



## PROJECT AUDIT (PEER REVIEW) REPORT

**TO:** WSSC Water

**FROM:** WSP USA Inc.

**SUBJECT:** Independent Evaluation and Audit (Peer Review) of the WSSC Water 48-Inch Patuxent Raw Water Main Project - BF1582E91

**RELEASED DATE:** November 19, 2025

**UPDATED DATE:** February 12, 2026 (Added Statement on Independence)

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### EXECUTIVE SUMMARY

The 48-inch Patuxent Raw Water Main (Contract BF1582E91) is a critical infrastructure project for Washington Suburban Sanitary Commission (WSSC Water) to install approximately 2.5 miles of large-diameter pipeline, boosting water supply capacity to 110 MGD for nearly 1.9 million residents in Prince George's and Montgomery Counties. Originally scoped as a 2.5-year, \$8.4 million effort (start Dec 2020, substantial completion finish in November 2022 with contract end date in March 2023), the project's substantial completion date has slipped to December 2024 amid numerous delays. Prolonged construction disruptions, cost increases, and community dissatisfaction prompted WSSC Water to commission an independent audit by WSP USA. This audit reviewed all phases – planning, design, permitting, procurement, construction, and community engagement – to identify root causes of issues and recommend improvements.

The project encountered considerable planning and design challenges. Outdated baseline data and disconnection of the community commitments—such as roadway paving and accommodating school schedules—in the construction execution led to frustration among residents. Frequent utility conflicts arose due to incomplete utility mapping, while geotechnical investigations did not adequately account for subsurface conditions, such as realignment of the transmission main during design, and insufficient spacing at critical location. Geotechnical information was not shared promptly with contractors at pre-construction, resulting in delays and potential change orders.

Rigid lay schedules with owner-supplied materials limited flexibility in handling field conditions during pipeline installation. Global supply chain disruptions caused bulk shipments of pipe, requiring extra storage and leading to inefficiencies in material handling. The linear lay schedule sequencing did not adapt well to shifting needs, particularly with pavement restoration and work near Bond Mill Elementary school, which contributed to prolonged temporary patching.

Documentation and quality control efforts were inconsistent. Incomplete records and the absence of a comprehensive QA/QC plan made it difficult to ensure compliance, and spot inspections revealed issues with compaction and backfill. Delayed responses to RFIs and change management processes affected both schedule and costs. Seven approved change orders raised overall costs by 13%. These change orders were approved by WSSC Water as lump sum costs added to the contract. The project was delayed by 641 days (as of December 2024 based on the most recent schedule update), largely because of unforeseen site conditions such as rock impacts, contractor demobilization, conflicts at vaults, reducing productivities due to soil condition and material handling, periodic utility conflicts, adjustments to lay schedule, delayed delivery of fittings, change orders etc. Extensive permitting and inter-agency coordination were required, yet overall outreach schedule update to the community was inconsistent. Residents experienced continued disruptions, poor communication,



about schedule changes, and a lack of clear engagement. Oversight, contractor performance, and agency collaboration throughout the project were limited and reactive.

The audit identified numerous systemic improvements to enhance future project delivery, including:

- **Proactive Risk Management:** For large, complex, and capital-intensive projects, WSSC Water should establish a formal risk register to centralize risk information and categorize risk's inevitability, mitigation approaches. This includes developing standardized templates, integrating the register with project management, applying a risk scoring system, and using technology for accessibility. Ongoing monitoring through scheduled reviews, leadership dashboards, and comprehensive staff training will help build a risk-aware culture and support continuous improvement. Practical risk management measures include phasing pipe installation and testing to enable timely pavement restoration and enforcing oversight of compaction, pavement installation and maintenance for public safety. Additionally, conduct thorough site investigations to mitigate risks from utility conflicts and soil conditions, ensuring proactive risk control throughout project execution.
- **Integrated Change Management:** Adopt an agile and structured approach by scheduling regular change review meetings. Requests for information (RFI) should be reviewed and responded to in a timely manner, and each change proposal should include a detailed assessment of its impact on schedule and cost, with formal review and approval before implementation. Ensure baseline schedules are aligned with contract specifications and community needs, and require formal review for all schedule updates. Keep comprehensive documentation of all correspondence, decisions, and approvals to improve accountability and consistent risk management.
- **Improved Process Management and QA/QC Process:** Implement formal Request for information (RFI) closure and submittal processes, ensure preconstruction documentation is complete, and require comprehensive daily inspection reports with material verification, safety photos, and traceability. Enhance quality assurance by mandating contractor Quality Control (QC) plans, reinforcing internal Quality Assurance (QA) inspections with corrective action follow-up, and holding regular QA/QC reviews. Empower contract managers and inspectors to enforce standards, including suspending work if necessary, and maintain a centralized registry (as WSSC Water currently uses Trimble/E-Builder) for submittals, RFIs, COs, DIRs, QA/QC Test Reports to drive transparency, accountability, and early issue identification and resolution.
- **Strengthening Communication, Collaboration & Engagement:** Formalize communication protocols and use a centralized project management system for real-time updates. Hold regular progress meetings, and align schedules with utilities, partner agencies and community calendars to minimize disruptions. Expand outreach beyond civic associations through pop-ups and dedicated meetings, create task forces for major projects, and maintain consistent contact with elected officials. Document commitments in contracts, enforce them during execution, and track permits centrally to ensure transparency and efficient delivery.



## STATEMENT ON INDEPENDENCE

WSP was retained under Master Agreement No. 67580 to conduct an independent evaluation and audit (peer review) of the Patuxent 48-inch Raw Water Main, Allentown Road Water Main Replacement, and South Osborne Road Water Main Replacement projects. Our mandate was to provide an objective and impartial review, grounded in verifiable evidence, with conclusions that are unbiased, evidence-based, and free from subjective interpretation. WSP developed and applied a process and methodology for the independent review founded on industry standards and best practices.

### **INDEPENDENT REVIEW STANDARD.**

For WSP, an “independent” standard means that judgments are made objectively, without bias or predisposition, and that reported results are supported by sufficient, appropriate evidence. This is consistent with ISO 19011:2018, which frames independence as the basis for auditor impartiality and emphasizes an evidence-based, risk-based audit process.

### **METHODOLOGY AND EVIDENCE CONTROLS.**

**Uniform, transparent methodology.** WSP developed a documented, repeatable approach across all three projects to minimize subjectivity and enhance comparability: comprehensive document and record reviews; compliance verification; construction-record audits; structured interviews with project personnel and stakeholders; root-cause analysis across planning /design /procurement /construction /outreach; and community /stakeholder feedback synthesis. The method and traceability of sources are reflected in the project peer review memos and public-facing materials. This methodology meant that all assessments and recommendations are based on the factual record of the review and can be readily traced to the information that was gathered and documented in each report.

**Evidence sufficiency and appropriateness.** We based findings on sufficient, appropriate evidence and maintained review logs that allow another qualified professional to understand the procedures performed and the basis for our conclusions. This included corroborating testimonial information against official records and independent sources to reduce over-reliance on any single perspective. This methodology meant that WSP based conclusions on the sufficiency of the comprehensive information that was available and did not rely on any one source.

**Analytical neutrality (triangulation) to avoid bias.** We triangulated inputs—documents, records, interviews, and data—before forming conclusions. Where viewpoints conflicted, we resolved them through traceable evidence and criteria, not opinion, to keep results unbiased and evidence-driven. (See project memos for the traceability of sources consulted.) This methodology limited any inherent bias in the assessment and recommendations.

**Clear criteria and reporting.** We stated scope, criteria, methods, and bases for conclusions in neutral language, enabling readers to see what was assessed, how it was assessed, and why the evidence supports the result. This methodology supports the transparency of our approach, allowing anyone who reads the reports to develop their own understanding of the projects and the report summaries.

### **CONCLUSION**

WSP’s evaluation and peer review were performed independently and presented objectively, in accordance with ISO 19011 principles. By using a transparent, replicable methodology, corroborating multiple lines of evidence, and maintaining reviewer independence and quality management, our results are **objective and impartial, grounded in verifiable evidence, and free from subjective interpretation.** WSP believes our independent review approach meets industry standards and resulted in unbiased, defensible reports and focusing on process improvements for WSSC Water.



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## List of Abbreviations

**AHA:** Activity Hazard Analysis

**AC:** Alternating Current

**BCE:** BOTA Consulting Engineers, Inc.

**BGE:** Baltimore Gas & Electric

**BOA:** Basic Order Agreement

**CO:** Change Order

**CIRT:** Report & Testing

**CPM:** Critical Path Method

**DIR:** Daily Inspection Reports

**DNR:** Department of Natural Resources

**DPIE:** Department of Permitting, Inspections, and Enforcement (Prince George's County)

**DPW&T:** Department of Public Works & Transportation (Prince George's County)

**EBA:** EBA Engineering Inc.

**E&S:** Erosion and Sediment Control

**FCP:** Forest Conservation Plan

**FIO:** For Information Only

**IFB:** Invitation for Bids

**INCRP:** Incident Report Compaction Testing

**JPA:** Joint State/Federal Application

**MDE:** Maryland Department of the Environment

**MOT:** Maintenance of Traffic

**NTP:** Notice to Proceed

**N&W:** Navarro & Wright Consulting Engineers, Inc.

**OT:** Overtime

**PO:** Purchase Order

**PCO:** Potential Change Order

**QA/QC:** Quality Assurance/Quality Control

**RFI:** Request for Information

**RFQ:** Request for Qualifications

**ROW:** Right of Way

**RTA:** Ready-to-Advertise

**SHA:** State Highway Administration

**SHC:** Sewer House Connection

**SUE:** Subsurface Utility Engineering

**TCP:** Traffic Control Plans

**USACE:** U.S. Army Corps of Engineers

**WHC:** Water House Connection

**WLCA:** West Laurel Civic Association

**WRA:** Whitman, Requardt and Associates

**WSSC Water:** Washington Suburban Sanitary Commission

**WSP:** WSP USA, Inc.

**WTBC:** Wilson T. Ballard Company



## 1. INTRODUCTION

The Patuxent 48-inch Raw Water Main Project (WSSC Water Contract BF1582E91) is a critical infrastructure initiative for Washington Suburban Sanitary Commission designed to improve water supply resiliency for nearly 1.9 million residents in Prince George's and Montgomery Counties. The 48-inch Patuxent Raw Water Main project, hereafter referred to as the Project, represented a critical element of WSSC Water's strategic initiative to strengthen water system resiliency for customers in Prince George's and Montgomery Counties. The central aim of the Project was to install a fourth raw water pipeline to the Patuxent Water Filtration Plant, thereby increasing the facility's maximum production capacity to 110 million gallons per day (MGD)—a substantial improvement over its standard output of approximately 72 MGD. WSSC Water has emphasized that this investment in "infrastructure resiliency and redundancy" is vital for maintaining consistent water supply and pressure, particularly during periods of high demand.

Initially scoped as a 2.5-year, \$8.4 million effort, the project starting in December 2020 had expanded with several change orders, the project's substantial completion date has slipped to December 2024, with final pavement restoration completion delayed into Fall 2025. Prolonged impacts on the community, particularly along Bond Mill Road, resulted in public dissatisfaction.

Although the draft Maryland Senate Bill 654 proposed a legislative audit of the project, WSSC Water responded proactively by commissioning an independent evaluation audit to assess the project's planning, design, construction, and community engagement practices. The audit was conducted by WSP USA Inc. to assess the project's delivery performance, identify areas for improvement, and provide recommendations to enhance future infrastructure execution. This report presents the findings of that evaluation, offering a comprehensive review of the project lifecycle and lessons learned.

### 1.1. BACKGROUND

The Project involves the installation of approximately 2.5 miles of 48-inch diameter pipeline, extending from the Rocky Gorge Pumping Station to the Patuxent Filtration Plant. As one of the largest public works projects in West Laurel, Maryland, the initiative is critical to WSSC Water's long-term water supply strategy.

Despite its strategic importance, the Project has encountered significant challenges, including:

- Extended construction timelines, originally 2.5 years ending in 2023, now final pavement restoration extended to Fall 2025.
- Community concerns regarding temporary pavement leading to rough road conditions, and prolonged disruptions.
- Multiple change orders and cost adjustments.
- Stakeholder dissatisfaction with communication and responsiveness.

These issues prompted WSSC Water to commission an independent audit to ensure transparency, accountability, and continuous improvement in its capital delivery processes.

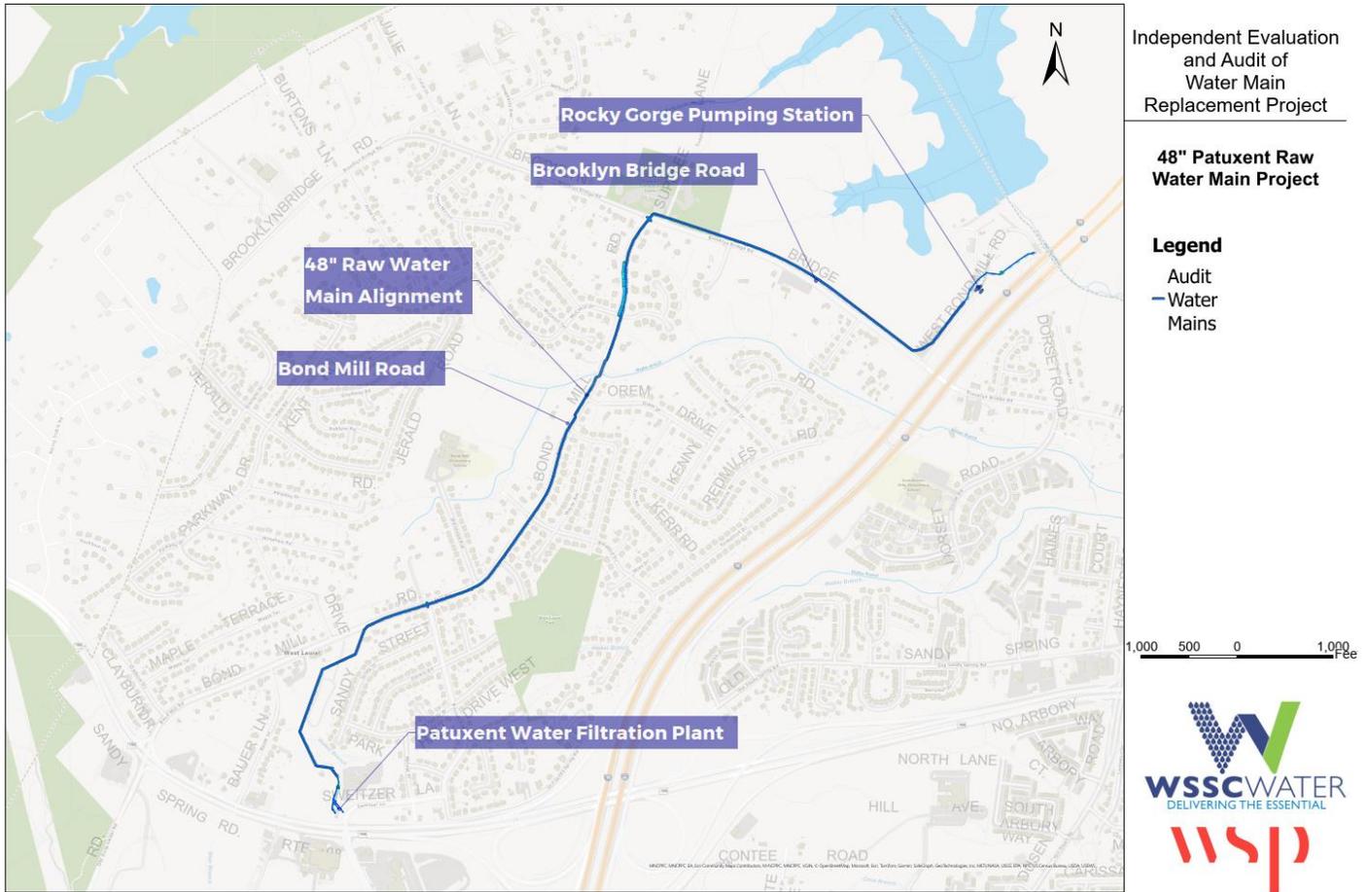


Figure 1-1 Project Overview Map

## 1.2. GOAL AND SCOPE OF THE AUDIT

The primary goal of the audit is to provide a comprehensive, objective assessment of the Project’s performance across all phases—planning, design and permitting, procurement, construction, and community engagement. Specifically, the audit aims to:

- Evaluate compliance with design specifications, permitting requirements, and contractual obligations.
- Review project documentation for completeness, accuracy, and adherence to WSSC Water workflow protocols.
- Assess quality, schedule, and financial performance against baseline expectations.
- Conduct stakeholder interviews to gather qualitative insights.
- Evaluate root causes of delays and deficiencies.
- Examine community feedback and WSSC Water’s engagement strategies.



The audit team, led by WSP, engaged in a comprehensive methodology that included document reviews, compliance verification, record audit, stakeholder interviews, and community feedback analysis, with the goal of informing continuous improvement in WSSC Water’s infrastructure delivery practices.

## 2. AUDIT METHODOLOGY

The independent evaluation and audit of WSSC Water’s pipeline projects was conducted using a structured, multi-pronged methodology designed to ensure transparency, accuracy, and actionable insights. The approach integrates document analysis, compliance checks, stakeholder engagement, and root cause investigation to assess project delivery across planning, design, construction, and community impact.

### 2.1. DOCUMENT REVIEW

The audit team was granted access to WSSC Water’s Trimble system (formerly E-builder), enabling a thorough review of project documentation. This included folder-level access to both the design and construction phases of the project.

A structured approach was used to manage and track the document review process. WSP developed a data request and review tracking log to document observations related to:

- The presence and sufficiency of documentation,
- The processes or workflows used for documentation and project construction, and
- The review systems in place.

If any key documentation was found missing from the project folder but deemed necessary for the audit, WSP requested the information directly from the WSSC Water Project Team. WSP recorded whether the requested additional information was provided and documented in the tracking log. The tracking log also included any observed deficiencies in the documentation, ensuring that gaps were clearly identified for review during later phases of the audit. See Appendix B.1 for the document tracking log based on the audit.

Table 2-1 summarizes the key documents reviewed and the specific areas of focus during the review. The document review established a foundational understanding of project scope, execution, and deviations from planned performance as well as sufficient on the documentation.



Table 2-1 Document Review and Review Focus Area

Project Phase	Documents Reviewed	Focus Areas
Proposal Phase	Scope of work	Adequacy for Project Need
Planning & Design	Design packages, permitting submittals, bid documents, comment logs, meeting minutes	Design adequacy, constructability, permit alignment, responsiveness to input
Procurement & Contracts	Bid documents, construction contracts, contract addenda	Contract clarity, scope definition, bid competitiveness
Construction Execution	Requests for Information (RFIs), change orders, contractor submittals, as-builts, inspection & Quality Assurance/Quality Control (QA/QC) reports, schedules (baseline & updated)	Timeline, responsiveness to site conditions, QA/QC practices, change management
Community Engagement	Community communication and complaints, public meeting summaries, outreach logs	Communication effectiveness, response to public concerns
Cost Management	Project budgets, cost tracking reports, invoices	Budget adherence, cost drivers, correlation with delays
Agency Coordination and Permitting	Correspondence and documentation with regulatory/local/state agencies	Permit timelines, inter-agency collaboration

## 2.2. COMPLIANCE VERIFICATION

Compliance verification focused on assessing adherence to design specifications, permitting requirements, and contractual obligations. The team evaluated whether the projects met regulatory standards and internal benchmarks, including constructability reviews and risk assessments. This step ensured that the projects were executed within the bounds of applicable codes and WSSC Water’s internal protocols.

## 2.3. CONSTRUCTION RECORD AUDIT (QUALITY, SCHEDULE & FINANCIAL)

A detailed audit of project records was conducted to evaluate performance across three dimensions:

**Quality:** Inspection logs and construction reports were analyzed to identify workmanship issues and quality assurance gaps.

Compaction test reports were examined for compliance with WSSC Water compaction test methods, backfill material’s characteristics (proctor test of borrow materials), method of compaction registered in the reports and compliance of compacted materials characteristics with borrow materials proctor test.

**Schedule:** Baseline schedule was compared against actual updates to pinpoint delays and their causes.

**Financial:** Cost data, including change orders and budget adjustments, were reviewed to assess fiscal discipline and identify overruns

## 2.4. PROJECT TEAM INTERVIEWS

The audit team conducted independent interviews with internal WSSC Water personnel, including design project manager(s), construction manager, contract manager and/or inspectors, compaction quality assurance



(QA) team, community outreach manager and specialist, , design consultants, construction contractors, and external stakeholders including elected officials and community representatives. The audit team also conducted field visits and walked the sites with WSSC Water construction manager and/or inspector(s), to discuss the site-specific challenges. These interviews provided qualitative insights into project challenges, communication gaps, and stakeholder expectations. See Appendix A.1 for the interview log, Appendix A.2 for field visit notes, Appendix A.3 for the interview with the WSSC Water Project Team, Appendix A.4 for the interview with the design engineer (construction phase), Appendix A.5 for the interview with the construction contractor, Appendix A.6 for a summary of the interview with elected officials, Appendix A.7 for a summary of the interview with community representatives, and Appendix A.8 for a summary of the interview with the WSSC Water compaction QA Team.

## 2.5. ROOT CAUSE ANALYSIS

Root cause analysis was applied to identify systemic issues contributing to schedule delays, construction challenges, and community dissatisfaction. The audit team synthesized findings from document reviews, compliance checks, and interviews to trace problems back to their origin—whether in planning, design, procurement, or execution. This analysis includes recommendations for future improvements.

## 2.6. STAKEHOLDER INTERVIEWS AND COMMUNITY FEEDBACK ANALYSIS

The audit team conducted external stakeholder interviews including elected officials and community member representatives. Community feedback was gathered through outreach meetings, email correspondence, and a structured feedback form distributed along project corridors. Complaints, concerns, and suggestions were logged and categorized by issue type, location, and response status. The audit team analyzed this data to assess public sentiment, identify recurring themes, and evaluate the effectiveness of WSSC Water’s engagement strategies.



### 3. THE PROJECT BASELINE

#### 3.1. PROJECT GOAL AND SCOPE

The Project construction scope was defined as the installation of approximately 2.5 miles of 48-inch diameter raw water pipeline and the relocation of about 0.11 miles of an existing 8-inch water main on Bond Mill Road. Phase I consisted of 11,494 linear feet of 48-inch raw water main installation, 648 linear feet of 8-inch water main relocation and replacement, water house connections and replacements, rehabilitation of an existing culvert, and installation of necessary structures. Phase II consisted of 1,374 linear feet of 48-inch raw water main, 24 linear feet of 42-inch raw water main, 364 linear feet of 36-inch raw water main, and 88 linear feet of 30-inch raw water main installation, as well as 129 linear feet of 8-inch raw water main relocation or replacement. Phase II also included installation of necessary structures and installation of pig launching and receiving vaults.

#### 3.2. PROJECT TEAM

Table 3-1 summarizes the project design and construction team:

*Table 3-1 List of Project Team*

<b>Project Team</b>	<b>Organization/Group</b>	<b>Key Team Members</b>
<b>WSSC Water Project Team</b>	WSSC Water Pipeline Design Division	Design Project Manager
	WSSC Water Pipeline Construction Division	Construction Manager
		Contract Manager
		Construction Inspectors
	WSSC Water Communications & Community Engagement	Community Relations & Outreach Specialist
<b>Planning &amp; Design Phase Engineer</b>	Whitman, Requardt and Associates (WRA)	Design Consultant (Design Phase)
<b>Construction Phase Engineer</b>	Wilson T. Ballard Company (WTBC)	Design Consultant (During construction)
<b>Construction Contractor</b>	Allan Myers Construction Company	Contractor

Interviews were conducted by WSP to obtain input from the project team involved in the design and construction. A site visit was conducted with WSSC Water’s contract manager and inspector. Additional Interviews were conducted virtually with the WSSC Water project team, the design engineer during construction - Wilson T Ballard Company (WTBC) and the construction contractor Allen Myers. The design engineering team, Whitman, Requardt and Associates (WRA), employee changed, and no commitment of resources to provide accurate details to response to the audit team. See Appendix A for the summary of



interviews and meeting minutes from these interviews. WSP submitted questions by email to the WSSC Water Team to obtain further project information and received responses to assist with the audit process.

### 3.3. PROJECT CONSTRUCTION BASELINE SCHEDULE AND COST

**Schedule:** The Construction Contract Notice to Proceed (NTP) Date started on December 7, 2020, with the contract end date on March 10, 2023, with a duration of 823 calendar days and was planned in two phases.

**Cost:** The original contract value awarded to Allen Myers was \$8,393,777.00.



## 4. PLANNING AND DESIGN

### 4.1. TIMELINE OVERVIEW AND DOCUMENT REVIEW

To support the audit review, Table 4-1 summarizes the key activities and milestones in the planning and pre-construction phases of the Patuxent Raw Water Pipeline project based on the available information.

**Observations:** Planning and design for the Patuxent Raw Water Pipeline began in 2004, but due to various constraints (budgetary constraints, private easement acquisition and permitting), construction started in 2021. This long gap created several challenges.

**Identified Gaps:** One major gap was the outdated site baseline conditions. Topographic survey, subsurface utilities engineering (SUE), geotechnical assessments, traffic studies, and community impact evaluations conducted during the planning phase were no longer fully representative by the time construction began. Additionally, the changing in alignment also impacting the relevance of the pre-design field investigation.

In addition, the long delay weakened the continuity of stakeholder engagement. While the planning phase included robust community outreach, the momentum and trust built during that period were not sustained through the years leading up to construction.

**Areas for Improvement:** For projects with extended planning and design phases, consider implementing mechanisms for:

- Reduce pre-construction period to minimize the risk of changes in field condition;
- Update baseline data periodically throughout the project lifecycle, ensuring accuracy and relevance as conditions change;
- Validating design assumptions closer to construction start; and
- Refresh stakeholder engagement.

