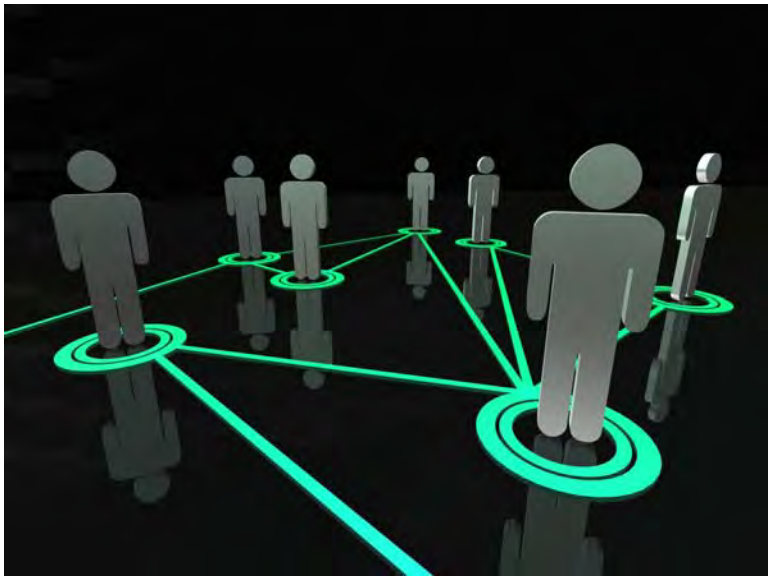
City of Lawrence

INFORMATION TECHNOLOGY

FIBER PROJECTS OVERVIEW

City of Lawrence, Kansas

By James Wisdom



March, 2013

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Introduction

This report is intended to be an overview of how the City of Lawrence currently uses fiber technology and to identify some of our current identified needs, and projects that have been planned, or already undertaken. The report will cover areas that include:

- City of Lawrence and I.T. Department Goals
- History of fiber installations
- Listing of Lawrence area Internet Service Providers
- Fiber descriptions or terms used by City to identify specific fiber runs
- Currently installed fiber infrastructure, recommended future projects
- Partnering opportunities with other government bodies
- Locating and documenting fiber
- Other goals and information related to fiber and the City of Lawrence.

The City of Lawrence has 65 buildings that have personnel, phones, and computers that require communication capabilities to allow the employees to perform their duties and provide services to the citizens of Lawrence. In the past the traditional methods were to install ISDN lines, T-1 lines, and broadband connections to provide services for locations. Today's bandwidth requirements make it more difficult to efficiently provide the necessary services using the lower speed connections. The City of Lawrence has been fortunate to install fiber at various times that has greatly increased our communication capabilities and options.

City of Lawrence and I.T. Department Goals

A summary to the I.T. goals are:

- Connect City Buildings together via fiber when possible.
- Complete or expand the Intelligent Transportation System (ITS) Network.
- Connect City water towers to the network
- Complete fiber ring(s) to improve network uptime
- Connect to City sewer lift / pump stations when costs are feasible.
- Develop a Fiber Committee to control the use and direction of fiber usage
- Document the fiber installations in detail for better support
- Partner with other government and public institutions
- Develop a multi-vendor fiber demarc at Farmland / East Hills to provide connectivity
- Connect to KanRen, a non-profit ISP supporting education and government entities
- Develop procedures and contacts for emergency fiber repairs

History of Fiber Installations

Building Fiber Infrastructure

1997 A Fiber backbone was installed in City Hall that has fiber connections that run from each floor of the building to the City's server room located on the third floor of City Hall. This provided a better network infrastructure than the previous copper network could provide.

1997 Fiber installed to connect Sanitation and Streets Buildings. The Street Division building had just been built and the new building needed phone and network connectivity. Instead of buying both, it was decided to run fiber from Sanitation to Streets to allow them to share the same phone system and use the same network connectivity.

1998 The Wastewater Plant has fourteen (14) buildings connected to the main Wastewater Building via fiber. The fiber was installed as part of the Wastewater Plant expansion and upgrade.

1998 The Kaw Plant Site had fiber installed that connected the main plant building to the other seven (7) buildings at the Kaw Plant site. The buildings have a variety of PC's SCADA Control Units, and view node PC's along with phones, supported from the Main Kaw Plant Building.

2001 The building inspection personnel that been located on the ground floor of City Hall were moved to the Riverfront Building located next to City Hall. Fiber was installed to support the city's staff, and the Training Room.

2007 Fiber was run from Clinton Plant's main building to the other buildings on the property as part of the water plant's expansion project.

Outside Plant Fiber Infrastructure

2002 The Municipal Court staff had already been re-located from the Law Enforcement Center at 111 E. 11th St. to 1006 New Hampshire St., but had slow (T-1) network connectivity. The City had just leased offices at 947 New Hampshire Street for Parks & Recreation, Transit and Parking Control offices and the new offices needed phones and network connectivity. Fiber and 50-pair copper cabling, was installed from the Law Enforcement Center to Municipal Court at 1006 New Hampshire and on to the 947 New Hampshire Street offices. This installation allowed the sharing of the Police Department's phone system.

2004 A government required lime residuals project was completed. The project required a pathway to connect the Kaw Water Treatment Plant to the Wastewater Plant. At the same time, fiber was installed between the two buildings that was centralized at City Hall, greatly improving the network capabilities of the Utilities Department. This also allowed the Information Technology Department to relocate backups and fail-over computer equipment to be relocated to the Wastewater Plant to better protect the City's servers and data.

2006 Fiber was installed between the City of Lawrence's City Hall Building and Douglas County's Building located at 111 E. 11th St. Douglas County handled the bidding process and the City and the County shared the costs. There were 48-strands of fiber installed, with both the City and County sharing 24-strands each.

2009 Fiber was installed to Lift Station #25. This lift station is located on the south side of the East Hills Business Park, and is part of the future strategy of connecting to fiber that will eventually be installed to the future wastewater treatment plant south of Lawrence. This fiber is intended to eventually be extended to 10-Highway and O'Connell Road to connect to the future plant and to complete a fiber ring for the SCADA network.

2009 Fiber was leased on a five-year lease from Knology for the Clinton Plant. The current contract expires in the fall of 2014. This is the only fiber that is leased by the City of Lawrence.

2010 Phase 1 of the Intelligent Transportation System (ITS) fiber was installed. 288 strands were installed from City Hall at 6th & Massachusetts Streets 6th & Iowa Streets, then to 23rd & Iowa Streets. During the Project, both the Traffic Building and Fire Station #5 were connected.

2011 Fiber was installed from the Law Enforcement Center to the South Park Offices and the Community Building. Parks and Recreation Administration moved their offices from 947 New Hampshire to South Park at 1141 Massachusetts St. and to the Community Building.

2012 Phase 2 of the ITS project was completed, connecting fiber from 6th & Massachusetts Streets and City Hall to the area north of I-70 known locally as Tee Pee Junction.

2012 Phase 3 of the ITS project was completed, installing 144 strands of fiber from 23rd & Iowa Streets to 23rd & Harper.

2013 Fiber is installed from 23rd & Harper to O'Connell Road and 10-Highway to support the new Traffic signal being installed at that intersection. (This project is currently underway).

2013 Fiber conduit installed under 10-Highway, connecting the existing DTI conduit (south side of 10-Highway) and Verizon conduit (north side of 10-Highway). No actual fiber has been installed in the conduit yet. The conduit will also allow the newly planned Water Reclamation Facility in short to have a future ring, with one path back to City Hall and the other path back to Wastewater via the Pump Station #25 fiber/conduit.

2013 Fiber (96-count) is being installed from 1320 Road, south to the planned Water Reclamation Facility, which will be the City's second Wastewater Treatment Plant. The fiber will still need to be extended north from 1320 Road to the junction of 10-Hwy and O'Connell Road.

2013 Fiber is to be installed, probably in March 2013, at 19th & Iowa to connect the City's network to Kansas University's network. The connection will offer many opportunities to both the City and KU. The installation costs to be split with Douglas County, with the City reserving 24 strands for the City, 24 strands for the County, and the remaining strands will be available for potential partners and projects that need to connect to KU.

City of Lawrence Fiber Definitions

I.T.S. (DTI) Conduit / Fiber: This conduit was originally installed by DTI, which later went bankrupt. The agreement made 1999 with the City of Lawrence allowed DTI access to the City's right-of-way to install conduit with the understanding that DTI would install a single 1-1/4" conduit specifically for the City of Lawrence. The DTI conduit consists of five separate 1-1/4" conduits of various colors. The "blue" conduit belongs to the City of Lawrence. Since the bankruptcy, there are two conduits under the control of the Kansas Department of Transportation (KDOT), two conduits belong to LightCore, and the one blue conduit belongs to the City of Lawrence. The conduit starts on the south side of 10-Highway near the East Hills Business Park and goes west to 23rd and Iowa, north to 6th & Iowa, East to 6th and Massachusetts, then proceeds under the east bridge over the Kansas River and proceeds north the the 24/40 Highway intersection. The City has 288 fiber strands installed from 6th & Massachusetts Streets to 6th & Iowa, and then to 23rd & Iowa Streets. The section going north from City Hall to 24/40 near what is known as Tee Pee Junction has 144 strands of fiber. The section from 23rd and Iowa to 23rd (10-Highway) and O'Connell Road also has 144 strands of fiber. The primary use of this fiber has been to lay the foundation of the City's Intelligent Transportation System (ITS). The fiber has also been used to connect the Traffic Building at 445 Mississippi Street, and Fire Station #5 at 1911 Stewart Avenue (19th & Iowa).

Map: Map-2 is a map of all the traffic signals with the City of Lawrence
Map: Map-55 is a map of the ITS/DTI Conduit
Map: Map-65 is a map of the conduit connecting the DTI and Verizon conduit

Verizon Conduit / Fiber: The Verizon conduit was installed in 2012. Verizon was running fiber from Topeka to Lenexa and was looking for a pathway through, or around, Lawrence. Verizon's consulting firm, Golden Field Services, of Tulsa, Oklahoma. Golden Field Services' Vice-President of Communications, Larry Stalcup worked with the City and Verizon to allow Verizon to use the City's right-of-way for installing a separate 1-1/4" conduit along with their conduit and appropriate pull-boxes in lieu of right-of-way fees. The conduit starts at East 800 Road, just to the west of the 10-Highway bypass west on 6th Street and proceeds to 6th & Wakarusa, proceeds south to Wakarusa and Clinton Parkway, then east down Clinton Parkway / 23rd Street past the East Hills Business Park, and goes down Noria Road. The conduit is currently empty, but plans are underway for its usage.

Map: Map-21 is a map of the 23rd & Iowa where Verizon and DTI conduit are in close proximity
Map: Map-22 is a map of the Clinton Plant and Fire Station #4 area around 2100 Wakarusa
Map: Map-23 is a map of the Wakarusa and Bob Billings area where KU and City have interest
Map: Map-24 is a map of the planned Rock Chalk Sports Complex where City & KU have interest
Map: Map-60 is a map of the Verizon Empty Conduit
Map: Map-61 to Map-64 are maps of the Verizon Pull Box Locations
Map: Map-65 is a map of the conduit connecting the DTI and Verizon conduit
Chart: A-30 is a summary of the estimated length of fiber to fill the Verizon Conduit.
Chart: A-31 is a listing of distances between major intersections along the Verizon Conduit.

Utilities SCADA Fiber Network: The City of Lawrence's Utilities Department has fiber connecting the water and wastewater plants that is both used for the City's network and the SCADA network. Wastewater, the Kaw Plant and the Clinton Plant each have SCADA networks that are firewalled off from the general network. The SCADA network is centralized at City Hall and connects all three water plants together. Fiber runs from City Hall east toward the Wastewater Plant which has fourteen buildings connected via fiber at the Wastewater plant. The Wastewater Plant has a server room that also serves as the City's backup site for servers outside of Wastewater. The fiber network proceeds eastwardly toward the south side of the East Hills Business Park to pump station #25. The fiber also proceeds to the west side of City Hall toward pump station #16, then through the park along the Kansas River to the Lime Residuals Building just to the north of the Kaw Plant. The Lime Residuals building has several network devices and UPS's that support the connection. The fiber proceeds to the Kaw Plant where there is a small server room. The approximate distance of the Kaw to Wastewater fiber is approximately 12,000 feet. The fiber also connects the Distributions Building, Collections Building, and two Warehouse buildings to the north of the main Kaw Plant Building. The Clinton Plant is connected via fiber leased from Knology. The five year lease expires in September, 2014.

The Information Technology Department and the Utilities Department highly recommends that the SCADA network be used strictly for the Utilities SCADA systems and physical security is the first level of security

Map: Map-4 is a map of the Stratford Water Tower, Security Cameras
Map: Map-10 is a map showing the locations of the sewage lift stations.
Map: Map-70 is an overview map of the Utilities Department SCADA Network
Map: Map-71 is a map of the planned Water Reclamation Facility location
Map: Map-72 is a map of the Kaw Plant network connections
Map: Map-73 is a map of the City Hall to Kaw Plant fiber
Map: Map-74 is a map of the City Hall to Wastewater Plant fiber
Map: Map-75 is a map of the Clinton Plant location.

City Hall Fiber and Network: The City's network is centralized at City Hall. The Information Technology Department supports all departments with the exception of the Police Department which has their own internal support staff. The City currently uses a Cisco Nexus 10GB core switch to support and connect the network. The network is centralized at the server room located on the third floor. Some of the features of the City's network are:

- Fiber backbone exists in City Hall having fiber from each floor terminating in the server room
- Each floor in City Hall has switches that connect to the third floor core switch via fiber.
- DTI/I.T.S fiber network terminates in server room
- Fiber run connects the offices and training room at the Riverfront Building to City Hall
- Fiber run connects the Wastewater Plant to City Hall
- Fiber runs connects the Kaw Plant to City Hall
- Fiber run connects the Law Enforcement and Douglas County to City Hall
- Fiber connects City Hall to AT&T's Central Office
- Fiber connects City Hall to Knology's network
- Community Wireless leases fiber within the ITS conduit
- Kansas Fiber Network has fiber that across the street from City Hall
- CenturyLink has a large fiber run that parallels the railroad tracks behind City Hall
- KDOT/ LightCore/CenturyLink have fiber conduits that parallel our ITS conduit
- Sprint has fiber that is across the street from City Hall
- Server room features:
    - 16KVA UPS
    - Generator support
    - Dual air-conditioning systems
    - Fire suppression
    - APC Cabinets

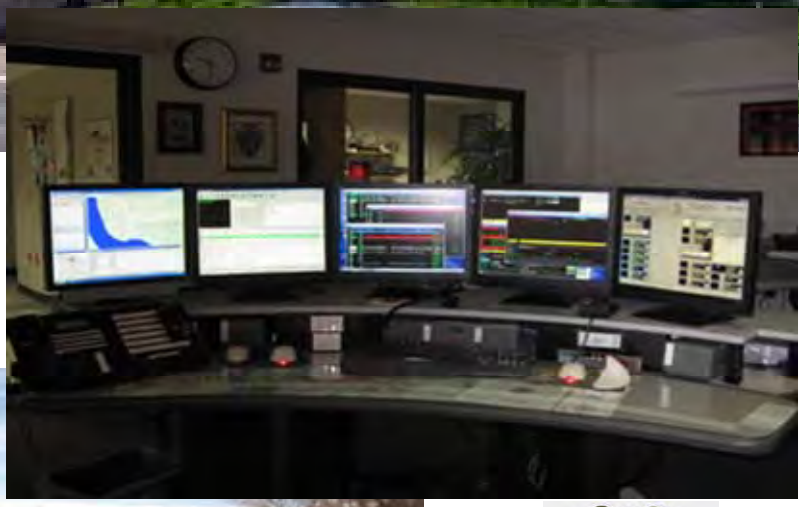
City Hall, Lawrence, KS

Map: Map-11 is a map fiber from City Hall to Riverfront Building

Map: Map-12 map of the City Hall area showing potential known partners, others may exist.

Police Network: The City's Police Department and Douglas County's Sherriff's Departments share a network based in the Law Enforcement Center, 111 East 11th St. The City and County share the Law Enforcement Office, the Jail Facility, dispatchers, and the 911 Computer Aided Dispatch (CAD) systems. The Law Enforcement Center connects to City Hall via the shared City/County fiber. The Investigation and Training Center (ITC) on Bob Billings uses wirelessly to the water tower on 6th Street which relays to a wireless connection on top of City Hall and from there uses fiber to connect to LEC. The LEC and ITC network uses a T-1 connection for failover connectivity. Completing the Verizon conduit/fiber project would allow the ITC Building to connect to LEC via fiber.

Law Enforcement Center, 111 E. 11th St.



Investigation and Training Center, 4820 Bob Billing Parkway

Map: Map-13 is a map of the City Hall to Law Enforcement connection.

Map: Map-14 is a map of the connections to the Law Enforcement Building.

Douglas County Fiber Connection: The Information Technology Departments of the City and County have worked well together in past projects and continue to have a good working relationship. In 2006, Douglas County had a bid to install 48-strands of fiber from their network closet / Network Operations Center (NOC) located at 111 East 11th Street to the City's network center on the third floor of City Hall at 6 East 6th Street. The fiber terminates in the network/phone closet used by the Police and Sherriff's Departments to support the 911 dispatchers near the southwest corner of the building. The fiber then proceeds north through the building to the northeast corner of the building. The fiber leaves the building at an angle to the southwest corner of 6th & Rhode Island Streets. The fiber proceeds north on Rhode Island Street on the west side to the west side of the lower level entrance of the Riverfront Parking Garage. The fiber proceeds diagonally across the entrance of the south side exit of the Parking Garage. The fiber proceeds along the ceiling of garage's lower level to the main support in the garage. The fiber proceeds to the south west exit of the lower level of the garage near the lower level entrance of City Hall. From the garage the fiber proceeds along a wall on the south side of the railroad tracks concrete wall to the northwest corner of City Hall where it enters City Hall and is ran through conduit to the I.T. Department's third floor server room.

The costs for this project were split 50/50 between the City and the County and each entity has access to 24-strands. At the time there was no formal agreement made, but there was a general understanding that the fiber would be used for the City and County I.T. networks and the Police and Sherriff's networks.

Since the initial installation the City's portion of the fiber has been used to connect the Police Department, Municipal Court, Transit Offices, Parking Control offices, South Park, Community Building and several other uses. Other uses still planned include expanding the Police Department's use for networking ITC, phone systems, camera systems and other uses.

Map: Map-13 is a map of the City-to-Douglas County Connection

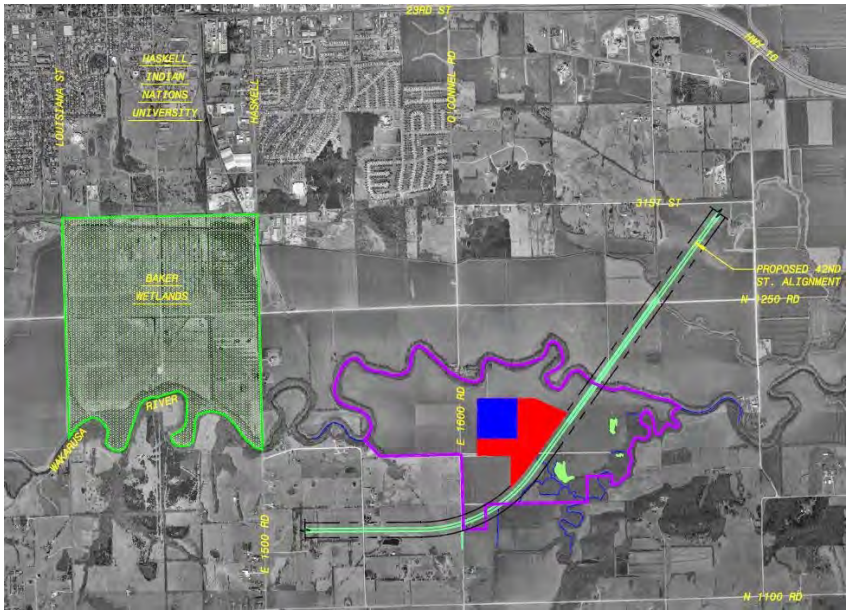
Kansas University's Ellsworth Fiber (March 2013?) The City connected fiber to Kansas University's network at the intersection of 19th & Iowa. The City has a pull box on the southeast corner of the intersection. KU's has a fiber entry point on the northeast corner of 19th & Iowa. The two locations are a little over 100 feet apart. KU's agreement allowed the City to use over 2,000 feet of existing conduit that connects to KU's Ellsworth Hall. KU has a significant amount of their fiber enter at the basement area of Ellsworth Hall. Much of the fiber is also connected to KU's network operations center. In addition, KanREN's (KU and the City's primary ISP) connection is also in the basement of Ellsworth. The City partnered with Douglas County to install 96-fiber count into Ellsworth. The intention is for the City and the County to reserve 24-strands each, and the remaining 48-strands to be used for organizations such as USD-497, Lawrence Public Library, and other potential partners. The City and County split the installation costs 50/50.

Map: Map-26 is a map of the KU-to-City Connection, 19th & Iowa
Map: Map-27 is a map of the KU-to-City Connection, Ellsworth Hall

I.T.S. (DTI) Fiber-to-Verizon Conduit: Fiber conduit installed under 10-Highway, connecting the existing DTI conduit (south side of 10-Highway) and Verizon conduit (north side of 10-Highway). No actual fiber has been installed in the conduit yet. The conduit will also allow the newly planned Water Reclamation Facility in short to have a future ring, with one path back to City Hall and the other path back to Wastewater via the Pump Station #25 fiber/conduit.

Map: Map-65 is a map of the Verizon-to-DTI Conduit at 10-Hwy & O'Connell Road

Water Reclamation Facility Fiber: The City is beginning the preparation for a second Wastewater Treatment Plant which will be required to allow for the continued growth of the City. The project is currently in the process of installing fiber (96-count) parallel to water lines that are being installed. The current project involves installing fiber from 1320 Road, south to the planned Water Reclamation Facility. The fiber will still need to be extended north from 1320 Road to the junction of 10-Hwy and O'Connell Road.



Map: Map-71 is a map of the planned Wakarusa Reclamation Facility

Crown Castle Fiber (Formerly NextG): In 2011, NextG was contracted by Sprint to install fiber at several locations within the City of Lawrence. Sprint used the fiber to expand their bandwidth and ability to support large number of users in more populated areas such as high-density apartments and other high-density areas. The Information Technology Department attempted to negotiate with NextG to use a buffer tube of fiber within their network, but NextG only agreed to allow the City to use 2-strands of fiber wherever their fiber was used. Soon after the installation NextG was acquired by Crown Castle which now owns the network. To date, the City has not attempted to use the 2-strands of fiber, but their routes are currently under evaluation for future opportunities. A large PDF file is available of the network layout.

City of Lawrence and I.T. Department Goals in More Detail:

Connect to City Buildings: As stated previously, the City has 65 different buildings that have computers, personnel and phones that are supported by the Information Technology Department. These buildings and locations make up a network that uses diverse communications to support the City of Lawrence's Network.

A current overview of the City of Lawrence's network consists of:

- 65 Buildings that have personnel or computer equipment in them.
- 27 of these buildings involve the three water plants, Wastewater (15), Kaw (7), and Clinton (5)
- 37 of the 65 buildings have fiber that connects back to City Hall
- 5 other buildings have some fiber connections, but don't reach City Hall yet.
- 8 buildings use T-1 lines from AT&T
- 7 buildings use broadband cable from Knology
- 9 buildings use point-to-point wireless or bridges owned by the City to connect to City Hall
- 3 locations use Verizon Wireless to connect to City Hall via a VPN connection
- 1 location (Baldwin Fire Station) uses Sprint DSL/VPN to connect to City Hall (paid by the County)
- 34 lift stations use ISDN BRI lines from AT&T to connect to Wastewater

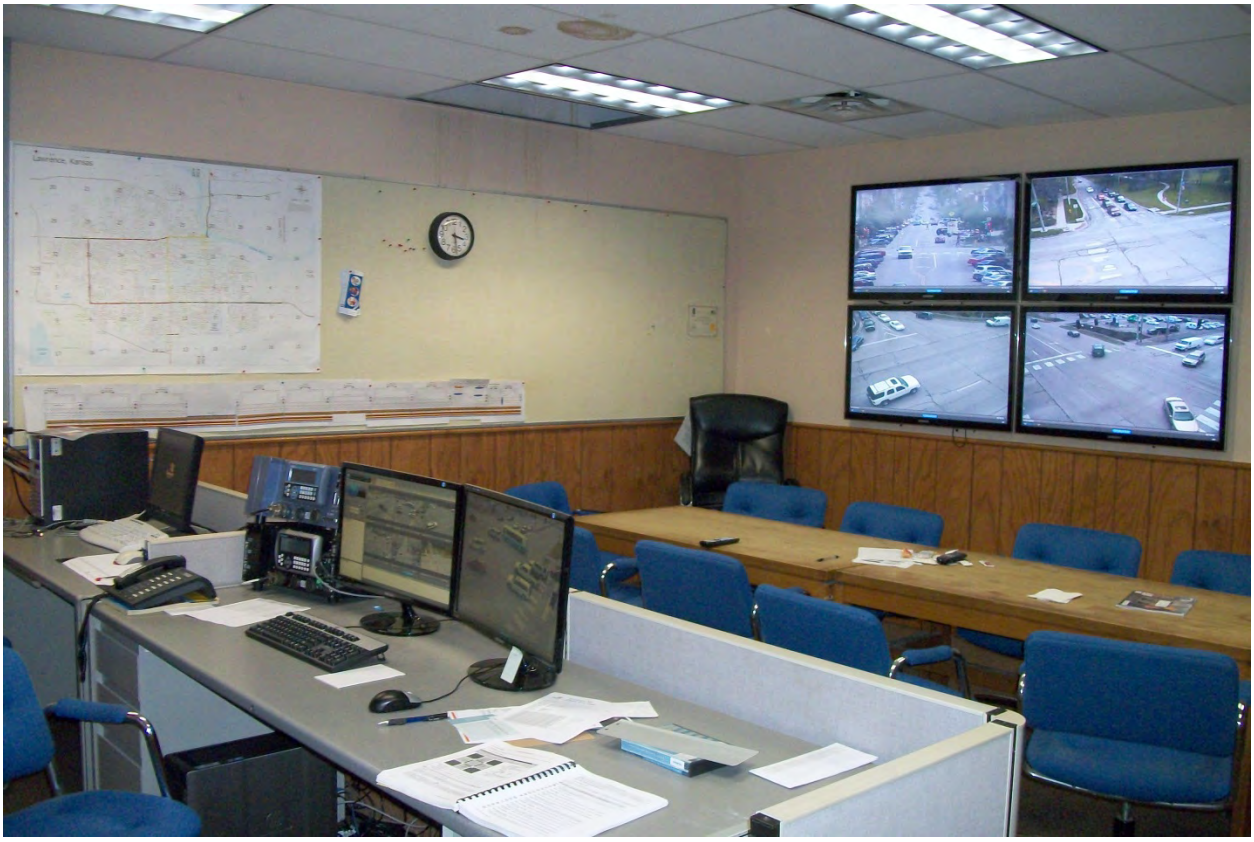
Map: Map-1 is a city-wide map overview of the City of Lawrence that identifies many of the City of Lawrence Buildings and some of the Douglas County, Kansas University, and other buildings that are under consideration as potential fiber projects.

Complete ITS Network: The City worked with a consulting firm, Kimley-Horn, to design the framework for an Intelligent Transportation System (ITS) plan. The ITS plan allowed the City of Lawrence to apply for grants that have helped the City obtain some of the funding needed to begin implementing a Traffic Operations Center located at the Traffic Building at 445 Mississippi Street and the framework on an ITS network. The Traffic Operations Center has four large screens that allow them to monitor the traffic and connect to the controllers where the necessary equipment and software have been installed.

The ITS project to date has been done in three phases:

- Phase #1: City Hall (6^{th} & Massachusetts St) to 6^{th} & Iowa, then to 23^{rd} & Iowa
- Phase #2: City Hall (6^{th} & Massachusetts St) north to 24/40 Highway
- Phase #3: 23^{rd} & Iowa Streets, east to 23^{rd} & Harder Streets.

The City hopes to add many additional intersections to the ITS infrastructure in the next year or so, but particular funding for the traffic cameras, network switches, and other related equipment have not been approved at this point. The City will probably complete some of the ITS project using other networking opportunities that are available.



Traffic Operations Center Room, 445 Mississippi Street, Lawrence, KS

The City of Lawrence currently has approximately eighty (80) traffic signals. The I.T.S./DTI fiber connection currently has twenty-one (21) intersections connected. In March 2013, the fiber is to be extended from 23 & Harper Streets to O'Connell Road and 10 Highway, which will add one more traffic system controllers capable of connecting, although the actual funding for the connection may not be part of that specific project.

Installing fiber in the Verizon Conduit would allow the City of Lawrence to connect an additional twelve intersections to the I.T.S. network. Other potential fiber projects may allow the City to connect to even more intersections in the very near future. The City may consider other connectivity options for those traffic intersections where fiber may not be a viable option for some time.

The Charts referenced below list fiber distributions that were used for planning purposes and don't recommend any agreements with the exception of the Red buffer tube (12-strands) used by Community Wireless. The Brown buffer tube (12-strands) has been reserved for Douglas County.

Map: Map-2 is an overview of the approximately 80 traffic signals within the City of Lawrence.
Chart: A-40 shows the initial strand distribution during planning for Phase 1 of the ITS Project
Chart: A-41 shows the initial strand distribution during planning for Phase 2 of the ITS Project
Chart: A-42 shows the initial strand distribution during planning for Phase 3 of the ITS Project

Connect to Water Towers: The City's Utilities Department monitors the status and security of water towers through network connectivity. The City's SCADA system monitors the tank levels and operations and most currently use AT&T ISDN BRI line connectivity to monitor these sites. Each water tower has security cameras mounted on them to monitor physical security. Currently, Community Wireless has wireless network connectivity at these towers and provides a wireless network that is centralized at the Stratford water tower and then connects via fiber to the City Network supporting the security monitors located at the water plants.

Stratford Water Tower: The City owns a conduit from the Stratford Water Tower to the ITS/DTI fiber at Iowa and Oxford Streets. The conduit mentioned was installed by Community Wireless and transferred to the City of Lawrence in lieu of payment of money owed to the City. The 2-inch conduit currently has two fiber runs installed in it by Community Wireless; the second was installed without informing the City of Lawrence. The City currently has a 96-count fiber cable on hand that is planned to be installed from the Iowa / Oxford hand hole to the Emergency Operations Center (EOC) building located on the tower property. The EOC building is the central location for the 911 communications equipment and radio system used by the Police, Sherriff, and Fire Departments. Douglas County currently has an EOC project where a new primary communications building will be built and the Stratford location will be the backup site for emergency communications. Additionally, there has been fiber sharing opportunities discussed to have Douglas County and the EOC to use some of the fiber soon to be installed.

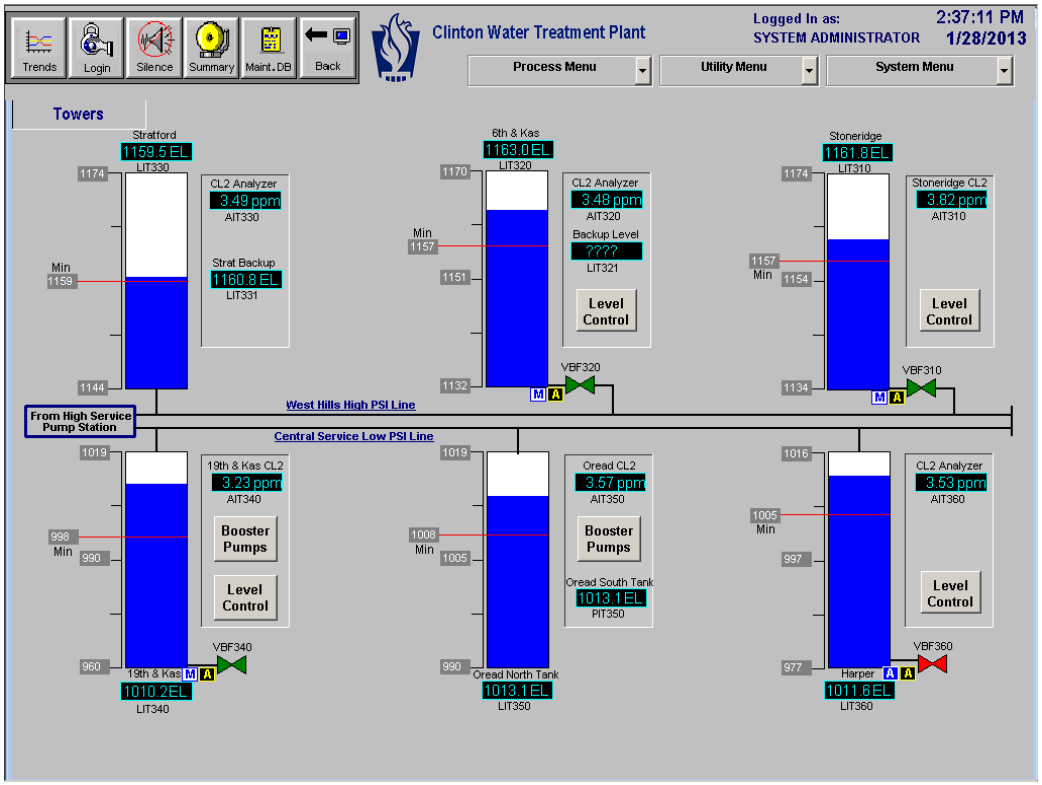
Harper Water Tower: The City has an opportunity to connect to the Harper Water Tower by partnering with Douglas County allowing them to connect to their Fairgrounds on Harper Street where they have their network failover site.

6th Street Water Tower: The City will probably have several opportunities to complete the fiber runs on 6th Street to improve the ITS monitoring of Traffic Signals. This water tower is next to Fire Station #3 which is another site the City would prefer a fiber connection

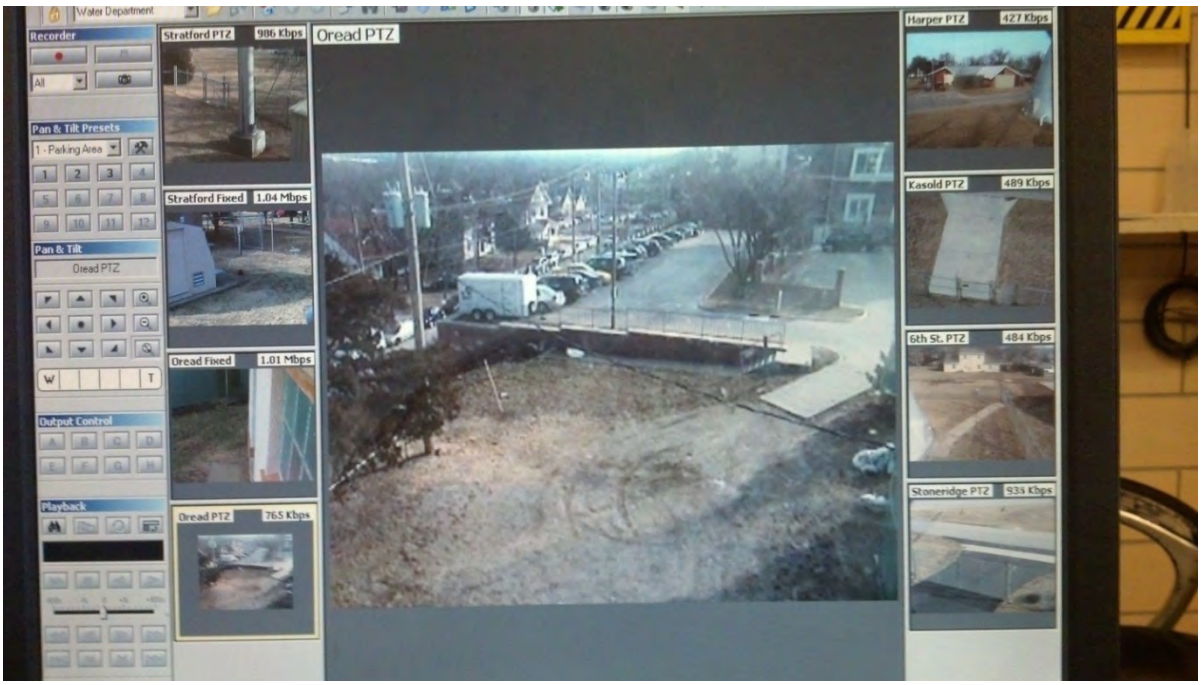
Map: Map-3 is an overview of the water towers within the City of Lawrence.
Map: Map-4 is a map of the Stratford Water Tower Project.

Stratford Water Tower

Lawrence, Kansas

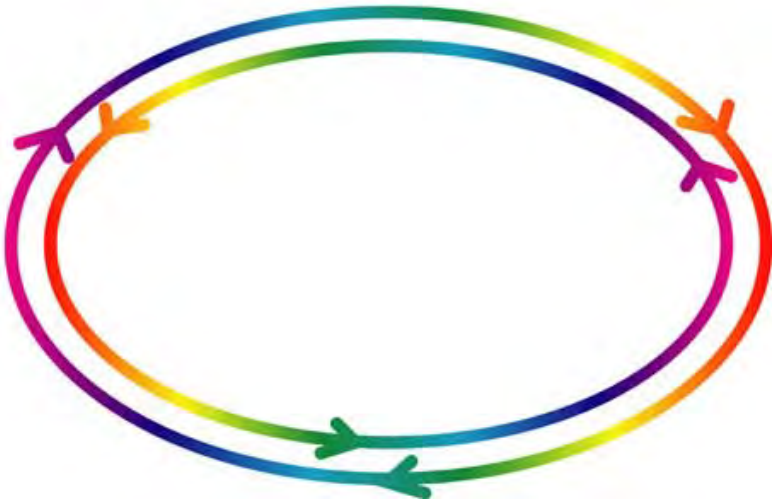


Screen displaying water tower capacity monitoring



Snapshot of screen watching Tower properties

Complete Fiber Network Ring(s): A goal of the City should be to complete fiber ring(s) to help prevent future downtime. Although it may not be practical to develop fiber rings for every fiber, the City's most critical equipment and services would be better served by connecting the fibers in a ring. The ring configuration helps the network to be connected in a circle type configuration allowing the data to flow either way in times of network or fiber troubles. A ring should be developed for the core services utilizing the ITS/DTI fiber cable, the future Verizon fiber, and the Utilities SCADA systems. In the case of the Verizon conduit, developing a ring involves completing the 6th & Wakarusa to 6th & Iowa connection and using fiber from both the Verizon and ITS/DTI installations to complete a ring.



