

**County Commissioners of Worcester County, Maryland**  
**INDEPENDENT CONTRACTOR'S AGREEMENT**

THIS AGREEMENT, made this 3<sup>rd</sup> day of May, 2019, by and between the **COUNTY COMMISSIONERS OF WORCESTER COUNTY, MARYLAND**, of Room 1103, Government Center, One West Market Street, Snow Hill, Maryland 21863-1195, hereinafter called "County" and CTC Technology & Energy, of 10613 Concord Street, Kensington, Maryland 20895 hereinafter called "Contractor".

1. **Services.** The County hereby contracts with Contractor to perform the following services as an Independent Contractor for the County: perform a broadband feasibility study for Worcester County, Maryland pursuant to bid specifications dated January 9, 2019 (attached hereto as Attachment A) by County and bid submittal dated February 7, 2019 (attached hereto as Attachment B) by Contractor.
  
2. **Terms of Agreement.** This Agreement shall commence upon signing. Contractor services shall be completed no later than one hundred eighty (180) days from Notice to Proceed by County.
  
3. **Payment.** Contractor shall be paid a total lump sum fee of \$60,000.00 (sixty thousand and 00/100 dollars), excluding optional Task 6, upon written invoices for completed work submitted and approved by the County. County shall not be required to pay for incomplete work. At the time of any payment or upon request, Contractor shall provide complete and proper lien releases, in such form as County may require, from all entities or persons having any right to claim a lien on account of the work.
  
4. **Performance by Contractor.** Contractor shall expeditiously proceed with Contractor's services hereunder and shall devote such time as may be necessary to complete them within the time provided. Contractor shall perform this contract promptly, properly, completely, in accordance with all codes, in a workmanlike manner and in accordance with industry

standards and all plans and specifications. Contractor pledges any and all payments paid or due hereunder for the faithful performance hereof. Contractor shall provide a copy of the company's certificate of good standing, if applicable.

5. **County will Provide:** County will provide the following services, materials, space or support:                     N/A                    .

6. **Terminations**

6.1 **Termination for Cause.** County may terminate this Agreement for any cause upon notice to Contractor. For the purposes hereof, "Cause" shall include, but not be limited to:

- A. Material breach of Contract
- B. Dishonesty, Fraud or Criminal Activity
- C. Incapability to perform
- D. Nonperformance
- E. Substandard performance or failing to make satisfactory progress in the prosecution of the contract
- F. Termination of any grant to the County which provides funding for this Contract.

In the event of termination, Contractor shall be entitled to be paid for work performed to date of termination, subject to the limitations herein set forth.

6.2 **Termination for Convenience.** The County may terminate the Agreement, in whole or in part, without cause, by providing written notice thereof to the Contractor. In the event of termination, without cause, the County shall advise the Contractor in writing of the termination date and of work to be performed during the final days prior to contract termination. The Contractor shall be paid for all reasonable costs incurred by the Contractor up to the date of termination set forth in the written notice of termination. The Contractor will not be reimbursed for any anticipatory profits, which have not been earned up to the date of termination. Payments to be provided

on a lump sum basis shall be prorated by the County based on the services rendered or goods delivered up to the date of termination set forth in the written notice.

7. **Contract Official.** Contractor shall report directly to, and receive instructions as necessary from Brian Jones, Director of Information Technology, (phone - 410-632-5610, ext. 1522) who shall be the County Contract Official. Final decisions with respect to the Contract on behalf of the County will be made by the Worcester County Commissioners.
  
8. **Confidential Information - Reports.** Contractor agrees that information received by Contractor during the administration of the Agreement may be considered confidential and upon notice agrees to keep such information confidential. Any report by Contractor shall be the sole and exclusive property of the County and may not be released to any other person or entity without the express written permission of the County.
  
9. **Employment of Others - Subcontractors.** Any Subcontractors of the Contractor shall be first approved in writing by the County prior to engagement. County may, from time to time, provide other employees to assist Contractor with performance of Contractor services or to perform related services required of Contractor hereunder. This Agreement is not assignable or transferrable and will be performed personally by Contractor as set forth in Contractor's proposal.
  
10. **Inducement.** Contractor has represented to County that Contractor is fully qualified to perform the services hereunder in a professional, state of the art manner to the highest standards within the parameters of this Agreement and specifically that the services required of Contractor hereunder may be accomplished under this Agreement for the compensation stated herein. Nothing herein shall require County to pay any overage or additional payment; the Agreement price herein stated being firm. Any limitation on County's liability hereunder, shall not be a limitation on services required of the Contractor.

11. **Independent Contractor.** The parties hereto do hereby agree that Contractor is an independent contractor in its performance of its obligations hereunder. Accordingly, Contractor shall be responsible for the payment of all taxes including, without limitation, Federal, State and Local taxes, State Income Tax, Social Security Tax, Unemployment Insurance Tax and all other taxes or business license fees as required arising out of Contractor's performance hereof. Contractor specifically agrees that to the extent required by law, Contractor shall carry Workers' Compensation Insurance in statutory required amounts and Liability Insurance unless waived in writing by County and agrees to provide County with copies of policies as requested. The Contractor agrees to indemnify and hold harmless County with respect to all the Contractor's activities hereunder including, without limitation, claims for negligence or malfeasance against Contractor and as well as Workers' Compensation claims. If this contract is for professional services, Contractor shall provide a minimum of \$1,000,000.00 (one million and 00/100 dollars) Errors and Omissions Insurance. At the option of the County, the Contractor may be required to add the County as an additional insured to any insurance that is required hereunder.
12. **Illegality of Performance.** If for any reason this Agreement or its execution by County Commissioners is determined to be illegal, ultra-vires or not in accordance with the law by County Commissioners, then County Commissioners may in their sole discretion and in good faith, declare it null and void.
13. **Immunity/limitation on Actions Against County Commissioners.** Nothing herein or any related agreement or any amendment hereto shall under any circumstances constitute or be construed as a waiver of immunities or limitations of liability that the County Commissioners, their officers, employees, agents, or servants, may have in by virtue of and in accordance with any law, including sovereign, statutory, qualified, official, common law, public general law or public local law immunity. No action may be brought with respect hereto other than in the appropriate State Court in Worcester County, Maryland. Contractor hereby consents and agrees to such provision and further waives any right to jury trial in any action relating hereto. County Commissioners, as a body politic, has become a party hereto

only in the capacity stated herein. No individual elected County Commissioner, contractor, employee, agent, or servant of County shall have any personal liability hereunder. Any indemnity herein or arising out of this Agreement, on the part of the County Commissioners, shall be only to the extent permitted by law and shall be subject to the non-waiver of immunity, limitations of liability and all other provisions of this Agreement. County Commissioners' liability under or arising out of this agreement shall be subject to annual budget appropriation and strictly conditioned thereon. The non-waiver and the limitation of liability to County Commissioners hereunder shall be contractual and it is agreed that such limitation is fair and equitable under the totality of the circumstances hereof. It is further agreed and understood that this provision is of the essence.

14. **Hold Harmless - Indemnification.** To the extent permitted by law, the Contractor shall defend, indemnify and hold harmless the County, its employees, agents and officials from any and all liabilities, claims, suits, or demands including attorney's fees and court costs which may be incurred or made against the County, its employees, agents or officials resulting from any act or omission committed by Contractor in the performance of the duties imposed by and performed under the terms of the Agreement. The Contractor shall not be responsible for acts of gross negligence or willful misconduct committed by the County.
  
15. **Insurance.** Contractor shall also provide Motor Vehicle Insurance and General Liability Insurance in amounts and with companies satisfactory to County. At the option of the County, the Contractor may be required to add the County as an additional insured to any insurance that is required hereunder.
  
16. **Bonds.** Contractor shall provide such bonds as required by the bid specifications. Contractor hereby binds Contractor to pay and satisfy to the extent legally required all suppliers, subcontractors or others having any right to a claim or action under the Maryland Little Miller Act and hereby pledges any amounts paid or due hereunder as payment security to provide for such payments or satisfactions. Contractor shall provide all lien releases required by County. Where lien releases satisfactory to County are not provided, County

may withhold payment to Contractor to the extent determined by County to be reasonably necessary to adequately provide for such claim or action.

17. **Delays and Extensions of Time.** The Contractor agrees to prosecute the work continuously and diligently and no changes or claims for damages shall be made by him for any delays or hindrances, from any cause whatsoever during the progress of any portion of the services specified in this Agreement. Such delays or hindrances, if any, may be compensated for by an extension of time for such reasonable period as the County may decide. Time extensions will be granted only for excusable delays such as delays beyond the control and without the fault or negligence of the Contractor as determined by the County.

A party shall not be held liable for failure of or delay in performing its obligations under this Agreement if such failure or delay is the result of an act of God, such as earthquake, hurricane, tornado, flooding, or other natural disaster, or in the case of war, action of foreign enemies, terrorist activities, labor dispute or strike, government sanction, blockage, embargo, or failure of electrical service. The non-performing party must make every reasonable attempt to minimize delay of performance.

18. **Accounting System and Audit, Accurate Information.** The Contractor certifies that all information the Contractor has provided or will provide to the County is true and correct and can be relied upon by the County in awarding, modifying, making payments, or taking any other action with respect to this Agreement including resolving claims and disputes. Any false or misleading information is a ground for the County to terminate this Agreement for cause and to pursue any other appropriate remedy. The Contractor certifies that the Contractor's accounting system conforms with generally accepted accounting principles, is sufficient to comply with the contract's budgetary and financial obligations, and is sufficient to produce reliable financial information.

The County may examine the Contractor's and any first-tier subcontractor's records to determine and verify compliance with the contract and to resolve or decide any claim or

dispute arising under this contract. The Contractor and any first-tier subcontractor must grant the County access to these records at all reasonable times during the contract term and for 3 years after final payment. If the Agreement is supported to any extent with federal or state funds, the appropriate federal or state authorities may also examine these records. The Contractor must include the preceding language of this paragraph in all first-tier subcontracts.

19. **Inspections.** The County has the right to monitor, inspect and evaluate or test all supplies, goods, services, or construction called for by the Agreement at all reasonable places (including the Contractor's place of business) and times (including the period of preparation or manufacture).
  
20. **Applicable Laws.** This Agreement must be construed in accordance with the laws and regulations of Maryland and Worcester County. The Contractor must, without additional cost to the County, pay any necessary fees and charges, obtain any necessary licenses and permits, and comply with applicable federal, state and local laws, codes and regulations. For purposes of litigation involving this contract, exclusive venue and jurisdiction must be in the Circuit Court for Worcester County, Maryland or in the District Court of Maryland for Worcester County.
  
21. **Equal Opportunity Employer.** The Contractor represents to County that Contractor is an Equal Opportunity Employer.
  
22. **Notice of Political Contributions.** The Contractor shall comply with the political contribution reporting requirements under Title 14 of the Election Law Article, Maryland Annotated Code, to which the Contractor may be subject.
  
23. **Notices.** All notices and communications hereunder shall be in writing and shall be deemed given when sent postage prepaid by registered or certified mail, return receipt requested, and, if intended for the County Commissioners, shall be addressed to it, to the attention of its

President, at Room 1103, Government Center, One West Market Street, Snow Hill, Maryland 21863-1195, or at such other address of which the County provided, and if intended for the Contractor, shall be addressed to its attention at 10613 Concord Street, Kensington, Maryland 20895, or at such other address of which the Contractor shall have given notice to the County in the manner herein provided.

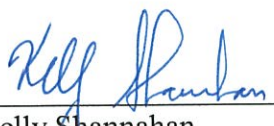
24. **Additional Attachments/Addendums** (if any). N/A


25. **Entire Agreement**. There are no promises, terms, conditions, or obligations other than those contained in this Agreement. This contract supersedes all communications, representations, or agreements, either verbal or written, between the parties hereto, with the exception of express warranties given to induce the County to enter into the Agreement.

If there are any conflicts between the terms and conditions of this Independent Contractor's Agreement and the terms and conditions of any attachments, incorporated proposals or bids, or addendums hereto, then the terms and conditions of this Independent Contractor's Agreement shall prevail and be binding on the parties.

**ATTEST:**

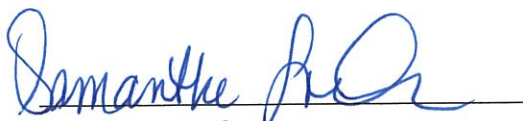
**COUNTY COMMISSIONERS OF  
WORCESTER COUNTY, MARYLAND**

  
\_\_\_\_\_  
Kelly Shannahan  
Assistant Chief Administrative Officer

By:  \_\_\_\_\_ (SEAL)  
Harold L. Higgins  
Chief Administrative Officer

**ATTEST:**

**CTC TECHNOLOGY & ENERGY**

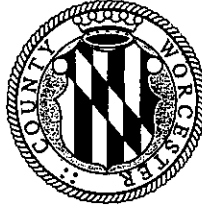
  
\_\_\_\_\_  
(Printed name) Samantha Lefter

By:  \_\_\_\_\_ (SEAL)  
Joanne S. Hovis, President

H:\1-wpdocs\BIDS\Contracts\Broadband Feasibility Study-2019 - CTC.wpd



TEL: 410-632-1194  
FAX: 410-632-3131  
E-MAIL: [admin@co.worcester.md.us](mailto:admin@co.worcester.md.us)  
WEB: [www.co.worcester.md.us](http://www.co.worcester.md.us)



Attachment  
A

COMMISSIONERS  
DIANA PURNELL, PRESIDENT  
JOSEPH M. MITRECIC, VICE PRESIDENT  
ANTHONY W. BERTINO, JR.  
MADISON J. BUNTING, JR.  
JAMES C. CHURCH  
THEODORE J. ELDER  
JOSHUA C. NORDSTROM

OFFICE OF THE  
COUNTY COMMISSIONERS

HAROLD L. HIGGINS, CPA  
CHIEF ADMINISTRATIVE OFFICER  
MAUREEN F.L. HOWARTH  
COUNTY ATTORNEY

## Worcester County

GOVERNMENT CENTER  
ONE WEST MARKET STREET • ROOM 1103

SNOW HILL, MARYLAND

21863-1195

January 9, 2019

**FAXED**  
1/9/19 @ 4:38 pm

TO: *The Daily Times Group and Ocean City Today Group*  
FROM: Kelly Shannahan, Assistant Chief Administrative Officer *KL*

Please print the attached Notice to Vendors in *The Daily Times/Worcester County Times/Ocean Pines Independent and Ocean City Digest/Ocean City Today* on January 17, 2019. Thanks.

### NOTICE TO VENDORS Request for Proposals

#### Broadband Feasibility Study Worcester County, Maryland

The Worcester County Commissioners are seeking proposals from qualified vendors to perform a Broadband Feasibility Study as a key input in the development of a comprehensive community broadband strategy. The feasibility study will explore the costs and logistics of procuring a countywide broadband network. Requests for Proposals (RFPs) are available from the Office of the County Commissioners, Room 1103 - Worcester County Government Center, One West Market Street, Snow Hill, Maryland 21863, obtained online under the "Bids" drop-down menu in the lower right hand side of the home page at [www.co.worcester.md.us](http://www.co.worcester.md.us), or by calling the Commissioners' Office at 410-632-1194 to request a package by mail. **Sealed proposals will be accepted until 1:00 PM, Monday, February 11, 2019** in the Office of the County Commissioners at the above address, at which time they will be opened and publicly read aloud. Envelopes shall be marked "**Proposal for Broadband Feasibility Study**" in the lower left-hand corner. Email submissions will not be accepted

After opening, proposals will be forwarded to the Department of Information Technology for tabulation, review and recommendation to the County Commissioners for their consideration at a future meeting. In awarding the proposal, the Commissioners reserve the right to reject any and all proposals, waive formalities, informalities and technicalities therein, and to take whatever proposal they determine to be in the best interest of the County considering cost, proposal content, qualifications of the vendor, quality of project approach, time of delivery or completion, responsibility of vendors being considered, previous experience of vendors with County contracts, or any other factors they deem appropriate. All inquiries shall be directed to Brian Jones, Director of Information Technology, at 410-632-5610, ext. 1522 or by email at [bjones@co.worcester.md.us](mailto:bjones@co.worcester.md.us)

**Worcester County  
Request for Proposal (RFP) for Broadband Feasibility Study**

**DATE OF THIS REQUEST: 1/8/2019**

**DESCRIPTION: *Broadband Feasibility Study***

**PROPOSAL DEADLINE: 2/11/2019 @ 1:00 p.m. EST**

**SUBMISSION REQUIREMENTS:**

Two (2) copies of the proposal, including one original (clearly marked "ORIGINAL"), and one copy in Microsoft WORD format or PDF on CD/Flash Drive, shall be submitted in a sealed container. The face of the container shall be clearly marked in the lower left corner as follows:

**RFP FOR: Broadband Feasibility Study**

**Proposals must be submitted to:**

Office of the County Commissioners  
"Proposal for Broadband Feasibility Study"  
One West Market Street Room 1103  
Snow Hill, MD 21863

PROPOSALS OPENED 2/11/2019, @ 1:00 p.m. EST

**Proposals must be received by the date and time stated above or they will remain unopened and recycled. No allowance will be made for postmark or error in delivery to incorrect address. It is the sole responsibility of the bidder to ensure timely and correct delivery of bid to the person and address stated above. Overnight delivery services may not guarantee timely next day delivery. Please check with the service you use.**

**Please direct all requests for information relating to this RFP in writing (Email Acceptable)**

**to:**

Worcester County Department of Information Technology  
Attn: Brian Jones  
One West Market Street  
Room 1003  
Snow Hill, MD 21863  
[bjones@co.worcester.md.us](mailto:bjones@co.worcester.md.us)

RFP Documentation can also be viewed electronically at:

[www.co.worcester.md.us](http://www.co.worcester.md.us)

Proposals shall be prepared at the bidder's expense, proposals become a County record and are subject to the Public Information Act.

