

**APPENDIX A
DAMAGE PREVENTION STEERING COMMITTEE**

David Draz	American Public Works Association
Cal McDole	Independence Right-of-Way Management
Scott Murphy	Kansas City, Mo (GIS)
Maher Khan	Kansas City, Mo Public Works
Steve Barquist	Kansas City, Mo Public Works
Jeff Mitchell	Kansas City, Mo Public Works
Dion Waldon	Kansas City, Mo Public Works
Roy Elmore	Kansas City, Mo Water Services
Ron Goold	Kansas City, Mo Water Services
Terese Gorman	Lawrence Public Works
Glen Martin	Lee's Summit Right-of-Way Management
John Caldwell	Lee's Summit Right-of-Way Management
Jerry Smith	Lee's Summit Right-of-Way Management
Monty Zimmerman	Lenexa Right-of-W ay Management
Bill Ramsey	Olathe Public Services
Doug Brown	OP City Engineer
Murv Morehead	Overland Park Right-of-Way Management
Bob Pryzby	Prairie Village Public Works
Tammy Snyder	Shawnee Public Works
Steven Powell	Shawnee Public Works
Gary Leftin	St. Joseph Public Works
George Sooter	Unified Government Public Works
John Sullivan	Westwood Public Works
Leo Haynos	Kansas Corporation Commission
Bill Haislip	Kansas Corporation Commission
Roger Sneegas	Kansas Corporation Commission
Amy Brox	Missouri Public Service Commission

Staff

Tom Bizal	Black & Veatch
Dean Katerndahl	Mid America Regional Council

**APPENDIX B
STAKEHOLDER QUESTIONNAIRE**

The following questionnaire was used as a guide by Black & Veatch staff for their interviews with 50 stakeholders in preventing damage to underground facilities.

	Importance			
	High	Med	Low	No Opinion
Planning and Design				
1. Should designers obtain underground facilities information for the planned excavation area? How? <ul style="list-style-type: none"> • Existing maps • On site reviews • Use of instrumentation • Non-destructive excavation, e.g., pot-holing 				
2. Do designers show existing facilities on preliminary and final drawings? Should this be a requirement?				
3. How can stakeholders be encouraged to communicate and coordinate better to address current and future project plans? Would this be beneficial? If so, how would it be done?				
4. Is advance lead-time typically available or provided to adequately perform planning and design services?				
5. Are set national and local (including facility owner/operator) guidelines and codes being followed? If not, what can or should be done to insure they are being followed?				
6. Do you have a viewpoint on the existing owner/operator standard for depths of utility service drops?				
7. Should contractors be pre-qualified prior to the awarding of work? If so, who and how?				
8. Would mandatory pre-bid conferences be beneficial? Should the designer be involved during the bidding process and throughout the construction phase of the project?				
9. Are there problems with as-built drawings being prepared and delivered? If so, what should be done?				

One Call Center				
1. What has been your experience with the one-call center? What has been working and not working?				
2. With respect to the one-call center, how can the lines of communication be improved between all the stakeholders?				
3. How can the excavation site be reported to more precisely identify the appropriate area to be marked by the locators?				
4. Can locate requests be addressed by the locators in a more efficient and timely manner? If so, how?				
5. Should all utilities (municipal, county, state, etc.) be required members of One-Call? Should fees be free, reduced, full?				
Locating and Marking				
1. Do/should locators routinely use available facility owner/operator records?				
2. Should locators report detected errors and/or omissions in the facility drawings to the facility owner/operator? To the One-Call Center?				
3. When the excavation cannot be clearly or adequately identified, should the excavator be required to white-line prior to the arrival of the locator?				
4. In your opinion, are locators adequately trained?				
5. Is the uniform color code and marking symbols adequate to identify the various facilities? Should anything be done to enhance the color code and marking symbols?				
6. Would you recommend using one locator for multiple facilities where conditions support this practice? How often would this situation arise?				
7. Should the locator also complete a visual inspection (e.g., to identify very new facilities) during the facility locating process? How often does this come into play?				

8. Is the match of markings to the surface conditions an area that should be addressed? Why or why not?				
9. Do you support the principle of positive response? How strongly?				
10. Is there a problem with multiple facilities in the same trench being identified? What is the solution?				
11. Is the location of abandoned facilities an area that should be addressed?				
12. In your opinion, are proper/best locating methods and techniques routinely utilized?				
13. Should the owner/operator of the facility be notably identified as well as the facility marked?				
14. Should permanent markings either above or below the ground be a mandatory practice for design/construction?				
15. Should tracer wire or electronic markers be utilized on a more prevalent basis?				
16. Please characterize communication between stakeholders. Are pre-location meetings (for complex or long duration projects) ever held? Should more of these meetings be held?				
17. Is the work that is being done by the locator adequately and accurately and routinely documented? Describe its importance.				
18. Is response time to locate requests adequate? Should facility owners/operators improve on the way they forecast and plan for workload fluctuations?				
19. Would locating facilities via a high-grade GPS receiver add value to the locating process?				
Excavation				
1. Are pre-excavation meetings held with all major stakeholders, citizens or facility locators for major or unusual projects? Should more be held?				

