ecological age class designation. Early successional condition with open canopy generally with less than 60 percent overstory tree cover and less than 2 inches mean diameter breast height. Vegetation is typically some combination of graminoids, forbs, and shrubs, and can have tree seedlings or saplings.

**Early seral (Terrestrial Vertebrate Habitat Condition Mode [TVHCM]):** A structural or size-class designation referring to sparsely vegetated, non-forest stands with 60-90 percent bare ground, including grass-forb, shrub, open sap-pole, and sparse vegetation. These stands may be included in early, mid, or late seral as defined in the REAP.

**Ecosystem management:** A land management system that strives to maintain the natural processes and balances as well as provide for human use

**Ecotone:** Edge habitat. For the purpose of this analysis, the area within 400 feet of the edge between mid/late seral forested stands and early seral of non-forested stands.

**Endangered species:** A native species found by the Secretary of the Interior to be threatened with extinction.

**Escapement:** Those fish that have survived all fisheries and will make up a spawning population.

**Ethnographer:** One who studies or is proficient in ethnography, which is the branch of anthropology that considers man geographically and descriptively, treating of the subdivision of races, the causes of migration etc.

**Extirpated:** Eliminated from a local area.

**Fifth Field Watershed:** A hierarchical catalog system designed by the U.S. Geological Survey and the Water Resource Council comprised of Region, Subregion, Accounting Unit, and Cataloging Unit. The Forest Service has added two additional levels of finer resolution. The structures for these levels are called the Watershed and Subwatershed. The Fifth Field Watershed is the fifth of these resolutions, or the "Watershed".

**Floodplain:** Level lowland bordering a stream onto which the stream spreads at flood stage.

**Fragmentation:** The degree to which the landscape is broken into distinct patch types.

**Guild:** A group of species aggregated together based on similarities in habitat requirements and anticipated response to changes in landscape conditions.

**Habitat Conservation Area (HCA):** Part of a network of habitat proposed by the Interagency Scientific committee to protect spotted owls. A contiguous block of habitat to be managed and conserved for breeding spotted owl pairs, connectivity, and distribution of owls. Has been replaced by late successional reserves as the working management unit for protecting spotted owl habitat.

**Healthy stock:** A stock of fish experiencing production levels consistent with its available habitat and within the natural variations in survival for the stock.

**Hibernacula:** Sites where hibernation occurs.

**Human influence zone:** Areas of human activity (recreation sites, roads, trails, buildings, mines, hydropower operations, etc.) buffered by 1/4 mile around trails and 1/2 mile around roads and other sites.

**Inner gorge:** Consists of steep (50 percent or greater), continuous slopes immediately above a channel.

**Landslide:** Any sudden movement of earth and rocks down a steep slope.

**Large woody debris:** Pieces of wood larger than 10 feet long and 6 inches in diameter located within a stream channel.

**Late seral (REAP):** An age class designation. Late successional condition with a single or multiple canopy structure, including mature, large sawtimber, and old growth stands.

**Late seral (TVHCM):** A structural of size-class designation referring to mature or old growth stands. These stands roughly correspond to the late seral forested stands as defined in the REAP.

**Late-successional forest:** Late-successional forests are those forest seral stages that include mature and old growth age classes. (ROD USDA-USDI, Standards and Guidelines 1994, B-1)

**lava flows:** Stream of molten rock that erupts relatively nonexplosively from a volcano and moves slowly downslope.

**Road Maintenance Level 1 (ML1):** Intermittent service roads managed as closed to vehicular traffic, and kept in storage until the next project access need; the closure period must exceed one year.

**Road Maintenance Level 2 (ML2):** Roads open for use by high clearance vehicles. Passenger car traffic is not a consideration. Traffic is normally minor, usually consisting of one or a combination of administrative, permitted, dispersed recreation or other specialized uses.

**Road Maintenance Level 3 (ML3):** Roads open and maintained for travel by a prudent driver in a standard passenger car. Roads are typically low speed, single lane with turnouts and spot surfacing.

**Road Maintenance Level 4 (ML4):** Roads that provide a moderate degree of user comfort and convenience at moderate travel speeds. Most roads are double lane and aggregate surfaced; however, some may be single lane. Paved surfaces or dust abatement may be used.

**Road Maintenance Level 5 (ML5):** Roads that provide a high degree of user comfort and convenience. These roads are normally double lane and paved, although some may be aggregate surfaced and dust abated.

**Mid-seral (REAP):** An age class designation. Mid successional condition. Defined in FEMAT as that period in the life of a forest between crown closure and first merchantability.

