

State of Utah

Economic Benefits of Nutrient Reductions in Utah's Waters



Executive Summary

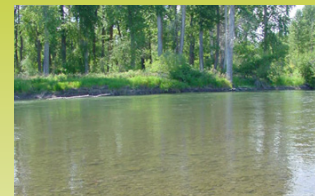
Protecting water quality is important to Utah's economy and the quality of life of Utahns. Excess nutrients (nitrogen and phosphorus) from treated wastewater, stormwater, and agricultural runoff can result in nuisance algae growth which degrades aesthetics, recreation and aquatic life in waterbodies. This study poses the question: **What are the economic benefits to Utahns maintaining and improving the quality of the state's lakes, rivers, and streams?** Through surveys administered to Utah households, the study found that residents place importance on protecting waters from excess nutrients for quality of life and recreation; for instance, 97 percent of Utah households surveyed indicated that it was important to maintain water quality for future generations. Utah households report that they are willing to pay from \$70 million to \$271 million a year to protect and improve

waters that are threatened by increasing levels of nutrients. Households who visit lakes, rivers and streams in Utah stated, and showed through their trip choices, a clear preference for recreating at cleaner waterbodies. The study found that annual economic benefits derived from enhancing recreational trips by improving water quality in Utah's waters accounted for about \$48 million of the total economic value. The remainder is due to other quality of life factors including sustaining water quality for future generations. Finally, this study estimated that residents of Utah spend about \$1.4 to \$2.4 billion a year on trips to the state's waters for water-based recreation activities. In this way, they not only derive a great deal of enjoyment from the state's water resources, but at the same time they make an important contribution to the state's economy.

Utah's lakes, reservoirs, rivers and streams play a significant role in the state's economy. Annual expenditures for recreation trips to Utah waters by state residents total between \$1.4 billion and \$2.4 billion. These expenditures to gasoline service stations and convenience stores, restaurants and fast food establishments, hotels and campgrounds, sporting good stores, and other suppliers are to support outdoor recreation activities on or near the water. These direct expenditures represent about 1 to 2 percent of the total state economy. Any spending by visitors from other states is in addition to these figures. For perspective, as described in the State of Utah Outdoor Recreation Vision, in 2011, 22 million domestic and international visitors traveled to Utah, spending an estimated \$6.87 billion. Many of these visitors are attracted to Utah for its beautiful natural amenities.

Anyone who swims or boats in rivers or lakes, or takes walks along a waterside in Utah, can appreciate the value of clean water. If clear, clean water was free, it is easy to imagine that most Utahns would prefer not to see algal blooms or experience unpleasant odors. Indeed as shown in Chapter 7, Utahns rated streams as undesirable

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for recreation and aesthetics based upon high levels of algal growth in the river bottom.

Unfortunately, for as long as rivers and lakes must serve multiple uses, clean water will not be free. As populations increase, so do the pressures on lakes and rivers to accommodate increasing levels of nitrogen and phosphorous in the wastewater streams that result from people going about their daily lives. It is costly to treat wastewater to remove these nutrients from homes and businesses before it is discharged to surface waters. In addition, managing stormwater from city streets and suburban yards as well as runoff from agricultural fields all come with a price tag.

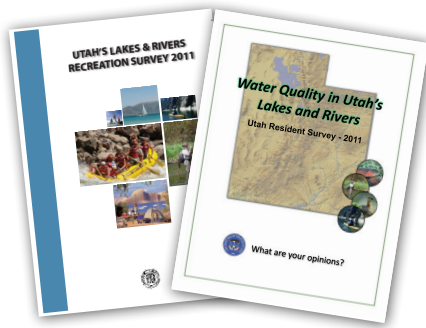
While a certain amount of nitrogen and phosphorous is necessary for the health of aquatic ecosystems, excess quantities from human activities can be harmful to fish and biodiversity and cause nuisance algal blooms, changes in water clarity, and undesirable odors. These detriments to people and aquatic life detract from the value of the state's waters and thus the quality of life of Utahns, which raises the question: What is the cost of failing to address current and future degradation from excess nutrients? Stating the question a different way: **What are the benefits to Utahns maintaining and improving the quality of the state's lakes, rivers, and streams?**

What is the problem with excess nitrogen and phosphorus?

Nitrogen and phosphorus are naturally occurring nutrients that flow into surface waters and are necessary to support aquatic life. However, man-made sources of nitrogen and phosphorus, such as sewage, stormwater and agricultural runoff, result in excess concentrations of nutrients that can cause nuisance algal growth. The increased algal growth and decomposition can lead to low oxygen levels in surface waters that harm fish and other aquatic organisms, and can reduce ecosystem diversity. The nuisance algae can also cause problems with taste, odor, and overall aesthetics that impede recreation, reduce property values, and can lead to increased drinking water treatment costs.