2. Do excavators appropriately coordinate with facility owners/operators when services will require temporary or permanent interruption?				
3. Is it beneficial that each and every excavator have a separate one-call reference number before excavation starts? Is this a current problem?				
4. Do you support the principle of positive response? How strongly?				
5. How often do facility owner/operators fail to respond to a locate request? When this happens, what should be the practice?				
6. Have excavators been verifying the excavation site to the one call request? <ul style="list-style-type: none"> • Correct location • Locate markings • Check for unmarked facilities • Use of a pre-excavation checklist 				
7. Should excavators document the location of markings before excavation work begins?				
8. Are callbacks made when identifying methods (e.g. pot holing) does not reveal the known existing facility, or are they ignored? Should the locator be requested to return to the site until the facility location is resolved?				
9. Would an on-site meeting between the excavator and the site crews be beneficial to discuss the underground facilities and safety issues?				
10. Does the site supervisor have the one call center number, facility owners/operators name and number, and the one call ticket number? Is this ever a problem?				
11. Have there been instances when excavators have not followed federal and state safety regulations? Are crewmembers adequately informed and trained regarding the protection of underground facilities?				
12. Is the excavator requesting re-marks of the excavation site when the initial marks are no longer visible? Or after the mark-out validation period has expired?				

13. Would it be beneficial to have an observer/assistant at the site to advise the equipment operator when operating excavation equipment around utilities?				
14. Should an excavation tolerance zone be defined and also be mandated by law?				
15. Should excavation techniques within the tolerance zone be established/approved prior to any excavation?				
16. Do excavators contact facility owner/operators if an underground facility is not found where one has been marked, or if an unmarked underground facility is found?				
17. Have you experienced problems with the actual construction depth of existing utility service drops? Are these drops typically located?				
18. Do excavators support and protect exposed underground facilities when detected?				
19. Should the “life” of a locate ticket be defined? When excavation continues past the life of a ticket, should the locate request be refreshed?				
20. When damage (not necessarily cuts) to an underground facility is discovered or occurs, is the facility owner/operator and one-call center routinely contacted?				
21. When damage to a facility occurs, is an investigation conducted in a timely manner? If not, what can help to speed up the investigation?				
22. For life, health, or property endangerment situations (e.g., electrical line penetration, natural gas line hit, etc.), <ul style="list-style-type: none"> • Are local emergency personnel or “911” calls placed immediately for handling of the emergency situation? • Should excavators be empowered to make immediate repairs to restore service or prevent a hazardous situation from getting worse? 				
23. Do excavators employ proper back-filling techniques?				
24. Is construction tracked such that accurate as-built drawings can be prepared? Are as-builts routinely provided?				

Trenchless or Non Excavating Technology (TT)				
1. Horizontal Directional Drilling (HDD) technology is utilized more and more frequently as a construction excavation alternative. Do you have any statistics on damage incidence rate? Do you believe that HDD is more or less apt to cause underground damage than conventional trenching type applications?				
2. When HDD is the construction technique utilized and a damage situation occurs, do you believe the fault typically lies with the HDD implementation or elsewhere?				
3. Are HDD practicing excavators adequately skilled in HDD techniques?				
4. Are HDD <u>operators</u> adequately trained?				
5. Can you identify the main problems associated with HDD technology? <ul style="list-style-type: none"> • New bore can cause existing problems to “grow” • Pressurized fluid can lead to scour and hydrology problems • Most problems encountered at exit end where control of drilling head is the most critical 				
6. Do you support a practice of doing soil borings along the path of the HDD, with resultant geotechnical analysis performed to help predict a potential problem so that alternative measures can be evaluated/proposed?				
7. Sending and receiving bore pits are utilized in TT applications. Characterize your experience on : <ul style="list-style-type: none"> • Peripheral area damages and how to minimize • Specifying/defining distance between pits 				
8. Do you have any recommendations regarding other TT: <ul style="list-style-type: none"> • Micro-tunneling • Pipe-jacking • Piercing 				
9. Have you seen the NASTT HDD Good Practices Guidelines? Are you using?				

10. Have you been involved in any HDD certification activities?				
11. Regarding HDD, are you doing anything beneficial and out of the ordinary that's not necessarily included in the Good Practices Guidelines?				
12. Regarding HDD, what techniques do you utilize when time is short?				
Mapping				
1. Should standard practices be established regarding electronic mapping database systems as follows: <ul style="list-style-type: none"> • Use of most precise geographical information available • Production of lat/long information (and the reverse) • Mandatory periodic updates of the land base • Established time frames for update of database for obtained facility information • Ability to produce ticket for smallest practical geographic area • Accessibility of the land base by the public • Accessibility of land base and database to one-call members for update of member database information 				
2. Are locators adequately trained in map reading and symbology?				
3. Should locators routinely provide feedback on discrepancies between land base or database information and actual in-field locates?				
4. Should the facility owner/operators and/or municipalities provide access to a mapping system that can also be used by the one-call center/locator?				
5. Should designers be required to adhere to owner/operator mapping standards?				
6. Should facility owner/operators be required to capture and provide a minimum standard set of facility based information, e.g. engineering stationing, lat/longs, physical benchmarks, marker locations, above and below ground facility attributes, etc.?				

