COTTON CREEK SANITARY SEWER STUDY
PHASE II
ENGINEER'S REPORT

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1. EXECUTIVE SUMMARY

Phase I of this project - **Analyze and substantiate the extent and severity of the reported problems and assess alternatives based on targeting individual lots with known problems** – was completed on February 20, 2007. The conclusions from Phase I indicated that the reported problems were real and widespread. Individual solutions such as relocating the existing tile fields or constructing Wisconsin Mounds were not a feasible solution. Please see Phase I Engineer's Report dated February 20, 2007.

Based on the Phase I conclusions and at the direction of the Shelby County Engineering Department, the Design Team proceeded to Phase II - **Determine and rank the various factors related to installation of either a local collection and treatment system (STEP/STEG Recirculation Sand Filter) or collection via conventional gravity/pressure system with conveyance to the Shelton Road Waste Water Treatment Plant in Collierville.**

Four alternatives were researched:

- Conventional Collection System conveying sewage to the Shelton Road Waste Water Treatment Plant (WWTP) in Collierville
- Conventional Collection System which would tap into the existing Spring Creek Ranch (SCR) force main which conveys sewage to the Shelton Road WWTP in Collierville
- A low pressure collection system which would convey only grey water to the existing SCR force main and ultimately to the Shelton Road WWTP in Collierville
- Local Collection and Treatment System (STEP/STEG Recirculation Sand Filter)

The preferred method of treating sewage is by conventional means. The Design Team investigated available avenues in order to pursue this option. Discussions with Town of Collierville officials revealed Shelton Road WWTP and collection system capacity issues that will make this option improbable at best and undoable at worst.

For reasons which are explained within the body of the Phase II Engineer's Report, the Design Team recommends pursuing the Local Collection and Treatment System (STEP/STEG Recirculation Sand Filter) alternative.

2. INTRODUCTION

This project involves an analysis of an existing neighborhood in rural eastern Shelby County that is currently served by standard septic systems. The project area is known as The Cotton Creek area and is located in the southeast quadrant of the intersection of Collierville-Arlington and Raleigh-Lagrange Roads. The area is roughly bounded by Collierville-Arlington Road on the west, Raleigh-Lagrange Road on the north, the Shelby County/Fayette County boundary on the east and the TVA power lines on the south. The study area is comprised of the following developments plus individual lots along Collierville-Arlington and Raleigh-Lagrange Roads: Kirkland Estates, Cotton Creek Subdivision and Fox Hollow Farms (1st and 2nd Phases). In total, there are ninety-one (91) residences included in the study area. Most of the homes in the study area were constructed in the late 1980's to early 1990's. The individual lots/homes range from 40 to 150 years old. A new home is currently being constructed along Cold Creek Cove. As of the date of this report, we have not received copies of the subsurface septic system plans for this address.

Through the years, residents have reported various problems with the operation of their septic systems. In response, Shelby County initiated a "fact-finding" questionnaire in early 2006 to the Cotton Creek area residents to determine the types of problems and whether the residents were willing to help pay for any recommended alternatives. Based on the responses received, Shelby County determined that further study was warranted.

The purpose of this project is to document the reported problems, determine the extent and severity of the problems, recommend to Shelby County possible alternatives to alleviate the reported problems and prepare design and construction documents based on the chosen alternative.

This project is to be performed in three phases. Phases I & 2 have been commissioned. Phase III is to be negotiated after an alternative has been selected.

Phase I Analyze extent and severity of reported problems and assess alternatives based on targeting the properties with known problems. **Engineer's Report Submitted February 20, 2007.**

Phase II Determine and rank the various physical and political factors/issues related to installation of either a local collection and treatment system such as STEP/STEG Recirculation Sand Filter or collection via conventional gravity/pressure system with conveyance to the Shelton Road Waste Water Treatment Plant in Collierville.

Phase III Prepare design and construction documents related to the chosen alternative.

The remainder of this report summarizes the Design Team's project approach, data collection efforts and conclusions related to **Phase II**.