Table 4-1 Milestones and Key Activities in Planning and Pre-Construction Phases

Phase	Date	Activity Type	Description	WSSC Water Review Records	Documentation	WSP Remarks
Planning	2004/06	Contract	Initial Design Contract awarded to Design Engineer for planning and design scope	-	E-builder/Trimble	
	2005/04	Field Assessment	Topographic Survey conducted	-	E-builder/Trimble	Detailed information was not available to confirm the quality level or the timing of Subsurface Utility Engineering (SUE) performed for the project.
	2006/10	Preliminary Study	Original Alignment Study Report completed	Not available	E-builder/Trimble	
	2010/10	Preliminary Study	Reissued Alignment Study Report with refined alternatives and updated evaluation	Not available	E-builder/Trimble	
	2011/04-2011/12	Community Engagement	Initial Community Engagement: 6 coordinated meetings with West Laurel Civic Association	-	E-builder/Trimble	Meeting notes available
	2011/10	30% Deliverable	Preliminary alignment (plans and profiles) with survey and Subsurface Utility Engineering (SUE), Surge Analysis, System Information etc.	Not available	E-builder/Trimble	
70% Design	2013/06	Field Assessment	Wetland and Waterway Investigation completed	Not available	E-builder/Trimble	
	2013/07	Field Assessment	Boring Plan submitted for review	Not available	E-builder/Trimble	
	2014/03	Field Assessment	Test Hole data collected	Not available	E-builder/Trimble	
	2014/04-2014/10	Field Assessment	Geotechnical Investigation: final report issued in 2016/08	Reviewed via E-plan	E-builder/Trimble	
	2015/04	70% Deliverables	Drawings (Generals, Plans & Profiles, E&S, Traffic Control, Forest Conservation Plan, Landscape, Corrosion Protection Plan)	Reviewed via E-plan	E-builder/Trimble	
90% Design	2016/03	Design Milestone	Original 90% Design Package submitted	Reviewed via E-plan	E-builder/Trimble	Plan suggested contractor to furnish materials
	2017/03	Field Assessment	Geotechnical Investigation: Additional boring performed at Piggings Vault location	Reviewed via E-plan	E-builder/Trimble	
	2017/07	Design Milestone	Phase II 70% Package submitted, focused on vault designs for tie-in locations	Reviewed via E-plan	E-builder/Trimble	
	2018/08-2018/11	Field Assessment	Geotechnical Investigation: Additional boring and seismic refraction survey near raw water pump station; report by 2019/05	Reviewed via E-plan	E-builder/Trimble	
	2018/09	90% Deliverables	Phase I & Phase II, Drawings, Specifications, Test Hole, Calculations, Cost estimate, Material Take off etc.	Reviewed via E-plan	E-builder/Trimble	Plan suggested WSSC Water to furnish materials and provide lay schedule
100% Design	2018/09	Community Engagement	WSSC Water gave a presentation and led a community discussion on the project.	-	WSSC Water Website	No meeting notes available
	2019/02	100% Deliverables	Drawings, Specifications, geotechnical reports, corrosion evaluation, cost estimate, material take off, contract completion time, calculations	Reviewed via E-plan	E-builder/Trimble	
Bid-Ready	2019/08	RTA	Ready-to-Advertise (RTA) submitted for Combined Phase I & II	Not available	E-builder/Trimble	
	2020/03	Revised RTA	CADD files, Communication files, Procurement documents, Reports, checklists, Misc documents (Agency comment forms etc.)	Not available	E-builder/Trimble	
Bid	2020/06/30	Bid Phase	Request for Qualifications (RFQ) released for bid	-	WSSC Water Supplier Portal	
	2020/07	Bid Phase	Four addendums issued during bid phase	-	WSSC Water Supplier Portal	
	2020/07/30	Bid Phase	Bid closed; nine bids received	-		Bid Submittals not available for review, only bid cost from each team available.
Procurement	2020/09/17	Procurement	Recommended for award	-	WSSC Water Website	
	2020/10/21	Procurement	Approval to award	-	WSSC Water Website	
	2020/12/07	Procurement	NTP for Construction	-	E-builder/Trimble	



## 4.2. PLANNING

**Background:** During the planning phase of the Patuxent Raw Water Pipeline project, the Design Engineer, WRA, evaluated a total of eleven (11) preliminary alignment alternatives. These options varied in their use of existing public roads, utility corridors, and WSSC Water-owned rights-of-way. The alternatives were assessed using a structured set of criteria that included engineering feasibility, environmental impact, construction complexity, cost, and potential impacts to the community. Early in the process, several routes were eliminated due to impracticalities—such as high construction costs, excessive disturbance to residential properties, or reliance on third-party corridors that were unlikely to be approved. For example, alternatives that followed the Baltimore Gas & Electric Company (BGE) transmission corridor or the I-95 highway right-of-way were ultimately ruled out after BGE and SHA confirmed they would not permit longitudinal utility installations within their right-of-way.

The evaluation process narrowed the field to two viable options: Alternative 6 (Bauer Lane) and Alternative 7 (Modified Bond Mill Road). Both shared a common segment from the Rocky Gorge Pumping Station through Brooklyn Bridge Road and Bond Mill Road but diverged in their final approach to the Patuxent Water Filtration Plant. Alternative 7 was ultimately recommended due to its shorter length, lower estimated cost (approximately \$1.4 million less), and reduced impact on residential streets.

The community was engaged during the planning phase. Based on the available documentation, WSSC Water held multiple public meetings in coordination with the West Laurel Civic Association (WLCA) in 2011, where residents expressed concerns about traffic disruption, safety near Bond Mill Elementary School, and long-term restoration of affected roads. In response, WSSC Water suggested several mitigation measures, including full-width road resurfacing, construction scheduling to avoid school hours, and exploring trenchless construction methods to minimize surface disturbance. These commitments helped build trust with the community.

This alignment was formally advanced into design in 2012, supported by the reissued Alignment Study and a record of public consultation.

**Identified Gaps:** The planning phase showed WSSC Water was diligent in evaluating alternatives, engaging stakeholders, and documenting the rationale for its decisions. The commitment listed above were incorporated into the project contract specifications – except full width resurfacing was addressed separately by WSSC Water resurfacing team. However, the construction phase revealed a disconnect between the commitments made and the actual execution on the ground, such as temporary asphalt patches used extensively; full resurfacing delayed due to prolonged construction period; work during active school days/hours; trenchless options not implemented and open-cut trenching used throughout, which will be discussed in detail on the later sections.

**Areas for Improvement:** Planning commitments must be backed by enforceable construction contract language along with construction oversight to ensure mitigation measures are implemented.



## 4.3. DESIGN

### 4.3.1. SUBSURFACE UTILITY ENGINEERING (SUE)

**Observations:** Given the major design alignment along an established roadway, numerous underground utilities (water service lines, sewer laterals, gas mains, telecom cables, etc.) intersected the project. Based on the drawing general notes, the topographic survey were originally conducted in 2005. Based on the original scope document, survey for connections to existing utilities was considered part of the overall survey task. There was no documentation available to the audit team to verify if additional SUE was conducted during later design phase or to confirm the SUE technique implemented during the design phase. Test holes were conducted at selected locations in 2014. Also, no documentation is available to the audit team to verify the coordination efforts with the utility owners during design phase. The contract plan and specification required the Contractor to perform test pits to confirm utility locations, which did uncover some conflicts early on during construction phase. However, several utilities were unmarked or differed from plan, leading to unexpected encounters during excavation. These utility conflicts triggered multiple RFIs, field directives, and change orders to resolve, thus impacting construction operations, cost, and schedule. The Utility Impact Log in Appendix B.2 summarizes each utility-related incident or conflict on Bond Mill Road, with its operational impact (how construction or services were affected) and the associated cost and schedule impacts. Sources from project memos, RFIs, daily reports, and change orders are cited for reference. Major conflicts – especially with sewer laterals and gas mains – required design changes and additional construction work, directly adding schedule and cost to the project. Minor utility strikes (water services, communication lines) were less consequential individually, but they demanded vigilance and emergency repairs to avoid cascading delays. Table 6-1 in the later section 6.2 also characterizes the utility conflicts.

**Identified Gaps:** The following summarizes the common causes of conflicts due to the deficiency of contract documents.

- **Unmapped or Outdated Records:** Several sewer house connections (SHC) were not shown in the contract drawings. Upon request from WSSC Water, the contractor performed CCTV of the existing sewer line and identified at least seven locations where SHCs were not documented in the drawings but confirmed via CCTV.
- **Elevation Discrepancies:** Utilities depicted in the design often differed in vertical alignment from actual field conditions (e.g. gas main at Sta. 49+20). Test hole data (i.e., TH-13) and plumbing card provided different vertical elevation or depth information.
- **Recently Installed Utilities:** Certain lines, such as the 6-inch BGE gas main, were installed after the design was finalized and were therefore absent from the contract drawings.
- **Mismarked or Erroneous Locates:** Incorrect utility mark-outs (e.g., WHC at Sta. 99+23) led to unnecessary hand excavation, added costs, and delays.

#### Areas for Improvement:

- Improve research records.
- Conduct SUE at Quality Level B and Quality Level A at critical locations. Update SUE if data is outdated.
- Early and continuous coordination with utility owners through project cycles.

- Overall System Improvement: Consider investing in improving asset management for sewer house connection and water house connection data.

### 4.3.2. GEOTECHNICAL INVESTIGATION

**Observations:** During the construction, two major subsurface issues were encountered that were not fully anticipated by the original geotechnical investigation or reflected in the design. These issues led to significant construction challenges, change orders, and delays:

- Rock elevation between Borings B-22, B-23, B-24, B-25 and B-26 (approx. Station 57+50 to 72+00). Upon reviewing the daily inspection reports and PCO #15 indicating the rock was encountered at these locations above the pipe inverts, the rock encountered appeared shallower (Station around 57+50 to 67+00) also shallower and harder than identified in the boring logs (Station 67+62 to 70+00).
- Unstable saturated sand in a deep trench near borings B-33 to B-35 (around the pipeline low point by Bond Mill Elementary School, ~Station 90+50 to 92+50).

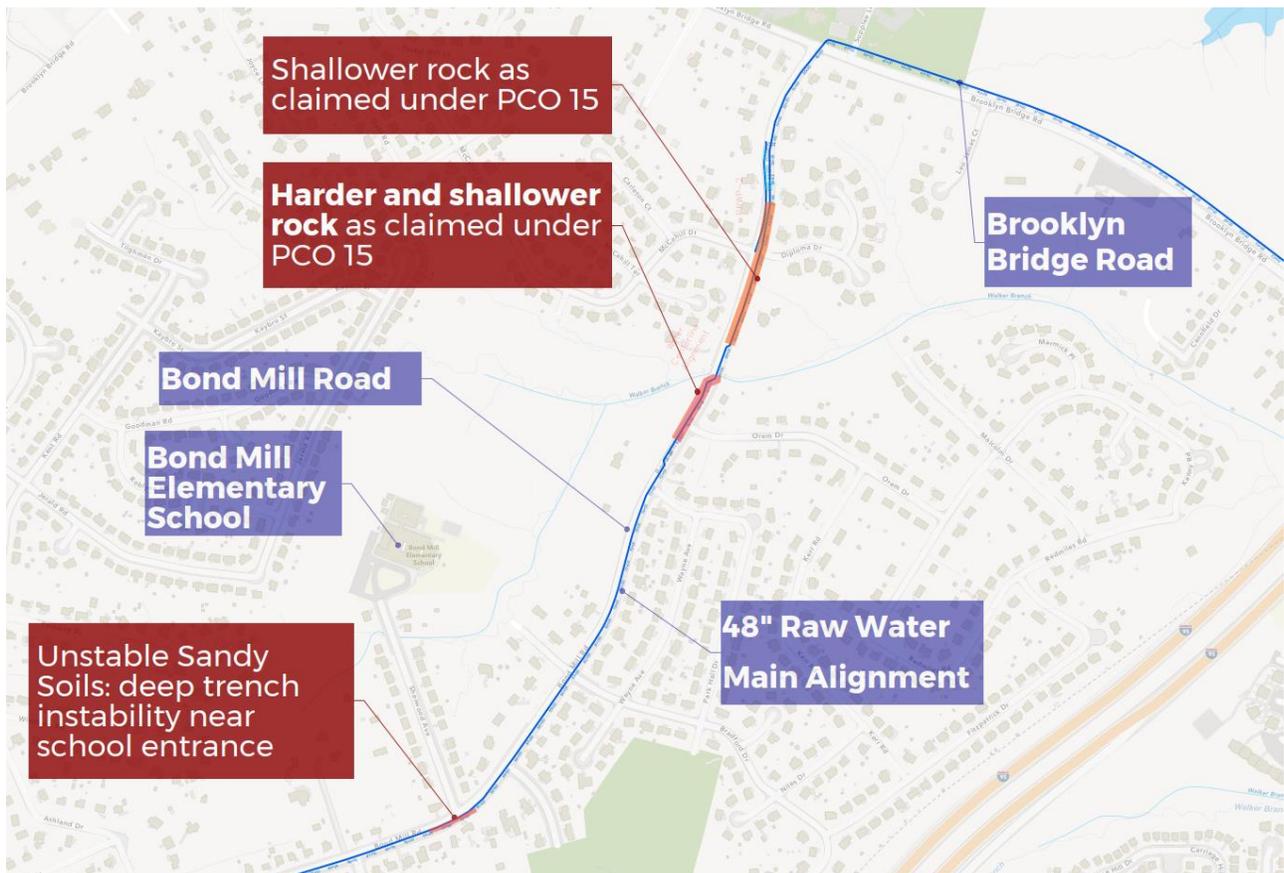


Figure 4-1 Geotechnical Challenges

Document review indicated the original boring plan was submitted to WSSC Water to review in 2013. The original boring plan showed the soil boring locations at intervals of approximately 300 feet and with the boring depth ranging from 15 to 25 feet below ground, based on the 2011 preliminary alignment set.

Total of forty-five (45) borings were performed for the project:



- Originally forty-nine (49) borings were selected, forty-two (42) borings were completed in 2014 April, and seven (7) borings at the end of water main alignment near the water filtration plant were eliminated due to site constraints. The borings were performed by an ATV-mounted drilling rig and were advanced to depths ranging from 14 to 25 feet by the hollow stem auger drilling method. The geotechnical report was assembled by EBA in 2014 October.
- A record from April 2018 indicates that WSSC Water reviewed boring logs and initiated additional geotechnical investigations. A PDF markup from WSSC Water containing the proposed alignment profiles for segments B-1 to B-12 (stations 0+00 to 29+00), representing the initial water main sections extending from Rocky Gorge Raw Water Pump Station, was identified as part of the documentation. Navarro & Wright Consulting Engineers, Inc. (N & W) conducted additional geotechnical investigation as an addendum to the geotechnical report prepared by EBA. This investigation focused on gathering further data regarding the bedrock along 400 feet of pipeline extending from the Rocky Gorge Raw Water Pump Station. Three (3) additional borings were completed, and a compressional seismic refraction survey was carried out over approximately 400 linear feet in the area of interest.

### Identified Gaps and Challenges:

**Boring Coverage, Depth and Design Gap:** The spacing and depth of borings generally conform to standard investigation requirements at most locations. However, at two construction segments, the geotechnical investigation was not sufficient for the conditions present.

- **For borings conducted in the rock area:**
  - **Insufficient spacing at shallow rock location:** All borings were spaced 300 feet apart except for B-25 and B-26, which were spaced 450 feet apart. The section between B-25 and B-26 encountered shallow rock, which impacted the overall construction schedule. The reason for spacing difference in this area was unknown.
  - **The boring at location B-26 did not reflect the final design changes:** B-26 was drilled at the preliminary alignment on the east side of Bond Mill Road during the planning phase, but the water main construction alignment was later moved to the west side of the road, likely due to utility conflicts with the gas and sewer mains. Historical plans show that Bond Mill Road was previously narrower, and existing utilities were installed within this original corridor, which is the current east side of the Bond Mill Rd. The updated water main alignment, where hard rock was encountered, extends beyond the original roadway area. As a result, the B-26 boring location does not accurately represent the subsurface conditions for the final design alignment.
  - **No intermediate borings taken:** Although B-23 and B-24 indicated bedrock at a depth of 15 feet, B-25 and B-26 encountered predominantly sandy residual soils and decomposed rock (weathered rock fragments) without evidence of intact bedrock within the 18 to 24 foot depth investigated. During construction, hard bedrock was found between borings B-25 and B-26. More closely spaced borings or geophysical surveys in this area could have detected the shallow rock outcrop within the geologically variable “Fall Line” zone. The geotechnical report noted that the project site sits in a transitional geology between Coastal Plain sands and hard Piedmont gneiss, resulting in abrupt changes in rock elevation. Therefore, the design-phase boring interval did not identify a local high point in the bedrock profile.



- **For unstable Sandy Soils near Bond Mill Elementary School,**
  - **Insufficient depth at Boring B-34 due to design changes:** Borings B-33, B-34, B-35, and B-36 were each spaced approximately 300 feet apart. B-35 boring depth stop at 25 feet, which covered the depth lowest point at the blow-off vault. However, the B-34 boring depth stop at 15 feet; however, the final water main design invert was approximately 1 foot lower than the B-34 boring depth.
  - **Challenges of alignment low point, utility clearance and unstable sand condition:** The intersection of Sherwood Avenue and Bond Mill Rd represents the lowest elevation point along Bond Mill Road between Bounds Avenue and Plowman Drive. As a result, the blow off vault was designed in this vicinity to align with the low point of the water main, facilitating pipeline drainage for future maintenance activities. The designer specified a water main depth of approximately 15 to 16 feet, likely to ensure sufficient vertical clearance from the parallel existing 8-inch sewer line. However, the combination of the required water main depth and the presence of wet running sand presented significant construction challenges.
  - **Lack of key warning of condition in construction documents:** The geotechnical report identified the soils here as part of the Coastal Plain alluvium – primarily loose to medium dense sand with a high water table. Boring B-33 (ground elev. 356) collapsed from groundwater inflow at only 8 feet down, indicating saturated conditions. B-35 similarly showed cave-in at 15.5 feet during drilling, with groundwater present at roughly Elev. 343 (9 feet below surface). These logs indicated “wet running sand” conditions. The geotechnical report recommended measures for such conditions: noting that excavations would extend below the water table and groundwater control (dewatering) would be necessary to maintain a dry, stable subgrade. It also advised that using tight excavation support systems (sheeting, shoring, etc.) where prolonged open cuts or adjacent structure protection would be needed. It would have been beneficial that the design plan noted key qualitative warnings about unstable soil and communicate them during the pre-bid conference or pre-construction meeting.
  - **Construction challenges with existing water valve leakage and wet weather conditions:** During construction, leakage from the nearby water valve and wet weather created challenges for dewatering and extended the timeline for deep trench excavation and pipe installation.

**Information not being updated due to prolonged project timeline and team changes:** WSSC Water reviewed the geotechnical reports and requested updates to boring logs to classify as bedrock in B-23 and B-24, and to note where rock excavation would be needed. Because EBA was no longer with WRA’s design team when comments were provided in 2018, the report and boring logs were not revised. WRA added a statement in the N&W addendum indicating rock excavation could be required between STA 0+00 and STA 69+00.

**Information not provided during bid phase:** The bid drawing general note referenced an “Appendix of the Contract Documents for the geotechnical report, The Contractor shall become familiar with the site and the subsurface conditions,” indicating that the design team planned to share the geotechnical investigation results with the Contractor. However, the EBA geotechnical report and N&W geotechnical addendum were not included in the original bid package; only the boring logs were present in the contract documents. These reports were also not provided to the Contractor at the start of construction or when WSSC Water was first



notified of rock presence in June 2022. The information was made available to the Contractor in 2023, after submission of an RFI.

**Inadequate provisions for rock:** The contract documents did not specify a rock excavation pay item or contingency because the presence of rock was not identified as a risk item during the design phase. The Contractor’s claim letter notes that the encountered rock differed from initial representations and exceeded reasonable pre-bid expectations. Alternative approaches could have included adding a hard rock removal line item or improving efforts to locate the rock high point during design, which may have allowed bidders to be informed about its possible presence.

**Lack of mandatory shoring requirements:** Despite the geotechnical report recommending that “excavation support systems be required to support the sides of excavations... to minimize impacts to roads and utilities”, the contract left the means and methods of trench support largely to the Contractor. The contractor drawing did include general note indicating excavation supporting and dewatering systems are the responsibility of the contractor. There was no specific instruction like “Use sheet piling or engineered shoring at Station 90+50–92+50 due to expected running sands.” As a result, the Contractor initially attempted conventional trench shoring and only switched to sheet piles reactively after failures occurred. This caused a delay and could have created hazardous conditions. A design identifying the need for more extensive trench support in this location (and allowed cost/time for it) would have been more appropriate.

#### **Areas for Improvement:**

- **Explicit communication of geotechnical risks:** All critical findings from the geotechnical reports—such as wet running sands, high groundwater, unstable soils, etc.—should be clearly communicated in design documents and emphasized during pre-bid meetings. This enables contractors to plan for suitable construction methods and safety provisions, minimizing reactive alterations and delays.
- **Timely and comprehensive data sharing:** Full geotechnical reports and addendums should be included in contract documents from the outset and shared with all stakeholders before construction begins. Delayed or incomplete dissemination of this data can create unnecessary uncertainty and risk.
- **Mandatory safety measures in design:** Design plans could require specific excavation support systems and contingency plans (such as shoring or dewatering) where adverse ground conditions are identified in the geotechnical investigation, rather than leaving these critical decisions solely to the Contractor.
- **Regular updates to reports and logs:** Geotechnical reports and boring logs should be updated throughout the project, especially if timelines are extended or teams change, to ensure all information remains current, accurate and actionable.
- **Conducting supplementary geotechnical investigations at key locations:** Conduct targeted geotechnical investigations in areas anticipated to pose construction challenges, where design changes occur between phases, or where previous data is insufficient. This proactive approach helps better identify ground conditions, such as unexpected rock formations or unstable soils, allowing for improved planning, risk management, and communication in design documents. WSSC Water 2017 design manual has added additional instructions related to the boring spacing and depth requirements which addresses some of the gaps as shown on this project. It is recommended the design team and constructability review to identify the potential geotechnical risks with the initial investigation and



follow the design guidelines for requesting and conducting supplementary geotechnical investigations at key locations.

#### 4.4. CONSTRUCTABILITY REVIEW & RISK ASSESSMENT

A comparison between the project design phase review and the construction execution identified several constructability challenges originating from the design and planning stages. WSSC Water confirmed that constructability site walks had been conducted multiple times during design with WRA during 70% and 90% design. Field review walk was also conducted with WTBC who provided the design service during construction in September 2020 before the Contractor was awarded to Contractor. As limited information was available to the audit team to review what had been discussed or captured during the constructability review process. Hence, the following section focuses on the major of constructability challenges and risks that appear not fully mitigated during the design phase, which lead to the construction schedule delay, or community complaints.

##### **RIGID LAY SCHEDULE WITH OWNER FURNISHED MATERIAL (LIMITED SEQUENCING FLEXIBILITY)**

**Background and constraints:** The project employed a rigid non-traditional “lay schedule” with owner furnished material approach, in which WSSC Water pre-ordered and supplied all major pipe materials and dictated the installation sequence. WSSC Water’s strategy was based on a strategic sourcing initiative, and the project was the second construction project for WSSC Water to consider this material furnishing approach. While intended to streamline procurement (via WSSC Water’s strategic sourcing contract with Core & Main/US Pipe) and ensure material availability and quality, this strategy significantly reduced field flexibility, especially this approach has encountered during the Covid-19 supply chain disruptions. There is no documentation indicating whether the lay schedule owner furnished approach was thoroughly evaluated in relation to the project's site-specific conditions, nor is there evidence of any associated risk assessments conducted during the design phase.

The schedule specified that all pipes would be laid in one direction without intermediate stops except at a couple planned vault tie-ins. There was an understanding that no permanent inline valves or breaks would be added beyond what was in the design because every joint was pre-accounted for in the lay schedule. This meant that if the crew encountered an unforeseen obstruction, the default response was to pause work until it was resolved rather than re-sequence around it (unless extra fittings were available to create a temporary break by skipping ahead). This fixed sequence limited the Contractor’s ability to adjust to unforeseen field conditions, such as rock formations, utility conflicts, or access constraints. The sequential dependencies also contributed to delay of pressure testing and permanent paving.

**Geotechnical Surprises (Rock):** When the Contractor encountered hard rock in Bond Mill Road (Stations 57+00 to 70+00) that was shallower and far more difficult to remove than anticipated, the pipeline installation ground to a halt. Under a more flexible approach, one might have rerouted or skipped ahead to work elsewhere. Additionally, the idea of introducing a temporary break in the line to come back to the rock later was complicated. The Contractor had requested WSSC Water procure extra sleeves and bends precisely to allow them to “isolate” problem areas (e.g., if rock or an obstacle was encountered, they could sleeve in a closure piece later and jump to another section). WSSC Water did agree to some of these contingency parts, but implementing this mid-project still required negotiation. Ultimately, because the rock was encountered in the middle of a run with no nearby junction to break at, work largely ceased when these issues were encountered until the rock or obstruction was removed. The lay schedule had contemplated linear progression with minimal



stoppages, so when confronted with a scenario that begged for re-sequencing (like skipping the rock zone and resuming further down), the team was hesitant and constrained by available materials.

**Utility Conflicts and Design Changes:** The project involved several design adjustments during construction. Each redesign impacted the lay schedule.

- For instance, a conflict with an uncharted gas line required a slight realignment of the 48-inch main near station 125+00. Because the pipe lengths were pre-set by the lay schedule, this misalignment meant the pre-cut pieces no longer fit exactly.
- By late 2023, it was discovered that the remaining pre-delivered pipes wouldn't "close" the gap correctly at the tie-in point.
- On August 6, 2024, a meeting with WSSC Water, the pipe supplier, and the Contractor concluded that four large pipe sections (30-inch and 36-inch diameter pieces used in reducers) had to be field-cut and re-beveled to achieve proper fit-up.

**Sequential dependencies:** The lay schedule approach meant certain tasks could not proceed until prior ones were 100% complete, since the pipeline had few intermediate shutoff points. A striking example is pressure testing and final connections. There was no intermediate valves designed except those two near the facilities, due to this pipeline is a raw water main, which is treated as force main, not water main. Pressure testing and final connections could only occur after the entire main was installed, preventing sectional testing and paving. This led to prolonged temporary pavement patches, with permanent restoration deferred until project completion. While sectional testing wasn't explicitly prohibited, the project setup discouraged it. Similarly, construction near Bond Mill Elementary School continued during active school days due to delays, despite the design calling for work only during summer recess, because the lay schedule without intermediate breaks made isolating that zone challenging.

## **PAVEMENT RESTORATION CONSIDERATION**

One of the major community complaints about the construction project was related to the temporary patching condition of the roadway. Reviewing the construction package, it was found that the contractor's approach to permanent paving directly conflicted with WSSC Water restoration specifications. Standard specification **Section 02950** mandates that a temporary trench patch be replaced with permanent pavement within **60 days**. Yet the Contractor's baseline schedule –deferred all permanent road restoration until the end of the project. In practice, this meant temporary patches remained far longer than allowed.

The design plan did not specify segmenting the project or installing intermediate valves or sleeves to enable phased testing/paving ( due to a raw water main design ) – which could have allowed sections of road to be permanently restored earlier. Although the specification required completing 40% of permanent patching before starting each new mile of the project, the contract drawings only provided a general construction sequence that was oversimplistic and did not specify the necessary details for phased testing or paving. The lay schedule was one of the contributing factors of the missing phased testing or paving as discussed earlier. The contractor's baseline schedule appeared to follow the design plans general sequence of construction, indicating pressure-testing of the entire new main as one, hence final paving was postponed to avoid the need to cut the new asphalt and re-pave if a leak was found. Although the selection of "means and methods" is technically the Contractor's responsibility, the contract documents did not address or mitigate the risk associated with allowing temporary patches to remain beyond the time limits permitted by the specification.



