

Date: October 8, 2010  
To: Erik Deyoe, P.E., Deputy Commissioner of Public Works  
Town of Bethlehem  
From: Gregory Daviero, Ph.D., P.E.  
Dana Bryant, P.E.  
Re: Water Supply Alternatives for Bethlehem  
Project No.: 4071013

At the Town of Bethlehem's (Town's) request, Malcolm Pirnie has completed an evaluation of water supply options for the Town through the end of the year 2023, which marks the expiration of the Town's current contract for finished water purchases with the Albany Water Board (AWB). A brief summary of the evaluation process and a detailed review of the acceptable alternatives are provided below. Attached to this Memorandum are calculations illustrating the individual costs for each element of the acceptable alternatives and the annual and cumulative costs for these alternatives through the year 2023.

## **BACKGROUND**

The Town currently operates two water filtration plants with independent water supply sources: the New Salem Water Treatment Plant (NSWTP) that is supplied through the Vly Creek Reservoir and the Clapper Road Water Treatment Plant (CRWTP) that is supplied through an infiltration gallery and a series of groundwater wells along the Hudson River. The Town also operates two other groundwater sources: the New Salem well field and a small production well that serves the South Albany Water District. In addition, the Town purchases finished water from the AWB through two interconnections with the AWB finished water transmission line and an emergency interconnection with the Town of Guilderland in North Bethlehem.

The Town currently provides water through two distribution zones: the industrial zone, fed primarily from the CRWTP, and the residential zone, fed primarily from the NSWTP. Despite the nomenclature, both zones serve residential customers and both have a connection to Albany's finished water transmission system. The two zones are separated by valves that can be opened to interconnect the zones. The Town's water supply system met an average daily demand of 5.12 million gallons per day (MGD) in 2009 and is on pace in 2010 for slightly higher usage.

The NSWTP has a nominal peak capacity of 5.7 MGD and the Vly Creek Reservoir has a 3 MGD safe yield. Safe yield is the quantity of water that can be taken from a source of supply over a period of years without depleting the source beyond its ability to be replenished naturally. Additionally, two New Salem wells feed directly into the NSWTP finished water main with a safe yield of just over 1 MGD. The CRWTP is designed to treat 6 MGD, but is currently producing 2 to 3 MGD due to current demand.

The CRWTP is limited by its pretreatment capabilities. The Town currently oxidizes the iron and manganese found in the source water by adding chlorine to the raw water at a temporary Dinmore Road Chlorination Facility located near the infiltration gallery. While this practice has enabled the CRWTP to achieve its treatment objectives, it has created operational and maintenance challenges due to oxidized material settling out in the raw water transmission pipeline and the raw water storage reservoir. This reservoir is effectively being used as a part of the treatment process and serving as a settling basin, which was never the design intent at the CRWTP

### **EVALUATION PROCESS**

Malcolm Pirnie completed an evaluation of water supply options for the Town through the end of the year 2023. The initial list of alternatives was selected based on prior evaluations that had been completed for the Town (by others), system knowledge, workshops with Malcolm Pirnie and Town staff, and discussions. The various sources of water considered included the Town's existing sources, supplemental sources including new or expanded Vly Reservoir storage, new groundwater sources, raw or finished water from the City of Watervliet, finished water from the City of Troy, finished water from the City of Schenectady, and raw or increased finished water purchases from the AWB.

For an alternative to be considered acceptable it had to meet the following criteria:

- Finished water quality must meet Albany County Department of Health (ACDOH), New York State Department of Health (NYSDOH) and the United States Environmental Protection Agency (USEPA) standards.
- Raw water quality must be acceptable for use or amenable to treatment to meet finished water standards.
- Costs must be reasonable and supportable over time by the Town's revenues.
- The alternative must be reliable, both the source water supply and delivery infrastructure, in the short and long-term.
- Supply must be adequate to meet the Town's current demands and projected long-term demands, but also be responsive to demands that may decline in the future.

Information used to support the evaluation included current and projected demands (as provided by the Town), details of the existing AWB contract and the AWB's most recent proposal for an amended contract, desktop studies of potential additional sources, meetings and discussions with potential new suppliers, previous studies and reports prepared for the Town (by others), operating expenses, plant operator reports, chemical usage, energy consumption, and Town water quality data.

**ACCEPTABLE ALTERNATIVES**

Three alternatives were determined to meet all the evaluation criteria:

- Alternative 1: Rebuild the New Salem Water Treatment Plant.
- Alternative 2: Purchase additional finished water from the AWB.
- Alternative 3: Maximize the Clapper Road Water Plant capacity.

These alternatives are described in more detail below.