Fiber rings allow the traffic to flow in either direction

Map: Map-6 is a map that displays completing a ring for the DTI conduit fiber
Map: Map-7 is a map that displays completing a ring for the Verizon conduit fiber in the future

Connect to Lift & Pump Stations: The City has approximately 34 sewer lift/pump stations located throughout the City. Currently, only lift stations #16 and #25 are connected via fiber to the City's network. The remaining lift stations are using ISDN BRI lines from AT&T to connect to the City's network. Lift stations typically have a router and a controller that are monitored by the Utilities Department systems. Uptime is critical for these stations to prevent backflows into residential homes and businesses and if connectivity is lost the department typically call employee in to specifically monitor these sites. Connecting lift stations may not always be cost justifiable, but in cases where the fiber is close we should take advantage of the connectivity option.

Map: Map-10 is an overview of the Sewage System Lift Stations
Chart: A-10 is a summary of the physical addresses of the Lift stations.

Develop a City Fiber Committee: The I.T. Departments recommends that the City develop a fiber committee that consists of City employees that could work together to further the installation and usage of fiber technology for the City of Lawrence. The Fiber Committee could oversee the usage and protect the City's interest in future projects dealing with existing and future fiber. The I.T. Department recommends the following employees to make up the Fiber Committee due to their involvement with fiber and the potential for future projects where fiber should be considered.

- James Wisdom, Director of I.T.
- John Williams, Network & Technology Services Manager
- Micah Seybold, GIS Coordinator
- Charles Soules, Director of Public Works
- David Cronin, City Engineer
- James Risner, Traffic Supervisor
- Dave Wagner, Director of Utilities
- Dave King, Utilities Maintenance Superintendent
- Diane Stoddard, Assistant City Manager
- Bill Stark, Fire Division Chief
- Jim Welsh, Lawrence Police Officer

In addition to this fiber committee a larger consortium group may need to be created that included personnel from other stakeholders in the City of Lawrence. Many of the potential key players on such a committee are listed within this report.

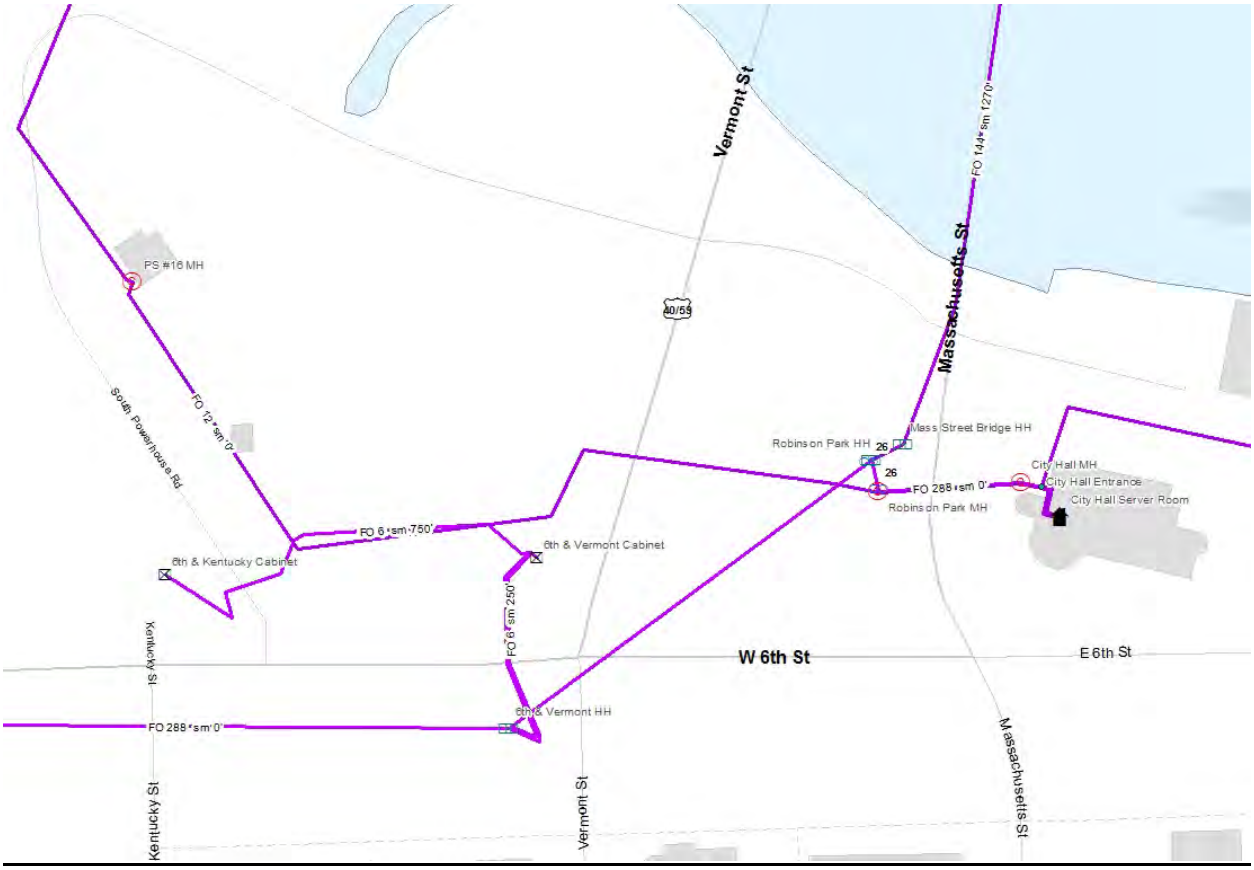
Better Document Fiber: The City has purchased a software product known as CrescentLink, which was developed by Palmetto Engineering Software, to document fiber. The City's GIS Coordinator has received training on how to enter the fiber data and the entry of information is underway. The software allows an organization to:

- Track every individual strand in every cable
- Manage circuits to the port level
- Trace entire circuits from any location
- Step along any circuit showing cables, panels, splitters, electronics, and patch cables
- Track owners, users, and leases
- Allows integration with ESRI GIS mapping data

Palmetto Engineering website: http://www.palmettoeng.com/

CrescentLink Software: http://www.palmettoeng.com/crescentlink.php

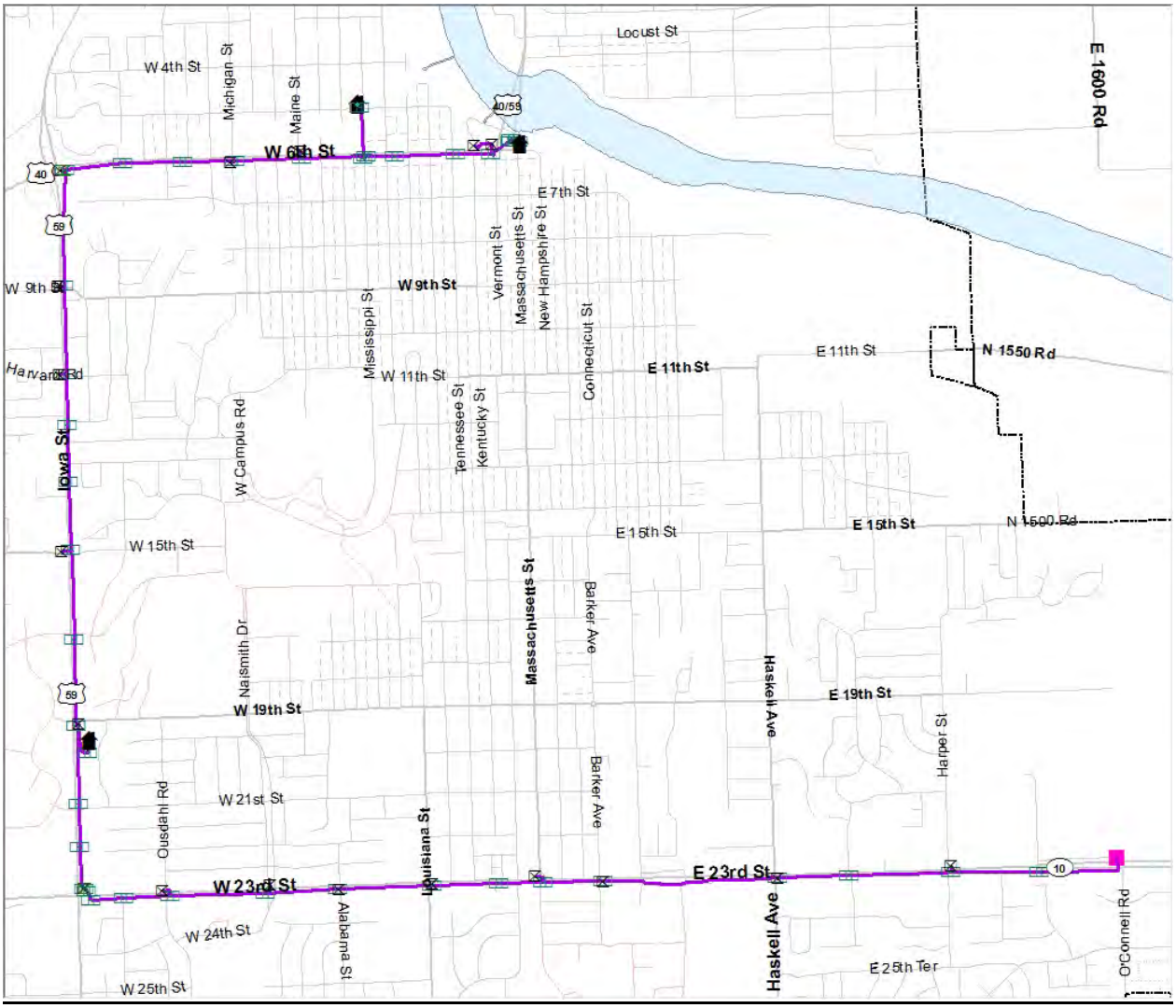
Additional screenshots can be seen at: http://www.palmettoeng.com/screenshots.php



An overview of the City of Lawrence fiber runs near City Hall

Micah Seybold, the City's GIS Coordinator, is currently going through the process of documenting the City's installed fiber. Micah has received training from Palmetto Software and they are working with him to best advise how to document our systems. Micah has been working closely with James Risner, the City's Traffic Supervisor, who has been at the forefront in working with the City personnel in designing much of the outside plant fiber, including the I.T.S. projects.

The Traffic Division has an Optical time-domain reflectometer (OTDR) which is used in troubleshooting and verifying fiber installs. In some cases, the fiber locations have been identified using the City's GPS equipment during the installation to identify the fiber route. The Public Works and Utilities Departments both have Trimble GPS equipment and both utilize the City's GPS relay station that allows the City to use the satellite navigations system to more quickly identify specific locations.



A screen-shot example that shows an overview of phase 2 and 3 of the City's ITS fiber.

An example of information on one single fiber.

Partnering with Other Government Entities: The Information Technology Department recommends partnering with other local government and public institutions on future fiber projects. This partnership is as a major goal to be achieved to help lower costs for services for these tax supported organizations. Of these potential opportunities, both Douglas County and Kansas University have been very involved and are ready to enter into formal agreements with the City of Lawrence. To date, the City I.T. staff has had extensive discussions with Douglas County and Kansas University, but other institutions have been included in these discussions. A listing of some of the potential partners that Information Technology has met with and discussed opportunities as follows:

Douglas County: The City and Douglas County have already partnered on one fiber project and have several excellent opportunities to work together. A proposed partnering agreement is currently under development by the City Attorney's Office. The City's primary contact at Douglas County has been Jim Lawson.

Website: www.douglas-county.com

Jim Lawson, Director of I.T. (Primary Contact)
jlawson@douglas-county.com
111 E. 11th St., Lawrence, KS 66044
(785) 832-5183, Office

Craig Weinaug, County Administrator
Weinaug@douglas-county.com
(785) 832-5328, Office

Scott W. Ruf, Director - Emergency Communications
sruf@douglas-county.com
111 East 11th Street, Unit 200
Lawrence, KS 66044
(785) 838-2470, Office

Douglas County Courthouse

Map: Map-4 is a map on the Stratford Water Tower, both EOC and Sherriff's have interest
Map: Map-15 is a map of the SWAN and Juvenile Detention Center in north Lawrence
Map: Map-16 is a map of the Douglas County Fairgrounds and Fire Station #2 Project
Map: Map-17 is a map of the Douglas County East Extension Project
Map: Map-26 is a map of the City / County –to- KU connection under consideration.
Chart: A-20 outlines many of the potential benefits to both the City and Douglas County on working together.

Kansas University: A partnership opportunity with KU offers many excellent opportunities to work together. The table in CHART A-21 outlines just some of the many potential benefits to both the City and Douglas County on working together. A proposed partnering agreement is currently under development by the City Attorney's Office. The City's primary contact at KU has been Jeff Perry.

In discussions with KU they have mentioned that our potential partnership meets some of the goals that KU has set. KU's Bold Aspirations strategic plan has a number of primary goals that align very well with this idea. These are:

KU Goal #3: "**Enhance research broadly with special emphasis upon areas of present and emerging strength in order to push the boundaries of knowledge and benefit society**." As part of this goal we are trying to increase public and private research activities, innovation, and funding as well as multidisciplinary strategic initiatives.

In our discussions there has been a common belief that by increasing the opportunities to network existing KU properties within the city we can provide the University, local non-profits, and various existing and future business incubation efforts with greater access opportunities to cutting edge research systems and educational resources at a greatly reduced price. Furthermore it's often difficult for research institutions to use typical commodity networking providers for certain types of research projects due to bandwidth, network response time, security, and advance feature requirements. So, not only would this lower the cost of entry to future collaborative projects but also begin to provide the area with advanced network technologies that aren't currently broadly available within the city. Examples of this are 40Gb/s and 100Gb/s networking and networks that are specifically designed for network and computing research. Many good examples can be found at the USignite website). KU is currently a member of Internet2, the GENI project, and many other national and international technology innovation groups.

Ignite website: http://us-ignite.org/next-gen-applications/

KU Goal #4: "**Engage local, state, national, and global communities as partners in scholarly activities that have direct public impact.**" As part of this goal KU is attempting to promote engaged scholarship, encourage and support scholarship, and promote active entrepreneurship with external partnerships. Enabling private, public, and not for profit organizations to have additional viable and cost effective access to cutting edge local IT resources such as distance learning, online learning, Telepresence, and research systems will give Lawrence a competitive advantage.

KU Goal #6: "**Responsibly steward fiscal and physical resources and energize supporters to expand the resource base**" As part of this goal KU is working to find ways that they can not only lower the cost of existing operations but to increase services as well.

Based on the discussions that KU's I.T. staff and the City's I.T. staff have had we agree whole heartedly that there are serious cost savings that can be had by all participating parties. While cost is a driver for KU, they are actually more excited about the increase in capabilities and opportunity to present their researchers and partners with new and innovative technology solutions.

Kansas University: …*continued*

Website: www.ku.edu
Current ISP: KanRen

Bob Lim, CIO
blim@ku.edu
Strong Hall, 1450 Jayhawk Blvd., Lawrence, KS 66045
Room 345
Lawrence, KS 66045
(785) 864-4999, Office

Jeff Perry, Deputy Technical Officer (Primary Contact)
perry@ku.edu
Computing Services Facility, 1001 Sunnyside Ave., Lawrence, KS 66045-7562
(785) 864-0489, Office

Eric Freeze, RCDD, Telecommunications Engineer
efreeze@ku.edu
Computing Services Facility, 1001 Sunnyside Ave., Lawrence, KS 66045-7562
(785) 864-9361, Office

Map: Map-20 map of the proposed connection between the City and KU at 19th & Iowa Streets
Map: Map-21 map of 23rd & Iowa showing how the City and KU would use the Verizon conduit.
Map: Map-22 map of the 2100 Block of Wakarusa showing Fire Station #4 and the Clinton Plant
Map: Map-23 map of Wakarusa / Bob Billings area where both the City and KU have buildings
Map: Map-24 map of the Rock Chalk Sports Complex where both the City and KU have interest
Map: Map-25 is a map of the Airport that could be connected if KU connects to a research farm.
Chart: A-21 outlines many of the potential benefits of the City and KU working together.

Kansas University Campus

Lawrence Public Library: A partnership wit*h* the Lawrence Public Library could potentially allow the City Library to connect to Kansas University's Library Systems, allowing citizens to access their available resources. Although no formal agreement is completed, this opportunity was mentioned by KU personnel. The City hopes to connect fiber to Fire Station #1 and to the new parking garage being built near the Library.to support a security system, this potential fiber project would pass by the Library. Brad Allen has been the primary contact with the Library. Although the drawing in map M30 indicates installing fiber on the east side of the street, but there is as much of an equal chance that it may be more cost effective installing the fiber on the west side of the street and crossing somewhere near the swimming pool.

Website: http://www.lawrence.lib.ks.us/
Current ISP: Knology

Brad Allen, Director (Primary Contact)
ballen@lawrence.lib.ks.us
707 Vermont St., Lawrence, KS 66044
(785) 843-3833

Tom Davin, IT Coordinator
tdavin@lawrence.lib.ks.us
(785) 843-3833

Map: Map-30 is a map of the Library, Outdoor Pool, Parking Garage, and Fire Station #1 Project

New Lawrence Public Library under construction

USD-497: The Lawrence Public School District 497 system currently uses Knology to support over 20+ schools and buildings via a Knology fiber network. There have been discussions with USD-497 personnel to connect their two network centers located at 110 McDonald Drive, and at Free State High School, at 4700 Overland Drive. A goal of USD-497 would be to connect their network to Kansas University's network and along with that to have the ability to connect to KanRen, a non-profit ISP that specializes in supporting government and educational institutions. Another preferred connection would be Lawrence High School, on the south side of the school property. The primary contact for these discussions to this point has been Karl Hague. The school district has not identified all of their needs, neither has the City developed a list of potential benefits in this partnership.

Website: www.usd497.org
Current ISP: Knology

USD 497 Administrative Offices
110 McDonald Drive
Lawrence, KS 66044-1063
(785) 832-5000, Main phone number

Chantel Nicolay, Division Director Technology & Library Services
cnicolay@usd497.org
(785) 832-5000, ext. 2664

Karl Hague, Network Administration (primary contact to date)
khague@usd497.org
(785) 330-2198, Office

Map: Map-35 is a map showing the schools and buildings of USD-497
Map: Map-36 is a map showing Free State High School's recommended entry location
Map: Map-37 is a map showing USD-497's Administration Office recommended entry location
Map: Map-38 is a map showing Lawrence High School's recommended entry location

Free State High School, Lawrence, High School

USD497's Two Network Operations Center Locations

Approximate fiber entrance for USD-497 Administrative Offices on McDonald Drive

Approximate entrance for fiber entry into Free State High School Building

Lawrence Memorial Hospital: There have been discussions with LMH personnel about the potential of partnering with them to connect the Lawrence Memorial Hospital, 325 Maine Street, to their other buildings in Lawrence. These buildings include the Surgical Center at 4th & Maine, the LMH South location at 3500 Clinton Place, near the intersections of Clinton Parkway and Kasold, and their physician offices located at 4525 W. 6th Street, which is on the southwest former of 6th Street & Folks Road. In addition, the hospital may be interested in connecting to the Lawrence Surgery Center at 1112 W. 6th Street, at the intersection of 6th & Maine Streets. The level of interest has not yet been determined, but would partially depend on the costs to the Hospital to participate. I.T.'s recommendation would be to work with them to close the fiber gap between 6th & Iowa Streets to 6th & Wakarusa. This project would allow the City to complete a fiber ring, connect to Fire Station #3 and adjacent water tower on next to the Fire Station, add an additional six traffic signal intersections to the ITS network and several other opportunities. The Hospital would benefit from their current leased communications with a long-term fiber solution. The primary contact person for this project has been Dan Maurin at LMH.

Website: www.lmh.org
Virtual Tour: https://www.lmh.org/virtualtour/index.jsp

Jane A. Maskus, CIO
Jane.Maskus@lmh.org
Lawrence Memorial Hospital
325 Maine Street

Dan Maurin, Technical Services Manager, (Primary contact)
Dan.Maurin@lmh.org
Lawrence Memorial Hospital
(785) 505-2968, Office

Map: Map-40 is a map of the potential networking of Lawrence Memorial Hospital facilities.
Map: Map-41 is a map of connecting 6th & Iowa to 6th & Wakarusa proposed fiber project
Map: Map-42 is a map of the LMH Building to 6th Street area

Lawrence Memorial Hospital

LMH South

Haskell Indian College: Haskell is a tribal university located in Lawrence, Kansas for members of federally recognized Native American tribes. Haskell was found in 1884 and has evolved into an accredited university that offers both associate and baccalaureate degrees. Enrollment at the campus is nearly 1,000 students per semester, representing approximately 140 Tribal Nations and Alaska Native communities. The University enjoys a positive reputation for hosting cultural and academic events that attracts visitors (both American Indian and non-Indian) from across the country and abroad. These activities include the annual Haskell Indian Art Market, the Stories-n-Motion Film Festival, and the Haskell Commencement Pow-Wow. These public events are held along with numerous educational conferences, workshops, and presentations.

155 Indian Avenue P
Lawrence, KS 66046
(785) 749-8404, Main Campus Phone

Campus Directory: http://www.haskell.edu/directory.html
Haskell Technology Link: http://www.haskell.edu/technology/index.html

Chief Information Officer
Joshua Arce, JD
jarce@haskell.edu
(785) 749-8482

Chief Financial Officer
Michael Lewis, MBA
mlewis@haskell.edu
(785) 749-8451

Map: Map-50 is a map of the Haskell Campus area on 23rd Street (10-Highway)

Other Partnerships:

Wicked Broadband (Community Wireless): The City has an existing agreement with Community Wireless, also known as Wicked Broadband. Community Wireless is a local privately owned company that provides wireless and fiber services to the residents of Lawrence and some rural residents. Wicked Broadband currently has a long-term lease on 12-strands of the City's DTI / ITS fiber. Wicked Broadband also has equipment installed on City water towers, City traffic light poles, City light poles, and Douglas County's emergency communications tower. Wicked Broadband has formerly been known as Community Wireless and Lawrence Freenet.

Website: www.lawrencefreenet.org

Joshua Montgomery, President
Joshua.montgomery@civicwifi.com
2321 Ponderosa Drive (P.O. Box 3532), Lawrence, KS 66046
(785) 371-4214, Office

NextG (Crown Castle International, Corp): In 2011, NextG entered into an agreement with the City of Lawrence involving fiber they were installing for Sprint. The agreement included the City of Lawrence having access to two strands of fiber anywhere their fiber was installed. The majority of their fiber was aerial mounted and is near apartment complexes for the most part. Crown Castle recently acquired NextG and notified the City of Lawrence to contact them regarding any issues involving the NextG installed fiber.

Mike Donnelon
Director of Implementation
Michael.Donelon@crowncastle.com
(314) 226-6910, Office

Crown Castle
Attention: Contracts Management
890 Tasman Dr.
Milpitas, CA 95035
contracts@nextgnetworks.net

Black Hills Energy: At the December 18, 2012 City Commission Meeting the City Commission approved partnering with Black Hills to share city-owned poles. Black Hills Energy is the natural gas provider for the Lawrence area. In an effort to improve and streamline their meter reading, Black Hills embarked on wireless meter reading, Advance Metering Infrastructure (AMI). Black Hills identified 29 locations at which they will need equipment to transmit data received from meters in the surrounding area.. The equipment consists of a pole, collector or repeater, solar panel, and antenna. Attached are typical installations and a list of the sites. The sites were determined through a propagation study. The City has requested and is working with Black Hills to co-locate on stop lights, where possible, to avoid/minimize adding poles in the right-of-way. The highlighted sites indicate those areas where Black Hills equipment will be added to a signal pole.

Black Hills currently operates within the City's right-of-way under a Franchise Agreement. These installations will obtain a right-of-way permit, go through a Historic Environs review (when applicable) and Black Hills will contact adjacent and affected neighbors. The City has also discussed the opportunity to possibly share some of this technology/infrastructure with Black Hills for water meter reading. There are a lot of details to this and Black Hills has indicated a willingness to cooperate when the City is ready to pursue this technology.

110 E. 9th St.
Lawrence, KS 66044
(785) 832-3999

Website: www.BlackHillsEnergy.com

Larissa Long
Manager of Community Relations (Kansas)
Larissa..long@blackhillscorp.com
(785) 832-3918, Office

Chuck Hoag
Operations Manager, Lawrence
chuck.hoag@blackhillscorp.com
601 N. Iowa
Lawrence, KS 66049
785-832-3944 (Office)

Westar Energy: Westar is Lawrence's electricity provider. Westar provides third party access to pole usage and rental. To become an approved attacher the organization must have a valid contract and insurance with Westar prior to submitting applications. Pole rentals require semi-annual payments. The chart below provides an estimated timeline required for completion of services. The pole rentals are typically $6.24 per pole annually, plus the engineering fees for the pole analysis which are approximately $100 dollars per pole.

Stage				
	Survey	**Estimate**	**Acceptance**	**Make-Ready**
Day:	0 45	59	73	133-148
Stage in days:	45	14	14	60-75
Owner Duty	• Conduct engineering survey.	• Provide cost estimate for make-ready.		• Give existing attachers 60 days notice. • Prepare poles if necessary. • Work with existing attachers' contractors.
Attacher Remedy	• Hire contractor to conduct survey (for attachments in the communications space).	• File complaint with Commission		• Hire contractor to perform make-ready.
Clock		• Parties may stop clock if no master agreement.		• Pole owner may stop clock for good and sufficient cause.

Westar Pole Rental Timeline Estimations

Below is Westar's pole rental approval process:

- Applications must be submitted to Westar Energy Compliance Services with a map indicating poles wanting to attach to. No more than 50 poles per application, if pole ownership is not available the Attacher must contact Westar Energy Compliance Services for the information.
- A load analysis of each pole must be conducted by a third party engineering firm. Each survey packet must be signed and stamped by a Professional Engineer, (at attacher's sole expense).
- Survey must be completed within 45 days and sent to Westar Energy Compliance Services, in the packet the Engineering Firm must include.
- Results of Westar Energy pole loading analysis and shall be sealed by a Professional Engineer registered in state of Kansas. The analysis completed shall include pole loading calculations for the final design along with any required pole changes, additions, and make-ready work required to full fill the pole loading and clearance requirement.

Continued on next page:

- The packet should have:
    - Application with tracking number on it and map (this is an update in the event changes were made from the original)
    - Attachment Application Summary Sheet- columns showing :
        - Pole number, referencing the map
        - Approved for attachment
        - Remedy required
        - Comments
        - Attachment height
        - Analysis class, no remedy or remedy
        - Liability, who had the liability to complete the remedy?
    - Pole Loading Analysis Report, including pictures taken in field-grade and district required
    - Copy of invoice
- Make ready – Once the pole loading analysis is completed compliance services will ask Westar's local office to provide a make ready estimate within 14 days. Compliance services will then prepare a make ready form for the attacher with the estimates. The attacher then must sign the form approving the estimated construction costs; return the form along with a check for the make-ready estimate within 14 days to compliances services. Westar Energy Compliance Services then will sign the form and send it to the division to begin the work. Once the job is complete if there are any other costs involved for the attacher Westar Energy Compliance Services will send the final construction bill and expect payment to be paid from the attacher within 30 days of construction.
- Tagging - Attacher has been given a tag number, attacher shall install tags at the time attacher facilities are installed. Identifying tags must be installed every third pole (see contract).
- Post inspections will be conducted and will be paid by the attacher. Post inspections will not be required on all jobs. Then ones targeted will be ones that require a lot of make ready before the attacher can attach.

Website: www.westarenergy.com
Corporate Communications Email: corpcom@westarenergy.com

Chad Luce
Manager, Customer & Community Relations
Chad.Luce@westarenergy.com
818 S. Kansas Ave.
PO Box 889
Topeka, KS 66601
(785) 575-8134 (Office)
(888) 613-0003 - Media Information Line

Missy Behymer
Joint Use Coordinator
Missy.Behymer@westarenergy.com
Topeka Ks 66601
(785) 575-8303 Office

Kansas Department of Transportation (KDOT): KDOT has worked with the City of Lawrence on our Intelligent Transportation System (I.T.S.) project grants. KDOT also has conduit that parallels the City's DTI/ITS conduit, along with LightCore. In the past, KDOT has expressed interest in connecting and sharing traffic cameras in the future.

Eisenhower State Office Building
700 SW Harrison
Topeka, KS 66604

(785) 296-3585, Office
(785) 296-0287, Fax

Website: www.ksdot.org

Kimberly Qualls
kqualls@ksdot.org
(785) 640-9340, Office

Leslie Spencer Fowler
Intelligent Transportation Systems (ITS) Unit
leslie@ksdot.org
(785) 296-5652, Office

Kansas Turnpike Authority (KTA): KTA handles the toll-road for Kansas. Lawrence has three exits off Interstate 70 into Lawrence. In the future Traffic and Police may want the ability to connect to the KTA's ITS system. The City of Lawrence has fiber near the exit in North Lawrence, but not the other two exits.

Website: http://www.ksturnpike.com/

David Jacobson
DJacobson@ksturnpike.com

Rex Fleming
RFleming@ksturnpike.com
(785) 224-7133.

9401 E. Kellogg
Wichita, KS 67207
(316) 682-4537

Road Conditions: Dial 511

Other Goals Related to Fiber

Develop a multi-vendor demarc at Farmland/East Hills: The City of Lawrence has purchased the former "Farmland" property on the east edge of Lawrence on 10 Highway. The property is approximately 467 acres and is adjacent to the City's current East Hills Business Park and is expected to be a preferred site to attract companies to locate in Lawrence. The City's Verizon conduit is on the south edge of this property and the ITS/DTI fiber is on the opposite side of 10-Highway. Some of the fiber could be used to attract new business to Lawrence, or others to expand at these sites. A recommended course of action would be to work with Internet Service Providers to locate demarc(s) at the Farmland site that could allow quick connectivity to potential companies considering this location. To date, I have had discussions with AT&T, Knology, and CenturyLink about this possibility.

Map: Map-45 is a map of the Farmland Project area

Empty Conduit: One of the advantages of having management and engineering professionals from Public Works and Utilities involved on a fiber committee would be the opportunities to identify projects where empty conduit could be buried at a lower cost during projects on identified right-of-way. Burying 3" conduit during projects would be preferred.

Connect All Lawrence Fire Station with Fiber: The Fire Department has several goals, including video conferencing for training and meetings that would benefit from fiber installations. Opportunities exist now that would allow for all stations that maintain full-time personnel to have fiber installed.

11th & Haskell Intersection Fiber Needs: The City has five buildings near the intersection of 11th & Haskell on the east side of Lawrence. These buildings have connectivity from the City of Lawrence's network by wirelessly connecting to the City's Wastewater Plant, then proceeding to City Hall via fiber. This should be a priority location for installing fiber to improve services provided by these locations. There are several options:

- Installing fiber to the Wastewater Plant, connecting with their fiber
- Installing fiber toward the Pump Station #25 fiber to obtain direct access.
- Installing fiber to the Police Law Enforcement Center to connect to the fiber from that building
- Find available fiber that might be able to leased.

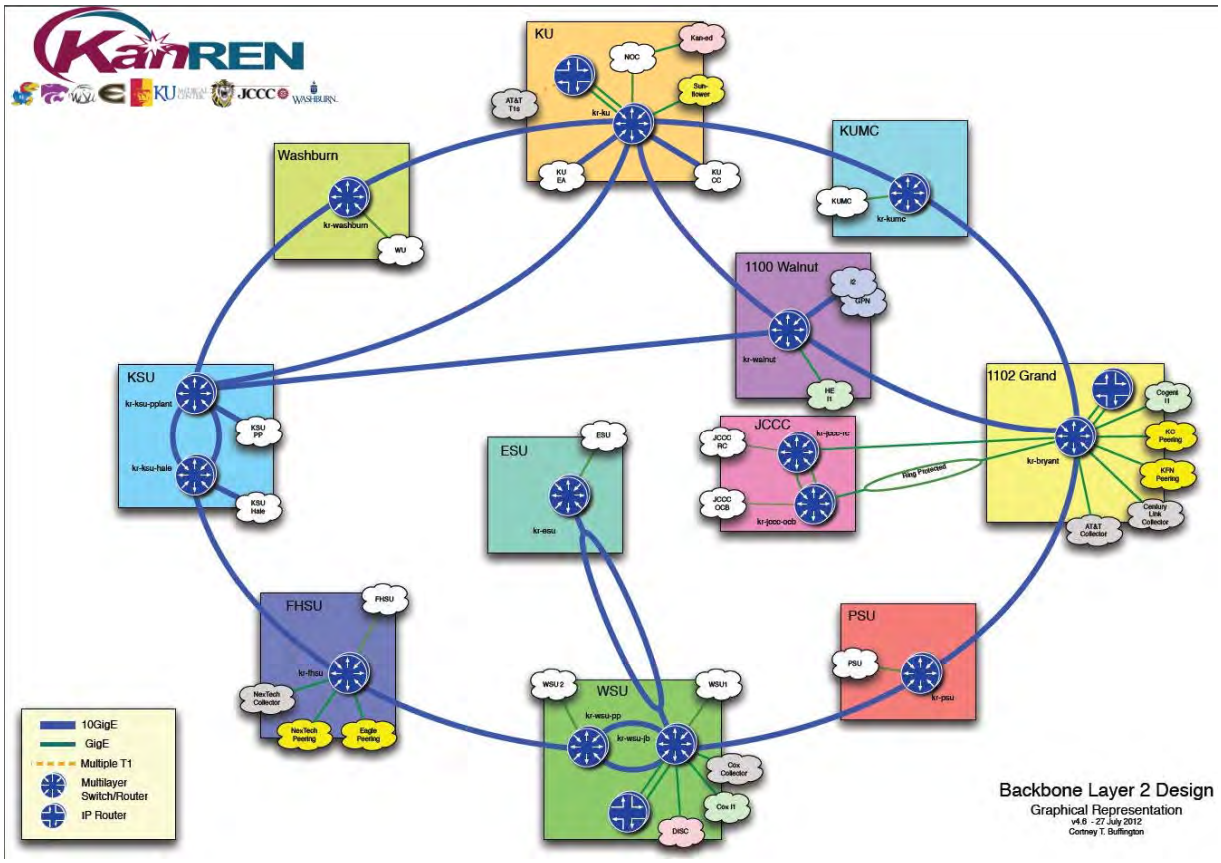
Map: Map-80 is a map of the City buildings at the 11th & Haskell intersection
Map: Map-81 is a map of the possibilities of connection to LEC or Wastewater Plant

Spring 2013 Project Opportunity: The City of Lawrence's Public Works and Utilities Departments will be replacing infrastructure in the right-of-way between 15th & Iowa Streets and 15th & Kasold in the Spring of 2013. This project would be an excellent opportunity for the City and KU to work together for mutual benefit to install conduit and fiber jointly as both have connectivity needs in this area.

Connecting to KanRen: KanRen is a non-profit Internet Service Provider (ISP) that currently provides Internet services for Kansas University, K-State, Wichita State, Emporia State, Pittsburg State, Washburn, Johnson County Community College, KU Medical Center, and many school districts and other organizations. KanRen has offices located at 1405 Wakarusa Drive here in Lawrence. KanRen is a non-profit ISP that has focused on education customers, but their charter allow for the dealing with cities and counties. KanRen has contacted the City of Lawrence and expressed interest in working with the City of Lawrence and Douglas County to begin offering services to other cities and counties. KanRen has a connection beneath Ellsworth Hall at KU, near 19th & Iowa Streets. The City of Lawrence plans to connect a 96-count fiber run to Ellsworth, with the costs to be shared with Douglas County. The City of Lawrence and Douglas County would reserve 24-strands each, and the remaining 48-strands could be used by USD-497, Lawrence Public Library, and other similar institutions.

Website: www.kanren.net

Cortney "Cort" Buffington, Executive Director (Primary Contact)
KanREN, Inc.
cort@kanren.net
(785) 856-9800, Office
(785) 865-7206. Cell



KanRen.net Network Diagram

Connecting to 1102Grand.com: A goal of the City of Lawrence is to connect fiber to the network systems located at 1102Grand.com in Kansas City, otherwise known as "telco hotel." There are internet services wholesalers, cloud technologies, disaster prevention, and many other companies offering services that could greatly improve the capabilities for the City of Lawrence.

Partial Vendor List:

An example of some of the vendors at 1102Grand.com

Other Miscellaneous Fiber Information

Fiber Locates: The City of Lawrence is a member of Kansas One Call, which does locates for utilities. The City's Utilities Department has two personnel that handle locates once a ticket has been created. At times, the Utilities Department personnel will refer to James Risner (Traffic Supervisor), Walt Ward (City Surveyor), and/or James Wisdom (I.T. Department) in assisting with locates. Some of the fiber was documented using GPS equipment during installation, and others have trace wires to aid in locates.

More information can be found at: www.kansasonecall.com

Aerial Fiber: The only place where the City has used aerial fiber is between the City's Street Division Building at 1120 Haskell Avenue and the Parks & Recreation Horticulture building just to the north. There is a very large gas energy piping between the buildings and the aerial fiber was installed to expedite the installation.

