Project Plan
Upper Cedar River
Riparian Conifer Release and Underplanting
Phase 1, 2008

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Project Introduction and Statement

The Upper Cedar River Riparian Conifer Release and Underplanting Project is intended to increase the conifer component in riparian forests along the Cedar River upstream of Chester Morse Lake to approximately the confluence of the Cedar River and Seattle Creek. This project is part of the Cedar River Watershed HCP Conifer Underplanting commitment and addresses the goals of this HCP program articulated in the HCP and the Riparian Restoration Strategic Plan, namely.

"…to enhance and restore stream habitats, increasing the structural complexity of riparian and instream habitat, by accelerating the reestablishment of diverse and structurally complex riparian forests and associated ecological functions." (City of Seattle 2000)

Site Description

The Cedar River upstream of Chester Morse Lake is a relatively low gradient (< 4%) and moderately confined stream. It is classified as Geomorphic Mapping Unit 14, which is defined as "wide, alluvial mainstems with pool-riffle and braided morphology" (Bohle et al 2008). The entire reach is approximately 5 miles long.

The reach of the Cedar River upstream of Chester Morse Lake to Seattle Creek has been impacted by harvest of riparian forest and in some areas destabilized channels. Channel destabilization has likely resulted from removal of riparian vegetation and loading of coarse sediment from mass wasting associated with timber harvest and road building. Examination of aerial photographs indicates that channels have widened and become braided in areas by the mid 1940s. In the upper portion of the reach, riparian vegetation (primarily alder) has colonized some areas resulting in narrowed channels, but in the lower portion of the reach below Roaring Creek, substantial areas of unstable, braided channels are still present. The input of coarse sediment has decreased following the end of commercial logging in the mid-1990s and the decommissioning or repair of roads

prone to failure. This reach of the Cedar River is below recommended amounts and size of large woody debris (LWD), due to removal of LWD from past watershed management practices and the loss of large diameter riparian trees from timber harvest.

The valley bottom is characterized by extensive floodplain and terrace surfaces, with about 41% of the riparian area classified as deciduous dominated and 46% classified as mixed conifer-deciduous (Figure 1). Deciduous dominated stands tend to be on floodplain surfaces, with mixed stands on terraces. The deciduous trees in the area are primarily red alder (*Alnus rubra*), with substantial amounts of big-leaf maple (*Acer macrphyllum*) and some black cottonwood (*Populus balsamifera ssp. trichocarpa*). Conifer trees on the valley floor are a mix of Douglas-fir (*Pseudotsuga menziesii*), western hemlock (*Tsuga heterophylla*), western redcedar (*Thuja plicata*), and (Sitka spruce (*Picea sitchensis*). Grand fir (*Abies grandis*), Pacific silver fir (*Abies amabilis*), and noble fir (*Abies procera*) are also present.

Understory composition and density varies in the valley-bottom forest from relatively open understory under denser conifer stands to dense salmonberry (*Rubus spectabilis*) in some alder dominated stands. Alder/salmonberry stands tend to be on floodplain surfaces, with swordfern (*Polystichum munitum*) common in mixed stands on terraces. The height and density of salmonberry understories are often lower on more frequently flooded surfaces.

The upper Cedar River below Seattle Creek is habitat for the federally threatened bull trout (*Salvelinus confluentus*) and another HCP species of concern, pygmy whitefish (*Prosopium coulteri*). Both species spawn in the lower portion of the reach, and bull trout rear in floodplain channels for one to two years before migrating to Chester Morse Lake, where they spend most of their lives. There are some apparent resident bull trout that utilize the upper Cedar River within the project area, as well. Rainbow trout (*Oncorhynchus mykiss*) and shorthead sculpin (*Cottus confusus*) also occur in the upper Cedar River.

The subreach intended for treatment in 2008 extends from 0.2 mile below Seattle Creek downstream for approximately one mile (Figure 2). The proposed treatment area has extensive terraces and floodplains having mostly mixed deciduous-conifer or deciduous dominated cover.

Project Description, Objectives, and Justification

The overall goal of this project is to increase the abundance and growth rate of riparian conifers in the upper Cedar River riparian zone in order to increase the rate and size of future large woody debris (LWD) recruitment to the stream channel and floodplain, increase shading to the Cedar River, and enhance structural complexity of riparian forests. Conceptual model that shows how this project will enhance ecological function of the stream-riparian system of the upper Cedar are shown in Figures 3 and 4 for terraces and Figure 5 for floodplains. The specific objectives of this project are to:

1. Release existing conifers from competition with deciduous trees and shrubs to increase their growth rate by 20% or more and
2. Increase the density of conifers to achieve densities of 36 conifer trees per acre,

This project area was identified as having high priority for treatment based on a prioritization process for riparian underplanting and release. The lower portion of the reach is within a "synergy" area for restoration identified in "A Synthesis Framework for the Cedar River Watershed Habitat Conservation Plan" (Erckmann et al 2008). Synergy areas were identified based on the overlap of 1) key fish habitat, 2) habitat connectivity and 3) areas adjacent to special ecosystems elements. These areas are intended to be foci of restoration for aquatic, riparian, and upland restoration in order to coordinate and achieve greater overall benefit from watershed restoration actions. Because the upper portion of the reach is important for LWD recruitment to the lower reach, it was considered to be connected to the high priority "synergy" area and also of high priority for treatment. The project area also has the greatest amount of riparian area dominated by deciduous and mixed forest cover in the watershed available for riparian underplanting and release treatment.

