Oregon and Washington Drinking Water Providers Partnership

Schooner Creek Sediment Reduction Project

Salmon Drift Creek Watershed Council &
City of Lincoln City

Funders
Oregon DEQ, Drinking Water Revolving Loan Fund,
Drinking Water Source Protection Grant Program &
US Forest Service, US Forest Service Partnership Agreement

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Introduction

January 2017 the Salmon Drift Creek Watershed Council staff partnered with the City of Lincoln City submitting a successful road sediment reduction project grant application to The Oregon – Washington Drinking Water Providers Partnership. The sediment reduction assessment focuses on the 4.6-mile stretch of Lincoln County Road 106 (Road Miles 4.7 to 9.3) that runs adjacent to Schooner Creek. Schooner Creek stream bank stability was also assessed upstream of Lincoln City's drinking water plant intake. Lincoln County Road 106 is also known as South Schooner Creek Road or simply Schooner Creek Road; we will usually refer to the project area road as Schooner Creek Road. The project vicinity map is found in Attachment A.

Schooner Creek is the primary source of water for Lincoln City residents. The treatment facility draws water from Schooner Creek by weir or infiltration gallery to meet the domestic water needs of Lincoln City residents. The water intake at River Mile 3.1 is adjacent to Schooner Creek Road at Road Mile Post 2.7; Attachment B is an aerial photo with marked road mileposts.

This Schooner Creek Sediment Reduction Drinking Water Providers Partnership project is an opportunity to address the City's desire to protect Schooner Creek water quality, which has been a local priority for many years. Salmon Drift Creek Watershed Council used an OWEB Technical Assistance Grant from April 2012 as background information for this successful Drinking Water Partners grant application. The successful Watershed Council and Lincoln City applicants are also working with Oregon Department of Fish and Wildlife and the US Forest Service through the Hebo Ranger District on this assessment.

It should be noted that the Lincoln County Public Works Road Maintenance and Operations Department current road maintenance practices have improved drainage and road surface condition when compared to road conditions observed in the 2011 road review. Lincoln County Public Works staff has done an excellent job in the past few years. Many of the issues the April 2012 grant application have been addressed with improved attention to road maintenance. Our suggestions for road drainage and stream bank stability improvements are designed to help landowners and road managers meet the drinking water providers grant objectives.

Ten drinking water protection actions lists as recommendations are found at the end of this assessment report. The recommendations are ranked by priority. The next step will be crafting grant proposals, working with Lincoln County Public Works staff and landowners to meet the Drinking Water Providers Partnership Sediment Reduction objections. Salmon Drift Creek Watershed Council can take the lead on the grant application process and coordinate landowner agreements. Lincoln County Public Works, Schooner Creek Road managers, would implement grant-funded improvements.

Findings

Road Drainage Assessment Summary

Assessment staff walked the nearly five-mile long project area examining; culverts, ditches, road cut banks, uplands near the road, fill slopes, and the road surface. The assessment recommendations are identified by road mile. Lincoln County Integrated Road Information System (IRIS) database lists 66 Schooner Creek Road culverts within the project area. IRIS database information includes culvert cross drain diameter, length, culvert material, and condition. The original IRIS database information provided by Lincoln County staff is found in Attachment C. Culvert mileposts were often marked on the edge of the road on posts driven into the ground. Culverts lacking a monument were located by measuring from a milepost. Lincoln County Public Works staff has GPS locations for each culvert on file. We recorded GPS coordinates for culverts using a Garmin, Oregon 650t during our fieldwork.

Project culvert notes, organized by road mileposts, are found in Attachment D. This table lists sites by road mile and longitude and latitude (GPS) the proposed action, existing culvert condition, and a brief description of the suggested work at each location. Column 1 of the table lists the ranked priority of each of the Project Opportunities given in the Recommendations. The following comments group culvert sites and road segments with similar conditions to show our first steps toward crafting recommendations. Our goal is to promote stable ditches that transport road surface water runoff to the forest floor entering Schooner Creek as ground water seepage. We hope to pass perennial streams under the road with limited sediment transport to Schooner Creek. A few ditches drain directly to Schooner Creek.

Techniques to improve road drainage and stabilize road surfaces to reduce sediment delivery to Schooner Creek is summarized and described by road mile. US Forest Service's typical drawings describe cross drain replacement work and roadway reconditioning recommendations. The National Road Construction Specifications are available online with a Google search (Road drawings USFS R-6). The information is public property made available for use by professional engineers qualified to adapt these drawing to local conditions. Recommendations are an example of one way to achieve the sediment reduction goal. Culvert replacement and patch paving edge transition to grave road surface examples are available in Appendix E. The professional engineer may choose another technique to achieve the sediment reduction outcome.

CULVERTS – No Change
No Changes are proposed at 20 existing culverts in good or very good condition. The IRIS database does not list the condition for culvert 7.75; we found it in good condition. A culvert in good condition that is not on the Lincoln County IRIS list was found at road milepost 7.53. We could not locate the twelve inch diameter, forty six foot long corrugated metal pipe listed at MP 7.06 in the IRIS database.

No Change culverts are currently benefiting from good road maintenance practices that maintain inlet ditch drainage and stable culvert outlets.

CULVERTS – Proposed Improvements, Replacements, and New Culverts
High Priority
Two culverts with inlet failures encroaching on the road surface are identified as high priority replacements. Culvert 4.912 is listed on IRIS as a timber culvert, 5.84 is identified as a precast concrete culvert; both are 15" diameter and listed in fair condition. Both sites are stream sediment and road maintenance challenges with ditches prone to plugging.

