Debt Repayment Obligations Created by the Proposed Bear River Development Project

2019

DEBT REPAYMENT OBLIGATIONS CREATED BY THE PROPOSED BEAR RIVER DEVELOPMENT PROJECT

A Report of the Economic Evaluation Unit
of the
University of Utah's Department of Economics

September 2019
[corrected printing]

Gabriel A. Lozada, Ph.D.,
with the assistance of
Stephen Bannister, Ph.D.

ECONOMIC EVALUATION UNIT

Table of Contents

U.S. Magnesium 5

Purpose of This Report 5

Report Authors 5

Executive Summary 6

1. Background of Proposed Bear River Development 8

2. Select Engineering Features of Bear River Development 8

Map of Proposed Bear River Development 9

3. Environmental Mitigation Cost 12

4. Total Costs and Inflation 13

5. Bear River Development Financing 13

6. Opting out of the Bear River Development 14

7. Participation Scenarios in Bear River Development Financing 15

8. Conclusions 19

Appendix A Bear River Development Participation Model Spreadsheet Information 20

Appendix B Future Bear River Water & Debt Calculations 23

Appendix C Engineering Features of Combination B by Participation Scenario 24

U.S. Magnesium

US Magnesium is one of the Renco Group Family of Companies. The plant in Rowley, Utah processes minerals present in the Great Salt Lake to produce magnesium metal, water purification chemicals, hydrochloric acid, and various salts used in de-icing and fertilizer products. US Magnesium is the largest producer of primary magnesium in North America, operating facilities on the Great Salt Lake where magnesium has been produced since 1972.

The Company has repeatedly made significant capital investments to increase magnesium production capacity, while concurrently reducing the environmental footprint. US Magnesium is committed to operating the facility in an environmentally responsible manner and is continually developing ways to positively impact the environment and local community. Environmental commitment is highlighted by the development and utilization of state-of-the-art magnesium electrolysis technology, minimizing both air emissions and energy requirements, alongside the extensive use of solar energy. US Magnesium is a conservation advocate for the Great Salt Lake, evidenced by its volunteer work with the Utah Division of Wildlife Resources and support of a Wildlife Interpretive Center providing conservation education and public access to the Lake.

The Purpose of this Report

This report was commissioned by U.S. Magnesium to ascertain what expenses the northern Utah cities slated to receive water from proposed Bear River Development would have to pay in return. In the future, this will enable comparisons between the costs of this water and the costs of other available water supplies in northern Utah.

Report Authors

The Economic Evaluation Unit (EEU) is a policy research organization within the Department of Economics at the University of Utah. EEU is comprised of students and faculty who work on a broad range of policy issues. Our policy groups work on forecasting, development, regional analysis, growth, and environmental economics. Research in applied policy targets issues related to labor, gender, health, education, poverty, and inequality. EEU partners include businesses, government agencies, and community organizations. Gabriel A. Lozada, Ph.D. prepared this analysis with the assistance of Stephen Bannister, Ph.D.[1]

usmag®

U.S. Magnesium is the only magnesium producer in North America, and one of two in the entire Western Hemisphere. It depends on the Great Salt Lake for its operations and the company is concerned about the future of this critical economic resource.

Executive Summary

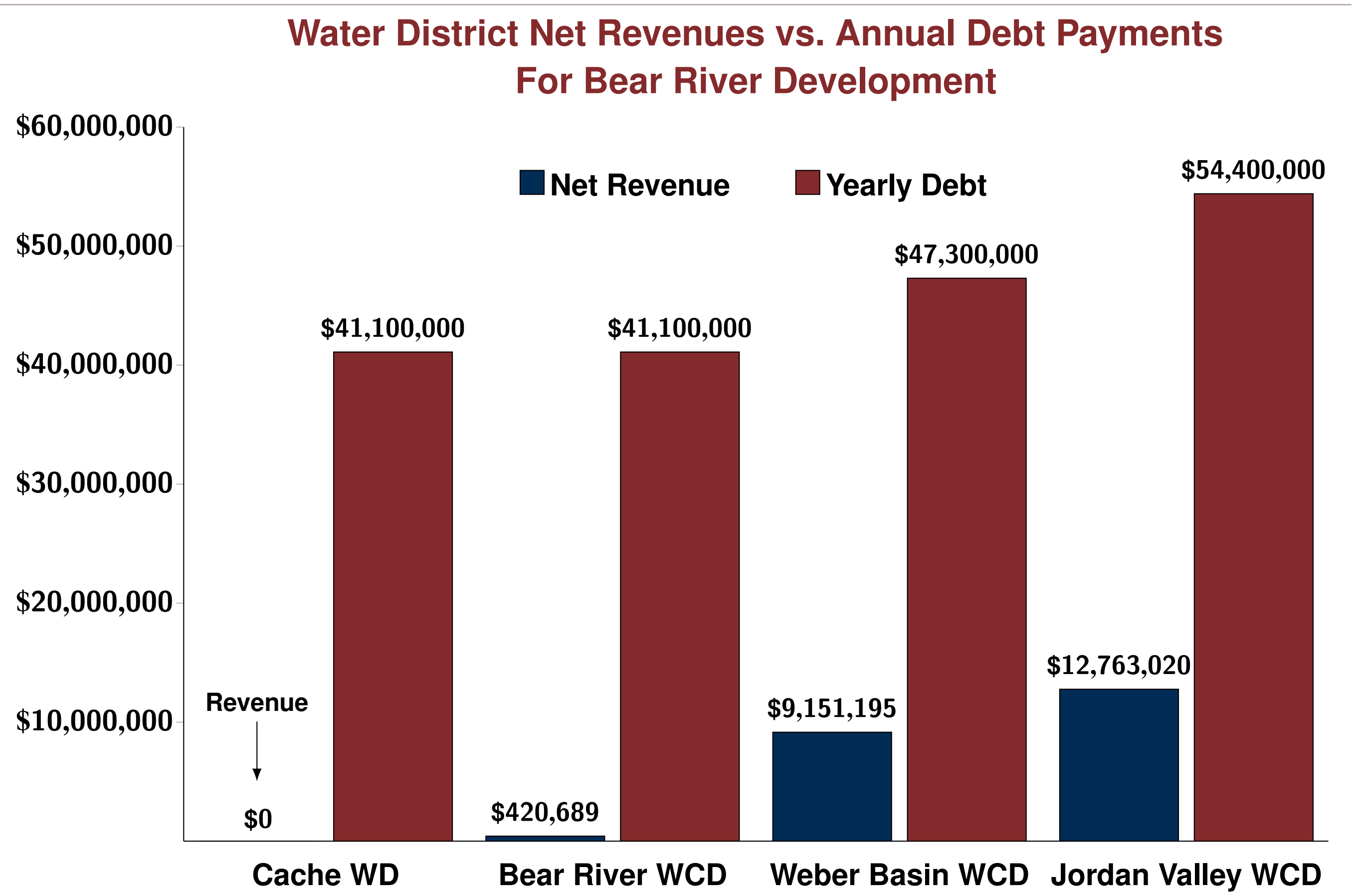
For nearly the last 20 years, an ongoing conversation about the proposed Bear River Development project has garnered the attention of the public, the media, elected officials, industry leaders and conservationists. Although much attention has focused on the environmental impacts of this project, relatively little focus has been given to the financial repercussions of this proposal. This Report offers the first step forward in examining the possible financial impacts of the proposed Bear River Development upon both the ratepayers and taxpayers of the Wasatch Front whom this project is intended to serve.

The primary question our economic analysis seeks to address is how the debt from the construction costs of the Bear River Development would affect the four water conservancy districts slated to receive water from the project. We obtained a reasonable estimate of construction costs from the most recent Bear River Development engineering report, then adjusted for inflation and for a base level of environmental mitigation.

After we amortized these project costs into a 30 year loan with an interest rate of 4%, we compared the annual debt payments of each of the four water conservancy districts receiving water from the project to their current net annual revenues. This test of affordability offered a preview of how the rating agencies might rate these bonds, were they to be issued on the private market.

Our analysis revealed that if all four water conservancy districts participated in the proposed Bear River Development in the near future, none of these agencies would be able to make their annual debt payments for the project given their current net revenues. The bar graph below compares the current net annual revenues of each of the four water conservancy districts with their annual debt payment for the Bear River Development.

