The Relationship Between Water Cost and Water Prices

A Review and Analysis of Errors Identified in Utah Professors'
Analysis of the Lake Powell Pipeline Project

September 2016

1. Twenty two university professors drafted a letter to state lawmakers suggesting the Lake Powell Pipeline project is financially and economically infeasible.

2. A cornerstone of the professors' analysis is that the project will increase Washington County water rates so high that there will be little demand for the water generated by the project.

3. The analysis uses an inaccurate price of water, understating the price actually paid by Washington County consumers by roughly 430 percent.

4. The error relative to water price undermines their analysis regarding price and demand and invalidates the professors' findings and conclusions.

5. Applying the correct price of water results in pricing and demand consistent with actual conditions.

6. Using the professors' analysis with corrections for the pricing errors, the estimated water rate impacts of the Lake Powell Pipeline on a typical household would be more modest, increasing approximately 68 percent compared to their most recent estimate of "more than 570 percent."*

*Analysis based on the professors' September 2016 model. Please note that these estimates simply reflect the outcome when revising the assumptions in the professors' model and do not reflect an expectation of actual impact or cost by the Washington County Water Conservancy District.

Notes & Limitations

- This analysis is intended to explain why one element of the professors' analysis is incorrect. This is not to suggest that this is the only error contained in the report. Other issues have been or will be addressed under separate cover.

- Recalculations of the professors' analysis are provided in this report. These recalculations are provided for illustrative purposes only. This should not be interpreted to suggest that other elements, including, without limitation, the relationship between water prices and demand, assumed by the professors are accurate.

- The Washington County Water Conservancy District continues to evaluate near-term and long-run water supply and demand issues as part of its resource planning process.

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Honorable Governor Herbert
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Honorable President Niederhauser
Utah State Senate
320 State Capitol
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Honorable Speaker Hughes
Utah House of Representatives
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Salt Lake City, Utah 84114

October 26, 2015

Dear Governor Hebert, President Niederhauser, and Speaker Hughes,

There has been discussion over the last several years regarding the Utah Division of Water Resources' proposed Lake Powell Pipeline ("LPP") project and the subsequent repayment obligations of the taxpayers of Washington County. We have conducted an analysis of the indebtedness of the Washington County Water Conservancy District ("the District") and the residents of Washington County by virtue of their participation in the LPP. Based on our analysis we have major concerns about the debt and increased water rates and/or increased impact fees that will be caused by this proposal.

The following pages summarize our findings, based on the LPP Preliminary Application Documents, the District's audited financial statements, and other public documents made available by various agencies. Based on this initial analysis, we have major concerns about the likelihood that Utah taxpayers will be repaid by the District for the costs of the LPP.

The District intends to participate in the LPP, proposing to receive 94.5% of the water from the pipeline. This would amount to 69,000 acre-feet, according to the project's 2011 Water Needs Assessment. We calculated different repayment scenarios based upon the 2012 Socioeconomics and Water Resource Economics Report's low and high project cost projections of $1.4 billion and $1.8 billion, respectively, assuming an interest rate of four percent and a 50-year repayment period. These cost estimates are in 2012 dollars and this analysis did not account for inflation.

The District will have to repay between $61.8 and $131 million of LPP debt annually on top of its existing debt portfolio, depending on final LPP project costs. The District's current

In October 2015, 22 professors from University of Utah, Utah State University and Brigham Young University issued a letter to state lawmakers raising "major concerns" regarding the Lake Powell Pipeline.

We conclude from our initial analysis that these debt obligations raise serious questions about the project the Division of Water Resources is proposing. The State should not facilitate Washington County's acquisition of this debt without a careful and thoroughly detailed study of whether Washington County residents have the need for this water, the will to pay dramatically more in water rates and/or impact fees, and the financial capacity to repay this large debt owed to the taxpayers of Utah. Without this study and subsequent discussion, there is no assurance that Utah taxpayers will ever see their loan repaid. Indeed if repayment really was highly likely, the District by itself could have borrowed the money on the bond market from eager investors and started construction already, without any State financial involvement, as the District has done on many past occasions.

Thank you for the opportunity to participate in this discussion.

Sincerely,

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The group was led by professors Gail Blattenberger and Gabriel Lozada and was undertaken in concert with the Utah Rivers Council, a Salt Lake City environmental organization engaged in active opposition to the Lake Powell Pipeline.

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The professors argue that astronomical water rate increases will be required as a result of the Lake Powell Pipeline, and as such, the demand for water will be sharply reduced.

"Due to the fact that the price elasticity of demand for water is estimated to be -0.5, repayment through water sales alone would require rate increases of 1665-1995 percent. This enormous increase in water rates would lead Washington County water users to need less water in 2060 than they used in 2010, meaning that there would be no need for the water supplied by the LPP. In other words, if the LPP is financed only by increasing water rates, water would become so expensive that future water demand would drop below the current water demand of WCWCD, even if one ignores other water sources identified above." [internal citations omitted]

Based on the expected growth of existing revenue streams due to population increase in the county, WCWCD's revenues can be projected over the next 50 years, as shown in Column H. The deficit schedule for the repayment period can be seen in Columns O and P. These columns show that the District's revenues fall significantly short of the District's expenses for every year of the 50-year repayment schedule (except for any initial payment-free years). Unless the District has an increase in revenues, WCWCD's cumulative debt would grow to between $5.84–6.76 billion (cell P73) by the end of the project repayment period. Clearly, participation by the WCWCD in the LPP will require significant increases in impact fees and/or water rates.

4. Water Rate and Impact Fee Increases Required to Repay Debt

The fundamental question is whether the WCWCD can make these debt payments via an increase in revenue[13], and if so how they will raise this revenue.

Increasing Property Taxes. According to Utah law, water conservancy districts in the Lower Colorado River Basin may not tax higher than 0.001 per dollar of taxable value of taxable property in the district.[14] WCWCD currently collects property taxes at the rate of 0.00097. However, even if WCWCD increased their levy to the maximum collection rate, this only increases revenues $301,642 and revenues would still fall short of their expenses by tens of millions of dollars each year, accumulating to a deficit of billions dollars at the end of the 50-year repayment period. Therefore increasing water rates and/or impact fees must also be implemented by WCWCD.

Increasing Water Rates. Columns Q and R examine whether increasing water rates alone, without any impact fee increases, could repay Washington County Water District's total future debt. Although one might think the WCWCD could simply increase water rates to raise revenues, raising water rates will result in a decrease in total water demand. Because the debt is relatively large, in order for water sales to cover the debt obligations of the project, water sales revenues would need to increase by 320–358 percent, depending upon the total cost of the LPP (spreadsheet cell B10). This would still require the WCWCD to shoulder significant deficits over time, but would result in a balance of essentially zero in 2063 (Columns Q and R; cell R73).

Due to the fact that the price elasticity of demand for water is estimated to be -0.5, repayment through water sales alone would require rate increases of 1665–1995 percent (cell B12). This enormous increase in water rates would lead Washington County water users to need less water in 2060 than they used in 2010 (cells O12 and AA12 of the "Water Demand" worksheet), meaning that there would be no need for the water supplied by the LPP. In other words, if the LPP is financed only by increasing water rates, water would become so expensive that future water demand would drop below the current water demand of WCWCD,[15] even if one ignores other water sources identified above.

Increases in water rates may slow the rate of population growth in Washington County, which would make the LPP both harder to pay back and less necessary. To avoid this and maintain the desirability of homes and building lots in Washington County in the face of increases in water rates, the price of that real estate would have to fall. The lower property values would decrease the

[13] In the low-cost scenario, we assumed repayments start immediately, which keeps costs as low as possible. In the high-cost scenario, we assumed repayments begin after a delay of 10 years, which is more realistic and raises costs.
[14] Utah Code, Section 17B-2a-1006. http://le.utah.gov/code/TITLE17B/htm/17B02a100600.htm
[15] This is because cell B11 is larger than cell B8 in both scenarios.

What is price elasticity of demand for water?

Definition

Price elasticity of demand is an economic concept suggesting that as the price for something rises consumers demand decreases. In this case, as the price of water goes up, the amount of water demanded would go down.

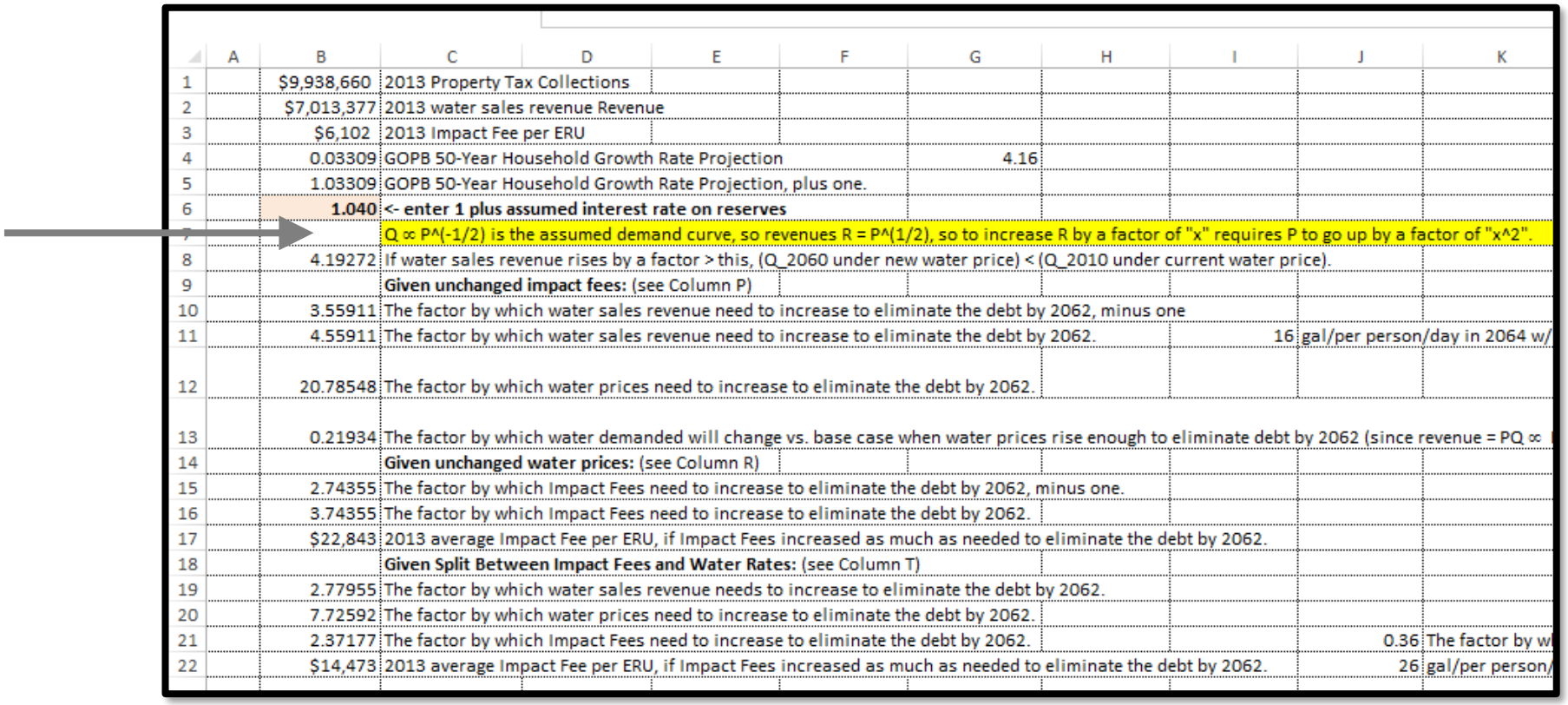
Formula

$$\frac{\text{\% Change in Quantity Demand}}{\text{\% Change in Price}} = \text{Price Elasticity of Demand}$$

Example

For every 10% increase in the price of sneakers, Sporty Shoes sees a 1% decrease in the number of sneakers that it sells. If its shoes go from $100 to $110 (a 10% increases), one can expect that sales of its sneakers will decrease from 10,000 to 9,900 (1%). Thus, its price elasticity of demand is -0.1.