**Proposal should include and will be evaluated based on:**

1. Cover Sheet (Provided)
2. General Vendor Information Sheet (Provided)
3. Customer Reference Form (Provided)
4. Demonstration of understanding of scope of work
5. Proposed approach to performing the work defined in this RFP.
6. Outline of staff expertise, technical and financial capabilities
7. Assurance of staff depth to meet project timeline
8. Experience related to the project
9. Fee Schedule and Cost Proposal to complete deliverables
10. Proof of insurance as described in Vendor Qualifications

## **Overview and RFP Purpose**

The Worcester County Department of Information Technology seeks qualified vendors to conduct a broadband feasibility study as a key input in the development of a comprehensive community broadband strategy. A more detailed description of the desired deliverables are provided in the following sections of this document. The County will consider proposals from single vendors or from multiple vendors working as a team, though a prime contractor must be identified in the case of the latter. The ideal vendor will have excellent technical and analytic depth in areas of interest to the County under this RFP, and must be highly-effective communicators, particularly in translating technical concepts to non-technical audiences. The County prefers firms with experience working with public sector organizations, having worked with governmental entities both larger and smaller than Worcester County. The County is employing this procurement method to both explore the costs and logistics of procuring the described services. The County reserves the right to reject any and all proposals or any part thereof, to waive any formalities or informalities, to award the contract to the most responsive and responsible respondent(s) as deemed in the best interest of the County, or to suspend the procurement if the desired outcomes are not achieved.

## **Background, Project Justification and Key Drivers**

### *General County Information*

Worcester County is the easternmost county within the State of Maryland and is the only oceanfront county in Maryland. The County is bordered to the south by the State of Virginia, to the west by Somerset County and Wicomico County, Maryland, to the north by the State of Delaware, and to the east by the Atlantic Ocean.

The County is mostly rural in nature with the exception of the northern portions of the County, which contains some of the more developed areas, including Ocean Pines, Ocean City, and Berlin. The County's area totals 695 square miles, of which 468 square miles are comprised of land and 227 square miles are comprised of water. The County has more than 750 miles of shoreline.

### *Justification of Broadband*

Without broadband service to residents, meaningful distance learning is not an option for those seeking higher education opportunities – resulting in many young people leaving the County.

While protecting the best interest of the County and its citizens, the goal of the County is to research the best options available that advance a viable means to bring the best possible broadband services to a county that has limited resources and sparse population

We acknowledge broadband is a critical service for quality of life, as is the case with roads, water, sewer, and electricity. Every home, business, non-profit organization, government

entity, and place of education should have the opportunity to connect affordably, easily, and securely. Worcester County should have broadband services that are shaped by the values of the citizens and businesses that take deep pride in our community.

### **Project Specifications and Deliverables**

Proposals should be prepared simply and economically, providing a straightforward, concise description of capabilities to satisfy the requirements of the RFP. Emphasis should be placed on completeness and clarity of content.

### **Scope of Work**

1. Research and evaluate the current supply of broadband communications assets, products and services in the County through a range of efforts and methodologies identified by the successful firm. Develop a communications and outreach strategy to engage stakeholders, disseminate information and provide opportunities for inclusion in the process.
2. Utilizing Surveys and other methods, evaluate the current and future demand for broadband products and services in the County through a range of efforts and methodologies, including but not limited to conversations with:
  - a) Public stakeholders (e.g. local and regional government agencies, educational institutions, federal laboratories and agencies, etc.).
  - b) Private stakeholders (e.g. local businesses, business organizations, health care providers, digital divide advocates, other interested consumers and interest groups).
  - c) Broadband providers regarding the demand for, and adoption of, their products.
3. Perform a Gap Analysis of the Current Broadband Environment - evaluate the current environment against the current and future needs of Worcester County, including all stakeholders defined in the project. Determine the general economic and community impact broadband issues are having on Worcester County.
4. Identify funding sources and provide strong justification for funding to serve as the basis for a grant/loan application to support project implementation.

### **Deliverables**

Using the results of the entire Scope of Work analysis, develop a comprehensive written report that presents alternatives to address the engineering and business parameters for deploying broadband services throughout Worcester County. The analysis must consider a wide continuum of business models and engineering options. It shall also highlight associated costs, alternative financing methods including other funding sources, as well as risk, timing and service quality considerations. The report must conclude the analysis by identifying a recommended strategy and associated action plan for its implementation.

Deliverables to include:

1. County demographics
2. Survey results to include but not limited to:
  - a. Demonstrate current level of service by identifying unserved and underserved residence and or businesses.
  - b. Tabulation of data based on findings in spreadsheet (Excel) form.
  - c. Equipment per household effected by lack of broadband
  - d. Needs of underserved or unserved residents
  - e. Geographical map showing underserved or unserved residents in Worcester County
  - f. Current broadband (broadband is defined as 25 MPS or more)providers if any available to resident
  - g. Current number of internet providers with bandwidth less than 25 MPS.
3. Incumbent providers, their location(s) and details on current services and technologies
4. Industry findings of network availability in the county along with backbone capabilities.
5. Similar projects that have been completed in other counties.
6. Potential project partners that may be used to obtain data for this study.
7. Synergies and sharing opportunities
8. Business and financial modeling in support of network build to include Fiber-to-the-Home (FTTH), Fixed Wireless Broadband or a Hybrid System
9. Estimation of project cost and construction timeline should Worcester County decide to expand on a broadband installation project in the future.
10. Provide any GIS-based shapefiles created or utilized for the Project
11. Report that clearly defines their stakeholder evaluation process including their recommended participant level in order to reach statistically reliable results.
12. List of recommendations and suggested implementation measures to be employed by Worcester County for its "Next Step" Phase
13. Determine the general economic and community impact broadband issues are having on Worcester County as described in the "Scope of Work" section.
14. The GAP Analysis should include an evaluation of key issues limiting broadband expansion as described in the "Scope of Work" section.

### **Vendor Qualifications**

1. Demonstrate to the county qualifications deemed necessary to determine the ability of the vendor, subcontractors or suppliers to perform the work requested. The vendor shall furnish to the County all such information and data.
2. Information provided shall include the following:
  - a. Name of parent company
  - b. Length of time in business
  - c. Total number of clients
  - d. Consulting tools that will be used to collect data
  - e. Physical location of office servicing this account
  - f. Number of staff at servicing location
  - g. Past experience and references
3. The County reserves the right to reject any proposal if the evidence submitted by or investigation of such vendor fails to satisfy the County that such vendor is properly qualified to carry out the obligations of the contract and/or to complete the work contemplated therein within the time required.
4. The vendor is specifically advised that any person, firm or other party to whom it proposes to award a subcontract or purchase order under this contract must be identified and found to be acceptable to the County.
5. The vendor must have the authority to do business in the State of Maryland and be in good standing.
6. The offeror shall be required to provide evidence that it has, and will maintain during performance of services under this contract, professional liability insurance and general liability insurance as applicable, and will be required to submit a Certificate of Insurance indicating the limits of such insurance that are satisfactory to the County.
7. The vendor accepts the terms that anything provided to the County, as a deliverable then becomes the sole property of Worcester County and cannot be redistributed in any form without the express written consent of the Worcester County Commissioners or its designees.
8. The County reserves the right to accept or reject all proposals or sections thereof when the rejection is in the best interest of the County. The County reserves the right to award without further discussion. Therefore, responses should be submitted initially with the most favorable terms the vendor proposes. The County reserves the right to reject the proposal of a vendor who has previously failed to perform properly or completed on time contracts and to reject the proposal of any vendor who in the opinion of the County, is not in a position to adequately perform the contract.

**Proposal Cover Sheet**

Name of Company	
Address of Home Office	
City of Home Office	
State of Home Office	
Zip Code of Home Office	
Phone Number of Home Office	
Federal EIN	
State EIN	

Contact Name: (Please print clearly)

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Contact Office Phone Number:

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Contact Cell Phone Number:

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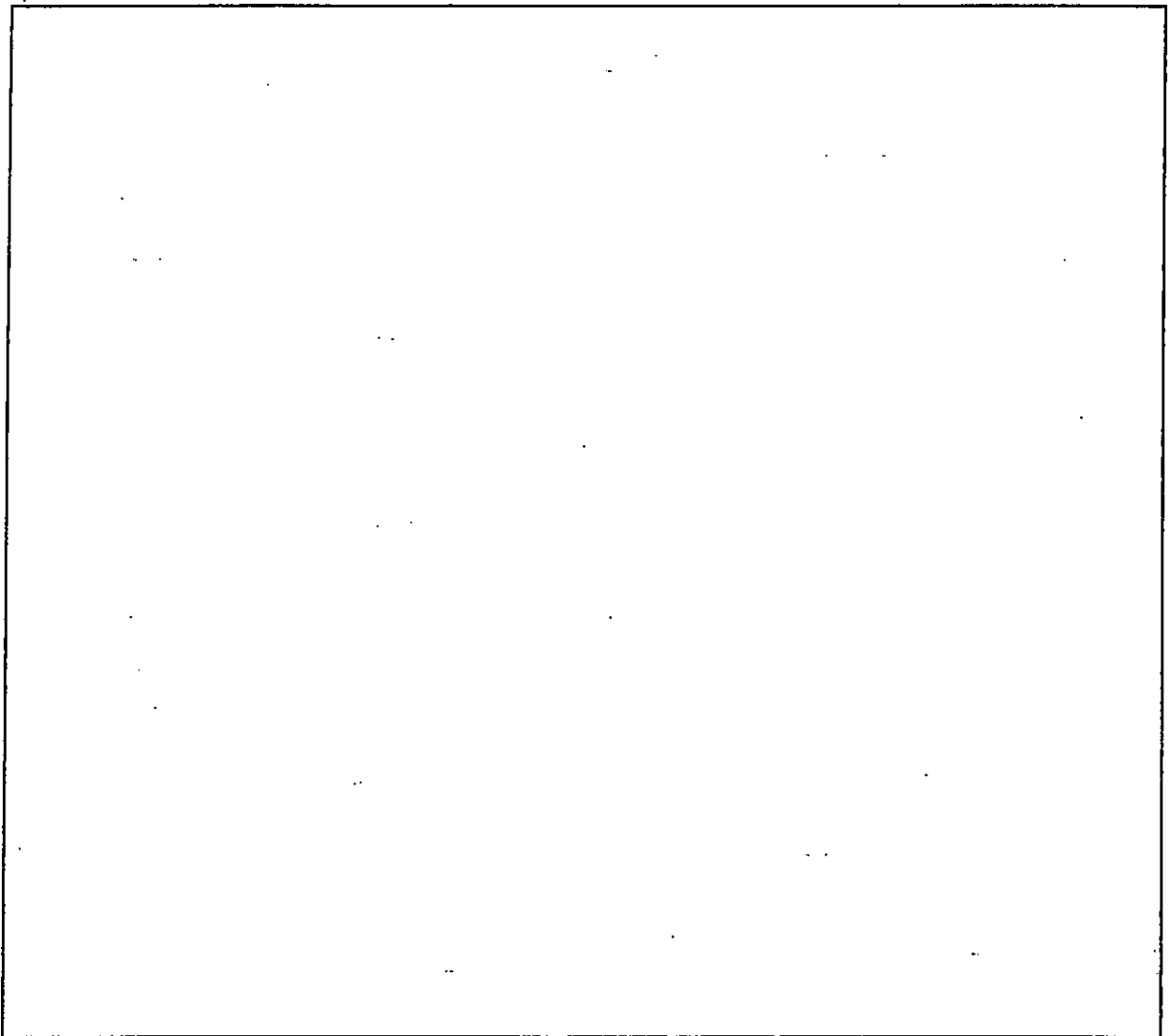
Contact E-Mail Address: (Please print clearly)

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“Proposal and cost schedule shall be valid and binding for ONE HUNDRED TWENTY (120) days following the proposal due date and will become part of the contract that is negotiated with the COUNTY.”



If the vendor has had any contract terminated for default during the past five years, all such incidents must be described. Termination for default is defined as notice to stop performance due to the vendor's nonperformance or poor performance; and the issue was either (a) not litigated or (b) litigated, and such litigation determined the vendor to be in default. In the space provided below, submit full details of all terminations for default experienced by the vendor during the past **five years**, including the other party's name, address, and telephone number. Present the vendor's position on the matter. The County will evaluate the facts and may, at its sole discretion, reject the vendor's proposal if the facts discovered indicate that completion of a contract resulting from this RFP may be jeopardized by selection of the vendor. If no such terminations for default have been experienced by the vendor in the past five years, declare so in the space provided.

A large, empty rectangular box with a thin black border, intended for the vendor to provide details of any contract terminations for default experienced in the past five years. The box is currently blank.

**Customer Reference Form (Include information for three references)**

Customer – client name	
Reference name	
Title	
Office Phone Number	
Cell Phone Number	
E-Mail Address	
Mailing Address	
Start Date	
End Date	
Contract amount	

Customer – client name	
Reference name	
Title	
Office Phone Number	
Cell Phone Number	
E-Mail Address	
Mailing Address	
Start Date	
End Date	
Contract amount	

Customer – client name	
Reference name	
Title	
Office Phone Number	
Cell Phone Number	
E-Mail Address	
Mailing Address	
Start Date	
End Date	
Contract amount	

**BID FORM**

**Broadband Feasibility Study for the Residents of Worcester County**

I/we have reviewed the specifications and provisions for furnishing a feasibility study for the residents of Worcester County. This study will serve the basis for data to provide Broadband coverage to Worcester County unserved residents at a later phase.

Total lump sum for services: \_\_\_\_\_

Services will be completed within \_\_\_\_\_ days from notice to proceed by Worcester County.

**BID MUST BE SIGNED AND DATED TO BE VALID**

Date: \_\_\_\_\_ Signature: \_\_\_\_\_

Typed Name: \_\_\_\_\_

Title: \_\_\_\_\_

Firm: \_\_\_\_\_

Address: \_\_\_\_\_

Phone: \_\_\_\_\_

# ctc technology & energy

engineering & business consulting

February 7, 2019

Attachment  
B

Mr. Brian Jones  
Department of Information Technology  
Worcester County  
One West Market Street, Room 1003  
Snow Hill, MD 21863

*Subject: Proposal to conduct broadband feasibility study*

Dear Mr. Jones:

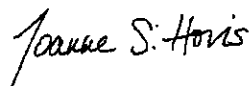
CTC Technology & Energy (CTC) is pleased to provide this proposal and background information regarding our decades of experience supporting clients on broadband needs assessments, strategy, business planning, and network engineering. We specialize in making complex technical and business data about broadband networks accessible to policy-makers and County staff.

CTC works primarily for public entities and has no financial relationships with equipment manufacturers, construction companies, or systems integrators. We will be your independent, objective adviser—and will be guided by your goals, priorities, and risk tolerance.

**We note, too, that we have a long, successful history of broadband engagements across our home state of Maryland.** We are proud of our work with Talbot and Harford counties, where we have been deeply engaged with rural broadband strategy, and our support of Garrett County—where we developed a broadband strategic plan and an award-winning public-private partnership (P3) approach that is considered the leading rural broadband P3 in the country. We are also working closely with the Governor's Office of Rural Broadband on three federal grant applications on behalf of rural Maryland counties.

Please do not hesitate to contact me if you would like to talk further. We look forward to the opportunity to work with you and your colleagues on this important initiative.

