Chapter 6: Recommendations

Watershed needs and opportunities are most effectively addressed by a consistent, cooperative effort between landowners and government agencies. In keeping with that principle the following recommendations are intended as general guidelines for cooperative efforts that can be undertaken to achieve watershed objectives. (Recommendations specific to BLM lands are given later in this chapter.) These recommendations are not intended to mandate what state and private landholders should do with their own land, but instead to identify potential opportunities for improvement of conditions within the Middle Tualatin-Rock Creek watershed. Implementation of these recommendations is completely voluntary on the part of the private landowner. Opportunities will be available through cooperation with private landowners to create partnerships to implement these recommendations. As the nexus of many different interests, the Tualatin River Watershed Council plays a vital role in facilitating these partnerships.

The nomenclature for these recommendations was designed with this concept of partnership in mind. Three groups have been identified. The actual implementation of these recommendations and objectives is performed by a large and varied group of individuals, grassroots organizations, and corporations. They voluntarily organize educational activities, donate material, contribute labor and expertise, and manage their lands to achieve desirable watershed objectives. Although the people in this group represent diverse interests, they work toward similar beneficial objectives, and here they are described collectively as **partners**. Another group, that of governmental **agencies**, has specific duties to achieve watershed objectives. Although they are also important partners in the watershed restoration efforts, when performing their official duties they will be referred to as agencies. Finally, the **Tualatin River Watershed Council** acts as facilitator to promote implementation of these recommendations. In this role, the council acts to coordinate efforts between partners to achieve beneficial watershed objectives.

Success of many programs delineated within these recommendations is contingent upon funding. There are several sources of expertise and funding for projects on private lands that could be used for the opportunities identified below. Oregon Department of Fish and Wildlife and state Restoration and Enhancement funds are available for restoration of riparian and stream habitat. The Natural Resources Conservation Service and the Washington County Soil and Water Conservation District have access to federal funds for improvement, particularly of agriculturally related problems in the lower watershed. The U.S. Fish and Wildlife Service, through its Partners for Fish and Wildlife program, also funds wildlife habitat restoration and improvement projects for wetland, riparian, and instream areas on non-federal lands. This availability of state and federal funding should encourage private landowners to join in the effort to improve the Middle Tualatin-Rock Creek watershed ecosystem. Furthermore, the Tualatin River Watershed Council and various agencies should pursue additional funding to address the identified needs within the watershed.

Through the watershed analysis process, several stream reaches and wetland areas were identified as priorities for preservation and restoration activities (Table 6-1). These priorities were generally based on the degree of degradation and the potential to restore specific beneficial uses (e.g., potential for salmonids to utilize improved habitat). Areas with relatively good habitat were earmarked for preservation.

Table 6-1. Priority subwatersheds for preservation, restoration, and monitoring activities.

Reach/subwatershed	Type of activity	Rationale
Rock Creek: Upstream of Beaverton Creek.	• Sediment reduction • Nutrient Reduction • Bacteria reduction • Riparian reforestation • Habitat survey • Instream habitat restoration	• Steelhead spawning habitat. • High levels of sedimentation • High nutrient levels • High bacteria levels • High temperature throughout reach • Riparian cover and shading very poor • Degraded fish habitat
McFee Creek: downstream of Finnegan Hill Pond.	• Habitat survey • Sediment control • Nutrient reduction • Bacteria reduction • Riparian preservation	• Steelhead spawning habitat. • Many nearstream roads • Intermittently high nutrient levels • Intermittently high bacteria levels • Relatively complete riparian forest
Christensen Creek	• Nutrient control • Bacteria control • Temperature control • Riparian revegetation	• Very poor water quality
Beaverton Creek	• Reduction of toxic inputs • Monitoring and control of organic compounds • Monitoring and control of heavy metals • Nutrient control • Bacteria control • Temperature control • Riparian reforestation • Habitat improvement projects	• Extremely poor water quality • Little riparian forest cover • Rearing habitat for cutthroat trout
Johnson Creek (South)	• Nutrient control • Bacteria control • Temperature Control • Sediment control structures	• Very poor water quality
Cedar Mill Creek	• Erosion monitoring/control • Sediment monitoring/control • Nutrient monitoring/control • Bacteria monitoring/control	• Upper portions are steep, unstable, and highly erodible • High urban and rural residential use • Spawning habitat for cutthroat trout
Abbey Creek	• Erosion monitoring/control	• Most of watershed is steep, unstable, and highly erodible.

6.1 General recommendations

6.1.1 Aquatic

6.1.1.1 Erosion issues

Issue #1: Soil disturbing activities on steep and unstable lands lead to increased hazards for surface erosion, mass wasting, and sediment delivery. Construction is a major contributor to erosion. Stream crossings facilitate sediment delivery.

Solution Strategy: Erosion control efforts in the foothills of the Middle Tualatin-Rock Creek watershed would best be concentrated in areas of steep slope and subbasins with high densities of roads and stream crossings. These include rapidly urbanizing lands in the Tualatin Mountains. Many of these lands lie under jurisdictional authorities that have programs to minimize the impacts of soil-disturbing activities. A coordinated effort between these entities to implement and monitor effectiveness of these programs would advance erosion control efforts.

Specific Recommendations.

