

WESTERN WAKE PARTNERS

Report to the Policy Advisory Committee (PAC08-21)

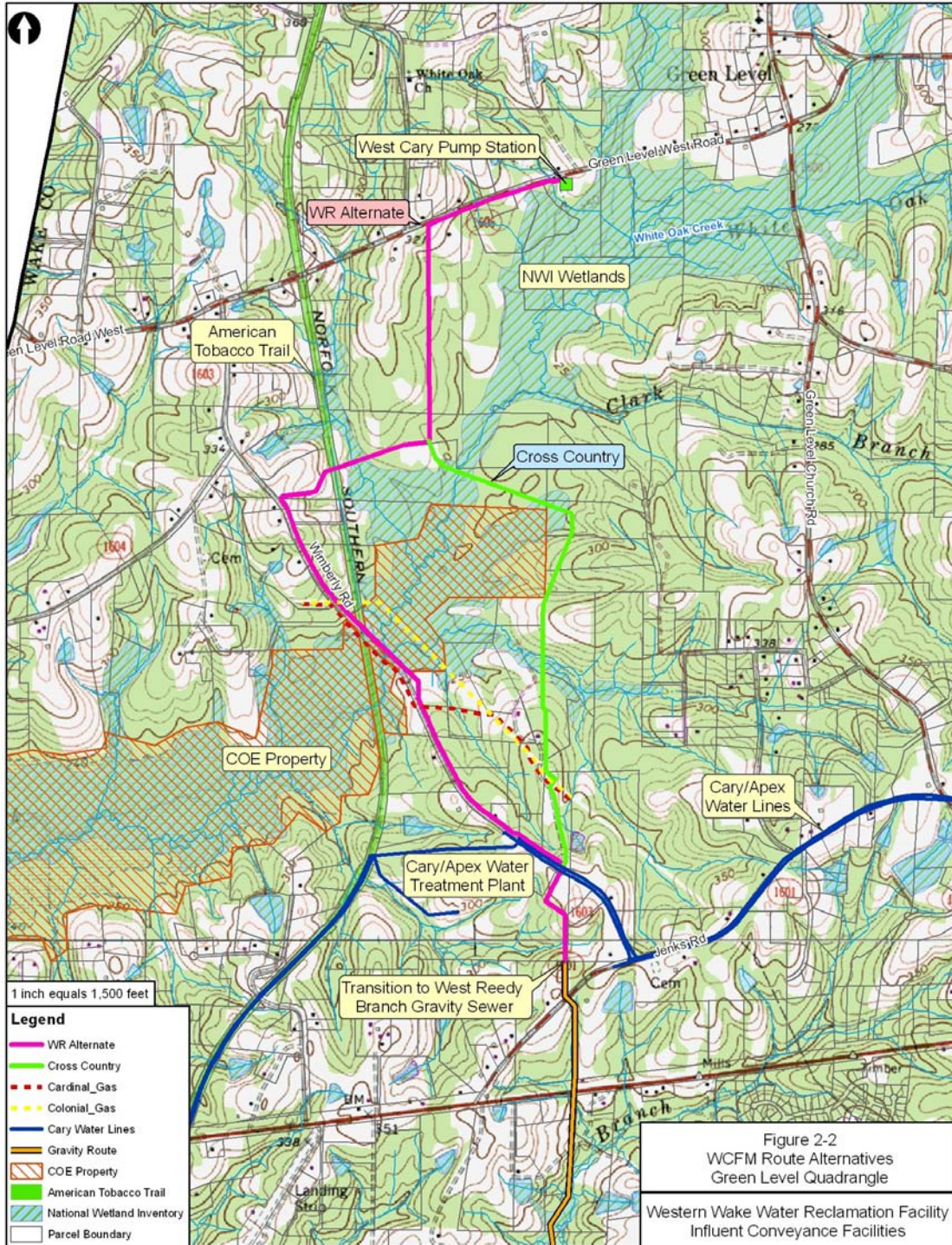
Date: March 12, 2008
To: Western Wake Partners
From: Tim Bailey, P.E., Director of Engineering, Town of Cary
Prepared by: Jamie Revels, P.E., Senior Engineer, Town of Cary
Subject: West Cary Force Main – Consideration of Dual Force Main Construction

Rationale for Dual Force Main Construction

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 based on long range flow projections. 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 buildout of the contributory service area. The primary 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 West Cary Force Main project includes the initial, Phase 1, construction of a 36-inch diameter pipeline to provide sufficient wastewater flow conveyance capacity for projected flows through 2020, which are estimated at approximately 12 million gallons per day, (MGD), on a maximum month basis. The Phase 2 plans for WCFM would require construction of a second parallel pipeline, 24-inches in diameter, to provide sufficient capacity through 2030. The maximum monthly flow projection for 2030 is 17 MGD, which coincides with buildout of the service areas contributing to the conveyance capacity of the West Cary Force Main. The West Cary 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 are 2 routing alternatives under consideration for the location of the West Cary Force Main. The West Cary Force Main, Alternate Route #1, the majority of which parallels Wimberly Road, is approximately 14,500 linear feet or 2.75 miles in length. The West Cary Force Main, Alternate Route #2, is a cross country route that minimizes the length of pipeline and extends for approximately 13,300 linear feet or 2.52 miles in length. Further information on preferred pipeline routing will be presented to the Policy Advisory Committee in a separate report. A map demonstrating the two pipeline alignment options has been included in Figure 2-2.



