

EXHIBIT "A"
TASK ORDER
UNDER AGREEMENT DATED MARCH 1, 2016
BETWEEN
LOUDOUN COUNTY SANITATION AUTHORITY (DBA: LOUDOUN WATER)
AND
DEWBERRY ENGINEERS, INC
for:
Community Water and Wastewater Program:
Historic Waterford Water Feasibility Study

BACKGROUND

The Community Water and Wastewater Program (Program) began in 2016 with the goal of addressing various community water and wastewater issues within Loudoun County (County). The Program is managed and administered by the County with support from Loudoun Water, the responsibilities for each organization are outlined in a joint memorandum. In March 2019 Waterford community members applied to the Program for assistance with their water needs and were subsequently notified that their application qualified for a feasibility study. The feasibility study will evaluate the concerns identified in the community's application. It will identify the technical feasibility of potential solutions, benefits of completion, estimated costs required to complete, and be fundamental in helping community members decide how the project should move forward.

SCOPE OF WORK

The purpose of this Task Order is to develop an engineering feasibility study for potential solutions to the community of Waterford's drinking water issues. It is anticipated that the feasibility study report will generally address:

- Project Background and Purpose for Study
- Overall Community Evaluation
 - General Topography
 - Permitting Considerations, Regulatory Requirements and Right-of-Way constraints
 - Policy Considerations
 - Rural Policy Area
 - Conservation Easements (Waterford Foundation, etc.)
 - National Register of Historic Places
 - National Historic Landmark
 - Federal Preserve American Community
 - National Trust for Historic Preservation
 - Virginia Department of Historic Resources (From Loudoun County Comprehensive Plan)

- Village Conservation District and Historic District
 - Wastewater Service District
- Water System Evaluation
 - Preliminary Existing System Analysis
 - Review of existing data and hydrological reports prepared for the area surrounding Waterford
 - On-site evaluations of existing conditions are limited to well testing of targeted wells to provide community wide assessment of groundwater hydrology. Individual assessments for all wells are excluded from this scope of work.
 - Current Estimated Water Demand and Potential Future Demand (based on current zoning and easement restrictions)
 - Source Water Identification
 - Groundwater
 - Surface Water
 - Water Treatment Alternatives
 - Water Conveyance Alternatives
 - Water System Recommendation
- Overall Costs
 - Water Treatment Capital Costs including land acquisition and estimated easement costs
 - Water Conveyance System Capital Costs
 - Additional Costs (Homeowner, Utilities, Existing System Abandonment, etc.)
 - Adjustments to current sewer rates with the addition of water rates (for community system alternative only)
 - Loudoun Water Operation and Maintenance Costs
 - Cost Summary
 - One (1) overall cost summary will be prepared for each of the five (5) alternatives outlined below, if they are deemed feasible.
 - Do Nothing – Upgrade Existing On-Site Systems to Improve Yield on Individual Wells
 - Shared Private Wells. This alternative does not meet the definition of a Public Water Works.
 - Communal Water Treatment Facility Owned and Maintained by Loudoun Water (Using New Community Wells)
 - Connection to a Nearby, Existing Community System
 - Wholesale Purchase of Water from or Connection to a Nearby Municipal System
- Recommendations

This scope of work has seven (7) tasks as follows:

Task 1 – Information Review, Survey and Site Visits

- Task 2 – Groundwater Supply Development Potential Study
- Task 3 – Preliminary Community Research
- Task 4 – Water Treatment and Conveyance System Evaluations
- Task 5 – Cost Estimates and Preliminary Schedule
- Task 6 – Feasibility Study Writing and Coordination
- Task 7 – Project Management

The remainder of this document provides the detailed scope of work that will be performed for each of these tasks.

PHASE 1 – PLANNING PHASE

Task 1 – Information Review, Survey and Site Visits

Dewberry will review information provided by Loudoun Water and Loudoun County relative to Waterford. In addition, Dewberry will review the application submitted by Waterford as well as research the community using Loudoun County geospatial data (Online RME/GIS). For the purpose of this feasibility study, the community boundaries are defined as the existing sewer service area as shown in Attachment B.

