

PROPOSAL FOR

Broadband Network Utility Feasibility Study



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PREPARED FOR

City of Stillwater, OK

City Clerk

City of Stillwater

723 S. Lewis Street

PO Box 1449

Stillwater, OK 74076

April 30, 2018



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April 30, 2018

City Clerk
City of Stillwater
723 S. Lewis St.
PO Box 1449
Stillwater, OK 74076

Subject: Broadband Network Utility Feasibility Study

Dear Liz Chrz and Other Selection Committee Members,

HR Green, Inc. (HR Green) is excited to respond to Stillwater's RFQ for a feasibility study for community owned and operated broadband network utility. We congratulate you on taking this important step for your City. High-speed, high-capacity broadband can have significant impacts in economic development, education, emergency services, city government services and virtually all facets that affect quality of lift and quality of life.

Our team is **nationally-recognized** and will act as a **seamless extension of Stillwater staff**, serving as your **trusted advisor** throughout your broadband planning initiative. Our proposed method to your study leverages a **programmatically and iterative approach**. Together, our team will focus on what we believe are the Key Success Factors for Stillwater through this process

- *Understand and Mitigate Risks:* The options available to improve broadband, including the possible deployment of community resources to build and operate a municipal broadband network, require a deep understanding of financial and technical aspects of those alternatives. Our proven roadmap will help Stillwater create a Vision that includes involvement from key constituents, and open access to our robust technical and financial modeling tools to keep Stillwater at the center of the process.
- *Understand Options and Possibilities:* To stay at the forefront of technological advances and proactively stay ahead of future needs, it is important to understand and develop state-of-the-art technical architecture that will meet the ongoing needs of residents, businesses and anchor institutions, including public works uses.
- *Aligning Funding Options:* Depending on the options that Stillwater chooses, there could be external funding possibilities. Knowing what those are and seeing if their timelines can align with Stillwater's schedules can be important in the feasibility equations.
- *Working Closely Together – On Stillwater's Details and Decisions:* Too many feasibility consultants rely on antiquated modeling tools, with limited access by study sponsors to the underlying assumptions and technology. HR Green provides open, and client-enabled solutions to keep your staff in the driver seat not only in Vision and Plan phases, but throughout any construction and into operations. We maintain a focus of helping you understand the options so that the Stillwater leadership can make well-informed decisions

HR Green staff have conceptualized, determined feasibility for, implemented, designed, constructed and operated some of the largest fiber deployments in your Northwest neighbor state, Colorado. We have been involved with the engineering of pioneering public broadband networks such as the design of the pilot program in the Cities of Longmont and Centennial and the **Delta-Montrose Electric Association**, which are now deploying fiber to the home in their communities. We have successfully completed the visioning, feasibility and strategy initiatives for

City Clerk
City of Stillwater, OK
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other Colorado jurisdictions, including **Buena Vista**, **Fountain**, and **Mountain Parks Electric Association**. We are currently working with **El Paso County** and **Manitou Springs**. We have been chosen for and successfully completed these projects because of our focus on, commitment to, and deep expertise in community broadband and planning.

HR Green also has extensive experience with universities in broadband and non-broadband settings. As you will see in the project list later in our response, Project Manager Ken Demlow worked directly in the UC2B FTTP project in Champaign/Urbana, Illinois. This was a collaborative project between the University and the two Cities (and other stakeholders) in which Ken and his team worked with the stakeholders to develop a fiber design and deployment. These projects give us a unique insight into the dynamics of collaboration in a large University community.

With HR Green having fifteen offices across nine states, we have significant experience in working with different government jurisdictions from local to regional and state levels. In broadband, we understand the political climate and possible funding sources. We bring our vast experience and network of relationships to focus on issues and opportunities specific to Oklahoma and Stillwater's specific issues and opportunities.

Our expertise and qualifications will help establish a world-class, actionable implementation strategy that engages stakeholders and leverages emerging technologies and "smart" solutions, while considering the latest in fiber optic, wired and wireless network technologies to extend reliable and redundant connectivity that improves your public telecommunications infrastructure, public services, and fosters economic growth.

Sincerely,

HR Green, Inc.



Kenneth Demlow
Project Manager



Edward Barrett
Practice Leader – Fiber & Broadband Services

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Project Understanding and Success Factors

The City of Stillwater, Oklahoma seeks to explore the City's options to provide reliable, cost-effective and fast broadband internet service to residents, business and industry in and around Stillwater. This study will consist of assessing stakeholder needs (citizens, businesses, anchor institutions, Oklahoma State University), documenting current infrastructure and provider options, complete modeling (costs, risks, funding, anticipated revenues) of the different options available to Stillwater (owning and operating, partnerships, leasing, etc.).

Issue: Evaluate Community Will and Help Stillwater Address Risk

It is essential that the City's citizens, business owners, political bodies and anchor institutions are actively engaged to understand the community's will and its tolerance for risk. Cities frequently begin their broadband journeys knowing that it will be good for their stakeholders. But this belief has often failed communities who did not create strong visions supported by community will. Navigating the complex communications landscape; understanding ownership and operational risks, and creating functioning business models will test the resolve of community leaders.

► **Solution: Leverage proven roadmap**

HR Green leverages a program management approach that looks not just at the technical or financial components of broadband feasibility. Instead, our team's philosophy focuses on a comprehensive, program management construct in which Stillwater takes a holistic approach to the five phases of broadband development below.



Stillwater has an active and engaged exploratory group. We will work with City officials and this team to determine how and when to expand the surveys completed to deepen the city's understanding of satisfaction with existing services.

► **Solution: Leverage the possibilities**

May choose to build, own and operate its own FTTP network, or seek new private partners. This entails risk of backlash from current providers, and our team will help plan ways to address this risk. A key consideration is to define the ways that this network will address needs of the community that go beyond traditional triple play (voice, video and internet). We will help your leaders and City Council to focus on defining and communicating successes - leveraging the good that is done so that the community can share in the successes, even if those come at an expense to the utility.

As a trusted advisor, we will ensure you not only understand the risks but are prepared to help move the community forward by proactively positioning the project and officials to respond to those issues effectively.

► **Success Factor: HR Green's Experience, Tools and Focused Process**

HR Green has been serving municipal governments for more than 105 years. Because of our experience in the space, we view ourselves as trusted extensions of your staff... not consultants armed with the pre-set, template “right” answers. In many cases, the study of broadband deployments requires a fluid solution, capable of rapidly evaluating numerous models in a rapidly-changing environment as various political, financial and situational realities become evident. Our tools are designed specifically to address these challenges and to keep the Stillwater’s staff actively engaged in the development of our solutions.

Issue: Understand Options and Possibilities

Once community will and risk tolerance is determined, there are several facets of developing a comprehensive, future proof and executable broadband plan. Those can be confusing, lead people off course and lead to paralysis through analysis. Our previously mentioned program management approach can guide the discussion to keep focus on developing the understandings that are central to the paths that lead to the key decisions to be made. In helping stakeholders understand options and possibilities, we help Stillwater take steps from knowledge to decision.

We will analyze Stillwater’s current circumstances, evaluate available options (which leverage the current circumstances), then work with staff and stakeholders to make sure there is a clear understanding of the options and possibilities – turning those in actionable steps. Some examples of areas of analysis, understanding an leveraging are:

► Solution: Analyze and leverage technical innovation and effective public policy

The careful alignment of this project with other community projects and the effective use of public policy offers a unique opportunity to install fiber for a fraction of the cost of a standalone build. Because we understand municipal government, we will work with you to create and leverage public policy to avoid costs. Our approach includes the coordination of these projects with the potential application of creative approaches like micro-trenching.

Stillwater can evaluate and enact “fiber-friendly” policies to advance broader community goals and benefit long-term sustainability. We will help you create cost recovery policies for street cut permits, pavement degradation fees and lane rental fees to determine if additional funds can be generated to cover the costs of existing Town services. We will also evaluate the creation of joint-use and open trenching policies to allow you to deploy important assets for pennies on the dollar.

► Solution: Analyze and leverage “open” architecture to facilitate smart options

With the Stillwater Utilities Authority providing other utilities (particularly electric and water), there are many opportunities to improve operations and customer experience through advanced networks. Examples of these are street lights, the strong branding of Main Street and the need for smart signage, entrepreneurship, future IoT applications, etc. But, a community can only take advantage of those, and differentiate themselves through them, if they have the right infrastructure. As part of our analysis and recommendations, we will help you explore these opportunities and if there are any funding sources related to them.

And, there are potentially disruptive technologies that are actively being developed. Future 5G and small cell deployment, autonomous vehicles, sensor-driven public works programs are examples of very real technologies that will require specific infrastructure and will likely significantly change our processes and even some aesthetics of our communities.

Because we understand the long-term opportunity provided by these assets, HR Green's preliminary architecture will include capacity for a robust communication network.

► **Solution: Analyze and leverage factors in possible business models**

Stillwater has several options of how to improve broadband for your citizens, businesses and anchor institutions. Having a clear understanding of the factors of each of those options (short term and long term costs, anticipated revenues, staffing, financing, etc.) is critical in making the decisions of what path to follow.

HR Green has developed modeling tools that not only make the data clear, but also help to make it understandable. And, our tools provide you with the ability to compare different assumptions and model different possibilities. Some consultants don't allow you to see those assumptions or use the tools. That, unfortunately, gives you a static look at one possibility. We believe that our role is to work with you to help you see and understand the different options that you have. We want you to have and to understand the assumptions and the data.

► **Success Factor:** *Leverage assets and information to fully understand your decisions*



Through working with your current GIS, HR Green will analyze Stillwater's current infrastructure and see what opportunities there are for fiber connectivity – for current possibilities, for future opportunities and for how that could be utilized (and maximized) if the City decides to build more fiber. We will present these ideas and options to the City in dynamic and understandable tools – then work with you to explore other assumptions and options. The key is to leverage what you have and the tools that we provide to help Stillwater's stakeholders be

comfortable with and understand the different options that you have – to make the best decisions for your City and your citizens.

Issue: Aligning Funding Options

As Stillwater explores the details of the possible options for improved broadband, one topic that usually is a key consideration is how to pay for that option. In 105 years of service to our clients, HR Green has developed an understanding of funding and relationships within funding sources to help our clients fund their decisions.

