Economic Support for the Elwha River Watershed: Final Economic Characterization Report with Monitoring Recommendations

Prepared for

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Prepared by

Battelle
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Executive Summary

In preparation of the planned 2009 removal of two dams on the Elwha River located on the Olympic Peninsula in Northwest Washington, the National Oceanic and Atmospheric Administration (NOAA) Coastal Services Center (the Center) is working with the University of Idaho and the Lower Elwha Klallam Tribe to develop baseline data and a characterization of the lower Elwha River in order to support the long-term management of the resource by the Tribe and other stakeholders. As part of this effort, NOAA has contracted Battelle, through Photo Science, Inc., to carry out the economic research described in this report.

The U.S. Bureau of Reclamation, National Park Service (NPS) and Lower Elwha Klallam Tribe previously commissioned an economic study of the benefits and costs associated with Elwha River dam removal [Elwha Human Effects Team 1995]. This benefit-cost analysis, however, is now dated. Further, it focused primarily on a narrow set of fish-related benefits that could be readily quantified given varying assumptions regarding the scope of the project undertaken and its impact.

The purpose of the Battelle work is the characterization of the economic impacts associated with Elwha River dam removal and subsequent river restoration. The purpose of this document is to present recommendations for establishing the economic baseline and future monitoring, and to carry out the baseline recommendations though the documentation of data sets and information relating to: socioeconomics, input-output relationships measured using IMPLAN, property values, timber harvests, the Elwha fishery, tourism and travel spending, and the Lower Elwha Klallam Tribe.

The economic assessment of the outcome of the removal of the Elwha River Dams should be carried out consistent with an economic impact analysis (EIA) framework described in the literature review, with sufficient information to offer a comparison with the original economic analysis [Elwha Project Human Effects Team 1995] and to highlight the full impact on the Tribe. The baseline was defined as the full set of data from present, pre-dam removal, with trends that are likely to prevail whether the dams are removed or not. In all cases, wherever data are used within this report to define the baseline, the underlying data set, including all reports and maps will be delivered to NOAA. Future monitoring will consist of recapturing updated values of the same variables from the same sources, taking care to record any methodological changes in how the agencies keeping the data record and report the variables.

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Acronym and Abbreviation List

BCA	Benefit-cost analysis
BEA	Bureau of Economic Analysis
CEA	Cost Effectiveness Analysis
CERP	Comprehensive Everglades Restoration Plan
CV	Contingent Valuation
Corps	U.S. Army Corps of Engineers
DOI	Department of the Interior
EIA	Economic Impact Analysis
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
HEA	Habitat Equivalency Analysis
GAO	General Accounting Office
MBF	Million Board Feet
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NRRSS	National River Restoration Science Synthesis
OMB	Whitehouse Office of Management and Budget
OSE	Other Social Effects
RIMS	Regional Input-Output Modeling System Bureau
RVM	Replacement Value Method
USDA	Department of Agriculture
WRC	Water Resources Council
WTA	Willingness to Accept
WTP	Willingness to Pay

1.0 Introduction

In preparation of the planned 2009 removal of two dams on the Elwha River located on the Olympic Peninsula in Northwest Washington, the National Oceanic and Atmospheric Administration (NOAA) Coastal Services Center (the Center) is working with the University of Idaho and the Lower Elwha Klallam Tribe to develop baseline data and a characterization of the lower Elwha River in order to support the long-term management of the resource by the Tribe and other stakeholders. As part of this effort, NOAA has contracted Battelle, through Photo Science, Inc., to carry out the economic research described in this report.

The U.S. Bureau of Reclamation, National Park Service (NPS) and Lower Elwha Klallam Tribe previously commissioned an economic study of the benefits and costs associated with Elwha River dam removal [Elwha Human Effects Team 1995]. This benefit-cost analysis, however, is now dated. Further, it focused primarily on a narrow set of fish-related benefits that could be readily quantified given varying assumptions regarding the scope of the project undertaken and its impact.

The purpose of the Battelle work is the characterization of the economic impacts associated with Elwha River dam removal and subsequent river restoration. The purpose of this document is to present recommendations for establishing the economic baseline and future monitoring, and to carry out the baseline recommendations though the documentation of data sets and information relating to: socioeconomics, input-output relationships measured using IMPLAN, property values, timber harvests, the Elwha fishery, tourism and travel spending, and the Lower Elwha Klallam Tribe.

The remainder of this document is broken into two major sections: the literature review (Section 2) and the baseline assessment (Section 3). Section 4 contains a bibliography of documents referenced and reviewed in compiling this report.

2.0 Literature Review

The purpose of this literature review is to build up an information base from which to draw recommendations for the baseline economic assessment and monitoring of the Elwha River restoration project. Section 2.1 details the project's existing economic study and provides sufficient documentation to broadly characterize the project. Section 2.2 covers guidance from Federal and other sources on economic analysis relevant to dam removal. Finally, Section 2.3 contains a limited overview of economic analysis carried out in support of river and other environmental projects from which lessons can be drawn to inform the Elwha economic baseline and monitoring recommendations.

2.1 The Elwha River Project

A number of documents have been produced that characterize the Elwha River dam removal and river restoration project and alternatives with a high degree of detail. Rather than attempting to reproduce all of the details, this section will provide a high level overview of the project and its documentation sufficient to inform the baseline economic characterization and future monitoring, with greater emphasis devoted to presenting the features of the existing economic analysis carried out in 1995 by the Elwha Human Effects Team.

There are two hydroelectric dams on the Elwha River: the 108-foot Elwha Dam, built 4.9 miles from the mouth of the river in 1911, and the 210-foot Glines Dam, built 13.4 miles from the river's mouth in 1925. The reservoir created by the Elwha Dam is known as Lake Alwell, and the reservoir created by the Glines Dam is Lake Mills. The dams restrict the indigenous anadromous fish populations to the lower 4.9 miles of the river, though historically they had access to the full 45 miles of the Elwha River and 100 miles of tributary streams now restricted by the dams. This is to the obvious detriment of the fish, but also to the detriment of the complex ecosystem the fish previously helped support, and the American Indian population that relied on the fish populations economically and spiritually. Under the Treaty of Point No Point signed in 1855, the Elwha Klallam ceded their native title to the land in exchange for the promise by the Federal Government of the United States of permanent rights to fishing, hunting, and gathering in their traditional areas. The construction of the Elwha Dam, just 56 years later, was a private effort on privately owned land but decimated the Klallam's ability to fish the river. The dam also failed during construction, sending forth flooding that damaged Indian homesteads.

In 1992, Congress passed the Elwha River Ecosystem and Fisheries Restoration Act (Public Law 102-495). This initiated the river restoration project and all of the study and planning documented in a series of environmental impact statements (EIS) prepared by the NPS in coordination with the U.S. Fish and Wildlife Service, Bureau of Reclamation, Bureau of Indian Affairs, U.S. Army Corps of Engineers, and the Lower Elwha Klallam Tribe.

The first EIS was completed in 1995 and evaluated the different alternatives for restoring the fisheries and ecosystem as mandated by Congress. The alternatives included installing fish passage measures on the dams, removing only the Elwha Dam and installing passage measures on the Glines Dam, removing only the Glines Dam and installing passage measures on the Elwha Dam, and the preferred alternative, which was removal of both dams [NPS 1995b]. These were each evaluated for impact relative to the "no action" case under which both dams remained without intervention to improve fish

passage. The EIS identifies the relevant fish species, their estimated recovery rates for each alternative, as well as the impacts on other aquatic and non-aquatic wildlife and vegetation. These impacts are considered not only in the context of the improved habitat that the majority of species are expected to experience after restoration, but also with respect to expected negative impacts associated with the construction activities—release of sediment and the loss of the habitat afforded by the reservoirs. Additionally, the EIS addresses impacts to safety, flooding, cultural resources, land use and recreation, and water quality. Water quality is a highly significant issue for the project because of the pent-up sediment retained behind the dams. The 1995 EIS deferred evaluation of alternatives for dealing with sediment to an implementation EIS to be completed after one of the overarching alternatives for restoration was chosen. The alternative chosen was the removal of both dams.

The implementation EIS [NPS 1996a and 1996b] addressed alternatives for the implementation of the removal of both dams. Some of the sediment removal and other alternatives were ruled out in initial review and described, but not extensively analyzed in the EIS. One alternative that was analyzed in the EIS but not chosen was to use a dredge and slurry technique, together with a pipeline to transport sediments to the Strait of San Juan De Fuca. This was expected to reduce the impact of sediment on water quality during the dam removal process. The preferred alternative, which was chosen, was to allow the river to naturally erode the sediments, with the rate of erosion controlled by the rate of the dam removal. The implementation EIS also covers the mitigation efforts that will be undertaken to maintain flood risks at current levels, preserve water quality and availability for a variety of water users, and mitigate the impacts of rising ground water on septic systems.

A notice was issued in 2002 [NPS 2002] of the intention to prepare a supplemental EIS because the continued study of the restoration project mitigation alternatives, along with local project-related changes, had led to the conclusion that different alternatives would be preferable to those described in the 1996 EIS. The changes since 1996 include the closing down of one of the industrial water customers, the listing of two additional fish species as threatened, growth in population, and changes in the feasibility of recycling concrete from the Glines Dam. The supplemental EIS was completed in 2005 [NPS 2005b and 2005b]. These changes led to the decision to create a water treatment facility to remove sediment during the sediment erosion and a new permanent treatment facility, pursue surface water rather than an infiltration gallery, protect the Dry Creek Water Association's well field from flooding, connect the Elwha Heights Water Association to the Dry Creek Water Association, relocate the Tribal fish hatchery with the assurance that it has an adequate water supply, continue operation and assure water supply for the State fish rearing channel, raise the Federal levee and complete other flood protection measures, create a waste water collection and treatment system for the reservation, create an accessible hiking trail for observation of the dam removal and site, and purchase space to offset the impact of the loss of the reservoirs for the trumpeter swans [NPS 2005c]. The 2005 supplemental EIS also includes changes to the vegetation plan.

During the decision-making process while reviewing the alternatives for the first EIS for the Elwha River restoration, the Elwha Human Effects Team (the Team) carried out an economic analysis of the anticipated effects of the project, titled *Economic Analysis Final Technical Report* [1995]. The Elwha Human Effects Team was made up of analysts representing the Lower Elwha Klallam Tribe, NPS, and the U.S. Bureau of Reclamation. The analysis was carried out for a 100-year period, beginning with the anticipated initiation of dam removal and projected into the future. This time frame was the

maximum duration of a study allowable by the Water Resource Council's *Principles and Guidelines* [WRC 1983], an important source of guidance on economic analysis of water related projects.

The Team used a benefit cost analysis (BCA) framework for carrying out the analysis. In this type of economic analysis, the positive features of each alternative (the benefits) are carefully tabulated in conjunction with each alternative's negative features (the costs). The sources of benefit the Team identified included the positive impacts on the fisheries, the positive impact on shellfish, the positive impacts on recreation and tourism, the cost savings associated with reduced need to carry out maintenance at Ediz Hook, and the non-use or existence values associated with dam removal and river restoration (the value people place on knowing a specific natural setting is in good condition and available to future generations even though they do not intend to experience it first hand).

The methodology the Team used for calculating the benefits associated with fishery recovery was based on biological projections of the recovery of fish stocks, the schedule for allowed harvests, and the distribution of the harvests among sports fishermen, commercial Tribal fisheries (under treaty), and non-tribal commercial fisheries. The increase in value added that the catches represent to the commercial industries associated with fishing (fishers, processors, retail) all were calculated using assumptions for market harvest prices and price mark-ups at each stage in the production process. The value for sports fishermen was calculated based on anticipated participation and sports fisherman expenditures per day drawn from a survey.

Non-fishing recreation and tourism benefits were based on a survey that estimated the potential increase in visitation after the restoration is complete, as well as data that described the duration of trips, the type of lodging preferred (camping versus hotel), and typical spending per day, all assessed in the context of existing lodging capacity.

Ediz Hook, which provides import protection to the harbor at Port Angeles, is expected to benefit from the removal of the dams because sediment will be allowed to flow freely down the river rather than being impounded by dams. This would reduce the current requirement to replenish Ediz Hook artificially. The Team used the actual costs of the existing replenishment program to value the reduction in replenishment costs.

Non-use values were assessed by the Team based on a survey carried out to estimate how highly residents of Clallam County, the rest of Washington State, and the rest of the United States value the resource affected. This survey was carried out using a technique called contingent valuation (CV). This was the only non-market source of benefit considered in the economic analysis. When tabulated, it produced significantly larger values than any of the other sources of benefit.

The Team also assessed the magnitude of the economic impact associated with the direct project spending that would take place within Clallam County. This is not included in the BCA, but represented an important distributional feature of the project. Another important distributional feature of the project is how it will benefit the regional Native American population beyond the Tribal Treaty commercial fishery income, in particular the Lower Elwha Klallam Tribe. The benefits to the Tribe associated with the fisheries are relatively easy to measure, but do not capture the enormity of the benefit to the Tribe, who place tremendous cultural and spiritual importance on the river, its fish, and the historic sites inundated by the dams' reservoirs. The Team described the adverse economic conditions

of the Tribe relative to the general Clallam County population and Washington State population, characterized the importance of the river and fish to the Tribe, and detailed the history of the Tribe's interaction with the U.S. government and American settlers including the building of the dams.

The costs identified in the Team's analysis include the direct construction costs, the loss of electrical power generation, and costs of flood mitigation (which were included within the construction costs). The cost of mitigation efforts in the implementation and supplemental EISs for local municipal and industrial water, septic systems, and flooding, were not known to the Team. Like the original flood mitigation costs, these additional project mitigation costs would be considered direct costs of the dam removal and river restoration project categorically considered with the construction costs. The Team relied on estimates of these costs for other project documentation that were generally engineering oriented.

Overall, the findings were that benefits significantly out-weighed the costs for removal of both dams over the range of discount rates used to estimate net present values. This was not the case for any of the other alternatives. The result was largely driven on the benefits side by the inclusion of the non-use values.

2.2 Guidance on Economic Analysis and Environmental Economic Analysis

Most of the guidance informing how economic studies for government projects and programs are carried out deals with assessing costs and benefits that will accrue in the future if the project or program moves forward—before decisions are made as to which alternatives for the project will be pursued or whether the project will proceed at all. While the economic monitoring of the Elwha River project entails assessing the actual impacts after the project moves forward, the scope of the economic impacts considered in the a priori studies are similar to those that should be considered here.

Reviewing guidance on economic analyses assures that the appropriate scope of the impacts is considered. While the review of sources that follows does not attempt to account for every possible source of guidance on economic analysis, it is a broad subset of the body of literature on economic analysis produced at the Federal level (2.2.1) and other sources (2.2.2), both of which are built up from and heavily reference a significant body of academic literature. It could be interpreted as a collection of recommendations considered best practices for performing economic analyses. Because this is a relatively rare study that is concerned with actual impacts rather than anticipated impacts, it is necessary in some instances to adapt some of this guidance. With that noted, the literature reviewed for this study did contain numerous useful concepts that led the research team to the methodology proposed in Section 3.2 of this report.

The literature reviewed for this study suggests that the economic costs associated with dam removal are complex and difficult to define. The cost components that are typically well understood and defined are those associated with explicit dam removal and the loss of hydropower; however, there are other costs that should be examined, including sediment removal, site stabilization and restoration, site management, water rights issues, loss of agricultural profitability, municipal and industrial water usage issues, negative impacts on inland navigation, and reduced flood control [WRC 1983].

The concept of total economic value is also stressed within the literature, leading the research team to the conclusion that in addition to direct use values, economic monitoring should also include the consideration of data to support the assessment of indirect use, non-use and intrinsic values [Elwha Project Human Effects Team 1995 and EPA 2000]. The data required to support the analysis of direct use values are outlined in Sections 3.3-3.9 of this report. To capture non-use values, an updated CV survey or the collection of CV studies to support benefit transfer analysis is recommended.

When performing an economic assessment of dam removal, experience indicates that what may originally be considered a benefit may actually result in a cost to society [NOAA 2000]. For example, when draining a reservoir the gain in developable land may be offset by the reduced property values associated with the loss of lakefront property. Another example is the lost recreational value associated with draining reservoirs, which are often popular boating and swimming destinations. When considering the impact of dam removal projects on tourism and recreation, it is important to capture these negative impacts as well as the beneficial ones associated with enhanced fishing, bird watching, hiking, and other benefits related to eco tourism.