This result means each of the four water conservancy districts would likely have to carefully weigh whether or not they should opt out of the Bear River Development. If one water conservancy district opts to not participate in



the co-financing of Bear River Development, it would shift the burden of costs to other remaining water conservancy districts. This creates a complicated set of scenarios of differing engineering features, varying project costs and increased or decreased debt burdens on each water district. We created a 15-scenario model which address all the permutations of water conservancy district participation in the Bear River Development project, each permutation associated with its unique required construction cost. In every scenario permutation of this model, financing the Bear River Development is not financially viable without a massive increase in revenues by each of the participating water districts—some more than others.

Although increasing water rates might at first be thought of as a panacea for raising the revenues needed for annual debt payments, the needed revenue increases are so significant that these rate increases would likely result in major decreases in water use, which questions the need for Bear River water for future population growth. More research would be required to determine the specific water rate increases necessary for each community Bear River water is intended to serve. Furthermore, urban water rate increases of this magnitude may make agricultural-to-urban water sales very highly attractive to both farmers and urban water districts, further negating the Bear River Development's value.

Our analysis is limited in nature because the State has not estimated costs of opt-out scenarios nor has any district yet decided to raise the needed revenue using specific policies which we could then analyze. Nevertheless we can demonstrate that the Bear River Development would require these four water conservancy districts to increase their revenues very substantially, in turn forcing the cities making up the districts to do the same.

Our numerical analysis is all contained in a spreadsheet which the public is invited to download and then critique or use to see how much the results change if the spreadsheet's parameters, such as the interest rate, change.

1. Background of Proposed Bear River Development

Bear River Development is a water project proposed by the Utah Division of Water Resources, an agency under the Utah Department of Natural Resources. The purpose of Bear River Development is to provide additional water to the Wasatch Front region and in particular to residents in Salt Lake, Weber, Davis, Box Elder and Cache Counties. The water delivery in these areas would be managed by the Jordan Valley Water Conservancy District (WCD), the Weber Basin WCD, the Cache WD and the Bear River WCD.

The project would divert 220,000 acre-feet of water from the Bear River through the construction of a 90 - 100 mile pipeline and several as-yet-unselected dams and reservoirs. The engineering features of proposed Bear River Development are being studied and evaluated by the Division of Water Resources and its subcontractors, who anticipate releasing the final engineering feasibility study for the project in the near future.

Bear River Development was authorized by the Utah Legislature in 1991 in the Bear River Development Act, which allocates the water for the project to participating water districts and stipulates other aspects of the project. The Bear River is the principal surface water source to the Great Salt Lake, so the proposed Bear River Development Project will affect the future of the Great Salt Lake and the businesses, such as U.S. Magnesium, which depend upon it for their continued operations.

2. Select Engineering Features of Bear River Development

The engineering components of Bear River Development that were utilized for this economic analysis came from the 2014 Bear River Pipeline Concept Report, commissioned by the Utah Division of Water Resources. The 2014 Concept Report was prepared by the engineering firm Bowen Collins & Associates in association with HDR Engineering. The 2014 Concept Report studied nine possible reservoir locations and identified how much water could be stored at each reservoir alongside making a construction cost estimate for each reservoir (see Table 1).

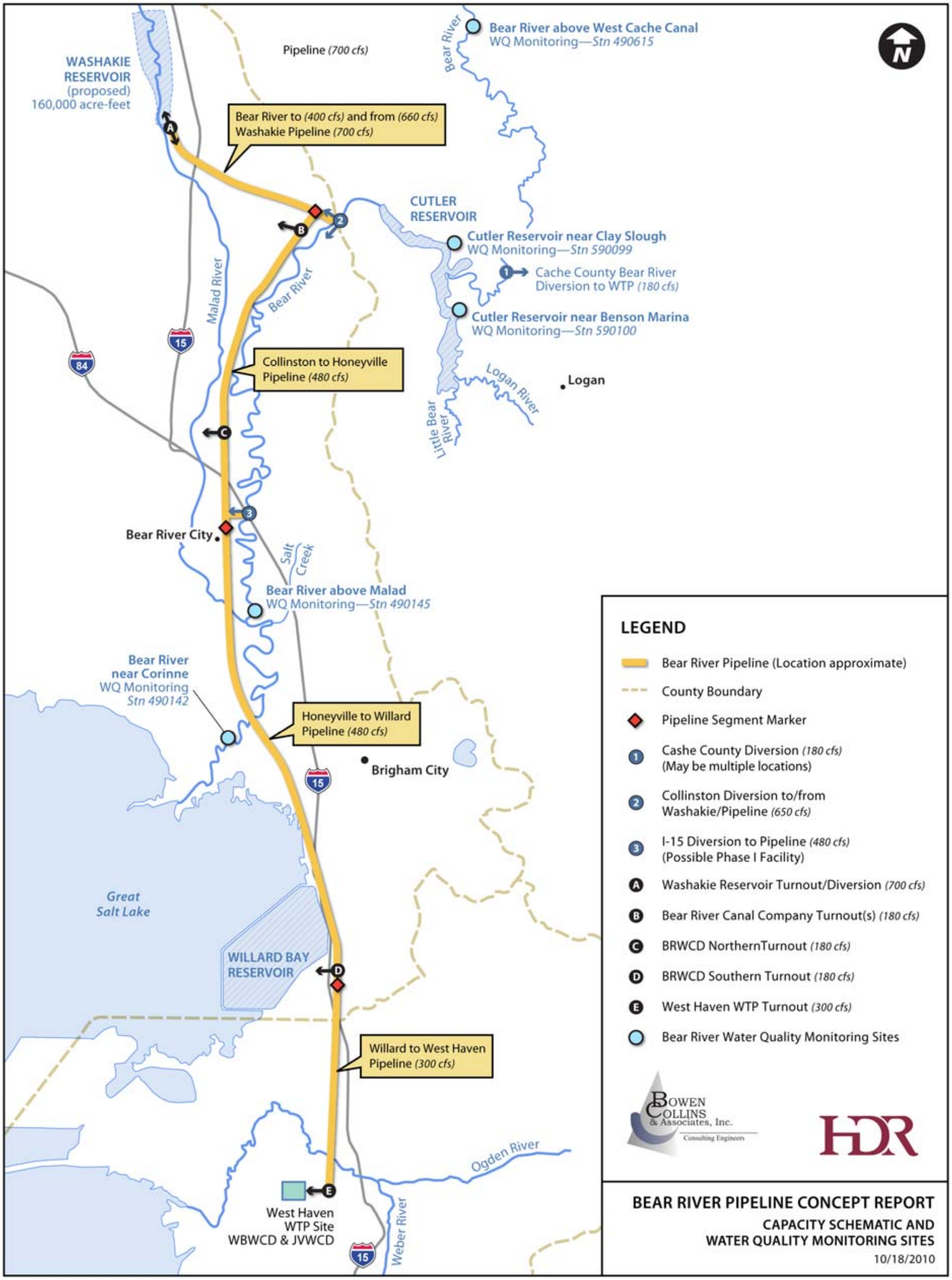
Of the many possible reservoir sites and other engineering features, the authors of the 2014 Concept Report identified a short list of reservoirs they favored for various reasons, which are described on page 10.

Table 1: List of Potential Reservoir Sites

Reservoir Name	Volume in Acre-Feet	Cost Per Acre-Foot of storage	Cost in Millions
Above Cutler Dam	51,000	$927	$47
Cub River	27,000	$1,586	$43
East Promontory	238,000	$1,106	$263
Fielding	70,000	$280	$20
Hyrum Enlargement	28,000	$660	$18
Temple Fork	40,000	$1,279	$51
Washakie	158,000	$2,278	$360
Whites Valley	170,000	$1,847	$314
Weber Bay	124,000	$1,277	$158

List of nine possible proposed Bear River reservoirs as part of Bear River Development. Source: Table 10-8 of the 2014 Bear River Pipeline Concept Report, commissioned by the Utah Division of Water Resources.

Bear River Pipeline Schematic and Water Quality Monitoring Sites



Proposed Weber Bay Reservoir

The Weber Bay reservoir is a proposed reservoir planned to be located adjacent to the Willard Bay Reservoir. The Weber Bay reservoir would store 124,000 acre-feet of water at an estimated construction cost of $197 million. The Weber Bay Reservoir would inundate 6,841 acres of wetlands and 70 acres of prime farmland. It is one of the most southern potential reservoirs for the project and thus would likely store water for Jordan Valley WCD and Weber Basin WCD if built.