The project will have two components, aligned with the two objectives. The first will entail girdling alder trees and clearing shrubs around existing conifers to release the conifers from competition. The second will consist of underplanting conifers in areas free of intense understory competition where establishment and growth can be reasonably expected.

Criteria for selecting conifer trees for release include:

- Location on terrace or high floodplain (i.e. not prone to frequent flooding or erosion);
- Presence of stumps, indicative of large conifers prior to logging;
- Substantial shading evident on crown from surrounding alder trees or understory plants;
- Low density of confer relative to deciduous trees; and
- Douglas-fir, Sitka spruce, and western redcedar preferred over other conifer species because of their lower shade tolerance and/or greater value as LWD.

Alders will be selected for girdling based on the degree they shade the conifers selected for release. It is expected that two to four alders will be girdled for each conifer. If selected conifers are small saplings or seedlings, understory clearing will be conducted to increase the rate at which the small trees will overtop the understory competition. Trees to be girdled will be marked with paint and understory areas to be cleared marked with flagging.

Underplanting areas will be delineated on maps, with specific planting sites determined in the field at the time of planting. Criteria for selecting underplanting sites include:

- Location on terrace (i.e. not prone to flooding or erosion);
- Presence of stumps, indicative of large conifers prior to logging;
- Low density of confer relative to deciduous trees; and

- Relatively open understory and at least moderately open deciduous overstory.

Species for underplanting will include Douglas-fir, western redcedar, Sitka spruce, western hemlock, and grand fir. Seedlings may be either bare root stock or one gallon potted plants (removed from pots for transport to site), depending on availability and site conditions. Since only sites with low understory competition will be selected for planting, extensive understory clearing around planted trees is not expected. However, some clearing may be done to reduce potential understory competion.

The project will proceed in phases with a portion of the entire reach treated each year for 3 to 5 years. This plan describes Phase 1, which is to be completed in October 2008. Phase 1 will be implemented in the upper portion of the project reach, downstream of Seattle Creek for approximately 1.2 miles (Figure 2). There are two 2008 treatment areas, with areas of 6.5 (Area 1) and 13 acres (Area 2). Both areas are on the right bank of the river.

Coordination With Other Projects

It is likely that there will be one or more LWD placement projects implemented in the project reach. The location or design of any of these projects have been identified yet, but if and when they do, conifer underplanting and release in the vicinity of these projects will be designed to complement the LWD placement.

Evaluation of Potential Effects

The potential positive benefits of the project are defined in the goals and objectives for the project, which briefly is to increase future LWD recruitment, shading, and riparian forest structural complexity. By increasing growth rates of existing conifer saplings and young trees and adding additional conifer seedlings, the riparian zone along the upper Cedar River will be able to contribute LWD at a greater rate and size sooner than it would without treatment.

Potential negative effects include channel destabilization, and reduced deciduous component of riparian forests. Girdling and subsequent death of alder trees could result in loss of root strength, which could lead to unstable channel banks if the dead trees where in a location subject to erosive forces. Although the number of alder trees to be girdled is relatively small, dispersed, and of limited extent (< 20 acres), the potential for erosion and bank destabilization will be minimized by selecting conifer trees away from sensitive locations. Sensitive locations include active floodplains, edges of terraces near the channel, and banks of side channels which the river might occupy during flood events.

Deciduous trees provide an element of biodiversity to the Cedar River Municipal Watershed, within a landscape that is predominantly conifer forest. Because there is a relatively small amount of deciduous forest in the watershed, the loss of any deciduous trees could be considered a negative impact. On terraces and high floodplains of the upper Cedar River, the presence of conifer stumps indicates that these areas were likely conifer dominated prior to timber harvest. The establishment of alders in these areas is

likely a consequence of disturbance from timber harvest, and reduction in the deciduous component of these areas would not be a reduction in the natural biodiversity of the watershed's riparian forest. Only a small fraction of the deciduous trees in the treated riparian areas will be girdled and there is abundant deciduous forest in more frequently flooded areas that will not be treated. Consequently, the reduction in this biodiversity element of the watershed will be minimal.

It is possible that project effectiveness will be reduced if flooding results in mortality to released or planted conifers. For that reason, only sites judged to have a low frequency of flooding will be selected for release or planting. If planting is conducted in association with LWD placement, risk of flooding is higher. However, in that case planting of conifer seedlings would be intended to contribute to stabilizing the area downstream of an apex engineered log jam.

Although competition from understory plants will likely reduce the effectiveness of planted conifer seedlings, selection of relatively open areas will reduce this risk. The expected outcome of the project is successful growth of at least 25 percent of the planted seedlings to reach sapling stage. These saplings could then be released from alder competition by additional girdling of alder trees, or their release could await natural senescence of the competing alders.

Project Mitigation

Mitigation for this project will consist of avoiding areas where bank destabilization is a potential negative impact. No other mitigation measures are intended necessary.

Evaluation of Costs versus Benefits

Implementation of Phase 1 of this project is estimated to cost a total of $7,650 including SPU costs (Table 1). The cost considered applicable to HCP commitment is estimated to be $7,650.

Table 1. Estimated project implementation costs for 2004 Rock Creek riparian restoration project.