3. Project Approach

The design team approached Phase II in the following manner:

a. **Analysis of Alternatives** - Analyze possible alternatives based on physical factors/issues. Rank those factors/issues and eliminate alternatives if possible.

b. **Town of Collierville Input** - Interview Town of Collierville officials regarding all alternatives related to conveying sewage to the Shelton Road Waste Water Treatment Plant. Also discuss Town's likelihood of supporting a Localized Collection/Treatment system within their Reserve Area.

c. **Ranking of Alternatives** – Investigate Localized Collection/Treatment systems to rank factors/issues

Following is discussion for each of the above mentioned tasks:

a. Analyze possible alternatives based on physical factors/issues. Rank those factors/issues and eliminate alternatives if possible.

This item relates to physical parameters such as terrain and existing infrastructure which would preclude any of the alternatives from consideration. After review of each alternative, none of the alternatives could be eliminated from consideration based on physical parameters alone. At this stage of the project, each alternative was considered viable.

Although none of the alternatives could be eliminated at this stage, physical parameters impact each of the alternatives.

- A conventional collection system conveying sewage to the Shelton Road WWTP is impacted by terrain and other issues more so than any of the other alternatives. Easements from homeowners would be necessary. R.O.W./easement issues along Collierville-Arlington and Raleigh-Lagrange Roads would have to be addressed. There is an existing sewer force main on the east side of Collierville-Arlington Road. With two sewer force mains operating side by side, maintenance issues would have to be addressed. A Wolf River crossing (probably horizontal directional drilling - HDD) would be necessary. As discussed later in this report, capacity issues at the Shelton Road WWTP will have to be addressed in order for this option to be seriously pursued. Town of Collierville Board of Mayor and Aldermen (BMA) approval will be required. Of the four (4) alternatives considered, preliminary estimates indicate that this option by far is the most expensive (please see page 8).

- A conventional collection system that taps into the existing SCR force main conveying sewage to the Shelton Road WWTP is also impacted by physical parameters. R.O.W./easement issues along Raleigh-Lagrange Road would have to be addressed. Easements from homeowners would be necessary. Modifications to existing agreements between the Town of Collierville and the SCR developers will be necessary (more details provided later in the report). As discussed later in this report, capacity issues at the Shelton Road WWTP and collection system will need to be addressed in order for this option to be seriously pursued. Town of Collierville BMA approval will be required. Of the four (4) alternatives considered, preliminary estimates indicate that this option is the 2nd most expensive (please see page 8).

- A small diameter low pressure collection system that taps into the existing SCR force main conveying grey water is also impacted by physical parameters. As with the other alternatives, easements from homeowners would be necessary. The existing septic tanks would be inspected for water tightness. Leaking septic tanks that could not be readily repaired would be replaced. The homeowners would be responsible for maintaining and pumping solids from their septic tanks. Grey water would be drawn from the septic tanks and conveyed via small diameter low pressure

collection system to the SCR force main. Modifications to existing agreements between the Town of Collierville and the SCR developers will be necessary (more details provided later in the report). As discussed later in this report, capacity issues at the Shelton Road WWTP and collection system will need to be addressed in order for this option to be seriously pursued. Town of Collierville BMA approval will be required. Of the four (4) alternatives considered, preliminary estimates indicate that this option is the least expensive (please see page 8).

- Local collection and treatment (STEP/STEG Recirculation Sand Filter) is also impacted by physical parameters. This option does not involve conveying sewage to the Shelton Road WWTP. The Town of Collierville does not support this alternative. However, Town of Collierville approval is not necessary. Easements from homeowners will be necessary. R.O.W./easement issues along Collierville-Arlington and Raleigh-Lagrange Roads would need to be addressed. Additional property (~ 6 acres) will be required for the drip fields, treatment system and controls. The existing septic tanks would be inspected for water tightness. Leaking septic tanks that could not be readily repaired would be replaced. Grey water would be drawn from septic tanks and conveyed via a small diameter, low pressure collection system to a drip field/sand filter for treatment. The homeowners would be responsible for maintaining and pumping solids from their septic tanks. Of the four (4) alternatives considered, preliminary estimates indicate that this option is the 3rd most expensive. Keep in mind that our cost estimate does not include land acquisition (~6 acres) for this alternative. This alternative could be the 2nd most expensive depending on land price negotiations (please see page 8).

b. Interview Town of Collierville officials regarding all alternatives related to conveying sewage to the Shelton Road Waste Water Treatment Plant as well as the Localized Collection and Treatment alternative.