Professors Lozada and Blattenberger assume that the price elasticity for water in Washington County is minus 0.5. This means that for every 10% increase in the price of water, the amount of water demanded will fall by 5%.



	A	B	C	D	E	F	G	H	I	J	K
1		$9,938,660	2013 Property Tax Collections								
2		$7,013,377	2013 water sales revenue Revenue								
3		$6,102	2013 Impact Fee per ERU								
4		0.03309	GOPB 50-Year Household Growth Rate Projection				4.16				
5		1.03309	GOPB 50-Year Household Growth Rate Projection, plus one.								
6		**1.040**	**<- enter 1 plus assumed interest rate on reserves**								
7			Q ∝ P^(-1/2) is the assumed demand curve, so revenues R = P^(1/2), so to increase R by a factor of "x" requires P to go up by a factor of "x^2".								
8		4.19272	If water sales revenue rises by a factor > this, (Q_2060 under new water price) < (Q_2010 under current water price).								
9			**Given unchanged impact fees:** (see Column P)								
10		3.55911	The factor by which water sales revenue need to increase to eliminate the debt by 2062, minus one								
11		4.55911	The factor by which water sales revenue need to increase to eliminate the debt by 2062.						16	gal/per person/day in 2064 w/	
12		20.78548	The factor by which water prices need to increase to eliminate the debt by 2062.								
13		0.21934	The factor by which water demanded will change vs. base case when water prices rise enough to eliminate debt by 2062 (since revenue = PQ ∝								
14			**Given unchanged water prices:** (see Column R)								
15		2.74355	The factor by which Impact Fees need to increase to eliminate the debt by 2062, minus one.								
16		3.74355	The factor by which Impact Fees need to increase to eliminate the debt by 2062.								
17		$22,843	2013 average Impact Fee per ERU, if Impact Fees increased as much as needed to eliminate the debt by 2062.								
18			**Given Split Between Impact Fees and Water Rates:** (see Column T)								
19		2.77955	The factor by which water sales revenue needs to increase to eliminate the debt by 2062.								
20		7.72592	The factor by which water prices need to increase to eliminate the debt by 2062.								
21		2.37177	The factor by which Impact Fees need to increase to eliminate the debt by 2062.							0.36	The factor by w
22		$14,473	2013 average Impact Fee per ERU, if Impact Fees increased as much as needed to eliminate the debt by 2062.							26	gal/per person/

Professors Lozada and Blattenberger first calculated the current price of water and the total quantity of water demanded, using "water sales revenue" of approximately $7.0 million from the annual financial statements of the Washington County Water Conservancy District.

	A	B	C	D	E	F
1		**WCWCD Revenue Stream**				
2	Source: 2013 WCWCD Audited Financial Statement					
3	**Property Tax**	$9,938,660		**Total Service Area Property Valuation**		$10,240,302,002
4				**2013 Property Tax Collection Rate**		0.000970544
5	**Impact Fees**			Maximum Legal Property Tax Rate		0.001
6	Total	$5,919,316		Additional Revenue if use Max. Rate		$301,642.00
7						
8	Cost per ERU	$6,102				
9	Total New 2013 ERU's	970				
10				Note: Equivalent Residential Unit (ERU) is the metric used to		
11	**Water Availability Surcharge**			determine cost of impact fee per lot, equivalent to 1 ERU per 10,000 sq. ft. of irrigable land		
12	Fee/ ERU	$1.75				
13	2013 Total	$1,248,977				
14	Total ERU's	713,701				
15				Note: The Water Availability Surcharge is charged to all water bills as a monthly fee		
16	2013 ERU Growth	0.001359199				
17						
18	**Operating Revenues**					
19	Power sale revenue	$926,134				
20	water sales revenue	**$7,013,377**				
21	Water Development and Connection Fees	$1,379,171		$2,305,305		
22	**Total Operating Revenues**	$9,318,682				
23						
24	**Real Property**					
25	Acres	1000	Annual	1200	Annual	According to page 7 of
26	Low Value	$50,000,000	$1,000,000	$60,000,000	$1,200,000	1000-1200 acres in re
27	High Value	$125,000,000	$2,500,000	$150,000,000	$3,000,000	additional funds. The
28	Average	$87,500,000	$1,750,000	$105,000,000	$2,100,000	$

This $7.0 million baseline price of water is used in the professors' "scenario" calculation schedules and then increased by the rate of population growth each year to estimate total water sales revenue for 2015 through 2064.

Baseline Price of Water →

Annual Adjustment Factor Based on Population Growth Rate →

Calculated Annual Water Rate Revenue →

Note: We ignore here that the professors miscalculate 2015 by only adjusting 2013 revenue by a single year, when it should have been adjusted by two years.

	A	B	C	D	E	F	G
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23	**Year**	**Property Taxes**	**water sales revenue**	**Power sale revenue and Surcharges**	**Impact Fees**	**Real Estate sale revenue**	**LPP Power sale revenue**
24	2015	$10,267,[illegible]	$7,245,479	$2,381,597	$9,399,311	$15,000,000	$0
25	2016	$10,607,367	$7,485,261	$2,460,414	$9,710,373	$15,000,000	$0
26	2017	$10,958,409	$7,732,979	$2,541,839	$10,031,729	$15,000,000	$0
27	2018	$11,321,068	$7,988,895	$2,625,959	$10,363,720	$15,000,000	$0
28	2019	$11,695,728	$8,253,281	$2,712,863	$10,706,699	$15,000,000	$0
29	2020	$12,082,788	$8,526,416	$2,802,643	$11,061,027	$15,000,000	$0
30	2021	$12,482,657	$8,808,590	$2,895,394	$11,427,082	$15,000,000	$0
31	2022	$12,895,760	$9,100,103	$2,991,214	$11,805,251	$15,000,000	$0
32	2023	$13,322,534	$9,401,262	$3,090,206	$12,195,936	$15,000,000	$0
33	2024	$13,763,431	$9,712,389	$3,192,473	$12,599,550	$15,000,000	$0
34	2025	$14,218,920	$10,033,812	$3,298,125	$13,016,520	$0	$0
35	2026	$14,689,482	$10,365,872	$3,407,274	$13,447,291	$0	$72,005,740
36	2027	$15,175,618	$10,708,921	$3,520,035	$13,892,317	$0	$74,885,970
37	2028	$15,677,841	$11,063,324	$3,636,527	$14,352,071	$0	$77,881,409
38	2029	$16,196,686	$11,429,455	$3,756,875	$14,827,040	$0	$80,996,665

To estimate the quantity of water demanded, the professors start with a baseline consumption level of 294.3 gallons per capita per day. They apply a conservation factor of 18 percent by 2060, and then multiply this value by the projected population in Washington County. This results in an estimated water demand of 45,739 acre feet in 2010, escalating to 157,251 acre feet in 2060 (with conservation).

Estimated Per Capita Water Use (with conservation)

Total Number of Acre Feet of Water Demanded (with conservation)

	A	B	C	D	E	F	G	H	I	J	K
1	Note: for this graph to look right, cell M6 of the "First Scenario" tab should be "A" and cell M6 of the "Second Scenario" tab should be "B".										
2											
3		Year	Current Supply	Supply with LPP	Base Per Capita Use (GPCD)	Assumed Conservation from 2005	Per Capita Use with Conservation (GPCD)	2005 Projected Water Demand w/ cons. (ac-ft/yr)	2012 Projected Water Demand w/ cons. (ac-ft/yr)	*Expressed in Gallons*	2012 Projected Water Demand w/o cons. (ac-ft/yr)
4		2009	82,010	82,010	294.3	0%	294.3	55408	*45,739*	*14,904,149,308*	*45,739*
5		2010	82,010	82,010	294.3	1%	291.4	54854	*45,282*	*14,755,107,815*	*45,739*
6		2020	130,840	151,010	294.3	5%	279.6	87646	*61,621*	*20,079,148,635*	*64,864*
7		2030	130,840	151,010	294.3	9%	267.8	124648	84,164	*27,424,865,746*	92,488
8		2040	130,840	199,840	294.3	12%	259.0	162359	107,842	*35,140,337,842*	122,547
9		2050	130,840	199,840	294.3	16%	247.2	196517	130,859	*42,640,583,401*	155,785
10		2060	130,840	199,840	294.3	18%	241.3	232576	157,252	*51,240,873,082*	191,771
11							**2060 demand as a fraction of 2010 supply ->**		192%		
12							**2060 demand as a fraction of 2010 demand ->**		344%		

Total Number of Gallons of Water Demanded

Note: The conversion to gallons was done by us simply to express total water demanded in units that people are more accustomed to seeing (gallons versus acre feet).

Applying the professors' logic to 2015 values results in approximately 16.2 billion gallons of water demanded by the residents of Washington County.

Estimated Washington County Population	155,000	
Gallons of Water Demanded Per Capita Per Day (GPCD)	285	← **Midpoint of 2010 and 2020 Estimates** *Note: We ignore here that the professors overestimate the per capita water demand in Washington County.*
Total Gallons of Water Consumed in Washington County Each Day (Population * GPCD)	44.2M	
Total Gallons of Water Consumed in Washington County Each Year (Population * GPCD *365 Days Per Year)	16.2B	← **Total Quantity of Water Demanded**

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Consumers typically pay for water based on a price per 1,000 gallons consumed. The professors suggest this unit price is approximately 45 cents per 1,000 gallons.

