

Appendix E. Assumptions Used to Conduct the Benefits Analysis of Restoration Element Options

This appendix summarizes the assumptions used to conduct the benefits analysis of the three restoration measure options (REOs). Assumptions describe the restoration measures and design employed and how habitats are expected to develop under each REO. Descriptions of how habitats are expected to develop describe only the development of structural characteristics of the habitats that are evaluated in the habitat quality and habitat suitability index models. Table E-1 identifies the models and associated variables used to assess each REO.

GENERAL ASSUMPTIONS

The following general assumptions were used to conduct the benefits analysis of the REOs:

- The area of each restored habitat under each REO is the same as the area of habitat under Alternative 1.
- The restoration construction period is 1 year.
- Habitat values are assessed over a 50-year period.

Specific assumptions about how habitats would be restored and how they will develop over time under the low and high input/output REOs are presented in Tables E-2 and E-3, respectively. Assumptions used to analyze the moderate input/output REO are the same as those described for Alternative 1 (see Table D-2 in Appendix D).

Table E-2. Assumptions Used to Conduct the Analysis of the Low Input/Output Restoration Element Option

Habitat Type	Restoration Methods	Habitat Development
Mixed riparian woodland	Plant tree and shrub species as cuttings.	Riparian tree and shrub plantings grow slow due to reduced maintenance practices. Initial plant densities are less and survival rate is lower than those in other REOs.
	No weed maintenance following initial plant installation.	
	Provide irrigation for 2 years following initial plant installation.	Percent shrub canopy cover increases in value over time through TY50.
	Plant at half the density of Moderate REO (20 feet on center).	The optimal habitat value for percent tree canopy cover and tree height is achieved in TY50 and TY31, respectively.
	No control of woody, non-native, invasive species.	The optimal habitat value for canopy layering is achieved in TY36 and is maintained through TY50.
Seasonal wetland	No plant protection tubes.	The percent of the site in woody riparian vegetation is 22% of the total project area.
	Grade to provide and maintain supporting surface hydrology.	The optimal habitat value for average vegetation height and percent herbaceous cover is achieved in TY6 and is maintained through TY50.
	Control seed bank of existing grasslands or agricultural land by grading.	Ten percent of herbaceous cover is provided by native seasonal wetland species.
Permanent marsh	No inoculation with seed mix or plugs.	
	Grade permanent wetland areas create shallow sloping sides and a mean water depth of 5 feet.	The assumption for average water depth is based on water levels expected during May. Some areas within the permanent marsh will dry out completely in late spring or summer. The average water depth is 1 foot.
	Emergent plug plantings are not installed.	The optimal habitat value for percent open water is achieved in TY11 but decreases over time as vegetation establishes.
	No weed control.	The optimal value for the number of emergent marsh species comprising at least 10% of the total cover is not achieved in the REO.

Habitat Type	Restoration Methods	Habitat Development
Valley oak/sycamore woodland	<p>Oaks to be installed in clusters that are 20 feet on center within the woodland habitat areas. Oaks are planted as acorns.</p> <p>Shrubs to be installed 80 feet on center. Shrub seedlings to be installed as Dee-Pots.</p> <p>Truck watering will be provided twice per month for the first 6 months after installation.</p> <p>No weed maintenance provided.</p> <p>Plant replacement: If plant survival is less than 50% the first three years following planting, replant to 100% of the initial planting sites.</p> <p>Disk and plow existing habitats and seed with a native perennial and annual seed mix.</p> <p>No post-seeding weed control treatment.</p>	<p>Twenty-five percent of planted oaks survive to TY50.</p> <p>The optimal habitat value for percent canopy cover by trees greater than 11 inches dbh is achieved in TY31 and is maintained through TY50.</p> <p>The optimal habitat value for percent groundcover provided by non-invasive grasses remains constant from TY0 through TY50.</p> <p>The optimal habitat value for percent shrub canopy cover is achieved in TY11 and is maintained through TY50.</p> <p>The growth rates for oak plantings under the different REOs are the same, however the densities differ based on assumed plant survival rates, planting technique, and maintenance methods.</p>

Habitat Type	Restoration Methods	Habitat Development
Valley oak/sycamore savanna	<p>Plants to be installed in clusters that are 200 feet on center within the savanna habitat areas. Planting site will be 40 feet on center within each cluster.</p> <p>Each cluster will consist of an average of 8 oak and 7 other tree and shrub plantings. All oak planting sites will be planted with acorns.</p> <p>Seedlings to be installed as Dee-Pots.</p> <p>Truck watering will be provided twice per month for the first 6 months after installation.</p> <p>No weed maintenance provided.</p> <p>Plant replacement: If plant survival is less than 50% in the first 3 years following planting, replant to 100% of the initial planting sites.</p> <p>Disk and plow existing habitats and seed with a native perennial and annual seed mix.</p> <p>No post-seeding weed control treatment.</p>	<p>Twenty-five percent of planted oaks survive to TY50.</p> <p>The optimal habitat value for percent groundcover provided by non-invasive grasses remains constant from TY0 through TY50.</p> <p>The optimal habitat value for percent shrub canopy cover is achieved in TY50.</p> <p>The growth rates for oak plantings under the different REOs are the same, but the densities differ based on assumed plant survival rates, planting technique, and maintenance methods.</p>
Herbaceous upland	<p>Disk and plow existing irrigated pasture and annual grassland</p> <p>No weed seed bank control prior to seeding.</p> <p>Drill seed with a native perennial and annual seed mix.</p> <p>No post-seeding weed control treatment.</p>	<p>The optimal habitat value for percent herbaceous cover provided by grasses is achieved in TY0 and is maintained through TY50.</p> <p>The optimal habitat value for percent herbaceous cover provided by native perennial grasses is not achieved in this REO. The percent cover by natives is assumed to be 25% beginning in TY3 and remains constant through TY50.</p> <p>The habitat value for the distance to the nearest tree remains constant from TY0 through TY10 and then increases and becomes optimal in TY50 as woody vegetation plantings in other habitat mature.</p>