The primary objective of this investigation is to answer this question by providing information on the value of clean water to the citizens of Utah. This objective is best accomplished by surveying a random sample of Utah households. Surveys were conducted and interpreted by a research team that included academic and consultant experts in survey research and economic analysis in coordination with state water quality professionals. The state determined current water quality conditions and developed predictions for future scenarios for water quality with and without additional interventions to limit nutrients. This information was mailed to a representative sample of Utah households as paper surveys. These surveys are described in Chapter 3.



stewardship of the state's waters and a full 97 percent rated this objective as of moderate importance or higher.

In addition, 63 percent also highly rated the importance of improving water quality for fish and wildlife. Most households indicated that it was also important to maintain water quality for recreational purposes.

Undeniably, water-based recreation is popular among Utah's 893,717 households. Based on survey results it is estimated that three-fourths (73.2 percent) of Utah households indicated that they visited a lake and/or river to swim, fish, boat, hunt or engage in near-shore activities at least once in the previous 12 months (see Table ES-1). These households are defined as "users" of Utah's waters. This means that only about 27 percent are "nonusers" because they did not take a trip to a waterbody in the last 12 months.

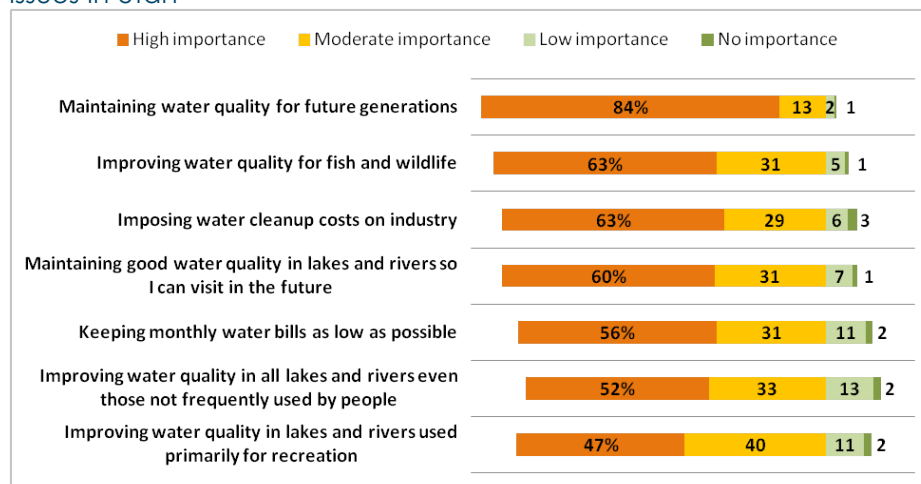
Public Benefits

The survey results indicated that regardless of whether or not households recreated at rivers and lakes, they at least wanted to prevent the state's waters from getting any worse (Chapter 5). Indeed, as shown in Figure ES-1, for the citizens of Utah as represented by the survey, the most important reason for protecting lakes and rivers from excess nutrients is to maintain water quality for future generations. Specifically, 84 percent of all respondents placed a high importance on the

TABLE ES-1
Distribution of Utah Households by Water-based Recreation

Total Households	893,717
Nonuser	239,516 (26.8%)
User	654,201 (73.2%)
Both River and Lake	475,457 (53.2%)
River only	67,029 (7.5%)
Lake Only	111,715 (12.5%)

FIGURE ES-1
Public Opinion on the Importance Of Water Quality-Related Issues In Utah



The households who visited rivers or lakes averaged more than 20 trips in the last year whether these trips were just day outings or longer. That translates to more than 13 million waterbody visits by Utah households! Table ES-2 shows the estimated number of day and overnight trips to the most popular lake and river destinations as reported in the survey.

Households may engage in more than one activity on their outing to a river or lake. As shown in Table ES-3, respondents were asked to report on their households' activities on their water-based recreation trips. Near shore activities, such as taking a walk along a riverside

(73.8 percent) or enjoying a picnic by the lake (59.6 percent) were taken by most households. Boating proved a more popular activity on lakes (64 percent) than rivers (13.7 percent). Swimming was also a more frequent activity at lakes (64.6 percent) than rivers (31.5 percent). Cold-water fishing was more popular than warm-water fishing whether in lakes or in rivers. Finally, a relatively small number of households also include hunting activities on their trips to the waterside. Thus, most Utah households have direct and varied experience with the state's waters as a recreational resource.