The studies reviewed for this report document numerous methods for evaluating economic impacts, including benefit-cost analysis, cost effectiveness analysis, economic impact analysis (EIA) and equity assessments. While benefit-cost analysis is effective in determining the overall societal impact of dam removal, EIA would examine both the economic impact and the distributional effects of the Elwha River restoration project, including transfer payments. Thus, the research team recommends using an EIA framework consistent with the guidelines issued by the EPA in its *Guidelines for Preparing Economic Analyses* [EPA 2000]. The EIA method would offer a more thorough assessment of the economic impacts of Elwha River dam removal on the local community and would address questions surrounding who benefits and who bears project-related costs.

In practice, the data requirements associated with any of the economic methods outlined in the previous paragraph are extensive but similar. When capturing baseline data, it is not enough to simply capture a snapshot in time. To form a more complete picture of local economic conditions, trends unrelated to dam removal (e.g., exurbanization of Seattle, aging of the population, decline of the timber industry) must also be considered (EPA 2000 and OMB 2003). Thus, we have attempted to identify and explore these trends whenever feasible in both qualitative and quantitative terms, while reviewing sources of the trends and documenting relevant connections. It is also essential that when capturing data in the future, any methodological changes in how agencies record and report data should be identified and factored into the analysis.

At its heart, economics is the science of choosing. It is not constrained to the domain of business and finance, but extends to everyone trying to make the best of limited resources. This broad view of the role of economics is consistent with both practice and literature, including the Federal and other guidance documents reviewed later in this section. Economic analysis can be applied to most, if not all, instances of Federal decision making, including those related to environmental quality, health and well being, and safety and risk. The reports detailed in Sections 2.2.1 and 2.2.1 provide guidance on how best to apply economic analysis to Federal decision making. This guidance formed the foundation upon which the methodology outlined in Section 3.2 was built.

2.2.1 Federal Guidance

A variety of sources in the Federal Government produce specific recommendations, guidance, and requirements governing how their staff and contractors conduct economic analyses to inform decision making. This section reviews the guidance and literature from several Federal agencies deemed to be relevant to the restoration of the Elwha River. These include the Environmental Protection Agency (EPA), the Whitehouse Office of Management and Budget (OMB), the Department of the Interior (DOI) NPS, DOI Bureau of Reclamation (Reclamation), NOAA, and the WRC.

The EPA has produced one of the most comprehensive sets of guidelines on environmental economic analysis, *Guidelines for Preparing Economic Analyses* [EPA 2000]. The creation of this document was "part of a continuing effort by the EPA to develop improved guidance on the preparation and use of sound science in support of the decision making process" [EPA 2000]. As this statement implies, the emphasis in the document is on forward looking analysis that anticipates policy/project effects to inform decision making, much in the way the original Elwha River project economic analysis did [Elwha Project Human Effects Team 1995]. However, as stated at the beginning of Section 2.2, there is considerable value in looking at the scope and treatment of the anticipated impacts in forward looking analysis to inform the scope and treatment of actual impacts for future monitoring. Additionally, establishing a baseline upon which those policy or project impacts reflect is central to both types of analysis.

EPA lays out three general, common frameworks for economic analysis—benefit-cost analysis (BCA, also commonly referred to as cost-benefit analysis), economic impacts analysis (EIA), and equity assessment. These three frameworks are very closely related and can overlap considerably in practice. The purpose of BCA is to collect all of the positive implications of a policy or project (benefits) to be weighed against any direct costs and other negative implications of the project (costs). This allows an analyst to demonstrate whether or not the program being analyzed creates value for society (benefits outweigh costs) or destroys value (costs outweigh benefits) by calculating the net benefits. Explicitly left out of BCA are transfer payments (a direct redistribution of wealth from one party to another) which can be considered to cancel out from the societal point of view (one party benefits for the transfer at the identical magnitude of expense of the other).

The difference between BCA and EIA is that EIA is more specifically used to examine the distributional impact of a policy—meaning the detail as to who benefits and who bears costs from the project are examined, including all gains and losses and transfer payments. Similarly, an equity assessment looks at the economic impacts on specific segments of the population, typically those who are considered disadvantaged. In both the EIA and the equity assessment, there may be transfer payment or qualitative impacts that would not be captured in the BCA. In practice, the differences between EIA and BCA are subtle, and many analyses carried out as BCAs contain most of the data needed to also construct an EIA by this definition. Because of the policy concern for local economic effects in the Elwha River Restoration project, some of which (such as increases in the visitor industry) may represent economic transfers from other regions and would not be considered in a BCA, EIA is the most relevant framework for addressing the Elwha River Restoration project, noting that the types of groups represented in an equity assessment should be included among the other groups considered in the EIA.

All three frameworks require defining a baseline, a matter on which the EPA document offers specific guidance. The short definition of the baseline given is "reality in the absence of the regulation" or

project [EPA 2000, p21]. EPA advises that creating a clear statement of the question the economic analysis is trying to answer will enhance understanding of what will need to be captured in the baseline. EPA also advises that the level of detail and analytical efforts that go into specifying the baseline should be appropriate for the task—meaning that effort should not be expended in carefully treating variables that it is known will not change if the policy or project goes through. Other points noted in the document include the importance of using a consistent baseline throughout an analysis, clearly establishing a "starting point" for the change being analyzed, letting the duration of the benefits and costs drive the time period considered for the analysis, and, finally, being as explicit as possible about areas for which uncertainty may be present in the baseline. In forward-looking analyses, this uncertainty may be due to the reliance on forecasts of future conditions, though incomplete or potentially biased information could lead to uncertainty in an analysis based in the present.

The EPA document spends considerable time detailing how costs and benefits should be gathered and treated, relevant to all three of the frameworks of analysis described. Beginning with the costs, for the most part EPA is more focused on pollution-related regulations than physical projects and programs, and as such their list of cost categories reflects this. These include:

- Compliance costs, including up front and ongoing costs of meeting the regulation
- Regulatory costs for the government including administrative, enforcement, and monitoring costs
- Losses in consumer and producer surplus associated with increases in prices or decreases in outputs
- Transition costs associated with a reallocation of resources due to incentives created by the regulation
- Indirect costs including impacts on productivity, innovation, and quality of products

While the Elwha River project will not explicitly produce compliance costs in the way that an environmental regulation governing industry practices or technology would, there are in this case equivalent direct costs of demolition and mitigation associated with the river restoration. Some of these may also be considered to spill into the regulatory cost category as well. The other categories translate more directly, with the main source of loss in consumer and producer surplus coming from the loss of power output from the dams. Consumer surplus describes the amount of value consumers place on goods and services above and beyond what they explicitly had to pay for them. Likewise, producer surplus represents the value for each unit sold above and beyond the incremental costs (this is related to profit, but distinct from it due to the impact of fixed costs on short run profits which would be outside the calculation of surplus).[1] Transition costs would take the form of costs associated with the reallocation of resources away from uses supported by the dams to uses supported by the restored river. Indirect costs may take the form of things like increased seasonal traffic congestion in Port Angeles associated with increased tourism to the region and the burden this could impose on local residents and industry.

[1] Sometimes direct measures of value to consumers or producers other than surplus are used in economic analysis. Often this is because insufficient data exist to precisely calculate the surpluses. For instance, the original Elwha River restoration BCA measures what the increased fishery yield would be worth to commercial fishers, processors, and retailers.

Moving on to benefits, the document describes two significant challenges—the first is that projects and policies can produce many benefits, requiring that the analysis be carried out "effect by effect" rather than holistically [EPA 2000, 59]. The second challenge stems from the need to assign monetary values to as many of the benefits ascribed to a policy or program as possible (so that they can be compared directly to costs and compared to other sources of value), though they may not have explicit market prices that can be used to value them. A variety of techniques exist to estimate these monetary values, but the actual challenge is that the cost of efforts required often exceeds the resources available to individual economic analyses to estimate them. This leads to a reliance on benefits transfer, the practice of adapting previously estimated values for an environmental feature in an economic analysis from other studies, even though those values were not estimated specifically for that feature and may require considerable adjustment for local circumstances. This is also common in economic analyses of safety and health. Both issues—the need for effect by effect analysis and the need to estimate values for environmental features—are relevant for the Elwha River study.

The effect-by-effect approach detailed by EPA had three primary steps, taken in the following order:

- Identification of benefit categories
- Quantification of significant physical effects
- Estimation of the value of the effects

These steps would be slightly different with respect to the differing focus of the Elwha project. Because there will be a significant direct economic impact associated with the physical effects, beyond a health or purely environmental quality effect, an intermediate step in between the second and third steps could be added for identifying relevant economic impacts. Otherwise, the final step could be interpreted broadly to include both aspects.

EPA warns that the effect-by-effect approach, improperly applied, can lead to double counting. Sometimes effects may overlap significantly and assigning the full value of the outcome to each effect could lead to an overstatement of benefits. In some cases a more aggregated approach may be necessary within the effect-by-effect approach. For an example relevant to river restoration, if someone takes a trip to the Elwha river to fish one day and to hike and observe wildlife a second day, attributing all of the value of their trip to improved fishing when considering the benefits of the effects on fisheries and then separately attributing it to the effects to other wildlife when treating the benefits of those effects would be an obvious case of double counting. Double counting is not always as obvious as in this example. For instance, sometimes a measurable benefit occurs, but it is not obvious whether the benefit is attributable to the project of interest. Tourism may increase in part because of population growth rather than any effects of the project. Likewise, when treating values within a broader EIA, as opposed to within a strict BCA, some double counting may be tolerated as the values are not intended to be aggregated for comparison in the same way. For instance, an EIA may want to report both the impact of effects on local employment and on local income—while these effects will overlap significantly, both can be reported within the same EIA as different ways of describing the level of well being and economic vitality of the community. What would be incorrect is to try to aggregate the two impacts as if they were independent.

The framework for environmental benefits described is built on the general environmental economic literature and begins primarily with the concept of willingness to pay (WTP) for an improvement in environmental conditions as the source of value for environmental commodities (and willingness to

accept (WTA) compensation for foregoing this improvement). This means that the value of the improved environmental feature is equal to the sum of what individuals would be willing to pay, if a market existed, to achieve that environmental feature. With respect to goods for which a market actually does exist, the marginal WTP is usually closely related to the actual price at which that good is sold. Many statistical and survey methodologies exist for uncovering this for goods that have no market—many are detailed in the EPA document, falling broadly into the two categories of revealed preference methods, where market data is used to statistically infer value for a non-market good, and stated preference methods, where individuals are surveyed using rigorous techniques. This focus on valuing environmental commodities in the EPA document does not imply that other economic features should not be considered, rather that for the scope of analysis typical for EPA that most of the benefits are of this type.

Table 1 presents a typology of environmental values, including direct use, indirect use, non-use and intrinsic values. These value categories in aggregate represent the total economic value of a natural resource. EPA identifies, consistent with the body of environmental economics literature, two main categories benefits fall into: use and non-use. Use benefits can entail direct and indirect benefits with the direct benefits being potentially market or non-market. Direct market benefits are the easiest to value because, as described in the previous paragraph, the market data can be the source for determining values. These benefits are comparable to those associated with commercial and sport fishing in the Elwha Project Human Effects Team's economic analysis [Elwha Project Human Effects Team 1995]. Direct non-market benefits can include things like recreational uses, where valued directly for themselves, rather than valued for the spending they generate for local economies. Non-use value can be categorized in a variety of ways—the EPA document suggests two: altruism and bequest value for future generations. Non-use value is what the CV survey presented in the Elwha Project Human Effects Team's economic analysis attempts to capture. A considerable body of literature exists that describes best practices for carrying out CV studies to value environmental features, including the recommendations of a panel of economists convened by NOAA [NOAA 1993]. While the method has had vocal critics, it, along with other survey methods, remains the only means for estimating nonuse and intrinsic values and support for the method, when carried out with the appropriate care, has steadily grown.

Table 1. Categories of Environmental Values[2]

(a) Direct use values: goods and services directly consumed by users
- Products (e.g., edible, ornamental, medicinal, inputs into production process)
- Recreation
- Waste assimilation
- Research
- Education

(b) Indirect use values: indirect benefits arising from ecological systems
- Biological support – links to other species and habitats
- Physical protection – coastal defense function
- Climate regulation
- Global life support – functions that aid in supporting life on Earth

(c) Non-use values
- Option value
- Existence value
  - Bequest motive
  - Stewardship motive
  - Benevolence motive

(d) Intrinsic value – organisms have a worth of their own regardless of usefulness to humans

While not specific to economic analysis of environmental projects, OMB has two important circulars that cover economic analyses. Circular A-4 covers regulatory analysis including BCA and cost effectiveness analysis [OMB 2003]. Circular A-94 is specific to BCA [OMB 1992]. These are useful to examine in that they provide a broader context for discussing benefits and costs than those in the EPA document. OMB suggests pursuing costs that include those "broader than private-sector production and compliance costs or government cash expenditures" and trying to assure that costs "reflect the opportunity costs of any resources used" (opportunity costs are the value that the resources being evaluated would have produced in their next-best alternative use) while ignoring sunk costs (uses for which the resources had previously been committed and are no longer subject to change—for example, the remaining financial depreciation on a road up the Elwha valley would be a sunk cost and would not be evaluated, while depreciation of a new road could be) [OMB 1992, p5]. OMB defines benefits at the social level, limiting it neither to private or government benefits. Like the EPA document, OMB's Circular A-4 supports WTP as the conceptual basis for benefits evaluation and reviews methods for valuing amenities and goods for which no market exists, including the practice of benefits transfer.

OMB identifies another form of economic analysis not considered in the EPA document—cost effectiveness analysis (CEA). CEA is only relevant for choosing among alternative projects that produce similar outcomes, and therefore is not a relevant framework for economic analysis of the Elwha River project moving forward. The OMB guidance states that BCA is the preferred method of analysis

[2] http://www.csc.noaa.gov/coastal/economics/envvaluation.htm

whenever there are different beneficial outcomes [OMB 2003, p12, and OMB 1992, p 3]. The document notes the importance of transparency, documentation, and reproducibility for any study or analysis, regardless of the specific framework used.

The OMB guidance also offers input on developing baselines. The basic formulation of the baseline parallels what the EPA suggests, in that it "should be the best assessment of the way the world would look absent the proposed action" [OMB 2003, p 15]. Among the suggestions for baseline development is that "changes in external factors affecting expected benefits and costs" need to be taken into account [OMB 2003, p 15]. This refers to underlying trends that are part of the dynamic status quo that could influence policy or program outcomes. These could include industry trends, population socioeconomic and demographic trends, or more direct physical changes. For instance, if a program is expected to spur economic growth in a local area, but the area was experiencing insignificant decline, that economic decline would be an important feature of the baseline. Exclusion of that type of external factor could lead to unrealistic expectations in a forward looking analysis, or significantly over or understated benefits in a monitoring situation.

Of a somewhat different character than the OMB or EPA guidance described above, NPS produces *Economic Impacts of Protecting Rivers, Trails, and Greenway Corridors, a Resource Book* [NPS 1995a]. What makes this publication different and potentially useful in building the recommendations for the economic monitoring of the Elwha River project is that it categorically documents the broader economic impacts of conservation projects. The purpose of this is to motivate individuals and groups to use economics in their conservation project planning and to illustrate the economic value of conservation projects. Below is a list of the economic impacts of conservation projects identified in the document:

- Increased property values
- Increased recreational expenditures by residents
- Commercial benefit
- Increased tourism
- Increased agency spending
- Corporate relocation and retention
- Public cost reduction

While the benefit of most of these impacts is obvious, one may demand more explanation than the others—increased agency spending. It is included on the list because increased agency spending creates jobs and supports businesses, similar to recreational spending by residents and tourism spending, which may be valid for an EIA, but would strictly represent a cost in BCA. NPS offers a framework for estimating the effects of spending focused on visitor expenditures. The framework presented, which is common to many sources on regional economic impact analysis, divides economic impacts into three categories that encompass the entire economic impact effect:

Direct Effects + Indirect Effects + Induced Effects = Total Economic Effects

NPS uses an example to illustrate the differences between the categories based on a sports fishing tourist visiting a river [NPS 1995a, p 6-3]. The sports fisherman purchases supplies which "may include food and beverage, fishing equipment, and gasoline for vehicles and boats" [NPS 1995a, p 6-4]. These purchases are the direct effect and may or may not all occur locally. Supplying the goods

for these purchases will require the suppliers to increase their input purchases, which in turn requires the input suppliers to purchase more resources, and so on in what NPS refers to as a "chain reaction" [NPS 1995a, p 6-4]. The aggregated chain reaction purchases are the indirect effect. Through the direct and indirect economic activity created, business owners and households earn additional profit and wages. The additional chain reaction of spending sparked by their expenditures of this additional income is the induced effects.