Project Element	Cost per Unit	Cost ($$)	HCP Commitment ($$)
Implementation			
Plant materials	200 plants @ $3.00 each	$600	$600
Contracted labor	3 crew days @ $1,600/day	$4,800	$4,800
Staff Supervision	20 hours @ $80/hour	$1,600	$1,600
Subtotal Implementation		$7,000	**$7,000**
Monitoring			
Monitoring and maintenance (4x over 10 yr)	48 hours @$80/hour	$3840	

Subtotal monitoring			
Total		**$10,840**	**$7,000**

It is inherently difficult to evaluate monetary costs in relation to the benefits of ecological services derived from a project such as this one. The techniques for valuation of ecological services are in a relatively early stage of development, and the effort entailed to conduct such a valuation for this project is likely not cost effective.

As described above, the expected benefits of this project are an increase in the rate and level at which certain ecological functions are provided by the treated riparian areas. These functions include LWD recruitment, shading, and riparian forest structural complexity. Planning and evaluation by SPU staff for this project have led to the conclusion that implementing a riparian underplanting and release project in this area will have significant ecological benefits, and if costs or other factors are not prohibitive, it should proceed.

These benefits were anticipated and planned for in the HCP, and this project is intended to contribute toward the HCP goals and objectives. As of September, 2008, there is about $160,000 remaining in the HCP Riparian Underplanting cost commitment, with an estimated 150 acres of riparian area expected to be treated by that remaining commitment. Phase 1 of this project will treat approximately 19.5 acres at a cost of $7,650 which is consistent with treating the expected number of acres within the remaining cost commitment. As a result, this project is considered to have an acceptable level of benefit for the estimated costs.

Outside Review, Permitting, and Approvals

We do not consider this project of a magnitude or level of complexity to warrant outside review. Potential regulatory requirements include Washington Forest Practices rules, Shoreline Management Act restrictions, and King County clearing and grading permit.

Based on the September 2008 agreement between Washington Department of Natural Resources (WDNR) and SPU, which exempts forest practice rules for HCP activities, no forest practices restrictions should apply to this project. Also, from an inquiry to WDNR about a possible need for permitting the girdling of alders we determined that there are no WDNR restrictions on girdling alders for this project, whether or not exempted.

The state Shoreline Management Act (SMA) as implemented through the King County Shoreline Master Program restricts activities within 200 feet of shorelines of the state, which includes the upper Cedar River in the vicinity of the project. Forest practices are exempt from SMA restrictions.

Girdling of trees could potentially be considered a clearing activity subject to a King County Clearing and Grading permit (Title 16- Chapter 16.82, KCC). Because clearing and grading permits are not required for forest practices and this project is considered a Class I forest practice, a clearing and grading permit is not required for this project.

Contract Development

Implementation of this project will be conducted by crews. Because SPU has an on-call contract for using Restoration Logistics, no specific contracting for this project is necessary. Orders and purchasing of plant materials is done through purchase orders.

Adaptive Management and Monitoring Plan

An adaptive management and monitoring plan will be developed in 2009.