Dewberry will review and supplement information gathered by Loudoun County relative to the Health Department and Department of Building and Development (Natural Resources) records for existing systems. This work includes reviewing database information gathered by Loudoun County and researching historic non-compliance issues with the Health Department and Virginia Department of Environmental Quality as well as discussions with staff from these agencies.

After completion of the desktop research, Dewberry staff members will visit the community to verify information and review potential locations for distribution systems and treatment facilities and identify potential conflicts with items that may result in issues with potential layouts (i.e. historic resources, manmade structures, environmental impacts, etc.).

Dewberry will develop a survey for residents of the service area to assess historic issues with water supply and private well systems. The survey will be developed primarily using yes/no questions and will be provided in self-addressed envelopes to assure one survey per household. The intent is for the survey to be anonymous. Surveys will be sent to the address on record. A draft survey will be submitted to Loudoun Water and Loudoun County for review and comment before sending to residents. Results of the survey will be anonymously included in the feasibility study.

The information gathered during the site visit and data review will be used to prepare the feasibility study.

Deliverables: (The following deliverables will be provided in Word and PDF format)

- Survey Results

Task 2 – Groundwater Supply Development Potential Study

After Task 1 has been completed, Dewberry will engage Tetra Tech to perform field work and desktop analysis of the soils and groundwater hydrology in the community to identify potential areas that could be viable for locating a community well(s) or water treatment system. Our team will utilize the existing hydrology study prepared by GeoTrans, Inc. (now Tetra Tech), to be provided by Loudoun Water, as a basis of study.

Tetra Tech will provide support with one (1) coordination/kickoff meeting, review existing data and compile results, identify new data collection efforts and prepare a report to document initial findings, perform hydraulic head monitoring using existing wells, aquifer testing using existing wells, review methods to improve yield of existing wells and increase water availability (i.e., home storage tank or other) and perform an initial modeling analysis of groundwater. All of this information will be compiled into a detailed report that will be incorporated into the feasibility study.

In addition, Tetra Tech will prepare a PowerPoint presentation and attend a meeting with the community to present findings.

A detailed scope of work for this task is included as Attachment C.

Deliverables:

- Groundwater Hydrology Report and Findings

Task 3 – Preliminary Community Research

During the site visits outlined in Task 1 above, Dewberry permitting specialists will review the community to determine potential conflicts. This work includes development of a permit register that identifies potential permitting requirements relative to wetlands and streams, floodplains, jurisdictional determinations, as well as a review of available database information on documented archaeological, cultural resources and threatened and endangered (T&E) species within the project area.

Dewberry personnel will review historic preservation and conservation easements and private roads for potential conflict. It is anticipated that two (2) site visits will be necessary to review the existing community. This work will include walking through the community in public right of way and will not include entering any private property. Using the information obtained during the community review, Dewberry will develop a Permitting Approval Technical Memorandum that outlines the feasibility and potential process required for installing a community system and shared private wells in Waterford. This Technical Memorandum will summarize the approval

process required for working in a National Historic Landmark, zoning ordinance reviews, and easement/land acquisition requirements. The Technical Memorandum will outline the specific requirements for each approval process, and the anticipated impact to the overall project implementation schedule (i.e. Phase 1 Archeological Studies, Phase 2 Archeological Studies, permitting timelines, etc.).

In addition, Dewberry will review health department records on the existing individual well systems using their online resources, that serve the community. The information will be used to establish the existing conditions of the systems in order to recommend proposed upgrades. The information will be summarized in the feasibility study report. Evaluating existing well water quality is limited to one (1) groundwater well sample at the end of the controlled aquifer test to analyze the National Testing Lab's Loudoun County Watercheck suite of parameters. Yield testing will be completed under Task 2.

