Socioeconomic Benefits of the Fisher Slough Restoration Project

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We gratefully acknowledge the assistance of the individuals who provided us with information and insight, but emphasize that we, alone, are responsible for the contents of this report. We have compiled the information based on information derived from government agencies, the reports of others, interviews of individuals, and other sources believed to be reliable. ECONorthwest has not independently verified the accuracy of information developed by others and cited here, and makes no representation regarding its veracity or completeness. Any statements nonfactual in nature constitute the authors' current opinions, which may change as more information becomes available

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ACRONYMS AND ABBREVIATIONS

DD3	Dike District 3
DD17	Drainage and Irrigation District 17
ECONW	ECONorthwest
EPA	Environmental Protection Agency
ESA	Endangered Species Act
NOAA	National Oceanic and Atmospheric Administration
NPV	Net Present Value
O&M	Operation and Maintenance
Project	Fisher Slough Tidal Marsh Restoration Project
TFI	Skagit Delta Tidegates and Fish Initiative Implementation Agreement
TNC	The Nature Conservancy
USACE	United States Army Corps of Engineers
WWAA	Western Washington Agricultural Association

I. INTRODUCTION AND SUMMARY

The Fisher Slough Tidal Marsh Restoration Project (the Project), completed in the fall of 2011, restored tidal wetlands and improved flood storage capacity within the Skagit River Delta in northwestern Washington. The Project, made possible by a partnership between The Nature Conservancy (TNC), Skagit County, Western Washington Agricultural Association (WWAA), local dike and drainage districts, and neighboring farmers, restored about 60 acres of freshwater tidal marsh, improved fish passage to 15 miles of salmon spawning and rearing stream habitat, and improved flood storage capacity to reduce flood damage in the lowland reaches of the 23-square mile watershed. About $5.7 million of the Project's total cost of $7.7 million[1] was funded from the National Oceanic and Atmospheric Administration (NOAA) through the American Recovery and Reinvestment Act.

The Project is expected to produce a wide range of benefits for fish and wildlife, farmers, and residents of communities in the Skagit River Delta. This is the first habitat restoration action to occur on private land within the Skagit Delta. In addition to restoring habitat for threatened salmon species, a goal of the project was to improve flood protection for the surrounding agricultural community, showing how farms and fish habitat can coexist on the landscape. As the Project neared completion, TNC and NOAA asked ECONorthwest (ECONW) to quantify the benefits that would accrue to the community, including farmers, local governments, and local residents. This report presents our findings. Other sources describe the benefits of the Project associated with salmon restoration, improved ecosystem function, and the number of jobs and amount of income the Project generated for workers and the local community.[2] Our findings should be taken together with these other benefits and economic impacts to understand the full range of economic effects the Project will generate.

Our analysis focuses on the Project's socioeconomic benefits enjoyed by those who live and work within and upstream of the Project, including farmers, local governments, and residents.[3] These benefits arise as investments in the Project and improve the types of capital that farmers and the communities rely on to produce goods and services. These types of capital include physical resources we often think of as inputs to the production of goods and services: infrastructure (human-built capital) and land and water (natural capital). The Project also may produce benefits by improving other types of capital, including the social relationships and institutional arrangements needed to solve

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[1] The total cost of $7.7 million includes land acquisition, feasibility and modeling, engineering, construction, and monitoring costs.

[2] Pipkin, W. 2011. "Fisher Slough restoration project nears completion." Goskagit.com. August 13. http://www.goskagit.com/news/article_0f5f1f70-c5ff-11e0-b5a9-001cc4c03286.html; Edwards, P.E.T. et al. 2012. "Investing in nature: Restoring coastal habitat blue infrastructure and green job creation." *Marine Policy*. May 15.

[3] We recognize that many residents and workers may also enjoy the benefits derived from ecosystem services the Project would enhance, such as salmon populations, other fish and wildlife populations, and water-related recreation. These benefits are addressed in other reports, and may be added to the benefits described in this report.

problems and accomplish broader community goals (social capital), and people's skills and knowledge (human capital).

With this broad understanding of the types of effects the Project may generate that would benefit farmers and the broader community, we use available data to quantify the effects over the next 50 years. A focus group of farmers, dike and drainage district managers, local government officials, and other stakeholders identified the major categories of benefits they would expect to see from the Project.[4] Through the focus group and subsequent interviews, the following benefits were identified as likely outcomes of the Project:

- New drainage and irrigation infrastructure is likely to require less frequent and less expensive investments in annual operation and maintenance (O&M), reduced energy costs, and reduced dredging costs, reducing farmers' and other landowners' annual operating expenses.
- Reduced flooding decreases damage to crops from rot, washouts, and pests, increasing farmers' annual income.
- Reduced flooding may allow farmers to plant higher-valued crops, including vegetable seed, increasing farmers' annual income.
- Reduced risk of large flood events may allow farmers to invest in permanent structures, such as greenhouses, that could facilitate the production of higher-valued crops, increasing farmers' annual income.
- Improved flood storage capacity likely reduces damage to transportation infrastructure, residential and commercial structures, and other property downstream and upstream.
- Restored tidal marsh habitat counts toward the obligations to create salmon habitat in the Skagit River Basin under the Skagit Delta Tidegates and Fish Initiative (TFI) Implementation Agreement, reducing the overall costs to provide habitat as farmers and other landowners maintain infrastructure and regulatory predictability.
- Newly forged productive working relationships among stakeholders enhance the social capital available to solve community problems in the future.
- Expanded expertise and knowledge of tidal wetland restoration in the Skagit River delta has the potential to reduce the costs and increase the success of future Projects in the region.

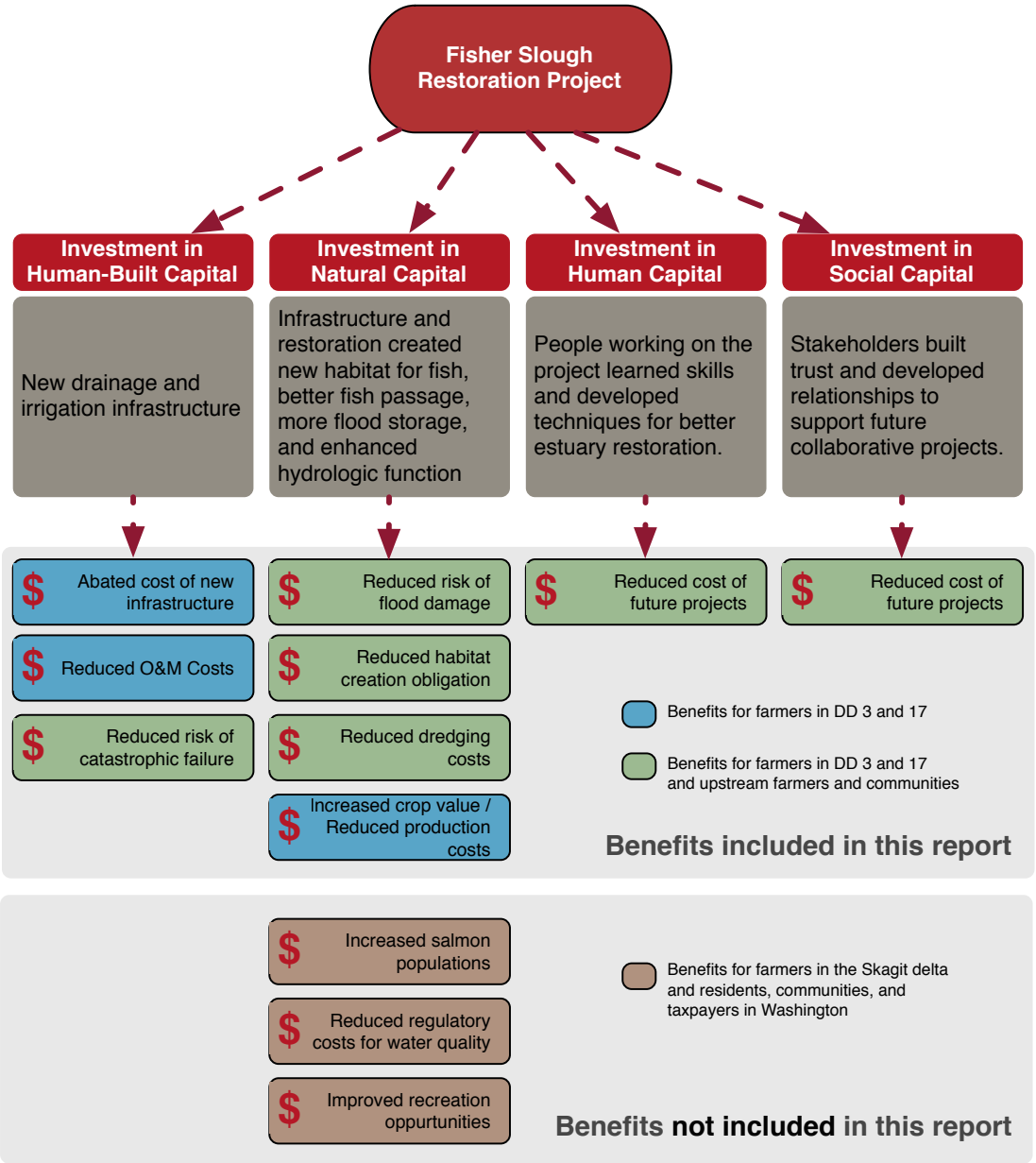
To quantify these benefits, we surveyed literature and data sources as well as interviewed many of the focus group participants to obtain sources of data related to the benefits described during the focus group. We also worked with a geotechnical and

[4] The focus group participants included representatives of Skagit County, Skagit County Dike District 3, Skagit Count Drainage and Irrigation District 17, Western Washington Agricultural Association, Skagit County Dike District 17, Skagitonians to Preserve Farmland, neighboring farmers and property owners.

environmental expert to develop additional sources of data.[5] Some of the benefits are not as readily quantifiable as others, so where data are not available, relying on our conversations with each stakeholder, we describe how and when the benefits would arise and to whom they would accrue.