In the NPS framework, resident expenditures are treated differently than tourist expenditures because tourist expenditures represent an external injection of spending into the local economy that would not have taken place otherwise. Increases in local residents' recreation expenditures, on the other hand, may or may not be offset by decreases in other kinds of spending that would not have been made in the community (offsetting effects), and as such may only have an impact on the types of economic activity supported in the economy, rather than the overall volume of economic activity in the economy. The *Regional Multipliers, User Handbook for the Regional Input-Output Modeling System (RIMS II)* is produced by the Bureau of Economic Analysis (BEA) in support of their RIMS model which is one of many models that can be used to carry out regional economic impact analysis consistent with this framework. It contains an example using a shopping mall, which, while multi-county rather than directly local, can be used to illustrate this offsetting issue:

> *The use of a multi-county region can sometimes complicate the impact analysis because of offsetting effects. For example, suppose a new shopping mall in a county draws a large share of its shoppers from nearby counties, where they previously shopped. For the county with the mall, the impact on sales and sales tax revenues is substantial. However, for the multi-county region, the impact of the mall also reflects the offsetting declines in sales and sales tax revenues in the nearby counties, so the impact on sales and sales tax revenues is smaller than that for the county.* [BEA 1997, p 7]

Thus, if residents would have spent the money elsewhere in the relevant local economy (a different mall) prior to the project that economic impact is being considered for, the economic impact may be entirely offset. In the multi-county region, there would be a distributional effect relevant for EIA but not for BCA. This clearly has implications for the geographic scope of the analysis as well, which was the context in which the example was originally presented.

This issue also extends to agency or government spending. For example, local government spending may more closely resemble resident spending, while Federal and State spending may more closely resemble tourist spending where the funds are infused in the local economy from outside the region.

Other than RIMS, there are many models that use similar and related techniques to carry out these analyses. Many are based on input-output analysis that relates the outputs of each industry as inputs of all other industries in a matrix form. The input-output matrix can be manipulated to estimate multipliers which characterize for each dollar of direct spending what the resulting indirect and induced effects will be. These effects are often measured in changes in income, the number of jobs, or gross output. While this has continued to be a relevant framework for local analyses, it should be noted that both the EPA document referred to above and the OMB guidance warn against using multiplier analysis to support decision making. The EPA Guidelines section on preparing distributional analyses [EPA 2000] stresses the importance of a general equilibrium framework as the most appropriate for considering the aggregate economic impact of policies and projects (regional

multiplier models usually do not rely on reaching an economic equilibrium). This means a framework in which the effects of all of changes in an economy are considered, including substitution amongst different types of inputs for industry and price changes for inputs (including labor) and final goods. While local citizens may not be concerned if new investment occurs at the expense of some other region within the U.S., Federal investments should lead to an overall increase in the welfare of the nation.

The impacts of conservation projects not directly related to increased spending listed by NPS include increase in property values, corporate relocation, commercial use, and reduction in public cost. The corporate relocation is drawn due to green spaces and good natural amenities—this would have an impact on spending, income, and employment similar to the spending effects listed above. The government cost savings suggested by NPS represent the savings over allowing intense development of a natural area. The positive impact on property values creates wealth for current property owners and increases property taxes collected by local government. Commercial use impacts, which are expected to be significant for the Elwha project, include all of the value business gain from using the preserved or restored natural area. Some commercial use impacts could take the form of direct and indirect impacts related to tourism expenditures described above, but others could result when the natural area is an input for the firm—as would be the case of commercial fisheries.

Finally, the NPS document offers suggestions for valuing environmental amenities beyond the economic impacts detailed in the rest of the document. These mainly include the different sources of values as well as the different methods for estimation that were also detailed thoroughly in the EPA [2000] document and reviewed in the OMB document [2003].

NOAA's Office of Sustainable Fisheries has also produced relevant guidance for economic analysis relating to domestic fishers, *Guidelines for Economic Analysis of Fishery Management Actions* [NOAA, 2000]. This document lays out a four-step process for estimating the economic impacts of fishery regulations necessary for completing BCA for regulatory impact reviews. The four steps, with some modification, would also be relevant to removal of the Elwha dams, insofar as they affect fisheries. The first step consists of estimating the changes in prices and the quantity of activities including production, consumption, and fishing or observation trips associated with the fishery management regulation. The next requires estimating the change in revenues and operating costs associated with the regulation and biological changes. The third step estimates responses of fleet size and composition associated with the effects described in the first two steps and the regulation. The final step is a biological analysis of marine resource stocks. The last step is especially significant for the evaluation of non-use or existence values, which the guidelines state should be pursued, consistent with EPA [2000] and OMB [2003]. The other sources of value that are condensed out of the analysis are the producer surplus and use-related consumer surplus.

The Water Resources Council put forth the oldest guidance document considered here, *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies* [WRC 1983]. This document, also known as the P&G, is included because it was a reference point for the existing economic analysis of the Elwha River project [Elwha Project Human Effects Team 1995] and because, while it has not been updated in decades, it is still an important source of guidance for decision analysis for water projects, utilized in water resources project plans for the Army Corps of Engineers (Corps), Bureau of Reclamation, Tennessee Valley Authority, and Soil

Conservation Service. OMB Circular A-94 explicitly exempts "water resources projects (guidance for which is the approved Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies)" [OMB 1992, p 2] from its requirements regarding economic analyses.

The P&G calls for establishing four accounts to track values associated with a water resource project. These include the National Economic Development (NED), Environmental Quality (EQ), Regional Economic Development (RED), and Other Social Effects (OSE). The effects considered in the NED and RED relate directly to the economy, from the implicit perspective that the plans being evaluated help the economy through improving municipal and industrial water supplies, agriculture, urban flood damage, hydropower, inland navigation, deep draft navigation, recreation, fishing, or other direct benefits. The description of the RED account specifically references indirect and induced economic impacts [WRC 1983, p 11]. The P&G advises several techniques, also detailed in the EPA [2000], OMB [2003], and NPS [1995] documents, for evaluating WTP with respect to recreational opportunities in the NED account that may be gained or lost associated with a plan.

The EQ account is intended to capture impacts of the plans evaluated on "the ecological, aesthetic, and cultural attributes of natural and cultural resources" with these impacts being "described in terms of duration, frequency, location, magnitude, and other characteristics such as reversibility, retrievability, and the relationships to long-term productivity, where their description is useful to decision making" and their significance "established based on institutional, public, and technical recognition" [WRC 1983, pp 10-11]. The P&G notes that any value of environmental quality that can be monetized should be included in the NED account. However, the P&G fails to recognize existence or non-use values associated with environmental quality in any of the aforementioned four accounts – NED, EQ, RED and OSE. While the document, in detailing how to approach recreational opportunities within the NED account, presents techniques for valuing non-market goods that could also be used to capture non-use values, it was not common practice to consider non-use value in such analyses in 1983. The guidance on decision-making given in the P&G is that plans should be pursued that those "with the greatest net economic benefit consistent with protecting the Nation's environment" [WRC 1983, p v]. This reflects absence of explicit valuation of all environmental values, which otherwise could be reflected in the net economic value.

Department of the Interior Bureau of Reclamation (Reclamation) has produced *Economic Analysis of Dam Decommissioning* [DOI 2003], which heavily references the P&G [WRC, 1983]. It also discusses the evolution of incentives and priorities that occurred to bring about consideration of dam removal by agencies historically focused on building dams, such as the Army Corps of Engineers and Reclamation itself. The document highlights sources for this change including the aging of the dam structures and the vocal support for dam removal by Indian tribes and the environmental community, as well as commercial and sport fishers. The document also gives an overview of BCA, the P&G, and the relationship between BCA and economic impact statements (EIS) carried out to satisfy the National Environmental Policy Act (NEPA).

Among the most relevant features of the Reclamation document for this review are the categorization and description of the general impacts of dam removal. These are presented in parallel with the impact categories relevant for dam commissioning within the P&G context (with the conclusion that if P&G applies to dam commissioning it should apply to removal as well).

The categories specific to cost include: explicit dam removal costs, cost of sediment removal, cost of site stabilization and restoration, ongoing site management costs, costs relating to water rights, loss in agricultural profitability associated with reduced water availability, municipal and industrial (M&I) water usage issues, loss of hydropower, negative impact on inland navigation, and reduction in flood control (or cost for flood mitigation). For each of these categories, the document supplies practical measurement approaches as well as general methodology and estimation techniques. In many cases, the practical measurement approach involves calculating the cost of a substitute for the feature that was supplied by the dam. This is the case for agriculture, hydropower, M&I water, and navigation. Substitutes could involve investment in technology that improves efficiency in the use of the type of dam related resource. For instance, agricultural water users could not only switch to different water sources, but could also replace irrigation equipment with types that conserve more water. Including water rights issues in an analysis with direct agricultural and M&I water availability will over-count the impact of dam removal if the agricultural and M&I entities have water rights.

Reclamation identifies recreation as a source of value that overall could be a benefit or cost in an economic analysis of dam removal. This is because reservoirs may have distinct recreational attributes that would be lost with dam removal that would need to be considered along with the recreational opportunities afforded by the restored river. Recreational activities could include land or water based activities and may be either consumptive (hunting) or non-consumptive (hiking). Some of these recreational opportunities may be related to the fisheries in the form of sport fishing. In general, recreation uses can be market (with commercial operators) or non-market. The relevant benefit (or cost) for commercial operators is their change in profitability; the benefits to the people they serve can be measured using the market value of the services they consume. The values for non-market recreation can be estimated using the techniques described in the EPA [2000], OMB [2003], and other documents, which are also described in the Reclamation document.

The categories identified by Reclamation as potential benefits from dam removal include positive effects for land use, benefits to commercial and tribal fisheries, and non-use preservation benefits. The land use benefits stem from the creation of land associated with the draining of reservoirs, though this could be a mixed benefit if there are property owners who benefit from lakefront property who will be unable to benefit from river front property.

For assessing commercial fisheries, the document advises evaluating the change in profitability at the harvest level because the majority of the economic benefits accrue at the harvest level. Additionally, the document discusses assessing the impact to commercial fishing in the context of the existing capacity (sufficient or excess boats and crews), and geographic or species substitution in the harvest. Unless the projected changes in harvest represent a large percent of the overall supply, the changes in prices for the catch are expected to be trivial since commercial fishermen are generally considered to be price takers.

Tribal fisheries are identified as producing fish for four potential uses—commercial, subsistence, permits for non-tribe sport anglers, or ceremonial. Commercial harvests under tribal fishery rights can be valued the same way that non-tribal commercial fish harvests are, though they should be accounted for separately so it is clear what benefits accrue to the tribes. Reclamation suggests using the price of purchasing fish for consumption for valuing subsistence harvests. The benefits of non-tribe angler permits can be valued in terms of profitability to the tribe and consumer surplus to the anglers.

Ceremonial values are extremely difficult to estimate, and the document declines to offer suggestions for doing so.

NOAA's Coastal Ocean Program has produced *Science-Based Restoration Monitoring of Coastal Habitats* [NOAA 2005]. It was compiled to offer guidance for creating a monitoring plan when seeking funds for restoration, as called for under the Estuaries and Clean Waters Act of 2000. It is broken into two volumes. The first volume provides a framework for creating a monitoring plan, and the second volume, which contains a chapter on the human dimensions of restoration, focuses on tools and methodology for monitoring. The document is not offered up as a technical manual for practitioners, but rather as an account of "what one can measure during restoration monitoring, why it is important, and what information it provides" [NOAA 2005, p 1.3].

Chapter 14 focuses on the "human dimensions" of restoration, which is a collection of social science derived attributes of restoration projects. It identifies the following goals for restoration with respect to the human dimensions [NOAA 2005, p 14.13]:

- Recreation, tourism, and access
- Enhancement of investment in the community
- Enhancement of educational opportunities
- Protection/improvement of human health
- Protection of cultural and historic values
- Enhancement of aesthetic and other non-market values
- Reduction in property damage
- Enhancement of property value
- Improvement in economic activity
- Enhancement of transportation and trade
- Improvement to commercial fisheries and shellfisheries

These goals can be interpreted as sources of benefits for restoration projects. Many of these goals have been discussed in the other documents described in this section or are relatively straightforward. One not well described within this document is the enhancement of investment in the community. What this refers to is the opportunity for promoting volunteerism and community involvement potential through restoration projects.

This document acknowledges the importance of a baseline for a monitoring undertaking and defines a baseline as a "starting point against which future measures can be compared" [NOAA 2005, p 14.9]. They also offer guidance on attributing changes in the monitored variables to the restoration project, noting:

> *Caution should be used when attributing post-restoration changes in human dimensions parameters to the restoration project. Restoration practitioners should assess and, to the extent possible, quantify the influence of all other factors to determine the proportion of the observed changes attributable to the restoration project.* [NOAA 2005, p 14.11]

This is particularly problematic for a small project where "the actual impact, measured in fishery yields and tourist expenditures, may be very small in relation to all the other factors affecting these parameters (e.g., fishing regulations, weather, the economy, gas prices)" [NOAA 2005, p 14.11].

However, the example given that defines a "small" restoration project is the restoration of 25 acres of wetland. With respect to larger projects, which would include restoration of a watershed, they note:

> *Larger restoration projects are also susceptible to extraneous factors that may influence the parameters measured. However, on a larger scale, parameter estimates will generally be more precise and the probability of reaching an erroneous conclusion regarding causality should be greatly reduced.* [NOAA 2005, p 14.11]

The document goes on to offer guidance on survey data and monitoring parameters (e.g., number of marinas, boat slips, boat ramps, trail miles, commercial providers and infrastructure development in response to restoration programs) before addressing each of the goal areas (from the list above) in detail. The cultural and historic section recommends interviewing as a technique for capturing information and offers several important sources for value in this dimension, including subsistence. The NOAA document defines subsistence as follows:

> *The term "subsistence" is used to describe customary and traditional uses of renewable resources (i.e., food, shelter, clothing, fuel) for direct personal/family consumption, sharing with other community members, or for barter. Subsistence communities are often held together by patterns of natural resource production, distribution, exchange, and consumption which help maintain a complex web of social relations involving authority, respect, wealth, obligation, status, power, and security.* [NOAA 2005, p 14.37]

They also note that, "coastal resources can also be important for spiritual, religious, and ceremonial uses and for the continuity of maritime customs, traditions, folklore, and myth" [NOAA 2005, p 14.37].

The section on aesthetic and non-market values explores the concepts of use and non-use value, breaking non-use value down into existence and bequest value [NOAA 2005, p 14.41]. In the discussion of techniques for capturing these values, the document covers revealed preference methods and survey techniques also discussed in several of the other documents. This report, similar to other documents referenced here, does not examine measures for estimating non-use values in detail. Instead, it presents overviews of recognized environmental valuation techniques, including the travel cost method, random utility models, hedonic pricing method, and CV method. The economic activity section discusses economic impact analysis, consistent with those discussed in other parts of this section. It describes supporting the economic impact analysis with input-output models and multipliers, specifically mentioning the IMPLAN model

The Department of Interior Bureau of Reclamation's Economic s Resources and Planning Group has published *Valuation of American Indian Land and Water Resources: a Guidebook* [Hammer 2002]. This document seeks to address problems like those raised with respect to putting a dollar value on ceremonial uses of fish. Drafting the guidebook was "undertaken in response to concerns that the U.S. Bureau of Reclamation Environmental Impact Statements, Environmental Assessments, and other project assessments and proposals sometimes pay too little attention to the significance of land and water resources to American Indians" [Hammer 2002, p3]. This is a significant point because although there are sections of environmental assessments and EISs that consider impacts on cultural and archeological resources as well as Indian Trust Assets, water usage and economic activity on American Indian land are often not well defined or understood. The guidebook works through why valuing

environmental and cultural resources for American Indians is difficult for economists and suggests ways of dealing with this.

According to the guidebook, the problems with using conventional economic methods for placing a monetary value on Indian resources stem from tribal members' deeply felt religious and cultural beliefs relating to natural resources. Though some economists have speculated that Native American objections to these conventional methods were strategically motivated, the guidebook challenges this view, noting that strategic behavior would be evident if respondents purposely over- or under-stated values in an attempt to influence survey results. Thus, refusing to address the question was not viewed by the author as effective strategic behavior. Further, the guidebook cites "unitheism" or the sacredness and connectedness of all things as a common theme in American Indian beliefs that drives their objection to placing monetary values on aspects of the environment, including their lands. In effect, when surveyed according to conventional stated preference methods like CV, Indian people tend to find environmental features so highly valuable that any dollar number they could assign to them is too small. Economists cannot use this infinite valuation to perform trade off analyses across different uses of resources, which often leads in practice to using a zero value.

