Delta Working Lands Program Final Report

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Executive Summary

The Delta Working Landscapes Program (Program) is a group of projects which demonstrate how farmers can integrate habitat restoration into farming practices. The objectives of the Program are to improve the environmental quality of existing landscapes in the Delta; coordinate programs with local farmers; understand the social, economic, environmental and governmental policy hurdles and/or incentives to perform conservation practices; and communicate to farmers the advantages of implementing wildlife friendly agricultural practices.

The Delta Protection Commission was awarded a three year grant to construct the program through the California Bay-Delta Program in 2005. Program partners included California Department of Fish and Wildlife Ecosystem Restoration Program, Hart Restoration (Hart) and Ducks Unlimited (DU). Hart established vegetative buffers along irrigation ditch banks and hedgerow grass plantings. These plantings were designed to provide habitat for wildlife, improve water quality by reducing runoff of pesticides and sediment, enhance levee stability, and retard levee erosion. DU coordinated restoration enhancement projects which included creating seasonal and permanent wetlands on marginal farmlands. These projects provide waterfowl brooding habitat, a food source, and additional habitat sites which promote healthier waterfowl flocks.

These projects total 312 acres of seasonal and permanent wetlands and 6.5 miles enhanced levees and waterways. Project areas established native plant life, have been repopulated by wildlife, and filter agricultural drainage which improves water quality and enhances levee stability. Multiple species of waterfowl are using the restoration habitat for brooding and feeding as well as staying later into the season. No easements, MOUs, fee purchases, or eminent domain were used.

Challenges to Working Landscapes projects include prior long term use of pesticides and herbicides which have created a hostile environment for native plants and wildlife. Additionally, some cultural practices are not conducive to habitat creation such as practices which rely on herbicides instead of tillage. Furthermore, economic costs are affiliated with physical land alterations, and in some cases permit requirements are cumbersome.

Despite these challenges, successful public/private partnerships are possible. Working Landscapes projects can be expanded through better communication between policy and regulatory agencies and publicizing successful projects.

Introduction

The Delta Protection Commission (DPC) Working Landscapes Program (Program) is a program with projects designed to encourage public/private partnerships to implement practices that address some of these threats while sustaining and enhancing agriculture.

Through Working Landscapes, farmers are encouraged to invest in habitat on farmland in a manner that is mutually beneficial to production agriculture and the Delta ecosystem. These farmlands not only produce food products for the State and Nation; but also provide opportunities for wildlife habitat, recreation, carbon sequestration, subsidence reversal, and water quality improvements.

Working Landscapes included developing native grassland as well as riparian and wetland habitats into ongoing farming operations. These projects are critical to the sustainability of the Delta. Agricultural operations that incorporate habitat improvements benefit wildlife (waterfowl, songbirds and native insects), native plants, soils, and water quality. Habitat projects enhance the value of farmland, reduce cultural costs, and provide opportunities for diversifying farm revenue from tourism, hunting, and other recreational activities. Economic activities also extend to businesses in the Delta that provide food, lodging, and visitor amenities. Successful habitat restoration partnerships can appeal to a broader regional and statewide audience; which can result in increased interest in protecting and sustaining the Delta.

Project Background

In 2005, the California Bay-Delta Program (CALFED) established a grant program for working landscape projects that would assist farmers in integrating agricultural activities with ecosystem restoration. CALFED defined a working landscape as "A place where agriculture and other resource-based economic endeavors are conducted with the objective of maintaining economic returns on investments, while protecting and enhancing the landscape's ecological health and generating tax revenues that support their local governments."

The DPC was awarded a three year grant (now managed by the California Department of Fish and Wildlife) to construct the a pilot Program that includes a public-private partnership to implement demonstration projects of farm habitat improvement and environmentally friendly agriculture practices to benefit fish and wildlife, reduce erosion and sediment runoff, and improve water quality.

The Program was also designed to support the policies and goals across multiple agencies: CALFED, the State Water Quality Control Board, Department of Water Resources, and the DPC. Additionally, the Program also supports Delta Vision's objectives to integrate agricultural activities with ecosystem restoration and the co-equal goals of water supply and habitat restoration of the 2009 Delta Reform Act.

Project Objectives

The objectives of Working Landscapes Projects are to:

1. Improve ecosystem quality, water quality, and levee system integrity by establishing wetlands and habitat buffers;
2. Demonstrate economic ways in which sustainable agricultural practices can improve ecosystem values;
3. Demonstrate to growers the economic benefits of using different cultural practices which improve water quality, and create water bodies or seasonally flooded areas that benefit wildlife and are compatible with existing cropping patterns;
4. Produce data on wildlife friendly farming that can assist other organizations working to restore habitat; and
5. Produce a document that can be a reference for establishing public/private partnerships for Working Landscapes.

For each project, the objective was to have each restoration site fully functional within three years. Fully functional is defined as established desirable vegetation, presence of wildlife, decreased erosion, and/or

fewer invasive species. Each site was evaluated to other sites with similar treatments to compare relative success of project implementation.

Program Partners

Delta Working Landscapes Program included a partnership of government (Delta Protection Commission and California Department of Fish and Wildlife), a nonprofit organization (Ducks Unlimited), private local enterprise (formerly Hart Restoration, Inc., now Delta Ecofarm), and landowners to implement demonstration projects. These organizations were identified as partners due to their long history of ecosystem restoration and strong relations with land owners in the Delta.

All participating landowners were interested in soil and resource conservation; all were interested in vegetated buffers that complemented their crops; and all had soil conditions suitable for establishing native plant buffers in areas that were not overgrown with invasive weeds. Landowners provided written authorizations for contractors to have ongoing access to the project property during the course of the program. Landowners also provided in-kind or monetary contributions for many of the projects. For wetland projects, a Site-Specific Agreement with the landowners outlining methods of payment, roles and responsibilities of each party was prepared.

Other third-party partner in-kind assistance was provided by Reclamation District 999 during the construction of the Winchester Vineyards project and additional funding for the San Joaquin Delta Farms project was received by the USFWS Partners for Fish and Wildlife Program.

Program Outreach Activities

Program outreach activities were conducted to provide an opportunity for Delta landowners to learn about the multiple advantages of wildlife friendly agriculture and how the Program can assist with implementing activities to cultivate those advantages, to build a landowner base for project implementation, and distribute post-project information and lessons learned.

Project outreach activities included the development of a Farmer Outreach Plan, informational fliers and other resource materials, a series of landowner meetings, public meetings, and a workshop. Public information meetings were held on November 20, 2009 and June 24, 2010. Where appropriate, farmers were also invited to observe established habitat projects on existing farms to see if these types of practices would be compatible with their operations. A project poster was developed for display at the 2012 Sacramento Bay-Delta Science Conference. A Delta Working Landscapes Public Workshop was held October 24th, 2012. The workshop presentation discussed the wetlands and wildlife friendly agricultural activities completed, successes, failures and lessoned learned, and the announced the availability of resource materials.

Program Documents

A series of documents were prepared as part of Program development and pilot project implementation. These materials included site-specific implementation plans and landowner agreements, information packets for landowners, environmental compliance documentation, a habitat project maintenance guide, scientific publication manuscript, monitoring reports, feasibility and cost analysis reports. Monitoring

Reports for the first three years of program implementation, the Feasibility Report, and Cost Analysis Reports are provided in Appendices A, B, and C, respectively.

Project Area

Projects for the Delta Working Landscape program were implemented within the Primary Zone of the Legal Delta as defined in section 12220 of the Water Code (Exhibit A). Overall, 16 projects were completed at 10 sites. Projects were located throughout the Legal Delta and are shown on, identifying the legal delta boundary and Exhibit B, identifying project locations. A summary of the projects is provided below in Table 1.

Table 1. Summary of Working Landscapes Projects

Project Name	Project Partners	Project Goals
Uslan Farms	Uslan Farm, Ducks Unlimited.	Create semi-permanent wetland, seasonal wetland and associated upland habitat.
Winchester Vineyards	Ducks Unlimited, Hart Restoration, Winchester Vineyards, Winchester Lake Ski Club, Reclamation District 999	Create habitat along Winchester Lake that promotes slope stability and create adjacent seasonal wetland habitat in low yield crop area.
Heringer Ranch (Elkhorn Slough)	Heringer Vineyards, Hart Restoration	Reduce erosion of landside levee slope and prevent burrowing animals through plantings of native grasses.
Heringer Ranch (Netherlands Road)	Heringer Vineyards, Hart Restoration	Reduce erosion on slopes along Netherlands Road through vegetation plantings.
Heringer Ranch (Vineyard)	Heringer Vineyards, Hart Restoration	Plant native vegetation and vegetation to reduce erosive surface water runoff and provide habitat for wildlife
Vino Farms (Lambert Road)	Vino Farms, Hart Restoration, Ducks Unlimited	Create slope wetland and use buffer plantings to stabilize slope bank.
Vino Farms (Ditch 1 & 2)	Vino Farms, Hart Restoration	Plant native grasses and vegetation to reduce erosive surface water runoff and provide habitat for wildlife.
C&M Orchards	C&M Orchards, Ducks Unlimited	Improve 3 acres of un-farmable land through creation of seasonal wetland.

Project Name	Project Partners	Project Goals
Woody's by the River	Woody's by the River, Ducks Unlimited	Create berms around existing corn field to facilitate seasonal flooding for water-bird habitat.
Wilson Farms	Wilson Vineyards, Hart Restoration	Create buffer strip to promote habitat and slope stabilization.
San Joaquin Delta Farms	San Joaquin Delta Farms, Ducks Unlimited, USFWS Partners for Fish and Wildlife Program.	Create seasonal wetland, upland habitat and brood pond on a 400 acre cereal crop farm.
Van Loben Sels Ranch	Van Loben Sels Farms, Hart Restoration	Plant native grasses were planted along the levee of Snodgrass Slough to prevent erosion. Plant wildrye, sedge, and rushes along the irrigation ditch to reduce runoff from irrigation.

Hypothesis

Three hypotheses were proposed regarding the economic costs and benefits of wildlife friendly agricultural practices:

- Hypothesis 1: Seed drilling is a less expensive method of native grass establishment than using of plug plants. To test this hypothesis, native grasses were planted using a drill planter and plug plants were transplanted on the same site. Effectiveness is measured by comparing the labor, costs, and the establishment of grass cover (measured by percent cover of natives vs. weeds).
- Hypothesis 2: Establishment of native grass cover will reduce maintenance costs along ditches. To test this hypothesis, paired tests (same adjacent crop, farm, soil types and management approach) comparing native grass and weed populations were conducted on sufficiently lengthy areas (±1000 linear feet for each). Effectiveness is measured by comparing maintenance costs between grass covered and non-grass covered ditches.
- Hypothesis 3: Vegetated ditch banks will erode less than bare/weedy banks. Effectiveness is measured using erosion pins and visual inspections of the extent of bank failure.

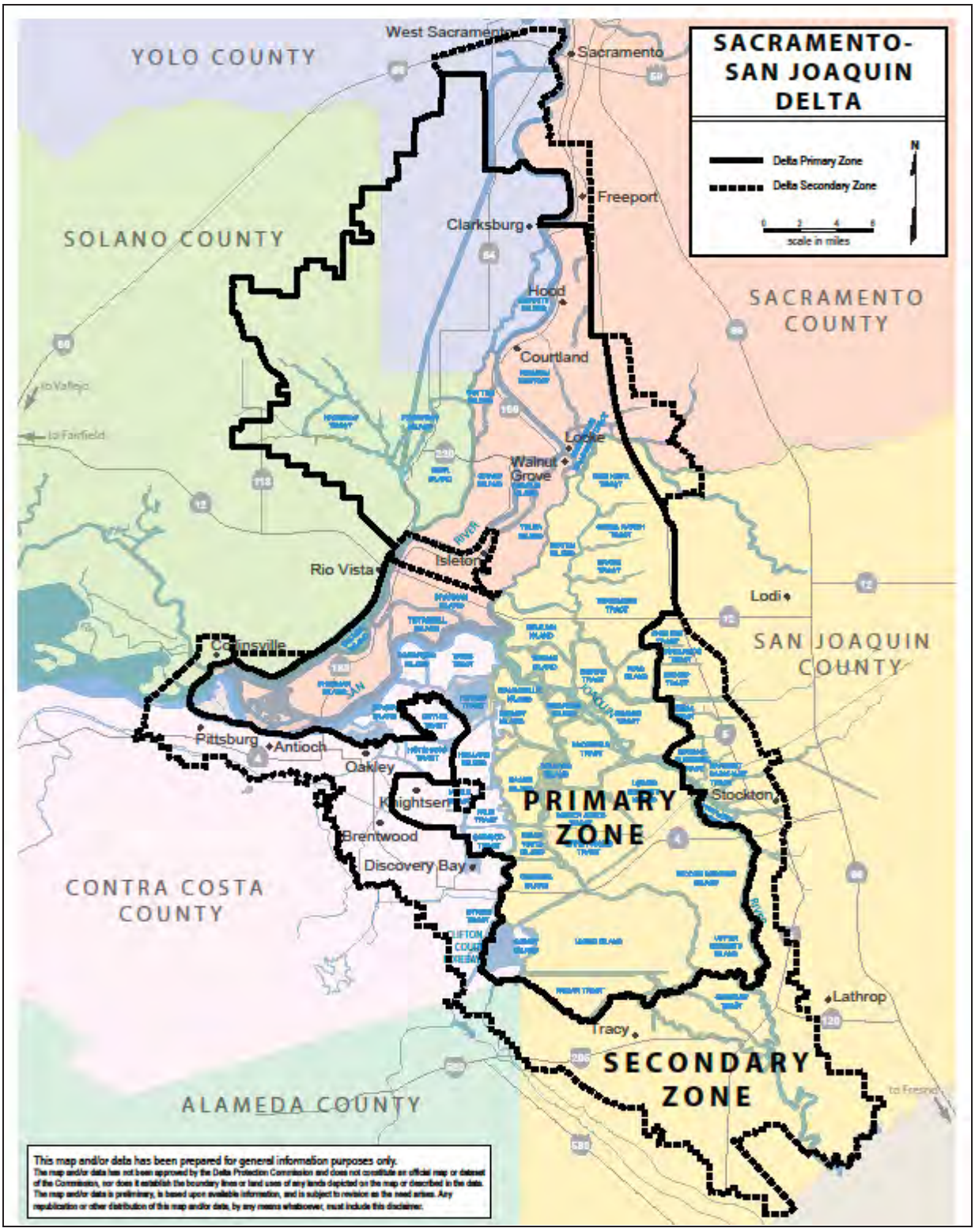


Exhibit A – Legal Delta Map

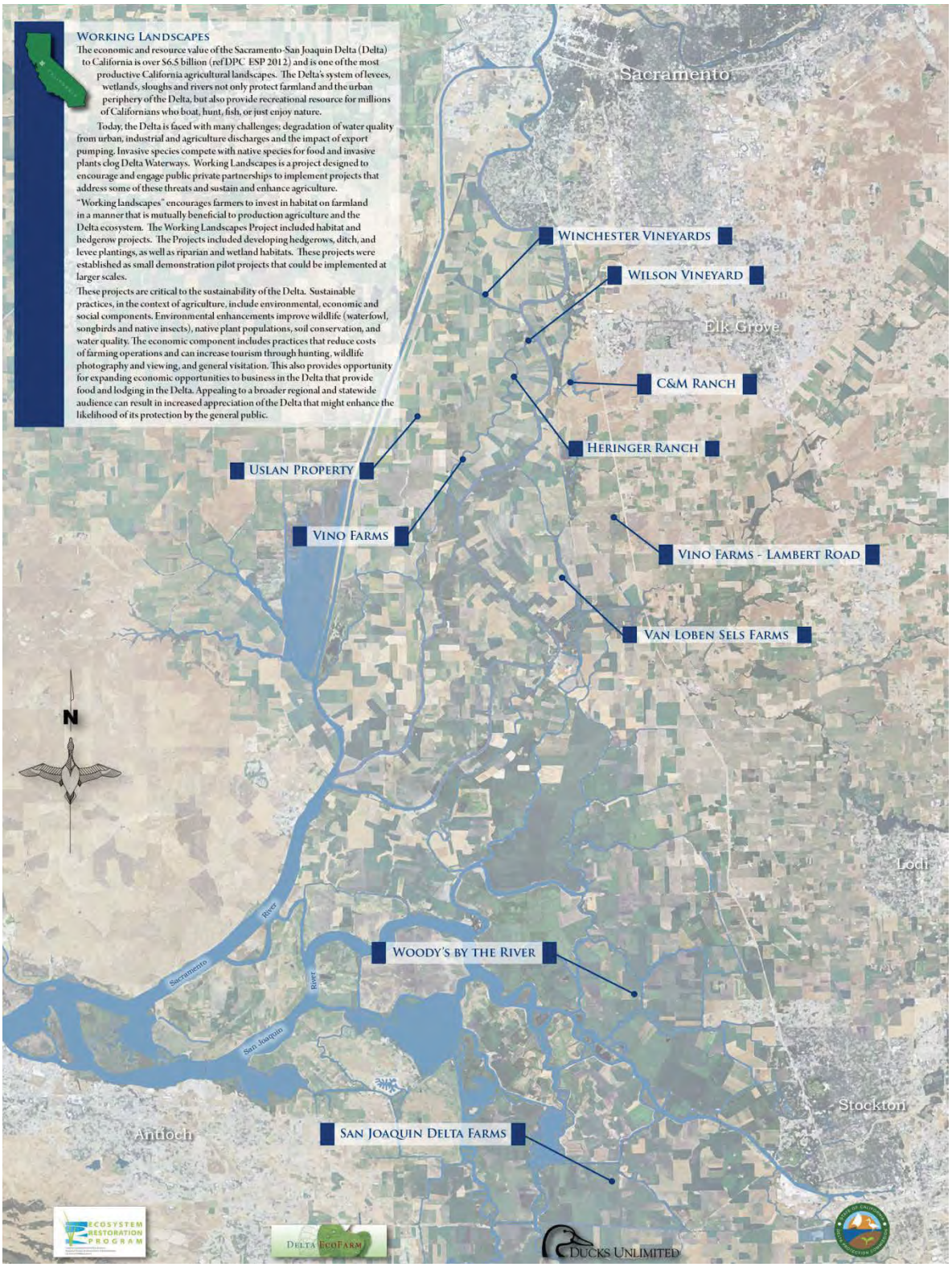


Exhibit B – Project Location Map

Methods and Materials

Habitat-friendly Agriculture Project Planting Methods and Species

The habitat-friendly agriculture projects included installing native plant buffers (i.e., vegetated ditches and grassland enhanced levee slopes) that separate farmland from waterways. The native species planted included creeping wildrye (*Leymus triticoides*), sedge (*Carex barbarae*), rushes (*Juncus balticus, J. effusus*) and tules (*Scirpus americanus*). None of the farmers thought that larger stature plants such as trees and shrubs would be compatible with their farming operations. Reclamation Districts and the California Department of Water Resources do not permit woody growth on levees. For installation purposes, these areas required initial weed management be performed by either disking, harrowing, or applying herbicides to troublesome weeds. A variety of sizes rooted planting materials were utilized, including small plugs and up to gallon-sized plants. These were hand planted with shovels and power driven augers. Planting was done during late fall to early spring when sufficient soil moisture would likely favor plant survival. One site included re-contouring the steep slopes of a tidally influenced channel prior to planting.

Habitat-friendly Wetland Design and Construction

For wetland restoration projects, the DU biologist and engineer met with growers and conservationists to identify restoration opportunities and the necessary components of the project. Restoration plans were then prepared that included survey of existing conditions and grading details, habitat niches, and guidance on how to manage and maintain wetland restoration projects.

The wetlands were constructed by experienced contractors utilizing large excavation equipment. Contractor work included the supply of all labor, material and equipment required to complete the excavation, hauling and placement of earth materials for the construction of created islands, embankment fills, and the excavation of swales and potholes, as shown on the restoration plans.

Specific construction work included:

- Disking of borrow and embankment areas.
- Excavation of suitable material from swales and potholes.
- Moisture conditioning of embankment material.
- Placements of embankment fill areas.
- Excavation and base preparation for water control structures and pipe.
- Excavations of suitable material from borrow areas for embankment backfill.
- Backfill of water control structures and pipe with compacted fill.
- Tie-in of backfill embankment to existing improvements.
- Installation of precast concrete water control structure weirs.
- Installation of corrugated HDPE pipe.
- Installation of wood stop logs.

Project Monitoring

Monitoring of the wildlife friendly farming and restoration projects included a comparison between pre- and post-project site conditions, specifically the presence of native plants and weedy species for wildlife friendly agriculture projects and wildlife friendly (forage) vegetation for wetland projects.

To document plant establishment for wildlife friendly agriculture projects, data was obtained by randomly placing 3-meter square quadrants along representative sections of the installed 2010 plantings. Cover classes of <1% (+); 1-5% (1); 6-25% (2); 26-50% (3); 51-75% (4); and 76-100% (5) were assigned to the plants in each quadrant. The species of native plants were lumped into one category as were the weed species. Photographs were also collected during site monitoring to provide visual information on site conditions.

Monitoring of projects that were designed to perform as managed seasonal wetlands included establishing photo points for each site, plant species establishment using line transects for each site, percent vegetation coverage using meter-square evaluations, and wildlife use through mid-winter visual surveys of each site. For all sites, specific quantitative data on the habitat objectives, including descriptions of various acres or linear-feet of habitat targeted and ultimately established, was collected.

Project Implementation

To implement the Program, willing landowners were identified through existing networks, including reclamation districts, the Center of Land-based Learning, and private duck clubs. Where appropriate, farmers were invited to observe established habitat projects on existing farms to see if these types of practices would be compatible with their operations. Interest levels were highest amongst duck clubs, grape growers, and younger farmers. Corn and commodity growers were generally less interested in participating.

Farm operators and farmland were selected based on:

1. Personal knowledge of farmer's representative of the Delta; which included a sampling of open ground, orchard, and vineyard types of agriculture.
2. Openness and willingness of the farmers to be involved.
3. A response of the potential farmers to the types of plants and their beneficial impact on the landscapes in question. At this step in the process some farmers were interested, while others were not.
4. Landscape settings on particular farms. Some landowners farm right up to the edge of their properties with little room for hedgerows and ditch plantings, so these farmers were not as receptive. Farmers with available space were most responsive.
5. Compatibility of proposed restorations with current farm practices.
6. Soil conditions suitable for adequate growth.
7. Absence of especially noxious weeds.

Habitat-friendly agriculture projects were implemented in a total of 15 different sites on 5 different ranches in the northern region of the Delta. All of the sites except one farm were planted with wine

grapes, with one being planted with GMO corn. A summary of agricultural project implementation is presented in Table 2.

