United States Department of Agriculture
Forest Service
Pacific Northwest Region
P.O. Box 3623
Portland, OR 97208-3623
333 S.W. First Avenue
Portland, OR 97204

File Code: 2350

Date: January 31, 2000

Colonel Randell J. Butler
District Commander
U.S. Army Corps of Engineers
P.O. Box 2946
Portland, OR 97208-2946

Dear Colonel Butler:

Enclosed is our finding under Section 7(a) of the Wild and Scenic Rivers Act for a private property bank stabilization proposal on the Upper Deschutes River in Deschutes County, Oregon (DSL Joint Permit Application # GA 17575). The proposed project will replace existing rip-rap, other hardened bank stabilization structures, and two docks with "soft" structure, native riparian and upland vegetation, and one community dock for the three properties. Based on this analysis, I find that the proposed project will not have a direct and adverse effect on the river's free-flow, water quality or outstanding values.

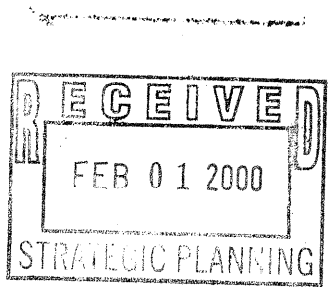
If any further coordination is required, please contact Mollie Chaudet on the Bend-Ft. Rock Ranger District of the Deschutes National Forest at 541-383-4769.

Sincerely,

Linda Goodman

HARV FORSGREN
for Regional Forester

Enclosure



DESCHUTES NATIONAL FOREST
BEND-FT. ROCK RANGER DISTRICT
DESCHUTES COUNTY, OREGON

Mills Bioengineering Project - Deschutes River
Section 7(a) Determination

Introduction

Section 7(a) of the Wild and Scenic Rivers (WSR) Act requires the river-administering agency to evaluate the effects of a federally assisted water resources project proposed within a WSR corridor on the river's free-flowing condition, water quality and outstandingly remarkable values (ORVs). Congressional intent was for the rivers included in the National System be managed to as near natural state as reasonably possible; eliminating activities such as rip-rapping stream banks, channelization, construction of dams and other facilities, or other activities which may alter the natural appearance and function of the river. The Section 7(a) analysis displays the potential impacts of the project on free flow, water quality, and geology, cultural resources, vegetation, recreation and fisheries values found to be outstandingly remarkable on the Deschutes WSR.

Implementation of this project requires a Section 404 permit (under the Clean Water Act) from the Army Corps of Engineers. Prior to the issuance of that permit, the Forest Service has the responsibility to determine whether the proposed project would have a direct and adverse effect on the river's free-flowing condition, water quality and ORVs. The following analysis is a summary of the impacts of a proposal to replace existing docks, rip-rap, and other "hard" stabilization measures along approximately 285 lineal feet of river bank with "soft" stabilization measures on the Upper Deschutes River near Sunriver.

Purpose and Need for Action

The proposed project lies within an area of dense residential development within the river corridor. Prior to the river's designation, landowners have used a variety of "hard" stabilization techniques to prevent erosion caused largely by the operation of an irrigation dam upriver of the proposed project area. The landowners in this case have employed rip-rap such as wooden and concrete retaining walls, old tires, rock, and other readily available materials to help prevent that erosion. There were also three docks that were in place at the time of designation, although only two are presently usable. One of the landowners, Al Mills, had stabilized the streambank on his property by building an elaborate stairway, wood terrace and dock without permit in violation of state, county, and federal requirements. Part of the proposed project would include a remedy for that fill and removal violation.

Consistency with Management Goals and Objectives

Comment: This section provides excellent context.

The *Upper Deschutes Wild and Scenic River and State Scenic Waterway Comprehensive Management Plan* (River Plan) was signed by 11 different tribal, federal, state, and local government agencies in July, 1996. The River Plan provides specific standards and guidelines for activities on federal and private lands to protect and enhance the ORVs for which the river

was designated in accordance with both federal and state law. The project area is within segment 3C of the Upper Deschutes River. This segment is not in the State Scenic Waterway program. The ORV's for segment 3 are geology, cultural resources, vegetation, recreation, and fisheries.

Although designated as a federal WSR, the water rights within the river are entirely allocated to irrigation uses. Thus the flow of the river is completely controlled by irrigation needs. This results in a flow regime that is significantly altered from what would otherwise be the river's natural hydrologic regime. Being a spring-fed system, flow fluctuation within the river would normally be minimal when compared with a surface-flow-dominated system. During the irrigation season, flows approximate a 25-year flood event for six months of every year. This results in significantly accelerated streambank erosion and channel modification, and makes restoring historic levels of large wood to the stream difficult.

The River Plan provides direction for considering soil bioengineering techniques when replacing existing or proposing new bank stabilization projects. It also identifies standards for replacing large woody material within the river channel that was once present, but was removed when the river was used as a medium for log transport from Wickiup and Crane Prairie Reservoirs and other early logging activities to the mills in Bend.

Other management plans that are relevant to the proposed project area include the *Oregon Plan for Salmon and Watersheds* (1997), and the Oregon Department of Fish and Wildlife *Deschutes River Sub-basin Fish Management Plan* (1996). All of these plans encourage restoration of riparian zones and fish habitat. The Deschutes River within the project area is included on the Oregon Department of Environmental Quality list of water quality impaired rivers (303(d) list). The parameters for which it is listed are turbidity, sedimentation, flow modification, dissolved oxygen, and habitat modification.