► **Solution: Maximize potential funding and revenue sources**

An important component of many projects is funding. HR Green will work with the City stakeholders to assess the opportunities and desire for funding options. Our staff has helped procure millions of dollars in funding, including grants and in-kind services from federal funding sources, DOTs, local agencies and even the private sector. Our Plan phase focuses on researching and identifying costs and decisions aligned with your desired alternatives and assessing not only technical design but the financial consequences of those decisions. And, we research both State of Oklahoma and federal options for funding opportunities in those decisions.

By focusing on these approaches with the end in mind, HR Green will help Stillwater research technically advanced, financially viable systems that achieve its shared, and now-well-defined operating outcomes. Aligning our timetable to the City's positions and funding streams will allow decisions to be made quickly, eliminating delays to time and schedule, and minimizing costs during any possible design and build phases of future broadband projects.

► **Success Factor:** *Experience in Creating a Funding Road Map*

Along with the analysis and knowledge transfer to get to decision points in a road map for improving the broadband in Stillwater, there needs to be a corresponding funding road map. Because of the nature of funding, we cannot guarantee that there is funding available, but we can analyze possibilities and work with staff to align those possibilities with decisions and timing.

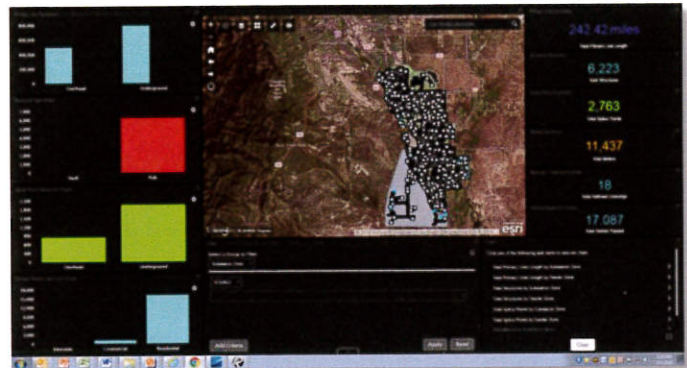
Issue: Working Closely Together – On Stillwater’s Details and Decisions

HR Green has been serving municipal and county governments for more than 105 years. Because of our experience in the space, we view ourselves as trusted extensions of your staff... not consultants armed with the right answers. In many cases, the study of broadband deployments requires a fluid solution, capable of rapidly evaluating numerous models in a rapidly-changing environment as various political, financial and situational realities become evident. Our tools are designed specifically to address these challenges and to keep the Golden staff actively engaged in the development of our solutions.

repeat

► **Solution: Powerful technical prototyping**

HR Green has developed a GIS toolkit that enables us to rapidly prototype potential fiber deployment zones in order to respond to the often-fluid considerations entailed in a broadband feasibility study. This uses Stillwater data to examine your individual, specific options. Our GIS tools will allow Stillwater to compare options with their costs and potential revenue. Some consultants provide you with one set of data – we provide you with that data and the tools to evaluate options. We share these tools with our municipal broadband clients because of our commitment to providing the best modeling, planning and communication tools to help your study be the most useful and effective possible. Our experience has shown us that these are the most compatible in the municipal broadband industry – and that holds true for Stillwater, as well.



► **Solution: Open and Shared Data**

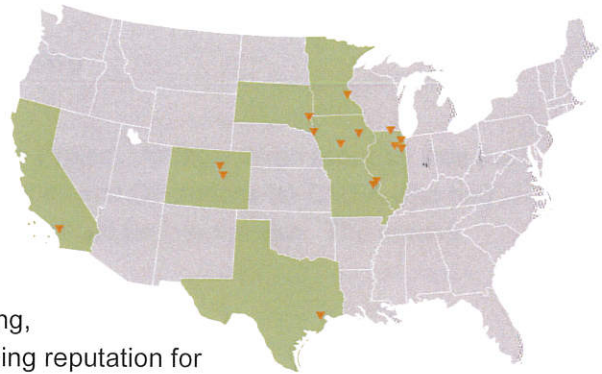
Because we aspire to be a trusted advisor, we provide direct access to our toolset, including GIS and financial planning spreadsheets. Our modeling spreadsheets are based on Stillwater’s information and assumptions that we provide you with so that you can understand them and we can examine different scenarios and options. This ensures that you, our client, have access to not only the results but also the assumptions that are so crucial to the outputs of any feasibility process.

► **Success Factor:** *HR Green’s Approach, Experience and Tools*

Our success as a company and in being selected and successfully completing the broadband projects you will see in the following pages is based not only on our experience, but mainly on our relationships with our clients.

Company Background

In business for more than 100 years, **HR Green, Inc. (HR Green)** perennially ranks as one of Engineering News Record's Top 500 Design and Top 100 Construction Management Firms in the United States.



HR Green has 450+ employees and 16 offices throughout the United States, including **two offices in Colorado, Colorado Springs and Denver**. HR Green is an engineering, technical, and management consulting firm with a longstanding reputation for alternative service delivery. We partner with agencies to meet the demand for services within their budget constraints.



HR Green has garnered numerous awards throughout the U.S. In 2017, the firm was recognized with the Premier Award for Client Satisfaction from PSMJ Resources, Inc.

The firm has completed numerous **broadband, fiber, and smart city** strategic planning and implementation projects. Our key proposed staff members have been instrumental in **the two largest fiber deployments in Colorado**; are **national thought leaders** on broadband and smart city topics/trends; are **based locally**; and bring recent and current applicable experience in the **assessment, visioning, planning, and deployment of broadband and "smart" solutions**.

Since being founded in 1913, HR Green has long maintained a strong and vibrant financial condition. Last year's revenue exceeded \$60 million. Our firm continues to have a strong balance sheet, is well capitalized, follows an aggressive financial discipline, and is very well positioned to fulfill all of its obligations.

HR Green Fiber and Broadband Services

Regional Collaboration Strategic Policy Development / Implementation

Project / Program Management
 Master Planning and Engineering

Telecommunications Network Design

Operational Modeling, Telecommunications Colocation Consulting

Business Model Assessment / Recommendation Business Case Needs Assessment

Construction Management

Regulatory Compliance
 Community Engagement

Grant Writing / Administration
 Market Assessment

Core Equipment Architecture and Design

ITS Design / Implementation GIS Mapping

Street Lighting Analysis / Design
 Fiber Capability Evaluation

Smart Grid Analysis, Design and Implementation

Representative Projects

► Broadband Assessment, Build and Operations DELTA MONTROSE ELECTRIC ASSOCIATION, CO



From 2016-2018 HR Green Senior Project Manager **John Monday** was the Vice President of Broadband Services and Operations for DMEA who had begun installing fiber between substations for internal use. **The issues confronting John were:**

- ✓ *Could fiber be used for more than just connecting substations?*
- ✓ *Could DMEA offer telecommunications services to their customers?*
- ✓ *How would the service be designed, financed and ensure a sustainable business model?*

PROJECT PROCESS

1. Identified Critical Needs:

- **Finished the substation fiber build** and acquired the telecommunication ROW easements
- **Designed, bid, procured, installed and configured** network equipment and outside plant
- **Identified internal resources** and made **infrastructure decisions for start-up** environment
- **Vendors:** Evaluated selection of partners and updated network designs updated.
- **Equipment:** Analyzed the designs and components to maintain cost controls and provide operational efficiency and customer service.
- **Deployment:** Evaluated decisions on where, when and how DMEA would provide service, balancing need to satisfy a ROI, providing affordability, and supporting future service needs.

2. **Flexible, Yet Focused:** Reviewing the “Outside Plant” (OSP) Design, significant changes were needed efficiency, ongoing operations and costs. John participated in a re-design to create a “distribution tap splice model” that saved several hundred dollars per distribution point location.

3. **Organizational Mentality:** A difficult issue in many start-up environments is the ability to create and have a consistent culture and organizational mentality. John restructured DMEA’s Broadband Services and Operations Department with a “Can-do” attitude and an intense customer service focus. DMEA already enjoyed an excellent reputation, and the new organization needed to live up to it.

RESULTS:

- Because of their crowd sourcing marketing methods, DMEA satisfied the pre-subscribed take rate requirement, ensuring the pro-forma was being met
- The core network has been completed
- 7,000 homes passed with Year #1 , with projections of 16,000 homes passed by end of Year #2
- 3,000 subscribers already turned up and receiving service
- New sources of funding have reduced the necessary take rate significantly lower than planned
- **DMEA is poised to become Colorado’s largest non-commercial broadband provider**

► **Broadband Vision and Feasibility Analysis**
CITY OF FOUNTAIN, CO



HR Green was engaged by the City of Fountain and Fountain Utilities to study the creation of a Vision for improving municipal broadband services in the city limits and in the nearby Electric Service Area (ESA) in surrounding unincorporated areas of the county. The initial phase of this multi-year project studied the existing infrastructure of the City and its suitability for both FTTP deployment and future uses. HR Green staff facilitated multiple meetings with staff and Council to educate the City on potential opportunities and risks associated with ownership and operating models for a municipal broadband service in the community, and identified potential backhaul solutions to ensure availability and affordability.

Based on the results of this effort, the City Council is seeking approval from citizens to pursue the deployment of a community-owned and operated FTTP deployment. HR Green has been retained by the City to facilitate public outreach with community residents, businesses and key anchor institutions, and to represent the city in regional broadband planning. HR Green will also study the financial feasibility of a community owned enterprise and will guide the council as it makes key decisions in 2018 that will chart the path, service territory and buildout phasing of the network upon approval of residents in November.

► **FTTP Feasibility Study**
MOUNTAIN PARKS ELECTRIC, INC., CO



**MOUNTAIN PARKS
ELECTRIC, INC.**

Your Touchstone Energy® Cooperative



HR Green assessed and studied the feasibility of a Fiber to the Premises (FTTP) network for Mountain Parks Electric, Inc., (MPEI), a northern Colorado electrical cooperative. Our work with MPEI began with creating a shared Vision for eventual deployment, including prioritization of conflicting project goals

such as ubiquity, financial sustainability and standardization of services. This was particularly important for MPEI, which has 21,000 meters installed over a low-density footprint covering two counties. The HR Green assessment included the creation of preliminary architecture and outside plant engineering estimates, development of alternative business models and the creation of a number of financial pro-forma to drive MPEI's decision-making process. Guided by the results of the feasibility study, MPEI's Board of Directors elected to avoid the high-risk deployment of a ubiquitous fiber to the premises network, and instead to create an internal network to service its own substation and related infrastructures. This network is being designed with excess capacity to facilitate middle-mile transport and enable future expansion into FTTP should the economics or funding environment shift favorably.