The guidebook offers three solutions—using a descriptive approach instead of valuation, using specific techniques to at least partially value the resources, and using administratively assigned values. First, fully describing the resources and the importance to the tribe can be enhanced using development and direct economic indicators such as Tribal poverty, health, per capita income, unemployment, and assets. Among the practices suggested in the guidebook for overcoming this issue with partial valuation, so that some culturally sensitive, reasonable input can be attributed to American Indian resource value in project assessments, are the replacement value method (RVM), habitat equivalency analysis (HEA), alternative stated preference methods, a revealed preference method using wage data for American Indians who choose not to live with their tribe, using the nonuse value obtained by stated preference of Non-American Indians value for American Indian environmental and cultural resources. All of these approaches have relative strengths and weaknesses. The third solution presented involves using any of the previous methods as a benchmark for an administrator or expert, someone trusted by the tribe, to assign values on their behalf so that they do not have to explicitly state dollar values themselves.

2.2.2 Other Sources of Guidance

The Heinz Center for Science, Economics and the Environment Panel on Economic, Environmental, and Social Outcomes of Dam Removal has produced a panel report entitled, *Dam Removal Science and Decision Making* [Graf 2002a]. The report covers a broad range of topics relevant for policy makers and researchers. These topics include reasons for dam building and removal, a census of dams and dams removed in the U.S., the Federal legal context for dam removal, the dam removal decision making process, and the physical, biological, economic, and social outcomes of dam removal. Some of the topics are in common with those covered in the Reclamation document on the economics of dam decommissioning [Reclamation 2003], though the Reclamation document offers significantly more depth on the economic analysis of dam removal. Additionally, the perspective of the Reclamation document is consistent with the broader role of economic analysis in describing many different types of resource impacts and outcomes, while some parts of the panel report separate economic considerations from social and other issues that might broadly be considered within the scope of economic analysis in the context of all of the guidance listed in the previous section [Graf 2002a, p 87]. The document also

displays some degree of relative pessimism about the practice of monetizing the impacts of environmental outcomes in contrast to the perspectives of the documents in the previous section [Graf 2002a, p 174], though it does describe the same various methods for performing valuation studies.

Among the reasons listed in the panel report for dam removal are structural obsolescence, safety and security, obsolescence of purpose, recreational opportunities, water quality, and ecosystem restoration. The adverse effects of dam removal listed include the direct costs of dam removal, the loss of dam services, any adverse environmental impacts including those related to sedimentation of the demolition of the dam, and the loss of aesthetic and historic values associated with the dam itself. The document details a step-by-step process for decision making with respect to dam removal that explicitly calls for data collection and monitoring afterward if dam removal is completed [Graf 2002a, p 79]. Part of the motivation for monitoring is to inform adaptive management, but it is also "essential to evaluate whether the goals and objectives of dam removal are met" [Graf 2002a, p 95].

The proceedings of the Heinz Center Dam Removal Research Workshop, *Dam Removal Research Status and Prospects* [Graf 2002b], also offer additional dam removal specific information. The proceedings examine research gaps, data and data needs, the relative lack of social science research to provide insights on the social perspectives, some of the economic benefits, the ecological effects, sediment management, and down stream hazards, preliminary monitoring results, and legal and regulatory requirements. Their discussion of monitoring is focused on direct water quality variables.

The discussion of the economic benefits of dam removal is focused on small dams, since of the 500 dams removed in the last 100 years in the U.S., the majority have been small. The report defines a small dam as one for which the removal decision and undertaking can be entirely handled by local entities. Researchers are looking to upcoming projects, including the removal of the Elwha dams, as important sources for data on larger projects. These benefits include relief from financial burdens and opportunities for economic growth associated with fishing, river recreation, community revitalization of riverfronts and the benefits to local business associated with the opportunities. Overall, though, the economic impact of dam removal is an area the proceedings highlight as one of the areas for which there is still a research gap. The proceedings note that there have not been studies that "actually look at post removal data to assess the impact on community, local business, or property value" [Graf 2002b, p 57].

The article by Whitelaw and MacMullan *A Framework for Estimating the Costs and Benefits of Dam Removal* [Whitelaw and MacMullan 2002] offers another perspective on economic analysis of dam removal projects. The purpose of the paper is to put forth a collection of principles "effective in assessing the economic consequences of environmental management decisions… then describe how those principles might be used for cost-benefit analysis" [Whitelaw and MacMullan 2002, p 724]. The six principles require consideration of both benefits and costs, both the positive and negative effects on jobs, distributional and equity considerations, rights and responsibilities of property owners and resource users, uncertainty and sustainability, and extending the analysis beyond the consideration of only salmon. These six principles were outlined in a letter to four governors of Pacific States and the premier of British Columbia by the primary author and other economists prior to the publication of this paper. The letter urged these leaders and members of their administrations "to consider the full range of economic consequences" when making decisions regarding salmon management [Whitelaw and MacMullan 2002].

The first two principles were emphasized as being of primary importance, and both are consistent with guidance for economic analysis considered in the previous section. The motivation for including the first principle, that both costs and benefits be considered, stems from the authors' observation that costs are frequently the main focus of economic analyses of environmental management decisions, which leads to reduced perception of the economic benefits.

The paper goes on to apply the principles to the lower Snake River dams, in the context of the economic analyses of breaching the dams completed by the Army Corps of Engineers in 1999 [Corps 1999]. In general, Corps economic analyses are expected to follow the WRC P&G, described in the previous section. Several of the authors' criticisms can be attributed to the age of the P&G as guidance, which fails to include non-use or existence values for natural resources and direct distributional consequences for marginalized populations. The authors also find that the Corps report overstates the negative impact on regional jobs by failing to take into account how the economy would adapt to the removal of the dams over time. As an example, the authors present the case of the northern spotted owl and how north western economies have adapted to the loss of jobs in the logging sector, replacing them with jobs in other sectors. Over all, the authors describe the Corps analysis based on the P&G guidance as describing "an extreme worst case scenario" [Whitelaw and MacMullan 2002, p 729].

2.3 Different Rivers and Other Projects

Analysis carried out for other rivers, such at the lower Snake River as mentioned in the previous section, represent an important potential reference point in considering the type and scope of economic analysis to be carried out longitudinally for the Elwha River project. Berhardt et al. [2006] presents an overview of ongoing river restoration work and the National River Restoration Science Synthesis (NRRSS) in *Synthesizing U.S. River Restoration Efforts* [Berhardt 2005]. The NRRSS has catalogued over 37,000 river restoration projects in its database. The most prevalent goals for these projects are reported to be enhanced water quality, management of riparian zones, improvement of in-stream habitat, improvement in fish passage, and bank stabilization. The NRRSS has found that only 58 percent of the projects had information on costs in the records used to fill in the database. Additionally, only 10 percent of projects reported any form of monitoring or assessment. The NRRSS has confirmed the U.S. General Accounting Office (GAO) assertion that "a comprehensive assessment of restoration progress… is not possible with the 'piecemeal' information currently available" [Berhardt 2005, p 637]. Despite the incompleteness or lack of data on many river projects, some documentation is available to inform the economic baseline and monitoring of the Elwha River project.

On the website maintained by Rhode Island Habitat Restoration, the costs of some environmental restoration projects are highlighted, including those related to salt marshes, seagrasses, and fish runs.[3] One project highlighted on this website used a case study approach to examine the costs associated with removing 30 dams in the United States. The study notes that the costs associated with removing small dams can be relatively low with some costing as little as $10,000, but the costs of removing large dams can well exceed $1 million (Friends of the Earth 1999). The costs were shown to vary significantly based on numerous factors, including the height and width of the dam, structure type,

[3] http://www.edc.uri.edu/restoration/html/tech_sci/socio/costs.htm

sediments, water rights, and easements. The need for monitoring was also shown to significantly impact cost.

The *Preliminary Economic Assessment of Dam Removal: the Klamath River* [Kruse 2006] is an example of a modern economic analysis of dam removal that tries to thoroughly weigh costs and benefits, considering market and non-market, use and non-use, and jobs gained and lost. As was the case with the literature and guidance detailed in the rest of the report, this study is forward looking and tried to anticipate the effects of dam removal. This report documents the findings of a benefit-cost analysis, with specific distributional consequences for local stakeholders and Siskiyou County, within which three of the four dams being considered for removal are located.

The study quantifies dam removal costs by three categories, which consist of dam deconstruction, lost services, and external costs associated with indirect dam services, such as habitat and lake views. Dam deconstruction is potentially a distributional benefit to Siskiyou County, which will experience job creation but not directly bear the direct cost of the deconstruction. Property values are considered not as a benefit or a cost in this analysis because there is a lack of literature sufficient to determine the direction of the impact. At issue is whether restored river front property is more valuable than the loss of lake front property. This is an issue of high significance to local stakeholders.

The removal of the lower Klamath dams would benefit both commercial and noncommercial fisheries as well as tribal and non-tribal harvests, and would benefit the local economy through jobs associated with the dam deconstruction, the fisheries, recreational use of the fisheries, and non-fish related recreation. The values of the jobs created by deconstruction and the return of the fish are presented with monetary values. The study also uses benefits transfer to attempt to value the non-use or existence value of the restored river. The circumstances of the tribe are described, but other than the value of the tribal fisheries, the benefits to the tribe are qualitative, with specific reference to the health effect of their present non-fish based diet.

The Headwaters Resource Conservation and Development Area covers eight counties in Montana and provides economic development assistance "through wise use and development of both human and natural resources" [Headwaters Economic Development Committee 2002, p 1]. The area, including the Upper Clark Fork River Basin, has experienced significant environmental degradation as a result of past mining activities. The area contains "the largest Superfund site in the world… owned by the Atlantic Richfield Company (ARCO)" [Headwaters Economic Development Committee 2002, p 128]. The *2002 Area Plan/Comprehensive Economic Development Strategy* [Headwaters Economic Development Committee 2002] contains basic economic characterizations of each of the eight counties to inform the development strategy. Much of the assessment is qualitative (referring to a "resurgence" in local tourism, rather than numbers of visitors or quantified economic impact [Headwaters Economic Development Committee 2002, p 128]), though it provides a thorough detailing of the relevant industries, and economic and population trends that exist county by county.

The Central and Southern Florida Project to restore the Everglades has had some ongoing economic analysis built into its framework, which is being carried out by the Army Corps of Engineers and the South Florida Water Management District. The *Comprehensive Everglades Restoration Plan, Environment and Economic Equity Program Management Plan* [Central and Southern Florida Project 2001] documents the Environment and Economic Equity Program, which is responsible for "the social

and economic efforts that will accompany and support the implementation of the Comprehensive Everglades Restoration Plan (CERP)" [Central and Southern Florida Project 2001, p 1]. While many of the tasks detailed in the management plan go beyond economic impact assessment (focusing more on the distributional equity associated with environmental consequences and equity in contracting for projects), the management plan details the tasks for establishing baseline data. Included in the baseline data are demographic factors, seasonal tourists and worker characteristics, employment statistics, income and income distribution and sources, regional industry sector economic output including significant detail on agricultural outputs, and water and land use patterns. There are additional data collection tasks under different headings, including those described in *Comprehensive Everglades Restoration Plan, Regional Economic Impact (Economics Data Collection Work Plan)* [Central and Southern Florida Project 2003], which is focused on assessing the economic impact of flood damage within the Everglade Agricultural Area. The information and data collected will cover land use, property values, production practices, and previous flooding, amongst other flooding-specific variables.

There has been criticism of the economic analysis carried out in support of the Central and Southern Florida Project. One of these critiques, *Missing Pieces in Ecosystem Restoration: the Case of the Florida Everglades*, specifically attacks the lack of consideration for growing tourism, urban development, population migration into the area, and changes in agriculture in the original Corps economic analysis of the project [Weisskoff 2000]. The study of these features relies heavily on the IMPLAN model, a model that can be used to do the types of regional economic impact studies like those described in the previous section. The author notes that it is important to take into account these dynamic impacts because failing to do so could lead to an understatement of the ultimate strain on regional water supplies over time, undercutting the effectiveness of the ecosystem restoration [Weisskoff 2000]. The impact estimates in this case, however, were relatively small relative to the underlying base.

3.0 Baseline Assessment

3.1 Geographic Stratification

While investigation down to the level of Port Angeles is advisable, several of the sources of data do not have resolution below the county level. As a result, this baseline analysis considers Clallam County as the largest geographic entity for the detailed local level of the analysis. Data on the Lower Elwha Klallam Reservation and the city of Port Angeles, the nearest population center, are used to gain further insight where possible. This is consistent with the geographic scope of the analysis of the Klamath River analysis focused on Siskiyou County, which like Clallam County, was where the dams are physically located and within which the majority of the economic impacts would be contained.

At the regional level, the Olympic Peninsula and Washington State are also considered. At the National level, it is expected that some of the economic impacts considered within the EIA framework would be purely distributional (e.g., eco tourism redirected from a location in another part of the United States to Olympic National Park), consistent with the example give in Section 2.2.1, though there would be some direct effects that would not be canceled out. These direct effects, however, would be small at the national level and difficult to attribute to the removal of the Elwha River Dams. Further, some of the benefits generated through dam removal may not be measurable using national economic data. These benefits include direct use (amenity, education), indirect use (water quality maintenance and biological support), and nonuse (bequest, existence, stewardship) values. Thus, national-level data are generally provided within the context of comparing location and regional trends to those at the national level, though relevant national data were collected and are included in this baseline assessment. The study area and points of interest dissecting or bordering the study area (e.g., Olympic National Park and Olympic National Forest) are shown in Figure 1. Figure 1 identifies:

- the population distribution in Clallam County using 2000 Census Block data
- Olympic National Park (including the stretch of park located along the Pacific coastline)
- Olympic National Forest
- the Elwha River and its tributaries
- cities located within Clallam County, including Port Angeles, Dungeness, and Sequim

3.2 Methodology

The economic assessment of the outcome of the removal of the Elwha River Dams should be consistent with the EIA framework described in Section 2.2.1, with sufficient information to offer a comparison with the original economic analysis [Elwha Project Human Effects Team 1995] and to highlight the full impact on the Tribe. This requires capturing data on:

- Actual costs of dam deconstruction, flood and water quality mitigation efforts, and all other direct project costs
- Changes in fisheries—catch and value of catch by species, location (as detailed as possible), and type of fishing entity (commercial, commercial tribal, sport, tribal), value of catch for both commercial types, numbers by tribal and sport

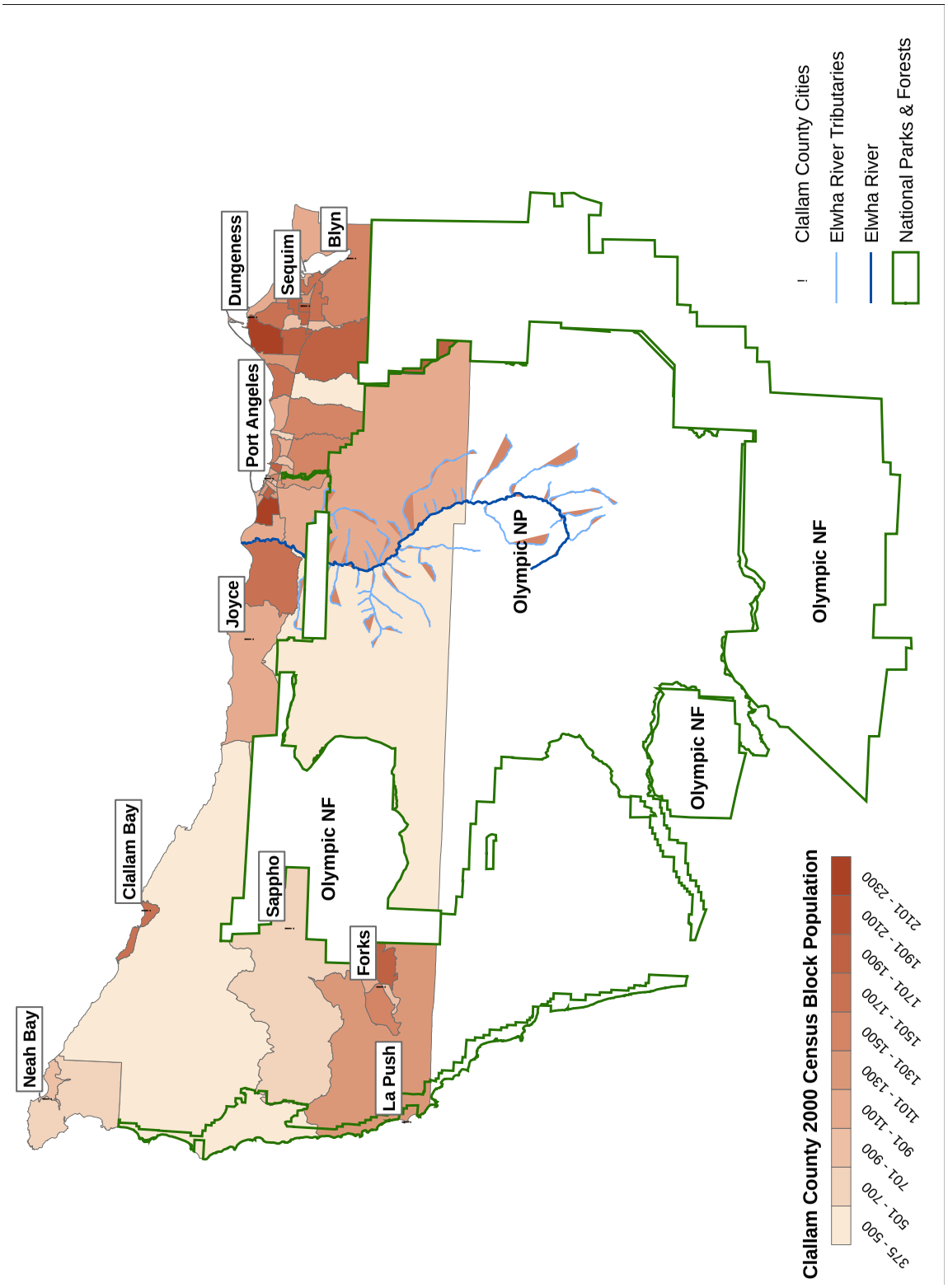

Figure 1. Geographic Overview of Study Area

- Changes in the visitor industry—number of visitors, characteristics of stay, activities, origin, and expenditures within Clallam County by type
- Changes in the structure of the economy—number and type of enterprises in Clallam county (and to the extent possible, the Port Angeles area separate from Sequim and Port Townsend), employment, incomes of employees, and sales and use taxes paid
- Changes in land use, including property values for Clallam County—from the Clallam County assessor's office GIS database, location, value of land, description and value of structures and zoning, as geographically detailed as possible
- Economic status and demographics broken out by age and sex
- Non-dam removal trends and changes including population growth due to exurbanization of Seattle, increases in the retired population, and decline of the timber industry

The baseline is defined as the full set of data from the present, prior to dam removal, with trends that are likely to prevail whether the dams are removed or not. Elements of the baseline that need to represent more than a single observation or data point, such as the trends or relationships in the economy, have been presented quantitatively and qualitatively with discussion of the significance and sources of the trends and connections. All data used to define the baseline, including all underlying data bases, reports, maps, and references and will be delivered to NOAA.

