LONG TERM CONTROL PLAN CONSTRUCTION PROJECT

Summary

- The Tell City Long Term Control Plan (LTCP) construction project includes improvements to the wastewater treatment plant to accept more flow. This Business Case addresses project components which are considered to meet the requirements for the Green Project Reserve. The components being considered are the UV Disinfection, Variable Frequency Drives (VFDs) and SCADA for all the significant pump motors, and High Efficiency Blowers with VFDs. For the UV disinfection, both water efficiency and energy efficiency are considered. For the pumps and blowers, energy efficiency only is a consideration.

- Estimated Loan Amount: $7,922,700

- Estimated Water/Energy Efficiency (Green) portion of the loan associated with the plant improvements are: $842,792 for construction and $85,750 for planning and design for a total of $928,542. The Green portion represents 12% of the estimated loan amount.

Background

- As part of the LTCP for the City of Tell City, improvements are proposed at the WWTP. The City submitted a CSO LTCP to the Indiana Department of Environmental Management (IDEM) on October 31, 2002 and revised it in July, 2007. The CSO LTCP was approved by the IDEM on August 2, 2007. The following CSO control measures for each of the active CSO outfalls were identified: CSO 010 will remain unchanged as an emergency discharge point; CSOs 006 and 009 will be converted to storm water outfalls due to sewer separation through construction of new sanitary sewers; CSO 003 will discharge flows only above a 10- year/1-hour design storm after construction of an expanded Mozart Lift Station that will send flows up to and including the 10-year/1-hour design storm to the WWTP; and CSO 102 will discharge peak flows up to 7.5 million gallons per day (MGD) after upgrades to the WWTP that include an activated biofilter (ABF) process and a new ultraviolet (UV) disinfection system. This WWTP sizing will allow full treatment of flow during wet weather up to and including the 10-year/1-hour design storm.

Water Efficiency Discussion – UV Disinfection

- If the City would have continued to use chlorine/sulfur dioxide for disinfection, a new ton cylinder system for each chemical would have been required to deliver the needed oxidation/reduction agent at 9.2 MGD of wastewater flow. To operate the required chlorine disinfection and sulfur dioxide de-chlorination systems, approximately 10 gpm of water would be required to create the vacuum needed for injection of these chemicals into the feed water. The WWTP uses **City water**. The system would be used continuously, thus **5.256 million gallons**

of water is saved per year by converting to UV Disinfection. At $1.50 per 1000 gallons, $7,900 is saved per year in water purchases.

- The cost of the UV Disinfection System is $353,338 as shown on line 43 of the schedule of values from Bowen Engineering Corporation, the General Contractor on the Tell City LTCP Project. The planning and design cost associated with the UV Disinfection System is estimated at $51,450. The total capital cost for the UV Disinfection System is $404,788.

- See the attached cost comparison table for the Disinfection alternatives. Note that the UV Disinfection System is cost effective with both the capital and annual O & M Cost being less than the costs for the chlorination/dechlorination alternative.

Energy Efficiency Discussion – UV Disinfection System

- As noted under the earlier Water Efficiency Discussion, there will be a savings for elimination of City water used in the chlorination/dechlorination process. Approximately 17% of the water cost is energy related. The energy savings associated with the water savings is $1,343 annually.

- Approximately 4,200 miles of transportation are currently required annually to receive chlorine and sulfur dioxide chemicals from the local supplier; this will increase by approximately 20% due to increased usage (wastewater plant will now have to treat 9.2 MGD peak flow in lieu of 3.5 MGD). At the 20% increase, 5,040 miles of truck transportation will be avoided annually by using UV Disinfection. At 5 miles per gallon, this equates to 1008 gallons of gasoline; at $3 per gallon, this equates to an annual savings of $3,024.

