**Final Design Report**

**Adopt A Stream Foundation**

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# Introduction

The Adopt A Stream Foundation (AASF) is working closely with the City of Redmond to improve the relationship between the local government and a private landowner along a highly degraded portion of Bear Creek. AASF has encouraged a stream-friendly land ethic in this landowner and has received permission to improve instream and riparian conditions along 350-linear feet of Bear Creek as it runs through the Friendly Village Mobile Home Park in Redmond, WA. The proposed improvements will benefit numerous salmonid species by achieving the following goals and objectives:

1. Build a good relationship with the landowner and help address erosion where it is compatible with stream restoration goals.
	1. Develop a project in an area of landowner concern
2. Increase channel complexity
	1. Install approximately four wood structures using 30 large logs and 17 rootwads
3. Improve channel stability
	1. Grade peninsula to better accommodate seasonal flooding and provide stable planting area for native trees and shrubs
4. Decrease thermal pollution
	1. Establish native plantings along 14,300 sq. ft. of streamside property

# Existing Conditions

Friendly Village is a 55+ mobile home park with access to approximately 1,400 linear-feet of highly degraded main stem Bear Creek. Few native trees and shrubs remain in the lawn-dominated riparian area. This reach of Bear Creek (Reach 6) has been identified in various plans as having:

* Decreased floodplain connectivity and decreased off-channel habitat because of channel confinement. Due to development, the channel is somewhat disconnected from its historic flood plain and is constricted by several road crossings which results in reduced habitat conditions and flooding in developed portions of the property.
* Very little large woody debris. Wood is important because it increases channel complexity, contributes to channel stability, develops pools, traps sediment, and reduces water temperature.
* Poor coverage of native riparian vegetation. Restoring riparian vegetation will improve channel stability, provide sources of large woody debris that can contribute to creation of pools, and reduce peak water temperatures that favor non-native species.

Before AASF made contact with the landowner, a significant barrier to any stream restoration at this location was resistance from the landowner due to distrust of local government and a lack of understanding of stream processes. AASF has been working with this landowner on stream restoration projects of increasing size since 2011 to develop this relationship and improve this degraded stream reach. With the successful completion of this project, AASF hopes to pave the way for even more significant improvements to Reach 6 of Bear Creek in the future.

# Design Alternatives

While numerous opportunities to improve the conditions of Bear Creek as it runs through Friendly Village are clearly visible to AASF and other agency specialists, the final project site was chosen as a compromise between salmon restoration goals and landowner concerns over stream bank erosion. While the option of solely armoring banks with rock in areas of severe erosion was available, this strategy would not have provided the long-term benefits to fish habitat that AASF desired and may have only exacerbated downstream erosion. In addition, the project area was limited to the left bank due to existing native vegetation and potential storm and sewer infrastructure along the right bank. With these issues in mind, the primary factors debated during the design process include:

* Bank Construction
* Existing Native Vegetation
* Chanel Enhancement
	+ LWD Placement
	+ Anchoring
* Cost

Three main plans have been considered during the design process. In 2012, AASF proposed a simple design of re-grading the slope to provide a more stable planting area, covering the new stream bank with coir fabric and using willow to help add stability in flood-prone areas (Appendix A). This plan included fairly conservative wood placement along the left bank Ordinary High Water Level and anchoring techniques including cable, rock, Manta Ray Earth Anchors, Duckbill Earth Anchors and a few rebar pins. While this plan was relatively low cost, it would have required the removal of an existing mature cottonwood tree. After review by the SRFB, it was decided that the value of existing mature vegetation was high enough to warrant adjustment to the first design.

The second design incorporated SRFB’s concerns and preserved the mature cottonwood tree (Appendix A). In order to do this, however, an existing high-water channel along the left bank would have to be armored and graded carefully to prevent the formation of a year-round side channel. Conservative wood placement was used to achieve this design objective. After review in 2013 by SRFB and WDFW, the suggestion to move the wood to more “aggressive” locations was shared with AASF, inspiring changes for the third design.

A third design modified the 2013 submittal to WDFW by adjusting the location of the logs so that more instream cover would be provided (Appendix A). Because finalizing project designs and completing cultural reviews required more staff time than anticipated, adjustments to the budget were necessary. Originally, a previous AASF habitat group supervisor proposed a strategy that eliminated the use of Manta Ray Earth Anchors to help cut construction costs. This design, which was featured in the Preliminary Design Report, was reviewed by the WRIA 8 Technical Committee in January 2014 and has also been reviewed by a WDFW engineer. However, the new AASF habitat group supervisor preferred Manta Ray Earth Anchors, since they provide additional stability for the project. No changes to wood placement were made, but Manta Ray Anchors were returned to the designs (no boulder anchors were removed). Instead, reductions in staff labor were made to bridge the budgetary gap. A minimal crew will be used to install the log structures and mainly volunteer laborers will complete on-site planting.