Table 2. Summary of Habitat-Friendly Agriculture Project Implementation

Property	Environment Planted	Linear Feet	No. Plants Installed	Species
Herringer Ranch	Levee slope (Elkhorn Slough)	9,284	13,289	Grasses[1]
	Swale (between interior road and vineyard)	1,172	2,104	Grasses
	Buffer (between Netherlands Road and vineyard)	2,706	10,110	Grasses
	Levee slope (Netherlands Rd)	5,700	8,112	Grasses
	Levee slope (Netherlands Rd)	--	191	Grasses[1]
Wilson Ranch	Levee slope	5,148	9,622	Grasses
	Levee slope (S. River Rd & Co. Rd 141)	2,000	2,400	Grasses
	Levee slope (S. River Rd & Courtland Rd)	1,100	2,736	Grasses
	Levee slope (Waukeena Rd & Courtland Rd)	700	3,360	Grasses
Vino Farms	Ditch #1 and 2 (Waukeena Rd), miscellaneous levee plantings	13,219	17,788	Grasses, rushes[2]
	Ditch (Lambert Rd)	3,000	8,928	Grasses, Sedges Tules[3],
Van Loben Sels Ranch	Levee slope	2,995	20,736	Grasses
Winchester Vineyards	Ditch (Winchester Lake)	4,100	2,074	Tules[3]
Totals		**51,124**	**101,450**	

1Grasses = Creeping wildrye (*Leymus triticoides*), sedge (*Carex barbarae*)
[2] Rushes = *Juncus effusus*
[3]*Tule = California tule (Scirpus callfornicus) at Winchester Lake and* three-square tule (*Scirpus americanus) for the Lambert Road Site.*

Different methods of planting were initially proposed: seeding, small seedling plugs and larger well rooted container stock. The per unit area cost increases from seeding, seedling "plugs", and the larger well-rooted container stock. However, the suitability of these different methods varies with different site conditions. Broadcast application of seed material is best suited for clean sites with little weed competition. For this method to work, considerable prior site preparation is required that generally involves re-contouring, soil treatment (disking, roto-tilling, etc.) and/or application of pre-emergent herbicides. Few sites in our project area were suitable for this approach. Many farmers feel that they don't have enough room to re-contour a ditch bank. Reclamation districts and flood control agencies are also resistant to alter levee slopes. The prior cleaning of sites with herbicides is also problematic in the vicinity of sensitive crops such as grapes. Moreover, seedling materials are more sensitive to soils with herbicides remaining in the soil as residuals than are larger, established plants that are more hardy. A site (the Van Loben Sels ranch) that we intended to plant with seeds was deemed to be too polluted with chemical residuals for seed materials to be applied. Seeding was done, however, along a re-contoured (the Lambert Road site on Vino Farms) site which initially appeared successful.

The success of planting also has varied with size of plants used in the initial installation. While the smaller seedling plugs are less expensive than the larger rooted container material, the latter are more hardy for sites where competition from competing exotic species is a major obstacle to plant establishment. As will be described later, we have had poor success with the smaller sized plug materials compared to well rooted materials.

Plant materials were installed in the fall of 2010, the winter and spring of 2011, and the fall and early winter of 2011. About 15 sites on 5 different ranches, totaling approximately 58,330 linear feet, were planted with nearly 100,000 plants along ditch banks and levee slopes (see Tables 1 and 2). The species planted included creeping wildrye (*Leymus triticoides*), sedge (*Carex barbarae*), rushes (*Juncus balticus, J. effusus*) and tules (*Scirpus americanus*).

Where possible, some form of weed control was practiced. This included prior application of herbicides to initially knock down the annual grasses in late fall/early winter, mowing or hand weeding. It was expected the landowner would show enough interest to take over the maintenance activities.

Habitat-friendly wetland projects were implemented on 5 different ranches in the northern and southern regions of the Delta. A summary of wetland project implementation is presented in Table 3.

Table 3. Summary of Habitat-Friendly Wetland Project Implementation

Project Name	Project Size
Uslan Farms	4 acres Semi-permanent Wetland 2 acres Seasonal Wetland 2 acres Upland Grassland
Winchester Vineyards	6.5 acres Seasonal Wetland 2,074 linear feet of lake fringe habitat
C&M Orchards	3 acres Seasonal Wetland
Woody's by the River	13,691 linear feet berm around two 70 acre fields (total of 140 acres)
San Joaquin Delta Farms	33 acres Seasonal Wetland 35 acres Seasonal Wetland 22 acres Seasonal Wetland 18 acres Semi-permanent Wetland 25 acres associated upland habitat

Regardless of the wetland type, projects generally contained perimeter berm to promote flooding within the wetland unit, swales and potholes to control the location and depth of open water vs. emergent vegetation, and water control structures for management wetland surface water depths and drainage.

Results

The results of the Delta Working Landscape projects have largely been successful, but the outcome has varied from one site and ranch to another. Monitoring of the projects was conducted over three years. Due to the timing of project development, post-construction monitoring results for some sites are not available for the full three years. The C&M Orchards project, for example, was developed in the fall of 2012. Therefore, little monitoring of this site has occurred; however, wildlife usage such as coyote and raccoon sign were observed even within this short period of time. In all cases, post project description revealed beneficial environmental functions and services. A summary of the monitoring results for the project is presented below. Detailed discussions of the results are presented in Monitoring Reports for years 1, 2, and 3 (Appendix A).

Table 4 presents a summary of monitoring results for habitat-friendly agriculture projects. The more successful outcome has occurred on the sites containing few herbicide residues and where larger-sized plant materials. It was observed that where landowners took personal interest in the project, project successes was more prevalent.

Table 4. Habitat-Friendly Agriculture Project Monitoring Results

Site	Percent Coverage (Native Plantings)	Percent Coverage (weeds)
Wilson Ranch, Clarksburg Site (levee slope)[1]	31.1%	3.8%
Van Loben Sels Ranch (levee slope)[1]	55.7%	34.3%
Vino Farms (Ditch #1)[2]	26.2%	36.8%
Vino Farms (Ditch #2)[3]	58.8%	9.4%
Winchester Lake [4]	64.1%	0%
Heringer Ranch	0%	0%

Notes: Sites were planted in 2010 and surveyed June 9, 2012 and August 11, 2013
[1]Sedge (*Carex barbarae*) and creeping wildrye (*Leymus triticoides*)
[2]Sedge (*Carex barbarae*), creeping wildrye (*Leymus triticoides*) and rush (*Juncus effusus*)
[3]Rush (*Juncus effusus*) and three-square (*Scirpus americanus*)
[4]Tule (*Scirpus californicus*)

The levee slopes bordering the Wilson Ranch have been well managed so that few invasive weeds were present during final monitoring. In addition, the levee slope on the Van Loben Sels property was successful, although this area was aggressively treated with herbicides, survival of planted materials continued due to large and vigorous planted materials.

Some instances of setbacks were noted at the Heringer property, were planted small seedling plugs faired very poorly. The lack of success is believed to be due to competition with annual grasses, compacted soils, and possibly herbicide drift or residues. It should be noted that even larger sized plants perished in this instance.

Overall, weedy sites planted with larger materials do relatively well despite plant competition. Plants installed along the ditches at Vino Farms are surviving, but will do much better if there is selective use of broad-leaved herbicides until the plants are well established.

Most of the plantings have been successful; however, long term success will depend upon the level of management on the part of the landowner or farmer outside the scope of this project.

Other factors affecting success include the amount and seasonal distribution of rainfall. The winter of 2010-11 was very wet; consequently, the success rate for plantings during this time period was very high. Conversely, the winter of 2011-12 was very dry; the success rate for plantings during this time period appears to be low.

At the Woody's by the River project site, a recreational club with managed seasonal wetlands and dry land corn fields, funds were utilized to install water control structures and berms around two corn fields both approximately 70 acres in size to facilitate winter flooding. Initial discussions with land owner

members were promising and project partners were eager on both sides. However, communication with field level staff was not provided which limited our findings. Qualitatively per personal communication with the field manager, winter flooding of corn was viewed as a success. As an observation through communication with other farmers and recreational enthusiasts, there are economic benefits to winter flooding of corn in the form of duck blind leases.

In all cases, close coordination with the farming operations and landowner including communication with field level staff, is needed for the success of the restoration areas and continued productivity of the agricultural operations.

Monitoring for semi-permanent and seasonal wetlands revealed desirable vegetation at each of the sites. Some sites such as the Winchester Wetlands struggled due to the highly weedy condition of the site prior to construction, whereas, sites such as Uslan and San Joaquin Delta Farms thrived as a result of less weedy conditions and close attention by the land owners.

Monitoring activities can only provide a snap shot of the site conditions at the time of monitoring. Communication with the land owners about wildlife usage is valuable data. Several discussions between Ducks Unlimited and landowners including Woody's by the River, Uslan Property, San Joaquin Delta Farms and Winchester Ranch have all indicated substantial increases in wildlife activity within the project area.

Wildlife response to managed seasonal wetlands and semi-permanent wetlands has been shown as beneficial and utilized by an abundant array of species including but not limited to American wigeon (*Anas americana*), cinnamon teal (*Anas cyanoptera*), gadwall (*Anas strepera*), green-winged teal (*Anas crecca*), mallard (*Anas platyrhynchos*), northern pintail (*Anas acuta*), northern shoveler (*Anas clypeata*), white-fronted goose (*Anser albifrons*), wood duck (*Aix sponsa*), greater and lesser sand-hill crane (G*rus sp.*).

Overall, land owner participation and a desire to be part of the restoration project process and a willingness to provide management and maintenance for the project was a significant factor in the success any of these restoration projects.

Project Analysis

During project implementation, it was very difficult to find sites entirely suitable to test some of the original hypotheses. Many of the sites either were entirely barren due to widespread application of herbicides or were extremely weedy. The barren sites were generally associated with annual crops, such as GMO corn. Some initial plantings in these sites were problematic, apparently due to chemical residues remaining in the soil. Related to this widespread situation is the constant herbicide drift associated with ongoing agricultural practices.

Conversely, many sites were extremely weedy; we largely excluded these sites, but even moderate amounts of weedy growth affected the success of planting. Another complicating factor was the extreme drought over the past two seasons which further impacted the potential success of the project. Due to these constraints, larger rooted plant materials were used rather than the risky installation of seed materials. Several specific hypotheses were originally proposed.

For Hypothesis 1, Seed drilling is a less expensive method of native grass establishment than planting of plug plants. As explained above, site preparation including re-contouring and disking was not feasible on the sites available to us.

For Hypothesis 2, the extent of which vegetated cover reduce maintenance costs, was also unrealizable, for several reasons. Most importantly, it would require several more years of establishment to be able to fully test this hypothesis. Second, it was thought that the farmers would be involved with maintenance activities, but only two farms expressed an interest or had the time to devote to the program.

Regarding Hypothesis 3, measuring the extent of erosion control, also proved to be problematic. The locations where successful ditch implementations occurred proved to not have a problem with erosion. The ditch bank conditions at Winchester Lake include rock/revetment, thus there is little erosion. The bank conditions at the Vino Farms Lambert Road site consist of hardpan soils where erosion is also not an issue. Other sites where native plants were installed consist of an abundance of weedy species, so again erosion is not a problem. The ditches with barren steep banks are very common throughout the region. However, they are barren because of the widespread application of herbicides, so planting was not an option.

Feasibility Analysis

The feasibility of implementing working landscapes projects was evaluated to provide baseline information regarding the different restoration practices and restoration planting techniques, and guide future grant or land owner based restoration activities. Feasibility of various restoration practices and planting techniques were found to be dependent upon site-specific factors like soil composition and existing weedy cover, implementation and maintenance costs, regulatory and permitting compliance and associated costs, and other social and cultural consideration. Barriers to environmental enhancement, especially establishing native plants were found to involve social/cultural considerations, lack of experience or knowledge about native plant and animal species, inherent incompatibilities between the needs of native species and crops, and potential health concerns.

When assessing feasibility, project costs should be considered in relation to the availability of funding assistance, economic incentives, and other ecosystem services and benefit outcomes. These benefits are not only qualitative, but can provide economic benefits as well, through improving the value of farmland and diversifying recreational opportunities.

The Delta Working Landscapes – Feasibility Analysis Report in Appendix B, provides more detail on each of these feasibility criteria. The Conclusions and Recommendation sections presented below provide guidance on overcoming social/cultural barriers and approaches for feasible implementation of working landscape projects.

Cost Analysis

Costs associated with conservation practices of habitat friendly farming and wetland farming practices on agricultural lands for the Working Landscape projects and the potential for cost savings and other benefits were evaluated. Costs for project implementation will vary significantly based on the type of restoration practice, site-specific conditions and preparation, and project design. Tables 1 and 2 identify the range of costs for various restoration practice and planting techniques. For the Working Landscapes projects, costs for buffer vegetated ditches, and levee slopes varied from $4.95-21.28 per linear foot. For wetland projects, cost between projects which ranged from approximately $1,200 per acre to over $12,000 per acre. Irrigation systems and wetland infrastructure contributed to the wide variation in costs across the same types of projects. For further information regarding implementation costs please refer to the Delta Working Landscapes – Cost Analysis Report in Appendix C.

Conclusions

Vegetative Buffers: Ditches, Levees and Borders

1. Certain types of farming operations are more amenable to planting native plant species along ditches and levee slopes. Large scale open field commodity crops (such as corn and wheat) are less likely to be compatible with these environmental enhancements as broad herbicide application (sometimes done by airplane) is incompatible with native plant survival.

2. Vineyards seem to be more compatible with planting native species as herbicide application is done in a more controlled manner.

3. Success or failure seems to be related to the size, structure and management of the farming operation. Small family-run farms may not have the time or the financial resources to break away from farming operations to participate in environmental enhancement. Larger farms -- and presumably with more resources -- seem to have more resources to participate in environmental enhancements. More critically, larger farms often hire younger, college educated managers who value environmental improvements for its own sake.

4. The success and/or failure of this type of project will vary with inherent environmental conditions of soil types. Poor soil conditions, such as coarse sandy or fine clayey situations, are more difficult for plant growth. The most ideal environment is a well-balanced loam, which may be difficult to locate as most environments tend towards the clayey end of the soil spectrum. Extremely sandy conditions, in the Delta, are often the result of former dredging operations that pile sandy river bottom materials onto levee slopes. These materials are often derived from former hydraulic mining activities which brought course materials downstream from the gold mining regions downriver to the Delta. Extremely clayey soils are often the result of dredging from ditches; these materials are then placed on ditch and levee banks.

5. The success and/or failure of this type of project will vary with pre-existing types of vegetation. Extremely weedy conditions, especially sites with rank species of blackberry and other perennial plants, are not easily converted to native plant communities. First, several years of weed control (often through spraying of herbicides) is required to prepare the site for planting. If native plants are installed within a weedy community, then competition with the weedy species reduces the success of the intended species.

6. The success and/or failure of this type of project will vary with past and ongoing land management practices. In particular, sites with long histories of herbicide application make for difficult conditions for native plant establishment.

7. The success and/or failure of this type of project will vary with moisture availability. Planting of moisture loving plants along ditches can be very successful, while planting on dry slopes (with either too much sand or clay) will have problematic results. Another factor for planting success along ditches will also be somewhat dependent upon the timing and seasonality of water availability. The timing and amount of water available in ditch environments may not be ideal for plant establishment. These factors must be understood before planting is planned.

8. The timing of planting is critical. There is a narrow window of opportunity for success. This is in the middle of fall after sufficient rains, but not too late in the season as conditions dry out by mid spring. Therefore, large planting crews need to be able to plant within a 2-month period. Starting earlier or waiting for a latter date requires expensive pre-irrigation or post-irrigation.

9. Some general weeding or mowing is required to reduce weed competition. Planting into annual grass communities is more feasible than planting into coarser weed communities as the former can be more easily controlled through mowing. The presence of rank weed species requires hoeing or the application of herbicides which can be expensive or problematic for survival of the native plant species.

10. The most successful environment for ditch and levee slope environments will therefore include: 1) better quality soils (such as loams); 2) inherently cleaner sites with fewer rank and/or perennial weeds; annual grasses are the least problematic for planting success; 3) certain cropping environments, such as larger vineyards with farm managers who share these environmental goals.

11. The size of the planting materials influenced survival. The larger the plant, generally, the greater the likelihood of survival. The use of seeds is not recommended except for weed free and tilled sites; this is more likely to occur in conjunction with newly constructed landscapes, such as re-contoured levees or ditch banks.

12. Two out of the three years of this project were extremely droughty. As global climate change will likely worsen conditions for plant survival, other measures, such as dedicated irrigation systems, will likely be needed.

Seasonal Wetlands

1. The rate and density of vegetation establishment for seasonal wetlands is variable whether using planting methods or passive methods. Spring draw downs and summer irrigations are the largest contributing factors in vegetation success.

2. It is more financially cost effective to develop larger restoration project due to the economy of scale. Subsequently, larger projects seem to provide greater avian habitat use.

3. The success of Seasonal Wetlands relies heavily on land owner/manager involvement. These types of projects require management effort to provide optimal habitat. When not managed correctly they provide minimal habitat opportunity.

4. Summer water is required for irrigations to maintain healthy vegetation growth, but requires close coordination with Mosquito Vector Control.

5. When managed correctly, seasonal wetlands provide the greatest habitat value to wintering waterfowl.

Semi-Permanent Wetlands

1. Landowners like these projects as they are visually appealing year round and require less management effort than Seasonal Wetlands.

2. Implementation of these projects typically cost more, due to greater excavation requirements.

3. Summer water is required to maintain surface water levels due to evaporation but requires less coordination with Mosquito Vector Control than seasonal wetlands.

4. These projects provide great habitat for multiple species of nesting and rearing birds.

Recommendations

1. Based on the wildlife benefits of semi-permanent wetlands identified within the reporting process of the Delta Working Landscapes, the next logical step would be to evaluate a Walking Wetlands program in the Delta. A Delta Walking Wetlands pilot project should be developed to determine if there are farming benefits for rotating wetlands in and out of the agricultural lifecycle, much like crop rotation, but utilizing wetlands as a crop type. Specific crop types that could be evaluated include potatoes, corn or other wildlife friendly agriculture. Ideal scenarios would have a non-flooded unit, adjacent to a winter flooded unit, adjacent to a semi-permanent wetland unit for a comprehensive evaluation.

2. Due to the highly cost effective manner of winter flooded agriculture, further evaluation of the economic benefits to agricultural industry should be promoted. Projects should target conservation minded farmers who are involved in the day to day operations of the farm or ranch and who are willing to put forth an effort to communicate the results. Funds should be provided to the land owner to provide crop data with specific management strategies and a well structured contract to ensure compliance.

3. Facilitate farmer-biologist conducted environmentally sensitive area tailgate talks would be a valuable component to future restoration activities. The communication disconnect between the farm manager or land owner and field level staff lead to some project challenges. Better communication at this level would better ensure the success of future restoration activities. In addition, Environmentally Sensitive Area Signage could better identify restoration practices so

field level staff can promote the correct maintenance activities associated with restoration practice. Development of best practices for signage would provide useful guidance for verbiage and installation techniques appropriate for various project types and locations.

4. The larger restoration projects were typically landowners who were focused on recreational aspects of wetland projects. Due to the economy of scale and the landowner incentive to manage these larger projects, future wetland restoration projects should focus on larger sized restoration projects with conservation minded land owners as well as recreational interested partners.

5. Establishment of an annual Delta Wetland Management Workshop would benefit new restoration project landowners. This type of ongoing management support should be offered in addition to site-specific management plans provided to the landowner upon completion of project construction.

6. Public grants for restoration typically involve a performance term requirement, anywhere between 20 and 30 years (based on NRCS, USFWS, Coastal Conservancy and Wildlife Conservation Board grant requirements). Public subsidies for wildlife-friendly land uses can require 10 year performance commitments (NRCS). Pilot projects should be required to provide a five to 10 year monitoring term to evaluate project performance. Administrators of public funds for substantial restoration projects should consider longer performance term requirements, in order to protect public investments.

Appendix A

Monitoring Reports

DRAFT

Delta Working Landscapes
Task 6.2 Annual Monitoring Report – Year 1

This document is being prepared as part of the requirements for the Delta Working Landscapes Project (Project) funded through a grant to the Delta Protection Commission (DPC) by the California Department of Fish and Game's Ecosystem Restoration Program (Agreement Number E0883001) as identified in Task 6.2.

This report describes methods used to evaluate the progression of the various subprojects implemented by the Project. The majority of monitoring methods focus on the establishment and development of vegetation and wildlife habitats. Other monitoring efforts also include documentation of economic changes due to implementation of wildlife friendly winter flooding actions. Monitoring activities occur annually in the late spring/early summer when peak vegetation growth is occurring.

The monitoring activities described in this report will help to evaluate the fulfillment of the Project's goals:

1. Improve the environmental quality of existing landscapes in the northern part of the Sacramento - San Joaquin Delta through a variety of demonstration projects;
2. Develop an educational mechanism and economic model to transfer environmentally friendly farming knowledge, techniques and practices to other Delta farmlands and stakeholders;
3. Facilitate environmental compliance through overcoming disincentives and increasing incentives towards achieving these goals;
4. Coordinate a research program with the farmers to understand the social, economic, environmental and governmental policy impediments and incentives to performing conservation practices.

Monitoring of Vegetated Buffer Task 4 Projects

Hart Restoration got started planting in late November and early December, 2010. During that time we cleaned a ditch for future planting and also planted several thousand feet of levee slope with creeping wildrye. Heavy December rains and the Christmas Holidays kept us out of the field. During the interim we prepared several tens of thousands of new rooted materials for out planting. As of January, 2011 we have begun anew with plantings along a ditch on Vino Farms.

We will be doing extensive plantings throughout this late winter and early spring. We will be implementing various approaches: different species, seed vs. rooted container stock, and different sizes of materials. Once all the materials are in the ground by early spring, we will then commence to document baseline conditions of plantings. To that end we will use standard quadrat sampling techniques to measure initial density and cover per site, documenting site specific conditions, species and management approaches. The following photos visually documents starting conditions on two of the sites, the installation of which is ongoing.

VINO FARMS SUBPROJECT
Project type: Restoration Project
Status: Implementation is expected for late spring 2011.

Project acre goals: Two acres of wetlands in two sites.
Year 1 results: Not applicable as the project is still in implementation.

Pre-project site conditions: Project site is along the steep embankment of a tidal slough.

Post Project site conditions goal: The desired post-project site conditions would consist of a gradually sloped transition between the slough and the adjacent uplands along the edge of the agricultural field. Habitat would consist of native emergent wetland as well as transitional ecotone native plants.
Year 1 results: Not applicable as the project has yet to be implemented.

Project vegetation goals: The project is expected to support a permanent tidal freshwater wetland vegetation community consisting predominately of hardstem bulrush (schenoplectus spp), Santa Barbara sedge (Carex barbarae), creeping wildrye (Leymus triticoides), various willow species, Baltic rush (Juncus balticus), and/or bent grass (Agrostis exerata). Monitoring of performance targets for this subproject includes 5 established line-transects per site documenting desirable vegetation at least every meter along a 50-meter transect. Readings are taken every meter along the transect. Monitoring of performance targets include quadrat monitoring for this subproject for 50% desirable species coverage using a meter-square evaluation randomly located along each line-transect. Transect locations will be determine once the project is fully complete.
Year 1 results: Not applicable as the project is still in implementation.