Members of the Design Team met with Town of Collierville Engineering and Public Services officials on February 26, 2007 to discuss the project and the alternatives. The Town is aware of the Cotton Creek area septic issues and is also aware that Shelby County is moving forward with its investigation. Following is a summary of that meeting:

- The Town of Collierville is on record of not supporting localized collection and treatment systems such as STEP/STEG Recirculation Sand Filters.

- When comparing standard collection/treatment vs. localized collection/treatment (STEP/STEG Recirculation Sand Filter), Town staff would prefer for the Cotton Creek area problems to be addressed by standard collection conveying to the Shelton Road WWTP. **HOWEVER**,

- There are capacity issues with the Shelton Road WWTP. The plant is currently being upgraded to adequately accommodate the expected flows for full build-out of the Town's current land use plan.

- Town's long-range plan does not include providing sanitary sewer north of Wolf River (Spring Creek Ranch Development – 520 residential lots - is the lone exception to this plan).

- The Shelton Road WWTP has experienced past Sanitary Sewer Overflows (SSO's). As a result of previous SSO's, the Town is under a State moratorium to address those issues. As mentioned previously, the plant is currently being upgraded to

accommodate the current land use plan. Understandably, Town staff is reluctant to endorse a plan which would add more flow to the Shelton Road WWTP than the current land use plan calls for.

- The developers of Spring Creek Ranch (SCR) have an agreement with the Town for 520 residential lots. The Town would be more willing to accept the flow from the Cotton Creek area **IF** the SCR developers do not anticipate building-out the entire 520 lots. An amendment to the existing agreement would be necessary.

- In addition to the Shelton Road WWTP capacity issues, the Town's Sanitary Sewer Model has identified a segment of 30" diameter sewer line north of and parallel to Shelton Road that currently experiences surcharging during wet weather conditions. This line accepts sewage from SCR and routes it to the Shelton Road WWTP. The Town knows that an upgrade of this sewer line is needed with or without the additional flow from the Cotton Creek area. The Town's timeframe for upgrading this sewer line is approximately 2 – 4 years away.

In order for any of the alternatives which involve conveying sewage to the Shelton Road WWTP in Collierville to be considered viable, the Design Team's opinion is that at a minimum, the following items would have to occur:

- The existing agreement between the SCR developers and the Town of Collierville would have to be modified to state that SCR does not and will not need sewer capacity equaling 91 residential lots, approximately 30,000 gal/day.

  This is doable, but we believe unlikely. Even if the developers do not intend to use the entire agreed upon capacity as stated in their agreement with Collierville, at this point, the developers have no incentive to modify the agreement.

  In addition, if odors in the area of the manhole where the force main from the SCR pump station discharges ever become an issue, SCR is obligated by contract to install an odor control system. The odor control system cost is estimated at $40,000. If sewer flows from the Cotton Creek area were added to the SCR system, it is likely that a cost sharing of these potential odor control costs would be requested.

- The above mentioned agreement would also need to be modified to allow lot connections to the SCR sewer system prior to those lots being annexed by the Town of Collierville.

  The current agreement states that an existing development that is experiencing septic system failures may connect to the SCR force main upon annexation.

- Assuming the SCR developers do not agree to reduce the number of lots in their current agreement with Collierville and Shelby County chooses to continue pursuing this option, the capacity of the SCR pump station and force main must be verified to ensure that there is adequate additional capacity for 91 lots.

- Upgrade of 30" diameter sewer line must be completed.