Deliverables:

The following deliverables will be provided in Word and PDF format:

- Draft Permitting Approval Technical Memorandum
- Final Permitting Approval Technical Memorandum

Task 4 – Water Treatment and Conveyance System Evaluations

Dewberry will estimate the water demand for Waterford based on current zoning and easement restrictions, using Loudoun Water's Engineering Design Manual requirements). Fire flow demands are excluded from this scope of work, due to Waterford being located in the County's Rural Policy Area. Fire flow demands are excluded from this scope of work, since they are outside the scope of the Water and Wastewater Program. Fire flow demands will only be considered as part of an alternative if it is required by local ordinances. The demands developed by Dewberry will be presented to Loudoun Water and Loudoun County in a technical memorandum. The flow analysis technical memorandum will include an analysis of two (2) flow scenarios; existing development estimates and potential future demand. The memorandum will provide a recommendation for demand flow and will be agreed upon by Loudoun Water and Loudoun County. This information will be utilized for sizing the water distribution piping and well/treatment systems for the community.

Utilizing available Loudoun County geospatial data Dewberry will identify potential layouts for water conveyance systems. Dewberry will coordinate with Miss Utility to identify other potential utilities in the ROW that may conflict with a new water utility.

The evaluation will account for property sizes and approximate locations of connections to individual properties. The evaluation will also account for challenging installations (i.e. crossing Catocin Creek) and propose installation methods that will help provide service to each of the properties within the study boundary. Dewberry will provide a conceptual alignment for the

water conveyance system. However, this alignment should not be construed as a final design. This study will not determine the exact distribution system location and size. Dewberry will recommend the preferred alternative for water conveyance based on the information in this feasibility study. The historic nature of Waterford, along with Loudoun County guidelines for the Waterford Historic District, will be included as part of the considerations for any permanent, above-ground structures.

The evaluation of water well/treatment facilities will include required well yields and available treatment alternatives. The recommended system for water treatment will assume that no contaminants are found in the recommended service well(s) and that the well(s) will have sufficient yield for the community. The study will include a brief description of impacts of potential treatment alternatives for Manganese Greensand Filtration and Membrane Treatment systems. This assumption will need to be verified during the course of further study and into design of a new system, but is sufficient for the purposes of this feasibility study. The water treatment evaluation will review the following alternatives:

- Do Nothing – Upgrade Existing On-Site Systems to Improve Yield on Individual Wells
- Shared Private Wells. This alternative does not meet the definition of a Public Water Works.
- Communal Water Treatment Facility Owned and Maintained by Loudoun Water (Using New Community Well(s))
- Connection to an Existing, Nearby Community System
- Wholesale Purchase of Water from or Connection to a Nearby Municipal System

Preliminary layout of the preferred water facilities will be developed. This will include identification of required utilities and potential hurdles with providing utilities (i.e. power) to the preferred site for the preferred treatment system evaluation. The site will be laid out assuming no formal treatment for contaminants (other than disinfection, pumping and storage) is required.

Deliverables:

- Flow Analysis Technical Memorandum

Task 5 – Cost Estimates and Preliminary Schedule

Dewberry will provide cost estimates for the construction of the recommended water treatment and distribution developed in Tasks 1 thru 4. This cost estimate will include a preliminary cost estimate of the project and determination of the total public cost, including design, land acquisition, construction, and permitting. In addition, Dewberry will include preliminary costs for abandonment of existing systems.

In addition to the capital costs developed above, Dewberry will provide a preliminary operation and maintenance cost for the treatment facility. This estimate will include yearly power costs, permitting costs, regulatory costs and operational costs. A 30-year net present value calculation

will be performed to compare alternatives.

Dewberry will outline the operational and maintenance costs associated with the chosen distribution system (if applicable). The costs for each alternative will be presented in a table with the initial capital costs and yearly operation and maintenance costs.

Example estimates for future water bill assuming a given usage rate will be developed for individual users.

A preliminary schedule will be developed including design, construction and startup will be included in the feasibility study.

Task 6 – Feasibility Study Report Writing and Coordination

Dewberry will utilize all of the information identified above and prepare a feasibility study report summarizing our findings and providing a recommended approach for water distribution and treatment for the community. The recommendation will include a Score Chart that addresses the Triple Bottom Line (economic, environmental, and social cost/benefits). It should be noted the community is not obligated to pursue the recommended approach and can decide to pursue any alternative that will address their water needs.