TABLE ES-2
Top Five Lakes and Rivers,
by Total Trips (Weighted)

LAKE	NUMBER OF TRIPS
Day Trips	
Utah Lake	492,000
Strawberry Reservoir	271,000
Deer Creek Reservoir	240,000
Pineview Reservoir	206,000
Bear Lake	199,000
Overnight Trips	
Flaming Gorge Reservoir	274,000
Strawberry Reservoir	263,000
Bear Lake	222,000
Jordanelle Reservoir	52,000
Rockport Reservoir	47,000

TABLE ES-3
Household Activities While Visiting Lakes
and Rivers (All Activities)

ACTIVITY	LAKES	RIVERS
Boating	64.0%	13.7%
Fishing—warm-water fishery	35.3%	18.4%
Fishing—cold-water fishery	57.1%	47.8%
Swimming	64.6%	31.5%
Near-shore activities	59.6%	73.8%
Hunting—waterfowl	8.9%	7.5%
Hunting/Trapping—other	4.5%	6.4%

RIVER	LOCATION DESCRIPTION	NUMBER OF TRIPS
Day Trips		
Logan River-1	Logan River from Cutler Reservoir to Third Dam	203,000
Provo River-1	Provo River from Utah Lake to Murdock Diversion	132,000
Provo River-3	Provo River from Olmsted Diversion to Deer Creek Reservoir	119,000
Jordan River-8	Jordan River from Narrows to Utah Lake	117,000
Chalk Creek-1	Chalk Creek from confluence with Weber River to confluence with South For Chalk Creek	111,000
Overnight Trips		
Green River-4	Green River from San Rafael confluence to Price River confluence	34,000
Provo Deer Creek	Provo Deer Creek from confluence with Provo River to headwaters	29,000
Huntington Creek-1	Huntington Creek from confluence with Cottonwood Creek to Highway 10	22,000
S. Fork Ogden River	From Pineview Reservoir to Causey Reservoir	21,000
Ogden River	From confluence with Weber River to Pineview Reservoir	19,000

Total Economic Benefits

The expressed opinions by the public provide valuable feedback about their attitudes toward managing water quality. However, these attitudes alone do not provide a direct measure of the economic value to the public. To this end, the surveys presented choice situations to respondents, similar to a vote in a referendum. Specifically, households could choose to pay nothing additional for their water and sewer services and allow some rivers and lakes to degrade or opt to pay higher monthly wastewater rates to prevent that degradation and in some cases, to improve waters that are already impaired by excess nutrients.

By making these choices, households indicated what economic value they place on protecting and improving the state's waters (shown in Figures ES-2 and ES-3). They chose what they would give up in terms of dollars that they could spend on other goods and services in the economy in return for cleaner water for their own use and enjoyment and for the quality of life of future generations living in Utah.

A look at the raw responses is instructive. The dollar amounts of the monthly payment or "bid" that was offered to respondents ranged from \$2 to \$50. About half the households were given the option to maintain water quality and the other half had the choice to go beyond simply preventing further degradation and to improve existing water quality. As shown in Table ES-4, the percentage of respondents who opted to make the extra monthly payments tended to be higher at the lower price levels, just as with other goods and services purchased in the market place. That is, the better the deal, the larger the number of buyers. More than 75 percent of households would pay \$2 to \$5 a month in return for maintaining water quality, but the percentage fell to about 40 percent at the \$20 per month price level. Finally, when the monthly cost reached \$50, about 25 percent of households indicated that maintaining water quality was worth that much to them.

Utah has over 130 priority lakes and reservoirs and hundreds of river destinations. The most popular day trips by Utahn households included Utah Lake, Strawberry Reservoir, Deer Creek Reservoir, Pineview Reservoir, Bear Lake and sections of the Logan, Provo, and Jordan rivers as well as Chalk Creek. For overnight trips Flaming Gorge Reservoir topped the list followed by Strawberry Reservoir and Bear Lake.



