

Executive Summary

Introduction

The bi-county water supply main project involves planning and designing a new 84-inch-diameter water main starting near the intersection of I-270 and Tuckerman Lane and extending to the existing 96-inch diameter main at Stoneybrook Drive and Beach Drive in Montgomery County, a distance of about 5.5 miles. The project is divided into the following three major phases:

1. Comprehensive bi-county supply main alignment study
2. Design and permitting of the supply main
3. Construction of the supply main

The three phases of the project will span almost six years; the study will take approximately one year to complete, followed by a 20-month design and permitting period. Construction is expected to start in the spring of 2007 and to take about three years to complete.

This report is part of the study phase of the project. Both the alignment and method of construction will be determined by this study. The project study area is shown in Figure ES-1.

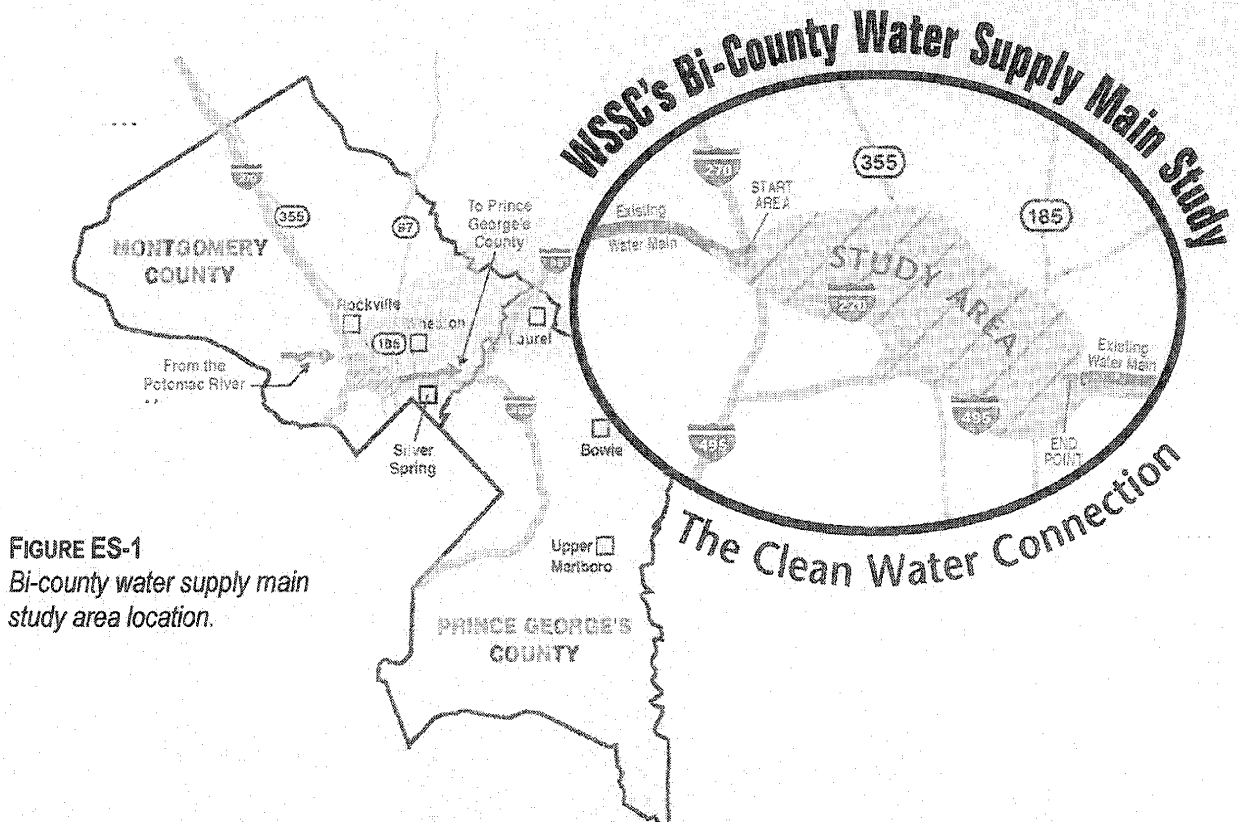


FIGURE ES-1
Bi-county water supply main study area location.

