Business Case Model

Cherokee WTP Improvements

Proposed Energy Efficient Retrofit

TVA Energy Efficiency SRF Pre-Application

KG Project # 150044

Existing Pumps & Operating Conditions

The original Cherokee Water Treatment Plant (WTP) was constructed in the 1960's and updated in the late 1990's. The WTP is currently rated for 0.5 MGD with two filters operating at a rate of 2 gpm/sf. The WTP includes 3 high service pumps and 3 raw water intake pumps as outlined below:

Existing High Service Pumps			
Pump	Flow (GPM)	TDH (Feet)	Motor HP
Pumps 1-3	700	349	100

Existing Raw Water Intake Pumps			
Pump	Flow (GPM)	TDH (Feet)	Motor HP
Pump 4-6	480	115	20

Pumps 1-6 were installed in the late 1990's. The average production of the plant is 0.265 MGD. The efficiencies noted in the O & M manuals for the original equipment installed in the plant were used in calculations. The equipment is approximately 20 years old. Efficiencies are expected to be even worse for the raw water pumps because of the nature of pumping raw water. The high service pump efficiencies would also have decreased because of the pump's age, impeller wear, and seal conditions. Actual pump efficiencies may be even less that what we have assumed.

Proposed Pumps & Operating Conditions

The proposed upgrades will include 3 new raw water intake pumps and 3 new high service pumps. The high service pumps will have variable frequency drives (VFD's). Estimated pump design conditions are as follows:

Proposed High Service Pumps				
Pump	Flow (GPM)	TDH (Feet)	Motor HP	% Eff.
Pumps 1-3	700	349	125	74

Proposed Raw Water Intake Pumps				
Pump	Flow (GPM)	TDH (Feet)	Motor HP	% Eff.
Pumps 4-6	480	117	20	85

Proposed Electrical Upgrades

The switch gear and panels have been in service since the late 1990's. The proposed retrofits will include new motor control centers and pump control panels with variable frequency drives. The motor control centers and VFDs will be housed in a separate room that will have adequate ventilation, cleanliness, and an anti-chemical attack friendly environment. Upgrades to the primary power supply will help keep harmonic distortions to the acceptable percentages established by IEEE.

Power Cost Analysis – Existing and Proposed Conditions

The proposed project eliminates the problems outlined above and improves the overall energy efficiency of the pump installation by an estimated 24%. The electricity cost is based on current power bills at the WTP and is $0.108 per kilowatt-hour. The raw water pumps run an average of 12 hours per day and pump an average of 0.265 million gallons. The high service pumps run an average of 6.5 hours per day. Based on the above electrical cost and amount of water pumped in a year, the following estimated electrical costs and savings are show below:

Estimated Electrical Costs & Savings					
Description	Existing Pumps			Proposed Pumps	
	HS Pumps	Raw Water Pumps		HS Pumps	Raw Water Pumps
Pump Number	1-3	4	5-6	1-3	4-6
Total Dynamic Head @ 0.5 MGD (ft)	349	115	Pumps Not in Service	349	117
Estimated Gallons Per Minute (gpm)	646	368		700	480
Estimated Operating Pump Efficiency	60%	57%		74%	85%
Motor Efficiency	94%	90%		95%	95%
Average Hours Run per Day	6.5	12		6	9.2
Electricity Cost (per 1,000 gal)	$0.210	$0.076		$0.168	$0.049
Electricity Cost (per year)	$19,295	$7,351		$15,484	$4,752
Estimated Annual Power Cost with Existing Pumps =				$26,646	
Estimated Annual Power Cost with Proposed Pumps =				$20,236	
Estimated Increase in Efficiency =				24%	

The above items are estimates based on data provided by Cherokee. The plant does not have operating flow meters installed.

Town of Cherokee

Preliminary Cost Estimate for Water System Improvements 12/21/2015

Item #	ITEM	UNIT	QTY	UNIT COST	TOTAL COST
1	Raw Water Intake Pump and Appurtenances	EA	3	$ 80,000.00	$ 240,000.00
2	High Service Pump and Appurtenances	EA	3	$ 80,000.00	$ 240,000.00
3	SCADA	LS	1	$ 90,000.00	$ 90,000.00
4	Flow Meters for Sand Filters	EA	2	$ 15,000.00	$ 30,000.00
5	District Meters with Vaults	EA	5	$ 10,000.00	$ 50,000.00
6	Pipe Gallery & Finished Water Monitoring	LS	1	$ 250,000.00	$ 250,000.00
7	Emergency Generator	LS	1	$ 150,000.00	$ 150,000.00
8	AMR Meters	EA	800	$ 215.00	$ 172,000.00
9	Engineering Design	LS	1	$ 120,000.00	$ 120,000.00
10	Construction Review	LS	1	$ 81,000.00	$ 81,000.00
11	DWSRF Pre-Application	LS	1	$ 2,500.00	$ 2,500.00
12	DWSRF Application	LS	1	$ 5,000.00	$ 5,000.00
13	Administration	LS	1	$ 10,000.00	$ 10,000.00
14	Water Meter Audit & GIS Mapping	LS	1	$ 50,000.00	$ 50,000.00
					$1,490,500.00

**Note cost estimates are made based on Engineer's experience, qualifications, and professional judgement. The Engineer has no control over costs of labor, materials, equipment, or services furnished by others or over the competitive bidding process or market conditions. The Engineer does not guarantee or warrant that proposals, bids, or actual construction costs will not vary from the above cost estimate. Cut and fill amounts are approximate until a topographical survey has been completed.*

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