## OTHER SITE CHALLENGES

In addition to the constructability and risk discussed above, additional challenges were experienced during the construction that demonstrate the need for additional constructability review and enhanced planning coordination.

- **Shutdowns and tie-in coordination challenges:** Resulted due to lack of a detailed sequence of construction specified on the contract documents.
- **Material Delivery Strategy & storage challenges:** No pre-plan for on-site material management was outlined when the owner-furnished approach was chosen. In this project, bulk delivery saved lead time and cost related to Covid-19 supply chain shortage concern, but introduced laydown and logistics challenges that impacted productivity. More details will be discussed later in section “Material Procurement”.
- **Safety and Environmental Risk factors**
  - Deep trench excavations in narrow rights-of-way along parts of the alignment.
  - Work within active traffic zones without full closures.
  - Proximity to overhead power lines and buried utilities.
- **Work hour constraints and traffic management**
  - Prince George’s County imposed strict working hours (9:00 AM to 3:30 PM), which limited productivity and complicated sequencing.
- **Community and stakeholder management risks**
  - The design phase did not include a comprehensive community impact mitigation plan, especially regarding the community request on construction time to be outside of the school time to accommodate the Bond Mill Road Elementary School.

**Areas for Improvement:** WSP recommends starting proactive risk management early, from planning through construction, with ongoing tracking. Section 6.8 details sample risks and mitigation strategies identified during design and construction audits.

This includes integrating risk management with the WSSC Water project team through project lifecycle, especially for large complex projects.

- Evaluating construction flexibility during design and incorporate to contract document
- Planning for phased water main installation work and pavement restoration
- Including detailed sequencing and safety measures in contract documents
- Coordinating closely with community stakeholders to reduce disruption

## 4.5. PERMITS

The project required multiple permits from state and county agencies, as well as internal WSSC Water approvals, prior to and during construction. Key permits, approvals and extensions are summarized in Table 4-2. The following section captured the major permitting process and renewal phase. Overall, the project team secured the necessary permits and provided renewal of the required permits.



**Prince George's County Special Utility Permit for work in public roadways:** This was a critical-path approval, requiring multiple plan reviews. The utility permit package bundled several plan approvals – including traffic control, utility sections, pavement restoration, etc. and the design team had addressed six rounds of comments from DPIE before the permit was granted. Several extensions of the permit were requested and approved, as noted in Table 4.3. During construction, an elected official requested a bike lane in March 2021. WSSC Water then reached an agreement with the County for pavement marking on Bond Mill Road, as covered under DPIE permits 38816-2016 (Patuxent project) and 1039-2018 (Fitzpatrick WMR). The plan was approved in August 2021. During 2025, as part of the West Laurel Task Force coordination, WSSC Water worked with the community and elected officials to consider additional improvements requested by the community, such as additional signs, modification of pavement marking, raised crosswalk etc. The redline of this plan was reviewed by Prince George's County DPW&T and approved during an on-site meeting.

**MDE & USACE Wetlands/Waterways Permit:** This is a joint state/federal application (JPA) for nontidal wetland and waterway impacts. The design team performed the natural resources assessment and submitted it to MDE in 2013. The location of the wetland and waterway impact was only located near the rehabilitation of a 7-foot by 11-foot Culvert. The initial approval permit and later modification authorized the project for construction in the nontidal wetland, buffer and waterway. The permit expired on May 19, 2024. Based on the construction activities, all the culvert activities were finished in 2021, within the permit expiration date.

**MDE Water Construction Permit:** A permit was issued by the MDE on June 20, 2019 authorizing water main construction. The permit remained valid for up to five years from the start of construction.

**MD-DNR Forest Conservation Plan (FCP):** The project team submitted a forest conservation plan to the DNR in 2014, which covered the forest impacts within the Limit of Disturbance shown on the plans. After review and public notice, the plan was approved by DNR on August 18, 2016. Since replanting was not possible over the installed underground pipeline, woodland mitigation credits were bought from an approved off-site Woodland Conservation Bank. The purchase of 11.7 acres of woodland conservation credit satisfies (at the required 2:1 ratio) the forest conservation requirement of 5.85 acres as documented on the Forest Conservation Worksheet and meets the forest conservation requirement.

**Tree Care Maintenance Authorization Permit (Roadside Tree Permit):** Initially issued on November 17, 2014, by the Maryland DNR through public agency (WSSC Water) roadside tree care maintenance authorized the removal and care of roadside trees. This permit authorizes tree limb & root pruning of trees within the public road right of way (ROW) as well as removals that are itemized, and planting of replacement trees. The permit was revised or extended nine (9) times since its initial approval. The latest approved permit allowed the removal of 21 trees (with replanting of 21 and pruning of 50) and carried out conditions to minimize clearing impacts. The permit was extended and updated based on field changes regularly to meet the construction schedule.

**Erosion & Sediment Control (E&S) Approval:** WSSC Water (under delegated authority from MDE) approved the project's Erosion & Sediment Control plan. An E&S permit for underground utility construction was executed on December 7, 2020. This permit allowed clearing/grading and installation activities to commence, valid for a period of two years.

**Stormwater Management Waiver:** During the design phase (early 2010s), WSSC Water and its consultants identified that the project would disturb a long but narrow corridor mostly within the existing roadway right-of-way and WSSC Water easement. In June 2014, WSSC Water consultant AMT (A. Morton Thomas and Associates, Inc.) prepared a SWM report and submitted the project's Erosion & Sediment Control plan,



Stormwater Management Report, and SWM Waiver Request to MDE for review pursuant to Section 3.3.A of Maryland Stormwater Management and Erosion & Sediment Control Guidelines for State and Federal Projects. Because the pipeline project would be underground, no impervious area would be added, and no hydrological changes were expected. No direct record regarding SWM waiver approval from MDE was found. However, email communications indicate that MDE received the package and deferred to WSSC Water for E&S plan review, in accordance with the Memorandum of Understanding (MOU) between MDE and WSSC Water for pipeline projects.

According to Subtitle 32-126 (Water Resources Protection and Grading Code) of the County Code of Prince George's County, a grading permit and stormwater management approval are required for any site development or grading of land. However, the WSSC Water projects in public rights-of-way and WSSC easements are exempt from obtaining a grading permit from the county per Section 32-127(5). Based on that permit exemption, stormwater management was deemed not required by the County for this project.



Table 4-2 Key Permits, Approvals, and Extensions

Permit Type	Issuing Agency	Permit No.	Application Date	Approval Date	Initial Expiration	Extensions / Renewals	WSP Review Remark
<b>Special Utility Work Permit</b> <i>(utility construction in county right-of-way)</i>  <b>Maintenance of Traffic (MOT)</b>  <b>Pavement Marking</b>	Prince George's County Dept. of Permitting, Inspections & Enforcement (DPIE)	#38838-2016	Apr 16, 2018	May 22, 2019	May 22, 2020	<b>1st ext:</b> issued May 22, 2020; exp. May 22, 2021. <b>2nd ext:</b> issued May 24, 2021; exp. May 24, 2022. <b>3rd ext:</b> issued April 20, 2022; exp. Sep 24, 2023 (permit kept active) <b>4th ext:</b> issued Nov. 27, 2023; exp. Sep 24, 2024 (extended to align with project delays) <b>5th ext:</b> issued Aug. 26, 2024; exp. Sep 24, 2025 (extended to align with project delays)	Documentation shown initial coordination with DPIE started in 2014 under 42576-2014
<b>Maryland MDE Water Construction Permit</b> <i>(required for large water mains; State environmental permit)</i>	Maryland Dept. of the Environment MDE (Water Supply Program)	#19-15-1075	May 26, 2015 (design submittal)	June 20, 2019	June 20, 2022	No available record. Permit indicated, if not specially extended, will remain valid for the remainder of construction for a period of up to five years from the start of construction.	
<b>Joint Wetlands &amp; Waterways Permit</b> <i>(Nontidal Wetlands and Waterways Authorization)</i>	Maryland Dept. of the Environment (Water & Science Admin.) and U.S. Army Corps of Engineers (USACE) (MD State Programmatic General Permit)	MDE Auth. #13-NT-0460 USACE #201361989	Nov 20, 2013	Apr 28, 2017 (MDE preliminary auth); Final Issue: Jul 09, 2019 (joint permit)	Sept 30, 2021	MDE/USACE extended authorization to May 19, 2024. Based on the construction activities, all the culvert activities were finished in 2021, within the permit expiration date.	
<b>FCP Approval</b>	Maryland DNR	FCP #S15-03	2014	Aug 18, 2016	Aug 18, 2021	In general, approval remains valid for the project provided that no changes have been made from the original application.	WSSC Water purchased an off-site Woodland Conservation Bank as part of the forest mitigation for the Tree impact of the project.
<b>Tree Care Maintenance Authorization</b> <i>(roadside tree removal permit; Forest Conservation Act compliance)</i>	DNR – Forest Service (via WSSC Water Environmental)	#2014-0410-141	2014	Nov 17, 2014	1-year validity	The permit was revised or extended nine (9) times since its initial approval. Since construction started, the following extension or revision has been issued:  <b>7<sup>th</sup> renewal or revision:</b> Issued Mar 05, 2021 (extended 1 year to 3/5/2022) <b>8<sup>th</sup> renewal or revision:</b> Issued Oct 07, 2022 (extended to 10/7/2023) <b>9<sup>th</sup> renewal or revision:</b> Issued Jul 19, 2024 (extended to 7/19/2025)	
<b>WSSC Water Erosion &amp; Sediment Control Permit</b>	WSSC Water (E&S Office, delegated by MDE)	#2011163P	Dec 7, 2020	Dec 10, 2020	Dec 10, 2022 (2-year validity)		
<b>Storm Water Management Waiver</b>	Maryland Dept. of the Environment MDE		June 2014	No available record	No available record	No available record	The email correspondence indicated MDE received the package and deferred to WSSC Water for E&S plan review based on MOU between MDE/WSSC Water on pipeline projects.



## 5. PROCUREMENT AND CONTRACTING

### 5.1. PROCUREMENT PACKAGE REVIEW

The procurement package provided by WSSC Water encompassed the contract, four contract addenda, design plans, as-built information, special conditions, scope of work, a key personnel experience summary form and bid forms. There are four addendums to the contract, which outline changes to specifications and drawings in addition to questions regarding details, specifications, scope, materials and submittal requirements asked by bidders. The first two addenda include minor updates to specifications and details, and the first three include questions from bidders and responses by WSSC Water, including a question regarding the trench detail to use on county roads, in which WSSC Water responds that the county detail applies to county roads. The fourth and final addendum dated July 23, 2020 only includes one clarification from a previous addendum regarding slope stabilization.

**Key Observations:** It was observed that multiple supporting documents were omitted from the procurement process, including all reports and two geotechnical studies. Additionally, plumbing cards were not included in the procurement package, but provided as RFI response when the contractor requested. Based on the interview with the WSSC Water project team and a review of the submittal records, all design phase reports were uploaded to Trimble/E-builder as part of the RTA package; however, these documents were not included in the bid package during procurement.

#### **Areas for Improvement:**

- Ensure all supporting technical documents—especially geotechnical reports—are included in the procurement package to avoid gaps in contractor understanding and bid accuracy.
- Contract document should include language for Contractors to request plumbing card information and reduce field conflicts during construction.

### 5.2. VENDOR SELECTION

For WSSC Water Contract BF1582E91 (Patuxent 48-inch Raw Water Pipeline Phase I & II), the solicitation was conducted as a multi-step Invitation for Bids (IFB) in mid-2020. This two-phase competitive process involved an initial qualification step followed by price bidding. Nine contractors submitted bids by the July 30, 2020 closing date. After bid opening and evaluation, two bids were deemed non-responsive (likely due to incomplete forms or not meeting requirements), leaving seven compliant bids for consideration.

The bid prices ranged from approximately \$8.4 million up to roughly \$12–13 million. The lowest bid came in at \$8,393,777 and was offered by Allan Myers MD, Inc., a large regional heavy-construction contractor. This bid was significantly below the engineer's estimate of about \$10.4 million. Other bids clustered higher, many near or above the engineer's estimate – indicating that Allan Myers's bid undercut most competitors by on the order of \$1–\$3+ million. The highest bid among the responsive contenders was on the order of the low-teens millions.

Following standard procedure for a construction IFB, WSSC Water evaluated all bids for responsiveness (complete, in compliance with the solicitation) and bidder responsibility (having the capacity and qualifications to perform the work). The contract was awarded Allan Myers MD, Inc., for \$8,393,777. The WSSC Water October 21, 2020 formally approved this award, noting the “Basis of Award: lowest, most responsible and responsive



bidder”. Allan Myers met all solicitation requirements and had a satisfactory past performance record with WSSC Water. The Notice of Award was issued in September 2020 and Notice to Proceed on December 7, 2020.

### 5.3. MATERIAL PROCUREMENT

This project had to follow a Lay Schedule that was approved on December 24, 2020, and Material were procured through WSSC Water from Core & Main/ US Pipe, therefore the following challenges were encountered during construction.

#### **SUPPLY CHAIN IMPACT ON THE MATERIAL PROCUREMENT PLANNING**

**Decision to Deliver All Remaining Materials:** In 2022, global supply-chain disruptions and surging material costs (especially for ductile iron) put pressure on the project’s procurement plan. Fearing potential shortages or price escalations if deliveries were delayed, WSSC Water made a pivotal decision: ship all remaining pipeline materials to the site in one massive batch, well ahead of the original schedule.

Internal correspondence indicates that on May 5, 2022, Core & Main pushed to schedule these deliveries, citing concerns about manufacturing timelines and costs. Allan Myers initially objected – warning there was not enough, and it was “well in advance of the project’s need” – but WSSC Water ultimately authorized Core & Main to proceed with the bulk delivery. Essentially, the entire remaining inventory for the 2.5-mile pipeline was delivered.

This impacted the project primarily in two ways:

- Allen Myer had to rent a BGE ROW property to store all the materials.
- The bulk delivery of material was not stored or organized in correspondence with the Lay Schedule; therefore, it impacted the production rate of contractor while searching for required material in stock, per Allen Myers. Thereafter, Allen Myers submitted a change order for lost production (PCO #16).

#### **APPROVAL AND PROCUREMENT:**

If design changes or field conditions required fittings, pipes, or accessories that were not initially planned or delivered, a MAC (Material Addition to Contract) was required by WSSC Water. There were 15 MAC requests throughout the project as documented.

**Schedule Impact:** The handling of MAC 14 had a relatively minor impact on the schedule, primarily manifesting as a procurement lead-time issue. By early May 2024, when WSSC Water issued the Purchase Order (PO), the project was slightly behind the (already extended) schedule but nearing substantial completion. Any delay in obtaining MAC 14 items could have potentially delay final tie-in work and testing; however, WSSC Water moved promptly once the need was identified.

One important aspect to note in how WSSC Water treated MAC 14 with was the alternate approach of procuring the materials directly from Core & Main via PO.

Another example of its impact to schedule is revisions to lay schedule for Sta 48+29 to 50+27 by November 1, 2021.

US Pipe struggled to get a PO from WSSC Water, they informed WSSC Water via email the November 1, 2021 deadline was not achievable and suggested the Contractor field wrap the pipes with corrosion prevention



wrap instead of coating at the Liberty shop. WSP does not have enough documentation to verify if the pipes/fittings were delivered coated or were wrapped onsite between STA 48+29 to 50+27.

**Timely Delivery and Storage:** Importance of timely delivery and proper storage of materials were emphasized during the pre-construction meeting. Lead time for pipe and fitting delivery was noted to be initially 10 to 12 weeks. Additional storage at the project site was needed for specialty and long lead-time materials.

WSSC Water's on-site inspector had to inspect materials at the time of delivery and track the large inventory over a long time for defects such as pipe coatings. Normally, materials arrive and are installed within weeks; here, some pipes were stockpiled for over 2+ years. The inspector had to periodically re-check the condition of stored materials (for coating damage, etc.)

The audit team does not have access to the documents that demonstrate the consistency of these inspections; however, the following examples from email correspondence indicate situations where these inspections were beneficial:

During early 2022 inventory, the team noticed a few 48-inch pipe pieces had slight coating damage from transport. Core & Main promptly sent a coating repair kit and those pipes were restored months before they were installed.

Another example is an initially supplied 36-inch sleeve was found to be the wrong diameter for an existing 42-inch main connection (discovered via RFI-26). Because this was identified while the piece was sitting in the yard (and not last-minute during a shutdown), WSSC Water had time to order the correct fitting. It arrived in time for the tie-in averting a potential delay.

## **MATERIAL DELIVERY SEQUENCE AND CHALLENGES**

Materials were to be delivered in sequence and distributed on site where possible. However, materials could not be stored along Bond Mill Road in residential areas. The Contractor required space to stockpile materials therefore the Contractor had to lease a BGE right-of-way parcel to use as the laydown yard. Because of the method used for delivery of materials, the yard became overcrowded and the materials were not organized according to the lay schedule, making retrieval inefficient. Crews had to locate and reorganize materials within the yard to get access to needed materials resulting in additional labor and equipment costs, ultimately leading to a loss in productivity. Other challenges associated with material storage include:

- Long-term storage required ongoing inspection and documentation.
- Some items were misplaced or buried under other stocks, complicating retrieval.

## **5.4. DESIGN ENGINEERING SUPPORT**

WSSC Water engaged WTBC to provide design services during construction after the Basic Order Agreement (BOA) with the original design engineer, WRA, expired and WRA was no longer able to participate in the project. The lack of project continuity background information such as rock investigations, lay schedule, utility destination etc. may lead to extra efforts for the different design team to address the field change conditions.



## 6. CONSTRUCTION EXECUTION

### 6.1. DOCUMENTATION REVIEW

As mentioned in our methodology, the audit team has reviewed and examined the following Construction Phase documents in Table 6-2 and summarized them with the documentation performance indicators.

### 6.2. REQUEST FOR INFORMATION AND THEIR IMPACT:

The project generated 27 RFIs, reflecting a range of field coordination needs, design clarifications, and unforeseen site conditions and utility conflicts. These RFIs were instrumental in resolving constructability challenges and maintaining project momentum. WSP’s remarks provide additional insight into the technical and procedural context of each issue. A log of all 27 RFIs can be found in Table 6-3.

#### Key Observations:

- Utility Conflicts and Documentation Gaps**  
 RFIs #1, #2, #4, #5, #6, #16, #17, and #18 addressed conflicts with gas mains, sewer laterals, and undocumented utilities. WSP noted that plumbing cards (RFI #2) lacked sufficient SHC data, and several RFIs (e.g., #4, #18) required field verification due to incomplete records.

Table 6-1 lists the common types of conflicts encountered during the project construction.

*Table 6-1 Types of Conflicts Encountered During Construction*

Conflict Type	Underlying Cause	Impact on Project
<b>Sewer Laterals (SHCs)</b>	Unmapped or mislocated house sewer connections due to outdated records	Multiple major rework and delays; Total ~\$307k change orders; ~51 days delay
<b>Gas Mains</b>	Incorrect utility data or new installations post-design	Work with Design modifications; ~\$93k; ~8 days delay
<b>Water House Connections (WHC)</b>	Not all identified or correctly marked by Miss Utility	Repairs/Clean up: ~22K, ~4 days
<b>Storm Drain/Other</b>	Conflicts with drainage structures or uncharted small mains	Cost Adjustment ~21k; no significant delay
<b>Communication Cables</b>	Unrecorded or unexpected telecom lines	Negligible impact; inactive lines; prompt restoration; no delay



Table 6-2 Overall Project Documentation Key Performance Indicators

Document Type	Brief Summary	Quality	Risk Identification	Approval Process	Timeliness	Accessible to field Inspectors	WSP Remarks
<b>Plans/Spec</b>	Set of Conformed Plans and Specifications were delivered to the Contractor for Construction	Yes	Yes	Yes	Yes	Unknown	All known conflicts/ risks were noted in the Plans and Specifications
<b>Meeting Minutes</b>	Pre-construction meeting was conducted on December 4 <sup>th</sup> , 2020, from 10am-12pm.	Yes	Yes	Yes	Yes	N/A	All potential risk and standard requirements were discussed in this meeting, Meeting notes were populated. No discussion around preconstruction submittals.
<b>Pre-construction Submittals</b>	E.g., Test pit stakeouts, Safety Plan, Dewatering Plan, Quality Control Plan, Pressure testing plan, tie-in procedures, Schedule of Values.	No	No	No	No	No	The Contractor only submitted their Baseline Schedule, and it looks like Schedule of Value (SOV) was submitted as well, WSP has no access to it.
<b>RFIs</b>	In total there were 27 RFIs in this project, where mostly in all of them the Contractor did provide a suggestion to the Client.	Yes	Yes	Yes	No	Unknown	Based on the RFI log, responses to all RFIs were delayed from 8days to 1042 days (Long delayed could be due to RFI not officially marked close in the system).
<b>Submittals</b>	In total we have record of responses to 60 submittals, which includes multiple schedule updates and other technical submittals (Borrow Material, Pipe, fittings, access hatches, etc.)	N/A	N/A	Yes	N/A	Unknown	WSP requested submittals log from WSSC Water but the information was not available. WSP created a summary log based on available information in Appendix B.5.
<b>Monthly Progress Meetings</b>	It appears during 2023 and 2024 more periodic progress meetings were conducted, we have no record of meetings conducted on a regular basis.	Yes	Yes	N/A	No	Unknown	Meetings were not conducted on a regular monthly basis.
<b>Daily Inspection Reports</b>	Fairly consistently from March 1, 2021, DIRs were created for the project.	Not always	No	Yes	Yes	Yes	There are times when DIRs were not created, missing information (e.g., crew, equipment, activity description).
<b>QC Reports (Compaction Test)</b>	BOTA Consulting Engineers, Inc.(BCE) was hired by AM to perform dry density test (compaction test) per report from 05/20/21.	No	No	Yes	No	Yes	There are multiple flaws in BCE reports: (delayed submission, compaction lifts are 12in, material is not consistently GAB under roadway, in some cases not enough test per lift were conducted for depth of the pipe)
<b>QA Reports</b>	Per spec section 02315 WSSC Water shall have spot checked Compaction of backfills. WSP's QA Team later provided us with compaction QA Reports ( CIRT and INCRP) indicating periodic spot check of compaction and backfill materials.	No	Yes	Yes	Not always	No	WSP could not independently verify if these QA inspection reports (CIRT and INCRP) were sent to the Contractor for rectification as they became available. WSP evaluated these reports available to us and compared them with the BCE Reports, and DIRs found discrepancies and irregularities list in Section 7.6 of this report.
<b>Schedule Updates</b>	The Contractor regularly provided WSSC Water with monthly updates, by providing a detailed narrative, only in some instances the submittals were reviewed as "FIO" or "Approved". WSP could not find any documentation showing a response sheet for Schedule Updates.	Yes	Yes	Occasionally	Yes	N/A	It appears that WSSC Water did not have a project control team member to technically review and respond to project schedule updates.



- **Vault and Alignment Adjustments**  
RFIs #8, #9, #13, and #14 focused on Vault G and Vault H constructability. WSP confirmed that redlines provided for Vault H led to lay schedule changes and that rock excavation at Vault G (RFI #9) was treated as non-compensable.
- **Corrosion Protection and Electrical Hazards**  
RFIs #12 and #21 introduced cathodic protection and AC mitigation measures. WSP acknowledged additional work such as ground mats and anodes, though noted RFI #21 remained open.
- **Design Clarifications and Tie-In Coordination**  
RFIs #10, #11, #20, #22, #24, #26, and #27 clarified connection details, pressure requirements, and installation methods. WSP highlighted that some RFIs (e.g., #11, #22) lacked formal responses and others (e.g., #24, #26) were not closed in eBuilder.
- **Schedule and Cost Impacts**  
17 RFIs resulted in design changes, and at least 14 had cost implications. WSP tracked schedule impacts and noted that several RFIs remained open or pending closure in eBuilder, including high-impact items like RFI #14 (Vault H) and RFI #17 (BGE gas main).

#### **Summary Metrics:**

- RFIs with Design Changes: 17
- RFIs with Cost Impact: 14
- RFIs with Time Schedule Impact: 12
- RFIs Not Closed in eBuilder: 13
- Longest Outstanding RFI: RFI #14 – 1,043 days late (not closed in system)
- Most Critical Utility Conflict: RFI #17 – Unmapped 6" BGE gas main (resolved via profile change)

#### **WSP Commentary Highlights:**

- Plumbing cards show WHC connection details, SHC information were very limited. (RFI #2)
- Redlines for Vault H resulted in lay schedule changes. (RFI #14)
- Test pitting was paid under contingency items. (RFI #6)
- Trench detail was provided by email. (RFI #7)
- No official response was provided to the Contractor RFI regarding hydrostatic pressure test limits. . (RFI #11)
- It appears that Multiple RFIs were not officially closed on eBuilder.

#### **Areas for Improvement:**

Based on WSP's findings and the RFI tracking data, the following improvements are beneficial for future projects:

- **Improve Utility Record Accuracy**
  - Digitize and validate plumbing cards and SHC data prior to construction.
  - Enforce Specification Section 01110.1.8.D. to receive a stakeout of test pits with actual utility locations and elevations prior to construction begins, for Engineer review and approval.
  - Require updated utility surveys during design phase, especially for older corridors.



- **Strengthen RFI Closure Protocols**
  - Implement a formal RFI closure checklist in eBuilder to ensure all RFIs are marked resolved once completed.
  - WSSC Water's standard practice should be for the WSSC Water Construction Manager to control the RFI process, not the Contractor as we observed for this project.