Figure 1 illustrates the types of investments the project generated, the categories of benefits included in our analysis and the other benefits not included, and the groups of stakeholders that would enjoy the benefits.

Figure 1. Project Investments, Benefits, and Beneficiaries



[5] David Cline, Consulting Project Manager and Engineer of Record, Fisher Slough Tidal Marsh Restoration Project.

Table 1 shows the net present value of the quantifiable socioeconomic benefits over the next 20 and 50 years, given different assumptions for lower and higher values. All dollar figures are reported in US 2011 dollars.

Table 1. Net Present Value[1] of the Quantifiable Socioeconomic Benefits of the Fisher Slough Restoration Project (2011$)

Benefit Category	Low Estimate[2]		High Estimate[2]	
	20-year total	50-year total	20-year total	50-year total
Human-built Capital				
Reduced O&M costs	At least $4,000	At least $7,000	At least $7,000	At least $13,000
Abated Cost of New Infrastructure[3]	At least $1,925,000	At least $1,925,000	At least $1,925,000	At least $1,925,000
Reduced risk of catastrophic failure of old infrastructure	Unquantified, but potentially substantial. Includes the avoided costs of emergency repairs and damage to downstream property and habitat.[4]			
Natural Capital				
Reduced cost of flood damage	$106,000	$198,000	$2,594,000	$4,852,000
Reduced habitat restoration obligations to districts under TFI agreement[4]	$5,775,000	$5,775,000	$9,333,000	$9,333,000
Reduced dredging costs	$198,000	$367,000	$417,000	$775,000
Increased crop value	$369,000	$729,000	$1,846,000	$3,646,000
Reduced crop production costs	Unquantified. Includes lower costs associated with reduced risk of disease and reduced planting costs. Data are unavailable to estimate these costs.[5]			
Social Capital				
Reduced costs of future projects from investments in stakeholder relationships	$121,000	$121,000	$121,000	$121,000
Human Capital				
Reduced costs of future projects from investments in skills and knowledge of estuary restoration	Unquantified. Planning and implementing estuary restoration with multiple benefits increases skills and improves efficiency for future projects.[6]			
Total Net Present Value of the Quantified Benefits	**$8,498,000**	**$9,122,000**	**$16,243,000**	**$20,665,000**

Notes:

[1] Net present value calculated using the real interest rates for 2012 on treasury bonds and notes of specified maturities, graduated over 30 years (0.0%–2.0%). Retrieved August 31, 2012, from http://www.whitehouse.gov/omb/circulars_a094/a94_appx-c

[2] Assumptions for low and high estimates for each benefit are described in Section III and Appendix A of this report.

[3] This benefit was calculated assuming 75 percent of the total project budget was required for habitat restoration and 25 percent was required for infrastructure improvements. Only the 25-percent infrastructure portion of these costs is included in this benefit. In reality because each construction element had a flood and fish benefit, separating the cost of habitat improvements from infrastructure improvements is very difficult. Infrastructure improvements alone, without the habitat components of the project, may have cost farmers more than this amount.

[4] This benefit includes reduced costs accruing to all districts included in the TFI Implementation Agreement, not just Skagit County Dike District 3 and Skagit Count Drainage and Irrigation District 17.

[5] Data are currently unavailable to quantify these impacts. More investigation and economic modeling of the project may yield a better understanding of past costs in these categories, but this effort was beyond the scope of this project.

[6] This benefit is difficult to quantify given currently available information. The cost savings may become apparent over time as more collaborative restoration projects are implemented in the Skagit delta.

The largest source of quantifiable benefits in Table 1 is associated the benefit to farmers from reduced costs associated with meeting habitat mitigation obligations. Potential increases in crop value as reduced flooding risk induces farmers to adopt higher-value but riskier crops into their rotations and reduced dredging costs are also significant. The broader community would benefit from reduced flood damage. Strengthened relationships among diverse stakeholders have already yielded tangible benefits and likely will continue to produce economic benefits in the community for the foreseeable future. These benefits should be considered lower bounds because of the numerous categories of benefits that have not been quantified.

II. DESCRIPTION OF THE PROJECT AND THE PROJECT AREA

Fisher Slough is a tidally influenced freshwater marsh within the Skagit River Delta. It drains the 23 square mile Fisher Watershed, which is comprised of six sub-watersheds. These watersheds span the landscape from the city of Mount Vernon in Skagit County to the north, to the northern border of Snohomish County at the southern end of the watershed. The land use in this area ranges from lower-density urban development in Mount Vernon to rural residential to farmland and timberland.[6] Figure 1 shows the sub-watersheds the Project is likely to affect and the land use characteristics of the area. Figure 2 shows the Project area and Project elements.

By the early 1900s, a majority of the tidal wetlands in the Skagit River Delta had been diked and drained and farming had begun on the high-quality soils. Farmers re-routed creeks and constructed drainage ditches and other irrigation infrastructure. Low-lying delta lands were used for agricultural row cropping and uplands were used primarily for pasture. Over the last 30 years, some of the farmland has been converted to rural residential, and this trend is expected to continue.[7]

Limited flood storage capacity within Fisher Slough could lead to damages to agricultural, residential, and commercial property within the watershed. Land use conversion from timber clearing, agriculture, and development, and modifications to natural drainage patterns have reduced the amount and quality of fish habitat and limited migratory fish passage from Puget Sound to the upper reaches of the watershed, especially during periods of high and low flows. Anticipated future development is likely to further exacerbate runoff and water-quality problems in the watershed.[8]

To address these flooding and water-quality challenges, federal, state, and local agencies have initiated planning efforts to improve ecosystem function throughout the Skagit River Basin.[9] The Project is part of this larger strategy, integrating improvements to both the ecosystem and to agricultural infrastructure. As the first restoration action on private land, the Project was seen as a chance to prove that farms and fish habitat restoration can coexist and that the agricultural community can receive benefits from such actions. The Project managers established equal goals of: 1. Create freshwater tidal rearing for juvenile Chinook salmon, 2. Provide fish passage for Coho and chum spawning access, 3. Improve flood storage to protect agricultural uses of adjacent properties, and 4. Create a diverse array of native vegetation communities.

Through the Project, TNC acquired 60 acres of farmland from a local farmer, which enabled the creation of new habitat and increased flood storage capacity. In Phase 1 of the Project, engineers replaced old floodgates at the mouth of Fisher Slough with gates that improved tidal exchange and allowed improved fish passage. In Phase 2 of the

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[6] Tetra Tech. 2007. *Fisher Slough – Preferred Restoration Plan.* Final Report. The Nature Conservancy. February.

[7] Tetra Tech 2007.

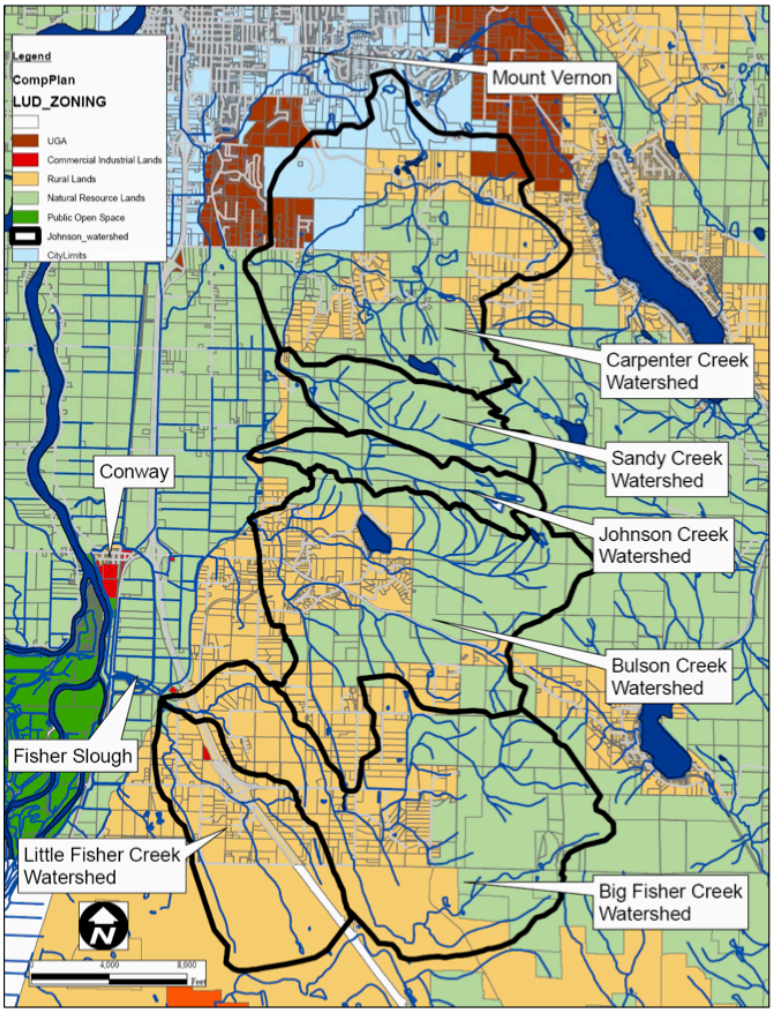
[8] Tetra Tech 2007.

[9] U.S. Army Corp of Engineers. 2009. *Skagit River Flood Risk Management and Ecosystem Restoration Feasibility Study, Skagit County, Washington.* August.