- Land owning partners in the foothills are encouraged to implement the following road-related practices: Avoid building new roads on steep and unstable lands. Evaluate roads for stability and potential for sediment delivery. Where feasible, decommission or obliterate unnecessary or undesirable roads (such as legacy roads) by pulling back sidecast material, removing culverts, outsloping where needed, subsoiling to restore infiltration, and revegetating the road surface and other disturbed areas with native species. Priority roads for obliteration include those built on midslopes with sidecast construction. Subwatersheds where these recommendations are particularly applicable include **Abbey Creek, upper portions of Bronson Creek and Cedar Mill Creek, Upper Rock Creek, and McFee Creek**.
- Agencies should improve monitoring of construction sites to ensure that BMPs for control of erosion and landslides are being implemented. The Tualatin River Watershed Council should work with construction industry stakeholders to facilitate distribution of educational pamphlets describing appropriate BMPs.
- If feasible, cuts and fills should be avoided on unstable lands. Where these are necessary, they should be designed in such a way as not to increase instability.
- Drainage-related erosion will be reduced if land owning partners and agencies with road maintenance authority maintain or improve road drainage by cleaning culverts, replacing decaying culverts, and installing downspouts on culverts that have outfalls at a substantial distance above the hillslope. Any culverts that are installed should be designed to withstand the 100-year flood event.
- In order to reduce erosion and sediment contribution to streams, landowning partners and agencies with road maintenance authority should maintain a vegetative cover on drainage ditches. These should be designed in consultation with neighboring landowners to avoid undesirable effects, such as the spread of weeds.
- Land owning partners and agencies with road maintenance authority can reduce sediment contribution to streams by implementing the following practices where high densities of roads and stream crossings exist: Decommission unnecessary roads. Survey remaining roads for areas with high risk of landslides or erosion from cutslopes, fillslopes, and road treads. Minimize such hazards. Locate culverts or drainage dips to avoid excess accumulations of water in ditches or on road surfaces. Minimize connectivity between drainage ditches and streams to minimize sediment delivery potential. These recommendations are particularly applicable to the following subwatersheds: **Upper Rock Creek, McFee Creek, Jaquith Creek, Abbey Creek, Baker Creek.**

Issue #2: Sheet, rill, and gully erosion from fields and streambank erosion is widespread in the valleys and adjacent foothills. The greatest problem from surface erosion occurs when soil is inadequately protected from rainfall. Bank erosion is greatest in areas of impaired riparian vegetation. Where riparian vegetation is lacking, accelerated sediment delivery to streams also occurs.

Road drainage ditches provide channels that facilitate transport of eroded sediments and associated pollutants from fields, and delivery of these substances to streams.

Systematic methodologies to assess the effectiveness of Voluntary Water Quality Farm Plans and agricultural Best Management Practices (both individually and in combination) are lacking.

Solution Strategy: Effective erosion control on agricultural lands will emphasize riparian restoration, residue management, cross-slope farming, rotations with sod-building crops, cover crops, filter strips and grassed waterways. The former objective is most efficiently achieved through voluntary efforts spearheaded by NRCS and SWCD. These agencies have a long history of working together with farmers to reduce soil loss. Additionally, these agencies are able to offer economic incentives and cost-sharing programs to implement Best Management Practices. When developing conservation plans, erosion predictions should be based on the most erodible slopes rather than average slopes in a field. Implementation of a systematic methodology and database to keep track of specific components of Water Quality Management Plans would assist agency sources in refining future prescriptions.

Specific Recommendations:

- NRCS, SWCD and other agencies should continue to promote implementation of Best Management Practices by agricultural interests. NRCS and SWCD should determine locations in the watershed where BMPs are least often used, and focus efforts on these areas. Together with the Tualatin River Watershed Council and the Farm Bureau, NRCS and SWCD should determine outreach measures to improve landowner interest in implementation of BMPs. These entities should actively seek funding to provide expanded assistance toward these objectives. They should pursue greater funding for cost-share programs and incentives to retain greater widths of riparian vegetation. Local governmental agencies should request a greater role in promoting programs such as the Conservation Reserve Enhancement Program (CREP), so that these programs best meet local needs.
- Public agencies responsible for road maintenance should maintain a vegetated lining in road ditches. Similarly, land owning partners will benefit from reduced erosion if they incorporate a vegetated design in drainage ditches on their property. Ditches should be designed in consultation with neighboring landowners so they do not have an adverse effect on their operations.
- When designing conservation plans, NRCS and SWCD should keep a database of practices implemented in each plan, and enhance monitoring of farms under such plans to determine the effectiveness of various prescriptions (This will partially fulfill Tualatin River Watershed Action Plan Item 6A.). As part of this effort, they should design a standardized format for the database so that information collected by different agencies can be easily interchanged. Although these recommendations are applicable to all agricultural subwatersheds, priority should be given to those with high proportions of highly erodible lands. These include the **McFee Creek, Heaton Creek, Baker Creek, and Jaquith Creek** subwatersheds.
- The Tualatin River Watershed Council should continue to coordinate efforts to restore and enhance riparian vegetation. As part of this effort, the Council should continue to coordinate programs with community groups to plant riparian vegetation. The Council, together with NRCS and SWCD, should assist landowners with restoration efforts. From an erosion standpoint, the areas of highest priority for revegetation include **Holcomb Creek**.
- The Tualatin River Watershed Council and its partners should adopt a policy to protect currently existing riparian vegetation. As part of this policy, they should advertise currently existing incentives and cost-share programs to remove riparian lands from agricultural production. Where these programs provide inadequate incentive for riparian restoration, the Tualatin River Watershed Council and its partners should work with the federal and state government to provide additional incentives.
- The Tualatin River Watershed Council, together with NRCS and SWCD, should work with Washington County to reduce the cost and other difficulties associated with permits for wetland restoration.

- The NRCS and SWCD should continue efforts to work with agricultural landowners to address conditions prohibited by the Tualatin River Subbasin Agricultural Water Quality Management Area Plan (OAR 603-95).

6.1.1.2 Hydrology and water quantity issues

Issue #3: Wetland and floodplain area is greatly diminished from historical levels. This has resulted in loss of hydrologic regulation of flows on the Tualatin River upstream of Scoggins Creek and on tributaries. Scoggins Dam has largely replaced this function at downstream sites, and some tributaries have small dams that control flow.

Solution Strategy: The most effective policy given current constraints is to protect existing floodplain and wetland resources, and to prevent encroachment of activities that are incompatible with floodplain and wetland function. Where incompatible uses do not exist, there may be opportunity to restore the functionality of degraded wetlands. Additionally, there may be partnership opportunities with sympathetic landowners to create or re-establish wetlands where they do not currently exist.