Prior to drafting the full feasibility study report, Dewberry will develop a preliminary detailed outline of the proposed feasibility study report for review and approval by Loudoun Water. The detailed outline will include preliminary sections, subsections and provide a brief description of what will be included in each part of the report. A draft and final version of the detailed outline will be submitted to Loudoun Water.

This scope of work includes preparation and attendance of thirteen (13) meetings with Loudoun Water and Loudoun County. Other parties will be included as specified. These meetings are preliminarily identified as follows:

- Project Kickoff Meeting – This meeting will occur prior to the start of research and will occur after Loudoun Water and Loudoun County meet with the Community. (Loudoun County, Loudoun Water, Dewberry)
- Initial Community Meeting – This meeting will occur after the kickoff meeting to introduce the project to the community and formally kickoff the process with the community coordinators. (Loudoun County, Loudoun Water, Dewberry, Village of Waterford)
- Loudoun County Health Department Meeting – This meeting will occur during the preparation of the Permitting Requirements TM and will be used to discuss history of wells in Waterford, feasibility of system alternatives (i.e. non-public utility well) and discuss yield and quality requirements for potable wells. (Loudoun County, Loudoun Water, Dewberry)
- Loudoun County Planning and Zoning Meeting – This meeting will occur during the

preparation of the Permitting Requirements TM and will discuss current and future zoning, potential development and commission permit and water layout alternatives. (Loudoun County, Loudoun Water, Dewberry)

- Historical Requirements Meeting – This meeting will occur during the preparation of the Permitting Requirements TM and will discuss the historic nature of the community and potential impacts and challenges for installing a water utility in the Village of Waterford. (Waterford Foundation Executive Director, Loudoun County, Loudoun Water, Dewberry)
- Permitting Analysis Technical Memorandum Meeting – This meeting will occur after submission of the draft permitting analysis technical memorandum and will discuss the challenges and hurdles associated with completing a project of this nature in a historic community such as Waterford. Specific requirements for obtaining approvals and permissions will be presented. (Loudoun County, Loudoun Water, Dewberry)
- Feasibility Study Report Meeting – This meeting is recommended to occur after submission of the feasibility study report draft. The meeting will take place to discuss the information presented in the feasibility study report and answer any questions or provide clarification on items. (Loudoun County, Loudoun Water, Dewberry)
- Additional Coordination Meeting/Workshops – Six (6) additional coordination meetings and workshops will be included in this scope of work for review of draft submissions of the report, coordination with Loudoun Water, Tetra Tech and Loudoun County staff and possible coordination and presentation with the community.

This feasibility study report will include all figures and layouts that were developed throughout the Task Order. Dewberry will submit six (6) hard copies and one (1) electronic copy (pdf and native files) of a draft feasibility study to Loudoun Water for review.

After review of the final feasibility study report, Dewberry will revise and submit six (6) hard copies and one (1) electronic copy of the final feasibility study report to Loudoun Water.

Deliverables:

- Draft Detailed Outline
- Final Detailed Outline
- 70% Draft Feasibility Study
- 95% Draft Feasibility Study
- Final Feasibility Study

Task 7 – Project Management

Dewberry will provide project management services throughout the duration of this task order. Dewberry's project task order manager and QA/QC manager will be responsible for the following:

- Respond to Loudoun Water requests
- Coordination of work
- Preparation of Decision Register

- Preparation of Risk Register
- Monthly progress calls with Loudoun Water and Loudoun County
- Bi-Monthly progress meetings at Loudoun Water
- Provide quality control monitoring of Dewberry work
- Preparation and submission of monthly progress report, schedule update and invoice
- Provide project closeout activities

PHASE 2 - DESIGN PHASE

Design phase assistance is not anticipated under this task order.

PHASE 3 – PERMITTING PHASE

Permit-related work is not anticipated under this task order.

PHASE 4 – BIDDING PHASE

Bidding phase assistance is not anticipated under this task order.

PHASE 5 – CONSTRUCTION PHASE

Construction phase assistance is not anticipated under this task order.

PHASE 6 – OPERATIONAL PHASE

Operational phase assistance is not anticipated under this task order.