The Proposed Activity

The proposed activity is located adjacent to and within the Deschutes River at approximately river mile 192.7 (refer to map). The proposed activity would occur entirely on private land, and is proposed jointly by three landowners: Al and Sela Mills; Ralph Krellwitz; and Mark and Susan Hosack. The project proponents have also applied for grant assistance for the project from the Upper Deschutes Watershed Council, and the Upper Deschutes Mitigation and Enhancement Fund administered by the Oregon Department of Fish and Wildlife (ODFW). The proposed activity would include removal of all existing rip-rap, hardened bank structure protection, stairs, and docks and replacement with "soft" or natural structures, native vegetation, and a single stairway and floating community dock to serve all three landowners (see Exhibit A).

The objectives of the landowners are to improve bank stability, increase the amount of riparian and upland vegetation along the streambank, maintain channel integrity, improve aesthetics, and provide for their access to the river.

The proposed project would meet those objectives using a combination of streambank shaping, large wood and rock placement, and riparian and upland vegetation plantings to restore riverbank stability. The project would place whole pine trees with root wads and crowns (12-16 inches diameter at breast height and 60-75 feet in length) at the toe slope of the bank and revegetate the bank with native riparian and upland vegetation. Project implementation is expected to take

three weeks. The project work is expected to be long-term for riverbank stabilization. The life expectancy of the dock is estimated to be at least 25 years. The dock could be readily replaced upon wearing out.

Environmental Impacts

Riverbank stabilization would be accomplished by revegetating the bare soil and physically protecting the bank from future erosive river flow using tree structures. The bank would be sloped back to a 7:12 slope. The majority of the trees would be placed parallel to the bank at the high water line, and would be cabled to the substrate with subterranean anchors to prevent washing out at high summer flows. They would be predominantly submerged during high flow. The trees would be placed as close to the bank as the branches allow. On-site native fill material would be placed between the tree and the toe slope of the bank, an area anticipated to be 1-3 feet wide. A fiber mat would be set over the bare soil from the tree structure to the top of the slope. Riparian vegetation such as rushes, sedges, and willows would be planted near the water line, and native upland vegetation such as pine trees, grasses, bitterbrush and aspen would be planted upslope. Cables would be attached in a manner that would not be visible to the casual observer. Approximately 2-3 additional trees would be placed with the root wad at the toe slope but with the crown at approximately a 15-20° angle into the channel. These trees would provide additional fisheries habitat. The dock, with dimensions of 16 feet by 20 feet, would be set at the mid-point of the project area after restoration activities are completed. A walkway with steps would lead from the dock to the upper slope.

Project construction would proceed during the low riverflow period in March and April, 2000 or 2001, depending upon funding and permitting processes. Maintaining natural appearance and quality construction would be project priorities.

Approximately .05 mile of riverbank would be affected out of 118.2 miles of riverbank between Bend and Wickiup Dam (both banks).

Relationship to Past and Future Management

Past riverbank stabilization projects have been undertaken by landowners along the river to curb the erosion by placing trees, boulders, concrete chunks, or concrete walls. The effectiveness of these techniques vary widely.

ODFW and the Forest Service have completed fish habitat restoration and riverbank stabilization projects on the Deschutes River in areas immediately downstream of the project area, and in other areas up to 30 miles downstream of the project area. A similar project was recently completed at Big Eddy Rapids near Bend. This type of work may be expanded eventually to other areas of the river from Sunriver to Wickiup Dam.

Describe How the Proposed Activity Will Directly Alter Within-channel Conditions.

(a) What is the position of the proposed activity relative to the streambed and banks?

Proposed improvement activities are designed to reduce riverbank erosion, change sediment depositional patterns, alter hydrological characteristics, and promote bankside vegetative growth. Trees would be placed in the river channel at the toe slope of the banks. The trees would be oriented in a downstream direction, lying flat on the streambed, and would not extend across the river channel. The trees used for fish habitat enhancement would have the root wads lying on the streambed but the crowns would be elevated above the bed. Navigation will not be impeded.

The tree structure would reinforce the banks and vegetation. The tree structures, designed to stabilize the riverbank, would be placed as close as possible to the toe slope of the bank. The riverbank, currently at approximately a 45° angle, would be sloped back to a reduced grade (approximately 27° angle). The top of the slope is approximately 15-20 vertical feet above the river. Some of the material excavated from bank sloping would be used to backfill behind the tree structures (approximately 10-15 cubic yards). Excess material would be spread in areas away from the project area. The edge of the dock closest to the riverbank would be approximately 4 - 8 feet out into the river. A ramp would connect the bank to the dock.

(b) Does the Proposed Activity Result in Changes in:

1) Active Channel Location?

The current lateral migration is at an accelerated rate because of the altered flow regime. Historically the Deschutes River was a very stable, spring-fed river system, with a mean flow of approximately 1190 cubic feet/second (cfs) measured at Benham Falls (water years 1925-41). The Benham Falls gaging station is nearly 13 miles downstream of the project area and includes discharge received from Spring River, which averages about 300 cfs. After construction of Wickiup Dam, which was initiated in 1942 and completed in 1949, the flow regime changed to support downriver irrigation needs. Water is stored during the winter (mid-October to mid-April), reducing flows to as low as 20 cfs below the dam during low precipitation years. The reduced flow in the channel increases the area of the riverbanks and riverbed that are susceptible to freezing. The ash and pumice dominated surface soils experience frost heave, loosening the soil structure and strength. Summer flow (mid-April to mid-October) that may exceed 2500 cfs (Benham Falls) transports the low-density soils downriver, leading to elevated turbidity levels and sedimentation of the gravels. (See flow data in Appendix B.) The river in essence experiences a 25 year flood event for much of the summer. The effects from flow regulation is reduced in the project area from that experienced in upstream reaches due to the stabilizing effects of Fall River and the Little Deschutes River.