Specific Recommendations:

- Planning agencies should restrict further residential and industrial development within the 100-year floodplain.
- The Tualatin River Watershed Council, partners and NRCS and SWCD should sponsor a study to determine priority sites for preservation or restoration of historic floodplain and wetland function. For each site, appropriate protection, restoration, or enhancement strategies should be identified. Information gained in this study should be systematically maintained in a database, where it can be referenced for future funding opportunities.
- Partners and appropriate agencies should acquire property or habitat conservation easements to protect or expand existing wetlands. They should also evaluate opportunities for land acquisition with which to create new wetlands. If wetland creation appears to be a viable option, they should purchase lands for this purpose.
- The Tualatin River Watershed Council should promote research projects designed to improve the effectiveness of wetland restoration. These include projects to determine the structure of native herbaceous wetland communities under reference conditions, as well as projects to determine ways to establish viable native herbaceous wetland communities.
- Agencies and partners should conduct post-project monitoring to determine the success of wetland restoration efforts.

Issue #4: Over much of the year, surface flow may be insufficient to support all beneficial uses at some locations. Current instream water rights may be inadequate to protect resources.

Solution Strategy: Water conservation is a necessary part of any strategy designed to optimize water supply for all beneficial uses. As irrigation is the largest use of surface water within the watershed, conservation efforts would benefit greatly if agriculture employs technological solutions to minimize waste during irrigation.

During formulation of its action plan, the Tualatin River Watershed Council (TRWC) considered the acquisition of additional water rights to supplement current instream water rights. The Watermaster, OWRD District 18, has determined that all Water Availability Basins within the watershed are a high priority for the acquisition of instream water rights. If the decision is made to acquire supplementary instream water rights, consideration should be given to the OWRD instream leasing program. Several considerations should go into any decision to acquire instream water rights. Seniority, of course, is a prime consideration. However, location of these water rights is also important. Acquisitions in McFee Creek and upper Rock Creek would be most directly beneficial to anadromous steelhead. At other locations, enhanced flow will help to improve water quality and could benefit resident cutthroat trout. However, they are unlikely to provide direct benefit to steelhead trout except during migration periods. Other native fish species, such as lampreys, would benefit from resulting improvements in water quality.

Specific Recommendations:

- TRWC, partners, and agencies should encourage irrigation water management, including the use of

technological soil moisture sensing devices and the conversion of sprinkler to drip systems on appropriate crops.

- TRWC, partners, and agencies should conduct a study to determine the adequacy of current instream water rights to provide adequate conditions for fish and other aquatic life. This analysis should focus on tributaries where augmented flows are not currently available. If current instream water rights are found to be inadequate, locations of greatest need for supplementary water rights should be noted. Priority for water rights acquisition should be given to the most senior rights available at these locations. When acquiring water rights, strong consideration should be given to use of the OWRD instream leasing program.

6.1.1.3 Stream channel issues

Issue #5: Most stream channels are severely deficient in large wood. This has limited the development of pools, which provide essential habitat for fish and other aquatic life. In most subwatersheds, little potential exists for recruitment of large wood to streams.

Solution Strategy: Intensive land use within the watershed limits the potential for recruitment of large woody debris. The best remaining potential exists in streams contributing to McFee Creek. Additionally, large ash trees adjacent to the Tualatin River provide large wood to the channel, although not at historical levels. Where attempts are made to restore this function, long-term development of large woody debris recruitment potential should be supplemented by short-term tactics. Potential elements of this strategy include re-introduction of conifers to hardwood stands, thinning within riparian zones to promote development of tree mass, and artificial placement of instream structures. Location of these restoration activities will depend on management objectives. Channel structure throughout the watershed would benefit from placement of large wood. The greatest direct benefit to salmonids would likely result from wood placement in McFee Creek and Rock Creek.

Specific Recommendations:

- The TRWC, in coordination with ODFW, should facilitate a stream habitat assessment on **McFee Creek** (below Finnegan Hill Dam). As part of this assessment, the feasibility of wood placement should be determined. Additionally, on **Rock Creek** above Beaverton Creek, the rapid stream assessment (conducted as part of the Watersheds 2000 project) should be supplemented with further survey efforts to determine the potential effectiveness of habitat restoration, including wood placement.
- As an interim measure, partners performing stream restoration should place large wood in channels, and construct instream structures to create pools in degraded habitat with high fisheries potential. Restoration projects should include substantial post-project monitoring to determine the effectiveness of restoration techniques. Channel structure throughout the watershed would benefit from this recommendation. Sub-basins where placement of large wood would have the greatest benefit for salmonids are listed in the aquatic species and habitat section (Section 5.1.5).
- Where feasible, landholding partners should manage riparian areas to develop late-successional characteristics so that they can eventually develop large wood for potential delivery to streams. This can include re-introduction of conifers to hardwood stands and some thinning within riparian zones.

6.1.1.4 Water quality issues

Issue #6: In many portions of the watershed, sediments are delivered to streams at levels well above reference conditions. These sediments often carry adsorbed pollutants.

Solution Strategy: Strategies to combat sedimentation are described under the erosion section (Section 6.1.1.1).

Specific Recommendations:

- The Tualatin River Watershed Council should work with the appropriate management agencies to facilitate use of sediment-reduction BMPs in construction sites, residential areas, and other urban sites. This will include distribution of educational material related to these BMPs.
- NRCS and SWCD should continue efforts to expand implementation of agricultural Best Management Practices to reduce sediment discharge to streams (see under Erosion).

- Agencies, partners, and TRWC should work together to restore riparian buffers (see under Erosion).
- Landowning partners and agencies with road maintenance responsibility should minimize connectivity of road drainage ditches to stream channels (see under Erosion). Where necessary, they should build a sediment settling system to detain runoff prior to stream entry.

Issue #7: High levels of bacteria and ammonia have adversely impacted streams within the watershed. In some cases, inputs of these constituents have caused streams to be listed under section 303(d) of the Clean Water Act.

Solution Strategy: The management strategy for problems related to bacteria and ammonia nitrogen should focus on keeping animal and human waste away from aquatic systems. Successful nitrogen management also relies on effective fertilizer management.