As part of the study, HR Green's technical team developed a unique technical solution that reduced Capital Expenses by as much as 20%. The design called for the use of ADSS cabling for aerial deployment in the reserved electrical use only space, and the creative deployment of underground microduct and microfiber inside existing electrical conduit created significant savings across the 1,900 mile footprint.

Despite efforts to reduce the capital costs of the network, the wide footprint and low subscriber density led to financial projections that created unacceptable risk for MPEI's board of directors. The HR Green team studied a number of deployment alternatives, including low, medium and high-density areas, and pilot projects, to provide the Board with a full board of options that could lead to improvement in broadband for its members. Ultimately, MPEI's Board of Directors elected to avoid the high-risk deployment of a

ubiquitous fiber to the premises network, and instead moved to create an internal network to service its own substation and related infrastructures. This network is being designed with excess capacity to facilitate middle-mile transport and to enable future expansion into FTTP should the economics or funding environment shift favorably.

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► **Broadband Assessment and Feasibility Analysis** **TOWN OF BUENA VISTA, CO**



HR Green with support from **Blakely + Company** performed a broadband assessment and feasibility analyses for the Town of Buena Vista. The study investigated alternatives for promoting advanced telecom services that would be inclusive, reliable, and deliver high speed at a reasonable cost.

HR Green's report identified a number of key findings and recommendations for consideration by the Town to advance its community broadband program.

- ✓ *Residents Are Not Satisfied with Current Provider Options*
- ✓ *Backhaul is Available but Lacks Physical Redundancy*
- ✓ *Municipal-Retail Broadband is Feasible for Buena Vista*
- ✓ *Public-Private Partnerships (P3) are unlikely but possible*
- ✓ *Regional Solutions May Offer Future Advantage*

► **Broadband Strategic Plan** **EL PASO COUNTY, CO**



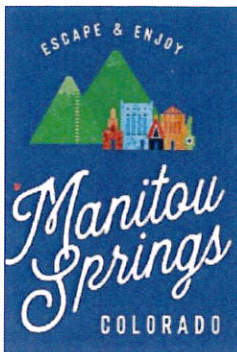
HR Green is currently assisting El Paso County, CO, with the creation of a county-wide Broadband Strategic Plan. While Colorado Springs is well-served in one of five commissioner districts, there are frequent complaints by residents in the county's unincorporated rural areas and its more rural towns and cities. Commissioners authorized the study and the creation of a strategic plan in order to evaluate the

county's wired and wireless infrastructure and to develop a long-term plan to address improvements in order to remain economically competitive and viable.

The highlights of this study include a major public involvement initiative that will survey residents and businesses, and include outreach to Potentially Affected Institutions (PAIs) to determine the extent of issues across this geographically and economically-diverse county. HR Green will conduct more than 80 hours of outreach with these groups to help the commissioners develop a Vision for the county's role in solving identified challenges.

The study is in process and will be conducted over more than nine months. The resultant Strategic Plan will establish the county's role and create a roadmap for the county to facilitate future improvements that benefit the county and region.

► Fiber Optic Connectivity / Deployment & Feasibility CITY OF MANITOU SPRINGS, CO



HR Green is working with Manitou Springs Urban Renewal Authority (MSURA), the City of Manitou Springs, and its affiliated agencies to advise on upgrading the prevailing low-speed internet service in the MSURA area to broadband (25+ megabits per second) and ultimately to ultra-high-speed, or “gigabit” (1,000+ megabits per second) service in the area.

The program aligns with the community’s goals of encouraging private investment and reinvestment in targeted areas, strengthening the tax base through project initiatives and facilitating the development of balanced, sustainable environments where people live, work and come together as a community.

As part of this project, HR Green provided engineering support for the immediate deployment of conduit and fiber. HR Green staff also facilitated the development of partnerships and intergovernmental agreements with other regional agencies, including a creating joint-use Agreement currently being negotiated with the Colorado Department of Transportation for fiber routing through the community. In April, 2018, the City authorized HR Green to expand its efforts to utilize joint-trenching and other policy solutions to expand infrastructure in the greater city limits, and to represent the city as it evaluates the potential for Public-Private Partnerships that can bring additional service to this community.

► Municipal Broadband / Fiber Deployment CITY OF CENTENNIAL, CO



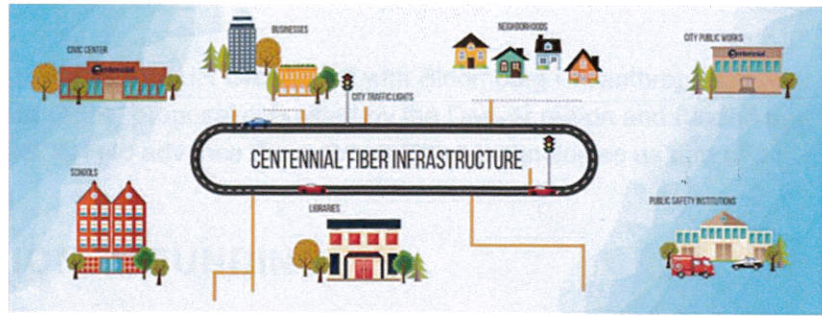
HR Green staff (**Dave Zelenok** and **John Merritt**) worked together on various phases of broadband development. Over a five year period (2010 - 2015), HR Green staff led a comprehensive, city-wide effort including assessment and feasibility analysis, design, construction and ongoing operations. The work completed during this period created **Colorado’s first large-scale municipal open access fiber optic network.**

During the same period, HR Green staff wrote and received numerous federal and CDOT grants worth millions of dollars to install conduit, fiber, and hardware to upgrade the City’s traffic signal system. In addition, our staff developed and managed a fiber optic collocation program that created a city-wide network of fiber optic infrastructure at little to no cost to the City.

Our staff reviewed, helped design and approved the first-ever city-wide wireless antenna network. In another instance, the City gained free street lighting (*image to the right*) in exchange for allowing the provider (NewPath Networks NPN) access to its infrastructure.

This nationally recognized initiative delivered more than 50 miles of fiber optic infrastructure throughout the City, including much of the Denver Tech Center. Spending only \$600,000 of City funds, the resulting network has been valued at over \$10 million dollars. Perhaps more importantly, the network now within one half mile of more than 95% of the city’s 106,000 population, 55,000 jobs and more than 3,000 businesses in the vicinity of the Denver Tech Center.

Recently, a major national telecommunications company, **TING**, announced they are launching gigabit-speed service later this year in what may become the state's largest broadband deployment over a municipal fiber optic network; again, conceived, designed and constructed largely by HR Green staff. Under the plan now being deployed, this network is poised to become one of the **nation's largest municipal gigabit-speed broadband deployments via a Public-Private Partnership (P3) model.**



HR Green staff designed, constructed and operated an extensive new fiber optic and wireless radio-based traffic signal master system and traffic operations center in conjunction with CDOT

In addition to structuring private sector partnerships, our staff integrated and expanded assets for both Arapahoe County and the City of Centennial, installing conduit and fiber optics between each government's facilities. The result was guaranteeing the County had fiber optic access on all City projects in the eastern area of the city and into the county beyond. This access plan included the future ability to connect the county's traffic signals from east of E-470 and into Douglas County near Highlands Ranch.

In Centennial, we've worked collaboratively with Arapahoe County to combine City and county conduit in developing a comprehensive, integrated fiber optic and conduit system to benefit both agencies and build critical traffic signal and weather station systems. **We've also helped procure millions of dollars in funding** including grants and in-kind services from CDOT, six local agencies, the private sector, and the Denver Regional Council of Governments (DRCOG) to purchase and install wireless and fiber-based communications equipment including conduit, fiber optic cable, data radios, cameras, and "smart city" sensors and detectors including vehicle tracking, traffic management and congestion mitigation systems throughout the City.

► "Smart Cities" Technology Assessment TOWN OF BRECKENRIDGE, CO



TOWN OF
BRECKENRIDGE

HR Green recently completed an organizational and operations assessment of the Breckenridge public works department including a review of their fiber optic infrastructure.

HR Green developed a strategic technology plan to meet the goals outlined in "Breck Forward," including identifying current trends and challenges in the Town, focusing largely on Public Works now and in the future, making recommendations for the implementation of state-of-the-art, Smart City technology applications.

As a result of this work, the Town is establishing new economic development-focused programs to manage parking, increasing transit services, expanding affordable housing options, enhancing traffic flow, and providing improved pedestrian-friendly environments. The assessment included an in-depth review of their telecommunications and fiber optic infrastructure and ways to bring municipal broadband to the mountain community.

Innovative Solutions

In 2017, much of the Smart Cities work pioneered by HR Green staff with Bloomberg Philanthropies in 2015 contributed to an even larger “Smart Cities” proposal submitted by the Denver region and funded by the US Department of Transportation (USDOT) to advance these Smart Cities technologies as part of a demonstration effort.

INNOVATIVE, INTERNATIONAL FUNDING

On an international level, our staff wrote and received a multi-million grant in 2015 from the **Bloomberg Philanthropies** to demonstrate a variety of emerging smart city technologies using the equipment, infrastructure “backbone,” and technologies obtained in partnership with CDOT, DRCOG as well as working collaboratively with Arapahoe County and neighboring communities. The City was one of 12 selected from a pool of 400 cities internationally to be recognized with such a major funding award from the Innovative/Smart Cities program initiated by former New York City Mayor Michael Bloomberg and granted through the philanthropic organization bearing his name.

The award, and subsequent case study “Reducing Traffic Congestion,” recognized Centennial for *“...reducing traffic and increasing the use of public transportation in their city. A suburban city with a large commuting population, Centennial engaged with cities across the country during its robust investigation phase, looking to surface and adapt best-in-class urban practices to their setting. They also utilized extensive data on traffic patterns and held open houses to solicit input from local residents. As a result, they developed a list of 30 potential solutions that were pressure-tested and explored with Centennial residents and other stakeholders.”* (<http://bit.ly/2hg0ftw>)

Related Service Include:

- Fiber-Optic Network Evaluation and Reporting
- Program Management
- City Council Reporting
- Street cut management
- Optical Time Domain fiber tracing
- Utility coordination
- Community Engagement
- Technology Needs Assessments
- GIS Mapping and Asset Management
- Co-location management
- “Piggybacking” programs
- Fiber-Optic Business Models and Options
- Construction Management
- Regulatory Assessment
- Public-Private Partnering
- Fiber optic infrastructure inventories
- Fiber Optic Master Planning
- Outreach Strategic Development
- Market and Financial Assessments
- Telecommunications Gap Analyses
- Dig-once initiatives
- Revenue Recovery Assessments

SMART GRID

HR Green staff (Ken Demlow) has more than twenty years of experience, including smart grid deployment, field construction, Google and Verizon projects, and FTTH projects.