Proposed Weber Bay Reservoir

Proposed Fielding Reservoir

The Fielding Reservoir would be located inside Box Elder County and store 70,000 acre-feet of water at an estimated cost of $38.3 million. The reservoir would inundate 790 acres of wetlands and 848 acres of prime farmland. The Fielding Reservoir is projected to be the lowest cost per acre of storage of any of the analyzed reservoirs in the 2014 Concept Report. This is due in part to the reservoir being on the main stem of Bear River and thus requiring no pumping to fill.

Proposed Fielding Reservoir

Proposed Cub River Reservoir

The Cub River Reservoir would be located on the Cub River just above its confluence with the Bear River. This reservoir would store 27,000 acre-feet of water at an estimated cost of $42.8 million. It would inundate 297 acres of wetlands and 775 acres of prime farmland. It is located in Cache County and could be used largely for the Cache Water District. However, at only 27,000 acre-feet, it would not be large enough alone to serve the 60,000 acre-feet allotted to Cache Water District.

Proposed Cub River Reservoir[2]

Bear River Development Reservoir Combinations

The authors of the 2014 Concept Report devised 13 different combinations of the nine possible reservoirs to achieve a total water storage volume large enough to divert 220,000 acre-feet of water each year from the Bear River. These combinations were labeled Combination A through M (see Table 2). The majority

Table 2:Potential Reservoir Combinations

Combination Name	Reservoir Combinations	Total Volume in Acre-Feet
A	Above Cutler, Fielding, Weber Bay	245,000
B	Cub River, Fielding, Weber Bay	248,000
C	Fielding, Hyrum Enlargement, Weber Bay	222,000
D	Above Cutler, Fielding, Hyrum Enlargement, Weber Bay	273,000
E	Fielding, Temple Fork, Weber Bay	234,000
F	East Promontory, Hyrum Enlargement	266,000
G	Cub River, East Promontory	265,000
H	Fielding, Whites Valley	240,000
I	Above Cutler, Cub River, Fielding, Hyrum Enlargement, Temple Fork	216,000
J	East Promontory, Fielding	308,000
K	Above Cutler, East Promontory, Fielding, Hyrum Enlargement	240,000
L	Above Cutler, Fielding, Washakie	279,000
M	Cub River, Fielding, Temple Fork, Whites Valley	257,000

Combinations derived from the list of nine possible proposed Bear River reservoirs as part of Bear River Development taken from Table 10-9 from the 2014 Bear River Pipeline Concept Report, commissioned by the Utah Division of Water Resources. Combinations B and M were identified by the authors of the 2014 Concept Report for further study.

of these reservoir combinations were dismissed due to concerns over feasibility, cost, and geography. The report concluded:

> "Based on the recommended reservoir sites for the Project and the location/volume requirements of the storage, it is recommended that Combinations B and M (Figures 10-20 and 10-30 [Volume II], respectively) be advanced for further study."[3]

Out of the two Combinations selected by the authors of the 2014 Concept Report for further study, this analysis only examined the least expensive of these scenarios, Combination B. Selecting Combination M would increase the debt that would be incurred by the beneficiaries of the Bear River Development. Combination B had an estimated 2010 total cost of $1.66298 billion compared to an estimated 2010 total cost of $1.80245 billion for Combination M.[4]

Combination B Engineering Features

Combination B consists of the Cub River, Fielding, and Weber Bay reservoirs, as well as the Collinston Connection to move water from Bear River to the pipeline, and various pipelines and pumping stations. Cost information is from the 2014 Concept Report, which uses 2010 cost figures. Starting in Section 4 we adjust for inflation in construction costs in the years since the original cost estimate.[5]

The costs of Combination B's pipelines, pumping stations, and other infrastructure were taken from the 2014 Concept Report's Tables 10-11 and 12-2. For the West Haven Water Treatment Plant and infrastructure located further south, the costs were taken from Table 12-5. Table 3 details the 2010 costs of Combination B. It is a summary that is shortened for readability from Table 12-5 of the 2014 Concept Report.[6]

Table 3: Combination B Cost Estimate Without Mitigation or Inflation

Stakeholder	Bear River to West Haven WTP	West Haven WTP	Water Pipeline to WBCWD/JVWCD	Water Reservoir and Pump Station	Total Combination B
Cache WD	$332,680,909	$0	$0	$0	$332,680,909
Bear River WCD	$332,680,909	$0	$0	$0	$332,680,909
Weber Basin WCD	$277,234,091	$123,125,000	$35,713,600	$15,480,400	$451,553,091
Jordan Valley WCD	$277,234,091	$123,125,000	$101,646,400	$44,059,600	$546,045,091
Total	$1,219,830,000	$246,250,000	$137,360,000	$59,540,000	$1,662,980,000

Combination B Costs in 2010 dollars based on table 12-5 of the 2014 Bear River Pipeline Concept Report, commissioned by the Utah Division of Water Resources.

3. Environmental Mitigation Costs

Bear River Development is estimated to inundate or dry up thousands of acres of wetlands near the Bear River and around the Great Salt Lake. The 2014 Concept Report explicitly estimates some mitigation costs in its Chapter 6. It includes some mitigation costs but not others on its page 10-27. It suggests that mitigation costs are not included at all in Table 12-2 and Table 12-5 because the last sentence of the first paragraph of chapter 12 notes that

> "Environmental mitigation costs are not included in these totals."[7]

Since environmental mitigation costs were probably not included in the tables used to underlie that report (Tables 10-8, 10-11, 12-2, and 12-5), the ultimate project cost will probably be larger than the numbers reported in those tables, but how much larger is unclear. The report itself gives some potential costs regarding environmental mitigation in Table 10-14.

The environmental review in the 2014 Concept Report does not mention any mitigation due to declining water levels around the Great Salt Lake itself. The writers of the 2014 Concept Report state that the cost they assumed for wetland mitigation was $50,000/acre and acknowledge that this estimate is half of what is normally assumed for wetland mitigation.[8] These factors make selecting an appropriate cost per acre for wetland mitigation difficult, and different analysts could decide upon different figures. A cost of $100,000 per acre was decided upon for this

Table 4: Conceptual Review of Reservoir Sites Summary of Environmental Review

Reservoirs	Total Inundation Area (Acres)	Inundated Acres of Wetlands	Wildlife Habitat Value	Number of Threatened, Endangered, and Sensitive Species	Inundated Acres of Prime or Unique Farmland	Social Resources Present	Environmental Mitigation Costs at $50,000/ Acre of Wetlands Inundated
Above Cutler Dam	4,250	2,535	Medium	11	1898	Bird watching, fishing	$136,000,000
Cub River	1,500	297	Medium	3	775	Limited bird watching, fishing	$19,000,000
East Promontory	28,170	25,533	High	6	4	Limited	$1,277,000,000
Fielding	1,700	790	High	6	848	Limited	$44,000,000
Hyrum Enlargement	730	542	High	5	80	Fishing, boating, camping	$28,000,000
Temple Fork	480	1	Very High	3	0	Trailheads, camping	$0
Washakie	4,970	288	Medium	2	278	Limited	$16,000,000
Whites Valley	2,060	4	High	5	80	Limited	$1,000,000
Weber Bay	6,900	6841	Very High	4	70	Bird Watching, Hunting	$342,000,000

Environmental analysis factors from the 2014 Bear River Pipeline Concept Report, as taken from Table 10-14.

analysis, but the spreadsheet accompanying this report allows the user to easily choose which mitigation cost estimate to use.

4. Total Costs and Inflation

The 2014 Project Concept Report, both in Table 12-2 and several other places, uses cost information from March 2010. Based on this analysis we estimate that Combination B for Bear River Development construction cost without environmental mitigation is $1.654 billion. Over the last nine years, consumer inflation has totaled 17%[9] but the Engineering News Record construction cost inflation index increase has totaled almost 30%.[10] By comparison the 2019 Draft Utah Regional Municipal and Industrial Water Conservation Plan authored by the Utah Division of Water Resources estimated a cost of $1.724 billion.[11] In this report the costs given in the 2014 Concept Report will be inflated by the Engineering News Record construction cost index, but the spreadsheet accompanying this report allows the user to easily choose which index to use. Our estimate of 2019 Bear River Development costs with environmental mitigation and accounting for inflation is $2.934 billion. There will also be $190 million of capitalized Operations and Maintenance costs over the next 30 years.