FIGURE ES-2
Nutrient Reduction Program - Maintain Scenario

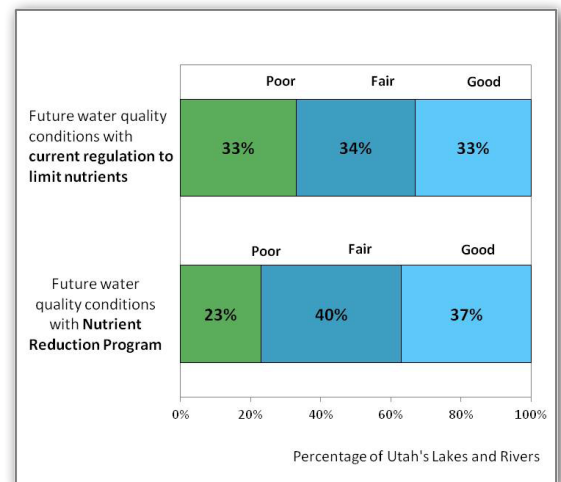


FIGURE ES-3
Nutrient Reduction Program - Improve Scenario

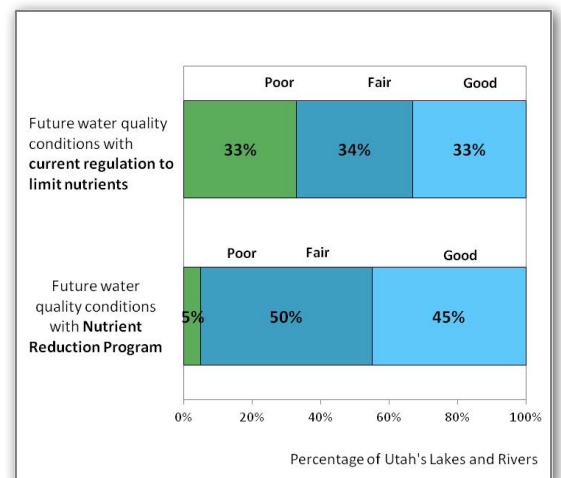


TABLE ES-4
Percent Responding “Yes” to Offered Bid by Survey Version

BID	MAINTAIN % 'YES'	IMPROVE % 'YES'
\$2	76%	75%
\$5	77%	68%
\$7	42%	62%
\$10	44%	54%
\$12	63%	50%
\$15	41%	47%
\$20	40%	62%
\$30	31%	51%
\$40	29%	32%
\$50	26%	31%

Overall, more households were willing to pay the monthly increase in their utility bills when given the opportunity to improve rather than simply maintain water quality. This is reasonable because these households were getting more for their money. For example, at the \$20 bid amount, the percentage who said “Yes” to the offer increased from 40 to more than 60 percent. In addition, half of the households were willing to pay as much as \$30 more each month in order to improve and protect water quality from too many nutrients entering the waterways.

The analysis of these data in Chapter 5 revealed different results depending upon whether the household was a recreational user or nonuser of the state’s waters. As shown in Table ES-5, on average, nonuser households stated that they would be willing to pay from \$2 to \$7 more each month to maintain current conditions. Households who actively recreate in or near waterways would pay \$3 to \$14 per month to prevent any further degradation in Utah’s waters and from \$ 8 to \$32 month if the nutrient reductions also improved waters that have already been impaired by excess nutrients. As shown in Table ES-6, on an annual basis and adding up the payments across all Utah households, this gives a range \$31 million to \$127 million to maintain water quality and between \$70 million and \$271 million per year to improve water quality. The upper bound of the range is based upon survey responses exactly as they were reported in the survey.

The lower bound of the range shows the results after conservatively adjusting the responses for how certain survey respondents felt about their answers. A respondent had to be at least 70 percent certain that they would be willing to pay the increase in their water bill for the response to count as a vote for the nutrient reduction program.

TABLE ES-5
Monthly and Annual Benefits per Utah Household

GROUP	FUTURE WATER QUALITY SCENARIO	MONTHLY WTP*		ANNUAL WTP	
		LOWER BOUND	UPPER BOUND	LOWER BOUND	UPPER BOUND
User	Improve	\$8	\$32	\$97	\$384
	Maintain	\$3	\$14	\$38	\$163
Nonuser	Improve/Maintain	\$2	\$7	\$26	\$85

* WTP = Willingness To Pay

TABLE ES-6
Total Utah Households Annual Benefits (2011 dollars)

SCENARIO		ANNUAL WTP		NUMBER OF USERS	NUMBER OF NONUSERS	UTAH ANNUAL WTP
		USERS	NONUSERS			
Maintain	Lower Bound	\$37.56	\$26.28	642,470	235,221	\$31 million
	Upper Bound	\$163.32	\$84.60	642,470	235,221	\$127 million
Improve	Lower Bound	\$97.32	\$26.28	642,470	235,221	\$70 million
	Upper Bound	\$383.64	\$84.60	642,470	235,221	\$271 million

Even the lower bound estimates are significant and suggest that Utah households value clean water. According to the survey, Utah households would be willing to continue these payments for at least 20 years. Using the lower bound estimates, and the 20-year time frame, means that maintaining water quality is worth about \$500 million, while improving water quality is worth more than \$1 billion. Not accounting for population growth, the upper bound for maintaining water quality is about \$2 billion and for improving water quality is more than \$4 billion. This is also a measure of the cost of not taking further action to address water quality problems due to too many nutrients.