Project, engineers relocated a drainage ditch and culvert system. In Phase 3 of the Project, levees were set back to create the new habitat and enhanced flood storage capacity.[10]

The Project's objective is to increase flood storage capacity and reduce flood damage in Fisher Slough and upstream along Carpenter Creek. It is also likely to reduce sedimentation throughout the watershed, which improves fish passage during lower river conditions and specifically during spring juvenile Chinook migration season and improve water quality parameters in the Slough and its tributaries.[11]

Figure 1. Fisher Watershed Area

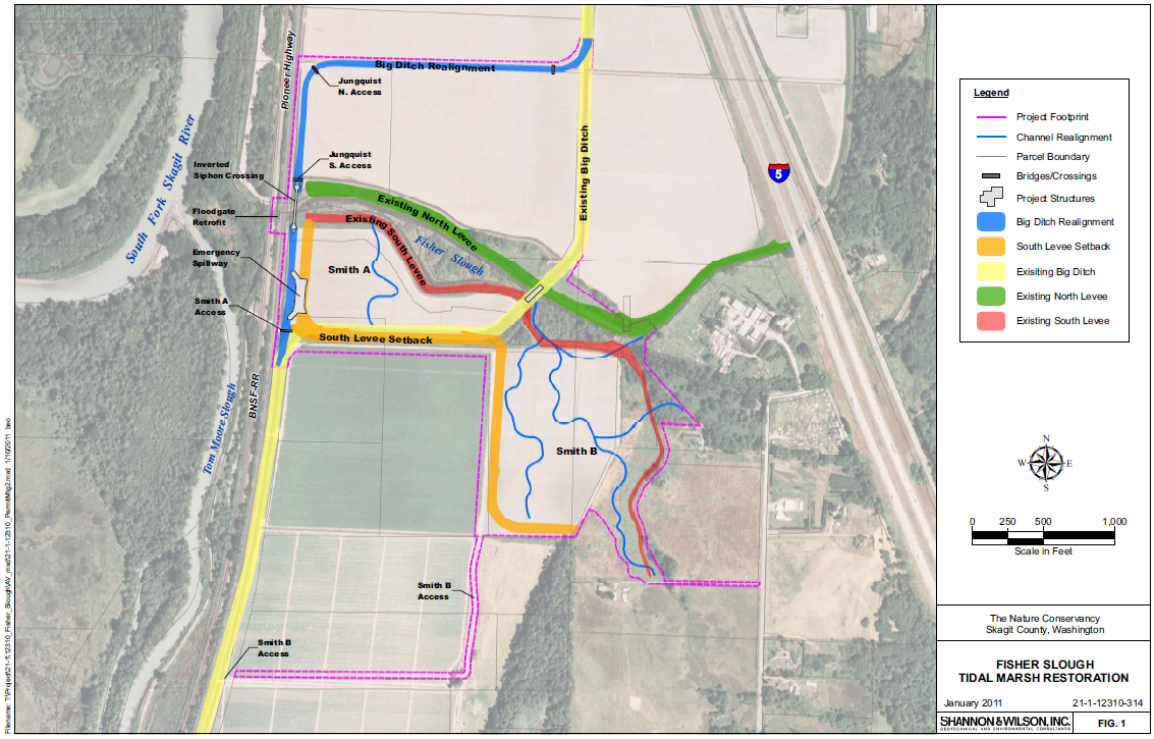


Source: Tetra Tech 2007

[10] The Nature Conservancy. 2011. *Fisher Slough: How it all Began*. September 26. Retrieved August 31, 2012, from http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/washington/explore/fisher-slough-how-it-all-got-started.xml

[11] Tetra Tech 2007.

Figure 2. Fisher Slough Project Area and Elements



Source: Cline, D. 2011. Shannon & Wilson Inc.

III. Socioeconomic Benefits

Our analysis focuses on the socioeconomic benefits that accrue to local farmers, property owners, and governments within and upstream of the Project area. The Project will produce other categories of benefits, which are explored in detail in other reports.[12] These other categories include benefits arising from improvements to the ecosystem that enhance fish and wildlife populations, water-quality, and associated recreational opportunities and aesthetic enjoyment. They also include the changes in employment and income earned by workers related to the Project's design, construction, and operation. We do not include these benefits in our analysis, so they may be added to the benefits we describe and quantify.

The Project's socioeconomic benefits arise as investments in the Project lead to changes in the basic inputs needed to produce things that people value. Economists refer to these inputs as capital, and distinguish between four distinct forms: human-built capital (i.e., canals, roads, and machinery), natural capital (i.e., fertile soil and clean water), human capital (i.e., skills and experience of workers), and social capital (i.e., relationships and institutional networks). In our focus group, participants identified a broad range of benefits.[13] We have organized the benefits identified by workshop participants by categorizing them into one of the four types of capital. It should be noted that the workshop participants did not categorize the benefits as such, but this reorganization facilitates analytically clear discussions of the benefits.

We describe each benefit below and, if quantifiable, provide an annual or per-unit value. We present the total net-present value of each benefit over 20 and 50 years in Table 1 (on page 3), based on the assumptions outlined in the discussion below.[14]

A. Changes in Human-Built Capital

The Project's investments in human-built capital include new floodgates, dikes, drainage structures, and culverts. Replacing and improving the infrastructure that supports farming in and upstream of the Project area represents a capital cost savings to farmers, and also lowers their costs of operating and maintaining the aging floodgates, dikes, and drainage canals. By replacing infrastructure before it degrades beyond its useful life, the Project also reduces the risk of catastrophic failures and the potentially substantial costs associated with emergency repairs.

Averted Infrastructure Replacement Costs

To accomplish the habitat restoration goals of the Project, managers replaced infrastructure critical to maintaining drainage and irrigation for farmland in the Project area. By replacing the infrastructure with modern structures that meet regulatory requirements, the Project saved the farmers and other landowners in Dike District 3

[12] Edwards, P.E.T. et al. 2012. "Investing in nature: Restoring coastal habitat blue infrastructure and green job creation." *Marine Policy*. May 15.

[13] A description of this focus group in Appendix B.

[14] For a more detailed description of these assumptions and our NPV methodology, see Appendix A.

(DD3) and Drainage and Irrigation District 17 (DD17) from having to make these capital investments on their own at some point in the future. To estimate the costs farmers would avoid because of the Project, we would need to know when farmers would have expected to replace the infrastructure and how much it would have cost.

Information to support this calculation was unavailable, so to estimate this benefit, we use the infrastructure-related expenses of the Project as a proxy for what farmers would have spent to replace infrastructure without the Project. We also assume, but for the Project, farmers would have completed these infrastructure improvements at the same time as the Project, and they would have completed them all at once. This approach potentially overestimates the actual benefit to farmers, depending on when they actually would have replaced the infrastructure without the Project.[15]

Estimating the infrastructure-related expenses of the Project has its own challenges. The infrastructure improvements were intertwined with the habitat restoration components of the Project, both functionally on the ground and through the Project's design, planning, and implementation activities. Thus, teasing out the infrastructure-related components of the budget is not a straightforward exercise. Project managers estimate, very roughly, that infrastructure expenses represented about 25 percent of the overall Project budget. This likely underestimates the actual cost farmers would have had to spend replacing infrastructure, because it incorporates efficiencies gained by replacing infrastructure and improving habitat at the same time and may not include all design, planning, and permitting costs that would have been required for infrastructure improvements alone. With all of these caveats, we estimate the averted infrastructure replacement costs enjoyed by farmers, in 2011 dollars, is about $1.9 million.

Reduced O&M Expenses

The new floodgates, new south levee, and new alignment of the Big Ditch, including replacement of a decaying box culvert with a new and improved siphon routing Big Ditch under Fisher Slough, are likely to improve the operability and reliability of the infrastructure farmers depend on in the Project area. The new infrastructure translates into savings in O&M costs, including labor, materials, and energy.

Documented reductions in O&M expenses are not yet identifiable in district budgets post-installation of the Project, and district managers were reluctant to identify specific differences in the way they spend their time operating and maintaining the new system. As the old system continued to age, however, more time-consuming and costly repairs likely would have been required and safety would have been compromised, leaving other activities uncompleted, requiring managers to hire additional labor, and/or requiring higher insurance premiums. For example, the old position of the levees with respect to Big and Little Fisher Creeks created structural integrity issues that required regular riprap and monitoring to maintain. In addition, changes in the flow patterns through the drainage infrastructure in the Project area change the timing and amount of

[15] This potentially overestimates the discounted net present value of the benefit assuming farmers actually would have completed the improvements in the future (say, for example, in five years) or would have spread the improvements over multiple years, because costs incurred in the future are worth less than costs incurred today, due to discounting.

pumping that must occur during certain times of the year. This reduces the annual energy costs associated with operating the system in addition to the reduction in costs from the regular placement of riprap. These cost savings are unquantifiable at this time.

District managers were able to provide us with information about labor costs related to operation and maintenance of the old infrastructure. Farmers from DD3 and DD17 are responsible for maintaining the infrastructure. District managers estimate that three farmers spend about 40 combined hours per year performing regular maintenance.[16] Typically these volunteer farmers receive an annual stipend of about $2,000 that covers their time.[17] We also understand that the old infrastructure did not meet regulatory requirements and upkeep involved numerous safety risks.[18] New infrastructure also requires maintenance, but may free up a portion of the hours that could be spent to accomplish other O&M activities that otherwise would have gone undone or for which managers would have had to hire outside help. In either case, the Project likely provides a benefit in the form of reduced O&M costs to dike and drainage district managers.

