Proposal to Provide
Broadband Analysis Consulting Services

RFQ DEV1224

Prepared for:

State of West Virginia

Presented by:
Joanne S. Hovis, President
Columbia Telecommunications Corporation
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Signed: Joanne S Hovis

Date: November 21, 2011

ORIGINAL

Prepared by

Columbia Telecommunications Corporation

CTC
COMMUNICATIONS
ENGINEERING & ANALYSIS
FOR THE PUBLIC INTEREST

10613 Concord Street • Kensington, MD 20895 • 301.933.1488 • 301.933.3340 fax • www.CTCnet.us

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November 21, 2011

Mr. Frank Whitaker
Department of Administration
Purchasing Division
Building 15
2019 Washington St., East
Charleston, WV 23505-0130

Re: Proposal for State of West Virginia Broadband Analysis

Dear Mr. Whitaker:

Columbia Telecommunications Corporation (CTC), in collaboration with our partners, Ms. Jane Patterson and the Baller Herbst Law Group, is pleased to submit this proposal to provide you with an independent, rigorous analysis of broadband across West Virginia and development of strategies for expanded broadband technologies.

The State of West Virginia was fortunate to receive one of the four largest (in excess of $100 million) Broadband Technology Opportunities Program (BTOP) grants for non-public-safety projects. CTC is currently consulting to three of the other statewide fiber optic networks comprising the top four, in Colorado (EagleNet), Maryland (One Maryland), and Pennsylvania (KINBER). In addition, our team has consulted on the full range of BTOP and BIP programs, from infrastructure, public computing centers, and sustainable broadband adoption programs to state mapping and planning.

We believe we offer you a number of other important distinguishing advantages, as well:

Rigorous independent analysis. We will provide clear and critical analysis of the State's current and future efforts for the purpose of ensuring that State investments in broadband planning target the right problems and have the greatest likelihood of success. CTC's reputation rests on our **track record of providing independent guidance** to hundreds of state and local entities—for nearly three decades, we have served the public sector in evaluating its broadband deployment efforts and in bringing an independent, sometimes critical, eye to communications efforts. We are not affiliated with equipment manufacturers, communications carriers, cable operators, or service providers; to ensure that we can provide independent guidance, we have, as a policy, **no financial stake** in the strategies you chooses to adopt.

*Reliable **local service** combined with national and international experience.* CTC is a small Maryland business of 40, focused on broadband planning and design for state and local government. We are a 28-year-old company—an established, respected, stable Maryland enterprise with a track record of hundreds of successfully completed projects. We have worked extensively in Appalachia, including in your neighboring Maryland counties. Our principals spend extensive time in the Appalachian regions of Maryland and Pennsylvania. We are currently providing broadband planning services in your neighboring areas of both of those states. We also work nationally and internationally, most recently assisting the government of New Zealand with its rural and urban broadband plans.

CTC is located a modest drive away from Charleston in Maryland. As an *almost*-local company, we commit to providing you with on-site support as necessary to meet your needs and interests, much as we have done for your neighbors in Pennsylvania and Garrett County, MD.

A unique partner. CTC has partnered with one of the pioneering leaders in statewide broadband planning, Ms. Jane Patterson of North Carolina, as well as with our longtime colleagues at the Baller Herbst Law Group.1 Jane is internationally recognized as the developer of the state-wide approach to broadband planning; she holds decades of experience with developing and critiquing programs around broadband adoption and deployment in partnership with the private sector. As a team, we have extensive combined expertise in the areas of broadband economics, technology, engineering, business planning, accounting, and program development. Our partnership brings to the table invaluable experience with federal broadband funding sources and expertise in best practices, network design, budget management, and financial analysis.

Highest caliber of efforts and analysis. CTC is a highly respected firm with considerable experience and intellectual resources. We also believe that every client project is singular. We do not perform "cookie cutter" work, and do not view the State's goals as a series of cookie cutter needs. Engaging with CTC and our team means receiving both customized analysis and the level of time, consideration, and care required to provide you with the answers you need. You will get the attention of the principals of the firms, including Joanne Hovis and Dr. Andrew Afflerbach of CTC; Jane Patterson; and Jim Baller. This is a team with both the experience and intellectual firepower to deliver unique analytical tools and knowledge of best practices.

As President and owner of CTC, I will serve as our team's project manager. My contact information is above, my fax number is 301.933.3340, and my e-mail address is jhovis@CTCnet.us.

[1] With our consent, the Baller Herbst Law Group is also participating in another response to the RFP.

We appreciate the opportunity to submit this proposal. Please feel free to contact me if I can provide any additional information.

Best regards,

Joanne S. Hovis

Joanne S. Hovis, President

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1. About Our Team

1.1 About CTC

Since 1983, CTC has served the public sector and the public interest—and performed a range of broadband network analysis, business planning, and engineering design tasks for hundreds of state and local governments, higher education and health care institutions, and non-profit consortia nationwide. Over the years, we have provided business and strategic planning services for enterprises as varied as the states of Delaware, New Mexico, Maryland, and Georgia; the Los Angeles Department of Water and Power; the cities of San Francisco and Seattle; higher education entities; and health care institutions such as the public health departments of the National Capital Region.

We are deeply familiar with BTOP and its parameters, across all areas of funding. We designed Maryland's capacity building application for the SBDD program of BTOP. We developed strategic visions, business plans, and pro formas for many successful BTOP grant applications, including the $115 million One Maryland Broadband Network; the $22.5 million Urbana-Champaign Big Broadband (UC2B) project led by the University of Illinois; the $32.1 million OpenCape project in Cape Cod; and Washington, D.C.'s $17.5 million Community Access Network. We are currently developing a sustainable business model and evaluating business plans for KINBER, the statewide network in Pennsylvania. We also helped EAGLE-Net, the statewide network in Colorado, to devise a sustainable business strategy; we are now under contract to EAGLE-Net to provide business planning and strategic planning services.

In addition, CTC President Joanne Hovis holds firsthand knowledge, on a national level, of the types of issues the State faces in developing sustainable broadband programs as well as ensuring sustainable business models for BTOP projects. Joanne is a charter member of the BTOP-funded United States Unified Community Anchor Network (U.S. UCAN) project's Task Force on Community Anchor Network Economic Models. U.S. UCAN, which was conceived by Internet2, aims to connect all of the BTOP middle-mile projects with a national backbone.

Joanne has also advised the State of Illinois' Partnership for a Connected Illinois and has addressed their meetings with regard to broadband access and adoption. She serves on the Board of Directors of the Benton Foundation. As president of NATOA, she works with a coalition of associations representing the public sector at the state and local levels to ensure that localism and local considerations are central to broadband policies. Through that role, too, she has been, and continues to be, deeply aware of what is happening in Washington in that regard.

CTC has supported more than a dozen clients with tasks related to NTIA funding, starting with the first round of BTOP applications in 2009 and continuing through due diligence and project implementation tasks for successful BTOP grantees. We have a particular expertise in network design, budget management, and financial analysis of BTOP-funded projects.

Importantly, CTC is not affiliated with equipment manufacturers, communications carriers, cable

operators, or service providers. We have no financial stake in the strategies the State chooses to adopt.

1.2 About Baller Herbst Law Group

Baller Herbst Law Group helps their clients make and implement comprehensive telecommunications plans; obtain stimulus funding and implement award conditions; develop advanced communications systems; comply with all pertinent federal, state and local legal requirements; identify and evaluate potential strategic partners and negotiate cooperative relationships with them; draft integrated right-of-way and zoning ordinances, franchises, licenses, permits, contracts, forms and other related documents; negotiate pole, duct, conduit, fiber, and tower agreements; prepare technical, financial and performance audits and reviews; and administer and enforce cable and telecommunications franchises.

Over the last 15 years, the Firm's clients have included many of America's leading public broadband projects, including more than 40 public fiber projects. Among the most best known are Bristol, Virginia (singled out for praise in the Federal Communications Commission's National Broadband Plan); Chattanooga, Tennessee (America's first gigabit service provider); Lafayette, Louisiana (admired throughout the international fiber community); and OneCommunity, Ohio (twice recognized as one of the world's top seven intelligent communities). Over the last year, Baller Herbst has also served as consultant to Google in its Fiber for Communities initiative.

The Firm also has been involved in several high-profile and large-scale broadband projects supported by the NTIA and RUS broadband stimulus programs, including the OneCommunity project in Northern Ohio, Maryland's OneMaryland project, Massachusetts' Mass123 initiative, and Missouri's MoBroadbandNow. The Firm also was recently brought in to assist the Florida Rural Broadband Authority in its efforts to review and reform its broadband stimulus project.

1.3 About Jane Patterson

Jane Patterson previously served as the Executive Director for the e-NC Authority, a non-profit that provided high-speed affordable access to the Internet for citizens, businesses and institutions of North Carolina, particularly in rural areas. She has led a focused effort on technology and understands that its application will enhance the economy of North Carolina and will advance technology applications that affect the learning process in education.

Jane's career has concentrated on the areas of information technology infrastructure and its impact on operations of government, industry, education and health. She has consulted with more than 20 countries worldwide and 38 states relating to the design and operation of information networks. She was the major visionary and leader in the development and implementation of the North Carolina Information Highway (NCIH), the first switched broadband ATM-Sonet deployment in the world. NCIH was a 1996 Global Information Infrastructure Awards Finalist. Jane chaired the Mega Project on Applications and served as a member of the U.S. National Information Infrastructure Advisory Council, appointed by both President Bill Clinton and Vice President Al Gore.

2. Attachment A: Vendor Response Sheet

2.3 Qualifications and Experience

2.3.1 Industry and Policy Analysis: State and Federal Funding Analysis; and Strategic Planning Support

2.3.1.1 Understanding and view of the broadband industry at both Federal and State levels to provide policy analysis and program development or planning assistance to clients

State of Maryland, One Maryland Broadband Network ("OMBN")
CTC serves as consultant to the state of Maryland in its broadband planning efforts and played a key role in strategic guidance of the OMBN grant application and the state's efforts to expand broadband to in both metropolitan and rural areas. Working closely with the Maryland Department of Information Technology (DoIT), we provided strategic guidance and were the lead engineering and business planning consultant in conjunction with the development of the OMBN application under the Broadband Technology Opportunities Program (BTOP). Our services included network architecture, plant engineering, and detailed project preparation. CTC also provided extensive business planning, business modeling, and pro forma preparation.

Following award of OMBN's BTOP grant, CTC prepared the OMBN project's required Environmental Assessment (EA). Our understanding of the National Telecommunications and Information Administration's (NTIA) EA priorities and requirements—coupled with our engineering and network design expertise—helped us advise OMBN on how to avoid pitfalls and work around areas that could otherwise prolong the EA process. This not only assured a successful Finding of No Significant Impact (FONSI) determination, but enabled OMBN to begin project implementation as soon as possible—a critical issue given the NTIA's requirements for timely project completion and demonstration of construction progress.

CTC continues to provide strategic consulting to the state in the broadband area—most recently, for example, devising key performance metrics for the state's use in gauging the success of its private fiber optic partners. In addition, we monitor developments in Washington that could impact OMBN funding and timelines; and prepare the data and communications tools for the OMBN website.

U.S. Small Business Administration (SBA)
In a year-long market research and analysis project for the SBA Office of Advocacy, CTC evaluated the effect of broadband speed, price, and availability on small businesses in metropolitan and rural areas across the United States. The project included conducting and analyzing the results of a written nationwide survey; an evaluation of existing broadband products, services, and technologies; and an assessment of emerging technologies. Based on the market research and independent data analysis, CTC developed policy recommendations for improving small business broadband access. The final

project report was delivered to the SBA and congressional committees in fall 2010.

OneCommunity (1C)
1C is one of America's leading middle-mile networks. Founded in 2001, it has helped to revitalize northeastern Ohio by stimulating both supply and demand for high capacity broadband connectivity and by working closely with both the public and private sectors to develop a community-driven state-of-the-art fiber network that serves multiple users in multiple ways. According to Blair Levin, former head of the task force that developed the FCC's National Broadband Plan, Baller Herbst's white paper describing 1C's unique program heavily influenced the Plan's anchor-institution strategy. The white paper also helped 1C to become the model for NTIA's Comprehensive Community Infrastructure program.

As OneCommunity's outside counsel, Baller Herbst has assisted it numerous ways that are relevant to the West Virginia project. With respect to broadband stimulus matters, Baller Herbst helped 1C to obtain two substantial grants; develop contracts between 1C and numerous other organizations to implement the grants; draft and negotiate various infrastructure agreements, including fiber IRUs and pole attachment agreements; develop compliance strategies and respond to audit request, etc. Baller Herbst has also assisted 1C in numerous other ways, including strategic planning and thought-leadership, developing ways to use the network for multiple purposes, and fund raising. 1C projects have generally been managed by Jim Baller on behalf of the Firm, with extensive involvement of Sean Stokes and Casey Lide.

(Please see Section 3 for a list of references.)

2.3.1.2 Domestic and international experience in assessment, engineering, design, operation and capacity building for broadband infrastructure and different business models applicable to both middle mile and last mile networks as evidenced by verifiable delivered work pertaining to same.

CTC President Joanne Hovis designed the state broadband capacity building program for Maryland and was consulted by the counterpart program in Illinois. CTC is also under contract to the State of New Mexico's Broadband Program to develop a guide for broadband planning and capacity building. Our related experience includes the following engagements:

City of Washington, D.C.
CTC has long served as strategic broadband consultant to the District of Columbia's Office of the Chief Technology Officer. Over the past years, we have provided analysis of the business case and technology analysis for DC-Net, a fiber optic telecommunications network that provides voice and data services for the District of Columbia. We developed a business plan for DC-Net and recommended business practices.

CTC serves in an ongoing role as strategic broadband advisor to the City, and provided business

planning, engineering, and project management services for the City's three successful BTOP stimulus grant applications.

City and County of San Francisco, California
Over the past five years, CTC has served as broadband consultant to San Francisco. In that capacity, we prepared a series of path-breaking analyses of strategic directions for the City to build a fiber-to-the-premises (FTTP) network to every home and business in San Francisco—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.

As part of this support to San Francisco, CTC also conducted extensive survey work of the small business and residential communities, to determine the gaps in service and use of broadband and to understand the barriers to broadband adoption. The surveys also enabled us to project potential use of new broadband technologies at various price points so that the City and its private partners could better target their efforts to increase broadband adoption.

City of Seattle and Seattle City Light
From 2008 to the present, CTC has performed market research and developed a feasibility study, a business case analysis, and an "off-the-balance-sheet" benefits analysis for the fiber-optic network proposed by the mayor of Seattle.