Capital Costs

The capital cost projections for each of the pipelines including separate phase 1 and phase 2 construction costs 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 to construct the pipelines in separate phases is \$240K to \$340K higher than constructing both pipelines at the same time.

Table 1: West Cary Force Main, Capital Construction and Easement Costs for Separate Phase Construction and Combined Phase 1 and Phase 2 Dual Pipeline Construction

	Phase 1 Construction 36-inch Pipeline 2008 Cost (\$)	Phase 2 Construction 24-inch Pipeline 2008 Cost (\$)	Separate Phases Both Pipelines 2008 Cost (\$)	Combined Construction Both Pipelines 2008 Cost (\$)
Option #1, Wimberly Road Alternate Route	\$7,906,000.00	\$3,033,000.00	\$10,939,000.00	\$10,698,000.00
Option #2, Cross Country Route	\$8,503,000.00	\$2,559,000.00	\$11,062,000.00	\$10,720,000.00

Table 2 shows the capital cost difference between constructing the Phase 1, 36-inch pipeline only, as compared to constructing both 36-inch and 24-inch pipelines in one construction project. The capital cost difference between combined construction and separate phase construction is \$2.8 and \$2.2 million for the Wimberly Road Alternate and Cross Country Options, respectively.

Table 2: West Cary Force Main, Capital Cost Difference between Phase 1 Single Pipeline Construction and Initial Phase Dual Pipeline Construction

	Phase 1 Construction 36-inch Pipeline 2008 Cost (\$)	Combined Construction Both Pipelines 2008 Cost (\$)	Capital Cost Difference 2008 Cost (\$)
Wimberly Road Alternate Route	\$7,906,000.00	\$10,698,000.00	\$2,792,000.00
Cross Country Route	\$8,503,000.00	\$10,720,000.00	\$2,217,000.00

The initial phase dual pipeline costs are essentially the same (~\$10.7 million), with the greater length of the Wimberly Road Alternate route offsetting the greater HDD costs associated with the Cross Country route. Preliminary field delineations of wetlands have yielded encouraging results that actual wetlands along the Cross Country Route are much less than anticipated by National Wetland Inventory maps. This reduction in wetland estimates may contribute to the decrease or elimination of HDD pipe installation altogether along the Cross Country Route, which will substantially reduce the capital cost in comparison with the Wimberly Road Alternate route.

Benefits of Constructing Both Pipelines

Table 2 shows the initial capital cost increase of constructing both pipelines will range from \$2.2M to \$2.8M depending upon which route is selected. The capital cost increase required for initial phase dual force main construction represents a 30% increase over single pipeline construction of the WCFM and approximately a 1% increase in the entire Western Wake Infrastructure Budget of \$300M.

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 36-inch and 24-inch WCFM 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 West Cary 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 West Cary 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 West Cary Force Main project only serves the Towns of Morrisville and Cary. Therefore, only Morrisville and Cary are partners in the construction, engineering, permitting and land acquisition costs required for the WCFM project. Since permitting, land acquisition and engineering for both pipelines would all occur during Phase 1, the most noticeable fiscal impact is the increase in construction pricing for the redundant Phase 2 pipeline. Cost increases for 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 for Cary ranges from \$1.9M to \$2.4M, while the cost increase for Morrisville ranges from \$270K to \$340K, depending upon which route is selected.

Table 3: Capital Cost Increase for 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 (\$)
Wimberly Road Alternate Route	\$7,906,000.00	\$10,698,000.00	\$2,792,000.00
Cary Share, 87.8%	\$6,941,468.00	\$9,392,844.00	\$2,451,376.00
Morrisville Share, 12.2%	\$964,532.00	\$1,305,156.00	\$340,624.00
Cross Country Route	\$8,503,000.00	\$10,720,000.00	\$2,217,000.00
Cary Share, 87.8%	\$7,465,634.00	\$9,412,160.00	\$1,946,526.00
Morrisville Share, 12.2%	\$1,037,366.00	\$1,307,840.00	\$270,474.00

Cary Town Council Update

The Cary Town Council considered dual pipeline construction for the West Cary 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. In the interim, future year 2009 budget updates have been revised to include dual pipeline construction for the West Cary Force Main.

Requested Action

Staff recommends PAC approval of the dual force main option for the West Cary Force Main Project.