To quantify the labor portion of this benefit, we assume that managers spend half of the hours they used to spend operating and maintaining the old system on different activities. This represents a total reduced labor expenditure of $221-400 per year for all managers and an increase in time spent on other farm-related activities. We calculate this based on a wage rate of $11 and $20 per hour. The lower end of the range represents the median hourly wages for agricultural laborers and the upper end represents the median wage for all employees in the farm, fish, and forestry sector as reported by the Bureau of Labor Statistics.[19]

Reduced Risk of Catastrophic Failure

New infrastructure also reduces the risk of catastrophic failure, emergency repairs, and the prevalence of safety hazards. These benefits are likely to far outweigh the wage and time savings described above. Estimating these savings requires detailed data about the probabilities of failure, potential damage estimates, and the costs of emergency repairs, which are currently unavailable and are beyond the scope of this report to develop. Although there are no data available to estimate the cost savings associated with this reduced risk, experience with infrastructure elsewhere suggests it is potentially considerable.[20]

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[16] Personal communication with district commissioners.

[17] Personal communication with district commissioners.

[18] Personal communication with David Cline.

[19] Bureau of Labor Statistics. May 2011 Northwester Washington nonmetropolitan area - Occupational Employment Statistics. http://www.bls.gov/oes/current/oes_5300001.htm

[20] Personal communication with David Cline.

B. Changes in Natural Capital

The Project's investments in natural capital have improved the function of the ecosystem, providing benefits to farmers in DDs 3 and 17 and upstream districts and communities. These improvements include increased flood storage capacity, which reduces flood damage and enhances farming opportunities in the Project area; reduced sedimentation, which reduces dredging costs within and upstream of the Project area; and new habitat, which counts towards farmers' obligations under the Skagit Delta TFI Implementation Agreement, reducing their overall costs for habitat restoration in the delta. Changes in natural capital provide a suite of other benefits not quantified in this report, including improvements in salmon populations, recreation opportunities, and water quality parameters. Other reports describe these in more detail.

Reduced Costs of Flood Damage

One of the major benefits of the Project is an enhanced ability to control flood waters with updated levees and dikes. This reduces costs associated with flooding. The new infrastructure staves off potential flood damage to private property and crops by providing approximately 250 additional acre-feet of flood storage.

Flooding causes significant damage to private property in Skagit County. Over a 100-year period, the Skagit River Watershed, to which Fisher Slough is a tributary, reached flood stage more than 60 times. Between 1990 and 2007 the total damage caused by floods was more than $84 million. If a 100-year flood event were to hit the Skagit River region again, the predicted damage that would result is estimated to be $1.4 billion. With 30,000 residents in the Skagit River 100-year flood plain and 108,000 in the entire county, even relatively minor floods represent a significant per capita expense.[21]

The Project addresses a small part of this larger problem: David Cline, Consulting Project Manager and Engineer of Record, estimates that the Project would reduce or eliminate flooding during a 10-year flood event across about 600 acres. Under the old system, 5-year events often resulted in the overtopping of the levees. Reductions in flood stage during more significant events could also occur, potentially throughout portions of the 23-square-mile Fisher Watershed.

Flood damage reductions directly attributable to the Project are not available because a major flood event that inundated the new infrastructure has not occurred since Project completion. David Cline indicated that just after the Project was completed in 2011, at least one 10-year tributary flood event occurred that would have caused the old infrastructure to fail and did not cause any damage to the immediate area.[22] Prior to the Project, 5-year Skagit River flood events caused some damage to farmland.

In 2009, the U.S. Army Corps of Engineers completed a flood hazard study within the Skagit River Basin. The study calculated that the expected annual flood damage to

[21] Skagit County Washington. 2007. "The Skagit River Flood Risk." Data updated to 2011 dollars.

[22] This 10-year flood event occurred on Fisher Slough, not on the Skagit River, and was not recorded because no gauge was present at the flood location. Local reports, however, document that it occurred.

residential, commercial, and agricultural property across the 3,100 square-mile watershed was about $90 million.[23] By eliminating the damage associated with the 10-year flood event, expected annual flood damage would be about $70 million. Applying these changes in expected values associated with mitigating the 10-year flood event to the portion of the watershed the Project directly affects, about 0.03 percent of the total area, the expected annual reduction would be about $6,000. If the benefit extends to the 23-square-mile Fisher Watershed, the expected annual reduction in flood damage would be $145,000. This upper end of the range is unlikely, given that the increased flood storage capacity is not significant enough to capture enough flood water to alleviate flooding across the entire watershed even in the 10-year flood event, but it does provide some sense of the value if the Project reduces flood stages across a broader area in a more significant flood event.[24]

Improved Farming Opportunities

The restoration Project has made water flows more predictable. In addition to reducing damages to crops this may also expand the range of crops farmers can grow. The most profitable crops also tend to be those that are the most difficult to grow. These crops often require specific conditions, whereas unpredictable and extended periods of heavy water levels can foster disease, if not complete eradication, of a crop. Diversification of crops may increase the incomes of farmers in the vicinity of the Project.

Farmers in the area reported that potatoes are the primary cash crop in the region.[25] Potatoes are grown on a 3-year rotation and with winter wheat grown in the off years, which brought in some revenue but also served to replenish soil nutrients for potatoes. Other crops could serve this same purpose, but the unpredictable and often adverse growing conditions have made many crops a poor gamble. Farmers reported that increased drainage and updated infrastructure mean that they may switch some acreage to higher-profit crops, such as cabbage seed.

Our calculations of the value of this benefit are based on farmers switching from wheat to one crop of vegetable seed over the off years, and maintaining potatoes in the third year. Switching an acre from wheat to vegetable seed in off years would result in a net benefit of about $1,000 per acre. Farmers reported that they would be unlikely to switch all of their wheat acres to vegetable seed, but were also reluctant to report what percentage they would be willing to switch over. In the absence of specific information from farmers, we assume that of the 600 acres potentially benefiting from reduced flooding, farmers may convert between 10 percent and 50 percent of the acres to the new

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[23] U.S. Army Corp of Engineers 2009.

[24] Ideally, this calculation would measure the damage done by each of the various points of old infrastructure and the reduced risk of failure of new infrastructure at each of these vulnerable points. This finely tuned data, however, was not available. One noteworthy study mentioned how specific infrastructure improvements would reduce flood risks, but neither quantified these risks nor monetized the benefits: *Carpenter Creek, Hill Ditch, Fisher Slough Watersheds Initial Flood and Sediment Study*. Tetra Tech, Inc. prepared for Skagit County. March 2007.

[25] Personal communication with district commissioners.

potato-vegetable seed rotation. The benefit of this change ranges from about $64,000 to about $320,000 per year.

Although vegetable seed was one of the higher-valued crops farmers mentioned, other revenue boosting opportunities emerge as flood risk subsides. The lower likelihood of damage to buildings from flooding makes building greenhouses or investment in other private, human-built capital a viable and potentially profitable enterprise. Greenhouses enable some crops to be grown over the winter months, other crops to be started early in spring when outside temperatures would otherwise make crops untenable, and make certain highly profitable products, such as garden center stock, viable. None of the focus group participants or people we subsequently contacted indicated any farmers had plans to invest in these types of opportunities, but these opportunities would not exist without the Project.

Additional benefits of reducing flood risk likely accrue to farmers, even if they don't switch from their current practices. Farmers once may have delayed planting a crop because of a rain-heavy forecast, but now can better predict water levels and schedule plans for future crops. Less water-logged soil may result in less rot and pests, reducing the potential for low productivity or higher management costs. Farmers were unable to provide data to quantify these benefits, but they may be as or more important than the benefits some farmers may gain from switching to higher-valued crops.[26]

Reduced Dredging Costs

Improvements related to rerouting stream channels away from levees and putting the streams in more natural alignments and changes in the grade of drainage ditches likely will reduce the amount of sediment that must be dredged to keep the ditch capacity open. Estimates suggest that dredging has historically occurred every 5 to 10 years, and about 2,000 yards of material are removed with each dredging operation. At about $60 per yard, this amounts to a cost of $120,000 every 5 to 10 years.[27] Downstream changes in sedimentation may also reduce upstream sedimentation of Carpenter Creek, which could reduce dredging in that sub-watershed by as much as 10 percent of volume, but data are unavailable to quantify this benefit in monetary terms.[28] As dredging costs are the financial responsibility of the relevant district, these benefits would accrue to the districts.[29]

Reduced Costs Associated with Habitat Restoration Obligations

In order to recover the threatened population of Puget Sound Chinook salmon that are native to Skagit River, the salmon recovery plan has called for the restoration of 2,700 acres of estuarine habitat.[30] In 2010, WWAA, NOAA's National Marine Fisheries Service

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[26] Personal communication with district managers and WWAA.

[27] Personal communication with David Cline.

[28] Personal communication with David Cline.

[29] Personal communication with Jan Flagan, Skagit County Public Works.

[30] Washington Agricultural Association, NOAA National Marine Fisheries Service, and Washington Department of Fish and Wildlife. 2010. *Skagit Tidegates and Fish Initiative Implementation Agreement.* April.

and Washington Department of Fish and Wildlife signed the Skagit Delta TFI Implementation Agreement. The TFI Implementation Agreement created a delta-wide approach to address maintenance of tide and flood gates needed to maintain agricultural lands in production in conjunction with achieving the Endangered Species Act (ESA) recovery goals for estuarine habitat in the delta. As they are implemented, habitat restoration actions identified in the Skagit Recovery Plan generate credits that can be used by the Diking and Drainage Districts to maintain, repair and replace existing tide or flood gates without the need for individual consultations for ESA impacts. While the agricultural community does not have to pay for individual habitat restoration actions directly, they are responsible, "in good faith and with due diligence" for securing public and non-public funds to accomplish the TFI habitat restoration goals.[31] If the restoration actions do not keep pace with tide and flood gate maintenance requirements, the agricultural community will lose assurances for maintaining critical infrastructure.