ASSUMPTIONS/CONDITIONS/EXCLUSIONS

In addition to the exclusions and assumptions listed above, the following list of exclusions/assumptions is included with this task order proposal:

1. This scope of work does not include any additional meetings outside of the meetings outlined in Task 1, Task 6 and Task 7.
2. Attendance at a public meeting is included. However, public outreach support (i.e. developing presentation boards, printing materials, developing PowerPoint presentations) is not included as part of this proposal.
3. For the purposes of this study, the boundary area is defined as the existing sewer service boundary area as shown in Attachment B. Only the parcels located in the boundary will be evaluated for connection to a water system. If a community system is the preferred alternative, the location of the facility would likely be located outside the boundary area and all parcels within this boundary would be provided service from a community system.
4. Dewberry will assume easement acquisition costs based on recent data provided by Loudoun Water. In lieu of recent cost data, Dewberry will make assumptions based on

industry standards and historic acquisition costs, that will be included in the overall cost estimates for this project.

5. Well quality sampling and/or analysis is limited to the National Testing Lab’s Loudoun County Watercheck suite of parameters. Existing well quality will be assumed based on Health Department records and the community survey.
6. Loudoun Water and Loudoun County will obtain homeowner approval to perform well tests for Tetra Tech sampling.

PROJECT SCHEDULE

Based on the scope of work outlined above, we estimate the project schedule to be as follows:

<u>Description</u>	<u>Date from NTP</u>
Project Kickoff Meeting	2 Weeks
Initial Community Meeting	4 Weeks
Loudoun County Health Department Meeting	6 Weeks
Planning and Zoning Meeting	6 Weeks
Flow Analysis Technical Memorandum	8 Weeks
Historic Requirements Meeting	8 Weeks
Permitting Analysis Technical Memorandum	10 Weeks
Permitting Analysis Technical Memorandum Meeting	12 Weeks
Soil Analysis and Groundwater Hydrology Report	16 Weeks
Detailed Outline Submission	18 Weeks
Outline Review and Comment	20 Weeks
Final Outline Submission	22 Weeks
Submission of 70% Draft Feasibility Study Report	36 Weeks
Feasibility Study Report Meeting	40 Weeks
Submission of 95% Draft Feasibility Study Report	44 Weeks
95% Report Meeting	48 Weeks
Submission of Final Feasibility Study Report	50 Weeks
Project Closeout	52 Weeks

The schedule assumes a four (4) week period for review of the draft feasibility study report prior to submission of the final feasibility study report.

It is anticipated that the Final Feasibility Study Report be delivered to Loudoun Water within 52 weeks from receipt of notice to proceed (NTP).

ESTIMATED FEE

The projected hours and estimated fee for this project are summarized in **Attachment A** and shall not exceed \$217,500 without prior written permission from Loudoun Water. Payment will be made at the agreed multiplier on a monthly basis and based upon actual expenditures for the project.