Best regards,



Joanne S. Hovis | President

**Columbia Telecommunications Corporation**

10613 Concord Street • Kensington, MD 20895 • Tel: 301-933-1488 • Fax: 301-933-3340 • [www.ctcnet.us](http://www.ctcnet.us)

# ctc technology & energy

engineering & business consulting

## Proposal Cover Sheet

Name of Company	Columbia Telecommunications Corporation dba CTC Technology & Energy
Address of Home Office	10613 Concord Street
City of Home Office	Kensington
State of Home Office	Maryland
Zip Code of Home Office	20895
Phone Number of Home Office	301-933-1488
Federal EIN	52-1442373
State EIN	D02077980

Contact Name: (Please print clearly)

Joanne Hovis

Contact Office Phone Number:

301-933-1488

Contact Cell Phone Number:

410-980-8378

Contact E-Mail Address: (Please print clearly)

info@ctcnet.us

“Proposal and cost schedule shall be valid and binding for ONE HUNDRED TWENTY (120) days following the proposal due date and will become part of the contract that is negotiated with the COUNTY.”

**Columbia Telecommunications Corporation**

10613 Concord Street • Kensington, MD 20895 • Tel: 301-933-1488 • Fax: 301-933-3340 • www.ctcnet.us

If the vendor has had any contract terminated for default during the past five years, all such incidents must be described. Termination for default is defined as notice to stop performance due to the vendor's nonperformance or poor performance; and the issue was either (a) not litigated or (b) litigated, and such litigation determined the vendor to be in default. In the space provided below, submit full details of all terminations for default experienced by the vendor during the past **five years**, including the other party's name, address, and telephone number. Present the vendor's position on the matter. The County will evaluate the facts and may, at its sole discretion, reject the vendor's proposal if the facts discovered indicate that completion of a contract resulting from this RFP may be jeopardized by selection of the vendor. If no such terminations for default have been experienced by the vendor in the past five years, declare so in the space provided.

CTC has never had a contract terminated for default.

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## 1. Customer Reference Form

### ***Customer Reference Form (Include information for three references)***

Customer – client name	<b>Garrett County, Maryland</b>
Reference name	Cheryl DeBerry
Title	Natural Resources Business Specialist Economic Development Department
Office Phone Number	(301) 334-6968
Cell Phone Number	N/A
E-Mail Address	<a href="mailto:cdeberry@garrettcounty.org">cdeberry@garrettcounty.org</a>
Mailing Address	203 South Fourth St., Oakland, MD 21550
Start Date	2012
End Date	2018
Contract Amount	\$229,000

Customer – client name	<b>Talbot County, Maryland</b>
Reference name	Mark Cohoon
Title	GIS Manager
Office Phone Number	(410) 770-8183
Cell Phone Number	N/A
E-Mail Address	<a href="mailto:mcohoon@talbgov.org">mcohoon@talbgov.org</a>
Mailing Address	11 North Washington St., Easton, MD 21601
Start Date	2008
End Date	Ongoing
Contract Amount	\$122,000

Customer – client name	<b>Anne Arundel County, Maryland</b>
Reference name	John Lyons
Title	<i>Formerly:</i> Cable Administrator, Anne Arundel County <i>Currently:</i> Asst. Director, Governor’s Office of Rural Broadband
Office Phone Number	(301) 429-7508
Cell Phone Number	N/A
E-Mail Address	<a href="mailto:itlyon00@gmail.com">itlyon00@gmail.com</a>
Mailing Address	MS-1335 44 Calvert Street, Room 315 Annapolis, MD 21401
Start Date	2001
End Date	Ongoing
Contract Amount	\$2.2 million

## **2. Demonstration of Understanding of Scope of Work**

We understand Worcester County's need for enhanced broadband infrastructure and services—because it is similar to the needs of other largely rural communities in Maryland and nationwide. And in rural areas where tourism, vacation rentals, and second-home buyers are an important part of the economy, broadband is that much more critical.

We think of broadband as a critical service like electricity and water—yet the private sector will not build costly wireline infrastructure to reach all homes and businesses in rural areas because the potential return on investment is insufficient to justify the investment. The same dynamics apply to virtually all areas of rural infrastructure development. In the case of broadband, the issues are starker because broadband is traditionally thought of as an area of private investment, rather than public investment.

These challenging economics, which result largely from the County's low population density, have real consequences for the community—affecting young people's access to education (including distance learning), the tourism industry's ability to meet vacationers' (and second-home owners') need for Wi-Fi, and economic development in general.

The County's scope of work represents a methodical approach to gathering the data and insight needed to develop a long-term community broadband strategy. We understand that the County's key goals include:

1. Developing an understanding of the gaps in broadband service across the County, both in terms of underserved and unserved residents and businesses
2. Developing candidate designs and associated cost estimates for networks that might fill the County's broadband gaps—using best-fit technologies that may vary in different parts of the County (e.g., fiber-to-the-premises, fixed wireless, hybrid)
3. Developing a strong, well-documented justification for potential grant or loan applications (federal or state)—which may also support future County efforts to attract private partners

Ultimately, we recognize that the County seeks a clear path forward to deploying (or supporting the deployment of) infrastructure that will enable affordable, equitable broadband access to Worcester's citizens, businesses, schools, libraries, and non-profits.

### 3. Proposed Approach

We propose an approach that, based on our experience conducting feasibility analyses and developing technical solutions for local governments nationwide, we believe will cost-effectively produce the insights and data that the County requires. Our approach involves methodical research, rigorous analysis, and regular communication.

Using a variety of industry-accepted evaluation methods, we will seek to identify current broadband use and needs among the County's residents and businesses—as well as a general overview of available services (and, by extension, an understanding of the locations of the County's unserved and underserved areas). We will then develop potential technical solutions that could form the basis for a strong grant or loan application (federal or state) and future private partnership planning.

CTC will be the County's independent adviser throughout the project and will develop realistic recommendations for enabling the County to realize its goals of ubiquitous broadband availability. As a matter of policy, we have no financial stake in the County's decisions; we do not seek to construct or operate your network.

#### Strategic Planning Workshop

Our project team will meet with County personnel and invited stakeholders to discuss project goals and objectives, review relevant maps and documents, establish project parameters, and confirm the County's expected timeline. We will also discuss with the County our proposed communications and outreach strategy for engaging stakeholders in the study.

#### Task 1: Assess the County's current broadband infrastructure (assets) and market (services)

As a foundational element of our analysis, we will assess both the existing infrastructure and the current competitive environment for broadband services in the County.

#### Analyze existing broadband infrastructure

We will evaluate the County's current supply of broadband assets through a combination of desk and field surveys. As an initial step, we will review any relevant maps, studies, documents, or data that the County can share with us. A CTC outside plant engineer will then conduct an extensive desk survey using the County's GIS maps, Google Earth imagery, and other relevant sources.

To supplement the desk survey, a highly experienced CTC engineer will conduct a day of field verification of representative portions of the County. This will include evaluation of representative County sites, with field survey work focusing on critical sites, as well as general areas that we believe may be particularly challenging, based on discussions with the County and

our previous experience in similar projects. In our experience, field survey of representative sites augmented by use of maps and existing plans is suitable for estimating level of effort.

The engineer will photograph, sketch, and take detailed notes on topography, rights-of-way, road crossings, railroad crossings, “hydro lines” (i.e., creeks, streams, rivers), and “hydro areas” (i.e., wetlands, bodies of water). The field survey will include measuring the green space available within the right-of-way for placement of conduit, and recording other pertinent details, including:

- Storm drains and street lights
- Edge of pavement
- Water and sewer lines
- Required test pits
- Slack storage, splice cases, pedestals, and vaults
- Required hardware

CTC’s engineer will survey pole lines to determine their ability to support fiber or wireless attachments, the need for make-ready and pole replacement, and the estimated cost. CTC’s engineer will note any potential barriers to construction, as well as what permits would be needed to construct fiber infrastructure. The field survey will enable us to identify specific details related to using the County’s rights-of-way, as well as targets of opportunity for connecting additional sites or providing physical path redundancy to enhance communications survivability between sites.

#### Assess the availability of broadband services

In this task, we will seek to determine what vendors are active in the area, what services are available, and what residents and businesses pay for varying levels of service. We will explore not just starter and enticement pricing, but also the actual pricing for established customers.

Our assessment will include:

- Developing a list of current broadband providers, including the costs for services, based on publicly available information
- Evaluating available FCC Form 477 data about services in the County
- Conducting outreach to local private providers to gather input on their service areas and their perceptions of service gaps (in conjunction with our discussions in Task 2, below)

Ideally, we will be able to use this multi-step analysis to develop a map that visually approximates what kind of services are available in each part of the County—to supplement and confirm the results of our desk and field surveys (see above). We approximate this inventory based on service and pricing information because the industry does not share data on its infrastructure. We will

make highly educated estimates, based on our experience, of competition gaps, affordability gaps, and service gaps.

In developing the County's feasibility study, it is critical to look not only at the range of broadband needs, but also the gaps in available and affordable services for business and institutional users. We commonly find that regions that are reported to be "well-served" still have supply issues, especially for small businesses. First, we typically find that broadband availability is not ubiquitous. Second, where service is available, the cost of getting a new "drop" connection to an office or other facility is often excessive, even for a large business. And third, the types of available services are not well suited to small businesses.

Often these regions have a range of available service options, including services such as dark fiber, cable modem, DSL (Digital Subscriber Line), Metro Ethernet, and MPLS (Multiprotocol Label Switching). But most of these services are tailored to either casual users (e.g., cable modem or DSL, which do not meet business or government performance needs) or large users (e.g., Metro Ethernet or MPLS, which meet business requirements but with unaffordable monthly costs that would represent a substantial portion of many business' ongoing operating costs).

Taken together, these issues and service gaps will drive the development of a strategy and roadmap for future County initiatives.

#### Task 2: Evaluate current and future demand for broadband (needs assessment)

We will conduct on-site discussion groups with representatives of the County's range of key stakeholders with a goal of understanding their broadband needs, constraints, and challenges. We will use the insights we develop to inform subsequent project tasks.

We anticipate conducting the in-person discussion groups over a period of a few days. For all of these meetings, we request the County's assistance in identifying the participants, scheduling and confirming the interviews, and arranging a suitable meeting place for the interviews.

In this task, we will develop a high-level sense of demand based on qualitative data. If the County would also like a quantitative assessment, we will prepare and distribute a residential market survey at additional cost (see the optional Task 6, below).

#### Facilitate discussion groups with key public stakeholders

To assess public stakeholders' operational needs for broadband, CTC will conduct one on-site discussion group with representatives of local and regional government departments (included invited representatives of the County's municipal governments) and educational institutions, and one on-site discussion group with representatives of federal agencies and other related stakeholders identified in collaboration with the County. For each of these sessions, we will seek

to explore specific current needs and future goals. We may also have conversations, either in-person or through teleconferences, with representatives of other public sector stakeholders.

#### Facilitate discussion groups with private stakeholders

We will conduct two discussion groups with representatives of local businesses and business organizations (e.g., the Chamber of Commerce)—key private stakeholders in the County’s broadband planning. Our goal will be to understand the broadband market for the County’s business customers, and to identify the participants’ specific broadband needs.

We will also conduct one discussion group with representatives of other important stakeholders that might include community groups, economic development agencies, organizations that have an interest in addressing digital divide issues, healthcare providers, non-profits, consumer groups, and other interested stakeholders and regional entities.

#### Facilitate discussions with broadband providers

Discussions with enterprise broadband service providers are an opportunity to explore potential partnerships and joint opportunities—and the enormous shared benefit that might result from creative planning. While service providers are typically reluctant to discuss competitive details about their business (e.g., customer demand, take rates, future buildout plans), in our experience many providers are interested in partnering with the public sector under a variety of models.

With that approach as our framework, we will seek to have constructive conversations with incumbent and competitive service providers in the region. Our request to discuss broadband planning with local providers will reflect the County’s openness to collaborating with these entities to mutual benefit.

### Task 3: Prepare high-level design and cost estimate for broadband deployment

In this task, we will develop a high-level candidate design and cost estimate for a fiber, fixed wireless, or hybrid network that might fill the broadband service gaps identified in previous tasks. We will identify the most topography-appropriate and cost-effective infrastructure.

We will include in our engineering analysis existing infrastructure (including fiber, but also rights-of-way access and locations for network hubs and other necessary infrastructure) that we believe the County can use to support the deployment.

We will identify routing for potential topologies and will consider construction and design practices to minimize overall cost, including planning construction in conjunction with capital improvements in the rights-of-way (e.g., road work, sidewalk replacement programs).

We will also be seeking to identify areas where relatively small investments in conduit or fiber extensions might add significant value to the County's infrastructure in terms of economic and community development goals.

Based on that analysis, we will develop a high-level estimate of likely costs and timelines for construction and implementation of a baseline network. We will identify incremental costs for enhancing construction methodology to include additional conduit capacity and access points to facilitate reduced-cost construction for potential future expansion and site additions. We will also seek to identify areas of risk.

Our network design and cost estimates will assume a phased approach to network deployment. To be clear, we will not be providing a blueprint-level network design or cost estimate. Rather, we will be providing an analysis of existing infrastructure, a conceptual design, high-level maps, and a system-level overview of the potential infrastructure—which in turn can become a roadmap for financial analysis and business modeling, and for future decisions (potentially including detailed engineering and contracting with private sector service providers).

#### Task 4: Evaluate funding options and develop a grant strategy

Public sector broadband network deployments reflect both an ambitious vision and, often, a public commitment to financing broadband access for all citizens. Many local governments have pursued grants or loans, taken out bonds, or otherwise sought funding for construction of publicly owned fiber networks.

We will help the County develop realistic options for funding. We will draw on our hands-on knowledge of broadband funding opportunities and our research capabilities in this area to conduct a high-level evaluation of existing state and federal grant programs that the County might consider. We will consider programs that have been proposed (but not yet approved) in the Maryland legislature, as well as a range of federal grant programs. Our goal in this task is to help the County determine whether it has a path toward at least partial funding for broadband deployment.

Task 5: Prepare and present a gap analysis and comprehensive written project report  
Our final deliverable will be a comprehensive feasibility analysis that documents our gap analysis of the County's current and future broadband needs—and presents our candidate technical solution to serving the currently underserved and unserved residents and businesses. The report will recommend a phased approach and a strategic roadmap of actions for the County's consideration. The report will include the data, insights, and recommendations developed in the previous tasks.

We will provide the County with an electronic draft of our report, which will include a concise narrative supported by tables, graphics, and maps as appropriate. We will incorporate feedback from reviewers and deliver an electronic version of the final report.

#### Optional Task 6: Conduct statistically valid residential market survey

Our goal for the mail survey will be to obtain statistically valid, quantitative data on the current and potential future use of broadband by residents in the community. We will seek to identify differences among users based on income level, education level, and other factors.

The residential market research we propose is designed to estimate demand for broadband services and to gather insight on a range of issues that will impact the County's future plans by:

- Providing statistically valid market data to assist in identifying the potential market for broadband—as well as the risk that the market is not sufficiently large
- Providing market data to encourage private sector involvement in the project (i.e., to incent private investment or a future public-private partnership)
- Establishing residents' needs and concerns
- Understanding residents' views on the role of County involvement in providing service
- Identifying residents' price sensitivities and willingness to pay for broadband
- Understanding customer satisfaction as well as perceptions of current prices and service attributes offered by the existing providers
- Understanding the overall market demand for communications services
- Quantifying the use of high-speed connectivity in the County
- Determining the number of residents subscribing to a service where it is available
- Gauging demand for alternative broadband services

The County will have an opportunity to review and edit the printed residential survey instrument.

We will purchase a mailing list and mail a written survey to about 2,100 randomly selected County residents. Based on this sample size, we would anticipate receiving about 375 responses (i.e., an 18 percent response rate, which is a reasonably conservative estimate). This would provide results within a confidence interval of  $\pm 5.0$  percent at the 95 percent probability level. That is, 19 times out of 20, the results from the respondents would be within  $\pm 5.0$  percent of the responses from the entire population.

The survey will require an estimated 12 to 15 minutes to complete. To encourage participation, the survey will be printed as a booklet (which enhances readability) and mailed in a non-standard



sized envelope (which increases the likelihood that it will be noticed and opened by the recipients). We will manage survey distribution, return mailing, processing, and data analysis.