The Project's restored acres will count toward this obligation. Restoration credits are released for use following a specific milestone schedule with the credits released in 30-, 30-, and 40-percent increments.[32] When the TFI agreement was signed the Fisher Slough project had already achieved the first 30-percent milestone, which was equal to 15.7 credit acres. According to the agreement, acres of habitat restored or credit milestones achieved before the agreement was signed do not qualify for habitat credits. These 15.7 credit acres count toward the base area's 2,700-acre restoration obligation, but do not equate to habitat credits for infrastructure improvements. The remaining 36.6 acres of habitat available for credit from the Project's second two milestones are available to satisfy future credit obligations of any of the diking and drainage districts that need credits.

The financial responsibility for ensuring the habitat credits are created is distributed across multiple parties, the districts among them. Ultimately, if sufficient habitat is not restored, districts would not be able to maintain critical infrastructure. This Project alleviates some of that financial burden by reducing the overall number of credits districts must secure on their own. If the cost for creating future credits were similar to the cost to complete the habitat-restoration portions of this Project, the benefit to the districts and property owners within the districts would be about $5.8 million. This represents the low estimate of our range. This is a very rough estimate, because the habitat components of the Project are very difficult to separate from the infrastructure components of the Project. This value assumes habitat-restoration costs make up about 75 percent of the $7.7 million budget. The Environmental Protection Agency (EPA) estimates the average cost to create an acre of wetland habitat in Washington is about $180,000, including the cost of purchasing the land.[33] Each acre of habitat created under this project represents an avoided cost of about $180,000, as each district would be

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[31] WWAA et al. *Skagit Delta Tidegates and Fish Initiative Implementation Agreement.* April 1, 2010.

[32] WWAA et al. *Skagit Delta Tidegates and Fish Initiative Implementation Agreement.* April 1, 2010.

[33] U.S. Environmental Protection Agency. 2011. Potential Indirect Economic Impacts and Benefits Associated with Guidance Clarifying the Scope of the Clean Water Act Jurisdiction. Available at: http://water.epa.gov/lawsregs/guidance/wetlands/upload/cwa_guidance_impacts_benefits.pdf

required to secure funding for this habitat without the Project. Using EPA's estimates, the total avoided cost for all the districts under the TFI agreement would be about $9.3 million for the 52.3 restored acres. This represents the high estimate of our range.

C. Changes in Social Capital

Through a concerted and deliberate investment in facilitation and outreach throughout the Project,[34] the managers of the Project established trust and built relationships among a diverse group of stakeholders. Distinct from past efforts, the Project managers involved the agricultural community in the decision-making process and ensured the Project would satisfy multiple objectives for habitat and farming. Prior to the Project's development, the notion that such restoration could benefit all involved parties was rare, but that perception has shifted for the members of the agricultural community who participated in the focus group. This shift likely has produced lasting benefits for the community as it attempts to address similar issues in the area.

These benefits are potentially widespread and only partially quantifiable. A representative of the WWAA indicated that the most obvious benefit arising from this new stock of social capital is that future projects won't need to make the initial investment in facilitation and outreach to accomplish the same objectives. WWAA pointed to two other projects where benefits are already being observed: the Fir Island Farms Project and the Farms, Fish and Flood Initiative. Others likely will follow in the years to come.

Individuals involved in this Project estimate the Project's initial investment in facilitation and outreach that laid the groundwork for trust and a working relationship among stakeholders cost between $50,000 and $100,000. To estimate the value of this benefit, we assume other projects would have had to invest a similar level of funding to generate social capital from scratch. We also recognize most projects would still need to invest some resources in reestablishing the relationships and expanding them to new stakeholders. Thus, we assume a benefit in the form of a cost savings of $25,000 per project. Projects of a magnitude requiring significant investments in building social capital don't occur from start to finish ever year, but facilitations efforts across multiple, long-term projects in the area are probably required once every other year. Moreover, the relationships built by the Project will need reinforcement over time as people move on, institutions change, and politics evolve, so we have only quantified this benefit in the short-run, for the next 10 years.

These shifts in the underlying capacity of social capital in a region do not come along every day. They likely produce benefits more broad and valuable than we actually recognize and are able to quantify in monetary terms. It is, thus, highly likely that we have underestimated the total benefits of the Project's investments in social capital.

D. Changes in Human Capital

The Project provides opportunities for planners, designers, engineers, and construction crews to gain experience creating estuary habitat in the Skagit River delta. These skills

[34] Personal communication with David Cline.

and knowledge provide a foundation on which future projects may be built. Greater efficiency increases the possibility of successful future work in the region, which will be important for achieving the 2,700-acre recovery goal.[35] The new habitat also has the potential to serve as a training ground for professionals studying the effects of the Project on the region's species so that they may develop strategies that improve efforts elsewhere. Currently, there are no data available to quantify the value of these benefits. They may become more apparent as more habitat restoration projects are implemented in the Skagit delta and the level of cost savings can be directly observed.

[35] Washington Agricultural Association, NOAA National Marine Fisheries Service, and Washington Department of Fish and Wildlife. 2010.

IV. CONCLUSION

The Project was completed less than a year ago, in October of 2011. It is early yet, but there are promising signs that socioeconomic benefits will materialize for the region's farmers and communities. Table 1 and Figure 1 in Section I summarize the benefits associated with the Project. The Project cost about $7.7 million. The net present value of the socioeconomic benefits we were able to quantify amount to between $9.1 and $20.6 million over the next 50 years, depending on the set of assumptions applied. This does not include other benefits associated with improved ecosystem function, which are detailed in other analyses. Most of the benefits quantified in this report are likely to accrue to the farmers closest to the Project, but some of the benefits, especially related to flood control, are likely to extend to landowners beyond the immediate Project area.

Our estimate of the Project's benefits likely underestimates the total socioeconomic benefits of the Project, potentially substantially. We've identified several specific benefits that we've not quantified or underestimated because of limited data and resources, as detailed in Table 1 and below.

- **O&M Costs are underestimated.** Much of the Project's perceived benefit arises from reductions in O&M arising from the new infrastructure and ecosystem improvements. We have not been able to procure DD3 and DD17 budgets where current O&M costs would be detailed, and interviews with managers have not provided sufficient detail to adequately understand the historic costs. Moreover, managers' understanding of O&M under the new infrastructure will take time to develop. Increased safety and related reduced insurance premiums are also potential O&M savings, but would require more data and better information about appropriate assumptions to calculate.
- **Insufficient Data are available to estimate the reduced risk of catastrophic failure.** The potential for catastrophic failure of the old infrastructure was high, and would have increased as it aged. The repairs and replacements of the Project have not only removed decaying dikes and levees with a higher relative risk of failing, but also improved overall water management in the flood control system. Both these variables, however, are highly complex particularly as they interact with variable water levels and precipitation rates. Estimating this benefit requires modeling and engineering analysis, and is beyond the scope of our analysis.
- **Insufficient data are available to estimate the reduced crop production costs.** The Project resulted in better drainage of nearby farmland. This is likely to lead to reduced crop disease and easier and earlier spring planting. These reduced costs, however, are impossible to estimate without more detailed data about historic disease prevalence and farm-specific labor and input costs.
- **Data are insufficient to fully quantify investments in social and human capital.** All participants in the focus group and others interviewed for this report agree that the Project generated valuable lessons for future projects, and enhanced the strength of collaboration among stakeholders. These investments will pay dividends on future projects, but are impossible to quantify. They may become more apparent as more projects are implemented in the Skagit delta.

Many benefits not covered in this study are described elsewhere. These include increases in salmon habitat and populations, which may lead to better harvests for commercial and tribal fisherman and recreational anglers; more recreational opportunities; and improved ecosystem functions, including improvements in water quality and habitat connectivity. The economic benefits associated with the Project's effects in these areas are very real, and would be additive to the benefits quantified in this analysis.

Beyond the benefits specifically underestimated or unquantified, there is some uncertainty in the benefits we have quantified. This uncertainty arises largely because the Project has only been fully operational for less than a year. Farmers have yet to fully realize the changes that the Project may bring, and so have not fully adjusted their behaviors and expectations to match the new conditions. Based on preliminary information from farmers and engineers involved in the Project, we have made many assumptions to quantify the benefits included in this analysis. Actual characteristics may be somewhat different than our assumptions. In our calculations, there are undoubtedly benefits we have not fully accounted for. Likewise, there are some benefits we may have overestimated, given that we do not know exactly how the Project will function. Nevertheless, this analysis provides a starting point for understanding the Project's benefits as they unfold over time.

APPENDIX A. NPV METHODOLOGY AND CALCULATIONS

Overview of discounting methods

The community near Fisher Slough will benefit from the estuary restoration and infrastructure improvements for decades to come. These benefits can be monetized as a dollar value benefit for each year into the foreseeable future. But simply summing the benefits across these years yields an inflated value. As an example, a promise of a single $100 payment ten years from now is very different than promising a $100 payment ten days from now. The method economists use to determine what a dollar value from some point in the future is worth today is called discounting. If there is a stream of such payments or values over a number of years then the calculation to reduce all these values to a single, current value is called Net Present Value (NPV)

There are two major determinations in calculating NPV: the discount rate and the relevant timeframe. The discount rate is similar to an interest rate or the percentage rate of return on an investment. To determine what $100 ten years from now is worth today, economists calculate the initial investment needed to yield exactly $100 ten years from now given the interest accrued on the investment each year. Seemingly small variations in discount rates can have significant impacts on NPV calculations.