Seven culvert replacements between Road Miles 4.903 and 7.83 are proposed for replacement to reduce road sediment transport to Schooner Creek. Downspouts with rock dissipaters are included at each site protecting road fill and the forest floor from storm runoff erosion. Recommended culvert diameters are slightly larger and the preferred material is PVC to improve ditch drainage. Improved ditch drainage reduces road related erosion and promotes road stability by reducing water saturation of road subgrades.

The addition of 5 culverts is proposed to drain standing ditch water and shorten the distance between culverts. Standing ditch water can wet and weaken the road subgrade. Ditch erosion is reduced when water velocity is kept slow, even during storm events, with a short run to the culvert inlet. Downspouts and rock dissipaters will be added as needed to protect road fills and the forest floor from high velocity water leaving the culvert outlets.

CULVERTS – Proposed Replacements
Lower Priority
Five culverts with inlet-plugging risks (RM: 6.98, 7.14, 7.45, 7.89, and 8.310) are not a drinking water protection priority. These culverts are maintenance challenges with inlets that tend to plug with storm runoff. Each culvert would benefit from an increased diameter or minor adjustment to the culvert inlet location or material change to PVC. Consider these culverts for future replacement, especially if the project area road is paved in the future.

If there is an opportunity to fund Schooner Creek Road drainage structure upgrades from Road Mile 4.7 to its junction with US Road 17, consider replacing each of the culverts listed below. They are currently functioning in fair condition or are maintenance challenges but are not a threat to Schooner Creek water quality.
(Road Mile: 4.793, 5.433, 6.61, 6.640, 6.98, 7.92, 8.01, 8.14, 8.70, 8.830, and 8.98)

DRAINAGE IMPROVEMENTS - Road Shoulders and Cut Banks

The seven turnouts identified in recommendations for road drainage improvement are well used throughout the year. Turnouts are rutted and generate mud and turbid water each winter. They currently meet the needs of traffic flow. Schooner Creek water quality could benefit from improved road surface strength with the addition of base rock and surface gravel. Each turnout should be sloped to drain to the forest floor. We do not recommend increasing turnout length or width if it would encourage parking or dispersed recreation.

A road shoulder slide at RM 7.18 has received truckloads of large riprap to help stabilize the site. It is a site that remains wet throughout the year and will continue to be a challenge. We do not recommend any additional treatment at this time.

We struggled and were unable to identify a solution to stabilize the eroding cut bank at MP 7.21. It is a site that has raveled for years and continues to drop both large and small

amounts of soil and rock on Schooner Creek Road. This site will continue to be a high road maintenance priority.

Schooner Creek road at MP 7.84 has a narrow running surface and steep drop to the waters of Schooner Creek. We recommend a focus on techniques to slow traffic approaching the narrow, 80' long site from both directions. Consider signage and road shoulder paddles to encourage drivers to slow as approaching this site. We do recommend dust abatement at this site to stabilize road surface fines adjacent to Schooner Creek.

Identification of Road Slide Soil Storage Areas

Steep road cut banks have slid onto the roads of Lincoln County for generations. Schooner Creek Road, within the project area, is no exception. Most stream sediment entering the creek is from episodic debris torrents that occur in first and second order stream channels (Drift Siletz WA, 1996) often blocking roads. Road maintenance crews are often tasked with opening roads throughout the County when winter storms bring both wind and rain. The road slide soil is loaded into dump trucks and carried to the closest storage area allowing crews to quickly move onto the next road hazard. Maintenance actions generate truckloads of soil requiring stable, local storage. The need for local, stable, road slide soil storage was identified early in the assessment. Storage areas along Schooner Creek Road are full highlighting the need for more short haul soil storage options to keep road slide soils out of Schooner Creek. Proposed soil storage areas are described and mapped in Attachment F.

Proposed Waste Storage Sites

Hancock Soil Storage Site
Hancock Forest Management Company manages the forestland accessed by a closed road at milepost 7.69. The gravel spur road climbs to the north and northwest with favorable grades less than 10%. Currently the road is closed at the County Road junction with large rocks. A gate and spot rocking is needed, as well as minimal ditch line construction to improve road drainage.

The beginning of the proposed soil storage site is located about 1100 feet from the Schooner Road junction. The waste area extends southwest of the main road as it continues climbing to the northwest and ends 400 feet later at an overgrown landing. Side slopes at the proposed waste site drop from the road edge at about 60% for twelve feet and the extend for fifty feet or more down slope at just over 20% slope. The site location is flagged with red ribbon along the upper side of the existing road from beginning to end. The flagged area is four hundred feet long, forty five to fifty feet wide, and with an average depth of twelve to fifteen feet could hold 7,000 to 8,000 cubic yards of material and only occupy about ½ to ¾ acre at full development. The recommendation for Lincoln County use is to start by expanding the existing road in the designated area by about one additional road width of twenty feet. Soil would be placed below the existing road and brought up to road level with a 1¼:1 fill slope. Then the surface would be compacted, sloped to drain, and rocked with pit run. This amount of development would require little more than ¼ of an acre to start and hold about 1000 to 1200 cubic yards of material. Future use would continue to expand the site by an additional road width, and each pass would hold substantively more material.

Miniski Soil Storage Site

The US Forest Service Schooner Rock Restoration Project Environmental Analysis (April 2017) includes development and use of the Miniski Quarry within the existing rock pit development plan. Quarry development includes a soil storage site. Hebo Ranger District staff support Lincoln County road maintenance use of the site for road slide soil storage through a Memorandum of Understanding. The Salmon Drift Creek Watershed Council will apply for grant funding to develop the soil storage site. Attachment G is a map of the project area.