The frost heave and the high summer flow cycle over the last 50+ years has led to an acceleration of riverbank erosion and channel morphology changes. The channel has increased in width approximately 20% during this time (UDWSR EIS). Proposed project activities are designed to reduce erosion and increase deposition of sediments along riverbanks and establish natural vegetation. As the project area become more resistant to erosion and begins to build the riverbank due to deposition, the erosive forces of the river may cause an increase in the erosional force exerted against the opposite bank. The bank opposite the project area is heavily vegetated

with sedges, and has a resiliency to erosion. There may be some additional undercutting of these stable banks, increasing hiding cover for fish. The erosion rate on the treated riverbank after implementation of the project would mimic natural conditions prior to flow regulation. There are no anticipated adverse effects to the active channel location of the Deschutes River resulting from the proposed project.

2) Channel Geometry?

The river is approximately 100 feet wide with a maximum depth of about 8 feet within the project area. The width-depth ratio is likely increasing at a slight rate at the project location, but is expected to decrease after implementation as the channel narrows and deepens. The channel may decrease up to 2-3 feet in width, but would probably increase in maximum depth less than 0.25 foot. The width-depth ratio, which is 23.2:1 for the reach from Spring River to the Little Deschutes, a distance of 2.2 miles, would decrease. The cross-sectional area is anticipated to remain nearly the same as the channel narrows and deepens simultaneously.

3) Channel slope?

There are no anticipated changes to the channel slope. The deposition is anticipated to occur at the river margins. In the event of a log jam forming as a result of placement of large woody material, channel slope could decrease immediately upstream of the log jam due to deposition. Direction from the River Plan states log jams are considered an important natural component of the river ecosystem and are to be left without human disturbance whenever possible. Manipulation of log jams is allowed under special circumstances, including if river values are being adversely affected.

4) Channel Form (e.g., straight, meandering, or braided)

The ability of the river to meander on the outside bends would be restricted within the project area, but would not affect the ability to meander up or downstream. The rehabilitation efforts would restore the bank to a more natural erosion rate. In the event of a log jam forming, there would be potential for braiding of the channel. Site-specific analysis would be implemented to determine if manipulation of the jam is necessary.

5) Relevant Water Quality Parameters?

The planned work period is concurrent with the seasonally lowest turbidity levels. There would be a temporary increase in turbidity in the Deschutes River of more than 10% above background levels while equipment worked in the river placing trees. The sources of the turbidity would be entrainment of bed sediment and introduction of sediment from the slope as equipment enters and exits the river, and places the trees. Turbidity levels would be expected to return to background within 30 minutes after the equipment leaves the river, based on observations from past projects that required heavy equipment working instream. An undeterminable volume of sediment would be introduced to the river while sloping of the bank occurs, although the equipment would work from the top of the bank. Sediments introduced from any project activity are anticipated to settle out of the water column within 2 miles downstream of the project area, and turbidity levels would return to background levels. A sediment fence would be deployed to reduce downriver turbidity levels. This device was successful in another bioengineering project

on the Deschutes River in significantly increasing deposition of sediments on-site and reducing downstream turbidity levels.

There would be a long-term benefit to water quality, although immeasurable, because of reduced turbidity associated with bank stabilization. Additional shading provided by planted vegetation and a reduced width-depth ratio may reduce summer water temperatures, but the changes would be immeasurable.

Describe How the Proposed Project Activity Will Directly Alter Riparian and/or Floodplain Conditions.

a) What is the position of the proposed activity relative to the riparian area and floodplain?

The river in and near the project area is characterized by a high bank on one side with virtually no floodplain, and a low bank on the other side with a floodplain across sedge/willow beds that are several hundred feet wide. The riparian vegetation zone is generally thin (<5 feet) along stable slopes in the vicinity of the project area. Where slope is present, the vegetation community quickly transforms into upland species. The proposed project is within the riparian area and floodplain of the Deschutes River. The location is adjacent to a steep slope with a narrow (5 feet) zone of riparian vegetation. Approximately 285 lineal feet of riverbank with steep slopes would be treated with bioengineering techniques. Approximately .15 land surface acres would be treated with tree structures and vegetation. The 4 feet wide, 19 foot long walkway to the dock crosses the narrow floodplain and riparian zone of the river.

b) Does the proposed activity result in changes in:

1) Vegetation Composition, Age Structure, Quantity, Vigor?

The project would be expected to improve the riparian vegetation composition, age structure, quantity, and vigor by reducing the riverbank erosion and replanting riparian vegetation. Deposition of sediments would also encourage establishment of riparian vegetation. Under current conditions, the continually undercutting of the riverbanks limits establishment of riparian and upland vegetation. Concentrating river access to one location (the dock) within the project area would protect and promote riparian vegetation by preventing trampling.

2) Relevant Soil Properties such as Compaction, Recent Bare Ground?

Bare ground on the slopes would eventually become revegetated as erosion of the toe slope is decreased, revegetation is implemented, and access is concentrated to one area.

3) Relevant Floodplain Properties such as Width, Roughness, Bank Stability, or Susceptibility to Erosion?

The proposed project is expected to improve existing floodplain properties within the project area. The width of the floodplain would be increased approximately 2-3 feet adjacent to the tree structures. Placement of structures is expected to reduce erosion, indirectly resulting in revegetation of riverbanks, which would increase floodplain roughness elements. The riparian plantings would also contribute to floodplain roughness. Concentrating river access to one point would reduce susceptibility to erosion that is occurring with multiple access points.

Describe How the Proposed Activity Will Directly Alter Upland Conditions

a) What is the Position of the Proposed Activity Relative to the Uplands?