The first study, "FTTP Municipal Broadband Risks and Benefits Evaluation," included the following elements:

- Internal needs analysis
- Market research of both residential and business customers
- Assessment of competing services and technologies
- Evaluation of the business case and business risks

Following on that report, CTC researched and wrote an "FTTP Benefits Evaluation," which explored the benefits of FTTP beyond the traditional balance sheet, including cost avoidance, monetary savings, and environmental impact. Notably, this report was one of the first of its kind to qualify and quantify (where possible) community-wide benefits of ubiquitous broadband connectivity such as enabling increased telecommuting, reductions in greenhouse gas emissions, and positive impacts on vulnerable populations such as the elderly and low-income residents.

In the most recent phase of this project, CTC advised the new Mayor of Seattle regarding the US communications market and business planning strategies for a citywide enterprise. CTC led and facilitated a business planning working group comprised of the Mayor's senior staff, the Directors of the city's two utilities (electric and water/sewer), and the city's CIO.

Crown Fibre Holdings (representing the government of New Zealand)
CTC serves as technical advisor to the Chief Technology Officer of Crown Fibre Holdings, the entity overseeing the construction of a $1 billion fiber optic network to 75 percent of all homes in

businesses in New Zealand, including rural and urban areas. CTC Director of Engineering Dr. Afflerbach worked closely with the candidate fiber construction companies across the nation to develop requirements for outside plant fiber and network electronics and to develop bid specifications for a nationwide procurement.

Utah Telecommunication Open Infrastructure Agency (UTOPIA)
In 2008, CTC performed an expert assessment of UTOPIA's business and marketing plan. 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. Our work focused on improving the participating UTOPIA communities' ongoing cash flow and increasing participation of households and businesses in those communities.

Case Western Reserve University Gigabit FTTH Project—Cleveland, Ohio
CTC is providing ongoing engineering and strategic support to the University Circle Innovation Zone "Beta Block" project in Cleveland, Ohio—a home-run architecture fiber-to-the-home (FTTH) initiative that was the first gigabit fiber-to-the-premises project in the United States. Among the implementation oversight tasks addressed for this project were:

- Construction inspection
- Fiber optic cable performance testing
- Provisioning
- Determining the feasibility of new applications
- Evaluating network electronics
- Interfacing FTTH with wireless system
- General network operations troubleshooting

City of New York
In the 1990s, CTC planned, designed, and built for the City of New York the first broadband fiber Institutional Network of its kind for government use. This fiber network connected numerous City buildings and schools throughout the five boroughs for purposes of financial management, education, and criminal justice. The network cost-effectively leveraged over a hundred miles of fiber infrastructure from competitive local exchange companies and cable operators. CTC served as network architect, engineer, and program manager. The New York network was the only communications network to remain operational in Lower Manhattan on September 11, 2001—even as all carrier networks failed.

(Please see Section 3 for a list of references.)

2.3.1.3 Advisory Assessment and program support for state and federal regulatory, federal funding programs, and Universal Service Fund reforms including an assessment of where existing Federal and State funding is underutilized as evidenced by verifiable delivered work product pertaining to same.

Garrett and Allegany Counties, Maryland
CTC is currently engaged in advising the rural counties of western Maryland regarding strategic plans for expanding broadband for economic development and education purposes. Central to that effort is our ongoing assessment of existing and potential program support and funding programs that can serve to support the counties in their efforts to expand broadband availability and use. We are evaluating a wide range of opportunities, from the newly created Connect America Fund (under the USF reform work underway at the FCC) to the E-Rate program (which has the potential to expand broadband use to schools and libraries in a competitive manner if undertaken correctly) to a range of loan and grant programs administered by the U.S. Department of Agriculture.

Paducah (KY) Power System
In 2011, Baller Herbst assisted Paducah Power System (PPS) in its successful efforts to take advantage of recent changes to the federal Universal Service Program for Schools and Libraries (known as the "E-Rate"). Amendments to the E-Rate program in late 2010 specified that eligible service providers under the E-Rate are no longer limited to regulated "telecommunications carriers," and clarified that construction costs for lit fiber are eligible, both within and external to the school or library property. Baller Herbst drew PPS's attention to these changes, and helped PPS obtain significant E-Rate funding for the construction of a lit fiber network serving the Webster County School District. Casey Lide managed the Firm's involvement with PPS.

Connect America Fund / USF Reform Rulemaking
The Baller Herbst Law Group participated in the FCC Connect America Fund rulemaking, drafting and filing comments in the proceeding on behalf of the American Public Power Association and the Iowa Association of Municipal Utilities.

Mid-Course Workshop for Broadband Awardees
In conjunction with NTIA and OneCommunity, the Baller Herbst Law Group helped organize and facilitate a three-day event in October 2011 for more than 400 broadband awardee participants to discuss and learn from broadband stimulus projects' progress to date.

(Please see Section 3 for a list of references.)

2.3.1.4 Assessment and development of comprehensive strategic and tactical plans for infrastructure deployment and capacity building for commercial entities, communities, and states.

Nationwide experience of Jane Patterson
Jane Patterson has worked with more than 20 countries and 38 states relating to the design and operation of information networks. As a vice president of ITT Telecom's Networks Systems Division, Patterson oversaw the design and implementation of the first NATO digital network. Previously she had worked to define and design with her government/university/private sector team the first initiative of a digital state network in the United States (early 1980s). In 1991-92, Patterson worked with BellSouth and Nortel to define and design infrastructure issues for an ATM-Sonet network, which was deployed with her team's oversight in 1993 and 1994 across more than 700 miles in North Carolina—and which led to the receipt of a major award for infrastructure from the National Association of State Chief Information Officers and an extensive article defining this work in the IEEE magazine.

State of New Mexico
CTC is developing a guidebook for the State's Broadband Program that will help local governments across the State, and at every level of sophistication regarding the planning and operation of communications networks, to get started in addressing their broadband needs. The guidebook will explore a range of technical, business, and partnership models that have been proven and established—as well as some that are more cutting edge—and will assess the benefits and risks of each.

Maryland Public Service Commission (PSC)
In an engagement similar to our work evaluating broadband technologies, CTC assisted the State of Maryland's Public Service Commission in evaluating evolving communications technologies that would be implemented by the private sector, under the state's oversight. We assessed the claims of potential hardware vendors and determined the true feasibility and value of the technology for the State.

CTC provided PSC staff with confidential and non-confidential public testimony and a range of clear, organized exhibits that addressed the relative merits and limitations of Advanced Metering Infrastructure (AMI) proposals filed with the PSC by multiple regulated electric utilities.

Our analysis included forward-looking evaluation of the changing nature of energy use, including distributed generation and the increased use of plug-in hybrid vehicles. We also examined issues of consumer acceptance and adoption—knowing that those are key factors in realizing the projected benefits of many AMI implementations. In addition, our vendor and technology evaluations included an assessment of the physical characteristics of the media used in each solution, as well as the impact of proprietary equipment on network architecture and lifecycle costs. Guiding all of our work was an effort to understand the impact that a given technology or solution would have on ratepayers, electric rates, and the power distribution and generation businesses.

U.S. Postal Service (USPS) Office of the Inspector General
CTC prepared a confidential broadband feasibility study that analyzed the USPS's options for providing broadband service to communities surrounding its facilities in rural areas nationwide. Our report, which identified the scope of the opportunity and the engineering and financial issues that such an initiative would entail, included an engineering analysis of the implementation of carrier-grade (LTE and WiMax) and best-effort wireless (WiFi) technologies. Based on our assessment that wireless technologies would be the most feasible, we explored three potential wireless broadband business models.

City and County of San Francisco, California
Over the past five years, CTC has served as broadband consultant to San Francisco. In that capacity, we prepared a series of path-breaking analyses of strategic directions for the City to build a fiber-to-the-premises (FTTP) network to every home and business in San Francisco—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.

As part of this support to San Francisco, CTC also conducted extensive survey work of the small business and residential communities, to determine the gaps in service and use of broadband and to understand the barriers to broadband adoption. The surveys also enabled us to project potential use of new broadband technologies at various price points so that the City and its private partners could better target their efforts to increase broadband adoption.

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In the most recent phase of this project, CTC advised the new Mayor of Seattle regarding the US communications market and business planning strategies for a citywide enterprise. CTC led and facilitated a business planning working group comprised of the Mayor's senior staff, the Directors of the city's two utilities (electric and water/sewer), and the city's CIO.

National Capital Region (NCR) Interoperability Program
CTC provided the concept, engineering design, and project management for the National Capital Region Interconnection Network (NCRnet)—a 120-mile public safety network interconnecting 19 fiber-optic based government networks in the greater Washington, D.C. region, including urban, metropolitan, and rural areas. Our work supports NCRnet in meeting a range of requirements under its funding by both NTIA's Public Safety Interoperable Communications grant program and DHS's Urban Areas Security Initiative.

As lead engineer for NCRnet, CTC conducted a needs assessment and requirement projection of overall networking needs throughout the region, and is now designing and deploying a fiber-optic and microwave network to interconnect the existing communications networks of the 19 jurisdictions in the region. CTC is designing NCRnet to form a region-wide redundant and scalable infrastructure, where possible, leveraging existing assets of the participating jurisdictions and determining the most cost-effective means of interconnection. The network uses both fiber optic cable and microwave, and also provides backhaul for wireless assets. The result will be a failsafe, secure high-capacity network able to meet present and future public safety and first-responder needs and scalable to serve new stakeholders and user communities.

Urbana-Champaign Big Broadband (UC2B) Coalition
CTC supported the Urbana-Champaign Big Broadband (UC2B) Coalition, comprising the University of Illinois and the cities of Champaign and Urbana, in preparing its 2009 application for a BTOP grant to support a 187-mile fiber-to-the-premises (FTTP) network. In addition to our Professional Engineer certification, we provided network engineering, strategic planning, and financial planning services for this project, which received $22.5 million in Round One funding in 2010. Upon notification of funding, CTC immediately began assisting UC2B with network design and deployment tasks. Our environmental project team lead worked with CTC engineers and analysts to prepare the project's required Environmental Assessment. Working closely with UC2B and the NTIA liaisons, we identified engineering solutions to potential problem issues; proposed potential steps to optimize UC2B's project schedule; and successfully worked through the iterative process of revising the project's draft EA to address federal agency concerns. Through our collaborative efforts, UC2B secured a Finding of No Significant Impact (FONSI) within just four months—enabling the project to advance to the next stages of deployment.

New York City, New York
In the 1990s, CTC planned, designed, and built for the City of New York the first broadband fiber Institutional Network of its kind for government use. This fiber network connected numerous City buildings and schools throughout the five boroughs for purposes of financial management, education, and criminal justice. CTC served as network architect, engineer, and program manager. The New York network was the only communications network to remain operational in Lower Manhattan on

September 11, 2001—even as all carrier networks failed.

State of Delaware
CTC has provided communications engineering consulting services to the State of Delaware Department of Transportation for 15 years. Most recently, our business analysts and engineers wrote the statewide master plan for deploying an integrated broadband fiber and microwave network. CTC has also advised the state on its statewide 700 MHz mobile data network, including a requirements analysis, propagation studies, and system design.

Los Angeles Department of Water and Power
CTC recently completed a business and technology plan for the Los Angeles Department of Water and Power to determine the feasibility of using the Department's fiber network to offer services to the public and businesses.

Gastonia, NC
In 2008, CTC conducted a comprehensive FTTP feasibility study for Gastonia's municipal electric utility which included a technology assessment, market analysis, and a competitive assessment. One of the project outcomes was assisting Gastonia in understanding the full range of opportunities and risks of a new telecommunication venture, and the likelihood of the venture to require financial support beyond subscriber revenues.

Norwich (CT) Public Utilities
CTC conducted a comprehensive fiber feasibility study for NPU, designed over 70 miles of fiber, and planned and designed network electronics. The efforts of the study led NPU to pursue a model that served city facilities, utility assets, schools, and the medical community rather than an FTTP approach. CTC prepared a bid specification for fiber construction and provided final signoff on the work. We are currently assisting NPU with an Advanced Metering Infrastructure (AMI) project.

Anne Arundel County, Maryland
For more than a decade, CTC has provided Anne Arundel County with a wide range of support in development of the County's fiber network and other networking resources. For example, CTC provided recommendations regarding system designs and cost benefits of constructing a fiber optic network. CTC also conducted performance testing of the County's fiber optic infrastructure interconnecting more than 100 facilities, which was constructed by the local cable operators.

Port Angeles, WA
CTC has performed a range of telecommunication planning and analysis for the City of Port Angeles. Over the past few years, we conducted a network needs assessment and an evaluation of the City's public safety communications needs, explored the feasibility of a wide-area integrated fiber optic–broadband wireless network, and developed an engineering plan for the project. We also assisted the City with its independent BTOP grant application and, later, with the integration of its plans with the NoaNet project as a sub-grantee to NoaNet.

City-Parish of Lafayette, Louisiana/Lusfiber

Lafayette has developed one of the most widely-known public fiber-to-the-home systems in the world, and Baller Herbst has served as Lafayette's outside counsel since 2004. Among other things, Baller Herbst has helped Lafayette support and defend the system against attacks by the incumbent phone and cable systems before the state legislature (several times), the state bond commission, the state public service commission, the courts, and the public. We have also helped Lafayette comply with all relevant FCC regulatory requirements, negotiate pole attachment agreements, obtain video programming and other content, develop agreements for use with multiple dwelling units, respond to state audits, apply for energy stimulus grants, and much more. Jim Baller primarily managed the Firm's relationship with Lafayette, with extensive involvement from Sean Stokes.

Bristol Virginia Utilities/Optinet
Bristol was the first entity in the United States, public or private, to offer the triple play of voice, video, and broadband services over a fiber-to-the-home network. Since then, Bristol's extraordinary achievements in using its fiber system to foster economic development in the city and the surrounding region have won it numerous awards, including recognition as one of the seven most intelligent communities in the world in 2009. Baller Herbst's submission to the FCC on behalf of the National Association of Telecommunications Officers and Advisors (NATOA) on the relationship between broadband and economic development, which featured Bristol (http://bit.ly/iXMeyy), prompted the FCC to single out Bristol in the National Broadband Plan as the model of a successful community broadband project (http://bit.ly/jdt9Sn at 153). As with Lafayette, Baller Herbst has been Bristol's outside counsel from the time that the project was in its early planning stages and has worked with Bristol on a broad range of federal, state, and local matters since then. Jim Baller continues to manage the Firm's relationship with Bristol, with further involvement by Sean Stokes and Casey Lide.