Empty Conduit: **Map-78** is a map showing the City's empty conduit that was installed during projects, having conduit on hand would be helpful for times that major work is done in strategic right-of-way.

Download Comparison: The following chart show a comparison of the time it takes to download a 10Mb file using various communication speeds:

Communication Type	Download Time Minutes / Seconds
ISDN	10 Minutes, 55 Seconds
T-1	54 Seconds
1 Gigabit	8 Seconds
10 Gigabit	.8 Seconds

Fiber Repair Services: The City of Lawrence needs to make arrangements and plans for handling future fiber cuts and interruption in services. Kansas University has set vendor standards and requirements and has multiple vendors pre-approved and available as an on-call basis. The plan for fiber repair services is yet to be determined.

Fiber Standard: **T**he City has standardized on CommScope Fiber. Examples of the fiber are below:

96-Count Fiber Part#: D-096-LA-8W-F12NS
http://www.commscope.com/catalog/uniprise/product_details.aspx?id=19112

144-Count Fiber Part#: D-144-LA-8W-F12NS
http://www.commscope.com/catalog/uniprise/product_details.aspx?id=19118

Area Internet Service Providers: *(May not be complete)*

AT&T

Website: www.att.com

AT&T has a central-office location at 734 Vermont Street in Lawrence. AT&T has fiber that connects to the City's server room. AT&T currently has a fiber connection to City Hall and is the current Internet Provider for the City of Lawrence. AT&T offers business and residential services to the citizens of Lawrence, KS. As of today, AT&T is the City's internet provider, providing a 20MB bi-directional connection. In January, 2013, the City of Lawrence released a request for proposal for 100MB bi-directional which has since been awarded to KanREN. In the next few weeks the transfer to KanREN will begin.

The City of Lawrence's assigned AT&T contacts are:

Michael Scott, MS4602@att.com
AT&T Services, Inc., Director of External Affairs
220 S.E. 6th Ave., Topeka, KS 66603-3507
(785) 276-8514, Office

Steve Hahn, SH3783@att.com
AT&T Services, Inc., President of Kansas
220 S.E. 6th Ave., Topeka, KS 66603-3507
(785) 276-8201, Office

Scott Mastenbrook, Scott.Mastenbrook@att.com
AT&T, Inc., Regional Sales Manager, (City of Lawrence's Sales Rep)
(816) 392-6953, Cell

Jarrod Thompson, jarrod.thompson@att.com
AT&T Inc., Technical Sales Rep, (City of Lawrence's Tech Rep)
500 E. 8th St., KC, MO 64106
(816) 275-1201, Office

CenturyLink

Website: www.centurylink.com

Note: CenturyLink has purchased fiber in Lawrence that was formerly owned by Embarq, Qwest, CenturyTel and LightCore. In addition, CenturyLink has acquired some of Sprint's fiber infrastructure. The former LightCore fiber now managed by CenturyLink runs in the same conduit bank as the City's ITS fiber from North Lawrence to the south side of Highway 10 near the eastern most part of the City limit. The picture on the next page displays the conduit route of the fiber formerly owned by Qwest, which serves as a major backbone of the internet, running from Kansas City to Denver. The former Qwest conduit passes behind City Hall, paralleling the railroad track, which also runs by the Farmland Business Park (under construction) and the East Hills Business Park.

Jeff Nelson, Jeffrey.d.nelson@centurylink.com
Century Link Business, Major Account Manager II (Gov't)
5454 W. 110th St., Overland Park, KS 66211
(913) 345-7614, Office

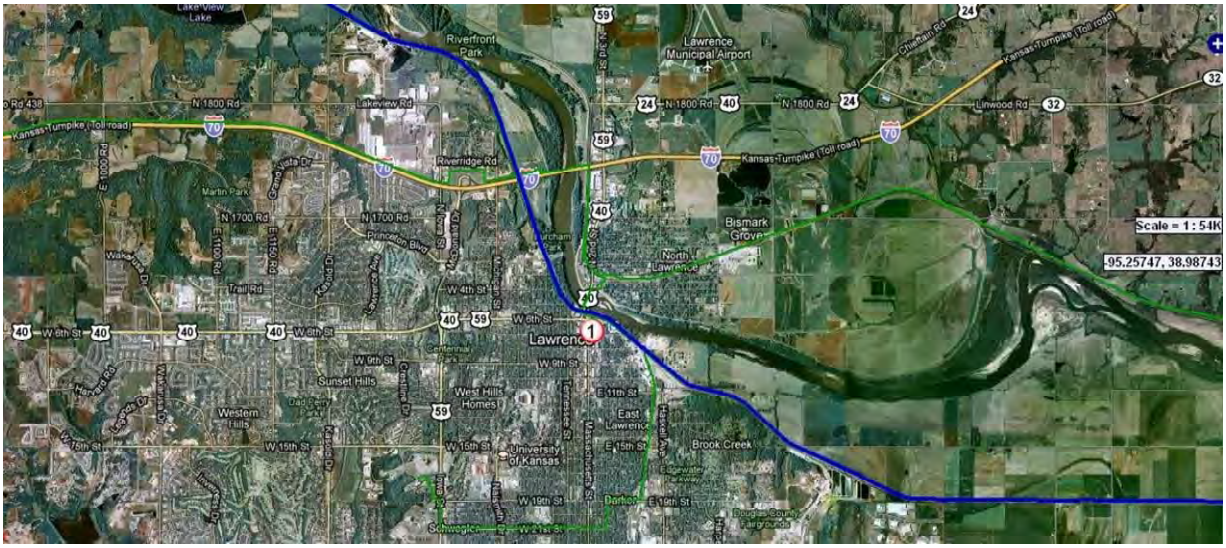
Mike Fizer, Mike.Fizer@centurylink.com
Century Link Business, Regional Sales Director
5454 W. 110th St., Overland Park, KS 66211
(913) 345-6817, Office

Brian Cornish, Brian.Cornish@CenturyLink.com
Century Link, Engineer III
5454 W. 110th St., Overland Park, KS 66211
(913) 345-7524, Office

Keith Fine, Keith.I.Fine@CenturyLink.com
Century Link, Kansas Representative
(888) 484-5246

Overview of CenturyLink Fiber

CenturyLink (formerly Qwest's) fiber, running behind City Hall, paralleling railroad tracks



City-wide view of CenturyLink fiber (KC to Denver)

Dish Network:

USDISH.com is a national Network retailer. Dish.Net is a privately held company with headquarters in Salt Lake City, Utah. DISH offers a wide variety of television packages and offers internet in three usage tiers, starting at $39.99/mo. when bundled with a qualified DISH TV programming package. DISH offers download speeds of up to 10 Mbps and data plans of up to 30GB. Dish advertisements show multiple DishNet providers in the Lawrence area.

Website: http://www.usdish.com/ks-dishnetwork-lawrence.html
Website: www.USDISH.com

5202 W. Douglas Corrigan Way, Suite 300
Salt Lake City, Utah 84116

Phone: 1.800.4DISH51 (1.800.434.7451)
Email: customersupport@usdish.com

Hours of Operation:

6am to 9pm MST - Monday through Friday
8am to 8pm MST - Saturday
9am to 6pm MST - Sunday

Google Fiber: (Not Available…yet)

The City of Lawrence was one of the more than 1,100 cities that applied to the Google Fiber Project, which ultimately chose the Unified Government of Wyandotte County. Kansas City, KS and Kansas City, MO are the initial focus of Google.

On October 16, 2012, James Wisdom, I.T. Director, met with Google's fiber representatives and discussed Google Fiber possibilities with the following notes from that meeting. The meeting followed a presentation by Google at the Regional I.T. Manager's Association (RITMA) meeting at Mid-America Regional Council (MARC) in KC. The notes from that meeting were:

- Google has an office at 1814 Westport Road in KC, MO where they demonstrate their services and ideas. Matt Hogan of Google said to contact him if we would like to have a tour or presentation.
- Google is currently offering three levels of services, ranging from free (after paying a $300 installation fee at $25/month); $70 a month for gigabit service ; or $120 a month for gigabit service plus T.V.
- Almost the total focus of Google is on neighborhoods—not businesses, schools, or government customers.
- Google isn't looking to support a "business class" connection where the service level agreement is at a higher level than a home user. At this point, if the City of Lawrence had Google fiber and it went down--it would be up when they get to it.
- Google does not want to connect their fiber to other fiber pathways or companies, meaning they weren't interested in coming to Lawrence using existing fiber that was already installed between Lawrence and K.C. Stating that if they come to Lawrence they would want to use their own fiber.
- Google is breaking up areas into "Fiberhoods" consisting on average of about 800 homes each, and then they evaluate each Fiberhood's interest level by the number of residents registering.
- Sounded as if Google first got off to a very slow start, but once they told communities that they would offer free access to their schools and public buildings, citizens really got involved. Several churches and schools developed committees to go door-to-door to try and sign everyone on.
- In July 2012, Google completed their first round of Fiberhood registrations and they have maps showing each neighborhood's status.

- Sounds as if the first fiber installations in the first two neighborhoods will begin late this fall or early winter—nothing is working yet.
- Google isn't interested in answering too many technical questions, they mainly want to hear from City Managers, Mayors, and Commissioner level personnel—taking their lead from them.
- Many of the people involved in their project that I know have signed non-disclosure agreements, so some details are hard to find out at this point.
- Looks as if Google was getting pressure from all of the KS suburbs (Olathe, Overland Park, Liberty, and many others wanting to be next in line.
- It was very obvious in the meeting that Google still has a lot of details to work out.
- The feeling I got from the Google representatives was that it will be sometime before they are ready to branch out beyond the immediate KC area, but they did say that if Lawrence wants to be considered that I should get the City Manager involved.

Website:

Google Fiber Information Link: https://fiber.google.com/about/
Google Fiber Blog: http://googlefiberblog.blogspot.com/
Google Fiber Communities: https://fiber.google.com/cities/kck/#header=check
Wikipedia Site: http://en.wikipedia.org/wiki/Google_Fiber

Rachel Hack
Community Manager
rhack@google.com
(816) 301-4311

Matt Hogan
Fiber Team Member
matthogan@google.com
(573) 220-0734

KanREN:

KanREN is a non-profit Internet service provider that specializes in government and education services. KanRen.net provides ISP services for KU, K-State, KU Medical, Johnson County Community College and many other organizations. KanRen's offices are located here in Lawrence on Wakarusa Drive. KanREN is a founding member of Internet2, which is an advanced not-for-profit United States networking consortium led by members from the research and education communities, industry, and government.

Although KanREN has focused on educational institutions their charter allows for dealing with City and County governments and community anchor institutions.

KanREN responded to the City's Internet Services request for proposal (R1217) in January and was awarded as the winner of the six proposals received. To complete a connection with KanRen the City would need to connect our fiber to KU's Ellsworth Hall building. The City and KU staffs had already begun agreement discussions to allow the City and KU to connect networks, which will provide a great number of opportunities beyond the KanREN connection. The City fiber pull-box and the fiber conduit entry for KU are only a little over 100 feet apart. The City and County both want to connect to KU, and plan to pay $5,531 each for the expense to complete the connection. KU would be allowing us to use approximately 2,000 feet of their existing conduit. This connection to Ellsworth would probably cost in the $30,000 to $40,000 range if KU was not allowing the City to connect using their existing conduit.

KanREN's charter allows them to deal with organizations such as schools, universities, city and county governments, libraries, and other city anchor institutions.

KanREN Website: http://www.kanren.net
KanREN Network: http://www.kanren.net/images/KanREN%20Backbone%20L2%20v4-6.pdf

Cort Buffington
Executive Director
cort@kanren.net
1405 Wakarusa Dr.
Lawrence, KS 66049
(785) 856-9800

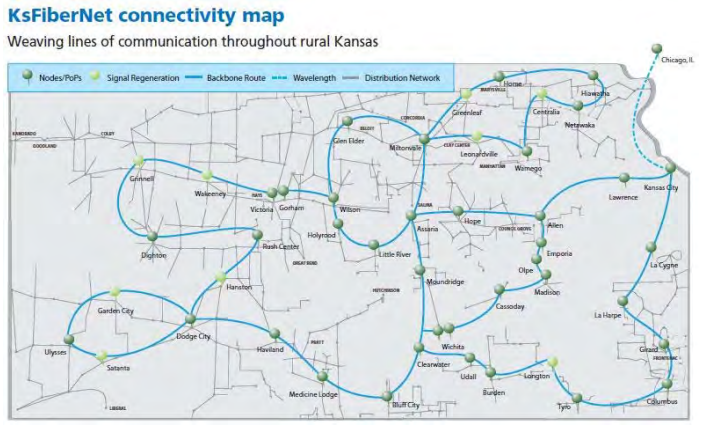
Kansas Fiber Network:

Kansas Fiber Network has 2,700 miles of Kansas Fiber Routes in Kansas, including fiber that comes off Interstate 70 on both the Lawrence East and West I-70 exits, connecting the AT&T's central office in downtown Lawrence. In meeting with their representatives they expressed interest in future fiber projects and discussed plans they had for future fiber projects on the south side of Lawrence. Kansas Fiber Network began by combining over 30 smaller telephone companies in Kansas providing a single state-wide network for them to share. Kansas Fiber Network's network spans the state with more than 40 points of presence (PoPs) is KsFiberNet's fiber-optic network, built to reach more rural Kansas locations than any other wholesale service provider. KsFiberNet's Ethernet services offer highly reliable performance, multiple low-latency paths and flexible bandwidth options with access interfaces ranging from 10 Mbps to 10 Gbps.

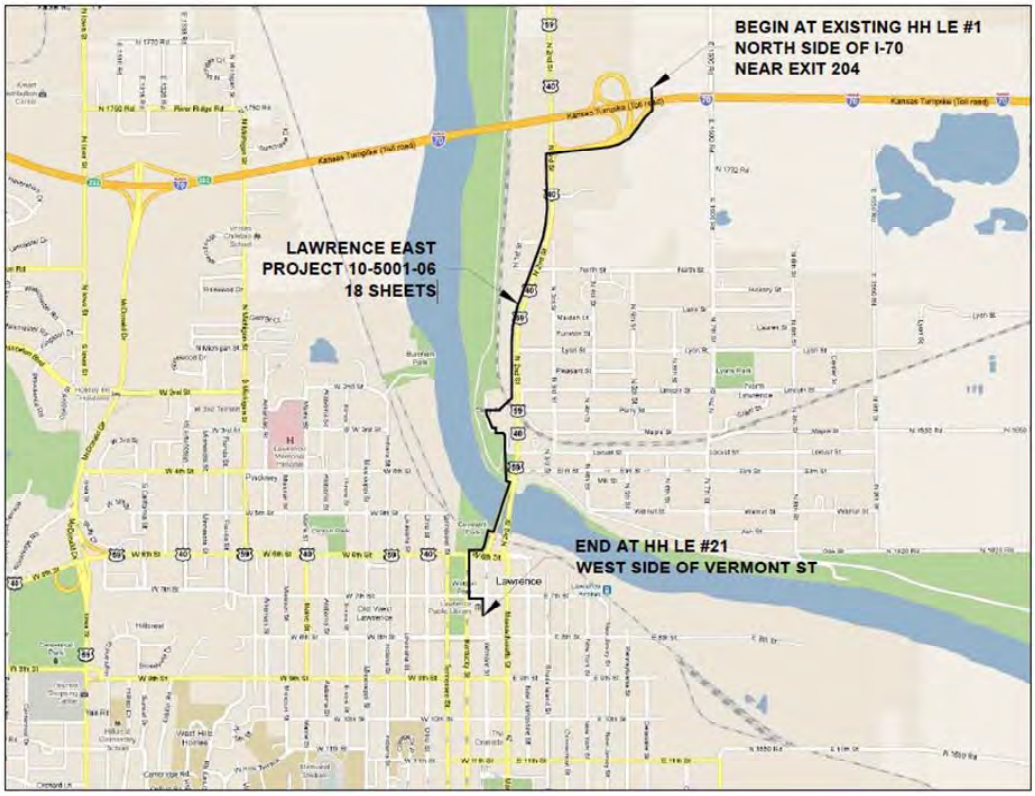
Website: www.kansasfibernetwork.com
Network: http://www.kansasfibernetwork.com/uploads/files/KFN_NetworkMap_SalesSheet.pdf

Earl Bean, ebean@ksfiber.net
Carrier Account Manager
121 N. Mead, Suite 200, Wichita, KS 67202
(877) 492-2555 Toll Free

Steve Lindner, slindner@ksfiber.net
Outside Plant Engineer
121 N. Mead, Suite 200, Wichita, KS 67202
(877) 492-2555 Toll Free; (316) 712-6016 Office



Kansas Fiber Network, *continued*



Kansas Fiber Network: East Lawrence Exit to AT&T Central Office

Kansas Fiber Network: West Lawrence Exit to AT&T Central Office

Knology (WOW)

Sunflower Broadband began doing business in Lawrence in 1970 and grew to be a successful broadband provider offering a variety of services. Sunflower Broadband was owned by the local Simons family, which also owned the Lawrence Journal World Newspaper and the local Channel 6 Television Station. Sunflower Broadband was sold in August, 2010 to Knology for 165 million dollars. Knology is a West Point, Georgia based provider. Knology consolidated the Sunflower Broadband and Knology personnel and eliminated many of the Lawrence based positions. In April 2012, Knology sold the Lawrence offices to WideOpenWest (WOW). To date, WOW has retained the Knology name, but eliminated many more positions and closed their Geek-on-Wheels technology division. WOW also moved the majority of the personnel from the One Riverfront Plaza offices to their 645 New Hampshire address.

Knology has a 240 count fiber ring installed in Lawrence, which was designed and installed by James Risner, the City's traffic supervisor. Mr. Risner has an in-depth knowledge of their fiber installations and operations.

Knology Website: www.knology.com
WOW Website: www.wowway.com

Head End: 644 New Hampshire St., Lawrence, KS 66044
Personnel Offices: 645 New Hampshire St., Lawrence, KS 66044
Walk-in Payment Offices: One River Front Plaza, Lawrence, KS 66044
Local number: (785) 841-2100

Brett Ritter, Brett.Ritter@knology.com
Director of Sales
5100 South Broadband Lane, Sioux Falls, SD 57108
(605) 965-9574, Office

Debbie Schmidt, debra.schmidt@knology.com
Business Manager
1 Riverfront Plaza, Suite 301, Lawrence, KS 66044
(785) 312-6925, Office

Aaron Hale, aaron.hale@knology.com
Business Service Accounts Manager
1 Riverfront Plaza, Suite 301, Lawrence, KS 66044
(785) 312-6908, Office

Mercury Wireless:

Mercury Wireless is based in Topeka, KS and uses wireless 4G WiMAX technologies in providing wireless broadband Internet services with download speeds up to 6 Mbps. Mercury Wireless does not limit the amount you can use your Internet and doesn't charge for exceeding a limit.

Customer premise equipment can be mounted outside of a house or business and is used to relay the wireless signal between your home and the tower site. Mercury Wireless has a variety of different CPEs depending on the location. Rooftop mounts are the most common type of installation. The radio is mounted at the peak of the roof, generally towards the backside of the house.

Mercury Wireless submitted a quote for the City's recent Internet request for proposal and visited with the City's I.T. staff. Mercury Wireless provides one service location for Kansas University a few miles north of town and has provided services primarily in the rural area west of Lawrence. Mercury Wireless stated they also had access to fiber in Lawrence in certain areas.

Website: https://www.mercurywireless.com/

Blake Wiseman
Owner
Blake.wiseman@mercurywireless.com
2825 SE California
Suite B
Topeka, KS 66605
(800) 354-4915, Ext 503, Office

Verizon Wireless:

Verizon Wireless offers mobile Broadband Internet Access Services for smartphones, basic phones, tablets, netbooks, USB modems, mobile hotspots and other wireless devices over our 3G Ev-DO and 4G LTE broadband networks. Verizon provides 4G LTE.connectivity in Lawrence.

- 4G LTE network: typical download speeds of 5 – 12 Mbps and upload speeds of 2 – 5 Mbps;
- 3G Ev-DO network: typical download speeds of 600 Kbps – 1.4 Mbps and upload speeds of 500 – 800 Kbps for Ev-DO Rev. A devices (if you are using an Ev-DO Rev. 0 device, typical download speeds are 400 - 700 Kbps and upload speeds are 60 - 80 Kbps).

The City of Lawrence uses Verizon Wireless connections along with Cisco- 819 Routers to provide connectivity to rural areas. Verizon's representatives have stated they are trying to become more competitive against AT&T providing more non-wireless communication systems.

Website: www.verizonwireless.com

Bob Henderson, Government Sales Manager
Verizon Wireless
Bob.henderson@verizonwireless.com
10740 Nall Ave.
Overland Park, KS 66211
(913) 344-2860 Office

Darryn Gillihan
Government Account Executive
Darryn.gillihan@verizonwireless.com
(785) 207-1200, Cell

Wicked Broadband: (Also known as Community Wireless and Lawrence FreeNet)

Wicked Broadband is a local Lawrence company owned by Joshua Montgomery. The company began as Lawrence FreeNet which was a non-profit company. Mr. Montgomery also owned Community Wireless, a for profit company. In recent history the companies were combined, and the various agreements with the City to allow access to water towers, traffic poles, and city light poles were combined. Wicked Broadband (Community Wireless) also has a long-term lease for the red buffer tube of twelve (12) fibers in the DTI/ITS conduit. Mr. Montgomery also leases space from Douglas County, having a dish on the top of the city's emergency communications tower. Now being called Wicked Broadband, the company supplies internet services to local residents and businesses. Wicked Broadband also has a number of KU fraternities and sororities as customers.

Website: http://www.lawrencefreenet.org

Joshua W. Montgomery, Joshua.montgomery@civicwifi.com
Community Wireless Communications
2321 Ponderosa Drive
P.O. Box 3532
Lawrence, KS 66046
(785) 371-4214, Ext 8001 Office

Chart Index

City of Lawrence, Kansas
Wastewater Lift Station Information

Lift Station #	Circuit ID	SPIDs	Address
1	71.IBJD.810730	785 840-1740, 1741	301 North
2	71.IBJD.810733	785 840-1746, 1747	570 Walnut
3	71.IBJD.054511	785 840-1770, 1771	720 Grant
4	71.IBJD.054512	785 840-1772, 1773	810 Walnut
5A	71.IBJD.054488	785 840-1706, 1707	2701 Delaware
5B	71.IBJD.054488	785 840-1706, 1707	2701 Delaware
6	71.IBJD.054513	785 840-1774, 1775	2449 Massachusetts
8	71.IBJD.054514	785 840-1776, 1777	2233 Alabama
9	71.IBJD.809087	785 840-1704, 1705	3613 Brushcreek
12	71.IBJD.054074	785 840-1754, 1755	1332 North 3rd
13	71.IBJD.810917	785 840-1700, 1701	2210 East 23rd
15	71.IBJD.810732	785 840-1744, 1745	231 North Michigan
16	Fiber		220 West 6th
18	71.IBJD.054508	785 840-1764, 1767	4740 Overland Dr
19	71.IBJD.054515	785 840-1778, 1779	1751 E 27
22	71.IBJD.054516	785 840-1780, 1781	3199 Haskell Ave.
23	71.IBJD.054517	785 840-1782, 1783	3003 O'Connell Rd.
25	Fiber		3799 Greenway Circle
27	71.IBJD.054076	785 840-1758, 1759	3099 Sherwood Dr.
28	71.IBJD.054507	785 840-1762, 1763	507 Sandpiper Dr
31	71.IBJD.811479	785 840-1752, 1753	2838 Meadow Dr
32	71.IBJD.054519	785 840-1786, 1787	1723 E 30
34	71.IBJD.054509	785 840-1766, 1767	3711 E. 23rd
35	71.IBJD.054520	785 840-1788, 1789	503 Sunchase Ct.
37	71.IBJD.054521	785 840-1790, 1791	1602 Matthew Terr.
38	71.IBJD.054510	785 840-1768, 1769	3611 E. 25th
40	71.IBJD.054522	785 840-1792, 1793	4622 Trail Rd.
41	71.IBJD.054523	785 840-1794, 1795	2504 East 27th Terr
42	71.IBJD.054524	785 840-1796, 1797	3460 Morning Dove Dir.
43	71.IBJD.054525	785 840-1798, 1799	4117 W 13
44	71.IBJD.811472	785 840-1750, 1751	390 Queens Road
45	71.IBJD.811471	785 840-1748, 1749	301 Queens Road
46	71.IBJD.054460	785 840-1736, 1737	1025 N. Minnesota
47	71.IBJD.054522	785 840-1784, 1785	2136 E. 26th

City / County Potential Fiber Sharing Notes

Item	City	County
General Items		
Current County-to-City Fiber (48-Strands)	Formalize agreement	Formalize agreement
Connection to 1102 Grand	Future consideration	Future consideration
KU Connectivity (Installing 96 Strands; 24ea, 48/future	Split costs 50/50, approximately $5,500	Split Costs 50/50, approximately $5,500
KanRen ISP Connectivity	Planned	Planned
Connect to Pump Station #25 to complete ring	Planned	N/A
Hand Holes	Separate from County	Separate from City
Fiber splicing	Pay for City splices	Pay for County splices
Establish standards for fiber work		
Develop a list of approved vendors		
Hold each other harmless for outages		
Document approval process for third-parties		
Each entity must approve uses within their buildings		
DTI Conduit (Existing ITS Fiber)		
Building / Structure Connectivity:		
Juvenille Detention Facility	No access	Allow access to ITS Fiber
Douglas County Jail	Fibers for City & City Police	Fiber to connect to DgCo Network
New Public Works Shop	No access	Fiber to connect to DgCo Network
Fairgrounds	Fire Station #2 / Water Tower	Fiber to connect to DgCo Network
Sattelite Offices at 27th & Iowa	Possible sharing for ITS	Fiber to connect to DgCo Network
Stratord Water Tower	(12) Fiber for Utilities SCADA	(12) Fiber for Douglas County I.T.
Note: Installing 96-count fiber from Iowa St	(12) Fiber for City Police	(12) Fiber for Sherriff's Dept / EOC
	(48) Fiber for City I.T. / General	
Miscellaneous Cooperation Notes:		
Current Experiences:		
Video arraignment	For Municipal Court	County allows us to access their equipment
Cost sharing for aerial photography	Cost split for aerial photography for GIS	
Douiglas County training cooperation	City employees allowed to attend classes	Full-time trainer on staff
Oblique photography shared at no cost to the City		$60,000 every two years
County purchases computers and tablets for ambulances		

KU / City Potential Fiber Sharing Notes

Item	City	KU
General Items		
Connection to 1102 Grand	Future consideration	Already Connected?
Douglas County Connectivity	Existing	Planned
KanRen ISP Connectivity	Planned	ISP for KU
Hand Holes, (as a rule)	Separate from KU	Separate from City
Fiber splicing	Pay for City splices	Pay for KU splices
Establish standards for fiber work	Need to develop vendor requirements	KU has approved list and work requirements
Complete 288-fiber from 6th & Iowa to 6th & Wakarusa		
KU and City to cooperate on needed easements for each org.		
Hold each other harmless for outages		
Document approval process for third-parties		
Each entity must approve uses within their buildings		
Share conduit from Wakarusa to Rock Chalk Sports, 5,000ft?		
Work with KU to connect City Library to KU Libraries		
Potential I.T. infrastructure Co-location possibilities		
DTI Conduit (Existing ITS Fiber)		
Currently 144 Strands from 6th & Mass to TeePee Junction		(Proposed usage of 12 or 24 Strands)
Currently 288 Strands from 6th & Mass to 23rd & Iowa		Connect to Biosciense north of airport
Currently 144 Strands from 23rd & Iowa to 23rd & Harper		Future part of City / KU Fiber Ring
KU Building / Structure Connectivity:		
DTI / ITS Fiber Connection	Connect Airport with KU Help	KU connect to Research Farm
KU Computer Center	Possible Future Access	Allow access to DTI and Verizon Conduits
Ellsworth Hall Building	City/County shared Access to KU	Host KanRen connectivity for City
Verizon Conduit		
Propose Shared-Installation of 288 Strands	(Proposed 192 Strands for City Usage)	(Proposed 96 Strands for KU Usage)
	City Buildings / Rock Chalk Sports	Rock Chalk Sports Location
	6th St. Traffic Signals / Cameras (3)	KU Research Building 1315 Wakarusa
	Wakarusa Traffic Signals / Cameras (1)	KU Research Buildings at 1505 Wakarusa
	Clinton Parkway Signals / Cameras (7)	
	Clinton Water Plant, 2101 Wakarusa	
	Fire Station #4, 2121 Wakarusa	
	City Fuel Station, 1901 Wakarusa	
	Police ITC, 4820 Bob Billings	

City of Lawrence
Verizon Conduit
Estimated Cable Lengths for Project

Conduit between HH Description:	Length (FT)	Loop (FT)
E 800 Road to Church entrance	4,274	100
Church entrance to E 902 Road	1,939	100
E 902 Road to GWW	1,811	100
GWW to Stoneridge	1,367	100
Stoneridge to Queens	1,306	100
Queens to Congressional	1,493	100
Congressional to 6th & Wakarusa	1,148	100
6th & Wakarusa to Harvard	1,503	100
Harvard to Legends/Inverness	1,654	100
Legends/Inverness to BBPW	2,290	100
BBPW to Innsbrook	4,289	100
Innsbrook to Clinton Parkway	824	100
Clinton & Wakarusa east to Inverness	2,658	100
Inverness to Crossgate	2,649	100
Crossgate to Hartford	1,196	100
Hartford to Kasold	1,381	100
Kasold to Heatherwood	938	100
Heatherwood to Lawrence Ave	1,640	100
Lawrence Ave to Crestline	1,315	100
Crestlint to Iowa	1,581	100
Iowa to Ousdahl	1,127	100
Ousdahl to Naismith	1,754	100
Naismith to Alabama	996	100
Alabama to Louisiana	1,221	100
Louisiana to Massachusetts	1,677	100
Massachusetts to Barker	1,041	100
Barker to Haskell	2,523	100
Haskell to Harper	2,674	100
Harper to O'Connell	2,596	100
O'Connell to Franklin	2,713	100
Franklin to East Hills	2,438	100
East Hills to Noria	3,048	100
		100
Innsbrook to FS#4	378	100
		100
23rd & Iowa north the Irving Hill Road	3,937	100
	65,378	3600

Total with Loops: 68,978 ft

Chart: A-30

City of Lawrence
Verizon Fiber Conduit Estimates for 288-Count Fiber

Intersection(s)	Distance (feet)	288-Count Fiber @ $2.40 / ft	Labor to Install @ $1 ft	Installed Costs
E 800 to 6th & Wakarusa	14,038	$33,691	$14,038	$47,729
6th & Wakarusa to Clinton Pkwy & Wakarusa	11,639	$27,934	$11,639	$39,573
Clinton Pkwy & Wakarusa to 23rd & Iowa St	14,157	$33,977	$14,157	$48,134
23rd & Iowa to 23rd & Harper St.	13,813	$33,151	$13,813	$46,964
23rd & Harper to 23rd & Noria Rd.	11,295	$27,108	$11,295	$38,403
KU, North to 23rd Street	4,037	$9,689	$4,037	$13,726
	68,979	$165,550	$68,979	$234,529

Note: Prices do not include butt-splicing of joints
or fusion splicing each organization would need.
Total estimate approximately $300,000 to $330,000

City Hall to 23rd & Iowa (288-Strands)

City Reserved:			
Traffic ITS for Traffic Lights / Cameras	144		Reserved 2-strands for each City intersection
City Buildings / I.T.	36		Connect Remote Locations to City Hall Network
Police	12		Connecting buildings, cameras, security
City-to-KanRen connection	12		Offers non-profit ISP connection, Connectivity to 1102 Grand
		204	
Other Governments / Agencies:			
Douglas County	12		In turn, DgCo would help with FS#4, Jail for I.T. and Police and extend ITS fiber
EOC / Sherriff	12		In turn we house our fiber in EOC building and expand to Stratford Water Tower
Kansas University	12		Many opportunities to partner in multiple areas
USD-497	12		Would allow connection to KanRen, other schools and most Universities in KS.
Lawrence Public Library	6		Could allow for connectivity to KU libraries and other educational opportunities
Lawrence Memorial Hospital	6		could replace their connections to LMH South and Offices on 6th Street
		48	
Other:			
Community Wireless	12		Current Agrrement
Farmland Expansion	12		Used to attract companies to Lawrence
East Hills Expansion	12		Used to attract companies to Lawrence
		36	
	TOTAL:	**288**	

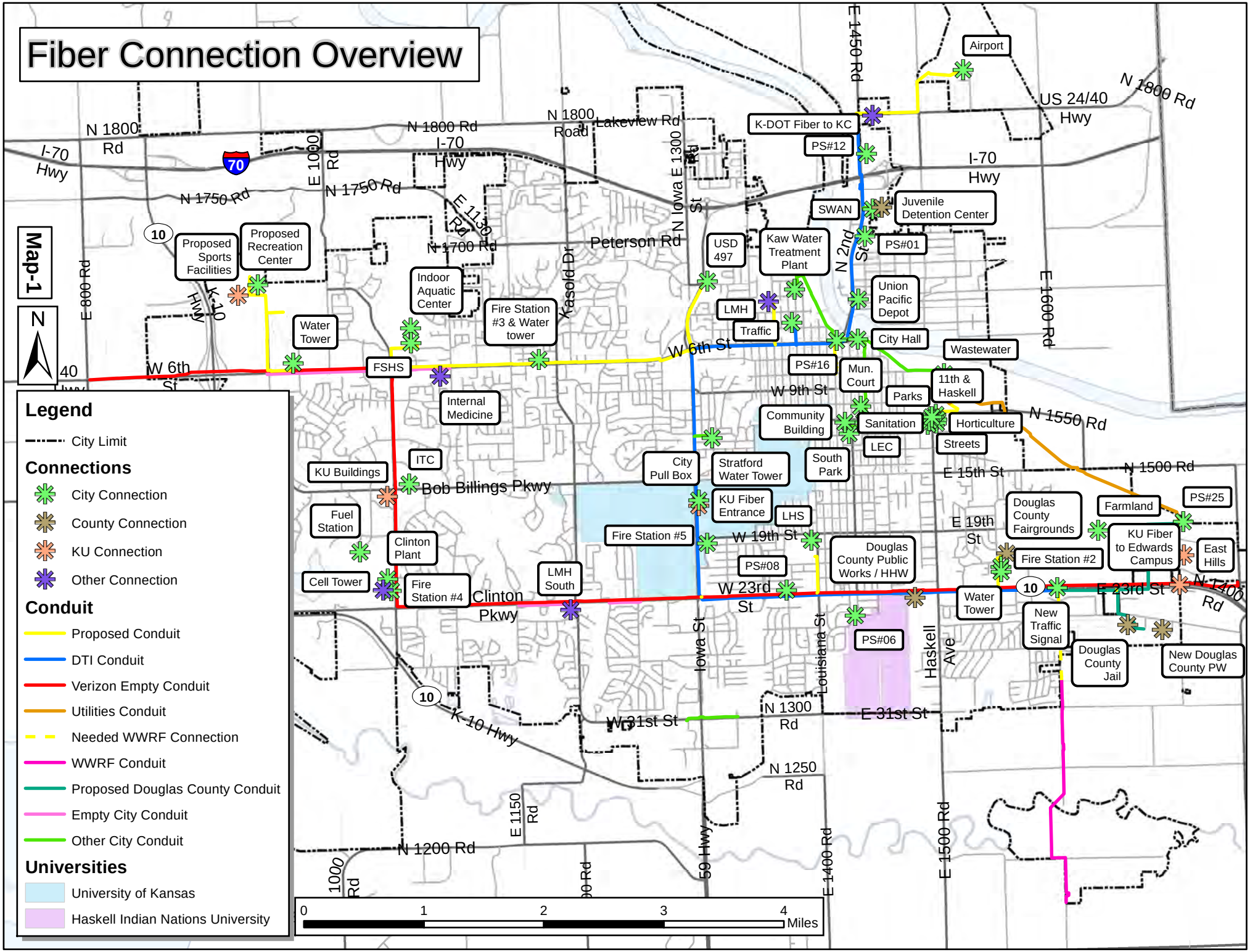
North Lawrence Fiber (144-Strands)