Specific Recommendations:

- The Tualatin River Watershed Council should coordinate with the appropriate management agencies to develop runoff management strategies in urban areas.
- Agencies should intensify efforts to identify and improve faulty septic systems near streams. In order to facilitate improvement of these systems, homeowners should be offered incentives such as cost-share opportunities. Because of demonstrable water quality problems, the **Christensen Creek** subwatershed is a high priority for these activities. Intermittent high bacteria counts indicate that other Chehalem Mountain subwatersheds, such as **Burris Creek** and **Baker Creek**, are a moderate to high priority. These efforts should also be part of a comprehensive effort to reduce bacteria levels in subwatersheds contributing to **Rock Creek**.
- Agencies and animal-owning partners should intensify efforts to keep sources of animal waste from entering streams. NRCS and SWCD should continue efforts to identify sources of animal waste to aquatic systems and to work with land owners to eliminate these sources. Together, they should implement appropriate measures, potentially including livestock exclusion, vegetation buffers, and proper storage and application of waste. NRCS and SWCD should continue efforts to publicize available cost-share programs to implement these measures. In order to remove streams from the 303(d) list, these efforts are applicable to most rural watersheds, particularly **Christensen Creek**. Additionally, pet waste has been identified as a potentially important bacteria source in urban subwatersheds.
- Agencies and partners should work together to improve fertilizer management for urban, agricultural, and forestry applications. NRCS and SWCD, other appropriate agencies, and educational institutions should seek funding to continue studies to determine optimal fertilizer application levels. As funding becomes available, they should conduct these studies expeditiously. They should distribute findings of these studies to applicable agency personnel and private agriculture, forestry, and landscaping businesses. Additionally, they should update publicly accessible literature to include the most current findings and create a distribution system to ensure that the literature makes its way to applicable personnel.
- NRCS and SWCD should continue to work with landowners to implement agricultural BMPs that reduce nutrient laden runoff to streams.

Issue #8: Phosphorus levels in portions of the watershed exceed established TMDLs.

Solution Strategy: Monitoring data indicate that instream phosphorus concentrations are well above those attributable to natural sources. Persistent effort will be essential to reducing instream phosphorus below current levels. Measures taken to minimize sediment delivery to streams, as well as effective nutrient and animal waste management will limit inputs of adsorbed phosphorus. Reductions in readily decomposable organic matter will reduce anaerobic streambed conditions that release phosphorus from sediments.

Specific Recommendations:

- The Tualatin River Watershed Council should coordinate with Metro and other appropriate management agencies to maximize implementation of BMPs related to reduction of nutrients and sediment in urban areas. This will include distribution of educational material.

- NRCS and SWCD should continue implementation of rural BMPs and educational programs, especially with respect to nutrient management, animal waste management, livestock grazing, and erosion control.
- Partners and agencies should implement measures to reduce inputs of sediment, manure, grass clippings and other non-woody organic matter to streams.
- Agencies and partners should avoid practices that resuspend stream bottom sediments.
- ODEQ or another agency source should conduct a study to investigate the role of inadequate septic systems in contributing to phosphorus loads. In stream reaches where inadequate septic systems are found to be a significant contributor of phosphorus, the source should be identified, and a cost-share program should be implemented to upgrade the septic system to adequate standards.

Issue #9: Most streams have summer temperatures detrimental to salmonids and other aquatic life preferring cool water conditions.

Solution Strategy: Strategies for temperature moderation should focus on protection and restoration of the riparian canopy. Some stream reaches would also receive local reduction of water temperature through leasing of additional instream water rights.

Specific Recommendations:

- The Tualatin River Watershed Council, partners, and agencies should work together to implement programs to restore canopy cover through revegetation of the riparian zone with appropriate species. (See under Erosion).
- The Tualatin River Watershed Council should explore leasing options for additional instream water rights (See under Hydrology/Water quantity)

*Issue #10: Summer dissolved oxygen levels in many streams are below optimal levels for salmonid rearing. This is particularly important on **McFee Creek** and **Rock Creek**, which are considered to provide habitat for steelhead trout.*

Solution Strategy: Strategies to improve dissolved oxygen levels throughout the watershed should emphasize thermal moderation. Additionally, ODEQ has found that dissolved oxygen levels in urban streams will receive a potentially substantial benefit if inputs of nutrients and organic material are reduced.

Specific Recommendations:

- The Tualatin River Watershed Council should work with appropriate management agencies to reduce fertilizer runoff, animal wastes, and organic debris from urban sources.
- NRCS and SWCD should work with land and animal owners to implement measures for management of waste and organic debris.

*Issue #11: Sedimentation appears to be impairing biological function in the watershed. Biological sampling indicates that high impairment exists in subwatersheds contributing to **Rock Creek**. Sediment-related impairment is also expected to be present in other subwatersheds.*

Solution Strategy: Sediment reduction strategies are indicated. Although the problem is only partially related to human management, that part can be addressed by implementing measures to address erosion and mass wasting caused by construction and other human activities. (See erosion section)

Specific Recommendations:

- Agencies, the Tualatin River Watershed Council, and concerned partners should work together to implement measures recommended to address erosion issues.
- Where erosion is occurring, concerned parties should consider the construction of sediment control structures, vegetated buffer strips and/or wetlands to prevent sediment delivery to stream systems or, alternatively, to remove sediments from streams. This is particularly important in subwatersheds contributing to McFee Creek, as well as the Upper Rock Creek subwatershed, where there is a substantial length of nearstream roads.

6.1.1.5 Aquatic species and habitat issues

Issue #12: Salmonid populations are declining. A large proportion of this decline can be attributed to degradation of habitat and water quality.

Solution Strategy: Attempts to restore salmonid populations should focus on habitat preservation and restoration. These efforts should concentrate on **Rock Creek** and **McFee Creek**, where most of the watershed's existing salmonid spawning and rearing habitat is located. The feasibility of habitat restoration on the **Tualatin River above Rock Creek** should also be considered. Cutthroat trout would also benefit from restoration efforts on **Beaverton Creek, Upper Beaverton Creek, and several unnamed Rock Creek tributaries**.

Habitat restoration can provide an important role in the watershed. However, restoration should not substitute for preservation of currently suitable habitats. Compared to watersheds further west in the Tualatin River subbasin, the Middle Tualatin-Rock Creek watershed has relatively little high quality salmonid habitat. Preservation opportunities will be available on a spotty basis, rather than for extensive stream reaches.