Energy Efficiency Discussion – Pump Motors with Variable Frequency Drives/SCADA

- Pump motors of significant size have been designed with Variable Frequency Drives (VFD's) to reduce demand charges and power consumption. We have 156.7 total motor horsepower that will operate intermittently at the WWTP and at the Mozart Pump Station that has been designed with VFD's. See the spread sheet titled "Tell City Pump Electrical Costs" herewith for a summary of each pump. Based upon estimated run times per motor, motor horsepower and VFD run time factor, the total monthly kw-hr savings is 24,396 for an annual kw-hr savings of 292,752 (48% reduction). Excluding demand charges, this relates to an annual savings based on the Tell City Electrical Utilities rate scale of $19,384. The demand charge savings associated with the use of VFD's is dependent upon starts and is estimated at $ 5,000 annually (with SCADA in place). The total estimated savings for using VFD's on all pump motors 5 hp or larger is $ 24,384 annually. The total present worth savings (8%/20 yr.) is thus $239,402.

- The cost for the design of the VFD's is estimated at $4,000. The cost for the VFD's associated with all submersible pumps is $140,780 as indicated on line 44 of the schedule of values submitted by Bowen Engineering Corporation. Total capital cost for the VFD's is thus $144,780.

- A SCADA system has been designed into the new wastewater treatment plant that will allow for the most efficient combination of pumps and to control pump speeds based on flow rates and levels. The design incorporated the following **SCADA** features which save energy 1) pump controllers which respond to wet well level thus keeping flow rates and discharge pressures minimal; and 2) control of pump VFD's to minimize and or eliminate demand charges (at start-up) and allow for optimal efficiency. These features will help optimize system performance and provide for increased efficiency. It can easily be assumed that the additional annual savings in electrical usage due to the installation of SCADA to increase electrical efficiency of the VFD's is 5%; using 5%, an additional 14,638 kw-hr annual savings would be achieved or $1,219 per year. The total present worth savings (8%/20 yr.) is thus $11,968.

- The cost of the SCADA system totals $82,094 and includes line items 23, 24, and 75 of the Bowen Engineering Corporation schedule of values. The design cost associated with the SCADA system is estimated at $9000. Total SCADA system cost is $91,094.

- Pump/Impeller selections to utilize the most efficient system at normal operating ranges were also incorporated into the design.

- Total Design and Construction Cost (VFD's/SCADA)is $ 235,874. Total Present worth savings is $251,370. **Since the Present Worth exceeds the initial construction cost, the inclusion of these devices is cost effective over the 20 year planning period.**

Energy Efficiency Discussion - High Efficiency Blowers with VFD's

- Highly efficient turbo blowers were used in the design of this process. Three 50 horsepower blowers with VFD's will provide for aeration of the new contact stabilization process and aerated sludge holding tanks. These blowers will operate full time at a reduced speed as compared to using blowers without VFD's which would also operate full time at full speed resulting in a waste of energy. **See the attached spread sheet for Aeration Blower Electrical Costs**. **The estimated annual kw-hr savings using VFD's at 70% speed is 493,080 or 51% power savings**. This results in an annual savings of $29,957 based on the Tell City electrical rates

- The design cost is $21,300. The cost of these blowers is $ 266,580 as identified on line 33 of the Bowen schedule of values. The total blowers/VFD's cost is $287,880.

- **Since greater than 20% energy savings is realized with this component it is our opinion that this project feature is categorical.**

Conclusion

- The proposed UV Disinfection System is the cost effective disinfection alternative. The annual water savings is estimated to be 5.256 million gallons of City water. The net energy savings for this alternative is estimated to be $552 including electrical cost associated with the water

savings and gasoline cost associated with chemical transport. Additional advantages of UV Disinfection are: 1) the use of hazardous chemicals and the safety concerns are alleviated and 2) the formation of disinfection by-products is eliminated.

- The proposed use of VFD's and SCADA for the significant size pump motors is cost effective and the energy savings is estimated to be 53% (48% for the VFD's and 5% for the SCADA) reduction in energy usage associated with this project component.
- The proposed high efficiency blowers with VFD's is estimated to result in a 51% power savings for this project component and, as such, is considered to be categorical for energy efficiency.