Attachment B – Community Boundary

**ATTACHMENT A
LOUDOUN WATER
Task Order**

Historic Waterford Water Feasibility Study

LABOR COSTS		STAFFING HOURS									Subtotal Hours
TASK DESCRIPTION	Labor Category	Kevin Wood, P.E.	Paul Longo, P.E.	Stephanie Acosta, EIT	Tom Mcguigan	Dave Boeing, P.E.	Peyton Stone, P.E.	Kimberly Larkin	Andrew Dietrich	TBD	
	Project Responsibility	Principal	Project Manager	Junior Engineer	CAD Technician	Senior Engineer	Project Engineer	Sr. Envir. Scientist	Sr. Envir. Scientist	Clerical	
	Average Hourly Rate	QA	Project Manager	Junior Engineer	Figures/ Sketches	Site Review	Site Review	Permtting Specialist	Permitting Specialist	Clerical	
PHASE 1 - PLANNING PHASE		\$111.05	\$68.41	\$34.13	\$36.92	\$93.20	\$40.58	\$62.97	\$30.45	\$33.00	
1	Information Review, Survey and Site Visit		8	12			8	8	8		44
2	Groundwater Supply Development Potential Study		8	20							28
3	Preliminary Community Research										
	Community Research (LCHD Records, Deeds, Easements)		16	60		8	40	20	50	4	198
	Preparation of Permitting Approval Technical Memorandum (Draft and Final)		12			4	20	16	40		92
4	Water Treatment and Conveyance System Evaluations		60	120	20		20	8	8		236
5	Cost Estimates and Preliminary Schedule		20	40			4	6			70
6	Feasibility Study Writing and Coordination	8	60	100			20	12	30	12	242
7	Project Management/QA/Meetings	12	48								60
	Prepare and Attend Up to 13 Meetings (4 Hours per Meeting)		52	52		8	24	24	8		168
PHASE 2 - DESIGN PHASE		NOT INCLUDED IN THIS SCOPE									
PHASE 3 - PERMIT PHASE		NOT INCLUDED IN THIS SCOPE									
PHASE 4 - BIDDING PHASE		NOT INCLUDED IN THIS SCOPE									
PHASE 5 - CONSTRUCTION PHASE		NOT INCLUDED IN THIS SCOPE									
PHASE 6 - OPERATIONAL PHASE		NOT INCLUDED IN THIS SCOPE									
Subtotal Hours		20	284	404	20	20	136	94	144	16	1138
Direct Labor Costs (\$)		\$ 2,221.00	\$ 19,428.44	\$ 13,788.52	\$ 738.40	\$ 1,864.00	\$ 5,518.88	\$ 5,919.18	\$ 4,384.80	\$ 528.00	\$ 54,391
Multiplier = 2.68		Labor Cost @ 2.681 multiplier (\$)									
		\$ 5,954.50	\$ 52,087.65	\$ 36,967.02	\$ 1,979.65	\$ 4,997.38	\$ 14,796.12	\$ 15,869.32	\$ 11,755.65	\$ 1,415.57	\$ 145,823

OTHER DIRECT COSTS						Qty	Unit	Markup	Unit Cost	Marked Up Cost
Mileage						800	miles		\$ 0.570	\$ 456
Miscellaneous (outside printing, overnight deliveries, etc.)						1	ls		\$ 327	\$ 327
Groundwater Supply Study (Tetra Tech)						1	ls	5%	\$ 67,518	\$ 70,894
Total Direct Cost										\$ 71,677

Summary of Costs	
Total for Labor	\$ 145,823
Other Direct Costs	\$ 71,677
Total Estimated Project Cost	\$ 217,500



January 30, 2020

Mr. Paul Longo, P.E.
Associate
Dewberry
Water and Wastewater Services
8401 Arlington Blvd.
Fairfax, VA 22031-4666
703.849.0217

Dear Paul,

Tetra Tech is pleased to provide this DRAFT scope-of-work to assist Dewberry and Loudoun Water determine the feasibility of using alternative methods to enhance residential water-supplies in Waterford, Virginia.

We have substantial experience and expertise in both evaluating and developing groundwater resources in western Loudoun County. As a Certified Professional Geologist in the Commonwealth of Virginia, I have been the principal investigator for more than 100 hydrogeologic studies in northern Virginia since the 1980s. This work has included:

- Detailed assessment of groundwater conditions in Waterford (see *Waterford Elementary School Groundwater Supply Report* prepared for Loudoun County Public Schools and dated 12/6/2006);
- Evaluation of groundwater and surface water resources, and of their interrelationship, in Loudoun County's Western Hills Watershed, which includes Waterford (see *Chapter 5 – Assessment of Groundwater Resources of the Western Hills Watershed Plan* dated 10/31/2019);
- Conduct of final hydrogeologic studies at subdivision sites near Waterford including at the *Crest at Waterford*, *Waterford Ridge*, *Waterford Creek*, *Glenmore Farm*, and *Wheatland Estates* subdivision sites, among others; and
- Public groundwater supply development, monitoring, and management for Purcellville, Lovettsville, and Middleburg.

Based on preliminary discussions to be held with Dewberry and County representatives, our draft scope-of-work might include the following Phase 1 and Phase 2 tasks.