Instream restoration strategies should focus on restoring channel structure, roughness elements, and habitat diversity. Additionally, reduction of nutrient and sediment inputs will be part of any successful habitat restoration activity. Lack of large woody debris (LWD) seems to be an important factor impacting channel structure. Current LWD recruitment potential is poor. LWD placement is a viable short-term option, but should not replace riparian protection and other measures that will provide for long-term recruitment potential. Other measures, such as restoration of stream canopy and improvement of water quality, coincide with objectives of other modules. If efforts are taken to address concerns related to erosion, hydrology, water quality, and stream channel characteristics, benefits to fish will accrue.

Specific Recommendations:

- TRWC, partners, and agencies should work together to preserve existing salmonid spawning and rearing habitat. They should conduct surveys to determine the location and condition of such habitat. During these surveys, appropriate restoration sites should be noted. For optimal results, surveys for steelhead trout habitat should be concentrated on **McFee Creek below Finnegan Hill Dam**. Additionally habitat surveys should be conducted on **Rock Creek above Beaverton Creek** to supplement data from rapid stream assessments. Additional habitat surveys for resident cutthroat trout may be valuable on longer reaches of these streams, as well as Beaverton Creek, Upper Beaverton Creek, and Cedar Mill Creek.
- TRWC, partners, and agencies should work together to restore instream habitats for salmonids. Such restoration may include placement of large woody debris and/or instream channel structures. Restoration projects should be accompanied by monitoring to determine the most effective techniques. Portions of **McFee Creek** and **Rock Creek above Beaverton Creek** are potential sites for restoration.
- TRWC, partners, and agencies should work together to restore riparian vegetation. Partners should plant appropriate native tree species where the natural riparian canopy has been removed. Where non-native shrub and herb species such as Himalayan blackberry and reed canarygrass have invaded riparian habitats, partners should replace these species with appropriate native trees and shrubs. This recommendation applies throughout the watershed. Areas where riparian restoration would provide the greatest potential benefit for fisheries include **Rock Creek above Beaverton Creek** and **McFee Creek below Finnegan Hill Dam**.
- Landowning partners and appropriate agencies should conduct culvert surveys to locate obstructions to fish migration. They should replace culverts and other stream crossing structures that do not provide adequate passage.
- Conservation organizations, other partners, or agencies should acquire land or conservation easements in crucial riparian habitats. Agencies should promote incentives for private land owners to implement BMPs designed to protect aquatic habitat. The TRWC, partners, and agencies should strive to form cooperative fisheries enhancement projects across ownership boundaries that maximize habitat improvement.

Issue #13: Reductions in wetland area have led to depletion of habitat for wetland and riparian species. This has adversely impacted populations of these species, especially amphibians.

Solution Strategy (Wetlands): The most effective policy given current constraints is to protect existing wetland resources, and to prevent encroachment of activities that are incompatible with wetland function. As financing becomes available, procurement of additional lands and conservation easements will also assist in providing wetland habitat. Where incompatible uses do not already exist, there may be opportunity to restore the functionality of degraded wetlands. For example, eradication of reed canarygrass and restoration with native vegetation may enhance the habitat values of these wetlands. Additionally, opportunities may exist to enhance habitat values within storage ponds. Many of these ponds already provide open water habitat for waterfowl. Emergent species could be planted along pond margins to increase habitat values for amphibians and other species dependent on shallow water habitat. However, this approach may cause conflicts with other interests using the ponds.

Solution Strategy (Riparian habitats): Strategies for riparian dependent species should emphasize increasing the amount of suitable riparian habitat. Programs are currently underway to meet this objective. One such program is the Conservation Reserve Enhancement Program (CREP). Administered by the NRCS, this program provides financial incentives for farmers to establish buffer strips along streams. It is hoped that this and similar programs will increase the amount and quality of habitat available to riparian dependent species.

Specific Recommendations:

- The TRWC should coordinate with the Tualatin Hills Parks and Recreation District, the Jackson Bottom Preserve, and other partners and agencies to perform population surveys to determine the extent of amphibian species, as well as other riparian and wetland-dependent species.
- The TRWC, partners, and agencies should evaluate and implement programs to restore wetland functionality. These are discussed in Section 6.1.1.2. Opportunities for wetland enhancement exist at **Jackson Bottom** and **Fernhill Wetlands**. Additional opportunities may exist elsewhere in the watershed.
- The TRWC, NRCS, and SWCD, should work with permitting authorities to simplify the permitting process, and to reduce costs associated with permits for wetland projects.
- Conservation organizations, other partners, or agencies should acquire habitat conservation easements in riparian areas.

6.1.2 Terrestrial

6.1.2.1 Vegetation issues

Issue #14: Management practices have resulted in a change in vegetational characteristics. The amount of vegetation in late-successional stages has been severely reduced from reference levels. Hardwoods have invaded areas formerly dominated by conifers.

Solution Strategy: Intensive land use within the watershed limits potential opportunities to manage for late-successional stand characteristics. Some potential may exist in subwatersheds draining to McFee Creek, as well as headwater reaches in the Tualatin Mountains. (These headwater reaches lie adjacent to Forest Park. The ability to develop late-successional habitat characteristics will depend on the management emphases of different landowners. Often, restoration of conifers to hardwood areas is in the management interests of both federal and private landowners.

Specific Recommendations:

- Where feasible, landowners are encouraged to reestablish native conifers on sites where hardwoods have invaded.
- Large landowning partners are encouraged to manage currently mature stands of private forests to develop late-successional characteristics including stand complexity, snags, and down wood.

Issue #15: Native species richness within much of the watershed has been compromised by invasive exotic and noxious weeds.

Solution Strategy: Solutions for management of exotic weeds are best managed by partnerships between agencies and landowners. In the watershed, however, fragmented land ownership makes formation of weed abatement partnerships difficult. Cooperative efforts between the Tualatin River Watershed Council, Oregon Department of Agriculture, and Washington County would provide a major step in forming effective partnerships.

To prevent recolonization by weed species, planting and cultivation of desirable species should accompany weed eradication.