  If the above mentioned agreements with SCR can be successfully negotiated, the next item is upgrading of the 30" sewer line. The Town recognizes that upgrading the sewer line is Collierville's responsibility. However, their timeframe for upgrading is somewhere in the 2 – 4 year time frame. The type of upgrade has not been determined. Perhaps lining the existing pipe to eliminate infiltration will suffice or upsizing the line to a 36" or 42" diameter may be necessary. If Shelby County wishes to move forward sooner than Collierville's 2 – 4 year timeframe, Shelby County/Town of Collierville negotiations will need to commence.

- Town of Collierville Board of Mayor and Aldermen (BMA) approval will be required. If all of the above items are accomplished and this project is ultimately presented to the Town's BMA for approval, approval is likely. If the above items are not agreed upon and this project is presented to the BMA, approval is much less likely.

c. Investigate Localized Collection/Treatment systems to rank factors/issues

As is the case with the Cotton Creek area, where high ground water, poor soils and other site constraints limit the effectiveness of standard septic systems and the service of Public Operated Treatment Works (POTW) is not available, Recirculating Sand Filter systems offer an ideal solution. With a Recirculation Sand Filter (RSF) primary treated wastewater from septic tanks is treated by percolating the water through a course sand bed during which the contaminants are broken down by naturally-occurring microorganisms living on the sand particles.

Currently there are two RSF systems in operation within Shelby County, Tennessee. One of the systems has been in operation for 5 years while the second has been operational 2.5 years. Both systems have given excellent service.

The highly aerobic flow from the sand filter bed then drains back to a recirculation tank where it mixes with the incoming wastewater. After a few more passes through the sand filter, the treated water is ready for discharge.

In typical operations, the raw wastewater from the septic tanks has high BOD levels (≥ 250 ppm); high Nitrogen levels (≥ 25 ppm) and high bacteria levels (≥ 60,000 cfu/100mL). A properly designed and operated RSF can achieve treatment quality levels of < 10 ppm BOD; < 5 ppm Nitrogen; and < 10 cfu/100mL Bacteria.

The treated water leaving the RSF is dispersed using drip technology where the water is dispersed at rates of 0.1 GPD/ft² to 0.2 GPD/ft² in an area that can be landscaped to look like a park. The dispersed water is then either evaporated into the air, or absorbed by the vegetation and dispersed via trans-evaporation principles.

The size of both the RSF and the drip (dosing) field are determined by the amount of water to be treated. Typically, the RSF will be sized to provide 1 ft² of surface area for each 5 GPD of water to be treated. The dosing field will require from 5 ft² to 10 ft² for

each GPD of wastewater treated, depending on the quality (absorbency) of the soils being used.

In order to proceed with this alternative, the Design Team recognizes the following issues that need to be addressed:

- Identify potential locations for drip field and treatment system. Preliminary calculations indicate that approximately 6 acres will be required. The TVA power lines located along the south boundary of the Cotton Creek study area may be a possibility. Also, the undeveloped portion of land south of the Cotton Creek study area (owned by Barzizza) may also be a possibility.

- Shelby County to acquire the property

- Although Town of Collierville approval is not necessary for this alternative, the Town is on record of not supporting these systems. In previous developments located within the Town's Reserve Area, Shelby County has allowed the Town to review and comment on the proposed plans for those developments. If that process is followed for this project, Town staffs' comments will likely be negative. However, Shelby County is under no obligation to address the Town's comments.

4. Conclusion/Recommendations

As mentioned previously, the preferred method for treating sewage is by conventional means. Therefore, the Design Team investigated avenues in which to utilize the existing SCR force main conveying sewage to the Shelton Road WWTP. Although those avenues are not closed, there are issues that must be addressed in order to convey sewage (whether raw sewage or grey water only) to the Shelton Road WWTP. To gain Town of Collierville's staff support, the first thing that needs to happen is for the SCR developers to agree to a modification of their agreement as described above (reduce the number of residential lots in the SCR development). If this item cannot be accomplished, there is very little reason for Shelby County to pursue this option. Shelby County should contact the SCR developers to at least gage their acceptance of modifying their existing contract with the Town of Collierville. If the SCR developers express reluctance**,** the Design Team does not recommend pursuing any of the conventional collection system alternatives conveying sewage to the Shelton Road Waste Water Treatment Plant in Collierville.