Project wildlife goals: Migratory bird usage for each site consists of mid-winter visual surveys documenting the number of species and the number of each species using the site at the time of the survey. Performance target for this subproject is a yearly increase in usage both the number of species and total amount of each species.
Year 1 results: Not applicable as the project is still in implementation.

Ditch Plantings on Vino Farms

Creeping Wildrye Plantings on Levee Slope. Herringer Property

Vino Farms Monitoring Map

Photo Documentation:

Pre Project Photos	Post Project Photos – Year 1
	NA
Point #1. Site 1. Looking West	Point #1. Site 1. Looking West

Monitoring of Wildlife Friendly Farming and Restoration Task 5 Projects

Monitoring of the wildlife friendly farming and restoration projects to be implemented under Task 5 consists of two activities:

1) A comparison between pre- and post-project site conditions, specifically the presence of wildlife friendly vegetation. Monitoring of subprojects that are designed to perform as managed seasonal wetlands includes established photo points for each site, plant species establishment using line transects for each site, percent vegetation coverage using meter-square evaluations, and wildlife use through mid-winter visual surveys of each site. For all sites, specific quantitative data on the habitat objectives includes descriptions of various acres or linear-feet of habitat targeted and ultimately established.

2) An economic benefits of wildlife friendly agricultural winter flooding practices will be documented. Economic data will include previous year yields, costs, and profit per field and per acre of non-winter flooded fields, as well as current and future year's yields, costs, and profit per field and per acre of winter flooded fields. Pre and post project data will be compared to evaluate any economic substantiation for winter flooding agricultural lands. Cost per acre for installation of wetland management infrastructure will also be documented.

Year 1 Monitoring Activities Summary:

Wildlife Friendly Agricultural Projects - No implementation of wildlife friendly agricultural projects occurred in Year 1, so no economic monitoring information was collected.

Restoration Projects - Project implementation activities commenced on only one of the proposed Task 5 subprojects: San Joaquin Delta Farms. Year 1 monitoring activities were limited to pre-project photo and existing site conditions documentation of the San Joaquin Delta Farms and Vino Farms restoration project sites.

SAN JOAQUIN DELTA FARMS SUBPROJECT

Project type: Restoration Project

Status: Implementation underway and approximately 33% completed. Project was halted in late fall due to poor site conditions from precipitation. Project is expected to re-start in late winter when site conditions dry out sufficiently.

Project acre goals: 134 acres total; 110 acres wetlands in four sites with 24 acres adjacent upland

Year 1 results: Not applicable as the project is still in implementation.

Pre-project site conditions: Project site was a leveled agricultural (wheat) field with multiple drainage and irrigation ditches. No wildlife habitat existed beyond the particular crop.

Post Project site conditions goal: The desired post-project site conditions would consist of a managed wetland area that contains typical moist-soil, seasonal wetland vegetation, established forested wetland plans, open water wetlands, and adjacent upland habitats.

Year 1 results: Not applicable as the project is still in implementation.

Project vegetation goals: The project is expected to support a moist-soil, seasonal wetland type vegetation community consisting predominately of smartweed (Polygonum spp)), Japanese millet (Echinochloa spp), and watergrass (Bulbostylis barbata). Additional desirable wetland vegetation would include cattails (Typha latifolia), hardstem bulrush (Schoenoplectus spp), black willow (Salix nigra), and others. Monitoring of performance targets for this subproject include 1 established line-transect per site documenting desirable vegetation at least every meter along a 50-meter transect. Readings are taken every meter along the transect. Monitoring of performance targets include quadrat monitoring for this subproject for 50% desirable species coverage using a meter-square evaluation randomly located along each line-transect. Transect locations will be determine once the project is fully complete.

Year 1 results: Not applicable as the project is still in implementation.

Project wildlife goals: Migratory bird usage for each site consists of mid-winter visual surveys documenting the number of species and the number of each species using the site at the time of the survey. Performance target for this subproject is a yearly increase in usage both the number of species and total amount of each species.

Year 1 results: Not applicable as the project is still in implementation.

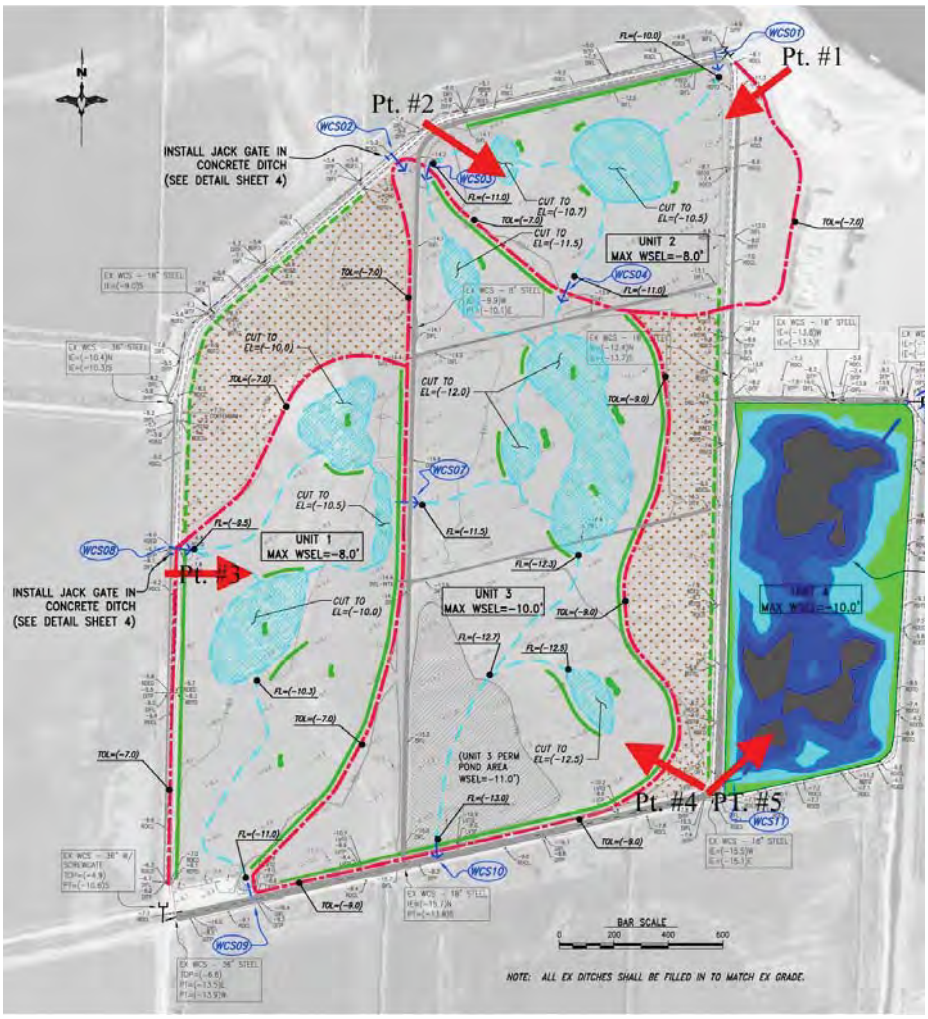
Photo documentation:

Pre Project Photos	Post Project Photos – Year 1

	NA
Point 1.Overview. Looking southwest	Point 1.Overview. Looking southwest
	NA
Point 2. Site 1. Looking southeast	Point 2. Site 1. Looking southeast
	NA
Point 3. Site 2. Looking east	Point 3. Site 2. Looking east

	NA
Point 4. Site 3. Looking northeast	Point 4. Site 3. Looking northeast
	NA
Point 5. Site 4. Looking northwest	Point 5. Site 4. Looking northwest

San Joaquin Delta Farms Monitoring Map.



INFORMATION AND EDUCATION

Monitoring activities for evaluating achievement of the Project's information and educational outreach goals include documentation of meeting the performance standards and associated deliverables identified in the Project scope of work. These include holding public meetings, development of a Farmer Outreach Plan, and Wetlands and Buffers Habitat Maintenance Guide, an Information Packet for Farmers, a Manuscript for a peer reviewed journal, Cost Tracking Analysis, a Feasibility Report, and Final Project Report. Many of these deliverables will be posted to the Delta Protection Commission's, and potentially Ducks Unlimited's, website.

Deliverables/Actions Satisfied: To date the Project has held is first official public meeting to describe the project, its goals, schedule, and scope. The public meeting was held on June 24, 2010. Oral presentations were made by Hart and DU regarding their specific roles in the project and the types of landowners that may be interested in participating.

The remaining deliverables are depending on full implementation of the all project tasks.

Delta Working Landscapes

Task 6.2 Annual Monitoring Report – Year 2

March 30, 2012

Prepared for:

Delta Protection Commission

Prepared By:

Ducks Unlimited, Inc and Hart Restoration

1.0 INTRODUCTION

This document is being prepared as part of the requirements for the Delta Working Landscapes (DWL) Project funded through a grant to the Delta Protection Commission (DPC) by the California Department of Fish and Game's Ecosystem Restoration Program (Agreement Number E0883001) as identified in Task 6.2.

This report describes methods used to evaluate the progression of the various subprojects implemented by the Project. The majority of monitoring methods focus on the establishment and development of vegetation and wildlife habitats. Other monitoring efforts also include documentation of economic changes due to implementation of wildlife friendly winter flooding actions. Monitoring activities occur annually in the late spring/early summer when peak vegetation growth is occurring.

The monitoring activities described in this report will help to evaluate the fulfillment of the Project's goals:

1) Improve the environmental quality of existing landscapes in the northern part of the Sacramento - San Joaquin Delta through a variety of demonstration projects;
2) Develop an educational mechanism and economic model to transfer environmentally friendly farming knowledge, techniques and practices to other Delta farmlands and stakeholders;
3) Facilitate environmental compliance through overcoming disincentives and increasing incentives towards achieving these goals;
4) Coordinate a research program with the farmers to understand the social, economic, environmental and governmental policy impediments and incentives to performing conservation practices.

2.0 Monitoring of Vegetated Buffer Task 4 Projects

Jeff Hart of Hart Restoration, Inc. started planting in late November and early December, 2010. During that time a ditch was cleaned for future planting, in addition, Hart Restoration also planted several thousand feet of levee slope with creeping wildrye. Heavy December rains and the Christmas Holidays kept us out of the field. During the interim Hart Restoaration prepared several tens of thousands of new rooted materials for out-planting.

Hart Restoration conducted extensive plantings throughout the late winter and early spring of 2011 and 2012. Various approaches were implemented, including: different species, seed vs. rooted container stock, and different sizes of materials. Once all the materials are in the ground by early spring, we will then commence to document baseline conditions of plantings. To that end we will use standard quadrant sampling techniques to measure initial density and cover per site, documenting site specific conditions, species and management approaches. The following photos visually documents starting conditions on two of the sites, the installation of which is ongoing.

2.1 Barriers and Stressors to Vegetating Ditches and Levee Slopes

Several obstacles to successful installation of plants along ditches, farm borders and levee slopes were initially considered at the initiation of this project. Over the several years since this project began, additional concerns and issues have been discovered. Barriers and stressors to the success of the project include social, economic, and environmental factors.

Individual farmers have varied in their receptivity to the project, and their interest is influenced by the kind of farming operations practiced. Farmers with annual crops (e.g., corn or wheat) in the central Delta have not been receptive to planting native plants along ditches, farmland borders or interior levee slopes. Farmers in the north Delta, growing perennial crops such as vineyards, were the most receptive to this program. The open ground farmers of annual crops were reluctant about planting native species on their farms because their method of weed control consists of broad scale aerial application of herbicides. These farmers could not ensure the survival of native plants given their methods of weed control.

Related to aerial application of pesticides on farms with annual crops is the general and widespread application of herbicides along ditches, property boundaries and levee slopes. Weed management practices vary among the different farmers and farming systems. Vineyards are particularly sensitive to herbicide drift, so wine grape growers are more discriminating about when and where herbicides are applied. Weed management practices vary considerably even within a grape growing region: some vineyards permit perennial grasses to be grown between grape rows, while in other vineyards everything but the grapes is sprayed.

And so a huge obstacle to the success of this project is the propensity of the traditional farmers and/or reclamation districts to apply herbicides on nearly all plants that aren't of direct economic value. This general practice has affected the outcome of this project. On one farm, despite the farmer communicating to the RD about the location of new native plant installations, the hired contractor none-the-less sprayed and killed several thousand native grasses. Long term application of herbicides also affects the quality of the soils to support native grasses. Soil build-up of chemical residues renders many irrigation ditches and levee slopes unsuitable for planting. Many ditch, borderlands and levee slopes have no plants growing on these sites. We learned that any planting of native species on these sites to be problematic.

Sites that were excessively weedy -- due to lack of weed control -- have equally proved problematic because of competition from these alien species. The sites varied somewhat with respect to soil types, varying from sandy, loam or hard packed clayey sites. Loamy soils are the most suitable sites for planting success.

Different methods of planting were initially proposed: seeding, small seedling plugs and larger well rooted container stock. The per unit cost increases from seeding, seedling "plugs", and the larger well-rooted container stock. However, the suitability of these different methods varies with different site conditions. Broadcast application of seed material is best suited for clean sites with little weed competition. For this method to work, considerable prior site preparation is required that potentially involves re-contouring, soil treatment (disking, roto-tilling, etc.) and/or

application of pre-emergent herbicides. Few sites in our project area were suitable for this approach. Many farmers feel that they don't have enough room to re-contour a ditch bank. Reclamation districts and flood control agencies are also hesitant to alter levee slopes. The prior cleaning of sites with herbicides is also problematic in the vicinity of sensitive crops such as grapes. Moreover, seedling materials are more sensitive to soils with herbicides remaining in the soil as residuals than are larger, established plants. The principle site (the Van Loben Sels ranch) where we intended to plant with seeds was deemed to be too polluted with chemical residuals for seed materials to be applied. Seeding was done, however, along a re-contoured (the Lambert Road site on Vino Farms) site which appears successful.

The success of planting also has varied with size of plants used in the initial installation. While the smaller seedling plugs are less expensive than the larger rooted container material, the latter are more hardy for sites where competition from competing exotic species is a major obstacle to plant establishment. As will be described later, we have had poor success with the smaller sized plug materials compared to well rooted materials.

Attitudes about native plants vary among individual farmers. Younger and more educated professional employees of the larger vineyards (Vino Farms) were particularly enthusiastic about having native species planted on the marginal, non-farmed areas of the farms. Older and more conservative farmers showed less interest in this project. The environmental awareness of the younger employees is probably related to their more recent training at colleges.

2.2 Materials and Methods to Installation

Plant materials were installed in the fall of 2010, the winter and spring of 2011, and the fall and early winter of 2011/2012. About 15 sites on 5 different ranches, totaling approximately 58,330 linear feet, were planted with nearly 100,000 plants along ditch banks and levee slopes (see Tables I and II). The species planted included creeping wildrye (*Leymus triticoides*), sedge (*Carex barbarae*), rushes (*Juncus balticus, J. effusus*) and tules (*Scirpus americanus*).

Where possible, some form of weed control was practiced. This included prior application of herbicides to initially knock down the annual grasses in late fall/early winter, mowing or hand weeding. This spring we may recommend application of broad-leaved herbicides to control weeds on some of the sites.

3.0 Task 4 Results

Although the outcomes have varied from one site and ranch to another, based on plant survival, growth and habitat condition, the results have largely been successful. The more successful outcomes have occurred on the sites where less herbicides or no herbicide residuals where present and have been used in combination with the larger-sized plant materials.

The levee slopes bordering the Wilson ranch has been well managed with few really invasive weeds. Going into the second season the installed plants are healthy, and with the benefit of recent March rains, the prospects for survival look very good. Another very successful site is the levee slope on the Van Loben Sels property. The levee slope had been aggressively treated with

herbicides. We fortunately planted large and vigorous materials which survived; had we applied seeds or planted with smaller materials, success would have been problematic due to the apparent residues of herbicides.

At the Heringer property, sites planted with small seedling plugs faired very poorly. The lack of success, I believe, is due to competition with annual grasses, compacted soils, and possibly herbicide drift or residues. Weedy sites planted with larger materials have done relatively well despite plant competition. The plants planted along the ditches at Vino Farms are surviving, but will do much better if there is selective use of broad-leaved herbicides until the plants are well established. Close coordination with the farming operations is needed since the nearby grape plants are sensitive to herbicides. Wetland plants, such as tules and rushes, that have been installed in the wetted perimeters of ditches have done quite well, such as at Winchester Lake and the ditch along Lambert Road. Most of the plantings have been successful, but long term success will depend upon some level of minimal management on the part of the farmers.

Table I Summary of Working Landscape Projects: Fall 2010/Winter and Spring 2011

Property	Environment Planted	Linear Feet	No. Plants Installed
Herringer	Levee slope	9284	13,289
	Swale	1172	2104
	Buffer (between rd. and vinyard)	2706	10,110
Wilson Ranch	Levee slope	5148	9,622
Van Loben Sels	Levee slope	2995	20,736
Vino Farms	Ditch #1 and 2(Waukeena Rd)	7225	11,272
Subtotal		28530	67,133

Table II New Plantings for Fall and Early Winter of 2011

Property	Environment Planted	Linear Feet	No. Plants Installed	Species
Vino Farms	Ditch (Lambert Rd)	3000	1536	Tules
	Ditch slope (Lambert Rd)	3000	3552	Rushes
	Ditch slope (Lambert Rd)	3000	3840	Grasses
Winchester Lake	Ditch (Winchester Lake)	4100	2074	Tules
Wilson Ranch	Levee slope (S. River Rd & Co. Rd 141)	2000	2400	Grasses

Property	Environment Planted	Linear Feet	No. Plants Installed	Species
	Levee slope (S. River Rd & Courtland Rd)	1100	2736	Grasses
	Levee slope (Waukeena Rd & Courtland Rd)	700	3360	Grasses
Vino Farms	Levee slope (Waukeena Rd)	6700	2736	Grasses
	Levee slope (Netherlands Rd)	3500	2112	Grasses
Herringer Ranch	Levee slope (Netherlands Rd)	5700	8112	Grasses
	Levee slope (Netherlands Rd)		191	Gallons
Total Planted	All sites	32800	32649	Mix

As these plants are just becoming established Hart Restoration has not yet analyzed for the effects of erosion control. Erosion monitoring has not been done for several reasons. First, the plantings are not yet dense enough to make a discernible difference on the potential erosion effects. On sites that are quite weedy the natives will not likely make a significant difference. On sites formerly devoid of plants, the planting of the native species was thought to be beneficial for erosion control; however, due to high chemical residues new plantings were ruled out. Visual inspections of the planting areas revealed no evidence of erosion such as sloughing or scour during the implementation phase of the project.

Widespread application of herbicides renders many sites unsuitable for native plant installation. Apparent chemical residues seem to linger for several years in the soil.

Small seedling plugs were planted along the borders of the Herringer vineyard. Survival has been poor due to competition with annual grasses, soil compaction, and possible herbicide drift.

Despite prior heavy herbicide application at this Wilson Ranch levee site, the larger sized planting materials have survived despite little rainfall this past year

This weedy ditch along one of the Vino farm vineyards was planted two years ago. The sedges and rushes have survived, but the site needs to be managed to reduce the presence of weeds.

Native sedges are surviving and growing along a levee slope on the Van Loben Sels property. Note the bare ground between the sedges: an indication of herbicide residues that stilll prevent germination of annual grasses.

Creeping wildrye on the levee at the Van Loben Sels ranch.

Native grass planting on levee at the Wilson ranch. Above photo, second season planting; photo below, first season planting.

4.0 Monitoring of Wildlife Friendly Farming and Restoration Task 5 Projects

Monitoring of the wildlife friendly farming and restoration projects to be implemented under Task 5 consists of two activities:

1) A comparison between pre- and post-project site conditions, specifically the presence of wildlife friendly vegetation. Monitoring of subprojects that are designed to perform as managed seasonal wetlands includes established photo points for each site, plant species establishment using line transects for each site, percent vegetation coverage using meter-square evaluations, and wildlife use through mid-winter visual surveys of each site. For all sites, specific quantitative data on the habitat objectives includes descriptions of various acres or linear-feet of habitat targeted and ultimately established.

2) An economic benefits of wildlife friendly agricultural winter flooding practices will be documented. Economic data will include previous year yields, costs, and profit per field and per acre of non-winter flooded fields, as well as current and future year's yields, costs, and profit per field and per acre of winter flooded fields. Pre and post project data will be compared to evaluate any economic substantiation for winter flooding agricultural lands. Cost per acre for installation of wetland management infrastructure will also be documented.

Year 2 Monitoring Activities Summary:

Wildlife Friendly Agricultural Projects - No implementation of wildlife friendly agricultural projects occurred in Year 1, so no economic monitoring information was collected. This project is under agreement, but was not implemented prior to harvest. No agricultural flooding occurred during the fall/winter of 2011/2012. The berms are scheduled to be constructed the summer of 2012 and data is to be collected.

Restoration Projects - Project implementation activities commenced on two Task 5 subprojects: Vino Farms and Winchester Vineyards. Year 2 monitoring activities included pre-project photo and construction conditions as well as well as summer conditions of the Delta Farms Project and Spring 2012 conditions.

4.1 SAN JOAQUIN DELTA FARMS SUBPROJECT

Project type: Restoration Project

Status: Project construction has been completed. The site was drained during our spring monitoring site visit. Most vegetation was in its decomposing or skeletal phase. Woody plant species were exhibiting new growth. Discussions with land owners were positive regarding the project and waterfowl use for its first year. Waterfowl use included but was not limited to American wigeon (*Anas americana*), cinnamon teal (Anas cy*anoptera*), gadwall (*Anas strepera*), green-winged teal (*Anas crecca*), mallard (*Anas platyrhynchos*), northern pintail (*Anas acuta*), northern shoveler (*Anas clypeata*), and white-fronted goose (*Anser albifrons*).

Project acre goals: Project acreage goals were achieved and included 134 acres total; 110 acres wetlands in four sites with 24 acres of adjacent upland.

Pre-project site conditions: Project site was a leveled agricultural (wheat) field with multiple drainage and irrigation ditches. No wildlife habitat existed beyond the particular crop.

Project site conditions goal: The post-project site conditions are managed wetland areas that contains typical moist-soil, seasonal wetland vegetation, established tree wetland plants (Scrub Shrub Class, but growing), open water wetlands, and adjacent upland habitats.

Year 2 results: The project is being managed with areas of seasonal wetland habitat as well as permanent open water habitat. The project exhibited great species survival and coverage as well as an abundant use of waterfowl, resulting in great success during the projects first season.

Project vegetation goals: The project supports a moist-soil, seasonal wetland type vegetation community consisting predominately of smartweed (Polygonum spp.), Japanese millet (Echinochloa spp), and watergrass (Bulbostylis barbata). Additional desirable wetland vegetation would include cattails (Typha latifolia), hardstem bulrush (Schoenoplectus spp.), black willow (Salix nigra), and others. Due to the skeletal conditions of vegetation during the time of our spring site visit, no transects were conducted. Transect lines would not have been representative of the on the ground habitat conditions. As an alternative qualitative observations were recorded for herbaceous plant growth based on observations, previous observations and inspection of new germination. Overall, prior to fall flood up, the site contained 100% coverage of desirable species. Due to the extended flooding period that is part of the management cycle all herbaceous coverage within the wetland units were died back. A small amount of new germination was observed in various areas. It is expected that the area will have more that 80 percent coverage the following summer and prior to fall flood up.