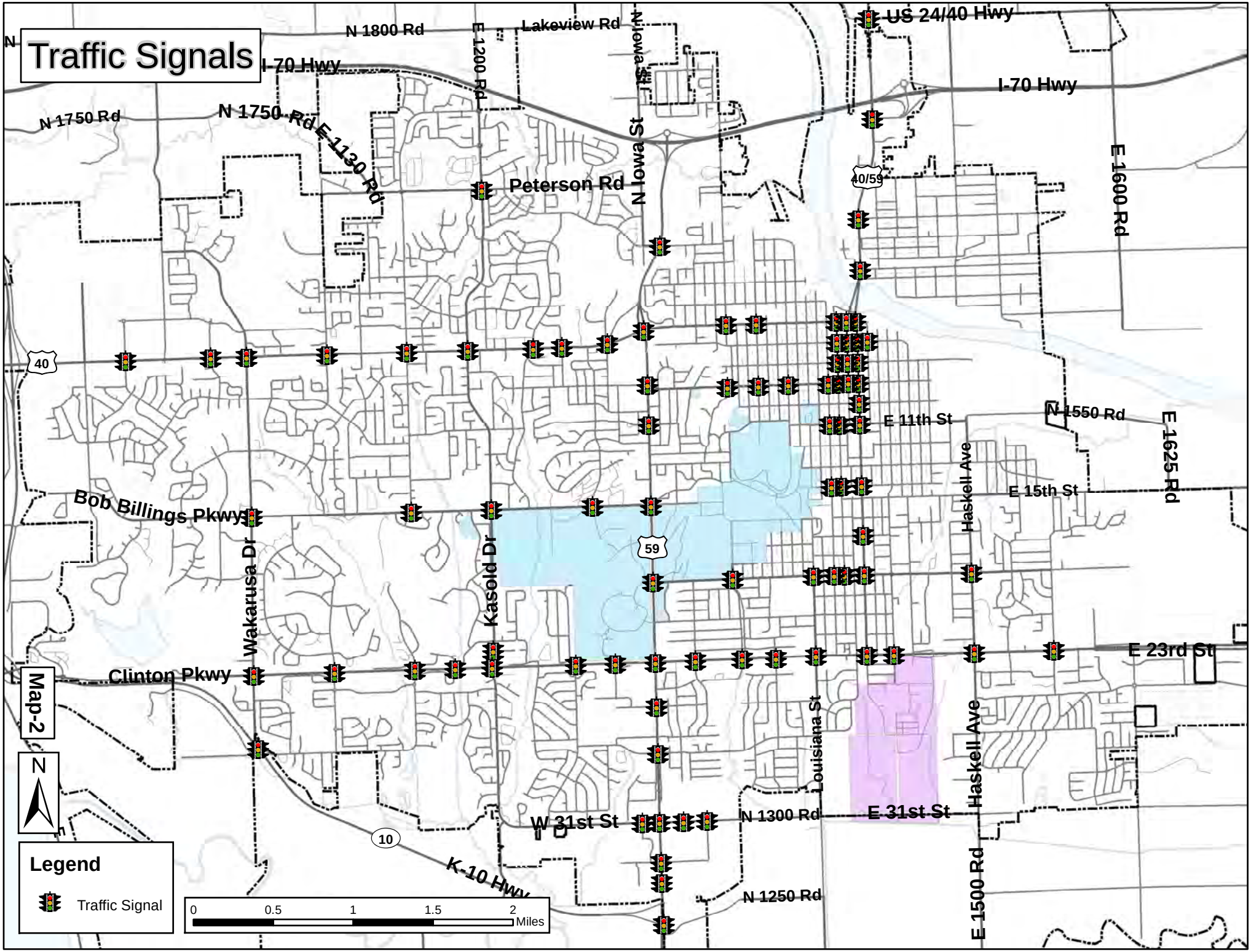
City Reserved:			
Traffic ITS for Traffic Lights / Cameras	24		Currently 10 intersections with O'Connell Road
City Buildings / I.T. / Utilities	24		Connect Remote Locations to City Hall Network (SWAN Bldg connected)
Police	12		Connecting buildings, cameras, security
		60	
Other Governments / Agencies:			
Douglas County	12		In turn, DgCo would help with FS#4, Jail for I.T. and Police and extend ITS fiber
EOC / Sherriff	12		In turn we house our fiber in EOC building and expand to Stratford Water Tower
USD-497	12		Would allow school system to connecto to KanRen / other schools & colleges
Kansas University	12		Connection to Research Farm, could include airport for the City
Kansas Dept. of Transporation (KDOT)	6		Potential expansion of Intelligent Transportation System network
Kansas Turnpike Authority	6		Potential expansion of Intelligent Transportation System network
		60	
Other:			
Community Wireless	12		Current Agrrement
LightCore / Connection to KC	12		Possible future connection to Kansas City area
		24	
TOTAL:	**144**		

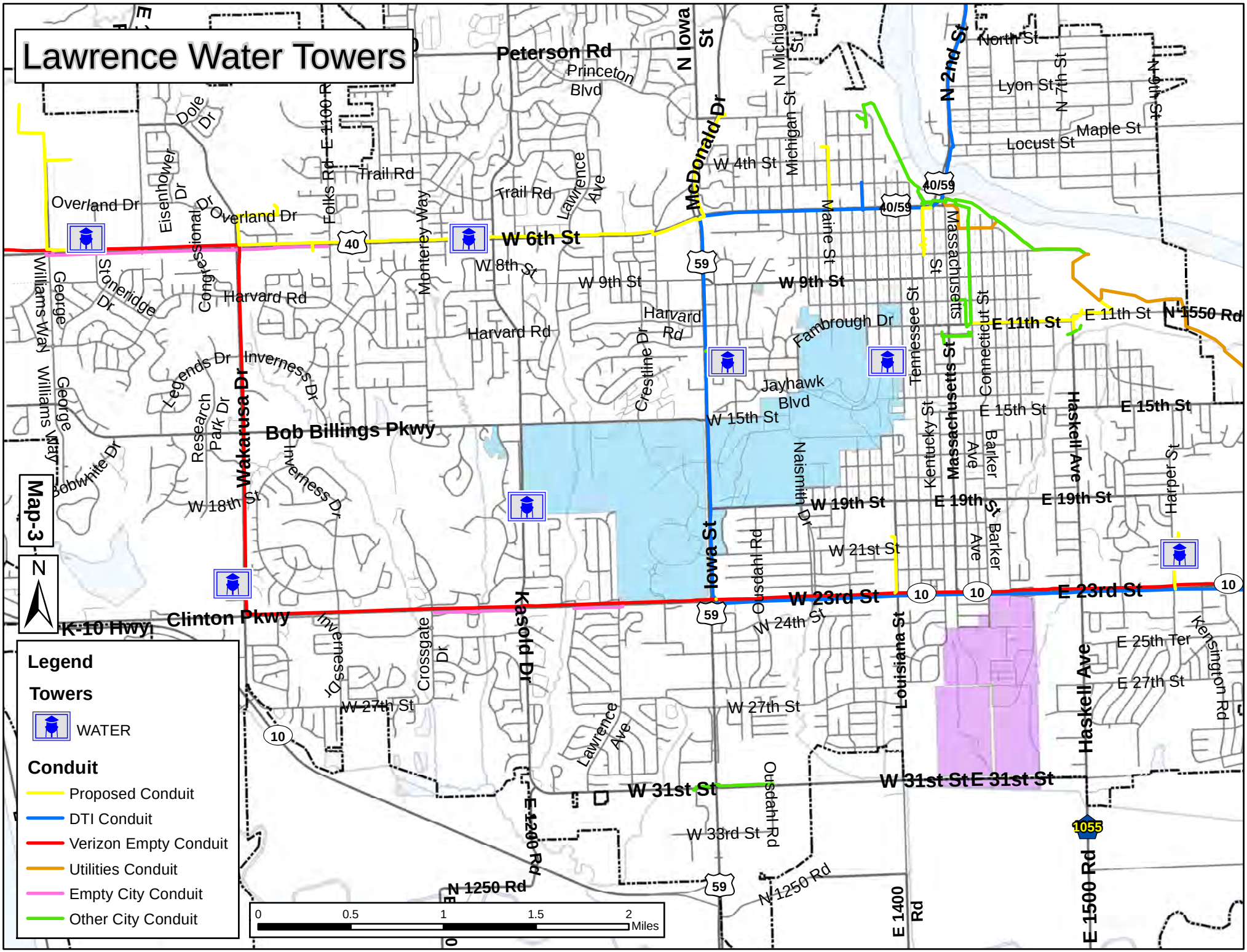
23rd & Iowa to 23rd & Haper (144-Strands)

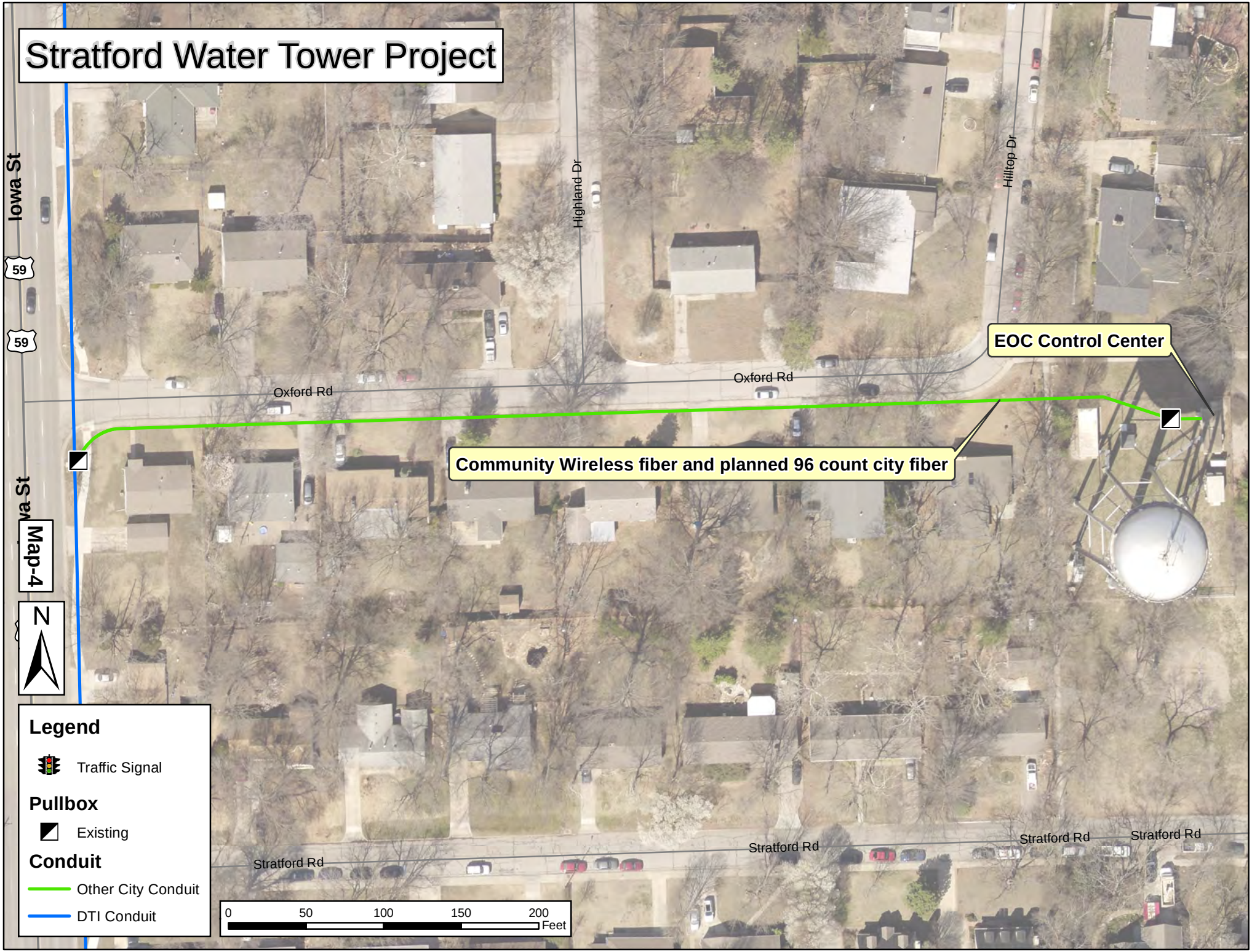
City Reserved:			
Traffic ITS for Traffic Lights / Cameras	24		Currently 10 intersections with O'Connell Road
City Buildings / I.T.	36		Connect Remote Locations to City Hall Network
Police	12		Connecting buildings, cameras, security
		72	
Other Governments / Agencies:			
Douglas County	12		In turn, DgCo would help with FS#4, Jail for I.T. and Police and extend ITS fiber
EOC / Sherriff	12		In turn we house our fiber in EOC building and expand to Stratford Water Tower
USD-497	12		Would allow school system to connect to KanRen / other schools & colleges
		36	
Other:			
Community Wireless	12		Current Agrrement
Farmland Expansion	12		Used to attract companies to Lawrence
East Hills Expansion	12		Used to attract companies to Lawrence
		36	
	TOTAL:	**144**	

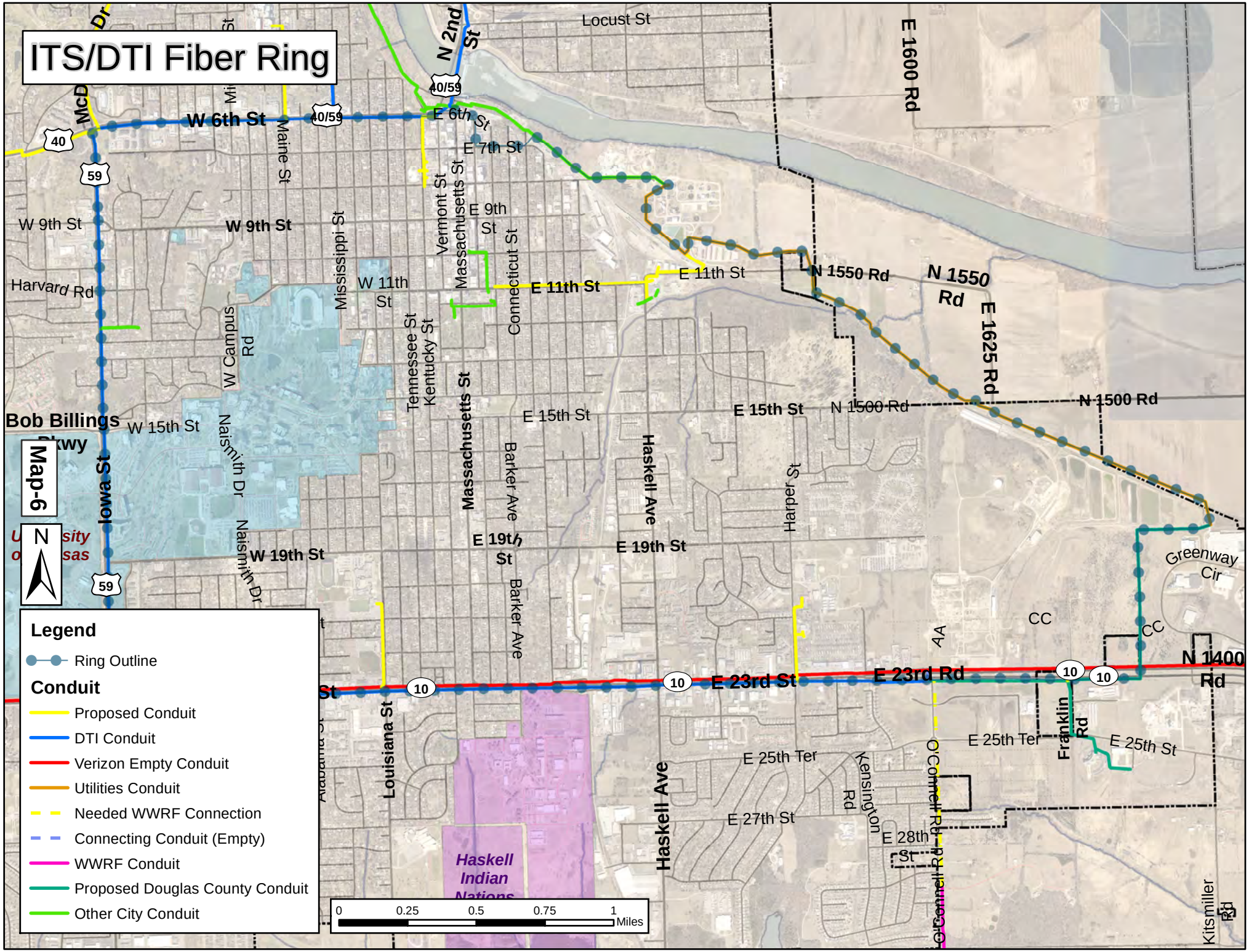
Maps Index

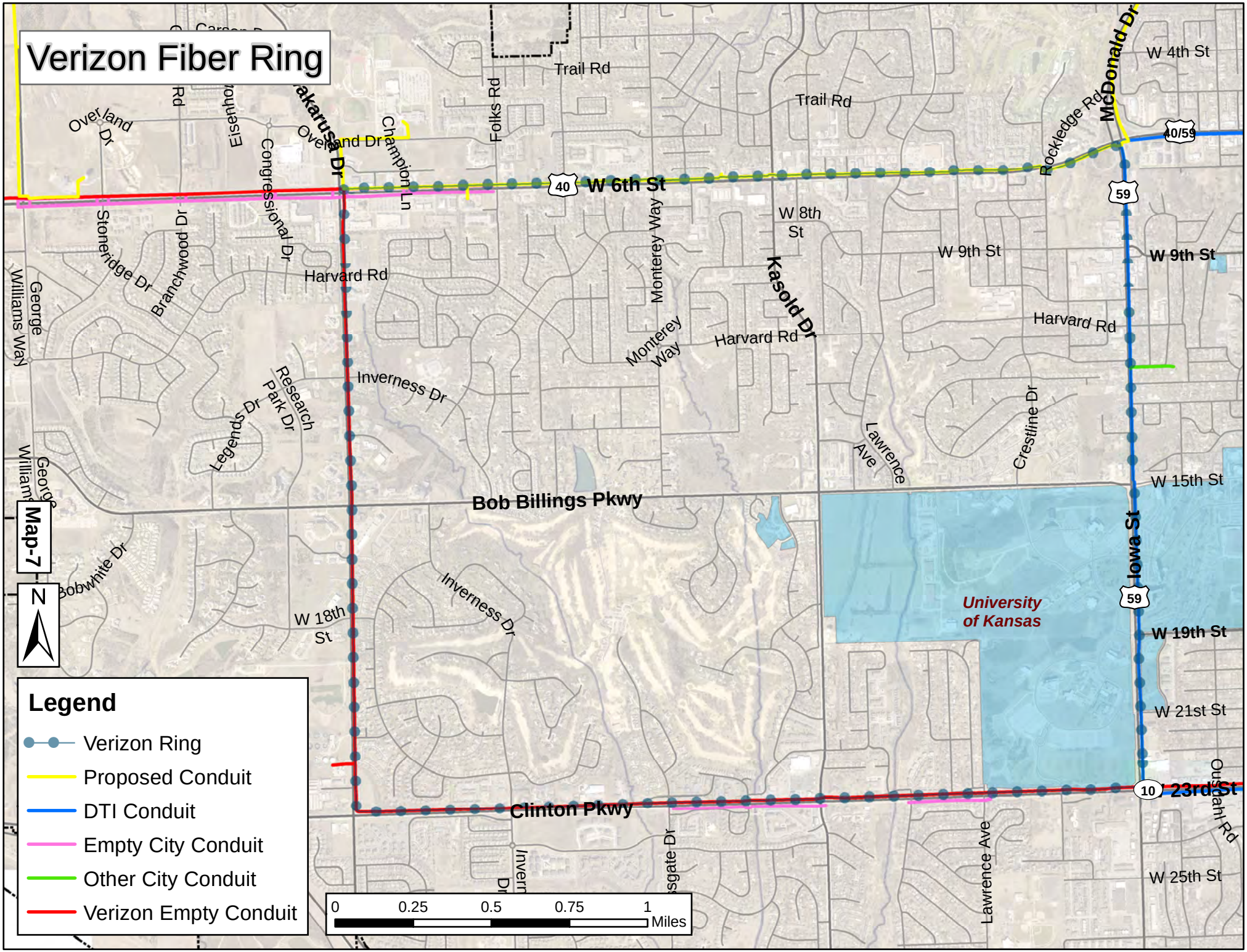

Fiber Connection Overview
Map-1
N
Legend
City Limit
Connections
City Connection
County Connection
KU Connection
Other Connection
Conduit
Proposed Conduit
DTI Conduit
Verizon Empty Conduit
Utilities Conduit
Needed WWRF Connection
WWRF Conduit
Proposed Douglas County Conduit
Empty City Conduit
Other City Conduit
Universities
University of Kansas
Haskell Indian Nations University
0 1 2 3 4 Miles
Airport
K-DOT Fiber to KC
PS#12
SWAN
Juvenile Detention Center
USD 497
Kaw Water Treatment Plant
PS#01
Union Pacific Depot
LMH
Traffic
City Hall
Wastewater
PS#16
Mun. Court
11th & Haskell
Parks
Community Building
Sanitation
Horticulture
Streets
LEC
Proposed Sports Facilities
Proposed Recreation Center
Indoor Aquatic Center
Fire Station #3 & Water tower
Water Tower
FSHS
Internal Medicine
ITC
KU Buildings
Bob Billings Pkwy
Fuel Station
Clinton Plant
Cell Tower
Fire Station #4
Clinton Pkwy
LMH South
City Pull Box
Stratford Water Tower
South Park
KU Fiber Entrance
LHS
Fire Station #5
PS#08
Douglas County Public Works / HHW
PS#06
Douglas County Fairgrounds
Farmland
PS#25
KU Fiber to Edwards Campus
East Hills
Fire Station #2
Water Tower
New Traffic Signal
Douglas County Jail
New Douglas County PW
N 1800 Rd
US 24/40 Hwy
I-70 Hwy
N 1750 Rd
E 1450 Rd
E 1000 Rd
N 1800 Road
Lakeview Rd
N Iowa E 1300 Rd
N 2nd St
Peterson Rd
Yasold Dr
W 6th St
W 9th St
N 1550 Rd
E 15th St
N 1500 Rd
E 19th St
W 19th St
W 23rd St
E 23rd St
N 1400 Rd
Iowa St
Louisiana St
Haskell Ave
W 31st St
N 1300 Rd
E 31st St
N 1250 Rd
E 1150 Rd
N 1200 Rd
E 1500 Rd
E 1400 Rd
59 Hwy
K-10 Hwy
E 800 Rd
E 1000 Rd
N 1700 Rd
E 1150 Rd

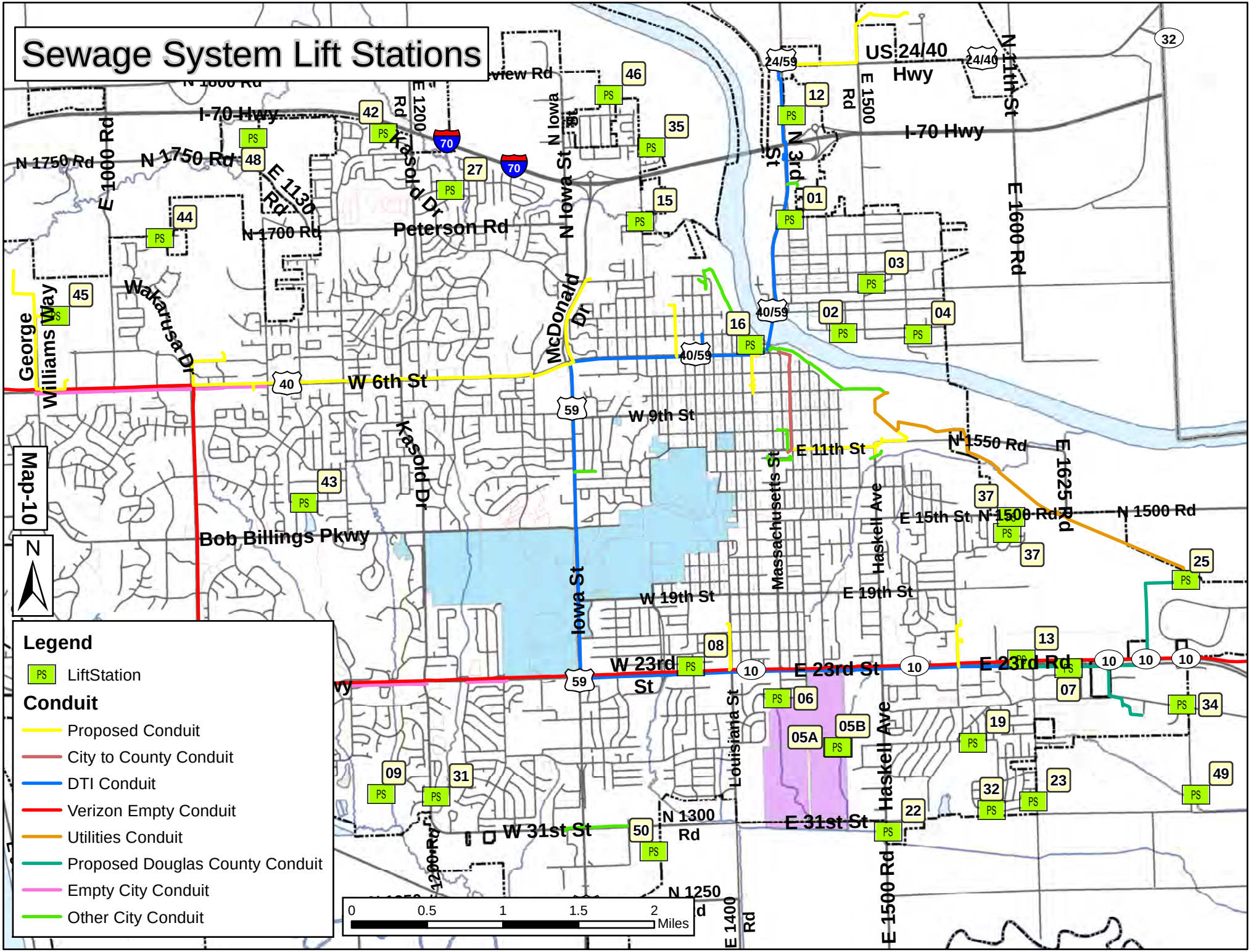

Traffic Signals
N 1800 Rd
Lakeview Rd
E 1200 Rd
N Iowa St
US 24/40 Hwy
I-70 Hwy
N 1750 Rd
E 1130 Rd
Peterson Rd
40/59
E 1600 Rd
40
E 11th St
N 1550 Rd
E 1625 Rd
Haskell Ave
Bob Billings Pkwy
E 15th St
59
Wakarusa Dr
Kasold Dr
Clinton Pkwy
E 23rd St
Map-2
N
Louisiana St
W 31st St
N 1300 Rd
E 31st St
10
K-10 Hwy
N 1250 Rd
E 1500 Rd
Legend
Traffic Signal
0
0.5
1
1.5
2
Miles

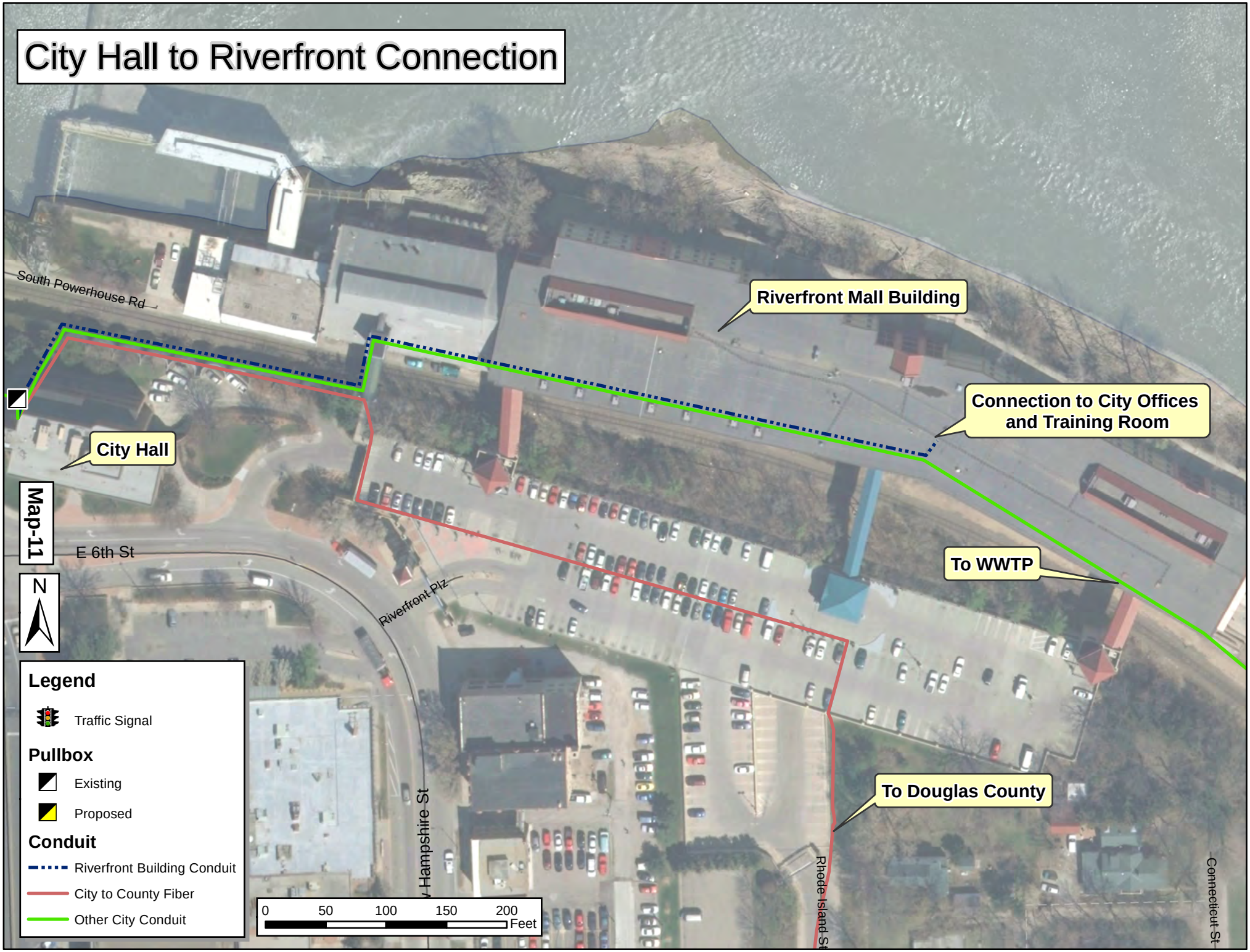

Lawrence Water Towers
Peterson Rd
Princeton Blvd
N Iowa St
N Michigan St
N 2nd St
North St
Lyon St
N 7th St
N 9th St
Maple St
Locust St
Dole Dr
Eisenhower Dr
Overland Dr
Folks Rd
E 1100 Rd
Trail Rd
Lawrence Ave
McDonald Dr
W 4th St
Michigan St
40/59
Maine St
Massachusetts St
W 6th St
40
W 8th St
59
W 9th St
Monterey Way
Congressional Dr
Stoneridge Dr
Williams Way
George
Harvard Rd
Crestline Dr
Fambrough Dr
Tennessee St
Connecticut St
E 11th St
N 1550 Rd
Legends Dr
Inverness Dr
Research Park Dr
Wakarusa Dr
Bob Billings Pkwy
Jayhawk Blvd
W 15th St
Naismith Dr
Kentucky St
E 15th St
Barker Ave
Haskell Ave
E 19th St
Harper St
Bobwhite Dr
W 18th St
W 19th St
W 21st St
Iowa St
Ousdahl Rd
W 23rd St
E 23rd St
10
K-10 Hwy
Clinton Pkwy
Kasold Dr
Crossgate Dr
W 24th St
Louisiana St
E 25th Ter
E 27th St
Kensington Rd
W 27th St
Lawrence Ave
W 31st St
E 31st St
Ousdahl Rd
W 33rd St
N 1250 Rd
E 1400 Rd
1055
E 1500 Rd
E 1200 Rd
Map-3
N
Legend
Towers
WATER
Conduit
Proposed Conduit
DTI Conduit
Verizon Empty Conduit
Utilities Conduit
Empty City Conduit
Other City Conduit
0
0.5
1
1.5
2
Miles

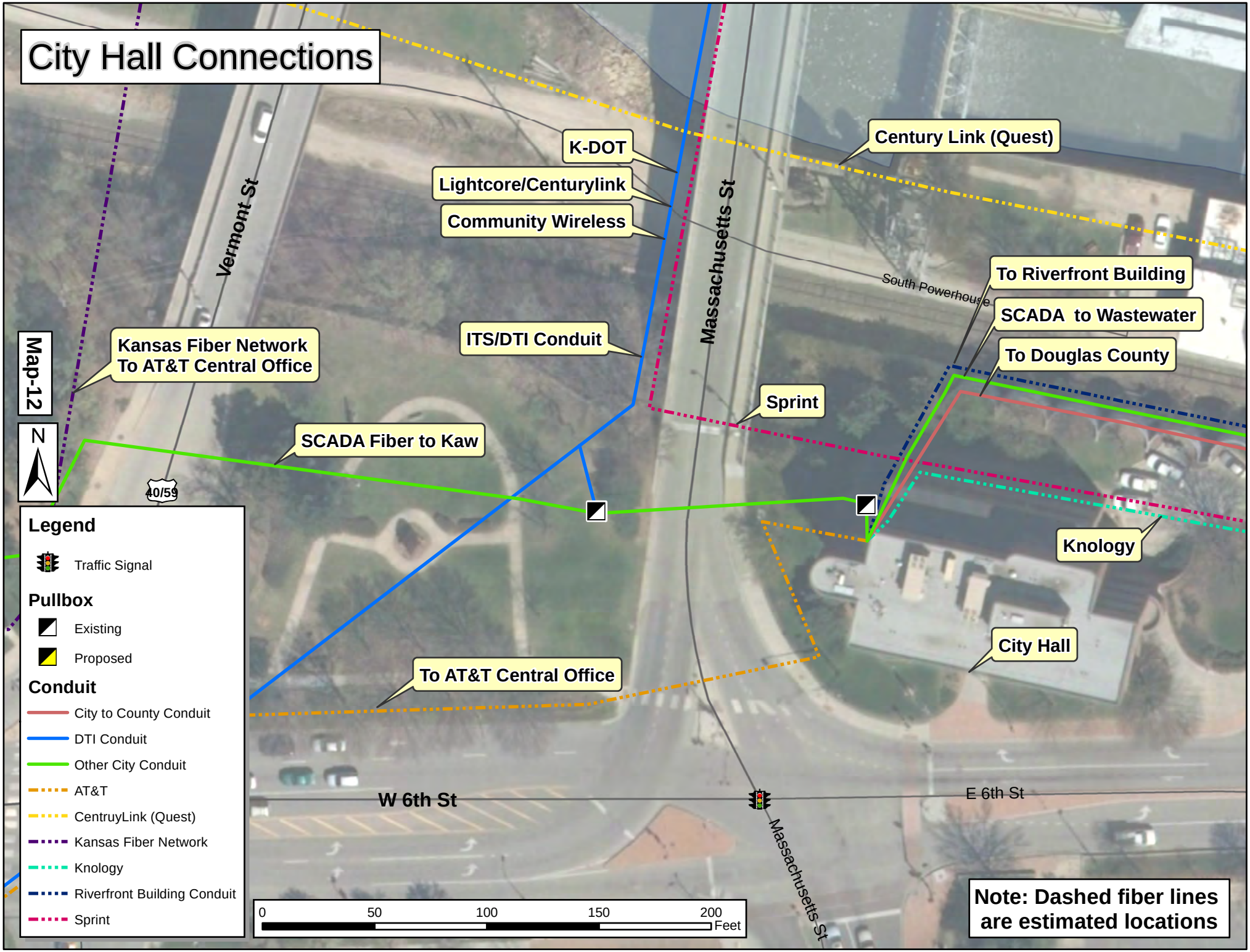

Stratford Water Tower Project
Iowa St
59
59
Highland Dr
Hilltop Dr
Oxford Rd
Oxford Rd
EOC Control Center
Community Wireless fiber and planned 96 count city fiber
Map-4
N
Legend
Traffic Signal
Pullbox
Existing
Conduit
Other City Conduit
DTI Conduit
Stratford Rd
Stratford Rd
Stratford Rd
Stratford Rd
0
50
100
150
200
Feet

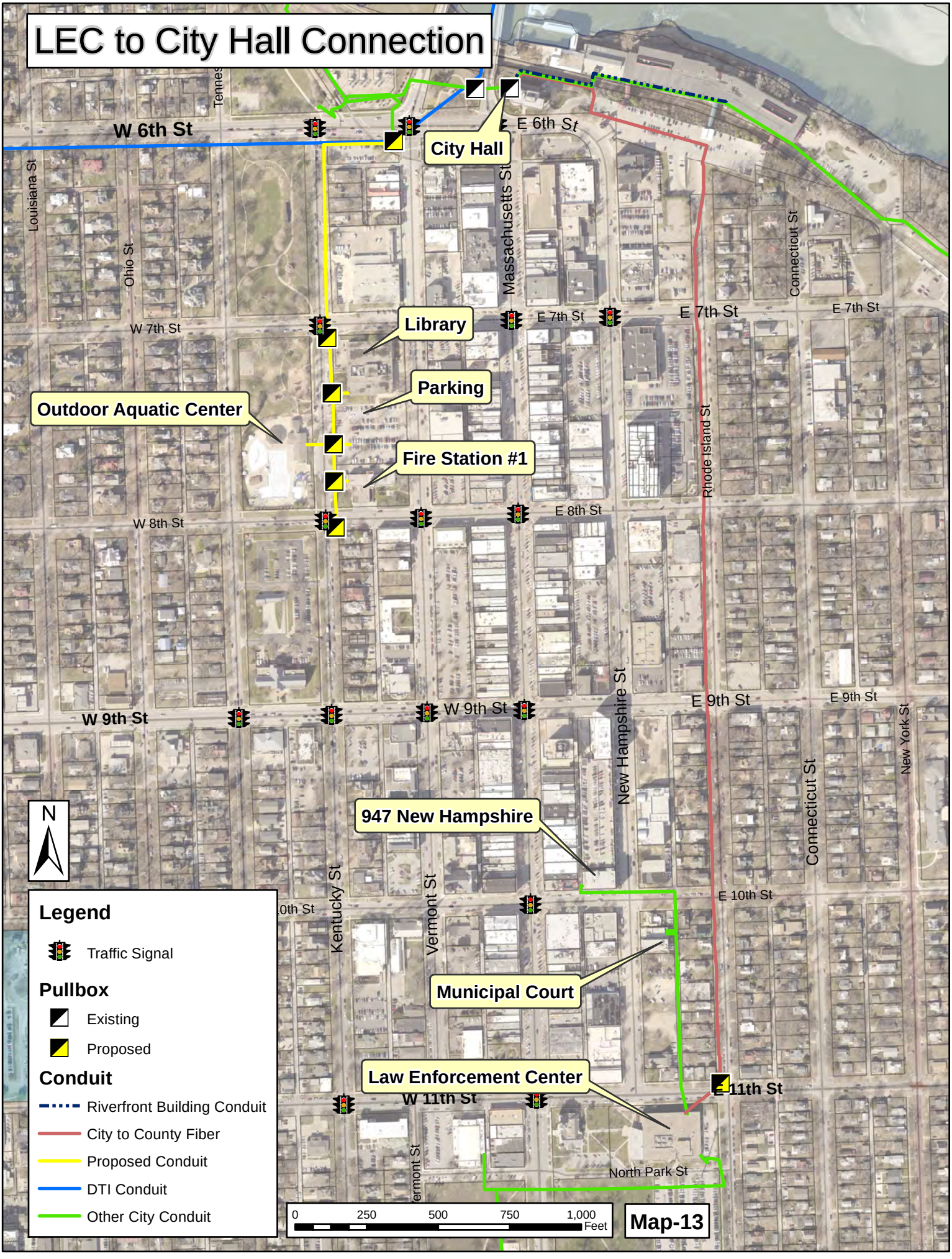

ITS/DTI Fiber Ring
Map-6
N
Legend
Ring Outline
Conduit
Proposed Conduit
DTI Conduit
Verizon Empty Conduit
Utilities Conduit
Needed WWRF Connection
Connecting Conduit (Empty)
WWRF Conduit
Proposed Douglas County Conduit
Other City Conduit
0
0.25
0.5
0.75
1
Miles
W 6th St
E 6th St
E 7th St
W 9th St
E 9th St
W 11th St
E 11th St
W 15th St
E 15th St
W 19th St
E 19th St
E 23rd St
E 23rd Rd
N 1550 Rd
N 1500 Rd
N 1400 Rd
E 1600 Rd
E 1625 Rd
Locust St
N 2nd St
Maine St
Vermont St
Massachusetts St
Connecticut St
Mississippi St
Tennessee St
Kentucky St
W Campus Rd
Naismith Dr
Harvard Rd
Bob Billings Pkwy
Iowa St
Barker Ave
Haskell Ave
Harper St
Louisiana St
Alabama St
Greenway Cir
Franklin Rd
E 25th Ter
E 25th St
E 27th St
E 28th St
Kensington Rd
O'Connell Rd
Kitsmiller Rd
Haskell Indian Nations
40/59
40
59
10
CC
VA

