

## **WESTERN WAKE PARTNERS**

### **Report to the Policy Advisory Committee (PAC08-22)**

Date: March 12, 2008  
To: Western Wake Partners  
From: Tim Bailey, P.E., Director of Engineering, Town of Cary  
Prepared by: Jamie Revels, P.E., Senior Engineer, Town of Cary  
Subject: Dual Force Main Construction for Beaver Creek Force Main

#### **Background:**

The Beaver Creek Force Main project was created to provide pipeline conveyance of raw wastewater from the Beaver Creek Pump Station to the proposed Western Wake Water Reclamation Facility in Apex. The Beaver Creek Force Main, (BCFM), is one of the vital links in the proposed Western Wake Wastewater Management Facilities pipeline conveyance system. Other projects included within the Western Wake Wastewater Management Facilities include the West Cary Pump Station, West Cary Force Main, West Reedy Branch Interceptor, Western Wake Water Reclamation Facility, Effluent Pumping Station and Effluent Pipeline. In total, the Western Wake Wastewater Management Facilities include approximately \$300M in capital improvements to provide long term wastewater conveyance and treatment facilities to Western Wake County.

In order to accurately forecast long term facility needs, the Western Wake Partners, including Cary, Apex, Morrisville and Holly Springs researched and developed the proposed wastewater facilities required to serve Western Wake County. The long term wastewater conveyance and treatment facilities were evaluated based on flow projections and divided into two separate construction phases. Phase 1 infrastructure included those pipelines, pump stations and treatment facilities required to serve Western Wake County through 2020. Phase 2 facilities would provide sufficient capacity to serve Western Wake County through 2030 or build out of the contributory service area. The benefit of this approach is minimizing capital costs required to establish the system in the near term, while delaying long term upgrades and improvements until required for future demand.

The phasing plan for the Beaver Creek Force Main project includes initial, Phase 1, construction of a 42-inch diameter pipeline to provide sufficient wastewater flow conveyance capacity for projected flows through 2020, which are estimated at approximately 15 million gallons per day, (MGD), on a maximum month basis. The phase 2 plans for BCFM would require construction of a second parallel pipeline, 36-inches in diameter, to provide sufficient capacity through 2030. The maximum monthly flow projection for 2030 is 24 MGD, which coincides with buildout of the service areas for the Beaver Creek Pump Station and Force Main. The Beaver Creek Pump Station has its own phasing plan separate from the scope of this report, which includes installing additional pumps to meet future capacity needs.

Presently, there is one preferred routing alternative under consideration for the location of the Beaver Creek Force Main. The preferred routing for the Beaver Creek Force Main was previously reviewed by the Policy Advisory Committee in report PAC07-16 on June 26, 2007 and by the Cary Town Council in report EN08-017 on August 9, 2007. The preferred BCFM route, the majority of which is adjacent to an existing Progress Energy overhead transmission line, is approximately 25,650 linear feet or 4.86 miles in length. A map demonstrating the preferred BCFM pipeline location has been included in Figure 2.1, located at the end of this report.

### **Capital Costs**

The capital cost projections for the preferred BCFM pipeline route including separate Phase 1 and Phase 2 construction compared with combined construction costs of constructing both pipelines during initial construction are presented below in Table 1. As shown in Table 1, the cost difference to construct the pipelines in separate phases is \$1.1M higher than constructing both pipelines at the same time.

**Table 1: Beaver Creek Force Main, Capital Construction and Easement Costs for Separate Phase Construction and Combined Phase 1 and Phase 2 Dual Pipeline Construction**

	Phase 1 Construction 42-inch Pipeline 2008 Cost (\$)	Phase 2 Construction 36-inch Pipeline 2008 Cost (\$)	Separate Phases Both Pipelines 2008 Cost (\$)	Combined Construction Both Pipelines 2008 Cost (\$)
<b>Beaver Creek FM, Progress Energy Corridor</b>	\$17,106,000.00	\$9,455,000.00	\$26,561,000.00	\$25,413,000.00

Table 2 shows the capital cost difference between constructing the Phase 1, 42-inch pipeline only, as compared to constructing both 42-inch and 36-inch pipelines in one construction project.