5. Bear River Development Financing

The Bear River Development Act envisions four water conservancy districts participating in the project. These water districts would receive Bear River water and simultaneously begin repayment of their respective portion of the project's construction costs with interest. The lender would be the State of Utah, though it in turn would issue bonds to pay project construction costs. In its role as lender, the State will loan funds which the water districts must repay over what this report assumes is a 30 year term with an assumed interest rate of 4 percent, but the spreadsheet accompanying this report allows the user to easily choose which term and interest rate to use. A separate loan would be issued between the State of Utah and each water district receiving Bear River Project water. The loan amount for each borrower will be mostly dictated by the percentage of Bear River water each water district receives from the project, though repayment of the southern infrastructure differs from this (see Appendix A). The Bear River Development Act dictates the maximum amount of water each water district will receive, and hence approximately their respective portion of the debt for the project, as shown in Table 5.

Table 6: Water District Net Revenues, Fiscal Year 2018

Water District	Change in Net Position
Bear River WCD	$420,689
Weber Basin WCD	$9,151,195
Jordan Valley WCD	$12,763,020
Cache WD	$0

Table 6 lists the most recent available net annual revenues of all four water conservancy districts based on their audited financial statements. In municipal finance, net revenues are translated as change in net position. As one can observe from these revenue streams, different water districts have different abilities to pay for additional debt. Note that the Cache Water District does not currently have any revenues because it has recently been created and has no revenue stream.

If one assumes that the construction cost of Bear River Development under Combination B, as described in the 2014 Concept Report, is approximately $1.6 billion, and then uses a level (mortgage-like) repayment scheme with mitigation costs, an interest rate, a repayment period, and inflation as described in Sections 3, 4 and 5 earlier, then Table 7 compares each water district's annual debt

Table 5: Amount and Percentage of Bear River Water Received; Approximate Percentage of Bear River Development Debt Received

District	Legal Maximum of Bear River Water in Acre-Feet	Percentage of Bear River Water Received
Jordan Valley WCD	50,000	22.7
Weber Basin WCD	50,000	22.7
Bear River WCD	60,000	27.3
Cache WD	60,000	27.3
Total	220,000	100

Table 7: Water District Annual Revenues, Debt, and Deficit

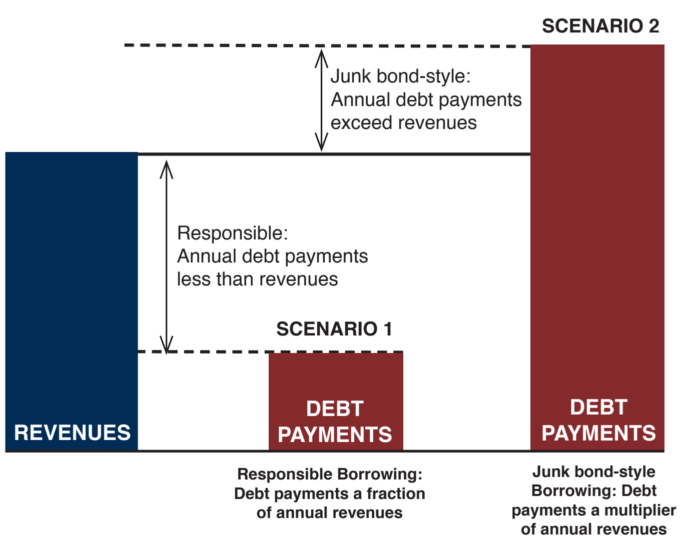
Water District	2018 Net Revenues	Annual Debt Payments Needed to Pay for Bear River Development	Deficit in Millions
Jordan Valley WCD	$12,763,020	$54,400,000	$41.6
Weber Basin WCD	$9,151,195	$47,300,000	$38.1
Bear River WCD	$420,689	$41,100,000	$40.7
Cache WD	$0	$41,100,000	$41.1
Total	$22,334,904	$183,900,000	$161.6

payments with its existing net revenues available to repay this debt. If a district has additional borrowing needs planned in the future then it may not be able to pledge all of its net revenues for repayment of the Bear River Development debt, and its deficit amount will be greater than that shown in Table 7.

6. Opting out of the Bear River Development

Given the fact that debt payments for Bear River Development greatly exceed net revenues for each water district, it is doubtful that all four water districts will participate in project financing from the onset of construction, because doing so would violate good lending practice and sound water delivery governance policy, more so for some of the water districts than for others. In particular, an investment-grade bond rating is typically incompatible with an issuer whose annual revenues fall short of its debt repayment obligations. This metric is conventionally measured by the "Debt Service Coverage Ratio," abbreviated "DSCR," which is the ratio of revenues to debt service. A higher DSCR is better. As described by Moody's Investors Service,[12] a DSCR of greater than two is compatible with an Aaa bond rating, and any DSCR below one corresponds to a junk bond rating.

Figure 1: Two Lending Scenarios: Responsible vs. Junk Bond-style Borrowing



In the two lending scenarios above, Scenario 1 represents responsible borrowing while Scenario 2 represents a junk bond-style borrowing situation.

Another way to express this concept is with a diagram. See Figure 1 below. If the annual debt payments to the State of Utah for Bear River Development exceeds any given water district's total available revenues, implying a Debt Service Coverage Ratio below one (corresponding to junk bonds), it is reasonable to presume that this borrower is highly likely to opt out of receiving Bear River Project water. In that case, its share of remaining project costs would have to be shouldered by the other water districts still left participating in the Project.

Clearly, the project costs would go down if specific engineering features servicing the opting-out agency were not needed by the remaining water districts. On the other hand, when a district pulls out, the cost of any engineering features which are still required for the remaining participants have to be borne by the smaller number of districts which remain. On net, the remaining districts' Debt Service Coverage Ratio will change, possibly for the worse, which could cause them to pull out in turn. In Section 7 we carefully investigate where this process could end up.

A critic might argue that future population growth expected along the Wasatch Front will lead to an increase in available revenues which could be used for Bear River Development debt payments. However, a number of requirements must be met for this population growth to translate into increased revenues to pay this debt. First, this population growth must be within a water district's taxing area in order for this growth to translate into increased property tax revenues. Many parts of the Wasatch Front are not in the taxing area of any of the districts scheduled to receive Bear River Development water. Second, in order for this population growth to result in increased water rate revenue for a water district, the new population's water needs must be served by the water district instead of by local cities supplying water from other sources.

Even if these conditions are met, this revenue growth will be accompanied by a growth in water delivery costs which must be subtracted from revenues. Therefore, whether the population growth will lead to a growth in net revenues suitable to repay additional borrowing is not clear. This question must also be asked alongside consideration of other, competing potential sources of water that are or may become available in the future. Such broad issues are beyond the scope of this analysis, so revenue growth is not considered further.

7. Participation Scenarios in Bear River Development Financing

As one can see from Section 6, the Bear River Development's financing requirements create problems for at least several of the water districts envisioned to participate in the project. For instance, the Bear River WCD's annual debt payments would be significantly higher than its current annual revenues and its Debt Service Coverage Ratio would be 0.01, where values below 1.00 are in the junk-bond range. Prudent financial policy would recommend that this water district opt out of Bear River Development, at least until such time as it can raise enough revenues to service this debt—which will not be in the foreseeable future if that would require a population increase of 100 times its current population.

If the Bear River WCD does opt out of participating in the Bear River Development, then as Section 6 pointed out that would mean the other three remaining water districts would be saddled with the construction and financing costs remaining of the diminished project. Appendix A discusses in detail how these costs would be apportioned excluding the opting-out district.

However, it is possible that the Cache WD would drop out before the Bear River WCD, since the Cache WD's Debt Service Coverage Ratio is zero. To fully analyze every one of the possibilities of various districts dropping out or remaining, each of the 15 possible permutations of co-financing the Bear River Development (see Table 8) were studied next.

Table 8: 15 Participation Scenarios

Scenarios	Cache WD	Bear River WCD	Weber Basin WCD	Jordan Valley WCD
1	✓	✓	✓	✓
2		✓	✓	✓
3	✓		✓	✓
4	✓	✓		✓
5	✓	✓	✓	
6			✓	✓
7		✓		✓
8		✓	✓	
9	✓			✓
10	✓		✓	
11	✓	✓		
12				✓
13			✓	
14		✓		
15	✓			

Scenario Results

The cost estimates for each Bear River Development participation scenario vary depending upon the geography being served and the engineering features needed to serve that geography. For each scenario, we examined which engineering components of the Bear River Development as assumed in Combination B were necessary for the water districts participating in that scenario. For each scenario, the least-cost combination of reservoirs that could provide the needed water storage was chosen.