The timeframe used may also have a significant impact on the NPV calculation. While high discount rates can make streams of revenue just a few years into the future relatively small in NPV terms, low discount rates can make benefits many years into the future have a significant impact on the NPV. Determining whether a project will yield benefits for, say, ten versus twenty years may drastically shift benefit estimates.

For the calculations of Table 1, we used real discount rates from the OMB.[36] These rates are based on federal budget forecasts and represent the value, controlling for inflation, of low-risk investments in US Treasury Notes and Bonds.

The 20-year and 50-year timeframes are standard for this type of analysis, and are appropriate to show the cumulative value of benefits in the near-term and long-term.[37]

[36] OMB. Discount rates for cost-effectiveness, lease purchase, and related analysis. Circular A-94, Appendix C. December 2011. http://www.whitehouse.gov/omb/circulars_a094/a94_appx-c

[37] U.S. EPA. 2010. *Guidelines for Preparing Economic Analyses.* EPA 240-R-10-001. December.

Net Present Value Calculations

Value of Reduced O&M Labor Costs – Low and High Scenarios

Low Scenario (11.03/hr laborer)

Year	20 hour labor cost reduction	Discount rate	Present Value	Cumulative Present Value	Discount year
2012	221	0.00%	221	221	0
2013	221	0.00%	221	441	1
2014	221	0.00%	221	662	2
2015	221	0.00%	221	882	3
2016	221	0.20%	219	1,101	4
2017	221	0.40%	216	1,317	5
2018	221	0.55%	213	1,531	6
2019	221	0.70%	210	1,741	7
2020	221	0.83%	206	1,948	8
2021	221	0.97%	202	2,150	9
2022	221	1.10%	198	2,347	10
2023	221	1.16%	194	2,542	11
2024	221	1.22%	191	2,733	12
2025	221	1.28%	187	2,920	13
2026	221	1.34%	183	3,103	14
2027	221	1.40%	179	3,282	15
2028	221	1.46%	175	3,457	16
2029	221	1.52%	171	3,627	17
2030	221	1.58%	166	3,794	18
2031	221	1.64%	162	**3,956**	19
2032	221	1.70%	157	4,113	20
2033	221	1.73%	154	4,267	21
2034	221	1.76%	150	4,417	22
2035	221	1.79%	147	4,564	23
2036	221	1.82%	143	4,707	24
2037	221	1.85%	140	4,847	25
2038	221	1.88%	136	4,982	26
2039	221	1.91%	132	5,115	27
2040	221	1.94%	129	5,244	28
2041	221	1.97%	125	5,369	29
2042	221	2.00%	122	5,491	30
2043	221	2.00%	119	5,610	31
2044	221	2.00%	117	5,727	32
2045	221	2.00%	115	5,842	33
2046	221	2.00%	113	5,954	34
2047	221	2.00%	110	6,065	35
2048	221	2.00%	108	6,173	36
2049	221	2.00%	106	6,279	37
2050	221	2.00%	104	6,383	38
2051	221	2.00%	102	6,485	39
2052	221	2.00%	100	6,585	40
2053	221	2.00%	98	6,683	41
2054	221	2.00%	96	6,779	42
2055	221	2.00%	94	6,873	43
2056	221	2.00%	92	6,965	44
2057	221	2.00%	90	7,056	45
2058	221	2.00%	89	7,144	46
2059	221	2.00%	87	7,231	47
2060	221	2.00%	85	7,317	48
2061	221	2.00%	84	**7,400**	49

High Scenario (19.99/hr Farm, Fish, and Foresty - All Occupations)

Year	20 hour labor cost reduction	Discount rate	Present Value	Cumulative Present Value	Discount year
2012	400	0.00%	400	400	0
2013	400	0.00%	400	800	1
2014	400	0.00%	400	1,199	2
2015	400	0.00%	400	1,599	3
2016	400	0.20%	397	1,996	4
2017	400	0.40%	392	2,388	5
2018	400	0.55%	387	2,775	6
2019	400	0.70%	381	3,155	7
2020	400	0.83%	374	3,530	8
2021	400	0.97%	367	3,896	9
2022	400	1.10%	358	4,254	10
2023	400	1.16%	352	4,607	11
2024	400	1.22%	346	4,952	12
2025	400	1.28%	339	5,291	13
2026	400	1.34%	332	5,623	14
2027	400	1.40%	325	5,948	15
2028	400	1.46%	317	6,265	16
2029	400	1.52%	309	6,574	17
2030	400	1.58%	302	6,875	18
2031	400	1.64%	294	**7,169**	19
2032	400	1.70%	285	7,454	20
2033	400	1.73%	279	7,733	21
2034	400	1.76%	272	8,006	22
2035	400	1.79%	266	8,271	23
2036	400	1.82%	259	8,531	24
2037	400	1.85%	253	8,784	25
2038	400	1.88%	246	9,030	26
2039	400	1.91%	240	9,270	27
2040	400	1.94%	233	9,503	28
2041	400	1.97%	227	9,730	29
2042	400	2.00%	221	9,951	30
2043	400	2.00%	216	10,167	31
2044	400	2.00%	212	10,380	32
2045	400	2.00%	208	10,588	33
2046	400	2.00%	204	10,791	34
2047	400	2.00%	200	10,991	35
2048	400	2.00%	196	11,187	36
2049	400	2.00%	192	11,379	37
2050	400	2.00%	188	11,568	38
2051	400	2.00%	185	11,753	39
2052	400	2.00%	181	11,934	40
2053	400	2.00%	178	12,111	41
2054	400	2.00%	174	12,285	42
2055	400	2.00%	171	12,456	43
2056	400	2.00%	167	12,623	44
2057	400	2.00%	164	12,787	45
2058	400	2.00%	161	12,948	46
2059	400	2.00%	158	13,105	47
2060	400	2.00%	155	13,260	48
2061	400	2.00%	152	**13,411**	49

Reduced Cost of Flood Damage – Low Scenario

Scaled to 600 acre impact area

Year	flood damage w/o restoration project	flood damage w/restoration project	Reduction in expected annual property damage	Discount rate	Present Value	Cumulative Present Value	Discount year
2012	27,081	21,170	5,911	0.00%	5,911	5,911	0
2013	27,081	21,170	5,911	0.00%	5,911	11,823	1
2014	27,081	21,170	5,911	0.00%	5,911	17,734	2
2015	27,081	21,170	5,911	0.00%	5,911	23,645	3
2016	27,081	21,170	5,911	0.20%	5,864	29,510	4
2017	27,081	21,170	5,911	0.40%	5,794	35,304	5
2018	27,081	21,170	5,911	0.55%	5,720	41,024	6
2019	27,081	21,170	5,911	0.70%	5,630	46,654	7
2020	27,081	21,170	5,911	0.83%	5,532	52,185	8
2021	27,081	21,170	5,911	0.97%	5,421	57,606	9
2022	27,081	21,170	5,911	1.10%	5,299	62,905	10
2023	27,081	21,170	5,911	1.16%	5,207	68,112	11
2024	27,081	21,170	5,911	1.22%	5,111	73,223	12
2025	27,081	21,170	5,911	1.28%	5,010	78,233	13
2026	27,081	21,170	5,911	1.34%	4,906	83,139	14
2027	27,081	21,170	5,911	1.40%	4,799	87,938	15
2028	27,081	21,170	5,911	1.46%	4,688	92,626	16
2029	27,081	21,170	5,911	1.52%	4,574	97,200	17
2030	27,081	21,170	5,911	1.58%	4,458	101,658	18
2031	27,081	21,170	5,911	1.64%	4,340	**105,998**	19
2032	27,081	21,170	5,911	1.70%	4,220	110,217	20
2033	27,081	21,170	5,911	1.73%	4,123	114,340	21
2034	27,081	21,170	5,911	1.76%	4,027	118,368	22
2035	27,081	21,170	5,911	1.79%	3,931	122,298	23
2036	27,081	21,170	5,911	1.82%	3,834	126,133	24
2037	27,081	21,170	5,911	1.85%	3,738	129,871	25
2038	27,081	21,170	5,911	1.88%	3,642	133,513	26
2039	27,081	21,170	5,911	1.91%	3,547	137,060	27
2040	27,081	21,170	5,911	1.94%	3,452	140,511	28
2041	27,081	21,170	5,911	1.97%	3,357	143,869	29
2042	27,081	21,170	5,911	2.00%	3,263	147,132	30
2043	27,081	21,170	5,911	2.00%	3,199	150,332	31
2044	27,081	21,170	5,911	2.00%	3,137	153,468	32
2045	27,081	21,170	5,911	2.00%	3,075	156,544	33
2046	27,081	21,170	5,911	2.00%	3,015	159,559	34
2047	27,081	21,170	5,911	2.00%	2,956	162,514	35
2048	27,081	21,170	5,911	2.00%	2,898	165,412	36
2049	27,081	21,170	5,911	2.00%	2,841	168,253	37
2050	27,081	21,170	5,911	2.00%	2,785	171,039	38
2051	27,081	21,170	5,911	2.00%	2,731	173,769	39
2052	27,081	21,170	5,911	2.00%	2,677	176,446	40
2053	27,081	21,170	5,911	2.00%	2,625	179,071	41
2054	27,081	21,170	5,911	2.00%	2,573	181,644	42
2055	27,081	21,170	5,911	2.00%	2,523	184,167	43
2056	27,081	21,170	5,911	2.00%	2,473	186,640	44
2057	27,081	21,170	5,911	2.00%	2,425	189,065	45
2058	27,081	21,170	5,911	2.00%	2,377	191,442	46
2059	27,081	21,170	5,911	2.00%	2,331	193,773	47
2060	27,081	21,170	5,911	2.00%	2,285	196,058	48
2061	27,081	21,170	5,911	2.00%	2,240	**198,298**	49