The proposed activity is adjacent to and includes the uplands. The uplands would be the upper portion of the riverbank.

b) Does the Proposed Activity Result in Changes in:

1) Vegetation Composition, Age Structure, Quantity, Vigor?

There would be beneficial effects to all of these factors after implementation. The current condition is continual erosion of the toe slope of the riverbanks, allowing ravel of the upslope soils. A decrease in ravel would allow for vegetation to become established, which would prevent further ravel. Planting of upland vegetation would also improve the composition, age structure, and quantity. Concentrating access to one walkway would protect and promote upland vegetation by preventing trampling.

2) Relevant Soil Properties such as Compaction, Recent Bare Ground?

There would be reduced bare ground in the uplands after implementation because of the re-establishment of vegetation.

3) Relevant Floodplain Properties such as Width, Roughness, Bank Stability, or Susceptibility to Erosion?

Floodwaters are unlikely to reach into the uplands, except for a very major event. The Deschutes River is a stable, largely spring-fed system that is also regulated upstream at Wickiup Dam. The project would have beneficial effects to bank stability and roughness, and there would be reduced susceptibility to erosion. Floodplain width would increase by 2-3 feet.

c) Will Changes in Upland Conditions Influence Archaeological, Cultural, or Other Identified Resource Values?

There are no known sites within the project area. The proposed project would have no effect on any sites adjacent to the Deschutes River.

Evaluate and Describe How Changes in On-site Conditions can/will alter Existing Hydrologic or Biologic Processes.

a) Does the Proposed Activity Affect:

1) Ability of the Channel to Change Course, Re-occupy Former Segments, or Inundate its Floodplain?

The flow of the Deschutes River is managed for irrigation as previously discussed. This has accelerated the rate that the channel is changing course downstream of Wickiup Dam. In some areas the rate the channel is moving toward former channels is accelerated, while at the same time the river is straightening in some areas, cutting off large bends and leaving oxbows. The unnaturally high summer irrigation flows have increased the ability for the river to inundate its floodplain on a yearly basis. Regulation of the flow at Wickiup Dam however would reduce the flow and the degree to which the floodplain is inundated in the case of a very large flow event.

The proposed project would stabilize the riverbank which would reduce the ability of the channel to move in the present direction of undercutting the bank. The project would not change the ability of the channel to change course at other areas. The ability of the river to occupy former segments is not affected at the project area or at other locations on the river. The ability of the river to inundate its floodplain is not affected.

2) Streambank Erosion Potential, Sediment Routing and Deposition, or Debris Loading?

The proposed project would reduce riverbank erosion within the project area by reducing the erosive force against the toe slope. Concentrating river access to one point would reduce bank trampling and reduce erosion. Sediment delivery from the riverbank to the river would be reduced, and less sediment would be delivered to downstream areas. Some bed sediments may be entrained and deposited downstream in the short term as the channel adjusts from the placement of the tree structures. Debris loading would be increased by 10-12 trees.

3) The Amount or Timing of Flow in the Channel?

There is no expected change in the amount or timing of flow in the Deschutes River from implementing the proposed project. The amount or timing of flow is a function of precipitation levels and releases from Wickiup Reservoir.

4) Existing flow patterns?

The gradient of the Deschutes River within the project area is very low, < 0.5%. During peak flows, which occurs in the summer, velocities within the project area are 2-3 feet/second. The existing flow patterns will change adjacent to each structure. The flow is expected to increase in velocity out from each structure toward mid-channel, decrease velocity immediately upstream of each structure, and decrease between each structure and the river bank. An undetermined percentage of the flow may be directed toward the opposite bank because of structure placements. The opposite bank is resilient to erosion due to its sedge/willow community.

The dock would have minor effects to flow patterns as it would extend only 2 inches down into the water column. Surface velocities would be reduced by the dock on its upstream side oas water is backed up. Surface velocities would be reduced on the downstream side of the dock. Sub-surface velocities would increase as flow goes under and around the dock.

5) Surface and Subsurface Flows?

Please refer to existing flow patterns described above.

6) Flood Storage?

The proposed project would have a slight but beneficial effect in the ability to store floodwaters. A stable, well-vegetated riverbank can store more water than an eroded bank with bare soil.

7) Aggradation/Degradation of the Channel?

The project is not anticipated to have a large effect on channel aggradation/degradation. With reduced erosion of the riverbank at the project area, there would be less sediments to aggrade at downstream locations. Fine sediments would aggrade between the trees placed in the river and the riverbank. This may lead to growth of the bank into the river. There may be some scour, or degradation, of the channel adjacent to the structures toward mid-channel as the velocity of the flow would increase going around the structures, increasing shear stress of the bed at these points. Bed sediments would be entrained that would be deposited at downstream locations as the channel adjusts. As velocities increase under and around the dock, an undeterminable volume of bed sediments would be entrained and deposited at downstream locations.

b. Does the Proposed Activity Affect Biological Processes such as:

1) Reproduction, Vigor, Growth and/or Succession of Streamside Vegetation?

The proposed project would result in improved reproduction, vigor, and growth as the vegetation becomes re-established. Plant succession should progress to grass/shrub and grass/pine/bitterbrush communities where there is presently bare soil.

2) Nutrient Cycling?

The addition of trees and riparian vegetation would increase nutrient cycling (addition of organic material) in the Deschutes River. As the riparian vegetation becomes re-established, leaf fall would add nutrients to the river environment.

3) Fish Spawning and/or Rearing Success?