▶ **Atlantic, IA**



Ken worked with existing GIS data to create a process the agency could use to update the installation of their AMI meters. As part of this process, the data collected automatically updated Atlantic's billing software, making the process more efficient and greatly reducing the opportunities for error. Though the project did not include fiber, Ken has identified robust, strategic-level improvements had fiber been in place.

▶ **South Haven, MI**



As part of South Haven's plan to upgrade their electric and water meters, Ken worked with the City of South Haven to evaluate their meter and data transport needs. After reviewing multiple options, Ken and his team provided a comprehensive report of findings and recommendations which were implemented by the City.

▶ **Urbana & Champaign, IL / University of Illinois (UC2B Network)**



The \$30 million FTTH ARRA project for UC2B will connect key institutions and provide internet service to underserved households. The project was awarded the National Association of Telecommunications Officers and Advisors (NATOA) 2012 Community Broadband Project of the Year.

PROPOSED SCOPE OF SERVICES

THE HR GREEN APPROACH



Our approach to meet Stillwater’s project goals will focus on the first two phases of our community broadband process. Uniquely, HR Green’s Program Management approach will leverage these early outcomes and allow Stillwater to seamlessly and cost-effectively continue into the next steps that you decide to take.

- Phase I - VISION:** The HR Green team will provide an assessment of key issues such as ownership and operations alternatives. We will evaluate current assets, and community needs, and guide Stillwater to establish its community goals. We will, to quote Steven Covey, “Begin with the End in Mind.” At the conclusion of this phase you will receive a market assessment and network architectural alternative concepts and cost opinions. This cost-effective approach provides Stillwater a **smart and efficient roadmap**, resulting in a detailed and implementable plan during Phase II.
- Phase II - PLAN:** Once preferred alternatives are identified, the HR Green team will move into the Plan phase, creating conceptual optimal technical architecture, build-out costs and experience-informed financial models to ensure Stillwater has a detailed, accurate, financially feasible, and bondable plan to move forward (if that is the desired path).

PHASE I - VISION

Task 1 - Community Engagement

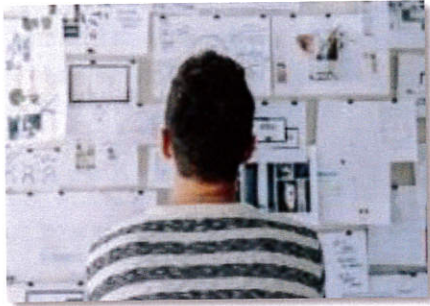


HR Green team members will coordinate with the City staff to develop and implement a community engagement program that fits the information needs that can include key stakeholders. If this is what the City determines to be needed, surveys of residents and business owners can help Stillwater decision makers better understand community needs. One-on-one and peer meetings with policy makers, anchor institutions and key influencers can drive visibility into community goals.

Our outreach plan can include the delivery of surveys for residents and businesses to determine the community’s desire for broadband service; current market conditions and deficiencies, predicted take rate and optimum monthly cost they would be willing to pay for the service; stakeholder needs, and what role the City government should take in providing the service.

Surveys will contain detailed questions to capture the data needed. Surveys can be emailed to citizens and local businesses as well as accessible via a link to the City’s website. The survey can request information about phone, television and internet services: which provider people use; at what costs; what they like and dislike today or would wish in the future; and, even a bit about what they do with internet services.

We can ask questions about the composition of their household, do they have children; do they work at home, solely or occasionally; and, the age of the respondent. We can also ask what is important to them personally, what do they value about communications services; what is important to the community; and, most importantly, what they think the City should do.



Well-attended public meetings, we believe, can be an important piece to the success of the community survey by providing stakeholders the opportunity to engage in the creation of community Vision. Public meetings further benefit the community by creating excitement surrounding the upcoming decisions and will assist with take rates once a decision has been made to build and operate a broadband network. Building that excitement is an important part of this phase of citizen engagement, so the timing of that is something to consider.

Our formal process and plan increases the prospects for consensus, reduces the probability of project delays, and inevitably leads to improved planning and engineering. Listening may be the most important part of communication. Key stakeholders will be identified early in the project and may include business owners, residents, community leaders, public officials, special interest groups and others. These stakeholders must feel that their concerns are heard and that they are part of the project's solution.

▷ KEY DELIVERABLES:

- Survey Development & Deployment
- Key Survey Findings for Satisfaction, Demand, Price Sensitivity and Overall Interest
- Public Involvement Feedback/Results
 - Public Feedback on Community Ownership and Competition
 - Risk Tolerance around incremental tax, bonding or debt assumption to fund plans.
 - Summary Feedback on Individual and Group Meetings

Task 2 - Conduct Local Broadband and Telecommunications Market Assessment



Competitive analysis is challenging due to the fluidity of market pricing, products offered and differences in the various sectors that need to be understood.

Providers that serve residential services offer products that are quite different than those providers that serve fiber connections to businesses. Moreover, the growth of home-based businesses, and work-at-home opportunities, create a hard to compare mixture of provider product offerings (services) and consumer importance of use or value.

Price and service differentiation creates competition between cities and/or regions. Citizens and businesses that pay more, or obtain better services, create economic disincentives locally – people and companies are beginning to look at these disincentives when they select locations. It has been documented repeatedly by the FCC that in the area of residential pricing alone, competitive municipal markets drive prices down at least 15% on average. Numerous studies have shown that a 15% reduction over five years is equivalent to the capital cost to build a FTTH network.

To begin this analysis, service offerings of each primary provider in Stillwater will be examined, cataloged, and compared with a few cities of similar size. Second, the survey of citizens and feedback from community meetings and anchor institutions will shed light on the actual practice of providers and, more importantly, on pricing and satisfaction, as well as determining what needs are in demand and are either not supplied by the marketplace or underserve the market. We will summarize current service offerings in the marketplace and their price points and establish possible price points for these services on a City- owned network.

▷ **KEY DELIVERABLES:**

- Summary of providers and current service offerings

Task 3 – Identify Public Sector Needs, including Emergency Response and Public Safety



What are the City's current fiber optic (Public Works Department, traffic signals, utilities, etc.) capabilities and can they be repurposed? How will the City handle primary backhaul and develop true physical redundancy? Are public safety needs being effectively met? We will evaluate commercially available fiber and integrate the efforts of the community around pending public and private broadband development projects to identify the best

solutions for backhaul, and primary public network solutions.

HR Green and its team members will collect information from the police department, emergency management officials, public works officials and other departments within the city and regional governments. The team will evaluate current status of public networks and assess long-term deployment requirements to create a roadmap of public sector network needs.

Meetings will be held with key stakeholders, including some or all of the following:

- Police Department
- Public Works/Transportation
- City Engineering
- City Administration
- Emergency Management Officials
- Public Information Office
- Stillwater Fire Department

▷ **KEY DELIVERABLES:**

- Summarize Current Capabilities and Provide a Gap Analysis

Task 4 - Evaluate Funding Alternatives

We anticipate discovery of multiple issues that may require some level of public involvement. The City will face difficult decisions on how best to pursue solutions. Whether the City pursues publicly-financed or public-private partnership alternatives to remedy gaps, solutions will require the deployment of scarce economic capital.

Our approach will include the evaluation of options for fund development. We will evaluate sources of funds which may be explored including direct financing such as: General Obligation Bonds, Revenue Bonds (assuming the City wishes to pursue an Enterprise), Special District and Metro District Assessments, Bank Debt and Private Financing.

Further, the ability to leverage federal, state and regional grants and programs can provide substantial benefits when economic feasibility is being studied. Our team will help you evaluate federal and state programs that fund community networks and allow you to piggyback on these programs to offset the cost of buildout. Programs at both levels will be explored and should be included as you look to minimize the physical spend required to build your community network.

▷ KEY DELIVERABLES:

- Source and Use of Funds Matrix for Relevant Programs

PHASE II - PLAN

Task 1 - Evaluate City and Regional Fiber-Optic Network Capabilities



What are the City's current fiber optic (Public Works Departments, traffic signals, etc.) capabilities and can they be repurposed? How will Stillwater handle primary backhaul and develop true physical redundancy? We will evaluate commercially available fiber and integrate the efforts of the community around pending solutions to identify the best solutions for backhaul, primary municipal network and last-mile builds.

HR Green team members will perform a technical evaluation of the City existing fiber-optic networks, based on available data, and their ability to expand to provide broadband services to users identified in the Business

Case Needs Assessment. We will leverage GIS mapping and encourage the City to consider developing an optional Fiber Asset Management System in the future. We explore those options with you.

Should you elect to develop a Fiber Asset Management System, these tools allow you to perform important tasks like doing fiber tracing; have your splicing available and editable, and so forth.

You can also enter values from OTDR equipment to determine the location of a dig-in or other cable fault.

Tools included with the application allow the City to allocate fibers to existing internal or external users or mark them as available or allocated, allowing for determining possible future bottlenecks in the routes.

Reports can be created that show all of the uses of the fibers in a cable based on names assigned by the City, giving easy access to information about a particular cable or route.

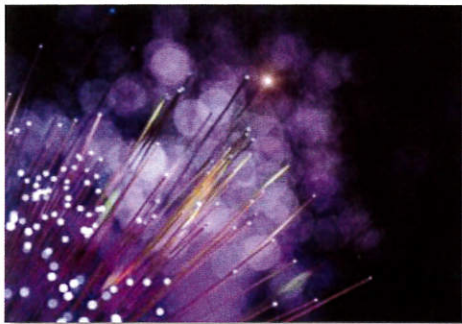
Our solution can also give you the ability to define and reconcile pole attachments and pole agreements. This can be a very powerful tool to help you keep track and manage these important pieces of fiber networks.