Some of the features in the list above can't be measured now, but will be important for future monitoring. For instance, the actual costs of the project will need to be captured, but if any baseline is relevant for this it is already documented in the project's EISs.

Capturing trends makes the baseline more than a static snapshot. As stated in the EPA guidelines, "the dynamic aspects of market and consumer behavior, and the many motivations leading to change, can make it more difficult to attribute economic costs and benefits to specific regulations" or projects [EPA 2000, p 22]. Likewise, OMB calls for "changes in external factors affecting expected benefits and costs" to be taken into account [OMB 2003, p 15].

As in any economic analysis, distinguishing the significance of observed movements in the elements being analyzed is a challenge, especially when explicit confidence intervals cannot be constructed. Because the project is relatively large, the impacts of the dam removal and river restoration on the tribe and Port Angeles should be large enough that they are distinguishable from the baseline, especially those that are directly tied to the river such as the economic value of the fish harvest. This is consistent with the NOAA monitoring guidance [NOAA 2005] referenced in the review section. Where it will become especially difficult to distinguish the significance will be as the geographic scope broadens to the state level and further.

Future monitoring will consist of recapturing updated values of the same variables from the same sources, taking care to record any methodological changes in how the agencies keeping the data record and report the variables. This will allow analysts to chart how the magnitude and composition of the Clallam County economy changes. For the baseline and for the ongoing analysis, this should, where possible, be presented in the context of the Olympic Peninsula, Washington State, and national data for contrast, for assisting in separating out the "external factors" and for discussing the broader

impact beyond Clallam County. Examination of some of the data at the Census block and zip code levels will allow further separation of exogenous factors by allowing comparison of the areas most directly impacted by the dam removal (Port Angeles and the Lower Elwha Reservation) with other communities in the county that are both further from the site and less economically connected to the site, such as Sequim and Forks.

The ultimate goal of the baseline assessment, therefore, is to enable a future economic assessment of Elwha River dam removal. The question, however, is how long should data be captured into the future? Ideally, an economic assessment would not be completed until ecological and economic changes resulting from dam removal were complete. In the case of the economic impact on the local fishery, for instance, it may take several years for fish runs to recover and the local fishing industry to reap enhanced harvests. In light of practical constraints, however, we recommend capturing data at 3, 5, and 10 years following project completion. At each interval, we recommend assessing the ecological and economic conditions to determine if an economic assessment should be completed.

Assessing the structure of the economy required data describing industry type, output, employment, and earnings. More depth in the understanding of the structure of the county economy has been attained by obtaining an economic impact model with data specific to Clallam County. The IMPLAN model [Lindall 2004], similar to RIMS discussed in Section 2.2.1 and discussed itself in Section 2.3, has a data file specific to Clallam county that identifies the relationships between different sectors in the economy. This model was obtained and examined, with model output presented and discussed in Section 3.4.

Consistent with methods described in the Bureau of Reclamation document *Valuation of American Indian Land and Water Resources: a Guidebook* [Hammer 2002] and the original Elwha Project Human Effects Team economic analysis, an effort has been made to characterize the economic circumstances of the Tribe (Section 3.9) using data on population, employment, and per capita income.

Additionally, we recommend ongoing research into non-use values for the restored Elwha River. This will be required if one of the goals of the ongoing economic monitoring will be to match actual data to the original economic analysis completed by the Elwha Project Human Effects Team. This would entail evaluating past studies, including the one used in the original economic analysis, on the basis of best practices for CV and their relevance for benefits transfer. Additionally, it may be desirable to complete a new CV study at some point, though this would require a significant investment of resources and extreme care in the development of the presentation of what is being compared and valued. The research and resurvey are both beyond the scope of the baseline analysis. Also beyond the scope of this report and the baseline study is the determination of appropriate values for benefits transfer to non-market impacts of the dam removal and river restoration.

3.3 Socioeconomic Profile

This section presents and examines socioeconomic data for Clallam County, Port Angeles, Washington State and the United States. All of the data underlying this analysis have resolution down to the county level and some have resolution down to the zip code level. The data underlying the socioeconomic profile constructed in this section were obtained from the following sources:

- 2000 American Fact Finder Series [U.S. Census Bureau 2000]
- 2002 Economic Census [U.S. Census Bureau 2002]
- 2004 County Business Patterns [U.S. Census Bureau 2006]
- Headwaters Economics' Socioeconomic Profile of Clallam County [Headwaters Economics 2006]
- State and County Quick Facts [U.S. Census Bureau 2007]

This section provides an overview of the key data elements and trends taking place in Clallam County. More detailed data sets, including GIS maps and reports, were collected and will be delivered to NOAA.

The Clallam County population by age and sex is examined in Table 2. As shown, the Clallam County population reached 64,525 in 2000, representing an increase of 8,061 since 1990. The majority of the growth has occurred in the 40-54 year age group, with growth among the elderly 65 years and over (2,199) more than doubling the growth experienced within the portion of the population under the age of 20 (952). The Clallam County population is composed of 32,054 males and 32,471 females. Females outnumber males in all age groups with the exception of the portion of the population under the age of 20 years [Headwaters Economics 2006].

Table 2. Clallam County Population by Age and Sex

	Total	Under 20 years		40 - 54 (Baby Boom in 2000)		65 years and over		Median Age	Density (Pop. per sq. mi.)
	Number	Number	Share	Number	Share	Number	Share		
Total Population									
2000	64,525	15,857	24.6%	14,450	22.4%	13,727.0	21.3%	43.8	37.1
1990	56,464	14,905	26.4%	9,536	16.9%	11,528.0	20.4%	38.4	32.4
10 Yr. Change	8,061.0	952.0	-1.8%	4,914	5.5%	2,199.0	0.9%	5.4	4.7
10 Yr. % Change	14.3%	6.4%		51.5%		19.1%		14.1%	14.7%
2000 Sex Breakout									
Male	32,054	8,283	25.8%	7,091.0	22.1%	6,197.0	19.3%	42.1	
Female	32,471	7,574	23.3%	7,359.0	22.7%	7,530.0	23.2%	45.3	

When compared to Washington State and the United States (Table 3), the population of Clallam County has grown at a rate that exceeds that of the U.S. (20.7 percent compared to 15.9 percent between 1990 and 2005) but falls short of the Washington State population, which grew by 26.3 percent between 1990 and 2005. The Clallam County population is significantly older than the Washington State or U.S. populations, with nearly 22.4 percent of its citizens in 2005 being 65 years of age or over; a rate nearly twice that of Washington State or the U.S. The percentage of its residents 65 years of age and older grew in Clallam County from 20.4 percent in 1990 to 21.3 percent in 2000, ultimately reaching 22.4 percent in 2005. Historically, Clallam County has had a large male population relative to the U.S. but in recent years, the male population in Clallam County has declined in percentage terms and now only represents 48.3 percent of the population, whereas males comprise 49.0 percent of the U.S. population and 49.7 percent of the Washington State population.

Table 3. Clallam County, Washington State and United States Population by Age and Sex

	Under 5 Years	18 Years and Over	65 Years and Over	Male	Female	Total
1990 Census						
Clallam County Population	3,593	42,775	11,528	28,084	28,380	56,464
(%)	6.4%	75.8%	20.4%	49.7%	50.3%	
Washington State Population	366,780	3,605,305	575,288	2,413,747	2,452,945	4,866,692
(%)	7.5%	74.1%	11.8%	49.6%	50.4%	
US Population	18,354,443	185,105,441	31,241,831	121,239,418	127,470,455	248,709,873
(%)	7.4%	74.4%	12.6%	48.7%	51.3%	
2000 Census						
Clallam County Population	3,313	50,355	13,727	32,054	32,471	64,525
(%)	5.1%	78.0%	21.3%	49.7%	50.3%	
Washington State Population	394,306	4,380,278	662,148	2,934,300	2,959,821	5,894,121
(%)	6.7%	74.3%	11.2%	49.8%	50.2%	
US Population	19,175,798	209,128,094	34,991,753	138,053,563	143,368,343	281,421,906
(%)	6.8%	74.3%	12.4%	49.1%	50.9%	
2005 Census						
Clallam County Population	3,054	55,074	15,274	32,941	35,206	68,147
(%)	4.5%	80.8%	22.4%	48.3%	51.7%	
Washington State Population	395,158	4,668,831	683,774	3,052,792	3,093,546	6,146,338
(%)	6.4%	76.0%	11.1%	49.7%	50.3%	
US Population	20,267,176	215,246,449	34,760,527	141,274,964	147,103,173	288,378,137
(%)	7.0%	74.6%	12.1%	49.0%	51.0%	

The racial compositions of the U.S., Washington State and Clallam County populations are examined in Table 4. In 2005, approximately 90.4 percent (61,615) of the Clallam County population was composed of white persons, as compared to 81.2 percent in Washington State and 74.7 percent for the nation. Clallam County has a much larger American Indian and Alaska Native population (4.2 percent of total county population) but a smaller percentage of black, Asian, and Hispanic persons relative to Washington State and the U.S. as a whole [U.S. Census Bureau 2007].

Table 4. United States, Washington State and Clallam County Population by Race

	White	Black	American Indian and Alaska Native	Asian	Native Hawaiian and Other Pacific Islander (a)	Other Race	Multirace	Hispanic or Latino (b)
1990 Census					-			
Clallam County Population	52,509	321	2,695	614	-	325	-	1,150
(%)	93.0%	0.6%	4.8%	1.1%	0.0%	0.6%	0.0%	2.0%
Washington State Population	4,308,936	149,801	81,483	210,958	-	115,513		214,570
(%)	88.5%	3.1%	1.7%	4.3%	0.0%	2.4%	0.0%	4.4%
US Population	199,686,070	29,986,060	1,959,234	7,273,662	-	9,804,847		22,354,059
(%)	80.3%	12.1%	0.8%	2.9%	0.0%	3.9%	0.0%	9.0%
2000 Census								
Clallam County Population	57,505	545	3,303	731	104	761	1,576	2,203
(%)	89.1%	0.8%	5.1%	1.1%	0.2%	1.2%	2.4%	3.4%
Washington State Population	4,821,823	190,267	93,301	322,335	23,953	228,923	213,519	441,509
(%)	81.8%	3.2%	1.6%	5.5%	0.4%	3.9%	3.6%	7.5%
US Population	211,460,626	34,658,190	2,475,956	10,242,998	398,835	15,359,073	6,826,228	35,305,818
(%)	75.1%	12.3%	0.9%	3.6%	0.1%	5.5%	2.4%	12.5%
2005 Census								
Clallam County Population	61,615	142	2,860	869	-	112	2,549	2,697
(%)	90.4%	0.2%	4.2%	1.3%	0.0%	0.2%	3.7%	4.0%
Washington State Population	4,988,017	202,286	88,363	405,000	28,400	229,830	204,412	541,722
(%)	81.2%	3.3%	1.4%	6.6%	0.5%	3.7%	3.3%	8.8%
US Population	215,333,394	34,962,569	2,357,544	12,471,815	397,030	17,298,601	5,557,184	41,870,703
(%)	74.7%	12.1%	0.8%	4.3%	0.1%	6.0%	1.9%	14.5%

(a) Pacific islander population included in Asian statistics in 1990 Census.

(b) Hispanic or latino persons can be included in any race and are, thus, included in both the hispanic or latino as well as other categories.

Clallam County consists of 1,739 square miles compared to 66,544 for Washington State. Clallam County is not as densely populated as Washington State with only 37.1 persons per square mile compared to Washington State's 88.6 persons per square mile. The population density is further defined in Figure 2, which identifies the population centers located to the east of the Elwha River in Port Angeles, Dungeness, and Sequim. Thus, Clallam County is a relatively sparsely populated

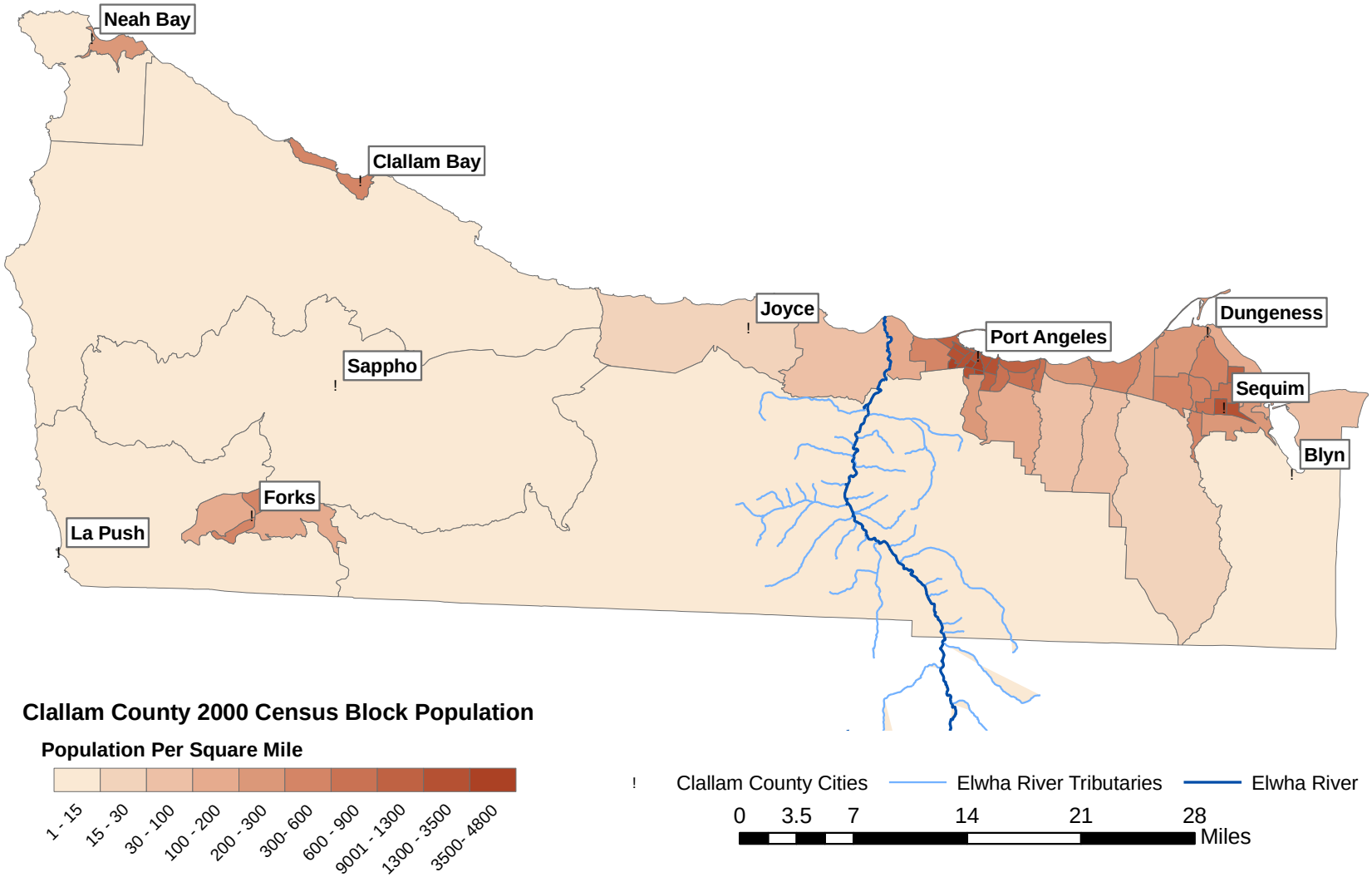

Figure 2. Population Densities, Clallam County, Washington

corner of Washington State representing only 2.6 percent of the State's land area and 1.1 percent of its population.