The residential survey will be designed to collect the following responses:

- Basic demographics of the respondent
- Respondent's income
- Number and ages of household residents
- Computer availability and usage rates
- Customer loyalty to existing services
- Satisfaction with current connectivity services and prices
- Interest in next-generation high-speed Internet
- Internet/email use, service, cost, and time since connected
- Use of telephone services
- Use of IP-based video and voice services
- Desired new services
- Motivation to switch communications service providers
- Perceived value of new voice, video, and data services
- Relationship of price vs. willingness to switch providers

In addition to traditional survey questions, we recommend including:

1. Questions on importance of service attributes versus satisfaction with services. Most surveys only ask for respondents' satisfaction level. Asking questions to determine the importance of aspects of their service allows for an evaluation of whether and where the private provider market is meeting or failing to meet consumers' needs.
2. Questions directed to what the respondents believe the County's role should be in promoting internet access. If a large majority of residents are skeptical of municipal involvement in this area, for example, that is an important piece of data for elected decision-makers.
3. Questions regarding respondents' willingness to switch services for a range of alternative pricing and service scenarios. We believe that the answers to these questions assist in predicting price points and market share.

Survey responses will be entered into a database format and analyzed. The raw data will be reviewed and processed following our standard data-cleaning protocol. This might include coding missing responses, establishing new response categories, verifying skip logic, and other steps necessary to ensure a clean and valid dataset.

The residential survey data will be weighted by the age of the respondent to minimize any age bias in the survey results. Because younger residents are much less likely to respond to surveys, weighting the survey responses based on the actual (Census) distribution of adult population by age cohort is necessary to minimize response bias. This is especially true for surveys regarding internet uses that may be more widely adopted by younger residents than by older residents.

Data analysis will include, at minimum, development of frequency tables for all responses and selected cross-tabulations and/or comparisons of mean ratings by geographic area and key demographics. Examples of key cross-tabulations that may be evaluated include:

- Internet connection type by age of respondent
- Internet connection type by geography (urban/suburban/rural or congressional district)
- Internet uses by business type (industry classification)
- Internet connection type by business size
- Satisfaction with vs. importance of internet service characteristics
- Use of telecommuting or distance learning by home internet connection type

Additionally, we will seek to identify key target segments by examining demographic, income, or other relevant drivers. The level of analysis completed will depend on the number of responses and the characteristics of the data collected.

For example, cluster analysis and/or classification trees can be used to segment and profile residents according to their needs or perceptions, and a gap analysis can help us evaluate whether and where the broadband Internet marketplace is meeting or failing to meet expectations for attributes that are important to respondents. That is, including questions about the level of importance respondents assign to various aspects of their service, along with their level of satisfaction with those aspects, enables us to identify areas where providers are meeting or failing customers' expectations. An example of this analysis is shown in the following table:

**Sample Gap Analysis**

	Mean Importance	Mean Satisfaction	GAP <-->	Significance?
Price	7.9	7.2	-0.7	Expectations not met
Local office	5.0	6.4	1.4	Expectations exceeded
Connection speed	8.3	7.6	-0.7	Expectations not met
Connection reliability	9.0	8.6	-0.4	Not significant

#### 4. Outline of Staff Expertise

We propose the following key team members—who will be supported by our staff of engineers and analysts. Resumes for key CTC team member are attached in Appendix A; additional resumes are available on request.

Key Personnel	Project Role
<b>Joanne Hovis</b> <i>President</i>	Project lead; strategic guidance; analysis
<b>Andrew Afflerbach, Ph.D., P.E.</b> <i>Chief Technology Officer</i>	Senior technical adviser
<b>Tom Asp, MBA</b> <i>Principal Engineer and Analyst</i>	Financial analysis; strategic guidance
<b>Matthew DeHaven</b> <i>Principal Engineer</i>	Technical and strategic guidance
<b>Marc Schulhof</b> <i>Senior Analyst &amp; Technical Writer</i>	Technical writer

#### Team Biographies

**Joanne Hovis, President**, will be the project lead. An attorney who has provided network business model analysis and recommendations for some of the largest public broadband networks in the country (i.e., large-scale concession planning and design-build projects), she is a nationally recognized authority on the broadband market and community broadband topics—and on the evolving role of government in the provision of communications services to the public.

Joanne oversees all ongoing CTC analysis for local government clients and provides innovative business planning for communications networking initiatives such as the pioneering broadband public-private partnerships in the cities of Boulder, Madison, Westminster, and Huntsville (Ala.).

Joanne has extensive experience developing business case and business model scenarios for public sector broadband initiatives; she draws on her deep knowledge of the decision-making process and decision metrics employed by network developers and investors, and her related understanding of the municipal bond market (e.g., credit analysis and ratings). She leads the CTC team that advises the states of Connecticut, Kansas, Massachusetts, and New Mexico, the cities

of Atlanta, Boston, Palo Alto, San Francisco, Seattle, and Washington, D.C., and the statewide broadband networks in Colorado, Maryland, and Pennsylvania.

Joanne is CEO of the Coalition for Local Internet Choice (CLIC) and a former president of the National Association of Telecommunications Officers and Advisors (NATOA). She is a member of the boards of directors of the Benton Foundation, the Fiber to the Home Council, and Consumer Reports.

**Andrew Afflerbach, Ph.D., P.E., Chief Technology Officer**, will be the project adviser. Andrew has designed fiber optic and wireless networks for large cities, counties, and regions, and conceived and developed the super-regional interoperable fiber optic network in the National Capital Region (including the District of Columbia, Maryland, Virginia, and 22 large local communities). In a previous engagement, Andrew served as technical adviser to the government of New Zealand in its nationwide FTTP initiative, where he developed the reference architecture for the effort and led the specification and procurement strategy. He is an experienced network planner who understands the business and financial implications of various network designs.

**Tom Asp, Principal Engineer and Analyst**, has more than 25 years of nationwide experience as a business and market analyst in communications and public power systems. His experience includes telecommunication system design, evaluation of network feasibility, and survey design and execution. He has developed financial statements and prepared quantitative business plan analyses for municipal and utility clients nationwide. He also has extensive experience presenting to local and state government officials, conducting needs assessment interviews, and facilitating stakeholder sessions.

**Matthew DeHaven, Principal Engineer**, has designed thousands of miles of fiber networks in urban and rural geographies across 10 states. He currently is managing the deployment of an FTTP network in Westminster, Maryland. He previously served as the Portfolio Manager for the One Maryland Inter-County Broadband Network; as the lead technical consultant on that project, he oversaw the use of approximately \$100 million in grant and matching funds to build approximately 800 miles of fiber optics and directly connect approximately 650 schools, libraries, government buildings, community colleges, and public safety agencies.

**Marc Schulhof, Senior Analyst and Technical Writer**, has 25 years of experience in technical writing, financial journalism, and corporate communications. He previously was the worldwide editor-in-chief of CIO program websites at IBM, a global editor at PricewaterhouseCoopers Consulting, and an associate editor at *Kiplinger's Personal Finance* magazine. He specializes in writing project deliverables that make complex technical and financial analyses more easily accessible to non-technical audiences.

### CTC Team's Broadband Thought Leadership

In addition to our work directly with clients, CTC principals Joanne Hovis and Andrew Afflerbach are recognized for thought leadership on next-generation broadband issues.

Joanne testified before the U.S. House of Representatives' Committee on Energy and Commerce, Subcommittee on Communications and Technology, about the critical importance of local participation in broadband planning (January 2018).<sup>1</sup> At a 2017 hearing, "Broadband: Deploying America's 21<sup>st</sup> Century Infrastructure," she testified on issues related to deployment of next-generation broadband infrastructure in rural communities.<sup>2</sup>

Joanne and Andrew authored "Gigabit Communities," an independent white paper on gigabit-facilitation strategies commissioned by Google.<sup>3</sup> Joanne also co-authored "The Emerging World of Broadband Public-Private Partnerships: A Business Strategy and Legal Guide" (published by the Benton Foundation).<sup>4</sup>

With the New America Foundation's Open Technology Institute, Joanne and Andrew co-authored a report on local broadband networks: "The Art of the Possible: An Overview of Public Broadband Options."<sup>5</sup> That study was cited in President Obama's report on public sector fiber networks, "Community-based Broadband Solutions: The Benefits Competition and Choice for Community Development and High Speed Internet Access."<sup>6</sup>

In addition, Joanne, Andrew, and other CTC staff have authored guides on community fiber development for the Utilities Telecommunications Council and the Tennessee Valley Public Power Association. These and other key documents are available on our website ([www.CTCnet.us/library](http://www.CTCnet.us/library)).

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*We are in an industry that is changing by the day with respect to regulatory frameworks, technology, and potential business models. CTC is engaging those issues every day, developing new strategies for leveraging public and private sector investment to enable sustainable last-mile connectivity.*

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<sup>1</sup> See <http://www.ctcnet.us/blog/ctc-president-joanne-hovis-testifies-before-u-s-house-of-representatives-subcommittee-on-closing-the-digital-divide-broadband-infrastructure-solutions/>

<sup>2</sup> See <http://www.ctcnet.us/blog/ctc-president-joanne-hovis-testifies-before-u-s-house-subcommittee-broadband-deploying-americas-21st-century-infrastructure/>

<sup>3</sup> See [www.Gigabit-Communities.com](http://www.Gigabit-Communities.com). While this work was commissioned and supported by Google, CTC's analysis was entirely independent and focused on promoting local governments' needs.

<sup>4</sup> <https://www.benton.org/sites/default/files/partnerships.pdf>

<sup>5</sup> <http://www.ctcnet.us/publications/the-art-of-possible-an-overview-of-public-broadband-options/>

<sup>6</sup> [http://www.whitehouse.gov/sites/default/files/docs/community-based\\_broadband\\_report\\_by\\_executive\\_office\\_of\\_the\\_president.pdf](http://www.whitehouse.gov/sites/default/files/docs/community-based_broadband_report_by_executive_office_of_the_president.pdf)

## **5. Assurance of Staff Depth to Meet Project Timeline**

CTC is an established national consulting firm with a unique combination of qualifications and capabilities in broadband financial analysis, business planning, engineering, and network strategic planning. **Founded in 1983, we have a 35-year track record of successfully managing our staffing allocations and meeting our clients' timelines.**

We provide independent financial, strategic, and technical, guidance to local governments, state governments, non-profit consortia, universities, and cooperative and municipal utilities. Our experience and expertise include all aspects of needs assessment, feasibility studies, strategic and business planning, and network engineering for next-generation broadband, both fiber and wireless.

We have conducted similar feasibility assessments—including community engagement (focus groups, working sessions, outreach), market surveys, business plans, engineering analyses, and financial pro formas—for public sector clients nationwide.

Many of our engagements have focused on low-risk public sector strategies to expand fiber or wireless infrastructure to promote economic development, enhance the availability of high-bandwidth services, and increase broadband competition.

We specialize in helping public sector clients develop phased approaches for implementing fiber networks to meet their needs; we are particularly experienced with helping communities identify private partners for broadband initiatives. Our goal in these engagements is to develop relationships in which the private partner shares the risk of expanding a network to serve the community's needs. In these engagements, too, we are vigilant about managing the community's risk with respect to partner financing and operations.

## 6. Representative Experience Related to the Project

The following project descriptions illustrate CTC's demonstrated experience in developing broadband feasibility studies—including stakeholder and community outreach, network planning, engineering, business modeling, business planning, and financial planning. These are just a few of our hundreds of successful engagements with clients similar in size to Worcester County—as well as clients smaller and larger than the County.

**We note, too, that we have a long, successful history of broadband engagements across our home state of Maryland.** We are proud of our work with Talbot and Harford counties, where we have been deeply engaged with rural broadband strategy, and our support of Garrett County—where we developed a broadband strategic plan and an award-winning public-private partnership approach that is considered the leading rural broadband P3 in the country. We are also working closely with the Governor's Office of Rural Broadband on three federal grant applications on behalf of rural Maryland counties.

In addition, we have decades-long consulting relationships with Anne Arundel, Montgomery, and Prince George's counties, and have worked extensively with Baltimore and Allegheny counties and Baltimore City. We also played key roles in the development of the One Maryland Broadband Network and the Maryland Inter-County Broadband Network.

### Talbot County, Maryland

Located on the eastern shore of the Chesapeake Bay, 90 minutes by car from both Baltimore and Washington, D.C., Talbot County offers full-time and part-time residents small-town and rural living in close proximity to the nation's capital and major employment centers. With an estimated population of 38,000, the County has an economy based on agriculture and maritime tourism.



Many tourists and part-time residents travel from regions with superior bandwidth and expect that type of connectivity to continue without interruption when they come to Talbot County. The County is known as a desirable vacation and second-home location for highly skilled individuals who require robust broadband connections to do their work. These visitors and potential residents are willing to pay for high-quality broadband—and they will not stay long in an area with poor service.

Real estate professionals report that properties in the County's underserved areas are suffering losses in value, and that it is sometimes difficult to sell homes without high-quality broadband. Part-time residents in the underserved areas are limited to costly, low-performance satellite services or inadequate DSL services. The County wants part-time residents to continue to visit—and to increase the amount of time they can spend in the County.

CTC currently supports Talbot County with strategic and technical guidance related to its broadband initiatives—including residential market research and guidance on the USDA ReConnect grant opportunity. We previously assisted the County in evaluating its process for siting new cellular towers. We examined the areas of the County where cellular coverage existed, as well as areas where service was not available or where service was deemed to be inadequate. We assisted the County in developing a more systematic approach. Our report addressed a variety of factors that needed to be understood in order to provide for an intelligent and fair distribution of cellular communications towers within the County. The report focused on technical and engineering issues, zoning, the concerns of nearby residents, and land availability—all of which will need to be weighed to optimize voice and broadband service availability while minimizing the impact of wireless structures.

### Garrett County, Maryland

In Garrett County, Maryland (a rural, mountainous community with a thriving tourism sector and a need to support telecommuters and home-schooling families), we helped the local government with engineering and strategic and business planning for expansion of middle-mile fiber—then helped the County negotiate with a private partner to leverage that fiber to support the deployment of a fixed-wireless broadband network.



The private partner is matching the public investment with its own capital and will assume operating risk. The County contribution (which was matched with development funds from the Appalachian Regional Commission—following a successful grant application that CTC developed with the County) made the economics of this opportunity attractive to the private partner.

The fixed wireless “TV White Spaces” network will serve up to 3,000 currently unserved homes in the most remote parts of the County.

This innovative technical solution to the County’s lack of broadband was featured in a 2017 “Motherboard” article, “Rural America Is Building Its Own Internet Because No One Else Will” ([https://motherboard.vice.com/en\\_us/article/paax9n/rural-america-is-building-its-own-internet-because-no-one-else-will](https://motherboard.vice.com/en_us/article/paax9n/rural-america-is-building-its-own-internet-because-no-one-else-will)).



### City of Westminster, Maryland

The Westminster model that CTC pioneered is the most influential broadband public-private partnership in establishing the model of city-owned fiber and private use of that fiber. This demand-driven model was the first of its kind. (For more details, see CTC's website: <http://goo.gl/h14Lqi>.)



The construction of the City's FTTP network and its groundbreaking partnership are the culmination of a multi-year engagement with CTC. CTC first prepared an FTTP feasibility study, cost estimate, and business case for the City in 2012 and 2013. Our report, which focused on maximizing available backbone network connectivity, included a technical design and cost estimates for two last-mile FTTP pilot projects (one focused on residential customers, one focused on businesses).

Based on the strength of the City's commitment to its principles, and the outcome of the feasibility analysis, the City decided to move forward with the small-scale pilot projects. As that focused construction began, CTC continued to work closely with the City to establish its principles and risk tolerance, then designed a potential public-private partnership model that would achieve a balance between those guiding forces. We established the City's preferred role in each aspect of network construction and operations, developed criteria for evaluating potential partnerships, and develop a financial analysis tool to model a range of assumptions.

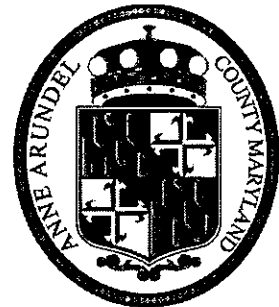
We then wrote an RFP to identify a private partner that would assume operating risk in providing services to the public over the City's FTTP infrastructure. The RFP led to successful negotiations, led by CTC President Joanne Hovis, and the announcement of a first-of-a-kind partnership with Ting Internet.

CTC continues to support the 80-mile FTTP deployment over a range of tasks spanning fiber infrastructure engineering, network design, construction bidding, construction oversight, and quality assurance inspection.

### Anne Arundel County, Maryland

CTC has provided the county with OSP fiber design and engineering for multiple large projects over more than a decade.

CTC currently provides the county with ongoing engineering support for various last-mile engineering projects and provides construction oversight and QA/QC work for the county.



In 2015, CTC provided OSP engineering for a county-funded project to connect schools and traffic signal locations and further extend the county-built fiber infrastructure by 90 miles.

CTC's work on both projects included field surveys, generating engineering prints and bills of materials, network and splicing design, permitting, and acceptance testing. CTC also developed RFP language for OSP construction and fiber maintenance.