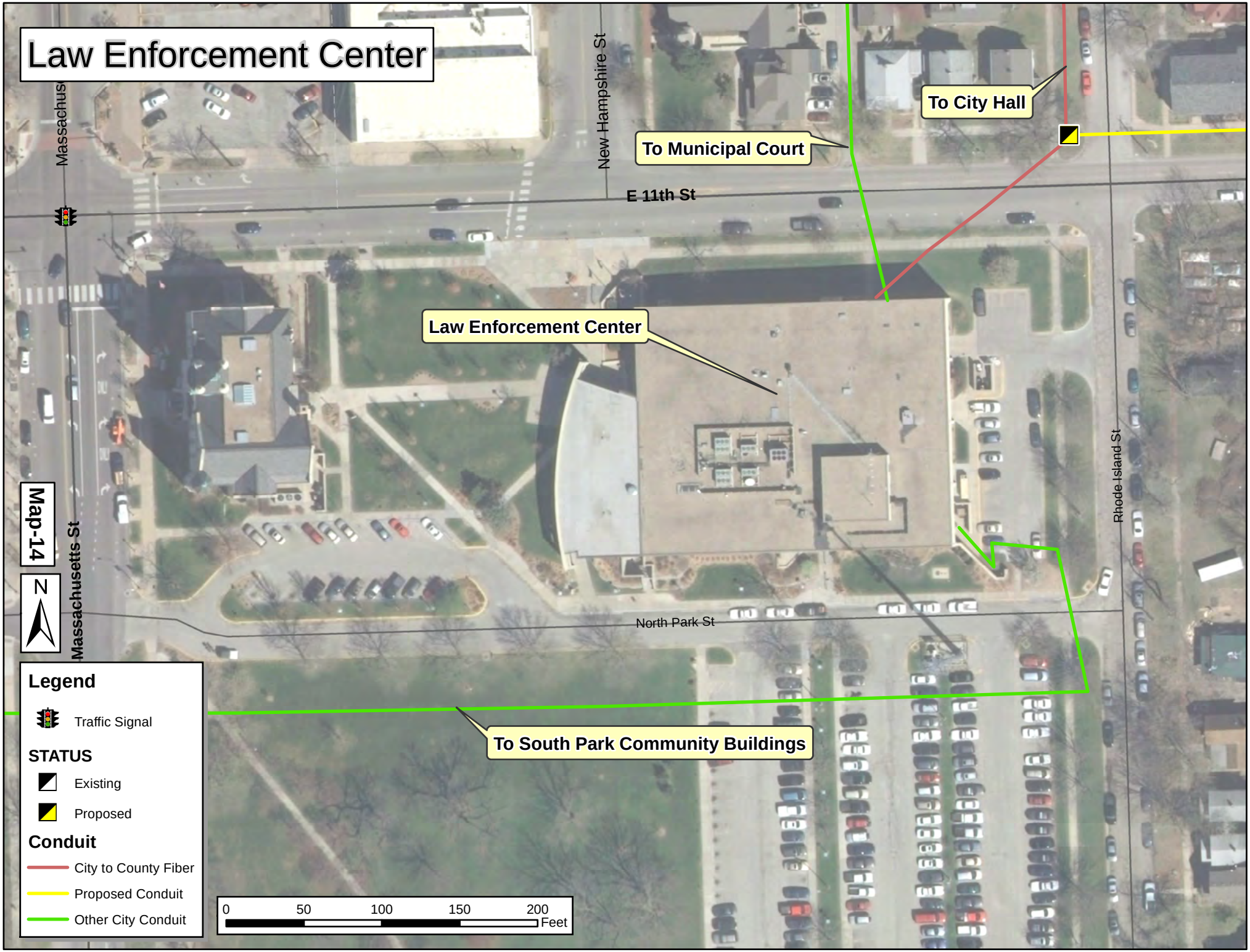

Verizon Fiber Ring
Overland Dr
Eisenhower Rd
Congressional Dr
Overland Dr
Champion Ln
Folks Rd
Trail Rd
Trail Rd
Rockledge Rd
McDonald Dr
W 4th St
40/59
59
40
W 6th St
Stoneridge Dr
Branchwood Dr
Harvard Rd
Monterey Way
W 8th St
Kasold Dr
W 9th St
W 9th St
Harvard Rd
George Williams Way
Legends Dr
Research Park Dr
Inverness Dr
Monterey Way
Harvard Rd
Lawrence Ave
Crestline Dr
W 15th St
Bob Billings Pkwy
Iowa St
Map-7
N
Bobwhite Dr
W 18th St
Inverness Dr
University of Kansas
59
W 19th St
W 21st St
10
W 23rd St
Clinton Pkwy
Lawrence Ave
W 25th St
Legend
Verizon Ring
Proposed Conduit
DTI Conduit
Empty City Conduit
Other City Conduit
Verizon Empty Conduit
0
0.25
0.5
0.75
1
Miles

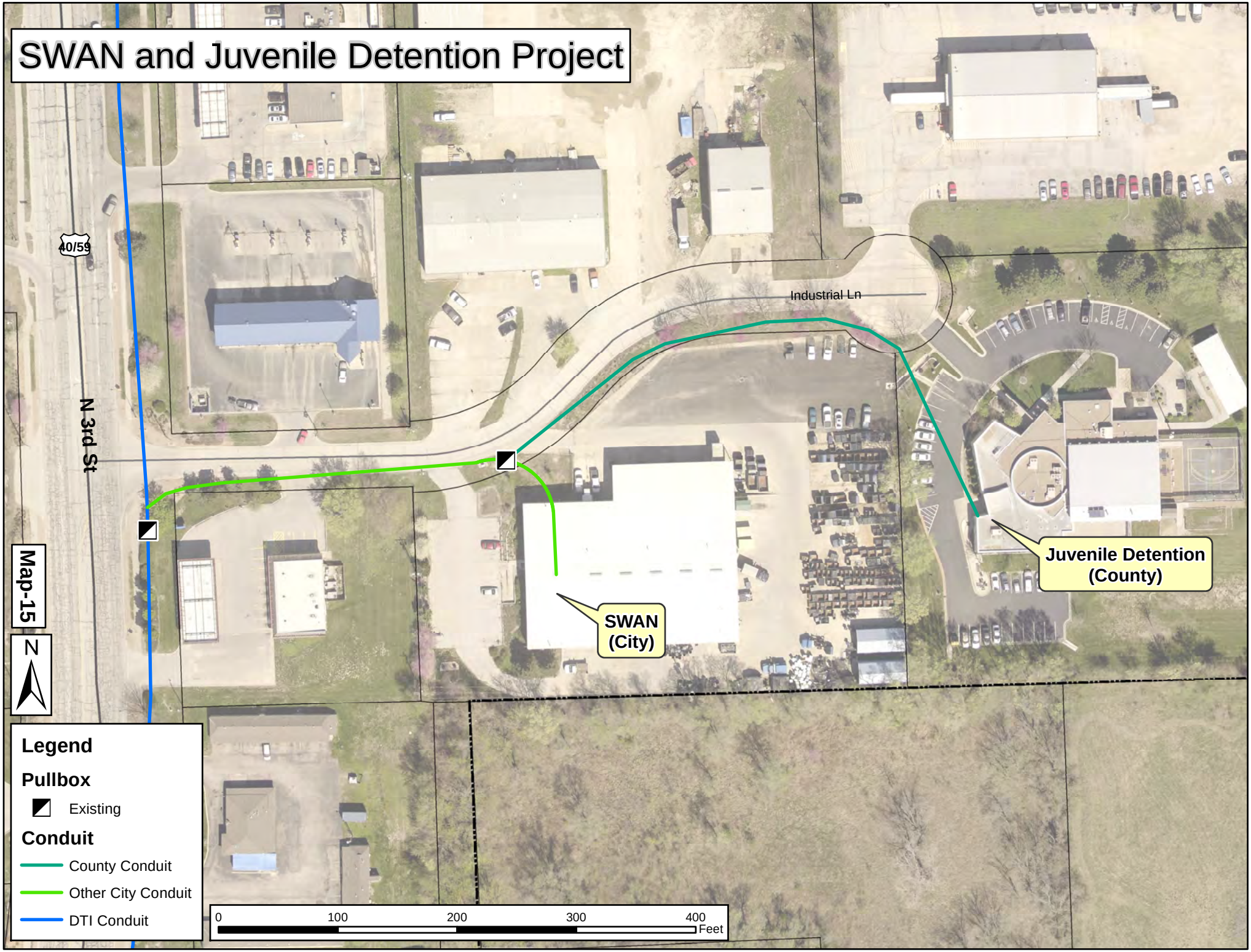

Sewage System Lift Stations
Map-10
N
Legend
LiftStation
Conduit
Proposed Conduit
City to County Conduit
DTI Conduit
Verizon Empty Conduit
Utilities Conduit
Proposed Douglas County Conduit
Empty City Conduit
Other City Conduit
0 0.5 1 1.5 2 Miles
I-70 Hwy
US 24/40 Hwy
W 6th St
W 9th St
W 19th St
W 23rd St
E 23rd St
E 23rd Rd
W 31st St
E 31st St
E 11th St
E 15th St
E 19th St
N 1500 Rd
N 1550 Rd
N 1300 Rd
N 1250 Rd
Peterson Rd
Bob Billings Pkwy
Wakarusa Dr
George Williams Way
McDonald Dr
Kasold Dr
Iowa St
N Iowa St
Massachusetts St
Haskell Ave
Louisiana St
N 1750 Rd
N 1700 Rd
E 1000 Rd
E 1130 Rd
E 1200 Rd
E 1400 Rd
E 1500 Rd
E 1600 Rd
E 1625 Rd
N 11th St
N 3rd St
01
02
03
04
05A
05B
06
07
08
09
10
12
13
15
16
19
22
23
25
27
31
32
34
35
37
42
43
44
45
46
48
49
50
59
40/59
24/59
24/40
40

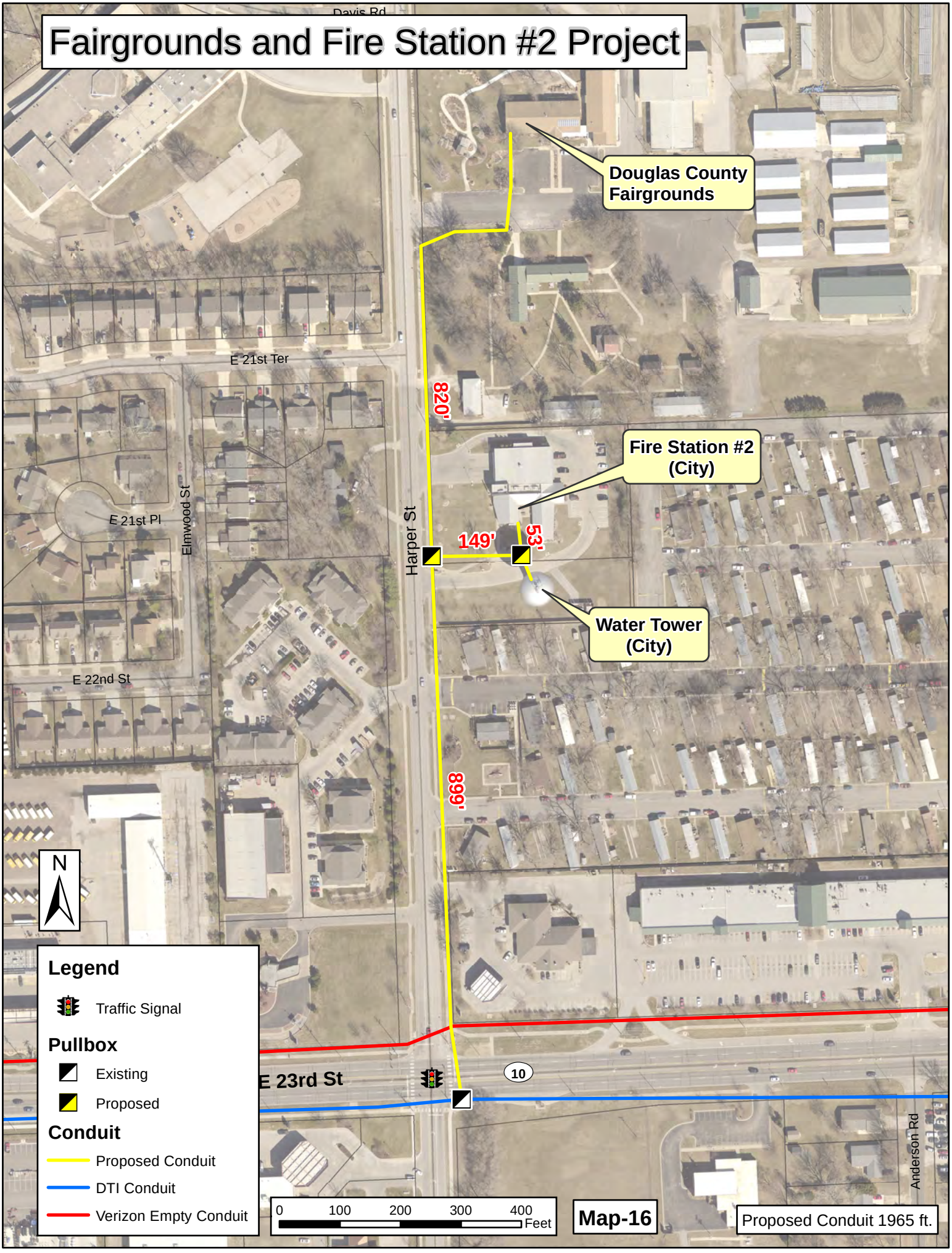

City Hall to Riverfront Connection
South Powerhouse Rd
Riverfront Mall Building
Connection to City Offices and Training Room
City Hall
Map-11
E 6th St
N
Riverfront Plz
To WWTP
To Douglas County
Legend
Traffic Signal
Pullbox
Existing
Proposed
Conduit
Riverfront Building Conduit
City to County Fiber
Other City Conduit
0 50 100 150 200
Feet
Hampshire St
Rhode Island St
Connecticut St

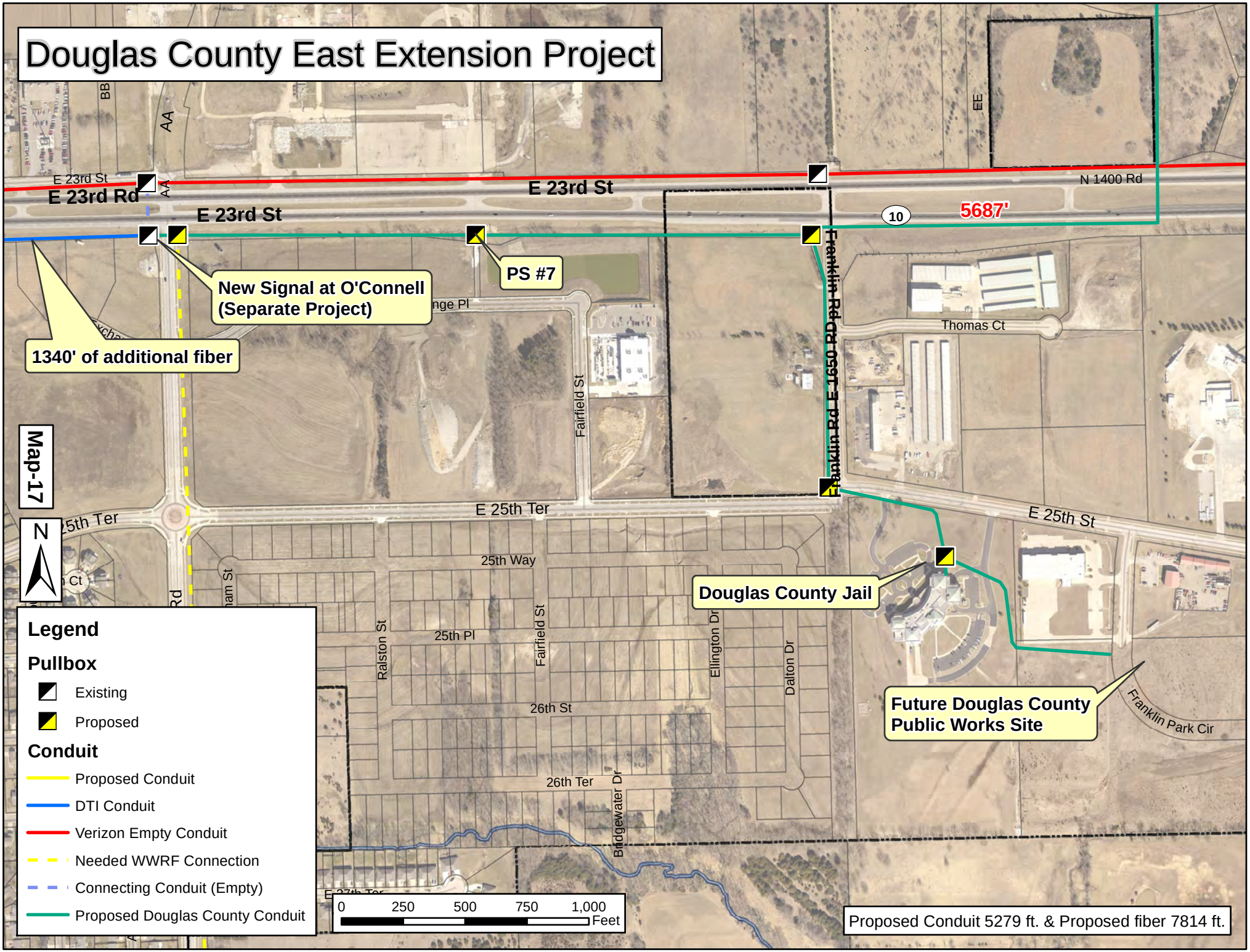

City Hall Connections
Vermont St
Massachusetts St
K-DOT
Lightcore/Centurylink
Community Wireless
Century Link (Quest)
South Powerhouse
To Riverfront Building
SCADA to Wastewater
To Douglas County
Sprint
ITS/DTI Conduit
Kansas Fiber Network
To AT&T Central Office
SCADA Fiber to Kaw
Map-12
N
40/59
Knology
City Hall
To AT&T Central Office
W 6th St
E 6th St
Massachusetts St
Legend
Traffic Signal
Pullbox
Existing
Proposed
Conduit
City to County Conduit
DTI Conduit
Other City Conduit
AT&T
CentruyLink (Quest)
Kansas Fiber Network
Knology
Riverfront Building Conduit
Sprint
0
50
100
150
200
Feet
Note: Dashed fiber lines are estimated locations

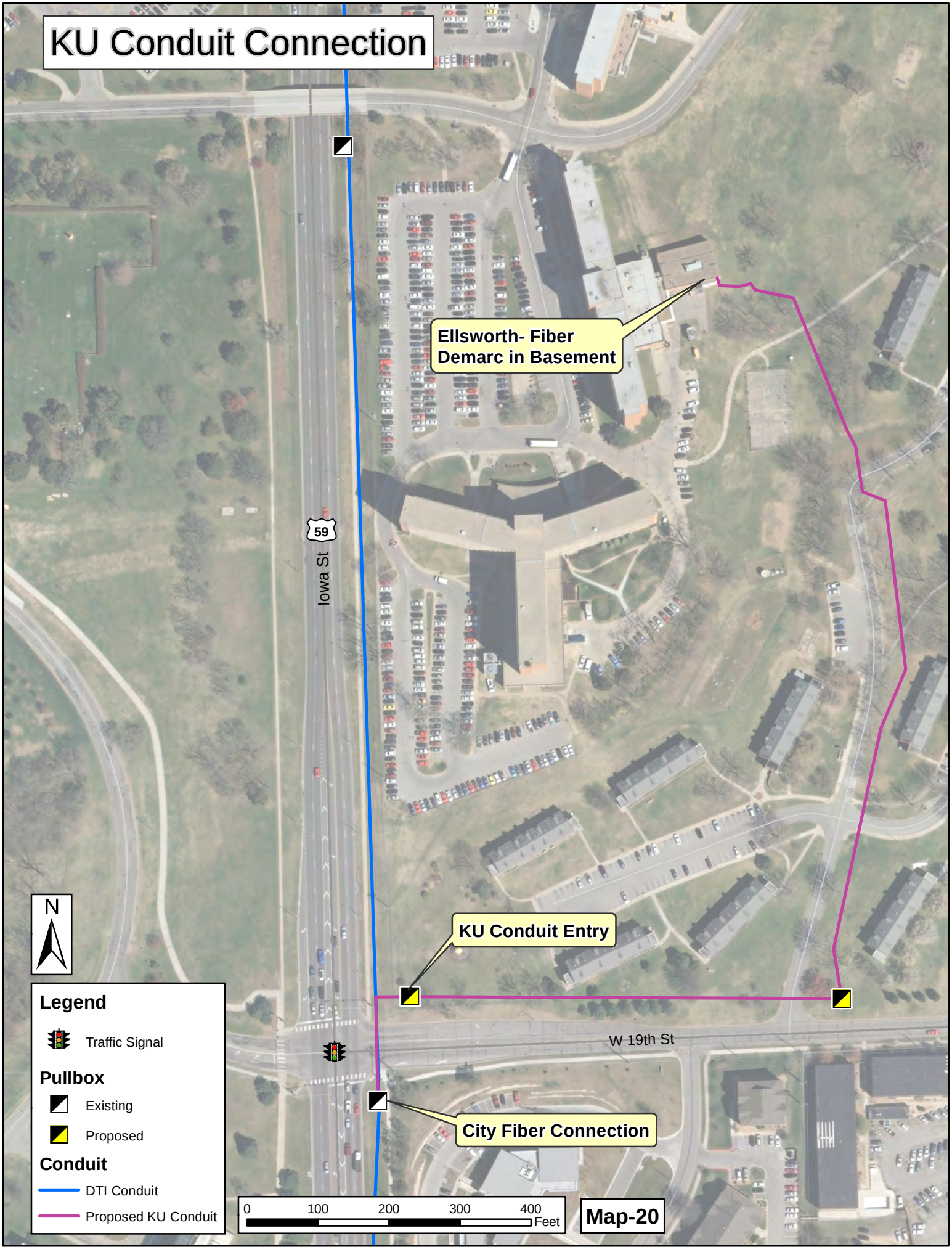

LEC to City Hall Connection
W 6th St
E 6th St
City Hall
Louisiana St
Ohio St
Massachusetts St
Connecticut St
W 7th St
E 7th St
Library
Parking
Outdoor Aquatic Center
Fire Station #1
Rhode Island St
W 8th St
E 8th St
W 9th St
E 9th St
New Hampshire St
New York St
947 New Hampshire
Kentucky St
Vermont St
E 10th St
Municipal Court
Law Enforcement Center
W 11th St
E 11th St
North Park St
N
Legend
Traffic Signal
Pullbox
Existing
Proposed
Conduit
Riverfront Building Conduit
City to County Fiber
Proposed Conduit
DTI Conduit
Other City Conduit
0
250
500
750
1,000
Feet
Map-13

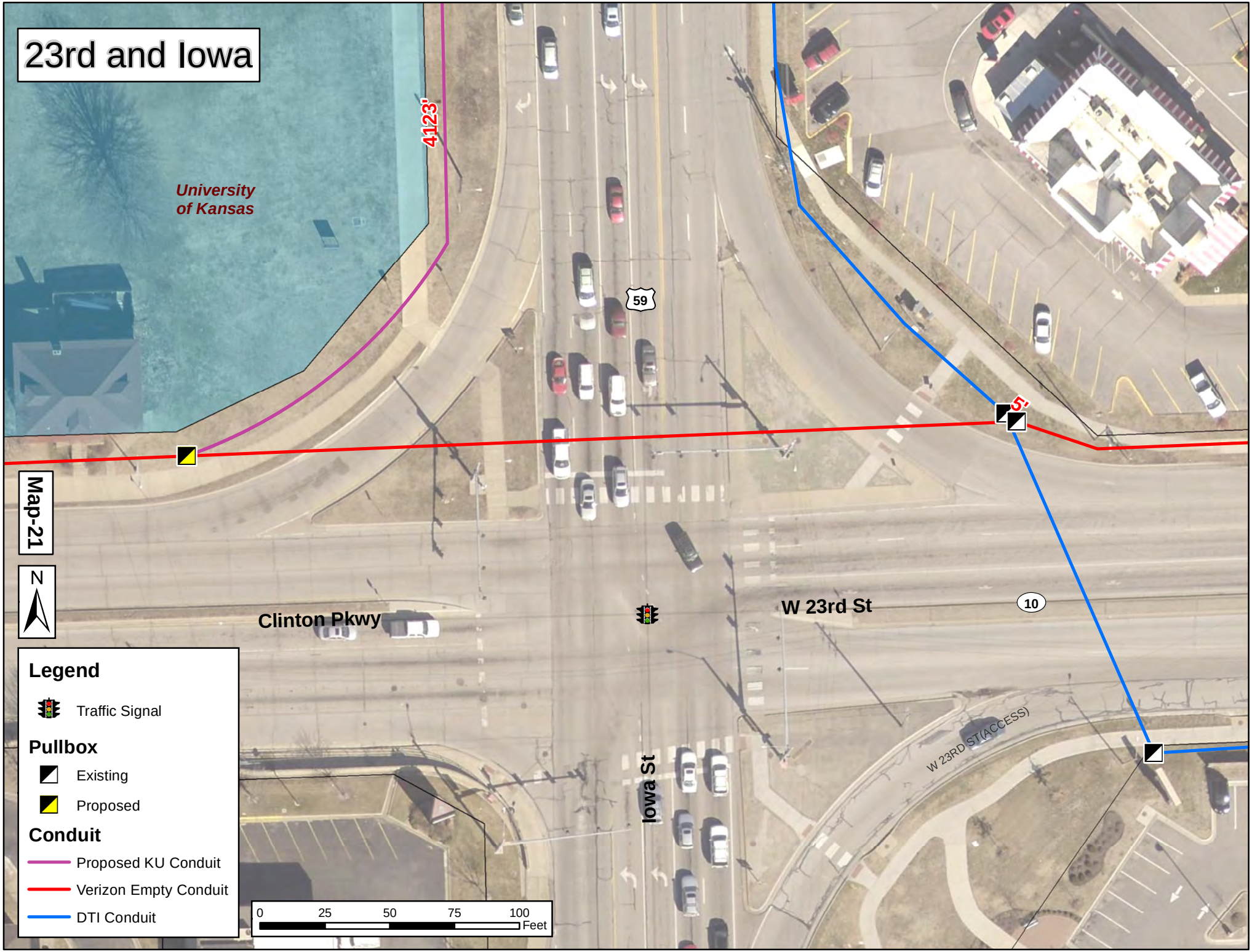

Law Enforcement Center
New Hampshire St
To City Hall
To Municipal Court
E 11th St
Law Enforcement Center
Rhode Island St
Map-14
N
Massachusetts St
North Park St
To South Park Community Buildings
Legend
Traffic Signal
STATUS
Existing
Proposed
Conduit
City to County Fiber
Proposed Conduit
Other City Conduit
0
50
100
150
200
Feet

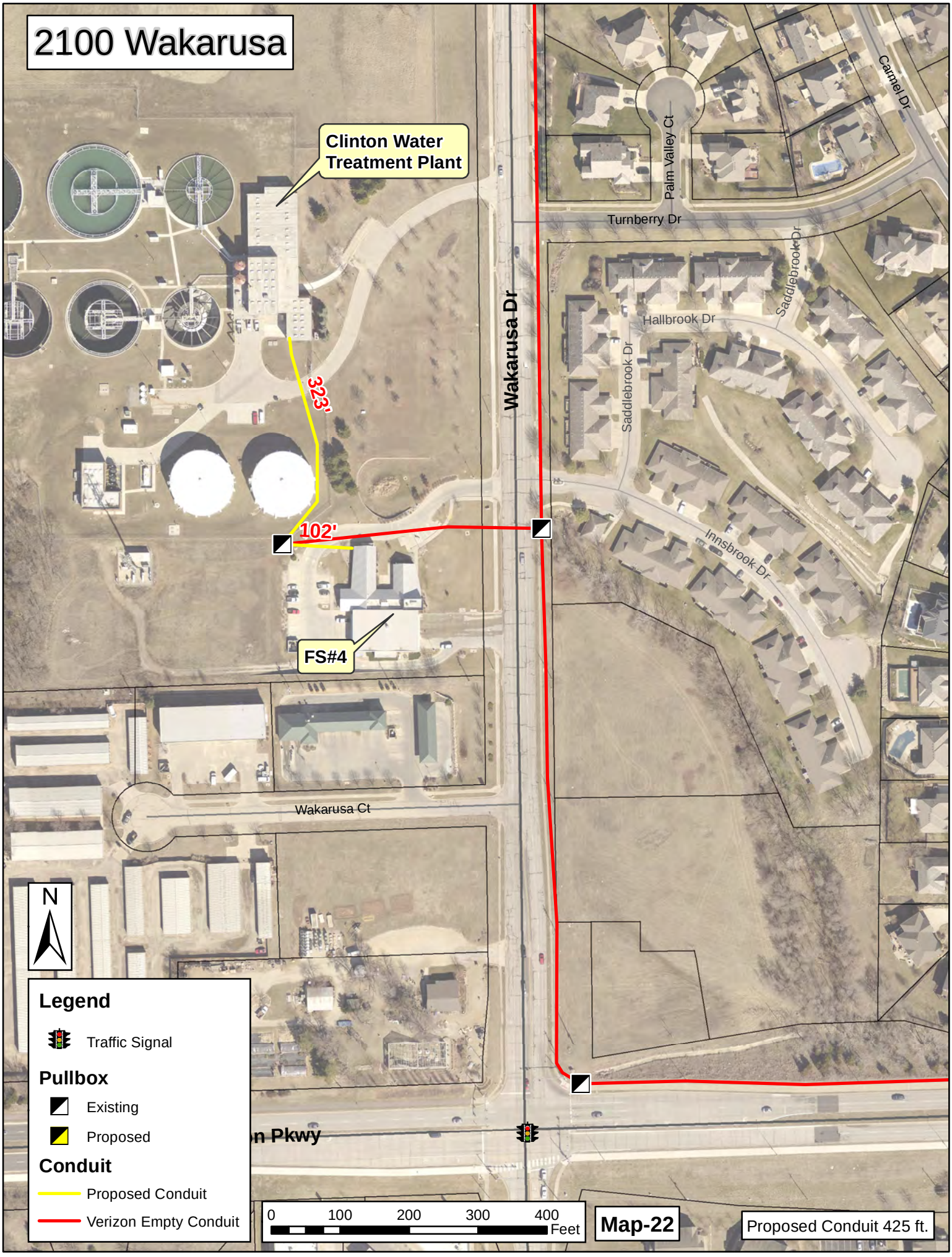

SWAN and Juvenile Detention Project
40/59
N 3rd St
Industrial Ln
Juvenile Detention (County)
SWAN (City)
Map-15
N
Legend
Pullbox
Existing
Conduit
County Conduit
Other City Conduit
DTI Conduit
0
100
200
300
400
Feet


Fairgrounds and Fire Station #2 Project
Douglas County Fairgrounds
Fire Station #2 (City)
Water Tower (City)
820'
149'
53'
699'
Harper St
Elmwood St
E 21st Ter
E 21st Pl
E 22nd St
E 23rd St
Anderson Rd
10
N
Legend
Traffic Signal
Pullbox
Existing
Proposed
Conduit
Proposed Conduit
DTI Conduit
Verizon Empty Conduit
0 100 200 300 400 Feet
Map-16
Proposed Conduit 1965 ft.

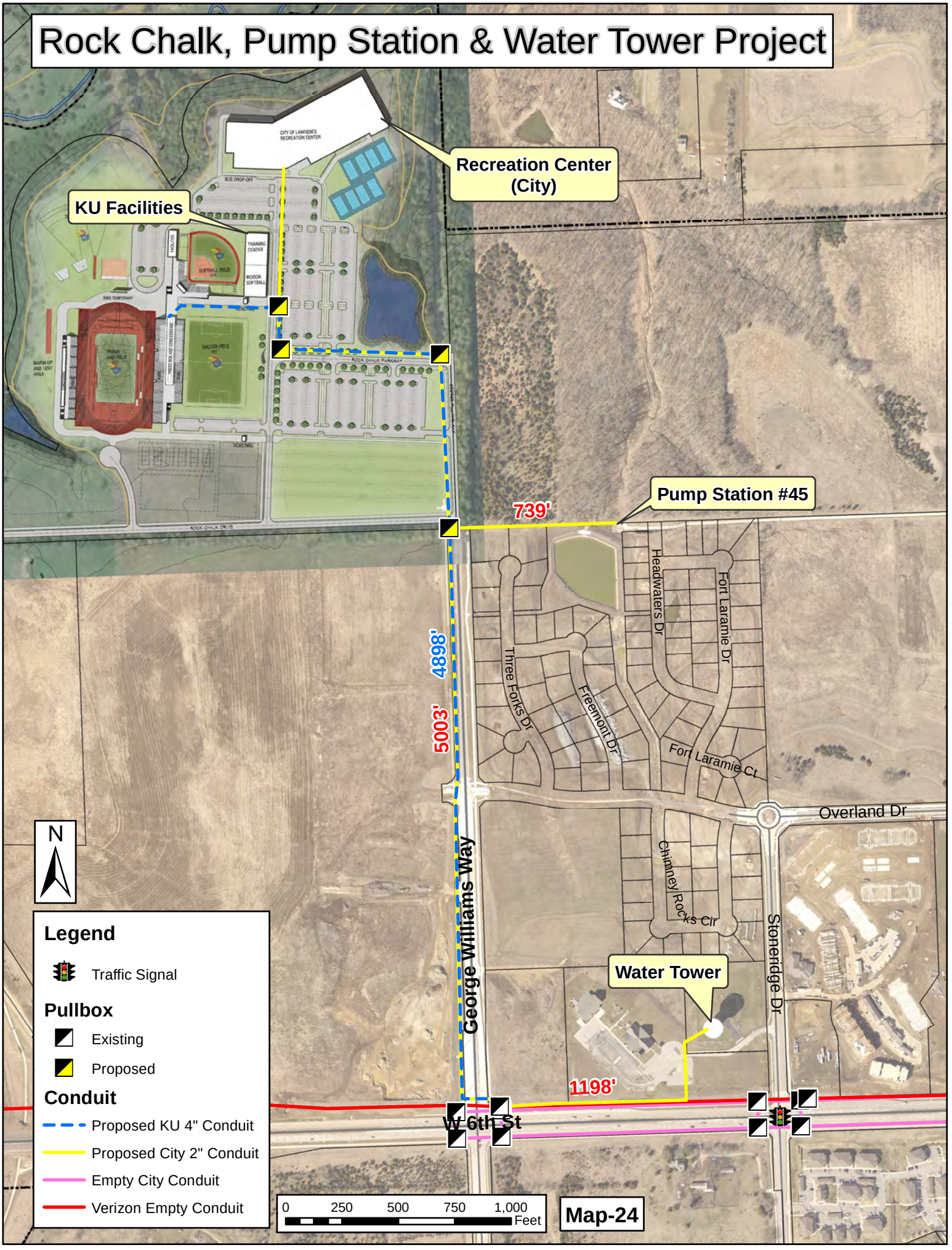

Douglas County East Extension Project
E 23rd St
E 23rd Rd
E 23rd St
E 23rd St
N 1400 Rd
10
5687'
New Signal at O'Connell (Separate Project)
PS #7
1340' of additional fiber
Franklin Rd
Thomas Ct
Fairfield St
Map-17
E 25th Ter
E 25th St
25th Way
25th Pl
26th St
26th Ter
Ralston St
Fairfield St
Ellington Dr
Dalton Dr
Bridgewater Dr
Douglas County Jail
Future Douglas County Public Works Site
Franklin Park Cir
N
Legend
Pullbox
Existing
Proposed
Conduit
Proposed Conduit
DTI Conduit
Verizon Empty Conduit
Needed WWRF Connection
Connecting Conduit (Empty)
Proposed Douglas County Conduit
0 250 500 750 1,000 Feet
Proposed Conduit 5279 ft. & Proposed fiber 7814 ft.


