

Learning Objectives:

- a. *Demonstrate critical analysis skills and capabilities expected of practicing water resources engineers, including to identify, evaluate, and recommend alternatives.*
- b. *Cohently and concisely present engineering designs in written format.*
- c. *Recognize, describe, and adapt engineering designs to physical, economic, environmental, social, political, and other constraints that limit water resources engineering and management.*
- d. *Complete water resources designs in a timely fashion*
- e. *Work individually to solve a water resources problem*
- f. *Apply public-domain water resources models to solve current water problems*
- g. Compare the costs and yields of additional Bear River reservoir storage options.

You are an engineer employed at BlueWater, Inc., a Logan, Utah water resources engineering firm. Cache County wants to make use of the 60,000 acre-feet of Bear River water the county was allocated under the Bear River Development Act. The County has hired your firm to determine how much water is currently available to the County for new urban users and determine the feasibility of building a reservoir at one of two proposed on-river sites to provide for the allocation. The proposed sites are (i) Above Cutler (near Amalga), and (ii) below Cutler (another on-stream facility downstream of Cutler).

For each option (no reservoir, Above Cutler, or Below Cutler), the County wants to know:

1. The annual firm yield of deliveries to new Cache County users,
2. The annual delivery-reliability curve, and
3. The estimated cost per acre foot of firm yield to new Cache County users.

Your analysis must consider Bear River inflows both above and below the proposed reservoir sites, reservoir evaporative losses, and reservoir operations to meet the needs of existing, higher-priority users both in Cache Valley and downstream (such as the Bear River Canal Company and the Bird Refuge). Figure 1 shows a schematic of the system including locations of major inflows, existing and new users, and the two proposed reservoirs. The County has provided you a data file containing some of the inflow, demand, and reservoir evaporation data for use in your analysis as well as a set of instructions to get started entering the data into your model. The data file also contains reservoir data for the nearby Barrens reservoir which was proposed 20 years ago but has since been abandoned for environmental reasons. Note inflow data in the data file spans from 1966 to 2006 and represents a 41-year historical record which you can use to simulate the performance of each proposed reservoir. Using this record in the analysis assumes future inflows will be similar to past observed inflows (in magnitude, variations, and serial correlations from month to month and year to year).