Total Water Rate Revenue (2015):	$7,245,479
Total Water Demanded, in Gallons (2015):	16,150,521,825
Gallons Demanded / 1,000 (2015):	16,150,522
Price Per 1,000 Gallons Consumed (2015):	**$0.45**

Residents of Washington County currently pay significantly more than 45 cents per 1,000 gallons of water consumed.

Below is a typical water bill for a single family household in St. George, Utah.

CITY OF ST. GEORGE - UTILITIES
PO BOX 1750
St.George, UT 84771-1750
435.627.4700 www.sgcity.org

I wish to donate $_____ to help those in need of assistance with their utility bills.

Please check lower portion of statement for important messages.

ACCOUNT NUMBER	SERVICE ADDRESS	BILLING DATE	DUE DATE	AMOUNT DUE
[redacted]	[redacted]	11/30/2015	12/22/2015	$157.88

If your mailing address has changed, please correct the address below.
(NOTE: If you are moving to a new location, you must complete a new application at the City Offices at 175 East 200 North.)

Return with Payment
Enter Amount Enclosed
if different from
AMOUNT DUE $_____

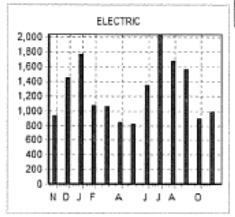
*** AUTO - CRRT C016
[redacted]

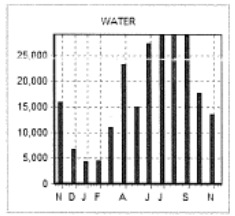
TO INSURE PROPER CREDIT, PLEASE TEAR AND RETURN THIS UPPER PORTION WITH YOUR PAYMENT PAYABLE TO City of St. George.
KEEP THIS LOWER PORTION FOR YOUR RECORDS

CITY OF ST. GEORGE - UTILITIES
PO BOX 1750
St.George, UT 84771-1750
435.627.4700 www.sgcity.org

ACCOUNT NUMBER: [redacted]
CUSTOMER NAME:
SERVICE LOCATION:
BILLING DATE: 11/30/2015

NOTE: YOUR BILL IS PAYABLE ON OR BEFORE DUE DATE. IF PAYMENT IS NOT RECEIVED BY DUE DATE A PENALTY OF 5% WILL BE ASSESSED.





SERVICE FROM	SERVICE TO	DAYS	DESCRIPTION	METER READING PREVIOUS	METER READING CURRENT	USAGE	MULTI-PLIER	AMOUNT
			PREVIOUS BALANCE					154.73
			PAYMENTS RECEIVED					154.73-
10/20	11/19	30	ELECTRIC	9916	10898	982	1	90.49
			Customer Charge			15.65		
			KWH Charge			74.84		
10/20	11/19	30	WATER	267993	269338	13450		
			SEWER					10.68
			GARBAGE					11.50
			ENERGY TAX					5.43
			DRAINAGE					1.50
			WCD SURCHRG					1.75
			FLOOD CNTRL					1.50
			SALES TAX					3.30
			CURRENT CHARGES					157.88
			AMOUNT DUE					**$157.88**

MESSAGES: ***ATTENTION**BUSINESS LICENSE HOLDERS**ATTENTION***
BUSINESS LICENSES WILL EXPIRE ON 12/31/15. COURTESY RENEWAL APPLICATIONS WILL BE MAILED BY 12/15/15 AND DUE BY 1/1/2016. IF YOU DO NOT RECEIVE AN APPLICATION PLEASE CONTACT THE BUSINESS LICENSE DEPARTMENT AT 435-627-4740. BLANK APPLICATIONS ARE AVAILABLE ON THE CITY WEB PAGE AT WWW.SGCITY.ORG.
BUSINESS LICENSES ARE DELINQUENT ON 2/28/2016, AT THAT TIME A $25.00 LATE FEE IS CHARGED.

Total Water Consumed: 13,450

Note: This is consistent with average consumption in the region. A typical household consumes about 160 gallons per capita per day. Assuming about 2.9 people per household, this translates into about 14,113 gallons consumed per month.

Residents of Washington County currently pay significantly more than 45 cents per 1,000 gallons of water consumed.

Below is a typical water bill for a single family household in St. George, Utah.

CITY OF ST. GEORGE - UTILITIES
PO BOX 1750
St.George, UT 84771-1750
435.627.4700 www.sgcity.org

I wish to donate $_____ to help those in need of assistance with their utility bills.

Please check lower portion of statement for important messages.

ACCOUNT NUMBER	SERVICE ADDRESS	BILLING DATE	DUE DATE	AMOUNT DUE
[redacted]	[redacted]	11/30/2015	12/22/2015	$157.88

If your mailing address has changed, please correct the address below.
(NOTE: If you are moving to a new location, you must complete a new application at the City Offices at 175 East 200 North.)

Return with Payment
Enter Amount Enclosed
if different from
AMOUNT DUE $_____

*** AUTO - CRRT C016
[redacted]

TO INSURE PROPER CREDIT, PLEASE TEAR AND RETURN THIS UPPER PORTION WITH YOUR PAYMENT PAYABLE TO City of St. George.
KEEP THIS LOWER PORTION FOR YOUR RECORDS

CITY OF ST. GEORGE - UTILITIES
PO BOX 1750
St.George, UT 84771-1750
435.627.4700 www.sgcity.org

ACCOUNT NUMBER: [redacted]
CUSTOMER NAME:
SERVICE LOCATION:
BILLING DATE: 11/30/2015

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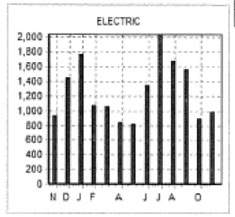

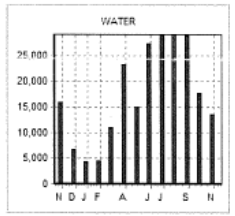

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← **Total Water Cost: $31.73**

Residents of Washington County currently pay significantly more than 45 cents per 1,000 gallons of water consumed.

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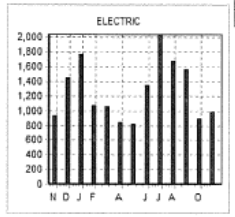

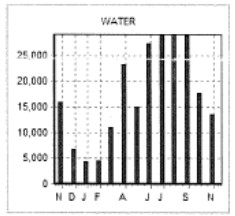

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Water Cost Per 1,000 Gallons Consumed: $2.36

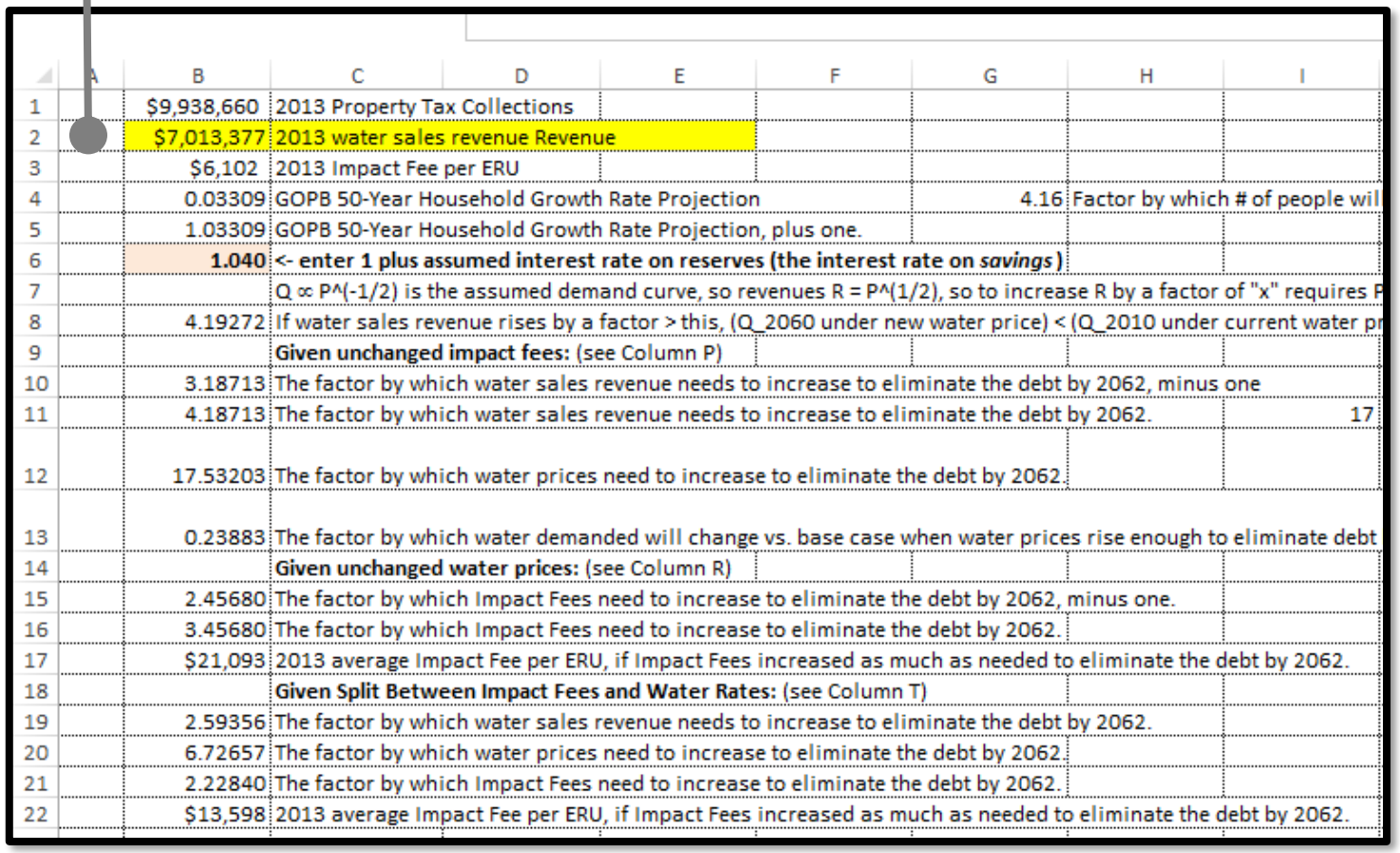
Note: This is simply the $31.73 divided by total consumption of 13,450 divided by 1,000.

The professors underestimate current water prices by about 5.3x or approximately 430%

Utah Professors' Estimated Cost Per 1,000 Gallons of Water in Washington County	**$0.45**
Actual Estimated Cost Per 1,000 Gallons of Water in Washington County	**$2.40**
Utah Professors' Error Factor (Rate) (Actual Rate / Estimated Rate)	**5.3x**
Utah Professors' Error Factor (Percent) (Percent Differential)	**430%**

Why do the professors make this error?