Purpose and Scope

Following are the basic objectives of the comprehensive alignment study:

1. Define the best alignment (or route) and method of construction for the 84-inch-diameter supply main.
2. Detail the approach for developing, evaluating and ranking the alternatives.
3. Through an extensive community outreach component, inform the public and solicit input.
4. Gather information to be used in assessing the magnitude of each impact.
5. Assess community, environmental, economic, engineering, construction, and regulatory impacts.

The alignment study is being conducted in four phases with results presented in four reports, as listed below, and with subsequent meetings with the WSSC, the Policy Review Group (PRG), and the community:

1. Initial Alignment Development Report
2. Refined Alignments Report (this report)
3. Developed Alignments Report
4. Final Alignment Report

Initial Alignment Development Report

The first report, the *Initial Alignment Development Report*, submitted to WSSC in December 2004, took a broad look at the alignment study to provide baseline information from which final alignment decisions would be made. That report provided basic information on 15 possible alignment alternatives. Through that report, including the subsequent information developed in *Technical Memorandum No. 1*, six alternatives were eliminated and nine alternatives were carried forward for discussion in this report. The remaining alignments consist of two open-cut pipeline alignments, four tunnel pipeline alignments and three open-cut/tunnel combination alignments. The nine alignments for further analysis are listed below.

Open-Cut Pipeline Alignments

- P1 – I-270/Beach Drive Open-Cut Pipeline
- P4 – I-270/I-495 Open-Cut Pipeline

Tunnel Pipeline Alignments

- T1 – I-270/Rock Creek Park Tunnel
- T2 – Tuckerman Lane/Saul Road Tunnel
- T3 – Nicholson Lane/CSX Railroad Tunnel
- T4 – Tuckerman Lane/CSX Railroad Tunnel

Combination Pipeline Alignments

- C1 – I-270 Open-Cut Pipeline/Rock Creek Park Tunnel
- C2 – I-270 Tunnel /Beach Drive Open-Cut Pipeline
- C5 – Nicholson Lane Open-Cut Pipe Replacement/CSX Railroad Tunnel

Refined Alignments Report

The purpose of the second phase of the Bi-County Water Supply Main Study is to take a closer look at the remaining alignments. The following work is covered in this phase for each alignment and is presented in this report:

- Evaluate methods of construction and discuss the pros and cons of various construction methods and materials, including secondary support systems, utilities needed, access and haul routes, and permanent and temporary rights-of-way.
- Identify utility crossing requirements for each alignment, including utilities requiring relocation.
- Identify the permit requirements.
- Refine potential community and environmental impacts for each alignment.
- Present planning-level cost estimates for each alignment alternative and construction method.
- Identify weightings/scoring of criteria, subcriteria, and alignment alternatives; present a model ranking the alternatives using the decision process tool, Criterium Decision Plus®.
- Present alignment alternatives recommended for elimination or modification.
- Relate community outreach efforts conducted to-date and outreach strategies for the future. ...

Technical Requirements

A range of technical requirements, as discussed in Section 3 of this report, is addressed to take a closer look at the remaining alignments. The following technical requirements are addressed in this report:

- Methods of construction
- Pipeline materials
- Secondary support systems
- Utility impacts
- Corrosion control
- Operability and maintainability
- Constructability

Information on these technical requirements will be refined further, developed in subsequent study phases, and considered in selecting the preferred alignment and construction method.

Properties and Access

Section 4 of this report discusses the alignment rights-of-way (ROW) and construction easements related to properties, and evaluates access/haul routes and staging areas to accommodate construction of each of the alignments.

In general, both open-cut pipeline alignments (P1 and P4) follow WSSC's existing 50-foot ROW along the I-270 segment. From east of Route 355 to the eastern terminus, the P1 alignment falls within lands owned by the Maryland National Capital Park and Planning Commission (M-NCPPC). The P4 alignment falls along side the I-495 corridor, which is within lands owned by the M-NCPPC. Most of the territory through which tunnel pipeline alignments T1 through T4 would pass is within public county roadways and lands owned by M-NCPPC. Working space for tunnel pipeline alignments is a concern only at the shaft locations. This will be a consideration in evaluating alternative shaft sites for final selection.