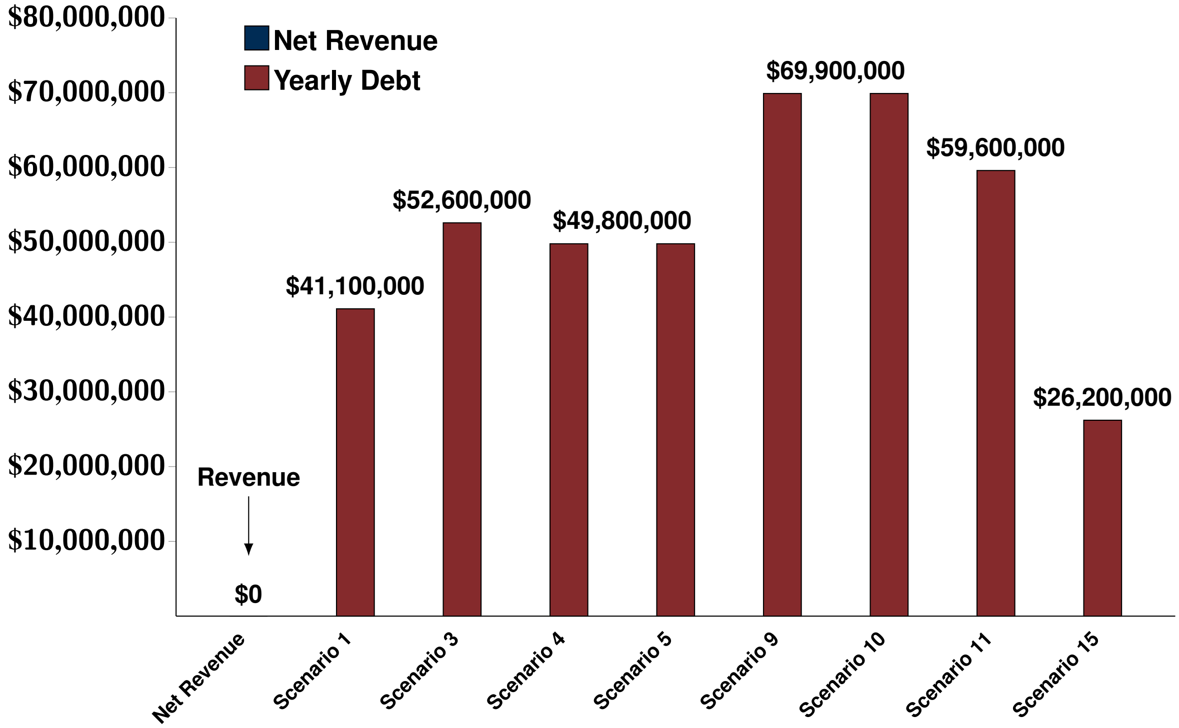
Scenario 1 entails all four water districts participating in Bear River Development, as described in Section 5. In Scenario 2, where Bear River WCD, Jordan Valley WCD, and Weber Basin WCD all participate in the project but Cache WD does not, we removed the Cache Project Facilities portion of Combination B. We also removed the Cub River Reservoir as the project will provide less water and thus does not need as much storage. Other scenarios were analyzed as described in Appendix C.

Scenario 1, with all the districts participating, has Debt Service Coverage Ratios of zero for Cache WD and 0.01 for Bear River WCD. No prudential lender or borrower would proceed with anything close to this financing situation. The Scenario 1 DSCRs for Weber Basin WCD and Jordan Valley WCD are 0.19 and 0.23, respectively, very far into the junk-bond range. As also discussed above, it is therefore likely that neither the Cache WD nor the Bear River WCD will participate in the Project. This would lead to Scenario 6, in which 50,000 acre-feet of water would be delivered to Weber Basin WCD and 50,000 acre-feet of water would be delivered to Jordan Valley WCD. We calculate that project costs in Scenario 6 would fall to 80% of the full Scenario 1 project costs, but nevertheless the DSCRs for the Weber Basin WCD and the Jordan Valley WCD would fall to 0.13 and 0.17, respectively. If then the Weber Basin WCD opted out, only the Jordan Valley WCD would remain, which is Scenario 12. By our estimates, project costs in this scenario fall to 47% of the full Scenario 1 project costs, but nevertheless the Jordan Valley WCD's DSCR falls to 0.15.

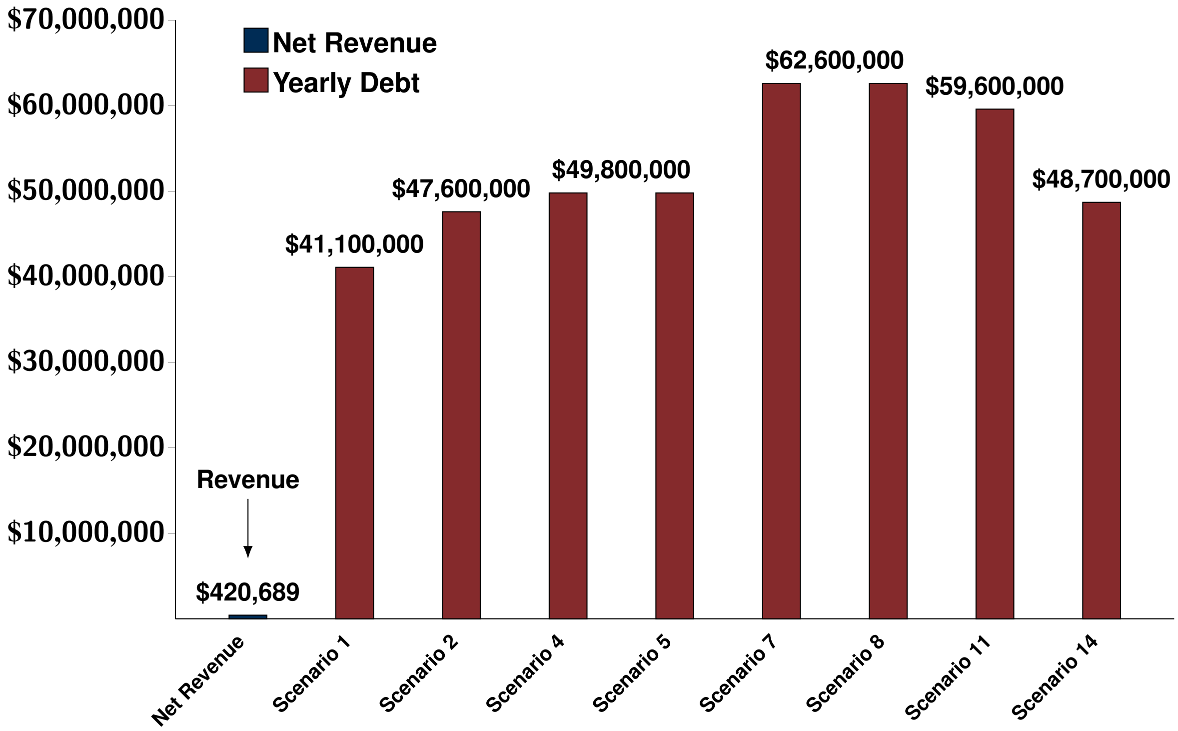
For another perspective on how unsatisfactory Scenario 12 would be, we investigated its implications for the retailers (mostly cities) within the Jordan Valley WCD service area which are forecast to need Bear River water in the future. This information was based upon the Utah State Water Plan prepared by the Utah Division of Water Resources, as described in the June 2010 Jordan River Basin Plan. This agency makes projections for water shortfalls for cities in the Jordan River Basin: see Appendix B. If one supposes that Bear River water, and therefore debt, is allocated to the cities in proportion to their projected 2060 water deficits then we can calculate how much of Scenario 12's $1.50 billion cost (debt) would be borne by each retailer. The result, in millions of dollars, is shown in Table 9 on page 19.