Table 6-3 RFI Log - BF1582E91 Patuxent Raw Water Pipeline

RFI #	Subject	Summary of Topic/Issue	Time Impact	Cost Impact	Status	Days Late	WSP Remark
1	Gas House Connection Information	Request for information on an existing gas service connection (location/depth) near the new pipeline.	Not Noted	Not Noted	Closed, Contractor to coordinate with BGE, test pitting required	105	Under Addenda #2, WSSC Water mentioned 14x GHC to be relocated without providing locations on the drawings, it is not clear if Contractor test pitted this prior construction.
2	Sewer House Connections	Identifying known sewer laterals along the route and asking if they will conflict with the new 48"-inch main.	Not Noted	Not Noted	Closed (WSSC Water provided info)	8	Plumbing cards were provided to the Contractor. However, plumbing cards show WHC connection details, SHC information very limited. Contractor requested information for SHC.
3	Phase 2 Stakeout Data	Request for survey stakeout data for Phase II portion of the pipeline (layout verification).	Not Noted	Not Noted	Closed (Data provided) Redline Plans were provided.	99	
4	Sewer House Connections (follow-up)	Follow-up on RFI #2 – further details or additional sewer laterals potentially in conflict with the new main.	Not Noted	Not Noted	Closed (Addressed; no WSSC Water response)	93	Field verification, plumbing cards, but as mentioned no valuable info regarding SHC is on the plumbing cards.
5	3-inch BGE Gas Main – Conflict at Station 42+20	Conflict with an existing 3"-inch BGE gas main at station 42+20; asking for resolution (lowering or re-routing).	Yes – CO#1	Yes – CO#1	Open (No formal answer)	133	
6	Unanticipated Utilities Found @ Sta. 7+00	Unexpected utility lines encountered around station 7+00; seeking guidance on how to proceed safely.	Not Noted	Not Noted	Closed (Resolved in field) Test pitting, field coordination	25	Test pitting was paid under contingency items.
7	48-inch Patuxent Raw Water – 48-inch DIP Trench Detail	Clarification on trench detail for 48" ductile iron pipe (bedding, backfill, etc.).	Not Noted	Not Noted	Open (No final response logged)	801	Trench Detail was provided by an Email.
8	48-inch Patuxent Raw Water – Vault G	Issue with Vault G (e.g., grade discrepancy at Access Vault G) requiring design adjustment.	Yes- CO#1	Yes – CO #1	Closed (Change Order issued)	86	
9	48" Patuxent Raw Water – Rock	Notifying that hard rock was encountered at Vault G- along the alignment and asking how to proceed (differing condition).	Not Noted	Not Noted	Denied (Treated as no extra per contract)	73	
10	30-inch and 36-inch PCCP Flange Adapters	Inquiry about special adapters needed to connect to 30"-inch and 36-inch PCCP (concrete pressure) pipes.	Not Noted	Not Noted	Closed – (WSSC Water provide the limited available info)	46	
11	Test Pressure – Water Main vs. Concrete Thrust Blocks	Clarification on test pressure requirements given the presence of concrete thrust blocks.	Not Noted	Not Noted	Closed– WSSC Water Acknowledged the RFI, no official response.	46	Even though the Contractor was asking a question regarding hydrostatic pressure test limits, but no official response was provided
12	8 & 12-inch Insulating Flange Joints / Test Station Needs	Question on adding insulating flange joints and test stations for cathodic protection on 8"-inch/12-inch" lines.	Yes	Yes	Closed – PCO to add Cathodic Protection.	10	
13	12-inch Watermain Relocation (approx. Sta. 126+50)	Inquiry about rerouting the new 12"-inch water distribution main where an existing electrical vault interfered with the planned 12" watermain relocation	Yes – PCO #09	Yes	Closed – WSSC Water reviewed redlines provided by the Contractor.	48	
14	Issues/Concerns at Proposed Receiving Vault H	Concerns regarding layout/elevation of Receiving Vault H (pig receiver vault) and associated fittings.	Not Noted	Yes.	Closed – (Answered, pending close)	1,043	Provided redlines for Vault – H. Which resulted in Lay Schedule Changes



RFI #	Subject	Summary of Topic/Issue	Time Impact	Cost Impact	Status	Days Late	WSP Remark
15	Existing 8-inch Tee and Valve at Bounds Ave – Relocation @ Sta. 1+25	Plan to relocate an existing 8" tee and valve on Bounds Avenue that conflicts with the new main.	Yes	Yes	Open – (Answered, pending close)	13	It looks like this RFI was not closed on Trimble/E-Builder.
16	16601 Supplee Lane – SHC Damage – Repair Options	Sewer lateral at 16601 Supplee Lane was damaged by construction; asking for design of a repair/relocation.	Yes – PCO #08	Yes – PCO #08	Open – WSSC Water internal.	60	It looks like this RFI was not closed on Trimble/E-Builder.
17	Discovered BGE Gas Main @ Sta. 111+00 – 119+00	Unanticipated 6-inch BGE gas main found crossing the alignment; seeking resolution (reroute or profile change).	Yes – PCO #11	Yes – PCO #11	Closed under PCO #11. Redlines provided by WSSC Water.	1,019	It appears that it was not officially closed on Trimble/E-Builder.
18	Potential Sanitary House Connection Conflicts	Identifying sewer lateral (house connection) crossings that might conflict with the 48-inch main.	Yes- CO#2	Yes – CO#2	Open – Contractor review	1,013	It appears that it was not officially closed on Trimble/E-Builder.
19	Lay Schedule Revisions	Proposed changes to the pipe installation sequence ("lay schedule") provided by WSSC Water.	Not Noted	Yes – Added Cost to WSSC Water by PO to C&M.	Closed – Revisions provided to pipe supplier	995	It appears that it was not officially closed on Trimble/E-Builder.
20	Water Main Tie-in Sleeves	Clarification on sleeves or fittings needed for connecting the new main to existing mains.	Yes	Yes	Open – Additional Sleeves Approved.	688	Not closed on Trimble/E-Builder
21	Pipeline Electrical Charge/Current @ Sta. 112+08 (BGE ROW)	Concern about stray electrical current near station 112+08 (within a BGE power line right-of-way).	Yes	Yes	Open – WSSC Water to respond Additional work (ground mats, anodes)	652	Not closed on Trimble/E-Builder
22	Working Pressure of the Existing Water Mains	Asking for the operating pressures of existing mains (for testing or tie-in planning).	Not Noted	Not Noted	Open – WSSC Water to respond	627	Not closed on Trimble/E-Builder
23	Documentation Request	Allen Myer's request for specific project documentation existing geotechnical reports, boring logs, and other project records from prior WSSC Water projects along Bond Mill Road.	Not Noted	Not Noted	Open – WSSC Water Provided the information available to them.	610	Not closed on Trimble/E-Builder
24	Restraint Issue @ Sta. 0+00	Question on thrust restraint at the pipeline's start (station 0+00) and need for additional measures.	Yes	Yes	Open – (MJ fitting) accepted, extra work	12	Not closed on Trimble/E-Builder
25	24-inch Storm Drain Conflict @ Sta. 1+25	Notifying a conflict with a 24-inch storm drain at station 1+25 along the pipeline route.	Yes	Yes	Open – Two MJ bends, new pipe required	217	
26	Transition Couplings at Ex. 42-inch Steel Pipe	Inquiry about proper transition couplings for tie-in to an existing 42-inch steel pipe main.	Yes	Yes	Open – Restrained coupling confirmed	204	Has not been closed on Trimble/E-Builder
27	Installation of 1-inch PVC Chemical Solution Corporations	Clarification on installing 1-inch chemical feed line taps (corporation stops) on the pipeline.	Yes	Yes	Open – Manifold solution due to space, accepted.	103	



### 6.3. SUBMITTALS LOG AND THEIR TIMELINESS REVIEW:

WSP was not provided with a formal Submittal Log or granted access to the original submittals throughout this review. Utilizing the available review responses provided, the audit team developed a submittal log and performed a comprehensive evaluation of the timeliness, completeness, and quality of the reviews. The submittal log developed by the audit team can be found in Appendix B.5.

#### Submittal Log Summary

- Total Submittals Logged: 72
- Approved: 17
- Approved as Noted: 7
- For Information Only (FIO): 20
- Rejected: 1
- Revise & Resubmit: 13

#### Review Timeliness

- Delayed Responses: 16 submittals were reviewed after their respective process due dates.
- Delay Range: 3 to 228 days
- Observation: All delayed submittals were related to schedule updates. These delays may have contributed to the project schedule slippage.

#### Review Completeness and Quality

- Submittal #05500-02 underwent three revisions before receiving approval, indicating potential issues with initial completeness or clarity.
- Submittal #02510-01-Test did not receive a resubmittal, leaving its status unresolved.
- Schedule Submittals were predominantly marked “For Information Only” and reviewed late. This suggests that project progress was not tightly monitored and that potential delays were not proactively identified.

#### Preconstruction Submittals:

Based on the documents available to WSP, there is no indication that preconstruction submittals were submitted or reviewed.

#### Conclusion

The submittal review process, as evaluated based on available records, reflects inconsistencies in timeliness and completeness. These gaps may have impacted project oversight and schedule control.

#### Areas for Improvement

- Require submission and review of preconstruction documents (e.g., baseline schedule, safety plan, QA/QC Plan, Utility Stakeout plan, dewatering plan, shutdown plan, Ti-in Plan) prior to mobilization.
- Include preconstruction submittals in the official submittal log and review workflow.
- Treat CPM schedule updates as actionable documents requiring formal review and approval.



- Avoid marking schedule submittals as “For Information Only” without review, especially when delays are evident.
- Use schedule reviews to identify risks and adjust field execution proactively. It is noteworthy that emails were sent to the Contractor in response to their schedule updates later in the project; however, these emails were not consistently documented responses. P, projects similar to this project in magnitude require proactive schedule update reviews and risk management.

#### 6.4. PROCESS & MANAGEMENT AUDIT

This section outlines the core process and management workflow adopted for the project, emphasizing the importance of clear decision-making structures and robust communication channels. Table 6-4 summarizes the established decision-making framework, detailing how key project decisions are made, the roles of involved stakeholders, and the methods used to document actions and outcomes.

*Table 6-4 Established Decision-Making Framework*

Decision Type	Process	Key Decision-Makers	Documentation
<b>Design Clarification (RFI)</b>	Contractor submits RFI via Trimble/E-Builder <b>Form Process.</b> WSSC Water design team proposes an answer a response. Contract Manager reviews and approves response. Contractor closes RFIs.	Design Engineer (WTBC or consultant) responds to technical questions; WSSC Water Contract Manager (or Construction Manager) signs off on solution.	RFI Log with official response text and date; e.g., RFI-16 answered on 8/30/21 approving SHC relocation.
<b>Field Directive (quality/safety)</b>	Inspector or WSSC Water representative gives on-site instructions to contractor (often verbal, then noted in DIR).	WSSC Water Field Inspector or Contract Manager if higher approval is needed.	Daily Inspection Report (WSSC Water) noting instruction and contractor action; e.g. DIR 7/14/22: “Inspector directed additional compaction in trench.”
<b>Progress/Schedule Adjustment</b>	Discussion in progress meeting. If minor (within contract scope), contractor and WSSC Water agree on field modification. If major (affecting milestones), formal notice given.	WSSC Water Construction Manager and Contractor PM in meetings; Chief Engineer if extending contract time formally.	Meeting minutes capturing agreement or action item; Official letters if schedule slippage, e.g., WSSC Water notice of delay on 7/12/23 requiring recovery plan.
<b>Change Order (Scope/Cost)</b>	PCO proposal prepared (by contractor for differing work, or by WSSC Water request). WSSC Water evaluates, negotiates. Internal	WSSC Water Contracts Manager & Section Manager negotiate and recommend; Pipeline Division Manager/Chief Engineer	PCO letter or Trimble/E-Builder form with cost/time breakdown; Change Order memo (Construction manager through Chief Engineer) summarizing



Decision Type	Process	Key Decision-Makers	Documentation
	approval memo up chain. Formal CO executed.	approve; Procurement issues CO; Contractor PM signs concurrence.	decision; Signed Change Order document adjusting contract.
<b>Submittal Approval</b>	Contractor submits product/work plan submittal in Trimble/E-Builder. WSSC Water engineer/inspector reviews for compliance and marks approved/approved as noted/revise.	WSSC Water Design Engineer or subject-matter reviewer (e.g., cathodic protection. expert for test station submittal).	Submittal register entry with status. (e.g., Shop Drawing #SD-12 for 48-inch valve – marked “Approved as Noted” by WSSC Water on 3/10/21). Not publicly cited but stored in Trimble/E-Builder project files.
<b>Payment Approval</b>	Contractor submits monthly pay request. Inspector/Manager verify quantities % complete. WSSC Water Section Manager approves payment.	WSSC Water Inspector validates field progress; WSSC Water Contracts Manager approves invoice; WSSC Water Section Manager signs off to accounting.	Pay Estimate form with signatures; e.g., Pay App #6 signed by Will Sigafoose (Allan Myers PM) on 8/1/21 and WSSC Water approval in Aug 2021.

**Observations:**

While clear decision-making structures were implemented, the project team fell short in most effectively following that structure. Some gaps noticing:

- The audit team could not verify if the Incident reports created by QA inspection were properly corrective and closed as per standard procedure.
- Meeting minutes were not properly documented.

**Areas for Improvement**

ENSURE CONSISTENCY IN PROCESS MANAGEMENT, DECISION RECORDS, CORRECTIVE ACTIONS, AND ISSUE CLOSURE.

**6.5. SITE INSPECTIONS REVIEW**

WSP had access to total of 973 Daily Inspection Reports (DIR) dated from March 1, 2021, through July 3, 2025 and reviewed them with regards to the following aspects:

**1. Timeliness:**

**Submission:** Fairly consistently whenever the Contractor had a crew onsite at the end of the day the inspector in charge of the project has created a DIR in Trimble/E-Builder.



**Review/Approval:** The Construction manager in charge has reviewed and, in some cases, provided comments on the DIR, eventually they were approved on a timely basis.

## 2. **Completeness/ Quality:**

Missing information is significantly evident in these DIRs:

- Backfill material, (in the majority of cases it is mentioned excavated material).
- Backfill loose lifts depth.
- Equipment used for compaction.
- Confirmation if the inspector verified that a proctor test was performed for native materials that were being used as backfill. It appears they heavily relied on compaction testing company BOTA.
- No pressure test information is recorded.
- Temporary asphalt material is not recorded.
- Depth of excavation not noted in multiple DIRs.
- Material for temporary backfills, and if those temporary backfills were compacted at all.
- Equipment and Labor active and idle hours.
- No indication of the inspection of pipe material & coating during pipe delivery and/or during storage in the DIRs.

## 3. **Safety concerns:**

- A nuclear density gauge was struck by a dump truck on July 11, 2022. MDE was informed of the incident. It's unclear if the seal of the gauge was breached but because security and precautionary measures were in place and followed, no persons or the environment were put at risk.
- From daily inspection photos it is apparent that on some occasions proper trench shoring has not been in place; however, the inspectors have not made any notes in their DIRs.
- In DIRs, mostly every day there is a statement that the Contractor is following the MOT plans without any reference which MOT plan has been used, as application of MOT plans are site specific. Additionally, there is no indication of any Traffic Control inspector visits.

## 4. **Incidents:**

Three dozen incidents have been noted in the DIRs. These incidents were typically hitting an existing utility or service to neighbor in Bond Mill Road. Some incidents are listed below to provide perspective (detailed information can be found in Appendix B.5 – Construction Review Log):

- Approx. STA 123+47.50 Allen Myers struck a 4-inch CIP, it was believed to be abandoned pipe but it actually an active water pipe for the Water Filtration Plant. Contractor fixed it same day. Poor workmanship of fix is evident DIR#471.
- Approx. STA 83+33.19 contractor hit a 4-inch Terra Cotta SHC (Sanitary House Connection), there has been a temporary fix, but there are not any indications of a permanent fix.



- Approx. STA 86+53.72 Contractor hit a neighbor's mailbox. It was repaired and neighbor was satisfied per DIR#562.
- Approx. STA 89+35.12 the contractor hit an unmarked 8-inch water main (WM). There was a complete road closure in place and emergency shutdown of WM to repair the 8and repair. They reinstated water to the neighbors without a bacterial test. DIR#587.
- At STA 92+20.12 the inspector reported that the contractor used unsuitable wet materials as backfill material. The action taken was just to monitor how it goes, and surprisingly compaction test passed in the same location. DIR#642. The inspector notes that an incident report was created as well which was not provided to WSP.
- At STA 92+27.12 the Contractor reported a leaky 8-inch WM while the inspector was out for lunch. , after further investigation, it was determined that an existing valve (V045) was leaking, thereafter WSSC WATER begin ab emergency shutdown of the WM, fixed the leak in house. DIR#657. The issue eventually was fixed around 1:00 am.
- At STA 92+86.12 the neighbor's basement was flooded with sewage because the Contractor had hit the neighbor's SHC. The repair was scheduled for the next day.
- At filtration plant, the contractor struck the 30" PCCP raw water main that feeds the plant, requiring WSSC Water crew to shut down valves and performed repairs. DIR#846.

## **AREAS FOR IMPROVEMENT**

### **Documentation & Reporting Improvements**

#### **1. Standardize Required Fields in DIRs:**

- Ensure consistent inclusion of:
  - Backfill material type and lift sizes.
  - Equipment used for compaction
  - Depth of excavation.
  - Temporary asphalt and backfill materials.
  - Pipe delivery, storage, material, and coating details.
  - Equipment and labor hours (active/idle).

#### **2. Testing & Verification Records:**

- Include inspector confirmation of proctor tests for native backfill materials.
- Record pressure test results and compaction test outcomes explicitly.
- Avoid sole reliance on third-party testing firms like BOTA without inspector verification.

#### **3. Material Traceability:**

- Track and document all materials used, especially temporary ones, and their in situ test results.

#### **4. Traffic Control Documentation:**

- Specify which MOT plan was used each day.
- Record visits or oversight by Traffic Control inspectors.



## Safety Oversight Enhancements

### 1. Incident Documentation:

- For events like the nuclear gauge strike, ensure:
  - Clear documentation of seal integrity checks.
  - Radiation leak test results.
  - Follow-up actions and MDE correspondence.

### 2. Trench Safety:

- Require inspectors to note trench shoring conditions daily.
- Include photographic evidence and commentary when shoring is absent or inadequate.

## Incident Management & Follow-Up

### 1. Utility Strikes & Repairs:

- Improve documentation of:
  - Immediate and permanent fixes.
  - Quality of repairs (e.g., DIR#471 shows poor workmanship).
  - Bacterial testing after water main repairs (e.g., DIR#587 lacked this).

### 2. Incident Reports:

- Ensure all incidents have corresponding formal reports accessible to stakeholders.
- Track resolution timelines and verify completion (e.g., DIR#642 and DIR#657).

### 3. Neighbor Impact Tracking:

- Document communication and resolution with affected residents (e.g., mailbox damage, flooded basement, etc.).
- Include satisfaction confirmation and repair verification.

## 6.6. QUALITY ASSURANCE PROCEDURE ASSESSMENT

No quality assurance plan has been developed and approved for this project.

The Specifications do not spell out a comprehensive QA procedure nor require a QA/QC plan to be submitted for review.

Per Sections 01450 and 02510 the Engineer to perform the following QC Inspections but no evidence this took place:

- Engineer will inspect, before installation, Commission and Contractor furnished materials delivered directly to work sites and mark.
  - Materials without inconsistencies or discrepancies with WSSC WATER's logo.
  - Materials not accepted as "Rejected".
  - Hydrostatic tests for water pipes.
  - For pipes 36-inch and larger diameter, an internal visual inspection will be made by WSSC WATER of entire test section before ends are closed for test.



Specification section 02315.1.3.A. requires the Engineer to perform QA testing of backfill compactions. After an interview with compaction testing division they made available to us some Compaction Inspection Report & Testing (CIRT) and Incident Report Compaction Testing (INCRP) for Patuxent 48in Water Main.

WSP could not independently verify if these QA inspection reports (CIRT and INCRP) were sent to the Contractor for rectification as they became available.

WSP evaluated these reports available to us and compared them with the BCE Reports and DIRs. See Appendix B.8 for this log:

- The CIRTs and INCRPs do not consistently record the precise activity locations based on pipe alignment stationing. In several cases, the addresses noted in the reports are hundreds of feet away from the actual backfilling operations. For example, INCRP No. 61, dated December 6, 2021.
- Nearly all reports reference the same proctor data (maximum dry density = 145.3 pcf, OMC = 5.5%) throughout the project. However, based on the nature of the work and the Daily Inspection Reports, it is evident that native soil conditions varied over time. Despite this, no updated proctor data appears to have been utilized, and there is no evidence confirming that the referenced values originated from an actual Modified Proctor Test.
- Inconsistent information regarding trench length and backfill length was noted in these CIRTs and INCRPs.
- These QA reports do not include anything regarding the thickness of backfilling lifts.
- The reports do not indicate the depth or exact location where backfill compaction tests were performed. In certain instances, failed compaction tests were recorded, followed by retests at the same location that yielded passing results. However, the reports do not specify what corrective actions, if any, were implemented—such as re-compaction or replacement of backfill material—leaving this information undocumented.
- The compaction test reports do not provide critical details such as the wet density or dry density of the soil after testing; they only indicate the relative compaction percentage. For quality control purposes, it is essential to document all parameters associated with each in-situ non-destructive test (NDT).
- No photographs were produced.
- Specifically, in CIRTs there is no mention of backfill material.

Additionally on February 7, 2024, WSSC Water’s representative visited the site to check backfilling material and compaction. On this day, the following violations were reported:

- No testing was conducted for the entire backfilling lifts.
- Contractor was allowed to continue backfilling even if the compaction in situ test had failed.
- The backfill material used had a different Proctor Test (Max. Dry Density) than what was approved.

## **AREAS FOR IMPROVEMENT**

### **1. Develop and Approval of a QA Plan by the Owner:**

- Issue: No QA plan has been developed or approved.



- **Improvement:** Create a formal QA plan tailored to the project scope. This should include:
  - Defined roles and responsibilities.
  - Definable features of work.
  - Inspection and testing protocols.
  - Documentation and reporting procedures.
  - Corrective action workflows.

## **2. Strengthen Inspection Protocols**

- Implement proactive inspection checklists.
- Require photographic documentation and traceability of inspected materials.
- Ensure inspections are logged and reviewed regularly.

## **3. Formalize Testing Oversight:**

- **Issue:** Visual inspections for large-diameter pipes are required but there is no evidence that this occurred.
- **Improvement:**
  - Define step-by-step hydrostatic testing procedures.
  - Include acceptance criteria, test durations, pressure thresholds, and documentation requirements.

## **4. Enforce QA Testing for Backfill Compaction**

- **Issue:** QA testing for backfill compaction is required but not performed at the beginning of project.
- **Improvement:**
  - Schedule periodic compaction tests and document results.
  - Use third-party or independent testing agencies hired by the Owner (WSSC Water).
  - Maintain logs of test frequency, locations, and outcomes.

## **5. Improve Communication and Accountability**

- **Issue:** The QA team procedure indicated the QA incident reports are issued to Contract Managers, which to address with the Contractor. However, no evidence if the construction team had followed up with the Contractor for corrective action.
- **Improvement:**
  - Assign QA responsibilities to specific team members (QA Inspector).
  - Conduct regular QA meetings to review findings and corrective actions.
  - Share QA reports with stakeholders to ensure transparency.

## **6.7. QUALITY CONTROL PROCEDURE ASSESSMENT**

The specification does not require contractors to develop and submit a comprehensive Quality Control plan tailored to the project scope with definable features of the work.



**SOIL TESTING**

- Per DIRs and email correspondences available to WSP we observed that BCE had been hired by the Contractor to perform soil compaction testing per 01450.1.3.A and 02315.1.3.B but it is not clear if the firm and their soil technicians' qualifications were submitted to WSSC Water for review and approval prior to hiring.
- There were instances when BCE’s Geotechnical Technician was absent from the site despite Daily Inspection Reports (DIRs) documenting backfilling activities on those dates—for example, April 14, 2022.
- BCE submitted their reports in some cases after a month; however, specification Section 02315.1.3.B.3 states that certified reports should be submitted within 2 business days.
- It is also unclear whether the reports were reviewed by the Engineer or WSSC WATER personnel to confirm compliance. The reports are not logged into Trimble/E-Builder for review.
- Only one proctor test report has been officially submitted for the entire life of the project, while per DIRs, and compaction test reports the Contractor has used native soils with different proctor test as backfilling material in many instances.
- BCE reports throughout the project show a loose lift depth of 1 foot, which is a deviation from WSSC Water’s specified 8-inch loose lift depth. Later in the project WSSC Water directed Allen Myers/ BCE to backfill and test the soil in 8-inch lifts. Numerous instances were observed where BCE documented backfill lifts measuring approximately 16 inches in thickness, rather than the specified 8 inches.
- A review of BCE’s documentation indicates that compaction testing was not conducted across the full depth of the trench, excluding the 1-foot zone above the pipe crown. For example, BCE Report No. 182 records compaction tests for only four backfill lifts, whereas the trench depth, as specified on Drawing C-9, is approximately 10 feet.
- BCE’s reports reference Modified Proctor Tests; however, aside from a single Proctor Report, no additional proctor test documentation has been identified for the native soils, which varied as the project progressed. There has been a contradiction between WSSC Water specification, addenda and Prince George’s County compaction specification . Bond Mill Rd is within Prince George’s County and in response to a question during addenda, WSSC Water did confirm that Prince George’s County’s standards were to be followed, therefore the Contractor stated they followed Prince George’s County specifications. A comparison of the Specifications can be found in Table 6-5.

*Table 6-5 Comparison of WSSC Water and Prince George’s County Compaction Specifications*

Criteria	WSSC Spec. 02315	PG County STD 300.18 / 300.19
Lift Thickness	8" Down to 1' Above Pipe	8" Down to 5' of Depth
		12" for All Else
Compaction Density	100% for Top 1' of Depth	95% for Top 2.5' of Depth
	95% for All Else	92% for All Else



## **CONCRETE TESTING**

At many locations per the Contract Drawings, reinforced concrete cast-in-place thrust collars were to be poured. Based on the documents provided to WSP for review, no concrete compressive strength test has been conducted for the thrust collars.

## **HYDROSTATIC PRESSURE TEST**

Specification Section 02510 requires hydrostatic pressure testing for all water pipes and valves. DIRs reflect scattered pressure testing of Valves and Watermain pipeline, these tests have not been documented separately and submitted to the Owner/ Engineer for review.

## **TEMPORARY ASPHALT**

Specification Section 02950.2.1.D. requires Hot Mix Asphalt (HMA) for temporary trench patching, the HMA had been submitted by the Contractor and approved, however during cold weather the same specification section allows the Contractor to use high performance Cold Asphalt Mix after Engineer's approval, unfortunately there is no indication that Cold Asphalt Mix was submitted or approved by WSSC Water, even though per DIRs, Cold Asphalt Mix has been used throughout the project.

Specification Section 02950.3.6.A.2. Stockpiling high-performance Cold Asphalt Mix is permitted if stored properly without infiltration and for less than one month. The inspector did not record any details on storage of the Cold Asphalt mixes, if applicable.

Per Spec Section 02950.3.6.A.5. Temporary Pavements can remain up to 60 days, with possibility of extension if permanent pavement material is unavailable due to wintertime. WSP's observations show that temporary pavement was in place well beyond 60 days, without any prior approvals from the Engineer/ WSSC Water.

## **PERMANENT PAVEMENT**

Specification Section 02950 and Prince George's County's Utility Patch details (300.18 and 300.19) provide clear direction for permanent pavements. Below is list of WSP observations that could have adverse impact on Bond Mill Road's Pavement:

- Temporary pavement remained in place for more than 60 days contrary to specifications.
- Based on DIRs, dimension of cutbacks for permanent pavement is not clearly logged. From the daily pictures, it is visible that in some instances there were no cutbacks at all.
- The Contractor did not apply a tack coated to asphalt edges, which could significantly impact pavement quality considering high volume traffic.