Most of the access routes would use public roadways owned and maintained by the Montgomery County Department of Public Works and Transportation (MCDPW&T). There are some private roads owned by associated developments and homeowners associations that would be used and would require easements. There also are a few access routes through private lands that would require easements. The relative property easement and ROW requirement impacts are summarized in Table 4-1 and incorporated into Table ES-1 below.

Permitting Requirements

The expected permitting requirements for the project are identified in Section 5 of this report. The report lists the different federal, state, and county agencies and private organizations and their permit or permission requirements for the project as a whole and for the different alignments. A summary of the permit agencies and permitting requirements for each alignment is presented in Table 5-1 (at the end of Section 5). The relative permitting requirement impacts are summarized in Table 5-3 and incorporated in Table ES-1 below.

Geotechnical Needs

During this phase of the study, no additional geotechnical data were obtained or developed. As a result, this report contains no geotechnical information. However, a separate memorandum, *Geotechnical Memorandum No. 1*, is being developed to provide preliminary subsurface information for the proposed alignments and to help refine the number of alignments for further consideration. The memorandum will be submitted separately.

Environmental Impacts

This report generally describes the environmental impacts expected from each of the alignments under consideration. Sensitive environmental resources found in the study area are discussed and the expected impacts to these resources are described in Section 7 of the report. Environmental resources and issues are assessed for parklands; streams; floodplains and wetlands; slopes, erosion, and sedimentation; vegetation; and wildlife and habitats.

A comparison of relative environmental impacts for each alignment and shaft location is summarized in Tables 7-1 and 7-2 (at the end of Section 7). As the alignments are further

refined, more detailed environmental assessment efforts will be conducted, and mitigation measures will be proposed. The third column of Table ES-1 below summarizes the relative environment impacts as evaluated in this report.

Community Impacts

This report also describes the community impacts expected from each of the alignments under consideration. Sensitive community issues identified in the study area are discussed and the expected impacts to these are described in Section 8 of the report. Community issues are assessed for private property, recreational areas, historic and archeological sites, disruption of traffic and residential access, dust and exhaust emissions, noise and vibrations, and utility disruption.

A comparison of the relative community impacts of each alignment is presented in Tables 8-1 and 8-2 (at the end of Section 8). As the alignments are further refined, more detailed community assessments will be conducted. The relative community impacts of each alignment are included in Table ES-1 below.

Summary of Impacts

The table below is a summary of the impacts in each of the areas listed above and of the extent of the relative impact of each alignment. For scoring the alternatives with the Decision Criterion Plus tool, the relative impact of each is represented in the report as follows:

<u>Score</u>	<u>Impact</u>
5	High
4	Moderate-High
3	Moderate
2	Moderate-Low
1	Low

TABLE ES-1
Summary of Comparison of Relative Impacts

Alignment	Properties and Access	Permitting	Environmental Impact	Community Impact
P1	3	4	5	5
P4	3	3	5	5
T1	2	3	1	2
T2	2	2	1	2
T3	2	3	1	2
T4	2	3	1	2
C1	3	4	3	3
C2	2	4	3	3
C5	3	4	5	5

Community Outreach Program

WSSC recognizes the need for extensive community outreach during all phases of the Bi-County Water Supply Main Study, and has developed a communications plan and schedule for outreach activities. Key stakeholders have been identified and formation of a Citizens Advisory Committee is beginning. Public meetings were being held concurrently with completion of this report. Details on the program strategy, schedule, and activities and products developed to-date are included in Section 9 of this report.

Cost Analysis

For this *Refined Alignments Report*, construction cost estimating was performed to establish an order of magnitude cost for each alignment. Cost estimates for open-cut and tunnel alignments were separated into eight different categories as indicated in Table ES-2 below. A description of the methodology used and summaries of cost estimates are included in Section 10 of this report.