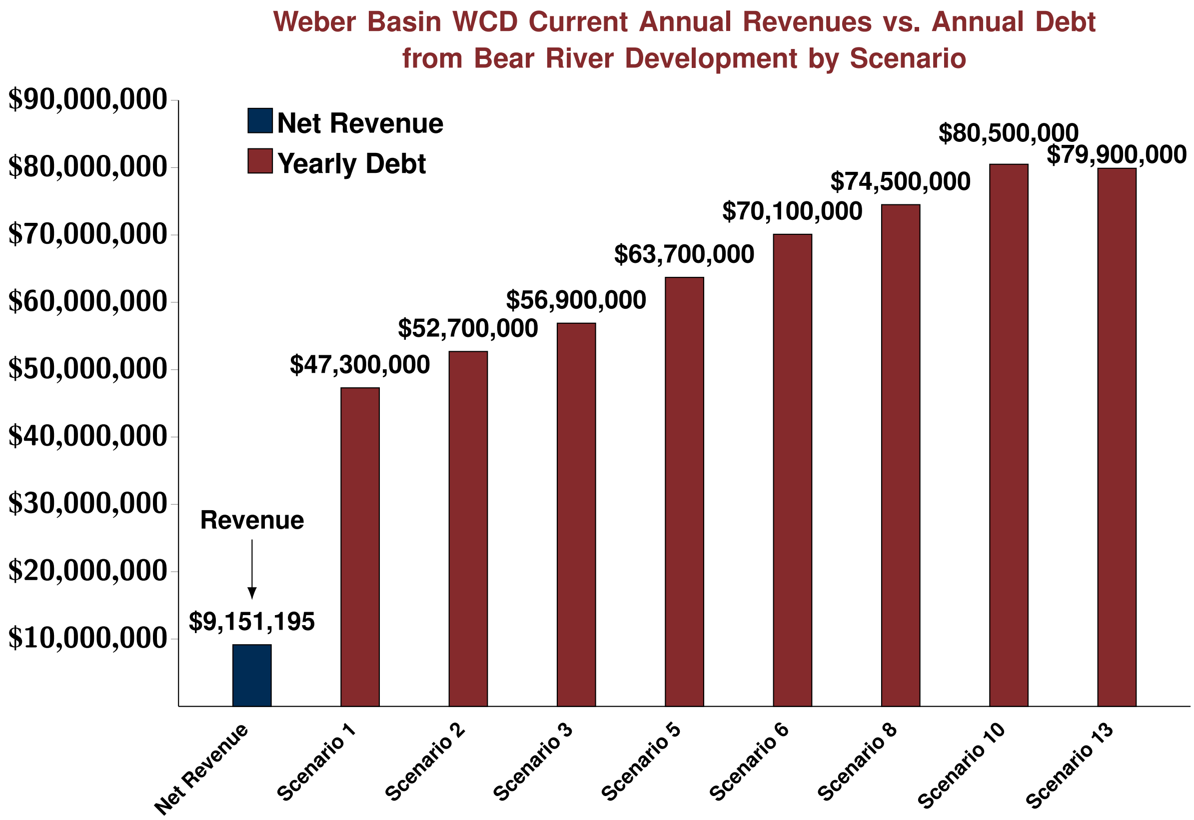
One aspect of our methodology leads to an upward bias in costs. In scenarios where Jordan Valley WCD but not Weber Basin WCD participates in the project, or scenarios where Weber Basin WCD but not Jordan Valley WCD participates in the project, we assumed that the West Haven WTP will still cost the same as in Scenario 1, even though in these two situations the treatment plant could be built at a smaller, less costly scale. Similarly, the pipe diameter of the Bear River Pipeline could be made smaller if it serves fewer districts, but the State has not studied what these cost savings might be so we cannot take them into account. On the other hand, our decision to put operations and maintenance expenditures at $50/acre-foot in 2010 dollars when the State gives $188/acre-foot[13] (in 2019 dollars) leads to a downward bias in costs. Omission of Great Salt Lake mitigation expenditures leads to another downward bias in costs. Yet another is that we assumed the Weber County Reach would be unnecessary whenever the Weber Basin WCD opted out, but if the Jordan Valley WCD has opted in, the Weber County Reach probably has to be built even if the Weber Basin WCD has opted out.

Cache WD Current Annual Revenues vs. Annual Debt from Bear River Development by Scenario



Bear River WCD Current Annual Revenues vs. Annual Debt from Bear River Development by Scenario




Weber Basin WCD Current Annual Revenues vs. Annual Debt
from Bear River Development by Scenario
$90,000,000
$80,000,000
$70,000,000
$60,000,000
$50,000,000
$40,000,000
$30,000,000
$20,000,000
$10,000,000
Net Revenue
Yearly Debt
Revenue
$9,151,195
$47,300,000
$52,700,000
$56,900,000
$63,700,000
$70,100,000
$74,500,000
$80,500,000
$79,900,000
Net Revenue
Scenario 1
Scenario 2
Scenario 3
Scenario 5
Scenario 6
Scenario 8
Scenario 10
Scenario 13

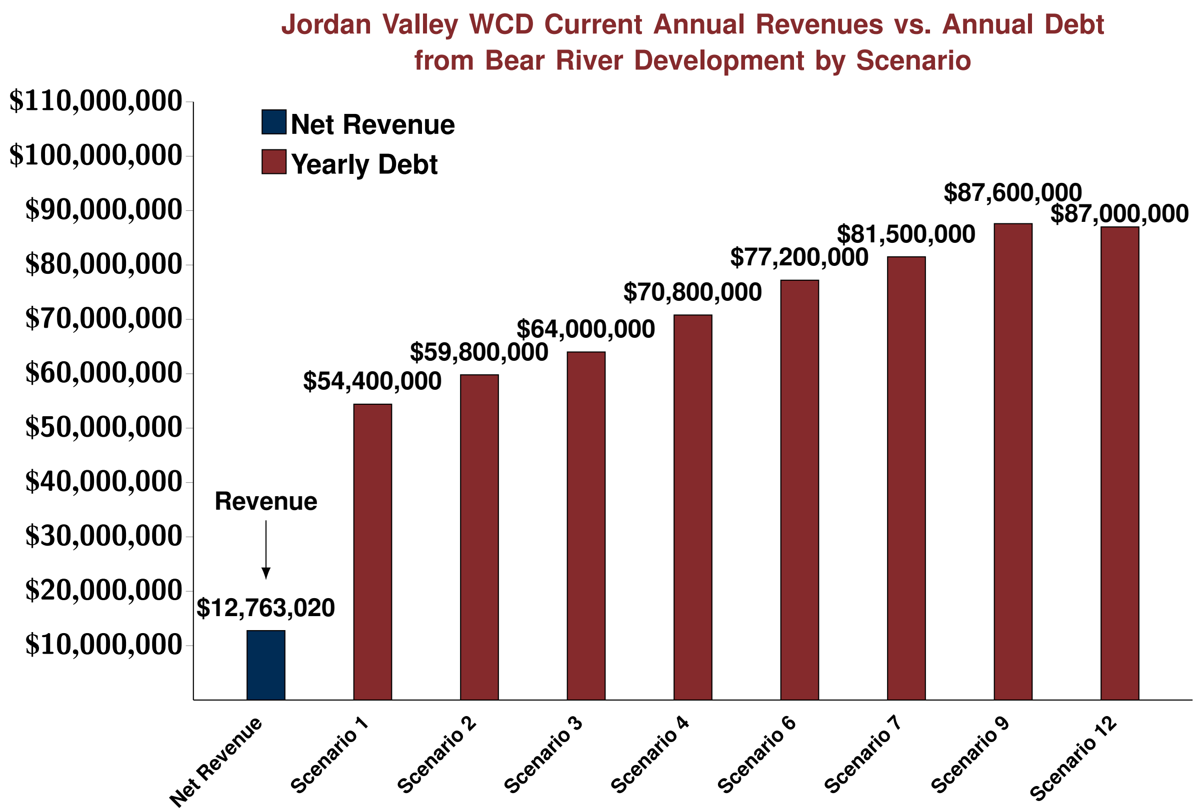

Jordan Valley WCD Current Annual Revenues vs. Annual Debt
from Bear River Development by Scenario
$110,000,000
$100,000,000
$90,000,000
$80,000,000
$70,000,000
$60,000,000
$50,000,000
$40,000,000
$30,000,000
$20,000,000
$10,000,000
Net Revenue
Yearly Debt
Revenue
$12,763,020
$54,400,000
$59,800,000
$64,000,000
$70,800,000
$77,200,000
$81,500,000
$87,600,000
$87,000,000
Net Revenue
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 6
Scenario 7
Scenario 9
Scenario 12

Table 9: Jordan Valley WCD Debt from Bear River Development, Scenario 12

Water System	Annual Payments for Bear River Development	Total Debt from Bear River Development
Bluffdale	$5,150,000	$79,200,000
Draper City Water	$2,650,000	$40,700,000
Water Pro	$4,380,000	$67,300,000
Granger-Hunter ID	$8,470,000	$130,200,000
Herriman	$6,160,000	$94,700,000
Kearns ID	$15,790,000	$242,700,000
Magna Water	$6,520,000	$100,200,000
Midvale City Water	$1,450,000	$22,300,000
Riverton Water	$6,870,000	$105,600,000
South Jordan	$12,700,000	$195,200,000
South Salt Lake Water	$1,230,000	$18,900,000
Taylorsville-Bennion ID	$3,810,000	$58,600,000
West Jordan City Water	$11,820,000	$181,700,000
Total	$87,000,000	$1,337,000,000

8. Conclusions

Our overall conclusion is that with current revenues, if the water districts had to get their own financing on the free market for the Bear River Development instead of being able to get financing from the State of Utah, obtaining that financing would be impossible. Furthermore, with current revenues, if the State lends the funds to the water districts it should place high probability on not being paid back, and the districts should place high probability on becoming insolvent.