This evaluation will reflect existing conduit, fiber- optic, vaults, and boxes and related outside plant infrastructure as well as capacity and usability. We will also identify backhaul providers and work to identify virtual and physically redundant backhaul paths out of Stillwater to ensure a robust, healthy network is possible.

▷ KEY DELIVERABLES:

- Technical Evaluation of City's Existing Fiber-Optic Networks
- Cost Opinions

Task 2 – Complete Conceptual Design



Drawing on field and desk surveys and the City's GIS maps, our engineers will prepare a system- level design and cost estimate for developing a next- generation network.

In developing this potential technical solution, the HR Green team will consider a wide range of technologies and approaches. Their focus will be on creating a robust, reliable, and cost-effective approach to meeting the City's networking needs. To that end, for example, the design will include excess dark fiber designed to enable the implementation of smart parking and smart lighting solutions across the community.

To be clear, we will not be providing a blueprint- level network design. Rather, we will provide an analysis of existing infrastructure, a conceptual design, high-level maps and routing, candidate specifications, and a system-level overview of the potential infrastructure— which in turn will become a roadmap for financial analysis and business modeling, and for future decisions (potentially including detailed engineering, construction, and operations).

HR Green's team will prepare a cost estimate and supporting documentation for network deployment and interconnection, inclusive of anticipated construction labor, materials, engineering, permitting, quality control, and testing. These estimates will be provided in the form of a cost range, with the lower-end estimates representing most likely costs, and the higher-end representing budgetary estimates with suitable contingencies included.

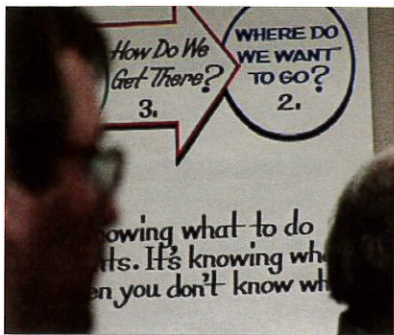
Importantly, and unlike some feasibility study vendors, HR Green will share all supporting data, spreadsheets, and assumptions. A written narrative will explain key construction characteristics that will have an impact on the cost estimates.

The analysis will provide guidance regarding ongoing costs, medium and long-term needs to refresh and replace equipment, and potential revenue sources to support network operations.

▷ **KEY DELIVERABLES:**

- Analysis of Existing Infrastructure
- Cost Estimate and Supporting Documentation for Network Deployment and Interconnection

Task 3 - Conduct Financial Analysis



HR Green will develop pro forma data for a potential City network. These financial analyses will be based on the recommended system-level design and related cost estimate.

This high-level financial model for proposed network construction will include a range of likely costs, including:

- Financing
- Operations
- Maintenance

Our analysis will outline operational attributes and processes including policies, staffing levels, maintenance agreements, and other considerations. We will pay particular attention to back-office and other operating requirements, as well as working capital projections. We will discuss a strategy for network maintenance and management based on best practices.

The model will include an overall analysis of viable potential services and will provide:

- Sensitivities of key assumptions including, but not limited to:
 - Customer segmentation
 - Market penetration
 - Pricing
 - Tiered revenue structures
 - Operating costs
 - System construction
 - Staffing levels
- Base, best, and worst-case analysis

The pro forma will follow accounting standards and will provide schedules that detail:

- Operating income and cash flow
- Net present value analysis
- Subscriber revenue by service
- Subscriber revenue by customer/customer class
- Debt service analysis
- Reserve fund requirements
- Uses and sources of funds
- Operating expenses
- Operational savings
- Depreciation summary
- Projected construction costs for network, hardware, buildings and other equipment
- Return on investment (ROI)

All assumptions and price sensitivities will be clearly stated and justified. The financial model will provide the City with order-of-magnitude estimates of the overall project cost, and will support the implementation roadmap by providing inputs for potential business models, financing options, and partnering opportunities.

In addition to the narrative report, they will provide the City with a detailed Excel workbook that includes all underlying data and assumptions, and can be manipulated to illustrate the impact of changing costs or revenue on the network's potential income statement. This is crucial as some vendors will provide you only with summary data, leaving you with nothing upon which you can build in the future.

▷ **KEY DELIVERABLES:**

- Financial Analyses
- Pro Forma
- Excel Workbook

Task 4 – Facilitate Strategic Direction Decisions

Our analysis and discussions with the City will culminate in the preparation of a broadband strategy that creates the greatest opportunity and value to implement a network that is capable of meeting current and long-term community needs. The strategic plan will include recommended approaches to broadband implementation.

For each approach, we will include customer billing alternatives that meet all federal, state, and local requirements; how to build the network (phase vs. community-wide), funding opportunities; and characteristics of a public- private partnership.



▷ **KEY DELIVERABLES:**

- Broadband Strategic Plan
- Facilitate Golden Decision Process

Task 5 – Engage with Potential Partners

Upon completion of the strategic plan in Task 4, Stillwater will be equipped with a planned approach to deployment that will be specific, action bound and attractive to a variety of providers.

Should Stillwater desire to pursue a Public-Private Partnership alternative, we will identify and evaluate potential service providers whose vision and business models compliment the desired outcomes of the community. This approach creates a faster- moving cycle in which partners can be identified and brought to the table more quickly and with a higher likelihood of successful progress.

▷ **KEY DELIVERABLES:**

- Identify Potential Partners
- Facilitate Stillwater Decision Process

OPTIONAL FUTURE PHASE SUPPORT

Future-Proofing

As the City makes decisions about next steps, HR Green has the in-house technical proficiency and depth of resources to seamlessly transition from feasibility to overseeing the next step. As such, we offer an array of optional services to provide continuity and efficiency, protect your interests, and ably shepherd your program to conclusion.

Many of the consultants in the broadband industry simply do not have the staff or expertise to provide continuity from phase to phase. Consequently, should the City choose any of the options that contain implementing any City owned infrastructure, there is often a lack of continuity from feasibility to the next step. This can lead to confusion and missed hand-offs. **At HR Green, we can provide this critical continuity.**

Moreover, having one consultant to go to for accountability and answers makes a project much more efficient. It can also greatly decrease the opportunity for passing the buck. Efficiency, clean hand-offs, clear communication channels are how we manage projects with different phases and many moving pieces. **We are a known and proven name in successful project delivery.**

PHASE III – DESIGN (FUTURE)

Task 1 – Establish Network Architecture

The network architecture is the basis for network design and engineering. We will work with the City to create an architecture that will meet the present and future needs of the proposed fiber network. This process will determine equipment requirements, specifications, and deployment strategies. In addition, it will address any redundancy requirements; construction techniques to minimize capital spend and analyze the best utilization of the City's existing assets.

We will collaborate with the City to ensure the solutions match their business plans, including discussion of the future delivery needs over the transport network.

This will include detailed determination of use of network beyond traditional triple play services. Wi-Fi cellular off-loading, ITS/Signalization, Smart Parking and other potential services desired by Stillwater will be included in the network design. Decisions on ubiquity of service will be discussed and a deployment plan developed to meet the goals established in the Vision phase. Following concurrence by the City on possible technologies, specific options for equipment and outside plant topologies will be defined.

Task 2 – Equipment and Material Specifications

Equipment and material specifications will be developed to be utilized within the network. The requirements will be driven by results of the architecture that has been finalized. These specifications will be used to establish the OSP and ISP design criteria.



Task 3 – ISP Design

The HR Green team will provide equipment specifications that can be accommodated by access, or transport network vendors.

These specifications will include complete equipment engineering necessary to provide gigabit transport services to support the intended load control, communications and SCADA networks. In addition; future FTTH deployment or middle/last mile transport will be included in the analysis.

Bill of Materials (BOMs) will be developed across multiple vendors including: power and backup requirements; redundancy; space in racks, huts or homes; and, environmental specifications. Installation drawings and diagrams will also be provided.

Upon a notice to proceed, a framework will be established to prepare the mapping land base for this project. We will utilize the City's current GIS data to establish a mapping system consistent with the needs of the planned and future fiber network.

Task 4 – Field Survey (OSP)

ROUTE AND PERMIT REVIEW

If necessary, meetings will be conducted with each governing permit authorities to solicit their review in advance of performing any field survey. The result of these meetings determines the ROW custodians' requirements for use of public right-of-way and their application process. Entities will have the opportunity to review the proposed route and be solicited for input on their own planned infrastructure projects and other construction impediments.

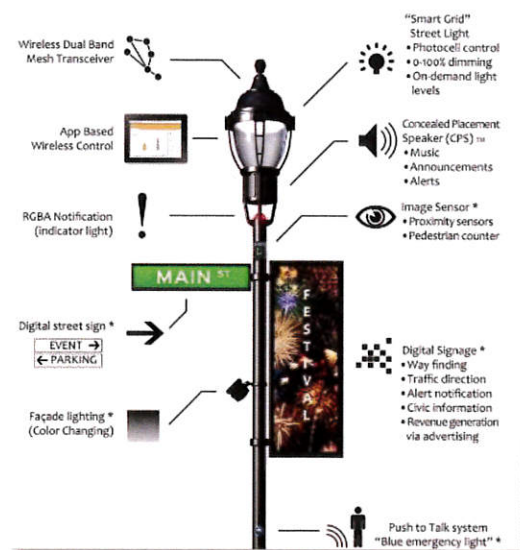
PROCESSING AREAS FOR FIELD SURVEY

Our team will identify and acquire any additional source materials that it would find useful for the basemap for the project, which will include the City's GIS facility data, and other cadastral, planimetric data. This land base and miscellaneous data will be processed to provide field survey crews the mapping prints/data for purposes of recording the field survey notes.

FIELD SURVEY AND SUPPORT STRUCTURE DESIGN

The field survey team will follow the established standards and project design requirements for this project. Because the HR Green team's intent is to optimize the network and reduce the overall cost, the field engineering must ensure that all possible routing alternatives are documented. The final fiber network design can only be optimized by analyzing all possible connectivity routes, the location of all service points and existing infrastructure.

Detailed routing information and support infrastructure will be collected for aerial and underground construction areas, service points, the construction methods to be used, and identifying and finding solutions to issues that present construction obstacles and best utilization of the City's existing network and support structure.