Existing Roadside Waste Piles

We propose excavation and transport of 1,150 CY of road slide soils currently stored on the roadside of Schooner Creek Road at MP 5.98 to 6.04 and MP 7.51 to 7.53. Slide soils would be transported by dump truck and stored at the Miniski site on US Forest Service land. The cleared roadside sites would be rocked and sloped to drain for use as temporary roadside soil storage when Lincoln County road maintenance is responding to storm damage throughout the County.

Road Shoulder Excavation

Cracks along the road shoulder at Road Mile 6.34 are evidence of an estimated 100 cubic yards of unstable side cast perched above Schooner Creek. Adjacent road shoulder west of this site has slid. This road shoulder has shown cracks for the past few years; it can slide at any time. A slide would reach Schooner Creek and could mobilize soil down slope resulting in more than 100 cubic yards of soil reaching the creek. An 18" diameter by 40' culvert passes through the unstable side cast draining the cut bank ditch. The existing culvert is prone to plugging in the winter, ponding water that increases the chance of shoulder failure by wetting the road fill. Replacement of the existing corrugated metal culvert with a PVC culvert and downspout with rock dissipater is proposed. We recommend fitting the existing culvert inlet with a slotted standpipe while unstable road fill remains onsite. A site photo and road fill profiles are found in Attachment H.

Road Surface Paving Options

Paving Short Segments

Five short road segments, Attachment G, are drinking water protection paving candidates. Road runoff, ditch water, and dust at each site are likely to find its way to Schooner Creek. A floodplain dissipation option for road drainage water is limited even with a fully functional road drainage system. A stable road surface is a good water quality protection option. Highest priority paving projects are found closest to the down stream Schooner Creek drinking water intake. We recommend not paving the narrow residential road surface from end of pavement, RM 4.7 to 5.028. Necessary road widening would disturb stable cut banks creating a high risk of slide debris delivery to Schooner Creek from the road surface and ditch.

Paving Segment 1 -Road Miles 5.028 to 5.159 (900 Feet)

Paving this 900-foot long road section will harden the road surface draining directly into Schooner Creek without restricting adjacent residential traffic to one lane. The school bus turnaround and private industrial timberland road junction are within the proposed paved segment. Rain runoff currently runs down the logging road ruts and ponds on Schooner Creek Road before finding the ditch and culvert draining into Schooner Creek. Our patch paving recommendation includes the addition of a culvert with a floodplain outlet and rock dissipater, east of the bus turnaround at Road Mile 5.17. The goal at this site is to reduce the creation of road related fine grain sediments, including clay. The post project ditch water with less sediment will be directed to a better culvert outlet site with sediment trapping floodplain soils and vegetation.

Paving Segment 2 -Road Miles 5.578 to 5.582 (200 feet)

The shotgun culvert draining directly into Schooner Creek at 5.58 is at a low point dividing this road segment. The road is immediately above and adjacent to Schooner Creek delivering ditch water directly to the stream. There is no practical floodplain culvert outlet option for ditch water discharge. The best water quality option is to keep ditch water as sediment free as possible with an improved road surface.

Paving Segment 3 - Road segment 5.71 to 5.94 (1,150 feet)

Much of this road segment is built on a stream bank rock buttress with ditch water draining directly to Schooner Creek. The existing 24" diameter, fair condition, corrugated metal pipe, at RM 5.77 passes a 42" wide perennial stream. We recommend replacing this culvert before paving with a 48" diameter culvert with inlet wings. Counter sink the new pipe matching the road cover depth of the existing culvert. Consider placing hand rocks and 2" minus rock throughout the culvert to trap downstream migrating streambed material. Before paving consider replacing a second pipe, the Precast Concrete culvert at RM 5.84 is currently in fair condition. The culvert inlet on the road shoulder has failed and could become a road hazard.

Paving Segment 4 - Road segment 6.60 to 6.725 (350 feet)

This Schooner Creek road segment is found in a low spot on the floodplain adjacent to the OWEB funded helicopter large wood aquatic habitat restoration project. We recommend replacing three culverts before paving. Tributary streams draining the hillsides come off steep slopes that are known to transport slide material plugging Schooner Creek Road culverts. Debris flows have plugged the existing culvert at RM 6.69 in the past. Replacing the culvert with a 48" diameter culvert with inlet wings is suggested. The rusting corrugated metal pipes at 6.61 and 6.64, both in fair condition, are recommended for replacement with larger diameter PVC culverts to reduce the risk of plugging.

Paving Segment 5 - Road segment 9.16 to 9.27 (580 feet)

This road segment is found on the floodplain near the headwaters of Schooner Creek. Schooner Creek water quality benefits are minimal due to the long distance from the Lincoln City water intake. This road/stream crossing site is suggested as both a benefit to emergency evacuation to the rally point at the junction of USFS Road 17 and Schooner

Creek Road as well as benefit upstream fish passage to both spawning and rearing habitat. Two side-by-side 48" diameter culverts pass the stream under the existing road. Side-by-side culverts are prone to plugging and road fill erosion is evident at the road-crossing inlet. Replacing these culverts with a twelve foot span concrete box culvert or squash pipe would protect the road from winter storm event.

Road Surface Dust Abatement Options

Road surface dust abatement treatments are another option to consider to better retain fine road rock and soil particles on the road and out of the ditch where ditch water can transport sediments to Schooner Creek. Dust abatement treatment is recommended on five road segments (2.1 miles) adjacent to Schooner Creek shown in Attachment H. The dust abatement product can be applied once or twice a year for up to five years for best results. We suggest Earthbind 100 dust abatement product manufactured by EnviRoad LLC in Portland, Oregon, Attachment I. The Earthbind 100 product is listed as approved by Oregon Department of Transportation. It is always important to apply the dust abatement product to the road surface with dry weather.