**Table 2: Capital Costs of Phase 1 Options for the Beaver Creek Force Main**

	Phase 1 Construction 42-inch Pipeline 2008 Cost (\$)	Combined Construction Both Pipelines 2008 Cost (\$)	Capital Cost Difference 2008 Cost (\$)
<b>Beaver Creek FM, Progress Energy Corridor</b>	\$17,106,000.00	\$25,413,000.00	\$8,307,000.00

### **Benefits of Constructing Both Pipelines**

As shown in Table 2, the capital cost increase of constructing dual pipelines during initial phase construction is estimated at \$8.3M for the preferred route. The capital cost increase required for initial phase dual pipeline construction represents a 50% increase in the Phase 1 capital cost of the BCFM single pipeline option.

There are several benefits associated with constructing both pipelines during Phase 1 that are not solely related to cost. The benefits of dual pipeline construction can be best summarized by examining long term system operations and maintenance capability in addition to community impacts.

Redundant Capacity: The construction of both 42-inch and 36-inch BCFM pipelines during Phase 1 construction will provide redundant capacity to

maintain operations during emergency conditions. An example of such an emergency condition would include damage incurred to one pipeline that requires removing it from service until repairs can be made, while the secondary pipeline continues to maintain the operation of the greater utility system. This type of emergency would most likely be created by a natural disaster that dislodges a portion of the pipeline or through unintended construction damage by private contractors, who are unaware of the pipes existence, either excavating or blasting adjacent to the pipeline. In the past, this type of emergency situation has been addressed by bypass pumping and piping until an emergency repair can be completed. However, given the size and scale of the Beaver Creek Pump Station and the associated flow rates; bypass pumping and piping along the pipeline in case of emergency is not a feasible option. The large pipelines and flow rates exceed the general capacity of most readily available bypass piping. Additionally, repair materials for the larger pipelines can require lead times of several days just to obtain the parts, pipes and fittings to complete the repair. Therefore, the construction of redundant pipeline capacity would be vitally important in the event of pipeline emergencies. This is especially apparent given the consideration that the wastewater conveyed through these pipelines is untreated wastewater that would be detrimental to water quality in local streams in the event of a spill. In conclusion, the only effective means to manage pipeline emergencies under these circumstances is by building some measure of redundant capacity into the system.

Minimize Impacts to Residents: The initial phasing plan would include constructing the Phase 1 pipeline by 2011 and constructing the second pipeline as a separate project by 2020 to keep pace with flow projections. Since the Phase 2 pipeline would follow the same routing as the Phase 1 pipeline, the same property owners would be impacted twice within a span of 10-years. Although the plan includes securing all easements for both pipelines in the initial acquisition period, the property owners would be subjected to two instances of construction disturbance including noise, traffic, and other construction related factors. In order to minimize community impacts, the construction of both pipelines is recommended during the initial phase of construction to assure property owners are only impacted once with construction related disturbances.

Future Development: After the Phase1 pipeline is constructed and the Western Wake Wastewater Management Facilities become operational, it is likely that development may infill around some of the pipeline corridors. Since the pipeline will be located in another jurisdiction outside of the Town of Cary, options to control access to the pipeline for future construction will be limited. Even though easements would be obtained for both pipelines during Phase 1 of the project, infill development could pose major problems for construction of a second pipeline 10-years removed from the first major construction initiative. As an example, other utility lines will be installed that may conflict with the construction of a secondary pipeline, 10-years later. As a means to limit future utility conflicts, assure access to the construction corridor, and minimize any effects from infill development, it is recommended that both pipelines be constructed during Phase 1.

Environmental Impacts: Throughout construction, measures are implemented to prevent soil erosion and other adverse impacts to the environment such as damage to trees outside the immediate construction work zone. Following construction, contractors are required to restore the site by grading to a natural contour similar to what existed prior to construction and to establish permanent vegetation throughout easement areas before removing temporary erosion control measures. The implementation of two separate pipeline construction projects would create two distinct phases in which the ground surface would be denuded to require new vegetation. In order to minimize environmental impacts, it is recommended that both pipelines be constructed during Phase 1. This would allow permanent vegetation to emerge undisturbed following construction except routine mowing of the maintenance corridor.