In 2004, there were 3,188 business establishments operating in Clallam County collectively employing 24,790 people with an annual payroll of approximately $649.4 million. Table 5 presents a breakdown of the number of establishments, employees, and annual payroll for each zip code area falling within Clallam County. Port Angeles serves as the largest employment center with 1,136 establishments employing 10,091 people (35.6 percent of all establishments) in Clallam County [U.S. Census Bureau 2006]. Sequim is the second largest employment center with 837 establishments (26.3 percent) and Port Townsend is third with 722 establishments (22.6 percent).

Table 5. Number of Establishments, Employees, and Annual Payroll of Establishments Operating in Clallam County, Washington

Geographic Area Name	Number of Establishments	Number of Employees	First-Quarter Payroll ($1,000)	Annual Payroll ($1,000)
ZIP 98305(BEAVER,WA)	18	156	$ 1,407	$ 5,903
ZIP 98320(BRINNON,WA)	23	82	$ 302	$ 1,327
ZIP 98326(CLALLAM BAY,WA)	19	87	$ 197	$ 976
ZIP 98331(FORKS,WA)	176	1,254	$ 6,585	$ 29,271
ZIP 98362(PORT ANGELES,WA)	926	8,545	$ 50,953	$ 222,072
ZIP 98363(PORT ANGELES,WA)	210	1,546	$ 11,597	$ 57,804
ZIP 98368(PORT TOWNSEND,WA)	729	6,658	$ 39,443	$ 166,771
ZIP 98376(QUILCENE,WA)	47	170	$ 864	$ 3,916
ZIP 98381(SEKIU,WA)	10	23	$ 48	$ 358
ZIP 98382(SEQUIM,WA)	837	5,009	$ 26,938	$ 123,297
ZIP 98563(MONTESANO,WA)	193	1,260	$ 8,131	$ 37,685
Total	3,188	24,790	$ 146,465	$ 649,380

More detailed data on the number of establishments operating within each of these zip codes in 2002 and 2004 were obtained from the 2002 Economic Census and 2004 County Business Patterns and cross matched. This data set includes detailed estimates of the number of establishments operating within each of the zip code areas in Clallam County for the key industries highlighted in Table 6. For each of these zip codes, detailed data were obtained from the 2002 Economic Census that provides further analysis of establishments, segmented according to annual revenue.

Table 6. Sectors in Economic Census Zip Code Statistics

NAICS	Sector
44-45	Retail Trade
54	Professional, Scientific, and Technical Services
56	Administrative, Support, Waste Management, Remediation Services
61	Educational Services
62	Health Care and Social Assistance
71	Arts, Entertainment, and Recreation
72	Accommodation and Food Services
81	Other Services (except Public Administration)

Industry employment data for 2001 and 2004 are presented in Table 7. Employment in the Clallam County population grew from 32,254 in 2001 to 34,244 in 2004. The single largest sector in the county is government and government enterprises, employing 7,202, followed by retail trade (4,782), health care and social assistance (3,040), accommodation and food services (2,632), and construction (2,612) [Headwaters Economics 2006].

Table 7. Employment by Industry, Clallam County, Washington

Category	2001	2004
Total employment	32,254	34,244
Wage and salary employment	22,795	24,098
Proprietors employment	9,459	10,146
Farm proprietors employment	362	344
Nonfarm proprietors employment	9,097	9,802
Farm employment	444	439
Nonfarm employment	31,810	33,805
Private employment	24,893	26,603
Forestry, fishing, related activities, and other	1,105	1,065
Mining	83	81
Utilities	26	28
Construction	2,254	2,612
Manufacturing	1,607	1,617
Wholesale trade	440	563
Retail Trade	4,600	4,782
Transportation and warehousing	815	785
Information	497	422
Finance and insurance	972	1,031
Real estate and rental and leasing	1,380	1,646
Professional and technical services	1,588	1,707
Management of companies and enterprises	184	172
Administrative and waste services	922	1,150
Educational services	247	327
Health care and social assistance	2,881	3,040
Arts, entertainment, and recreation	599	670
Accommodation and food services	2,461	2,632
Other services, except public administration	2,232	2,273
Government and government enterprises	6,917	7,202
Federal, civilian	481	433
Military	503	554
State and local	5,933	6,215
State government	1,359	1,318
Local government	4,574	4,897

The unemployment rate in Clallam County has followed a trend similar to that of Washington State, well exceeding the national average in recent years (Figure 3). Historic unemployment rates in Clallam County climbed to as high as 10.5 percent in the mid-1990s due to the decline of the timber and related industries. From 1987 to 1995, the timber and manufacturing industries lost 992 jobs in

Clallam County. In recent years, employment growth in the construction and services industries has caused unemployment rates in Clallam County to fall and nearly converge with the Washington State and U.S. unemployment rates of around 5 to 6 percent in 2005 [Headwater Economics 2006].

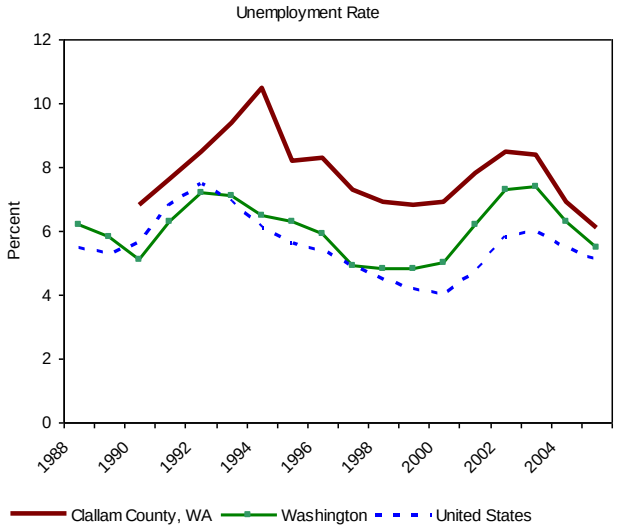

Figure 3. Unemployment Rates in Clallam County, Washington and United States (1988-2005)

In 2004, total personal income was 1.95 billion, up from 1.84 billion in 2001 (Table 8). From 2001 to 2004, the largest gains in terms of personal income were made in the government ($32 million), construction ($25 million), and retail trade ($16 million) sectors [Headwater Economics 2006]. Figure 4 highlights growth in personal income in Clallam County, Washington State, and the U.S. between 1970 and 2005. Figure 3 demonstrates that personal income growth in Clallam County has been robust, growing by 212 percent between 1970 and 2005 compared to 139 percent growth for the U.S. Personal income declined significantly during the recessions of the early 1980s but has since rebounded, with strong growth in the service, construction, retail trade, finance, insurance and real estate industries.

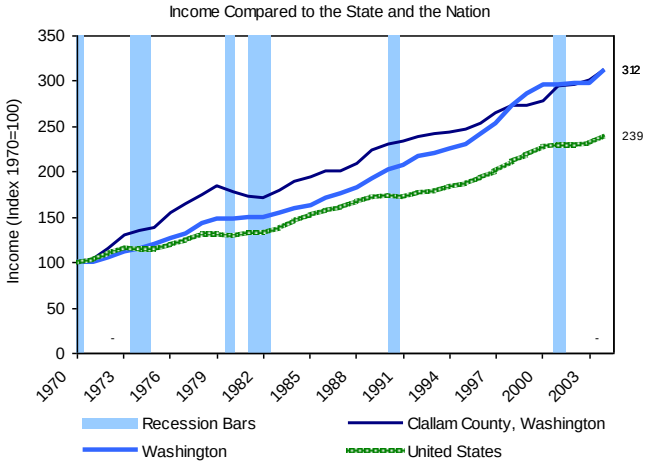

Figure 4. Personal Income Index, Clallam County, Washington and United States (1970-2005)

Table 8. Income by Industry, Clallam County, Washington

Category	2001	2004	Growth (Decline)
Personal income	1,841	1,949	107
Wage and salary disbursements	621	693	72
Proprietors' income	181	170	(11)
Farm proprietors'	0	1	1
Nonfarm proprietor	181	169	(12)
Farm earnings	2	3	1
Nonfarm earnings	936	1,031	94
Private earnings	638	700	62
Forestry, fishing, related act., and oth.	60	58	(2)
Mining	1	1	0
Utilities	1	1	(0)
Construction	74	98	25
Manufacturing	76	67	(9)
Wholesale trade	16	22	6
Retail Trade	100	116	16
Transportation and warehousing	27	28	1
Information	14	12	(1)
Finance and insurance	31	29	(2)
Real estate and rental and leasing	16	21	6
Professional and technical services	39	41	2
Management of companies & enterp.	11	10	(1)
Administrative and waste services	10	12	3
Educational services	3	4	1
Health care and social assistance	86	93	7
Arts, entertainment, and recreation	5	5	0
Accommodation and food services	32	36	5
Other services, except public admin.	39	45	6
Government and government enterp.	298	330	32
Federal, civilian	31	31	0
Military	18	29	10
State and local	249	270	22
State government	60	57	(2)
Local government	189	213	24

3.4 Input-Output Analysis of the Clallam County Economy Modeled by IMPLAN

The regional economic modeling system, IMPLAN (IMpact analysis for PLANning), was used to develop a custom model of the Clallam County economy. Originally developed by the U.S. Forest Service, in cooperation with the Federal Emergency Management Agency, IMPLAN provides a framework for analyzing the economic impacts (changes in employment, output, income, etc.) from any number of scenarios where changes in the local economy take place. Examples include effects of public policy, new plant locations, tourism expenditures, plant closings, major events, or technology change.

For the Clallam County model developed for the Elwha study, 2004 IMPLAN data (MIG 2006) were assembled into a regional economic model using the IMPLAN software. The I-O data developed for IMPLAN are always tied to the U.S. economic structure reflected in the latest BEA national table, but the dollar flows are price-updated each year and employment levels are updated. That means that

until the 2002 national table is released by BEA (expected in late 2007), the 1997 snapshot of national economic structure is reflected in all stock IMPLAN models. The model was then altered by condensing IMPLAN's 528 industry sectors to the 52 sectors most representative of Clallam County's economy. Appendix A includes an overview of the IMPLAN model.

Aggregating the model also permits the model to be implemented in an Excel spreadsheet, which was done for the Clallam model. Spreadsheet implementation provides the ultimate flexibility for developing economic impact scenarios, because in addition to easily specifying final demand shocks, the modeler can also easily evaluate scenarios involving changes to the economic structure of the regional economy. Spreadsheet implementation also provides for complete transparency of the modeling calculations. The Clallam spreadsheet IMPLAN model was set up to allow the user to easily specify final demand changes implied by policy cases affecting the local economy. A simple Visual Basic for Applications macro was employed to automate economic spending rounds in the regional economy.

To analyze economic impacts of a particular initiative using IMPLAN, we need to determine what would be the net change in "final demand," or purchases made within a regional economy, due to the effect of an economic impact scenario. This is accomplished by determining the expenditure profile of those potentially affected in the scenario. Table 9 lists the 52 sectors represented in the Clallam IO model.

Table 9. Industry Sectors included in the Clallam County IO Model

Industry Sector	
01 Crops Production	27 Other Transportation
02 Animal Production	28 Postal and Delivery Services
03 Forest Products	29 Motor Vehicles and Parts Stores
04 Fishing, Hunting, Trapping	30 Household Goods
05 Ag and Forestry Support	31 Food and Beverage Stores
06 Mining	32 Health and Personal Care Stores
07 Utilities	33 Gas Stations and Carwashes
08 Residential Construction	34 Misc. Retail
09 Nonresidential Construction	35 Publishing
10 Seafood Products	36 Communications and Software
11 Other Food Products	37 Finance, Insurance, Real Estate (F.I.R.E.)
12 Textiles	38 Rental Services
13 Sawmills	39 Business Services
14 Plywood and Veneer	40 Travel Services
15 Other Wood Products	41 Personal and Community Services
16 Pulp and Paper	42 Education
17 Printing and Publishing	43 Health Services
18 Concrete, Stone, Clay, Glass Mfg.	44 Social Services
19 Metal Fabrication Mfg.	45 Recreation Services
20 Ship and Boat Building	46 Hotels and Accommodations
21 Wood Furniture and Fixtures	47 Food and Beverage Services
22 Sporting Goods Mfg.	48 Equipment Repair Services
23 Other Manufacturing	49 Households
24 Wholesale Trade	50 State and Local Government
25 Tourism and Passenger Transport	51 Federal Government
26 Freight Transport and Warehousing	52 Other

3.4.1 Observations about the Clallam County Economy Based on the Input-Output Table

Clallam County does not have a highly interdependent economy; i.e., most businesses depend on other regions for goods and services rather than purchasing them locally. The lack of interdependence between local industries in Clallam County results in relatively small multipliers. This is common with small, largely rural economies. However, there are sectors where there is significant additional impact when a local business sells a good or service outside of the county. These include the wood products industry sectors—both the production of forest products and the milling of those products into lumber and other finished goods, which have a significant interaction effect. For example, $1million in sales of final demand by the "Plywood and Veneer" sector requires $540K in locally-supplied goods and services across Clallam County to produce. Many of the local businesses serve local consumers; thus, increases in consumer income and purchases circulate in the local economy and generate additional induced impacts.

There are thus three types of important sectors in the economy: (1) large sectors that themselves currently generate many of the jobs and income in the economy; (2) sectors that are significantly interconnected with the rest of the economy and thus generate sales, jobs, and income in other sectors whenever they expand; and (3) sectors that provide a significant linkage to the outside world—they sell goods and services to other regions and generate profits and wage income that get circulated locally.

Which sectors are counted as biggest depends on whether you count output (sales), employment, or value added, as illustrated below in Table 10. The four biggest sectors in the 52-sector version of the Clallam County economy from an output perspective are Forest Products; State and Local Government Services; Finance, Insurance, and Real Estate; and Health Services. From an employment standpoint they are State and Local Government Services; Education Services; Food and Beverage Services; and Health Services and from a value added standpoint, they are State and Local Government Services; Finance, Insurance, and Real Estate; Education Services; and Health Services. The latter measurement is important because it shows how much of the total production value actually is local and contributes to family incomes, local taxes and profits.

Table 10. Largest Sectors in Clallam County by Measure*

Largest Output	$Million	Largest Employment	Jobs	Largest Value Added	$Million
03 Forest Products	225.640	50 State and Local Government	3,414	50 State and Local Government	187.762
50 State and Local Government	207.744	42 Education	2,557	37 F. I. R. E.	130.888
37 F. I. R. E.	205.515	47 Food and Beverage Services	2,108	42 Education	102.365
43 Health Services	138.400	43 Health Services	2,104	43 Health Services	90.336
Total Output	777.299	Total Employment	10,184	Total Income	511.351
County Totals	2,821		29,510		1,650

** Dollars are 2004 dollars; Jobs include both full- and part-time jobs.*

3.4.2 Most Interconnected Sectors

Table 11 shows which sectors generate the highest indirect impacts on other sectors per dollar of final demand (sales outside of the region and to government and consumers inside the region, as well as local investments of all types). This can be judged from their direct and indirect impact multipliers. This table shows which sectors generate the most overall regional economic activity, the most jobs, and the most income per dollar of sales to final demand.