1. Road Miles 4.7 to 5.2

This Schooner Creek Road segment starts at end of pavement and runs adjacent to the Creek for one half-mile. The school bus turnaround and private industrial timberland road junction are at the eastern end of the road segment. Log trucks use the bus turnaround at the bottom of the industrial forest road to stop and tighten their bindings. Water runs down the logging road ruts and ponds in the Schooner Creek Road ditch before draining to Schooner Creek. We recommend adding a culvert with downspout and rock dissipater at RM 5.17, draining water onto the floodplain.

2. Road Segment 5.4 to 6.0

The shotgun culvert at 5.58 is at a low point dividing this road segment. The road is adjacent to Schooner Creek delivering road dust and ditch water directly to the creek. Much of this road is built on a stream bank rock buttress with ditch water draining directly to Schooner Creek.

3. Road segment 6.4 to 6.9

Consider replacing the RM 5.77 undersized corrugated metal culvert, currently in fair condition, with a 48" wide culvert with inlet wings to pass water and debris from the 42" bank full width tributary stream. Consider replacing the Precast Concrete culvert at RM 5.84, currently in fair condition. The culvert inlet on the road shoulder has failed and could become a road hazard.

4. Road segment 7.6 to 7.9

This portion of road above Schooner Creek is narrow with limited road shoulder between RM 7.84 and 7.85. We recommend replacing the culvert at RM 7.83 with an 18"x50' PVC pipe placed at a south 10° west angle with a down spout draining to the floodplain. Dust abatement treatment will benefit water quality and may also help with traffic safety by defining the road edge around the approaches to the short segment with narrow road shoulder.

5. Road segment 9.0 to 9.4

This road segment is found on the floodplain near the headwaters of Schooner Creek. Two side-by- side 48" diameter culverts at RM 9.19 pass the stream under the existing road. Side-by-side culverts are prone to plugging and road fill erosion is evident at the road-crossing inlet. Replacing these culverts with a twelve foot span squash pipe or concrete box culvert would protect the road from winter storm events and improve upstream fish passage to both spawning and rearing habitat. Consider extending the dust abatement treatment beyond the project area to the junction with Forest Service Road 17 at Schooner Creek Road Mile 9.7.

Stream bank stability assessment

This Schooner Creek Sediment Reduction Assessment's primary focus is on road/stream fine soil and rock particle retention to improve Schooner Creek water quality. The stream bank stability assessment component of the assessment looked upstream of the drinking water intake in this 9,650 acres watershed for stream bank, riparian area, and upland soil stability and erosion control opportunities.

The land ownership pattern is similar to many other north coast watersheds with private, stream adjacent land low, and National Forest and private timber company lands upstream. Approximately 70% of Schooner Creek watershed land is in Federal ownership, the majority managed by the Siuslaw National Forest. Private timber holdings comprise 29% of the watershed. The National Forest manages for old growth forest characteristics through the Late Successional Reserve (LSR) land allocation. Private timberland is managed on a 40 to 45 year harvest rotation through State Forest Practices Act standards.

The City of Lincoln City water treatment plant water intake structures are found at Schooner Creek River Mile 3.1 adjacent to South Schooner Creek Road Mile 2.7. This narrative will use River Miles for site reference locations. Water treatment plant operators can deal with turbid water (within limits) but treating clear water is always preferred. As such we wanted to identify potential problem areas that might contribute sediment to the stream. We assessed floodplain and stream bank stability to look for potential chronic or episodic sediment sources.

Private residential stream adjacent lands were unobtrusively observed or entered with landowner permission. We looked at 7.5 stream miles above the water intake (4.6 miles Schooner Creek, 2.0 miles North Fork, and 0.9 miles South Fork). Stream survey information, Schooner Creek Watershed Assessments, and restoration project accomplishment reports aided in the efficiency of the assessment.

Residential property dominates Schooner Creek floodplain private ownership from the water plant intake at River Mile 3.1 to River Mile 5.5. This stream reach is actually below the gravel portion of Lincoln County Road 106, Schooner Creek Sediment Reduction Project focus (Road Mile 4.8 to 9.4). It is important to look at the floodplain above the water treatment plant as an area that can have a direct impact on water quality above the intake. Schooner Creek stream gradient flattens out 0.6 miles above the water intake. Peak stream

flows spread out across the wide, flat floodplain and water velocity slows down. Flat, vegetated floodplains can slow water velocity and capture stream sediments.

We found few examples of human debris in Schooner Creek, no trash dumping, and only one dispersed recreation camper on Schooner Creek. Recommendations are intended to serve the current level of residential and commercial traffic with drinking water protection upgrades. We did not want to draw more visitors to the Schooner Creek watershed.

Photo 1. Private residential property at River Mile 3.45 managed as wildlife habitat with a vegetated floodplain.

Photo 1. River Mile 3.45 is an example of a flat, vegetated floodplain that is a good fine sediment catcher. There are seven landowners in this important stream reach. Several landowners are managing for wildlife habitat. The SDCWC can explore ways to help the landowners keep their floodplains well vegetated.

The Schooner Creek stream reach from River Mile 3.7 to 5.5 is a mixture of private residential and private industrial forest. Private forestland with Schooner Creek floodplain is found on the east bank, accessed by logging systems that would yard away from Schooner Creek.

One half-mile of the 1.8-mile Schooner Creek floodplain between River Miles 3.7 and 5.5 is residential. A few of these properties could benefit from riparian planting on the stream edge to improve stream bank stability. The undeveloped floodplain in the reach is well-

vegetated, stable, and not in need of erosion control. Stream reaches with limited floodplain typically have stable basalt stream banks.