**Alternative 1: Rebuild the NSWTP**

Under this alternative, the NSWTP would be replaced with a new water treatment plant capable of producing an average of 3 MGD and a peak of 6 MGD. The NSWTP would continue to serve the residential zone along with the New Salem wells. Although a separation of the systems is not required, the distribution system would continue to operate as two separate zones and the CRWTP would continue to serve the industrial zone. Separation of the distribution zones is presumed since, if they could be unified as a matter of Town policy, the cost to rebuild the NSWTP is much greater than maximizing the usage of the CRWTP. AWB water purchased under the existing contract would continue to be used in both zones.

The estimated capital cost for the new NSWTP is \$11M. According to the Town, the existing transmission main from the plant to the Town must be replaced before it can be used for higher capacities due to its age and condition, including a history of breaks. The capital cost is estimated at \$2.9M for a 24-inch transmission main. As described under Alternative 3, pretreatment would also be added the CRWTP at an estimated cost of \$3.75M.

This option allows the Town to maximize the use of the Vly Creek Reservoir and its 3 MGD safe yield. The Town would not be required to sign another long-term contract with the AWB for water that it may or may not need in the future. However, should demand decline significantly in the future, the Town will have two reasonably new water treatment plants and would likely need to shut one down or underutilize them. This is also the most costly alternative in terms of immediate capital improvements needed.

**Alternative 2: Purchase Additional Finished Water from the AWB**

Under this alternative, the Town would agree to the preliminarily negotiated terms of the AWB's latest contract offer and purchase additional finished water from the AWB. [REDACTED]

[REDACTED]

[REDACTED]

In order to get more water to the residential zone from the AWB, a new interconnection would be required in the area of Creble Road and Esplande Street along with new corrosion control treatment equipment required as a result of the different pH of the AWB water. The estimated capital cost of this work is \$2.75M. The capital cost of the new interconnection could be eliminated if the distribution zones were unified. As described under Alternative 3, pretreatment would also be added the CRWTP at an estimated cost of \$3.75M.

[REDACTED] The capital costs for this alternative fall in the middle of the three acceptable alternatives. [REDACTED]

**Alternative 3: Maximize CRWTP Capacity**

The use of CRWTP is maximized by unifying the two Town distribution zones and increasing production at the plant to meet future demands and offset the reduced production at the NSWTP. Total system demands would be met by the CRWTP, limited production from the existing NSWTP, the New Salem wells, and water purchased under the existing AWB contract.

There are no unique capital improvements needed to implement this alternative. The interconnections between the distribution zones are in place and could be opened by the Town's operators almost immediately. However, pretreatment to remove iron and manganese is required to achieve its required capacity. Also, the raw water reservoir would be dredged to remove settled iron and manganese, the temporary Dinmore Road chlorination station would be taken off line, and the raw water line from the well field would be cleaned. The estimated cost for this work is \$3.75M. No other treatment improvements are needed. Thousands of water tests over the past 15 years of CRWTP operation demonstrate that the plant has continually met all primary drinking water regulations.

This alternative allows the town to maximize the use of infrastructure for which it is already paying. The Town would not be required to sign another long-term contract with the AWB for water that it may or may not need in the future or take on significant additional debt, which would add to the fixed costs of operating the Town's water system. It has the lowest immediate capital improvement cost of the three acceptable alternatives. The CRWTP is already in use as a source of water to residential customers in the Town and meets all State and Federal requirements. Should demand decline significantly in the future, no additional funds have been invested in infrastructure or in the form of a purchase agreement with the AWB, allowing the Town the greatest flexibility to respond to changing demands. All other options would still be

available to the Town in the future, should they prove necessary, without making a commitment at this time. Additional water production from the CRWTP will require additional pumping from the source water wells and likely increase maintenance cost for the well fields.

**FINANCIAL ANALYSIS**

To further differentiate between the three acceptable alternatives, a financial model was developed to evaluate the potential short and long-term financial impacts of the three acceptable alternatives. Assumptions about capital investment, inflation, and cost escalations were made to predict annual operating costs and a cumulative cost for each alternative through the year 2023. The attached spreadsheet summarizes the detailed financial model and shows the various costs for each year and a total for each alternative.

**Assumptions**

The following assumptions were made to support the financial analysis:

- For each alternative, the New Salem Wells produce an average of 0.8 MGD.
- For alternatives 2 and 3, the existing NSWTP receives some upgrades and continues to produce 1 MGD to keep the source active and help with pressure concerns in portions of the distribution system. [REDACTED]  
 [REDACTED] At this production level the existing transmission main would not be replaced.
- For each alternative, pretreatment to remove iron and manganese is added at the CRWTP to achieve its required capacity. Additionally, the wells require periodic redevelopment to maintain their capacity and the estimated time for redevelopment is approaching. [REDACTED]  
 [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]

**Findings**

Table 1 below summarizes the predicted initial and cumulative cost for the three alternatives.