The Design Team recommends pursuing the Localized Collection and Treatment Alternative (STEP/STEG Recirculation Sand Filter). Even though this option may not be the least cost alternative, this alternative offers the least amount of potential political issues with the Town of Collierville. This option eliminates the Town of Collierville's capacity issues concerning the Shelton Road WWTP and collection system. It also eliminates any potential issues/conflicts with the existing agreements between the Town of Collierville and the Spring Creek Ranch developers. Although the Town of Collierville is on record of not supporting Localized Collection and Treatment Systems (STEP/STEG Recirculation Sand Filters) within its' current Town Limits or Reserve Area, Shelby County is under no obligation to accommodate the Town's concerns.

5. PRELIMINARY COST ESTIMATES

Alternative 1 - Conventional Collection System Conveying Sewage to Shelton Road WWTP

Description	Quantity	Unit	Unit Cost	Extended
8" Diameter PVC Pipe (DR 26)	15,000	lft	$75.00	$1,125,000.00
Manholes (assume 400' spacing)	38	ea	$4,500.00	$171,000.00
4" Diameter Force Main	20,000	lft	$35.00	$700,000.00
Wolf River X'ing (HDD)	750.00	lft	$140.00	$105,000.00
Pump Station	2.00	ea	$50,000.00	$100,000.00
Removal of Existing Septic Tanks	91.00	ea	$750.00	$68,250.00
Field Surveying	1.00	LS	$15,000.00	$15,000.00
			Total	**$2,284,250.00**

Does not include design, permitting, R.O.W./Esm't acquisition or potential 30" diameter pipe upgrade and odor control cost shares

Alternative 2 - Conventional Collection System Tapping Into Existing Spring Creek Force Main Conveying Sewage to the Shelton Road WWTP

Description	Quantity	Unit	Unit Cost	Extended
8" Diameter PVC Pipe (DR 26)	15,000	lft	$75.00	$1,125,000.00
Manholes (assume 400' spacing)	38	ea	$4,500.00	$171,000.00
4" Diameter Force Main	4,800	lft	$35.00	$168,000.00
Pump Station	2.00	ea	$50,000.00	$100,000.00
Removal of Existing Septic Tanks	91.00	ea	$750.00	$68,250.00
Field Surveying	1.00	LS	$7,500.00	$7,500.00
			Total	**$1,639,750.00**

Does not include design, permitting, R.O.W./Esm't acquisition, potential 30" diameter pipe upgrade or odor control cost shares

Alternative 3 - Low Pressure Collection System Tapping Into Existing Spring Creek Ranch Force Main Conveying Only Grey Water

Description	Quantity	Unit	Unit Cost	Extended
Septic Tank and STEP System	91	ea	$5,500.00	$500,500.00
Low Pressure PVC Collection System	15,000	lft	$20.00	$300,000.00
Pump Station	2	ea	$50,000.00	$100,000.00
Field Surveying	1.00	LS	$5,000.00	$5,000.00
			Total	**$905,500.00**

Does not include design, permitting, R.O.W./Esm't acquisition, potential 30" diameter pipe upgrade or odor control cost shares

Alternative 4 - Local Collection and Treatment System STEP/STEG Recirculation Sand Filter

Description	Quantity	Unit	Unit Cost	Extended
Septic Tank and STEP System	91	ea	$5,500.00	$500,500.00
Low Pressure PVC Collection System	15,000	lft	$20.00	$300,000.00
Drip Field (complete in-place)	1	ea	$250,000.00	$250,000.00
Recirculating Sand Filter (complete in-place)	1	ea	$250,000.00	$250,000.00
Field Surveying	1	LS	$12,000.00	$12,000.00
			Total	**$1,312,500.00**

Does not include design, permitting, cost of land acquisition (~ 6 acres), R.O.W./Esm't acquisition operation and maintenance