KU Conduit Connection
Ellsworth- Fiber
Demarc in Basement
59
Iowa St
KU Conduit Entry
W 19th St
City Fiber Connection
N
Legend
Traffic Signal
Pullbox
Existing
Proposed
Conduit
DTI Conduit
Proposed KU Conduit
0
100
200
300
400
Feet
Map-20

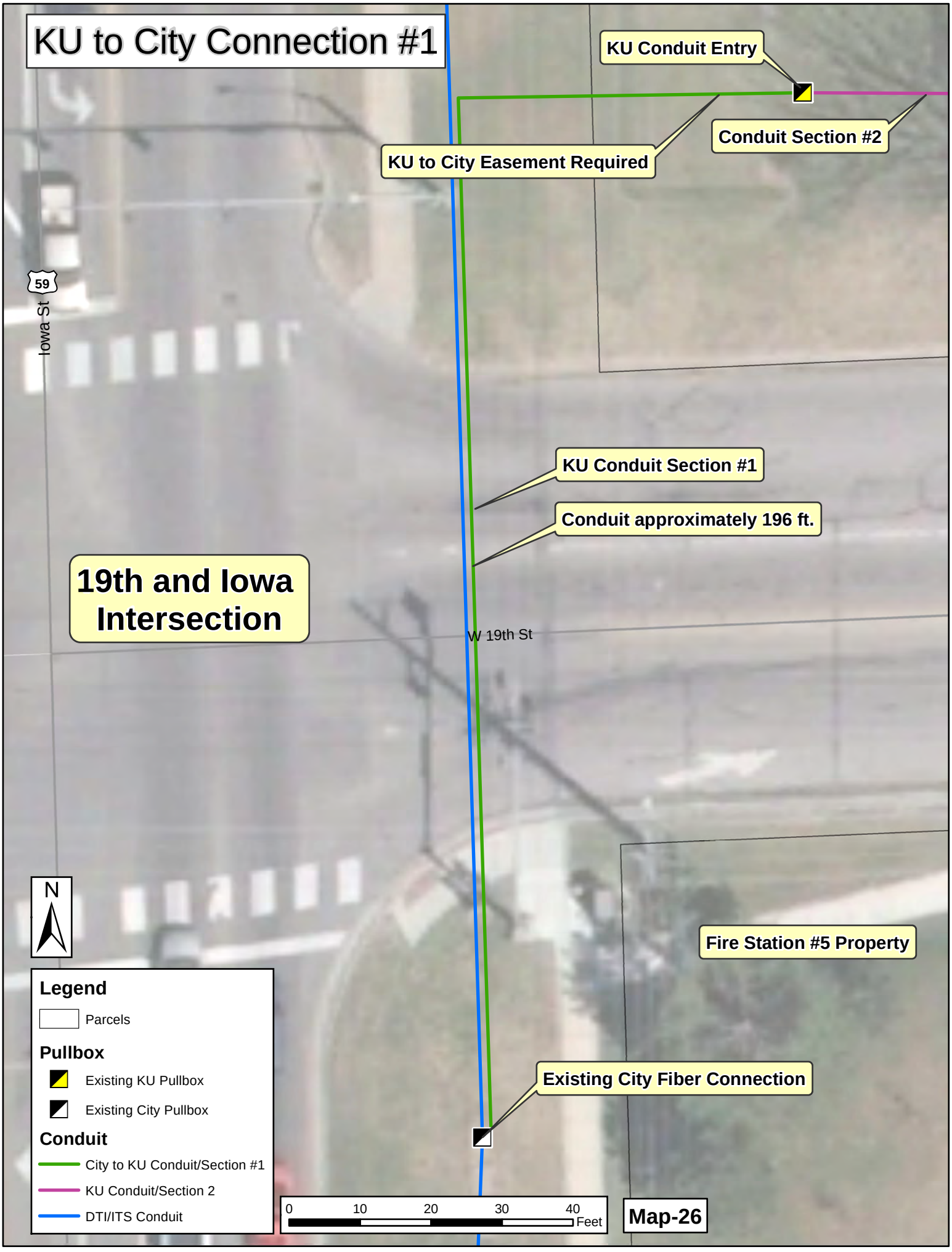

23rd and Iowa
4123'
University of Kansas
59
5'
Map-21
N
Clinton Pkwy
W 23rd St
10
Iowa St
W 23RD ST (ACCESS)
Legend
Traffic Signal
Pullbox
Existing
Proposed
Conduit
Proposed KU Conduit
Verizon Empty Conduit
DTI Conduit
0
25
50
75
100
Feet

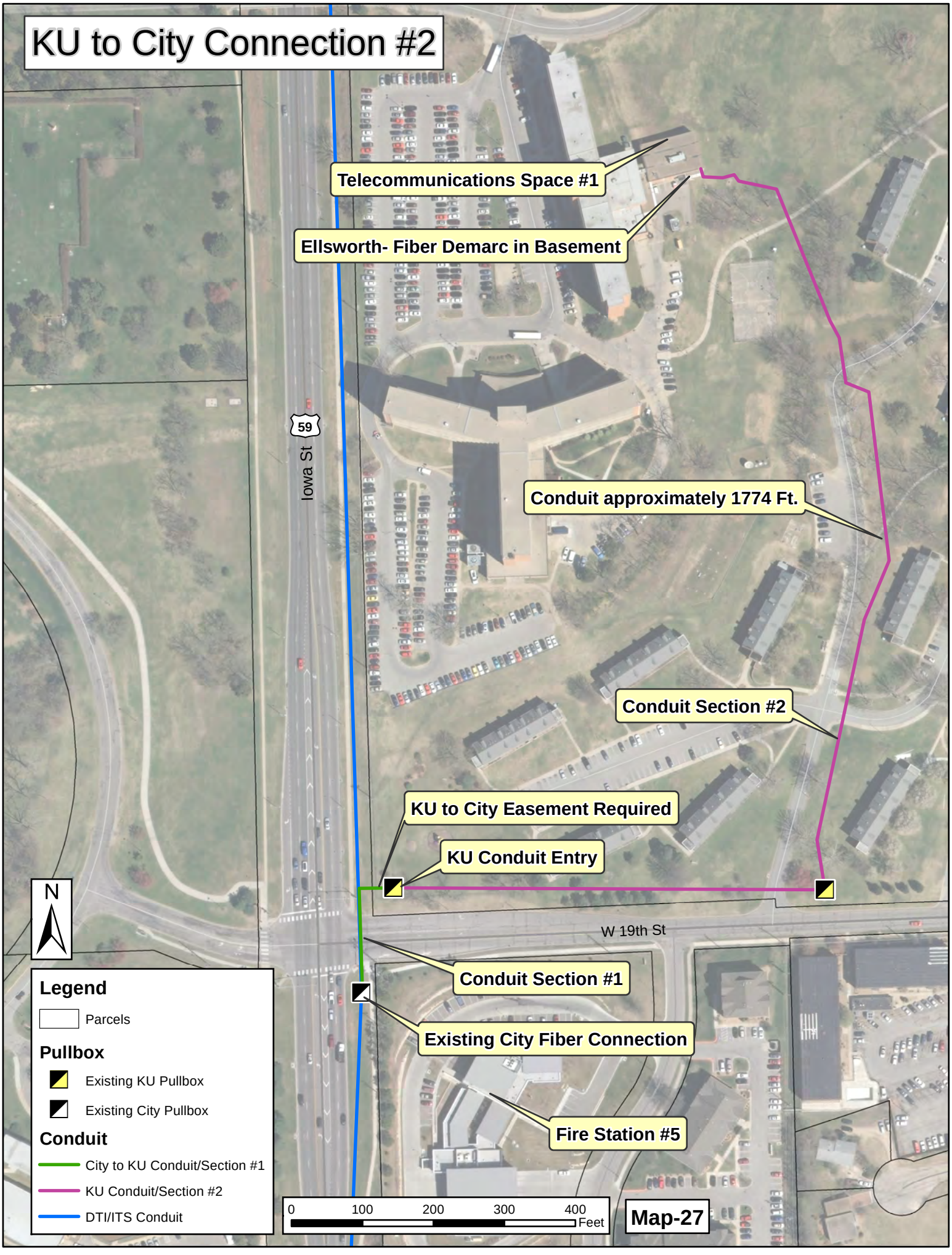

2100 Wakarusa
Clinton Water Treatment Plant
323'
102'
FS#4
Wakarusa Dr
Palm Valley Ct
Carmel Dr
Turnberry Dr
Saddlebrook Dr
Hallbrook Dr
Saddlebrook Dr
Innsbrook Dr
Wakarusa Ct
N
Legend
Traffic Signal
Pullbox
Existing
Proposed
Conduit
Proposed Conduit
Verizon Empty Conduit
0 100 200 300 400 Feet
Map-22
Proposed Conduit 425 ft.


Wakarusa and Bob Billings Project
1315 Wakakrusa (KU)
Quail Crest Pl
1405'
Research Park Dr
Oread West Dr
Oread West Dr
Investigations & Training Center (City)
Bob Billings Pkwy
784'
93'
1505 Wakarusa Dr. (KU)
312'
Wakarusa Dr
N
1501 Wakarusa Dr. (KU)
Legend
Traffic Signal
Pullbox
Existing
Proposed
Conduit
Proposed Conduit
Verizon Empty Conduit
0 100 200 300 400 Feet
Map-23
Balmoral Dr
Brandon Woods Ter
Brandon
Proposed Conduit 2501 ft.

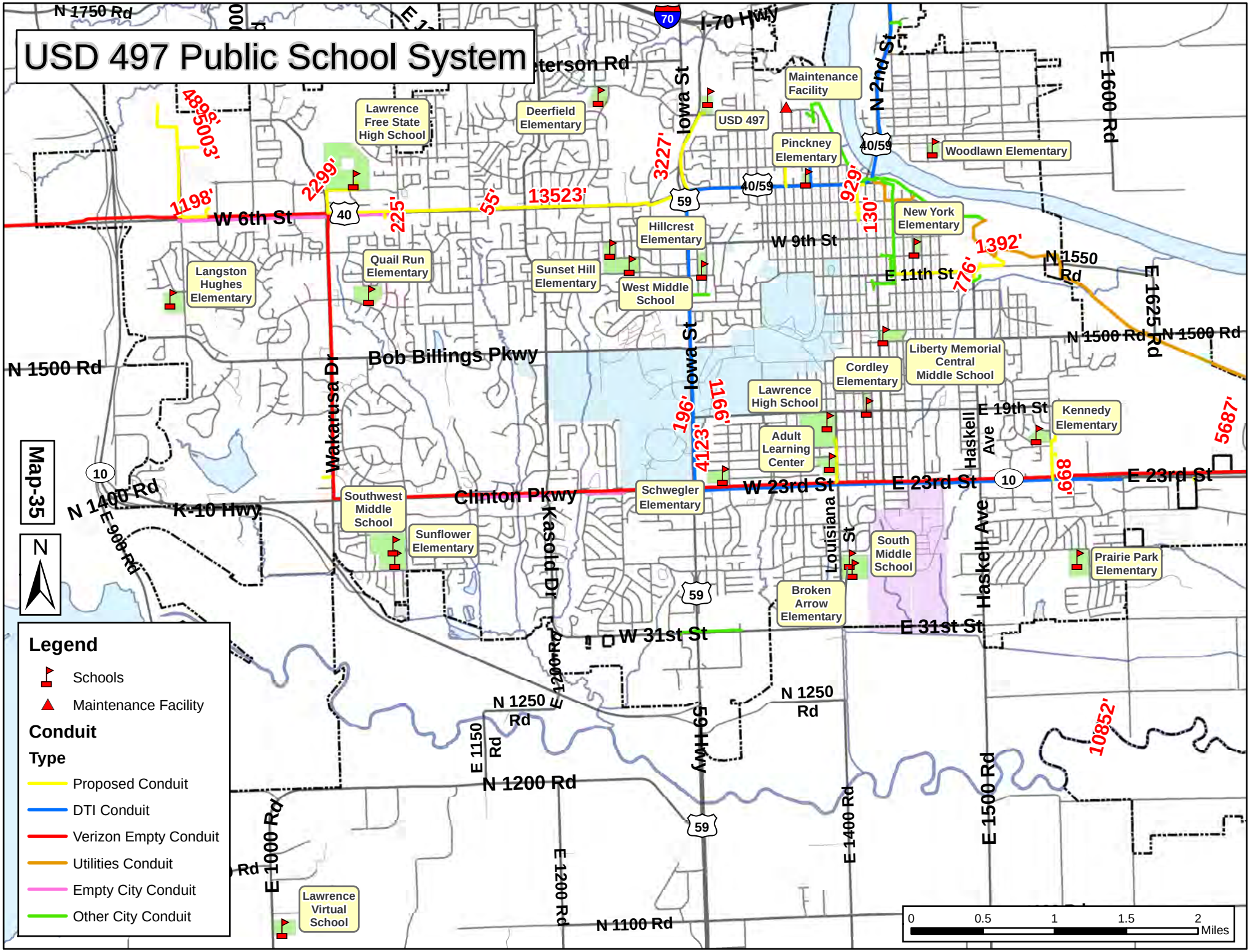

Rock Chalk, Pump Station & Water Tower Project
Recreation Center (City)
KU Facilities
Pump Station #45
739'
4898'
5003'
1198'
Headwaters Dr
Fort Laramie Dr
Three Forks Dr
Freemont Dr
Fort Laramie Ct
Overland Dr
Chimney Rocks Cir
Stoneridge Dr
George Williams Way
Water Tower
W 6th St
N
Legend
Traffic Signal
Pullbox
Existing
Proposed
Conduit
Proposed KU 4" Conduit
Proposed City 2" Conduit
Empty City Conduit
Verizon Empty Conduit
0 250 500 750 1,000 Feet
Map-24

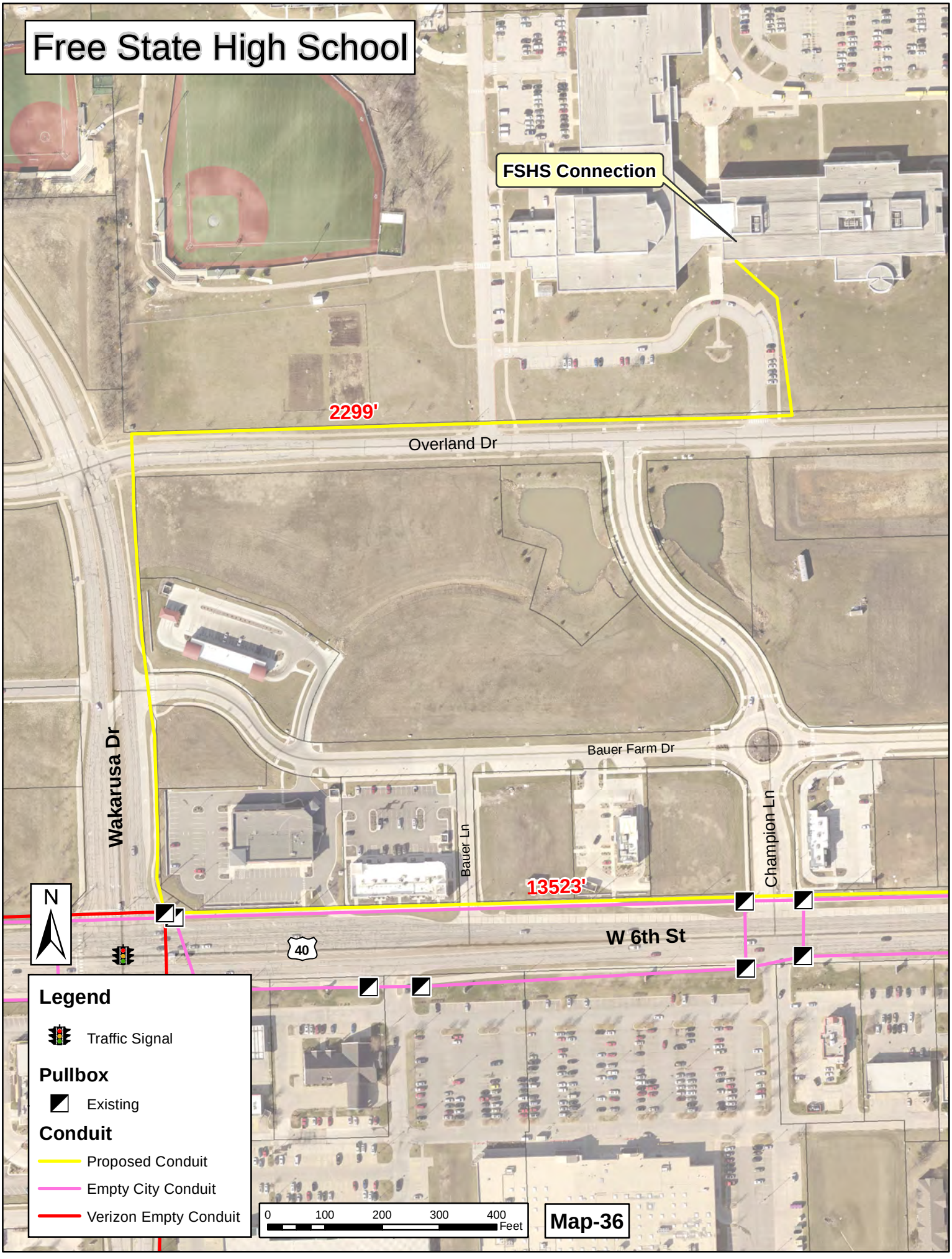

North Lawrence Airport Project
E
Rd
24/59
E 1500 Rd
N 7th St
1376'
Airport
Bryant Way
Taylorcraft Rd
Waco St
N 1825 Rd
N 3rd St
E 1500 Rd
4779'
24/40
US 24/40 Hwy
Map-25
N
E 1450 Rd
N 3
9
E 1500 Rd
Legend
Traffic Signal
Pullbox
Existing
Conduit
Proposed Conduit
DTI Conduit
0
500
1,000
1,500
2,000
Feet
Proposed Conduit 6155 ft.


KU to City Connection #1
KU Conduit Entry
Conduit Section #2
KU to City Easement Required
59
Iowa St
KU Conduit Section #1
Conduit approximately 196 ft.
19th and Iowa Intersection
W 19th St
N
Fire Station #5 Property
Existing City Fiber Connection
Legend
Parcels
Pullbox
Existing KU Pullbox
Existing City Pullbox
Conduit
City to KU Conduit/Section #1
KU Conduit/Section 2
DTI/ITS Conduit
0 10 20 30 40 Feet
Map-26


KU to City Connection #2
Telecommunications Space #1
Ellsworth- Fiber Demarc in Basement
59
Iowa St
Conduit approximately 1774 Ft.
Conduit Section #2
KU to City Easement Required
KU Conduit Entry
W 19th St
Conduit Section #1
Existing City Fiber Connection
Fire Station #5
N
Legend
Parcels
Pullbox
Existing KU Pullbox
Existing City Pullbox
Conduit
City to KU Conduit/Section #1
KU Conduit/Section #2
DTI/ITS Conduit
0
100
200
300
400
Feet
Map-27

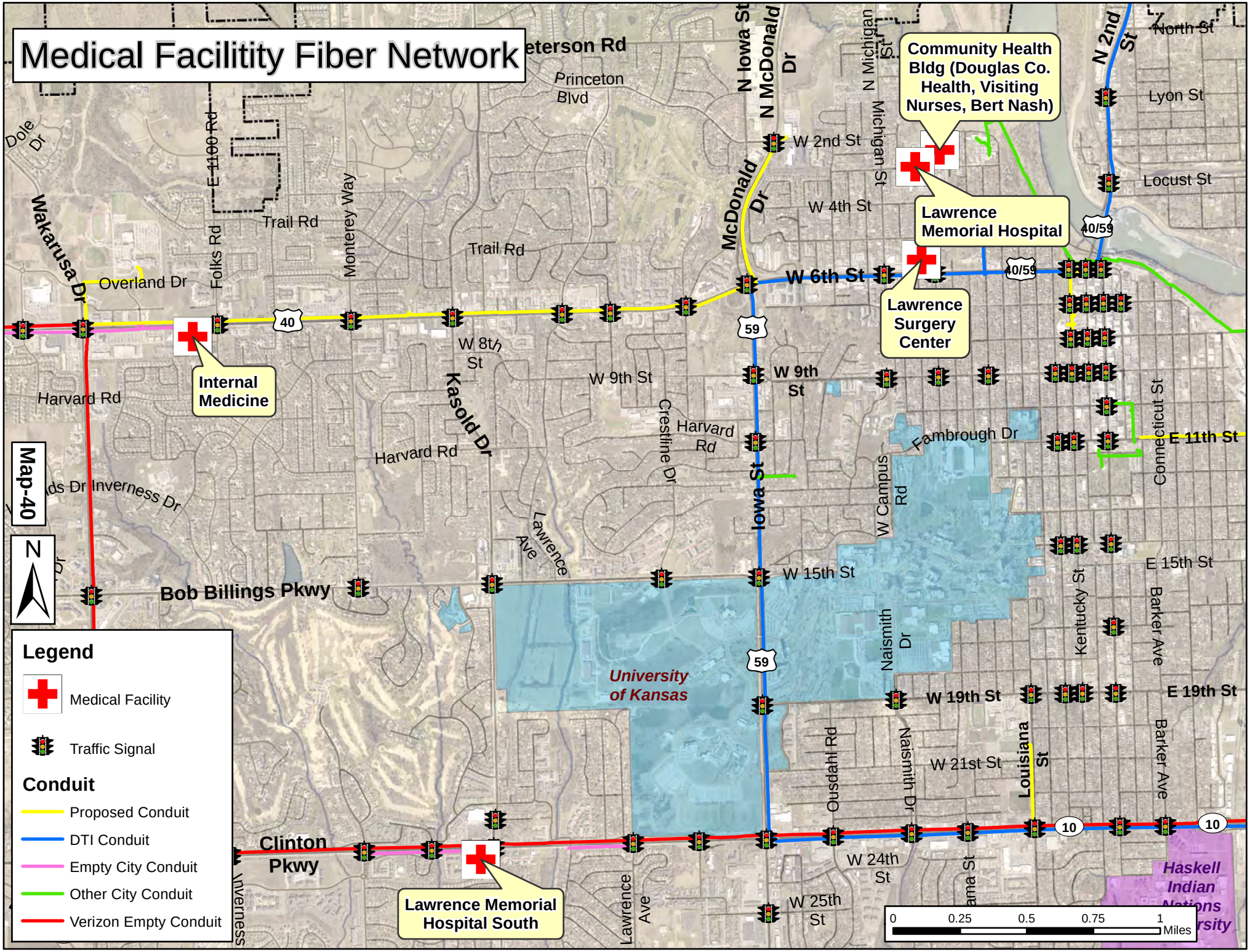

Library, Pool, & Fire Station #1 Project
W 6th St
40/59
Vermont St
Massachusetts St
W 7th St
Kentucky St
Ohio St
Library
Outdoor Pool
Proposed Parking Garage
FS#1
N
Legend
Traffic Signal
Pullbox
Existing
Proposed
Conduit
City to County Conduit
Proposed Conduit
DTI Conduit
Other City Conduit
0 100 200 300 400 Feet
Map-30
Proposed Conduit 1844 ft.

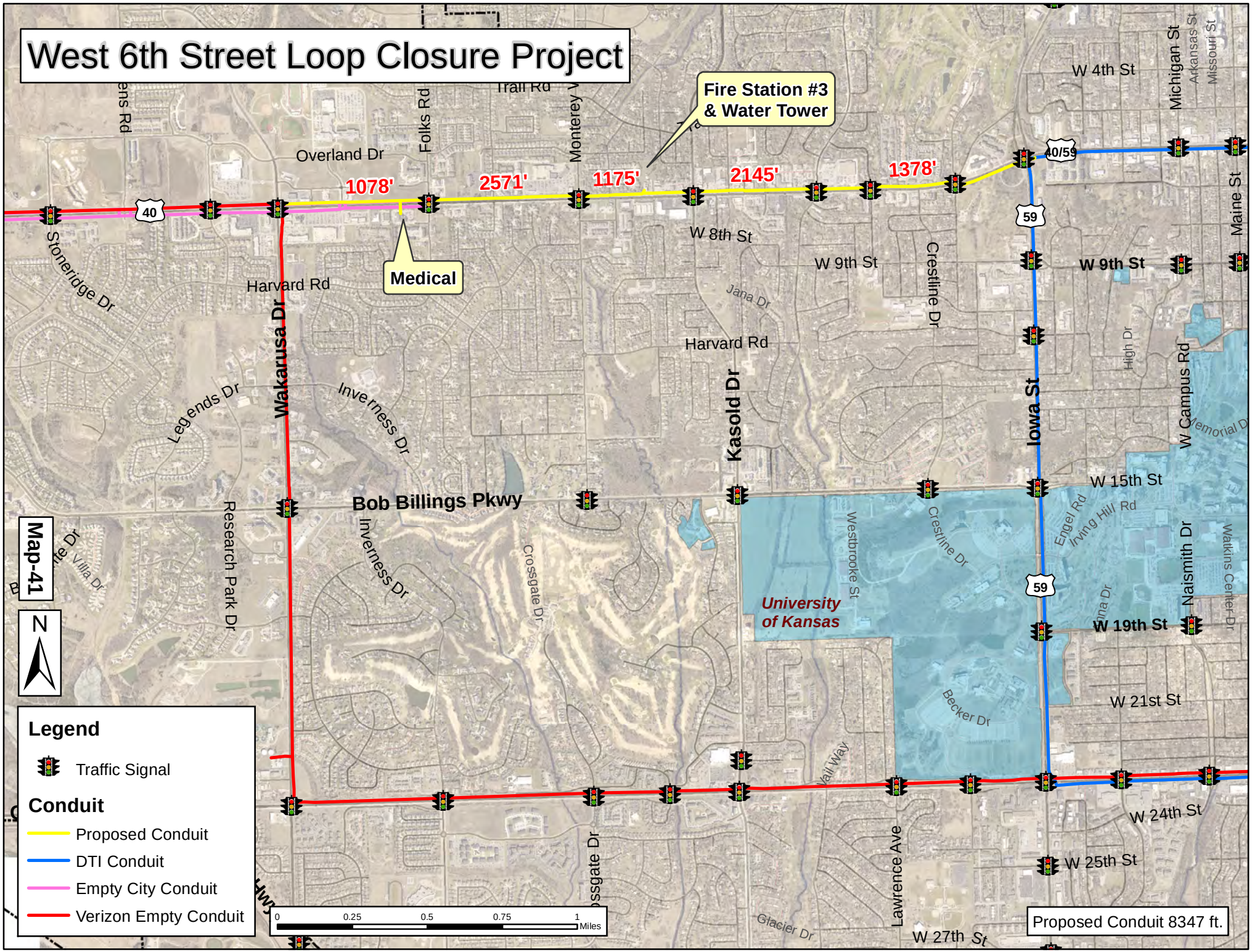

USD 497 Public School System
Lawrence Free State High School
Deerfield Elementary
Maintenance Facility
USD 497
Pinckney Elementary
Woodlawn Elementary
New York Elementary
Hillcrest Elementary
Quail Run Elementary
Langston Hughes Elementary
Sunset Hill Elementary
West Middle School
Liberty Memorial Central Middle School
Cordley Elementary
Lawrence High School
Adult Learning Center
Kennedy Elementary
Schwegler Elementary
Southwest Middle School
Sunflower Elementary
South Middle School
Broken Arrow Elementary
Prairie Park Elementary
Lawrence Virtual School
W 6th St
W 9th St
E 11th St
Bob Billings Pkwy
Clinton Pkwy
W 23rd St
E 23rd St
W 31st St
E 31st St
N 1500 Rd
N 1400 Rd
N 1250 Rd
N 1200 Rd
N 1100 Rd
N 1750 Rd
N 1550 Rd
E 1600 Rd
E 1625 Rd
E 1500 Rd
E 1400 Rd
E 1200 Rd
E 1150 Rd
E 1000 Rd
E 900 Rd
Wakarusa Dr
Iowa St
Kasold Dr
Louisiana St
Haskell Ave
E 19th St
N 2nd St
I-70 Hwy
K-10 Hwy
59 Hwy
Map-35
N
Legend
Schools
Maintenance Facility
Conduit
Type
Proposed Conduit
DTI Conduit
Verizon Empty Conduit
Utilities Conduit
Empty City Conduit
Other City Conduit
0 0.5 1 1.5 2 Miles

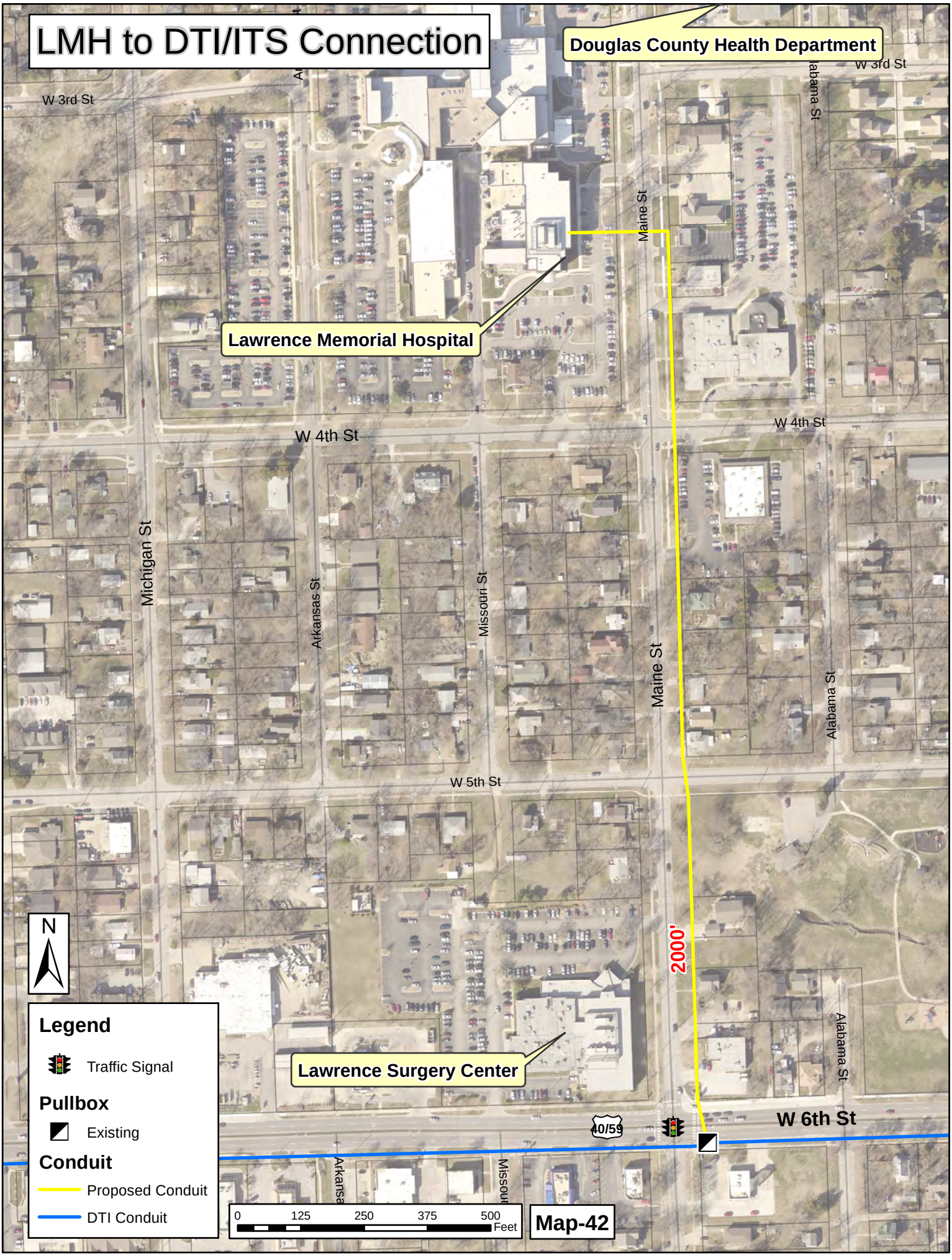

Free State High School
FSHS Connection
2299'
Overland Dr
Wakarusa Dr
Bauer Farm Dr
Bauer Ln
Champion Ln
13523'
W 6th St
40
N
Legend
Traffic Signal
Pullbox
Existing
Conduit
Proposed Conduit
Empty City Conduit
Verizon Empty Conduit
0 100 200 300 400
Feet
Map-36

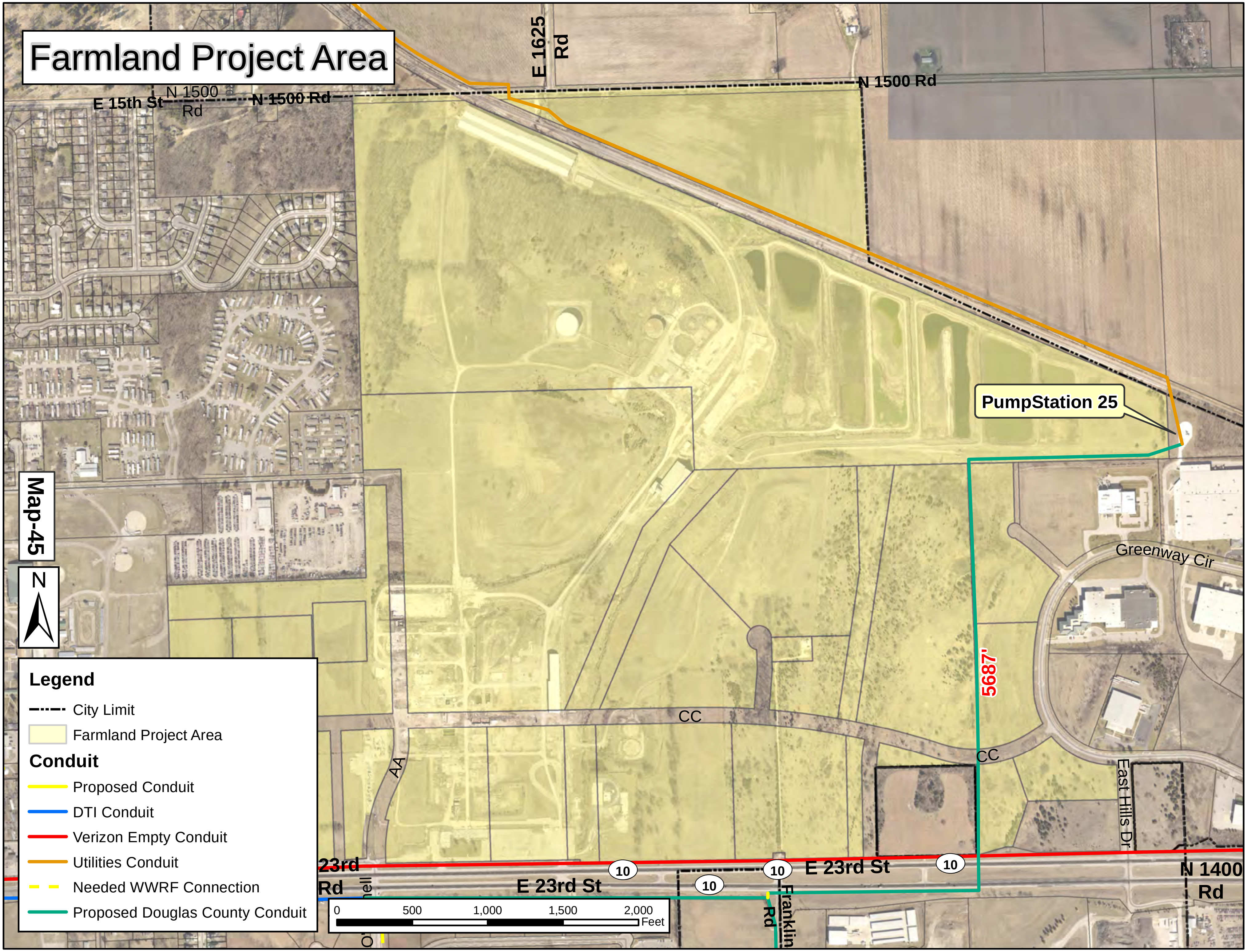

USD 497 Office
USD 497 Office Connection
Princeton Blvd
W 2nd St
Iowa St
Providence Rd
Concord Rd
Hill Ct
3227'
W 3rd St
W 3rd Ter
Northwood Ln
Birch Ln
California St
W 4th St
Country Club Ct
Countryside Ln
Grandview Ter
W 5th St
McDonald Dr
Rockledge Rd
Bluffs Dr
W 6th St
40/59
40
Country Club Ter
N
Legend
Traffic Signal
Pullbox
Existing
Conduit
Proposed Conduit
DTI Conduit
0 200 400 600 800
Feet
Map-37