Task 4 – Field Survey (OSP) - CONTINUED

UNDERGROUND ROUTE DESIGN:

- Construction running line is identified with respect to property boundaries, easements and rights-of-way, as well as roadway control points.
- Determine existing conduit which may be used
- Identify where surface cuts are required, notation will be made of the compositions of route surfaces such as streets or driveways, indicating where they are asphalt, concrete, or gravel.
- Identify proposed cabinet, pedestal and vault locations.
- All surfaces (driveways, walkways, etc.) that would represent obstructions to underground placement of the network will be annotated and dimensioned accordingly.
- Bore locations will be dimensioned as necessary to support any permit requirements.
- All notes relevant to network construction detail will be annotated.
- Service points and routing of such will be identified based on a detailed survey of the site buildings.
- Approximate location of underground facilities; water, sewer, drainage, telecom, electric which can be verified visually or with data provided by the various entities.

AERIAL ROUTE DESIGN:

- Location of all pole structures will be validated
- Ownership
- Pole Identification
- Existing poles size/class
- Proposed placement on structure
- Identify all other attachments on structure and their attachment points which validate placement
- Characterize any make-ready which is required to facilitate attachment
- Risers will be characterized
- Anchoring requirements
- Ground system designed
- Service points and routing of such will be identified based on a detailed survey of the site buildings.

SITE SURVEY AND ENGINEERING FOR SERVICE POINTS

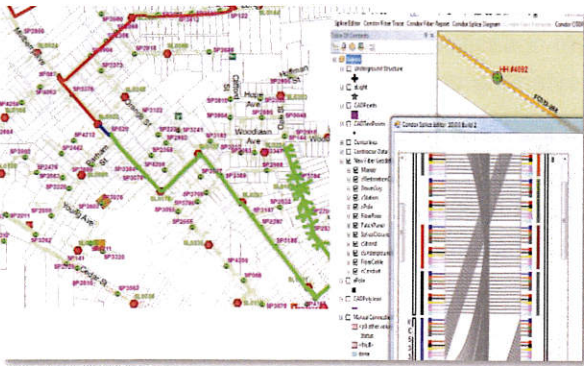
In order to design the fiber transport network to support a future FTTH network, our team will identify service point sources such as meter locations, etc.

These can be geocoded to approximate locations that will determine fiber density requirements.

If available, other resources would be used such as County or City data identifying multi-tenant structures and industrial/commercial service locations for purposes of designing the transport network to accommodate future business opportunities.

Task 5 - OSP Network Design

As a contiguous area is surveyed and posted, the actual fiber network is designed. The designer will optimize the network design by assessing the service points and all possible fiber routing options and existing City infrastructures. Based on the high-level network architecture, the network fiber system will be sized to accommodate the planned service points, distribution points. Fiber splice and slack storage



locations will be identified and documented as features within the GIS. The fiber loss budget for each segment is validated to ensure it is within acceptable limits of the network specifications.

As the future service areas are established for a FTTH project, each fiber segment design, fiber assignment, and splice documents are completed. A comprehensive bill of materials (BOM) will then be generated for purposes of material requirements for construction of the network. This BOM will become part of a construction document set.

FIBER MANAGEMENT SYSTEM

Should the City desire to evaluate FMS systems for future use, HR Green will provide scope and cost information to assist the City to identify a system best suited for implementation of the current communication network and with capacity to support the City's future FTTP and AMI projects.

PERMITTING PROCESS

By submitting data in a format that is manageable in size and easily understandable, we have been able to quickly obtain permits and sign-offs where others have struggled. Often times we will use the permitting agencies' own data to support our case; and by providing detailed GIS maps of the project areas and potential impacts, we can focus on only potential problem areas not the entire route.

For projects of this size and scope it would be broken down into manageable portions so that as permitting is completed, sections can be built.

Permits may be required for attachments proposed on poles owned by other entities. Our process would include the attachment request to those entities, too.

OPTIONAL Task 6 - Develop Construction Documents

A CD set will be printed for each fiber service area under the oversight of a licensed professional engineer. HR Green's team will provide one printed set of documents and provide a set in PDF digital form for reproduction. On project closeout, we will transfer to the City all geodatabase files, map documents and other files in their original format.

OPTIONAL PHASE IV – BUILD / CONSTRUCT

OPTIONAL Task 1 - Support Contractor Selection



The HR Green team will provide the City support in creating the construction bid documents for purposes of selecting a contractor to construct the physical facility. The RFP will include a comprehensive specification manual, complete design documents with permits and a comprehensive bill of materials.

Our team will act as owner's rep and support bid letting, pre-bid conferences that may occur and assist in formatting timely response to questions that may arise. Furthermore, our team can provide its professional opinion upon review of the various responses and formulate recommendations of choice.

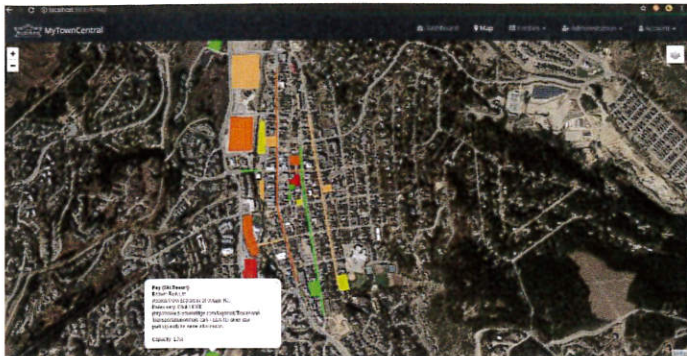
Task 2 - Construction Oversight



Our Construction Observation team will work as an owner's rep to ensure that the construction meets the engineered specifications of the project. Field inspectors will act as a liaison between the contractor and design engineers to minimize impacts on the construction timeline. Services included in construction observation include, but are not limited to:

- Attendance at a project kick-off meeting, and facilitate regular project status conference calls with the Contractor.
 - Review and approve project timelines for engineering and construction prepared by the Contractor.
- Review of contractor construction management and safety plans.
- Development of quality assurance inspection checklists to facilitate construction oversight.
- Perform onsite inspection during construction for safety and workmanship.
- Perform onsite post-construction inspection for compliance with the approved designs and workmanship, to include a detailed review of accuracy and completeness for a sampling of as-built documentation provided by the Contractor
 - this may include verifying pole attachment clearances; confirming slack loop cable lengths; verifying proper bonding/grounding; and verifying location of outside plant assets (splice enclosures, slack loops, handholes, etc.) using precision GPS receivers
- Review Contractor construction invoices for consistency with design and observed construction progress.
- Review of all Contractor-provided fiber optic performance test data, and perform independent testing (OTDR and power meter) for a suitable sampling to validate Contractor-provided test data.
- Prepare a comprehensive report documenting the results of our test data review, independent testing, and post-construction inspection to provide verification that the network, as installed, is suitable for the City's purposes and conforms to the approved final design.

PHASE V – OPERATE (FUTURE)



The HR Green team currently provides staff augmentation service to numerous clients across the United States.

Should Stillwater desire to own and operate the network and avoid the expansion of City government staff, HR Green would be pleased to discuss opportunities to partner on the management of staff resources to operate the City's network.

This can be particularly important because many communities are concerned with how they would operate their network or their part of the network. HR Green can provide the staff for the City to be able to do operations. This can help you control costs and have the technical expertise necessary for whatever decision you make to move forward.

On-Time and Budget

Through over a century of service to diverse clients, we have learned a great deal about the process of meeting and exceeding client expectations. From this vast experience, a coherent approach to project delivery has evolved at HR Green.

- ▶ **Goal:** *Our constant goal is not merely to finish projects, but to help clients reach successful and satisfying outcomes.*

There are five key facets that comprise our approach to achieving this goal:

1. Project Management
2. Quality Assurance
3. Financial Sensitivity
4. Open Communication
5. Risk Management

Facet 1: Project Management



At HR Green, a Project Manager (PM) is more than an internal taskmaster. This person is charged with the pivotal role of bringing our company's efforts together with your expectations, your budget and your schedule.

▶ 30-60-90

In our experience, an intermediate deliverable approach is the best way to accomplish this. We call it "30-60-90." Your PM will deliver the results of our work to you at 30%, 60% and 90% milestones of completion.

Obviously, your PM will be accessible and responsive to you at all junctures in the project. Specifically, HR Green proposes the following methods to guide our overall project communication for this short-fuse project:

- **Proactive Project Manager:** To ensure continuity of the project, **Ed Barrett**, will serve as your main point of contact and oversee all aspects of efficient project management, on-time and within budget service.
- **Project Reporting:** MS Project will be utilized as the primary tool to create and manage the project milestones and deliverables. This will be modified based on the needs of Stillwater and throughout the project.
- **Weekly Updates/Bi-Weekly Meetings:** We will provide weekly, written updates on project status, complete with percent complete on major milestones, issue logs and risk management logs. These tools will be managed and updated by HR Green and will be reviewed on a bi-weekly basis in person with your assigned project lead.
- **Program Coordination:** HR Green's project manager will be available, as needed, to participate in broader coordination discussions with other members of the program team to ensure interdependencies of schedule and technical natures are understood and planned for.

As we approach the 30-60-90 milestones, a formal meeting will be held, allowing a focused opportunity to sit down together and review progress on the project. This approach requires careful listening from the PM to client input. It also requires the PM to closely monitor the project schedule and budget to know when these milestones are approaching. Please note, finally, that it invites active participation from you as part of our team. Your voice is crucial to the success of this management approach.

Facet 2: Quality Assurance

HR Green has a detailed internal program for quality assurance. We understand that our personal and corporate reputations depend on the quality of our work.

Our quality assurance program has several layers:

- Quality for each technical discipline within the firm is guided by a Chief Technical Advisor, who establishes the standards and procedures for that discipline.
- On a project-specific basis, a Quality Control plan is established at a project kick-off meeting. This plan will usually call for an internal review of our work, by the PM, at each stage in the intermediate delivery process (discussed above).
- Internal reviews become progressively more stringent as the project nears completion. The most thorough reviews are conducted at 90% and 100% milestones.

From a **value engineering perspective**, we strive to identify and achieve project cost reductions whenever possible. We start at the concept level by gaining a full understanding of the design problem and possible solutions which is usually accomplished at the project definition stage. As the project progresses through the construction phase, it is not uncommon to find unanticipated field conditions which frequently can present a cost liability. At this point, our team vigorously searches out options to eliminate, transfer, share, or reduce these unforeseen costs. In some instances these unanticipated conditions can actually be an opportunity for additional cost savings.