WSP developed a pavement summary log using the locations identified in the pavement deficiency notifications submitted by WSSC Water to the Contractor. The log provides detailed information on the duration between the initial installation of temporary pavement, as indicated by the DIRs, and the issuance date of each corresponding notification letter. The findings of the summary demonstrate that the identified problem areas significantly exceeded the permitted timeframe for temporary pavement. The pavement log can be found in Appendix B.6.



### **GALVANIC ANODE CATHODIC PROTECTION**

Per specification Section 13110, the Cathodic protection shall be tested for post installation corrosion control and to be witnessed by the Engineer. WSP has not received any documentation reflecting that post-installation testing has been conducted for cathodic protection.

### **GEPOLYMER LINING**

Geopolymer Lining was specified for the culvert repairs and required field testing; however, WSP does not have access to any reports that confirm a field testing was conducted.

### **AREAS FOR IMPROVEMENT**

Similar to QA procedure, for a better-Quality Control process WSSC Water should consider the followings:

- Require contractors to submit a comprehensive QC plan, by defining all features of work and assigning a QC person alongside their field crew.
- Perform regular QA/QC meetings, list all deficiencies and follow up on the status.
- Require contractors to provide a registry for all their anticipated submittals at preconstruction phase, this will allow all stakeholders to trace required submittals.
- Enforce timeliness of test reports.
- Based on the emails, at least one day there was no compaction technician onsite to test backfill. The inspector reached out to his supervisor and no action was taken. WSSC Water's inspectors should stop work in these situations.

## **6.8. EFFECTIVENESS OF RISK MANAGEMENT DURING CONSTRUCTION AUDIT**

After reading through DIRs and emails, WSSC Water had a reactive approach to all risks (utility conflicts, delayed compaction reports, pressure testing, settlement in pavements, etc.).

### **Areas for Improvement**

WSP recommends a proactive approach to risk mitigation for the project. Table 6-6 details the risk management methods, actions, tools, and responsible parties and Table 6-7 provides sample risks and mitigation strategies based on design and construction observations for the project.



*Table 6-6 Suggested Risk Management*

<b>Stage</b>	<b>Action</b>	<b>Tools/Methods</b>	<b>Responsible Party</b>	<b>Output</b>
<b>Risk Identification</b>	Spot potential risks during planning, design, or construction phases	<ul style="list-style-type: none"> <li>- Site investigations</li> <li>- Utility records</li> <li>- Geotechnical reports</li> <li>- Lessons learned from past projects</li> </ul>	Design Engineer, WSSC Water PM, Contractor	Risk Register Entry (initial)
<b>Risk Logging</b>	Document the risk formally in the project risk register	<ul style="list-style-type: none"> <li>- Risk Register Template</li> <li>- RFI/Field Report logs</li> <li>- Meeting minutes</li> </ul>	WSSC Water Project Controls, PM	Risk ID, Description, Phase, Owner, Status
<b>Risk Assessment</b>	Evaluate likelihood and impact of each risk	<ul style="list-style-type: none"> <li>- Qualitative scoring (Low/Med/High)</li> <li>- Historical data</li> <li>- Expert judgment</li> </ul>	WSSC Water Risk Manager, PM, Technical Leads	Risk Matrix (Heat Map), Prioritized Risk List
<b>Mitigation Planning</b>	Define proactive and reactive strategies to reduce or respond to the risk	<ul style="list-style-type: none"> <li>- Mitigation Plan Template</li> <li>- Design revisions</li> <li>- Contingency planning</li> </ul>	Design Team, Contractor, WSSC Water PM	Mitigation Measures added to Risk Register
<b>Risk Monitoring</b>	Track risk status and effectiveness of mitigation	<ul style="list-style-type: none"> <li>- Weekly Progress Meetings</li> <li>- QA/QC Reports</li> <li>- Change Order Logs</li> </ul>	WSSC Water CM, Inspectors, Contractor	Updated Risk Register, Action Items
<b>Risk Closure</b>	Close risk once resolved or no longer applicable	<ul style="list-style-type: none"> <li>- Final inspection</li> <li>- Audit confirmation</li> <li>- Lessons learned documentation</li> </ul>	WSSC Water PM, QA/QC Lead	Risk marked "Closed" in Register, Lessons Logged



Table 6-7 Major Encountered Risks and Mitigations

Risk	Cause	Impact	Potential Mitigation Strategy
<b>Lay Schedule</b>	Lay Schedule limited construction flexibility	Schedule delay	Coordinate layout schedule to allow flexibility at critical construction location
<b>Unmapped sewer/gas/telecom lines</b>	Incomplete utility records; outdated surveys	Work stoppage, redesign, service disruption	Test pitting, Enforce Specification to get utility stakeout from the Contractor, coordination with utility owners (BGE, Verizon, etc.)
<b>Hard rock excavation</b>	Inadequate geotechnical data	Slow progress, change orders	Pre-bid boring logs, contingency excavation plans (this was discussed during a meeting with the Engineer of Record). Value Engineering (VE) for Alternative Options, WSP does not have documentation to show that VE has taken place.
<b>Unstable sandy condition</b>	Inadequate Geotech data and design planning	Slow progress, safety concerns	Communicate geotechnical risks in contract documents and pre-construction meeting
<b>Construction during school time</b>	Construction schedule delay	Safety concerns at sole school entrance Community dissatisfaction	Pre-planning break points of pipe segments to allow the construction near school to be executed during the planning time.
<b>Pavement cannot be restored timely</b>	Construction schedule delay	Roadway condition Community dissatisfaction	Pre-plan pavement timeline in sequence of construction and schedule Discuss at pre-conference meeting for expectation
<b>Culvert crossing restrictions</b>	County DPW&T concerns over clearance	Alignment redesign, multi-year delay	Early agency engagement, alternate routing scenarios
<b>Power line ROW denial (BGE)</b>	BGE refusal to allow parallel alignment	Forced reroute into congested corridor	Early negotiation with BGE, perpendicular crossings only
<b>Inconsistent QC reports</b>	Delayed or missing compaction/concrete test results	Pavement settlement, rework, community complaints	Enforce QA/QC protocols, require timely reporting, independent inspections
<b>Use of unapproved materials</b>	Contractor deviations from approved submittals	Potential non-compliance, performance risks	Strict submittal review process, field verification, corrective action enforcement



## 6.9. SAFETY COMPLIANCE

A safety plan has been discussed during pre-construction meeting based on meeting minutes; however, it was not available for WSP through Trimble/E-Builder files to review. Therefore, the audit team assumes that a safety plan was developed by Allen Myers and implemented throughout the construction.

WSP has record of one safety incident that occurred on the project which per OSHA 29 CFR 1904.7 is major recordable injury, an untrained laborer attempted to use a Roller CS34 – Carter CAT #052059, during the maneuver, the roller overturned, and its roof impacted Laborer’s left ankle, resulting in a fracture and significant bleeding.

Prompt action has been taken by the Contractor and WSSC Water’s field inspector:

- Called 911, the laborer was transported to a health care facility
- Allan Myers recorded the incident, enhanced safety briefing to avoid recurrence.
- WSSC Water requested formal incident report from AM.
- Required AM to conduct a review of internal equipment safety protocols.

We recommend that WSSC Water should require contractors to provide safety plans and conduct Activity Hazard Analysis (AHA) meetings or toolbox meetings on a daily basis.

## 6.10. CHANGE MANAGEMENT- UNFORESEEN CONDITIONS

In total there are 40 Potential Change Orders (PCOs) which then were compiled into 7 Change Orders (COs) for the project. The summary of the PCO logs created by the audit team can be found in Appendix B.3.

Overall change management/ unforeseen conditions in the project followed a standard workflow by notifying WSSC Water through emails and follow-up with official RFIs.

The contractor then submitted cost proposals PCOs for all additional scope changes; however, response to RFIs took longer than specified duration and the PCOs were after the work had been completed.

WSSC Water’s Contract Manager did review PCOs and resolve them except for PCO #15- Rock presence allegedly differing from the boring logs. Our understanding is that WSSC Water is currently negotiating PCO #15 with the contractor.

On at least one occasion (PCO #01) has been reviewed by a third-party cost estimation firm (Pheonix Engineering); however, no documentation was available demonstrating that all 40 PCOs were reviewed by a third-party consulting firm.

## 6.11. FIELD OVERSIGHT STRUCTURE AND ROLES

Contract Manager: Reviewed all correspondence related to the project, actively involved in decision making, approved submittals, PCOs, pay estimates, etc.

Field Inspectors: Created daily reports along with pay estimate items, reported on incidents to the contract manager, etc.

Contractor PM and his subordinates reported to the contract manager and field inspectors.



Figure 6-1 outlines the field oversight structure.

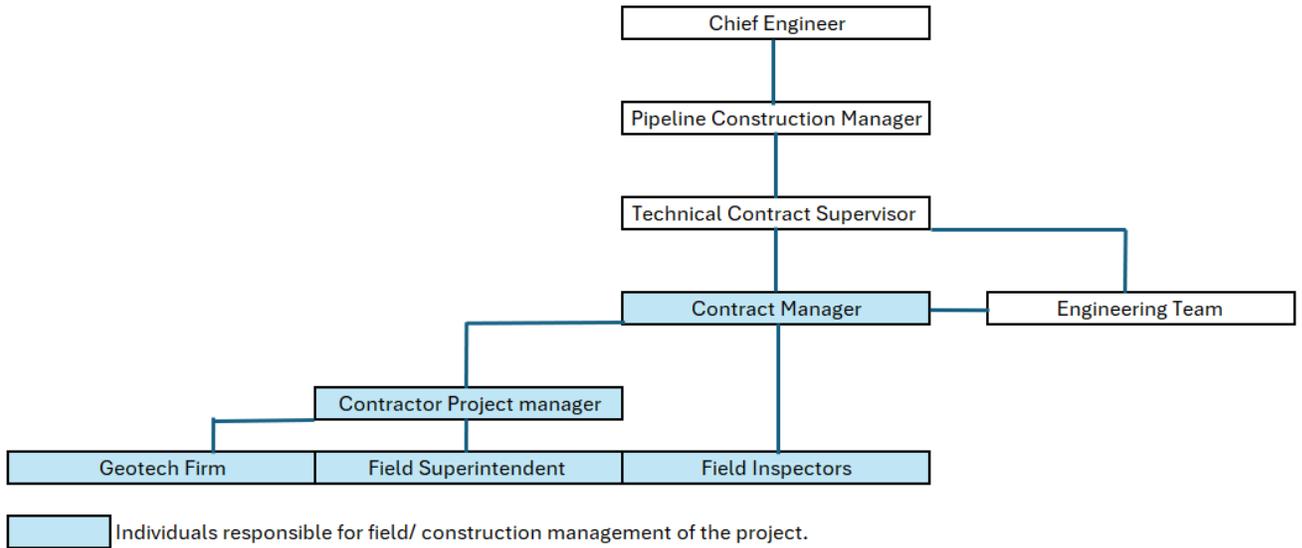


Figure 6-1 Field Oversight Structure

## 6.12. COMMUNITY IMPACT AND CUSTOMER NOTIFICATION

**Identified Gaps:** The project did not maintain a comprehensive log of community communications or complaints. This made it difficult to track what was communicated, when, and to whom. The audit team reconstructed a community impact & communications log from daily reports and available emails on the project folder to understand what outreach occurred. Implication: Without a formal record, some communication lapses went unrecognized until residents complained. The community log can be found in Appendix B.7.

Examples of community impacts include utility damages that result in service interruptions for residents, such as disruptions to water, sewer, cable, and power lines; property damage, including the displacement of silt fences that may lead to flooding in homeowners' backyards; incidental damage from construction vehicles or heavy machinery affecting vehicles, curbs, mailboxes, and similar items; trash; and substandard pavement conditions.

Stakeholder interviews revealed at least one instance where a resident received no warning of a water shutdown, particularly during an emergency repair. A community representative reported that their water was cut off without proper notice. Although WSSC Water did typically provide customer notification for planned water main shutdown, in that case (apparently an emergency repair shutdown), proper advance notice wasn't given, highlighting a gap in alerting customers during unscheduled outages.

There was no documentation available to indicate WSSC Water maintained system tracking on the water shutdown and customer notification for this project. The audit team reconstructed a shutdown log based on daily inspection reports and other available documents, which can be found in Appendix B.5. To be noted the audit could not find a corresponding event in the project records for the event that related to water main shutdown event without proper notice, indicating a lapse in the emergency notification process as well as event documentation.

The audit also finds that even when notifications were issued, there were issues with the clarity and accuracy of the information provided to customers. Community feedback noted an instance of incorrect contact



information on project signage, particularly during the personnel change in this Project, residents trying to get information or report issues but cannot reach to the correct contract had led to frustration.

### **Areas for Improvement**

- **Establish a community communication log** for the project. Record when, how, and to whom notices are sent, and log any resident inquiries or complaints.
- **Implement an Emergency Alert Protocol.** For unplanned shutdowns or unexpected damaged, have a system to rapidly notify all affected customers (e.g. automated phone calls/SMS based on the service address) and, door-to-door notification by field staff.
- **Increase lead time for planned shutdown notices** when possible. Coordinate with community schedules. Provide clear, honest explanations in the notice.
- **Improve message clarity and accuracy.** All notification letters and signs should provide a correct contact (phone/email of a project outreach lead) for questions. When there are changes to the key contact, notifications should be updated accordingly across online platforms, signs, and letters.
- Adopt a **multi-channel outreach** strategy: continue door-hanger flyers but also use at least one direct channel per customer – for instance, mailed letters for scheduled work (reinforces the flyer) and email or text alerts for those who opt in.



## 7. TIMELINE AND SCHEDULE EVALUATION

### 7.1. BASELINE VS ACTUAL TIMELINE

#### **BASELINE SCHEDULE (ICPM / BASELINE 01, JANUARY 2021)**

- NTP: December 7, 2020
- Projected Substantial Completion (Baseline): October 4, 2022
- Required Substantial Completion Date (Contract): March 10, 2023
- Original Duration: 823 Calendar Days

#### **WSP OBSERVATIONS ON BASELINE SCHEDULE:**

- In the Baseline schedule, the contractor projected a substantial completion of October 4, 2022, showing the project completion 157 days ahead of schedule.
- Final Paving had been planned as the last phase of the project.
- Longest Path Runs through procurement of owner-supplied 48-inch pipe/fittings and pipeline installation.
- Bond Mill Elementary/Sherwood Ave Constraint, Work in this area only allowed during summer recess (June 15 – August 30).
  - The Contractor did suggest three options to overcome this constraint that could have caused the project a forced delay:
    - Stop and wait, should the predecessor work be performed as scheduled. Worst case.
    - Buy an additional sleeve to skip over STA (91+00 to 93+00) and resume when work is available. There will be costs associated with this option.
    - Coordinated approach to get a contingency plan in place, for work in front of the school.
- Culvert Rehabilitation: Must be completed before pipeline installation between Stations 66+15 and 67+15 with in-stream work restricted by moratorium (March 1 – June 15).
- The Contractor has established reasonable conservative pipeline installation: Production rates:
  - 80 LF/shift (green area)
  - 40 LF/shift (roadway)
  - Precast structures/thrust collars: 4 shifts each
- Baseline schedule did not follow Sequence of Construction as set forth under specification Sections 01110 and 01330, specifically related to permanent pavements.
- Per Section 01330, the Engineer/ Owner was required to review and analyze baseline and subsequent project schedules along with the contractor. This has not been done.
- Float is on working days and it is not for exclusive use of the Contractor or WSSC Water Per Section 01330.
  - Figure 7-1 has a snapshot of Baseline Schedule Longest Path. See Appendix B.4 for the Baseline Longest Path and Baseline Comparison with the Current Schedule:



48" Patuxent Raw Water Pipeline - Ph 1 and 2 - ICPM / BL01				Classic Schedule Layout														16-Sep-25 11:40														
Activity ID	Activity Name	Original Duration	Remaining Duration	Schedule % Complete	Start	Finish	Total Float	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J
MS1000	Project Bid Date	0	0	0%	07-Dec-20		11																									
MS1010	Notice of Award	0	0	0%	07-Dec-20		11																									
MS1020	Notice to Proceed	0	0	0%	07-Dec-20		11																									
AMD0010	Provide Final Lay Drawing for Contractor Approval (Sub. #XXX)	7	7	0%	07-Dec-20	13-Dec-20	14																									
ADM0010	Prepare / Submit Certification of Final Lay Schedule / Drawing (Sub. XX)	7	7	0%	14-Dec-20	20-Dec-20	14																									
ADM0011	Review/Approve - Contractor Certification of Final Lay Schedule / Drawing (Sub. XXX)	30	30	0%	21-Dec-20	19-Jan-21	14																									
OWN0020	Fab / Del Pipe for Stat 6+40 to 14+27 (AREP-1) - incl. vault wall collars	90	90	0%	20-Jan-21	19-Apr-21	14																									
PIPE0020	Install Pipe - Stat 6+40 to 14+27 (AREP-1)	14	14	0%	20-Apr-21	10-May-21	11																									
PIPE0030	Install Pipe - Stat 14+27 to 17+49 (Thrust Block)	8	8	0%	10-May-21	20-May-21	11																									
PIPE0040	Install Pipe - Stat 17+49 to 24+00 (Cannfield Dr)	8	8	0%	20-May-21	03-Jun-21	11																									
PIPE0050	Install Pipe - Stat 24+00 to 33+80 (EP-1)	16	16	0%	03-Jun-21	28-Jun-21	11																									
PIPE0060	Install Pipe - Stat 33+80 to 40+00 (Leo James Ct)	12	12	0%	28-Jun-21	14-Jul-21	11																									
PIPE0070	Install Pipe - Stat 40+00 to 48+30 (Enter Bond Mill Rd)	10	10	0%	14-Jul-21	29-Jul-21	11																									
PIPE0080	Install Pipe - Stat 0+00 (PS) to 6+40 (Sleeve)	12	12	0%	30-Jul-21	17-Aug-21	11																									
PIPE0090	Install Pipe - Stat 48+30 to 53+30	17	17	0%	17-Aug-21	13-Sep-21	11																									
PIPE0100	Install Pipe - Stat 53+30 to 60+00 (Bond Mill / Diploma)	17	17	0%	13-Sep-21	06-Oct-21	11																									
PIPE0110	Install Pipe - Stat 60+00 to 65+46 (BO-2)	18	18	0%	06-Oct-21	08-Nov-21	11																									
PIPE0120	Install Pipe - Stat 65+46 to 68+59 (EP-2)	12	12	0%	08-Nov-21	01-Dec-21	11																									
PIPE0130	Install Pipe - Stat 68+59 to 74+50 (Thrust Collar)	19	19	0%	01-Dec-21	04-Jan-22	11																									
PIPE0140	Install Pipe - Stat 74+50 to 80+51 (Vert Bend)	15	15	0%	04-Jan-22	31-Jan-22	11																									
PIPE0150	Install Pipe - Stat 80+51 to 86+54 (AREP-3)	19	19	0%	31-Jan-22	03-Mar-22	11																									
PIPE0160	Install Pipe - Stat 86+54 to 91+00 (Bond Mill / Sherwood)	15	15	0%	03-Mar-22	28-Mar-22	11																									
PIPE0170	Install Pipe - Stat 91+00 to 92+87 (BO-3) / Through Sherwood (6/15 - 8/	9	9	0%	28-Mar-22	11-Apr-22	11																									
PIPE0180	Install Pipe - Stat 92+87 to 97+00	10	10	0%	12-Apr-22	26-Apr-22	11																									
PIPE0190	Install Pipe - Stat 97+00 to 102+52 (1/64 HB)	15	15	0%	26-Apr-22	18-May-22	11																									
PIPE0200	Install Pipe - Stat 102+52 to 105+00 (Thrust Collar / BGE ROW)	10	10	0%	18-May-22	02-Jun-22	11																									
PIPE0210	Install Pipe - Stat 105+00 to 107+65 (incl. 66" Steel Casing)	7	7	0%	02-Jun-22	15-Jun-22	11																									
PIPE0220	Install Pipe - Stat 107+65 to 112+00 (AREP-4)	9	9	0%	15-Jun-22	27-Jun-22	11																									
PIPE0230	Install Pipe - Stat 112+00 to 123+98 (BO-4)	19	19	0%	28-Jun-22	26-Jul-22	11																									
PIPE0240	Install Pipe - Stat 123+98 to 126+00 (Rec. Vault G)	7	7	0%	26-Jul-22	04-Aug-22	11																									
PIPE0250	Install Pipe - Stat 126+00 to 127+20 (Reducer)	4	4	0%	04-Aug-22	11-Aug-22	11																									
PIPE0260	Install Pipe - Stat 127+20 to 128+95 (36x36 Tee)	8	8	0%	11-Aug-22	23-Aug-22	11																									
PIPE0270	Install Pipe - Stat 0+00 to 1+64 (36x36 Tee)	8	8	0%	23-Aug-22	06-Sep-22	11																									
PIPE0280	Install Pipe - Stat 0+00 to 0+88 (30x30 Tee)	7	7	0%	06-Sep-22	15-Sep-22	11																									
PIPE1000	Flush / Pressure Test - 48" Pipeline	10	10	0%	15-Sep-22	29-Sep-22	11																									
PIPE1010	Tie In 1 - 42" Steel (Treatment Plant)	3	3	0%	29-Sep-22	04-Oct-22	11																									
PIPE1020	Tie In 2 - 30" PCCP (Treatment Plant)	3	3	0%	29-Sep-22	04-Oct-22	11																									
PIPE1030	Tie In 3 - 36" PCCP (Treatment Plant)	3	3	0%	29-Sep-22	04-Oct-22	11																									
PIPE1040	Tie In 4 - 42" DIP (Pump Station)	3	3	0%	29-Sep-22	04-Oct-22	11																									
MS5000	Substantial Completion (Required by March 10, 2023)	0	0	0%		04-Oct-22	20																									
REST1000	Perm. Patch - Sawcut Neatline (Sub: Mattiola)	5	5	0%	04-Oct-22	12-Oct-22	11																									
REST0110	Perm. Patch - Mill / Excavate Full Depth	5	5	0%	12-Oct-22	20-Oct-22	11																									
REST0120	Perm. Patch - Place Asphalt	5	5	0%	20-Oct-22	31-Oct-22	11																									
REST0130	Complete Line Striping (Sub: XXX)	5	5	0%	31-Oct-22	09-Nov-22	11																									
MS9999	Project Complete	0	0	0%		09-Nov-22	122																									

Figure 7-1 Longest Path on Baseline Schedule



## LAST UPDATE (CPM SCHEDULE UPDATE 42 DATA DATE DECEMBER 10, 2024)

- NTP: December 7, 2020
- Actual Substantial Completion: December 10, 2024
- Actual Duration: 1,464 Calendar Days
- Project Delay: 641 Calendar Days

### WSP OBSERVATIONS:

- The only activity shown not complete in Update 42 is REST0140 – Plantings by their subcontractor.
- All other activities have been noted as 100% complete, including additional scope under the PCOs.

## 7.2. ROOT CAUSE ANALYSIS OF DELAYS

A summary of the root causes of delays can be found in Table 7-1. The following summary the details on early float consuming, activities that delayed the project and the logistic changes that impact the schedule.

Actual Mobilization Date: **February 25, 2021.**

Delays started as early as schedule update #2, these delays consumed the available float in the original project schedule, i.e., by March 31, 2021, the contractor lost 20 days of available float due to the activities below:

- **Utility Locating Conflict:** Issues with marking utilities on WSSC Water property; resolved for pump station area in March 2021, allowing test pitting to proceed.
- **Gas Main Conflict (RFI 004):** 3-inch gas main at Stat. 49+20 may require relocation; RFI issued March 18, 2021, awaiting response from WSSC Water.
- **Culvert Rehabilitation:** Submittal (CSR-20) remains open and not approved; advanced approval needed for procurement and scheduling. Controlled by MDE permit restrictions.

### ACTIVITIES THAT CONSUMED BASELINE FLOAT:

The following activities are those that, according to the official CPM schedule updates and various update reports, to have **consumed available float in the baseline** - i.e., activities that were not originally on the critical path but became critical (zero float) as the project progressed, or activities that lost float due to delays, disruptions, or logic changes. **Key Activities That Consumed Float (Most of these activities were already on the Baseline's Longest Path)**

#### 1. Pipe Installation Activities (Bond Mill Road and BGE ROW)

- **PIPE0120:** Install Pipe – Stat. 65+46 to 68+59 (EP-2)  
Was non-critical in earlier updates, became critical as rock impacts slowed production
- **PIPE0130:** Install Pipe – Stat. 68+59 to 74+50 (Thrust Collar)
- **PIPE0140:** Install Pipe – Stat. 74+50 to 80+51 (Vert Bend)
- **PIPE0150:** Install Pipe – Stat. 80+51 to 86+54 (AR/EP-3)
- **PIPE0160:** Install Pipe – Stat. 86+54 to 91+00 (Bond Mill / Sherwood)
- **PIPE0170:** Install Pipe – Stat. 91+00 to 92+87 (BO-3 / Through Sherwood)
- **PIPE0180:** Install Pipe – Stat. 92+87 to 97+00
- **PIPE0190:** Install Pipe – Stat. 97+00 to 102+52 (1/64 HB)



- **PIPE0200:** Install Pipe – Stat. 102+52 to 105+00 (Thrust Collar / BGE ROW)
- **PIPE0250:** Install Pipe – Stat. 126+00 to 127+20 (Reducer)
- **PIPE0260:** Install Pipe – Stat. 127+20 to 128+95 (36x36 Tee)
- **PIPE0270:** Install Pipe – Stat. 0+00 to 1+64 (36x36 Tee)
- **PIPE0280:** Install Pipe – Stat. 0+00 to 0+88 (30x30 Tee)

## 2. Vault and Structure Activities

- **VAULT0570:** Receiving Vault H – Install Metals / Vault Guts
- **VAULT0580:** Receiving Vault H – Remove SOE / Backfill

## 3. Owner-Provided Pipe Fabrication/ Delivery (Fab/Del)

- **OWN0260:** Fab/ Del Pipe for 127+20 to 128+95 (36x36 Tee)
- **OWN0270:** Fab / Del Pipe for 0+00 (36x36 Tee) to 1+64 (42x36 Tee)
- **OWN0280:** Fab / Del Pipe for 0+00 (36x30 Tee) to 0+88 (30x30 Tee)

## 4. Change Order/PCO Activities (that became critical)

- **PCO #13:** Relocate 8" WM at Stat. 48+80 (added back to critical path after being removed)
- **PCO #12:** Test Pit (Vac) Unknown SHC on Bond Mill Rd.
- **PCO #05:** Chemical Injection Lines at Pump Station
- **PCO #04:** Cut and Regrade Vault G
- **PCO #09:** Vault H Revisions
- **PCO #11:** Conflict with BGE Gas in BGE ROW

## **ACTIVITIES THAT ACTUALLY DELAYED THE PROJECT AND WHY - BASED ON THE CONTRACTOR'S SCHEDULE UPDATES:**

### 1. Pipe Installation on Bond Mill Road (Stat. 57+00 to 92+87)

- **Activities:**
  - **PIPE0110:** Install Pipe 57+00 to 65+46
  - **PIPE0120:** Install Pipe 65+46 to 68+59
  - **PIPE0130:** Install Pipe 68+59 to 74+50
  - **PIPE0140:** Install Pipe 74+50 to 80+51
  - **PIPE0150:** Install Pipe 80+51 to 86+54
  - **PIPE0160:** Install Pipe 86+54 to 91+00
  - **PIPE0170:** Install Pipe 91+00 to 92+87
- **Why Delayed:**
  - **Severe Rock Impacts:**
    - In some sections, the presence of rock in the trench at shallower depths than indicated by borings, slowed the installation production. Particularly at activity “PIPE0120: Install Pipe 65+46 to 68+59”, the presence of hard, non-rippable rock in the trench, at shallower depths than indicated by borings, caused extremely slow production—sometimes less than 12 inches of excavation per shift.