Specific Recommendations:

- TRWC should facilitate contact between the BLM, Farm Bureau, ODA, NRCS, SWCD, private industrial landholders, and other entities representing landholders to form partnerships to combat noxious weeds. TRWC should coordinate efforts by other groups with current efforts being conducted by the Oregon Department of Agriculture. If feasible, eradication efforts should emphasize non-chemical methods near aquatic systems. Non-chemical methods should also be considered for other areas.
- NRCS, SWCD, and other applicable agencies should advertise the availability of educational pamphlets encouraging eradication of noxious weeds. These pamphlets should be updated as necessary to address problems specific to the Tualatin Valley.
- TRWC, ODA, SWCD, and concerned partners should form a committee to determine which plants have the capability to become noxious weeds within the Tualatin Basin. The committee should work with the appropriate agencies, nurseries, and consumer groups to restrict the ability of these plants to become naturalized within the basin.

6.1.2.2 Terrestrial species and habitat issues

Issue #16: Many plant and animal species in the watershed are sensitive to management-induced habitat changes. The Bureau of Land Management has included many of these species on its list of sensitive species. Habitat for many of these species has been reduced from former levels.

Solution Strategy: Proper management strategies for sensitive species will vary by the species. The Bureau of Land Management has identified management strategies for species considered by the Bureau to be sensitive[33].

Knowledge of species distribution is an important prerequisite for successful management for sensitive species. In order to gain this knowledge, systematic surveys should be conducted where habitats are suitable for these species.

Specific Recommendations:

- TRWC should act as a facilitator to formulate uniform habitat management policies.
- TRWC should support research into ways to facilitate sustainable native plant communities.
- Government policy makers should consider providing incentives for landowners to manage forests for recruitment of snags and down wood.
- TRWC should seek funding and facilitate partnerships to conduct systematic surveys for sensitive species.

6.1.3 Social

6.1.3.1 Issues related to human uses

Issue #17: Timber, agricultural, domestic, industrial, and wildlife interests often come into conflict for limited resources. As population increases, this competition will intensify.

Solution Strategy: A cooperative approach between various interests is necessary to resolve competing watershed demands. The Tualatin River Watershed Council plays a major role in facilitating this cooperation.

Specific Recommendations:

- In order to achieve Oregon's environmental policy objectives, the Oregon Watershed Enhancement Board should continue funding for the Tualatin River Watershed Council.

6.1.3.1.1 Recreation

Issue #18: Nearstream recreational activities can lead to disturbance of the riparian zone. Support activities associated with recreational facilities can contribute pollutants to streams.

Solution Strategy: Measures should be taken to minimize the effects of recreational activities upon streams. These include regulation of stream access, maintenance of vegetated buffer strips between streams and activities detrimental to the aquatic system, and monitoring to determine the location, nature, and magnitude of recreation-associated impacts on streams.

Specific Recommendations:

- TRWC, agencies, and partners should work together to conduct a survey to determine specific sites of impacts due to recreational access to streams. Determine whether recreational benefits outweigh impacts at these sites. Where continued access is considered beneficial, consider armoring the streambank or otherwise constructing facilities to minimize impacts.
- Agencies should monitor parks to ensure that they do not contribute appreciable inputs of fertilizers, pesticides, and herbicides to stream systems. Managers of these facilities should be encouraged to develop conservation plans through NRCS and SWCD.

6.1.3.1.2 Road-related issues

Issue #20: Roads are significant contributors to problems related to erosion, water quality, stream channels, and aquatic life (see respective sections).

Solution Strategy: A diversified strategy is necessary to deal with road-related problems. This strategy will consist of a combination of measures to restrict road-related impacts upon streams.

Specific Recommendations:

- Landowning partners should avoid building new roads on steep terrain. Where feasible, roads in these areas should be decommissioned. (See Section 6.1.1.1). Potential criteria for road closure are given on page \h 122.
- Surveys should be conducted to locate "legacy roads" and abandoned railroad grades that may be posing problems to watershed resources. Additionally, funding should be sought to reduce impacts from these roads.

6.2 Recommendations on BLM lands

The following recommendations were specifically designed to fulfill management objectives on BLM lands. Table 6-2 identifies project types that would be useful on specific parcels.

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Table 6-2. The following table displays a list of eight projects that the ID team recommends be implemented in the Middle Tualatin-Rock Creek 5th field watershed. This list is intended to serve as a reservoir of potential projects that could be done in the watershed on BLM land. Whether these projects are implemented, and the order in which they occur, is entirely dependent upon BLM management discretion.

Project #	Location	Resources Affected	Description	Issues* addressed	ACS ** objectives
1.	T2N R2W Section 15	Silviculture	This section would benefit from density management and density management with small openings in patches of *Phellinus weirii*. Portions of this section would be converted from hardwood to conifer. Openings would be reforested with species that are tolerant, resistant or immune to *P.weirii*. Some shrub control would be necessary for the first few years to help disease resistant tree regeneration.	12,14	1, 9
2.		Botany	English ivy eradication project: Eradicate English ivy that has become established in Section 15.	11	2,8,9
3.		Wildlife	Wildlife trees, snags and down logs could be created in appropriate areas of section 15.	11	2,8,9
4.		Silviculture	This section would benefit from density management in 60 year old stands in Section 13. Portions of this section would be converted from hardwood to conifer. Some shrub control would be necessary for the first few years to help disease resistant tree regeneration.	12	1,9
5.		Silviculture/ Botany	Stand typing should be reviewed in Section 13. Where mapped stand types are found to be inconsistent with actual vegetation, the stands should be retyped.		
6.	T2S R3W Section 23	Silviculture	This section would benefit from density management and density management with small openings in patches of *Phellinus weirii*. Portions of this section would be converted from hardwood to conifer. Openings would be reforested with species that are tolerant, resistant or immune to *P.weirii*. Some shrub control would be necessary for the first few years to help disease resistant tree regeneration.	12,14	1, 9

Project #	Location	Resources Affected	Description	Issues* addressed	ACS ** objectives
7.		Silviculture/ Botany	Stand typing should be reviewed in Section 23. Where mapped stand types are found to be inconsistent with actual vegetation, the stands should be retyped.		
8.		Land Exchange	There may be opportunity to exchange the parcel in Section 23 for land elsewhere, thus fulfilling the BLM objective to consolidate its ownership into larger blocks.	5,9,15	1,2

* Each potential project responds to at least one or more of the issues identified in Chapter 6: Recommendations on BLM lands. The number of the issues(s) is written in the column.