Facet 3: Financial Sensitivity



Clients have depended on us to help them find solutions that are financially feasible. No engineering concept may fairly be called a “solution” if it is not scaled appropriately to the client’s ability to pay. At the same time, we understand the difference between what is financially sensible and what is merely cheap. Our goal is to find for our clients a solution that is financially, environmentally, and practically sustainable over the long haul.

Financial sensitivity requires accurate opinions of probable cost to support the business and financial models. Because of our company’s size, longevity and geographic coverage, we have a vast reservoir of project cost information at our fingertips. But we do not rely only on “what happened last time” when we develop an opinion of probable cost. We stay current on trends in the material and construction industries, in order to assure that our clients are not getting yesterday’s news from us.

Facet 4: Open Communication

Any firm that makes unmatched client service a core value should be open to constructive criticism from its clients. We want you to feel that you can express your concerns openly to your Project Manager. Nevertheless, we understand that some clients may feel awkward about expressing such criticism face-to-face. For that reason, we utilize a process called Green Commitment, in which you have an opportunity – personally and confidentially – to tell us how your HR Green project team is performing. The Green Commitment survey includes questions like, “Are we responding adequately when you have questions or special requests?” You will receive a Green Commitment form at the 50% milestone of your project’s completion.

Facet 5: Risk Management

Our program management experience is a direct result of our client’s need to accommodate demands for transparency, accountability and good stewardship of tax dollars.

Risk assessment and mitigation is an important part of the team’s responsibilities. The first step is to develop a Risk Matrix, where specific and general risks are noted and scored, along with action plans and status tracking. Each “risk” is evaluated for its potential impact on the project’s cost and/or schedule. A risk mitigation action plan will be developed in collaboration with the project team. Risks may include:

- Equipment Availability & Costs
- Equipment Delivery Timelines
- Progress of Built Environment (Communication Huts/Central Offices)
- Training Resource Availability

An approach that works!

History validates the effectiveness of this approach to client satisfaction. Some of our current clients have been with us for more than 70 years.

Availability

HR Green has selected our project team based on individual staff members' specific expertise and availability. Our core staff is part of a 430+ person firm with a national footprint.

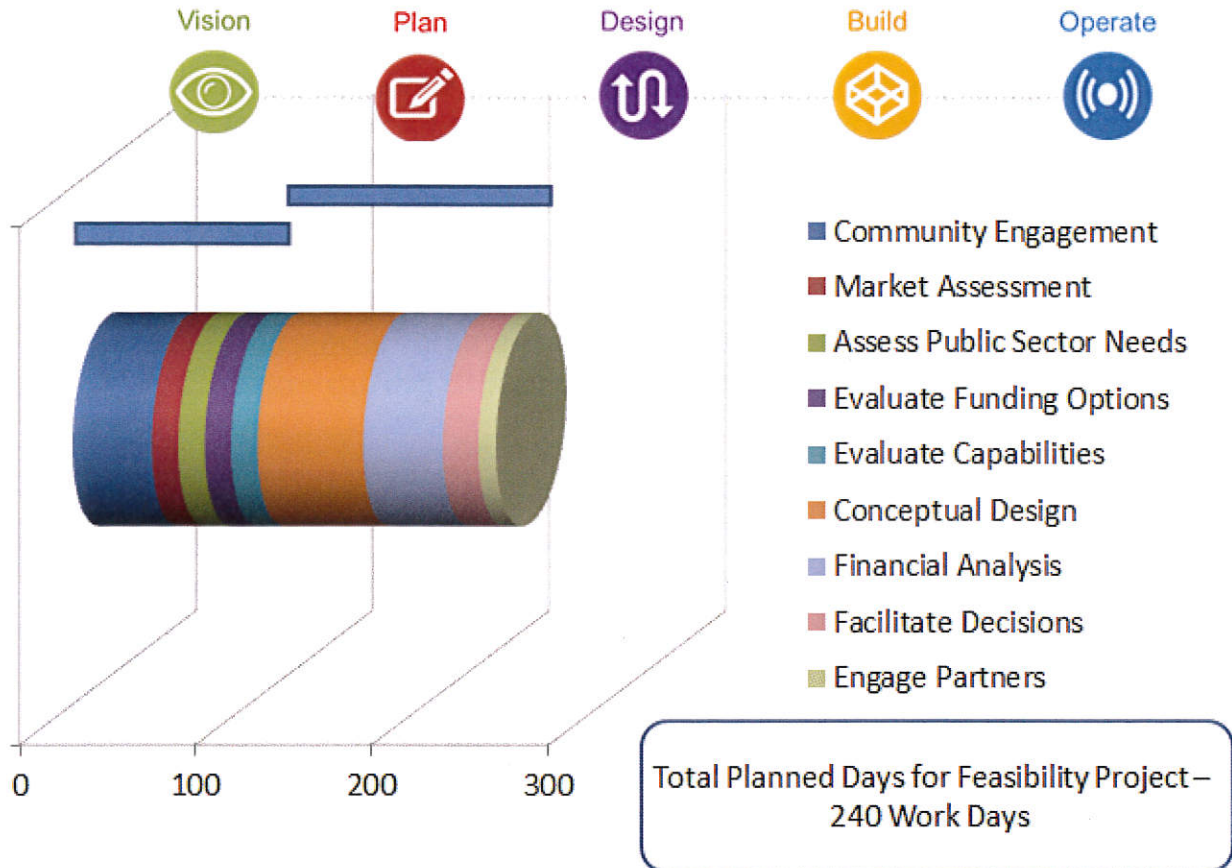
Our key task leaders are committed to integrating and delivering specialty areas in a cost-effective, time-efficient manner. Each technical area has a depth of qualified staff we can leverage to expedite your project needs.

Team-wide resources will be reviewed frequently to make certain that project schedules are being met and the necessary staff is assigned to meet schedules. Our software monitors individuals assigned to specific projects and compares that to time actually spent. Management can track in real time labor utilization and availability in order to mobilize additional resources based on project-specific needs, workload spikes, and schedule requirements.

In addition, our internal project teams set frequent milestones and meetings to maintain close communication and coordination on project issues that may impact budget and schedule if not anticipated and/or proactively addressed.

Project Schedule

In the RFP, the City provided a planned timeline. We feel comfortable that we can meet those milestone dates and that is reflected in our schedule above. There are some factors that we cannot control (when information is returned to us, responses in the surveys) that could have an impact on the schedule. But, we feel that the City has developed a timeline that is reasonable and should be achievable.



ADDITIONAL SERVICES AND PHASES

If it is determined that additional services are required, HR Green can provide future, follow-on broadband development (Design, Construct, and Operate Phases for future broadband networks); analysis, assessment and implementation of emergency and cellular communications within your network.

Project Team

The HR Green team was assembled to leverage a unique combination of municipal management and strategic research experience.

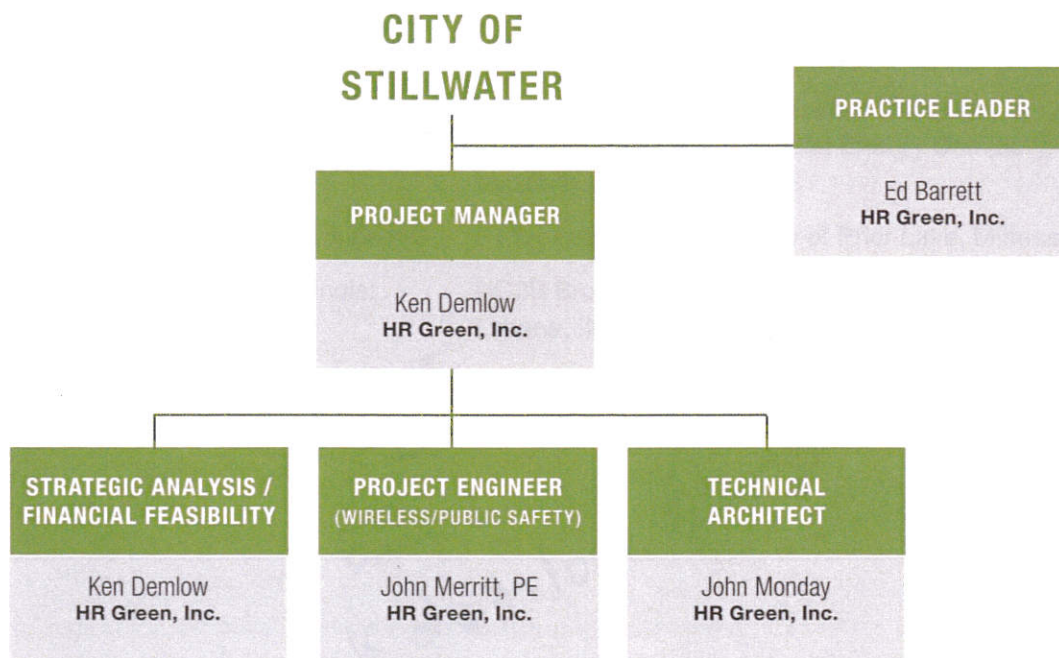
Our **Project Manager, Ken Demlow**, understands the unique challenges faced by Stillwater and has walked in your shoes as a broadband project leader in a University Community. Ken was actively involved in conceptualizing and constructing the UC2B project, a collaborative partnership between two communities, a regional public University and its private sector partners..

He and **Practice Leader Ed Barrett** will work closely with in-house strategic research and financial feasibility experts to provide innovative, practical, well-documented, and rationalized models and recommendations to best protect the City’s interests. Additionally, **HR Green staff members John Merritt, PE and John Monday** are assigned to this project due to their knowledge of broadband technologies in general, and their particular understanding of planning, emergency communications, and engineering modeling.

The HR Green team has been at the forefront of fiber and broadband assessment and implementation for years. We are confident that we will add value during this project and as a long term, strategic partner.

Our focus is to deliver effective analysis to aid you in deciding how best to move forward with your Broadband Strategic Plan.

Organizational Chart





Ken Demlow

HR Green – Project Manager & Strategic Analysis / Financial Feasibility

Ken brings over 20 years of experience in the industry, from working in field construction installing fiber, to Google and Verizon projects, and several FTTH projects.

He is nationally known for his industry knowledge on Smart Meters and Smart Grid. Recent publications and presentations include “Planning for Poles,” Broadband Communities magazine, October 2017 and “Broadband in Smart Grid” presentation, Iowa Association of Municipal Utilities, March 2017.