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Attached Documents –

- Bernardin Lochmueller & Associates' Energy Use/Cost for Pumps and Blowers
- Cost Comparison Table for Disinfection

Referenced Material –

- Bowen Engineering Corporation Construction Schedule of Values
- Bernardin Lochmueller & Associates' Tell City LTCP Green Project Reserve Business Case, August 2010

TELL CITY LTCP CONSTRUCTION PROJECT BUSINESS CASE
COST COMPARISON

Present Worth Analysis - Chlorination vs. UV

	Chlorination	UV	Cost Difference
Capital Cost	$ 500,000	$ 404,788	$ 95,212
Annual O & M Cost			
Electrical ($0.06/kw-hr)	$ -	$ 3,815	$ (3,815)
Chemical Cost	$ 7,321	$ -	$ 7,321
Maitnenance	$ 2,080	$ 6,500	$ (4,420)
Water Purchase	$ 7,900	$ -	$ 7,900
Total Annual O & M	$ 17,301	$ 10,315	$ 6,986
			$ -
Present Worth of O & M	$ 169,861	$ 101,273	$ 68,589
			$ -
Present Worth Value	**$ 669,861**	**$ 506,061**	**$ 163,801**

It is assumed that the chemical cost includes the cost to transport the chemical.
The chemical cost includes a gas energy savings related to the transport. Per write-up - $3024/yr.

Overall Energy $ Savings -			
Electrical ($0.06/kw-hr)	$ -	$ 3,815	$ (3,815)
Water Purchase (17%)	$ 1,343	$ -	$ 1,343
Chemical Transport	$ 3,024	$ -	$ 3,024
Total Energy Savings	$ 4,367	$ 3,815	$ 552

Overall Water Savings -			
Purchase Volume (MG)	5.25	0	5.25
Annual Cost	$ 7,900	$ -	$ 7,900
Total Cost Savings	$ 7,900	$ -	$ 7,900

CONCLUSION

The UV disinfection option is the cost effective alternative. There are both energy and water usage savings with this alternative.

Tell City Pump Station Electrical Costs																
System	**Unit**	**Mozart PS**		**Headworks Grit**		**RAS Pumps**		**WAS Pumps**		**Effluent Pumps**		**Sludge Transfer Pumps**		**Sludge Dewatering Pumps**		**TOTALS**
		No VFD	VFD	No VFD	VFD	No VFD	VFD	No VFD	VFD	No VFD	VFD	No VFD	VFD	No VFD	VFD	
Pump Power	hp	25		20		10		2.7		85		7		7		156.7
Run Time Factor	%	100	65	100	70	100	60	100	65	100	75	100	75	100	75	
Baseline Pumping Duration	hr/day	18		4		12		12		18		4		4		
Baseline Pumping Duration	min/day	1080		240		720		720		1080		240		240		
Equivalent	min	1080	1662	240	343	720	1200	720	1108	1080	1440	240	320	240	320	
Motor Demand Factor (based on motor speed)		1.0000	0.2746	1.0000	0.3430	1.0000	0.2160	1.0000	0.2746	1.0000	0.4219	1.0000	0.4219	1.0000	0.4219	
Motor Demand	kW	18.65	5.12	14.92	5.12	7.46	1.61	2.01	0.55	63.41	26.75	5.22	2.20	5.22	2.20	
Energy Consumption	kW-hr/day	335.70	141.83	59.68	29.24	89.52	32.23	24.17	10.21	1141.38	642.03	20.89	11.75	20.89	11.75	
Energy Consumption	kW-hr/month	10071.00	4255.00	1790.40	877.30	2685.60	966.82	725.11	306.36	34241.40	19260.79	626.64	352.49	626.64	352.49	
Consumption Savings per month	kW-hr/month		5816.00		913.10		1718.78		418.75		14980.61		274.16		274.16	24396
Unit Cost for 1st 2000 kW-hr	$/kW-hr	$ 0.0530		$ 0.0530		$ 0.0530		$ 0.0530		$ 0.0530		$ 0.0530		$ 0.0530		
Cost for 1st 2000 kW-hr	$/month	$ 106.00	$ 106.00	$ 94.89	$ 46.50	$ 106.00	$ 51.24	$ 38.43	$ 16.24	$ 106.00	$ 106.00	$ 33.21	$ 18.68	$ 33.21	$ 18.68	
Unit Cost for 2000 to 4000 kW-hr	$/kW-hr	$ 0.0525		$ 0.0525		$ 0.0525		$ 0.0525		$ 0.0525		$ 0.0525		$ 0.0525		
Cost for 2000 to 4000 kW-hr	$/month	$ 105.00	$ 105.00	$ -	$ -	$ 35.99	$ -	$ -	$ -	$ 105.00	$ 105.00	$ -	$ -	$ -	$ -	
Unit Cost for 4000+ kW-hr	$/kW-hr	$ 0.0515		$ 0.0515		$ 0.0515		$ 0.0515		$ 0.0515		$ 0.0515		$ 0.0515		
Cost for 4000+ kW-hr	$/month	$ 312.66	$ 13.13	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,557.43	$ 785.93	$ -	$ -	$ -	$ -	
Fuel Cost Adjustment (FCA) Rate	$/kW-hr	$ 0.008769		$ 0.008769		$ 0.008769		$ 0.008769		$ 0.008769		$ 0.008769		$ 0.008769		
Cost for FCA	$/month	$ 88.31	$ 37.31	$ 15.70	$ 7.69	$ 23.55	$ 8.48	$ 6.36	$ 2.69	$ 300.26	$ 168.90	$ 5.50	$ 3.09	$ 5.50	$ 3.09	
Customer Charge (fixed rate)	$/month	$ 20.00		$ 20.00		$ 20.00		$ 20.00		$ 20.00		$ 20.00		$ 20.00		
Cost per month	**$/month**	**$ 631.97**	**$ 261.44**	**$ 130.59**	**$ 54.19**	**$ 185.54**	**$ 59.72**	**$ 64.79**	**$ 18.92**	**$ 2,088.69**	**$ 1,165.83**	**$ 58.71**	**$ 21.77**	**$ 58.71**	**$ 21.77**	
Savings per month	**$/month**		**$ 370.52**		**$ 76.40**		**$ 125.82**		**$ 45.87**		**$ 922.87**		**$ 36.93**		**$ 36.93**	**$ 1,615**
Cost per year	$/year	$ 7,584	$ 3,137	$ 1,567	$ 650	$ 2,227	$ 717	$ 777	$ 227	$ 25,064	$ 13,990	$ 704	$ 261	$ 704	$ 261	
Savings per year	$/year		$ 4,446		$ 917		$ 1,510		$ 550		$ 11,074		$ 443		$ 443	**$ 19,384**