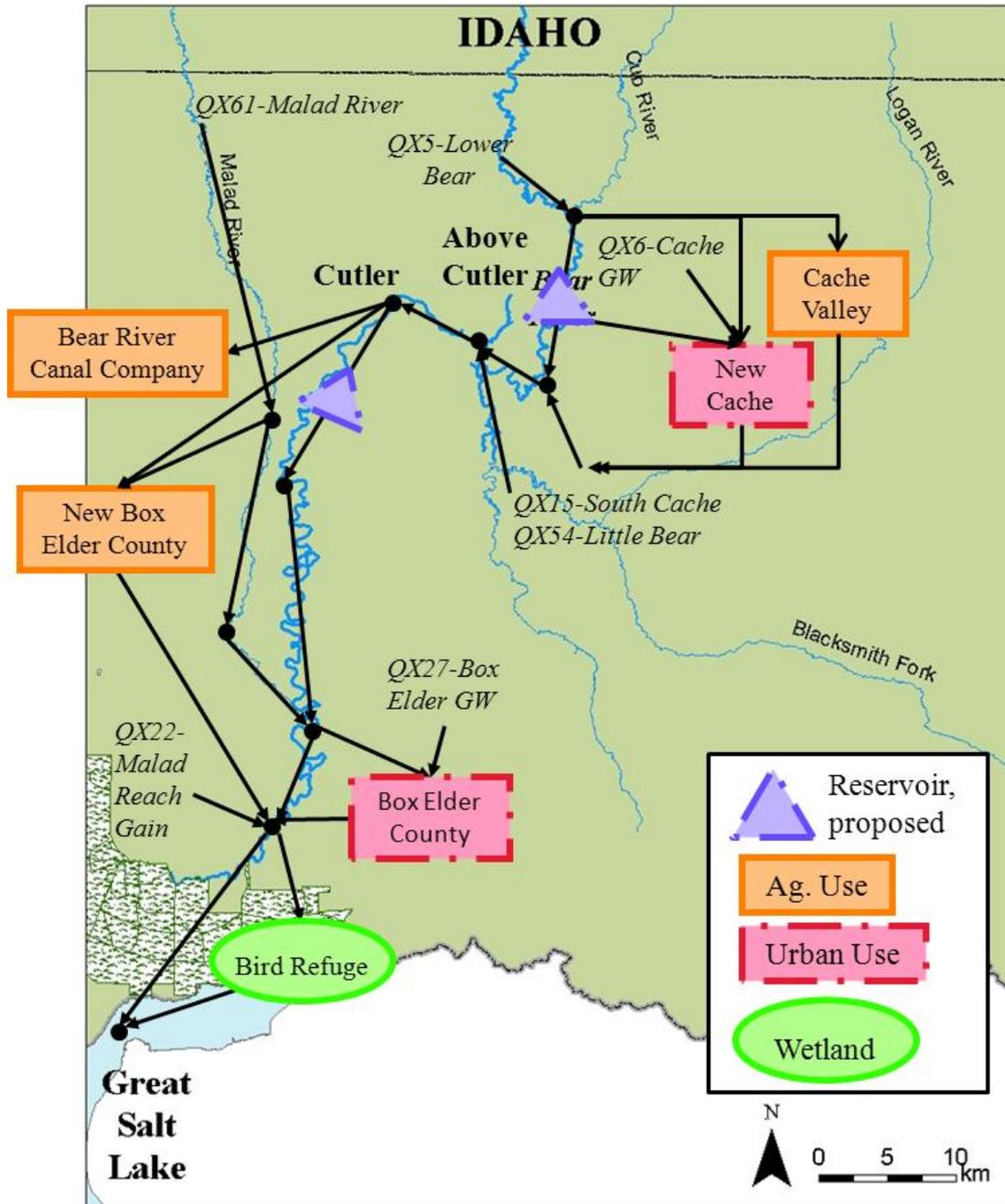


Figure 1. Lower Bear River Schematic.

Note that elevation-storage-area curves do not yet exist for either reservoir site; the County may provide this data in the next week. If not, it is your responsibility to develop this relationship. To do so, you may either use (i) digital elevation model (DEM) data available from the Utah GIS Portal (<http://gis.utah.gov/data/>) or (ii) assume the reservoir will comprise the wider channel cross section shown in Figure 2 and stretch up-river for 20 miles. It is your responsibility to obtain all the other data you need.

Your report must recommend the option the County should pursue.

Resources to help with this PBL

- [Lower Bear River Data File](#)
- [Getting Started entering the data](#)
- [WEAP Area for the Lower Bear River](#)

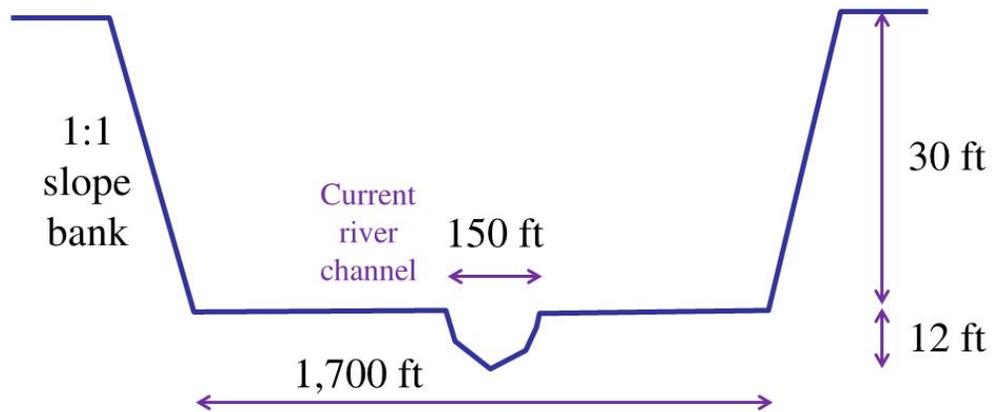


Figure 2. Hypothesized cross section for Above-Cutler dam site.