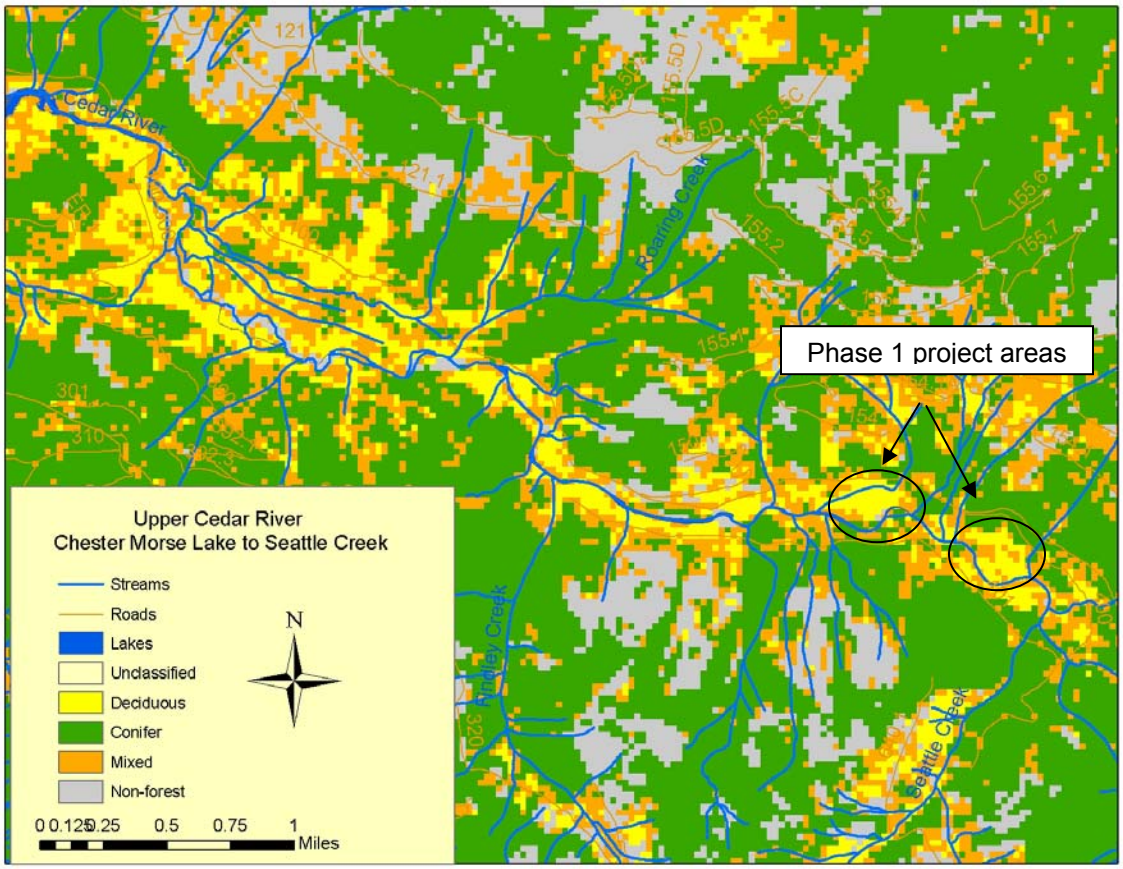

Figure 1. Upper Cedar River riparian cover types.

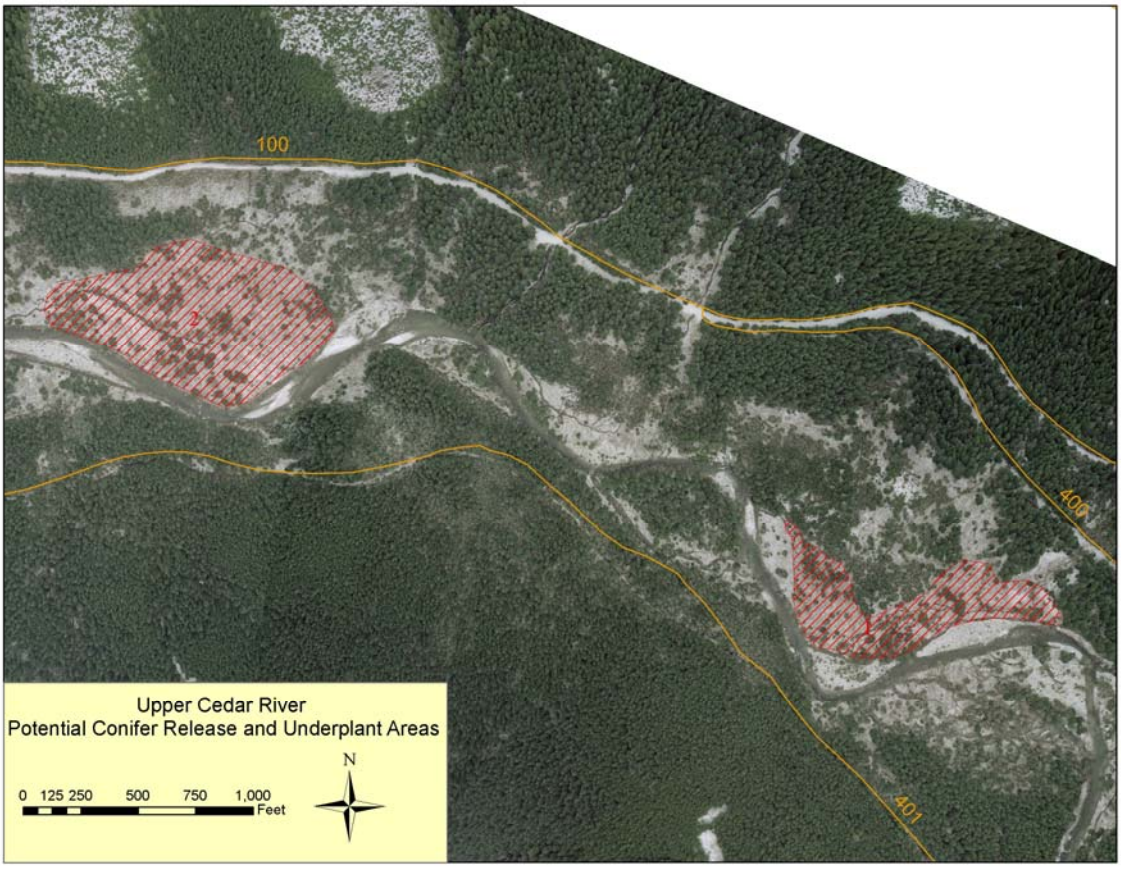

Figure 2. Proposed 2008 riparian conifer release and underplanting areas on the upper Cedar River.