The professors assume that 2013 water rate revenue reported by the Washington County Water Conservancy District is reflective of the price paid for all water consumed. It is not; they ignored revenue generated by local municipal utilities.



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4		0.03309	GOPB 50-Year Household Growth Rate Projection				4.16	Factor by which # of people wil	
5		1.03309	GOPB 50-Year Household Growth Rate Projection, plus one.						
6		**1.040**	**<- enter 1 plus assumed interest rate on reserves (the interest rate on *savings*)**						
7			Q ∝ P^(-1/2) is the assumed demand curve, so revenues R = P^(1/2), so to increase R by a factor of "x" requires P						
8		4.19272	If water sales revenue rises by a factor > this, (Q_2060 under new water price) < (Q_2010 under current water pr						
9			**Given unchanged impact fees:** (see Column P)						
10		3.18713	The factor by which water sales revenue needs to increase to eliminate the debt by 2062, minus one						
11		4.18713	The factor by which water sales revenue needs to increase to eliminate the debt by 2062.						17
12		17.53203	The factor by which water prices need to increase to eliminate the debt by 2062.						
13		0.23883	The factor by which water demanded will change vs. base case when water prices rise enough to eliminate debt						
14			**Given unchanged water prices:** (see Column R)						
15		2.45680	The factor by which Impact Fees need to increase to eliminate the debt by 2062, minus one.						
16		3.45680	The factor by which Impact Fees need to increase to eliminate the debt by 2062.						
17		$21,093	2013 average Impact Fee per ERU, if Impact Fees increased as much as needed to eliminate the debt by 2062.						
18			**Given Split Between Impact Fees and Water Rates:** (see Column T)						
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21		2.22840	The factor by which Impact Fees need to increase to eliminate the debt by 2062.						
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1. Twenty two university professors drafted a letter to state lawmakers suggesting the Lake Powell Pipeline project is financially and economically infeasible.

2. A cornerstone of the professors' analysis is that the project will increase Washington County water rates so high that there will be little demand for the water generated by the project.

3. The analysis uses an inaccurate price of water, understating the price actually paid by Washington County consumers by roughly 430 percent.

4. **The error relative to water price undermines their analysis regarding price and demand and invalidates the professors' findings and conclusions.**

5. Applying the correct price of water results in pricing and demand consistent with actual conditions.

6. Using the professors' analysis with corrections for the pricing errors, the estimated water rate impacts of the Lake Powell Pipeline on a typical household would be more modest, increasing approximately 68 percent compared to their most recent estimate of "more than 570 percent."*

*Analysis based on the professors' September 2016 model. Please note that these estimates simply reflect the outcome when revising the assumptions in the professors' model and do not reflect an expectation of actual impact or cost by the Washington County Water Conservancy District.

Recall the professors assume that for every 10 percent increase in the cost of water, total consumption will be reduced by 5 percent—a price elasticity of -0.5.

They assert that massive increases in rates will be required to support the Lake Powell Pipeline, resulting in similarly massive reductions in water demand in Washington County.

Based on the expected growth of existing revenue streams due to population increase in the county, WCWCD's revenues can be projected over the next 50 years, as shown in Column H. The deficit schedule for the repayment period can be seen in Columns O and P. These columns show that the District's revenues fall significantly short of the District's expenses for every year of the 50-year repayment schedule (except for any initial payment-free years). Unless the District has an increase in revenues, WCWCD's cumulative debt would grow to between $5.84–6.76 billion (cell P73) by the end of the project repayment period. Clearly, participation by the WCWCD in the LPP will require significant increases in impact fees and/or water rates.

4. Water Rate and Impact Fee Increases Required to Repay Debt

The fundamental question is whether the WCWCD can make these debt payments via an increase in revenue[13], and if so how they will raise this revenue.

Increasing Property Taxes. According to Utah law, water conservancy districts in the Lower Colorado River Basin may not tax higher than 0.001 per dollar of taxable value of taxable property in the district.[14] WCWCD currently collects property taxes at the rate of 0.00097. However, even if WCWCD increased their levy to the maximum collection rate, this only increases revenues $301,642 and revenues would still fall short of their expenses by tens of millions of dollars each year, accumulating to a deficit of billions dollars at the end of the 50-year repayment period. Therefore increasing water rates and/or impact fees must also be implemented by WCWCD.

Increasing Water Rates. Columns Q and R examine whether increasing water rates alone, without any impact fee increases, could repay Washington County Water District's total future debt. Although one might think the WCWCD could simply increase water rates to raise revenues, raising water rates will result in a decrease in total water demand. Because the debt is relatively large, in order for water sales to cover the debt obligations of the project, water sales revenues would need to increase by 320–358 percent, depending upon the total cost of the LPP (spreadsheet cell B10). This would still require the WCWCD to shoulder significant deficits over time, but would result in a balance of essentially zero in 2063 (Columns Q and R; cell R73).

Due to the fact that the price elasticity of demand for water is estimated to be -0.5, repayment through water sales alone would require rate increases of 1665–1995 percent (cell B12). This enormous increase in water rates would lead Washington County water users to need less water in 2060 than they used in 2010 (cells O12 and AA12 of the "Water Demand" worksheet), meaning that there would be no need for the water supplied by the LPP. In other words, if the LPP is financed only by increasing water rates, water would become so expensive that future water demand would drop below the current water demand of WCWCD,[15] even if one ignores other water sources identified above.

Increases in water rates may slow the rate of population growth in Washington County, which would make the LPP both harder to pay back and less necessary. To avoid this and maintain the desirability of homes and building lots in Washington County in the face of increases in water rates, the price of that real estate would have to fall. The lower property values would decrease the

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[13] In the low-cost scenario, we assumed repayments start immediately, which keeps costs as low as possible. In the high-cost scenario, we assumed repayments begin after a delay of 10 years, which is more realistic and raises costs.
[14] Utah Code, Section 17B-2a-1006. http://le.utah.gov/code/TITLE17B/htm/17B02a100600.htm
[15] This is because cell B11 is larger than cell B8 in both scenarios.

These claimed price increases are so large that the professors suggest that water consumption in Washington County would fall from roughly 280 gallons per capita per day in 2020 to as low as 61 gallons per capita per day with the Lake Powell Pipeline.

Professors' Analysis of Current Conditions

Year	Current Supply	Supply with LPP	Base Per Capita Use (GPCD)	Assumed Conservation from 2005	Per Capita Use with Conservation (GPCD)	2005 Projected Water Demand w/ cons. (ac-ft/yr)	2012 Projected Water Demand w/ cons. (ac-ft/yr)	2012 Projected Water Demand w/o cons. (ac-ft/yr)
2009	82,010	82,010	294.3	0%	294.3	55408	*45,739*	*45,739*
2010	82,010	82,010	294.3	1%	291.4	54854	*45,282*	*45,739*
2020	130,840	151,010	294.3	5%	279.6	87646	*61,621*	*64,864*
2030	130,840	151,010	294.3	9%	267.8	124648	84,164	92,488
2040	130,840	199,840	294.3	12%	259.0	162359	107,842	122,547
2050	130,840	199,840	294.3	16%	247.2	196517	130,859	155,785
2060	130,840	199,840	294.3	18%	241.3	232576	157,252	191,771

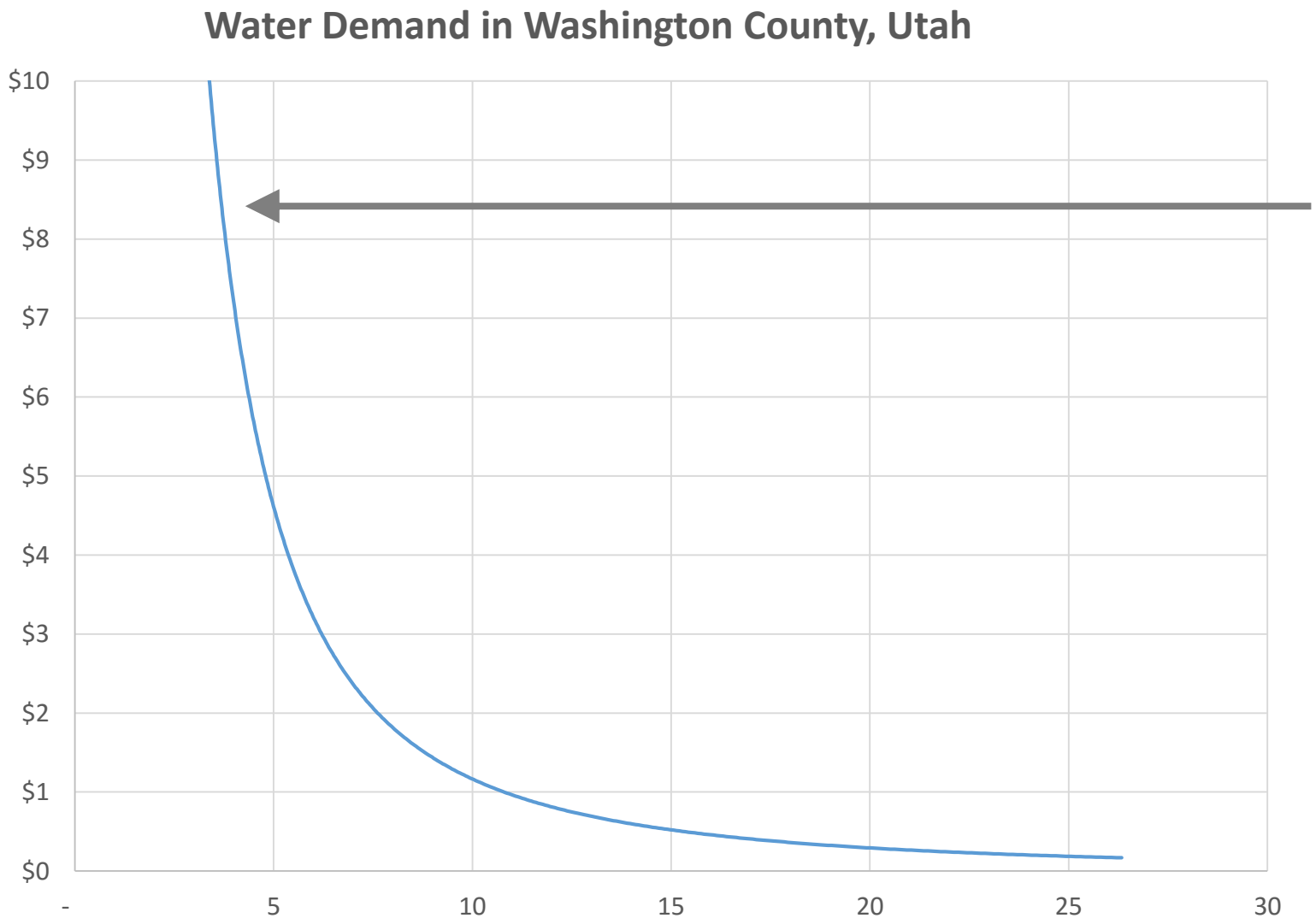
Professors' Analysis With Lake Powell Pipeline Scenarios