Year 2 results: Woody planted species have achieved excellent survival rates for the first growing season. Typically, restoration sites will see the highest mortality rate within the first growing season and diminished mortality subsequent seasons. Although there was not 100% success of planted woody vegetation, the areas that exhibited mortality were relatively minor. Planted woody vegetation along the northern project boundary was the only area the exhibited greater than 5% mortality. Several of the installed willow stakes did not show new signs of growth for the 2012 early growing season. It is possible that some of these plants were still dormant. Generally, the plants that appeared to be dead were upon closer inspection (scrapings) were determined to be dead. Therefore, most of the surviving plants were exhibiting signs of new growth. We estimate the overall survival of planted woody vegetation to be greater than 92% success.

Project wildlife goals: Migratory bird usage for each site consists of mid-winter visual surveys documenting the number of species and the number of each species using the site at the time of the survey. Performance target for this subproject is a yearly increase in usage both the number of species and total amount of each species.
Year 2 results: Migratory bird use was successful. The 2011/2012 wintering waterfowl season was irregular this past season due to weather conditions. However, documented waterfowl use was noted and the presence of a multitude of waterfowl species was abundant.

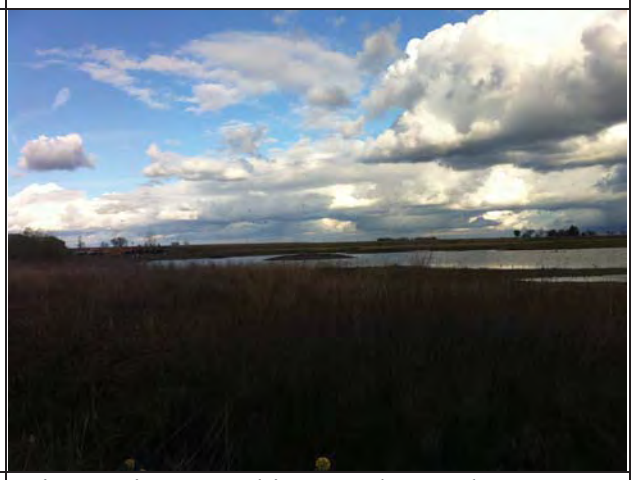
The photo below is comprised predominantly of white-fronted geese with a mix of green wing teal, and mallard ducks.

Waterfowl Flushed during Monitoring (3-1-12)

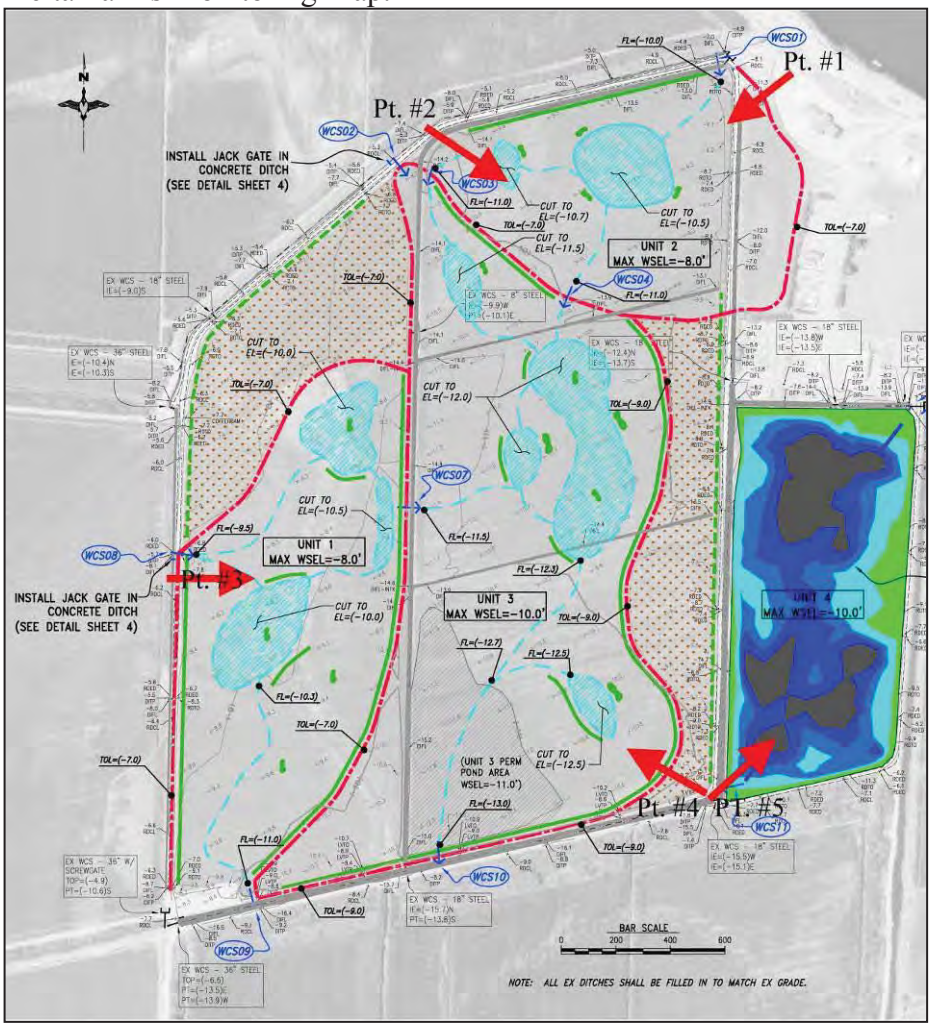
Vegetation during the summer of 2011

Photo documentation:

Pre Project Photos	Post Project Photos – Year 1
	
Point 1.Overview. Looking southwest	Point 1.Overview. Looking southwest
	
Point 2. Site 1. Looking southeast	Point 2. Site 1. Looking southeast
	
Point 3. Site 2. Looking east	Point 3. Site 2. Looking east

	Photo did not turn out…
Point 4. Site 3. Looking northwest	Point 4. Site 3. Looking northwest
	
Point 5. Site 4. Looking northeast	Point 5. Site 4. Looking east by northeast

San Joaquin Delta Farms Monitoring Map.



4.2 Vino Farms Subproject

Project type: Restoration Project
Status: Grading and planting for this project has been completed.

Project acre goals: 2 acres of wetlands in two sites.
Year 2 results: The steep banks of the tidal slough channel have been graded back to a gentler slope. The slopes have been planted with a mixture of herbaceous and emergent species. The tops of the banks have been drill seeded. Additional plantings were installed along the slopes of an existing wetland.

Pre-project site conditions: Project site is along the steep embankment of a tidal slough.
Post Project site conditions goal: The desired post-project site conditions would consist of a gradually sloped transition between the slough and the adjacent uplands along the edge of the agricultural field. Habitat consists of native emergent wetland with sparse but growing coverage as well as transitional ecotone of native plants.

Year 2 results: The project overall is successful within its first early growing season. Minor amounts of mortality were observed as well as some minor areas of erosion. The tidal areas adjacent to poor soils have exposed planted root wads as well as the root systems of installed plugs. The soils in these area were generally very sandy and erosive by nature.

Project vegetation goals: The project is expected to support a permanent tidal freshwater wetland vegetation community consisting predominately of hardstem bulrush (schenoplectus spp), Santa Barbara sedge (Carex barbarae), creeping wildrye (Leymus triticoides), various willow species, Baltic rush (Juncus balticus), and/or bent grass (Agrostis exerata). Monitoring of performance targets for this subproject include 5 established line-transects per site documenting desirable vegetation at least every meter along a 50-meter transect. Readings are taken every meter along the transect. Monitoring of performance targets include quadrant monitoring for this subproject for 50% desirable species coverage using a meter-square evaluation randomly located along each line-transect. Transect locations will be determine once the project is fully complete.

Year 2 results: Although the plantings exhibited some mortality within areas were root wad exposure was present, no significant population of weedy species is present at this time. The project exhibited 15-20% mortality due to sandy soil conditions. It is anticipated that volunteer populations will pursue in following seasons and will establish a dominant native emergent cover.

Project wildlife goals: Migratory bird usage for each site consists of mid-winter visual surveys documenting the number of species and the number of each species using the site at the time of the survey. Performance target for this subproject is a yearly increase in usage both the number of species and total amount of each species.

Year 2 results: Several mallard ducks both hens and drakes were observed utilizing the slough. These birds flushed upon mild disturbance.

Vino Farms Monitoring Map.

Photo Documentation:

Pre Project Photos	Post Project Photos – Year 1
	
Point #1. Site 1. Looking West	Point #1. Site 1. Looking West

4.3 WINCHESTER VINEYARDS SUBPROJECT

Project type: Restoration Project

Status: Project construction has been completed. The site was dry during our winter site visit. The majority of vegetation was not present due to recent land clearing to create the internal swales and pot holes for the project. Discussions with land owners were positive regarding the project outcome and process. We look forward to future conditions and coordination on management practices.

Project acre goals: Project acreage goals were achieved and included 6 acres of managed seasonal wetland as well as enhance 2700 lineal feet of lake-fringe wetland habitat.

Pre-project site conditions: Project site was once leveled agricultural (corn) field with multiple drainage and irrigation ditches. Due to its poorly drained soils, this area was generally left fallow.

Project site conditions goal: The post-project site conditions are to be managed wetland areas that contain typical moist-soil, seasonal wetland vegetation. The goals this year will be to control pepper-weed and establish an herbaceous/emergent cover that will provide quality habitat for wintering waterfowl.

Project vegetation goals: The project is barren soil at this point, however, it should supports a moist-soil, seasonal wetland type vegetation community consisting predominately of smartweed (Polygonum spp)), Japanese millet (Echinochloa spp), and watergrass (Bulbostylis barbata). Additional desirable wetland vegetation would include cattails (Typha latifolia), hardstem bulrush (Schoenoplectus spp), black willow (Salix nigra), and others. Monitoring of performance targets for this subproject include 1 established line-transect per site documenting desirable vegetation at least every meter along a 50-meter transect. Readings will be taken every meter along the transect.

Year 2 results: This project has just been constructed. Future monitoring reports will document the use and success of this project.

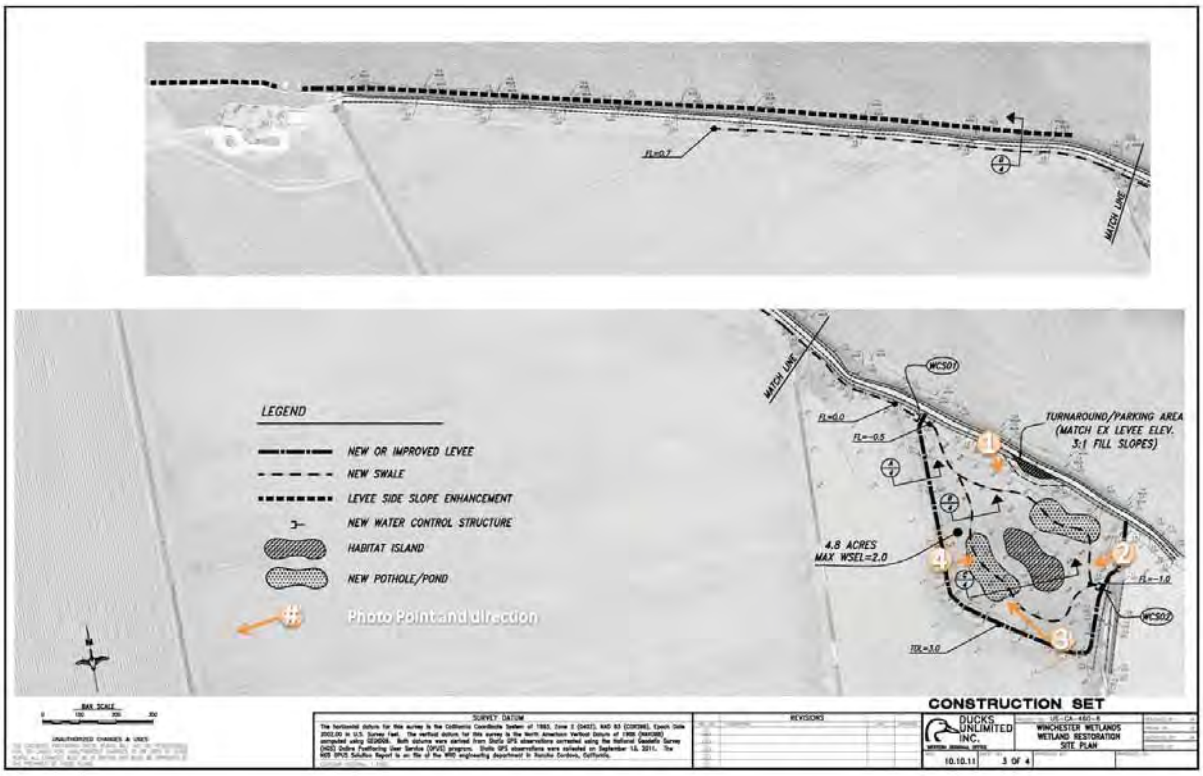
Project wildlife goals: Migratory bird usage for each site consists of mid-winter visual surveys documenting the number of species and the number of each species using the site at the time of the survey. Performance target for this subproject is a yearly increase in usage both the number of species and total amount of each species.

Year 2 results: No migratory bird us was observed this year due to the non-flooded conditions, as this project site was recently constructed. Minor bird use is expected next fall/winter and increase bird use is expected the following wintering season.

Pre Project Photos	Post Project Photos – Year 1
	
Point 1. Site 1. Looking southwest	Point 1. Site 1. Looking southwest
	
Point 2. Site 2. Looking west	Point 2. Site 2. Looking west
	
Point 3. Site 3. Looking northeast	Point 3. Site 3. Looking northeast

	
Point 4. Site 4. Looking southeast	Point 4. Site 4. Looking southeast

Winchester Vineyards Monitoring Map



4.4 Additional Subprojects

Two additional subprojects have been contracted and have been designed. These projects will be constructed in the summer of 2012. Monitoring of these projects will occur in the winter and following early growing season.

5.0 INFORMATION AND EDUCATION

Monitoring activities for evaluating achievement of the Project's information and educational outreach goals include documentation of meeting the performance standards and associated deliverables identified in the Project scope of work. These include holding public meetings, development of a Farmer Outreach Plan, and Wetlands and Buffers Habitat Maintenance Guide, an Information Packet for Farmers, a Manuscript for a peer reviewed journal, Cost Tracking

Analysis, a Feasibility Report, and Final Project Report. Many of these deliverables will be posted to the Delta Protection Commission's, and potentially Ducks Unlimited's, website.

Deliverables/Actions Satisfied: To date the Project has held is first official public meeting to describe the project, its goals, schedule, and scope. The public meeting was held on June 24, 2011. Oral presentations were made by Hart and DU regarding their specific roles in the project and the types of landowners that may be interested in participating. Additional public outreach is in the planning process. A public outreach meeting is expected for some time in June with a follow up outreach meeting in October/November.

The remaining deliverables are depending on full implementation of the all project tasks.

Working Landscapes

Vino Farms
Ditch #1

Plant Monitoring Form

Site No._____ Date 6/8/12 Biologist Jeff Hart

Plot No.	Scientific Name	% Cov.
1	sedge / rye / rush — weed	2/1
2	"	3/2
3		3/3
4		2/3
5		3/4
6		2/4
7		3/2
8		2/4
9		2/4
10		3/4
11		2/3
12		2/3
13		2/2
14		3/2
15	" "	3/2

15.5	2.5
38.5	15.5
39.5	39.
15.5	38.
38.5	63.
15.5	63.
38.5	15.
15.5	63.
15.5	63.
38.5	63.
15.5	38.
15.5	38
15.5	15.
38.5	15.
39.5	15.
393.5	551
26.2	36.

Other minor species/notes_____

Cover Classes: + = < 1; **1** = 1-5%; **2** = 6-25%; **3** = 26-50%; **4** = 51-75%; **5** = 76-100%

(2.5) (15.5) (38.5) (63.5) (88.5)

Working Landscapes

Van Lobensels
Levee slope

Plant Monitoring Form

Site No. 1 Date 6/9/12 Biologist Jeff Hart

Plot No.	Scientific Name	% Cov.
1	LeymTri	5
	weed	2
2	LeyTri	5
	Weed	+
3	LeyTri / CarBar	5
	Weed	1
4.	Carex bar	2
	weed	5
5	Weed	5
	Carex	2
6	LeyTri. / weed	5/2
7	LeyTri	5
	Weed	2
8.	Carex bar.	2
	weed	4
9	LeyTri	4
	Weed	1
10	Carex	3
	Weed	3
11	Sedge / weed	3/4
12	Sedge / weed	2/4
13	rye / weed	5/1
14	rye / weed	4/2
15	Sedge / weed	3/3

88.5 15
88.5 .5
89.5 2
15.5 15 88
15.5
89.5 15.
88.5
15 15.
15.5 63
63.5 25
38.5 38.
38.5 63
15.5 63.
88.5 2.5
63.5 15
39.5 39
835.5 514
55.7 34.

Other minor species/notes_____

Cover Classes: + = < 1; 1 = 1-5%; 2 = 6-25%; 3 = 26-50%; 4 = 51-75%; 5 = 76-100%

Working Landscapes

Wilson Ranch
Levee Slope

Plant Monitoring Form

Site No.____ Date 6/9/12 Biologist Jeff Hart

Plot No.	Scientific Name	% Cov.		
1	Sedge / weed	2 / 2	15.5	15.5
2	" "	3 / 1	38.5	2.5
3	Rye / weed	3 / 2	38.5	15.5
4	sedge / weed	2 / +	15.5	.5
5	Rye / weed	2 / 1	15.5	2.5
6	Rye / weed	2 / 1	15.5	2.5
7	Rye / weed	3 / 1	38.5	2.5
8	Sedge / weed	4 / 1	63.5	2.5
9	Rye / weed	4 / +	63.5	.5
10	sedge / weed	3 / +	38.5	.5
11	sedge / weed	3 / 1	38.5	2.5
12	rye / weed	2 / 1	15.5	2.5
13	rye / weed	2 / 1	15.5	2.5
14	sedge / weed	3 / 1	38.5	2.5
15	sedge / weed	2 / 1	15.5	2.5
			466.5	57
			31.1 %	3.8

Other minor species/notes_____

Cover Classes: + = < 1; **1** = 1-5%; **2** = 6-25%; **3** = 26-50%; **4** = 51-75%; **5** = 76-100%

Working Landscapes

Vino Farms
Ditch # 2

Plant Monitoring Form

Site No.____ Date 6/8/12 Biologist Jeff Hart

Plot No.	Scientific Name	% Cov.
1	Juncus sedge Scirpus / weed	4 / 1
2		3 / 1
3		3 / 1
4		2 / 1
5		5 / 2
6		5 / 2
7		4 / 1
8		3 / 2
9		5 / 2
10		5 / 1
11		4 / 2
12		4 / 2
13		3 / 2
14		2 / 2
15		5 / 1

63.5	25
38.5	25
38.5	25
15.5	2.5
88.5	15.
88.5	15
63.5	25
38.5	155
88.5	15
88.5	25
63.5	15
63.5	15.5
38.5	15.
15.5	15.
88.5	2.
891.5	141
58.8	9.4

Other minor species/notes_____

Cover Classes: + = < 1; **1** = 1-5%; **2** = 6-25%; **3** = 26-50%; **4** = 51-75%; **5** = 76-100%

Appendix A

In place of the line transect method, 3-meter quadrants were used as this approach seemed more appropriate for the sparse nature of the vegetation. This data was obtained by randomly placing 3-meter square quadrants along representative sections of the installed 2010 plantings. Cover classes of <1% (+); 1-5% (1); 6-25% (2); 26-50% (3); 51-75% (4); and 76-100% (5) were assigned to the plants in each quadrant. The several species of native plants were lumped into one category as were the weed species. The table below represents the overall averages of percent cover for four different sites.

Monitoring results of 2010 Plantings, Hart Restoration

Site	Percent Coverage (Native Plantings)	Percent Coverage (weeds)
Wilson Ranch, Clarksburg Site (levee slope)*	31.1%	3.8%
Van LobenSels Ranch (levee slope)**	55.7%	34.3%
Vino Farms Ranch (ditch #1)***	26.2%	36.8%
Vino Farms Ranch (ditch #2)****	58.8%	9.4%

*Sedge (Carex barbarae) and creeping wildrye (Leymus triticoides)
** Sedge (Carex barbarae) and creeping wildrye (Leymus triticoides)
*** Sedge (Carex barbarae), creeping wildrye (Leymus triticoides) and rush (Juncus effusus)
**** Rush (Juncus effusus) and Scirpus americanus

These plants are well established and it is not anticipated that there will be any further mortality. But it will be important that the sites are maintained properly for long term plant survival and to ensure that these native species spread throughout the sites.

Most of the plants of the 2010 installation at the Herringer Ranch did not survive. Part of the explanation is that many of these installed plants were made up of tiny seedlings (plugs) compared to the installations at the other sites where larger and better rooted plants were utilized. Another reason for failure is pesticide drift.

Delta Working Landscapes

Task 6.2 Annual Monitoring Report – Year 3

September 2013

Prepared By:

Ducks Unlimited, Inc. and Hart Restoration

1.0 INTRODUCTION

This document is being prepared as part of the requirements for the Delta Working Landscapes (DWL) Project funded through a grant to the Delta Protection Commission (DPC) by the California Department of Fish and Wildlife's Ecosystem Restoration Program (Agreement Number E0883001) as identified in Task 6.2.

This report describes methods used to evaluate the progression of the various subprojects implemented by the Project. The majority of monitoring methods focus on the establishment and development of vegetation and wildlife habitats. Other monitoring efforts also include documentation of economic changes due to implementation of wildlife friendly winter flooding actions. For wildlife friendly agriculture, monitoring activities occurred in the late spring/early summer when peak vegetation growth is occurring.

The monitoring activities described in this report will help to evaluate the fulfillment of the Project's goals:

- Improve the environmental quality of existing landscapes in the northern part of the Sacramento -San Joaquin Delta through a variety of demonstration projects;
- Develop an educational mechanism and economic model to transfer environmentally friendly farming knowledge, techniques and practices to other Delta farmlands and stakeholders;
- Facilitate environmental compliance through overcoming disincentives and increasing incentives towards achieving these goals; and
- Coordinate a research program with the farmers to understand the social, economic, environmental and governmental policy impediments and incentives to performing conservation practices.

2.0 MONITORING OF WILDLIFE FRIENDLY AGRICULTURE TASK 4 PROJECTS

Hart Restoration conducted extensive plantings throughout the late winter and early spring of 2011. Once all the materials are in the ground by early spring, we will then commence to document baseline conditions of plantings. To that end we will use standard quadrant sampling techniques to measure initial density and cover per site, documenting site specific conditions, species and management approaches. Photo documentation of site monitoring is included in Appendix A. Field monitoring forms are included in Appendix B.