From 2010 to 2012, CTC provided OSP engineering for a federally funded project to connect anchor locations (e.g., government buildings, schools) and expand the county's fiber infrastructure. The engineering for that project totaled over 70 miles, and included a rural FTTP network in the southern portion of the county.

### Montgomery County, Maryland

CTC has provided technical, engineering, and strategic support to Montgomery County's Department of Technology Services on its most significant recent infrastructure initiatives, including:

- *FiberNet*: The CTC FiberNet Team Lead serves as CTC's on-site liaison to the FiberNet manager. At the FiberNet manager's direction, the team lead spends up to 20 hours per week at the FiberNet offices, supporting the FiberNet team on a range of significant short- and long-term design and planning engagements.



CTC developed the initial design and architecture, in collaboration with the Department of Public Works and Transportation, for the network that would later become FiberNet. We did this in response to the immediate need to support traffic communications and cameras—but also in response to what we saw as the County's future needs for networking, video, data services, and the Internet.

Later, during the County's cable TV franchise renewal, we identified as a high priority the need to obtain fiber-optic infrastructure from the cable operator; this outside plant would complement the County's existing infrastructure and become part of FiberNet—and enable the County to have high availability services at a reasonable cost. As a result, the County has become a national leader in its network and enterprise capabilities.

CTC also assists the County by providing support for the technological evolution of FiberNet, so it can better meet the growing customer demand caused by the growth of the network's physical footprint.

Recently, CTC completed a preliminary analysis of optical network hardware platforms based on a high-level understanding of growing capacity demands and emerging

requirements across FiberNet's increasingly diverse customer base. The analysis identified differentiating attributes among market-leading optical network platforms offering strategic advantages aligned with the County's objectives and developed baseline specifications and a system-level design for an initial upgrade phase. We also evaluated options for DTS to use FiberNet to expand service to Montgomery College and Montgomery County Public Schools.

CTC also completed an Organizational Governance Study that evaluated County goals and objectives against its current operational, technological, and organizational structure; to recommend a series of changes to improve its value delivery and operational efficiency; and to better align its operations and financial performance to key stakeholder objectives.

- *Wireless Facility Siting:* CTC was central to the development of the 500-square-mile County's wireless siting process, which has been identified by the Intergovernmental Advisory Committee at the FCC and others as providing notable examples of many best practices.<sup>7</sup>

We have been the designated coordinator for the Montgomery County Telecommunications Facilities Coordinating Group (TFCG) from its inception in 1996 until today—marshaling DAS, small cell, and other wireless siting applications from filing to final action by the TFCG. We seek to balance the County's rights and regulations, the wireless industry's interest in delivering services, and the public's interest in minimizing the visual impact of wireless facilities in their neighborhoods.

We provide technical engineering support, coordinate and review carriers' applications to site transmission facilities in the County, conduct physical inspections of proposed siting locations, review applicants' RF engineering submittals, and provide recommendations on each siting request based on zoning standards, the potential visual impact of the installation, and other parameters. We also ensure the County's compliance with the FCC's "shot clock" for processing applications.

Over the course of this 20-year commitment and collaboration, we have drafted policies and procedures for review of applications, provided recommendations on related aspects of zoning text amendments, and informed the TFCG of changes in federal regulations governing the processing of applications to site wireless facilities in the

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<sup>7</sup> Report on Siting Wireless Communications Committee Presented to the Federal Communications Commission, July 12, 2016, <https://transition.fcc.gov/statelocal/IAC-Report-Wireless-Tower-siting.pdf>

County. We advise the County on approaches to enabling robust wireless service while being as mindful as possible of the impact of new antennas in the community.

- *UltraMontgomery*: To support development of the County's UltraMontgomery fiber infrastructure, CTC prepared a fiber market analysis, conducted a competitive assessment of the fiber market, developed a set of proposed in-building wiring standards, and identified a likely evolution path to guide the County's planning. During the initial stages of this ongoing project, we identified opportunities to cost-effectively expand County fiber to serve the Great Seneca Science Corridor and White Oak Science Gateway, as well as to link the area near NIST to the Equinix Data Center in Ashburn, Virginia.
- *Maryland Inter-County Broadband Network (ICBN)*: CTC provided technical leadership and detailed outside plant design services for the ICBN. As the Portfolio Manager for this project, we oversaw and directed engineering and fiber network construction contractors—including the expansion of FiberNet with 132 additional miles of fiber constructed to 100 new sites.
- *NCRnet*: Through our engineering, planning, and integration efforts, the County continues to maximize the benefits of its interconnection with the National Capital Region interoperability network—supporting public safety, video conferencing, and other applications and ensuring reliable communications across jurisdictions.

Our ongoing support of the County's technical needs has included assisting the County in responding to economic development initiatives, such as planning fiber and broadband in downtown Silver Spring and strategies to bring broadband to unserved areas. We have also identified ways to support Montgomery County Public Schools and Montgomery College, and supported the implementation of public safety applications such as automatic vehicle location.

### One Maryland Broadband Network

Working closely with the Maryland Department of Information Technology (DoIT), CTC provided strategic guidance and was the lead engineering and business planning consultant in conjunction with the development of OMBN's successful \$115 million federal grant application. Our services included network architecture, plant engineering, and detailed project preparation, with a focus on expanding the state's existing fiber optic network to reach underserved areas and achieve other program goals. CTC also provided extensive business planning, business modeling, and pro forma preparation.

### Maryland Inter-County Broadband Network

CTC was also the lead engineer, program manager, and project manager for the development of the Maryland Inter-County Broadband Network (ICBN) project—the largest sub-grantee of the One Maryland Broadband Network.

In that role, we designed and engineered approximately 360 miles of ICBN fiber routes for four large counties in the state; oversaw and directed engineering and fiber network construction contractors for the deployment of nearly 800 miles of fiber to 645 anchor institution sites; executed a strong management plan, staffing plan, and quality control plan; maintained the project plan for our work; allocated resources; tracked every aspect of the OSP process; oversaw the budgets and worked with the design team’s Project Coordinators to manage deliverables and due dates; and oversaw \$100 million in project funding.

During the ICBN design process, we conducted field walk-outs throughout the jurisdictions. We also worked with the State Highway Administration and the county departments of transportation to determine the availability of existing duct and cabinets, and included those in the design to cost-optimize the routes.

We played a key role in developing ICBN design principles such as fiber quantity, storage locations, access points, and building entry; developing bills of materials (BOMs); analyzing design options (e.g., use of aerial versus underground, use of existing infrastructure); and coordinating with the environmental assessment study.

### Delaware Department of Transportation

CTC has provided communications engineering consulting services to the Delaware Department of Transportation (DelDOT) for almost 20 years—including, recently, guidance on DelDOT’s use of the rights-of-way. Among our notable tasks are the following:

- We advised DelDOT about the viability, risks, and opportunities of developing collaboration with the private sector for deployment of communications infrastructure. We prepared strategic analyses and memoranda regarding the risks and opportunities of the potential collaborations and advised DelDOT regarding technical and business means by which to protect its assets and interests.
- CTC engineers currently are overseeing the deployment of a 4.9 GHz point-to-multipoint wireless network for traffic device interconnection and public safety communications. That high-speed, high-capacity wireless deployment will connect DelDOT’s fiber network to critical and high-bandwidth devices located in remote areas unserved by fiber.



- We are advising the State of Delaware, through DelDOT, on its FirstNet public safety wireless network planning and implementation.
- CTC's engineers and business analysts wrote the statewide master plan for deploying an integrated broadband fiber and microwave network. That project included an evaluation of DelDOT's existing use of technology and communications networks, and detailed recommendations for a technology strategy and hardware implementations.
- We have advised the State on its statewide 700 MHz narrowband mobile data network, including a requirements analysis, propagation studies, and system design.
- In a previous DelDOT engagement, our team developed specifications for and oversaw the implementation of a mobile traffic camera system utilizing standards-based 802.11b wireless Ethernet transmission and MPEG-2 video encoding for flexible deployments in construction zones and emergency situations.
- CTC engineers supported the implementation and operation of DelDOT's Travelers Advisory Radio System (TARS). Our design employed innovative technologies, including GPS synchronization, IP-monitored field devices, and backbone fiber optic transmission technology. We are providing ongoing maintenance and FCC compliance oversight on the statewide network.
- DelDOT filed our comments on the Federal Communications Commission's proposed spectrum rulemaking on 5.9 GHz communications for dedicated short-range communications (DSRC).<sup>8</sup>

#### State of Maryland – Maryland Transportation Authority

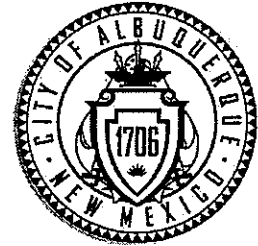
Over a number of years working for MdTA, CTC engineers have analyzed the Interstate 895 corridor to determine the best method of connecting CCTV cameras to the traffic management center, including such matters as use of existing physical plant and cable pathways, construction of new fiber optics, and use of wireless and microwave technologies. We also evaluated various methods of data and video signal transport in multiplexing and recommended a Gigabit Ethernet packet-based approach that was adopted by MdTA. Further, we performed fiber optic testing and review of fiber optic documentation to verify that that all fibers tested met the specifications required by MdTA's contract plans.

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<sup>8</sup> "Reply Comments of DelDOT," July 22, 2016, <https://goo.gl/sVtxiD>

### City of Albuquerque

CTC developed a strategy for connecting the City's key stakeholders and locations with a network that will have the most impact on its economic development and digital inclusion goals. CTC surveyed candidate network routes and developed a system-level design and pricing estimates for the construction and operation of fiber infrastructure. Our strategic design maximized potential economic development, minimized budgeting risks, and positioned the City for future network expansion. CTC then prepared the technical portions of an RFP for the City's procurement process to identify an expert partner for the proposed fiber and wireless construction.



### City of Bloomington, Indiana

CTC is supporting the City's efforts to develop ubiquitous, Gigabit-class broadband. We collaborated with City staff and other stakeholders to facilitate a public symposium and related communications materials on the value of next-generation infrastructure. We performed in-depth analysis of the local broadband market and fostered engagement with a range of public and private stakeholders. CTC's analysts and engineers also assessed the City's existing assets, prepared a competitive assessment of broadband services, benchmarked the City's broadband availability, and developed high-level engineering and cost estimates. Additionally, our team developed and administered an RFI to gauge public-sector interest in partnering with the City to achieve its broadband goals.



### City of Boulder

CTC conducted a comprehensive broadband and FTTP feasibility study to support the City's ConnectBoulder initiative, which focuses on ensuring ubiquity, competition, and digital inclusion.

During the engagement, CTC facilitated extensive stakeholder engagement, assessed the City's existing infrastructure, developed a high-level network design and cost estimate, prepared a request for information (RFI) to identify potential private partners, scored the RFI responses, and facilitated ongoing discussions with finalists. CTC worked closely with the City to evaluate several public-private partnership models to determine which was most viable, and worked with the City to refine the cost models.



### City of Lexington and Fayette County, Kentucky

CTC prepared a broadband feasibility study to help the Lexington-Fayette Urban County Government (LFUCG) understand the challenge of meeting broadband needs in the rural areas of Fayette County, and to develop cost estimates and potential strategies for meeting those needs. CTC evaluated the County's current broadband supply and demand, and potential approaches to filling that gap—through public-private partnership, middle-mile fiber, or a fiber-to-the-premises (FTTP) network.

We found that businesses in the rural areas of Fayette County had very limited broadband connectivity options, and service providers had no active plans for widespread deployment. A major reason for the lack of service was the high cost of buildout in low-population-density areas; we estimated that the cost of network construction in the County was nine times higher than the cost of construction in the City of Lexington.

To illustrate LFUCG's options, CTC's engineers undertook two system-level design and cost estimation efforts for networks in the Fayette County area of the LFUCG: middle-mile and FTTP.

Following the County's decision to move forward with a public-private partnership approach, CTC helped the City negotiate a partnership with MetroNet, which currently is constructing a fiber network under an agreement that shifts most of the financial risk to the private company. (For more details, see: <https://www.kentucky.com/news/local/counties/fayette-county/article217385750.html>).

### City of Madison, Wisconsin

CTC wrote a fiber-to-the-premises (FTTP) feasibility study for the City in mid-2016.<sup>9</sup> Over the course of the engagement, CTC engineers and analysts inventoried the City's key physical infrastructure, including the Metropolitan Unified Fiber Network (MUFN); conducted interviews with representatives of City departments and stakeholders; researched the region's available broadband services and costs; evaluated potential public-private partnership business models; and developed pro forma financial statements for a City-owned fiber network. In addition to those tasks, CTC conducted residential market research to supplement the report's findings, and to help gauge the community's interest in broadband.



CTC recently began a citywide audit and inventory of conduit, fiber, and splice information for the Madison Unified Fiber Network (MUFN) outside plant network.

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<sup>9</sup> The final report is available on our website: <http://www.ctcnet.us/news/city-of-madison-releases-ctc-report/>



### City of Palo Alto, California

CTC has a multi-decade relationship with the City of Palo Alto and Palo Alto Utilities. In two parallel projects in 2015, for example, CTC developed both a fiber-to-



the-premises (FTTP) master plan and a wireless network plan for the City. In the fiber realm, CTC determined the extent to which the City's infrastructure could be used to enable FTTP buildout. We developed a full FTTP feasibility study for a range of potential business models, including public; private, and public-private partnership. In the wireless engagement, CTC conducted a system-level requirements analysis and a needs assessment, and recommended wireless technologies, network designs, and business models.

CTC previously provided strategic guidance and advice to the City on expanding its dark fiber network to create opportunities for enhanced utility, municipal, and commercial services. We assessed how to leverage existing infrastructure to promote commercial wireless broadband deployment and improve municipal Smart Grid and public safety technologies. We also prepared a framework for establishing a public-private partnership to encourage greater infrastructure deployment.

CTC engineers also developed a "dig once" ordinance and related processes for the City.

### City of Pharr, Texas

With support from the Federal Reserve Bank of Dallas, CTC has collaborated with the City since 2016—developing a broadband strategic plan that includes business planning and engineering guidance for a fiber network that would serve lower-income areas of the City and nearby colonias.<sup>10</sup> CTC's engineers and analysts assessed the City's broadband infrastructure and market; evaluated current and future demand for broadband; analyzed potential federal and regional funding mechanisms for fiber deployment;



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<sup>10</sup>For more details on the ways in which our work dovetails with the Dallas Fed's goals for serving the colonias, see: "Las Colonias in the 21<sup>st</sup> Century," Federal Reserve Bank of Dallas, <https://www.dallasfed.org/~media/microsites/cd/colonias/index.html>

and explored options for the City to engage with the private sector on a potential partnership to expand the City's broadband infrastructure.

#### City of Pikeville, Kentucky

CTC supported the City on a fiber-to-the-premises (FTTP) feasibility study and strategic planning. Our work included an FTTP cost estimate and financial analysis. As part of our ongoing engagement, we wrote and administered a request for information (RFI) and a follow-up request for proposals (RFP) to identify potential for-profit and non-profit entities interested in partnering with the City to develop a citywide FTTP network. The City is committed to enhancing broadband availability for all its businesses, residents, and anchor institutions.



#### City and County of San Francisco

CTC kicked off a major broadband strategic planning project with the City in February 2017. We provided strategic, financial, and technical advisory services as part of a broad effort to analyze the City's broadband options. We completed the first phase of this project, culminating in the delivery of a major study.<sup>11</sup>



CTC also recently developed technical specifications for a municipal "dig once" policy to facilitate the cost-effective expansion of broadband infrastructure throughout the City.

We previously prepared a series of path-breaking analyses of the feasibility of the City building and operating a fiber-to-the-premises (FTTP) network—including a system design and detailed analysis of candidate architectures and open access models. The project also included analysis of multiple business models and business recommendations customized for San Francisco's unique circumstances.

In another strategic initiative, CTC assisted the City in developing and evaluating options for backhaul to serve City-operated Wi-Fi service to the public and to residents of public housing.

CTC also provided ongoing consulting and strategic guidance with respect to an FTTP pilot and related technology projects, and helped the City with business planning, financial analysis, and engineering design to support its preparation of an extensive application for federal grant funding. The market research analysis provided measurements to predict emission reductions

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<sup>11</sup> <http://www.ctcnet.us/publications/fiber-for-san-francisco-initiative-the-potential-for-ubiquitous-open-fiber-to-the-premises-in-san-francisco/>

and other ancillary benefits of facilitating work-at-home initiatives through an FTTP implementation.

#### City of Seattle and Seattle City Light

As the City's broadband consultant, CTC has delivered business, technical, and strategic guidance to the City as it has explored options for FTTP network deployment in light of its changing local marketplace and the emergence of new business models.