Second Scenario
Increased Water Prices only

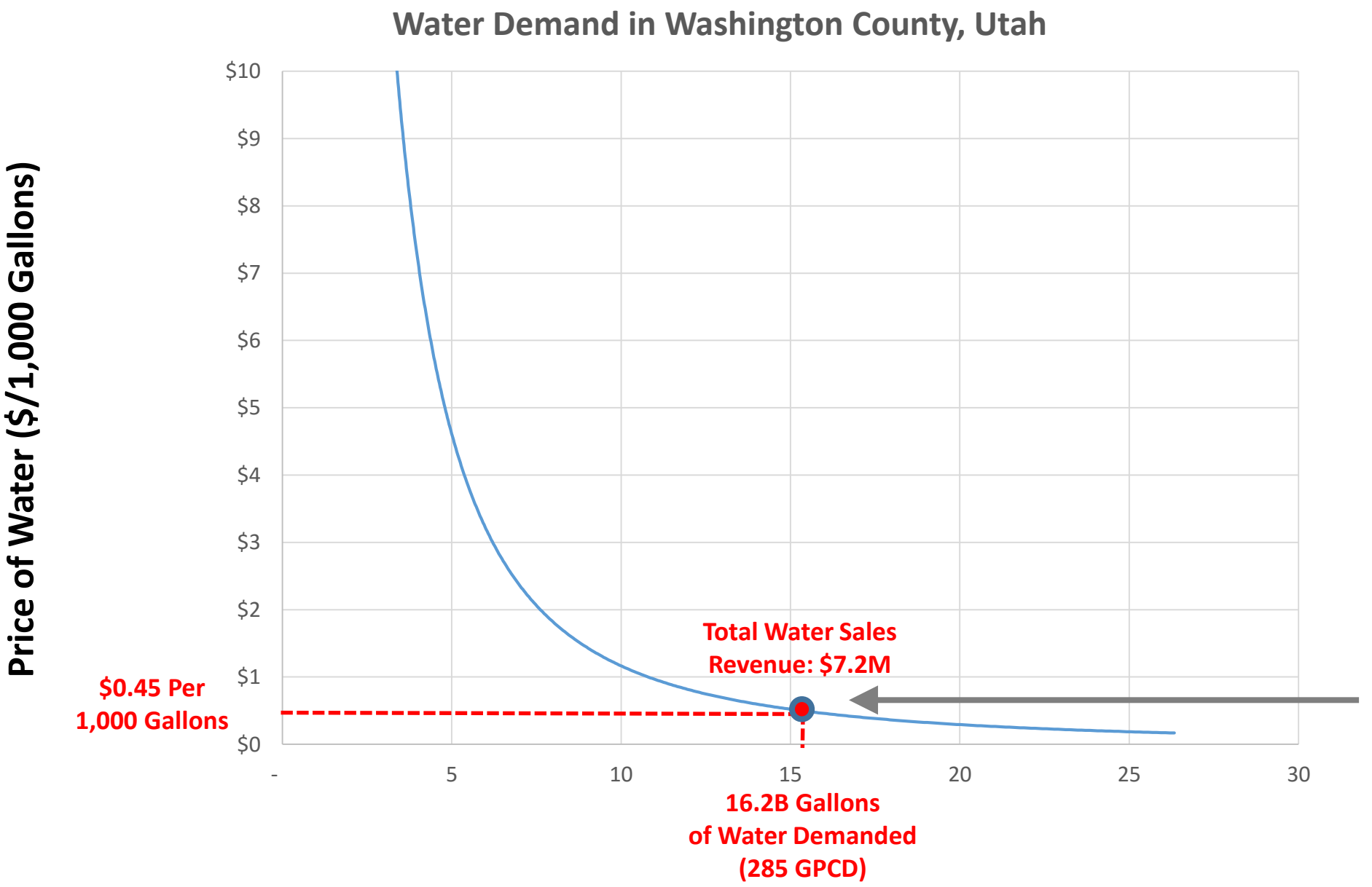
Demand w/ cons. (ac-ft/yr)	GPCD w/ cons.	Demand w/o cons. (ac-ft/yr)	GPCD w/o cons.	Demand (ac-ft/yr)
10,032	64.6	10,032	64.6	*10,032*
9,932	63.9	10,032	64.6	*10,032*
13,516	61.3	14,227	64.6	*14,227*
18,461	58.7	20,286	64.6	*20,286*
23,654	56.8	26,880	64.6	*26,880*
28,703	54.2	34,170	64.6	*34,170*
34,492	52.9	42,063	64.6	*42,063*

Second Scenario
Increased Water Prices and Impact Fees

Demand w/ cons. (ac-ft/yr)	GPCD w/ cons.	Demand w/o cons. (ac-ft/yr)	GPCD w/o cons.	Demand (ac-ft/yr)
16,456	105.9	16,456	105.9	*16,456*
16,291	104.8	16,456	105.9	*16,456*
22,169	100.6	23,336	105.9	*23,336*
30,280	96.4	33,274	105.9	*33,274*
38,798	93.2	44,089	105.9	*44,089*
47,079	88.9	56,047	105.9	*56,047*
56,575	86.8	68,994	105.9	*68,994*



To explain this, the professors create a theoretical price elasticity curve indicating how much water would be demanded at each price point, assuming that every 10 percent increase in price would result in 5-percent decreases in the quantity of water demanded.



According to the professors' analysis, Washington County is currently on the point of this curve where $7.2 million in water revenues are generated from the sale of 16.2 billion gallons of water at $0.45 per gallon.

The professors claim that water sales revenue will need to increase by a factor of 2.6x to pay for the Lake Powell Pipeline and that, because higher prices will lead to decreased demand for water, prices will need to increase by a factor of 6.7x to generate a sufficient amount of revenue.

	A	B	C	D	E	F	G	H	I
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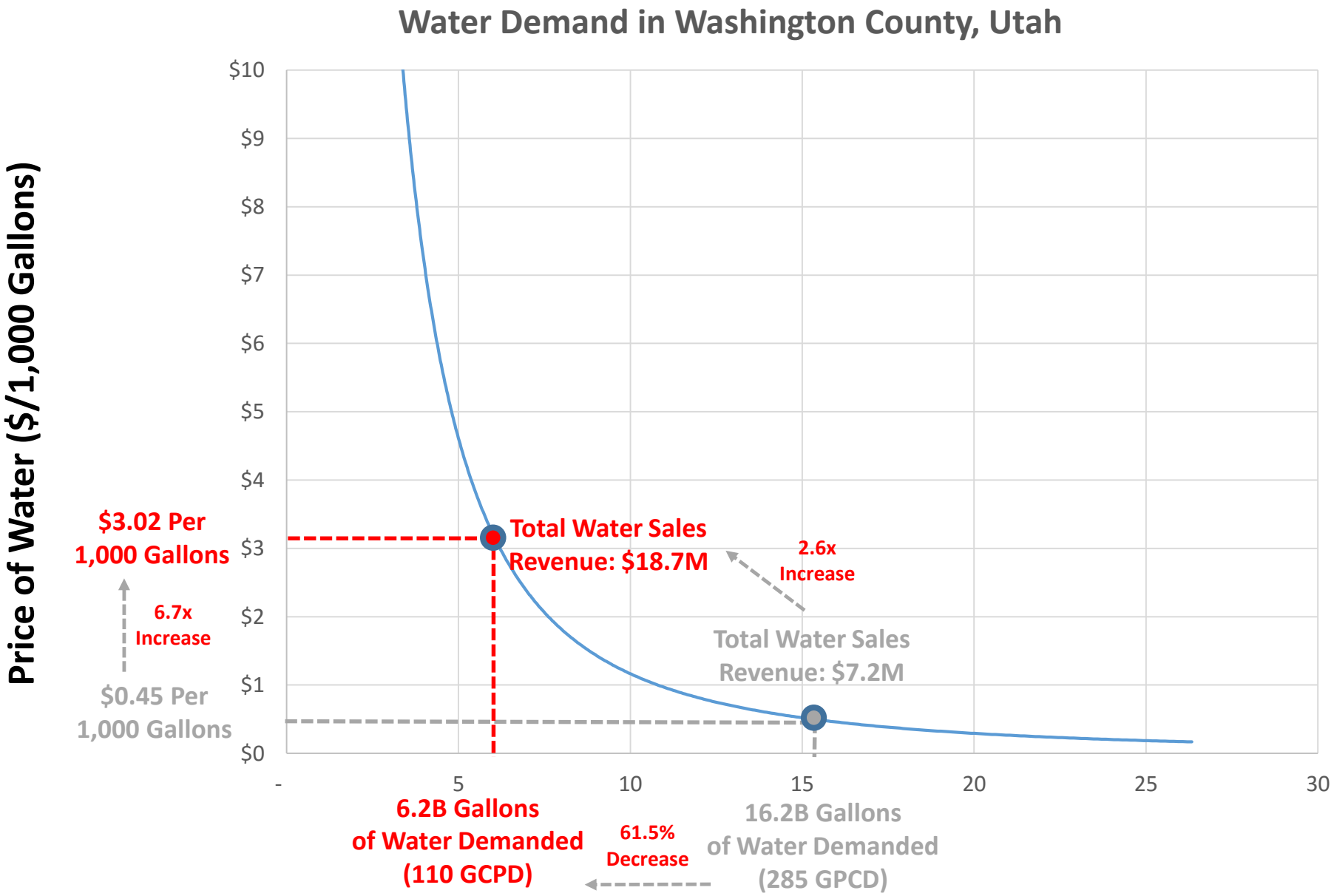
Note: This review is based on a single scenario, which assumes the Lake Powell Pipeline is repaid over 50 years and costs are allocated equally between water rates and impact fees. In other scenarios, where 100 percent of the cost is borne by water rates or the repayment period is shortened, the magnitude of the professors' errors are magnified.



Under the professors' analysis, water rates increase by a factor of 6.7x, or from the inaccurately assumed $0.45 per to $3.02 per 1,000 gallons. This, in turn, reduces total water demanded from 16.2 billion to 6.2 billion, resulting in a 61.5-percent decrease in per capita water use in Washington County. Because this reduction in water use would be impractical to achieve, the professors conclude that the Lake Powell Pipeline is infeasible.

1. Twenty two university professors drafted a letter to state lawmakers suggesting the Lake Powell Pipeline project is financially and economically infeasible.

2. A cornerstone of the professors' analysis is that the project will increase Washington County water rates so high that there will be little demand for the water generated by the project.

3. The analysis uses an inaccurate price of water, understating the price actually paid by Washington County consumers by roughly 430 percent.