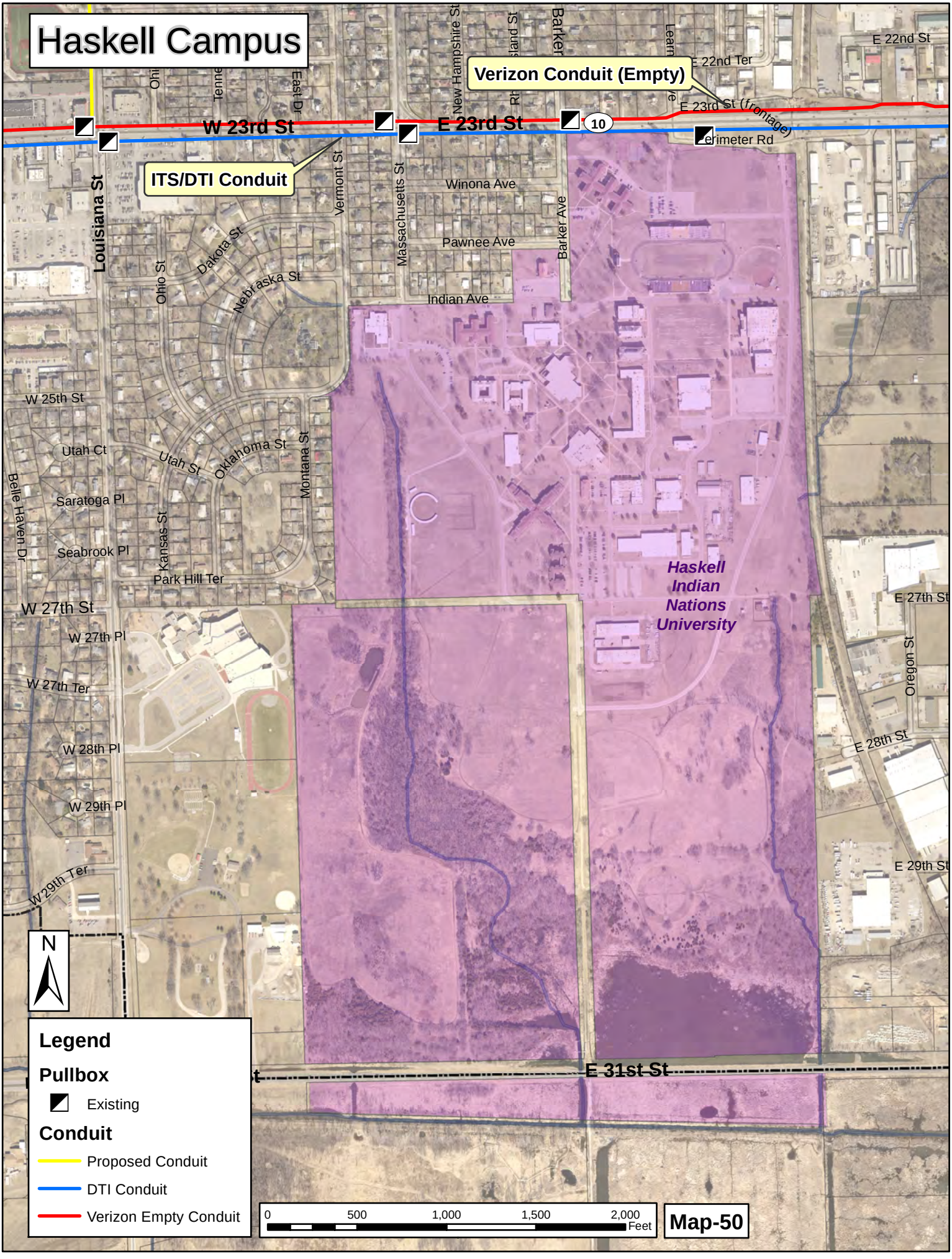

Lawrence High School
LHS Connection
W 21st St
Virginia St
Louisiana St
Greever Ter
1703'
Ohio St
Adult Learning Center
(USD 497)
(JCCC)
W 22nd St
W 22nd St
N
Legend
Traffic Signal
Pullbox
Existing
Conduit
Proposed Conduit
DTI Conduit
Verizon Empty Conduit
10
0 100 200 300 400 Feet
Map-38

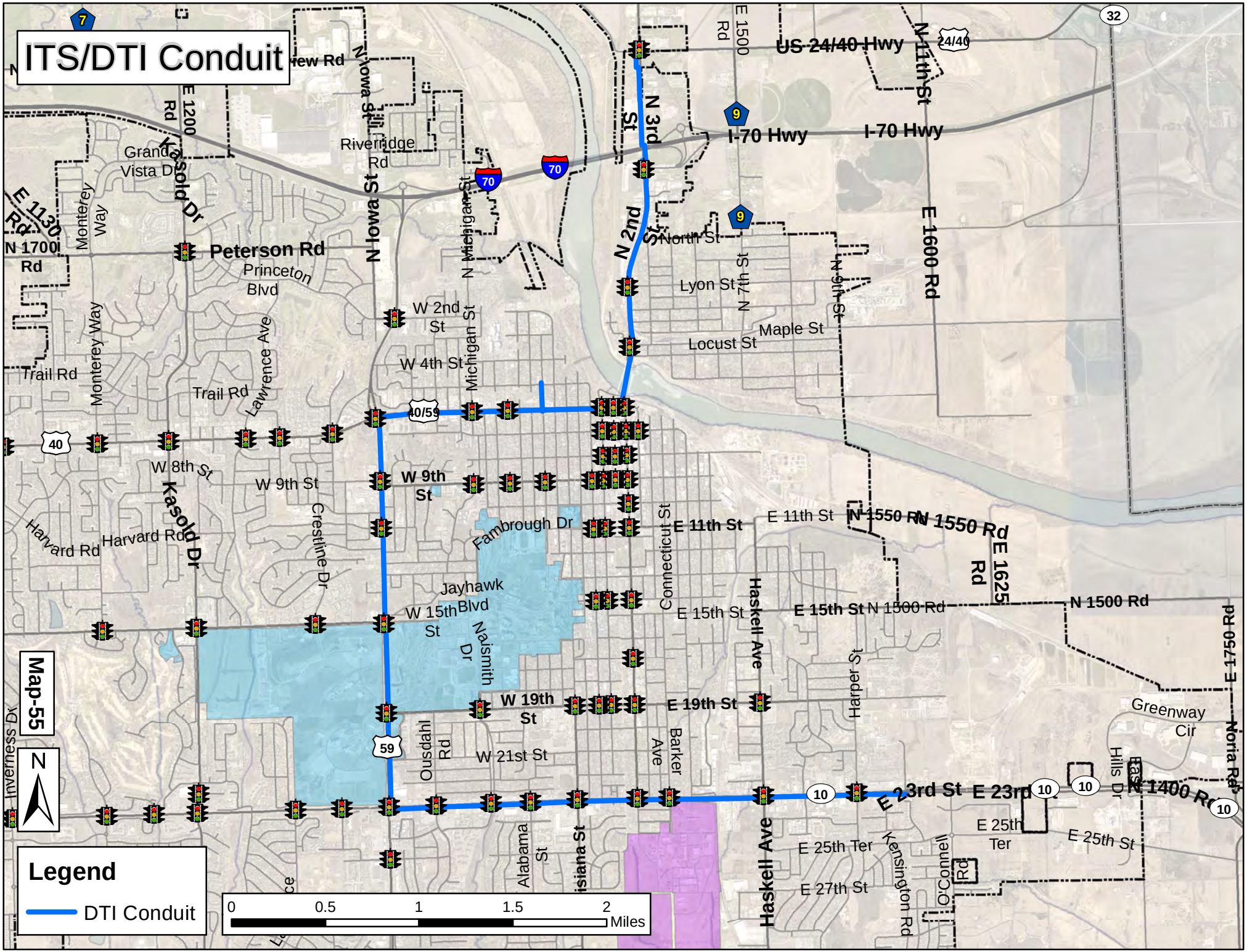

Medical Facilitity Fiber Network
Community Health Bldg (Douglas Co. Health, Visiting Nurses, Bert Nash)
Lawrence Memorial Hospital
Lawrence Surgery Center
Internal Medicine
Lawrence Memorial Hospital South
Princeton Blvd
Dole Dr
E 1100 Rd
Trail Rd
Monterey Way
Folks Rd
Wakarusa Dr
Overland Dr
Harvard Rd
Kasold Dr
Crestline Dr
Inverness Dr
Bob Billings Pkwy
Clinton Pkwy
Lawrence Ave
N Iowa St
N McDonald Dr
McDonald Dr
N Michigan St
W 2nd St
W 4th St
W 6th St
W 8th St
W 9th St
Iowa St
W Campus Rd
Fambrough Dr
Connecticut St
E 11th St
N 2nd St
North St
Lyon St
Locust St
W 15th St
E 15th St
Kentucky St
Barker Ave
Naismith Dr
W 19th St
E 19th St
W 21st St
Louisiana St
Ousdahl Rd
W 24th St
W 25th St
University of Kansas
Haskell Indian Nations
40
59
40/59
10
Map-40
N
Legend
Medical Facility
Traffic Signal
Conduit
Proposed Conduit
DTI Conduit
Empty City Conduit
Other City Conduit
Verizon Empty Conduit
0
0.25
0.5
0.75
1
Miles

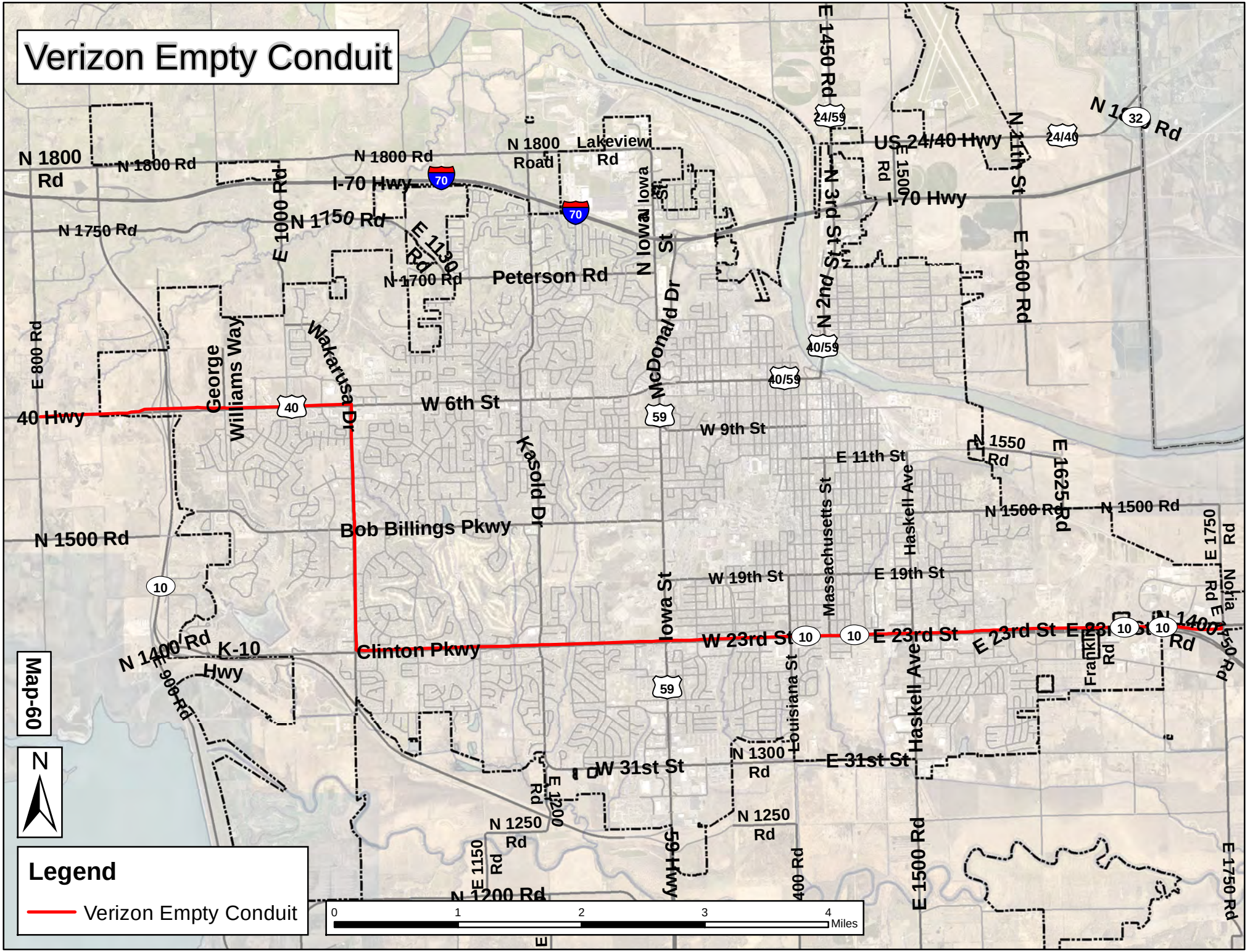

West 6th Street Loop Closure Project
Fire Station #3 & Water Tower
Medical
1078'
2571'
1175'
2145'
1378'
Overland Dr
Folks Rd
Monterey Way
Trail Rd
W 4th St
Michigan St
Arkansas St
Missouri St
Maine St
40/59
59
W 8th St
W 9th St
Crestline Dr
Jana Dr
Harvard Rd
Stoneridge Dr
Legends Dr
Wakarusa Dr
Inverness Dr
Kasold Dr
Iowa St
High Dr
W Campus Rd
Memorial Dr
W 15th St
Bob Billings Pkwy
Research Park Dr
Villa Dr
Westbrooke St
Crestline Dr
Engel Rd
Irving Hill Rd
Naismith Dr
Watkins Center Dr
Crossgate Dr
University of Kansas
W 19th St
Jayhawk Blvd
Becker Dr
W 21st St
Vail Way
W 24th St
W 25th St
Lawrence Ave
Glacier Dr
W 27th St
Map-41
N
Legend
Traffic Signal
Conduit
Proposed Conduit
DTI Conduit
Empty City Conduit
Verizon Empty Conduit
0 0.25 0.5 0.75 1 Miles
Proposed Conduit 8347 ft.

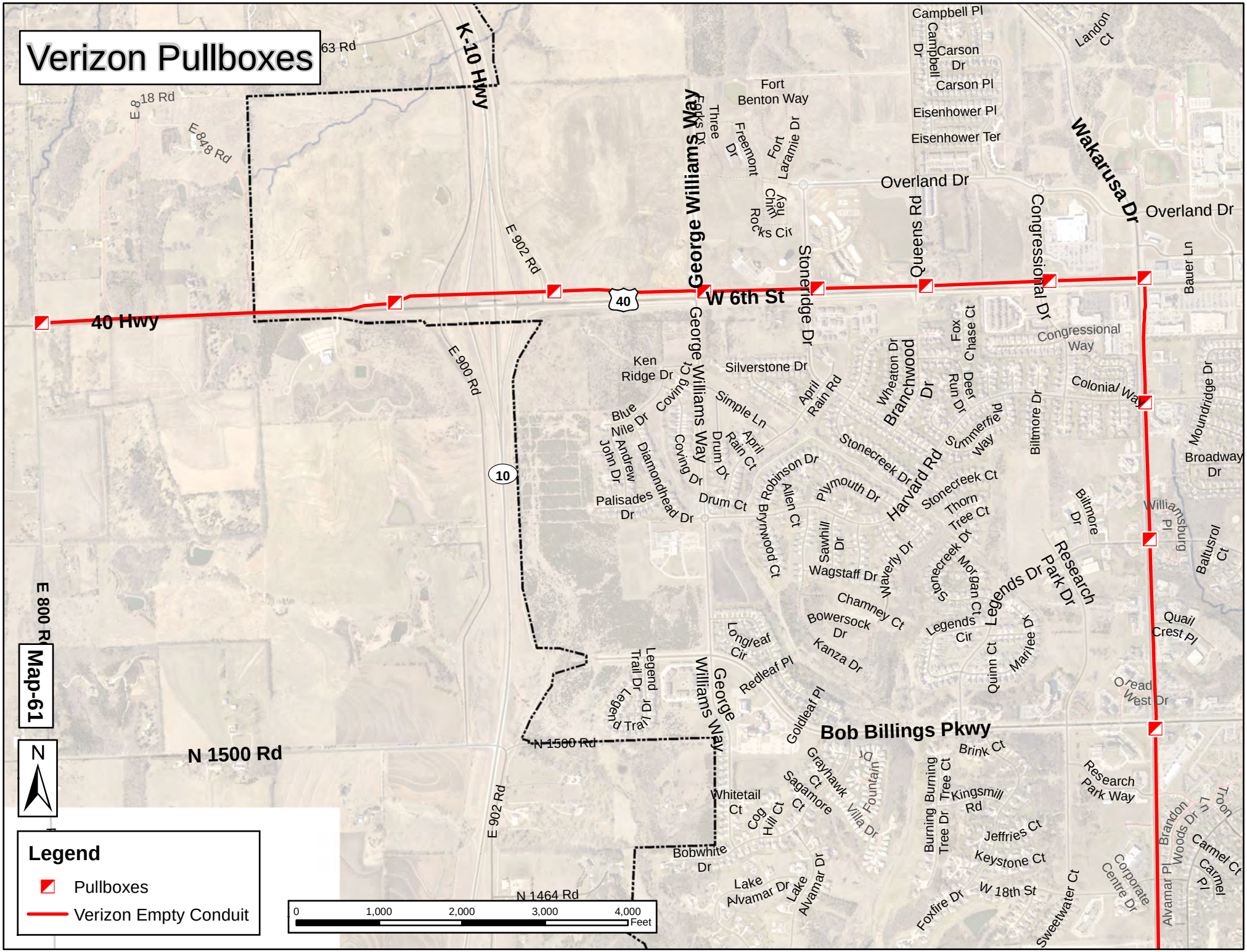

LMH to DTI/ITS Connection
Douglas County Health Department
Lawrence Memorial Hospital
Lawrence Surgery Center
W 3rd St
W 4th St
W 5th St
W 6th St
Michigan St
Arkansas St
Missouri St
Maine St
Alabama St
2000'
40/59
N
Legend
Traffic Signal
Pullbox
Existing
Conduit
Proposed Conduit
DTI Conduit
0 125 250 375 500 Feet
Map-42

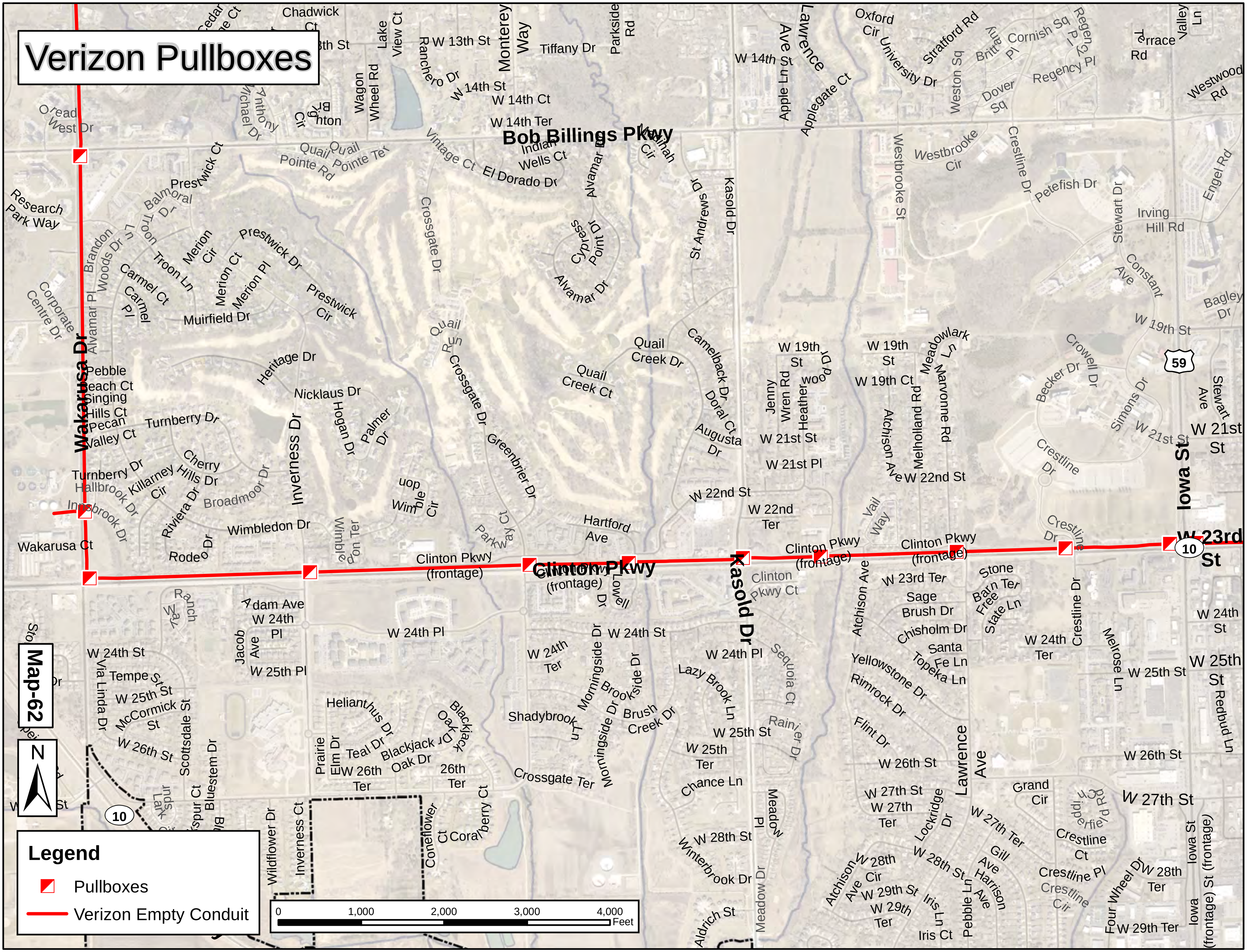

Farmland Project Area
Map-45
N
E 15th St
N 1500 Rd
N 1500 Rd
E 1625 Rd
N 1500 Rd
PumpStation 25
Greenway Cir
5687'
CC
CC
AA
East Hills Dr
23rd Rd
E 23rd St
E 23rd St
N 1400 Rd
Franklin Rd
10
10
10
10
Legend
City Limit
Farmland Project Area
Conduit
Proposed Conduit
DTI Conduit
Verizon Empty Conduit
Utilities Conduit
Needed WWRF Connection
Proposed Douglas County Conduit
0
500
1,000
1,500
2,000
Feet

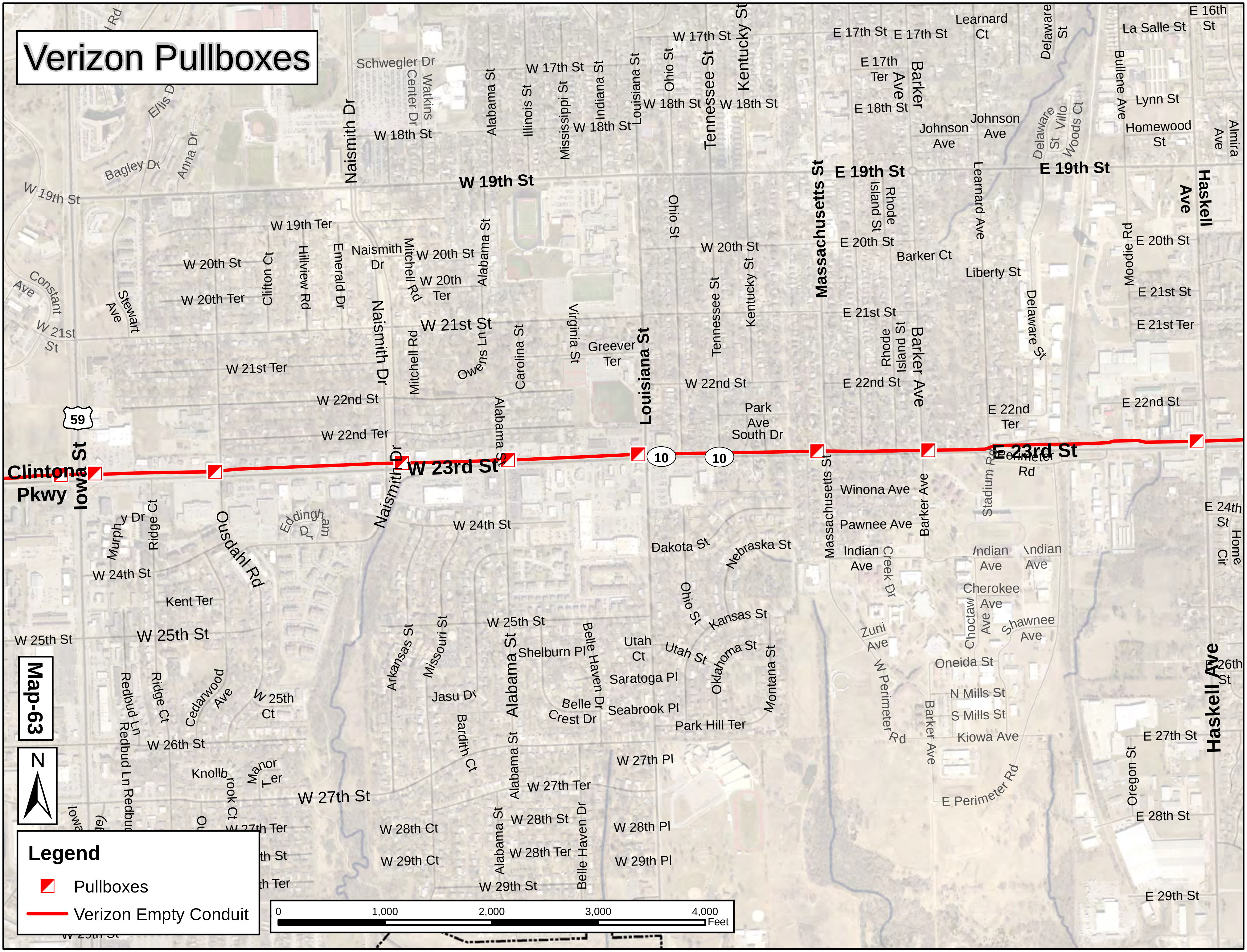

Haskell Campus
Verizon Conduit (Empty)
ITS/DTI Conduit
W 23rd St
E 23rd St
E 23rd St (frontage)
Perimeter Rd
E 22nd St
E 22nd Ter
10
Louisiana St
Vermont St
Massachusetts St
New Hampshire St
Barker Ave
Winona Ave
Pawnee Ave
Indian Ave
Dakota St
Nebraska St
Ohio St
W 25th St
Utah Ct
Utah St
Oklahoma St
Montana St
Belle Haven Dr
Saratoga Pl
Seabrook Pl
Kansas St
Park Hill Ter
W 27th St
W 27th Pl
W 27th Ter
W 28th Pl
W 29th Pl
W 29th Ter
Haskell Indian Nations University
E 27th St
Oregon St
E 28th St
E 29th St
E 31st St
N
Legend
Pullbox
Existing
Conduit
Proposed Conduit
DTI Conduit
Verizon Empty Conduit
0
500
1,000
1,500
2,000
Feet
Map-50

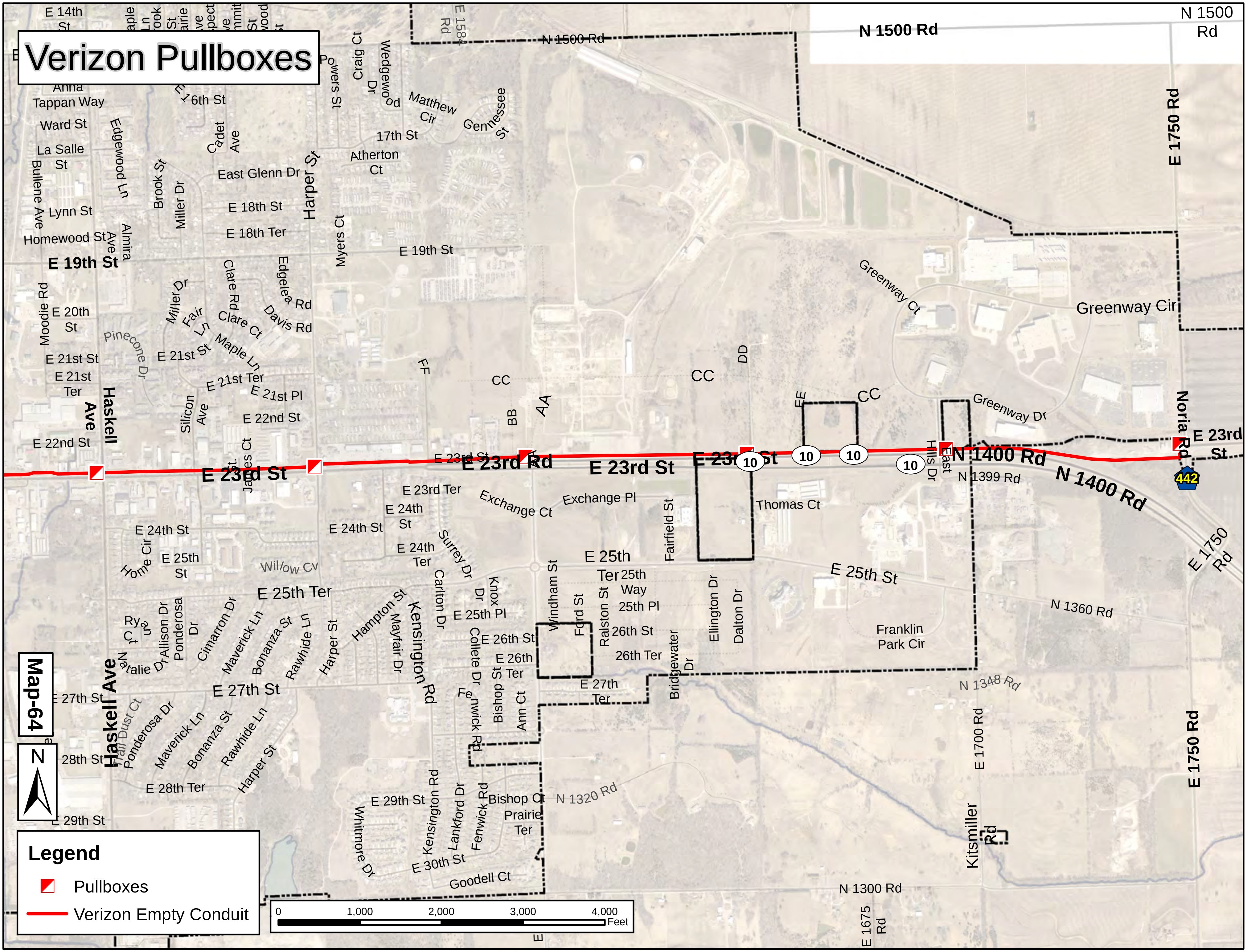

ITS/DTI Conduit
Map-55
N
Legend
DTI Conduit
0
0.5
1
1.5
2
Miles
US 24/40 Hwy
I-70 Hwy
N 3rd St
N 2nd St
N Iowa St
N Michigan St
E 1600 Rd
E 1500 Rd
N 11th St
E 1200 Rd
Kasold Dr
Riverridge Rd
Grand Vista Dr
Monterey Way
E 1130 Rd
N 1700 Rd
Peterson Rd
Princeton Blvd
Trail Rd
Lawrence Ave
W 2nd St
W 4th St
Michigan St
North St
Lyon St
N 7th St
N 9th St
Maple St
Locust St
W 8th St
W 9th St
Crestline Dr
Fambrough Dr
Jayhawk Blvd
Naismith Dr
Harvard Rd
W 15th St
W 19th St
W 21st St
Ousdahl Rd
Inverness Dr
E 11th St
Connecticut St
E 15th St
Haskell Ave
N 1550 Rd
E 1625 Rd
N 1500 Rd
E 1750 Rd
Harper St
E 19th St
E 23rd St
Barker Ave
Alabama St
Greenway Cir
Hills Dr
E 1400 Rd
E 25th Ter
E 25th St
E 27th St
Kensington Rd
O'Connell Rd
40/59
40
59
70
9
10
7
32
24/40


Verizon Empty Conduit
N 1800 Rd
N 1800 Rd
N 1800 Rd
N 1800 Road
Lakeview Rd
I-70 Hwy
70
N 1750 Rd
N 1750 Rd
E 1000 Rd
E 1130 Rd
N 1700 Rd
Peterson Rd
N Iowa St
McDonald Dr
E 1450 Rd
24/59
US 24/40 Hwy
24/40
N 11th St
E 1500 Rd
N 3rd St
I-70 Hwy
N 2nd St
E 1600 Rd
40/59
E 800 Rd
George Williams Way
Wakarusa Dr
40 Hwy
40
W 6th St
W 9th St
Kasold Dr
E 11th St
E 1550 Rd
E 1625 Rd
N 1500 Rd
N 1500 Rd
Bob Billings Pkwy
Massachusetts St
Haskell Ave
W 19th St
E 19th St
E 1750 Rd
Nokia Rd
10
N 1400 Rd
K-10 Hwy
E 900 Rd
Clinton Pkwy
W 23rd St
E 23rd St
E 23rd St
Iowa St
Louisiana St
Haskell Ave
Franklin Rd
N 1400 Rd
E 1450 Rd
59
W 31st St
E 31st St
N 1300 Rd
E 1200 Rd
N 1250 Rd
N 1250 Rd
E 1150 Rd
59 Hwy
400 Rd
E 1500 Rd
E 1750 Rd
N 1200 Rd
Map-60
N
Legend
Verizon Empty Conduit
0
1
2
3
4
Miles

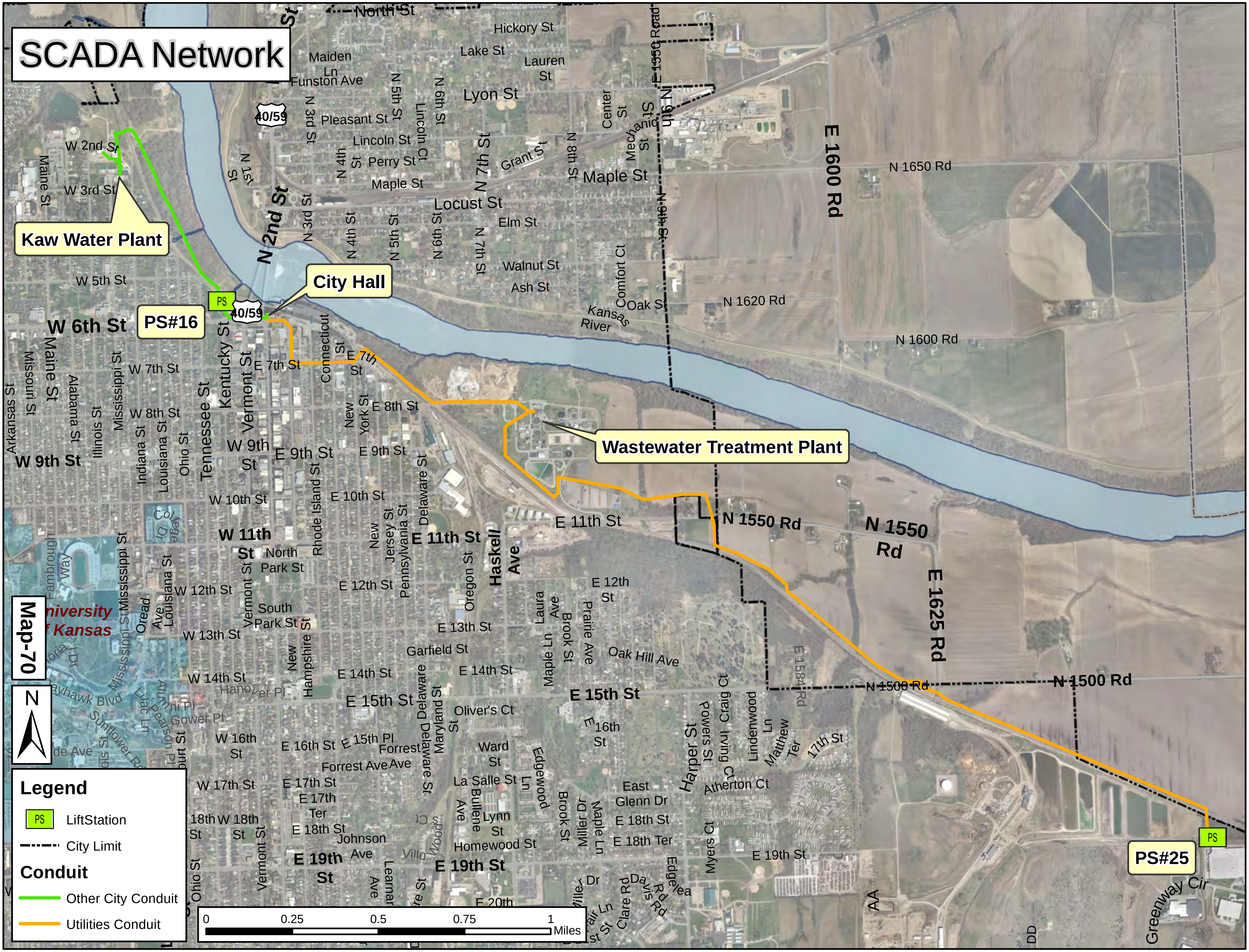

Verizon Pullboxes
63 Rd
K-10 Hwy
E 818 Rd
E 848 Rd
E 902 Rd
E 900 Rd
E 800 Rd
40 Hwy
40
W 6th St
George Williams Way
Stoneridge Dr
Queens Rd
Wakarusa Dr
Overland Dr
Congressional Dr
Congressional Way
Bauer Ln
Moundridge Dr
Broadway Dr
Colonia Way
Campbell Pl
Campbell Dr
Carson Dr
Carson Pl
Landon Ct
Eisenhower Pl
Eisenhower Ter
Fort Benton Way
Three Forks Dr
Freemont Dr
Fort Laramie Dr
Hay Chimney Rocks Cir
Ken Ridge Dr
Covington Ct
Silverstone Dr
Simple Ln
April Rain Rd
Blue Nile Dr
Andrew John Dr
Diamondhead Dr
Palisades Dr
Covington Dr
Drum Dr
Drum Ct
April Rain Ct
Robinson Dr
Allen Ct
Brynwood Ct
Plymouth Dr
Stonecreek Dr
Harvard Rd
Wheaton Dr
Branchwood Dr
Fox Chase Ct
Deer Run Dr
Summerfield Way
Biltmore Dr
Stonecreek Ct
Thorn Tree Ct
Sawhill Dr
Wagstaff Dr
Waverly Dr
Stonecreek Dr
Morgan Ct
Legends Dr
Legends Cir
Park Dr
Research Park Dr
Biltmore Dr
Williamsburg Pl
Baltusrol Ct
Quail Crest Pl
Chamney Ct
Bowersock Dr
Kanza Dr
Longleaf Cir
Redleaf Pl
Legend Trail Dr
Legend Trail Ct
George Williams Way
Goldleaf Pl
Quinn Ct
Marilee Dr
Oread West Dr
Bob Billings Pkwy
N 1500 Rd
E 902 Rd
Whitetail Ct
Cog Hill Ct
Sagamore Ct
Grayhawk Ct
Fountain Dr
Villa Dr
Bobwhite Dr
Lake Alvamar Dr
Lake Alvamar Dr
N 1464 Rd
Brink Ct
Burning Tree Ct
Burning Tree Dr
Kingsmill Rd
Research Park Way
Jeffries Ct
Keystone Ct
W 18th St
Foxfire Dr
Sweetwater Ct
Corporate Centre Dr
Alvamar Pl
Brandon Woods Dr
Troon Ln
Carmel Ct
Carmel Pl
Map-61
N
Legend
Pullboxes
Verizon Empty Conduit
0
1,000
2,000
3,000
4,000
Feet