TABLE ES-2
Cost Categories for Open-Cut and Tunnel Cost Estimates

Cost Category	
Open-Cut	Tunnel
Pipeline earthwork	Tunnel earthwork
Pipeline and components	Tunnel liner and components
Utility and routing conflicts	Utility conflicts
Traffic control	Traffic control
Surface restoration	ROW acquisitions and mitigation
General requirements	General requirements
Contingencies	Contingencies

A summary of the cost estimate for each alignment is listed in Table ES-3 below. Unit prices are established using historical cost data obtained on several projects similar in size and components to the bi-county supply main project and include estimates for specific mitigation measures associated with each alignment. Construction costs are trended at an inflation rate of five percent per year for an anticipated mid-point of construction in the Year 2009. A 30-percent contingency factor is applied to the subtotal of each alternative to account for unknowns. Additional analysis will be performed in subsequent report phases to further refine these cost estimates.

TABLE ES-3
Estimate of Costs for Alignments (trended to year 2009)

Alignment	Length (linear feet) ¹		Unit Cost (per linear foot) ³	Estimated Cost ^{4, 5, 6}
	Open-Cut	Tunnel ²		
P1	28,900	-	\$3,500	\$101,500,000
P4	28,500	-	\$3,900	\$111,800,000
T1	-	27,600	\$4,400	\$121,600,000
T2	-	25,400	\$4,500	\$115,000,000
T3	-	30,200	\$4,400	\$133,100,000
T4	-	28,400	\$4,400	\$123,600,000
C1	13,200 ²	14,700	\$4,400	\$121,800,000
C2	15,800 ²	13,100	\$4,100	\$117,500,000
C5	11,800 ²	18,500	\$4,300	\$130,000,000

¹ Lengths are approximate to within 500 +/- feet, rounded to nearest 100.

² Lengths will vary depending on final shaft location.

³ Unit costs rounded to the nearest \$100.

⁴ Expected accuracy of plus 50% or minus 30% based on AACE guidelines. Rounded to nearest \$100,000.

⁵ Construction cost is trended at an inflation rate of 5% per year for an anticipated mid-point construction in the Year 2009.

⁶ Recent increases in construction industry (i.e. steel prices) were considered in developing the construction cost.

Alternatives Screening and Recommendations

This *Refined Alignments Report* presents more detailed information on and analysis of the nine remaining alternatives carried forward from the initial alignment development stage for consideration by WSSC, the PRG, and other stakeholders. Once this information is reviewed, the WSSC and the PRG will meet again to address the following objectives relating to the *Refined Alignments Report*:

- Review the relative rankings of impacts and costs of the nine remaining alternative alignments.
- Consider public comment received to-date regarding the alternative alignments.
- Review the results of the decision making model based on the current level of evaluation including:
 - Reviewing previous weightings of the evaluation criteria and subcriteria.
 - Performing sensitivity analysis in a group setting using the model.
 - Reviewing cost vs. non-cost factors in the evaluation process.

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- Determine which of the remaining nine alternatives can be eliminated from further evaluation based on current findings
- Provide direction to WSSC and the consultants on the focus for the next phase of study.

After the meeting, the WSSC and PRG comments will be compiled, documented, and addressed in a technical memorandum to supplement the *Refined Alignments Report*. The comments will be considered in the next study phase, the developed alignments phase.

The screening of alternatives and recommendations are presented in Section 11. The PRG provided relative weightings of the importance of the major evaluation criteria and subcriteria at the January 10, 2005 meeting. The relative importance of each subcriteria as compared to other subcriteria within each major criterion were also weighted by the PRG. The consensus weightings for the major criteria are given in Table ES-4.