4. The error relative to water price undermines their analysis regarding price and demand and invalidates the professors' findings and conclusions.

5. **Applying the correct price of water results in pricing and demand consistent with actual conditions.**

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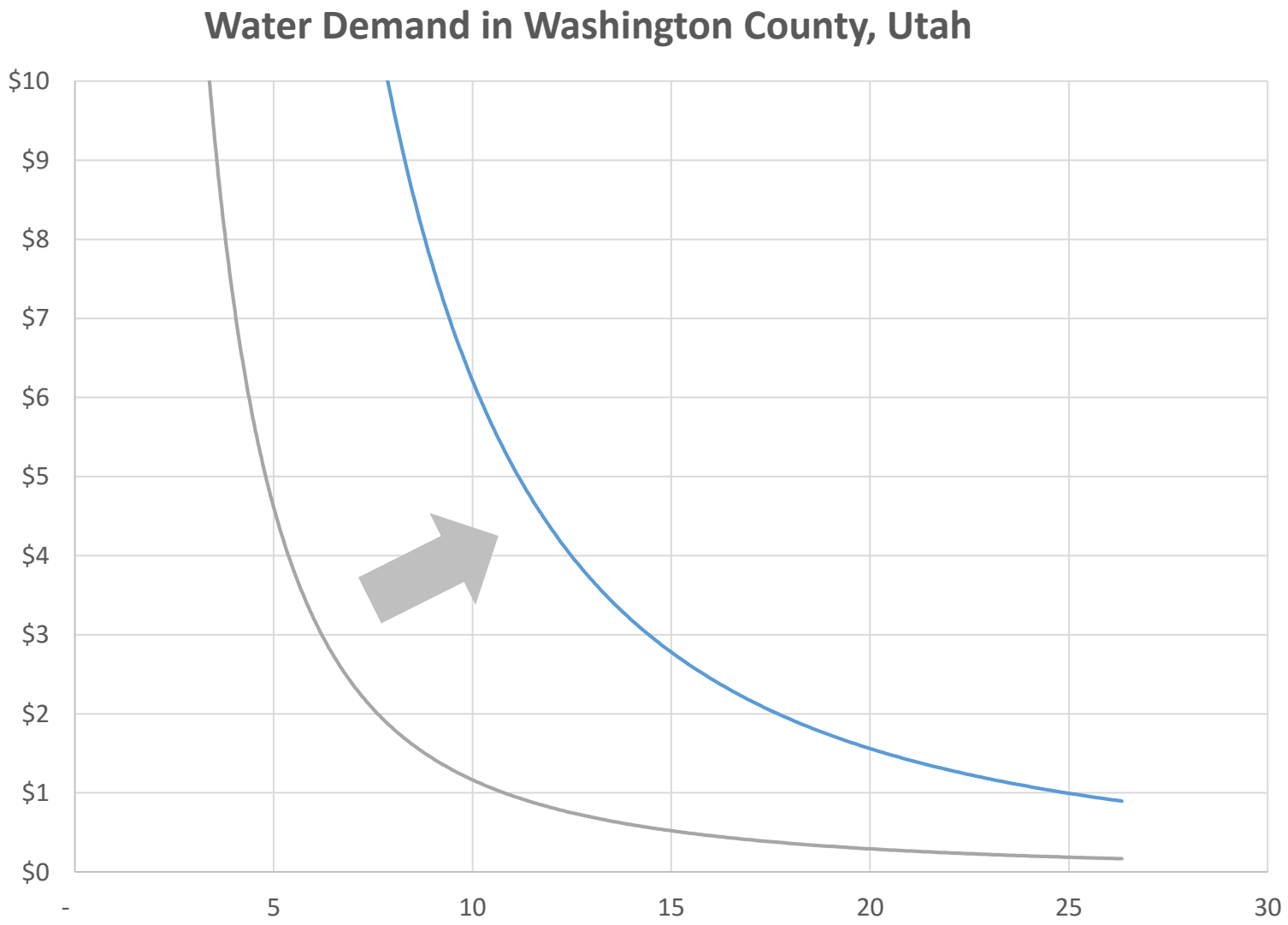
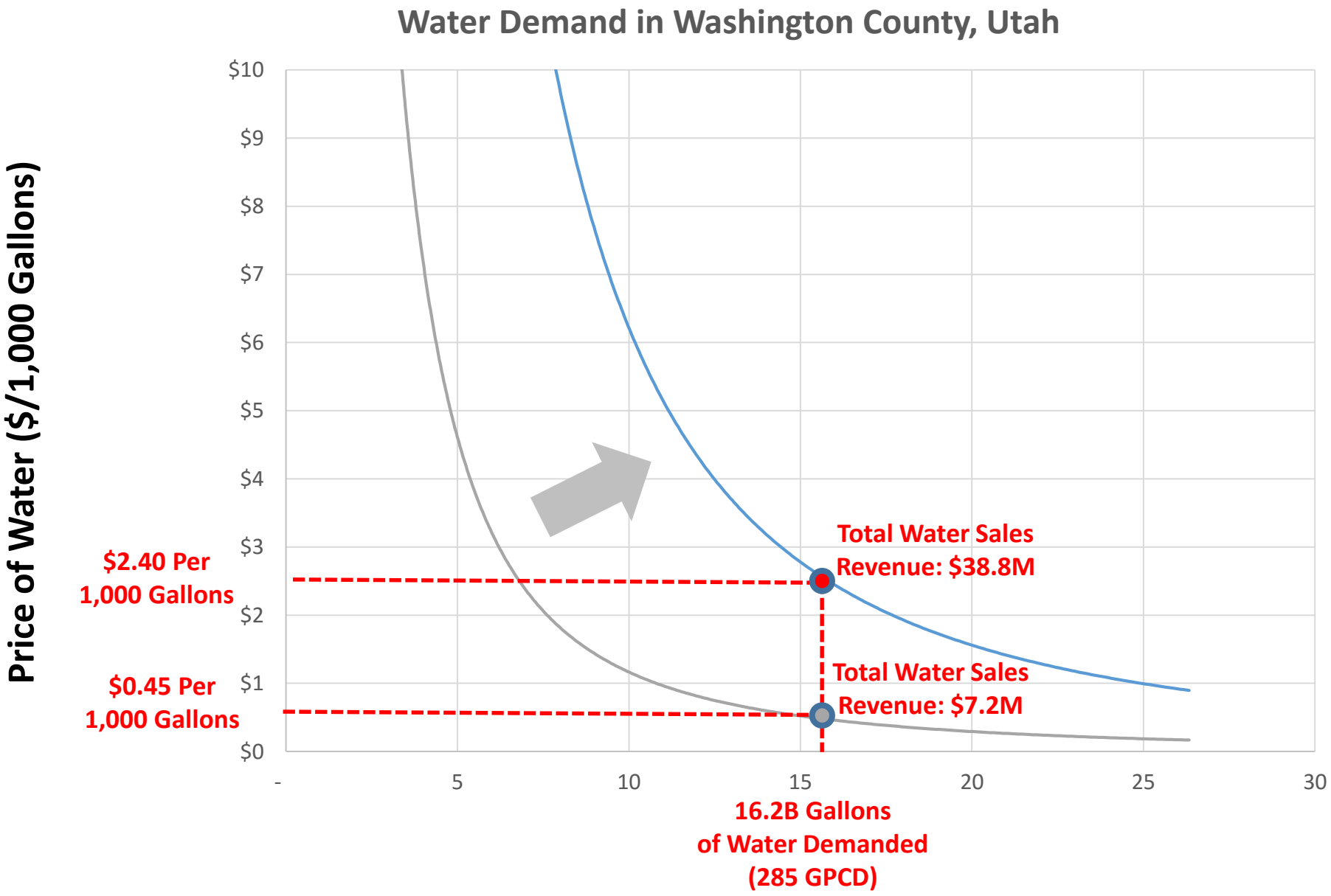


When the correct price of water is applied, the price elasticity curve shifts to the right, reflecting higher quantities demanded at all price points.

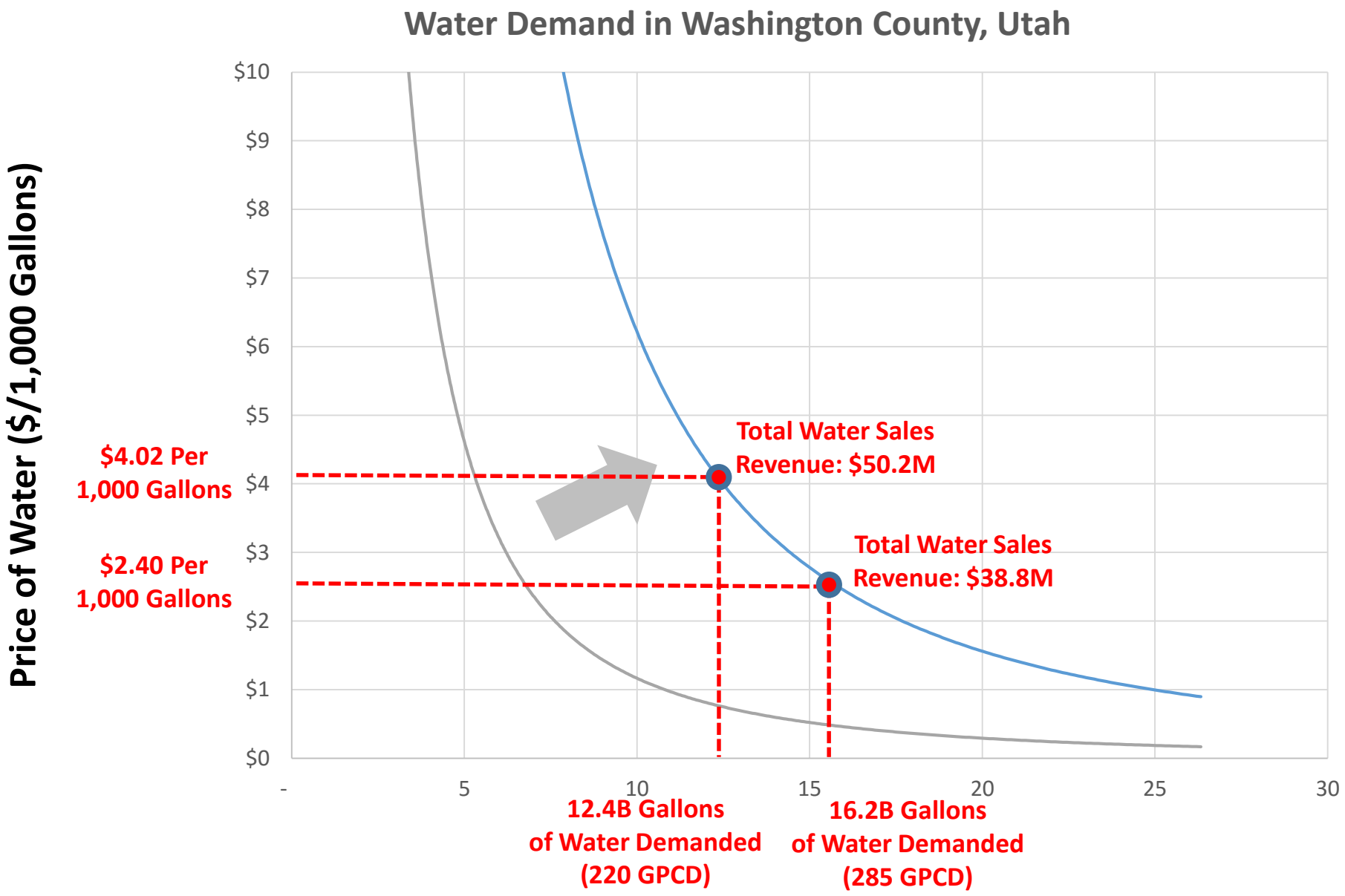


Using the correct price of water in Washington County, the total water demanded, as estimated by the professors, generates approximately $38.8 million per year as compared to $7.2 million, a revenue increase of 433 percent.