** Most of the projects directly respond to one or more of the Aquatic Conservation Strategy (ACS) Objectives. A list of these objectives can be found in Appendix 3. The number of the ACS objective is written in the column.

6.2.1 Aquatic

6.2.1.1 Erosion and hydrology issues

Issue #1*:* Portions of the BLM lands in the fifth field watershed have soils that are naturally erodible and unstable. Extra care must be taken on those lands, when planning and implementing management activities such as road building and timber harvesting.

Recommendations:

- Incorporate considerations related to slope, soils, habitat objectives, and hydrologic function into the decision-making process when planning and designing roads, especially when they are proposed to be located within Riparian Reserves.
- When considering methods to provide access to lands without currently maintained roads, consider upgrading and using legacy roads rather than constructing new roads. In sensitive areas, if no mapped roads or legacy roads access the management area, consider other access alternatives in preference to construction of new roads.
- Road construction, upgrading, maintenance, and closure should be performed in accordance with Best Management Practices, as listed in Appendix C of the *Salem District Record of Decision and Resource Management Plan*.

Issue #2: Poorly designed and implemented management activities, including timber harvest and road construction, can lead to soil compaction and may result in reduced soil productivity, increased water runoff and erosion, and altered stream flows.

Recommendations:

- As applicable, use the Best Management Practices for timber harvest and road construction as described in Appendix C of the *Salem District Record of Decision and Resource Management Plan* to minimize soil compaction*.*

6.2.1.2 Stream channel issues

Issue #3: Coarse wood and larger snag recruitment potential is poor along some stream reaches because the stand age is relatively young, stand density is high causing the trees to be smaller, and conifers are reduced or absent.

Recommendations:

- Conduct surveys to determine appropriate sites for restoration projects to increase the amount and size of large woody debris in stream channels, floodplains, and riparian areas.
- The highest priority areas for instream and floodplain wood placement are low gradient stream reaches deficient in large wood.
- The highest priority for riparian restoration projects are those streamside areas that are dominated by hardwoods or overstocked conifer stands that would benefit from thinning or underplanting.
- Where a few scattered understory conifers are growing within riparian areas strongly dominated by alder or other conifers, consider treatments to increase understory and overstory conifer growth, vigor, and exposure to sunlight.
- Consider possible conversion or pocket planting of conifers along stream segments that are dominated by hardwoods.
- Plant appropriate vegetation in unstable areas, such as landslides along streams and flood terraces.

6.2.1.3 Water quality issues

Issue #4: Appreciable reduction in canopy cover within riparian zones could affect water temperature downstream.

Recommendations:

- When doing enhancement projects in Riparian Reserves, avoid removal of vegetation along perennial streams that will result in increases in stream temperature.
- When conducting forest density management projects inside Riparian Reserves, leave a no-cut vegetation buffer along all intermittent and perennial stream channels, lakes, ponds, and wetlands. The width of this buffer should be determined on a site-specific basis. Additionally, the buffer should include stream-adjacent slopes with a high potential for landslides. The purpose of this is to protect the streams and riparian zones from any direct or indirect disturbance from project activities, and to ensure that existing shading is not reduced.

6.2.1.4 Aquatic species and habitat issues

Issue #5: BLM lands only comprise a small portion of the watershed and efforts to restore aquatic species and habitat are unlikely to succeed unless BLM forms partnerships with other landowners.

Recommendations:

- Maintain active participation in the Tualatin River Watershed Council. Continue to have a BLM employee act as liaison with the council. Participate and cooperate in projects when possible and requested to do so by the council.
- Explore partnership opportunities with other landowners to evaluate best areas for stream restoration.

Issue #6: Sedimentation along some stream reaches is degrading aquatic habitat.

Recommendations:

- When implementing silvicultural prescriptions in Riparian Reserves, consider use of logging systems and site preparation methods that would reduce site disturbance, and maintain a “no-cut buffer” appropriate to site specific conditions along stream channels.
- Where feasible, avoid road-building activities within Riparian Reserves. Where these activities are necessary, use practices that meet the Aquatic Conservation Strategy objectives.
- When yarding within or through Riparian Reserves, yard away from and require full log suspension over all stream channels, lakes, ponds, and wetlands. Limit soil disturbance by selecting appropriate yarding systems and restrictions based on site analysis.
- Evaluate all stream segments capable, or potentially capable, of supporting salmonid spawning and rearing for potential stream habitat improvement projects.
- Take an active role in fisheries information collection and cooperatively distribute information to other land or resource managers. Develop a system to conduct follow-up stream habitat inventories to assess habitat trends over time.

Issue #7: Poorly designed and improperly placed stream crossings can impose migratory barriers to aquatic life, contribute sedimentation to streams and increase the concentration of flow.

Recommendations:

- When constructing or improving roads, place culverts in a manner where they will not create velocity barriers for migrating salmonids.

6.2.2 Terrestrial

6.2.2.1 Vegetation issues

Noxious/Exotic Plants

Issue #8: Road networks and disturbed areas adjacent to BLM lands provide pathways for introduction of English ivy, Himalayan blackberry and other non-native, exotic plants.

Recommendations:

- Where appropriate, develop “Memoranda of Understanding” (MOUs) with adjacent landowners and state and county agencies in order to expedite weed control goals.
- Where consistent with safety and management considerations, protect existing native vegetation along roads. When building new roads, keep the clearing limit as narrow as safely possible to reduce available growing sites for invasive species.
- Consider cleaning heavy equipment that will be used on BLM land for management activities, with a high-powered sprayer. Cleaning should occur before entering BLM land, and discarded seeds should not be allowed into open water courses.
- Consider information from the Oregon State University Weed Survey Report, Spring 1998, to control and prevent exotic/noxious weeds (and invasions of such weeds) on BLM administered lands in the watershed.
- Control noxious weed infestations through appropriate control measures (manual labor, biological controls, herbicides, prescribed fire) where consistent with ecological objectives.
- Depending upon site-specific conditions, consider providing “visual buffers” adjacent to density management harvest units to limit disturbances to wildlife as well as help with limiting the spread of noxious weeds.