(Please see Section 3 for a list of names and references.)

2.3.1.5 Implementation and management of broadband adoption programs on a regional and national level

State of North Carolina
Jane Smith Patterson has designed and implemented adoption programs at the state, regional, national, and international levels. Most recently, she has chaired the adoption and delivery of North Carolina's program on broadband (e-NC). Through her team's efforts, 82 percent of the citizens of North Carolina have adopted the Internet—up from just 32 percent prior to the program's launch. Using the Internet as a platform, more than one-third of North Carolina's citizens now operate small businesses out of their homes. Patterson's work with farmers and craftspeople, especially, has enabled those groups to use broadband as an underlying factor in their movement to electronic commerce. Many of the e-NC team's manuals and toolkits have been used by states throughout the United States and other nations, such as Japan, Australia, Singapore and the European Commission as guideposts for their adoption programs.

Patterson co-chaired during the mid-90s the applications committee of the U.S. National Information Infrastructure Advisory Council appointed by President Clinton. During the Bush Administration, she represented the states on the U.S. Innovation Partnership of the National Governors Association□The White House and chaired the Electronic Commerce initiative. Patterson served as the initial Chair of the Global Spatial Data Initiative, which developed the international guidelines for the GIS metadata standards.

Her work in state government on the development of programs in health care information infrastructure led to a collaborative process that was designed and implemented that enabled North Carolina to gain two of the three implementation development models for the national online health infrastructure. Long active in technology and learning, she was selected to serve on the National Commission on Technology and Adult Learning as well as the recent Working Group of the National Institute for Libraries and Museums as they initiated a review for the future of libraries and technology.

Patterson has served as a member of the Networked Enabled Studies program of the John F. Kennedy School of Government, which has produced many recognized documents designed to enable government to more effectively use technology in the management of government in its delivery of services to citizens.

(Please see Section 3 for a list of references)

2.3.2 Specialized Broadband Mapping

We have a demonstrated ability to support specialized data capture, create specialized mapping and analysis, and provide a variety of data specific overlays, including various technology and demographic information as required by NTIA standards for state specific broadband.

CTC is a sophisticated boutique engineering consulting firm focused on broadband networking. We have within our staff multiple GIS professionals dedicated to working in the area of specialized mapping, as well as the full suite of software necessary to prepare the highest level of deliverables. All of our GIS work is overseen by licensed Professional Engineers.

Most recently, CTC has prepared GIS layers for the ICBN portion of **the One Maryland Broadband Network** project, comprising 10 central-Maryland counties.

In addition, Jane Smith Patterson pioneered and oversaw the **State of North Carolina's** mapping efforts, which have been ongoing for more than a decade—and, importantly, pre-date the federal government's mapping initiative. The mapping program under Jane's leadership and direction has been the model for many states around the country, and is considered the gold standard for understanding the availability of broadband in a state. More details follow:

State of North Carolina
Jane Patterson has led the activities of North Carolina's broadband authority for the past 11 years.

North Carolina was the first state to develop a Broadband Authority, in 2000. In 2001, it became the first state to develop a statewide broadband map. Since that time North Carolina has reviewed the most cost-effective ways to map, looking at three different ways to collect data and develop interactive maps. Working with an advisory team of professors from across academia (e.g., economists and GIS predictive modeling professors), North Carolina uses these maps with additional data layers to work with economic developers and private sector small businesses, as well as citizen groups, to seek out ways to reach unserved populations and areas and assist companies in developing funding initiatives to gain deployment of additional information infrastructure across their state. Jane Patterson has also advised other states with her team. The goal has been to develop a cost-effective mapping process that can be sustained after federal funding and possibly state funding has evaporated—and to define more effectively how mapping can be utilized as a resource for other than just viewing on the Internet.

(Please see Section 3 for a complete list of references.)

2.3.3 Strategic Communications

We have demonstrated experience initiating public awareness campaigns, including the promotion of standards and best practices. CTC has used a wide range of communications mechanisms over the years, both within stakeholder communities and externally to the broader public. (Our recommendations for how to approach strategic communications in the context of the State's project will necessarily be based on the detailed goals of the State, which we will be able to effectively evaluate once we meet in person with stakeholders.)

For example, we have used strategies such as putting high-profile documents out for public comment for a period of time; conducting public meetings; and integrating formal public comments into a final deliverable. CTC did this for the phase-one feasibility report we prepared for the **City of San Francisco**; Joanne Hovis, in her role as a charter member of a BTOP-funded U.S. UCAN project task force, was involved in receiving public comment on that group's work, both in response to its draft report, and to its white papers.

Similarly, in **Garret County, Maryland**, we have publicized an e-mail address specifically for receiving public comment related to the expansion of broadband access. This sort of communications effort is a very common practice, in our experience, if the client is interested in soliciting input and ideas from the community.

A second approach to strategic communications is relevant to situations in which the information dissemination and strategic communications plans are targeted toward reaching a group of core stakeholders. For example, in the case of the **One Maryland Broadband Network (OMBN)**, we are tasked with managing strategic communications—primarily to inform stakeholders (including NTIA, state agencies, and the state's many project partners), but also to communicate about the project to the public.

Working closely with the Maryland Department of Information Technology (DoIT), we developed a

public-facing website that presents detailed information about the project, from concept to construction. The website, which dovetails with the state's broadband map, is updated weekly with project progress data (i.e., route miles engineered and constructed, and the number of community anchor institutions connected to the backbone). It also serves as a springboard for citizens and small business owners who want to learn more about the state's overall broadband efforts, including not just infrastructure expansion but also plans to facilitate the availability of new services and bridge the digital divide.

State of North Carolina
Jane Patterson has been the leader and the public figure representing the North Carolina broadband authority throughout North Carolina and nationally for many years, and is extensively experienced with strategic communications. She can bring to bear all the lessons learned in North Carolina to West Virginia's project, as she has in consultation to many other states nationwide.

(Please see Section 3 for a list of references.)

2.4 Statement of Work

2.4.1 Objective 1: Assessment of West Virginia's Current Broadband Efforts

Please describe how you would perform an assessment of West Virginia's current broadband efforts across the State's governmental entities with regard to strengths, weaknesses, opportunities and threats.

Summary: We propose to undertake a series of data-collection efforts to enable us to rigorously and methodically evaluate the State's efforts to date, as well as the existing status of broadband deployment and adoption in West Virginia. To this end, we propose the following tasks:

Task 1: Extensive Engagement with Stakeholders in Public Sector and Elsewhere
We suggest a methodology of extensive engagement with the State's key stakeholders, including public entities, private partners, BTOP and RUS awardees, and other participants you suggest. Our project team will undertake an extensive information-gathering process, first through an extensive on-site kickoff strategy session with State officials and other State-identified stakeholders to discuss the project vision, motivations, objectives, and policy position. The on-site meetings and follow-up conversations will be designed to accomplish the following agenda items among others:

- Discuss the project goals and objectives, and learn more about the State's broadband development process to date.

- Conduct focused meetings with representatives of the Department of Development and the Broadband Deployment Council to understand the organizational model currently in place and the full range of stakeholders.

- Determine metrics for the success of the State's efforts and the current broadband efforts underway, so as to methodically be able to assess their methodologies and outcomes in a consistent way.

- Provide a briefing on other efforts comparable to that of West Virginia, including its counterpart state-wide fiber network projects in Colorado, Maryland, and Pennsylvania (all of which CTC currently serves as consultant). We will also address the BTOP state mapping and planning efforts, as well as the BTOP and BIP programs elsewhere. Based on our experience with other state-level broadband agencies we will prepare discussion points based on national case studies to share best practices.

- Develop extensive data regarding the ongoing mapping, deployment, adoption, and educational efforts in West Virginia, including those funded by federal and State sources, so as to provide a basis for our assessment work.

- Review and evaluate the National Broadband Map as it pertains to West Virginia, and conduct a spot-check analysis with State stakeholders of its accuracy and sufficiency. This effort is intended to serve as the first step in compiling data regarding the State's mapping efforts to date.

Task 2: Statewide Surveys (Optional Task)

As the next step in data collection, we propose to survey households, businesses, and community anchor institutions (CAIs) in West Virginia to develop a baseline for benchmarking the State's current status and to enable tracking of progress in the key areas of interest for this project over time. We will analyze the data collected through these surveys; we will also develop both broadband utilization benchmarks and a comparative analysis index that define the current state of broadband use in the State. We have the capacity to perform this work internally and cost-effectively.

Specifically, CTC proposes (as an additional, optional task) to conduct statistically significant survey/market research in West Virginia to quantify the needs, resources, and baseline for further State efforts. Our research will address the residential and business sectors. The data and resulting analysis will serve as a tool for the State to understand the size of the broadband service and adoption gaps; to baseline the State's efforts going forward; to benchmark the State's success to date relative to other states; and also to demonstrate to potential private sector partners the size of the potential broadband market.

Based on our own experience and observed best practices, we recommend using our initial surveying as the basis for a longitudinal data set. Additional annual surveying would allow for time series tracking of broadband issues and opinions in the State. It would also enable State officials to compare internal results to national polling projects on technology issues, like those from the Pew Research Center.

Residential Survey

CTC will perform a survey and market research study of the residential sector to determine:

- Consumer use of broadband services
- Barriers to broadband adoption
- Customer satisfaction with current service providers and the services offered
- Potential unmet broadband needs in the residential community
- Ways in which improved communications services could benefit the community.

This study will be conducted via a random written (postal) survey. To achieve a reasonable level of statistical significance for the survey results, we recommend a survey of 2,500 residences. Based on similar surveys conducted in other states nationwide, a response rate of between 10 to 15 percent can be expected.

Our experience suggests that the residential survey would likely yield about 375 survey responses, which would provide results with a statistical significance of ±5.0 percent at the 95 percent probability level (the typical industry standard for strong results).

The initial survey questions will be developed using questions from previous CTC surveys and input from the State. A draft of the questionnaire will be provided to the State for review, comment, and revision. We will work with the State to finalize the survey form and will be responsible for all printing, mailing, fulfillment, handling and data entry.

The questionnaire will be printed in booklet format that will include a cover, an instructions page, and eight to 12 pages (4.25″ x 5.5″) of questions. Most questions will be discrete choice (check the box) format, although a small number may be open-ended (write-in) format. In our experience, this format is most "user-friendly" and most likely to result in a high rate of participation.

The survey will be mailed in an envelope bearing the State's logo and address to help ensure that consumers open the envelope. A postage-paid envelope will be provided for the respondent to return the survey to the survey processor.

Business Survey

Following the same guidelines as above, CTC will perform a survey and market research study of the business sector to allow the State to understand both the potential unmet broadband needs in the business community and ways in which improved communications services could benefit businesses.

This study will be conducted via a random written (postal) survey. We recommend a survey of 2,500 businesses. Based on our experience with similar surveys conducted elsewhere in the business sector, a response rate of 10 percent can be expected. The standard survey would likely yield about 250 survey responses, which would provide results with a statistical significance of ±6.2 percent at the 95 percent probability level (the typical industry standard for strong results).

Survey Analysis

Survey responses will be entered into a database format where data will be verified and cleaned.

Survey analysis will be completed in SPSS2 software and will include frequency tables, selected cross-tabulations, and other data summary techniques. Survey summary results will be exported to Excel for summary and graphing purposes.

We will analyze the data, perform a statistical analysis of the responses, and write a summary report of the results. The report will document the survey process, methodologies, results, and insights gained from the survey. An Excel file summarizing the survey data and graphs can also be provided to document the results and for easy transfer to other documents, as needed.

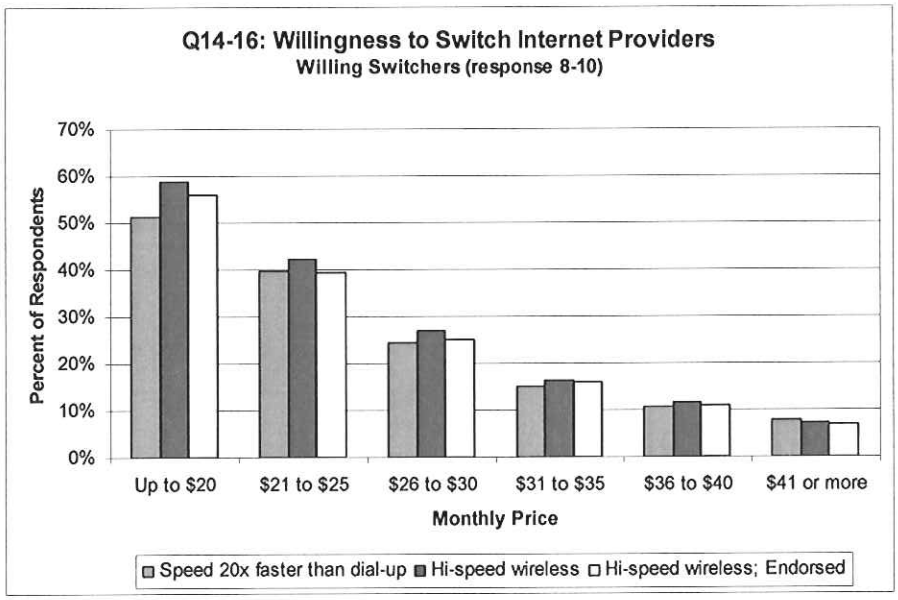
The market research analysis and results we will provide will have histograms for each question and cross tabulations of significant relationships. Our analysis goes beyond the histograms and cross tabs. For example, most surveys only ask for the satisfaction level of services provided. We also ask questions on the importance level, allowing for an evaluation of if and where the market is meeting or failing to meet attributes that are important. An example of this analysis is shown in the following table.