# City of Seattle

Most recently, CTC developed a strategic wireless plan that recommends technical approaches to filling broadband gaps (e.g., in underserved neighborhoods) and a sustainable business model for deployment. CTC engaged various stakeholders and agencies on the City's behalf and conducted outreach to private sector entities—including Internet service providers and wireless carriers—through an RFI process.<sup>12</sup> CTC's engineers and analysts evaluated the potential for public-private partnerships (P3) and provided a high-level financial and technical approach to fill the City's broadband gaps.

In spring 2017, the City released a CTC study that examined the feasibility of using the City's fiber to support Wi-Fi. That report, available on CTC's website (<https://goo.gl/o5cNLS>) represents a strategic approach for deploying Wi-Fi and other wireless technologies as a tool for addressing Seattle's digital equity and digital inclusion needs. The plan balances the City's two key project goals: The need to serve the public by filling broadband gaps (due to lack of availability or affordability), and the need to deploy services through a financially sustainable business model.

This engagement follows on multiple significant projects we have completed with the City and its electric utility over more than eight years. In 2015, we completed a major FTTP feasibility study (<http://www.seattle.gov/tech/initiatives/broadband/studies-and-history>) that included residential and business market research, financial projections for multiple buildout approaches, and a risk assessment. CTC has previously performed market research and developed a feasibility study, a business case analysis, and an "off-the-balance-sheet" benefits analysis for a proposed citywide FTTP network.

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<sup>12</sup> <http://www.ctcnet.us/blog/city-of-seattle-releases-rfi-for-collaboration-and-or-partnership-for-wireless-services-and-potential-smart-cities-deployments-including-in-low-income-districts-and-parks/>

### Summit County, Colorado

A rural county deep in the Rocky Mountains, Summit County is known for resorts that attract visitors year-round. Despite its proximity to significant communications infrastructure, and the demand created by its residents and visitors, some parts of the County lack sufficient access to reliable and robust broadband.



To identify strategies that will help the County reach its goals—improved broadband connectivity for residents, businesses, and public safety users; greater digital inclusion; the delivery of municipal services; governmental cost savings; and more efficient “connected government”—the County hired CTC to evaluate existing communications infrastructure, conduct outreach to the cellular carriers; evaluate potential solutions (including partnerships); and develop requests for information (RFI) to seek partners willing to engage on wireless or fiber-to-the-premises (FTTP) deployment in the County.

CTC and the County conducted a comprehensive needs assessment session to understand the County’s goals and objectives for the project. CTC then evaluated the existing wired and wireless communications infrastructure and services; spoke with the town managers/mayors, affected citizens, and other stakeholders to gather insight and information; and facilitated discussions with cellular carriers and tower companies that could potentially fill the coverage gaps.

To seek input on options for public–private partnerships, CTC developed and assessed responses to two requests for information (RFI): one for fiber-to-the-premises (FTTP) throughout the County and one for wireless broadband, primarily targeting the County’s unserved areas. We also developed a high-level design and cost estimate for a County-implemented wireless broadband solution for the unserved areas.

CTC’s work with the County resulted in igniting discussions with major carriers who may be able to fill the coverage gaps in the County. These conversations have been instrumental in the County establishing good relationships with private carriers that have the potential to provide additional coverage in areas of the County.

### Cities of Urbana and Champaign / University of Illinois (UC2B Network)

CTC has been the strategic and business planning consultant to Urbana, Champaign, and the university for more than seven years—since the coalition conceived of constructing a middle-mile fiber network to connect community anchor institutions.



Following construction of the middle-mile fiber, we prepared a request for information (RFI) to enable the cities and the university to identify a private partner that would finance and operate an FTTP expansion of the network to serve 100 percent of the community. We evaluated potential partners' proposals, then helped to negotiate with two partners to reduce the community's risks and ensure that a partnership would achieve the coalition's policy goals for digital inclusion.

As a result of the coalition's partnership, UC2B secured an open access Gigabit FTTP network buildout that, based on the negotiated agreement, would protect its public policy interest by providing the same opportunity for access to the entire community. In return, UC2B's partner would have access to UC2B's existing middle-mile infrastructure (which the partner would operate) and the foundation of a significant last-mile consumer network.

#### City of Vallejo, California

CTC developed a Fiber Optic Master Plan that would guide the feasibility, long-term planning, budgeting, and implementation of a municipal broadband network for the City. The City's goals were to comprehensively assess its options, evaluate the advantages and drawbacks of potential business models, design and estimate the cost of key fiber routes to enhance the City's existing fiber infrastructure (which had been focused on traffic communications applications), identify funding requirements (to be assumed by a combination of public and/or private entities), and lay the groundwork for a phased implementation that would enable on-demand build-out without incurring any debt. The City also sought to balance need with equity when determining areas to prioritize with fiber construction.



### 7. Fee Schedule and Cost Proposal / Bid Form

CTC proposes to perform the tasks identified in the scope of work above (excluding the optional survey in Task 6) for the not-to-exceed cost of \$60,000, including travel. At the County's direction, we will perform Task 6 for the additional not-to-exceed cost of \$29,500. Our signed bid form is below.

We will bill our work at the hourly rates listed below.

Labor Category	Rate
Chief Technology Officer/ Director of Business Consulting	\$225
Principal Analyst	\$200
Senior Analyst	\$175
Staff Analyst	\$155

CTC's billing rates are inclusive of all travel expenses.

**BID FORM**

**Broadband Feasibility Study for the Residents of Worcester County**

I/we have reviewed the specifications and provisions for furnishing a feasibility study for the residents of Worcester County. This study will serve the basis for data to provide Broadband coverage to Worcester County unserved residents at a later phase.

Total lump sum for services (excluding optional Task 6): \$60,000

Services will be completed within 180 days from notice to proceed by Worcester County.

**BID MUST BE SIGNED AND DATED TO BE VALID**

Date: February 7, 2019

Signature: *Joanne S. Hovis*

Typed Name: Joanne Hovis

Title: President

Firm: Columbia Telecommunications Corp.


d/b/a CTC Technology & Energy

Address: 10613 Concord St.

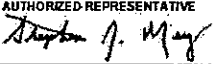
Kensington, MD 20895

Phone: 301.933.1488

## 8. Proof of Insurance

	<b>CERTIFICATE OF LIABILITY INSURANCE</b>	COLUTEL-01	JOTTO DATE (MM/DD/YYYY) <b>10/03/2018</b>
<p><b>THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.</b></p>			
<p><b>IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must have ADDITIONAL-INSURED provisions or be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).</b></p>			
<b>PRODUCER</b> The Insurance Exchange, Inc. 9713 Key West Avenue Suite 401 Rockville, MD 20850	<b>CONTACT NAME:</b> PHONE (A/C, No, EM): <b>(301) 279-5500</b> FAX (A/C, No): <b>(301) 330-1270</b> E-MAIL ADDRESS:		
<b>INSURED:</b>  Columbia Telecommunications Corporation (CTC) 10613 Concord Street Kensington, MD 20896	<b>INSURER(S) AFFORDING COVERAGE</b>		<b>NAIC #</b>
	INSURER A: <b>Continental Casualty Company</b>		<b>20443</b>
	INSURER B: <b>Valley Forge Insurance Company</b>		<b>20508</b>
	INSURER C: <b>The Continental Insurance Company</b>		<b>35289</b>
	INSURER D:		
	INSURER E:		
INSURER F:			

COVERAGE	CERTIFICATE NUMBER:	REVISION NUMBER:				
<p>THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.</p>						
INSR CTR	TYPE OF INSURANCE	ADDL INSR INSD LWD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS
A	<input checked="" type="checkbox"/> COMMERCIAL GENERAL LIABILITY <input type="checkbox"/> CLAIMS-MADE <input checked="" type="checkbox"/> OCCUR  GEN'L AGGREGATE LIMIT APPLIES PER: <input type="checkbox"/> POLICY <input checked="" type="checkbox"/> PRO. <input type="checkbox"/> LOC OTHER:		6074574563	10/01/2018	10/01/2019	EACH OCCURRENCE \$ 1,000,000 DAMAGE TO RENTED PREMISES (Ea occurrence) \$ 1,000,000 MED EXP (Any one person) \$ 10,000 PERSONAL & ADV INJURY \$ 1,000,000 GENERAL AGGREGATE \$ 2,000,000 PRODUCTS - COMP/OP AGG \$ 2,000,000
B	<input checked="" type="checkbox"/> AUTOMOBILE LIABILITY <input checked="" type="checkbox"/> ANY AUTO OWNED AUTOS ONLY <input type="checkbox"/> SCHEDULED AUTOS <input type="checkbox"/> HIRED AUTOS ONLY <input type="checkbox"/> NON-OWNED AUTOS ONLY		6072808672	10/01/2018	10/01/2019	COMBINED SINGLE LIMIT (Ea accident) \$ 1,000,000 BODILY INJURY (Per person) \$ BODILY INJURY (Per accident) \$ PROPERTY DAMAGE (Per accident) \$
A	<input checked="" type="checkbox"/> UMBRELLA LIAB <input checked="" type="checkbox"/> OCCUR <input type="checkbox"/> EXCESS LIAB <input type="checkbox"/> CLAIMS-MADE DED <input checked="" type="checkbox"/> RETENTION \$ 10,000		6074574577	10/01/2018	10/01/2019	EACH OCCURRENCE \$ 7,000,000 AGGREGATE \$ 7,000,000
C	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? (Indicate by Y/N) If yes, describe under DESCRIPTION OF OPERATIONS below	N/A	6072808879	10/01/2018	10/01/2019	<input checked="" type="checkbox"/> PER STATUTE <input type="checkbox"/> OTHER E.L. EACH ACCIDENT \$ 500,000 E.L. DISEASE - EA EMPLOYEE \$ 500,000 E.L. DISEASE - POLICY LIMIT \$ 500,000
A	Professional Liab.		6074574563	10/01/2018	10/01/2019	Ea. Claim/Aggregate 5,000,000
DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)						

<b>CERTIFICATE HOLDER</b>  _____	<b>CANCELLATION</b> SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.  AUTHORIZED REPRESENTATIVE 
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## Appendix A: CTC Staff Resumes

Joanne S. Hovis, Esq. | President

Joanne Hovis is a nationally recognized authority on broadband markets and on the evolving role of public-private partnerships in the provision of communications services to the public. For more than 20 years, she has overseen all client relationships and directed consulting services related to strategic planning, business modeling, and financial analysis for CTC's hundreds of clients nationwide.

Joanne leads the CTC teams that advise the states of Connecticut, New Mexico; the cities of Atlanta, Boston, San Francisco, Seattle, and Washington, D.C.; and the statewide broadband networks in Colorado, Maryland, and Pennsylvania. She also leads CTC's consulting on federal funding programs such as E-Rate, the Connect America Fund Phase II, and the Healthcare Connect Fund.

She has testified before Congress on rural broadband and the digital divide, and has provided expert presentations to the Federal Communications Commission, the U.S. Conference of Mayors, the National League of Cities, and other national organizations.

Joanne is also CEO of the Coalition for Local Internet Choice (CLIC) and a member of the boards of directors of the Benton Foundation and the Fiber Broadband Association. She is a former president of the National Association of Telecommunications Officers and Advisors (NATOA).

### Public-Private Partnership (P3) Planning and Negotiations

Joanne has spearheaded projects that explore a range of business models by which local and state government clients can leverage their assets to build or expand fiber networks, and to incentivize private sector broadband expansion.

- Joanne has provided extensive business planning, market assessment, and strategic planning for the **City and County of San Francisco** over a dozen years. In 2018, she played a key role in the project team that developed an innovative partnership strategy for deploying a ubiquitous fiber-to-the-premises (FTTP) network. In an earlier project that laid the groundwork for the city's current efforts, Joanne conducted an independent evaluation of the feasibility of San Francisco constructing and operating such a network.
- Joanne prepared a fiber feasibility study and business case for the **City of Westminster, Maryland** in 2012 and 2013. Following the city's decision to move forward with FTTP pilot projects designed by CTC engineers, Joanne assisted the city in identifying and negotiating with a private partner to assume operating risk in providing services to the public over the city's FTTP infrastructure.
- Joanne has been the strategic and business planning consultant to the **Urbana-Champaign Big Broadband (UC2B) Coalition (University of Illinois and the cities of Champaign and Urbana)** for more than eight years. Following construction of the coalition's middle-mile network to connect anchor institutions, she wrote an RFI to enable the coalition to identify a private partner that would finance and operate an

FTTP expansion. She evaluated potential partners' proposals, then helped negotiate with two partners to reduce the community's risks and ensure that a partnership would achieve economic development and digital inclusion goals. As a result of the final partnership, UC2B secured an open access gigabit FTTP network buildout.

*Business Planning and Feasibility Analysis*

Joanne is sought nationwide as an expert in municipal broadband business models and planning. Among the projects she has led are the following CTC engagements:

- Joanne advised the **City of Atlanta** on strategic and tactical approaches it can take to plan, build, and operate its own fiber network to cost-effectively serve its internal needs, promote private sector broadband investment, and enable competition in the City's residential and business broadband markets. She assisted the City in its discussions with telecommunications providers about options for joint build and partnership.
- Joanne has advised the **City of Seattle** regarding business planning strategies for a citywide fiber enterprise and facilitating equitable access to wireless broadband services. In her report on citywide fiber, she analyzed the public subsidies a network would require and delivered a full assessment of opportunities and risks. The report included an internal needs analysis, statistically significant market research, an assessment of competing services and technologies, and an evaluation of the business case and financial risks. Joanne led further analysis of the benefits of FTTP beyond the traditional balance sheet, including cost avoidance.
- Joanne advises the **State of New Mexico's Department of Information Technology** on broadband planning. She led a team of analysts that produced a guidebook for New Mexico's local governments on the business, financial, and strategic planning necessary to implement city- or county-owned broadband networks. The guidebook discusses strategies for exploring public-private partnerships to facilitate broadband expansion.
- Joanne supported the **State of Kansas Department of Commerce** on a needs assessment of the state's network infrastructure. She conducted major market surveys of core sectors across the state (residents, businesses, and community anchor institutions) to evaluate the current uses and needs of broadband infrastructure. She also developed a strategy for the evolution of Kan-ed, the state-created broadband program that serves schools, hospitals, libraries, and higher education institutions.
- Joanne has advised officials in the **District of Columbia** government on a range of telecommunications and fiber optic projects for almost a decade. She worked with the Office of the Chief Technology Officer (OCTO) to create a business plan and strategy for building a municipal fiber optic network with a wireless overlay in the least-served wards of the city. She performed a business case and technology analysis for DC-Net, a fiber optic telecommunications network that provides voice and data services for the District. She analyzed governmental, educational, and public safety uses of the network.

- Joanne devised a business strategy and wrote a business plan for **KINBER**, the statewide backbone and middle-mile fiber infrastructure focused on the higher education and healthcare sectors in Pennsylvania. One highlight of the KINBER strategy was developing an actionable plan to increase early cash flow.
- Joanne developed a broadband feasibility study for **Garrett County, Maryland**, with a focus on maximizing the benefits and use of the state's grant-funded fiber backbone. That initial analysis led to strategic planning and support for the county's successful Appalachian Regional Commission grant funding and a pioneering public-private partnership that has deployed TV White Spaces wireless service to unserved rural parts of the county.

#### Federal Funding and Grant Planning

Joanne's expertise includes the funding opportunities available to local government broadband planners through the federal government and other sources. She has guided clients through project planning, application writing, and fund management. Her work on behalf of clients has included successful applications for funding from a range of programs, including E-rate, Rural Utilities Service (RUS), Broadband Technology Opportunities Program (BTOP), Public Safety Interoperable Communications (PSIC), the Appalachian Regional Commission (ARC), and the Department of Homeland Security's Urban Areas Security Initiative (UASI).

#### Speaking and Advocacy

Joanne is in wide demand as a speaker and expert source on broadband deployment and public-private partnership issues. She has testified before the U.S. Congress on matters of broadband deployment and policy; has been interviewed by publications including *Business Week*, *The Washington Post*, *The New Yorker*, and *The Baltimore Sun*; and has been featured on C-SPAN's "The Communicators."

She has provided expert presentations to the Federal Communications Commission, the U.S. Conference of Mayors, the National League of Cities, the Broadband Communities Summit, Technology Policy Summit, the University of Illinois, Case Western Reserve University, the New America Foundation, and the Congressional Internet Caucus.