6.2.2.2 Species and habitat issues

Issue #9: The area is currently inadequate to sustain populations of many species dependent upon late-successional forest. Little interior habitat is present, and habitat connectivity is poor for ground-based species dependent on late-seral habitat.

Recommendations:

- Evaluate stands in the AMA and Riparian Reserves to consider the application of silvicultural prescriptions to benefit the development of late-seral stage habitat. Potentially beneficial treatments include thinning to encourage rapid growth and enhance the development of late-seral stage habitat, creating snags (eventual down woody debris), and underplanting with long-lived coniferous species in areas where they are largely absent.
- Consistent with project objectives, consider the use of logging systems and site preparation methods that would reduce disturbance to reserve trees, existing snags and down wood, especially when operating in Riparian Reserves.

Issue #10: BLM-managed lands in the watershed are deficient in both snags and down logs. Both primary and secondary cavity nesters, as well as a variety of other vertebrate species depend on these structural components for their livelihood.

Recommendations:

- When planning projects, measure actual CWD levels in the project area and consider performing some of the following to make progress to achieving CWD goals:
- Coarse woody debris that is already on the ground should be retained and protected from disturbance to the greatest extent possible.
- Existing snags should be protected in harvest areas to the extent possible. A good technique is to place a buffer of green trees around the snag to protect it from damage.
- When planning density management thinnings, evaluate adjacent areas that are not being considered for silvicultural treatment, for snag or CWD creation projects. Stands with lower stocking that won’t be treated

with density management thinning, Riparian Reserves or TPCC withdrawn areas would all be good candidates for evaluation.

6.2.2.3 Forest resources issues

Issue #11: Some timber stands appeared to be inaccurately typed..

Recommendations:

- Re-evaluate the typing for stands where vegetation on the ground appears to be inconsistent with the mapped forest type.

Issue #12: Many stands, including some in Riparian Reserves, are too densely stocked to efficiently develop late-successional characteristics.

Recommendations:

- Consider density management thinning of well-stocked and over-stocked mid-aged conifer stands, both inside and outside of riparian reserves, to accelerate size development and promote windfirmness in remaining conifers. Variable-density thinning could also be used to enhance structural complexity of relatively dense conifer stands depending on stand density and characteristics of potential “leave” trees.
- Treatments within 30-50 year old stands should take place within the next 15 years (USDA and USDI 1998). Most stands should be treated within the next 10 years.
- In all management operations, maintain a buffer of trees and brush along stream channels (both intermittent and perennial) sufficient to provide adequate shade to the stream and protect the stream banks and channel.
- Because grand fir, western redcedar, and western hemlock are normally only a small component of these stands, select these trees as leave trees in density management thinning. Natural regeneration from these species following density management can help to initiate a more diverse understory and form the basis for another canopy level that could be developed through further management actions. Bigleaf maple should also be maintained in these stands.

Issue #13: In stands with high concentrations of fresh, down Douglas-fir wood, elevated Douglas-fir bark beetle populations have the potential to cause substantial Douglas-fir mortality.

Recommendations:

- When creating woody debris, try not to leave more than three fresh down Douglas-fir trees per acre greater than 12 inches DBH at any one time. This is especially true when the down trees are shaded and where tree vigor of the remaining trees is reduced because of root disease or other causes. Where down trees are exposed to full sunlight, the number of trees left for down wood could probably be doubled without posing an undue risk to the surrounding trees. Because the efficiency of beetle breeding in standing dead trees is about one-half of that in down logs, about twice as many snags could be created to enhance coarse woody debris without undue risk to stand health.
- When there is a need to add large amounts of fresh down Douglas-fir trees or logs to increase the amount of down wood or create snags, add them in a series of events spaced at about five years apart. Always consider the creation of snags rather than falling live Douglas-fir as a way of increasing woody debris over time.
- When creating down logs or snags, fell Douglas-fir trees no earlier than July and no later than the end of September. This will avoid beetle breeding and dispersal periods for the current year and reduce the suitability for beetle breeding the following year.
- In cases where subsequent beetle killing may be desirable for snag creation, such as in Riparian Reserves, it may be appropriate to fell the trees before July or fell additional trees for down wood.

Issue #14: Parts of the watershed have moderate levels of the root rot fungus, Phellinus weirii. This fungus can contribute to excessive mortality of Douglas-fir, either directly or indirectly because diseased trees are highly prone to killing by Douglas-fir beetles.

Recommendations:

- *P. weirii* spreads from tree to tree through root contact between susceptible host species. To reduce disease spread where infection centers are well defined, create small patch cuts in root disease centers and reforest these areas with species that are tolerant, resistant, or immune to *P. weirii*.
- Retain tolerant, resistant, or immune tree species that may have naturally regenerated in the patch cut areas. Disease-created Douglas-fir snags and down logs can remain in the patch cut areas.
- Islands of trees that appear to be relatively free of disease can receive density management thinning. To reduce the probability of disease spread to these islands of "leave trees," remove susceptible host trees along the outer edge of the islands in a one-tree (leave tree) spacing to disrupt root continuity to susceptible trees in the islands.
- In density management thinnings in the presence of *P. weirii*, select resistant, tolerant, or immune species in disease centers as leave trees in preference to Douglas-fir or grand fir—both of which are highly susceptible to this disease.

6.2.3 Social

6.2.3.1 Issues related to human uses

Issue #15: Given the existing land ownership patterns and differing management objectives between land owners, management options on BLM land can be affected by the cumulative impacts resulting from non-federal land practices, and access to public land can be blocked.

Recommendations:

- BLM employees should make themselves available for 1 to 1 contact with user groups in the areas and other state agencies.
- "Retain lands with unique resource values" (ROD/RMP 53).