Table E-3. Assumptions Used to Conduct the Analysis of High Input/Output Restoration Element Option

Habitat Type	Restoration Methods	Habitat Development
Mixed riparian woodland	Plant tree and shrub species as seedlings. Seedlings to be installed as Dee-Pots.	Riparian tree and shrub growth and survival rates are the highest under this REO, contributing to high plant densities.
	Plant 10 feet on center.	Riparian species with relatively slow growth rates will be restricted to the upper elevation planting areas.
	Provide irrigation for 5 years following initial plant installation.	Percent shrub canopy achieves optimal habitat value in TY6 and TY11, then decreases over time as the overstory canopy develops.
	Provide weed maintenance of herbaceous weeds for 2 years following initial plant installation.	The optimal habitat value for percent tree canopy cover is achieved in TY11 and decreases slightly in TY36 through TY50 as canopy cover increases.
	Provide weed maintenance of woody, non-native, invasive species 5 years following initial plant installation.	The optimal habitat value for tree height is achieved in TY6 and maintained through TY50.
	Provide plant protection tubes.	The optimal habitat value for canopy layering is achieved in TY11 and maintained through TY50. The percent of the site in woody riparian vegetation is 22% of the total project area.
Seasonal wetland	Grade to provide and maintain supporting surface hydrology.	The optimal habitat values for all variables are achieved in TY6 and are maintained through TY50.
	Control seed bank of existing grasslands or agricultural land by grading.	
	Inoculate with native seasonal wetland seed mix and plug plantings. No follow up treatment.	
	Provide post-planting weed control for 2 years.	
	Reseed bare spots for 2 years.	
Permanent marsh	Grade permanent wetland areas to optimize AAHU values	Average water depth is based on historically observed water levels during May. Some areas within the permanent marsh will dry out completely in late spring or summer. The average water depth for all permanent marsh wetland areas throughout the year is 2 feet.
	Intall plugs in 50% of the habitat area (3 feet on center)	
	Provide weed control for 2 years following initial planting	Optimal habitat values are achieved in TY6 and are maintained through TY50.

Habitat Type	Restoration Methods	Habitat Development
Valley oak/sycamore woodland	Oaks are installed as Dee-Pots 20 feet on center.	Forty percent of planted oaks survive to TY50.
	Shrubs to be installed as Dee-Pots 40 feet on center.	The optimal habitat value for percent canopy cover by trees greater than 11 inches dbh is achieved in TY31 and is maintained through TY50.
	Provide irrigation for 5 years following initial plant installation.	The optimal habitat value for percent groundcover provided by non-invasive grasses is achieved in TY6 and is maintained through TY50.
	Provide weed maintenance of herbaceous weeds for 5 years following initial plant installation.	The optimal habitat value for percent shrub canopy cover is achieved in TY11 and is maintained through TY50.
	Provide plant protection tubes.	The growth rates for oak plantings under the different REOs are the same, but the densities differ based on assumed plant survival rates, planting technique, and maintenance methods.
	Disk and plow existing habitats and seed with a native perennial and annual seed mix.	
	Provide 1 year of post-seeding weed control treatment.	
Valley oak/sycamore savanna	Plants to be installed in clusters that are 200 feet on center within the savanna habitat areas. Planting site will be 40 feet on center within each cluster.	Forty percent of planted oaks survive to TY50.
	Each cluster will consist of an average of 8 oak and 7 tree and shrub plantings.	The optimal habitat value for percent groundcover provided by non-invasive grasses is achieved in TY6 and is maintained through TY50.
	Oaks and shrubs are planted as Dee-Pot-sized seedlings.	The optimal habitat value for percent shrub canopy cover is achieved in TY50.
	Provide irrigation for 5 years following initial plant installation.	The growth rates for oak plantings under the different REOs are the same, however the densities differ based on assumed plant survival rates, planting technique, and maintenance methods.
	Provide weed maintenance of herbaceous weeds for 5 years following initial plant installation.	
	Provide plant protection tubes.	
	Disk and plow existing habitats and seed with a native perennial and annual seed mix.	
Provide 1 year of post-seeding weed control treatment.		

Habitat Type	Restoration Methods	Habitat Development
Herbaceous upland	Disk and plow existing irrigated pasture and annual grassland	The optimal habitat value for percent herbaceous cover provided by grasses is achieved in TY6 and is maintained through TY50.
	Provide 2 years of weed seed bank control prior to seeding pretreat with herbicide and disk twice (spring, summer) before planting.	The optimal habitat value for percent herbaceous cover provided by native perennial grasses is achieved in TY3 and is maintained through TY50.
	Seed with a native perennial and annual seed mix.	The habitat value for the distance to the nearest tree remains constant from TY0 through TY6 and then increases as woody vegetation plantings in other habitats mature.
	Provide 5 years of post-seeding weed control treatment.	