**Mid-seral (TVHCM):** A structural or size-class designation referring to closed sap-pole, open mature, closed immature and residual stands. These stands roughly correspond to the mid seral forested stands as defined in the REAP.

**Native resident fish:** An indigenous stock of fish that has not been substantially impacted by genetic interactions with non-native stocks or by other factors, and is still present in all or part of its original range.

**Neotropical migrants:** Birds that migrate from North America to regions south of the Tropic of Cancer (latitude 23 1/2 degrees north) to winter.

**Non-native fish:** A fish stock that has become established outside of its original range.

**Noxious weeds:** Invasive non-native plant species, some of which are toxic to livestock and/or wildlife as designated by the State Noxious Weed Board under the Washington State Noxious Weed Law RCW 17.10.

**Omnivore:** Animal that feeds on both plants and animals.

**pH:** A measure of the hydrogen ion concentration in a solution.

**Plant association (PA):** The basic unit of vegetation including all its successional stages; a potential natural plant community of definite floristic composition and uniform appearance.

**Plant association group (PAG):** Groups of plant associations with similar floristic characteristics.

**Pyroclastic flows:** A hot (570-1470 degrees F), dry, fast-moving, and high-density mixture of ash, pumice, rock fragments, and gas formed during explosive eruptions or from the collapse of a lava dome.

**Pyroclastic surges:** Turbulent, low-density cloud of hot rock debris and gases that moves over the ground surface at high speed. Similar to a pyroclastic flow but of much lower density (higher gas to rock ratio).

**Rendezvous sites:** Temporary resting sites used for several days at a time by a wolf pack during summer months while pups are developing.

**Riparian zone:** Those terrestrial areas where the vegetation complex and microclimate conditions are products of the combined presence and influence of perennial and/or intermittent water, associated high water tables, and soils that exhibit some wetness characteristics. Normally used to refer to the zone within which plants grow rooted in the water table of these rivers, streams, lakes, ponds, reservoirs, springs, marshes, seeps, bogs, and wet meadows.

**River mile:** Length of the river course extended from salt-water confluence to headwaters.

**Road decommissioning treatment:** Treatment (including obliteration) applied to some roads no longer needed, which if treatment is not performed, present an unacceptable hazard to habitats and watershed condition. It removes those elements of a road and reroute or impede hillslope drainage and present slope stability hazards.

**Road maintenance levels:** one of five levels assigned based on the maintenance required to provide the desired type of access.

**Road Obliteration:** Full physical site restoration that attempts to re-contour slopes with the intent to completely remove the road from the landscape.

**ROD:** Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl. Sometimes known as “The President’s Plan”, it is the guiding document for doing watershed analysis.

**Salmonid:** Any member of the taxonomic family Salmonidae, which includes all species of salmon, trout, and char.

**Security habitat** Habitat that is outside of human influence zones.

**Sensitive species:** A species that occurs on the Regional Forester’s Sensitive Species list (Forest Service Manual 2670). Includes species that are candidates for listing under the Federal Endangered Species Act.

**Seral:** Of or pertaining to the series of stages in the process of ecological succession.

**Silt:** A soil particle between 0.05 and 0.002mm in diameter.

**Stock:** Group of fish that is genetically self-sustaining and isolated geographically or temporally during reproduction. The following status descriptions are from SASSI (Washington State Department of Fish and Wildlife and Western Washington Treaty Indian Tribes 1992).

**Stock status:** The current condition of a stock, which may be based on escapement, run size, survival, or fitness level.

**Suitable habitat:** Habitat in which an animal or plant can meet all or some of its life history requirements.

**“Survey and Manage Species”:** Species to be protected through survey and management standards and guidelines on federal lands as identified by the Standards and Guidelines for Management of Habitat for Late-successional and Old-growth Forest and Related Species Within the Range of the Spotted Owl (ROD, Appendix J2).

**Tephra falls:** Materials of all sizes and types that are erupted from a volcano and deposited from the air.

**Threatened species:** A native species likely to become endangered within the foreseeable future.

**Turbidity:** An expression of the optical properties of a sample, which causes light rays to be scattered and absorbed rather than transmitted through the sample. Measured in nephelometric turbidity units (NTUs).

**Ungulate:** Hooved mammal.

**Vegetation series:** A group of habitat types having the same dominant canopy tree species at climax, i.e., western hemlock, silver fir, or mountain hemlock.

**Vegetation zone:** Elevational bands within which a certain vegetation series predominates, e.g., the western hemlock zone occurs between 1,400 and 3,500 feet elevation in the watershed

**Wetland:** Lands where saturation with water is the major factor in determining soil development and the types of plants that grow there.