Significance of Importance and Satisfaction Gaps of Internet Characteristics (Example)

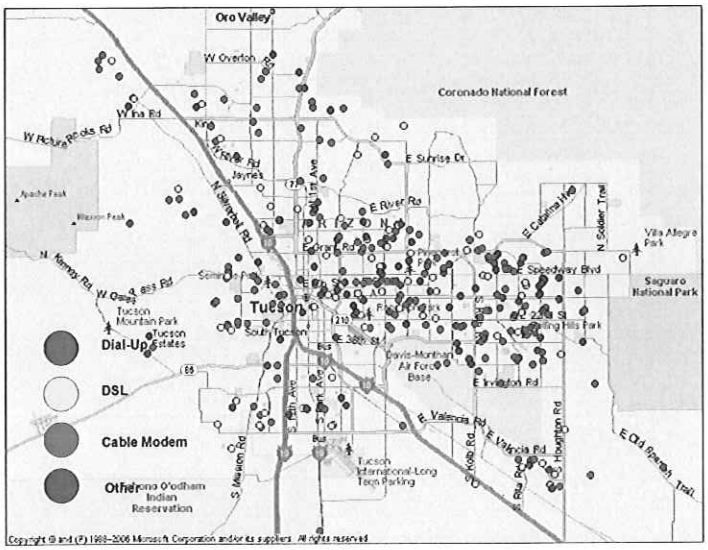
	Mean Importance	Mean Satisfaction	GAP < -- >	Significance?
Price (n=345)	7.9	7.2	-0.7	Expectations not met
Local office (n=322)	5.0	6.4	1.4	Expectations exceeded
Connection speed (n=343)	8.3	7.6	-0.7	Expectations not met
Parental control (n=308)	5.0	5.6	0.6	Expectations exceeded
Ability to contact provider (n=337)	7.6	7.3	-0.3	Not significant
Use telephone & Internet at same time (n=340)	8.1	8.2	0.1	Not significant
Mobility within City (n=296)	5.9	6.4	0.5	Expectations exceeded

In our survey, we will also ask a battery of questions regarding price and service—and willingness to switch providers. We believe that the answers from these questions assist our clients to understand the extent of the need for more, better broadband. Examples of these price points are shown below.

2 Statistical Package for the Social Sciences www.spss.com



We are also able to map results to help gain additional insights regarding availability and other parameters. For example, the following map created for Tucson, Arizona depicts potential DSL availability gaps. Mapping the results is an important tool to meet the State's objectives.



The residential and business survey results, our analysis, and the information indicated above will be provided in our written report along with key insights and recommendations.

We note that this task, among others listed here, will require support from State staff. For example, we will need identifying and scheduling stakeholder involvement for further discussions. The availability of State staff support to convey knowledge, arrange meetings, and support the ongoing development of the study will be critical to the success of this engagement.

2.4.2 Objective 2: Assessment of Impact of Federal Programs and Policies

Please describe how you would perform an assessment of federal programs and policies, including those at the National Telecommunications and Information Administration, the Federal Communications Commission and the U.S. Department of Agriculture that will impact the state and its broadband plans.

Summary: We propose to develop a detailed understanding of the State's specific circumstances through in-person discussions, then focus our written assessment on those federal programs and policies most likely to impact the State.

Drawing on our extensive involvement with NTIA and RUS broadband stimulus projects, and our long experience advising clients on various FCC programs and policies, the Baller Herbst Law Group will provide the State with a detailed written assessment, including a current snapshot and a prognosis, of relevant federal programs and policies at the NTIA, FCC, USDA and other federal agencies.

To provide the most targeted analysis possible, we propose to commence this task at the on-site kickoff meeting described above. At this meeting we will provide the State with an initial verbal assessment of the relevant federal programs and policies and, more importantly, we will have the opportunity to listen and learn more about the State's particular circumstances. With the detailed understanding gained from the kickoff meeting, we will proceed to draft a detailed written assessment of those federal programs and policies most likely to impact the State, focusing in particular on possible opportunities and potential threats presented by such programs and policies. To the extent possible, we will provide initial advice to the State on how best to take advantage of opportunities and how it might avoid potential obstacles to the successful implementation of the State's plans.

The deliverable for this task item will be a written report, and will include appropriate follow-up communications immediately following its publication. As indicated, the report may include proposed strategies that the State may wish to implement. While at this point it is impossible for us to predict the extent of such advice or our potential role in advising the State in an ongoing basis, we would be pleased to provide a proposed framework for such an arrangement to the State, based on the ultimate content of the written report.

2.4.3 Objective 3: Increasing Access and Adoption of Broadband

Please describe how you would assist in the development and implementation of a plan/strategy focused on increasing access and adoption of broadband technologies around the State's small business and entrepreneurial communities to include benchmarking, analysis, a detailed work plan and measurable results.

Summary: We propose to develop a series of recommendations and a work plan based on

quantitative and qualitative data, as well as on our understanding of the small business markets in metropolitan and rural areas. To this end, we propose the following tasks:

Task 1: Develop and Analyze Data Regarding Current Efforts

As part of the proposed kickoff meeting, we would request to meet with State officials handling small business, economic development, and broadband issues to assess the current level of activity and coordination with other small business stakeholder organizations. So long as the State is willing, we would also conduct extensive interviews with key business groups such as the Chamber of Commerce (we find, significantly, that the Chamber frequently serves as one of the most active, engaged stakeholders in many rural broadband planning processes).

Once we have developed these data, we propose to benchmark them against national data, both quantitative and qualitative, to understand West Virginia's status to date. In the qualitative area, we will use the data collected in metropolitan and rural areas nationally when CTC was competitively selected in 2009 by the US Small Business Administration to survey and analyze small business broadband use and availability throughout the United States, in response to a direct request of the small business sub-committees on Capitol Hill.

In the qualitative area, we will use our combined team knowledge of best practices around the United States. CTC's senior project staff, combined with Jane Patterson, have among them worked on broadband planning efforts in more than half the states, and have evaluated and studied programs in all 50 states and abroad. This knowledge serves as an invaluable data base for our efforts to benchmark work in West Virginia.

These data will enable us to establish a baseline for the current use, adoption, and availability of broadband for West Virginia small businesses. Based on those data, will we analyze the gaps that the State can possibly fill with high-quality programs. That analysis will serve as the basis for our recommendations in the following Task.

Task 2: Develop Recommendations and Work Plan

Based on all these data and the resulting analysis, we will develop a series of recommendations in the form of a detailed work plan for how the State can support rural and metropolitan small businesses in the broadband area. Members of our proposal team have extensive experience directing state-supported small business technology support centers in rural areas. The centers provide not only technical assistance but also digital literacy and broadband adoption support work. We will develop our recommendations regarding small business support in light of our experience with best practices from these centers as well as the methodology for how their effectiveness is evaluated.

Task 3: Develop Models for Integrating Small Business Programs with Those Aimed at Anchor Institutions

We propose also to develop a series of recommendations for integrating the programs aimed at small businesses with those aimed at other key anchor institution sectors. In our experience providing strategic guidance and business planning support for other state-level broadband deployment projects, we have found it critical to engage many other stakeholders in deployment discussions,

including representatives from: schools, libraries health care providers, other institutional users, local governments in addition to businesses. Demonstrating a demand among the small business community alone rarely provides enough support, or financial return, to warrant infrastructure expansion. However, when that demand can be coordinated with needs of sectors listed above, it creates a strong and more sustainable model for broadband deployment.

Task 4: Develop Survey Data (optional, as proposed above) for Measuring Impact
As part of the optional survey tasks proposed above, one part of our survey efforts would focus specifically on the small business community. We believe that these data not only enable development of well-targeted programs but also serve to enable the State to measure its progress over time, by establishing a baseline (as of approximately the first quarter of 2012) regarding small business broadband use, adoption, and availability.

2.4.4 Objective 4: Analysis of Impact of Universal Service Fund and Connect America Fund

Please describe how you would perform an analysis of the Universal Service Fund as it relates to West Virginia's current community of service providers and in anticipation of forthcoming changes at the federal level/initiation of the Connect American Fund to include potential impact on West Virginia's citizens of the forthcoming changes and solutions to lessen any anticipated impact.

Summary: We propose to learn more about the State's particular environment, especially relating to the service provider community in the State, at our project kick-off meeting. Then, based on our analysis of both the FCC's just-released Order concerning Universal Service reform and the Connect America Fund, we will assess the impact of the changes on the State's service provider community and, to the extent feasible, the State's citizens.

The Baller Herbst Law Group will provide an in-depth written analysis of the federal Universal Service Fund as it relates to the State's current community of service providers. In particular, we will focus our analysis on: 1) expected changes resulting from the Connect America Fund, and 2) opportunities presented by recent changes to the Universal Service Schools and Libraries Program ("E-Rate"), which may provide a source of funding for fiber construction projects and other services by a variety of entities, including non-regulated service providers.

The FCC has just released its written Order concerning Universal Service reform. Until we have had an opportunity to thoroughly evaluate the Order, it is difficult for us to predict the exact scope of this task as it relates to the State. Accordingly, as we suggested for Objective 2, we will commence this task as well at the proposed two-day kickoff meeting to which we referred above. At that meeting we will provide a verbal overview of key points relating to Universal Service reform efforts in general and the Connect America Fund in particular, including a review of the FCC's Universal Service reform Order. We will outline the potential opportunities under recent changes to the E-Rate program, together with a general overview of how that program operates. And again, we will take the opportunity presented at the two-day meeting to learn more about the State's particular environment, especially relating to the service provider community in the State.

Following the meeting, we will proceed to draft a detailed written analysis of the federal Universal Service Fund and changes resulting from the Connect America Fund. Drawing on knowledge obtained from the State, we will assess the impact of the changes on the State's service provider community and, to the extent feasible, the State's citizens. We will identify opportunities and potential threats, and will suggest strategies and tactics to respond accordingly. While at this point it is impossible for us to predict the extent of such advice, or our potential role in advising the State in an ongoing basis, we would be pleased to provide a proposed framework for such an arrangement to the State based on the ultimate content of the written report.

2.4.5 Objective 5: Analysis of State Broadband Map

Please describe how you would perform the review and analysis and report of findings focused on the current State broadband map with regard to national standards, best practices, levels of granularity and inclusion of all current broadband technologies being offered in West Virginia (wire line, wireless, fiber, satellite) in an effort to monitor, assess, and influence broadband infrastructure deployment, affordability and sustainability moving forward.

Summary: We propose to utilize our engineering capabilities as well as Jane Patterson's pioneering experience developing mapping methodologies to develop a series of recommendations to improve the current broadband mapping efforts in West Virginia and to enable the data collected to better serve the State's needs in moving broadband forward. To this end, we propose the following tasks:

Our team proposes to utilize both engineering and industry expertise to thoroughly review the State's mapping efforts and recommend best practices going forward. All technical analysis will be performed by CTC's GIS engineers and overseen by CTC Director of Engineering Dr. Andrew Afflerbach. All best practices evaluation will be conducted by experienced analysts and overseen by Jane Patterson, who is recognized nationally as the pioneer of state-wide broadband mapping efforts.

Task 1. Collect Data Regarding Mapping Methodologies and Outcomes

Our team will:

- Meet with members from both the State's GIS and broadband mapping teams
- Review the methods currently being used by State officials for the collection of broadband availability data used to populate the public broadband map
- Consult with carriers to determine the fullness of the data being collected
- Review state, local, and private carriers infrastructure that should be reflected in the map and could be leveraged in future deployment projects
- Spot-test the map to determine its strengths and weaknesses (in rural Maryland, Alaska, and other states, we have found both under-reporting and over-reporting of broadband availability)

Task 2. Evaluate Mapping Methodology and Provide Recommendations

Once we have a full understanding of the state's efforts to date, we will:

- Evaluate a range of different data collection methods that may be well–suited to meet West Virginia's needs, such as web mining, provider-generated data, and consumer surveys. We will discuss benefits and drawbacks of each approach, with respect to data accuracy and cost to collect
- Provide recommendations for best practices in mapping, customized to meet West Virginia's needs
- Provide recommendations for how mapping data can better influence deployment policy; thus, for example, we would evaluate what other State-wide information could be layered into broadband mapping efforts and share strategies for how to use the results. Combining broadband infrastructure mapping with population density data could identify certain areas as attractive deployment candidates to providers and begin to build a business case for expansion of service areas

Our team has experience both managing a state-level broadband availability mapping program in coordination with NTIA's National Broadband Map as well as reviewing and critiquing the quality of the data provided.

2.4.6 Objective 6: Assessment of School-Based Broadband Access

Please describe how you would perform an assessment and analysis of West Virginia's current school-based (K-12) broadband access and adoption rates to include potential solutions to any identified shortcomings.

Summary: With the goal of providing recommendations to improve K-12 broadband access and adoption, we propose to meet with key stakeholders, assess school capacity, identify partnership opportunities that enable schools to leverage higher education expertise, and prepare a guide to enable schools to maximize the benefits of the federal E-Rate program. To this end, we propose to undertake the following tasks:

Task 1. Develop Strategies Regarding Regional and Local Collaboration

We will meet with representatives of the K-12 community to discuss their current approach to school networking connectivity. A focus of our discussion will be the level of networking infrastructure coordination between school systems and their county or municipal governments. With our long history of advising school districts on networking architecture solutions, we can lead a discussion on the joint approaches taken by public schools and local governments in other states. The purpose of this task will be to encourage local entities to work together to leverage their collective buying power to negotiate improved services and pricing from their providers.

Task 2. Develop Strategies for School Capacity-Building to Enable Maximization of Resources

After determining the level of interactive services possible at schools based on their current connectivity technology we will compare these findings to what standards are needed for what are recognized as the most effective networking-based learning programs. During this discussion one must also evaluate if schools have the capability to use more advanced connection technologies once they are in place. If such resources are found to be lacking, we can develop a process for reaching

functional levels based on our experience with digital literacy programs and technology implementation programs.

Task 3. Develop Strategies for K-12 Collaboration with Higher Education for Joint Benefit
Greater gains will be realized from expanding outreach efforts from K-12 education to the wider educational community, particularly to include community colleges and universities. A larger coordinated approach during the process of deploying broadband technologies would see economies of scale, access to greater educational resources, and promote partnerships between institutions in order to generate the innovative educational content that improved broadband connectivity would allow access. Particular attention will be paid to strategies to incorporate and leverage the existing research and education network facilities from West Virginia Network (WVNet). In this area, we believe the opportunities are enormous for K-12; in her capacity as a charter member of the U.S. UCAN Task Force to develop an economic model, Ms. Hovis worked with universities around the U.S. who demonstrated their interest, for the sake of the university community, in connectivity to K-12 institutions, believing that the relationships will greatly enhance the Universities.

Task 4. Develop Guide to Maximize the Benefits of E-Rate
The federal E-Rate program, while hugely successful and appreciated, is also underutilized and complex to navigate. We propose to provide strategic guidance for understanding the program and how best to maximize the opportunity for the E-Rate subsidy to schools throughout the State.

2.4.7 Objective 7: Analysis of Opportunities to Leverage Funding

Please describe how you would perform an analysis of opportunities to leverage additional funding with State-based resources around the development, deployment, adoption of broadband technologies to include the specific market opportunities and technical assistance around addressing ant identified opportunities.