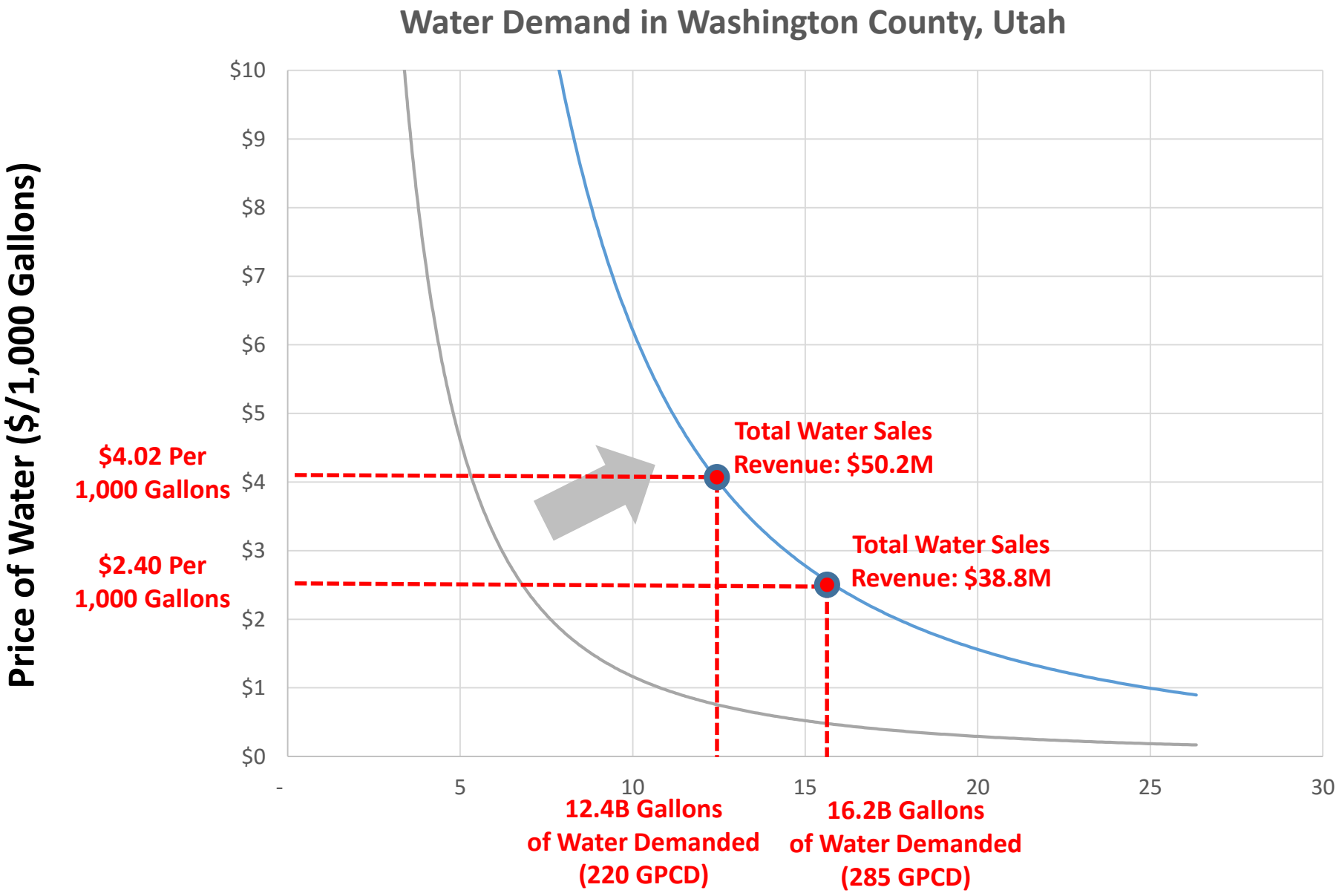
The professors estimate that, under current demand conditions, Washington County will need to increase water sales revenue by roughly $11.5 million to cover the cost of the Lake Powell Pipeline.

This $11.5 million is the difference between the professors' assumed annual water revenue of $7.2 million and $18.7 million, the revenue they estimate to be required by multiplying $7.2 million by the 2.6x water sales revenue factor needed to "eliminate debt by 2062."

	A	B	C	D	E	F	G	H	I
1		$9,938,660	2013 Property Tax Collections						
2		$7,013,377	2013 water sales revenue Revenue						
3		$6,102	2013 Impact Fee per ERU						
4		0.03309	GOPB 50-Year Household Growth Rate Projection				4.16	Factor by which # of people will	
5		1.03309	GOPB 50-Year Household Growth Rate Projection, plus one.						
6		**1.040**	**<- enter 1 plus assumed interest rate on reserves (the interest rate on *savings*)**						
7			Q ∝ P^(-1/2) is the assumed demand curve, so revenues R = P^(1/2), so to increase R by a factor of "x" requires P						
8		4.19272	If water sales revenue rises by a factor > this, (Q_2060 under new water price) < (Q_2010 under current water pr						
9			**Given unchanged impact fees:** (see Column P)						
10		3.18713	The factor by which water sales revenue needs to increase to eliminate the debt by 2062, minus one						
11		4.18713	The factor by which water sales revenue needs to increase to eliminate the debt by 2062.						17
12		17.53203	The factor by which water prices need to increase to eliminate the debt by 2062.						
13		0.23883	The factor by which water demanded will change vs. base case when water prices rise enough to eliminate debt						
14			**Given unchanged water prices:** (see Column R)						
15		2.45680	The factor by which Impact Fees need to increase to eliminate the debt by 2062, minus one.						
16		3.45680	The factor by which Impact Fees need to increase to eliminate the debt by 2062.						
17		$21,093	2013 average Impact Fee per ERU, if Impact Fees increased as much as needed to eliminate the debt by 2062.						
18			**Given Split Between Impact Fees and Water Rates:** (see Column T)						
19		2.59356	The factor by which water sales revenue needs to increase to eliminate the debt by 2062.						
20		6.72657	The factor by which water prices need to increase to eliminate the debt by 2062.						
21		2.22840	The factor by which Impact Fees need to increase to eliminate the debt by 2062.						
22		$13,598	2013 average Impact Fee per ERU, if Impact Fees increased as much as needed to eliminate the debt by 2062.						



Using the professors' curve, a more modest water rate increase of 67.5 percent, from $2.40 per 1,000 gallons to $4.02 per 1,000 gallons, would generate the required $11.5 million in new revenue.



Applying the professors' analysis with the corrected water demand and price reduces estimated water consumption from 285 to 220 gallons per capita per day, which is more achievable and in line with expectations.

1. Twenty two university professors drafted a letter to state lawmakers suggesting the Lake Powell Pipeline project is financially and economically infeasible.

2. A cornerstone of the professors' analysis is that the project will increase Washington County water rates so high that there will be little demand for the water generated by the project.

3. The analysis uses an inaccurate price of water, understating the price actually paid by Washington County consumers by roughly 430 percent.

4. The error relative to water price undermines their analysis regarding price and demand and invalidates the professors' findings and conclusions.

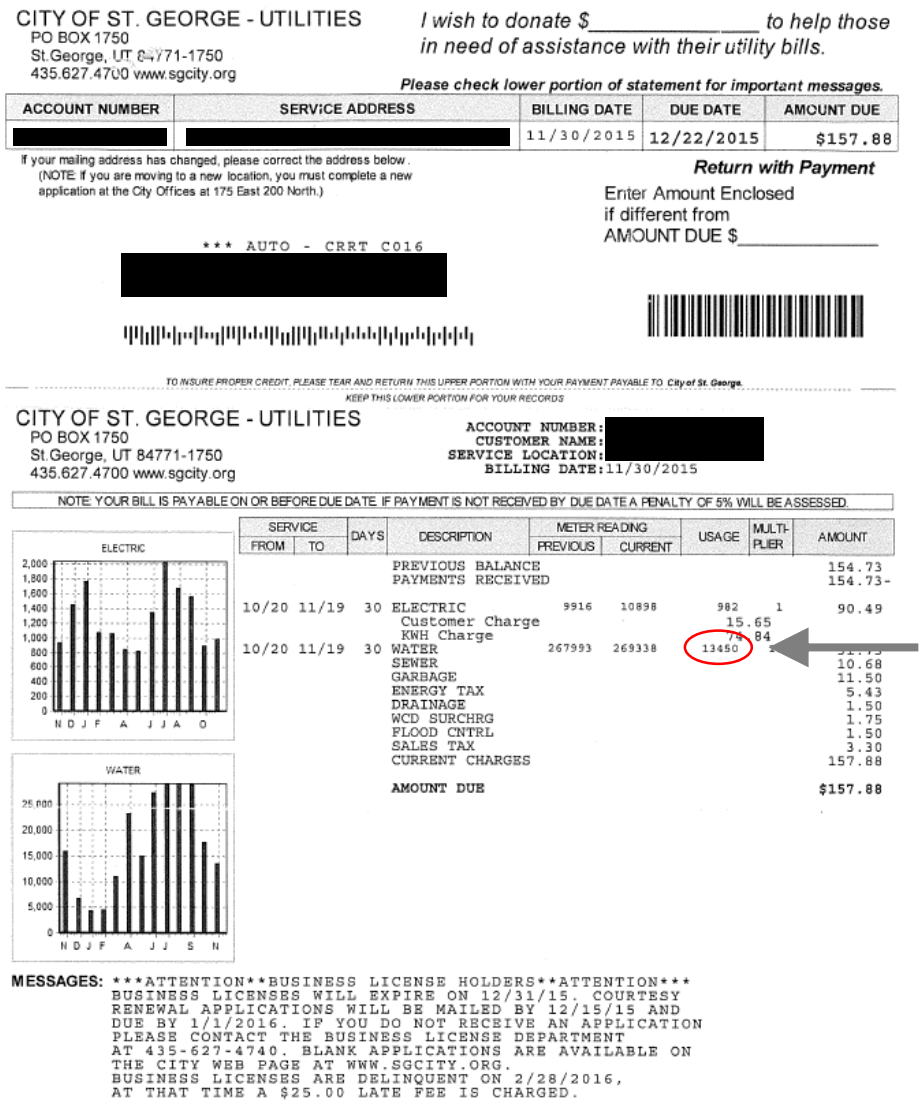
5. Applying the correct price of water results in pricing and demand consistent with actual conditions.