#### **EDUCATION**

***Juris Doctor, with honors***, University of Chicago Law School, 1994

***Bachelor of Arts, with distinction***, University of Wisconsin, Madison, 1990

#### **PROFESSIONAL CERTIFICATIONS/LICENSES**

Member of Illinois Bar Association

Member of District of Columbia Bar Association

#### **ORGANIZATIONS**

- Coalition for Local Internet Choice, CEO
- Benton Foundation, Director
- Fiber Broadband Association, Director

- Consumer Reports, Director
- United States Unified Community Anchor Network, Task Force on Community Anchor Network Economic Models, Charter Member
- National Association of Telecommunications Officers and Advisors, Past President

**PRIOR TO COMING TO CTC IN 1997**

1996–1997    Litigation/Communications Attorney  
Mintz, Levin, Cohn, Ferris, Glovsky, & Popeo P.C., Washington, D.C.

1994–1996    Litigation Attorney  
Jenner & Block, Chicago

**SELECTED PUBLICATIONS**

- “Leaping the Digital Divide: Encouraging Policies and Partnerships to Improve Broadband Access Across North Carolina,” co-author, published by the North Carolina League of Municipalities, 2018
- “The Emerging World of Broadband Public–Private Partnerships: A Business Strategy and Legal Guide,” co-author, published by the Benton Foundation, 2017
- “The Atomic Age of Data: Policies for the Internet of Things,” contributor as participant at the Aspen Institute Conference on Communications Policy, 2015
- “The Art of the Possible: An Overview of Public Broadband Options,” with the New America Foundation, 2015
- “Better Communities through Better Broadband: A Coalition of Public and Private Interests Affirms the Need for Local Internet Choice,” Benton Foundation Blog, 2015
- “The Killer App for Local Fiber Networks,” *Broadband Communities* magazine, November/December 2014
- “Gigabit Communities: Technical Strategies for Facilitating Public or Private Broadband Construction in Your Community,” 2014—an independent report sponsored by Google as a guide for local government leaders and planners
- “How communities can facilitate fiber construction,” Google Fiber Blog, 2014
- “Facilitating Broadband Construction,” *Broadband Communities* magazine, January/February 2014

## Andrew Afflerbach, Ph.D., P.E. | CEO and Chief Technology Officer

Dr. Andrew Afflerbach specializes in the planning, designing, and implementation oversight of broadband communications networks, smart cities strategies, and public safety networks. His expertise includes state-of-the-art fiber and wireless technologies, the unique requirements of public safety networks, and the ways in which communications infrastructure enables smart and connected applications and programs for cities, states, and regions.

Andrew has planned and designed robust and resilient network strategies for dozens of clients, including state and local governments and public safety users. He has delivered strategic technical guidance on wired and wireless communications issues to cities, states, and national governments over more than 20 years. He has advised numerous cities and states, including New York City, San Francisco, Seattle, Atlanta, Washington, D.C., and Boston, and served as a senior adviser to Crown Fibre Holdings, the public entity directing New Zealand's national fiber-to-the-home project.

In addition to designing networks, Andrew testifies as an expert witness on broadband communications issues. And he is frequently consulted on critical communications policy issues through technical analyses submitted to the Federal Communications Commission (FCC) and policymakers. He has prepared white papers on:

- Estimating the cost to expand fiber to underserved schools and libraries nationwide
- Conducting due diligence for the IP transition of the country's telecommunications infrastructure
- Developing technical frameworks for wireless network neutrality
- Streamlining deployment of small cell infrastructure by improving wireless facilities siting policies
- Limiting interference from LTE-U networks in unlicensed spectrum

As CTC's Chief Technology Officer, Andrew oversees all technical analysis and engineering work performed by the firm. He has a Ph.D. and is a licensed Professional Engineer.

### Fiber Network Planning and Engineering

Andrew has architected and designed middle- and last-mile fiber broadband networks for the District of Columbia (Washington, D.C.); the city of San Francisco; the Delaware Department of Transportation; the Maryland Transportation Authority; and many large counties.

He oversaw the development of system-level broadband designs and construction cost estimates for the cities of Atlanta, Boston, Boulder, Palo Alto, Madison, and Seattle; the states of Connecticut and Kentucky; and many municipal electric providers and rural communities. He is overseeing the detailed design of the city-built fiber-to-the-premises (FTTP) networks in Westminster, Maryland; Alford, Massachusetts; and Holly Springs and Wake Forest, North Carolina.

In Boston, Andrew led the CTC team that developed a detailed RFP, evaluated responses, and participated in negotiations to acquire an Indefeasible Right of Use (IRU) agreement with a fiber vendor to connect schools, libraries, public housing, and public safety throughout the City. This approach was designed to allow the City to oversee and control access and content among these facilities.

### Wireless Network Planning and Engineering

Applying the current state of the art—and considering the attributes of anticipated future technological advancements such as “5G”—Andrew has developed candidate wireless network designs to meet the requirements of clients including the cities of Atlanta, San Francisco, and Seattle. In a major American city, Andrew led the team that evaluated wireless broadband solutions, including a wireless spectrum roadmap, to complement potential wired solutions.

In rural, mountainous Garrett County, Maryland, Andrew designed and oversaw the deployment of an innovative wireless broadband network that used TV white space spectrum to reach previously unserved residents. To enhance public internet connectivity, Andrew provides technical oversight on CTC’s Wi-Fi-related projects, including the design and deployment of Wi-Fi networks in several parks in Montgomery County, Maryland.

Andrew also advises local and state government agencies on issues related to wireless attachments in the public rights-of-way; he leads the CTC team that supports the Texas Department of Transportation (TxDOT) and many large counties on wireless attachment policies and procedures.

#### Public Safety Networking

Andrew leads the CTC team providing strategic and tactical guidance on FirstNet (including agency adoption and other critical decision-making) for the State of Delaware and Onondaga County, New York. In the District of Columbia, he and his team evaluated the financial, technical, and operational impact of building the District’s own public safety broadband network, including the design of an LTE system that provided public-safety-level coverage and capacity citywide. This due diligence allowed the District to make an informed decision regarding opting in or out of the National Public Safety Broadband Network.

Andrew currently is working with the State of Delaware to evaluate LTE coverage gaps throughout the state to assist agencies in their choice of public safety broadband networks. On the state’s behalf, he and his team are also conducting outreach to AT&T and other carriers to evaluate their public safety offerings. He is performing similar work as part of CTC’s engagement with El Paso County, Colorado.

Earlier, Andrew led the CTC team that identified communications gaps and evaluated potential technical solutions for the Baltimore Urban Area Security Initiative (UASI), a regional emergency preparedness planning effort funded by the U.S. Department of Homeland Security (DHS).

He previously served as lead engineer and technical architect for planning and development of NCRnet, a regional fiber optic and microwave network that links public safety and emergency support users throughout the 19 jurisdictions of the National Capital Region (Washington, D.C. and surrounding jurisdictions), under a DHS grant. He wrote the initial feasibility studies that led to this project for regional network interconnection.

#### Smart Grid

Andrew and the CTC team provided expert testimony and advisory services to the Public Service Commission of Maryland regarding Advanced Metering Infrastructure (AMI). CTC provided objective guidance to the staff as it evaluated AMI applications submitted by three of the state’s investor-owned utilities (IOUs). This contract represented the first time the PSC staff had asked a consultant to advise them on technology—a reflection of the lack of standards in the Smart Grid arena.

Broadband Communications Policy Advisory Services

Andrew advises public sector clients and a range of policy think tanks, U.S. federal agencies, and non-profits regarding the engineering issues underlying key communications issues. For example, he:

- Provided expert testimony to the FCC in the matter of the preparation of the **national broadband plan** as a representative of the National Association of Counties (NACo) and the National Association of Telecommunications Officers & Advisors (NATOA).
- Served as expert advisor regarding broadband deployment to the U.S. Conference of Mayors, NACo, National League of Cities, Public Knowledge, New America Foundation Open Technology Institute, and NATOA in those organizations' filings before the FCC in the matter of determination of the deployment of a **national, interoperable wireless network in the 700 MHz spectrum**.
- In connection with the FCC's ongoing **Open Internet proceeding**, advised the New America Foundation regarding the technical pathways by which "any device" and "any application" regimes could be achieved in the wireless broadband arena as they have been in the wireline area.
- Provided expert technical advice on the **700 MHz broadband and AWS-3 proceedings** at the FCC for the Public Interest Spectrum Coalition (including Free Press, the New America Foundation, Consumers Union, and the Media Access Project).
- Served as technical advisor to the **U.S. Naval Exchange** in its evaluation of vendors' broadband communications services on U.S. Navy bases worldwide.
- Advised the **U.S. Internal Revenue Service** regarding the history of broadband and cable deployment and related technical issues in that agency's evaluation of appropriate regulations for those industries.
- Advised the Stanford Law School Center for Internet and Society on the technical issues for their briefs in the **Brand X Supreme Court appeal** regarding cable broadband.

Broadband Communications Instruction

Andrew has served as an instructor for the U.S. Federal Highway Association/National Highway Institute, the George Washington University Continuing Education Program, the University of Maryland Instructional TV Program, ITS America, Law Seminars International, and the COMNET Exposition. He developed curricula for the United States Department of Transportation.

He taught and helped develop an online graduate-level course for the University of Maryland. He developed and taught communications courses and curricula for ITS America, COMNET, and the University of Maryland. His analysis of cable open access is used in the curriculum of the International Training Program on Utility Regulation and Strategy at the University of Florida.

Andrew has also prepared client tutorials and presented papers on emerging telecommunications technologies to the National Fire Protection Association (NFPA), NATOA, the National League of Cities (NLC), the International City/County Management Association (ICMA), and the American Association of Community Colleges (AACC). He taught college-level astrophysics at the University of Wisconsin.

## EMPLOYMENT HISTORY

- 1995–Present            CEO/Chief Technology Officer, CTC  
                                 Previous positions: Director of Engineering, Principal Engineer, Senior Scientist
- 1990–1996              Astronomer/Instructor/Researcher  
                                 University of Wisconsin–Madison, NASA, and Swarthmore College

## EDUCATION

- Ph.D.**, Astronomy, University of Wisconsin–Madison, 1996
- NASA Graduate Fellow, 1993–1996. Research fellowship in astrophysics
  - Elected Member, Sigma Xi Scientific Research Honor Society

**Master of Science**, Astronomy, University of Wisconsin–Madison, 1993

**Bachelor of Arts**, Physics, Swarthmore College, 1991

- Eugene M. Lang Scholar, 1987–1991

## PROFESSIONAL CERTIFICATIONS/LICENSES

Professional Engineer, Commonwealth of Virginia and states of Delaware, Maryland, and Illinois

## HONORS/ORGANIZATIONS

- Disaster Response and Recovery Working Group, FCC’s Broadband Deployment Advisory Committee (BDAC)
- Association of Public-Safety Communications Officials (APCO)
- Board of Visitors, University of Wisconsin Department of Astronomy
- National Association of Telecommunications Officers and Advisors (NATOA) Technology and Public Safety Committees
- Armed Forces Communications and Electronics Association (AFCEA)
- Society of Cable and Telecommunications Engineers (SCTE)
- Institute of Electrical and Electronic Engineers (IEEE)
- Charleston Defense Contractors Association (CDCA)

## SELECTED PUBLICATIONS, PRESENTATIONS, and COURSES

- Declaration in Response to FCC’s Order, “Accelerating Wireless Broadband Deployment by Removing Barriers to Infrastructure Investment,” prepared for the Smart Communities and Special Districts Coalition, filed with the FCC, Sept. 2018
- Declaration in Response to the Proposed T-Mobile/Sprint Merger, prepared for the Communications Workers of America, filed with the FCC, Aug. 2018
- “A Model for Understanding the Cost to Connect Anchor Institutions with Fiber Optics” (co-author), prepared for the Schools, Health & Libraries Broadband Coalition, Feb. 2018
- “How Localities Can Prepare for—and Capitalize on—the Coming Wave of Public Safety Network Construction,” Feb. 2018
- “Network Resiliency and Security Playbook” (co-author), prepared for the National Institute of Hometown Security, Nov. 2017
- “Mobile Broadband Service Is Not an Adequate Substitute for Wirelines” (co-author; addressing the limitations of 5G), prepared for the Communications Workers of America, Oct. 2017



- "Technical Guide to Dig Once Policies," April 2017
- "Streamlining Deployment of Small Cell Infrastructure by Improving Wireless Facilities Siting Policies," prepared for the Smart Communities Siting Coalition, filed with the FCC, March 2017
- "How Localities Can Improve Wireless Service for the Public While Addressing Citizen Concerns," Nov. 2016
- "LTE-U Interference in Unlicensed Spectrum: The Impact on Local Communities and Recommended Solutions," prepared for WifiForward, Feb. 2016
- "Mobile Broadband Networks Can Manage Congestion While Abiding by Open Internet Principles," prepared for the New America Foundation's Open Technology Institute – Wireless Future Project, filed with the FCC, Nov. 2014
- "The State of the Art and Evolution of Cable Television and Broadband Technology," prepared for Public Knowledge, filed with the FCC, Nov. 2014
- "A Model for Understanding the Cost to Connect Schools and Libraries with Fiber Optics," prepared for the Schools, Health & Libraries Broadband Coalition, filed with the FCC, Oct. 2014
- "The Art of the Possible: An Overview of Public Broadband Options," prepared jointly with the New America Foundation's Open Technology Institute, May 2014
- "Understanding Broadband Performance Factors," with Tom Asp, *Broadband Communities* magazine, March/April 2014
- "Engineering Analysis of Technical Issues Raised in the FCC's Proceeding on Wireless Facilities Siting," filed with the FCC (<http://apps.fcc.gov/ecfs/document/view?id=7521070994>), Feb. 2014
- "A Brief Assessment of Engineering Issues Related to Trial Testing for IP Transition," prepared for Public Knowledge and sent to the FCC as part of its proceedings on Advancing Technology Transitions While Protecting Network Values, Jan. 2014
- "Gigabit Communities: Technical Strategies for Facilitating Public or Private Broadband Construction in Your Community," prepared as a guide for local government leaders and planners (sponsored by Google), Jan. 2014
- "Critical Partners in Data Driven Science: Homeland Security and Public Safety," submitted to the *Workshop on Advanced Regional & State Networks (ARNs): Envisioning the Future as Critical Partners in Data-Driven Science*, Internet2 workshop chaired by Mark Johnson, CTO of MCNC, Washington, D.C., April 2013
- "Connected Communities: How a City Can Plan and Implement Public Safety & Public Wireless," submitted to the International Wireless Communications Exposition, Las Vegas, March 2013
- "Cost Estimate for Building Fiber Optics to Key Anchor Institutions," prepared for submittal to the FCC by NATOA and SHLB, Sept. 2009
- "Efficiencies Available Through Simultaneous Construction and Co-location of Communications Conduit and Fiber," prepared for submittal to the FCC by the National Association of Telecommunications Officers and Advisors and the City and County of San Francisco, 2009, referenced in the National Broadband Plan
- "How the National Capital Region Built a 21st Century Regional Communications Network" and "Why City and County Communications are at Risk," invited presentation at the FCC's National Broadband Plan workshop, Aug. 25, 2009

Thomas J. Asp, BSEE, MBA | Principal Engineer and Analyst

Mr. Asp specializes in evaluating connectivity (voice, video, and data) options and recommending effective solutions for clients throughout the United States. He holds more than 25 years of experience as an engineer and analyst in communications and public power systems. His experience includes electric and telecommunication system design, network feasibility, evaluation of the financial impact of projects on operations, and provision of expert testimony.

Mr. Asp is recognized as an expert in evaluating and offering recommendations regarding municipal broadband communications systems. He has been actively involved with telecommunication market research and feasibility analysis for over a decade, both with CTC and previously as a partner at the public accounting firm of Virchow Krause (Baker Tilley). Mr. Asp also has significant experience in the communications industry working in the areas of cellular, cable TV, broadband, and mobile radio, including as a product manager in the Cellular Mobile Telephone, Automatic Meter Reading, and Distribution Automation industries.

Broadband Networks (Wired and Wireless)

Mr. Asp is regarded as one of the premiere analysts in the United States regarding municipal planning and deployment of broadband systems to meet economic development, digital inclusion, and other needs. He has assisted numerous local governments, municipal utilities, and municipal consortia to evaluate their communities' communications needs and determine the financial parameters and business case for meeting those needs.

In this area, Mr. Asp's experience includes preparing connectivity feasibility studies for municipal networks, including economic analysis, market assessment, technology review, vendor analysis, and business plan development. He has assisted numerous communities with evaluating the feasibility of advanced connectivity services alternatives including provider partnerships and city-owned networks. He has reviewed options under cable franchise agreement for municipal purchase and operation. Mr. Asp has reviewed offerings and operations of incumbent telecommunications providers and assisted in negotiations with incumbent telecommunications providers to enhance availability of existing services and to encourage new and innovative offerings.