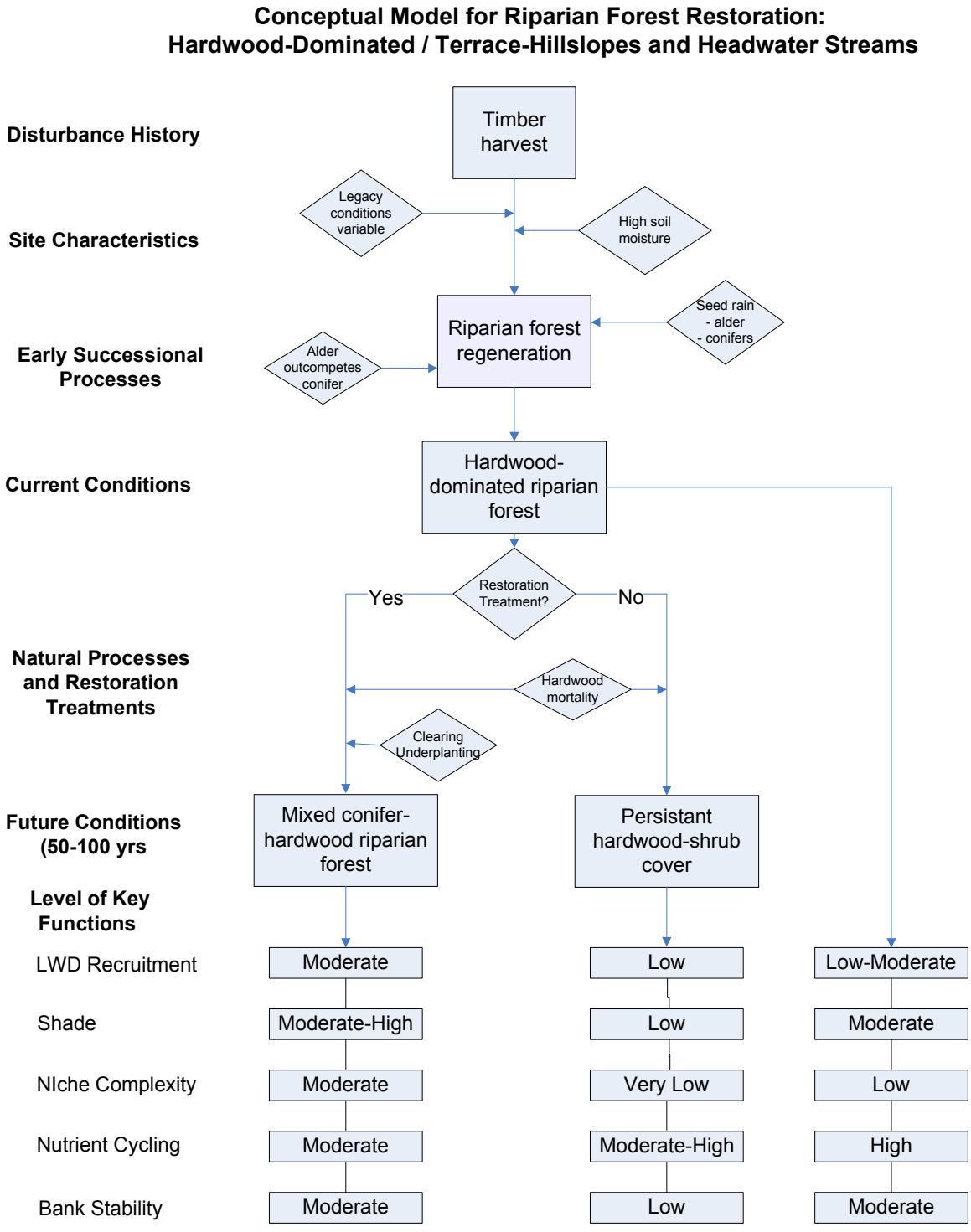

Figure 3. Conceptual model for riparian forest treatment: hardwood dominated terrace/hillslopes and headwater streams