Verizon Pullboxes
Map-62
N
Legend
Pullboxes
Verizon Empty Conduit
0
1,000
2,000
3,000
4,000
Feet
Bob Billings Pkwy
Clinton Pkwy
Clinton Pkwy (frontage)
Wakarusa Dr
Kasold Dr
Iowa St
W 23rd St
Inverness Dr
Lawrence Ave
10
59
W 14th St
W 19th St
W 21st St
W 22nd St
W 24th St
W 25th St
W 26th St
W 27th St
W 28th St
Crossgate Dr
Crestline Dr
Atchison Ave
Wakarusa Ct
Research Park Way
Prestwick Dr
Quail Creek Dr
Westbrooke Cir
Meadowlark Ln

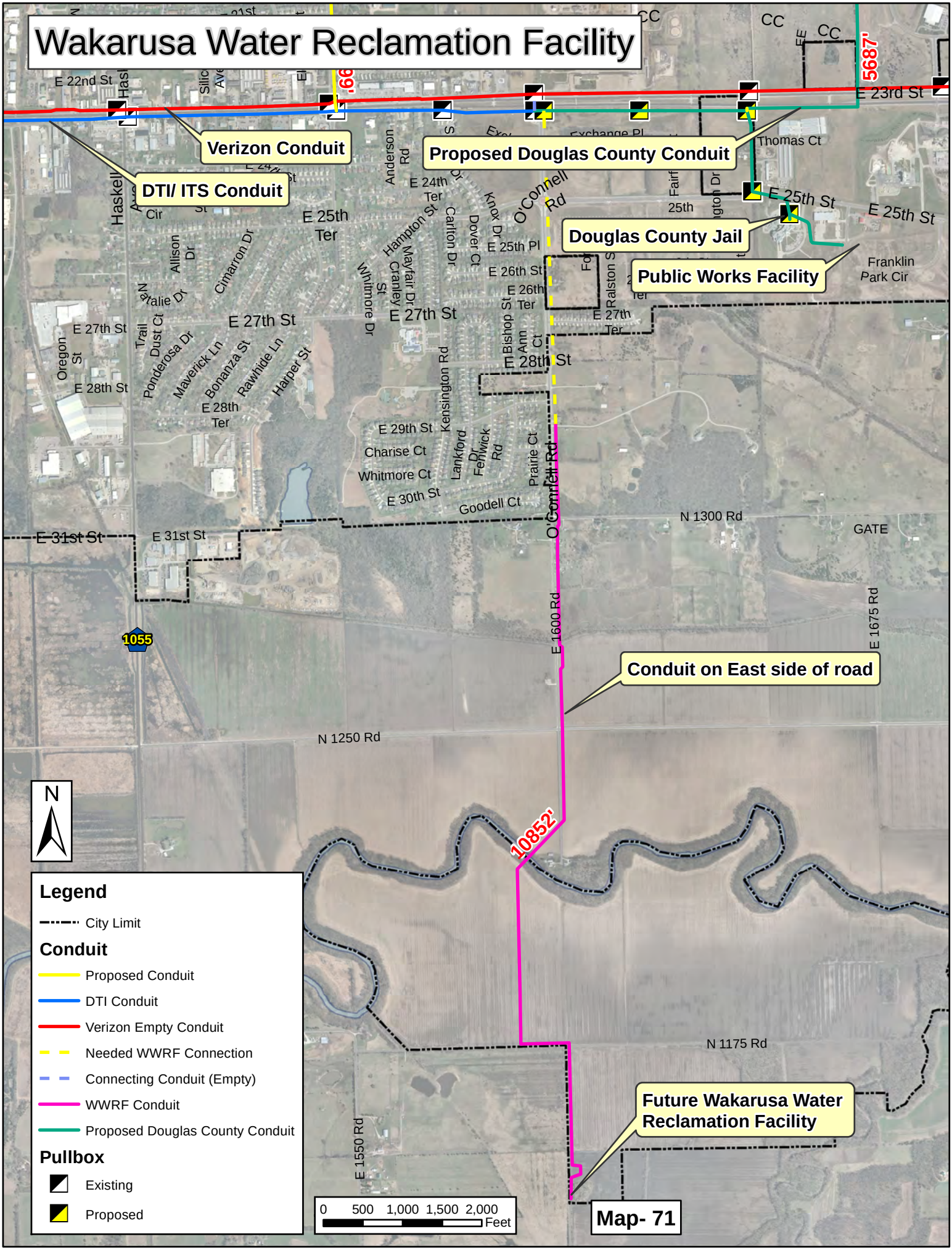

Verizon Pullboxes
Map-63
N
Legend
Pullboxes
Verizon Empty Conduit
0
1,000
2,000
3,000
4,000
Feet
W 19th St
E 19th St
W 23rd St
E 23rd St
Clinton Pkwy
Iowa St
59
10
Naismith Dr
Louisiana St
Massachusetts St
Barker Ave
Haskell Ave
Ousdahl Rd
W 17th St
E 17th St
W 18th St
E 18th St
W 19th Ter
W 20th St
E 20th St
W 20th Ter
W 21st St
E 21st St
W 21st Ter
E 21st Ter
W 22nd St
E 22nd St
W 22nd Ter
E 22nd Ter
W 24th St
E 24th St
W 25th St
W 26th St
E 26th St
W 27th St
E 27th St
W 27th Ter
W 27th Pl
W 28th St
E 28th St
W 28th Ct
W 28th Ter
W 28th Pl
W 29th Ct
W 29th St
E 29th St
W 29th Pl
Schwegler Dr
Watkins Center Dr
Alabama St
Illinois St
Mississippi St
Indiana St
Ohio St
Tennessee St
Kentucky St
Learnard Ct
Learnard Ave
Delaware St
La Salle St
Bullene Ave
Lynn St
Homewood St
Almira Ave
Johnson Ave
Villo St
Woods Ct
Rhode Island St
Barker Ct
Liberty St
Moodie Rd
Ellis Dr
Bagley Dr
Anna Dr
Constant Ave
Stewart Ave
Clifton Ct
Hillview Rd
Emerald Dr
Naismith Dr
Mitchell Rd
Owens Ln
Carolina St
Virginia St
Greever Ter
Park Ave South Dr
Stadium Rd
Perimeter Rd
Winona Ave
Pawnee Ave
Indian Ave
Creek Dr
Cherokee Ave
Choctaw Ave
Shawnee Ave
Oneida St
N Mills St
S Mills St
Kiowa Ave
E Perimeter Rd
W Perimeter Rd
Zuni Ave
Home Cir
Oregon St
Murphy Dr
Ridge Ct
Eddingham Dr
Dakota St
Nebraska St
Kansas St
Oklahoma St
Montana St
Utah Ct
Utah St
Saratoga Pl
Seabrook Pl
Park Hill Ter
Belle Haven Dr
Shelburn Pl
Belle Crest Dr
Arkansas St
Missouri St
Jasu Dr
Bardith Ct
Kent Ter
Cedarwood Ave
W 25th Ct
Redbud Ln
Knollbrook Ct
Manor Ter

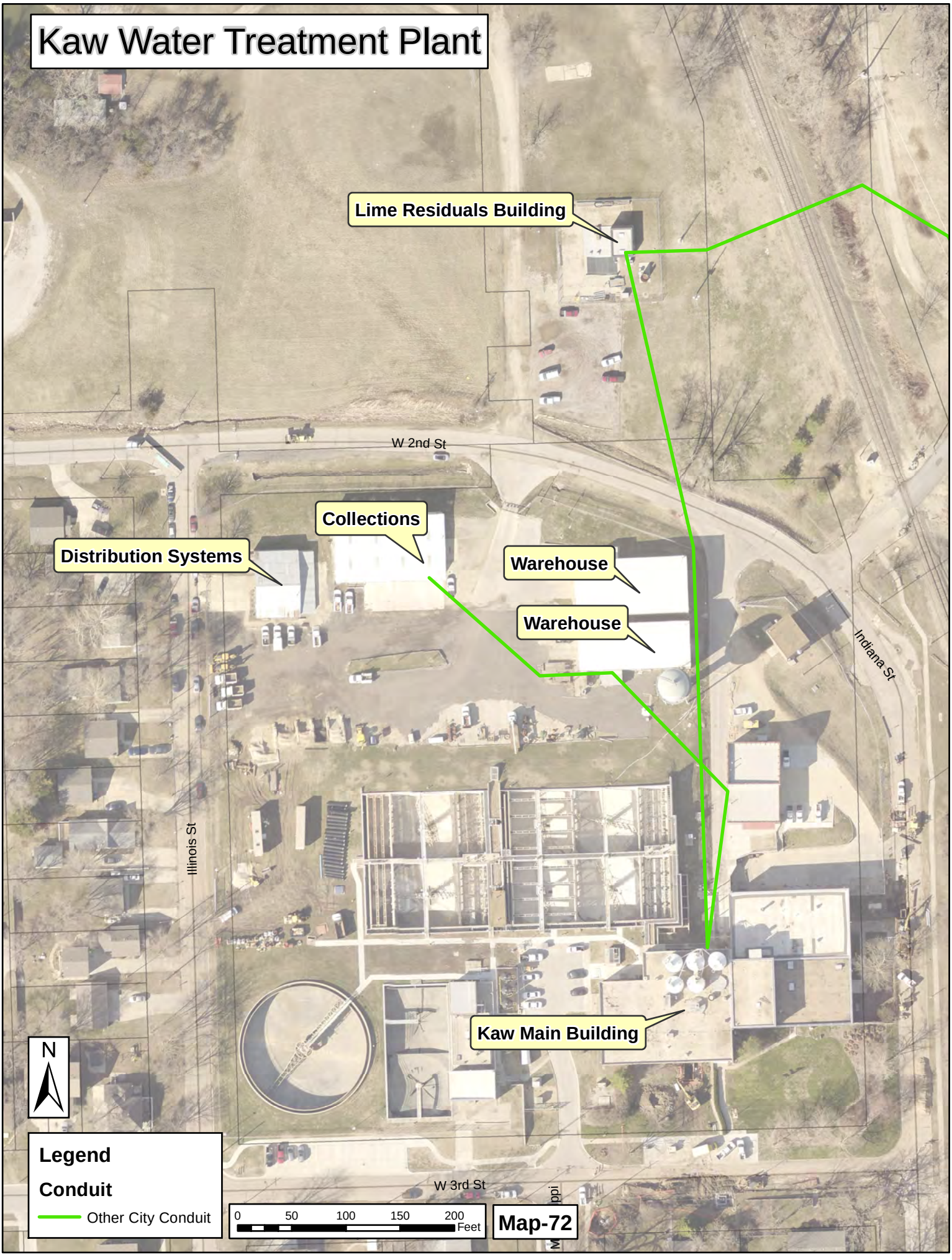

Verizon Pullboxes
Legend
Pullboxes
Verizon Empty Conduit
0
1,000
2,000
3,000
4,000
Feet
N
Map-64
E 23rd St
E 23rd Rd
N 1400 Rd
N 1500 Rd
E 1750 Rd
Noria Rd
E 23rd St
442
10
Haskell Ave
Harper St
E 19th St
E 25th St
E 25th Ter
E 27th St
Kensington Rd
Greenway Cir
Greenway Dr
Greenway Ct
N 1399 Rd
N 1360 Rd
N 1348 Rd
N 1320 Rd
N 1300 Rd
E 1700 Rd
Kitsmiller Rd
Exchange Ct
Exchange Pl
Thomas Ct
Franklin Park Cir
Fairfield St
Ellington Dr
Dalton Dr
Bridgewater Dr
Windham St
E 1675 Rd
AA
BB
CC
DD
EE
FF

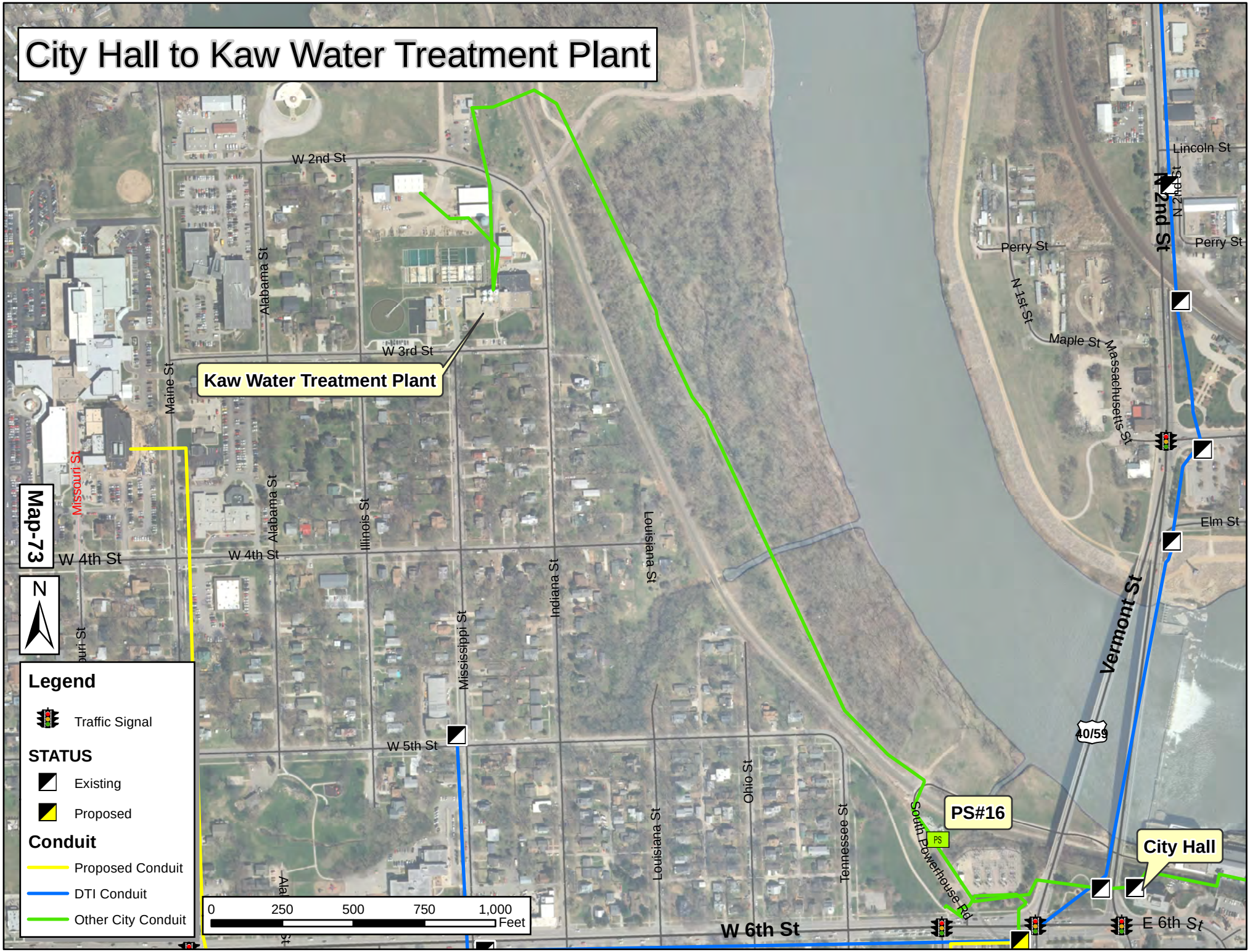

Verizon to DTI/ITS Conduit
AA
BB
Verizon Conduit
E 23rd St
AA
E 23rd Rd
E 23rd St
10
DTI/ITS Conduit
144 Strands
Proposed Douglas County Conduit
O'Connell Rd
N
Legend
Pullbox
Existing
Proposed
Conduit
Connecting Conduit (Empty)
Needed WWRF Connection
Proposed Douglas County Conduit
DTI Conduit
Verizon Empty Conduit
Exchange Ct
Exchange Pl
0
50
100
150
200
Feet
Map- 65

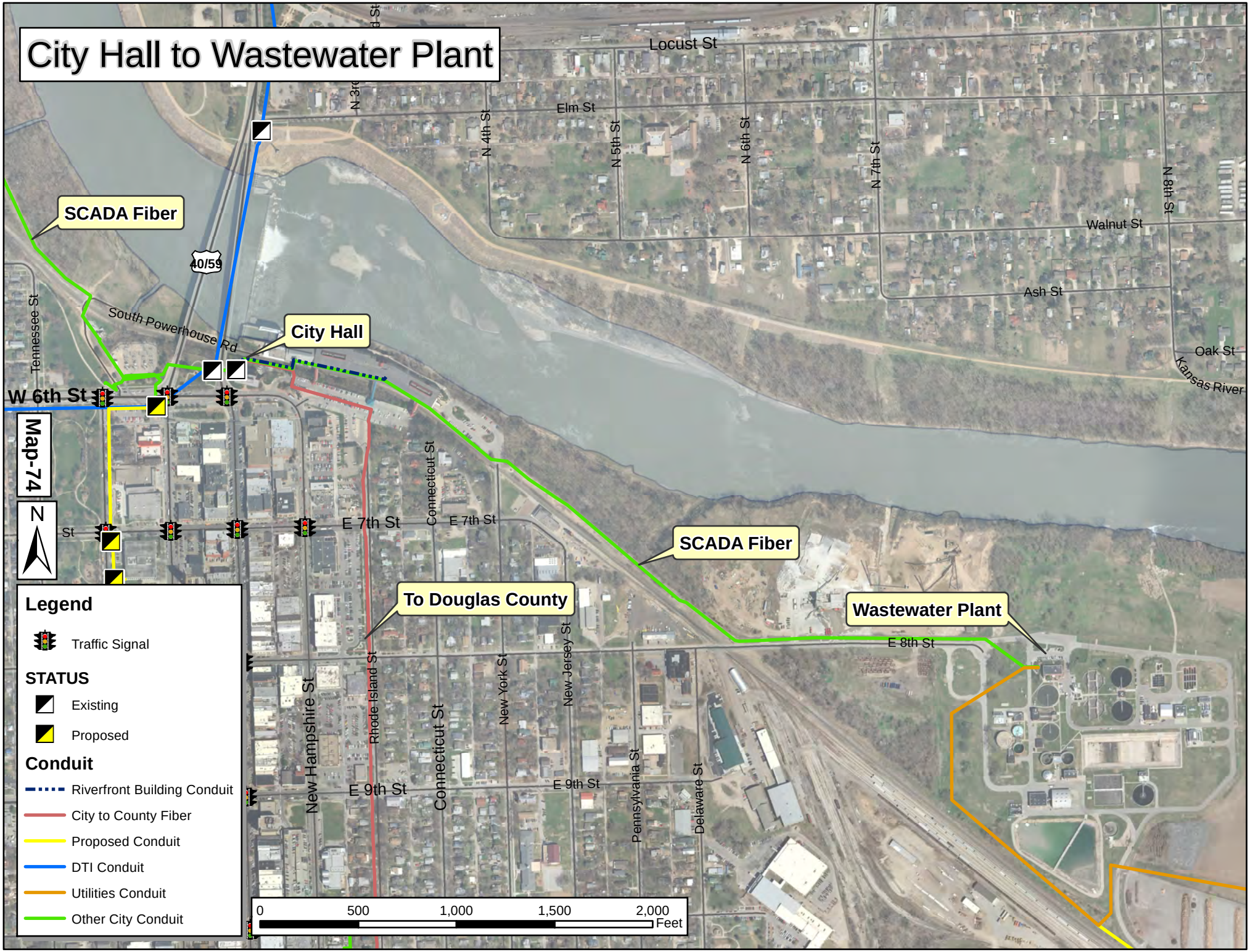


SCADA Network
Kaw Water Plant
City Hall
PS#16
Wastewater Treatment Plant
PS#25
Map-70
N
Legend
LiftStation
City Limit
Conduit
Other City Conduit
Utilities Conduit
0
0.25
0.5
0.75
1
Miles
Kansas River
W 6th St
W 9th St
E 9th St
W 11th St
E 11th St
E 15th St
E 19th St
Haskell Ave
N 2nd St
N 7th St
E 1600 Rd
E 1625 Rd
N 1550 Rd
N 1500 Rd
N 1620 Rd
N 1600 Rd
N 1650 Rd
University of Kansas

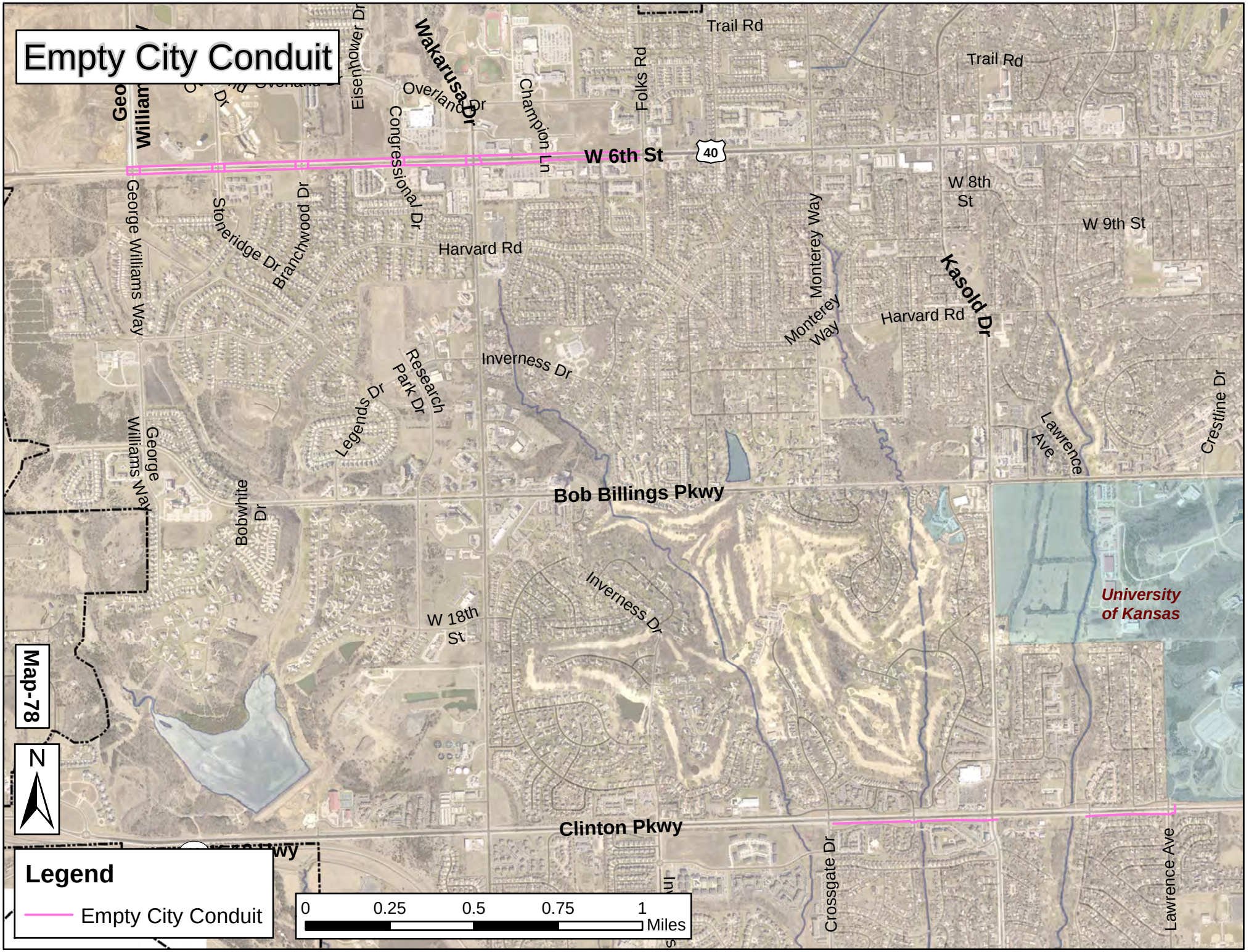

Wakarusa Water Reclamation Facility
Verizon Conduit
DTI/ ITS Conduit
Proposed Douglas County Conduit
Douglas County Jail
Public Works Facility
Conduit on East side of road
Future Wakarusa Water Reclamation Facility
Map- 71
5687'
10852'
E 23rd St
E 25th St
E 22nd St
E 24th Ter
E 25th Ter
E 25th Pl
E 26th St
E 26th Ter
E 27th St
E 27th Ter
E 28th St
E 28th Ter
E 29th St
E 30th St
E 31st St
O'Connell Rd
E 1600 Rd
E 1675 Rd
E 1550 Rd
N 1300 Rd
N 1250 Rd
N 1175 Rd
Thomas Ct
Franklin Park Cir
Anderson Rd
Kensington Rd
Bishop St
Ralston St
Ponderosa Dr
Maverick Ln
Bonanza St
Rawhide Ln
Harper St
Hampton St
Whitmore Dr
Dover Ct
Prairie Ct
Goodell Ct
Charise Ct
Whitmore Ct
Lankford Dr
Fenwick Rd
Allison Dr
Cimarron Dr
Oregon St
Trail
Dust Ct
Ann Ct
GATE
1055
N
Legend
City Limit
Conduit
Proposed Conduit
DTI Conduit
Verizon Empty Conduit
Needed WWRF Connection
Connecting Conduit (Empty)
WWRF Conduit
Proposed Douglas County Conduit
Pullbox
Existing
Proposed
0 500 1,000 1,500 2,000 Feet

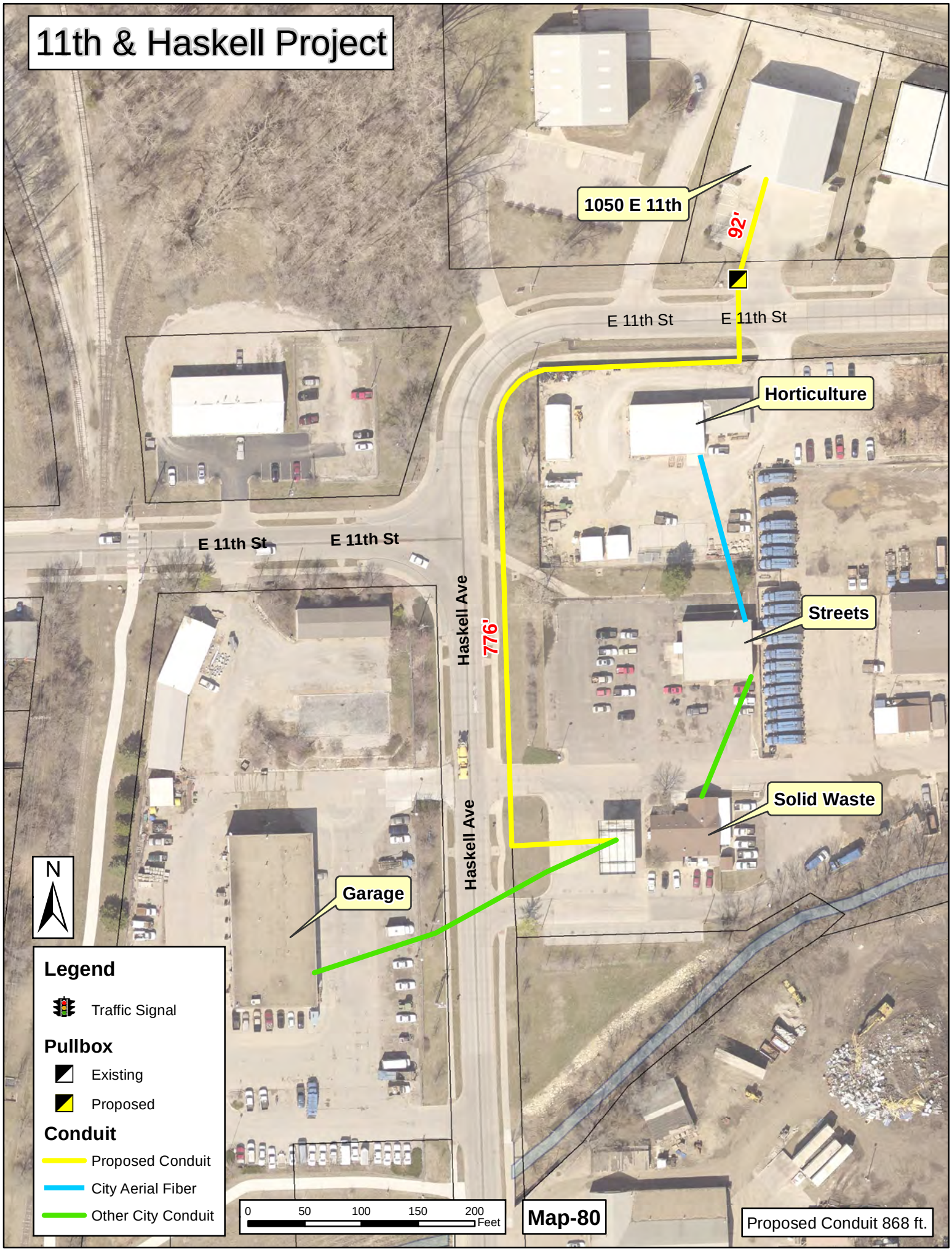

Kaw Water Treatment Plant
Lime Residuals Building
W 2nd St
Collections
Distribution Systems
Warehouse
Warehouse
Indiana St
Illinois St
Kaw Main Building
N
Legend
Conduit
Other City Conduit
W 3rd St
0 50 100 150 200 Feet
Map-72

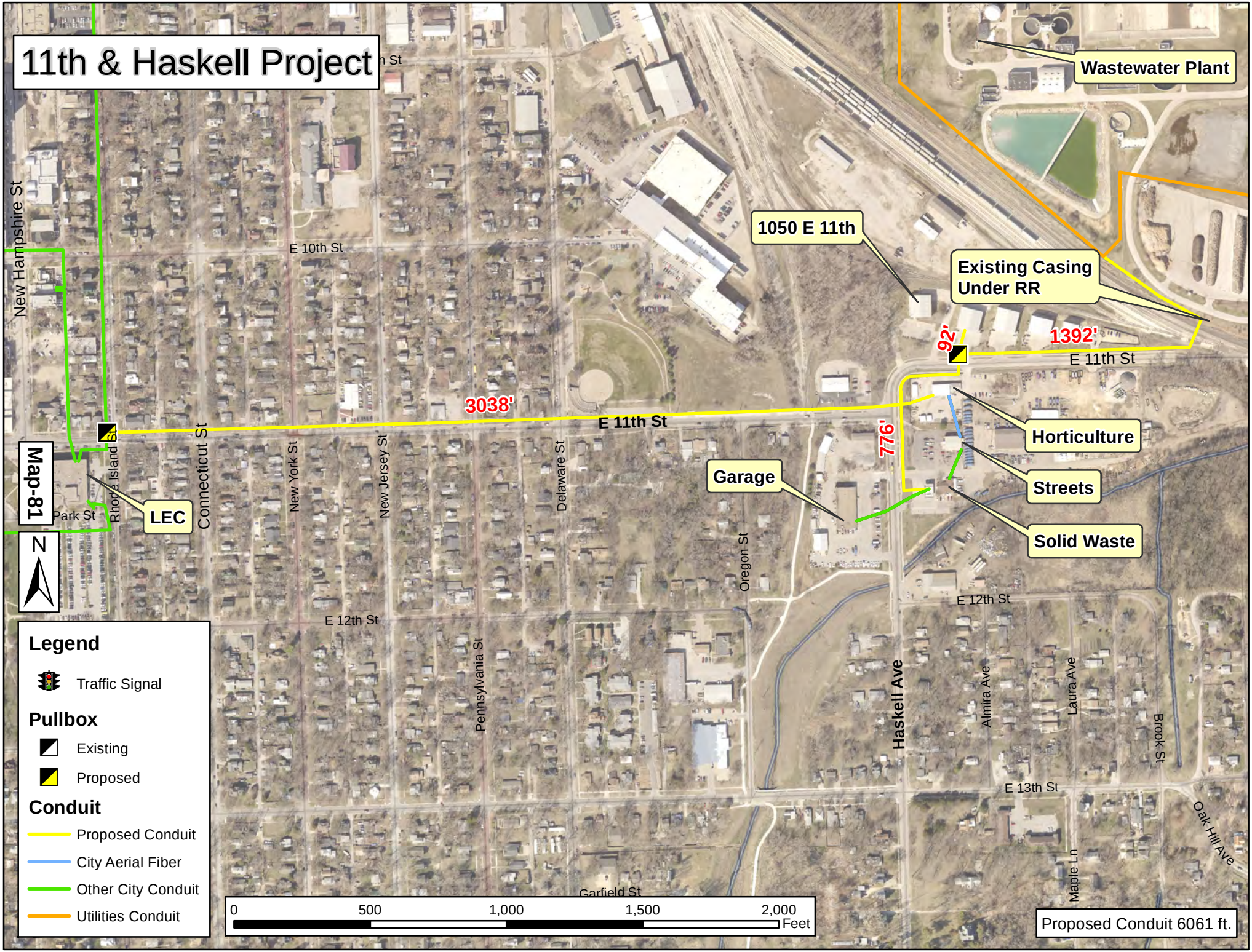

City Hall to Kaw Water Treatment Plant
Kaw Water Treatment Plant
PS#16
City Hall
Map-73
N
W 2nd St
W 3rd St
W 4th St
W 5th St
W 6th St
E 6th St
Alabama St
Maine St
Missouri St
Illinois St
Mississippi St
Indiana St
Louisiana St
Ohio St
Tennessee St
Perry St
N 1st St
Maple St
Massachusetts St
Lincoln St
N 2nd St
Elm St
Vermont St
40/59
South Powerhouse Rd
PS
Legend
Traffic Signal
STATUS
Existing
Proposed
Conduit
Proposed Conduit
DTI Conduit
Other City Conduit
0 250 500 750 1,000
Feet


City Hall to Wastewater Plant
SCADA Fiber
City Hall
To Douglas County
SCADA Fiber
Wastewater Plant
Map-74
N
Legend
Traffic Signal
STATUS
Existing
Proposed
Conduit
Riverfront Building Conduit
City to County Fiber
Proposed Conduit
DTI Conduit
Utilities Conduit
Other City Conduit
0
500
1,000
1,500
2,000
Feet
Locust St
Elm St
Walnut St
Ash St
Oak St
N 4th St
N 5th St
N 6th St
N 7th St
N 8th St
Tennessee St
South Powerhouse Rd
W 6th St
40/59
Kansas River
E 7th St
Connecticut St
E 8th St
New Hampshire St
Rhode Island St
New York St
New Jersey St
Pennsylvania St
Delaware St
E 9th St


Clinton Water Treatment Plant
Verizon Conduit (Empty)
Clinton Water Treatment Plant
Wakarusa Dr
Carmel Dr
Singing Hills Ct
Pecan Valley Ct
Turnberry Dr
Turnberry Dr
Wakarusa Ct
Clinton Pkwy
N
Legend
Traffic Signal
Pullbox
Existing
Conduit
Verizon Empty Conduit
0 125 250 375 500 Feet
Map-75


Empty City Conduit
W 6th St
40
Wakarusa Dr
Eisenhower Dr
Overland Dr
Champion Ln
Folks Rd
Trail Rd
Trail Rd
Congressional Dr
Branchwood Dr
Stoneridge Dr
George Williams Way
Harvard Rd
Monterey Way
Monterey Way
W 8th St
W 9th St
Kasold Dr
Harvard Rd
Inverness Dr
Research Park Dr
Legends Dr
George Williams Way
Bobwhite Dr
Bob Billings Pkwy
Inverness Dr
W 18th St
Lawrence Ave
Crestline Dr
University of Kansas
Clinton Pkwy
Crossgate Dr
Lawrence Ave
Map-78
N
Legend
Empty City Conduit
0
0.25
0.5
0.75
1
Miles


11th & Haskell Project
1050 E 11th
92'
E 11th St
E 11th St
Horticulture
E 11th St
E 11th St
Haskell Ave
776'
Streets
Solid Waste
Haskell Ave
Garage
N
Legend
Traffic Signal
Pullbox
Existing
Proposed
Conduit
Proposed Conduit
City Aerial Fiber
Other City Conduit
0
50
100
150
200
Feet
Map-80
Proposed Conduit 868 ft.


11th & Haskell Project
Wastewater Plant
1050 E 11th
Existing Casing Under RR
92'
1392'
E 11th St
3038'
E 11th St
776'
Horticulture
Streets
Solid Waste
Garage
LEC
Map-81
N
New Hampshire St
E 10th St
Rhode Island St
Connecticut St
New York St
New Jersey St
Delaware St
Park St
Oregon St
E 12th St
Pennsylvania St
Haskell Ave
Almira Ave
Laura Ave
Brook St
E 13th St
Maple Ln
Oak Hill Ave
Garfield St
Legend
Traffic Signal
Pullbox
Existing
Proposed
Conduit
Proposed Conduit
City Aerial Fiber
Other City Conduit
Utilities Conduit
0
500
1,000
1,500
2,000
Feet
Proposed Conduit 6061 ft.