



**City Utilities
Design Standards
Manual**

Exhibit GR5-1 (1 of 2)
Project Coordination - Life Cycle Cost – Sample Calculations

Created: October 2012

Revised:

Example: The City of Fort Wayne needs an additional supply of water from the St. Joseph River. The engineer has selected two plans for comparison:

Gravity Plan: Divert water at a point ten miles up the St. Joseph River and carry it through a pipeline by gravity to the water plant.

Pumping Plan: Divert water at a point near the water plant and pump it through 2 miles of pipeline to the plant. The pumping plant can be built in two stages, with half capacity installed initially and the other half ten years later.

Use a 40-year analysis period and 8% interest. Salvage values can be ignored. During the first ten years, the average use of water will be less than during the remaining 30 years. Costs are as follows.

	Gravity	Pumping
Initial investment	\$2,800,000	\$1,600,000
Additional investment in tenth year	\$0	\$200,000
Operation, maintenance, replacements	\$10,000/yr	\$30,000/yr
Power cost (average first 10 years)	\$0	\$60,000/yr
Power cost (average next 30 years)	\$0	\$100,000/yr

Select the more economical plan.

<i>Factor Table for I= 8%</i>									
<i>n</i>	<i>F/P</i>	<i>P/F</i>	<i>A/F</i>	<i>A/P</i>	<i>F/A</i>	<i>P/A</i>	<i>A/G</i>		
40	21.725	0.0460	0.0039	0.0839	259.057	11.925	10.570		

Sample Calculations:

Since we have a 40-year analysis period, the problem may be solved by any of the exact analysis techniques. An annual cash flow analysis would appear to require the least calculations.

Gravity Plan

Initial Investment	= \$2,800,000 (A/P, 8%, 40)	
	= \$2,800,000 (0.0839) =	\$234,920
Operation, Maintenance, & Replacements		\$10,000
<i>Equivalent Uniform Annual Cost (EUAC) for Gravity Plan=</i>		<i>\$244,920</i>

Pumping Plan

Initial Investment	= \$1,600,000 (A/P, 8%, 40)	
	= \$1,600,000 (0.0839) =	\$134,240
Annual Power Cost		\$60,000
Additional Power Cost last 30 yrs	= \$60,000 (F/A, 8%, 30)(A/F, 8%, 40)	
	= \$60,000 (113.283)(0.0039) =	\$26,509
Additional Investment in 10 th Year	= \$200,000 (P/F, 8%, 10)(A/F, 8%, 40)	
	= \$200,000 (0.4632)(0.0839) =	\$7,770
Operation, maintenance & replacements		\$30,000
<i>Equivalent Uniform Annual Cost (EUAC) for Pumping Plan=</i>		<i>\$258,519</i>

For a minimum Equivalent Uniform Annual Cost (EUAC), choose Gravity Plan



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Revised:

- i = Interest rate per interest period.
- n = Number of interest periods
- P = A present sum of money
- F = A future sum of money. The future sum F is an amount, n interest periods from the present, that is equivalent to P with interest rate i .
- A = An end-of-period cash receipt or disbursement in a uniform series continuing for n periods, the entire series equivalent to P or F at interest rate i .
- G = A uniform arithmetic gradient representing a period-by-period increase in payments or disbursements.