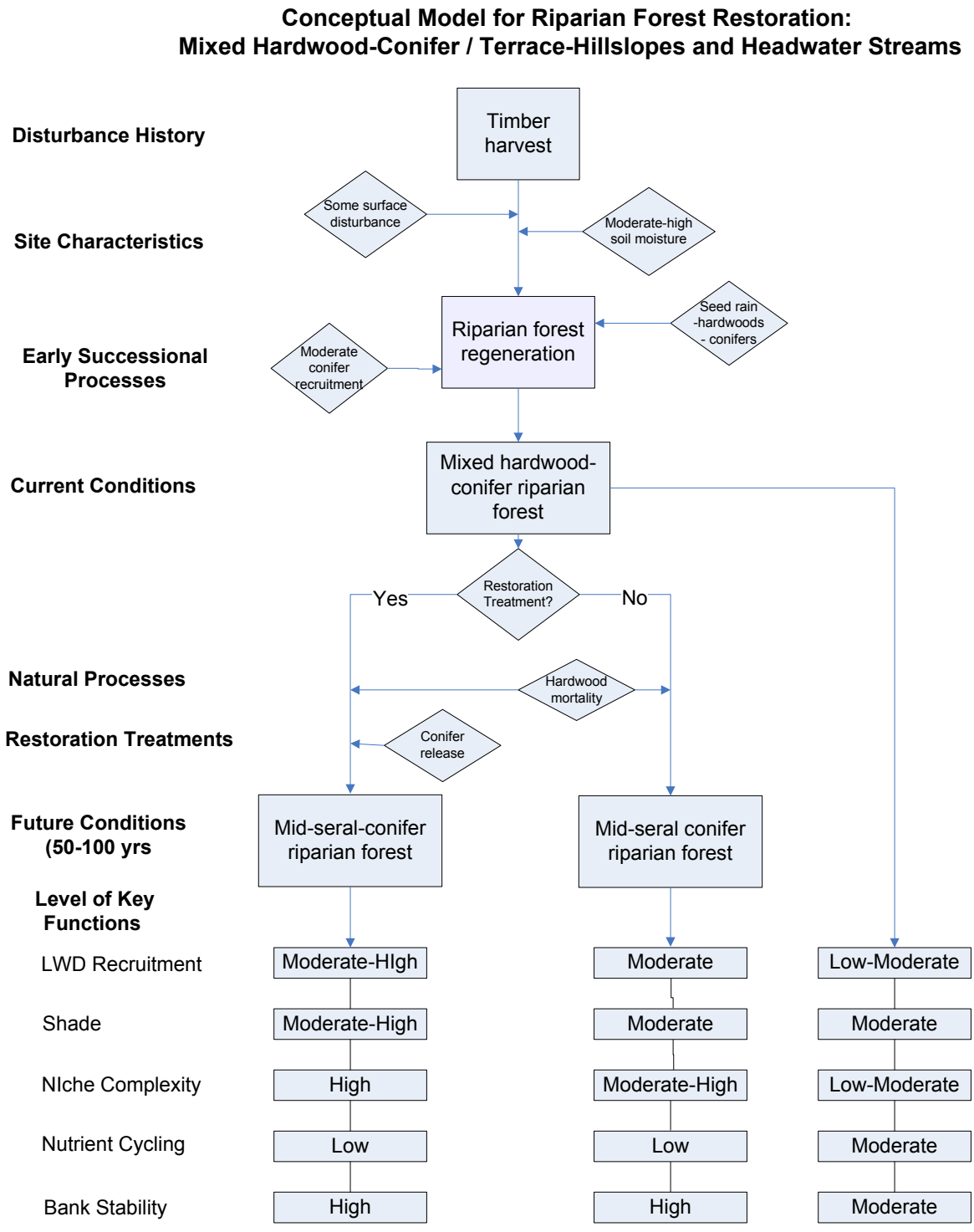

Figure 4. Conceptual model for riparian forest treatment: mixed hardwood-conifer terrace/hillslopes and headwater streams.

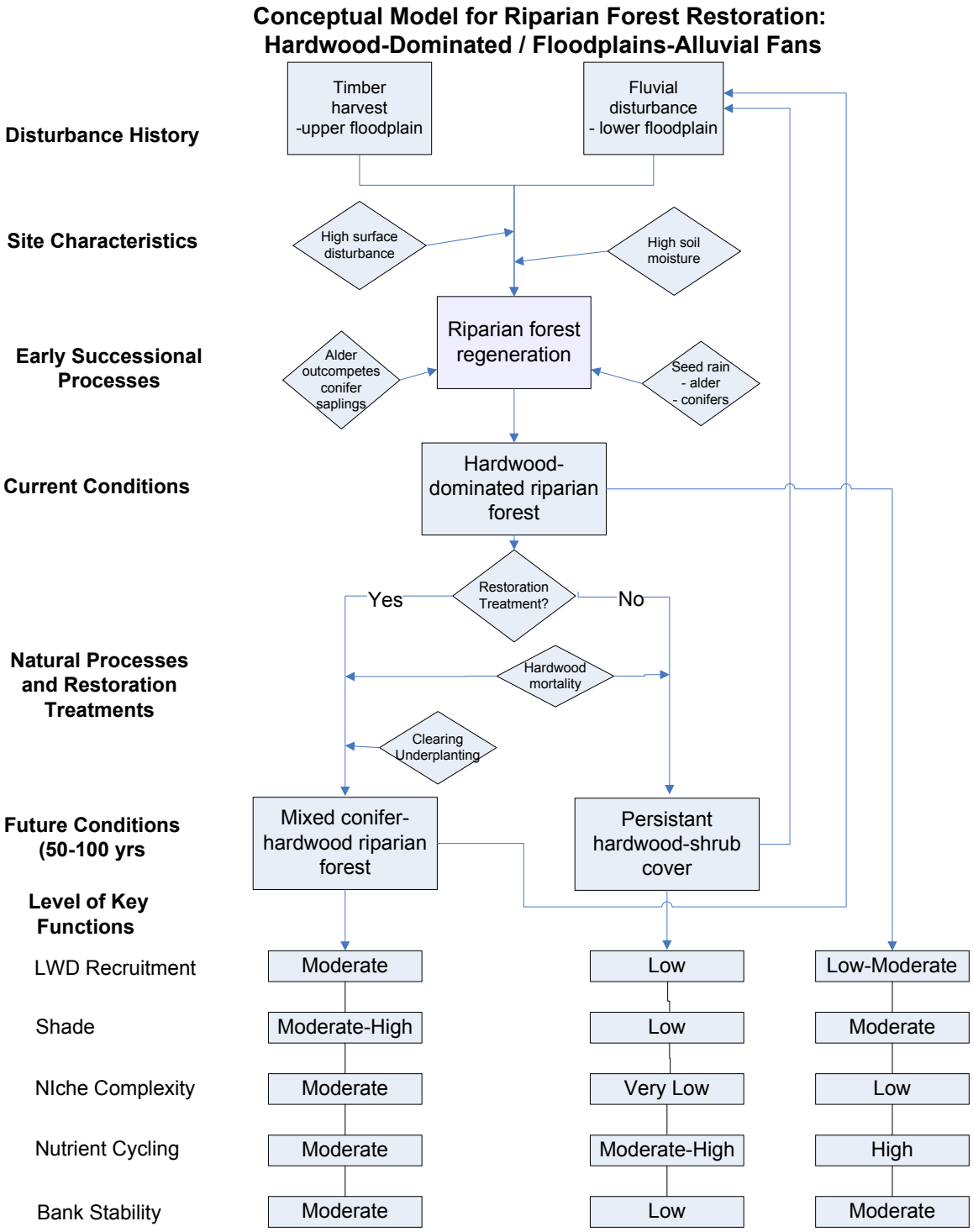

Figure 5. Conceptual model for riparian forest treatment: hardwood dominated floodplains and alluvial fans.