Schooner Creek, from the upstream extent of residential property at River Mile 5.5 to the North/South Forks junction at River Mile 7.7 is mixed private industrial forestland and US Forest Service ownership. The floodplain is typically narrow and well vegetated; stream banks are stable. Two mature knotweed plants were found that could spread this invasive plant down stream reducing vegetation floodplain function and wildlife habitat. We recommend Lincoln Soil and Water Conservation District add these two sites to their invasive plant control efforts.

Knotweed photos taken above River Mile 6.5.

Stream gradient flattens between River Miles 6.9 and 7.2. Helicopter placed large wood is found functioning as aquatic habitat and trapping streambed fine sediment. There are no floodplain or stream bank areas, unrelated to Schooner Creek Road, which would benefit from erosion control or riparian planting.

Photos taken along South Fork Schooner Creek Road Decommissioning.

South Fork Schooner Creek is a stream with a long domestic water source history. The dam and fish ladder are both intact with a very low risk of failure that could trigger an episodic muddy water event. Stream banks and floodplains below and above the dam are stable and well vegetated. No differences were noted from my previous walk in 2011. South Fork Schooner Creek Stream survey data (Woods and Stone, 2011) describes a stream 34 feet to 25 feet wide at a moderate gradient of 2 to 4 percent. Winter stream flows are confined to

a relatively narrow stream channel with a flood prone area width less than twice the active stream channel width. We found stable stream banks and few key large wood pieces.

The 1.5 mile long US Forest Service road running parallel to South Fork Schooner Creek was decommissioned. Access to the fish ladder was retained. The decommissioned road surface is not a South Fork Schooner Creek sediment source. Culverts were removed to prevent plugging and road fill failure. We did find continuing erosion at culvert removal locations and recommend follow-up erosion control. Straw and shrub planting erosion control on excavated slopes would be helpful. Five wetted stream channels through the road footprint would benefit from willow planting and rock dissipaters where tributary streams are head cutting.

The mouth of North Fork Schooner Creek is a fish passage structured originally built in 1985, damaged in 1995 and repaired with a constructed roughened chute fish passage structure in 2007. This is the entrance to a steep V-shaped channel with a narrow floodplain and an average gradient of over 8% extending for approximately 1,000 feet. This stream reach opens up on a relatively flat, wide floodplain that has been the site of large wood placement to improve aquatic habitat. No erosion control actions are needed in this stream reach.


North Fork Schooner with flat stream gradient and well-vegetated floodplains.

North Fork Schooner Creek (Woods and Stone, 2007) flattens out to an average stream gradient of 1.0%. Two aquatic habitat restoration projects have added large wood to this area of North Fork Schooner with good success. The large wood complexes are intact, trapping stream sediments, and providing good winter rearing habitat conditions for juvenile coho salmon. Braded stream channels are common. North Fork Schooner does get up on its floodplain during high stream flows, slowing velocity and dropping fine sediments. There are no erosion control measures needed on the floodplains of North Fork Schooner Creek.

Recommendations

Drinking water protection recommendations are grouped by potential grant packages and ranked in priority order. The opportunities are described in necessary detail to select and group actions for grant funding. Cost estimates are included to help group actions to match minimum and maximum grant funding available for each grant opportunity considered.

Project Opportunities – ranked by priority

1. **Prepare the Miniski soil storage site on National Forest land**
   The US Forest Service Schooner Rock Restoration Project Environmental Analysis (April 2017) includes use and development of the Miniski Quarry within the existing pit development plan. Quarry development includes a soil storage site. Hebo Ranger District staff support Lincoln County road maintenance use of the site for road slide soil storage through a Memorandum of Understanding. The Salmon Drift Creek Watershed Council will apply for grant funding to develop the soil storage site. Attachment G is a map of the soil storage area project areas.

   An existing landing would be expanded with additional fill material while maintaining the existing level of the landing and roadway with all work meeting the EA Project Design Criteria and seasonal and daily time restrictions. Fifteen to 20 merchantable plantation trees (10"-16"dbh) would be cut and stacked. Landing slash and brush piled on the landing will be removed to prepare an area for dump trucks to maneuver. Brush and slash removed from the landing will be piled and prepared for burning. This initial clearing would prepare an area that could contain 2,500 to 4,000 cubic yards of soil. However, the potential development of the entire 1.5-acre area as a waste site is quite large, and it could hold 15,000 to 20,000 cubic yards for quarry development.

Cost	
$ 600	Sawyer
$2,450	70 CY 1½ x ¾ inch rock delivered @35/CY
$1,050	30 CY ¾ inch minus rock delivered @35/CY
$ 750	Erosion control
$4,200	325 Cat Excavator – 2 days + Move in-Move out

   Total Cost $9,050

2. **Reopen roadside temporary soil storage sites**
   Excavate and transport 1,150 Cubic Yards of road slide soils stored on the roadside of Schooner Creek Road. The soil is stored in piles along the road shoulder at two sites; MP 5.98 to 6.04 and MP 7.51 to 7.53. The dirt piles will be loaded into dump trucks by excavator and hauled to a nearby permanent soil storage site. The Miniski site on US Forest Service land is a possible storage location and will be used for estimating haul costs. The cleared roadside sites would be rocked and sloped to drain for use as temporary roadside soil storage when Lincoln County road maintenance is responding to storm damage throughout the County. Attachment F is a map of the project areas.