6. **Using the professors' analysis with corrections for the pricing errors, the estimated water rate impacts of the Lake Powell Pipeline on a typical household would be more modest, increasing approximately 68 percent compared to their most recent estimate of "more than 570 percent."***

*Analysis based on the professors' September 2016 model. Please note that these estimates simply reflect the outcome when revising the assumptions in the professors' model and do not reflect an expectation of actual impact or cost by the Washington County Water Conservancy District.

Consider the impacts of this change in cost on a typical consumer.

Below is a typical water bill for a single family household in St. George, Utah.



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435.627.4700 www.sgcity.org

I wish to donate $_____ to help those in need of assistance with their utility bills.

Please check lower portion of statement for important messages.

ACCOUNT NUMBER	SERVICE ADDRESS	BILLING DATE	DUE DATE	AMOUNT DUE
[redacted]	[redacted]	11/30/2015	12/22/2015	$157.88

If your mailing address has changed, please correct the address below.
(NOTE: If you are moving to a new location, you must complete a new application at the City Offices at 175 East 200 North.)

Return with Payment
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*** AUTO - CRRT C016
[redacted]

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ELECTRIC

WATER

SERVICE FROM	SERVICE TO	DAYS	DESCRIPTION	METER READING PREVIOUS	METER READING CURRENT	USAGE	MULTI-PLIER	AMOUNT
			PREVIOUS BALANCE					154.73
			PAYMENTS RECEIVED					154.73-
10/20	11/19	30	ELECTRIC	9916	10898	982	1	90.49
			Customer Charge			15.65		
			KWH Charge			74.84		
10/20	11/19	30	WATER	267993	269338	13450		
			SEWER					10.68
			GARBAGE					11.50
			ENERGY TAX					5.43
			DRAINAGE					1.50
			WCD SURCHRG					1.75
			FLOOD CNTRL					1.50
			SALES TAX					3.30
			CURRENT CHARGES					157.88
			AMOUNT DUE					$157.88

MESSAGES: ***ATTENTION**BUSINESS LICENSE HOLDERS**ATTENTION***
BUSINESS LICENSES WILL EXPIRE ON 12/31/15. COURTESY RENEWAL APPLICATIONS WILL BE MAILED BY 12/15/15 AND DUE BY 1/1/2016. IF YOU DO NOT RECEIVE AN APPLICATION PLEASE CONTACT THE BUSINESS LICENSE DEPARTMENT AT 435-627-4740. BLANK APPLICATIONS ARE AVAILABLE ON THE CITY WEB PAGE AT WWW.SGCITY.ORG.
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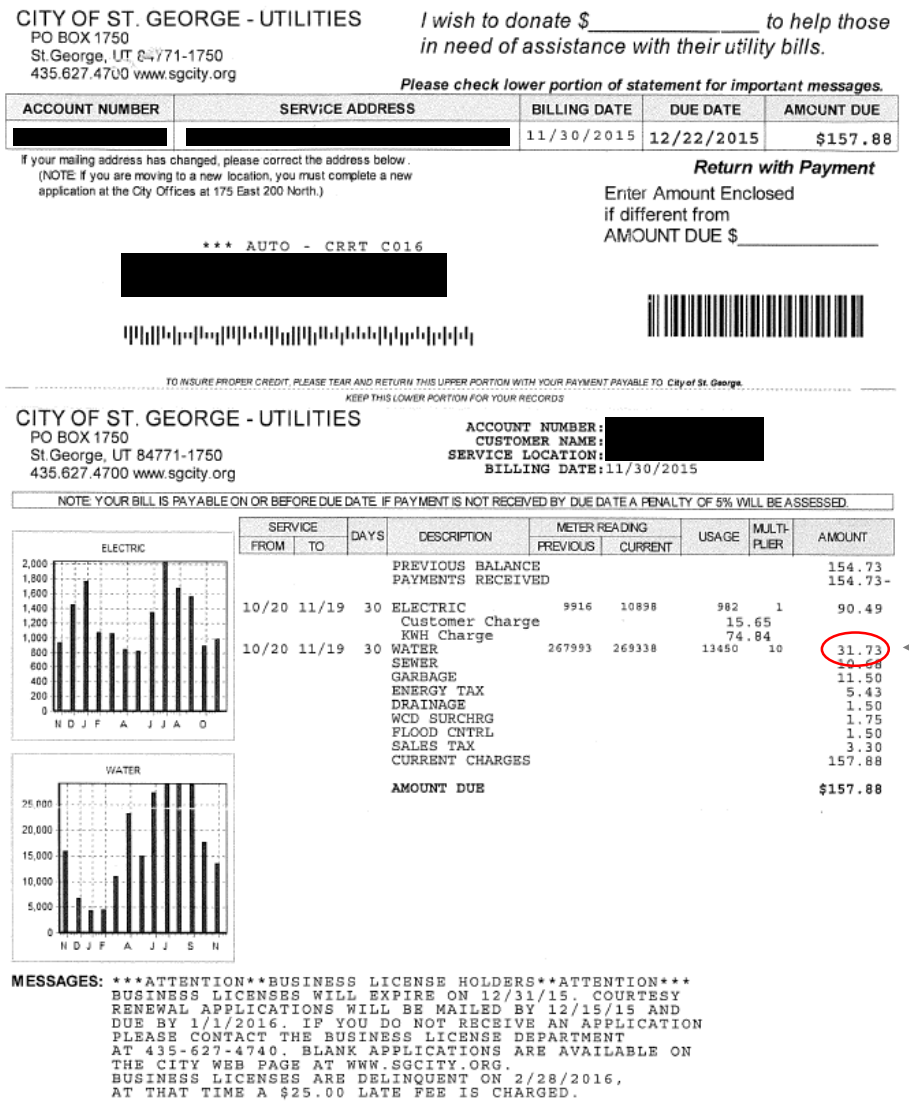
Total water consumed decreases by 15 percent, or from 13,450 to 11,432 because higher water prices increase conservation and decreases consumer demand for water.

Note: It is anticipated that the higher savings rates will be realized on commercial, industrial and institutional consumers. Thus, the 15-percent reduction in demand is slightly below the overall conservation rate.

Consider the impacts of this change in cost on a typical consumer.

Below is a typical water bill for a single family household in St. George, Utah.



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Cost per 1,000 gallons increases by 67.5 percent.
Note: This is an increase from $2.35 per 1,000 gallons to $3.95 per 1,000 gallons. Tiered pricing will also lead to higher prices for larger commercial, industrial and institutional water customers.

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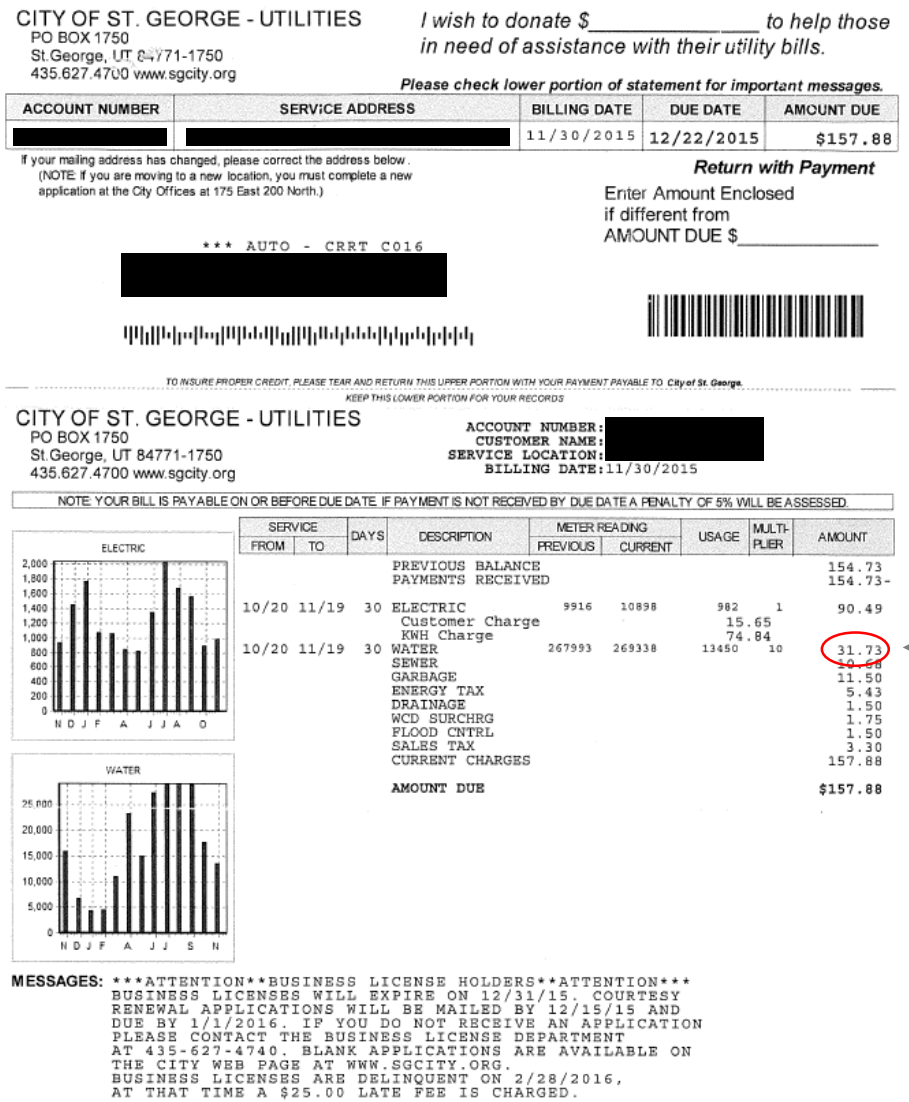

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Typical residential consumer water bill increases from $31.73 per month to $45.18 per month, an increase of $13.45 a month.

Assuming roughly three people per household, this translates into roughly $4.48 per person per month.