Appendix A

Project As-Built Documentation

Seattle Public Utilities
Watershed Services Division, Ecosystems Section

Project Name: Upper Cedar River Riparian Conifer Release and Underplanting, Phase 1

Date of Implementation: October 20-21, 2008

Brief Project Description (what was implemented): Project areas 1 and 2 were treated as planned by girdling alders around marked conifers and underplanting additional conifers. The total area treated was 10.1 acres (4.4 and 5.7 acres, respectively for areas 1 and 2). The trees released and planted are shown in Tables A-1 and A-2 and Figures A-1 and A-2.

The number of alders girdled ranged from one to seven trees (Table A-1). Conifers selected for release were often in groups, resulting in several released trees at a site. A total of 86 conifer trees or saplings were included in release sites.

Species underplanted were limited to western redcedar and Sitka spruce. An informal experiment was set up to test the hypothesis that planting cedar and spruce together reduces browse by deer and elk, because the animals avoid spruce. The experimental design was to plant half of the cedars with spruce in the same hole and half of the cedars alone. Total number of cedar and spruce planted was 78 and 39, respectively (Table A-2).

Project Location: Terraces on right bank of Upper Cedar River downstream of Seattle Creek (see Figure 2 in project plan).

SPU Project Manager: David Chapin

Other Organizations Involved in Implementation (and their role): Restoration Logistics provided labor for girdling and underplanting. Seedlings for planting were purchased from Wabash Farms Nursery.

Approximate Implementation Costs:

Cost Category	Cost $$
SPU Labor 16 hours @$80/hour	$1,280
Equipment Rental or Usage	0
Contractor/Consultant Labor	4,453
Materials (75 cedar, 40 spruce 1 gal pots)	337
Other (specify)	0
Total	$6,070

The effort for the project was somewhat less than anticipated. A crew of 4-5 and one staff implemented the project in about 12 hours total field time (not including travel to site).

File Locations of Project Plan and Other Relevant Documents:

Plan title: Project Plan: Upper Cedar River Riparian Conifer Release and Underplanting, Phase 1, 2008

File location: J:\SSW\WS541\Public\IDTeams\RiparianRestoration\Projects\2008 upper Cedar conifer underplant-release
SIC – Cedar and Tolt Watershed Services\Watershed Ecosystems\Riparian\Intervention or Restoration

Other document title: none

Other document file location: none

GIS file location: F:\projects\riparian restoration\2008 upper Cedar conifer underplanting and release

Significant Changes from Project Plan (add detail, figures as appropriate):

Fewer seedlings were planted than originally planned. There were not as much available planting area that was suitable for planting without extensive understory clearing.

Have significant changes been captured in GIS? Yes

Table A-1. Conifers released in Upper Cedar River conifer release/underplanting project, Phase 1

Area-Site #	Species released	DBH (in) or # saplings	# alders girdled
1-1r	PISI	7.0	4
1-2r	PISI	4.2	4
1-3r	TSHE saplings	8	7
1-3r	PISI saplings	5	
1-3r	PISI	6.0	
1-3r	PISI	3.7	
1-3r	PISI	3.6	
1-3r	PISI	3.2	
1-3r	PISI	3.0	
1-3r	TSHE	5.6	
1-3r	TSHE	5.9	
1-3r	TSHE	2.8	
1-3r	TSHE	7.0	
1-3r	TSHE	7.2	
1-4r	PISI	12.2	2
1-5r	ABAM	10.5	3
1-6r	PISI	2.8	2
1-7r	PSME	8.3	5
1-7r	PSME	9.3	
1-7r	TSHE	13.0	
1-8r	TSHE sapling	1	3
1-8r	TSHE	5.1	
1-8r	TSHE	3.7	
1-9r	TSHE	5.4	3
1-10r	ABAM	10.3	1
1-11r	TSHE sapling	2	3
1-11r	TSHE	3.0	
1-11r	TSHE	3.0	
1-12r	PISI	3.0	6
1-12r	TSHE sapling	1	
1-12r	TSHE	7.1	
1-12r	TSHE	3.0	
1-12r	ABAM sapling	2	
2-1r	THPL	9.0	3
2-2r	ABGR sapling	2	5
2-2r	ABGR	5.0	
2-3r	ABGR sapling	3	3
2-4r	TSHE	8.5	3
2-4r	TSHE	7.6	
2-4r	PISI sapling	1	
2-5r	ABGR sapling	10	8

2-5r	ABGR	10.0	
2-5r	ABGR	3.0	
2-5r	ABGR	3.0	
2-5r	TSHE	5.0	
2-5r	TSHE	3.0	
2-5r	TSHE	3.0	
2-5r	TSHE	3.0	
2-6r	TSHE	12.4	7
2-6r	TSHE	9.6	
2-7r	TSHE	5	1
2-8r	PSME	13.2	2
Total		89 trees and saplings	75 alders girdled

Table A-2. Conifers underplanted in Upper Cedar River conifer release underplanting project, Phase 1.