Cost	
$ 3,150	90 CY 1½ x ¾ inch rock delivered @35/CY
$ 1,050	30 CY ¾ inch minus rock delivered @ 35/CY
$ 700	Erosion control
$17,250	1,150 Cubic Yards @ $15 per yard with 9 mile round trip haul

   Total Cost $22,150

3. Road shoulder excavation

Excavate and haul 100 cubic yards of unstable road shoulder soil perched at Road Mile 6.3 above Schooner Creek. Place the soil in an area designed for permanent storage.

Cracks along the road shoulder running for 69 feet have been exposed for over five years at Road Mile 6.34 above Schooner Creek. The concave remnant of past road shoulder, adjacent to the west of this site, is evidence of a past slid. An 18" diameter by 40' corrugated metal culvert passes through the unstable side cast draining the cut bank ditch. The existing culvert is prone to plugging in the winter, ponding water that increases the chance of shoulder failure by wetting the road fill. An episodic slide event could happen at any time of year. A slide would reach Schooner Creek and could mobilize down slope soil in addition to road shoulder resulting in more than 100 cubic yards of soil reaching the creek.

We recommend excavating an estimated 100 CY road shoulder soil. Using a track-mounted excavator, remove and haul soil to a permanent storage site. Place a silt fence at the bottom of the clearing area to prevent loose soil from reaching the waters of Schooner Creek. Covering bare soil with straw is recommended for erosion control. Native shrubs and brush will soon cover the newly disturbed site but we do recommend planting potted shrubs to jumpstart recovery. Replacement of the existing corrugated metal culvert with a larger diameter PVC culvert will help the ditch pass cut bank slide soils. A downspout with rock dissipater is also recommended. A site photo and road fill profiles are found in Attachment H.

Rock the turnout. We also recommend fitting the existing culvert with a slotted standpipe to prevent culvert inlet plugging while unstable road fill remains onsite.

Cost

$5,600	Culvert replacement – 18" x 50' with downspout and rock dissipater
$1,050	30 CY 1½ x ¾ inch rock delivered @$35/CY
$ 750	20 CY ¾ inch minus rock delivered @ $35/CY
$1,750	Erosion control + shrub planting
$5,700	325 Cat Excavator – 3 days + Move in-Move out
$1,500	Haul 100 CY soil @ $15/CY

Total Cost $16,350

4. **Soil storage site development**

Hancock Forest Management staff will work with SDCWC to develop a soil storage area on land managed by Hancock. The potential area for soil storage is extensive. An area four hundred feet long, fifty feet wide, with an average depth of twelve to fifteen feet has been flagged. The site could hold, at full development, up to 8,000 cubic yards of soil dumped, while occupying less than **½** acre. Soil storage will expand the area of the existing landing that will be needed for timber harvest in an estimated twenty five years.

The spur road at Schooner Creek Road Mile 7.69 accesses the site climbing to the

north and northwest at 5% to 15%. Currently the road is closed and blocked by large rocks about 40 feet from the Schooner junction. The road surface is currently rocked with pit run, has a ditch line in a few places, and no culverts. This road is heavily brushed over by blackberry and nearly impassible in many sections. The road was hand brush for field inspection and site flagging.

Machine brushing 1,100 feet of road between Schooner Creek Road and the soil storage site is needed to access the storage site. The soil storage site would be cleared of extensive brush, numerous non-merchantable plantation conifers, and old logging slash. The short spur road to the east at the beginning of the proposed waste site offers a good area for slash disposal site. Trees and slash debris from the clearing the soil storage area will be windrowed on the downhill area boundary. At the base of each fill, a shallow ditch with a 2' tall berm will be prepared to allow water to drain laterally away from the storage area. Attachment F is a map of the project areas.

Road preparation will require 1½ minus rock placed twelve feet wide and eight inches deep. Rock will be stock piled at the storage site to cover the compacted soil surface expanding the landing area. A drivable drain dip is flagged three hundred feet from the Schooner Creek Road junction where road gradient breaks from 4% to near 10% draining into brush on relative flat ground. Two turnouts will be rocked on the 1,100' long access road. A gate will be placed on the spur road near the Schooner Creek Road junction. In addition, sufficient room for a truck turn-around for a ten cubic yard dump truck will be cleared on the landing.

The recommendation for Lincoln County use is to start by expanding the existing road in the designated area by about one additional road width of twenty feet. Road slide soil would be dumped and brought up to the existing road level with a 1¼:1 fill slope. Then the surface would be compacted, rocked with pit run, and sloped to drain. This amount of development would require little more than ¼ of an acre to start and hold about 1,000 to 1,200 cubic yards of material – if developed to the full length along the road way. Future use would continue to expand the site by an additional road width, and each pass would hold substantively more material. An access permit between Hancock Forest Management and Lincoln County Publics works, renewable, not to exceed three years, is required.

Cost

$15,000	500 CY 1½-inch minus rock delivered @$30
$ 1,050	30 CY ¾ inch minus rock delivered @$35
$ 1,350	Erosion control
$ 1,500	Cat dozer - 2 days + Move in-Move out
$ 5,400	325 Cat Excavator – 3 days + Move in-Move out
$ 4,500	Pre-fabricated Gate installed

Total Cost $28,800

5. **Road drainage improvement**

Culvert upgrades with downspouts and rock dissipaters and rocking well-used turnouts will reduce gravel road chronic sediment delivery to Schooner Creek. The highest priority culverts and turnouts have been selected for the first round of grant

applications. These high priority culverts are mapped in Attachment K.

Culverts at Mile Posts 4.793, 4.912 and 5.84 are fifteen-inch diameter pipes in fair condition with damaged inlets. The three culvert inlets are encroaching on the road surface. Upgrading these culverts with eighteen inch diameter PVC culverts will solve ditch drainage maintenance issues. Moving the culvert inlet back to the proper location at the ditch will reduce road surface fine particle delivery to Schooner Creek.