Phase 1 – Project Scoping, Data Review/Analysis, Studies Using Existing Wells, Analysis and Reporting

1. **Scoping meetings.** Tetra Tech will review select documents and participate in meetings to finalize a plan for Phase 1 investigations. Initial project scoping will include clarification of water-supply development options and feasibility parameters (e.g., drilling costs, pipeline costs, well setback regulations, etc.), community interest in connecting to new public or private community water systems, and options for monitoring and testing of private well yields and groundwater elevations in Waterford.

2. **Data compilation and review.** Tetra Tech will (a) update the Waterford Water Atlas and associated interpretative maps that we prepared in 2006; (b) identify new data collection efforts that will inform decisions regarding the feasibility of water-supply development options; and (c) prepare a report to document our initial findings and recommendations. The report will include a detailed plan for monitoring groundwater elevations and performing controlled aquifer tests in local wells.
3. **Hydraulic head monitoring using existing wells.** In 2006, Tetra Tech measured groundwater elevations in approximately 50 wells in Waterford. These data were used to prepare a hydraulic head contour map and assess drawdown conditions resulting from and affecting individual well pumping. Tetra Tech will perform a similar and hopefully expanded survey of groundwater elevations in area water wells during a period of several days and will also place automated water-level dataloggers in approximately five to ten wells to record hydraulic heads every 10 minutes for an extended period (perhaps up to one year). We anticipate downloading recorded hydraulic head data after one month of datalogger operation and then quarterly for one year thereafter. A report will be prepared to document the results of the hydraulic head survey and the first month of water-level monitoring. This report will include a refinement of the local well aquifer testing plan based on the results of hydraulic head monitoring and increased knowledge of local well parameters and owner interests.
4. **Aquifer testing using existing wells.** During Task 3 and 4, Tetra Tech will evaluate the feasibility of using existing private wells to perform controlled aquifer tests during which impacts on nearby wells will be recorded using pressure transducer dataloggers and a sonic water-level probe. Pumping time-rate data will be recorded using a flowmeter datalogger. Flow control and monitoring, and pumping discharge locations, will be determined based on plumbing configurations (and related factors) at each test location. Variable pumping rate data will be analyzed using superposition theory as implemented in the Aqtesolv well test analysis program. Tetra Tech will collect one groundwater sample near the end of each test for analysis of National Testing Lab's Loudoun County Watercheck suite of parameters. This information will assist analysis of the potential to develop new private or public community water-supplies using in-Town wells. Results of aquifer testing will be submitted in a letter report.
5. **Review of methods to improve the yield of existing wells.** Tetra Tech will review options for well deepening, reaming, hydrofracking, and other means to rehabilitate and/or increase existing private well yields. As part of this effort, Tetra Tech will consult with local and regional drilling firms to determine their experience and results using different yield enhancement options.
6. **Initial modeling analysis.** Tetra Tech will refine its three-dimensional MODFLOW model of groundwater flow in western Loudoun County to examine potential impacts of alternative groundwater supply development options. Our model will incorporate and conform (as reasonable) to newly acquired data. Sensitivity analyses will be performed to assess the significance of parameter uncertainty on assessing groundwater supply development options.

- 7. Data interpretation and reporting.** Tetra Tech will prepare a detailed report and a Powerpoint presentation to document methods, findings, and recommendations emanating from our Phase 1 work. This report will identify specific properties where additional groundwater development might be successful both in and outside of Town. We will also participate in meetings to support this project.

Phase 2 – Groundwater Supply Exploration, Development, and Testing

- 1. Scoping meetings.**
- 2. Detailed evaluation of groundwater development target areas.**
- 3. Electrical resistivity surveys.**
- 4. Test well drilling.**
- 5. Aquifer testing and water quality testing.**
- 6. Reporting and water-supply design assistance.**

We assume that the scope of Phase 2 activities will be determined after completing the Phase 1 work.

Please do not hesitate to contact me if you have any questions or need additional information. We look forward to providing water-supply development evaluation assistance to Dewberry, Loudoun Water, Loudoun County, and residents of Waterford.

Sincerely,



Robert M. Cohen
Principal Hydrogeologist
Certified Profession Geologist
Commonwealth of Virginia