Summary: We propose to meet with a range of potential partners to identify opportunities to leverage private sector efforts and encourage additional investment, as well as to identify non-carrier partners with a stake in West Virginia's future who may be interested in supporting the State's crucial development efforts. To this end, we propose the following tasks:

Task 1. Conduct Additional Meetings With Key Stakeholders
After consultation and support from State officials at the kickoff meeting, we would conduct a series of additional stakeholder interviews with any groups not already present initially. It is critical to engage as many different sectors as possible to assess their future bandwidth connectivity needs in order to identify marketing opportunities, provide strategic recommendations and create sustainable business models.

Other portions of this proposal specifically identify certain constituencies that should be engaged, such as small businesses and public education. We would seek to engage representatives from health care providers, agriculture, county and municipal governments, libraries, among others. Of particular interest will be health care and agriculture. Health care services are among the most bandwidth

intensive industries operating today and are likely to have many of their networking needs unmet by current broadband options available. Also, there is growing understanding for the application of broadband technologies to improve the sustainable agricultural sector. We are familiar with applications integrating broadband and agriculture, programs which could help spur demand and adoption in rural areas of the State.

Task 2. Conduct Additional Meetings With Potential Carrier Partners to Determine Possible Joint Initiatives

We would also recommend strategies for partnerships with the private providers. In our experience advising other state-wide broadband deployment projects, we are familiar with a range of public-private partnership models. We would propose to meet with Frontier Communications and other incumbent and potential wireline or wireless providers in the State to discuss existing offerings and future plans and interest in offering services. In our experience with Frontier in other states, particularly North Carolina, we have found them to be a willing partner in pilot programs to promote broadband adoption among low-income residents. Similarly, we have found Shentel and Comcast to be willing partners in rural Maryland and other areas, both with respect to infrastructure and adoption programs (the FCC's recently announced Connect to Compete program is modeled on a Comcast initiative and could have strong impact in the State). The potential exists to implement similar programs in West Virginia.

Task 3. Conduct Additional Meetings With Manufacturers and Other Potential Partners to Determine Possible Funding Streams

In our experience, in many states the private sector has not been fully engaged in supporting public broadband programs. We believe there is an untapped opportunity to ask manufacturers and other large employers in the State to support the State's broadband initiatives, in part because the improved economic and education outcomes will serve those companies well. We therefore propose to undertake an exploratory effort to determine if there exist potential private funding streams for the State's efforts.

2.4.8 Objective 8: Advisory Consultancy Services

Please describe how you would provide advisory consultancy service for the development, implementation or refinement of state broadband projects and programs focused on development, deployment or adoption of broadband technologies to include an independent and objective analysis of existing plans and operational strategies around the same.

Summary: We propose to undertake a rigorous evaluation of the State's potential and existing programs on both the deployment (supply) side and adoption (demand) side. The evaluation will be based on the extensive data collection proposed above. Most importantly, it will be independent. To this end, we propose the following tasks:

Task 1. Prepare Demand Side Evaluation and Recommendations

As discussed in the previous sections, our team will prepare a final report that would include the following:

- Document findings from stakeholder interviews
- Present the results of data collection efforts, including the optional survey work
- Identify opportunities to coordinate and aggregate regional broadband demands
- Recommend State and local projects that can serve to meet both demand and suppy side needs for broadband, including with discussion of different business models and funding options

Task 2. Ongoing Consulting as Necessary to Develop and/or Critique Relevant Programs

As an optional, additional task, our project team members are available to provide ongoing support in reviewing, updating, and guiding the efforts of the State. CTC's principals currently serve as ongoing consulting support to the District of Columbia, State of Maryland, and Colorado Eagle-Net project in their BTOP-funded broadband efforts.

3. References

The following references can speak to our performance and experience on engagements similar to the tasks we are proposing for the State of West Virginia. Many additional references are available on request.

3.1 CTC References

CTC has provided business planning services for a range of clients. The following references can speak to our work on projects of similar size and scope to proposed State of West Virginia engagement. Additional references are available on request.

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Gregory.Urban@doit.state.md.us

Service provided:

CTC provided extensive business planning, business modeling, and pro forma preparation for the State of Maryland's One Maryland program, a BTOP-funded initiative to build an interconnected fiber-optic broadband network that will reach every county and city in Maryland and will provide backbone and middle-mile capacity for commercial carriers. Our work on this statewide effort is ongoing.

Dates: 2009 to present

Mr. Jeff Reel
Executive Director
Keystone Initiative for Network Based Education and Research (KINBER)
(814) 863-2428
jreel@kinber.org

Service provided:

CTC is currently developing a sustainable business model and evaluating business plans for KINBER, the statewide BTOP-funded network in Pennsylvania. The focus of our analysis has been to provide recommendations and insight on business plan improvements and risks in the effort to increase KINBER's range of potential customer/stakeholders, improve take rates and cash flow, and enhance the financially viability of the KINBER enterprise. Our work on this statewide effort is ongoing.

Dates: 2011 to present

Mr. Frank Shap
Assistant Director of Economic Development
Garrett County, Maryland
203 South 4th Street, Room 208
Oakland, MD 21550
301-334-1986
fshap@garrettcounty.org

Service provided:

CTC is currently developing a broadband feasibility study and network design, with a specific focus on maximizing the benefits and use of the fiber backbone being built by the One Maryland Broadband Network (OMBN) project, which is funded through a Broadband Technology Opportunities Program (BTOP) grant. This project also focuses on increasing broadband access for County residents, businesses, and visitors. Our work on this engagement is ongoing.

Dates: 2011 to present

Ms. Adriana Umberger
MIS Coordinator, Prince George's County, Maryland
Prince George's County Office of Information Technology and Communications
9201 Basil Ct, Suite 250
Largo, MD 20774
(301) 952-3303
aumberger@co.pg.md.us

Service provided:

CTC provided the concept, engineering design, and project management for the National Capital Region Interconnection Network (NCRnet)—a 120-mile public safety network interconnecting 19 fiber-optic based government networks in the greater Washington, D.C. region. Our work supports NCRnet in meeting a range of requirements under its funding by both NTIA's Public Safety Interoperable Communications grant program and DHS's Urban Areas Security Initiative. Our work on this engagement is ongoing.

Dates: 2005 to present

Mr. Michael Smeltzer
Director, Campus Information Technologies and Educational Services (CITES)
University of Illinois at Urbana–Champaign
2101 Digital Computer Laboratory, MC-256
1304 West Springfield Ave
Urbana, IL 61801
(217) 244-3835
smeltzer@illinois.edu

Service provided:

CTC supported the Urbana-Champaign Big Broadband (UC2B) Coalition, comprising the University of Illinois and the cities of Champaign and Urbana, in preparing its successful application for a BTOP grant to support its proposed FTTP network. CTC provided financial planning services and developed the project's required pro forma statements, among other network engineering, and strategic planning tasks. Our work on this engagement is ongoing.

Dates: 2009 to present

Dr. Lev Gonick
Chief Information Officer and Vice President, Information Technology Services
Case Western Reserve University
(216) 368-1025
Lev.Gonick@Case.edu

Service provided:

CTC is providing ongoing strategic and engineering support to the University Circle Innovation Zone "Beta Block" project in Cleveland, Ohio—the first gigabit fiber-to-the-premises (FTTP) initiative in the United States. Our work on this engagement is ongoing.

Dates: 2009 to present

Mr. Chris Vein
Deputy United States Chief Technology Officer for Innovation
Office of Science and Technology Policy
The White House
Formerly Chief Information Officer, City and County of San Francisco
cvein@ostp.eop.gov
(415) 225-7254 (mobile)

Service provided:

Over the past five years, CTC prepared a series of path-breaking analyses of the feasibility of the City of San Francisco building and operating a fiber-to-the-premises (FTTP) network to every home and business in San Francisco—including analysis of multiple business models and financial recommendations customized for San Francisco's unique circumstances, as

well as a system design and detailed analysis of candidate architectures and open access models. CTC also helped the city with business planning, financial analysis, and engineering design to support its preparation of a BTOP application for the FTTP project.

Dates: 2007 to 2011

Mr. Tegene Baharu
Deputy Chief Technology Officer, Infrastructure Services
Government of the District of Columbia
655 15th St NW, Suite 400
Washington, D.C. 20005
(202) 727-7349
tegene.baharu@dc.gov

Service provided:

CTC has prepared extensive business case and business plan analysis for DC-Net, a fiber optic telecommunications network that provides voice and data services for the District of Columbia. We also developed the strategy and business plan for the city's successful BTOP grant application. Our work on this engagement is ongoing.

Dates: 2008 to present

Ms. Carol Butler
Director, Corporate Performance Division
Seattle City Light
700 Fifth Avenue, Suite 3036
P.O. Box 34023
Seattle, WA 98124-4023
(206) 615-1249
carol.butler@seattle.gov

Service provided:

CTC conducted a feasibility study, business case analysis, and "off-the-balance-sheet" benefits analysis for the city's proposed fiber-optic network. In addition, CTC has done extensive business planning, market assessment, and business modeling for Seattle over several years.

Dates: 2008 to present

3.2 Baller Herbst Law Group References

The following individuals can provide extensive insights about Baller Herbst's work on public broadband projects. Contact information for current or former clients is available on request.

Mark Ansboury
President, Gigabit Squared
Cleveland, Ohio
(216) 216 401-8023

Tom Barzee
General Counsel
North Kansas City, Kansas
(816) 274-6009

Katie Espeseth
Head of Chattanooga Fiber Project
Chattanooga, Tennessee
(423) 648-3297

Terry Huval
Director, Lafayette Utilities System
Lafayette, Louisiana
(337)-278-0306

Jack Pace
Senior Counsel, City of Chicago
Chicago, Illinois
(612) 744-6997

Steve Reneker
Chief Information Officer, City of Riverside, California
(951) 826-5109

Wes Rosenbalm
Utility Director, Bristol Virginia Utilities
(276) 645-8701

Scot Rourke
CEO, OneCommunity
Cleveland, Ohio
(216) 403-0877

3.3 Jane Smith Patterson References

The following references can speak to Jane Smith Patterson's experience on a range of broadband analysis and development engagements, including her work for the State of North Carolina.

Representative Joe Tolson
Co-Chair, elearning Commission and Joint Select Committee on Information Technology
North Carolina Houses of Representatives
(929) 715-3024
Joe.tolson@ncleg.net

Brooks Raiford
President & CEO
North Carolina Technology Association
(919) 890-0770
braiford@nctechnology.org

Mark Wells
Executive Director
Rockingham Business and Technology Center
(336) 342-7853
mwells@rockinghambusiness.org

Sam Walls, Sr.
CEO, Arkansas Capital Corporation
(501) 529-1792 (mobile)
swalls@arcapital.com

Billy Ray Hall
President, North Carolina Rural Economic Development Center
(919) 250-4314
brhall@ncruralcenter.org

Dr. Hope Williams
President, North Carolina Independent Colleges and Universities
(919) 832-5817
(919) 345-6825 (mobile)
williams@ncicu.org

Galen Updike
Broadband Initiative Director, Arizona Department of Administration
(602) 364-4794
(602) 614-3831 (mobile)
galen.updike@azdoa.gov

4. Key Project Personnel

4.1 *Columbia Telecommunications Corporation*

Joanne S. Hovis, Esq.
President and Director of Business Consulting

Joanne Hovis is President of CTC and directs all work in the areas of business consulting, strategic planning, market assessment, and management consulting. She is an attorney with a background in communications and commercial litigation. Ms. Hovis is a 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.

Ms. Hovis oversees all ongoing CTC research and analysis for local government clients and frequently provides business planning and market analysis for communications networking initiatives such as San Francisco's planned fiber network and the regional, interoperable public safety communications network currently under development in the Washington, D.C. metropolitan area. She advises not-for profit and public entities regarding strategic and business considerations for building community broadband networks, both in the "middle" and "last" mile areas, and provides guidance in the areas of funding opportunities including the federal E-rate and other Universal Service Fund programs.

Ms. Hovis is in wide demand as a speaker and expert source on broadband deployment issues. She has been interviewed by publications including *BusinessWeek*, the *Washington Post*, and the *Baltimore Sun*. She has been featured as a guest on the C-SPAN show "The Communicators." She has provided expert guidance to the National League of Cities, the National Association of Telecommunications Officers and Advisors, Technology Policy Summit, Google, ARCEP (the French communications regulatory agency, equivalent to the FCC), and the Congressional Internet Caucus.

She has advised numerous foundations and policy non-profits regarding broadband, including the Ford Foundation; the Corporation for Public Broadcasting; the Humboldt Area Foundation; Redwood Coast Rural Action; the Berkman Center for Internet and Society at Harvard University; OneCommunity; the Knight Center of Digital Excellence; the William Penn Foundation; the Institute for Next Generation Internet at San Francisco State University; and the Metropolitan Washington Council of Governments. Ms. Hovis leads the CTC teams that advise the cities of San Francisco, Seattle, and Washington, D.C. regarding fiber-to-the-premises networking. She advises a number of universities regarding broadband planning, including the University of Illinois and Case Western Reserve University.

Ms. Hovis serves as President of the National Association of Telecommunications Officers and Advisors (NATOA), the national association that represents local governments and promotes community interests in communications matters. She is also a member of the Benton Foundation's

Board of Directors, and a charter member of the United States Unified Community Anchor Network (U.S. UCAN) project's Task Force on Community Anchor Network Economic Models.

Ms. Hovis leads the company's work for not-for profit entities and oversees CTC's educational offerings and training programs, which are offered by several universities. Ms. Hovis has authored extensive white papers on communications topics for government agencies (including the Internal Revenue Service) and non-profit organizations (including the Center for Internet and Society at Stanford Law School, Free Press, Media Access Project, the Institute for Next Generation Internet at San Francisco State University, National Public Lightpath, the William Penn Foundation, the Center for Digital Democracy, and the American Civil Liberties Union).

Ms. Hovis previously worked as an attorney with Jenner & Block in Chicago and Mintz, Levin, Cohn, Ferris, Glovsky, & Popeo PC in Washington, D.C. At those firms, she worked on complex communications and litigation projects for such clients as Salomon Brothers and Turner Broadcasting.

EDUCATION

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

- Patino Fellow, awarded for academic achievement and community service, 1991–1994

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

- General Distinction and Distinction in the Major, 1990
- Dean's List, 1988–1990
- Weinstein Award, 1990

Hebrew University of Jerusalem, Davis Institute for International Studies, 1989

PROFESSIONAL CERTIFICATIONS/LICENSES

Member of Illinois Bar Association
Member of District of Columbia Bar Association

ORGANIZATIONS

Benton Foundation, Director
National Association of Telecommunications Officers and Advisors (NATOA), 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

Andrew Afflerbach, P.E., Ph.D.
CEO and Director of Engineering

Dr. Andrew Afflerbach specializes in system-level planning, design, and implementation of wide-area and local-area telecommunications networks. Based on his extensive experience with high-capacity networks, Dr. Afflerbach brings a clear understanding of the capabilities and limitations of broadband services to bear on the analysis of candidate architectures, vendor proposals, network needs assessments, and market research.