Replace 7 culverts, one each at Road Miles: 4.903, 5.26, 5.374, 6.16, 6.46, 6.98, and 7.83. Add downspouts and rock dissipaters to these culverts.

Add rock dissipaters to the outlets of the 7 culverts listed below.

Rock and slope to drain, 7 traffic turnouts, each at the following Road Miles: 5.159, 5.55, 6.34, 6.98, 8.10, 8.16, and 8.35. These turnouts hold turbid water all winter and are rutted well into the summer. Each is a source of road surface soil particles to Schooner Creek.

Cost	
$12,000	Replace 4.793, 4.912 and 5.84 culverts–18"x30' PVC culverts @ $4,000 ea.
$20,000	Replace 4.903, 5.26, 5.374, and 6.16 precast concrete culverts –with 18"x30' PVC culverts and downspouts 12', 12', 30', and 10' long @ $5,000 each
$12,000	Replace 6.46 and 7.83 culverts – with 18"x 68' and 18"x50' culverts and downspouts 25' long @ $6,000 each
$ 2,800	Add rock dissipaters at 5.69, 6.51, 6.81, 7.08, 7.53, 7.58, and 7.61 culvert outlets
$ 7,500	Replace the culvert at MP 6.98 – 18"x33' PVC culvert and add a rock dissipater. Rock the turnout at this site with 8 inches deep 1½ inch minus rock covered by ¾ minus rock four inches deep.
$17,500	Slope to drain and rock seven traffic turnouts; 5.159, 5.55, 6.34, 6.98, 8.10, 8.16, and 8.35 with 8 inches deep 1½ inch minus rock covered by ¾ minus rock 4 inches deep. Estimate $2,500 each per turnout
Total Cost	**$71,800**

6. **Add 5 new culverts**

Each of these proposed new culverts address ditches that hold standing water, several well into late spring and early summer. Aiding ditch drainage helps maintain dry and stable road subgrade, improving road strength and stability. Ditches do not drain well to down slope culverts at these sites. Each new culvert will improve road

drainage and reduce chronic fine sediment delivery to Schooner Creek. These proposed project sites are mapped in Attachment L.

Cost

$6,500	MP 5.17 – 18”x60’ PVC culvert with 20’ downspout and dissipater
$4,000	MP 5.34 – 18”x30’ PVC culvert only
$4,800	MP 6.03 – 18”x50’ PVC culvert only
$5,500	MP 7.50 – 18”x25’ PVC culvert with 40’ downspout
$4,000	MP 9.275 – 18”x30’ PVC culvert

Total Cost $24,800

7. **Road drainage improvement – prevent road fill erosion**

Replace three culverts (Road Mile: 4.998, 5.77, and 6.69) with larger diameter structures. Consider adding wing walls at culvert inlets. These proposed project sites are mapped in Attachment M.

RM 4.998 culvert – The project site is adjacent to private road 4969 and property owned by JD Liswig. The landowner reports high water overtopping the road when debris from storm flows plug the culvert inlet. The culvert alignment to the stream has shifted over the years to near 90° with flow turning at the road fill base.

We propose leaving the existing culvert in place as an overflow culvert. Add a 48”x45’ long corrugated metal pipe culvert with the new culvert inlet in alignment with the stream. The new culvert outlet could exit the five foot deep road fill near the current culvert outlet. This site will require maintenance after storm events but will be less likely to plug, reducing the threat of road fill failure. Cost estimate is using installation techniques that will allow traffic to pass during construction.

$5,000	Design
$3,500	MP 4.998 – 48”x45’ Corrugated Metal Pipe culvert
$1,000	Traffic control
$6,500	Installation

Total Cost $16,000

RM 5.77 culvert – The existing culvert is a 24”x32’ corrugated metal pipe passing a perennial stream with a 3.5 foot bank full width. The current culvert passes seasonal high stream flows but is prone to plugging with storm events. Road fill over the culvert is less than two feet.

We propose replacing the existing undersized culvert with a 48”span x 40’ long squash corrugated metal pipe to reduce the chance of plugging during storm flows. The top of the new culvert would be set at the elevation of the existing culvert. The new culvert would be installed at a flat grade. The culvert outlet will be near the bottom of the existing plunge pool. Place riprap in the bottom of the existing plunge pool to prevent erosion and down cutting. The streambed above the new culvert

inlet will adjust to the lower elevation of the new pipe but we do recommend placing hand rocks within the new culvert, near the culvert inlet to catch native stream bed sediments within the new pipe. Cost estimate is using installation techniques that will allow traffic to pass during construction.

$5,000 Design
$7,160 MP 5.77 – 48"x40' Corrugated Metal Squash Pipe culvert
$1,000 Traffic control

Total Cost $13,160

RM 6.69 culvert – The existing culvert, a 30"x44' corrugated metal pipe, passes flow from a perennial stream. The current culvert passes seasonal high stream flows but is prone to plugging when storm events bringing debris slide rock and wood filling and overtopping the culvert. The culvert can be placed at 2% grade with a rock dissipater at the outlet. Consider a concrete inlet wing walls and collar.

$ 5,000 Design
$ 7,500 MP 6.69 – 48"x44' Corrugated Metal Squash culvert, riprap wing walls
$ 1,000 Traffic control
$6,500 Installation

Total Cost $20,000

8. **Road drainage improvement**

Replace 8 culverts that are ditch inlet maintenance challenges with larger diameter culverts that will remain free flowing with storm runoff. Chronic road surface fine delivery to Schooner Creek will be reduced with stable, well functioning culvert inlets. These proposed project sites are mapped in Attachment N.