Tell City Aeration Blower Electrical Costs				
System	**Unit**	**Aeration Blowers**		**TOTALS**
		No VFD	VFD	
Pump Power	hp	150		150
Run Time Factor	%	100	70	
Baseline Pumping Duration	hr/day	24		
Baseline Pumping Duration	min/day	1440		
Equivalent	min	1440	2057	
Motor Demand Factor (based on motor speed)		1.0000	0.3430	
Motor Demand	kW	111.90	38.38	
Energy Consumption	kW-hr/day	2685.60	1315.94	
Energy Consumption	kW-hr/month	80568.00	39478.32	
Consumption Savings per month	kW-hr/month		41089.68	41090
Unit Cost for 1st 2000 kW-hr	$/kW-hr	$ 0.0530		
Cost for 1st 2000 kW-hr	$/month	$ 106.00	$ 106.00	
Unit Cost for 2000 to 4000 kW-hr	$/kW-hr	$ 0.0525		
Cost for 2000 to 4000 kW-hr	$/month	$ 105.00	$ 105.00	
Unit Cost for 4000+ kW-hr	$/kW-hr	$ 0.0515		
Cost for 4000+ kW-hr	$/month	$ 3,943.25	$ 1,827.13	
Fuel Cost Adjustment (FCA) Rate	$/kW-hr	$ 0.008769		
Cost for FCA	$/month	$ 706.50	$ 346.19	
Customer Charge (fixed rate)	$/month	$ 20.00		
Cost per month	**$/month**	**$ 4,880.75**	**$ 2,384.32**	
Savings per month	**$/month**		**$ 2,496.43**	**$ 2,496**
Cost per year	$/year	$ 58,569	$ 28,612	
Savings per year	$/year		$ 29,957	**$ 29,957**