2.1 Materials and Methods for Installation

Different methods of planting were initially proposed: seeding, small seedling plugs and larger well rooted container stock. The per unit area cost increases from seeding, seedling "plugs", and the larger well-rooted container stock. However, the suitability of these different methods varies with different site conditions. Broadcast application of seed material is best suited for clean sites with little weed competition. For this method to work, considerable prior site preparation is required that generally involves re-contouring, soil treatment (disking, roto-tilling, etc.) and/or application of pre-emergent herbicides. Few sites in our project area were suitable for this

approach. Many farmers feel that they don't have enough room to re-contour a ditch bank. Reclamation districts and flood control agencies are also resistant to alter levee slopes. The prior cleaning of sites with herbicides is also problematic in the vicinity of sensitive crops such as grapes. Moreover, seedling materials are more sensitive to soils with herbicides remaining in the soil as residuals than are larger, established plants that are more hardy. A site (the Van Loben Sels Ranch) that we intended to plant with seeds was deemed to be too polluted with chemical residuals for seed materials to be applied. Seeding was done, however, along a re-contoured (the Lambert Road site on Vino Farms) site which initially appeared successful.

The success of planting also has varied with size of plants used in the initial installation. While the smaller seedling plugs are less expensive than the larger rooted container material, the latter are more hardy for sites where competition from competing exotic species is a major obstacle to plant establishment. As will be described later, we have had poor success with the smaller sized plug materials compared to well rooted materials.

Plant materials were installed in the fall of 2010, the winter and spring of 2011, and the fall and early winter of 2011 (Photos 3, 4). About 15 sites on 5 different ranches, totaling over 50,000 linear feet, were planted with over 100,000 plants along ditch banks and levee slopes (see Tables 1 and 2). The species planted included creeping wildrye (*Leymus triticoides*), sedge (*Carex barbarae*), rushes (*Juncus balticus, J. effusus*) and tules (*Scirpus americanus*).

Where possible, some form of weed control was practiced. This included prior application of herbicides to initially knock down the annual grasses in late fall/early winter, mowing or hand weeding. It was expected the landowner would show enough interest to take over the maintenance activities.

2.2 Results

The results have largely been successful, but the outcome has varied from one site and ranch to another. The more successful outcome has occurred on the "cleaner" sites using the larger-sized plant materials and at ranches where particular individuals took a personal interest.

The levee slopes bordering all of the sites at the Wilson Ranch property have been well managed so that few really invasive weeds were present (Photos 5 and 6 in Appendix A).

Another very successful site (at least initially) is the levee slope on the Van Loben Sels Ranch. The levee slope had been aggressively treated with herbicides. We planted large and vigorous materials which survived; had we applied seeds or planted with smaller materials, success would have been problematic due to the apparent residues of herbicides (Photos 7 and 8 in Appendix A) that seem to affect smaller plants.

At the Heringer property, the four sites (levee slope and buffer site) planted with small seedling plugs faired very poorly. The lack of success, I believe, is due to competition with annual grasses, compacted soils, and possibly herbicide drift or residues. Even larger sized plants (swale site) perished.

Weedy sites planted with larger materials have done relatively well despite plant competition. The plants planted along the ditches at Vino Farms are surviving (Photos 9, 10, 11, 12, 13 in

Appendix A), but will do much better if there is selective use of broad-leaved herbicides until the plants are well established. Wetland plants, such as tules and rushes, that have been installed in the wetted perimeters of ditches along Lambert Road have done quite well. Close coordination with the farming operations is needed since the nearby grape plants are sensitive to herbicides. The young farmers at Vino Farms have been particularly interested in the plantings and have responded by implementing their own maintenance program which appears to be successful.

The wetland plants along Vino Farms Ditches 1 and 2 have done relatively well (See Table 2, below).

Wetland plants, such as tules and rushes, that have been installed in the wetted perimeters of ditches have done quite well, such as at Winchester Lake (Photo 14 in Appendix A).

Another factor affecting success was the amount and seasonal distribution of rainfall. The winter of 2010-11 was very wet; consequently, our success rate for plantings during this time period was very high. Conversely, the winter of 2011-12 was very dry; our success rate for plantings during this time period appears to be low.

Table 1. Implemented Sites

Property	Environment Planted	Linear Feet	No. Plants Installed	Species
Heringer Ranch	Levee slope (Elkhorn Slough)	9,284	13,289	Grasses[1]
	Swale (between interior road and vineyard)	1,172	2,104	Grasses
	Buffer (between Netherlands Road and vineyard)	2,706	10,110	Grasses
	Levee slope (Netherlands Rd)	5,700	8,112	Grasses
	Levee slope (Netherlands Rd)	--	191	Grasses[1]
Wilson Ranch	Levee slope	5,148	9,622	Grasses
	Levee slope (S. River Rd & Co. Rd 141)	2,000	2,400	Grasses
	Levee slope (S. River Rd & Courtland Rd)	1,100	2,736	Grasses
	Levee slope (Waukeena Rd & Courtland Rd)	700	3,360	Grasses
Vino Farms	Ditch #1 and 2 (Waukeena Rd), miscellaneous levee plantings	13,219	17,788	Grasses, rushes[2]
	Ditch (Lambert Rd)	3,000	8,928	Grasses, Sedges Tules[3],

Property	Environment Planted	Linear Feet	No. Plants Installed	Species
Van Loben Sels Ranch	Levee slope	2,995	20,736	Grasses
Winchester Vineyards	Ditch (Winchester Lake)	4,100	2,074	Tules[3]
Totals		**51,124**	**101,450**	

1Grasses = Creeping wildrye (*Leymus triticoides*), sedge (*Carex barbarae*)
[2] Rushes = *Juncus effusus*
[3]*Tule = California tule (Scirpus callfornicus) at Winchester Lake and* three-square tule (*Scirpus americanus) for the Lambert Road Site.*

Table 2. Habitat-Friendly Agriculture Project Monitoring Results

Site	Percent Coverage (Native Plantings)	Percent Coverage (weeds)
Wilson Ranch, Clarksburg Site (levee slope)[1]	31.1%	3.8%
Van Loben Sels Ranch (levee slope)[1]	55.7%	34.3%
Vino Farms (Ditch #1)[2]	26.2%	36.8%
Vino Farms (Ditch #2)[3]	58.8%	9.4%
Winchester Lake [4]	64.1%	0%
Heringer Ranch	0%	0%

Notes: Sites were planted in 2010 and surveyed June 9, 2012 and August 11, 2013
[1]Sedge (*Carex barbarae*) and creeping wildrye (*Leymus triticoides*)
[2]Sedge (*Carex barbarae*), creeping wildrye (*Leymus triticoides*) and rush (*Juncus effusus*)
[3]Rush (*Juncus effusus*) and three-square (*Scirpus americanus*)
[4]Tule (*Scirpus californicus*)

This data was obtained by randomly placing 3-meter square quadrants along representative sections of the installed 2010 plantings. Cover classes of <1% (+); 1-5% (1); 6-25% (2); 26-50% (3); 51-75% (4); and 76-100% (5) were assigned to the plants in each quadrant. The several species of native plants were lumped into one category as were the weed species. The table above represents the overall averages of percent cover for four different sites.

The plants are well established at the site locations presented in Table 2 and it is not anticipated that there will be any further mortality. But it will be important that the sites are maintained properly for long term plant survival and to ensure that these native species spread throughout the sites.

Most of the plants of the 2010 installation at the Heringer Ranch did not survive. Part of the explanation is that many of these installed plants were made up of tiny seedlings (plugs) compared to the installations at the other sites where larger and better rooted plants were utilized. Another reason for failure is pesticide drift.

The locations where successful ditch implementations occurred proved to not have a problem with erosion. The ditch bank conditions at Winchester Lake include rock/revetment, thus there is little erosion. The bank conditions at the Vino Farms Lambert Road site consists of hardpan soils where erosion is also not an issue. Other sites where native plants were installed consist of an abundance of weedy species, so again erosion is not a problem. The ditches with barren steep banks are very common throughout the region.

3.0 MONITORING OF WILDLIFE FRIENDLY FARMING AND RESTORATION TASK 5 PROJECTS

Monitoring of the wildlife friendly farming and restoration projects to be implemented under Task 5 consists of two activities:

1) A comparison between pre- and post-project site conditions, specifically the presence of wildlife friendly vegetation. Monitoring of subprojects that are designed to perform as managed seasonal wetlands includes established photo points for each site, plant species establishment using line transects for each site, percent vegetation coverage using meter-square evaluations, and wildlife use through mid-winter visual surveys of each site. For all sites, specific quantitative data on the habitat objectives includes descriptions of various acres or linear-feet of habitat targeted and ultimately established.

2) An economic benefits of wildlife friendly agricultural winter flooding practices will be documented. Economic data will include previous year yields, costs, and profit per field and per acre of non-winter flooded fields, as well as current and future year's yields, costs, and profit per field and per acre of winter flooded fields. Pre and post project data will be compared to evaluate any economic substantiation for winter flooding agricultural lands. Cost per acre for installation of wetland management infrastructure will also be documented.

Year 3 Monitoring Activities Summary:

Wildlife Friendly Agricultural Projects – Woody's by the River constructed berms around two existing 70 acre corn fields to promote wildlife friendly agriculture. Multiple wildlife benefits were observed. In addition to an abundance of winter waterfowl utilizing the two fields, shorebirds were observed utilizing the area in late spring.

Restoration Projects - Project implementation activities commenced on two Task 5 subprojects: Year 3 monitoring activities included pre-project photo and post-construction conditions as well as summer of 2012 and spring 2013 conditions (Appendix C).

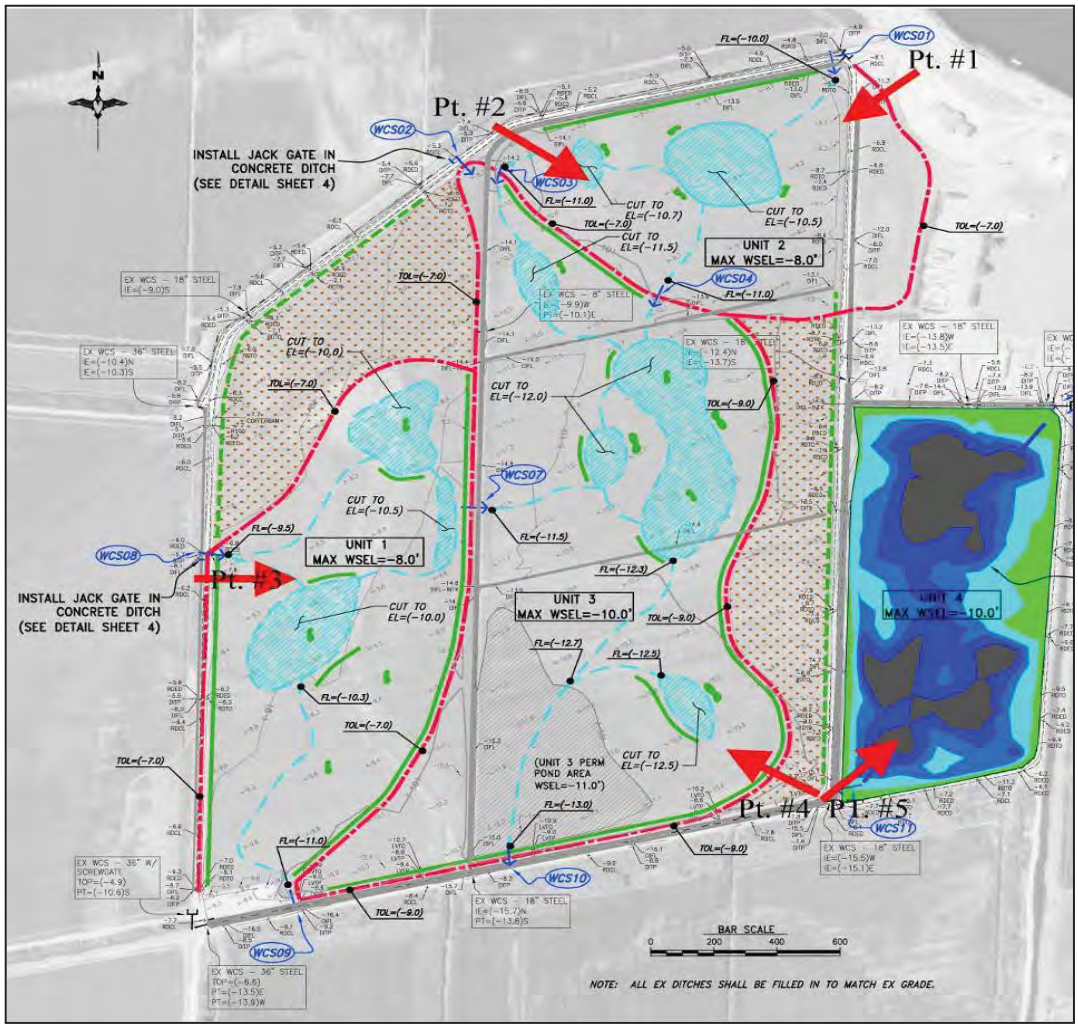
3.1 San Joaquin Delta Farms Subproject

Project type: Restoration Project

Status: Project construction has been completed. The site was mostly drained during our spring 2013 monitoring site visit. The project design has been slightly altered by the land owner. Additional excavation within the pot holes was conducted to provide management ability for year round water within the wetland units. This alteration was made in coordination with DU, to promote dispersion of mosquito fish during spring and summer irrigations, thereby reducing the use of pesticides and other mosquito abatement costs.

Remnant vegetation from the previous growing season was in its skeletal phase. New growth was abundant and it is anticipated that 100 percent emergent cover will be achieved once again. Waterfowl use continued to be dominantly but not limited to American wigeon (*Anas americana*), cinnamon teal (*Anas cyanoptera*), gadwall (*Anas strepera*), green-winged teal (*Anas crecca*), mallard (*Anas platyrhynchos*), northern pintail (*Anas acuta*), northern shoveler (*Anas clypeata*), and white-fronted goose (*Anser albifrons*).

San Joaquin Delta Farms Monitoring Map



Project acre goals: Project acreage goals were achieved and included 134 acres total; 110 acres wetlands in four sites with 24 acres of adjacent upland.

Pre-project site conditions: Project site was a leveled agricultural (wheat) field with multiple drainage and irrigation ditches. No wildlife habitat existed beyond the particular crop.

Project site conditions goal: The post-project site conditions are managed wetland areas that contains typical moist-soil, seasonal wetland vegetation, established tree wetland plants (Scrub Shrub Class, but growing), open water wetlands, and adjacent upland habitats.

Year 3 results: The project is being managed with areas of seasonal wetland habitat as well as semi-permanent open water habitat. The project exhibited great species survival and coverage as well as an abundant use of waterfowl, resulting in great success during the projects second season.

Project vegetation goals: The project supports a moist-soil, seasonal wetland type vegetation community consisting predominately of smartweed (*Polygonum spp*.), Japanese millet (*Echinochloa spp*), and watergrass (*Bulbostylis barbata*). Additional desirable wetland vegetation included cattails (*Typha latifolia*), hardstem bulrush (*Schoenoplectus spp*.), black willow (*Salix nigra*), and others. Due to the homogenous conditions of vegetation during the time of our spring site visit, no transects were conducted. As an alternative, qualitative observations were recorded for herbaceous plant growth based on observations, previous observations and inspection of new germination. Overall, prior to fall flood up, the site contained 100% coverage of desirable species. Due to the extended flooding period that is part of the management cycle all herbaceous coverage within the wetland units were in abundant amounts. The sites has repeatedly exhibited 80-100 percent cover of desirable species, dominated by Japanese millet, smart weed and broad-leaved cattails.

Year 3 results: Very minimal mortality was exhibited within the woody planted species. Woody species continue to have excellent survival rates and are vigorous growth. Planted woody vegetation along the northern project boundary was the only area the exhibited greater than 5% mortality. Landowners have added additional appropriate plantings within this area. The landowners estimated the overall survival of planted woody vegetation to be greater than 95% success when including the additional woody plantings.

Project wildlife goals: Migratory bird usage for each site consists of mid-winter visual surveys documenting the number of species and the number of each species using the site at the time of the survey. Performance target for this subproject is a yearly increase in usage both the number of species and total amount of each species.

Year 3 results: Migratory bird use was successful. The 2012/2013 wintering waterfowl season was slow this past season due to calm weather conditions. This affects bird usage on the smaller wetland areas as waterfowl find the larger refuges that don't have hunting pressure. Without inclimate weather to move them off the refuge, bird observations were respectfully lower than expected. However, documented waterfowl use was noted and the presence of a multitude of waterfowl species was abundant. Winter site visit revealed abundant use by northern pintail in the southwest corner. Tallying nearly into the 200's on a

single day. In addition, during a spring site visit approximately 500 white-fronts were observed using the constructed wetland on a single day.

Photo 1 in Appendix C contains white fronted geese lifting off of the permanent wetland.

3.2 Vino Farms Subproject

Project type: Restoration Project

Status: Grading and planting for this project has been completed.

Vino Farms Monitoring Map

Project acre goals: 2 acres of wetlands in two sites.

Year 3 results: The steep banks of the tidal slough channel have been graded back to a gentler slope. The slopes have been planted with a mixture of herbaceous and emergent species. The tops of the banks have been drill seeded. Additional plantings were installed along the slopes of an existing wetland.

Pre-project site conditions: The Project site is along the steep embankment of a tidal slough.

Post Project site conditions goal: The desired post-project site conditions consist of a gradually sloped transition between the slough and the adjacent uplands along the edge of the

agricultural field. Habitat consists of native emergent wetland with increasing density and cover. The site maintains a transitional ecotone of native plants.

Year 3 results: The project continued to be successful within its first growing seasons as we observed increasing densities of native volunteering emergent plants. Minor amounts of mortality observed in the first year have begun to fill in by native colonizers even in areas that historically exhibited minor erosion. Erosive sandy areas have begun to stabilize as vegetation has set in. Although still slightly erosive, these areas are appear to be significantly less erosive than pre-project conditions as no additional grading is required.

Project vegetation goals: The project supports a permanent tidal freshwater wetland vegetation community consisting predominately of hardstem bulrush (*Schenoplectus spp*), Santa Barbara sedge (*Carex barbarae*), creeping wildrye (*Leymus triticoides*), various willow species, Baltic rush (*Juncus balticus*), and/or bent grass (*Agrostis exerata*). Monitoring of performance targets for this subproject for vegetation was completed by Hart Restoration. The qualitative/quantitative results are included under section 2.1 of this report.

Year 3 results: Although the plantings exhibited some mortality within areas were root wad exposure was present, no significant population of weedy species is present at this time. The project exhibited 15-20% mortality due to sandy soil conditions. It is anticipated that volunteer populations will pursue in following seasons and will establish a dominant native emergent cover.

Project wildlife goals: Migratory bird usage for each site consists of mid-winter visual surveys documenting the number of species and the number of each species using the site at the time of the survey. Performance target for this subproject is a yearly increase in usage both the number of species and total amount of each species.

Year 3 results: Several mallard ducks both hens and drakes were observed utilizing the slough during the Year 2 monitoring site visit. No waterfowl were observed during our formal monitoring site visit for Year 3. However, minor bird usage consistent of year two's finding has been observed with informal monitoring of the area. The area is used predominantly by resting mallards.

3.3 Woody's By the River

Project type: Wildlife Friendly Project

Status: Construction completed summer of 2012. Flooded for the Fall/Winter of 2012/2013.

Woody's by the River Monitoring Map

Project Acre goals: Project acreage goals were to develop the infrastructure needed to support winter flooding of 140 acres of existing corn field.

Pre-Project Conditions: The site was existing dry land corn field surrounded by winter flooded seasonal wetlands.

Post-Project Conditions: The project site has developed berms surrounding two fields with a combined acreage of 140 acres. Total berm length is over 13,691 linear feet. The berms support winter flooding of the agricultural fields.

Project Site Condition goal: The post project site conditions are to winter flooded agricultural fields to support wintering waterfowl.

Project vegetation goals: The project is agricultural land and is routinely disked and worked. The vegetation goals will not alter from the pre-project conditions, with the exception that the corn stubble will be winter flooded in addition to being disked.

Year 3 results: Although repeated communication attempts were made with the land manager, staff were unable to find out ahead of time when the corn and post harvest flooding was going to occur. Harvest was conducted in October of 2012 and subsequently flooded that fall/winter.

DU staff asked the farm manager for harvest numbers on several occasions. Unfortunately due to extenuating circumstances, DU was unable to acquire the post harvest data.

Project wildlife goals: Migratory bird usage for each site consists of mid-winter visual surveys documenting the number of species and the number of each species using the site at the time of the survey. Performance target for this subproject is a yearly increase in usage both the number of species and total amount of each species.

Year 3 results: Although DU was not notified of the harvest and flooding regime until the spring of 2013, we were able to verify wildlife activity by personal communication with the landowners. Wildlife use within the flooded agricultural fields included use by Teal, Mallards, Widgeon, Northern shoveler, egrets, sand hill cranes, herons and various small shorebirds.

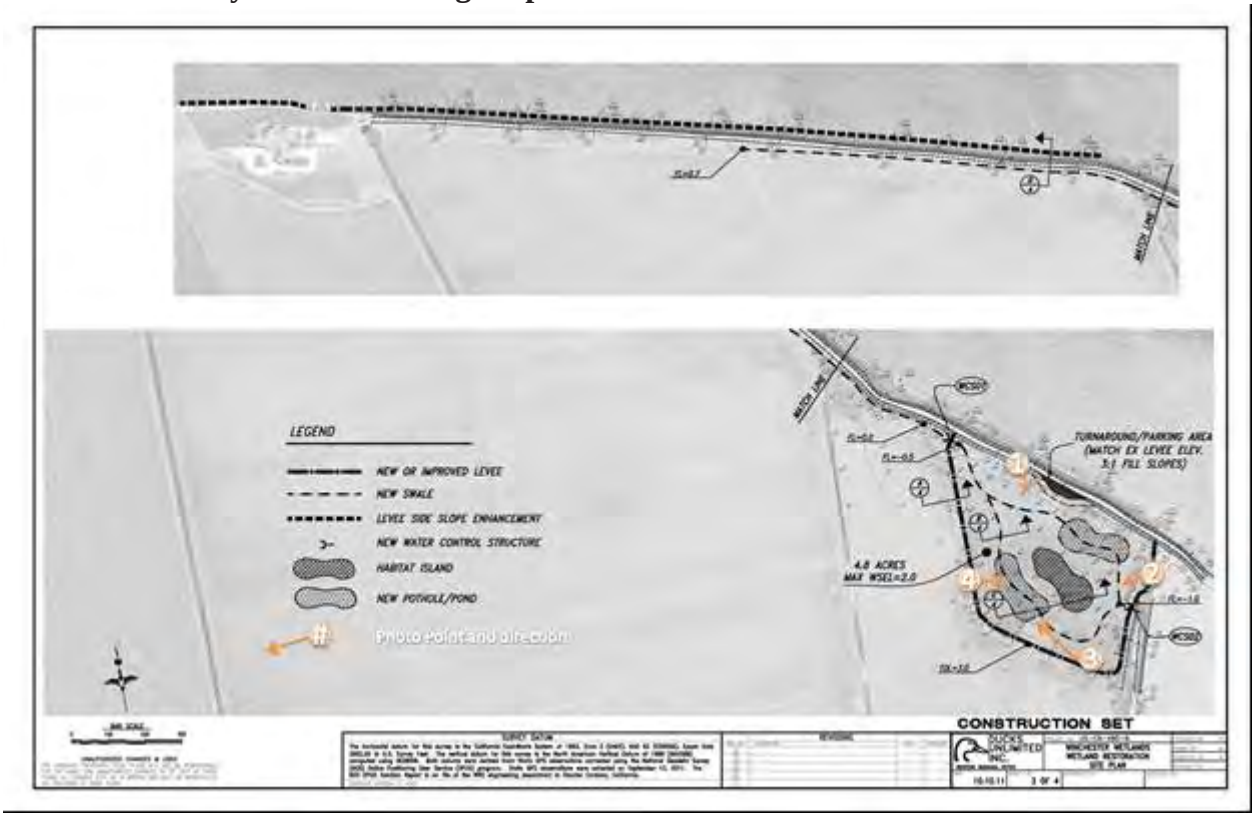
A field visit was conducted on January29th 2013. During our field visit minimal to moderate bird usage was observed. Species noted included Mallard ducks, Green Winged Teal along with snowy egrets and American coots. The Stockton Record also joined us during the site investigation to talk about the project and other working landscape projects.