It is true that districts can increase their revenues, for example by raising water rates. But increased water rates will reduce water demand, calling into question the need for the Bear River Development water in the first place. Districts might also be able to use interest-only or negative-amortization financing to back-load repayment obligations. On the free market such structuring usually results in a higher interest rate and lower debt rating, which may or might not be the case here. In addition, as mentioned above, there are reasons to think that our cost estimates for the opt-out scenarios are overestimates, and we recommend the State develop more accurate cost estimates for the opt-out scenarios. On the other hand, pre-construction budget projections often turn out to be underestimates, and the costs we use for operations and maintenance are also likely to be underestimates.

Environmental mitigation costs are responsible for some of the low DSCRs but even if mitigation costs were zero the DSCRs would not increase much. The Scenario 1 DSCRs, which were zero, .010, .19, and .23 for the Cache WD, Bear River WCD, Weber Basin WCD, and Jordan Valley WCD, respectively, would rise to zero, .015, .25, and .29. The Scenario 6 DSCRs, which were .13 (Weber Basin WCD) and .17 (Jordan Valley WCD), would rise to .18 and .22. The Scenario 12 Jordan Valley WCD DSCR of .147 would rise to .155. Furthermore, considering that our environmental mitigation costs include no mitigation for the Great Salt Lake, it is not unreasonable to think that they may be underestimates not overestimates.

For more information and a full list of all of our results, the reader is invited to download the Excel spreadsheet which generated the results and its accompanying Technical Appendix from the hyperlinks given at the beginning of Appendix A.

Appendix A
Bear River Development Participation Model Spreadsheet Information

This appendix explains the contents of the spreadsheet created for this report and explains how the reader can edit the assumptions made in the analysis to customize figures in the spreadsheet. The spreadsheet is available online at http://content.csbs.utah.edu/~lozada/Research/BearRiverScenarios.xlsx
and more details are available with its accompanying Technical Appendix at
http://content.csbs.utah.edu/~lozada/Research/ExplanationOfBearRiverSpreadsheet.docx.

JdnWbr

This sheet is composed of costs exclusive to Weber Basin WCD and Jordan Valley WCD. The components detailed in this sheet are the West Haven Water Treatment Plant, the pump stations for Weber Basin WCD and Jordan Valley WCD, as well as the pipelines from the West Haven Water Treatment Plant to Weber Basin WCD and Jordan Valley WCD. The costs are unequally allocated between the two districts as specified by Table 12-5 of page 12-7 of Vol. I of the State's 2014 Concept Report. The costs are calculated for each of the 15 scenarios in cells H17 to L32.

Reservoirs

This sheet details the reservoir combination choice for each scenario, the construction costs for the reservoir combination chosen in each scenario, and the amount of wetland inundation for the reservoir combination represented by each scenario. The reservoir combination chosen for each scenario is listed in column J. Combination costs are in column H, and the figures for inundated wetlands are in column I. All of these costs are allocated to each district according to the amount of water it is scheduled to receive. These reservoir costs for each scenario are described in the range from cell L38 to cell P53 with overhead costs included. Overhead consists of oversight expenses and administration costs. The 2014 Concept Report estimates oversight expenses as 10% of construction costs and administration costs are 30% of construction costs and oversight expenses combined. Calculations for the lowest cost reservoir combination in each scenario and wetland acreage inundated in each scenario are also described on the sheet. Costs are allocated according to the water share of each scenario.

T12dash2

This sheet details engineering features and costs from Table 12-2 of the 2014 Concept Report other than the reservoir combinations and costs described in Reservoirs. Among these features are the North and South Box Elder Reach pipelines and the Collinston Connection; these three components are combined into one cost number, in millions, in cell H4. Other engineering features are the Weber County Reach Pipeline, with a cost given in cell H6, and the Cache County Project Facilities, its cost listed in cell H8. Both of those cost figures are also in millions of dollars. These cost values are adjusted for overhead in column K. The costs of each of these engineering features are attributed to whichever water district benefits from that feature as given in the range from cell A3 to cell F47, then summed and reallocated according to the water share of each scenario.

Totals

This sheet is a summary of all major results in the report. Rows five through 19 of column H give the total construction cost estimated for each scenario. These construction cost figures are calculated from summing the cost information for each scenario from sheets JdnWbr, Reservoirs, and T12dash2. These costs, plus capitalized Operation & Management ("O&M") costs, are given in rows five through 19 of Column I. O&M costs are discussed in the range cell K6 to cell R14.

Cells K15 and K16 are construction cost index figures from Engineering News Report. Cell K15 gives the value of the index as of March 2010. This index value is the value used by the 2014 Concept Report. K16 is the construction cost index as of March 2019. Consumer price index numbers are also provided on the sheet if the reader wishes to inflate construction costs by consumer prices: K17 is the consumer price index as of March 2010, which is the date used to calculate the cost of Bear River Development in the 2014 Concept Report, and K18 is the consumer price index as of March 2019. Both consumer price index numbers were taken from the Bureau of Labor Statistics website.

Step 1 is a cost table summarizing the costs given on the prior three sheets. Step 2 summarizes acre-feet of water taken by each water district in each scenario. (Step 10 summarizes acre-feet of water taken as a percentage of the total water diverted.) Step 3 gives the capitalized value (present value) of O&M costs, using the interest rate chosen by the reader in cell O14 (4% in this report), the number of years chosen in cell Q13 (30 in this report), and the "dollars of O&M costs per acre-foot of water" chosen in cell K6 ($50/af in this report). Step 4 adds the construction costs and the capitalized O&M costs.

Step 5 summarizes annual debt service payments required by each water district given that Step 4's amounts are paid back in equal yearly payments. This is calculated using the interest rate (O14) and term (Q13) described in the previous paragraph. Step 6 is identical to Step 5 except that its construction costs are adjusted by the adjustment factor for inflation chosen by the reader in cell L64. Step 7 is a cost per acre-foot calculation based on the debt payments of Step 5. Step 8 is a cost per acre-foot calculation based on the debt payments of Step 6.

Step 9 introduces wetland mitigation costs. The cost of wetland mitigation per acre is chosen by the reader in cell E109 ($100,000/acre in this report). Column J, rows 113 through 127, gives the total cost of Bear River Development for each scenario. Step 11 calculates annual wetland mitigation cost for each water district assuming that the cost is assigned to each water district based on their percentage of water from Bear River Development (Steps 2 and 10) (and also assuming that this cost is paid off using cell O14's interest rate and cell Q13's years of repayment, with level annual payments). Step 12 adds together the cost numbers of Step 11 and Step 6. Step 13 is a cost per acre-foot table based on the cost numbers of Step 12.

Presentation

Presentation is a sheet detailing financial information for each water district. The sheet also provides financial projections for each water district depending on the scenario. The range from cell A1 to cell E3 gives current debt loads as of the fiscal year 2018. The range from cell I1 to cell M3 provides current debt service costs and current net revenues as of the fiscal year 2018. The range in cell A5 to cell E22 brings over Step 12 from the Totals sheet. Cell F8 to cell F22 calculates the sum of annual debt payments so as to calculate the yearly debt service payments overall due to Bear River Development in each scenario. Cell G8 to G22 compares total yearly debt service payments in each scenario to yearly overall debt service payments in Scenario 1.

The range from cell A40 to cell D114 gives the extent of how much net revenue, before Bear River Development cost, would have to increase for the water districts to meet projected annual debt payments. The range of E40 to F114 is the simplest model projecting wholesale water rates if the Bear River Development was paid off solely with water rate increases. This model is not used in the report.