Some select examples of his projects include:

- Provided Jackson (Tennessee) Energy Authority an independent evaluation of responses to JEA's 2010 request for proposals (RFP) soliciting vendors to provide wholesale voice services. With JEA staff input, he developed the evaluation system and scoring matrix to ensure a balanced approach that best met JEA's needs. Responses were evaluated on the basis of strategic fit, operational fit, reliability, and overall cost; recommended two respondents as finalists for further consideration by JEA; and assisted JEA in negotiating with those finalists. As a final step in the process, CTC presented to JEA management a written report recommending the "best-fit" vendor.

- Completed a business and technology plan for Los Angeles Department of Water and Power (LADWP) to determine the feasibility of expanding the connectivity services offered to the businesses and institutions over the Department's fiber network. Included in the analysis was a valuation of additional fiber routes that LADWP acquired from the City of Los Angeles.
- Served as a business consultant to the City and County of San Francisco. Investigated the feasibility of the city building and operating a fiber-to-the-premises (FTTP) network to every home and business in San Francisco. The project included an analysis of multiple business models and business recommendations customized for San Francisco's unique circumstances.
- Developed a business case analysis for DC-Net, a District-owned and operated fiber optic telecommunications network that provides voice and data services. The network consists of resilient, interconnected fiber optic rings that connect more than 400 government buildings in the District, including Police Department, Emergency Management Agency, and Fire Department radio towers.
- Conducted a feasibility study, a business case analysis, and an "off-the-balance-sheet" benefits analysis for a fiber-optic network proposed by the mayor of the City of Seattle. The first study, FTTP Municipal Broadband Risks and Benefits Evaluation, sponsored by Seattle City Light, included the following elements:
  - Internal needs analysis
  - Market research of both residential and business
  - Assessment of competing services and technologies
  - Evaluation of the business case and business risks

Following on that report, Mr. Asp researched and wrote an FTTP Benefits Evaluation for the City, which explored the benefits of FTTP beyond the traditional balance sheet, including cost avoidance, monetary savings, and environmental impact.

- Performed an expert assessment of a business and marketing plan for Utah Telecommunication Open Infrastructure Agencies (UTOPIA's) open access FTTP network. The project included a strategy session with key stakeholders, collection of relevant background material, an analysis of UTOPIA market research and marketing models, and an independent evaluation of UTOPIA's business plan. Mr. Asp's work focused on improving the participating UTOPIA communities' ongoing cash flow and increasing participation of households and businesses in those communities.
- Prepared a fiber optic business plan for Richland Utilities, Washington to meet the needs of city facilities, the electric utility, schools, hospitals, banks, and other institutions. Work included preparation of various business models, review of operational requirements, and preparation of pro-forma financial statements.
- Provided extensive business planning assistance to the State of Maryland's One Maryland program, which lead to build an interconnected fiber-optic broadband network that reaches every county and city in Maryland and will provide backbone and middle-mile capacity for commercial carriers.
- Managed project assisting Bountiful City, UT with the development of a business plan for a citywide wireless network. This project included the review of a conceptual design,

reviewing proposed business relationships and staffing, and conducting a cost-benefit analysis.

- Project manager in assisting Ames, IA with the review of existing architecture, development of a network design, and preparation of detailed cost estimates for the acquisition and installation of Wi-Fi hot spots and supporting infrastructure. This project has now moved into implementation preparations.
- Led consulting team in investigating several Wi-Fi deployment models, development of a business plan (including market research and financial analysis), and development of a partnership RFP for St. Louis Park, MN. Mr. Asp assisted the city to pilot the network and then prepared specifications and bid documents to identify both integrators and operators for the network.
- Assisted the City of Tucson, AZ with a wireless feasibility study that included market research, competitive industry assessment, internal and external needs assessments, financial analysis, and the development of a business plan.
- Assistance in the implementation of an Institutional Fiber Network (I-Net) for Norwich Public Utilities in Norwich, CT. Project included development of a plan and strategy for the Fiber Optic Enterprise.

#### DA, AMR, SCADA

In the areas of Distribution Automation (DA), Supervisory Control and Data Acquisition (SCADA), mobile radio, and Advanced Metering Infrastructure (AMI), Mr. Asp has assisted municipal utilities and public power cooperatives with extensive evaluative and design services. Specifically, he has prepared evaluations and submitted recommendations on AMI alternatives and benefits. He has assessed existing and evolving technologies and services to support AMI and DA for electric utilities and has developed and directed demonstration plans to test technologies to support distribution automation -- including providing recommendations for establishing vendor alliances, performing research and designs networks to combine multi-utility communications, and outlining, evaluating, and recommending communication requirements and options for electric utility DA, SCADA, mobile radio, and AMI.

#### **TESTIMONY & VALUATION**

In addition to assisting over 80 communities and counties in evaluating financial opportunities to provide voice, data, and video services, Mr. Asp has provided financial and technical testimony and expert advice. Some examples include:

- Conducted an exhaustive business case analysis and prepared expert witness testimony on behalf of the City of Alameda in a federal court case involving the business practices, business results, and ultimate sale of its fiber optic enterprise. The testimony included a comparative analysis of business models employed by municipal fiber networks nationwide and a review and valuation of several recent cable business transactions.
- Maryland Public Service Commission regarding Baltimore Gas & Electric's application for deployment of AMI and smart grid technologies. Written and sworn testimony included an analysis of smart grid technologies, vendor development, and impact to rates.

- Pacific Gas & Electric regarding the financial and technical viability of the use of Broadband over Power line (BPL) for Automatic Meter Reading (AMR) and support of new business opportunities. Mr. Asp prepared a report in anticipation of being called to testify before the California PUC
- The City of Lebanon, OH in connection with a dispute over an Assessment of Infrastructure Connectivity Fee with home-builders and Time Warner Cable. The Assessment and disposition regarded the reasonableness of the connection fee assessed to each new home by the municipal telecom department
- The City of Marshal, MO in determination of the value of the incumbent cable television system owned and operated by Time Warner.

#### **EDUCATION**

**Bachelor of Science**, Electrical Engineering, North Dakota State University, 1979

**Master of Business Administration**, University of St. Thomas, St. Paul, 1989

## Matthew DeHaven | Principal Engineer

Matthew DeHaven specializes in wired and wireless communications and broadband telecommunications technology for public safety and other local government and institutional needs. He has 20 years of engineering experience designing, developing, installing, and overseeing construction and integration of middle-mile and fiber-to-the-premises (FTTP) networks. His work focuses on local and wide area networks for institutional, public safety, and Intelligent Transportation System (ITS) applications.

Mr. DeHaven has experience at many levels of wired and wireless network design, procurement, and implementation for high-capacity metropolitan-area networks. He leads network designs and the preparation of specifications for competitive bid processes and serves as project manager overseeing implementation and testing for a wide range of CTC's local and state government clients.

Mr. DeHaven also prepares designs and cost models to support decision-makers in the deployment of a range of wireless and wireline data network technologies. He serves as CTC's lead engineer on numerous wide area network projects. Among many other projects, he served as a primary technical architect for the 19-jurisdiction fiber optic/microwave network deployed in the National Capital Region (NCRnet) to support public safety interoperable communications.

### Wireless Communications

Applying the current state of the art—and considering the attributes of anticipated future technological advancements such as "5G"—Mr. DeHaven has developed candidate wireless network designs to meet the requirements of clients including the cities of Atlanta, San Francisco, and Seattle. In a major American city, he supported the CTC team that evaluated wireless broadband solutions, including a wireless spectrum roadmap, to complement potential wired solutions.

Mr. DeHaven assesses clients' existing and projected communications needs and recommends potential strategies for using established and emerging wireless technologies to enhance and improve network operations and services. Some select examples of his ongoing and past projects include:

- Overseeing the Delaware Department of Transportation's (DelDOT) deployment of a 4.9 GHz point-to-multipoint wireless network for traffic device interconnection and public safety communications. That high-speed, high-capacity wireless deployment connects DelDOT's fiber network to critical and high-bandwidth devices located in remote areas unserved by fiber.
- Developing the wireless engineering elements of broadband deployment feasibility analyses for the City of Baltimore and other major American cities.
- Developing a strategic plan for a wireless data network to meet public safety and local government needs in Seattle, WA. CTC previously conducted a feasibility study that

identified these needs.

- Providing engineering support for the deployment of a citywide 4.9 GHz public safety radio mesh network for the City of Port Angeles, WA. CTC conducted a needs assessment of the city's network and reviewed public safety mobile data communications considerations, which led to the development of network specifications and overseeing the procurement for the expansion of the city's fiber network and a citywide wireless network serving both public safety and public access needs.
- Assessing the city of Cincinnati's networks and recommending updates to the city's long-term strategic plan. This project involved assessing and identifying new department and network application needs, assessing the current networks to meet identified needs, assessing emerging fiber and wireless technologies, recommending wireless strategies, and providing recommendations and strategies for meeting foreseeable needs.
- Designing a broadband wireless network for Annapolis, MD, that provides connectivity for a citywide video surveillance system. The network was designed to provide high-degrees of security and has substantial reserve capacity to support the addition of new video requirements, expand toll-quality IP-based voice and data services, and, potentially, provide backhaul for a future mobile wireless solution.
- Overseeing the development of an infrastructure plan to support the implementation of Wi-Fi services throughout a downtown area targeted for economic development in Rockville, MD. The plan focuses on deploying a flexible architecture of physical support infrastructure to enable a wide range of wireless connectivity options for visitors, residents, and business tenants while maintaining the aesthetics of the development.
- Researching current and future wireless technologies and evaluating the feasibility of implementing a secure public safety wireless network in Prince George's County, MD. Designed and implemented a pilot project to test the feasibility of a public safety network. A successful solution was deployed to enable Mobile Data Computers in emergency response vehicles to securely roam from a carrier CDMA network to private, County-operated Wi-Fi hotspots.

### Public Safety Networking

In addition to supporting the design and deployment of NCRnet, Mr. DeHaven is the lead engineer responsible for one of the key applications leveraging this regional network. Mr. DeHaven is responsible for the design, implementation, and ongoing operations of a regional videoconferencing network supporting Emergency Management among the 21 jurisdictions in the National Capital Region (DC, MD, VA). CTC developed the systems' designs and oversaw implementation under a grant from the Department of Homeland Security Urban Areas Security Initiative (UASI). This network now serves thousands of end users, integrated tightly with the ever-growing videoconferencing and VoIP systems leveraged by these jurisdictions.

In Anne Arundel County, MD, Mr. DeHaven assisted with the deployment of traffic surveillance cameras. He provided analysis of candidate technical solutions for cameras using the County's high-speed fiber-optic I-Net to transport video and control signals, developed system specifications, and oversaw the implementation of the County's video surveillance capabilities.

Mr. DeHaven was also involved in the planning and implementation of a statewide network in Delaware that provides traffic information and traffic control capabilities to transportation management facilities. Such a network allows remote control of traffic signal systems and variable message displays, while providing real-time traffic surveillance in the form of video images and microwave sensor data. He has developed expertise in the numerous forms of technology used in this type of project, ranging from fiber optics to wireless digital spread-spectrum communications.

Mr. DeHaven served as CTC's lead engineer for the Delaware Department of Transportation's Advanced Traffic Advisory Radio System, the first Advanced TARS system in the country. He trained on-site staff, specified and installed new equipment, and monitored system performance.

#### Fiber-to-the Premises

Mr. DeHaven has assisted in the planning and deployment of dozens of FTTP networks for public sector clients, providing expertise in varying roles from the development of system-level designs and cost estimates to detailed engineering and construction oversight. He led the engineering team responsible for the design of a rural FTTP network in southern Anne Arundel County, Maryland, to serve more than 600 homes within a previously unserved neighborhood. He is currently managing the engineering designs and overseeing construction for an FTTP network in Westminster, Maryland, comprised of approximately 80 route miles of fiber plant to serve more than 6,000 residential and business passings.

#### Inter-County Broadband Network

Originally serving as part of the grant application development team that successfully led the State of Maryland to a \$115 million Broadband Technology Opportunities Program (BTOP) administered by the National Telecommunications and Information Administration (NTIA), Mr. DeHaven served as the Portfolio Manager for the One Maryland Inter-County Broadband Network (ICBN) BTOP grant project.

The ICBN is a nine-jurisdiction consortium in central Maryland led by Howard County, Maryland, and was a key sub-recipient of the State's grant award. Mr. DeHaven served as the lead technical consultant overseeing the use of approximately \$72 million in grant funds to build over 800 miles of fiber optics and directly connect approximately 650 community anchor institutions, including schools, libraries, government buildings, community colleges, and public safety agencies. Mr. DeHaven was tasked with overseeing numerous engineering and construction contractors, as well as playing a key role in overall network design during this aggressive three-year endeavor.

#### Video and Unified Communications Engineering



Mr. DeHaven's experience includes the management, design, and procurement of video, voice, and data networks. Some select examples of his recent project work include:

- System-level design and procurement support for the deployment of a multi-tenant unified communications network for Harford County, MD. The network supports approximately 3,000 users across all County agencies, Libraries, and Schools.
- Development, implementation, and continued support of videoconferencing and unified communications tools for the 21 jurisdictions in the National Capital Region (DC, MD, VA) Emergency Operations Centers (EOCs) and Emergency Communications Centers (ECCs) over a state-of-the-art fiber-optic and microwave network.
- Preparation of system-level design recommendations and cost estimates for an extensive, countywide system to support interactive and on-demand video training communications for the Anne Arundel (MD) County Fire Department. CTC also developed the design for a video display system for the Fire Department's new dispatch center, intended to allow key sources of information to be prominently displayed throughout the facility.
- Preparation of system-level design recommendations and cost estimates for an extensive, citywide system to support interactive and on-demand video communications for training, emergency collaboration, and routine meetings between Mesa, AZ Fire Department personnel. CTC also integrated a pilot videoconferencing system to demonstrate certain capabilities of the system design.
- Development of a videoconferencing system for homeland security applications on behalf of Arlington County, VA—the site of the September 11<sup>th</sup> Pentagon attack. The system links numerous public safety and other government users and aims to ensure uninterrupted emergency communications in the event of a terrorist attack or natural disaster.

#### Instruction/Expertise

Mr. DeHaven led the CTC research team that prepared Web-based Intelligent Transportation System (ITS)-Communications courses on behalf of the University of Maryland Center for Advanced Transportation Technology. He served as an online instructor for these courses for more than six years.

Mr. DeHaven has also provided expert technical witness reports and testimony in connection with litigation related to a large commercial carrier's failure to complete construction of a citywide fiber network in a major North American city.

#### **EDUCATION**

**Bachelor of Science, Electrical Engineering, in progress, The Johns Hopkins University**

## Marc Schulhof | Senior Analyst and Technical Writer

Marc Schulhof has 25 years of experience in technical writing, financial journalism, and public and corporate communications. As an analyst and editor, he plays an integral role in developing CTC's client deliverables, including:

- Strategic and master plans (business and engineering)
- Needs assessments
- Feasibility studies
- Requests for proposal (RFP) and requests for information (RFI)
- Survey instruments
- Expert witness testimony
- Federal and regional grant applications
- Wireless facility siting reports
- E-rate RFPs and bids
- Research reports
- White papers

Over the course of his nine years as CTC's senior technical writer, Marc has supported dozens of CTC clients—including the District of Columbia, the states of Connecticut, Delaware, Kentucky, Maryland, and New Mexico, and the cities of Atlanta, Boston, New York, Palo Alto, San Francisco, and Seattle. He has collaborated on white papers on topics related to fiber optic and wireless technologies, including technical reports filed with the Federal Communications Commission. He is the co-author, with CTC President Joanne Hovis, of "The Emerging World of Broadband Public-Private Partnerships: A Business Strategy and Legal Guide."

Prior to joining CTC, Marc was the worldwide editor-in-chief of CIO program websites at IBM, where he established editorial direction for 36 country-specific CIO websites and worked with local editors to update each site's mix of multimedia content. He also wrote and edited feature articles and white papers on information technology and business topics.

Earlier, as a global editor at PricewaterhouseCoopers Consulting, Marc wrote and edited reports on a variety of technology and business topics. He served as daily editor of the PwC-sponsored *BusinessWeek Online Handheld Edition*, a news summary service for mobile device users in the pre-smartphone era. Marc began his career at *Kiplinger's Personal Finance Magazine*, where he researched, analyzed, and wrote about a range of complex financial issues, first as a reporter and later as an associate editor.

### **EDUCATION**

**Master of Science, Journalism, Northwestern University**

**Bachelor of Science, Journalism, Northwestern University**