3.4 Winchester Vineyards Subproject

Project type: Restoration Project

Status: Project construction has been completed. The site was dry during our winter site visit. The majority of vegetation was disked under for maintenance purposes. Coordination with the landowner is ongoing for vegetation maintenance. The perimeter berm is expected to be drill seeded the fall of 2013. Species and quantities have been coordinated with the landowner and the supplier.

Winchester Vineyards Monitoring Map



Project acre goals: Project acreage goals were achieved and included 6 acres of managed seasonal wetland as well as enhance 2700 lineal feet of lake-fringe wetland habitat.

Pre-project site conditions: Project site was once leveled agricultural (corn) field with multiple drainage and irrigation ditches. Due to its poorly drained soils, this area was generally left fallow.

Project site conditions goal: The post-project site conditions are to be managed wetland areas that contain typical moist-soil, seasonal wetland vegetation.

Project vegetation goals: The project is barren soil at this point, however, it should supports a moist-soil, seasonal wetland type vegetation community consisting predominately of smartweed (*Polygonum spp*.), Japanese millet (*Echinochloa spp.*), and watergrass (*Bulbostylis barbata*). Additional desirable wetland vegetation would include cattails (*Typha latifolia*), hardstem bulrush (*Schoenoplectus spp*.), black willow (*Salix nigra*), and others.

Year 3 results: This project has struggled to achieve desirable plant communities. Although species are present, the lack of winter flooding and summer irrigations has limited its progress. Further conversations with the landowner continue to work toward developing the desired wetland vegetation densities. The vegetative coverage was limited due to recent disking activities to combat invasive species. Non-disturbed areas exhibited 70 percent coverage, with a desirable species coverage of approximately 15-20 percent.

Project wildlife goals: Migratory bird usage for each site consists of mid-winter visual surveys documenting the number of species and the number of each species using the site at the time of the survey. Performance target for this subproject is a yearly increase in usage both the number of species and total amount of each species.

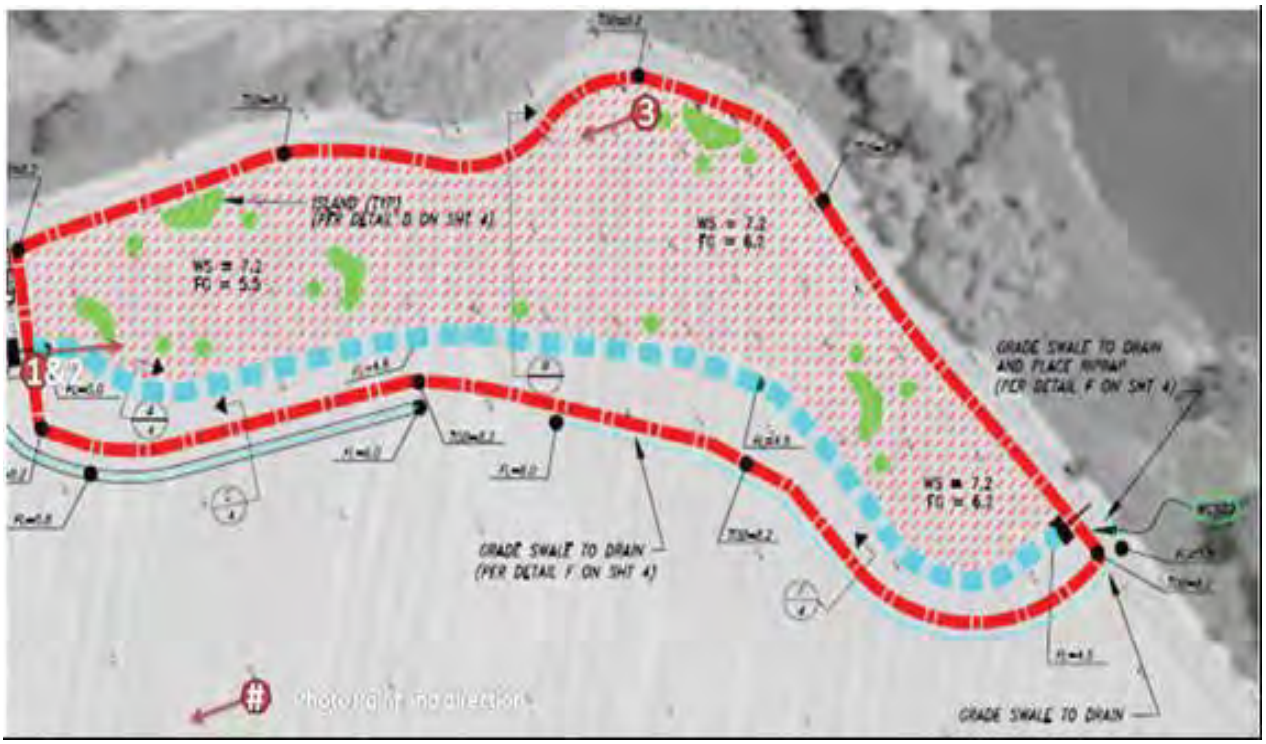
Year 3 results: In the late spring of 2012 a brood of gadwall ducks was observed in the wetland area. This brood consisted of one hen and 6-7 chicks. These birds upon disturbance moved into dense vegetation and were not observed again. Minimal water was observed within the swale during the spring of 2013 and no wildlife was observed. Ongoing maintenance of invasive species is continuing and further action is required to increase the wintering capacity of this seasonal wetland. Although minimal wintering benefits have been observed, the site has the capacity to function as intended with increased water management. DU will continue to work with this land owner outside the scope of Delta Working Landscapes project to better ensure the success of this wetland.

3.5 C &M Ranch Subproject

Project type: Restoration Project

Status: Project construction was completed during fall of 2013. The site was dry during our spring site visit.

C&M Ranch Monitoring Map



Project acre goals: Project acreage goals were achieved and included 3 acres of managed seasonal wetland.

Pre-project site conditions: Project site was once leveled agricultural (alfalfa) field with multiple drainage and irrigation ditches. Due to its poorly drained soils, this area was generally left fallow or produced low yields.

Project site conditions goal: The post-project site conditions are to be managed seasonal wetland that contain typical moist-soil, seasonal wetland vegetation that support an array of wildlife.

Project vegetation goals: The project should support a moist-soil, seasonal wetland type vegetation community consisting of smartweed (*Polygonum spp.*), watergrass (*Bulbostylis barbata*) and various sedges and rushes. Additional desirable wetland vegetation would include cattails (*Typha latifolia*), hardstem bulrush (*Schoenoplectus spp.*), black willow (*Salix nigra*), and others.

Year 3 results: This project has just been constructed. Although very little time has passed for this project, the site is responding very well. Emergent wetland vegetation has established itself and consists of but is not limited to, smartweed, water-grass, swamp timothy and dock (*Rumex spp.*). It is expected that with proper fall flood up, the site will be utilized by an abundance of water bird species. Passive planting restoration was utilized for this project. Overall there was approximately 65 percent coverage with 40 percent being desirable species such as smartweed, sedges and water grass. This is expected to dramatically increase the following spring.

Project wildlife goals: Migratory bird usage for each site consists of mid-winter or spring visual surveys documenting the number of species and the number of each species using the site at the time of the survey. Performance target for this subproject is a yearly increase in usage both the number of species and total amount of each species.

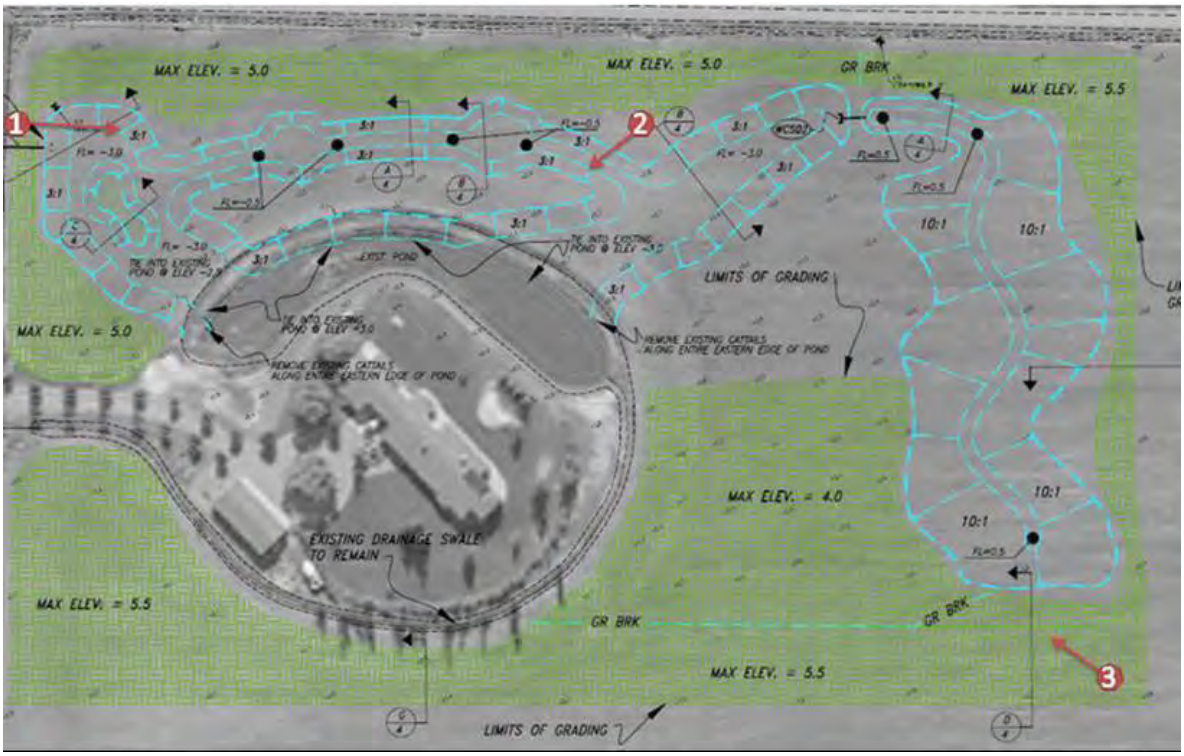
Year 3 results: No migratory bird use was observed this year due to the non-flooded conditions, as this project site was recently constructed. Minor bird use is expected next fall/winter and increase bird use is expected the following wintering season. This project site did contain signs of wildlife use including coyote scat, and raccoon foot prints.

3.6 Uslan Subproject

Project type: Restoration Project

Status: Project construction has been completed. The upland vegetation is well established and the emergent wetland planting communities are beginning to naturally colonize.

Uslan Monitoring Map



Project acre goals: Project acreage goals were achieved and included 2 acres of managed seasonal wetland as well as approximately 6 acres of semi-permanent wetland and 2 acres of native upland grassland.

Pre-project site conditions: Project site was once leveled agricultural field (dichondra) with multiple drainage and irrigation ditches as well as a barrow pit for the single family residence. Due to its poor site conditions, some areas were left follow.

Project site conditions goal: The post-project site conditions are managed wetland areas that contain typical semi-permanent and seasonal wetland vegetation. The goals this project will be to establish an herbaceous/emergent cover that will provide quality habitat for wintering waterfowl as well as spring brood habitat.

Project vegetation goals: The goal of this subproject is to support a diversity of ecotones such as upland habitat, semi-permanent wetland as well as a moist-soil, seasonal wetland vegetation community. Wetland plant species will consist predominately of smartweed (*Polygonum spp.*), creeping wildrye (*Lymus triticoides*) and watergrass (*Bulbostylis barbata*). Additional desirable wetland vegetation would include cattails (*Typha latifolia*), hardstem bulrush (*Schoenoplectus spp*.), black willow (*Salix nigra*), and others.

Year 3 results: The project site has been largely successful as documented by the land owners observations and efforts to maintain and manage the restoration area. A dominance of native grasses has been established and is comprised of purple needle grass (*Stipa pulchra*), blue wild-rye (*Elymus glaucus*), slender wheatgrass (*Elymus trachcaulus*), meadow barley (*Hordeum brachyantherum*) and small fescue (*Festuca microstachys*). Drill seeding was used

for upland and seasonal wetland grasses. Initial germination is estimated at over 95 percent in early spring of 2012. The planted species are currently estimated at 90 percent survival rate for the 2013 growing season.

Project wildlife goals: Migratory bird usage for each site consists of mid-winter visual surveys documenting the number of species and the number of each species using the site at the time of the survey. Performance target for this subproject is a yearly increase in usage both the number of species and total amount of each species.

Year 3 Monitoring: The land owner is a very active birder and has recorded many new species utilizing the property. He volunteers with a birding group that also has an operational banding permit. Our visual observations included a pair of nesting mallards within the semi-permanent wetland as well as foraging mergansers. The land owner has recorded several other species. Below is a portion of an email correspondence of his account, dated May 2013.

> "We have wood ducks, kestrels, owls and swallows in the various boxes around our property. I banded all of the above about three weeks ago. There are two pairs of nesting mallards in the rye grass that we don't disturb. Interesting that one of the drakes is banded….not by me. There is a presence of quail I haven't seen before. The otters are eating my fish and enjoy playing in the aerators. I wish they would leave! Three Forster's Terns showed up last week and make a couple of appearance each day… I planted bulrushes around about 25% of deep pond which are doing well."

Appendix A

Wildlife Friendly Agriculture Sites Photo Monitoring

Photos 1 & 2. Site conditions as a result of application of herbicides (Photo 1) and Example of an excessively weedy site (Photo 2).

Photos 3 & 4. Installation of plants

Photos 5 & 6. Sedge (Carex barbarae) planting on levee slope at Wilson Ranch (January 15, 2013). Planted in fall of 2011.

Photos 7 & 8. Wilson Ranch levee slope plantings (January 15, 2013). Sedge (Carex barbarae has done much better than creeping wildrye (Leymus triticoides). The site was planted in mid winter of 2012.

Photos 9 & 10. Van Loben Sels Ranch. After a successful early establishment of grasses and sedges at the base of the levee, the project was removed by the landowner without discussion.

Photos 11 & 12. Del Vino Farms (January 15, 2013). Several species were planted: Juncus effusus (1), Carex barbarae (2) , Leymus triticoides (3), and Scirpus Americanus (4). This site was planted in 2011.

Photos 13 & 14. Vino Farms Lambert Road ditch side plantings. Photo above, summer of 2012. Photo below,January 15, 2013. Nearly 100% coverage with Scirpus americanus along shoreline. This site was planted in 2011

Appendix B

Field Monitoring Forms

8-10-13

Winchester

Plant Monitoring Form

Site No. 1 Date 8-10-13 Biologist JH Total Cover Vegetative_____

Scientific Name	Common Name	Native/ Introduced	% Cov.	
S. Cal.			4	63.5
			5	89.5
			5	
			5	
			4	
			5	
			4	
			3	39.5
			3	
			4	
			4	
			5	
			5	
			4	
			3	
" " Typhus			5	
			5	
			3	
			5	
			2	
			3	
			4	
			3	
			5	
			1	2.5
+ Typha			5	

Other minor species/notes_____

_____

Cover Classes: + = < 1; **1** = 1-5%; **2** = 6-25%; **3** = 26-50%; **4** = 51-75%; **5** = 76-100%

8-10-13

Lambert Rd

Plant Monitoring Form

Site No._____ Date_____ Biologist JH Total Cover Vegetative_____

	Scientific Name	% Cov.
1	Scirp. Amer. Jun. eff.	5
	weed	1
2	J. eff.	2
	weed	2
3	Sc. am, Jun. eff., Pip.	4
	weed	2
4	Sc. amer.	3
	weed	2
5	Sc. am.	5
	weed	2
6	Sc. am.	<
	weed	1
7	J. eff.	3
	weed	1
8	Sc. am., Bach. sal.	5
	weed	1
9	Sc. am., Jun.	2
	weed	1
10	Carex b, Bl. Scir. am	5
	weed	+
11	J. eff.	2
	weed	+
12	Sc. am	3
	weed	+
13	J. eff	3
	weed	+
14	M. Sc. am, B. carex	5
15	J. eff	2
	weed	1
16	S. am.	5
	weed	+

Other minor species/notes_____

Cover Classes: + = < 1; **1** = 1-5%; **2** = 6-25%; **3** = 26-50%; **4** = 51-75%; **5** = 76-100%

Lambert Rd

Page #2

Plant Monitoring Form

Site No._____Date_____Biologist_____ Total Cover Vegetative_____

	Scientific Name	% Cov.
17 L	Sc. am., Sal. good.	5
	weed	+
19 L	S. am.	2
	weed	+
19 L	J. eff. Bac. sal., Sal.	3
	weed	1
20 L	J. eff.	2
	weed	1

Other minor species/notes_____

Cover Classes: **+** = < 1; **1** = 1-5%; **2** = 6-25%; **3** = 26-50%; **4** = 51-75%; **5** = 76-100%

Working Landscapes

Van Lobenseis
Levee slope

Plant Monitoring Form

Site No. 1 Date 6/9/12 Biologist Jeff Hart

Plot No.	Scientific Name	% Cov.
1	leym Tri	5
	weed	2
2	Ley tri	5
	weed	+
3	Ley tri / car bar	5
	Weed	1
4.	Carex bar	2
	weed	5
5	Weed	5
	Carex.	2
6	Ley tri. / weed	5/2
7	Ley tri	5
	weed	2
8.	Carex bar.	2
	weed	4
9	Ley Tri	4
	Weed	1
10.	Carex	3
	Weed	3
11	Sedge / weed	3/4
12	sedge / weed	2/4
13	rye / weed	5/1
14	rye / weed	4/2
15	sedge / weed	3/3

88.5 15.5
88.5 .5
88.5 2.5
15.5 88.5
88.5
15.5
99.5 15.5
88.5
15.5 15.5
15.5 63.5
63.5 2.5
38.5 38.5
38.5 63.5
15.5 63.5
88.5 2.5
63.5 15.5
39.5 39.5
835.5 514.5
55.7 34.3

Other minor species/notes_____

Cover Classes: + = < 1; **1** = 1-5%; **2** = 6-25%; **3** = 26-50%; **4** = 51-75%; **5** = 76-100%

Working Landscapes

Vino Farms
Ditch # 2

Plant Monitoring Form

6/8/12

Site No._____ Date_____ Biologist Jeff Hart

Plot No.	Scientific Name	% Cov.
1	Juncus sedge Scirpus / weed	4 / 1
2		3 / 1
3		3 / 1
4		2 / 1
5		5 / 2
6		5 / 2
7		4 / 1
8		3 / 2
9		5 / 2
10		5 / 1
11		4 / 2
12		4 / 2
13		3 / 2
14		2 / 2
15		5 / 1

63.5	2.5
38.5	2.5
38.5	2.5
15.5	2.5
99.5	15.5
88.5	15.5
63.5	2.5
38.5	15.5
88.5	15.5
88.5	2.5
63.5	15.5
63.5	15.5
38.5	15.5
15.5	15.5
88.5	2.5
891.5	141.5
59.8	9.4

Other minor species/notes_____

Cover Classes: **+** = < 1; **1** = 1-5%; **2** = 6-25%; **3** = 26-50%; **4** = 51-75%; **5** = 76-100%

Working Landscapes

Vino Farms
Ditch #1

Plant Monitoring Form

Site No._____ Date 6/8/12 Biologist Jeff Hart

Plot No.	Scientific Name	% Cov.
1	Sedge / rye / rush — weed	2/1
2	" / " / "	3/2
3		3/3
4		2/3
5		3/4
6		2/4
7		3/2
8		2/4
9		2/4
10		3/4
11		2/3
12		2/3
13		2/2
14		3/2
15	" "	3/2

15.5	2.5
38.5	15.5
38.5	38.5
15.5	38.5
38.5	63.5
15.5	63.5
38.5	15.5
15.5	63.5
15.5	63.5
38.5	63.5
15.5	38.5
15.5	38.5
15.5	15.5
38.5	15.5
38.5	15.5
393.5	551.5
26.2	36.8

Other minor species/notes_____

Cover Classes: + = < 1; **1** = 1-5%; **2** = 6-25%; **3** = 26-50%; **4** = 51-75%; **5** = 76-100%

(2.5) (15.5) (38.5) (63.5) (88.5)

Appendix C

Wetland Sites Photo Monitoring

SAN JOAQUIN DELTA FARMS SUBPROJECT

Photo 1. White fronted geese lifting off of the permanent wetland

Photo 2. Waterfowl Flushed during Monitoring (4-10-13)

Photo 3. Planted willows growing approximately 16-feet tall (4-10-13)

Photo documentation: San Joaquin Delta Farms Subproject

Pre Project Photos	Year 2 Monitoring Photo	Year 3 Monitoring Photo
		
Point 1.Overview. Looking southwest	Point 1.Overview. Looking southwest	Point 1.Overview. Looking southwest
		
Point 2. Site 1. Looking southeast	Point 2. Site 1. Looking southeast	Point 2. Site 1. Looking southeast

		
Point 3. Site 2. Looking east	Point 3. Site 2. Looking east	Point 3. Site 2. Looking east
	Photo did not turn out…	
Point 4. Site 3. Looking northwest	Point 4. Site 3. Looking northwest	Point 4. Site 3. Looking northwest

		
Point 5. Site 4. Looking northeast	Point 5. Site 4. Looking east by northeast	Point 5. Site 4. Looking northeast

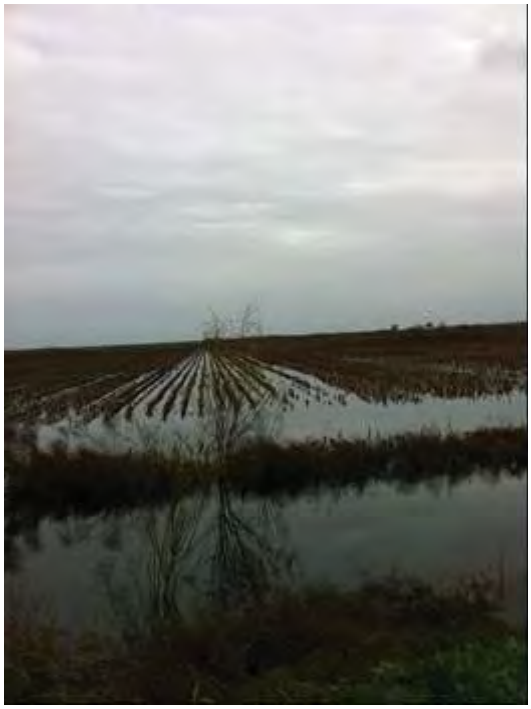
VINO FARMS SUBPROJECT

Photo Documentation: Vino Farms Subproject

Pre Project Photos	Year 2 Monitoring Photo	Year 3 Monitoring Photo
		
Point #1. Site 1. Looking West	Point #1. Site 1. Looking West	Point #1. Site 1. Looking West

WOODY'S BY THE RIVER SUBPROJECT

(Left - Rob Hormel - Farm Manager, Center – Aaron Will - DU Biologist, Right – Alex Breitler – Stockton Record)



Central flooded corn field looking east

4 Sand hill cranes flying over flooded ag.

WINCHESTER VINEYARDS SUBPROJECT

Photo documentation: Winchester Vinyards Subprojects

Pre Project Photos	Year 2 Monitoring Photo	Year 3 Monitoring Photo
		
Point 1. Looking southwest	Point 1. Looking southwest	Point 1. Looking southwest
		
Point 2. Looking west	Point 2. Looking west	Point 2. Looking west

		
Point 3. Looking northeast	Point 3. Looking northeast	Point 3. Looking northeast
		
Point 4. Looking southeast	Point 4. Looking southeast	Point 4. Looking southeast

C &M RANCH SUBPROJECT

Coyote scat within the wetland area.