Avoid Damage to Existing Pipeline: A secondary consequence of postponing construction of the Phase 2 pipeline is that construction will occur immediately adjacent to the Phase 1 pipeline at a time when the pipeline is in operation. Through undertaking construction immediately adjacent to the existing pipeline, any mishaps or excavation in the wrong location could impact and damage the existing pipeline. Since the Phase 2 pipeline will not be operational, there will be no redundant capacity to account for emergencies. In order to assure long term safe operation of the pipelines, it is advisable to construct both pipelines during Phase 1, when neither of the pipelines is required for operational purposes.

Efficient and Flexible Pump Management: The ability to utilize both force mains will also benefit life cycle operations management of the Beaver Creek Pump Station. The optimization of pumping and power requirements is a balance of minimizing the total pumping head required for flow conveyance against maintaining ideal flow velocities in the range of 2.5 ft/s to 4 ft/s. For example, during low flow conditions, the flexibility offered by utilizing the smaller diameter pipeline will allow flow velocities to be optimized and achieved by operating smaller pumps, which require less power. Conversely, using smaller pumps with a larger pipeline under low flow conditions could potentially lower pipeline velocity below 2 ft/s and allow the solids in the wastewater to settle, which contributes to the development of chronic odor and other imbalances in the treatment process. As a result, the flexibility gained from utilizing the smaller diameter pipeline during low flow conditions, while using the larger diameter pipeline or both pipelines during peak flow events assures system operators the ability to effectively manage a wide range of flow events. By maintaining flow velocity within the ideal range, pumping costs can be managed to prevent using excess power, while at the same time assuring that wastewater solids are kept in suspension as they are conveyed to the treatment process. In conclusion, the installation of both pipelines during Phase 1 will provide added flexibility in managing life cycle efficiency of pumping and power requirements at the pump station.

In general, construction of both pipelines during Phase 1 provides redundant capacity for emergency service conditions, minimizes long term impacts to adjoining property

owners, minimizes impacts and utility conflicts created by infill development, reduces environmental impacts, avoids the prospect of damaging the existing pipeline during construction of the second pipeline, and provides for efficient and flexible pump management.

**Fiscal Impact**

The Beaver Creek Force Main project serves the Towns of Apex, Morrisville and Cary. Therefore, only Apex, Morrisville and Cary are partners in the construction, engineering, permitting and land acquisition costs required for the BCFM project. Since permitting, land acquisition and engineering would all occur during phase 1, the most noticeable fiscal impact is the increase in construction cost for the redundant phase 2 pipeline. Cost increases for Apex, Cary and Morrisville that would be attributable to constructing both force mains during Phase 1 are shown below in Table 3. As noted from Table 3, the capital cost increase for Cary is \$5.7M to construct both pipelines during Phase 1 construction.

**Table 3: Capital Cost Increase for Apex, Cary and Morrisville of Constructing Dual Force Mains**

	Phase 1 Construction 36-inch Pipeline 2008 Cost (\$)	Combined Construction Both Pipelines 2008 Cost (\$)	Capital Cost Increase 2008 Cost (\$)
<b>Preferred Pipeline Route</b>	<b>\$17,106,000.00</b>	<b>\$25,413,000.00</b>	<b>\$8,307,000.00</b>
Apex Share, 21.3%	\$3,643,578.00	\$5,412,969.00	\$1,769,391.00
Cary Share, 69.0%	\$11,803,140.00	\$17,534,970.00	\$5,731,830.00
Morrisville Share, 9.7%	\$1,659,282.00	\$2,465,061.00	\$805,779.00

**Cary Town Council Update**

The Cary Town Council considered dual pipeline construction for the Beaver Creek Force Main at its January 10, 2008 meeting. After reviewing this topic, Council unanimously approved of constructing dual force mains during initial construction phasing. Council also recommended submitting this topic for additional consideration by the Western Wake Policy Advisory Committee and the Western Wake Partners. In the interim, future year 2009 budget updates have been revised to include dual pipeline construction for the Beaver Creek Force Main.

**Requested Action:**

Staff recommends PAC approval of the dual force main option for the Beaver Creek Force Main Project. Staff further recommends consideration of this topic by the Western Wake Partners for their concurrence.

Figure 2.1: Beaver Creek Force Main, Preferred Pipeline Route