Dr. Afflerbach and CTC have assisted numerous governments and non-profit institutions with technological projects—ranging from fiber-optic to wireless communications networks; from video networking and applications to Homeland Security applications; from communications system performance evaluation to development of targeted emergency override capabilities; from assessment of current needs to development of strategic networking roadmaps; and from negotiations with the telecommunications industry to the technical briefing of Commissioners and staff of the U.S. Federal Communications Commission (FCC).

Dr. Afflerbach has planned and overseen implementation of a wide variety of data, video, and voice networks utilizing the full range of communications technologies, including fiber-optics, cable modem, and wireless. These networks include the infrastructure of metropolitan area governments, multi-campus colleges, and state-wide networks for public safety, government, and educational facilities.

He assists officials in planning network requirements; preparing requests for proposals; evaluating potential service providers, equipment vendors, and systems integrators; and overseeing construction and cut-over from existing systems. He has modeled communication networks for system performance, reliability, and potential costs relative to alternative designs.

In addition, Dr. Afflerbach has architected, designed, and overseen implementation of numerous broadband networks for local and state governments, including those of Washington, D.C.; Crown Fibre Holdings (Government of New Zealand); San Francisco; the Delaware Department of Transportation; the Maryland Transportation Authority; and many large counties. Some of his other recent clients include Los Angeles, Cincinnati, and Seattle.

Dr. Afflerbach serves as technical advisor to the Chief Technology Officer of Crown Fibre Holdings, the entity overseeing the construction of a $1 billion fiber optic network to 75% of all homes in businesses in New Zealand. Dr. Afflerbach worked closely with the candidate fiber construction companies across the nation to develop requirements for outside plant fiber and network electronics and to develop bid specifications for a nationwide procurement.

Dr. Afflerbach 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 current lack of standards in the Smart Grid arena, and the magnitude of the investment that the regulated utilities were proposing.

Dr. Afflerbach's expertise includes emerging technologies and state-of-the-art technological applications, as well as public safety networking. Dr. Afflerbach is a licensed Professional Engineer and, as Director of Engineering, he oversees all engineering work performed by CTC.

Advisory Services

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

- Served as technical advisor to the 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.
- Provided, in August 2009, expert testimony to the U.S. Federal Communications Commission (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, 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.
- Prepared technical reports and analysis regarding fiber construction for submittal to the FCC, in connection with preparation of the National Broadband Plan, by NATOA, the City and County of San Francisco, and the Schools, Health, and Libraries Coalition.
- Provided expert technical advice on the 700 MHz 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).
- Advised, during the height of the broadband "open access" debate, a variety of public interest associations and communities, including the City of Los Angeles and Stanford University, regarding the technical means by which cable networks could be opened to competition.
- 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.
- Provided technical advice to numerous non-profits, associations, and agencies as diverse as the Center for Internet and Society at Stanford Law School; the Internal Revenue Service, the

Alliance for Community Media, the William Penn Foundation, the Center for Digital Democracy, and the FCC's Local and State Government Advisory Board (LSGAC).

- Has been invited to speak about communications technologies before such organizations as the Public Technology Institute, American Association of Community Colleges, ICMA, ILCMA, and the Practicing Law Institute.
- Developed curricula for a wide variety of organizations, including the University of Maryland, the United States Department of Transportation, and the George Washington University.
- Has taught courses and delivered seminars regarding communications for numerous educational and government institutions.

Wireless Communications Engineering

Dr. Afflerbach and the CTC team create wireless plans, design wireless networks, and engineer/implement pilot projects for our clients. CTC engineers and analysts assess existing and projected wireless broadband needs and technologies and recommend potential strategies for utilizing these technologies and services to enhance and improve network operations and services in the future for numerous clients. Some of the examples of CTC's representative client projects under Dr. Afflerbach's leadership include:

- Designed and implemented a microwave network to enable extensive patient tracking by the public safety and public health communities in the 19-jurisdiction (DC, MD, VA) regional interoperability network of the National Capital Region in the event of an emergency. Site selections, frequency coordination, and microwave path analysis were completed, and this innovative inter-jurisdictional microwave network is designed to mesh with a fiber-optic network connecting the D.C. metro jurisdictions and provide airbridges to hospitals in the D.C. metro area. This project is funded by a grant from the Department of Homeland Security Urban Areas Security Initiative (UASI).
- Designed and specified equipment needed for a wireless network of hot spots in the central business district in Northbrook, IL. This wireless network leverages the existing fiber optic network in the community as the backhaul.
- Advised, designed, and implemented the deployment of a "wireless downtown" for Skokie, IL to enhance economic development and Internet accessibility for residents and visitors to the downtown area.
- Led a team who designed a cost-effective, broadband wireless network for Annapolis, MD. This network will serve as a backbone to link all city facilities, and ultimately provide connectivity for a citywide video surveillance system. The network will have the capacity to meet all current needs, provide 99.999% availability, and have substantial reserve capacity to support the addition of new video requirements, expanded toll-quality IP-based voice and data services, and potentially support backhaul for a future mobile wireless solution.
- Assisted the City of Rockville, MD in developing an infrastructure plan to support implementation of WiFi services throughout a downtown area targeted for economic development. The plan focused 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.

- Provided an assessment of existing and projected wireless broadband needs and technologies in Alexandria, VA. Also recommended potential strategies for using these technologies and services to enhance and improve City operations.
- Assisted Mesa, AZ in evaluating bids from wireless service providers who responded to the City's RFP. In an earlier phase of the project, CTC provided an assessment of WiFi technology and potential expansion of the fiber optic infrastructure via mass wireless communications, potentially for an intelligent transportation system application and for free Internet access for citizens.
- Researched current and future wireless technologies and evaluated the feasibility of implementing a secure public safety wireless network in Prince George's County, MD. CTC also designed and implemented a pilot project to test the feasibility of a public safety wireless network. Also successfully deployed a solution to enable Mobile Data Computers in emergency response vehicles to securely roam from a carrier CDMA network to private, County-operated WiFi hotspots.

Video and Cablecast/Broadcast Communications Engineering

Under Dr. Afflerbach's leadership, CTC provides engineering and analysis services in the area of video and cable/broadcast engineering for a wide variety of government agencies and users in a variety of applications including public safety, public health, emergency response, criminal justice, and programming. Dr. Afflerbach oversees CTC engineers in planning and development of infrastructure for signal transmission, design technology, and equipment and engineering design. He and his staff work with federal agencies, local governments, first responders, and programmers in developing equipment specifications and preparing invitations for bids from equipment suppliers. CTC engineers also design studio and transmission facilities for use in production. Dr. Afflerbach oversees CTC engineers who review equipment funding requests by critiquing equipment lists for technical compatibility with existing equipment, ensuring that equipment requests are reasonable in terms of present and emerging technology, and consistent with network system design. Under Dr. Afflerbach's supervision, CTC video technicians also oversee equipment maintenance and troubleshoot problems as necessary.

Some select examples of Dr. Afflerbach's recent work include:

- Assisted the U.S. Navy Exchange Service Command with the review and revision to an RFP for a private provider to offer cellular, WiFi hot spot, cable television, and high-speed Internet access to all living quarters on base in Guam, as well as providing similar services to off-base personnel.
- Assisted the emergency managers of the 19 jurisdictions in the National Capital Region (Washington, D.C. and surrounding jurisdictions) to develop state-of-the-art videoconferencing and teleconferencing tools for the region's Emergency Operations Centers (EOCs) and Emergency Communications Centers (ECCs). CTC developed the systems' designs and oversaw implementation to interconnect the EOCs and ECCs throughout the region, under a grant from the Department of Homeland Security Urban Areas Security Initiative (UASI).

- Prepared system level design recommendations and cost estimates for the Mesa (AZ) Fire Department for an extensive, citywide system to support interactive and on-demand video communications for training, emergency collaboration, and routine meetings between Fire Department personnel. The system is designed to leverage private digital cable television channels and cable modem services acquired by the City, and a rapidly growing private fiber infrastructure. Working with a local cable television provider, a pilot videoconferencing system was integrated to demonstrate certain capabilities of the system design.
- Designed and delivered video and telemetry from the traffic helicopter to the Prince George's County (MD) TRIP Center, the display of video and the helicopter location at the TRIP Center, and quick implementation at a low cost. This project leveraged existing antennas and the active private County fiber optic network.

Public Safety Network Interoperability and Interconnection

Dr. Afflerbach serves 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 grant from the U.S. Department for Homeland Security's Urban Areas Safety Initiative. He wrote the initial feasibility studies that led to this project for regional network interconnection.

Instruction/Expertise

Dr. Afflerbach 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 teaches 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 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.

Dr. Afflerbach has also prepared client tutorials and presented papers on emerging telecommunications technology 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 also taught college-level astrophysics at the University of Wisconsin.

EMPLOYMENT HISTORY

1995–Present	CEO/Director of Engineering, CTC Previous positions: 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, 1993-96. Selected by NASA for elite research fellowship.

Master of Science, Astrophysics, University of Wisconsin–Madison, 1993
Bachelor of Arts, Physics, Swarthmore College, 1991

PROFESSIONAL CERTIFICATIONS/LICENSES

Professional Engineer, Commonwealth of Virginia

HONORS/ORGANIZATIONS

- Armed Forces Communications and Electronics Association (AFCEA)
- Society of Cable and Telecommunications Engineers (SCTE)
- National Association of Telecommunications Officers and Advisors (NATOA) Technology and Public Safety Committees
- Institute of Electrical and Electronic Engineers (IEEE)
- Charleston Defense Contractors Association (CDCA)
- NASA Graduate Fellow, 1993-96. Research fellowship in astrophysics
- Elected Member, Sigma Xi Scientific Research Honor Society

SELECTED PUBLICATIONS, PRESENTATIONS, and COURSES

- "Cost Estimate for Building Fiber Optics to Key Anchor Institutions," prepared for submittal to the FCC by the National Association of Telecommunications Officers and Advisors and the Schools, Health, and Libraries Coalition, September 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, August 2009.
- "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, August 25, 2009.
- "Existing and Emerging Broadband Technologies," presented at the annual NATOA Conference, Orlando FL, October 2007.
- "An Assessment of the Technical Capabilities of the AWS-3 Spectrum," expert report prepared for Free Press, December 2007.
- "An Engineering Assessment of Select Technical Issues Raised in the 700 MHz Proceeding," expert report prepared for FCC filing for Free Press and Media Access Project (Public Interest Spectrum Coalition), May 2007.

- "Understanding FiOS and U-Verse Architecture," presented at NATOA's Policy and Legal Conference, Washington, D.C., Spring 2007.
- "Fiber to the Premises and Fiber to the Node," Journal of Municipal Telecommunications Policy, Fall 2006.
- "Communications Infrastructure Primer," presented to the National Fire Protection Association, Miami Beach, FL, 2006.
- Supplemental Report, "Technological Analysis of Open Access and Cable Systems," http://www.aclu.org/Privacy/Privacy.cfm?ID=17507, prepared for the American Civil Liberties Union and the Stanford Law School Center for Internet and Society, 2005.
- *Affordable Telecommunication Networks for Local Government*, International City/County Management Association, November 2004.
- "Telecommunications and ITS: What You Need To Know," prepared curriculum for two-day training course for the University of Maryland, 2001.
- "Technological Analysis of Open Access and Cable Systems," http://archive.aclu.org/issues/cyber/broadband_report.pdf, prepared for the American Civil Liberties Union, 2001.
- "No Pipes: Wireless Broadband," Journal of Municipal Telecommunications Policy, Fall 2001.
- "Interactive PEG: A Technical Strategy for Implementation," Community Media Review, Winter 2000.
- "Telecommunications and Intelligent Transportation Services," two-day training course, presented in multiple cities for the US Department of Transportation/ITS America, 1999.
- "Building Integrated Voice, Data, and Video Networks for the Local and Wide Area," two-day training course, presented for the University of Maryland, College Park, MD, April 29-30, 1999.
- "Integrated Data, Video & Voice Broadband Networks," week-long training course, presented at the COMNET Exposition, Washington, DC, and January, 1999.
- "LANs: Design and Installation of Networks that Support Voice, Data, and Video Applications," multi-day training course, presented for the George Washington University Continuing Engineering Education Program, July, 1996; July, 1997; February, 1998; July, 1998; May, 1999.
- *Cable Network Technology: A Primer for Local Officials*, International City/County Management Association, September 1998.
- "I-Nets and the Internet," Infotech Report, August 1998.
- "Integrated Data, Video & Voice Broadband Networks" and "Design & Implementation of Metropolitan Area Networks (MANs)," presented at the COMNET Exposition, Washington, DC, and January, 1998.
- "Interactive Data, Video & Voice Via the Cable-TV Subscriber Network," NATOA News Quarterly, Fall 1997.
- "High Speed Data Service Now Available Over Standard Telephone Lines," NATOA News Quarterly, Spring 1997.

Thomas J. Asp
Principal Engineer and Business Analyst

With more than 20 years of experience as a business analyst and an engineer on communications networks and public power systems, Tom Asp is widely recognized as an expert in broadband business and strategic planning. Mr. Asp, who holds both an MBA and an engineering degree, has served as lead for more than 50 broadband projects during his career—both with Columbia Telecommunications Corp. and, previously, as a partner at the public accounting firm Virchow Krause—and brings a wealth of practical fiber optic business planning experience to his projects.

Mr. Asp is regarded as one of the premier analysts in the United States regarding planning and deployment of broadband systems to meet economic development, digital inclusion, and other needs. He has assisted more than 100 governments, municipal utilities, and consortia to evaluate their communities' communications needs and determine the financial parameters and business case for meeting those needs.

Mr. Asp's experience includes preparing economic analysis, market assessment, technology review, vendor analysis, and business plan development for municipal networks. He has conducted market assessments to evaluate the feasibility of city-owned networks, and has reviewed options under cable franchise agreements for municipal purchase and operation. Mr. Asp has also reviewed the offerings and operations of incumbent telecommunications providers and assisted municipalities in their negotiations with incumbent telecommunications providers to enhance the availability of existing services and to encourage new and innovative offerings.

In addition to evaluating financing scenarios and the financial impact of projects on operations, Mr. Asp specializes in evaluating network connectivity options from an engineering standpoint and recommending effective network solutions for local governments and utilities. Mr. Asp also has significant experience in cellular, cable TV, broadband, and mobile radio, including as a product manager in the cellular mobile telephone, automatic meter reading (AMR), and distribution automation (DA) industries.