Panorama photo merge taken from the Northern berm looking southwest

Pre-Project Photos	No Year 2 Monitoring Photo	Year 3 Monitoring Photo
		
Point 1. Looking south		Point 1. Looking south

		
Photo exhibits Agricultural Disturbance Regime		New emergent wetland vegetation

		
Point 3. Looking north		Point 3. Looking north

USLAN SUBPROJECT

Pair of nesting Mallards on upland island

Homeowner has installed bird boxes and has successful nesting wood ducks.

Pre Project Photos	Monitoring Photo 4-10-13	Monitoring Photo 7-23-13
		
Point 1. Site 1. Looking south	Point 1. Site 1. Looking south	Point 1. Site 1. Looking south
		
Point 2. Site 1. Looking west	Point 2. Site 1. Looking west	Point 2. Site 1. Looking west

		
Point 3. Site 2. Looking northeast	Point 3. Site 2. Looking northeast	Point 3. Site 2. Looking northeast

Appendix B

Feasibility Report

Delta Working Landscapes – Feasibility Report

September 2013

Introduction

This report addresses the feasibility of the Delta Working Landscapes program and the continuation of completing similar restoration activities. The intent is to provide baseline information regarding the different restoration practices and restoration planting techniques in order to guide future grant or land owner based restoration activities. Although no two restoration projects are the same, understanding the restoration practices and restoration planting techniques for working landscape projects can inform decisions about the feasibility of success for a particular circumstance.

Project Goals

The Delta Working Landscapes Program was designed to encourage public/private partnerships to implement practices that improve the quality of the Delta environment and sustain and enhance agriculture. The goals of the Working Landscapes projects are to:

1. Improve environmental quality of existing working landscapes.
2. To develop an educational mechanism and economic model to transfer environmentally friendly farming knowledge, techniques and practices to other farms.
3. To facilitate environmental compliance through overcoming disincentives and increasing incentives towards achieving these goals.
4. Coordinating a research program with the farmers to understand the social, economic, environmental and governmental policy impediments and incentives to performing conservation practices.

Project Objectives

The Delta Working Landscapes Program project objectives are to:

1. Create vegetated buffers on ditch banks and hedgerow plantings that improve water quality by reducing runoff of sediment and pesticides.
2. Create vegetated levees with native grasses, sedges and other low-growing species that will stem erosion, discourage burrowing animals and reduce weed growth.
3. Creating wildlife friendly habitats such as native grassland plantings, riparian forests and wetlands in areas uneconomical to farm.
4. Identifying farming practices that benefit wildlife and environmental values such as v-shaped ditches, interior berm construction, and conversion to permanent wetlands on marginal farm lands.

Restoration Practices and Planting Techniques

This report evaluates two critical elements to restoration projects 1) Restoration Practices and 2) Restoration Planting Techniques. Restoration planting techniques are methods in which restoration ecologists can utilize to develop Restoration Practices. Ideally, the restoration ecologist will utilize different planting techniques where appropriate to provide the most cost effective successful restoration project.

Habitat Friendly Agriculture

Vegetated Ditch Banks: Ditch banks are challenging sites for restoration. Ditch bank characteristics vary based on site conditions. In the Delta, soils near ditches tend to consist of heavy, clayey materials that seasonally vary from wet to very dry, and are often compacted. These sites also vary from barren, due to frequent use of herbicides, to extremely weedy. Certain techniques are suitable for ditch banks, while others are not. As ditch banks are generally steep, the use of mechanized equipment, such as tractors and seed drills, is not always feasible. Hand planting is therefore a preferred strategy. Before planting, weed control is recommended techniques include hand weeding, mowing , weed trimming and some sites may require the judicious use of herbicides. The size of container plants can vary: seedling plugs (generally 1" x 1" by 3" deep), tree bands (2 7/8 x 2 7/8 by 9" deep), to one gallon sized materials. The larger sized materials have better developed root systems and so they are more likely to survive in conditions of drought and weed competition. The preferred time of planting is mid to late fall after sufficient rainfall has wetted the soil to a depth of 6-8 inches. Planting is facilitated by the use of hand held, power augers. A two-person crew with one person digging holes and the other planting can expect to install 800-1000 plants per day. After planting comes the maintenance phase. Initial weeding with hoes to remove competing weeds, mowing or the selective use of broad-leaved herbicides (if only grasses are planted) is recommended. Several years of weeding is needed to ensure success of the project. Should drought conditions prevail, a not unlikely consequence of global climate change, then supplemental irrigation may be necessary.

Vegetated Waterside/Landside Levee Slopes: Levee slopes may be installed with certain plants, provided that they do not compromise flood control objectives. Concerns about vegetation are different for waterside conditions compared to landslide levee slopes. During flood events, it is imperative that the landslide of levees be visible for inspection of possible leaks. Low growing grassy vegetation is recommended for ease of visibility of levee conditions. For the waterside of levees, more robust vegetation can be tolerated for several reasons. Vegetation can help to resist the forces of erosion, so planting and establishing appropriate vegetation can be an asset. However, vegetation that is too large, such as cottonwood trees, can present a hazard should a tree fall and dislodge a portion of the levee slope. Small woody vegetation, small shrubs and robust grasses and forbs can be tolerated at the lower portion of the levee slope, a location that is beneficial to many species of wildlife. The upper 1/2 to 2/3 of the slope should be only planted with grasses and grass-like plants, however; this is to facilitate flood fighting during periods of high water. Several techniques are available for installation of plant materials. The waterside of the levee, as it is often steep, is not well-suited for mechanized equipment, such as tractors. Hand-planting techniques, as described above, are appropriate in these locations. The installation of well rooted materials is recommended. However, should willows be tolerated, the direct installation of 3-4 ft. long cuttings is appropriate. Supplemental irrigation, using overhead sprinklers, is often deployed to

insure survival of the plants. Ideally, newly re-contoured levee slopes are better suited for restoration as one is starting out with a relatively weed free environment. But the cleanliness of the site is also a function of certain pre-emptive actions to further reduce weed growth. This may involve the selective use of herbicides (provided that the soil does not become contaminated with pre- and post-emergent ingredients), disking and mowing. A good time of the year to spray is after fall rains have germinated weed seeds. At this time the site may be lightly disked or sprayed. More than one treatment can be implemented. The sowing of seeds, generally with a range drill, is generally the technique of choice. Range drills are used because they can bury the seeds at the appropriate depth of about 1 inch. After the seeds have germinated, and the seedling grasses are 6-8 inches tall, the judicious and careful application of a broad-leaved herbicide may be applied. Other techniques include mowing of the grasses to eliminate the growth of annual plants, especially exotic grasses, during the spring. This should be done before the alien grasses overtop the perennial species and before the former go to seed. This mowing regime (and occasionally supplemented with the use of broad-leaved herbicides) should be practiced not only during the establishment period but also as a permanent maintenance practice.

Wetlands

Restoration practices and techniques for development of semi-permanent and seasonal wetlands include a multitude of considerations. Considerations for Delta Working Landscape restoration projects generally included land owner desired wetland conditions, farmland type, crop type, soil type, hydric status, drainage status, water availability, distance to other native habitats, and other site specific circumstances. Overall, this information influences restoration design practices and implementation techniques.

Initial design for evaluating wetland restoration should take a watershed and a historical ecological approach whenever possible. This is not always possible due to specific site constraints, landowner desires, management capabilities and potential impacts on listed species and surrounding landowners.

In many instances current social and science based community partners are pushing for passive wetland systems that restore more of the historic conditions of the Delta. For the Delta this technique generally includes restoration of tidal connectivity, flood plain connectivity, seasonally flooded areas. However, this presents extreme challenges while trying to maintain a working landscape as these are large scale restoration practices.

For the Delta Working Landscapes restoration projects, managed wetlands were designed and built to provide a higher degree of habitat reliability and landowner risk reduction. To maintain the working landscapes Delta Working Landscapes restoration project focused on managed semi-permanent wetlands and managed seasonal wetlands.

Managed seasonal wetlands were designed and built to be managed as moist-soil wetland units. This type of wetland management promotes the germination of specific types of plants. Managed seasonal wetlands provide an abundance of plants that provide a high carbohydrate food source, necessary for the high energy demands of flight, for migratory waterfowl. Plant species such as crabgrass (*Digitaria spp*.), millet (*Echinochloa spp*.), smartweed (*Polyganum spp*.), and swamp timothy (*Heleochloa schoenoides*), etc. contain vital carbohydrates. Waterfowl and other migratory waterbirds utilize these food sources during wintering periods to replenish body fat consumed in migration flight.

Managed semi-permanent wetlands were designed and built to provide year round water with an interspersion of upland, emergent and open water habitat communities. Generally semi-permanent wetlands provided much need water in the late spring and summer months. Semi-permanent wetlands provide a host of benefits for a plethora of wildlife, and are especially utilized by waterfowl for brood-rearing, molting, loafing, foraging and predation avoidance.

Each of these wetland types contribute to various water-bird life cycle stages. There are multiple benefits and costs associated with each restoration practice. The restoration comparison table further elaborates on several of these factors, which may better inform the most appropriate restoration practice associated with the restoration projects goals.

Planting Techniques

Various techniques are deployed in habitat restoration, such as seeding, plug and larger container sized direct installation of plants.

Seeding for Native Grasses. The use of seeds in working landscapes restoration is best applied on sites that have been thoroughly cleaned and/or reconfigured. These restoration sites resemble a well-cared for agricultural field. Seeds can be successfully used but weed control is especially critical. Initial pre-planting weed control can consist of plowing, disking and roto-tilling to physical remove weeds. This approach can be supplemented with the careful use of herbicides. Contact herbicides are applied directly onto the weedy plants to be controlled. Pre- or post emergent herbicides may also be used, but these can negatively impact the planted grasses so caution is required. Once a field has been well prepared then seeds can be applied, especially with range drills that bury the seeds. The timing of planting is critical: generally fall planting after initial rains is the best time of the year as there would be sufficient warmth to foster seed germination. Mid winter planting can be problematic as native grasses do not readily germinate during the coldest months of the year. Once the grasses have germinated, then maintenance techniques are required to ensure success. Spring mowing to knock down invasive weeds is needed. Judicious use of broad-leaved herbicides may also be required. Long term maintenance of native grassland sites is required.

Planting Plugs. Many restoration professionals prefer planting small plugs, which are barely rooted juvenile plants. These can be successful installed on relatively clean sites using a dibble stick to create a planting hole. A good time to install these plants is between fall and winter rains. Planting too late in the spring does not provide sufficient time for the plants to become established.

Larger Container Stock. Well rooted and relatively more mature plants stand a better chance of survival than smaller plants. These plants may be installed in wetland or upland environments, and the plants involved may includes grasses, herbs, and woody plants. Since these materials are more expensive that seeds or plugs, their use is recommended for smaller acreages and/or more difficult sites. Tules and rushes can be planted along the wetted perimeters of wetland sites at nearly anytime of the year (provided there is sufficient moisture content). Upland sites using grasses and sedges should be installed during the cool, wet season. There is somewhat more latitude of the planting season than for the smaller plug plants, but late spring planting should still be avoided unless artificial irrigation is provided. Weeding of these sites is required through the establishment period. Planting of woody native species also involves larger

sized container plants. Power augers are often used to dig the planting hole. The use of landscape fabric to control weeds and the application of a temporary irrigation system is required. Generally 2-3 years of irrigation and weed control is necessary for plant establishment.

Passive Restoration. Typically, working landscape seasonal wetlands are designed and built to be managed as moist-soil wetland units. This type of wetland management promotes the germination of specific types of plants by drawing down a flooded wetland at specific times within the growing season, generally in Early, Mid or Late Spring. By managing water levels through the use of water control structures, the manager can promote a variety of plants that provide a high carbohydrate food source, necessary for the high energy demands of flight, for migratory waterfowl. This technique is considered a passive technique as no seed or installation costs are associated with seed production.

Plant species such as crabgrass (*Digitaria spp*.), millet (*Echinochloa spp*.), smartweed (*Polyganum spp*.), and swamp timothy (*Heleochloa schoenoides*), and other wetland species contain vital carbohydrates. Waterfowl utilize these food sources during wintering periods to replenish body fat consumed in migration flight. By winter flooding the vegetation and subsequent seed heads, the food source becomes available to ducks and geese, as well as a variety of other water-birds.

Comparison of Restoration Practices and Techniques

The restoration practices and techniques comparison table below identifies several of the ecosystems, restoration and land owner constraints and benefits identified within the Delta Working Landscape program (Table 1).

Table 1: Comparison of Restoration Practices

Restoration Practice	Waterbird Benefits	Other Biologic and Social Benefits	Short Term Maintenance Requirements	Long Term Maintenance Requirements	Implementation Cost
Semi-permanent Wetlands	Moderate to High	Moderate	Low-Moderate	Low to Moderate	High
Seasonal Wetlands	High	High	Moderate to High	Moderate to High	Moderate
Wildlife Friendly Flooded Agriculture	Moderate to High	Moderate	Low	Low	Low
Vegetated Ditch Banks	Moderate to High	High	Moderate	Low	Moderate
Native Grasslands	Low to Moderate	Moderate	Moderate to High	Low	Low
Hedgerows and Buffers (Herbaceous)	Low	Moderate to High	High	Low	Moderate to High

Although no two restoration projects are equal, the table attempts to evaluate the general nature of the restoration technique or practice based on the findings from the developed projects. Cost evaluations were

determined based on direct project costs, and vary considerably due to the economy of scale and site specific conditions.

Restoration planting techniques were evaluated for hedgerow, buffer strip and levee slope projects. However, the findings from these projects do cross over to other restoration practices such as seasonal wetland and semi-permanent planting techniques. The findings are summarized in the Restoration Planting Techniques table below (Table 2).

Table 2: Comparison of Planting Techniques

Restoration Planting Technique	Weed Competition	Versatility	Short Term Maintenance	Long Term Maintenance	Implementation Cost	Site Constraints And Limitations
Drill Seed	Low	Moderate	Moderate	Low	Low	Limited in Weedy conditions, compact, clayey soils. (Drill seeding more versatile if site is prepped)
Plug Planting	Moderate	Moderate	Moderate	Low	Moderate	Weedy conditions, poor soil.
Root Stock/ Container Plantings	High	High	Moderate	Low	High	Economic limitations
Passive	Low	Low	High	Moderate	Low	Depends on residual seed bank.

Low, moderate and high rankings were established for evaluation of Restoration Practices and Restoration Planting Techniques for each criterion. The comparisons are made with respects to each of the identified practices and do not financially or ecologically define ratings of low, moderate or high. As example, the high waterbird benefits of Seasonal Wetlands does not constitute a given population usage or duration of use per year or acre over that of the low waterbird benefits for Hedgerows and buffers. The logic is comparative, general observations made throughout the projects have lead us to believe that seasonal wetlands provide greater waterbird benefit than hedgerows or buffers strips.

Short term maintenance would typically be considered all maintenance activities required from project implementation to 3 years post project implementation. Long term maintenance would the required activities after the short term maintenance period. For further information about maintenance activities please refer to the Delta Working Landscapes – Vegetative Buffer and Wetland Habitat Management Guide dated September 2013.

Economic Considerations

When determining the feasibility of Working Landscape projects, cost is an important consideration. Costs that should be considered include project implementation and construction, short-term and long-term maintenance costs, and environmental compliance and permitting. When assessing feasibility, project costs should be considered in relation to the availability of funding assistance, economic incentives, and other benefits.

Project Implementation and Maintenance Costs

Costs for project implementation will vary significantly based on the type of restoration practice, site-specific conditions and preparation, and project design. Tables 1 and 2 identify the range of costs for various restoration practice and planting techniques. For the Working Landscapes projects, costs for buffer vegetated ditches, and levee slopes varied from $4.95-21.28 per linear foot. For wetland projects, cost between projects which ranged from approximately $1,200 per acre to over $12,000 per acre. Irrigation systems and wetland infrastructure contributed to the wide variation in costs across the same types of projects. For further information regarding implementation costs please refer to the Delta Working Landscapes – Cost Analysis Report, dated September 2013.

Due to the short time frame of this study, the costs associated with the short or long term maintenance of the restoration practices were not thoroughly evaluated; however, professional judgment through our years of coordinated restoration projects we have made some general assumption on the level of effort and costs associated with maintenance activities. It is important to understand that not all projects are the same and the Low, Moderate and High rankings for costs in Tables 1 and 2 not absolute.

Regulatory/Permitting Costs

Regulatory and permitting compliance and associated costs are also important feasibility considerations. Restoration practitioners as well as landowners have indicated that there could be high costs and level of effort associated with permitting and regulatory compliance for voluntary restoration like Working Landscape projects (CRAE 2010). Depending on the project, permitting costs can range in the thousands to tens of thousands of dollars (CRAE 2010).

For the Working Landscapes Program, environmental compliance and permitting was overcome by a California Environmental Quality Act categorical exemption and the utilization of other programmatic permits. Many of the project actions fell under agricultural exemptions and ongoing reclamation district operational permits.

There are a variety of web-based permitting assistance tools that are available to assist with identifying permitting requirements for Working Landscapes projects (CARCD 2009; CRAE 2010). Funding assistance may also be available to assist with project permitting (described further below).

Incentives and Assistance Programs

There are various funding and incentive programs available for Working Landscape projects that can significantly reduce implementation costs for landowners. Some programs also provide annual incentive payments, which may offset ongoing maintenance costs. An overview of major incentive programs is presented in Table 3.

Table 3: Incentive Programs for Working Landscape Projects

Program Name	Description	Incentive
Wildlife Habitat Incentive Program (WHIP)	Voluntary program for people who want to develop and improve wildlife habitat primarily on private land.	Up to 75% cost share for 5 to 10 years
Conservation Reserve Program (CRP)	Assistance to farmers and ranchers regarding soil, water and natural resources concerns and compliance with Federal, State and tribal laws.	Financial and technical assistance
Environmental Quality Incentives Program (EQIP)	Voluntary conservation program for farmers and ranchers to implement structural and management practices to improve environmental quality.	Financial and technical assistance, up to 75% cost share for 1 to 10 years
California Wetlands Reserve Program	Farmers can sell easement of lands for conversion to wetlands and riparian habitat, and may also benefit from sale of hunting rights.	Financial and technical assistance
California Landowner Incentive Program (LIP)	Assistance to private landowners to enhance and manage the region's three predominant historic habitat types: riparian, wetland, and native grassland.	Incentive payments for a 3 to 5 year contract range between $25/acre/year to $400/acre/year depending on the habitat type
Source: Riparian Habitat Joint Venture (2009); Department of Fish and Wildlife (2013)		

Research on creating additional regulatory and economic incentive programs for agriculture stewards to enhance the environmental benefits they provide, including payments for ecosystem services and conservation credits in California is ongoing (CRAE 2012).

Other Considerations

Barriers to environmental enhancement, especially establishing native plants, are a real concern and involve social/cultural considerations, lack of experience or knowledge about native plant and animal species, inherent incompatibilities between the needs of native species and crops, and potential health concerns.

Most cultivated landscapes are nearly monocultural in nature. The farm landscape consists of neat rows of well kept crops in which competing weeds are kept at bay through intensive cultivation techniques, including disking and the application of herbicides. From a practical standpoint, establishing native plants in the context of the widespread use of herbicides is fraught with problems of drift and impacts potential restoration efforts. This is not a friendly environment for native plant species. The dearth of native species may have, in part, a cultural explanation. To many farmers the unruly appearance of native species is suggestive of weeds. The presence of native species doesn't fit into the concept of neat and straight rows idealized by farmers. To a large extent the presence of native plant species in the Delta, when they occasionally can be found, is the result of benign neglect. The potential beneficial use of native species is a new concept for most farmers. Simply stating their benefits may not be convincing. Farmers may also believe that native species cause harm to crops. An example is the many methods of scaring birds away from cherries during the brief harvest season. In recent years, there have been increased food safety concerns and the potential health risks of having native species of animals (i.e., rabbits) in agricultural fields, the concerning being that some disease might spread from the animals to the crops.

Ecosystem Services and Benefit Outcomes

Working landscapes provide a broad-range of ecosystem services and benefits. A summary of the potential ecosystem benefits for vegetative buffers and seasonal and semi-permanent wetlands is presented in Table 4.

Wildlife friendly agriculture projects are intended to provide habitat for wildlife, improve water quality by reducing runoff of pesticides and sediment, enhance levee stability, and retard levee erosion. Wetland restoration practices provide waterfowl brooding habitat, a food source, and additional wetland functions and services which promote healthier waterbird populations. These benefits are not only qualitative, but can provide economic benefits as well, through improving the value of farmland and diversifying recreational opportunities.