The range of G96 to X98 gives projections of future Jordan Valley WCD purchases. These projections are based on projected water deficits from Table 17 of the 2010 Jordan River Basin Plan, detailed in Appendix B. Range H99 to T114 projects annual costs of Bear River Development debt for cities in the Jordan Valley under each scenario. This range is created by taking the debt Jordan Valley WCD would receive under each scenario and multiplying this debt figure by the water proportion projections derived in G96 to X98. These annual debt service costs for the cities are converted into present value costs in the range from G115 to T130. Other summaries appearing in the report are located at cells V29 to AA49, U52 to Y62, S65 to AA87, Z90 to AK156, and H139 to J158.

Appendix B
Future Bear River Water & Debt Calculations for the Jordan Valley WCD

To project the amount of Bear River water, and hence presumably Bear River Development debt, delivered to specific cities in the Jordan Valley WCD, the Utah State Water Plan was used as a guide. The 2010 Jordan River Basin Plan analyzed the water supply of the Jordan River Basin and also gave projections on future water use and future water needs. Page 42 of the document contains Table 17, reproduced here as Table B, which projects year 2060 water deficits for cities served by the Jordan Valley WCD.

The precise procedure to allocate debt was as follows. From Table B, all of the water deficits of water providers in the Jordan Valley WCD (except for White City Water which is not projected to have a deficit) were added up to get the total projected 2060 deficit. Each water provider's projected 2060 deficit was divided by the overall projected 2060 deficit to get a proportion of the total deficit. The report assumes that this proportion is equal to the proportion of future Jordan Valley WCD purchases, and thus is equal to the proportion of Bear River Development debt each water provider would have to pay off. (This assumes this nine-year-old document is accurate and that these water deficit numbers are a proxy for future Jordan Valley WCD purchases.)

Table B: Jordan Valley 2060 Water Projections

Water System	2010 Dry Year Supply (in Acre-Feet)	2060 Water Use Projections (in Acre-Feet)	2060 Water Deficit Projections (in Acre-Feet)
Bluffdale	0	10,551	10,551
Draper City Water	0	5,435	5,435
Water Pro	4,583	13,551	8,968
Granger-Hunter ID	9,393	26,737	17,344
Herriman	434	13,050	12,616
Kearns ID	1,816	34,141	32,325
Magna Water	4,308	17,657	13,349
Midvale City Water	2,800	5,767	2,967
Riverton Water	5,040	19,118	14,078
South Jordan	0	26,000	26,000
South Salt Lake Water	3,157	5,682	2,525
Taylorsville-Bennion ID	7,500	15,297	7,797
West Jordan City Water	3,000	27,199	24,199
White City Water	4,052	2,971	(1081)
Jordan Valley WCD retail	102,335	14,043	(88,292)
Total	148,418	237,199	88,781

Appendix C
Engineering Features of Combination B by Participation Scenario

This appendix details which engineering features are included in each water district participation scenario. The baseline of engineering features is Scenario 1 of this analysis, the scenario where all water districts participate. The engineering features of this scenario include:

1. Cub River Reservoir
2. Fielding Reservoir
3. Weber Bay Reservoir
4. North & South Box Elder County Reach Pipelines & Collinston Connection
5. Weber County Reach Pipeline
6. West Haven WTP
7. Jordan Valley WCD Pump Station and Pipeline
8. Weber Basin WCD Pump Station and Pipeline
9. Cache County Project Facilities

"Jordan Valley WCD Pump Station and Pipeline" is a combination of costs attributed to Jordan Valley WCD on Table 12-5 of the 2014 Concept Report in the columns "Finished Pipeline to WBWCD/JVWCD" and "Finished Water Reservoir and Pump Station." We treat this as one engineering feature as we assume both of these costs can be dropped if Jordan Valley WCD does not participate. The same explanation holds for Weber Basin WCD Pump Station and Pipeline.

The other engineering features listed above are described in the main body of our report. The table below explains which engineering features were dropped from the analysis in each scenario.

Table C: Engineering Features of Bear River Development, Combination B, Dropped in Each Participation Scenario

Scenarios	Water Districts Dropped	Engineering Features Dropped
1	None	None
2	Cache WD	Cub River Reservoir and Cache County Project Facilities
3	Bear River WCD	Cub River Reservoir
4	Weber Basin WCD	Cub River Reservoir, Weber Basin WCD Pump Station and Pipeline
5	Jordan Valley WCD	Cub River Reservoir, Jordan Valley WCD Pump Station and Pipeline
6	Cache WD and Bear River WCD	Fielding Reservoir, Cub River Reservoir, Cache County Project Facilities
7	Cache WD and Weber WCD	Fielding Reservoir, Cub River Reservoir, Cache County Project Facilities, Weber Basin WCD Pump Station and Pipeline
8	Cache WD and Jordan Valley WCD	Fielding Reservoir, Cub River Reservoir, Cache County Project Facilities, Jordan Valley WCD Pump Station and Pipeline
9	Bear River WCD and Weber Basin WCD	Fielding Reservoir, Cub River Reservoir, Weber Basin WCD Pump Station and Pipeline
10	Bear River WCD and Jordan Valley WCD	Fielding Reservoir, Cub River Reservoir, Jordan Valley WCD Pump Station and Pipeline
11	Weber Basin WCD and Jordan Valley WCD	Fielding Reservoir, Cub River Reservoir, West Haven WTP, Jordan Valley WCD Pump Station and Pipeline, Weber Basin WCD Pump Station and Pipeline, Weber County Reach
12	Cache WD, Bear River WCD, Weber Basin WCD	Weber Bay Reservoir, Cub River Reservoir, Weber Basin WCD Pump Station and Pipeline, Cache County Project Facilities
13	Cache WD, Bear River WCD, Jordan Valley WCD	Weber Bay Reservoir, Cub River Reservoir, Jordan Valley WCD Pump Station and Pipeline, Cache County Project Facilities
14	Cache WD, Weber Basin WCD, Jordan Valley WCD	Weber Bay Reservoir, Cub River Reservoir, West Haven WTP, Jordan Valley WCD Pump Station and Pipeline, Weber Basin WCD Pump Station and Pipeline, Cache County Project Facilities, Weber County Reach
15	Bear River WCD, Weber Basin WCD, Jordan Valley WCD	All engineering features except Fielding Reservoir and Cache County Project Facilities

Endnotes

1 The reader is invited to direct comments by e-mail to Prof. Lozada at lozada@economics.utah.edu. He may also be reached at (801) 581-7650.

2 2014 Bear River Concept Report Volume II, Part 4-chapter 10 appendix A.

3 2014 Bear River Pipeline Concept Report Volume I. Page 30 of chapter 10.

4 2014 Bear River Pipeline Concept Report Volume I. Table 12-4. Page 6 of chapter 12.

5 The costs for the reservoirs in particular come from Table 10-8 of the 2014 Concept Report Vol. I unless it conflicted with Tables 10-11 and 12-2, in which case the latter, which agree with each other, were used.

6 The column called "Bear River to West Haven WTP" in our table was called "Combination B" in Table 12-5 of the 2014 Concept Report, but the former is a better description.

7 2014 Bear River Pipeline Concept Report Vol. I. Page 1 of chapter 12.

8 "Comparison Mitigation cost assumed at $50,000 per acre of wetlands and $5,000 per acre of prime farmlands. A more typical wetlands mitigation cost is $100,000 or more per acre, but inventory acreage may be exagerated [sic] on certain sites. It is also possible that UDWRe would not have to mitigate 100% of these impacts if it can be shown that the reservoirs could be operated to maintain some of the wetlands or that the operations would only change, possible [sic] improve, the existing wetlands function." 2014 Bear River Pipeline Concept Report Vol. I Page 27 of Chapter 10.

9 Bureau of Labor Statistics, https://www.bls.gov/cpi/tables/supplemental-files/historical-cpi-u-201907.pdf

10 Engineering News Record, March 8, 2010, and March 4/11, 2019. Construction Cost Index.

11 Utah's Regional M&I Water Conservation Goals Draft February 2019 p. 46

12 Page 20 of "US Municipal Utility Debt," July 30, 2014, Moody's Investors Service. Downloaded from https://www.amwa.net/sites/default/files/moodys-rfc-municipalutilitybonds.pdf

13 Utah's Regional M&I Water Conservation Goals Draft February 2019 p. 44 Table 5-3 row 2 column "O&M."