Spawning habitat for salmonids within and adjacent to the project area is limited, if existent at all. A stabilized riverbank would result in less fine sediment delivered to downstream spawning areas, although volumes of fine sediment would be immeasurable. The tree structures placed for bank protection and fish habitat enhancement would provide some hiding cover for juvenile mountain whitefish, brown trout, and rainbow trout.

4) Riparian Dependent Avian Species?

The proposed project would have a beneficial effect to avian habitat as the vegetation becomes re-established. Many bird species use vegetation within the riparian zone for nesting and foraging.

5) Amphibian/Mollusk Needs?

Improvements to the riparian vegetation would improve amphibian habitat. Any benefits to the aquatic environment (reduced sediment and instream structure) would increase available habitat for amphibians and mollusks in the Deschutes River.

Estimate the Magnitude and Spatial Extent of Potential Off-Site Changes

a) Consider and Document:

1) Changes that Influence Other Parts of the River System.

There are no significant off-site changes anticipated. There would be reduced sediments delivered to downstream reaches in the long term.

2) The Range of Circumstances Under Which Off-Site Changes Might Occur.

If the project proceeds, a decrease in sediments delivered to the river would be realized. In the event that the tree structures broke loose, they would travel downriver an undetermined distance before becoming lodged adjacent to the riverbank or within existing instream wood.

3) The Probability or Likelihood that Predicted Changes Will be Realized.

Similar projects have been successful on the Deschutes River and other river systems in reducing erosion and sediments delivered to the aquatic environment. The likelihood is high that this project would reduce erosion.

b) Specify Processes Involved such as Water, Sediment, Movement of Nutrients.

There may be increased nutrients and reduced sediments to off-site areas, but these would be immeasurable.

Define the Time Scale Over Which Steps 3-7 are Likely to Occur.

a) Review Steps 3-7 Looking Independently at the Element of Time.

The proposed project is expected to begin achieving its objectives within the first year of implementation. Re-establishment of the riparian vegetation to a maturity that functions in holding soils, providing significant leaf fall, and offering wildlife habitat may take 2-3 years.

b) Consider Whether Conditions, Processes and Effects are Temporary or Persistent. That is, Attempt to Define and Document the Time Scale Over Which Effects Will Occur.

Processes, effects, and changes in conditions are expected to be persistent. Within the first year changes would begin to occur, and would continue into the future. The life expectancy of the dock is 25 years or more. Upon wearing out, it could be readily replaced.

Compare Project Analysis to Management Goals and Objectives.

The proposed project is consistent with the River Plan and Environmental Impact Statement (1996), the Oregon Department of Fish and Wildlife Deschutes River Sub-basin Fish Management Plan (1996), and the Oregon Plan for Salmon and Watersheds (1997). These plans encourage restoration of riparian habitat and fish habitat.

References

The procedure used for this analysis was based on "Procedure For Evaluation of Water Resources Projects," Forest Service Manual 2354.76

Upper Deschutes Wild and Scenic River Record of Decision and Final Environmental Impact Statement. 1996. Deschutes National Forest, Bend/Ft. Rock Ranger District, Bend, Oregon.

Upper Deschutes Wild and Scenic River and State Scenic Waterway Comprehensive Management Plan. 1996. Deschutes National Forest, Bend/Ft. Rock Ranger District, Bend, Oregon.

Oregon Plan for Salmon and Watersheds. 1997.

Oregon Department of Fish and Wildlife Deschutes River Sub-basin Fish Management Plan. 1996. Upper Deschutes Fish District, Bend, Oregon.

Deschutes River Stream Survey, 1989-91. Deschutes National Forest, Bend/Ft. Rock Ranger District, Bend, Oregon.

Inland Native Fish Strategy Environmental Assessment, USDA Forest Service, 1995.

Prepared by:
Tom Walker
Bend/Ft. Rock Ranger District Fisheries Biologist
01/19/00

Comment: Excellent discussion of cause and effect to support the findings.