Some select examples of Mr. Asp's projects include:

- Managed project assisting Bountiful City, UT with the development of a business plan for a city-wide 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 WiFi hot spots and supporting infrastructure.
- Led CTC team in investigating several WiFi deployment models, development of a business plan (including market research and financial analysis), and development of a partnership RFP for St. Louis Park, MN. CTC 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.
- Assisted the District of Columbia with DC-Net, the City's internal broadband communications network, including strategic technical and business planning for meeting the needs of City users and agencies.
- Assistance in the implementation of an institutional fiber network (I-Net) for Norwich Public Utilities in Norwich, CT. CTC is also providing assistance to develop a plan and strategy for a Norwich fiber optic enterprise.
- Assisting the Los Angeles Department of Water & Power with a fiber optic strategic plan for its fiber optic enterprise.
- Providing market research and analysis for the second phase of a fiber-to-the-premises (FTTP) study in San Francisco, CA. CTC prepared a path-breaking analysis of the feasibility of the City building and operating an FTTP network to connect every home and business in San Francisco. This was the first study of its kind by a major American city.

EMPLOYMENT HISTORY

2006–present	Principal Engineer/Analyst, Columbia Telecommunications Corporation
2000–2006	Partner, Virchow Krause & Company, LLP
1993–2000	Principal, Power System Engineering
1991–1993	Product Manager, Iris Systems Inc.
1983–1991	Product Manager, E.F. Johnson Company
1980–1983	United Power Association

EDUCATION

- **Bachelor of Science**, Electrical Engineering, North Dakota State University, 1979
- **Master of Business Administration**, University of St. Thomas, St. Paul, 1989

SELECTED PUBLICATIONS

Mr. Asp was a contributing author of municipal broadband publications commissioned and distributed by the American Public Power Association (APPA), including:

- Reviewer, author, and editor, "Community Broadband Guidebook, A Management Guide to Business Opportunities and Telecommunications Technologies for U.S. Public Power Systems," April 2003
- Reviewer, author, and editor, "Utilities Telecommunications Guidebook, A Management Guide to Business Opportunities and Telecommunications Technologies for U.S. Public Power Systems," September 2000

Mr. Asp has co-authored, reviewed, and edited a number of publications and articles in a range of publications for the National Rural Electric Cooperative Association (NRECA) Cooperative Research Network (CRN) including:

- Reviewer and editor, "An Overview of Selected Information/Automation Technologies"
- Reviewer and editor, "Automating a Distribution Cooperative from A to Z"
- Primary author, "Catalogue of Distribution Automation Products"
- Reviewer, "Enterprise-Wide Data Integration in a Distribution Cooperative"
- Co-author, reviewer, and editor, "The New Telecommunications Environment"
- Reviewer, "Power Line Communication: Capabilities and Limitations" Reviewer, "Shared Inventory Viewing: A Demonstration of Information Systems Linking Groups of Cooperatives"
- Primary author, "Use of Low Earth Orbiting Satellites by Electric Cooperatives"
- Reviewer and editor, "An Overview of Selected Information/Automation Technologies"

Mr. Asp also contributed to Columbia Telecommunications Corporation's series of strategic reports for public entities. Among the topics he covered were:

- Bridging the Digital Divide, January 2006
- Broadband: A Key Development Strategy, December 2005
- Broadband Network Financial Analysis—Factors to Consider, February 2006
- Broadband Technology Selection Frame Work, January 2006
- Communicate the Value of Connectivity to Bridge the Digital Divide, January 2006
- Fiber-to-the-Home: Deployment Considerations, February 2006
- Five Steps for Designing an Effective Survey, January 2006
- Public Safety and Wireless Networks, December 2005
- Strategy for Municipal Connectivity, January 2006

In addition, many of Mr. Asp's articles have been published in association journals, including:

- *All WiFi Projects are Not the Same: A Comparison of Major Community Wireless Plans,* NATOA Journal of Municipal Telecommunications Policy, National Association of Telecommunications Officers and Advisors (NATOA), Spring 2007
- *WiMax? WiFi? Which One?*, Minnesota Association of Community Telecommunications Administrators (MACTA), MACTA Connections, Spring 2005
- *Broadband Power Line Technology*, Minnesota Association of Community Telecommunications Administrators (MACTA), MACTA Connections, Spring 2004
- *Is Broadband Power line Technology Ready for Widespread Deployment?*, Minnesota Municipal Utility Association, March 2004
- *Assessing the Marketplace for Telecommunications Services*, Minnesota Association of Community Telecommunications Administrators (MACTA), MACTA Connections, Winter 2003
- *Link Michigan: Broadband for All...Can You Imagine the Possibilities?,* Journal of Municipal Telecommunications Policy, National Association of Telecommunications Officers and Advisors (NATOA), Fall 2003
- *Assessing the Marketplace for Telecommunications Services,* Public Power Magazine, American Public Power Association Public Power, September 2001
- *Creating Advanced Communications in Your Community: Where to Begin*, Illinois Municipal Review, January 2001

- *View AMR as a Customer Link to Realize Benefits, Increase Efficiency and Select the Right Technology*, AMRA News, Automatic Meter Reading Association, August 2000

Mr. Asp has also published a range of articles on other telecommunications topics:

- "Is There Anything Wrong With the Community Overbuild Triple Play Picture?" April 2005
- "Municipal Fiber-to-the-Home Advocates: Is the Tail Wagging the Dog?" April 2005
- "WiMAX? Wi-Fi? Which One?" April 2005
- "Broadband Over Power Line (BPL) and Wireless Technology Update," January 2005
- "Municipal Connectivity: The Legal Debate," January 2005
- "Universal, Affordable Access to Broadband: A Notable Goal… But Undefined," January 2005.
- "Obtaining Competitive Broadband Services in Your Community," January 2005
- "Five Steps for Designing an Effective Survey," June 2004
- "Is Your Broadband Network Financial Analysis Accurate? Factors to Consider," June 2004
- "Developing Strategies to Advance Telecommunications," June 2003

Wes Kelley
Principal Analyst

EXPERIENCE SUMMARY

Wes Kelley specializes in fiber-to-the-premises (FTTP) operations/networking, Smart Grid technologies, and advanced metering infrastructure (AMI), as well as general telecommunications and information technology. He has more than a decade of experience in network development, marketing, financial analysis, community/economic development, strategic planning, and network deployment, and has worked for and with utilities, municipalities, and higher education institutions. He has particular expertise in business planning, continuity of operations, interoperability reviews, technical and business project management, market research, customer service, and public policy.

As Chief Executive Officer of Pulaski Electric System (PES)/PES Energize, Mr. Kelley provides executive leadership to an electric and telecommunication utility with 70 employees and combined revenues over US$43 million. He has direct, day-to-day responsibility for the planning, operation, marketing, and deployment of an FTTP network that delivers broadband voice, video, and data services to that municipal electric's customers. He also leads and facilitates strategic and financial planning with policymakers and the executive management team to address capital and operational budgeting, ratemaking, human resource management, and other utility-related disciplines. As Executive Vice President, he directed the customer service, billing, metering, energy services, marketing, and information technology departments of the 14,500-customer utility.

At CTC, Mr. Kelley has evaluated and offered guidance on operational and business issues for a range of electric utilities and municipal government clients. Mr. Kelley is currently an executive adviser to the government of Washington, D.C. in regard to business planning and operations of its DC-Net fiber network.

Mr. Kelley's diverse professional experience also encompasses a range of other challenging telecommunications projects, including:

- As the project manager for a 33,000-square-foot building expansion/renovation project, he guided the construction of a state-of-the-art utility operations and data center within a fully redundant bunker built to withstand an F5 tornado.
- Mr. Kelley has launched many operational software systems, including customer information systems, billing and provisioning systems, outage management systems, and network element management systems.

EMPLOYMENT HISTORY

2008–Present	Principal Analyst Columbia Telecommunications Corporation
2009–Present	President & Chief Executive Officer Pulaski Electric System (PES)/PES Energize, Pulaski, TN
2005–2009	Executive Vice President & Chief Marketing Officer Pulaski Electric System (PES)/PES Energize, Pulaski, TN

2003–2005	Economic Development Director City of Hillsdale, MI
1999–2005	Assistant Director of Utilities Hillsdale Board of Public Utilities, Hillsdale, MI
1996–1999	Associate Director for Network Development Hillsdale College, Hillsdale, MI

EDUCATION

Bachelor of Arts, Political Economy and Christian Studies (*cum laude),* Hillsdale College

The George Washington University, Graduate School of Political Management—*Master's Degree, in progress*

SELECTED PROFESSIONAL ORGANIZATIONS AND SERVICE

- American Public Power Association's Economic Development Committee
- American Public Power Association's Broadband Committee
- President of Giles County Chamber of Commerce (2009)
- Vice Chairman of Tennessee Fiber Optic Communities
- Tennessee Valley Public Power Association's Technology Application Committee
- Alternate Commissioner to the Michigan South Central Power Agency

SELECTED SPEAKING ENGAGEMENTS

- "Valley Experience with AMI," TVPPA Engineering & Operations Conference, 2010
- "AMI Communications: FTTH," TMEPA Engineering & Operations Conference, 2009
- "Municipal Success Stories and Lessons Learned," FTTH Council, 2008
- "Selling Utility Services," TVPPA Customer Service Training, 2008-2010
- "Getting Started with Fiber-to-the-Home," American Public Power Association Community and Economic Development Conference, 2007
- "Planning Municipal Broadband Networks," SEATOA Annual Conference, 2007
- "Executive Roundtable," APPA Community and Economic Development Conference, 2006
- "Peer-to-Peer Case Study Review," APPA Telecommunications Workshop, 2001
- "Your Utility and Its Business Plan," APPA Telecommunications Workshop, 2000

David L. Randolph, MSEE, P.E.
Principal Engineer

David Randolph has been responsible for the design, construction, operation, and maintenance of thousands of miles of communications plant. He has overseen construction of new systems, rebuilds, and upgrades for more than 200 cable systems and public networks using fiber optic, microwave, and hybrid technology. Over the course of his career with CTC, and previously, as a Vice President for Engineering with Adelphia Communications, Mr. Randolph has been responsible for evaluating architecture, assessing technical performance, and overseeing construction of communications networks in more than 50 jurisdictions in eight states.

As Principal Engineer for CTC, Mr. Randolph has completed fiber-to-the-premises (FTTP) network designs for Dubuque, IA, Palo Alto, CA, San Francisco, CA, Portland, OR, and Lake City, CO. He has also designed, evaluated, and overseen upgrades of fiber optic networks for municipal and utility company usage, including for Northbrook, IL, Breese, IL, Norwich, CT, Dover, DE, Lake Forest, IL, Murfreesboro, TN, Palo Alto, CA, Ventura, CA, Victorville, CA, Fredericksburg County, VA, and Arlington, VA.

Mr. Randolph's additional experience includes the design and construction of an 18 GHz omni-directional microwave system in Warsaw, Poland; 28 GHz MDS microwave; and broadband AML microwave with active reverse in the 7-18 GHz frequency range. He has overseen the integration of T1, DS3, OC-48, and proprietary formats for the provision of data and television services.

Mr. Randolph has 40 years of broad and diversified experience including 10 years in the teaching and broadcast fields and 35 years of progressive communications expertise. He holds Professional Engineer licenses in the states of Illinois, Maryland, and Tennessee.

WORK EXPERIENCE

2001–Present Principal Engineer, Columbia Telecommunications

1998–2001 Regional Vice President for Engineering, Adelphia Communications, Santa Monica, CA

- Launched local control digital TV, data, and planned IP telephony in over 400,000 passings;
- Consolidated 2,400,000 passings, 17,000 miles of plant, from Century, Comcast, and T.C.I. to Adelphia;
- Budgeted technical operations, upgrades, and rebuilds for 30 systems in the Southwest Region;
- Completed upgrades of over 3,000 miles of plant to 860 MHz;
- Established and cultivated excellent technical relations with franchise authorities and Consultants;
- Designed and constructed City fiber I-Nets in numerous franchises in the Southwest Region; and

- Implemented technical policies, CLI, FCC, and construction procedures, with a staff of 12 engineering department heads.

1994–1998 Senior Systems Engineer, Cable AML, Torrance, CA

- Designed, tested, and installed broadband 18 GHz. Omni-directional microwave system in Poland;
- Tested and installed broadband microwave equipment in the 7–28 MHz range in the U.S., South America, Europe, Asia and Australia. Systems designed and delivered for wide-band bi-directional data services including 28 GHz. LMDS; and
- Integrated T1, DS3, OC48, and proprietary data formats into microwave systems.

1989–1994 Regional Director/Engineering, Century, Santa Monica, CA

- Completed 1,800-mile rebuild in Los Angeles with first use of fiber and WDM technology;
- Reduced service calls by over 50 percent;
- Implemented technical policies, CLI, FCC proofs and construction policies and established Regional Technical Training Center;
- Developed and managed operational and capital technical budgets for the entire region;
- Region included 225,000 customers, eleven franchises, and 2,500 miles of plant;
- All new upgrades designed with self-healing fiber loops; and
- Provided fiber for use by AT&T/TCG and established co-located facilities.

1984–1989 Vice President/Engineering, Southwest - ATC, Grapevine, TX

- Completed all product evaluations for ATC while located in Denver;
- Developed budget for 140,000 customers, eight franchises, and 1,900 miles of plant;
- Initiated successful technical consolidation of Group W acquisition; and
- Reduced service calls by 25 percent and established all engineering policies.

1980–1984 Vice President Franchising/Engineering, Times Mirror, Irvine, CA

- Established Corporate Construction Manual and budgeted all construction projects;
- Instituted design specifications, construction parameters, and contractor selection;
- Represented Corporation as technical expert before all franchising and utility bodies;
- Prepared technical evaluation for purchase of Storer Arizona and California properties; and
- Responsible for construction of cable systems in Phoenix, Arizona.

1975–1980 Western Director/Engineering, Storer Cable TV, Houston, TX

- Franchised, designed, and constructed 2,500 miles of plant;
- Acquired and built 35 Franchises, served as technical expert before franchising authorities, and Established technical and construction standards for the region.

1964–1975 Chief Engineer/Faculty, Bradley University, Peoria, IL

- Taught Senior Electrical Engineering, was Chief Engineer for Telecommunications Center; and designed and constructed a statewide multi-channel microwave system.