<b>Table 1</b>		
<b>Summary of Predicted Initial Capital and Cumulative Costs</b>		
<b>Alternative</b>	<b>Initial Capital Costs</b>	<b>Cumulative Cost Through 2023</b>
1. Rebuild NSWTP	\$17.65 M	\$142 M
2. New AWB Contract	\$ 6.50 M	\$130 M
3. Maximize CRWTP	\$ 3.75 M	\$130 M

As the attached graph, “Cumulative Costs (2011 - 2023)” shows, the cumulative costs are highest for a new NSWTP for the entire length of the planning period. The cumulative costs for a new AWB contract are the next highest through the year 2023, at which point the CRWTP alternative matches it. The next graph, “Annual Costs (2011 - 2023)”, shows the impact of the initial capital expenditures on the Town and how the annual costs escalate over time. As illustrated in the graph, the annual predicted costs for the CRWTP alternative begin to exceed the costs of the new AWB contract alternative after the year 2018 with the cumulative costs converging in the year 2023.

To further differentiate between total expenditures on the various system elements, the “Cumulative Costs to 2023 by Option and Expense” chart was prepared. This chart shows the comparative fraction of each separate cost through the year 2023 for each of the three alternatives. From this graph it can be seen that Alternatives 2 and 3 have similar cumulative costs even though Alternative 2 has higher initial capital investment needed and more spending on AWB water as a result of the annual operating costs that accumulate over time at the CRWTP.

After the year 2023 the costs of operating the Town water system change significantly due to the ending of the existing AWB contract and the end of debt service payments for the initial construction of the CRWTP.

## **RECOMMENDATION**

All three alternatives detailed here are acceptable solutions for the Town and satisfy the basic community needs for sustainable drinking water supply and treatment. Each meets the five requirements described above. As the financial analysis shows, the new NSWTP requires a significantly higher initial capital investment and a cumulative cost that is approximately \$10M higher than the other alternatives. The new AWB contract and maximized CRWTP alternatives have essentially the same cumulative cost over the planning period.

Since the financial analysis shows that the cost differential between acceptable alternatives is very small, other criteria were considered in making a final recommendation. Only one alternative provides the Town with maximum flexibility both now and in the future and that is the alternative that maximizes the use of the CRWTP. This is an investment that the Town already has made and this alternative also requires the lowest initial capital cost.

In the near term, the annual costs and budget impacts of the AWB contract are significant. The Town will need to upgrade its ability to take water from the AWB because the separation of distribution zones makes it impossible to make full use of the existing interconnections. Additionally, the Town needs to upgrade the pretreatment capabilities of the CRWTP regardless of the selected alternative, so this added cost provides no benefit to the residential zone when the zones are separated.

In the long-term, there are known uncertainties regarding some of the Town's largest water customers and these large customers have a large impact on the operation of the Town's water system. Two customers, Sabic Innovative Plastics and Selkirk Cogen, represented over 36 percent of the Town's meter water sales revenue in 2009. It is possible that the Town could find itself in the position of having invested in more capacity than it needs. Due to other suppliers in the area, identifying and executing water sales to new large customers does not appear likely at this time. By maximizing the use of infrastructure that is already in place instead of investing in a new solution, the Town has the greatest flexibility to address future conditions, whether they are higher or lower demands. If demand declines, the Town can simply produce less water at the CRWTP, which will only reduce costs due to treatment and pumping. It will not have to pay for a more expensive source while its own infrastructure is underutilized or unused. If demand increases, the Town can easily increase the CRWTP to its full capacity and, since it was designed to be expandable in the future, eventually expand the capacity available in the future with limited capital investment. Additionally, if demand increases to the point where a new supply is justifiable, the other alternatives, including those considered unacceptable due to cost or availability at this time, are still open to the Town. The Town could build a new NSWTP in the future, sign a contract to purchase water from another utility, or invest in new Town sources of supply. None of the other alternatives or existing sources of supply have been eliminated from future consideration, maintaining the system's flexibility.

Finally, a choice to not improve the Town's water supply and/or treatment capabilities is not an acceptable choice at this time as a result of the Stage 2 Disinfectants and Disinfection Byproducts Rule promulgated by the USEPA. This Rule sets more stringent byproduct levels on public water systems and the Town will soon need to be in compliance. The current sources operating in the current manner are not expected to meet the more stringent future requirements.

The flexibility in the face of uncertain future demands is one element that a commitment to either a new NSWTP or a new contract with AWB cannot provide. Therefore, while all three alternatives will meet the basic, immediate needs of the Town, maximizing the use of the CRWTP is the recommended and most cost effective alternative.

## Attachments