Category (Max. Score)	No Evidence	Doesn't Meet Standard	Nearly Meets Standard	Meets Standard	Exceeds Standard	Self-Score	Instructor Score
Title (2)	Absent 0	Evidence of two or less 0	Evidence of three 1	Evidence of four 1	Title – can assess main point from title alone; Name, Instructor's Name, Course, Date, Neatly finished. 2		
Introduction (10)	Absent, no evidence 0	There is no clear introduction or main topic. 1 - 5	Introduction states the main topic but either: 1. Does not give a full overview, Or: 2. Too detailed, repeats later in the paper. 6 - 7	The introduction states the main topic and previews the structure of the paper. 8	The introduction states the main topic and previews the structure of the paper. Good overview of the design and strategy. An effective summary. Gives enough detail to interest the reader. 9 - 10		
Organization and structural development of the idea: procedure, results, discussion (15)	Not applicable	Paragraphs fail to develop the main idea. No evidence of structure or organization. 1 - 9	Organization of ideas not fully developed. Paragraphs lack supporting detail sentences. No transitions. 9 - 11	Paragraph development present but not perfected. Each paragraph has sufficient supporting detail sentences. No transitions. 12 - 13	Section headers and paragraphs sequence ideas and show logic. The first sentence of each paragraph summarizes the paragraph. Successive sentences provide detail and develop the main idea. Transitions enhance organization. 14 - 15		
Engineering Design (33)	The writer has no clue what they are talking about. 0 - 42%	One, possibly two design points addressed. 45 - 58%	Sketchy: left out required design points. Did not work on this as much as you should have, and it shows. 61 - 79%	All the necessary points are covered, but discussion lacks adequate detail. 82 - 88%	Provides what was explicitly asked for. The function of each piece is demonstrated to the reader in adequate, but not overwhelming, detail. 91 - 100%		
	1. Enter data in WEAP for base case (10)						
	2. Identify alternatives and model in WEAP (6)						
	3. WEAP firm yield and delivery-reliability results (11)						
	4. Cost results for each alternative (3)						
	5. Recommendation (3)						

Category (Max. Score)	No Evidence	Doesn't Meet Standard	Nearly Meets Standard	Meets Standard	Exceeds Standard	Self-Score	Instructor Score
Word Usage and Format (15)	Not applicable	Writing is consistently unclear, not acceptable, & unprofessional for college level. Numerous errors in punctuation, capitalization, spelling, word usage, sentence structure, tables, and figures. <u>1-8</u>	Writing is understandable, but has misspelled words, poor English grammar and word choice. Figures are too small and/or poorly labeled, although they are usually of acceptable quality and focus. Bad or inconsistent fonts. Could be improved by being more meticulous. <u>9-11</u>	Almost no errors in punctuation, capitalization, spelling, sentence structure, word usage, significant figures, and presentation of figures and tables. <u>12-13</u>	Punctuation, capitalization, spelling, sentence structure, word usage, and significant figures all correct. Clear, consistent fonts. Good word processing skills. Figures have adequate contrast. Informative figure and table titles and legends. Figures have appropriate axis tick spacing, labels, and legends. Table columns cohesive, labeled, and specify units. Document is firmly stapled. <u>14-15</u>		
Conclusion (10)	Absent <u>0</u>	Incomplete and/or not focused. <u>4-6</u>	The conclusion does not adequately restate the main results. <u>7</u>	The conclusion restates the main results. <u>8</u>	The conclusion restates the main results, and is an effective summary. <u>9-10</u>		
References (5)	Absent <u>0</u>	Off-the-wall sources cited and/or multiple errors. <u>1-2</u>	Appropriate sources cited, but multiple errors in citing and formatting references. <u>3</u>	Good sources used, only a few errors in citing and formatting references. <u>4</u>	All prior work cited; bibliography in the correct format with no errors. Uses innovative sources of information. <u>5</u>		
Appendices (10)	Absent or data vomited onto last page. <u>0-3</u>	Too much data or too little data OR Evidence of one. <u>4-5</u>	Too much data or too little data OR Evidence of two. <u>6-7</u>	Too much data or too little data OR Evidence of three. <u>8</u>	Separate appendix for each topic, each contains a title, discussion, and proper formatting and display of information. <u>9-10</u>		
TOTAL (100)							