- Rock impacts began to severely affect progress from mid-2022 through 2023 and into 2024, resulting in cumulative delays of **over 7 months**.
- **No further acceleration is possible** due to lack of sleeves for concurrent work.
- **Temporary Crew Demobilization (Aug–Nov 2022)**
  - **Root Cause:**

The **primary pipe crew was demobilized** from August 18 to November 7, 2022, to address an emergency on another project.
  - **Impact:**
    - This resulted in an **81-day period** with no pipeline progress, directly adding to the schedule delay.
    - The project lost all positive float and fell further behind schedule.
    - Both WSSC Water and Allan Myers acknowledge this demobilization as a negative impact, but the Contractor notes that even with the crew present, the rock conditions would have continued to drive delays.
    - Contractor was non-compliant with Articles 15 and 19 of the General Conditions.
- **Running Sand & Wet Conditions:**
  - In early 2024, “running sand” soils combined with wet weather made shoring and excavation very slow and hazardous, further reducing productivity.
- **Weather Shutdowns:**
  - Multiple months (January to March 2024) saw significant weather shutdowns (rain, snow, ice), with Bond Mill Road often unworkable due to Prince George’s County restrictions.
- **Leaking Water Main:**
  - In March 2024, a leaking WSSC Water 8-inch water main inundated the trench, causing a complete stoppage for three shifts (8hr/shift).

## 2. Owner-Provided Pipe Fabrication and Delivery

- **Activities:**
  - OWN0260: Fab/Del Pipe 127+20 to 128+95
  - OWN0270: Fab/Del Pipe 0+00 to 1+64
  - OWN0280: Fab/Del Pipe 0+00 to 0+88
- **Why Delayed:**
  - **Late Delivery & Material Availability:**
    - Delays in fabrication and delivery of owner-provided pipe and fittings caused critical path activities to become delayed, especially in 2023 and 2024.
    - Multiple schedule narratives cite “great concern that material will not be provided in time for its scheduled installation”.

## 3. Change Orders and Utility Conflicts

- **Activities:**
  - PCO #13: Relocate 8-inch WM at Stat. 48+80
  - PCO #12: Test Pit (Vac) Unknown SHC on Bond Mill Rd.
  - PCO #05: Chemical Injection Lines at Pump Station



- PCO #09: Vault H Revisions
- PCO #11: Conflict with BGE Gas in BGE ROW
- PCO #21: Repair of WHC at Stat. 89+00
- PCO #22: Leaking WSSC Water Main (March 2024)
- **Why Delayed:**
  - **Scope Added Back:**
    - Some activities (e.g., PCO #013) were previously removed from the critical path but had to be reinstated due to field discoveries (e.g., a kicker on the 8-inch WM), causing new delays.
  - **Unforeseen Utility Conflicts:**
    - Discovery of unknown or mislocated utilities (SHC, gas mains, etc.) required test pitting, design changes, and additional relocations, halting progress until resolved.
  - **Change Orders:**
    - Change orders for chemical lines, vault revisions, and other scope items added time to the critical path.
  - **Emergency Repairs:**
    - Emergency repairs (e.g., leaking water main, PCO #21/22) caused direct work stoppages.
  - Repair of a damaged WHC at ~Sta. 89+00

#### 4. Material Handling / BGE ROW (PCO #16)

- **Why Delayed:**
  - **Double/Triple Handling:**

WSSC Water’s decision to release and stage pipe in the ROW required double/triple handling according to the contractor, which was not in the original plan and consumed critical path time.

#### **AN ADDITIONAL DELAY BECAUSE OF LOGIC CHANGES:**

##### 1. December 2023 (CPM #33)

- **Cause:**
  - Correction of 2024 calendar to include non-workdays, holidays, and weather days.
  - This one-time correction added 68 days to the schedule completion deadline.

Figure 7-2 shown the Gantt Chart indicates impacted milestones and their respective impact on the project schedule, vs. original project duration.

Figure 7-2 is a snapshot of Activity Level Delays captured in Contractor’s CPM:



Task	Actual Start	Duration Days	Actual Finish
Project Original Duration	12/7/2020	823	3/10/2023
Actual Project Duration	12/7/2020	1464	12/10/2024
Owner Provided Materila Procurment	12/3/2020	1214	3/31/2024
Pipe installation effort	5/20/2021	1300	12/10/2024
Vaults H and G Installation	5/24/2021	963	1/12/2024
Test Pit - WWTP Tie In Area/ Marking	8/9/2021	1121	9/3/2024
Change Orders Work	11/1/2021	1037	9/3/2024

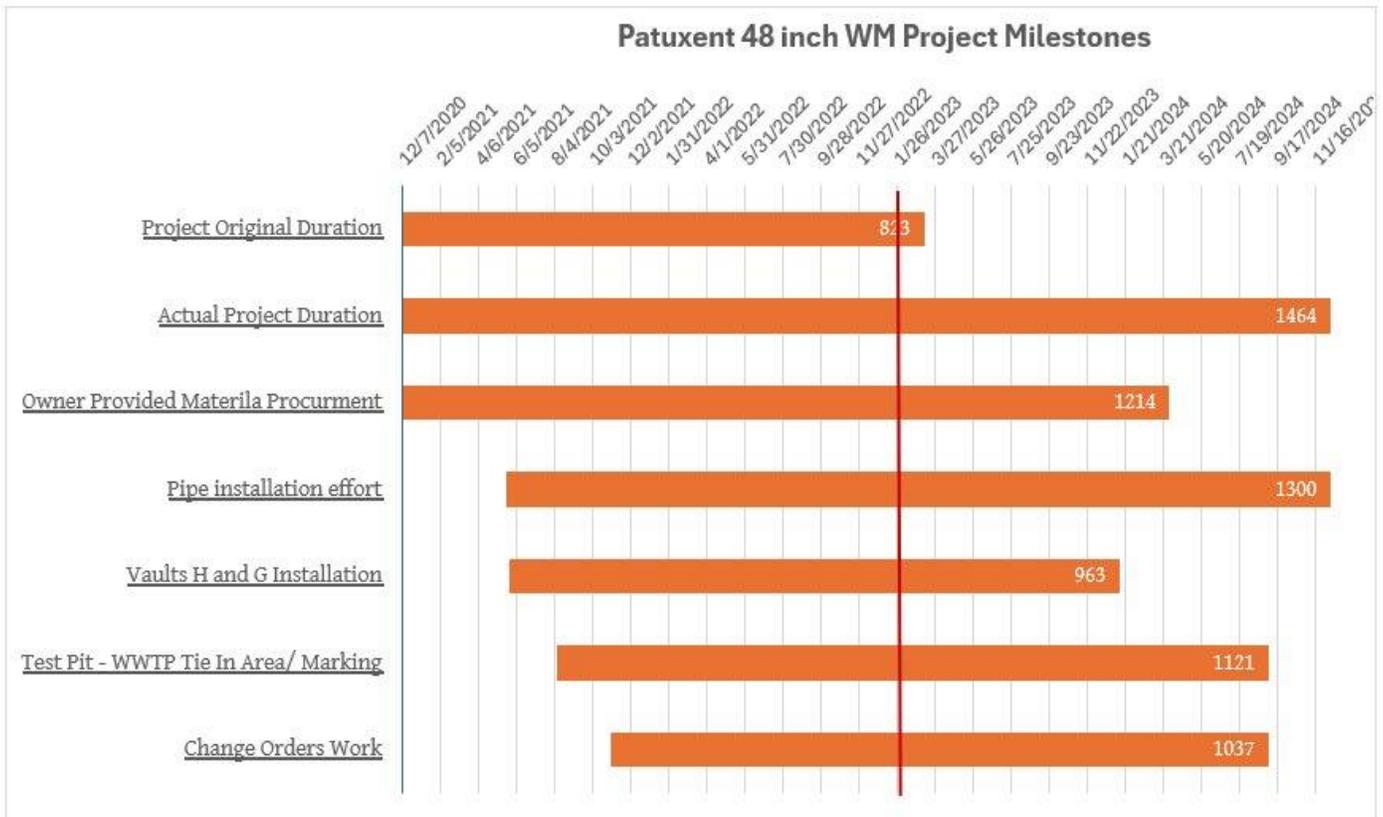


Figure 7-2 Activity Level Delays from Contractor's CPM Schedule

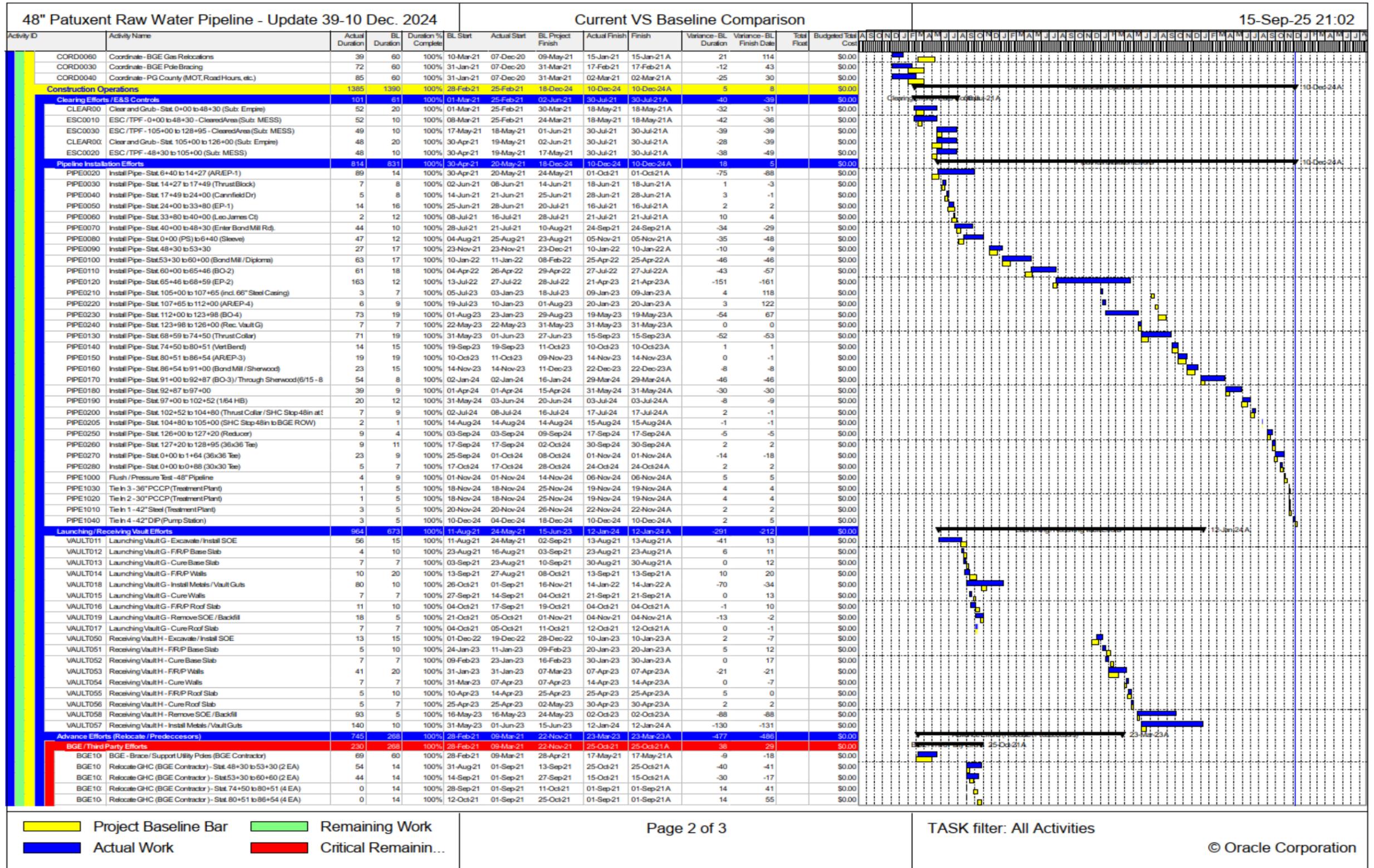


Figure 7-3 Activity Level Delays from Contractor's CPM Schedule



## SUMMARY OF DELAYS

Table 7-1 Root Cause of Delays Summary

Category	Activity Code(s)	Description	Timeframe	Impact on Schedule
Early Float Consumption	—	Utility locating conflict on WSSC WATER property delayed test pitting	Feb–Mar 2021	Consumed ~20 days of float
Early Float Consumption	RFI 004	3" -inch gas main at Sta. 49+20 may require relocation	Mar 2021	Awaiting response; float erosion
Early Float Consumption	CSR-20	Culvert rehab submittal pending; MDE permit restrictions	Q1 2021	Delayed procurement and trenching
Baseline Float Consumption	PIPE0120– PIPE0200	Pipe installation Sta. 65+46 to 105+00	Mid-2022 onward	Became critical due to rock delays
Baseline Float Consumption	PIPE0250– PIPE0280	Tie-in pipe segments Sta. 126+00 to 128+95 and 0+00 to 1+64	2023	Late fittings caused float loss
Baseline Float Consumption	VAULT0570– VAULT0580	Vault H installation and backfill	2024	Became critical due to pipeline delays
Baseline Float Consumption	OWN0260– OWN0280	Fabrication/delivery of owner-supplied pipe	2023–2024	Late delivery pushed tie-in work
Baseline Float Consumption	PCO #04, 05, 09, 11, 12, 13	Change orders added scope and consumed float	2021–2023	Became zero-float activities
Actual Delay	PIPE0110– PIPE0170	Pipe installation Sta. 57+00 to 92+87	Mid-2022 to Mar 2024	Rock, weather, crew demobilization caused 7+ month delay
Actual Delay	OWN0260– OWN0280	Owner-provided pipe delays	2023–2024	Critical path delay due to missing materials
Change Orders & Utility Conflicts	PCO #13	8-inch WM relocation reinstated due to field discovery	2022–2023	Reintroduced delay to critical path
Change Orders & Utility Conflicts	PCO #12	Test pit for unknown SHC on Bond Mill Rd.	2022	Required redesign and halted progress
Change Orders & Utility Conflicts	PCO #05, 09, 11	Chemical lines, vault revisions, BGE gas conflict	2021–2023	Added time to critical path
Change Orders & Utility Conflicts	PCO #21, 22	Emergency repairs: WHC and leaking water main	Feb–Mar 2024	Direct work stoppages
Material Handling Delay	PCO #16	Double/triple handling of pipe in BGE ROW	2021–2022	Inefficient logistics consumed critical path time
Logic Change	CPM Update 33	Calendar correction added non-workdays and holidays	Dec 2023	Added 68 days to schedule completion deadline



### 7.3. SCHEDULE MANAGEMENT AND RESPONSIVENESS

WSP only has access to review responses to the Baseline Schedule – which was approved with no comments – and Updates 2 through 16, which predominantly were reviewed as “For Information Only”. It is not clear whether WSSC Water authorized the contractor to demobilize from the site or not, but there are email correspondences available showing WSSC Water’s concern about the Contractor not being on site, and directing them to mobilize back as soon as possible.

Overall, the project schedule updates/ review process was not detailed and WSSC Water has not tracked potential delays rigorously throughout the project; however, since our review is based on the contractor's Schedule Updates and it appears that the contractor provided schedule updates mostly in a monthly basis, and in the CPM schedule update the Contractor did track down delays and kept WSSC Water Informed of potential complications.

Again, it is WSP’s understanding that there was not a meaningful collaboration between the contractor and WSSC Water in addressing potential conflicts/ delays proactively.

Since rock from Approx. STA 57+00 to 90+87 had the most significant impact on the project schedule, there had been a letter dated July 12, 2023 in response to Allen Myer’s Schedule Update 27, that is noteworthy in Table 7-2.



Table 7-2 Summary of Response Letter to Allen Myer Schedule Update 27

WSSC Water Point	Allan Myers Response	WSP's Observation
1. WSSC Water claims it directed Allan Myers to perform test pits at specific boring locations during the June 6, 2023, meeting.	Allan Myers states no written directive was ever issued, as required by contract. Test pitting was discussed as a plan, not a directive, and would be performed when a small crew became available to avoid disrupting main operations. The lack of progress on this does not impact on the schedule.	Allan Myers in that letter also alleges that WSSC Water does not issue meeting minute notes. Best practice would have been to issue a filed directive, requesting the contractor to perform new boring samples when the Rock issue was first reported. It is also worth noting that specification section 02315.3.1.F state that investigation of rock is contractor's responsibility, whether it is shown in the Contract Documents, and shall be excavated at no additional cost to WSSC Water.
2. WSSC Water suggested a second crew be procured to work concurrently with the main crew on Bond Mill Road, but this was not done due to financial reasons.	Allan Myers explains that adding a second crew was not feasible due to project design, lack of additional sleeves, and logistical constraints. A graphic was provided to show why two crews could not work in the same area. Referenced a previous letter for more details.	
3. WSSC Water asserts that boring logs demonstrate high blow counts where rock is present and low blow counts where no rock was found.	Allan Myers disputes this, providing examples where logs indicated manageable materials, but actual conditions required mechanical breaking of hard granite at shallower depths. Cites WSSC Water's own inspection reports and photos as evidence.	Why were additional borings not directed/ authorized? Why was adding an additional sleeve so difficult to create a break point? Per interview with WSSC Water team, they mentioned that micro-tunneling was dropped from the options because of the cost. It was not clear to the audit team if WSSC Water performed a cost-benefit analysis.
4. WSSC Water notes that Allan Myers' crews demobilized from the jobsite for almost 3 months (8/12/22 to 11/7/22), negatively affecting completion.	Allan Myers acknowledges the demobilization (81 days), but notes the project was previously ahead of schedule. Efforts were made to recover lost time by adding a second crew and a subcontractor but continued rock impacts offset these efforts.	Per Specifications, available float in the project is a shared commodity. In this case Allen Myers – without advance approval of WSSC Water– demobilized and used all the float, which should be brought up in negotiations of PCO #15.
5. WSSC Water does not agree that the presence of rock is a change in condition.	Allan Myers maintains that the subsurface conditions encountered differ materially from those advertised by WSSC Water, and not all geotechnical information was provided to bidders. The presence of rock is the controlling delay and is unforeseeable; liquidated damages should not apply, and a time extension is warranted.	During the audit team interview with Allen Mayers, they declined to answer specific questions related to rock issue because this change order was in negotiation. WSP has have a specific question regarding PCO #15 AM showing the rock pattern from STA 57+00 to 92+87 changes linearly. It is unclear to the audit team how the Contractor came to this conclusion, and how was the hardness of rock confirmed onsite. The PCO #15 claimed it was Gneiss.



WSP suggest the following in Table 7-3 for better CPM Schedule Control:

*Table 7-3 Suggestions for Higher CPM Schedule Control*

<b>Step</b>	<b>Action</b>
1. Initial Review	Review (project controls team); check for compliance and completeness.
2. Logic Check	Validate activity sequencing, durations, and critical path.
3. Risk Identification	Flag delays and ask corrective actions from the Contractor.
4. Documentation	Request for time impact analysis and revised schedule for changes.
5. Approval	Contractor shall obtain written approval before implementing schedule changes.
6. Continuous Monitoring	Treat updates as actionable; document responses and adjust proactively. Be mindful of Float Usage, while reviewing PCOs.



## 8. COST AUDIT AND FINANCIAL ANALYSIS

### 8.1. BUDGET VS FINAL EXPENDITURE ANALYSIS

The original contract price from the 48-inch Patuxent Watermain Replacement project was \$8,393,777.00. The Pay Request No. 49 covering the period from May 1, 2025 to May 31, 2025 was the latest pay estimate that WSP was able to locate on the Trimble/E-Builder website. Per Pay Request No. 49, the total value of the approved change orders was equal to \$1,093,280.05, which is the total value of adjustments requested as part of CO #1 - 7. It should be noted that WSSC Water is currently in negotiations with the contractor regarding the costs associated with PCO #15, which involves costs incurred by the contractor due to rock excavation necessary to install the proposed 48-inch watermain. The aforementioned approved change order total value does not include the costs associated with this PCO, and as such, the total value of the approved change orders may change pending any agreements that are reached between WSSC Water and the contractor.

The audit team has summarized the PCO/ CO LOG in Table 8-1, which captures all scope changes and associated USD cost **except PCO #15**:



Table 8-1 PCO/CO Log

CO#	Description/ Reason	Change Order Issuance date	Time Impact (days)	Cost Impact (USD)	New Contract Price listed on CO (USD)	Related IDR, RFI, PCO (Date, Number)	WSP's Remarks
1	<p><u>PCO #01</u>: Gas Conflict to revise Pipe profile, work described as part of RFI 004. <b>(Cost adjustment = \$73,620.00 and contract time extension of 6 calendar days.)</b> <sup>6</sup></p> <p><u>PCO #04</u>: Cut and re-grade at Vault G. <b>(Cost adjustment = \$83,085.00.)</b></p> <p><b>Total time extension = 6 calendars days (4 shifts)</b></p>	9/21/2021	6	\$156,705.00	\$8,550,482.00	<p>PCO #01</p> <p>PCO #04</p>	<ul style="list-style-type: none"> <li>For PCO #01, Contractor added 10% OH to direct costs, and an additional 10% profit to direct costs plus OH.</li> <li>PCO #04 includes 15% OH/profit for all labor, equip., materials and subcontractor work. Contract states that 15% is allowed for labor and materials, and 5% for equipment.</li> </ul>
2	<p><u>PCO #05</u>: Chemical feed lines from existing WSSC chemical building to the new 48" raw water line not shown on the original drawings; modifications included (5) double containment PVC piping (360 LF each), a new manhole and cost associated with drilling and connection to new 48" raw water line. <b>(Cost adjustment = \$227,995.00 and a contract time extension of 25 calendar days.)</b></p> <p><u>PCO #08</u>: existing sewer in conflict with new 48" raw water line alignment was not shown on original drawings. Work associated with RFI 16 and includes installation of 3 new manholes and over 150 LF of pipe. <b>(Cost adjustment = \$192,550.00 and contract time extension of 25 calendar days.)</b></p> <p><u>PCO #09</u>: Relocation of Receiving Vault H due to conflicts with other utilities associated with responses to RFIs 13 and 14. <b>(Cost adjustment = \$13,644.00 and no contract time extension.)</b></p> <p><u>PCO #11</u>: conflict with an existing 6" gas main and new 48" raw water line, which was not shown on original drawings. Work associated design revisions submitted as part of response to RFI 17. <b>(Cost adjustment = \$18,949.00 and contract time extension of 2 calendar days.)</b></p> <p><u>PCO #12</u>: Test pitting as required to locate existing sewer house connections that may conflict with the 48" raw water line. Sewer connections were not shown on original drawings. <b>(Cost adjustment = \$60,750.00.)</b></p> <p><u>PCO #13</u>: 8" water main relocation previously removed as part of CO #1 now required. <b>(Cost adjustment = \$20,587.00 and contract time extension of 2 calendar days.)</b> <sup>6</sup></p> <p><b>Total time extension = 65 calendars days</b></p>	11/16/2021	65	\$534,475.00	\$9,084,957.00	<p>PCO #05</p> <p>PCO #08</p> <p>PCO #09</p> <p>PCO #11</p> <p>PCO #12</p> <p>PCO #13</p>	<ul style="list-style-type: none"> <li>PCO #05, 08, 09 and 11 includes 15% OH/profit for all labor, equip., materials and subcontractor work. Contract states that 15% is allowed for labor and materials, and 5% for equipment.</li> <li>Cost listed in PCO #12 differs from what is shown on CO #2. (PCO cost = \$51,698.62 vs CO cost = \$60,750). PCO #12 also includes 15% mark-up for labor and subcontractors. Contract states that 15% is allowed for labor and materials, and 5% for equipment.</li> <li>PCO #13 was work previously required as part of original drawings but removed with CO #1. Contractor added 10% OH to direct costs, and an additional 10% profit to direct costs plus OH.</li> </ul>
4	<p><u>PCO #06</u>: Added 6 new corrosion control test stations and new insulation joints. Work associated with Contractor's interpretation of WSSC's response to RFI 012. <b>(Cost adjustment = \$44,458.00 and contract time extension of 7 days.)</b></p> <p><u>PCO #16</u>: Global supply chain issues required Contractor to extend their lease agreement with BG&amp;E to store excess materials. Includes the labor and equipment costs associated with handling material within BGE ROW and BGE Leased Lot. <b>(Cost adjustment = \$49,556.00 and contract time extension of 17 days.)</b></p> <p><u>PCO #20</u>: Original drawing did not ID/OD of existing 42" steel pipe. Contractor state industry standard for steel pipe is OD, when ID/OD not provided, although WSSC intended to reflect ID. Cost covers the price difference of new 42"x36" tee and two new 43" couplings. <b>(Cost adjustment = \$18,328.31.)</b></p> <p><u>PCO #21</u>: cost associated with repairs and cleanups due to unmarked WHC not shown on original drawings. <b>(Cost adjustment = \$16,501.28 and contract time extension of 4 days.)</b></p> <p><u>Contingency Item #1</u>: Test pit in paved area (non-arterial state road) via direction of WSSC Water to ascertain the presence of rock within trench line. <b>(Cost adjustment = \$8,631.90.)</b></p> <p><u>Contingency Item #3</u>: Test pit in paved area at beginning of project <b>(Cost adjustment = \$475.00.)</b></p> <p><u>Contingency Item #4</u>: Gravel backfill below subgrade due to ground water; Contractor directed to use 57 stones for bedding. <b>(Cost adjustment = \$28,757.04 and contract time extension of 5 days.)</b></p> <p><u>Contingency Item #7</u>: Crusher run material to be used where native soil is determined to be unsuitable. <b>(Cost adjustment = \$40,018.00.)</b></p>	9/30/2024	33	\$206,725.53	\$9,291,682.53	<p>PCO #06</p> <p>PCO #16</p> <p>PCO #20</p> <p>PCO #21</p>	<ul style="list-style-type: none"> <li>PCO #06 includes 15% OH/profit for all labor, equip., materials and subcontractor work. Contract states that 15% is allowed for labor and materials, and 5% for equipment.</li> <li>Cost listed in PCO #16 differs from what is shown on CO #4. (PCO cost = \$44,340 vs CO cost = \$49,556). Contractor's fee provided in PCO #16 was calculated correctly per the General Conditions.</li> <li>Cost listed in PCO #20 differs from what is shown on CO #4. (PCO cost = \$22,962 vs CO cost = \$18,321.31.) Contractor added 10% OH to direct costs, and an additional 10% profit to direct costs plus OH, as opposed to 15% to labor and materials.</li> <li>Cost listed in PCO #21 differs from what is shown on CO #4. (PCO cost = \$21,010 vs CO cost = \$16,501.28). Contractor's fee provided in PCO #21 was calculated correctly per the General Conditions.</li> </ul>