Reduced Cost of Flood Damage – High Scenario

Scaled to 23-square mile impact area

Year	flood damage w/o restoration project	flood damage w/restoration project	Reduction in expected annual property damage	Discount rate	Present Value	Cumulative Present Value	Discount year
2012	662,621	517,983	144,639	0.00%	144,639	144,639	0
2013	662,621	517,983	144,639	0.00%	144,639	289,277	1
2014	662,621	517,983	144,639	0.00%	144,639	433,916	2
2015	662,621	517,983	144,639	0.00%	144,639	578,554	3
2016	662,621	517,983	144,639	0.20%	143,487	722,041	4
2017	662,621	517,983	144,639	0.40%	141,780	863,822	5
2018	662,621	517,983	144,639	0.55%	139,956	1,003,778	6
2019	662,621	517,983	144,639	0.70%	137,746	1,141,523	7
2020	662,621	517,983	144,639	0.83%	135,348	1,276,871	8
2021	662,621	517,983	144,639	0.97%	132,642	1,409,513	9
2022	662,621	517,983	144,639	1.10%	129,650	1,539,163	10
2023	662,621	517,983	144,639	1.16%	127,405	1,666,568	11
2024	662,621	517,983	144,639	1.22%	125,051	1,791,619	12
2025	662,621	517,983	144,639	1.28%	122,596	1,914,215	13
2026	662,621	517,983	144,639	1.34%	120,047	2,034,262	14
2027	662,621	517,983	144,639	1.40%	117,413	2,151,675	15
2028	662,621	517,983	144,639	1.46%	114,701	2,266,376	16
2029	662,621	517,983	144,639	1.52%	111,920	2,378,296	17
2030	662,621	517,983	144,639	1.58%	109,078	2,487,373	18
2031	662,621	517,983	144,639	1.64%	106,183	**2,593,556**	19
2032	662,621	517,983	144,639	1.70%	103,244	2,696,800	20
2033	662,621	517,983	144,639	1.73%	100,891	2,797,692	21
2034	662,621	517,983	144,639	1.76%	98,534	2,896,226	22
2035	662,621	517,983	144,639	1.79%	96,176	2,992,402	23
2036	662,621	517,983	144,639	1.82%	93,819	3,086,221	24
2037	662,621	517,983	144,639	1.85%	91,466	3,177,687	25
2038	662,621	517,983	144,639	1.88%	89,119	3,266,806	26
2039	662,621	517,983	144,639	1.91%	86,782	3,353,588	27
2040	662,621	517,983	144,639	1.94%	84,457	3,438,045	28
2041	662,621	517,983	144,639	1.97%	82,146	3,520,190	29
2042	662,621	517,983	144,639	2.00%	79,851	3,600,041	30
2043	662,621	517,983	144,639	2.00%	78,285	3,678,326	31
2044	662,621	517,983	144,639	2.00%	76,750	3,755,076	32
2045	662,621	517,983	144,639	2.00%	75,245	3,830,321	33
2046	662,621	517,983	144,639	2.00%	73,770	3,904,091	34
2047	662,621	517,983	144,639	2.00%	72,323	3,976,414	35
2048	662,621	517,983	144,639	2.00%	70,905	4,047,319	36
2049	662,621	517,983	144,639	2.00%	69,515	4,116,834	37
2050	662,621	517,983	144,639	2.00%	68,152	4,184,986	38
2051	662,621	517,983	144,639	2.00%	66,816	4,251,802	39
2052	662,621	517,983	144,639	2.00%	65,505	4,317,307	40
2053	662,621	517,983	144,639	2.00%	64,221	4,381,528	41
2054	662,621	517,983	144,639	2.00%	62,962	4,444,490	42
2055	662,621	517,983	144,639	2.00%	61,727	4,506,217	43
2056	662,621	517,983	144,639	2.00%	60,517	4,566,734	44
2057	662,621	517,983	144,639	2.00%	59,330	4,626,064	45
2058	662,621	517,983	144,639	2.00%	58,167	4,684,231	46
2059	662,621	517,983	144,639	2.00%	57,026	4,741,257	47
2060	662,621	517,983	144,639	2.00%	55,908	4,797,166	48
2061	662,621	517,983	144,639	2.00%	54,812	**4,851,978**	49

Increased Crop Values – Low & High Scenarios

Year	Potato + wheat per acre	Potato + vegetable seed per acre	Increased revenue per acre	Discount rate	Present Value per acre	Cumulative Present Value per acre	Discount year	10% switch to seed (low)	50% switch to seed (high)
2012	5,003	5,003	0	0.00%	0	0	0	0	0
2013	-62	0	62	0.00%	62	62	1	3,741	18,707
2014	-62	1,005	1,068	0.00%	1,068	1,130	2	67,802	339,011
2015	5,003	5,003	0	0.00%	0	1,130	3	67,802	339,011
2016	-62	0	62	0.20%	62	1,192	4	71,514	357,569
2017	-62	1,005	1,068	0.40%	1,047	2,238	5	134,308	671,542
2018	5,003	5,003	0	0.55%	0	2,238	6	134,308	671,542
2019	-62	0	62	0.70%	59	2,298	7	137,872	689,358
2020	-62	1,005	1,068	0.83%	999	3,297	8	197,817	989,087
2021	5,003	5,003	0	0.97%	0	3,297	9	197,817	989,087
2022	-62	0	62	1.10%	56	3,353	10	201,171	1,005,855
2023	-62	1,005	1,068	1.16%	940	4,293	11	257,599	1,287,995
2024	5,003	5,003	0	1.22%	0	4,293	12	257,599	1,287,995
2025	-62	0	62	1.28%	53	4,346	13	260,770	1,303,851
2026	-62	1,005	1,068	1.34%	886	5,232	14	313,939	1,569,697
2027	5,003	5,003	0	1.40%	0	5,232	15	313,939	1,569,697
2028	-62	0	62	1.46%	49	5,282	16	316,906	1,584,532
2029	-62	1,005	1,068	1.52%	826	6,108	17	366,476	1,832,379
2030	5,003	5,003	0	1.58%	0	6,108	18	366,476	1,832,379
2031	-62	0	62	1.64%	46	6,154	19	**369,223**	**1,846,113**
2032	-62	1,005	1,068	1.70%	762	6,916	20	414,950	2,074,748
2033	5,003	5,003	0	1.73%	0	6,916	21	414,950	2,074,748
2034	-62	0	62	1.76%	42	6,958	22	417,498	2,087,492
2035	-62	1,005	1,068	1.79%	710	7,668	23	460,095	2,300,474
2036	5,003	5,003	0	1.82%	0	7,668	24	460,095	2,300,474
2037	-62	0	62	1.85%	39	7,708	25	462,461	2,312,304
2038	-62	1,005	1,068	1.88%	658	8,366	26	501,932	2,509,660
2039	5,003	5,003	0	1.91%	0	8,366	27	501,932	2,509,660
2040	-62	0	62	1.94%	36	8,402	28	504,117	2,520,583
2041	-62	1,005	1,068	1.97%	606	9,008	29	540,499	2,702,495
2042	5,003	5,003	0	2.00%	0	9,008	30	540,499	2,702,495
2043	-62	0	62	2.00%	34	9,042	31	542,524	2,712,620
2044	-62	1,005	1,068	2.00%	567	9,609	32	576,517	2,882,584
2045	5,003	5,003	0	2.00%	0	9,609	33	576,517	2,882,584
2046	-62	0	62	2.00%	32	9,640	34	578,425	2,892,125
2047	-62	1,005	1,068	2.00%	534	10,174	35	610,457	3,052,286
2048	5,003	5,003	0	2.00%	0	10,174	36	610,457	3,052,286
2049	-62	0	62	2.00%	30	10,204	37	612,255	3,061,276
2050	-62	1,005	1,068	2.00%	503	10,707	38	642,440	3,212,199
2051	5,003	5,003	0	2.00%	0	10,707	39	642,440	3,212,199
2052	-62	0	62	2.00%	28	10,736	40	644,134	3,220,672
2053	-62	1,005	1,068	2.00%	474	11,210	41	672,578	3,362,890
2054	5,003	5,003	0	2.00%	0	11,210	42	672,578	3,362,890
2055	-62	0	62	2.00%	27	11,236	43	674,175	3,370,873
2056	-62	1,005	1,068	2.00%	447	11,683	44	700,978	3,504,888
2057	5,003	5,003	0	2.00%	0	11,683	45	700,978	3,504,888
2058	-62	0	62	2.00%	25	11,708	46	702,482	3,512,412
2059	-62	1,005	1,068	2.00%	421	12,129	47	727,739	3,638,697
2060	5,003	5,003	0	2.00%	0	12,129	48	727,739	3,638,697
2061	-62	0	62	2.00%	24	12,153	49	**729,157**	**3,645,786**

Reduced habitat restoration obligation costs

Area	Acres that count towards obligation	Abated cost to restore habitat
DD3 & DID17	34.27	$6,114,848.78
All other districts	18.03	$3,218,452.32
Total benefit	52.30	$9,333,301.10

Based on a per-acre cost of wetland habitat restoration for the state of Washington of $178,457