A number of factors contribute to the validity of the results:

- » The results have internal validity based on the fact that responses showed an economically sensible inverse relationship between the amount households were asked to pay and their likelihood of paying the increase in their water bill.
- » Given the information in the survey booklet, the familiarity Utah households have with paying a water bill, and the fact that nearly three-fourths of Utah households visit Utah lakes and/or rivers, the survey results should be considered well-informed economic values.
- » The statistical tests found no evidence of sample selection bias, and weights were applied so that the values represent Utah households as a whole.
- » A range of benefits have been provided with an upper bound based on responses by households to the survey and a conservative lower bound to bracket the value that the economic literature indicates will correspond to what households would pay when it comes time to part with real money.



Recreation Benefits

Another way to validate the results and to learn more about how water quality affects the value of the recreation experience is to observe and analyze the recreation decisions made by households. Specifically, if people show by their behavior that they tend to bypass eutrophic waters to visit cleaner water bodies to enjoy their favorite recreation activities, this further corroborates their statements about the importance of maintaining and improving water quality. Table ES-7 shows the changes in water quality relative to current conditions for the water bodies most utilized for water-based recreation in Utah. Under the status quo 46 lakes and 73 rivers would degrade. However, if the state adopts measures to maintain water quality, that degradation would not occur. Under the improve policy, the state would go beyond maintaining water quality and improve waters that have already degraded.

TABLE ES-7
Summary of the Effect of Future Water Quality Policies on 131 Lakes and 153 Rivers

	NUMBER THAT DEGRADE	NUMBER HELD CONSTANT	NUMBER THAT IMPROVE
Status Quo			
Lakes	46	62	23
Rivers	73	64	16
Maintain			
Lakes	0	108	23
Rivers	0	137	16
Improve			
Lakes	0	85	46
Rivers	0	80	73

Status Quo: Comparison of water quality in twenty years under Current Policy, relative to current 2011 conditions.

Maintain: Comparison of water quality in twenty years under a Maintain Water Quality Policy, relative to current 2011 conditions.

Improve: Comparison of water quality in twenty years under an Improve Water Quality Policy, relative to current 2011 conditions.

The survey of outdoor recreation is described in Chapter 3 and the analysis of the survey data is explained in Chapter 6 (Table ES-8). The annual value of maintaining water quality in terms of enhancing the recreation experience is more than \$18 million; whereas improving water quality is valued at more than \$48 million per year. This recreation value is not in addition to the amount that households are willing to pay each year to maintain and improve water quality. Rather it shows that the recreation value is just one component of total value. These results also show that a decision about which water body to visit is only partly based on water quality. Other important factors, such as distance from home, are described in greater detail in Chapter 6. Besides their own use and enjoyment, Utah households are willing to pay a sizable amount each year to sustain water quality and protect the quality of life of future generations of Utahns. Indeed, 97 percent of Utahns reported that protecting water quality for future generations was somewhat or extremely important when directly asked (Chapter 5).

Using the lower bound estimates, and the 20-year time frame, means that maintaining water quality is worth about half a billion dollars while improving water quality is worth over a billion dollars.



TABLE ES-8
Annual Net Economic Benefits of Future Water Quality Policies (\$ millions)

	STATUS QUO	MAINTAIN	IMPROVE
Specification 2			
Day trips	-\$3.91	\$6.01	\$10.96
Overnight trips	-\$2.02	\$12.34	\$37.49
Total	-\$5.93	\$18.35	\$48.45

Other Benefits

As a final note, there are other ways that clean water can benefit Utahns. One is through higher values of lakefront properties that are affected by the aesthetics of clean water views and a second is lower drinking water treatment costs due to higher quality water at the drinking water intake. The state is currently investigating the relationship between excess nutrients and drinking water treatment costs. Those results are presented in a separate report. However, the effects of water clarity on lakefront property values are described in Chapter 8. Compared to other states, Utah has very little private lakefront property. Most of the state’s waterfront is owned by the public. Of Utah’s 130+ priority lakes, only a fraction have shorelines in private ownership subject to property tax payments, and only 17 of those waterbodies showed changing water clarity conditions from the nutrient control scenarios. The water clarity in these lakes could improve by almost 1 meter by reducing excess nutrients; whereas, continuation of the status quo could cause water clarity to decline by about 0.27 meter (about 1 foot). In property value terms, reducing nutrients would produce a gain in property values of \$20.2 million. No new action would lead to a loss of around \$7.4 million. These benefits to lakefront property owners are small in relation to the total benefits to the Utah residents as a whole.