CO#	Description/ Reason	Change Order Issuance date	Time Impact (days)	Cost Impact (USD)	New Contract Price listed on CO (USD)	Related IDR, RFI, PCO (Date, Number)	WSP's Remarks
5	<p><u>PCO #18:</u> Energized AC Ground Mats in BGW ROW and installation of test leads via thermite welds to connect anodes to casing, work associated with RFI 021. Cathodic protectic work. <b>(Cost adjustment = \$63,016.00)</b></p> <p><u>PCO #22:</u> Dewatering Cleanup of Leaking Valves. <b>(Cost adjustment = \$18,173.00.)</b></p> <p><u>PCO #23:</u> SHC Conflict 15626 Bond Mill Road <b>(Cost adjustment = \$7,691.00.)</b></p> <p><u>PCO #24:</u> Mis-Marked WHC 15627 Bond Mill Road (PCO 23). <b>(Cost adjustment = \$5,084.00.)</b></p> <p><u>PCO #26:</u> Force Account T&amp;M / SHC 15611 Bond Mill. <b>(Cost adjustment = \$95,793.00 and a contract time extension of 23 calendar days.)</b></p> <p><u>PCO #27:</u> Pipe Modifications / Field Cuts as needed to correct alignment issues with the project's approved pipe laying schedule. <b>(Cost adjustment = \$30,929.00 and contract time extension of 6 calendar days.)</b></p> <p><u>PCO #28:</u> BGE Lease Agreement Extension. Cost includes a 15% mark-up. <b>(Cost adjustment = \$5,227.00.)</b></p> <p><u>PCO #29:</u> Force Account T&amp;M - 15617 Bond Mill Road, cost associated with a conflicting SHC discovered at Sta. 103+95. <b>(Cost adjustment = \$11,051.00 and contract time extension of 3 calendar days.)</b></p> <p><u>PCO #30:</u> Additional Test Pitting of Unidentified Pipe. <b>(Cost adjustment = \$2,120.00.)</b></p>	10/30/2024	45	\$239,084.00	\$9,530,766.53	PCO #18	<ul style="list-style-type: none"> <li>• #For PCO #27, Contractor added 10% OH to direct costs for labor, materials and subs, and an additional 10% profit to direct costs plus OH.</li> <li>• Cost listed in PCO #22 differs from what is shown on Pay Request No. 49. (PCO cost = \$20,712 vs CO cost = \$18,173.)</li> <li>• Cost listed in PCO #23 differs from what is shown on Pay Request No. 49. (PCO cost = \$15,376 vs CO cost = \$7,691.)</li> <li>• Cost listed in PCO #24 differs from what is shown on Pay Request No. 49. (PCO cost = \$10,167 vs CO cost = \$5,084.)</li> <li>• Cost listed in PCO 26 differs from what is shown on Pay Request No. 49. (PCO cost = \$98,639 vs CO cost = \$95,793.)</li> <li>• Cost listed in PCO #26 differs from what is shown on Pay Request No. 49. (PCO cost = \$98,639 vs CO cost = \$95,793.)</li> </ul>
						PCO #22	
						PCO #23	
						PCO #24	
						PCO #26	
						PCO #27	
						PCO #28	
						PCO #29	
PCO #30							
6	<p><u>PCO #31:</u> Storm drain at Sta. 128+40 <b>(Cost adjustment = \$4,001.00)</b></p> <p><u>PCO #34:</u> 6" WM at Sta. 128+50. <b>(Cost adjustment = \$3,733.00.)</b></p> <p><u>PCO #35:</u> Storm drain at Sta. 1+28 <b>(Cost adjustment = \$20,557.00.)</b></p> <p><u>PCO #36:</u> 30in TR Flex Restraint Joint. <b>(Cost adjustment = \$911.00)</b></p> <p>Material Furnished by WSSC for Emergency Replacement. <b>(Cost adjustment = -\$12,913.54.)</b></p>	12/31/2024	6	\$16,288.46	\$9,547,054.99	PCO #31	PCO #31, #34, #35 and #36 and breakdowns of costs were not included in the documents from eBuilder. Cost adjustment for each PCO taken from Pay Request No. 49.
						PCO #34	
						PCO #35	
						PCO #36	
7	<p><u>PCO #38:</u> Fitment Issues experienced at the 30" and 36" tie-in located at the south end of the Project. Required field modifications and work to be performed over 40 additional MHs. <b>(Cost adjustment = \$7,475)</b></p> <p><u>PCO #39-1:</u> 42in Tie-in/Out of Roundness. Work performed over 15 total MHs between 5 crew members at the end of shift to reshape existing 42" steel water main for its original oblong shape to allow for installation of new coupling. <b>(Cost adjustment = \$3,729)</b></p> <p><u>PCO #40:</u> Repair of Existing Damage to 36" PCCP. Work performed over 36 total MHs between 9 crew members. <b>(Cost adjustment = \$6,680).</b></p>	3/21/2025	7	\$17,884.00	\$9,564,938.99	PCO #38	Mark-ups to all PCOs were applied correctly per the General Conditions of the Contract.
						PCO #39-1	
						PCO #40	



## 8.2. CHANGE ORDERS & VERIFICATIONS AUDIT

As part of the audit, WSP reviewed each change order and their respective PCO documents against the terms listed in the signed contract and reviewed the Contractor's justifications to validate the requested cost adjustments and determine if an overpayment had been improperly assessed to WSSC Water.

Our understanding is that a Lump Sum Change Order agreement – except for CO#1 - has not been reached before work for most of these PCOs were completed, therefore we reviewed them as Force Account.

See Appendix B.3 for additional details for the Change Order Cost and Log.

### **CHANGE ORDER #1:**

Change Order #1 is comprised of two PCOs, PCO #01 and PCO #04. PCO #01 was requested due to the necessary change in profile of the new 48-inch watermain to avoid conflict with an existing 3-inch gas main, while PCO #04 was initiated based on elevation discrepancies related to work around Access Vault G. Upon review of the associated PCOs, WSP observed that CO#1 was negotiated and settled as Lump Sum cost to the Contract, therefore they are in compliance with Article 14 of General Conditions, we take no exception.

It is not part of the audit team scope to prepare an independent cost estimate to validate the contractor's claim for labor, material, equipment hours and their respective rates. Therefore, the team only reviewed completeness and accuracy based on the project manual.

### **CHANGE ORDER #2:**

Per the email received from WSSC Water all these PCOs were settled as Lump Sum Cost to the contract.

Upon further review of the breakdown of the PCOs, WSP had the following comments:

- In multiple activities for PCOs #05, #08, #09, #11 and #12, the contractor included the cost of labor for a superintendent and foreman. In each instance, the superintendent worked for the half of the amount of the time as the foreman (i.e., if the foreman worked 1 shift then the superintendent worked 0.5 shifts). Without further dialogue with the contractor the need for two individuals performing supervisory roles is unclear. The foreman's time matched that of the other laborers indicating that this individual provided oversight. Superintendent is unbillable for CO work per Article 14.1.3.1.5 of General Conditions.

### **CHANGE ORDER #3:**

Per the receipts of the subsequent change order documents, it was noted that Change Order #3 was an administrative change order with no cost adjustments to the contract price. This change order consisted of moving \$296,314.23 from the Patuxent 48-inch Raw Water Main – Phase II budget to the Patuxent 48-inch Raw Water Main – Phase I budget. Given that no additional costs were incurred, WSP has no further comments or exceptions taken regarding this change order.

### **CHANGE ORDER #4:**

Change Order #4 is comprised of the costs for efforts and activities associated with four PCOs (PCO #06, #16, #20 and #21) and the four contingency items listed in the bid form of the contract. Per the CO#4 document, these



activities resulted in a total cost increase to the contract price of \$206,725.33. At this time of this report, the signed copy of the contractor’s bid form listing the costs associated with the four contingency items was not located on the Trimble/E-Builder website or made available to WSP for review.

Upon review of the PCOs #06 and #20, it was determined that the contractor had incorrectly calculated their contractor’s fees by applying a 15% mark-up to labor, equipment, materials and subcontractor work, as opposed to following the terms detailed in the General Conditions. Nonetheless, it is WSP’s understanding that the costs that are approved for Change Order #4 are agreed upon between the Contractor and WSSC WATER, and the utility is not able to reclaim these savings. Therefore, the terms listed in Article 14 would not apply or supersede the cost listed in the approved change order.

Upon further review of the breakdown of the PCOs, WSP had the following comments:

- In multiple activities for PCOs #05, #08, #09, #11 and #12, the contractor included the cost of labor for a superintendent and foreman. In each instance, the superintendent worked for the half of the amount of the time as the foreman (i.e., if the foreman worked 1 shift, the superintendent worked 0.5 shifts). Without further dialogue with the contractor, it is unclear why two individuals performing supervisory roles is needed. The foreman’s time matched that of the other laborers indicating that this individual provided oversight. Superintendent is unbillable for change order work per Article 14.1.3.1.5 of General Conditions.
- The contractor’s fees associated with PCO #21 was calculated correctly to meet the terms listed in the General Conditions.

**CHANGE ORDER #5:**

Change Order #5 comprises the costs for efforts and activities associated with nine PCOs (PCO #18, #22, #23, #24, #26, #27, #28, #29 and #30). Per the CO #5 document, the total cost increase to the contract price associated with these activities is \$239,084.00. Upon review of the aforementioned PCOs, it was confirmed that the contractor followed the terms listed in Article 14.1.3 for General Conditions to their Contractor’s Fee for all PCOs with the exception of PCO #27. However, it was noted that equipment hours were in contradiction with Article 14.1.3.1.3. where it directs contractor to charge only the actual time of equipment is in use and no more than 8 hours per day. A breakdown of a portion of PCOs can be seen in Table 8-3.

*Table 8-2 Comparison of a Portion of PCOs in CO #5 to Contract Agreed Prices*

Change Order (CO) No.	Potential Change Order (PCO)	Direct Costs & Bond	Total Overhead & Profit Requested by Contractor	Total Overhead & Profit as Stipulated by Contract <sup>1</sup>	Difference or Savings to be Realized <sup>3</sup>
CO #5	#18	\$58,655	\$4,362 <sup>2</sup>	\$4,362	+\$0
	#22	\$19,783	\$929	\$929	+\$0
	23	\$14,576	\$801	\$801	+\$0
	24	\$9,682	\$485	\$485	+\$0
	26	\$92,340	\$6,299	\$6,299	+\$0
	27	\$30,929	\$2,579	\$2,533	+\$46
	28	\$4,500	\$675	\$675	+\$0
	29	\$10,358	\$693	\$693	+\$0
	30	\$2,002	\$118	\$118	+\$0



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<sup>1</sup> Refer to Article 14.1.3.2 of the General Conditions for the requirements for calculating the Contractor's fee related to costs associated with labor, materials, equipment and subcontractor work.

<sup>2</sup> Contractor calculated their overhead and profit separately by applying 15% mark-up to all labor, equipment, materials and subcontractor for overhead.

<sup>3</sup> WSP's calculation of an overpayment (or underpayment) by WSSC Water for the services provided based on how the Contractor's mark-up should have been determined per the General Conditions of the contract.

Upon further review of the breakdown of the PCOs, WSP had the following comments:

- The contractor utilized only one foreman for all activities, regardless of the crew size, which is inconsistent with the costs that the contractor included on other change orders. ???
- PCO #028:
  - The contractor categorized the rental costs associated with the BGE yard lease under materials, which made these costs subject to a 15% mark-up to calculate the Contractor's Fee. Per Section 01110.1.7.B.1, obtaining staging area for material is the contractor's responsibility.

#### **CHANGE ORDER #6:**

Change Order #6 is for the activities associated with four PCOs (PCOs #31, #34, #35 and #36), along with refurbishment of materials furnished by WSSC Water for emergency replacement. Per the CO #6 document, the total cost adjustment for these activities, including the reimbursement for materials, was equal to \$16,288.46. At the time of the report, copies of each PCO with breakdown and justification for the proposed cost had not been provided to WSP for review and complete the audit.

#### **CHANGE ORDER #7:**

Change Order #7 is comprised of work associated with three PCOs (PCOs #38, #39-R1, and #40) that consider work requested as part of an email dated November 20, 2024 from WSSC Water. The total cost adjustment to the contract price from CO #7 is \$17,884.00. Upon review of the aforementioned PCOs, WSP found that OH&P was calculated consistently and in accordance with the terms outlined in the General Conditions. Thus, there are no additional savings, with respect of OH&P from the contractor's Fee.

Upon further review of the breakdown of the PCOs, WSP had the following comments:

- PCO #38:
  - Two foremen were used to oversee a crew consisting of three operators and three laborers.
- PCO #39-R1:
  - One foreman was used to oversee a crew consisting of two operators and two laborers.
- PCO #40:
  - The work was performed on Friday, which made all labor costs subject to overtime (OT) rates, given that the Contractor's crew had worked 40 hours that week prior to the point.



## 9. INTERNAL AND EXTERNAL COORDINATION

Effective coordination—both internally among project teams and externally with stakeholders—is essential for the successful delivery of complex infrastructure projects. This section outlines the key roles, communication channels, and collaborative efforts involved among WSSC Water departments and highlights the interactions with external parties. By examining both internal and external coordination practices, the audit can better understand the strengths and challenges that shaped project outcomes.

### 9.1. INTERNAL COORINATION

#### WSSC Water DEPARTMENTS AND ROLES INVOLVED

The Project spanned multiple WSSC Water departments and teams:

**Engineering & Design:** WSSC Water Pipeline Design Division **Project Manager** worked with design consultant(s) handled project planning, design development, and permit preparations, the design packages were submitted and reviewed by different internal stakeholders at various design milestones.

**Procurement & Contract Administration:** WSSC Water’s Contracts/Procurement department prepared the construction bid documents and contract.

**Construction Management & Field Operations:** The execution phase was managed by WSSC Water’s Pipeline Construction Division. WSSC Water **Depot Manager/Construction Manager** oversaw construction projects, and **Contract Manager/Supervisor** provided supervision of onsite WSSC Water Construction Inspector and responsible for the overall management of the project, supported by **Construction Inspector(s)** for daily oversight and monitoring of the Contractor’s operations . Within Pipeline Construction Division, WSSC Water **QA Compaction oversight team** monitoring the operations of the Contractors and third-party geotechnical firms (Provided independent testing for the Contractors backfill operation).

**Shutdown and Repairs:** WSSC Water Utility Services Maintenance staff performed necessary repairs during construction related to the water main leaks and valve repairs that were not causing by the construction. They also coordinated with the WSSC Water construction team for shutdown related work.:

**Customer & Community Affairs (Communications):** Given the project’s community impact, WSSC Water’s Communications and Community Outreach Department was involved. Initially this may have been limited to periodic updates and handling incoming inquiries, but as issues grew a dedicated **Public Outreach Manager** and **Outreach Specialist** became active. WSSC Water assigned a **Customer Advocate** for northern Prince George’s County as well, and a **Community Outreach Specialist** to interface with residents.

**Leadership and Inter-Department Coordination:** Senior leadership within WSSC Water (e.g., division heads, executives) became directly involved once the project encountered significant troubles. It was noted that “**engagement improved following leadership changes at WSSC Water**”, including more effective internal meetings and the formation of a **Cross-Functional Task Force**.

#### INTERNAL COMMUNICATION CHALLENGES AND GAPS

**Personnel Turnover and Continuity Gaps:** Due to the extended timeline of the overall project, key personnel, such as project design manager (both WSSC Water and Design Engineer), contract manager, inspectors, have been changed from the project planning, design and construction execution phases. As a result, critical knowledge and decision-making information were not consistently transferred, leading to gaps in project



continuity and understanding. Also, the changes disrupted communication and transparency. For instance, the WSSC Water Contract Manager role changed during construction. Residents reported a “6-month lag” in updating the construction manager’s contact information on public signs and in communications. The document review identified inconsistencies in how information was recorded within the Trimble/E-builder system. These discrepancies led to gaps in documentation or loss of previously made decisions during personnel transitions.

**Design–Construction Handoff Issues:** There were gaps in transferring critical information from the design phase to construction. Notably, geotechnical findings were not fully conveyed to the construction team/contractor at NTP.

**Response Time Delay on Unforeseen Conditions and Changes:** The project experienced slow responses to unexpected issues, some due to internal communications delays between groups, and unclear escalation processes. These led to longer project timelines and highlight the need for quicker protocols to address unplanned developments.

**Siloed Departments and Reactive Communication:** The project revealed a lack of seamless communication between WSSC Water departments. For example, community complaints about road conditions and safety were coming in throughout 2022 and 2023, but the field inspectors’ reports noting “sunken temporary patches” did not trigger prompt action by WSSC Water until the issue had escalated publicly. The Construction Team on site reported issues up the chain, but there wasn’t an effective internal mechanism to address chronic problems proactively.

**Delayed Internal Escalation of Issues:** Many of the project’s most significant issues (rock excavation halting work, extensive change orders, temporary road degradation, etc.) were known to the project team well in advance of becoming public controversies. However, it seems that these issues were not internally escalated to higher management or across departments early enough.

**Difficulty Enforcing Corrective Action from QA Inspection:** The audit identified communication issues between the QA team and construction team related to the implementation of corrective actions from QA inspections. Communication challenges among inspection teams, managers, and contractors sometimes resulted in delays or incomplete follow-through, which allowed issues to remain unresolved until they became more prominent. These factors affected the overall effectiveness of the QA process and contributed to repeated field problems.

**Fragmented Communication with the Community:** The internal disconnects translated into an uneven external communication strategy. Because internal departments weren’t always in sync, WSSC Water sometimes gave the public information that later proved incorrect or outdated (e.g., optimistic timelines).

## **AREAS FOR IMPROVEMENT**

- Create cross-functional project teams from the start.
- Improve handoff of documents and information between departments.
- Structured risk management and joint problem solving.
- Use shared systems to track updates and risks.
- Hold regular coordination meetings and escalate issues early.



- Improved communication on enforcing corrective actions.
- Ensure public-facing teams have accurate, timely info from internal sources.

## 9.2. INTER-AGENCY COLLABORATION

### KEY EXTERNAL AGENCIES AND ENTITIES

The project required extensive coordination with external agencies at the county, state and federal levels, as well as with utility companies. Key external agencies included Prince George's County DPIE, Prince George's County Department of Public Works & Transportation (DPW&T), MDE, USACE, and Maryland DNR, among others. Refer to Section 4.5 Permits for a summary of the permits obtained for the project.

In addition to the agencies, the project engaged with other local/state entities as well as utility companies.

- **Other Local/State Entities:** The project fortunately did not require a State Highway Administration (SHA) permit since it did not directly impact state roads (the alignment stayed on county roads or WSSC Water property). Note that during the alignment selection phase years prior, WSSC Water had explored routing options along SHA right-of-way (MD-198) and BGE's transmission corridor; however, but both SHA and BGE formally refused to allow a longitudinal pipeline on their property.
- **Utility Companies:** A critical aspect of interagency coordination was dealing with private utility owners whose infrastructure intersected the project. Major utilities included BGE (gas and electric), Verizon (telecom), and Comcast (telecom).

### OBSERVATIONS AND LESSON LEARNED IN INTERAGENCIES COORDINATION

- **Multi-Agency Sequencing:** The project had to comply with county, state and federal bodies, each with its own process. WSSC Water's design team initiated permit applications early (some years in advance) to align with agency review cycles.
- **Work Hour Restrictions:** Prince George's County initially restricted weekday construction on Bond Mill Road to 9:00 AM–3:30 PM to avoid rush hour and school traffic, which significantly limited productivity. According to an email and progress meeting agenda in August 2021, WSSC Water negotiated with DPIE, which, after consulting the traffic division and the community, extended work hours to 8:30 AM–5:00 PM via a permit modification and community notification. This collaboration added about two productive hours daily. **Lesson:** Engage permitting authorities early if restrictions are problematic and consider seeking broader allowances upfront to avoid mid-project changes.
- **Traffic Control & Restoration Plans:** The Special Utility Permit required WSSC Water to submit and get approval for Traffic Control Plans and pavement restoration for Bond Mill Road. As construction wrapped up, PG DPW&T requested updates to the signing and striping plan to meet current standards. WSSC Water and DPIE expedited this by exchanging design sketches via email, with the County assisting in the redesign. Once finalized, WSSC Water formally revised the permit. This collaborative, flexible approach sped up the process, leading to an agreement for the County to share costs for enhancements like bike-friendly striping. **Insight:** Open, early and continuous communication with agencies having jurisdiction and leveraging their expertise can expedite approvals and improve outcomes for complex permits.



- **Utility Company Coordination:** Coordinating with utility companies posed several key challenges. The project experienced the challenge that BGE was unwilling to allow new water infrastructure in their right of way, which required an alternate route. In addition, the project's lack of correspondence records and approvals from private utility owners—BGE, Verizon, and Comcast—led to issues such as an unidentified gas main discovered during construction, which required a redesign of the water main. **Lesson:** Early and clear communication with utility owners, as well as thorough documentation, is essential. Gaps in records can lead to unexpected complications, such as unidentified infrastructure requiring design changes during construction. Establishing robust channels for engagement and maintaining comprehensive records helps mitigate risks and avoid delays. When utility coordination proves challenging, adaptability and a willingness to seek alternative solutions are necessary to keep the project on track.



## 10. COMMUNITY ENGAGEMENT

Community engagement is a key component to a successful design and construction project. It provides direct access to impacted customers and ensures the goals of projects are being achieved for the end user. Effective community engagement entails clear, transparent, consistent and frequent communication with residents in a digestible and approachable format. WSP reviewed existing outreach documentation, met with key stakeholders, requested community feedback through a public comment form, and documented key findings throughout the process to document current gaps in the process and support improved community engagement in the future.

### 10.1. REVIEW OF EXISTING OUTREACH DOCUMENTATION

The audit team conducted a thorough review of existing outreach documentation. This included project meeting presentations, project update announcement flyers, internal documentation of feedback, correspondence with the community and other key stakeholders regarding the project, and DIRs during construction. Based on discussions with the WSSC Water team, all necessary documents were provided to the audit team, and no documentation was noted as missing or incomplete. The team reviewed this information to identify examples of success, existing gaps or challenges, consistent complaints from the community or key stakeholders, and problem resolution when applicable.

Through the review of existing documentation, as well as interviews with the project team, WSP determined WSSC Water did have an engagement approach for this project dating back to 2011. Between 2011 and 2025, WSSC Water hosted three (3) community and five (5) stakeholder meetings relating to the project. The topics covered in the community meetings included existing ROW constraints, proposed alternative location discussions, the selection of the final alternative, design and construction timelines, and potential community impacts. The first community meeting was held in 2011 and the last community meeting hosted by WSSC Water was held in April of 2025. The first meeting was during the planning portion of the project and focused on potential alternative ROW considerations and potential alternative locations. The final meeting provided a project update as well as introducing the community to the project task force, identified to assist the project team in incorporating community requests into the final project deliverables. In addition to the community meetings, WSSC Water hosted five (5) meetings with key stakeholders including elected officials, West Laurel Civic Association (WLCA) and eventually the West Laurel Task Force. WSSC Water also attended seven (7) meetings hosted by WLCA regarding the project. The purpose and discussions of these meetings were similar to the community and key stakeholders meetings. Table 10-1 provides a summary of the meetings held. In addition to WSSC Water and WLCA hosted meetings, the WSSC Water sent mailers to impacted residents and community members, as well as answered several emails, phones calls, and met with residents as requested.

The main challenges documented for the 48-inch Patuxent Raw Water Main project were; 1) temporary paving and damage caused to the community, 2) trash being left on the project site, 3) minor damage to residents' property through ongoing construction, 4) delays in project completion without satisfactory explanation and 5) lack of frequent and consistent communication to the wider community. The documentation revealed that while not all, most issues were resolved in a timely manner, and most residents were overall satisfied with the resolution. There were a few examples where community members' complaints were not resolved but per most documentation notes, those issues were outside the control of WSSC Water, the inspector, or the Contractor.