Reduced Dredging Costs – Low & High Scenarios

2000 yds, $60/yd

Dredging every 10 years

Year	Cost of dredging	Discount rate	Present Value	Cumulative Present Value	Discount year
2012	0	0.00%	0	0	0
2013	0	0.00%	0	0	1
2014	0	0.00%	0	0	2
2015	0	0.00%	0	0	3
2016	0	0.20%	0	0	4
2017	0	0.40%	0	0	5
2018	0	0.55%	0	0	6
2019	0	0.70%	0	0	7
2020	0	0.83%	0	0	8
2021	120,000	0.97%	110,015	110,015	9
2022	0	1.10%	0	110,015	10
2023	0	1.16%	0	110,015	11
2024	0	1.22%	0	110,015	12
2025	0	1.28%	0	110,015	13
2026	0	1.34%	0	110,015	14
2027	0	1.40%	0	110,015	15
2028	0	1.46%	0	110,015	16
2029	0	1.52%	0	110,015	17
2030	0	1.58%	0	110,015	18
2031	120,000	1.64%	88,095	**198,110**	19
2032	0	1.70%	0	198,110	20
2033	0	1.73%	0	198,110	21
2034	0	1.76%	0	198,110	22
2035	0	1.79%	0	198,110	23
2036	0	1.82%	0	198,110	24
2037	0	1.85%	0	198,110	25
2038	0	1.88%	0	198,110	26
2039	0	1.91%	0	198,110	27
2040	0	1.94%	0	198,110	28
2041	120,000	1.97%	68,152	266,262	29
2042	0	2.00%	0	266,262	30
2043	0	2.00%	0	266,262	31
2044	0	2.00%	0	266,262	32
2045	0	2.00%	0	266,262	33
2046	0	2.00%	0	266,262	34
2047	0	2.00%	0	266,262	35
2048	0	2.00%	0	266,262	36
2049	0	2.00%	0	266,262	37
2050	0	2.00%	0	266,262	38
2051	120,000	2.00%	55,434	321,696	39
2052	0	2.00%	0	321,696	40
2053	0	2.00%	0	321,696	41
2054	0	2.00%	0	321,696	42
2055	0	2.00%	0	321,696	43
2056	0	2.00%	0	321,696	44
2057	0	2.00%	0	321,696	45
2058	0	2.00%	0	321,696	46
2059	0	2.00%	0	321,696	47
2060	0	2.00%	0	321,696	48
2061	120,000	2.00%	45,475	**367,171**	49

Dredging Every 5 years

Year	Cost of dredging	Discount rate	Present Value	Cumulative Present Value	Discount year
2012	0	0.00%	0	0	0
2013	0	0.00%	0	0	1
2014	0	0.00%	0	0	2
2015	0	0.00%	0	0	3
2016	120,000	0.20%	119,045	119,045	4
2017	0	0.40%	0	119,045	5
2018	0	0.55%	0	119,045	6
2019	0	0.70%	0	119,045	7
2020	0	0.83%	0	119,045	8
2021	120,000	0.97%	110,015	229,059	9
2022	0	1.10%	0	229,059	10
2023	0	1.16%	0	229,059	11
2024	0	1.22%	0	229,059	12
2025	0	1.28%	0	229,059	13
2026	120,000	1.34%	99,598	328,657	14
2027	0	1.40%	0	328,657	15
2028	0	1.46%	0	328,657	16
2029	0	1.52%	0	328,657	17
2030	0	1.58%	0	328,657	18
2031	120,000	1.64%	88,095	**416,752**	19
2032	0	1.70%	0	416,752	20
2033	0	1.73%	0	416,752	21
2034	0	1.76%	0	416,752	22
2035	0	1.79%	0	416,752	23
2036	120,000	1.82%	77,837	494,589	24
2037	0	1.85%	0	494,589	25
2038	0	1.88%	0	494,589	26
2039	0	1.91%	0	494,589	27
2040	0	1.94%	0	494,589	28
2041	120,000	1.97%	68,152	562,742	29
2042	0	2.00%	0	562,742	30
2043	0	2.00%	0	562,742	31
2044	0	2.00%	0	562,742	32
2045	0	2.00%	0	562,742	33
2046	120,000	2.00%	61,203	623,945	34
2047	0	2.00%	0	623,945	35
2048	0	2.00%	0	623,945	36
2049	0	2.00%	0	623,945	37
2050	0	2.00%	0	623,945	38
2051	120,000	2.00%	55,434	679,379	39
2052	0	2.00%	0	679,379	40
2053	0	2.00%	0	679,379	41
2054	0	2.00%	0	679,379	42
2055	0	2.00%	0	679,379	43
2056	120,000	2.00%	50,208	729,587	44
2057	0	2.00%	0	729,587	45
2058	0	2.00%	0	729,587	46
2059	0	2.00%	0	729,587	47
2060	0	2.00%	0	729,587	48
2061	120,000	2.00%	45,475	**775,062**	49

Reduced Costs for Future Stakeholder Relationship Building

Year	Value of social capital spillover effects	Discount rate	Present Value	Cumulative Present Value	Discount year
2012	0	0.00%	0	0	0
2013	25,000	0.00%	25,000	25,000	1
2014	0	0.00%	0	25,000	2
2015	25,000	0.00%	25,000	50,000	3
2016	0	0.20%	0	50,000	4
2017	25,000	0.40%	24,506	74,506	5
2018	0	0.55%	0	74,506	6
2019	25,000	0.70%	23,809	98,315	7
2020	0	0.83%	0	98,315	8
2021	25,000	0.97%	22,920	**121,234**	9
2022	0	1.10%	0	121,234	10
2023	0	1.16%	0	121,234	11
2024	0	1.22%	0	121,234	12
2025	0	1.28%	0	121,234	13
2026	0	1.34%	0	121,234	14
2027	0	1.40%	0	121,234	15
2028	0	1.46%	0	121,234	16
2029	0	1.52%	0	121,234	17
2030	0	1.58%	0	121,234	18
2031	0	1.64%	0	121,234	19
2032	0	1.70%	0	121,234	20
2033	0	1.73%	0	121,234	21
2034	0	1.76%	0	121,234	22
2035	0	1.79%	0	121,234	23
2036	0	1.82%	0	121,234	24
2037	0	1.85%	0	121,234	25
2038	0	1.88%	0	121,234	26
2039	0	1.91%	0	121,234	27
2040	0	1.94%	0	121,234	28
2041	0	1.97%	0	121,234	29
2042	0	2.00%	0	121,234	30
2043	0	2.00%	0	121,234	31
2044	0	2.00%	0	121,234	32
2045	0	2.00%	0	121,234	33
2046	0	2.00%	0	121,234	34
2047	0	2.00%	0	121,234	35
2048	0	2.00%	0	121,234	36
2049	0	2.00%	0	121,234	37
2050	0	2.00%	0	121,234	38
2051	0	2.00%	0	121,234	39
2052	0	2.00%	0	121,234	40
2053	0	2.00%	0	121,234	41
2054	0	2.00%	0	121,234	42
2055	0	2.00%	0	121,234	43
2056	0	2.00%	0	121,234	44
2057	0	2.00%	0	121,234	45
2058	0	2.00%	0	121,234	46
2059	0	2.00%	0	121,234	47
2060	0	2.00%	0	121,234	48
2061	0	2.00%	0	121,234	49

APPENDIX B. FOCUS GROUP MATERIALS

AGENDA

Fisher Slough Technical Stakeholders Meeting
July 24, 2012, 1:00 to 3:30 pm
Dike District #3 Bldg, Conway

1:00 Introductions *(Kris Knight, TNC)*

1:10 Purpose of the Meeting (Polly Hicks, NOAA)

1:15 Expected Outcomes and Agenda Overview (Lisa Dally Wilson)

1:20 Project Update and Status (Kris Knight, TNC)

1:40 Identification of Benefits or Improvements resulting from Fisher Slough Project *(All)*

- Identify benefits/improvements
- Dot Exercise - Rank benefits/improvements

2:15 Break

2:25 Results of Ranking - Quantify Benefits/Improvements (All)

2:45 Q&A and Discussion

3:00 Meeting Adjourned (Kris Knight)

3:00- 3:30 Please feel free to stay for one on one discussions – Assist us with Ground Truthing Flood Impacts and Project Benefits

Expected Outcomes

1. Understand benefits or improvements the local community is experiencing from the Fisher Slough Project
2. Understand which of these benefits are most important to the community if we were to do another project of this type in the area
3. Provide our partners with a status update on the project
4. Provide an opportunity for Q&A to our partners and clarify results of the project

Summary of Stakeholder Meeting Minutes

- **Direct benefits of new infrastructure for farmers**
  - Better drainage on neighboring farmland.
  - Reduced overtopping of levees. So far the levees have worked quite well.
  - Increase of 250 acre-feet of flood storage.
  - Reduced sediment excavation from big fisher creek. Previously needed to be completed every 10 years.
  - Reduced erosion at outflow of the levee; reduced need for riprapping.
  - Box culvert is no long prone to washout and other failures.
  - Reduced electricity energy costs to power water pumps since water moves better on its own now.
  - More storage capacity for irrigation.
- **Broader impacts of the project**
  - Brought People together
  - Regulatory predictability of TFI mitigation credits.
  - Gave a market to undesirable land.
  - Reduced traffic problems for small parcels of land.
  - Siphons are now more fish friendly, leading to regulatory certainty.
  - Built attitude of teamwork, group problem solving.
  - Helping fundamental drainage of water away from Mt. Vernon.
  - Proactive rather than reactive approach to problem solving now predominant.
- **Jobs**
  - Project used a contractor from Burlington so jobs stayed in the community.
- **Costs**
  - If not for this project the districts did not know how they could afford repairs and replacements, such as the box culvert.
  - Less administration (i.e., permitting, etc.) through this project than would have otherwise been required.
- **Negative impacts**
  - Loss of privacy.
  - Loss of farmland.
  - Increased kayakers and other recreational users in the area.
  - Better access for others that don't live nearby to use the land.
- **Quotes**
  - "The dike is pretty damn good"