Mills Bioengineering Project
Deschutes River
Section 7(a) Determination

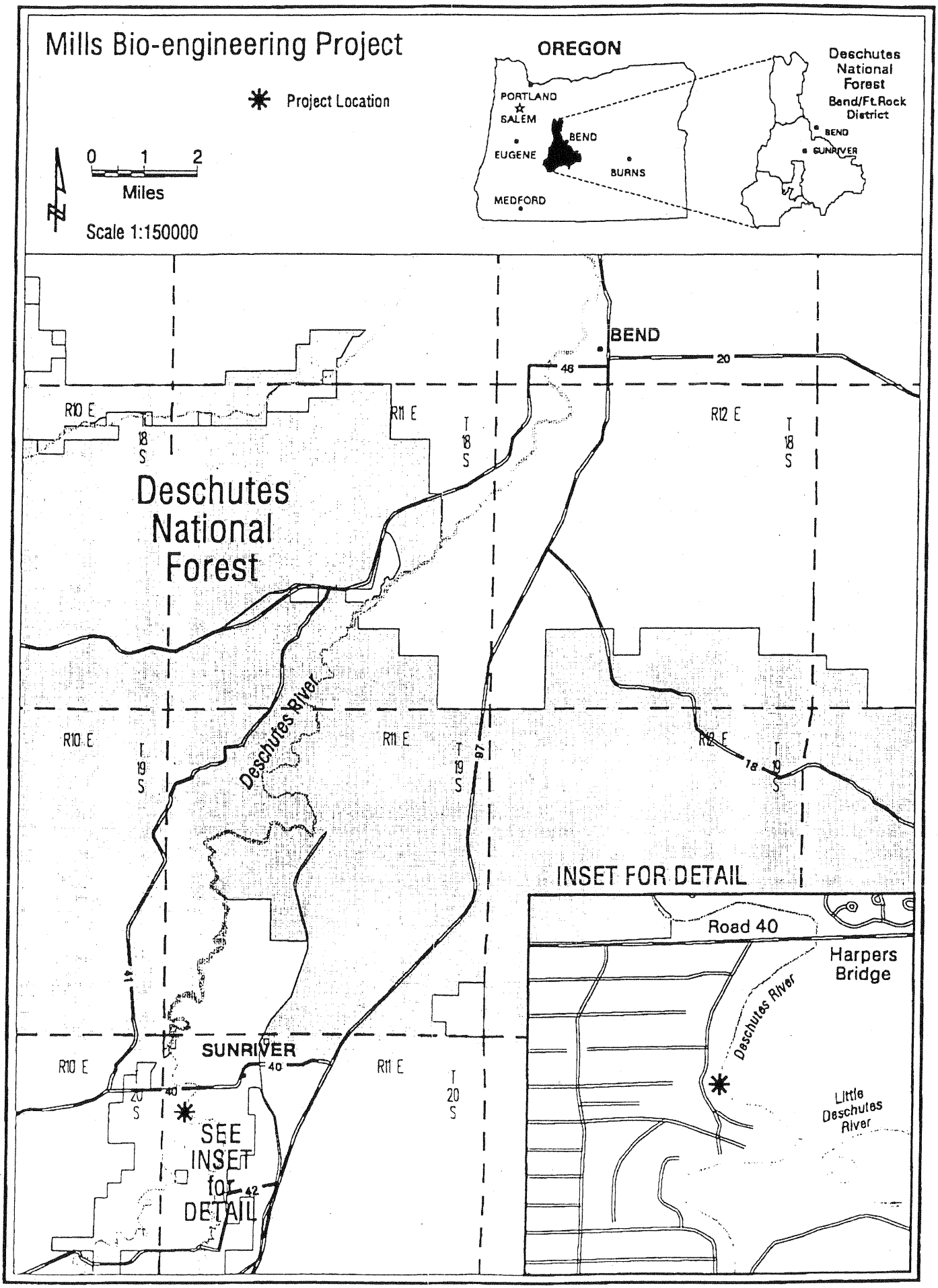
Placement of the tree structures at the toe slope of the riverbank, backfilling, planting riparian vegetation, and installing a free-floating dock would affect the free-flowing nature of the river slightly by preventing bank undercutting and subsequent lateral migration of the river channel along 285 lineal feet of the river. However, the ability of the river to migrate laterally would be improved over current conditions, given the nature of the existing rip-rap and other site hardening techniques in place at the time of the river's designation. Vegetation will exist where currently concrete and other rip-rap prevent the bank from functioning in a normal manner to absorb and disperse water.

The riverbank after project implementation would better mimic natural conditions prior to flow regulation than if no action was taken. The scale of the project is small, and it does not include structural designs that would block or make major changes in flow patterns of the river. Placement of wood in the channel would improve fish habitat, and contribute to meeting the River Plan's long-term goals for restoration of large wood. Scenic values would be improved by removal of the unsightly rip-rap and replacement with native vegetation. Concentration of landowner use to one stairway and a single dock would reduce the human impacts to streambank vegetation and reduce the total amount of streambank devoted to landowner access.

Implementation of the project provides a net effect of protecting and enhancing river values by restoring natural characteristics of the river, and improving water quality. The impacts to the free-flowing condition are minimized to the extent practicable. I have determined that there would be no direct and adverse effect to the river's free flow, water quality, or outstandingly remarkable values.