Table 11. Comparison of Indirect Multipliers in the Clallam County Model

Largest Output Multiplier	Indirect/ Direct Output	Largest Employment Multiplier	Indirect/ Direct Jobs	Largest Value Added Multiplier	Indirect/ Direct Value-Added
14 Plywood and Veneer	1.83	27 Other Transportation	3.25	10 Seafood Products	3.37
13 Sawmills	1.82	16 Pulp and Paper	2.56	27 Other Transportation	2.37
03 Forest Products	1.57	13 Sawmills	2.09	14 Plywood and Veneer	2.29
11 Other Food Products	1.45	10 Seafood Products	1.94	11 Other Food Products	2.28

Some sectors are of special interest in the current project because they represent sectors targeted for growth through removal of the Elwha River dams. Table 12 shows what happens in the Clallam County economy for three types of growth. The first is growth of $1 million in sales by the fishing industry; the second is a growth in $1 million in hotel and restaurant receipts from additional "tourism" because the County becomes more attractive to visit and the last is a growth of $1 million in sales from additional retired or commuting residents moving to the county to enjoy its amenities (having first homes or vacation homes in Clallam County, but earning their income somewhere outside the county).

Table 12. Impact of $1 Million in Additional Sales in Three Key Targeted Sectors ($Million)

Impact Scenario	Output Impact	Employment Impact (Jobs)	Total Value-Added Impact
Fishing Industry Growth	2.17	25	1.04
Tourism Growth	4.95	71	2.73
Amenity Migration Growth	6.61	103	4.95

These scenarios show the expected results. Export demand for seafood primarily impacts the local seafood production industry, and was modeled as a direct impact to just that sector. The tourism scenario was modeled as two-thirds impact to hotels and accommodations and one-third impact to restaurants—directly impacting two sectors. The amenity migration scenario represents an increase in consumption spending by new, high-income, consumers relocating to the area, and as such, was modeled as a direct impact in proportion to the consumption spending pattern of this segment of consumers.

3.5 Property Values

With the removal of the two hydroelectric dams on the Elwha River (the Elwha and Glines Dam) and the resulting impacts on Lake Alwell and Lake Mills, along with the change in recreational opportunities and the amenity value of the land located near the Elwha River and its tributaries, housing and property values could be significantly impacted, and thus, current real property values were captured. A simple snapshot of the real estate market in Clallam County, however, is not sufficient to determine the housing and property impacts of the dams' removal due to the presence of other trends affecting the market, including the exurbanization of Seattle, increases in the retired population, and the decline of the timber industry.

To examine the recent trends in real property values in the study area and in Washington State generally, county assessor data obtained and summarized by the Washington State Department of Revenue (DOR) were summarized in Table 13 [Washington State Department of Revenue 2006]. From 1999 to 2005, Clallam County followed the national and statewide trends of rapid property value escalation with real

property assessments increasing by 63.2 percent from $3.6 billion to $5.8 billion. In 1999, Clallam County real and personal property tax assessed value in dollar terms represented roughly 0.97 percent of total statewide assessments. The Clallam County proportion of total statewide assessments dropped from 1999 to 2002, reaching a low of 0.85 percent of total assessments, before increasing back up to 0.97 percent by 2005.

Detailed county assessor GIS data were obtained, examined, and used to prepare the maps highlighted in Figure 5 and Figure 6. Figure 5 presents housing values for the entire Clallam County. Not surprisingly, higher property values cluster around major population centers. More specifically, clusters appear within the eastern half of the Upper Peninsula, from Joyce in the West to Blyn in the East. This area is examined in further detail in Figure 6. The highest density of property values appear near Port Angeles, Dungeness, and Sequim.

Table 13. Real and Personal Property Assessed Values and Parcel – Clallam County

Year	Total Assessed Value	As % of All WA Counties	Real Property	RP as % of Total	Personal Property	PP as % of Total	Real Property Parcels	Personal Property Accounts
1999	3,808,865,084	.97%	3,580,502,512	94.0%	228,362,572	6.0%	47,207	1,775
2000	3,948,994,210	.92%	3,721,442,482	94.2%	227,551,728	5.8%	47,282	1,923
2001	4,118,820,942	.89%	3,906,257,118	94.8%	212,563,824	5.2%	47,393	1,847
2002	4,211,461,283	.85%	4,050,756,456	96.2%	160,704,827	3.8%	47,552	1,939
2003	4,588,208,869	.88%	4,425,140,223	96.4%	163,068,646	3.6%	47,872	1,882
2004	5,093,691,805	.91%	4,943,944,880	97.1%	149,746,925	2.9%	48,051	1,738
2005	6,004,641,016	.97%	5,843,927,067	97.3%	160,713,949	2.7%	48,584	1,821

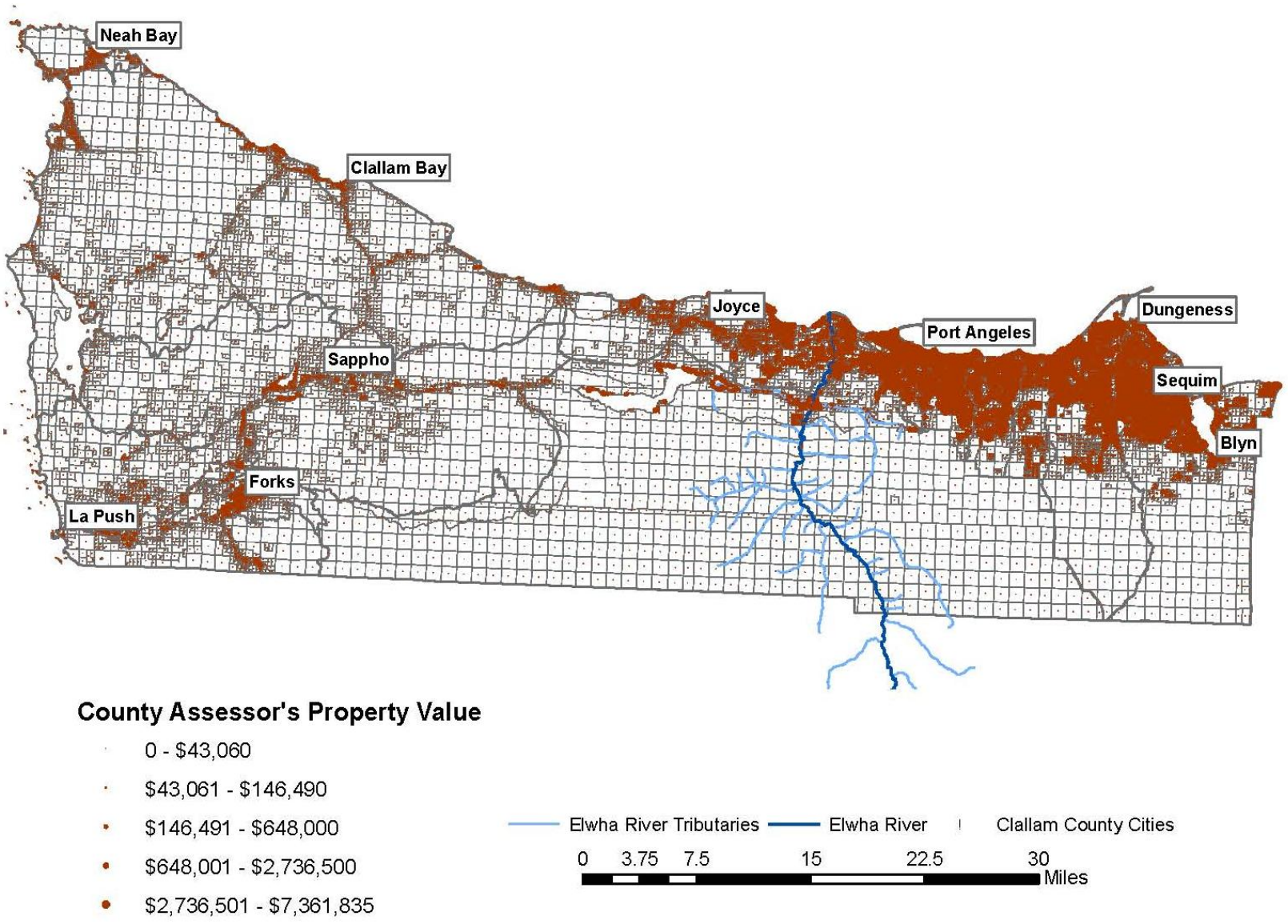

Figure 5. Assessed Property Value Clallam County

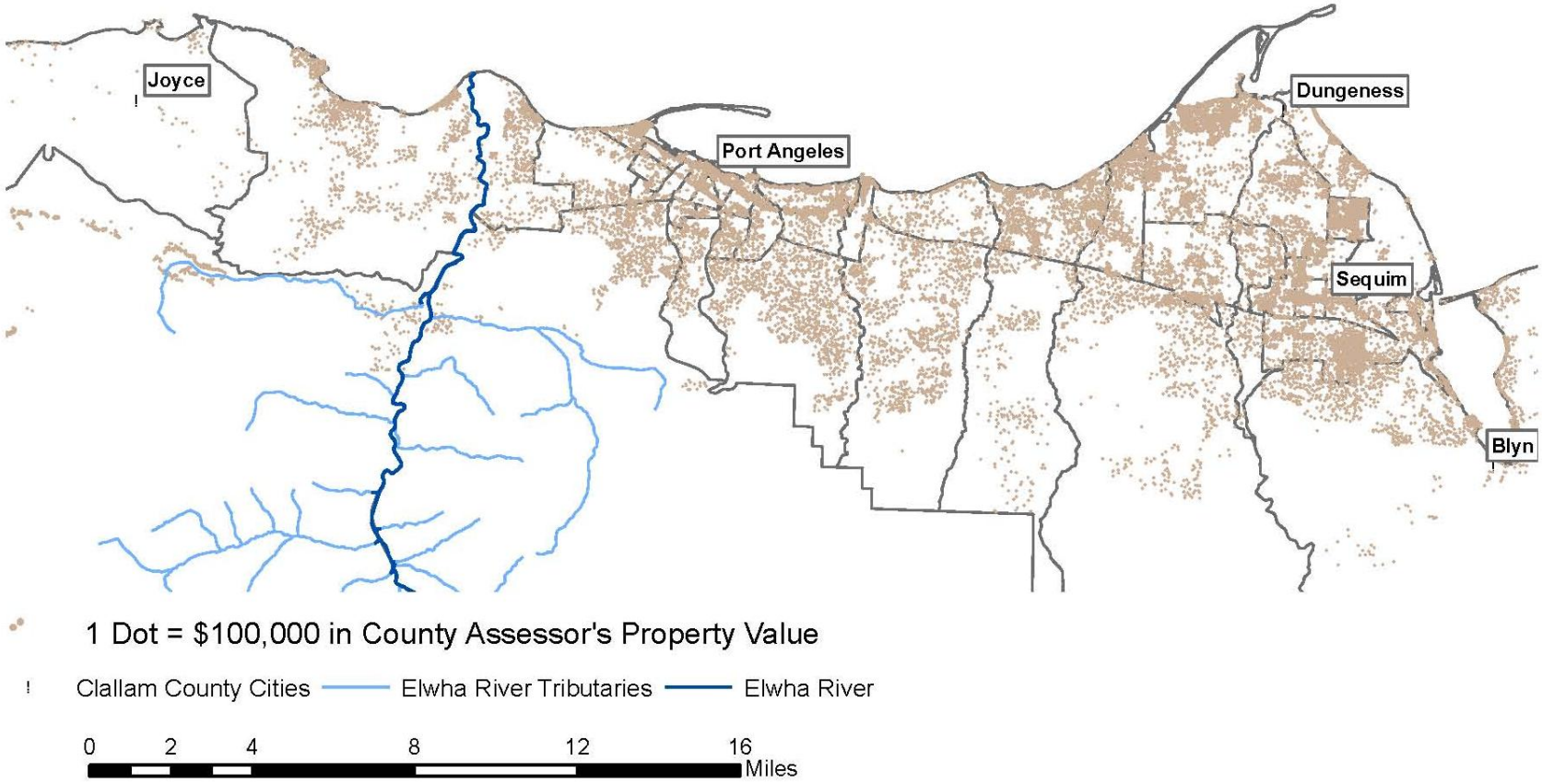

Figure 6. Assessed Property Value Upper Olympic Peninsula from Joyce to Blyn

3.6 Timber Harvests and Tax Revenue

Timber is one of the most important commodities in the Washington State economy, with lumber and wood products accounting for $2.2 billion of the State's $176 billion gross State product in 1997 (1.2 percent of the total) and paper and allied product accounting for an additional $1.3 billion [Inland Northwest Forest Products Research Consortium 2003]. The state's timber industry, however, has been in steady decline in recent years with its output, as measured in million board feet (MBF), falling by 45.4 percent statewide since 1986, as demonstrated in Table 14 [Office of Financial Management, State of Washington 2006]. Reasons for this decline include market forces, such as large volumes of lumber imports from Canadian and non-Canadian sources and the market shift away from structure plywood towards Oriented Strand Board, as well as non-market forces tied to shifting public lands management policies and legal challenges to public timber harvests [Inland Northwest Forest Products Research Consortium 2003].

Table 14. Washington Timber Harvest by Owner Class and Region

Million Board Feet

Calendar Year	State Total	Owner Class					State Region	
		Private	State	Other Nonfederal	National Forests	Other Federal	Western	Eastern
1986	6,556	4,223	1,064	15	1,233	21	5,332	1,224
1987	7,035	4,602	970	22	1,423	18	5,698	1,337
1988	7,045	4,677	826	39	1,485	18	5,748	1,297
1989	6,852	4,845	842	13	1,142	10	5,492	1,360
1990	5,849	4,330	657	30	817	15	4,674	1,175
1991	5,104	3,822	535	33	703	11	4,014	1,090
1992	5,018	4,030	476	43	461	8	3,955	1,063
1993	4,329	3,513	461	17	322	16	3,307	1,022
1994	4,086	3,552	323	7	200	4	3,178	908
1995	4,392	3,720	496	20	150	6	3,417	975
1996	4,249	3,529	600	33	86	1	3,273	976
1997	4,245	3,390	645	31	166	13	3,258	989
1998	4,022	3,319	546	36	111	10	3,129	892
1999	4,383	3,580	662	15	117	9	3,375	1,008
2000	4,177	3,507	559	17	81	13	3,224	953
2001	3,716	3,116	496	26	68	11	2,842	874
2002	3,582	3,000	457	40	72	13	2,704	878

The trend present in Washington State has been evident in Clallam County as well, documented as it is in Washington State Department of Revenue data presented in Table 15. Since 2000, private harvest volumes in Washington State as measured in MBF harvested have declined at an average annual rate of 1.6 percent, while ton volume harvested has declined at a more rapid 5.1 percent average annual rate. In Clallam County, the decline has been more significant with private timber output declining at an average annual rate of 4.0 percent and 9.1 percent when measured by MBF and ton volume, respectively. The losses in private timber harvested have been somewhat offset by the recent expansion of public harvests.

In 2005, Clallam County timber harvests totaled roughly 181.5 MBF or 5.5 percent of the state's total harvest of 3.3 million MBF. Tax assessed on the Clallam County timber harvest totaled approximately $2.3 million in 2005 or 4.2 percent of the State's $55.3 million in total timber tax collections.

Table 15. Public and Private Timber Harvests and Assessed Tax in Washington State and Clallam County

Private Harvests

	MBF Volume Harvested	Ton Volume Harvested	Total Volume Harvested MBF / TON Harvested	Taxable Value	Tax Assessed
Clallam County					
2000	168,211	252,013	196,212	$ 54,962,855	$ 2,748,143
2001	159,641	190,804	180,837	$ 42,453,002	$ 2,122,650
2002	163,258	133,914	178,130	$ 37,209,114	$ 1,860,455
2003	145,955	157,910	163,504	$ 33,870,284	$ 1,693,514
2004	184,973	290,335	217,230	$ 42,632,152	$ 2,131,607
2005	137,152	156,485	154,546	$ 35,174,008	$ 1,758,700
Average Annual Growth	-4.0%	-9.1%	-4.7%	-8.5%	-8.5%
Washington State					
2000	2,831,640	2,937,225	3,163,084	$ 1,019,920,172	$ 50,996,009
2001	2,471,697	2,726,002	2,779,605	$ 854,534,041	$ 42,726,690
2002	2,548,991	2,104,131	2,788,150	$ 762,628,043	$ 38,131,389
2003	2,416,827	2,533,281	2,703,000	$ 687,961,470	$ 34,398,062
2004	2,753,573	2,659,021	3,053,421	$ 767,464,642	$ 38,373,217
2005	2,609,463	2,255,018	2,865,581	$ 850,512,944	$ 42,525,631
Average Annual Growth	-1.6%	-5.1%	-2.0%	-3.6%	-3.6%

Public Harvests

	MBF Volume Harvested	Ton Volume Harvested	Total Volume Harvested MBF / TON Harvested	Taxable Value	Tax Assessed
Clallam County					
2000	19,250	-	19,250	9,663,960	483,198
2001	43,349	-	43,349	11,666,598	583,330
2002	14,709	-	14,709	6,150,489	307,524
2003	37,137	-	37,137	9,910,303	495,515
2004	22,861	-	22,861	9,925,445	496,272
2005	44,334	-	44,334	11,460,926	573,046
Average Annual Growth	18.2%	-	18.2%	3.5%	3.5%
Washington State					
2000	471,748	5,083	472,398	226,571,120	11,328,556
2001	604,384	4,412	604,956	191,495,127	9,574,753
2002	595,866	286	595,905	166,246,066	8,312,300
2003	622,824	42	622,828	197,017,203	9,850,856
2004	734,616	939	734,720	235,945,019	11,797,246
2005	706,774	112	706,786	255,401,992	12,770,095
Average Annual Growth	8.4%	-53.4%	8.4%	2.4%	2.4%

In the Olympic National Forest, public timber sold has fluctuated significantly in recent years, growing from 3.6 MBF in 1999 to 7.7 MBF in 2003 [United States Department of Agriculture, Forest Service 1999-2003]. In 2000, Olympic National Forest timber sales fell to .75 MBF but rebounded to 10.35 MBF before dropping back to 5.2 MBF in 2002.