Cost
$4,000 MP 5.028 – 18"x24' PVC culvert
$4,500 MP 5.20 – 18"x30' PVC culvert
$4,500 MP 5.228 – 18"x31' PVC culvert
$6,500 MP 6.61 – 24"x40' PVC culvert and rock dissipater
$4,500 MP 6.64 – 18"x36' PVC culvert, 6' downspout and rock dissipater
$5,500 MP 6.87 – 18"x40' PVC culvert
$7,500 MP 7.14 – 48"x 65' CMP culvert
$4,500 MP 7.45 – 18"x 41' PVC culvert and rock dissipater

Total Cost $41,500

9. **Strengthen the road surface – Grant funded test application**

Consider 2.4 miles of dust abatement treatment to road segments adjacent to Schooner Creek. Earthbind 100 manufactured by EnviRoad LLC in Portland, Oregon is marketed as an environmentally friendly dust control palliative and soil stabilizer. It is a liquid concentrate diluted in water, designed to replace calcium or magnesium chlorides commonly used for dust abatement. Earthbind is an emulsion and is mixed with water for application purposes; the weather needs to be dry enough for the water in the Earthbind solution to evaporate. Earthbind is considered cured when all the water in the solution evaporates. Also there should not be a threat of rainfall

for at least seventy two hours to ensure curing. Attachment I is a map of the proposed project areas.

A treated road surface would better retain fine rock and soil particles, reducing the likelihood of ditch transport of sediments to Schooner Creek. Dust abatement products are often applied after road blading. The work can be done once or twice a year, late spring and/or early fall. It must be applied in dry weather.

$ 3,000 Application by one distributor truck in one day
$ 1,800 Truck and trailer freight charge for 2 loads @ $900/load
$13,141 3,092 gallons @ $4.25/gallon Earthbind 100 stabilizer/dust suppressant

Total Cost $17,941 – For each treatment of 2.44 miles at 18 feet wide

10. **Pave 5 short road segments**

Pave five short segments of Schooner Creek Road, a total length of 0.6 miles x 18 feet wide, each located between MP 4.7 and MP 9.4 adjacent to Schooner Creek. The minimum acceptable full width paving length is 200 feet. Pave 4" depth with two 2" lifts of nominal compacted depth hot mix asphalt. Total paving area is (+/-) 57,024 square feet. Asphalt base prep work is not included in cost estimates. Ten culverts are likely replacement candidates before pavement application. Attachment O is a map of the proposed project areas.

Asphalt cost per mile is an estimated $231,000 per mile for asphalt only. Asphalt base preparation and culvert replacements are not included in this price. The cost of asphalt only from end of pavement at Road Mile 4.7 to junction with FS Road 17 at Road Mile 9.7 is not less than $1,155,000. This estimate does not include road base preparation, turnout paving, culvert replacement, and a survey of paving locations and dimensions. The cost of paving the gravel portion of Schooner Creek Road between MP 4.7 and 9.7 could easily exceed $1.5 million dollars. The cost of patch paving 0.6 miles of road adjacent to Schooner Creek with culvert replacements at MP 6.69, MP 5.028, and MP 6.61 would exceed $ 200,000.

$ 3,000 Mobilization
$ 136,620 1,584 tons of hot mix asphalt @ $86.25 per ton
$ 174,000 1584 tons hot mix asphalt delivery
$ 5,000 Replacement cost of each culvert - new 18" diameter culvert

Total Cost $318,620 – 0.6 miles 18' wide, 4" deep hot mix asphalt only

Conclusion

Lincoln County Public Works road maintenance and operations department is doing an excellent road maintenance job on the gravel road within our project area. Our suggestions for road drainage improvements are designed to help road managers meet the drinking water providers grant objectives.

The ten project opportunities are identified and ranked by priority. They are also grouped in potential grant packages. We feel it is necessary to develop local soil storage site options before excavation, haul, and storage of large volumes construction material and road slide soil. Both potential soil storage sites require memorandums of understanding or special use agreements before development, one with the US Forest Service on Federal land and the other on private industrial forestland. It might be possible to modify existing agreements.

Schooner Creek Road culverts and road drainage system, within the project area are functioning well. Twenty of 66 culverts are in good condition and not recommended for replacement or upgrade under any recommendation. Our recommendations are intended to help local government staffs stretch their road maintenance budgets to meet the public needs for both transportation and the highest quality drinking water possible.

Our stream bank and floodplain assessment is very positive. Schooner Creek, above the Lincoln City water treatment plant intake are well vegetated, stable, and are not in need of erosion control or riparian planting. Two small patches of knotweed were found near River Mile 6.6 (44° 56.884', -123° 55.647') and another patch at River Mile 6.8 (44° 56.886', -123° 55.633'). We suggest working with the Lincoln County Soil and Water Conservation District for early noxious weed control. The forest road decommissioned along South Fork Schooner Creek, past the fish ladder road, is very stable. The old running surface is well vegetated. Culvert removal excavation slopes would benefit from additional erosion control and willow planting.

John Sanchez, Principal
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References

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Schooner Rock Restoration Project Environmental Analysis, April 2017. EA is available at the Hebo Ranger District, Siuslaw National Forest.

Woods and Stone, June 2007. Oregon Department of Fish and Wildlife Aquatic Inventory Project Stream Report, North Fork Schooner Creek. The aquatic inventory is available at the MidCoast Watershed Council Office, Newport, Oregon.

Woods and Stone, August 2011. Oregon Department of Fish and Wildlife Aquatic Inventory Project Stream Report, South Fork Schooner Creek. The aquatic inventory is available at the MidCoast Watershed Council Office, Newport, Oregon.