Linda Goodman
HARV FORSGREN
for Regional Forester

Date 1/31/00


Mills Bio-engineering Project
Project Location
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Scale 1:150000
OREGON
PORTLAND
SALEM
EUGENE
BEND
BURNS
MEDFORD
Deschutes National Forest
Bend/Ft.Rock District
BEND
SUNRIVER
BEND
46
20
R10 E
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Deschutes National Forest
Deschutes River
T 19 S
SUNRIVER
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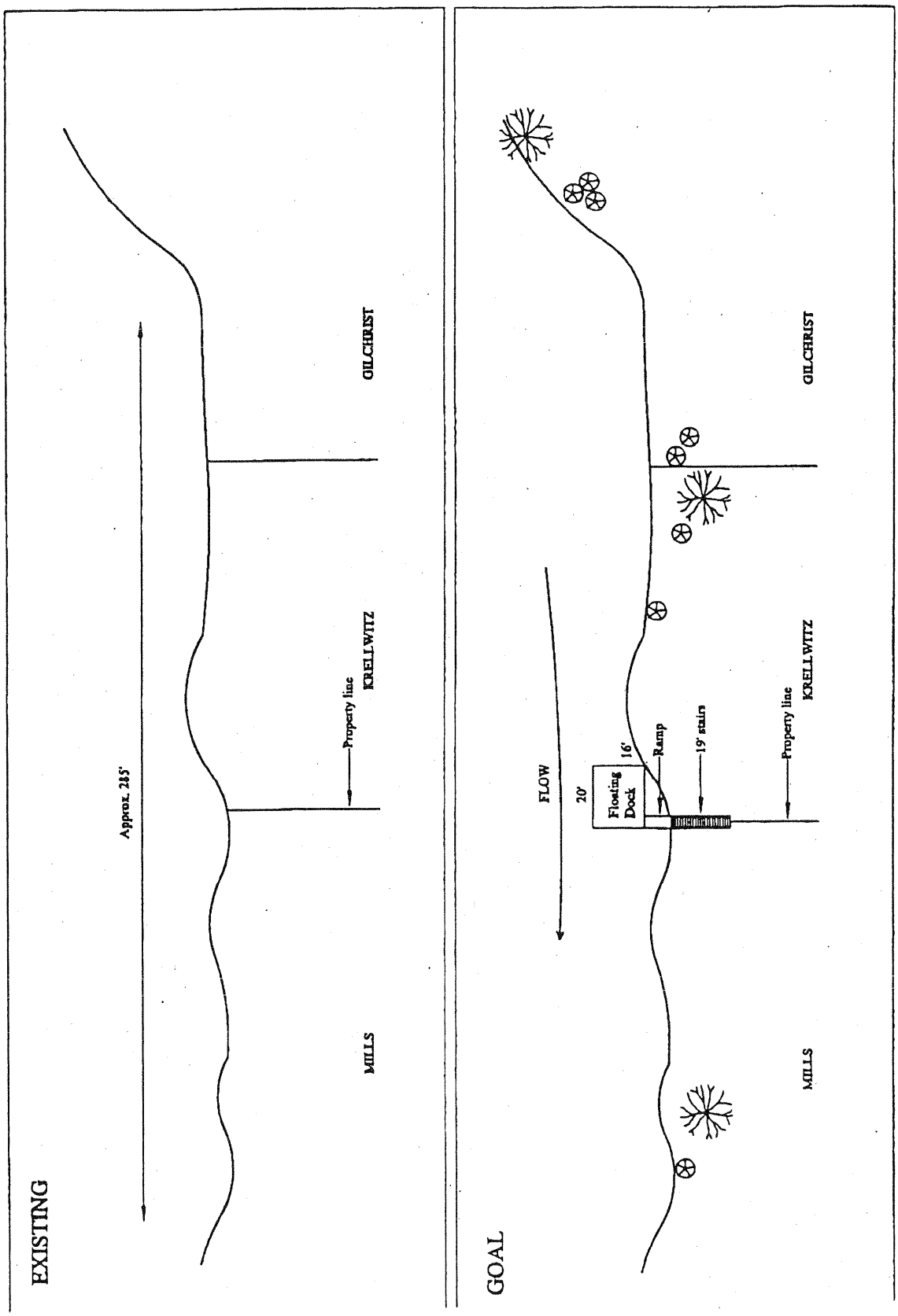
SEE INSET for DETAIL
42
INSET FOR DETAIL
Road 40
Harpers Bridge
Deschutes River
Little Deschutes River