EDUCATION
M.S.E.E., Bradley University, Peoria, Illinois, 1967

PROFESSIONAL AFFILIATIONS and HONORS

- National Society of Professional Engineers (NSPE)
- Licensed Professional Engineer, states of Illinois, Maryland, and Tennessee
- Eta Kappa Nu, National Electrical Engineering Honor Society

Marc Schulhof
Senior Analyst and Technical Writer

Marc Schulhof has 17 years of experience in technical writing, financial journalism, and public and corporate communications. Marc's excellent editorial skills and his extensive experience with analyzing IT and business topics have enabled him to play an integral role in supporting a range of research and writing projects, including:

- Needs assessments
- Feasibility studies
- Master plans (business and engineering)
- Strategic plans
- Expert witness testimony
- Federal grant applications
- Requests for proposal
- Cable system test reports
- Cellular tower siting reports
- Letters, press releases, and website content

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.

Marc's experience also includes his role as a global editor at PricewaterhouseCoopers Consulting, where he wrote and edited reports on a variety of technology and business topics, and served as editor of the PwC-sponsored *BusinessWeek Online Handheld Edition* daily news summary for mobile device users. As an associate editor at *Kiplinger's Personal Finance Magazine,* he researched, analyzed, and wrote about a range of complex financial issues.

Marc has also written and edited articles on a variety of topics for numerous non-profit organizations and associations, including the National Coalition for Cancer Survivorship and the American Society of Clinical Oncology.

EDUCATION
Bachelor of Science, Journalism, Northwestern University
Master of Science, Journalism, Northwestern University

HONORS/ORGANIZATIONS
In 2010, Marc was appointed by the U.S. Secretary of Health and Human Services to serve on the federal Advisory Council on Blood Stem Cell Transplantation.

4.2 Baller Herbst Law Group

Jim Baller
Senior Principal and Lead Counsel

Mr. Baller, who will serve as lead counsel if Baller Herbst is selected, is a senior principal based in the firm's office in Washington, D.C. His clients include the American Public Power Association, the National Association of Telecommunications Officers and Advisors, and dozens of local governments, public power utilities, and other entities in a wide range of communications matters. He has also been working with Google on its Fiber for Communities initiative. In addition, he was the founder and president of the US Broadband Coalition (www.bb4us.net), a consortium of more than 160 prominent organizations of all kinds that promoted the development of a national broadband strategy for the United States and recommended the framework that the Federal Communications Commission used in its National Broadband Plan.

The Fiber to the Home Council has recognized Jim as "the nation's most experienced and knowledgeable attorney on public broadband matters," and MuniWireless called him "the foremost legal expert on U.S. public broadband matters." In 2001, NATOA named Jim its Member of the Year. In 2006, MuniWireless awarded him its first "Esme Award" for "working tirelessly to protect the interests of municipalities, many times in the face of huge opposition." In 2007, NATOA honored him as its first "Community Broadband Visionary of the Year," for "almost single-handedly putting the need for a national broadband strategy to the forefront of public consciousness." Later in 2007, *Washingtonian Magazine* included Jim in its list of "Washington's Best Lawyers" (defined as the top one percent). In 2009, *Ars Technica* included Jim on its list of the 25 "Top Names in Tech Policy," and *FiberToday* named him its "Person of the Year." He is a frequent keynoter on broadband matters and is also co-host of the broadband television services, "Inside Voices on Critical Choices." He is a graduate of Dartmouth College and Cornell Law School.

Adrian E. Herbst
Principal

Adrian E. Herbst is a principal and in charge of the Firm's Minneapolis, Minnesota office. He has over 30 years of experience in municipal and governmental work. Adrian has represented hundreds of local governments throughout the country on cable television matters, including franchise renewals, transfers of ownership, governmental ownership alternatives, local I-Nets and PEG access, franchise compliance audits, rate regulation issues, and federal and state legislative and FCC regulatory proceedings. He has also been extensively involved in rights-of-way management, telecommunications regulation, development of fiber optic networks, municipal websites, social media issues, wireless zoning, and public radio system 800 MHz rebanding. He is a frequent presenter on these subjects at various state and national conferences.

Adrian was a City Council member for the City of Bloomington, Minnesota, as well as its City Attorney. He has served as President of the Minnesota Trial Lawyers Association and Vice President of the League of Minnesota Cities. Adrian is a charter member of the National Association of Telecommunications Officers and Advisors (NATOA), as well as various other legal organizations including the International Municipal Lawyers Association (IMLA), the Federal Communications Bar Association, and the Telecommunications Committee of the Minnesota State Bar Association.

Sean Stokes
Principal

Mr. Stokes became a principal in the Firm in 1998. Since then, he has worked closely with Jim Baller on all of the Firm's public broadband matters, and he is also the Firm's primary expert on pole attachment and wireless matters. Before joining Baller Herbst, he was Associate General Counsel for the Utilities Telecommunications Council (UTC), where he directed the legislative and regulatory strategy of the nation's electric, gas and water utilities, and natural gas pipelines, regarding the adoption and implementation of the Telecommunications Act of 1996. He is a graduate of Denison University and the National Law Center at George Washington University, holds Martindale-Hubbell highest peer-reviewed *AV*-rating, and is a member of numerous bars and bar associations.

Casey Lide
Principal

Mr. Lide joined the Firm in 2002 and has been a principal for the last five years. During that time, he has worked on numerous public broadband projects and stimulus matters. He is also the firm's primary expert on privacy, CALEA, the federal E-Rate program, copyright, and social media matters. Prior to joining Baller Herbst, Casey served as Director of Policy and Networking Programs for EDUCAUSE, a national information technology association that represents the interests of the Nation's colleges, universities and other institutions of higher education. In this capacity, he was responsible for identifying and implementing association policy and representing the association on a variety of legislative and Federal Communications Commission initiatives in the telecommunications area. He also directed working groups and provided policy advice to the association on such topics as advanced networking and the Next Generation Internet, wireless communications, Internet security, the digital divide, domain name policy, privacy, the Health Insurance Portability and Accountability Act, federal investment in information technology research, and distance education. He is a graduate of the E.W. Scripps School of Journalism at Ohio University and Ohio State University College of Law.

4.3 Jane Smith Patterson

Jane Smith Patterson

Jane Patterson has completed degree programs at UNC-Chapel Hill, and N.C. State University with additional study at Harvard University and received a John F. Kennedy School of Government certificate. She is a strong subscriber to the practice of life-long learning and is always taking new courses of study. She has published articles and chapters of books on information infrastructure policy and applications in Japan, England, Europe and the United States.

Jane served in Governor Jim Hunt's cabinet as Deputy and later Secretary of Administration during his first two terms. She led the development of the first integrated information technology services effort in the 50 states. SIPS, now known as the Office of Information Technology Services, was developed at that time. Several of the management and technology programs Jane developed won the Innovations Awards from Harvard University and the Council of State Governments. Over the next six years, Jane worked in private industry as a vice-president of ITT Corp.- Network Systems Group, of ITT-Alcatel and Alcatel, NA where, at various times, she had direct responsibility for all activities in applications engineering, marketing and communications, cost-price-margin, contracts and turn-around management. She was recruited by UNC-Wilmington to serve as an interim vice-chancellor, where she oversaw a reorganization of advancement and also created and served in a new vice-chancellorship for extended education and public service. In 1993, Governor Hunt brought her back to government as his Chief Advisor for Policy, Budget and Technology. In the fourth administration of Governor Hunt, Patterson served as the Senior Advisor for Science and Technology and Director of the Office for Technology. She led a focused effort on technology and its application to enhance the economy of North Carolina and to advance technology applications that affect the learning process in education. Currently, Patterson is the Executive Director of the e-NC Authority. The Authority's goal is to bring high-speed affordable access to the Internet for citizens, businesses and institutions of North Carolina, particularly in rural areas.

Jane's career has concentrated on the areas of information technology infrastructure and its impact on operations of government, industry, education and health. She has consulted with more than 20 countries worldwide and 38 states relating to the design and operation of information networks. She was the major visionary and leader in the development and implementation of the North Carolina Information Highway (NCIH), the first switched broadband ATM-Sonet deployment in the world. NCIH was a 1996 Global Information Infrastructure Awards Finalist. Jane chaired the Mega Project on Applications and served as a member of the U.S. National Information Infrastructure Advisory Council, appointed by both President Bill Clinton and Vice-President Al Gore.

She was recognized in 1995 as one of the top women in computing in the United States. Jane was selected by the National Academy of Public Administration and the Alliance for Redesigning Government to receive its Public Innovator Award for 1997 for her work in advancing the use of information technology in redesigning the delivery of government services and the operations of

government. In 2003, *Government Technology* magazine named Jane to its first 25 Doers and Thinkers of Information Technology. In 1983, Jane was named a Distinguished Alumnus of UNC-Chapel Hill and became the first woman to deliver the main address at University Day in the history of the University. Jane has focused on the issue of regional innovation and currently chairs the board of Regional Technology Strategies. The e-NC Authority program she directed won an Innovator Award from the Southern Growth Policies Board in 2006, NCTA Award in 2006, and a 2007 Techie Award from the national Nonprofit Technology Network. In 2011, The Broadband Properties National Magazine Cornerstone Award for Broadband Advocacy was awarded to Jane. Jane is an elected Fellow of the National Academy of Public Administration.

Jane serves as a trustee or board member of numerous organizations, including:

- Z. Smith Reynolds Foundation (www.zsr.org)
- Harvard Policy Group for Network Enabled Government Services
- Rural Telecon Board vice-chair
- Regional Technology Strategies Chair
- NC Virtual School
- NC elearning Commission
- NC Health Information Communications Alliance (www.nchica.org)
- NC Aquarium Society
- Microelectronics Center of N.C. (MCNC)
- Advisory Board, UNC-Chapel Hill Gillings School of Global Public Health

Jane's previous board memberships are:

- Friday Institute for Educational Innovation
- Chair, Marine Science Council
- TransAtlantic Alliance Training Institute
- The N.C. Rural Center
- Explornet NC Energy Policy Council
- Chair, N.C. Aquarium Society
- Chair, NC Oil Re-Refining Center
- Chair, N.C. Geographical Coordinating Council
- Chair, Global Spatial Data Initiative
- Advisory Council for Council of Entrepreneurial Development
- Babcock School of Business MBA Program Wake Forest University
- Duke Sanford Institute for Public Policy and Public Affairs
- UNC Foundation for Public Television
- UNC-Chapel Hill Board of Visitors
- N.C. School Technology Commission
- Regional Selection Committee-White House Fellows Program
- Ruth Fleishman Foundation
- NC Equity Women's Forum
- Advisory Board of the Conserve School

- Terry Sanford Institute for Public Policy Duke University
- UNC-Chapel Hill Center for the Environment
- U.S. Innovation Partnership NGA-White House (Electronic Commerce Chair)
- N.C. Information Resource Management Commission
- Vice-Chair, National Task Force on Management of Knowledge and Intellectual Property
- National Commission on Technology and Adult Learning
- U.S. Advisory Council on the National Information Infrastructure (U.S. Presidential Appointment)
- Applications Committee Co-Chair
- Southern Technology Council
- Working Group National Institute for Libraries and Museums
- N.C. Center for Science and Technology
- Legislature Off Shore Energy Task Force
- NC Legislature Gov. Performance Audit Commission (Budget Finance Co-Chair & Education Co-Chair
- Working Group on Smart Metering and Broadband
- Advisory Council on Regional Innovation of the U.S. Council on Competitiveness
- NC State University NASA Advisory Commission

5. Attachment B: Mandatory Specification Checklist

List mandatory specifications contained in Section 2.5:

Not applicable.

I certify that the proposal submitted meets or exceeds all the mandatory specifications of this Request for Proposal. Additionally, I agree to provide any additional documentation deemed necessary by the State of West Virginia to demonstrate compliance with said mandatory specifications.

Columbia Telecommunications Corporation (CTC)
(Company)

Joanne S. Hovis, President
(Representative Name, Title)

Phone: 301-933-1488 / Fax: 301-933-3340
(Contact Phone/Fax Number)

Joanne S. Hovis
(Signature)

November 21, 2011
(Date)

RFQ No. DEV1224

STATE OF WEST VIRGINIA
Purchasing Division

PURCHASING AFFIDAVIT

West Virginia Code §5A-3-10a states: No contract or renewal of any contract may be awarded by the state or any of its political subdivisions to any vendor or prospective vendor when the vendor or prospective vendor or a related party to the vendor or prospective vendor is a debtor and the debt owed is an amount greater than one thousand dollars in the aggregate.

DEFINITIONS:
"Debt" means any assessment, premium, penalty, fine, tax or other amount of money owed to the state or any of its political subdivisions because of a judgment, fine, permit violation, license assessment, defaulted workers' compensation premium, penalty or other assessment presently delinquent or due and required to be paid to the state or any of its political subdivisions, including any interest or additional penalties accrued thereon.

"Debtor" means any individual, corporation, partnership, association, limited liability company or any other form or business association owing a debt to the state or any of its political subdivisions. "Political subdivision" means any county commission; municipality; county board of education; any instrumentality established by a county or municipality; any separate corporation or instrumentality established by one or more counties or municipalities, as permitted by law; or any public body charged by law with the performance of a government function or whose jurisdiction is coextensive with one or more counties or municipalities. "Related party" means a party, whether an individual, corporation, partnership, association, limited liability company or any other form or business association or other entity whatsoever, related to any vendor by blood, marriage, ownership or contract through which the party has a relationship of ownership or other interest with the vendor so that the party will actually or by effect receive or control a portion of the benefit, profit or other consideration from performance of a vendor contract with the party receiving an amount that meets or exceed five percent of the total contract amount.

EXCEPTION: The prohibition of this section does not apply where a vendor has contested any tax administered pursuant to chapter eleven of this code, workers' compensation premium, permit fee or environmental fee or assessment and the matter has not become final or where the vendor has entered into a payment plan or agreement and the vendor is not in default of any of the provisions of such plan or agreement.

Under penalty of law for false swearing (***West Virginia Code*** §61-5-3), it is hereby certified that the vendor affirms and acknowledges the information in this affidavit and is in compliance with the requirements as stated.

WITNESS THE FOLLOWING SIGNATURE

Vendor's Name: Columbia Telecommunications Corporation

Authorized Signature: _____ Date: November 21, 2011

State of Maryland

County of Montgomery, to-wit:

Taken, subscribed, and sworn to before me this 21th day of November, 2011.

My Commission expires GITY BANIASSAD NOTARY PUBLIC STATE OF MARYLAND My Commission Expires March 13, 2013, 20___.

AFFIX SEAL HERE **NOTARY PUBLIC** _____