Ken works directly with clients to assess their current fiber and broadband circumstances, develop broadband visions and strategies assess financial costs and feasibility, while driving approved projects through the Design and Build phases and into operations mode.

Prior to joining HR Green, Ken was National Business Development Manager at NewCom Technologies where he was involved in the design, engineering, and project management of many miles of telecommunications plant, including thousands of miles of lit fiber.

Ken continues to author articles on fiber best practices and economic development strategies associated with municipal broadband.

CURRENT / RECENT PROJECTS

- Colorado: El Paso County, Fountain, Bachelor Gulch Metro District, Manitou Springs
- Iowa: Indianola Municipal Utilities; Iowa Fiber Alliance; Algona Municipal Utility; MidAmerican Energy Company; Muscatine Power & Water
- Minnesota: FTTH Feasibility Study City of Prior Lake, Minnesota
- Illinois: UC2B Broadband Fiber Infrastructure, Champaign / Urbana, Illinois

EXPERIENCE

20+ Years

Broadband assessment and strategy development

Design, engineering, and project management of thousands of miles of lit fiber

Fiber and utility project management

EDUCATION

Bachelor of Arts,
American Studies

103 years

Email

kdemlow

@hrgreen.com

719-644-7077



Edward Barrett

HR Green - Practice Leader/Principal in Charge

Ed brings more than 10+ years of telecom and broadband services experience working with both carriers and local communities. He has worked with both U.S. and international clients to analyze client needs, develop detailed specifications, and prepare implementation strategies. As a program manager, Ed has worked on multi-year product development and integration projects.

EXPERIENCE

10+ Years

Extensive interface with Broadband and Telecom Carriers and Municipalities

Managed telecom program implementation and market analysis

EDUCATION

BA, Journalism & Mass Communication

FIBER DEPLOYMENT FEASIBILITY, MOUNTAIN PARKS ELECTRIC, INC., CO

Project Manager to help this rural electric cooperative study the feasibility of two fiber deployment alternatives as part of a multi-year program. The first is the design of a 160 mile fiber to the substation build; the second alternative is an 1,800+ mile fiber to the home deployment.

BROADBAND FEASIBILITY STUDY, CITY OF BUENA VISTA, CO

Strategic Advisor and QA/QC Manager for completion of a feasibility study including both Vision and Plan phase services to help move the community's broadband initiative forward. Coordinated the activities of the HR Green team and interfaced with City staff and the Board of Trustees to ensure deliverables were completed on time and on budget. Provided strategic advice and quality assurance on activities and deliverables and ensured customer satisfaction and quality metrics were achieved.

BROADBAND AND FIBER FEASIBILITY STUDIES, CITY OF FOUNTAIN AND EL PASO COUNTY., CO

Project Manager to prepare a broadband and feasibility assessment and study to determine viability of a community fiber program for each jurisdiction.

COMMUNITY DEVELOPMENT PLANNING, HENDRICKS COUNTY, IN

Project Manager, responsible for assisting Hendricks County with the design and implementation of online Land Development planning software. Gathered system requirements from key stakeholders in the County's Planning & Building Departments to convert manual, paper-based record keeping to a fully automated, online records management system. Developed the implementation schedule and drove the customization, implementation and rollout of software to the user community.

LAND PLANNING AUTOMATION, ABU DHABI, UNITED ARAB EMIRATES

Project Planner, responsible for gathering system requirements from key stake-holders in the Western Region Municipality's Land Planning Bureau to convert manual, paper-based record keeping to a fully automated, online records management system. To develop the implementation schedule, he gathered inputs from a diverse mix of consultants, regional development staff, governmental leadership and local constituents.

VP OF STRATEGY, SECURITYCOVERAGE, INC.

Oversaw the design and development of outsourced technical support services and security products designed to meet the needs of local and regional broadband ISP, cable and telecom providers. Developed services that positioned providers to successfully increase penetration and average service price levels in the core markets of more than 450 carriers through the sale of value added services. Ed developed national services agreements with the National Cable Television Cooperative to co-market company services into the regional carrier market.

John Monday

HR Green - Senior Technical Architect



EXPERIENCE

20+ Years

Proven experience in project management & product development across multiple platforms and networks

Satellite Communications & Ground Radio Communications experience with the United States Air Force

Served in the US Air Force and Wisconsin Air National Guard from 1991 to 2000

IP and Network Certified by Cisco and Nortel

EDUCATION

BS, Electronic / Electrical Engineering Technology

John is a Senior Project Manager and Lead Technical Architect at HR Green. He brings over 20 years of experience in the telecommunications industry, and is responsible for leading the firm's overall fiber and broadband technical team. In this role, John directs the firm's technical experts to ensure that Planning, Study and Design projects meet the firm's quality standards and are architected to enable success for our clients. John works directly with clients to assess financial costs and feasibility of projects.

Prior to joining HR Green, John was the VP of Broadband Services and Operations for Delta-Montrose Electric Association / Elevate Fiber, where he directed all activities of the fiber to the premise (FTTP) subsidiary and implemented its fiber to the home (FTTH) project. This included determining objectives and establishing operating procedures to create and maintain financial soundness and profitability while ensuring optimum service to subscribers.

FIBER DEPLOYMENT FEASIBILITY, MOUNTAIN PARKS ELECTRIC, INC., CO

Project Architect to help rural electric cooperative study the feasibility of two fiber deployment alternatives as part of a multi-year program. The first is the design of a 160 mile fiber to the substation build; the second alternative is an 1,800+ mile fiber to the home deployment.

DELTA-MONTROSE ELECTRIC ASSOCIATION / ELEVATE FIBER, CO

Vice President of Broadband Services and Operations, responsible for directing all activities of the fiber to the premise subsidiary and implementation of the fiber to the home projects. Determined objectives and established operating procedures to ensure optimum service to subscribers.

FASTTRACK COMMUNICATIONS, CO

Director of Network Engineering and Operations responsible for all aspects of a regional ISP, a facilities-based CLEC and optical transport (SONET and DWDM) network. Provided expertise in network design, planning and operations, while ensuring projects related to strategic

initiatives were completed within desired timelines and cost objectives.

NORLIGHT, INC, MULTIPLE LOCATIONS

Senior Network Engineer and Design and Engineering lead for all products and services related to VoIP infrastructure. Completed proof of concept integration testing and provided additional documentation, training and Tier III support for the Operations' groups. Completed IP related tasks required for assigned projects including updating Core and Edge router/switches, Firewalls, DNS, Session Border Controllers and Softswitches. Provided VoIP SME expertise to Director of Network Engineering and Senior Management Team.

John Merritt, PE

HR Green - Senior Project Engineer



EXPERIENCE

40+ Years

Extensive, innovative design experience, including signal master hardware and software, radio systems, and traffic counts

Signal timing, traffic operations and Intelligent Transportation System expertise

EDUCATION

Masters, Transportation Engineering

BS, Transportation Engineering

REGISTRATION

Professional Engineer, CO #15826

John brings 40+ years of diverse engineering experience, including fiber optic systems, review, transportation and traffic engineering. He has served as Traffic Engineer to the Cities of Centennial and Boulder and the Town of Superior, Principal Traffic Engineer to the City of Colorado Springs, and Transportation Administrator and Engineer to the City of Lakewood. He has expertise in street lighting and telecommunications, such as the installation of a 350 mile fiber optic system, the development of a right-of way co-location permit system requiring telecommunication companies to install City conduit at the time of their bore work, and led negotiation efforts for the takeover of the Colorado Springs' street light system. While working for the City of Centennial, John worked collaboratively with Arapahoe County to guarantee both agencies benefited from fiber and conduit installations, developing a fiber and conduit integrated, comprehensive system.

TRAFFIC ENGINEERING, CITY OF GOLDEN AND TOWN OF SUPERIOR, CO

Over the past two years John has been spearheading a **regional traffic signal master system** connecting **Golden** and Superior.

TRAFFIC ENGINEERING, CITY OF COLORADO SPRINGS, CO

Principal Traffic Engineer responsible for ITS / Traffic Operations Center as well as a \$5 million annual CIP and operations budget for traffic and transportation activities. Helped develop a two-pronged communications system to support local and State ITS projects – one system included 350 miles of fiber-to-the node (FTTN) and two wireless communications systems to interconnect the 480 traffic signals; the second system was dedicated to automatic vehicle location and fire pre-emptive systems. Developed a Traffic Operations Center that included a number of innovations: reusing a 110 year old warehouse, signal master software written and customized by contract staff for the specific needs of traffic engineers, and a video screen assembled by City staff, saving \$225,000. Received international recognition, winning the *Institute of Transportation Engineer's* Individual Award for his ITS work.

TRAFFIC ENGINEERING, CITY OF CENTENNIAL, CO

Traffic Engineer responsible for traffic engineering and developing traffic management plans Installed more than 60 miles of fiber optic infrastructure in/near the Denver Tech Center. Procured a new traffic signal master system, Designed and implemented telecommunications system for a new city-wide ITS using a hybrid system of digital radios connecting to a fiber optic backbone was recommended. Initiated dozens of public/private partnerships and was successful in obtaining millions in regional grants to implement the plan.

SMART CITY / BROADBAND / FIBER ASSESSMENT AND DEPLOYMENT, VARIOUS CO JURISDICTIONS

Technology/IT Analysis Task Leader for **Smart City/Broadband/Fiber Assessment** (*Breckenridge, Fountain, and El Paso County*) and Staff Augmentation Engineer for **Fiber Deployment** (*Manitou Springs Urban Renewal Authority*).

References

Detailed project write-ups of the following references are included earlier in our proposal.

▶ **Municipal Broadband / Fiber Deployment**
CITY OF CENTENNIAL, CO

Daniel Hutton
Denver South Economic Development Partnership
404.531.8386

▶ **FTTP Feasibility Study**
MOUNTAIN PARKS ELECTRIC, INC., CO

Tom Sifers
General Manager
970.887.3378

▶ **Broadband Assessment, Build and Operations**
DELTA MONTROSE ELECTRIC ASSOCIATION, CO

Mark Kurtz
Smart Grid Supervisor/Fiber Project Manager
970.240.6817

▶ **Broadband Assessment and Feasibility Analysis**
TOWN OF BUENA VISTA, CO

Larry Deffenbaugh, IT Director
719.395.8643 x4