Area-Site #	**Species**	**Number planted**
1-1u	THPL/PISI	14/7
1-2u	THPL/PISI	4/2
1-3u	THPL/PISI	8/4
1-4u	THPL/PISI	16/8
1-5u	THPL/PISI	16/8
2-1u	THPL/PISI	10/5
2-2u	THPL/PISI	10/5
Total	THPL/PISI	78/39

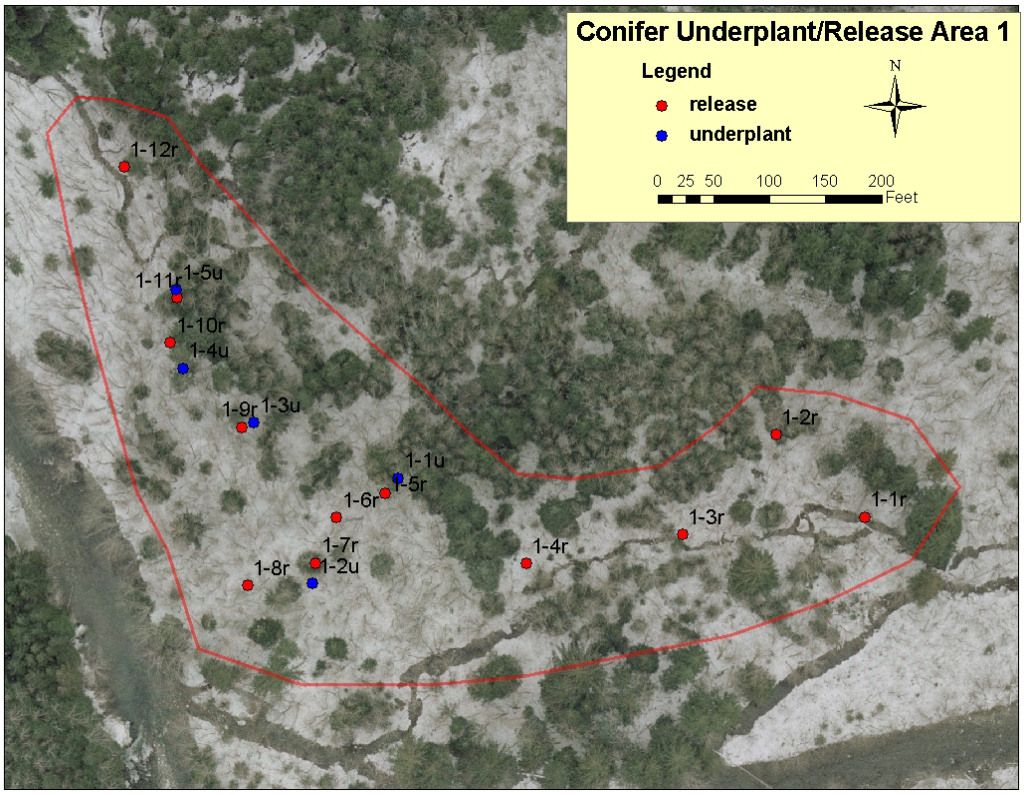

Figure A-1. Locations of conifer release and underplant in Upper Cedar area 1.

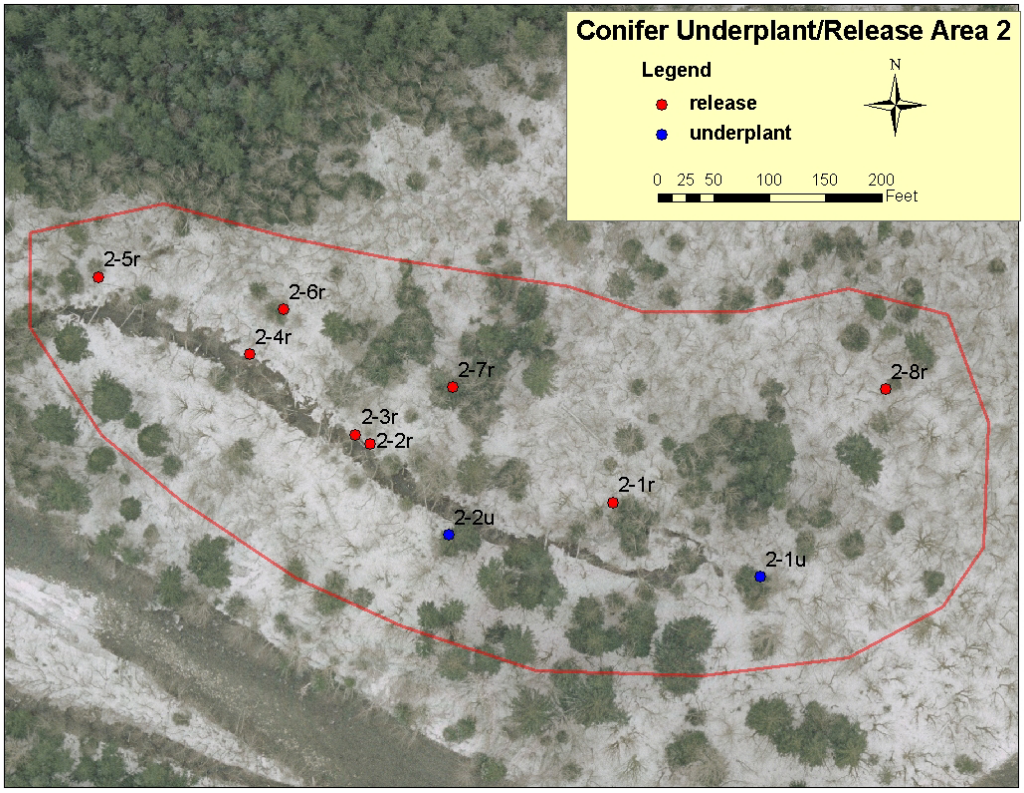

Figure A-2. Locations of conifer release and underplant in Upper Cedar area 2.