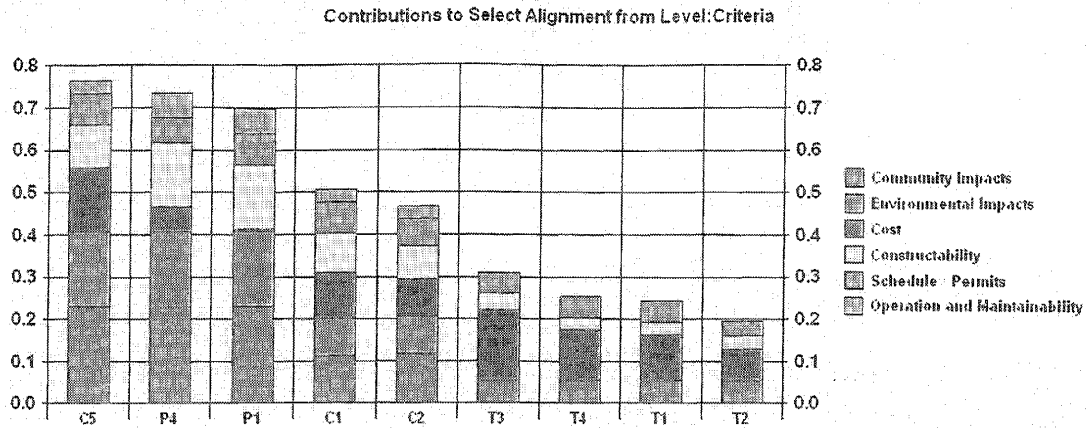
TABLE ES-4

Consensus Weighting of Importance of Main Evaluation Criteria

Criterion	Consensus Weighting
Community	5
Constructability	4
Cost	4
Environmental	4
Operation and Maintainability	3
Schedule and Permits	3

Based on information developed in this report, the nine alternatives were scored against the subcriteria on a scale of 1 (low impact) to 5 (high impact). For example, if an alternative had a high impact on water quality (a subcriterion of environmental impact), it would receive a score of 5. The scores were then entered into the decision model along with the relative weighting factors provided by the PRG at the subcriteria level. The alternatives with the lowest impact scores are the most desirable. The results of this evaluation process are summarized in Figure ES-2.

FIGURE ES-2
Decision scores and Relative Contributions by Criterion.



Note: Environmental impacts at tunnel shaft locations were considered in developing the graph above but their contribution is not visible due to their low impact compared to open-cut and combination alignments and the relative scale of the graph.

This preliminary decision making process described in Section 11 reveals that tunnel pipeline alignments outscore open-cut pipeline and combination alignments by a wide margin. In fact, there is such a significant disparity between the decision scores of the tunnel alternatives and the open-cut and combination alternatives that it would take a significant change in criteria weightings to narrow this gap, as confirmed by sensitivity analyses in the decision model.

Based on this sensitivity analysis, cost would need to count for 65% of the decision weight to make an open-cut pipeline alignment (P1) the favored alternative. This means that community, environmental, permitting and schedule, and constructability factors together would only make up 35% of the decision-making criteria. If broken down further, this would mean that community impacts would only account for 9% of the decision criteria and the other factors would weigh even less. The reason cost would need to be made such a high percentage of the decision-making criterion is because the costs are relatively close. The estimated cost for the least expensive pipeline alternative (P-1) is \$101 million and the cost for the middle of the road tunnel alternative (T-2) is \$121.6 million, a difference of \$20.6 million or 20% of the pipeline costs.

This result indicates that the top preferred alternatives, based on the criteria weightings and preliminary technical scorings, are all tunnel pipeline alignments.

Summary

In conclusion, it is recommended that WSSC and the PRG eliminate all but the three most promising tunnel alternatives (T1, T2, and T4) from further consideration in the next phase of the study. This recommendation is based on the discussion above and specifically:

- The community and environmental impacts are substantially less for tunnel options than for all other options.

- The combination alternatives do not have any cost advantage over the tunnel alternatives and still have significant community and environmental impacts.
- Tunneling costs are about 20% more than the least expensive open-cut options. This is substantially less than was indicated in previous reports.
- As evaluated by the decision making model, cost would need to account for the majority of the decision making criteria (65%) in order for a non-tunneling alternative to be considered.

In addition to only considering the three most promising tunnel alternatives, the Commission and the PRG may wish to carry a pipeline alternative into the next phase for comparative purposes. As discussed in Sections 3.1.1.1, evaluation of the open-cut alignments revealed some constructability issues. This resulted in a recommendation to consolidate P1 and P4 alignments into a single P1* (modified). If a non-tunnel alignment is carried forward, it is recommended that the modified P1 alignment be selected for comparative purposes only.

In the next report (Developed Alignment Report), the remaining alignments will be studied in more detail, particularly in the area of tunnel shafts, traffic control and other impacts. More detailed technical analyses will be performed, including field surveys and non-intrusive geophysical investigations to further define the geology. Discussions with regulatory agencies, property owners, and other stakeholders will be expanded. Input received from community outreach activities, and especially the Citizens Advisory Committee, will be considered in the evaluations. All information will be integrated into the decision making process to select a single preferred alignment and construction approach.