Table 10-1 Summary of Community Outreach Meetings/Updates

Project Phase	Outreach Date	Location	Host	Representatives	Communication Summary	WSP Remarks on Project Status	Challenges/Delays encountered after the community meeting
Planning	2011/04	West Laurel Community Building	WLCA/ WSSC Water	WLCA Boards, Elected Officials, WSSC Water, Design Engineer Team	Discussed the purpose of the Patuxent raw water pipeline project, alternative alignments, and community impact.	Project at 30% Planning phase.	WSSC Water encountered budgeting issues and delayed the project design schedule.
	2011/05	West Laurel Community Building	WLCA/ WSSC Water	WSSC Water, Design Engineer Team, WLCA, Community	WSSC Water gave presentation and held community discussion on Patuxent raw water pipeline project to receive community input on the alignment.		
	2011/06	WSSC Water Headquarters	WSSC Water	WSSC Water, Design Engineer Team, WLCA, Community	The community and elected officials pushed for BGE and SHA to allow for longitudinal occupancy of their ROWs for the water main.		
	2011/07	WSSC Water Headquarters	WSSC Water	WSSC Water, Design Engineer Team, BG&E, SHA, WLCA	BGE and SHA stated they cannot allow longitudinal occupation of their ROWs for the water line. The WLCA expressed concerns regarding public safety near the school, repaving, sidewalks assess, and communications from WSSC Water regarding community impacts and schedule.		
	2011/12	WSSC Water Headquarters	WSSC Water	WSSC Water, Design Engineer Team, Elected Officials, WLCA	The pipeline's preliminary alignment was discussed.		
Design	2018/09	West Laurel Community Building	WLCA	Community, WSSC Water, WLCA	WSSC Water presented the project, stating design anticipating completed in 2018, construction to start in 2019 and to complete in Fall 2021.	Outreach meeting at 100% Design	WSSC Water coordination with Prince George's County on the Culvert rehabilitation work and MOU delayed the project started date.
Construction	2021/05	Virtual at WLCA Spring General Meeting	WLCA	Community, WSSC Water, WLCA	WSSC Water gave a presentation on community impacts to expect during construction. Anticipated start of construction was Summer/Fall 2021 and completion was Fall 2023.	NTP received, contractor started mobilized. Based on CPM schedule, project was 6 months in construction, schedule on track	Utility conflicts, Rock impact slow down progress during later stage



Project Phase	Outreach Date	Location	Host	Representatives	Communication Summary	WSP Remarks on Project Status	Challenges/Delays encountered after the community meeting
	2022/10	West Laurel Community Building	WLCA	Community, WSSC Water, WLCA	WLCA held a community meeting that WSSC Water personnel attended to provide project updates.	Rock encountered during construction. Contractor demobilized from 8/18/2022.	Contractor demobilized schedule impact as 81 days. Rock started significantly after the Contractor resumed work in 11/2022.
	2023/02	WLCA Spring General Meeting	WLCA	Community, WSSC Water, WLCA	WLCA held a community meeting that WSSC Water personnel attended to provide project updates.	Rock delayed construction progress	Rock issues significantly impacted installation progress. Unstable sandy condition slow pipeline installation process.
	2024/06	WSSC Water Headquarters; Hybrid with virtual option	WSSC Water	Community, WSSC Water	WSSC Water gave a presentation on an updated timeline for the project which discusses the rock encountered in August of 2023.	Rock and unstable sandy condition delayed construction progress Global supply chain impact on material handling	Sewer House Connection conflicts, Final tie-in fitment issues
	2024/11	Location not stated	WSSC Water	Elected Officials, WSSC Water	WSSC Water held a meeting for the elected officials to get their feedback before the upcoming community meeting.	-	-
	2024/12	West Laurel Community Building; Hybrid with virtual option	WLCA	Community, WSSC Water, WLCA	WLCA held a community meeting that WSSC Water personnel attended to provide project updates.	Permanent Patching installed in Nov 2024.	NA
	2025/03	Online, via Teams	WSSC Water	Elected officials, WLCA President, WSC Water	The Task Force discussed action plans	Task Force to prioritize and refine community requests, to conduct final paving and striping.	NA
	2025/04	Online, via Teams	WSSC Water	Community, WSSC Water, WLCA, DPIE, DPW&T, Elected Officials	The Task Force was introduced to incorporate community requests		
	2025/06	Online, via Teams	WSSC Water	Elected officials, WLCA President, WSC Water	WSSC Water provided updates on the items pertinent to the Task Force		



## 10.2. SUMMARY OF STAKEHOLDER ENGAGEMENT AND SURVEY

Four elected officials were interviewed

- Delegate Mary Lehman,
- Senator Jim Rosapepe,
- Council Member Tom Dernoga, and
- Delegate Ben Barnes.

Communications and public involvement specialists conducted a combination of in-person and virtual interviews, each lasting approximately 45 minutes, to gather feedback from these officials. After presenting the project background and outlining the scope of the audit, the team invited input on the officials' experience with the project, feedback received from constituents, and recommendations for improving planning, communication, or community outreach for future projects.

In addition, three key community stakeholders were interviewed, these stakeholders included the president of the West laurel Civic Association, a member of the project task force, and an actively involved resident living along Bond Mill Rd. Virtual interviews, also lasting about 45 minutes each, were conducted to collect their perspectives on the project, community engagement, and suggestions for future improvements. To broaden community input, a comment form was circulated, resulting in 17 responses from community members impacted by the 48-inch Patuxent Raw Water Main project.

Feedback from both community members and elected officials consistently described the 48-inch Patuxent Raw Water Main project as disruptive and frustrating during its implementation, though many acknowledged that the completed project brought significant improvements to the area. Three key areas of concern emerged:

- Community Experience,
- Project Planning, Management, and Execution, and
- Community Outreach and Communication.

The three areas of concern that emerged from stakeholder interviews and comment form feedback were aligned with the five challenges documented in the project documents reviewed by the team. Community members and officials alike cited frustration stemming from major project delays, a lack of transparency, increased traffic congestion near the school, and what was perceived as insufficient communication from the WSSC Water Project Team. The delay attributed to rock was questioned by both groups, who suggested that more comprehensive pre-construction surveys might have helped anticipate or address this issue. The timing of notifications regarding delays was another concern, as many felt they should have been informed sooner. This delay in notification was verified through documentation review and project meeting timelines. The public was not informed of the extent of the delay and reasoning until well after the issue was identified by the project team.

Additional frustration arose when the Contractor left the site without notifying the community, leaving equipment and debris behind, which led to perceptions of inequity and a sense that another community was being prioritized. There was conflicting information regarding the site conditions during this pause in work as the WSSC Water Team noted the site was left in adequate condition while the community disagreed. There



were no photos obtained to verify the site conditions and therefore the audit team is unable to provide further comment on the matter.

While the final repaving and improvements were appreciated, temporary patching and roadway conditions during construction caused vehicle damage and inconvenience. Some community members, particularly those on the West Laurel Civic Association Board and project task force, valued being included in the final stages to provide feedback, but others felt that compensation for the disruption was inadequate, with requests for amenities such as a dog park or paved path going unfulfilled. The audit team does not believe these requests fall within WSSC Water's scope to fulfill. If the community has identified them as important, an interagency task force - including all relevant parties - should be convened to address the requests collaboratively.

In terms of project planning and management, both community members and elected officials observed what they described as poor contractor performance and limited oversight from WSSC Water. The proximity of an elementary school heightened concerns, as many felt that the project planning did not adequately account for the potential disruptions to school operations. Publicly shared project timelines were repeatedly not met, which negatively affected public perception and overall trust in WSSC Water's project management capabilities. Abrupt staff changes within the project team further disrupted communication and transparency.

Regarding outreach and communication, both groups noted that communication was inconsistent, particularly about delays and their root causes. However, interviewees noted that engagement improved following leadership changes at WSSC Water, with more effective meetings and direct outreach, including the formation of a task force and better agency coordination. Despite these improvements, some residents felt that communication relied too heavily on the West Laurel Civic Association, leaving out directly impacted individuals along Bond Mill Road. They also felt that some issues such as incorrect contact information on signage and lack of notification about water shutoffs persisted. Elected officials also noted that some residents perceived the project as primarily benefiting future development rather than addressing the needs of existing community members, highlighting the importance of early engagement and clear project framing for future initiatives.

### 10.3. KEY FINDINGS

The 48-inch Patuxent Raw Water Main project presented a range of challenges and opportunities for improvement as it relates to community engagement. Through the documentation review, stakeholder interviews, and analysis of the community feedback form several key themes emerged. These findings reflect the lived experiences of those impacted by the project and highlight areas where planning, communication, and construction oversight can be strengthened.

- **Outreach lacked consistency, breadth, inclusiveness, and proactiveness:** While WSSC Water did send mailers and placed project update flyers on residents' doors along Bond Mill Road, the majority of outreach focused on the West Laurel Civic Association. There was limited in-depth engagement with residents living along or directly off Bond Mill Road as well as with the Bond Mill Elementary School Community. This increased community frustration and had an impact on the overall perception of WSSC Water with community members. Additionally, WSSC Water often presented at community meetings as a response to community complaints or at the request of elected officials rather than presenting to the community pre-emptively. The lack of proactive engagement tainted the community's and their elected officials view of WSSC Water's project planning and management abilities. There were also long gaps between WSSC Water hosted or attended community meetings



regarding the project. Once delays were recognized, it was almost 10 months before WSSC Water shared that information with the community. It should be noted that WSSC Water has made improvements in this area by launching initiatives like the Customer Advocates program which is responsible for making additional efforts to engage with all impacted community members and stakeholders.

- **Oversight and contractor performance were inadequate:** While WSSC Water did have an assigned Contract Manager and Inspector checking on the construction site, there were many issues the community and their elected officials noted could have been resolved with additional oversight. These items included the condition of temporary patching, community members often had to complain about the poor conditions before they were rectified by WSSC Water. With additional oversight, these issues could be resolved before they become a problem. Additionally, the trash and debris that were left at the sight was a major concern for the community and another issue that could be rectified with additional daily oversight.
- **Agency collaboration was limited and reactive:** The community observed that at several points during the project, other agencies such as DPWT and DPIE conducted construction work on or adjacent to the Bond Mill Rd Project. A lack of coordination and awareness among agencies has historically caused harm to communities - and continues to do so today. Early coordination between projects and proactive communication with residents should be prioritized to improve community experience and minimize disruptions from all concerned agencies. Early coordination can also create opportunities to deliver additional community benefits. The community noted this type of coordination was demonstrated at the end of the project, when new sidewalks, pavement markings, signage, and raised pedestrian crosswalks were installed. Providing these benefits helps strengthen community trust and buy-in for major projects like this one.



## 11. LESSON LEARNED

The audit of the 48-inch Patuxent Raw Water Main project identified various lessons that may be applicable to future infrastructure projects. This section provides a summary of the main challenges, gaps, areas for improvement, and recommendations for process enhancement based on prior findings.

### 11.1. SUMMARY OF CHALLENGES AND GAPS

#### PRECONSTRUCTION CHALLENGES AND GAPS

##### 1. Long planning and design phase

- Outdated baseline data due to prolonged project planning and design phase.
- The long delay weakened the continuity of stakeholder engagement.
- Disconnection between the planning commitment and the construction execution.

##### 2. Utility Conflicts

- Outdated utility destination assessment and incomplete records led to multiple utility conflicts (sewer laterals, gas mains, water service lines, telecom cables) resulting in delays, change orders, and additional costs.

##### 3. Geotechnical Investigation Gaps

- The original geotechnical investigation underestimated subsurface variability, missing shallow hard bedrock and unstable saturated sands.
- Boring logs and reports were not sufficiently updated due to team changes, or shared with the Contractor during the bidding or prior to construction.

##### 4. Rigid Lay Schedule with Owner Furnished Materials

- Owner-furnished materials and a fixed installation sequence limited flexibility to respond to unforeseen field conditions (e.g., rock formations, utility conflicts, access constraints)

##### 5. Sequence of Construction and Pavement restoration timeline gaps

- Design didn't provide flexibility for isolating sections in proximity of the school to avoid working during normal school hours, which the community raised as a concern during planning phase.
- Design and sequence of construction didn't plan properly to allow for phased testing and paving to avoid long duration of temporary patching.

##### 6. Permitting & Agency Coordination

- Multi-agency permitting (county, state, federal) required extensive coordination and multiple rounds of review, causing delays.
- Work hour restrictions requirements were not fully integrated into the project plan, slowing productivity.



## **CONSTRUCTION CHALLENGES AND GAPS**

### **7. Preconstruction Meeting did not highlight**

- Temporary pavement duration.
- Required preconstruction submittals (utility stakeout plan, tie-in procedures, QA/QC plan, test procedures, etc.).

### **8. Utility Conflicts**

- Numerous unmarked or inaccurately mapped underground utilities (sewer house connections, gas lines, communication cables) led to service disruptions, emergency repairs, and design modifications.
- Outdated records and incomplete documentation required frequent field verification, often requiring hand excavation, and triggered multiple RFIs and change orders.
- Reactive test pitting.

### **9. Bulk Delivery/ Handling of Material**

- Bulk delivery of materials was decided to address supply chain disruption impact, however it created storage and handling challenges, impacting productivity.

### **10. Documentation & Reporting Gaps**

- DIRs often lacked key details (backfill material, compaction equipment, depth of excavation, pressure test info).
- Quality assurance and control procedures were inconsistently implemented; no comprehensive QA/ QC plan was developed or approved.

### **11. Site Health and Safety:**

- No Activity Hazard Analysis has been performed.
- Traffic Control Inspector was rarely onsite to verify MOT setup.

### **12. Delayed RFI Responses & Change Management**

- 27 RFIs were generated, many with delayed responses (some over 1,000 days late), impacting schedule and cost.
- Deviations from Article 14 of specification were not discussed with the contractor.
- Several RFIs and change orders remained open or unresolved in the project management system.
- Except for PCO #01, which was reviewed by a cost estimator, the rest of change orders lacked proper independent cost estimates.
- Per Article 14, of General Conditions the Contractor is allowed to charge 50% of the actual rate for the equipment downtime, it appears they did not abide by this clause.

### **13. Schedule Delays**



- Severe rock impacts, utility conflicts, weather shutdowns, and contractor demobilization led to cumulative delays of over 210 days.
- Temporary patches remained far longer than allowed by the specifications, resulting in community complaints.
- Schedules (baseline and updates) were not reviewed in detail.
- Lack of close collaboration between the contractor and WSSC Water resulted in major delays. Like:
  - Contractor left the site after they encountered rock without WSSC Water's approval.
  - Stakeout of existing utilities as required per specification 01110 prior to construction activities started

#### 14. Quality Control/ Quality Assurance Issues

- **Compaction Related**

- **QC Test Gaps:**

- **Qualifications & Approval:** BCE's technician credentials were not clearly submitted to WSSC Water for pre-approval, as required by specifications 01450.1.3.A and 02315.1.3.B.
  - **Site Presence:** BCE's geotechnical technician was absent during documented backfilling activities (e.g., April 14, 2022), violating specification requirements for continuous inspection.
  - **Reporting Timeliness:** BCE's compaction test reports were frequently submitted up to a month late, despite Section 02315.1.3.B.3 mandating certified reports within 2 business days.
  - **Review & Documentation:** There is no evidence that BCE's reports were reviewed by WSSC Water or the Engineer, nor are they logged in Trimble/E-Builder for compliance verification.
  - **Proctor Test Records:** Only one official proctor test report was submitted for the project, while multiple native soils and proctor values were used for backfilling without supporting documentation.
  - **Lift Thickness Non-Compliance:** BCE routinely documented loose lift thicknesses of 1 foot and, in some cases, 16 inches, contrary to the specified 8-inch maximum. WSSC Water later directed compliance, but non-conforming lifts persisted.
  - **Incomplete Depth Testing:** Compaction testing was not performed across the full trench depth; for example, BCE Report No. 182 only tested four lifts for a trench with a specified depth of ~10 feet (Drawing C-9).
  - **Proctor Test Reference Issues:** BCE referenced Modified Proctor Tests in reports, but only one actual proctor report was found for the native soils used throughout the project.

- **QA Test Gaps:**

- **Location Documentation:** Reports do not consistently record precise activity locations based on pipe alignment stationing. In several cases, the addresses noted are hundreds of feet away from actual backfilling operations (e.g., INCRP No. 61, December 6, 2021).



- **Proctor Data Usage:** Nearly all reports reference the same proctor data (max dry density = 145.3 pcf, OMC = 5.5%) throughout the project, despite varying native soil conditions. There is no evidence that updated or site-specific proctor values were used, nor confirmation that the referenced values originated from an actual Modified Proctor Test.
- **Trench/Backfill Length:** Reports contain inconsistent information regarding trench length and backfill length.
- **Lift Thickness:** QA reports do not document the thickness of backfilling lifts, making it impossible to verify compliance with specified lift sizes.
- **Test Depth/Location:** Reports do not indicate the depth or exact location where compaction tests were performed. When retests occurred after failed compaction, corrective actions (e.g., re-compaction or replacement) were not documented.
- **Test Data Completeness:** Compaction test reports omit critical details such as wet density and dry density, reporting only relative compaction percentage. For quality control, all parameters from each in-situ NDT should be documented.
- **Photographic Evidence:** No photographs were produced to support the reported activities or test results.
- **Material Documentation:** CIRTs do not mention the type of backfill material used.
- **Temporary and Permanent Pavement Noticeable Gaps:**
  - Usage of unapproved cold asphalt mixes, while specification prohibits usage unless approved by the Owner per 02950.
  - Temporary Pavement had to be replaced within 60 days of placement per 02950, but in this project it took much longer (months longer).
  - Undocumented storage of cold asphalt mix for temporary patches
  - Unknown cutback width for permanent patches.
  - No evidence available for tack coat of new asphalt patches with existing asphalt.
  - No data has been recorded for Hot Asphalt Mix, no delivery tickets.

**15. Customer notification issues:**

- Outreach/complaints not systematically tracked, causing oversight of issues.
- Residents not notified in some cases

**16. Risk Management:**

- No documents indicating proactive risk management in the project. Everything was managed reactively.

**COMMUNITY ENGAGEMENT CHALLENGES, GAPS AND IMPROVEMENT**

17. Outreach lacked frequency, consistency and inclusiveness.



18. Reactive rather than proactive engagement.
19. Positive outcomes from late-stage coordination: At the project's conclusion, enhanced collaboration with the community and local agencies resulted in improvements such as new sidewalks, pavement markings, signage, and raised pedestrian crosswalks, which helped restore community trust and support.

## 11.2.RECOMMENDATIONS FOR PROCESS IMPROVEMENT

**Comprehensive Risk Identification & Management:** A more proactive risk management approach should be standard, especially for large and complex projects, which capital-intensive, multi-disciplinary infrastructure initiatives that involve significant planning, design, permitting, and construction efforts. On the Project, many risks (utility conflicts, extended patch duration, rock excavation difficulty, deep trenching with unsaturated sand conditions, rigid lay schedule ) were handled reactively. Going forward, it is recommended WSSC Water to implement a formal risk register for large and complex projects because it centralizes risk information, categorize risk's inevitability, and mitigation approaches, and enables proactive mitigation to prevent cost overruns and delays. To implement effectively, WSSC Water should establish clear governance and ownership, develop a standardized template with key fields (risk ID, category, likelihood, impact, mitigation plan, owner, status, as shared in Table 6-6 and 6-7 in this report), integrate the register into project management processes, apply a risk scoring framework, and leverage technology for accessibility and visualization. Regular monitoring through scheduled reviews, leadership dashboards, and staff training will foster a risk-aware culture and ensure continuous improvement.

**Comprehensive Pre-Construction Investigations:** The project emphasized the necessity of conducting thorough site investigations prior to finalizing design decisions. SUE activities should be elevated to at least Quality Level B or A in critical zones to minimize unexpected utility discoveries during construction. Additionally, detailed geotechnical investigations should be performed and any associated risks must be clearly communicated within the contract documents. Note that it may be necessary to perform subsequent investigations if the alignment changes as the design progresses as was the case for this project.

**Enhancing Stakeholder Coordination for Construction Efficiency:** WSSC Water should strengthen stakeholder coordination by engaging roadway authorities and key stakeholders early, aligning construction schedules with community calendars such as school activities, and requesting flexible work-hour provisions during initial permit applications. Additionally, commitments and requirements agreed upon with stakeholders should be documented in the construction contract and enforced during execution to ensure compliance. Formalizing stakeholder notification protocols and implementing centralized tracking for permits and renewals will further prevent delays, improve communication, and support smoother project delivery.

**Enhance Change Management with Schedule and Cost Integration:** The Project highlighted the need for nimble yet controlled change management. WSSC Water should improve how changes are documented, approved and communicated. Change Management should be agile to be quickly responded to the field changes, also change review meetings with the project team so that potential changes (i.e., RFIs, differing site conditions) are addressed in a timely, transparent way.

**Integrate Schedule and Contract Requirements for Better Control:** Project controls and design teams at WSSC Water should align baseline schedules with specifications and community needs. Schedule updates must be formally reviewed and approved, enabling proactive risk identification and adjustment of field activities. Document all correspondence to ensure consistent risk management across similar projects.



**Improve Documentation and Process Management:** WSSC Water’s project team should improve the documentation, reporting and process management in the following areas:

- **Implement a formal RFI closure checklist** to verify all RFIs are marked as resolved when complete.
- **Standardize the submittal and review process:** Confirm that all preconstruction documents are submitted and reviewed prior to mobilization, and recorded within the official submittal log and workflow.
- **Standardize Daily Inspection Reports** for consistent documentation of repairs, materials, and testing.
- **Verify material deliveries and QC tests** are clearly documented by inspectors.
- **Material Traceability & Traffic Control:** Record materials used with daily documentation and maintain records of traffic control practices, including oversight visits.
- **Safety Oversight:** Update safety incident records and daily trench shoring reports with photographs and detailed notes.
- **Incident Management:** Document both temporary and permanent repairs, post-repair bacterial testing, and confirm all incidents have formal reports with tracked resolution timelines.
- **Neighbor Impact Tracking:** Log communications and resolutions with residents, confirm satisfaction, and verify completed repairs.

**Strengthening QA/QC:** The Project experience showed some QA/QC process gaps that can be improved.

- **Contractor Quality Control Plans:** Require contractors to submit a comprehensive QC plan at project outset, detailing how they will meet specs for each major work item.
- **Strengthen correction process:** Enforce follow-up procedures in response to inspection findings regarding non-compliance issues on compacting, pavement, testing or erosion and sediment control.
- **Regular QA/QC Meetings:** Instituting weekly or biweekly QA/QC meetings between WSSC Water inspectors and the Contractor can facilitate early identification of quality issues.
- **Enforcement of Standards:** WSSC Water’s field inspectors should be empowered – and expected – to halt work when critical QA standards aren’t met.
- **Submittal and Testing Tracking:** Another improvement is maintaining a registry of required submittals and test reports with status and deadlines.

**Inter-Departmental Coordination:** Internally, it is recommended to implement formal communication protocols and regular milestone meetings between design, construction, and utility divisions. A centralized project management system should enable real-time sharing of updates and site conditions. Rapid-response teams from each department should address unforeseen issues promptly.

**External Agency Coordination:** Externally, WSSC Water should implement consistent communication and coordination practices with partner agencies such as DPWT and DPIE to ensure projects are aligned and minimize disruption to the community. Coordination should include discussions on scheduling, timelines and joint community engagement efforts. This approach promotes transparency, maximizes community benefit and helps prevent resident fatigue from overlapping meetings or competing priorities.



**Establish Regular Communication Protocols with Elected Officials:** WSSC Water should implement protocols for regular communication with elected officials for major projects, including kickoff meetings to present project overviews, followed by major milestone meetings to keep officials informed and prepared to update constituents. Additionally, special meetings should be held before presenting to community meetings to allow for feedback, ensuring alignment with community priorities. For minor projects, teams should share summary overviews and provide milestones updates to elected officials' office.

**Increase the Frequency of Community Engagement:** WSSC Water should prioritize early and consistent communication with the community and key stakeholders throughout the project lifecycle. Proactive outreach and regular updates will improve transparency, elevate the community experience and ensure meaningful input is incorporated. Community meetings should be held at all major milestones included but not limited to alternative analysis and selection of the final alternative during the planning phase, 30, 60, and 100% design milestones, as well as the beginning of construction. During construction, the Project Team should engage with residents through corridor pop-ups and informal check-ins to proactively address concerns. If significant changes occur, such as delays, a dedicated meeting should be scheduled to keep the community informed.

**Enhance Proactive and Broad Community Engagement Practices:** WSSC Water should maintain a proactive approach to community engagement by consistently initiating dialogue with residents and stakeholders throughout the project lifecycle. This includes timely communication of major project changes, such as delays. This will provide transparency for the community as well as build trust. Engagement efforts should consistently extend beyond civic associations to include the broader community, ensuring all voices are invited to provide feedback and input. The broader engagement efforts should be combined with ongoing active engagement with the Civic Association.

**Continue the Use of Project Task Force:** For major initiatives like the 48-inch Patuxent Raw Water Main Project, WSSC Water should form and actively engage a dedicated project task force. This group would provide a structured platform for interested community members to offer feedback and stay informed throughout the project. The task force can also serve as a forum to review and refine engagement materials, ensuring they reflect the community's priorities and concerns. Additionally, it can help facilitate inclusive outreach by ensuring participation from all impacted groups—including community centers, hospitals and care facilities, schools, neighborhoods, and local businesses.



## 12. CONCLUSION

The independent evaluation and audit of the WSSC Water 48-inch Patuxent Raw Water Main Project revealed that while the initiative is essential for long-term water supply resiliency, its delivery was challenged by a combination of outdated baseline data, unforeseen subsurface conditions, utility conflicts, rigid lay schedule sequencing, and gaps in quality assurance and community engagement. The project's extended timeline and cost overruns were primarily driven by hard rock excavation, utility strikes, and reactive rather than proactive management of risks and schedule, also impacted by the Contractor being allowed to leave the site for an extended period. These issues, resulting in extended disruptions and stakeholder dissatisfaction during key phases of the project.

Despite these challenges, the project's completion reflects WSSC Water's commitment to addressing community concerns and delivering essential water infrastructure, such as taking corrective measures to restore public trust, such as building a task force to engage the community during the final project close-out and strengthening the oversight to the Contractor on pavement and compaction. However, the audit findings underscore the need for systemic improvements in risk management, pre-construction investigations, stakeholder coordination, and quality assurance processes to prevent similar issues in future capital projects.

Moving forward, WSSC Water should strengthen project delivery through four integrated strategies:

- Formal Risk Management with centralized registers, scoring, and continuous monitoring;
- Structured Change Control with timely RFI responses, impact assessments, and full documentation;
- Standardized QA/QC Processes with centralized tracking, detailed inspections, and empowered enforcement;
- Enhanced Communication & Engagement through formal protocols, real-time project management, milestone meetings, and proactive outreach.

By implementing these recommendations, WSSC Water can transform lessons learned from this project into actionable improvements that drive efficiency, accountability, and stakeholder confidence. These measures will not only mitigate risks and enhance quality but also position WSSC Water as a proactive leader in delivering complex infrastructure projects that meet community expectations and regulatory standards.



## APPENDICES

### **A. INTERVIEW TRANSCRIPTS AND SUMMARIES**

- A.1. INTERVIEW LOG
- A.2. FIELD VISIT NOTE
- A.3. INTERVIEW WITH WSSC WATER PROJECT TEAM
- A.4. INTERVIEW WITH DESIGN ENGINEER (CONSTRUCTION PHASE)
- A.5. INTERVIEW WITH CONTRACTOR
- A.6. INTERVIEW SUMMARY WITH ELECTED OFFICIALS
- A.7. INTERVIEW SUMMARY WITH COMMUNITY REPRESENTATIVES
- A.8. INTERVIEW WITH WSSC WATER COMPACTION QA TEAM

### **B. REVIEW LOGS**

- B.1 DOCUMENT REVIEW LOG
- B.2 UTILITY IMPACT LOG
- B.3 COST AUDIT DOCUMENT
  - CHANGE ORDER AND COST LOG
  - PCO LOG
- B.4 SCHEDULE
  - BASELINE LONGEST PATH
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- B.5 CONSTRUCTION PROCESS
  - CONSTRUCTION REVIEW LOG
  - SUBMITTAL LOG
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- B.6 PAVEMENT SUMMARY LOG
- B.7 COMMUNITY COMMUNICATION LOG
- B.8 COMPACTION QA INCIDENT LOG