APPENDIX A



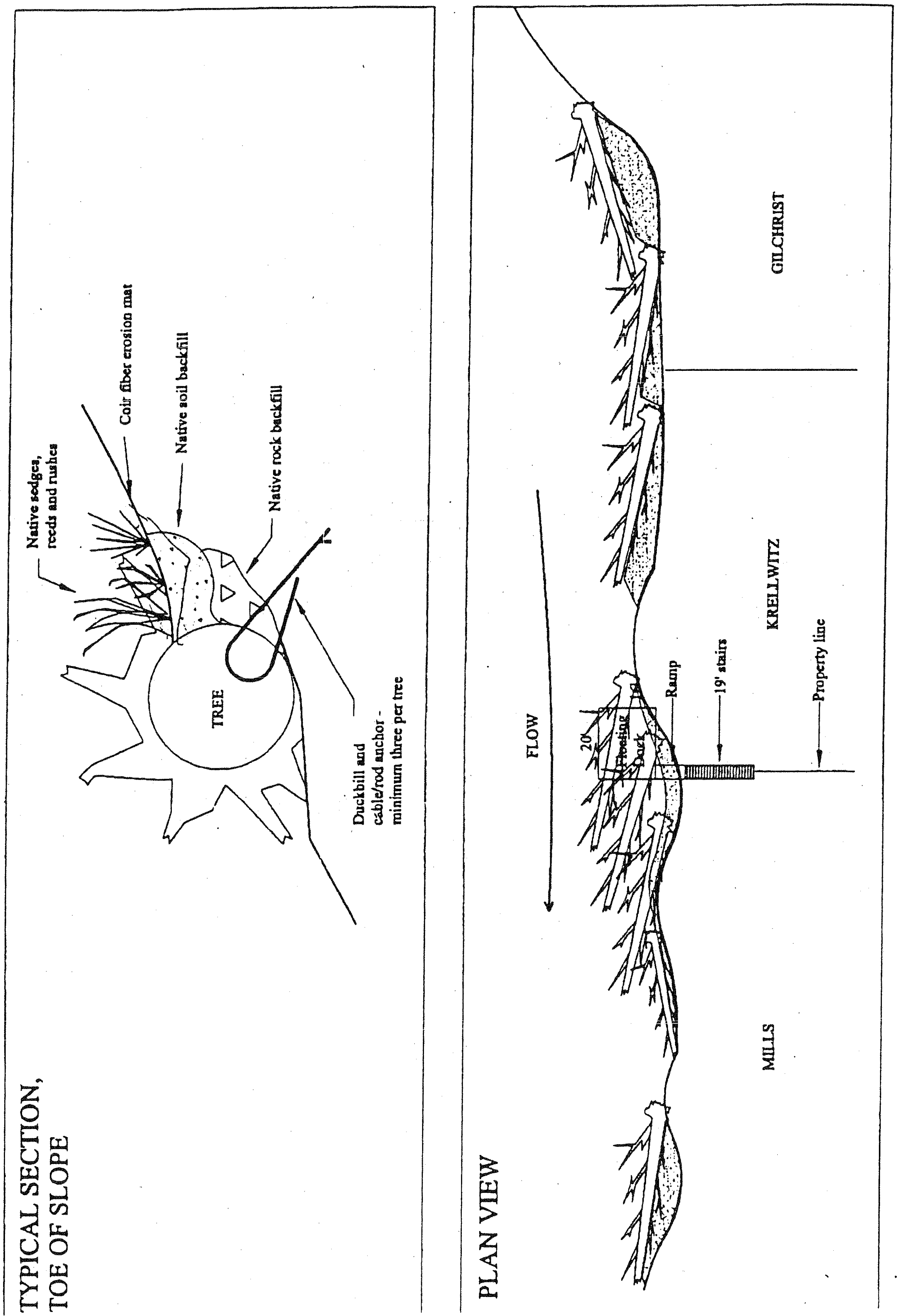
DESCHUTES RIVER RESTORATION PLAN

Mills/Krellwitz/Gilchrist Properties

Deschutes County, Oregon

Figure 1:
Existing Condition and Community Dock Goal

HENDERSON LAND SERVICES LLC
1012 South Shore Blvd.
Lake Oswego, OR 97035
(503) 699-8999, Facsimile (503) 699-8777

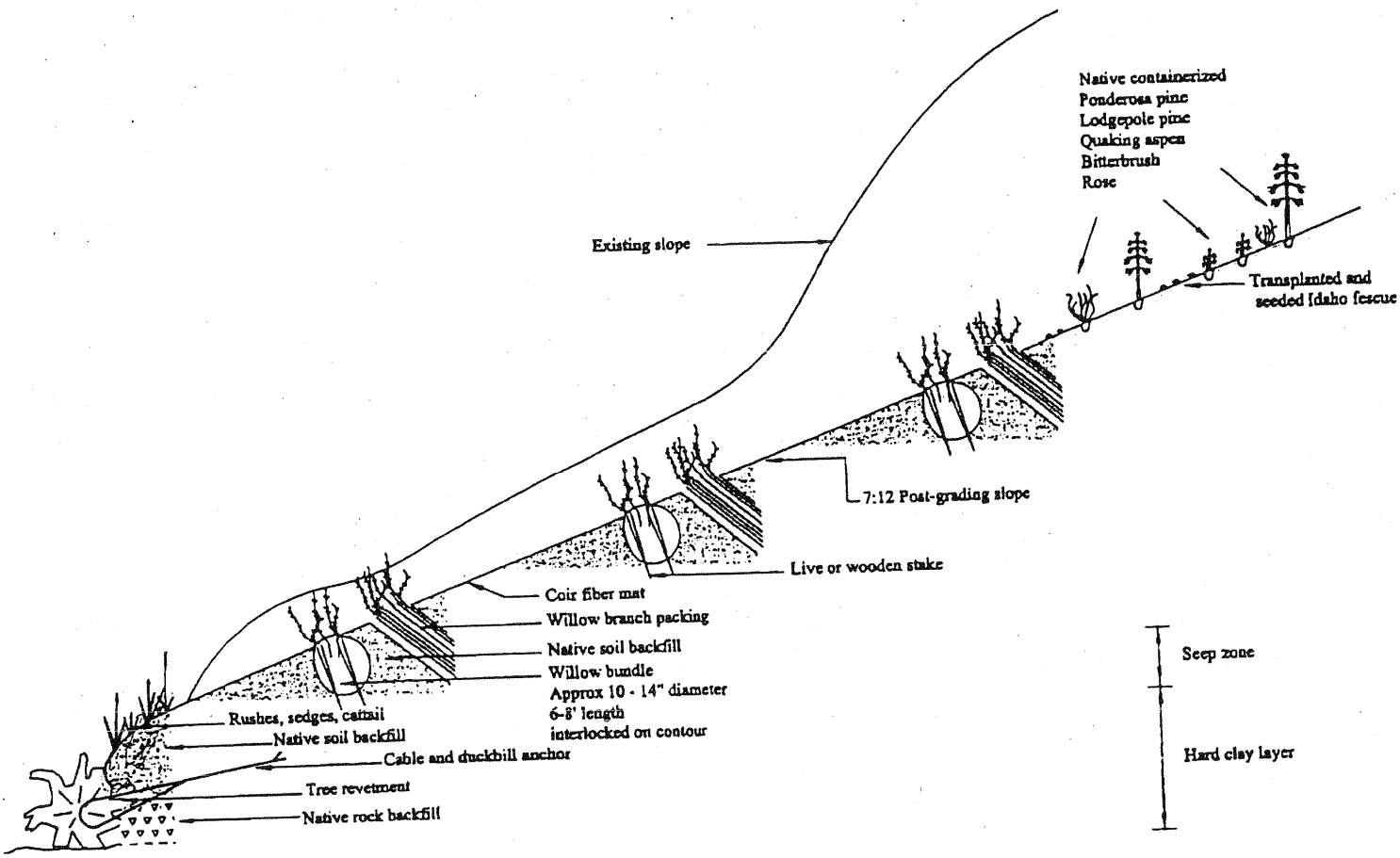


DESCHUTES RIVER RESTORATION PLAN

Mills/Krellwitz/Gilchrist Properties
Deschutes County, Oregon

Figure 2:
Restoration Plan View and
Toe of Slope Typical Section

HENDERSON LAND SERVICES LLC
4212 South Shore Blvd.
Lake Oswego, OR 97035
(503) 699-8999, facsimile (503) 699-8777



DESCHUTES RIVER RESTORATION PLAN

Mills/Krellwitz/Gilchrist Properties

Deschutes County, Oregon

Figure 3:
Bank Restoration
Typical Section

HENDERSON LAND SERVICES LLC
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APPENDIX B

Historical Streamflow Daily Values Graph for Deschutes R At Benham Falls Nr Bend,Oreg. (14064500)