3.7 Tourism and Travel Impacts

The tourism and travel industry represents a significant component of the local economy in Clallam County employing 2,551 individuals or 16 percent of the private workforce and paying on average approximately $11,969 annually, as shown in Table 16 [Headwaters Economics 2006]. The Olympic Peninsula represents one of the largest tourist destinations in the State of Washington, with attractions

that include the coastal cities of Port Angeles and Sequim, the Olympic National Park and numerous campgrounds and other recreational sites.

Table 16. Clallam County Wages and Employment in 2005 (Private Sector Only)

	Employment	% of Total	Average Annual Wages
Total, all industries	16,088	100%	25,297
Goods-Producing	3,480	22%	34,659
Natural Resources and Mining	597	4%	32,685
Construction	1,433	9%	31,003
Manufacturing	1,451	9%	39,082
Service-Providing	12,608	78%	22,713
Trade, Transportation, and Utilities	4,510	28%	25,946
Information	302	2%	29,705
Financial Activities	741	5%	26,972
Professional and Business Services	1,079	7%	32,852
Education and Health Services	2,498	16%	23,250
Leisure and Hospitality	2,551	16%	11,969
Other Services	926	6%	17,604
Unclassified	#N/A	#N/A	#N/A

The direct impacts of travel spending in Clallam County are presented in Table 17. From 1991 to 2000, visitor spending in Clallam County grew at an average annual rate of 3.3 percent. From 2000 to 2005, direct visitor spending in Clallam County grew at a higher rate (4.6 percent), reaching $166.1 million in 2005. In 2005, travel spending in Clallam County represented approximately 1.3 percent of the statewide total of $12.7 billion. Tax receipts associated with travel spending in Clallam County totaled roughly 1.5 percent of total statewide receipts of $884.5 million. Earnings associated with travel spending were most significant in the accommodations and food service industries ($30.4 million in 2005), with arts, entertainment and recreation reaping the second largest earnings as a result of travel spending ($12.1 million in 2005). Travel spending in Clallam County generated approximately $3.3 million and $9.1 million in local and State tax receipts, respectively, in 2005 [Dean Runyan Associates 2006].

The direct impacts of travel spending highlighted within this section of the baseline assessment exclude indirect impacts or the intermediate inputs used in the production process (e.g., apples purchased from Washington orchards) and the induced impacts associated with purchases made by those employed in industries that depend on travel spending. For any industry, there is an associated multiplier that can be used to estimate associated indirect and induced impacts. In Washington State, the indirect impacts associated with travel spending generate a 1.35 multiplier and with induced impacts included, the multiplier grows to 2.1. Thus, the total contribution of the travel industry is estimated at 2.1 times its own impact on gross State product [Washington State Department of Community, Trade and Economic Development 2004].

Table 17. Clallam County Direct Travel Impacts

	1991	2000	2005	Average Annual Growth 1991-2000	Average Annual Growth 2000-2005
Total Direct Travel Spending ($Million)					
Visitor Spending at Destination	98.7	132.4	166.1	3.3%	4.6%
Other Travel	0.8	0.8	0.7	0.0%	-2.6%
Total Direct Spending	99.5	133.1	166.8	3.3%	4.6%
Visitor Spending by Type of Traveler Accommodation ($Million)					
Hotel, Motel	50.6	64.2	85.3	2.7%	5.8%
Private Campground	9.5	15.2	17.1	5.4%	2.4%
Public Campground	5.7	7.3	8.4	2.8%	2.8%
Private Home	13.0	18.5	22.5	4.0%	4.0%
Vacation Home	1.8	3.4	4.1	7.3%	3.8%
Day Travel	18.1	23.8	28.6	3.1%	3.7%
Spending at Destination	98.7	132.4	166.1	3.3%	4.6%
Visitor Spending by Commodity Purchased ($Million)					
Accommodations	18.7	26.0	33.9	3.7%	5.4%
Food & Beverage Services	28.1	36.6	47.5	3.0%	5.4%
Food Stores	6.7	9.6	11.8	4.1%	4.2%
Ground Transp.& Motor Fuel	8.7	15.0	22.6	6.2%	8.5%
Arts, Entertainment & Recreation	17.8	21.9	25.6	2.3%	3.2%
Retail Sales	18.7	23.2	24.7	2.4%	1.3%
Air Transportation (visitor only)	0.1	0.1	-	0.0%	N/A
Spending at Destination	98.7	132.4	166.1	3.3%	4.6%
Industry Earnings Generated by Travel Spending ($Million)					
Accommodations & Food Service	17.0	23.0	30.4	3.4%	5.7%
Arts, Entertainment & Recreation	7.9	10.6	12.1	3.3%	2.7%
Retail	3.4	4.7	5.5	3.7%	3.2%
Auto Rental & Ground Tran.	0.4	0.8	1.0	8.0%	4.6%
Air Transportation (visitor only)	-	-	-	N/A	N/A
Other Travel	0.4	0.3	0.4	-3.1%	5.9%
Total Direct Earnings	29.1	39.5	49.3	3.5%	4.5%
Industry Employment Generated by Travel Spending (Jobs)					
Accommodations & Food Service	1,550.0	1,570.0	1,730.0	0.1%	2.0%
Arts, Entertainment & Recreation	940.0	910.0	1,130.0	-0.4%	4.4%
Retail	270.0	270.0	260.0	0.0%	-0.8%
Auto Rental & Ground Tran.	20.0	40.0	40.0	8.0%	0.0%
Air Transportation (visitor only)	<5	<5	<5	N/A	N/A
Other Travel	20.0	20.0	10.0	0.0%	-12.9%
Total Direct Employment	2,800.0	2,820.0	3,170.0	0.1%	2.4%
Tax Receipts Generated by Travel Spending ($Million)					
Local Tax Receipts	1.3	2.2	3.3	6.0%	8.4%
State Tax Receipts	5.6	7.5	9.1	3.3%	3.9%
Total Direct Tax Receipts	6.9	9.8	12.4	4.0%	4.8%

Visitor spending associated with trips to Olympic National Park is of particular significance to the Elwha Restoration Project because more than 80 percent of the Elwha watershed lies within its boundaries. Olympic National Park accounts for more than 3.3 million annual recreational visits, generating total spending of nearly $90 million annually within and outside of the park [Stynes, Propst, and Sun, 2001]. More than half (53 percent) of the U.S. visitors to Olympic National Park were out-of-state travelers. Most common activities included sightseeing/scenic drives (88 percent), walking on nature trails (77 percent) and viewing wildlife (72 percent). The most common length of stay was less than one day (32 percent) but 64 percent of all visitors stay for two or more days. On average, group expenditures at or near the park total $394 [Omer, Littlejohn, and Gramann 2001].

3.8 Local Fishery

The Elwha and Glines dams have restricted access of salmon and seagoing trout to all but the lowest 4.9 miles of the Elwha River. Salmonids that are restricted to the lower 4.9 miles of the river are faced with poor spawning grounds and higher than normal water temperatures due to the presence of the dams and associated reservoirs.

The native anadromous spawning salmonids dropped in number from an estimated 380,000 to fewer than 3,000 in 1995. Removing the dams and draining the reservoirs are expected to enable natural sediment movement, open 70+ miles of river to migrating salmon, and restore high quality habitat in the Elwha River's middle and lower reaches [NPS 1996b].

The revenue generated through enhanced commercial, tribal, and sports fishing could be significant, measurable through both enhanced catch values and increased tourism realized due to enhanced sports fishing opportunities. Fish stocks expected to be enhanced by the Elwha restoration project include Coho, Pink, Chum, Sockeye and Chinook Salmon, and Steelhead Trout. In the economic analysis conducted for the Elwha River Restoration Project, the impact of dam removal was estimated for both the commercial fishery and local sport fishing businesses over a 100 year time period. The present value of the enhanced catch to commercial fisherman was valued at $150.7 million when no discount rate was applied to the annual catch values and $18.9 million when using a 4 percent discount rate. The economic impact on sport fishing businesses was estimated at $25.5 million over the 100-year time horizon when no discount rate was used and $2.8 million when a 4 percent discount rate was applied [Elwha Project Human Effects Team 1995].

When measuring changes in fisheries it is important to measure changes in catch numbers and value by species and location (as detailed as possible). The type of fishing entity benefiting from the catch (i.e., commercial, sport, tribal) should also be identified. The data to support this assessment are expected to be collected through monitoring efforts conducted by the Elwha River Dam Removal Study Team. Thus, no baseline fishery data are provided within this report.

3.9 Lower Elwha Klallam Tribe

The Lower Elwha Klallam Tribe has 776 enrolled members with 112 members residing on the Lower Elwha Reservation. The reservation consists of 443 non-contiguous acres located at the mouth of the Elwha River approximately 10 miles from Port Angeles. The Lower Elwha Klallam Tribe obtained guaranteed fishing rights to the Elwha River as a result of the 1974 Boldt Decision, which allocated 50 percent of the commercial harvest to Western Washington tribes. Thus, the Lower Elwha Klallam Tribe represents a significant stakeholder in the Elwha River Restoration project.

The total tribal labor force is represented by 35 members. The unemployment rate on the Lower Elwha Reservation is 48.6 percent. Per capita income on the reservation is $5,159. Approximately 36.7 percent of the tribal members are high school graduates. The major employer on the reservation is the tribal government, which employs approximately 60 people through its environmental, health, fisheries, and administrative programs. The tribe also operates a fishery, which employs seven tribal members. The region's commercial fishing industry also employs tribal members. There are four people employed in the operation of Saturday night bingo games at the Tribal Center. Tribally owned businesses are limited

to a smoke shop, which employs five tribal members, and seasonal fireworks stands (United States Department of Commerce, Economic Development Administration 2007).

The Lower Elwha Klallam Tribe has signed a Class III gaming compact with Washington State, which could open the door for a casino located on the Lower Elwha Reservation. The development of a tribal casino would have significant impacts on the Clallam County and Port Angeles economies. The impact associated with such a significant development would need to be considered when conducting any EIA of the Elwha River Restoration Project.

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Appendix A – Overview of the IMPLAN Model

IMPLAN is a static, non-survey, input-output model which uses a 528-sector adaptation of the 498-sector U.S Bureau of Economic Analysis (BEA) national input-output transactions table otherwise known as the "national table," which contains a comprehensive snapshot of purchases and sales of goods and services among individual sectors of the economy. IMPLAN uses tested techniques for estimating purchases and sales among this same set of 528 industries at the regional level. A detailed discussion of the IMPLAN regional model is provided in MIG (2000). BEA derived the national table based on information from its national income and product accounts (NIPA accounts) covering the production and sales of all commodities in the U.S. economy. The most recent national table, which BEA released in 2002 (BEA 2002), represents the industrial technologies in-place in 1997. Technology relationships represented in the input-output table are relatively stable over 10-15 year spans for most industries. Rapidly changing industries such as the computer industry are exceptions and should be evaluated in cases where they are affected by the economic impact scenario.

Detailed economic effects can be measured for the nation, state or group of states, or any single county or group of counties. Baseline economic data for all counties in the country are constantly updated and maintained by the Minnesota IMPLAN Group, Inc. The heart of the IMPLAN system is the benchmark input-output table for the U.S. economy, maintained by the BEA. IMPLAN can adapt that table to any region of the country using import and export information for that region. IMPLAN provides several methods for regionalizing the national I-O table. These options include supply-demand pooling, location-quotient, and regional purchase coefficients. The Clallam model was constructed using the RPC approach. RPC estimates adjust the production functions represented in the model by the proportion of inputs supplied locally, within the impact region (Clallam County in this case). This results in an I-O structure that best represents the local transactions necessary to satisfy local demands. The other methods can be classified as brute-force methods that can be applied to regionalize the structure of I-O models for regions that are not well understood, or for which very little data exist. Also, RPC values can be overridden by the analyst to reflect locally-collected or more recent data on the trade occurring in production input sectors. Thus, IMPLAN thus is an extremely flexible tool that allows locally collected or more recent economic data to override default values and permits a high level of customization of regional economic models.

Since IMPLAN is a static I-O model, the production input proportions are fixed. This means that all responses to shocks are linear. No accounting is made for unemployed resources or excess capacity. Using static I-O models assumes that all resources required to satisfy an economic expansion are either immediately available within the study region or can be immediately imported. The IMPLAN model is initialized by a set of data on employment, output, value-added, final demand, personal consumption expenditures, sales, etc. (MIG 2000).

IMPLAN's economic impact formulation follows the Leontief inverse. IMPLAN begins with a matrix B with row elements, i, and column elements, j, where i=j. Represented in the rows are industry sales to purchasing industries. Represented in the columns are estimated industry purchases from producing industries. Hence, any element represents the amount of industry i's production purchased by industry j. Dividing these industry by industry dollar flows through the total industrial output of each industry, X_i yields the industry direct coefficients matrix, A, with elements, a_{ij}, equating to the coefficient form of the b_{ij} elements described above. The A matrix is derived by dividing the

total purchases (columns of matrix B) in each sector and thus represents the estimated purchases by each sector from every other sector per dollar of sales. The A matrix embodies the interrelatedness between industries for a given, static, period of time. Over that time period, the coefficients represent the production technologies used in the economy being modeled. Economic impacts then can be estimated for any economy in which the A matrix or direct coefficients matrix has been estimated using the formulation:

$$(I - A)^{-1} Y = X$$

In this formulation, Y is a vector of industry final demand changes reflective of a given impact scenario. $(I-A)^{-1}$ is the total requirements matrix or multipliers matrix. X is the vector of resulting change in regional industrial output caused by the impact scenario. This calculation yields an estimate of the direct and indirect effect of an impact scenario on the industrial output of the affected region. To estimate the additional "induced" effects of resulting local spending of profits and consumer incomes earned in local businesses, other factors must be considered, as described below.

Formulation of induced effects varies depending on whether the model is open or closed with respect to the final demand sectors (households, governments, investment, etc.). I-O models are either open or closed models. If elements of final demand such as households, governments, investment, etc., have not been mathematically included in the structure of the direct coefficients matrix, then the model is "open." A closed model attempts to capture these outside monetary flows to the other sectors of the economy by "endogenizing" them, or including them in the structure of the direct coefficients matrix, and therefore, also within the total requirements matrix. This results in making final demand and value-added a part of the structure of the economy and allows the induced effects to be calculated simply using the equation above.

In the IMPLAN open model framework, the final demand and value-added components of the economy remain exogenous to the structure of the economy. Applying the equation above will result in an estimate of the indirect effects of an impact scenario, but additional steps are needed to estimate the induced effects. The resulting vector, *X*, is the estimate of change in regional industrial output associated with the impact scenario. Each X_i is multiplied by a corresponding response coefficient, e_i, w_i, and g_i to estimate the economy's response in terms of employment (*e*), income (*w*), and government spending (*g*). Response coefficients simply are the value of the measure per unit of industry output. The employment response coefficient for any industry (i) is the number of jobs; $jobs_i$ divided by the industry output (expressed in millions), $output_i$: $jobs_i/output_i = e_i$. The calculation is identical for income and spending responses. When the flows are monetary (not employment), the cumulative response across industries is summed and multiplied by the region's household spending function or government spending function, as the case dictates. This results in vectors of new expenditures made by the households and governments of the region in response to the indirect effect of the impact scenario. These new expenditures make up subsequent impact rounds or monetary turnover in the regional economy and are treated as additional final demand impulses in the model. The process iterates until the resulting changes converge to near zero, and the total economic effect results.