# Preferred Alternative

The preferred alternative, which will be implemented in August 2014, is the design including 30 straight logs and 17 rootwads that includes both rock and Manta Ray anchoring. Rebar may be used at select areas to help stitch logs together. The WRIA 8 Technical Committee reviewed the layout of these logs, and AASF already has an HPA and U.S. Army Corps of Engineers permit for this work. The planting area spans approximately 14,300 sq, ft. and includes native trees, shrubs, and groundcovers to develop a tiered riparian habitat and long-term shade. The composition and layout of these plants (Appendix A) has been chosen to also provide an aesthetic feature for Friendly Village Park residents.

# Design Considerations and Analyses

*Bank Construction*

The primary goal for bank construction is to provide stable, sloping banks that support long-term native plant establishment. Bank gradient has been adjusted as designs evolved to achieve this objective. After grading is complete, AASF will lay coir fabric, coir logs, straw wattles, and/or similar erosion control materials to help maintain bank stability while native plantings establish. This is a commonly accepted bank stability practice. Native plantings will also span all disturbed soil to reduce the likelihood of future erosion.

*Existing Native Vegetation*

Because one of the main concerns for the health of Reach 6 is the lack of native vegetation, AASF and project partners prioritized preservation of most existing native vegetation while planning the project.

*Channel Enhancement*

Large woody debris placement for this project must provide as much instream habitat as possible while preventing the formation of a permanent side channel. Such a side channel would pose a long-term threat to adjacent plantings and residences. While AASF increased the aggressiveness of the proposed wood structures under the advisement of SRFB and WDFW, reviewers should note that slight adjustments to wood placement might be made in the field to ensure both objectives are met. Due to the size of wood installed, a combination of anchoring techniques will be used on the site. In anticipation of this project, AASF has already tested the use of rebar as an anchoring strategy on a smaller, conservative wood project in Friendly Village upstream of the proposed project site. This wood structure, installed in 2012, has held up well to the winter flows of Bear Creek. Other anchoring strategies detailed in the final project plans have been utilized by AASF in similar-sized projects along Little Bear Creek and Scriber Creek.

*Cost*

There is ample space for more wood and planting throughout the Friendly Village property. Additional planting and LWD placement within the Friendly Village Mobile Home Park (both upstream and downstream of the project site) would benefit Reach 6 of Bear Creek but would require additional funding. AASF will continue to seek funding to complete additional planting and/or wood habitat projects at this site in the future.

# Final Designs

Few changes have been made to the designs since the submission of the Preliminary Design Report in February 2014. First, a small typo was corrected on the plans. In the Preliminary Design Report, 30 logs were depicted visually on the site designs, however, only 23 logs were listed in a text box summarizing the project. This number was corrected back up to 30 logs in the summary for the Final Design Report. Second, AASF staff ecologists have also added a symbol Manta Ray Earth Anchors to the designs to show where they will be installed. As mentioned previously, additional Manta Ray Anchors will be used to add stability to the project, as per the current AASF habitat group supervisor’s recommendations. In the Preliminary Design Report, it was noted on page 7 of the designs that “M1 Manta Ray anchors may be substituted 1 to 1 for rocks up to 3000 lb…” Instead of substituting Manta Ray anchors in for rocks, one Manta Ray anchor will be installed for approximately every 2 logs. An updated set of designs has been included in Appendix A of this report.

The budget has been revised to accommodate the wood and additional Manta Ray Earth Anchors. Labor costs have been reduced to the minimum staff needed on site to fund the differences in material cost. This will also help ensure that the project is completed within budget, despite the additional year of permitting and design review from 2013.

Essential aspects of the final designs are:

* Native planting of 0.3 acres of lawn
* Installation of 100 native trees and 300 native shrubs.
* 30 Large Wood pieces and 17 root masses installed, with root masses extending at least 1/3 into the channel.
* Preservation of existing native shrubs on the left bank
* Grading of slope to eliminate sheer banks and provide area for planting and wood placement

# Permitting and Stakeholder Consultation

The primary local stakeholders for this project are the landowner, neighboring residents of the mobile home park, and the City of Redmond. The City of Redmond is fully supportive of this project and has agreed to assist with long-term maintenance and monitoring at the site. The WRIA 8 technical committee and WDFW biologists and engineers have also reviewed plans. An HPA has been received by WDFW and a Nationwide permit has been received by U.S. Army Corps of Engineers, so work can begin in August 2014.

## Appendix A: Designs

Included:

* 1st design (2012)
* 2nd design (2013)
* Updated Final Design

## Appendix B: Design Review Comments

Included:

* SRFB Early Application Review Panel Comments
* AASF Response to SRFB Comments
* Correspondence

## Appendix C: Technical Specifications

Included:

* WSDOT General Specifications

## Appendix D: Construction Costs

Included:

* Friendly Village Cost Estimates

## Appendix E: Other Report Deliverables

* Contract Bidding Documents—Not Applicable. AASF plans to complete construction work using our experienced staff.
* Construction Permits—
	+ HPA
	+ Army Corps Permit