Table 4: Ecosystems Functions and Services of Working Landscape Projects

ECOSYSTEM SERVICE	DESCRIPTION	POTENTIAL BENEFITS	
		Vegetative Buffers	**Seasonal and Semi-permanent Wetlands**
Provisional Services—Products obtained from ecosystems			
Food	Food and energy sources derived from plants, animals, and microbes	Allows for ongoing land cultivation for food production.	Seasonal wetlands provide food production of high carbohydrate plant food sources for a variety of wildlife. Semi-permanent wetlands promote aquatic invertebrate food sources for birds and may promote fish propagation under certain conditions.
Freshwater Water Supply	Storage or retention of fresh water and groundwater recharge	Provides improvements to water quality for water supplies.	Provides improvements to water quality for water supplies Increases groundwater recharge and promotes flood water attenuation for later release.
Fiber and Fuel	Wood and other biological materials that provide fiber for products or sources of energy	Vegetative buffers can produce woody materials.	Seasonal wetlands can produce highly productive cottonwood stands utilized in the pulp industry.
Biochemical Resources	Natural biota with a variety of medicinal uses	Native Americans have historically used several native plant species commonly found throughout the Delta for medicinal uses.	Native Americans have historically used several native plant species commonly found throughout the Delta for medicinal uses.
Genetic Materials	Generating or sustaining genes and genetic material for animal and plant breeding	Provides pollinator habitat and increases genetic diversity throughout the native plant community.	Without large expanses of habitat, wildlife breeding areas are diminished and subsequently reduce population sizes which reduces the gene pool with further propagates negative genetic mutations and reduces genetic diversity of wildlife. Semi-permanent wetlands are critical for the ongoing breeding of avian species within the Delta.

ECOSYSTEM SERVICE	DESCRIPTION	POTENTIAL BENEFITS	
		Vegetative Buffers	**Seasonal and Semi-permanent Wetlands**
Regulating Services—Benefits obtained from regulation of ecosystem processes			
Climate Regulation/Air Quality Maintenance	Provides climate regulation, including temperature, precipitation, and carbon capture; promotes resiliency and resistance to climate variability; contributes and/or extracts chemicals from the atmosphere	Uptake of CO_2, carbon sequestration, general air quality improvement.	Although no GHG protocol has been established for wetlands, research indicates that semi-permanent wetlands sequester atmospheric carbon, promote climate change resiliency and other climate regulation benefits.
Water Regulation	Regulation of hydrological flows, including flood flows and fluctuations in surface and groundwater	Plantings provide shade for ditches which can reduce evaporation and protect water quality and reduce diversion.	Provides for floodplain storage and attenuation of floodwater.
Water Purification and Waste Treatment	Filter impurities, contribute and/or extract chemicals into the atmosphere	Improves agricultural return water quality by filtration and sequestration of contaminants. Reduces herbicide use on restored areas.	Improves agricultural return water quality by filtration and sequestration of contaminants. Reduces herbicide use on restored areas.
Erosion Control/ Soil conservation	Promotes soil retention, reduces wind or water erosion, sedimentation and scouring, prevents landslides; retards subsidence	Reduces wind and water erosion of soil with vegetative cover and windbreaks; provides bank protection and increases slope stability.	Reduces water erosion of soil with vegetative cover; retards oxidation of peat and associated subsidence.
Biological Control	Affects the prevalence of ecosystem pests, pathogens and disease, and/or the spread of invasive species	Reduces noxious weeds.	Reduces noxious weeds.
Pollination	Promotes pollen transfer between plants, without which may plants cannot reproduce	Provides habitat for bees that pollinate crop plants.	Provides habitat for bees that pollinate crop plants.
Natural Hazard Regulation; Flood Attenuation	Provides regulation of natural hazards like wildfires, storm events and flooding; protects from or reduces damage caused by natural hazards	Provides windbreaks Reduces levee failure after flooding.	Seasonal and Semi-permanent wetlands provide additional storage and attenuation flood waters.

ECOSYSTEM SERVICE	DESCRIPTION	POTENTIAL BENEFITS	
		Vegetative Buffers	**Seasonal and Semi-permanent Wetlands**
Supporting Services—Services necessary for the production of all other ecosystem services			
Nutrient Dispersal and Cycling	Storage, internal cycling, processing, or acquisition of nutrients	Upland plants and wetland plants are an integral part of nutrient cycling.	Wetlands provide large amounts of nutrient cycling including the sequestration of atmospheric carbon.
Habitat Establishment / Provision	Establishment of habitat for resident and migratory species	Provides habitat for birds and other wildlife; attracts beneficial insects.	Provides habitat for birds and other wildlife; attracts beneficial insects.
Soil Formation	Processes that form soil, sustain soil fertility, or contribute to subsidence reversal	Provides organic matter for soil formation.	Provides organic matter for soil formation and retains floodwater sediments in wetlands May contribute to subsidence reversal.
Cultural Services—Nonmaterial benefits obtained from ecosystems			
Recreational	Provides for recreation opportunities like ecotourism, wildlife viewing, and hiking	Provides increases in birds and other wildlife for recreational enjoyment.	Provides increases in birds for recreational enjoyment.
Aesthetic	Provides for desirable conditions for sensory enjoyment of the environment like scenic views	Increases attractiveness of land for tourists, farm stand customers, and recreationists.	Increases attractiveness of land for tourists, farm stand customers, and recreationists.
Educational	Provides opportunities for formal and informal learning, including enhancement of scientific understanding	Provides for educational opportunities and contributes scientific knowledge for land conservation practices and environmental stewardship.	Provides for educational opportunities and contributes scientific knowledge for land conservation practices and environmental stewardship.
Sense of Place	Maintains or enhances unique or well-recognized features of the environmental that contribute to a sense of place	Enhances the aesthetics of agricultural and native landscapes which contribute to a sense of place in the Delta.	The long rich agricultural and hunting history within the Delta Community is well documented. By restoring wetlands and providing additional habitat and hunting opportunity contributes to a sense of place in the Delta.
Cultural Heritage	Maintains or enhances historically important landscapes or culturally significant species	Preserves productive agricultural landscapes which are important to the cultural heritage of the Delta.	Wetlands have been identified as culturally significant as well as containing culturally significant species.

ECOSYSTEM SERVICE	DESCRIPTION	POTENTIAL BENEFITS	
		Vegetative Buffers	Seasonal and Semi-permanent Wetlands
Source: UN Millennium Ecosystem Assessment (2005); Natural England Commissioned Report 102 (2012); Yolo County RCD (2012)			

Conclusion

The Delta Working Landscapes program has been a learning experience for the sponsors and contractors who implemented the grant. Hart Restoration, Inc. and Ducks Unlimited were each responsible for different aspects of the overall project. Hart was responsible for restorations, using native plant species, along the borders and edges of the property: ditches, levees and other borders of agricultural fields to improve various environmental parameters. Ducks Unlimited was responsible for within farm wetland development to enhance wildlife values. The projects differed in approaches, outcomes and lessons learned.

Vegetative Buffers: Ditches, Levees and Borders

1. Certain types of farming operations are more amenable to planting native plant species along ditches and levee slopes. Large scale open field commodity crops (such as corn and wheat) are less likely to be compatible with these environmental enhancements as broad herbicide application (sometimes done by airplane) is incompatible with native plant survival.

2. Vineyard sites seem to be more compatible with planting native species as herbicide application is done in a more controlled manner.

3. Success or failure seems to be related to the size, structure and management of the farming operation. Small family-run farms may not have the time or the financial resources to break away from farming operations to participate in environmental enhancement. Larger farms -- and presumably with more resources -- seem to have more resources to participate in environmental enhancements. More critically, larger farms often hire younger, college educated managers who value environmental improvements for its own sake.

4. The success and/or failure of this type of project will vary with inherent environmental conditions of soil types. Poor soil conditions, such as coarse sandy or fine clayey situations, are more difficult for plant growth. The most ideal environment is a well-balanced loam, which may be difficult to locate as most environments tend towards the clayey end of the soil spectrum. Extremely sandy conditions, in the Delta, are often the result of former dredging operations that pile sandy river bottom materials onto levee slopes. These materials are often derived from former hydraulic mining activities which brought course materials downstream from the gold mining regions downriver to the Delta. Extremely clayey soils are often the result of dredging from ditches; these materials are then placed on ditch and levee banks.

5. The success and/or failure of this type of project will vary with pre-existing types of vegetation. Extremely weedy conditions, especially sites with rank species of blackberry and other perennial plants, are not easily converted to native plant communities. First, several years of weed control (often through spraying of herbicides) is required to prepare the site for planting. If native plants are installed within a weedy community, then competition with the weedy species reduces the success of the intended species.

6. The success and/or failure of this type of project will vary with past and ongoing land management practices. In particular, sites with long histories of herbicide application make for difficult conditions for native plant establishment.

7. The success and/or failure of this type of project will vary with moisture availability. Planting of moisture loving plants along ditches can be very successful, while planting on dry slopes (with either too much sand or clay) will have problematic results. Another factor for planting success along ditches will also be somewhat dependent upon the timing and seasonality of water availability. The timing and amount of water available in ditch environments may not be ideal for plant establishment. These factors must be understood before planting is planned.

8. The timing of planting is critical. There is a narrow window of opportunity for success. This is in the middle of fall after sufficient rains, but not too late in the season as conditions dry out by mid spring. Therefore, large planting crews need to be able to plant within a 2-month period. Starting earlier or waiting for a latter date requires expensive pre-irrigation or post-irrigation.

9. Some general weeding or mowing is required to reduce weed competition. Planting into annual grass communities is more feasible than planting into coarser weed communities as the former can be more easily controlled through mowing. The presence of rank weed species requires hoeing or the application of herbicides which can be expensive or problematic for survival of the native plant species.

10. The most successful environment for ditch and levee slope environments will therefore include: 1) better quality soils (such as loams); 2) inherently cleaner sites with fewer rank and/or perennial weeds; annual grasses are the least problematic for planting success; 3) certain cropping environments, such as larger vineyards with farm managers who share these environmental goals.

11. The size of the planting materials influenced survival. The larger the plant, generally, the greater the likelihood of survival. The use of seeds is not recommended except for weed free and tilled sites; this is more likely to occur in conjunction with newly constructed landscapes, such as re-contoured levees or ditch banks.

12. Two out of the three years of this project were extremely dry. As global climate change will likely worsen conditions for plant survival, other measures, such as dedicated irrigation systems, will likely be needed.

Seasonal Wetlands

1. The rate and density of vegetation establishment for seasonal wetlands is variable whether using planting methods or passive methods. Spring draw downs and summer irrigations are the largest contributing factors in vegetation success.

2. It is more financially cost effective to develop larger restoration project due to the economy of scale. Subsequently, larger projects seem to provide greater avian habitat use.

3. The success of Seasonal Wetlands relies heavily on land owner/manager involvement. These types of projects require management effort to provide optimal habitat. When not managed correctly they provide minimal habitat opportunity.

4. Summer water is required for irrigations to maintain healthy vegetation growth, but requires close coordination with the local Mosquito Vector Control.

5. When managed correctly, seasonal wetlands provide the greatest habitat value to wintering waterfowl.

Semi-Permanent Wetlands

1. Landowners like these projects as they are visually appealing year round and require less management effort than Seasonal Wetlands.

2. Implementation of these projects typically cost more, due to greater excavation requirements.

3. Summer water is required to maintain surface water levels due to evaporation but requires less coordination with Mosquito Vector Control than seasonal wetlands.

4. These projects provide great habitat for multiple species of nesting and rearing birds.

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Appendix C

Cost Analysis Report

Delta Working Landscapes – Cost Analysis Report

September 2013

Introduction

This report discusses the costs associated with conservation practices of habitat friendly farming and wetland farming practices on agricultural lands for the Working Landscape projects and the potential for cost savings and other benefits.

Project Implementation Costs

Implementation costs for the Working Landscape projects are presented in Table 1. The cost analysis table provides a breakdown of costs per project site. In some cases, multiple projects were completed at a single project site.

Project costs include both grant funding, landowner in kind services and/or monetary contributions on a per site basis. Several projects received outside funds and/or services provided at no additional cost to the grant or land owner, such as reclamation districts conducting grading work or funding from the USFWS Partners Program. These costs are included in the implementation costs as "Other". For Habitat Friendly Agriculture efforts, several individual projects were implemented on each site. In these instances, the individual project costs were averaged across project sites. For example, the Wilson Ranch Site costs include costs from four separate restoration areas. Cost do not include indirect costs associated with the restoration project, including the cost of the land, the opportunity cost for lost revenue of agricultural production for wetland projects, maintenance, or overhead costs associated grant funding oversight and administration.

Contractor and material costs typically include project associated costs such as mobilization of equipment, operation of equipment such as scrapers, excavators and tractors, labor, control structures, plants and seed. Private costs associated with conservation derive from installation and maintenance costs. The Program costs included labor and material costs at each site, including those provided in kind by the landowners.

Bio-Engineering services include Hart Restoration and Ducks Unlimited's staff costs and generally consist of project management, biological services, engineering services, land surveying and other associated staff costs directly related to the project.

Habitat Friendly Agriculture

The habitat friendly agriculture projects included installing native plant buffers (i.e., vegetated ditches and grassland enhanced levee slopes) that separate farmland from waterways. A total of 15 sites, on five different ranches, totaling 55,336 linear feet, were planted with over 100,000 plants along farm edges, ditch banks and levee slopes.

For installation purposes, these areas required initial weed management be performed by either disking, harrowing, or applying herbicides to invasive weeds.

Three different plant sizes were installed including, seeds, seedlings, and larger-size plants up to 1 gallon-sized containers. The suitability of these different planting techniques varies with different site conditions. Broadcast application of seed material is best suited for clean sites with little weed competition. For this method to work, considerable prior site preparation is required that generally involves re-contouring, soil treatment (disking, roto-tilling, etc.) and/or application of pre-emergent herbicides. Few sites in our project area were suitable for this approach. These plants were installed were hand planted with shovels and power driven augers. One site included re-contouring the steep slopes of a tidally influenced channel prior to planting.

Costs for buffer vegetated ditches, and levee slopes varied from $1.95-$4.19 per plant; $4.95-21.28 per linear foot; which roughly equates to $14,000-$72,000 per acre. Estimated acreage equivalents for buffers and vegetative ditch banks were based on an average planted buffer widths, ranging from 3 to 20 feet, length of project in an attempt to provide a cost per acre comparison for different types of restoration practices and planting techniques. This estimation should only be used for comparison purposes. Generally speaking, lineal projects should only be compared to other lineal projects.

Several factors account for the variation of costs for habitat friendly agriculture. These include the degree of weed infestation and site preparation needed, the size of the container plants used, the width of the linear strips, various site conditions, irrigation, and other environmental factors. Weedier sites, such as the ditches at Vino Farms Ranch (Ditch Site #1) required more labor and were more expensive than cleaner sites. Larger sized container plants are more expensive than smaller plugs, for example. Our larger well rooted tree bands (2 7/8 square by 9 inches deep) cost about $1.95, while plugs may only cost about $0.30. Wider buffer strips (such as the Van Loben Sels Ranch) are more expensive than narrower strips. Hardpan clay soils are more difficult and expensive to plant than well balanced loam soils. During two of the three winters of the project extreme drought required some additional irrigation (such as the Van Loben Sels Ranch), and this added to the cost as well.

Seasonally Flooded Agriculture and Wetlands

Wetland and agricultural demonstration projects involved the winter flooding of agricultural lands, creating seasonal and semi-permanent wetlands. Restoration of wetlands was accomplished by installing water management infrastructure such as water control structures and water conveyance channels. In addition, perimeter and interior berms were constructed to manage the extent and depth of flooding. Seasonal wetlands and winter flooded agricultural areas are ideally managed to provide shallow flooding from a 4-18 inches to provide optimal foraging opportunity. Semi-permanent wetlands are managed with greater water depth (typically greater than 2.5-feet) within the swales to promote hydrogeomorphic interspersion and vegetation strata diversity.

Wetlands were constructed by experienced contractors utilizing large excavation equipment. Contractor work included the supply of labor, material and equipment required to complete the excavation, hauling and placement of earth materials for the construction of created islands, embankments fills, and the excavation of swales and potholes.

Specific construction work included:

- Disking of borrowing and embankment areas
- Excavation of suitable material from -swales and potholes
- Moisture conditioning on embankment materials
- Placements of embankment fill areas
- Excavation and base preparation for water control structures and pipe
- Excavation of suitable material for borrow areas for embankment backfill
- Backfill of water control structures and pipe with compacted fill
- Tie-in of backfill embankment to existing improvements
- Installation of precast concrete water control structure weirs
- Installation of corrugated HDPE pipe
- Installation of flash boards
- Installation of wetland and upland vegetation

For wetland projects, there is tremendous difference in cost between projects which ranged from approximately $1,200 per acre to over $12,000 per acre. Several factors are attributed to these differences. Some of the project costs usually remain the same from project to project. Generally, the cost of control structures remained the same throughout our projects. However, dependent on water availability and size of project, different sizes and quantities of control structures to efficiently manage water were required, which contributed to cost variability.

The cost of constructing swales, potholes, berms and islands is generally referred to as earthwork and is largely the most substantially different cost per project. The economy of scale has a great affect on the cost per acre for these types of projects. Earthwork variables include quantity of excavation and placement of materials. Specifically the type of material placement such as whether you are building a loafing island or a compacted berm can largely affect the cost. Site conditions can change the type of equipment the contractor will need to use, which in turn can raise or lower the cost for earthwork.

Types of soil can dramatically affect the cost of handling soil materials. If the soils are hard compact clay, versus loam materials the effort to excavate and place those materials is dramatically different. The opposite end of the soil spectrum can equally affect the cost of

earthwork such as if the materials are sandy, this may entirely limit certain types of activities all together. Generally, the easier the soil material is to work with, the lower the cost will be.

In addition, the less adverse the project conditions the easier it is for the contractor to complete the work in a timely manner, which corresponds to less cost to the project.

It should be noted, that the cost per acre for developing infrastructure related to winter flooding of corn had the lowest cost per acre of all the restoration activities at a cost of $395 per acre in comparison to an average cost of $6,118 for seasonal and semi-permanent wetland restoration projects.

Potential Cost Savings and Benefits

Conservation practices using native or non-invasive plants have been found to have potential long-term cost savings associated with reduced maintenance as well as other benefits. One study found a $60 per acre per year long-term cost savings associated with maintenance costs of hedgerows in comparison with clean field borders that require spraying and mowing (Audubon California 2013).

In order to track the potential for long-term cost savings, baseline operation and maintenance data, project implementation costs, and ongoing project maintenance costs would need to be collected over time and then compared. In order to establish a comprehensive baseline for cost tracking, the following operations and maintenance cost data would need to be collected from the landowner:

- Management hours
- Laborer hours
- Equipment operator hours
- Equipment hours and type of equipment
    - Operating costs of equipment
- Cost of materials:
    - Additional planting costs
    - Selective Herbicide and Pesticide application costs
    - Volume and cost of irrigation water (if applicable)

- Pest Management Cost
    - Rodent shields
    - Beaver damage repair
- Mosquito vector costs
- Monitoring hours

In addition to a potential for maintenance cost savings, wildlife friendly agriculture projects are intended to provide habitat for wildlife, improve water quality by reducing runoff of pesticides and sediment, enhance levee stability, and retard levee erosion. Wetland restoration practices provide waterfowl brooding habitat, a food source, and additional wetland functions and services which promote healthier waterbird populations. These benefits are not only qualitative, but can provide economic benefits as well through, improving value of farmland and diversifying recreational opportunities. Long-term monitoring for wildlife use and erosion by the landowner on the project sites can be performed to track these benefits. The Yolo County Resource Conservation District has developed a guide for landowners to track these benefits (Yolo County RCD 2002). For an additional discussion regarding these and other non-monetary benefits, refer to the Delta Protection Commission Working Landscapes Program Feasibility Report.

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Table 1. Working Landscape Project Implementation Costs

Site	Contractor/Materials	Bio-Engineering Services	Total	Size (Acres)	Cost per Acre	Size (Linear Feet)	Cost per Linear Foot
Habitat Friendly Agriculture							
Heringer Vineyards							
Hart	$ 65,922.00	$ 27,400.00	$ 93,322.00				
Total	**$ 65,922.00**	**$ 27,400.00**	**$ 93,322.00**	**6.5**	**$ 14,363.32**	**18,868**	**$ 4.95**
Wilson Ranch							
Hart	$ 35,330.00	$ 16,725.00	$ 52,055.00			8,948	$ 5.82
Total	**$ 35,330.00**	**$ 16,725.00**	**$ 52,055.00**	**0.72**	**$ 72,402.96**	**8,948**	**$ 5.82**
Van Loben Sels Ranch							
Hart	$ 40,435.00	$ 23,287.00	$ 63,722.00				
Total	**$ 40,435.00**	**$ 23,287.00**	**$ 63,722.00**	**1.03**	**$ 61,866.02**	**2,995**	**$ 21.28**
Vino Farms (Vegetated Buffers)[1]							
Hart	$ 17,410.00	$ 9,200.00	$ 26,610.00				
Total	**$ 17,410.00**	**$ 9,200.00**	**$ 26,610.00**	**1.03**	**$ 25,758.48**	**3,000**	**$ 8.87**
Winchester Vineyard							
Hart	$ 4,044.00	$ 10,985.00	$ 15,029.00				
Other[2]	$ 8,100.00		$ 8,100.00				
Total	**$ 12,144.00**	**$ 10,985.00**	**$ 23,129.00**	**0.38**	**$ 61,432.88**	**4,100**	**$ 5.64**
Seasonally Flooded Agriculture and Wetlands							
Vino Farms Wetland Site (Lambert Rd)							
DU	$ 25,550.00	$ 6,237.00	$ 31,787.00				
Landowner	$ 3,000.00	$ -	$ 3,000.00				
Total	**$ 28,550.00**	**$ 6,237.00**	**$ 34,787.00**	**6**	**$ 5,797.83**		
San Joaquin Farms							
DU	$ 75,000.00	$ 8,092.70	$ 83,092.70				
Landowner	$ 49,960.00	$ -	$ 49,960.00				

Site	Contractor/Materials	Bio-Engineering Services	Total	Size (Acres)	Cost per Acre	Size (Linear Feet)	Cost per Linear Foot
Other[3]	$ 25,000.00	$ -	$ 25,000.00				
Total	**$ 149,960.00**	**$ 8,092.70**	**$158,052.70**	**134**	**$ 1,179.50**		
Uslan Property							
DU	$ 64,539.00	$ 17,538.40	$ 82,077.40				
Landowner	$ 5,000.00	$ -	$ -				
Total	**$ 69,539.00**	**$ 17,538.40**	**$ 82,077.40**	**8**	**$ 10,259.68**		
C&M Ranch							
DU	$ 21,039.00	$ 12,216.60	$ 33,255.60				
Landowner	$ 1,500.00	$ -	$ 1,500.00				
Total	**$ 22,539.00**	**$ 12,216.60**	**$ 34,755.60**	**3**	**$ 11,585.20**		
Woody's by the River							
DU	$ 21,034.00	$ -	$ 21,034.00				
Landowner	$ 33,966.00	$ -	$ 33,966.00				
Total	**$ 55,000.00**	**$ -	**$ 55,000.00**	**140**	**$ 392.86**		

Notes:

Estimated Acreage Equivalent	Based on an average planted buffer widths, ranging from 3 to 20 feet, and length of project

[1]Costs are for Vino Farms Lambert Road Sites and Ditch Site #1. Costs for Ditch Site #2 are unavailable
[2]Funding provided by the USFWS Partners for Fish and Wildlife program
[3]Additional in kind services provided by Reclamation District 999