7. Should GIS/GPS technology be a focus of future mapping and locational data requirements?				
Compliance				
1. What would encourage compliance by all stakeholders with the requirements of current laws and regulations?				
Public Education and Awareness				
1. Does increased emphasis need to be placed in the area of Public Education and Awareness? If so, which of the following will be most effective? <ul style="list-style-type: none"> • Identify target audiences and their needs. • Structure education programs to individual audiences. • Do target mailings. • Use paid advertising. • Use free media. • Use give-aways. • Establish strategic relationships. 				
Reporting and Evaluation				
1. There is a universal lack of consistent reporting and subsequent evaluation of damage prevention data across the industry. Would a practice devoted to obtaining similar and standard data from <u>all</u> stakeholders involved with damage prevention be beneficial?				
2. Based on a simple and standardized process, should qualified information on incidents that could have, or did, lead to a damaged underground facility be collected for evaluation?				
General				
1. From an overall viewpoint, characterize the effectiveness of current practices.				

<p>2. From an overall viewpoint, characterize the</p> <ul style="list-style-type: none"> • Participation in the one-call program by facility owner/operators • Compliant use of the one-call program by excavators 				
<p>3. Characterize the % breakdown of land use in your jurisdiction</p> <ul style="list-style-type: none"> • Urban • Developing • Rural 				
<p>4. Estimate the % breakdown of recent underground construction by type</p> <ul style="list-style-type: none"> • Hand-digging • By Machine <ul style="list-style-type: none"> -- backhoe -- trenching -- plowing -- vacuum excavating • Boring <ul style="list-style-type: none"> -- HDD -- micro-tunneling -- pipe-jacking -- piercing 				

APPENDIX C BEST PRACTICES

Strategic Relationships and Pre-construction Meetings Practice

1. Objective

The objective of this practice is to identify and recommend ways of developing strategic relationships between key stakeholders that will foster the exchange of useful information regarding facility location and protection.

2. Requirements

Historically, it is not uncommon for some stakeholders involved in excavation projects in public rights-of-way to classify relationships between each other as adversarial, rather than collaborative. A key element to fostering goodwill among stakeholders is for each party to share a common goal. The first step is for each stakeholder to understand, respect and embrace the common goal of facility and right-of-way damage prevention. The next step is collaboration between stakeholders to reach the common goal of damage prevention. Promoting goodwill between stakeholders and opening the lines of communication best achieve this step.

This practice applies to all stakeholders with an interest in protecting underground facilities. However, it relies solely on the voluntary participation and communication of stakeholders to make this practice a success.

3. Practice Statement

Developing goodwill and positive relationships between key stakeholders will result in the exchange of useful information regarding facility location and protection.

4. Practice Description

4.1. *Strategic Relationships*

The strategy is for an individual stakeholder to develop positive relationships with other individual stakeholders in order to gain mutual respect and a desire to work together in preventing facility damage. For example, if a facility owner's project manager and the city right-of-way manager have a positive rapport and a route conflict arises due to an existing buried facility, the two individuals will be more willing to work out a mutually acceptable solution.

In order for relationships to develop it is necessary that stakeholders have an opportunity to meet and interact as well as establish a means of making future contact for exchange of information.

4.1.1. Stakeholders. A stakeholder is any entity (company, organization, agency, government, facility owner, property owner, contractor, etc.) that has a vested interest in

protecting and preserving the public right-of-way and/or the facilities within the right-of-way. Below is a list of key stakeholders and examples of key positions within the stakeholders' organization that may be involved in developing and fostering positive relationships:

- City, County or other Right-of-way owner
 - Right-of-Way Manager
 - Records and Drawing Information Manager
 - Permitting Manager
 - Locators/Designators

- Existing Facility Owners/Operators
 - Records and Drawing Information Manager
 - Operations Manager
 - Damage Prevention Manager
 - Locators/Designators

- Project Owner (Owner of new facility)
 - Project Manager
 - Construction Manager
 - Engineer

- Contractors and Subcontractors
 - Construction Manager
 - Construction Superintendent
 - Crew Supervisors

- One Call Centers
 - Center Field Manager
 - Records Manager
 - Locators/Designators

4.2. Pre-construction Meetings

Pre-construction meetings are held to review the construction plans and activities prior to commencing work. Even with mandatory pre-construction meetings, the permitting agency only has direct influence over the permittee's attendance by requiring the meeting for permit approval. Other parties attend only on a volunteer basis. It is possible to encourage meeting attendance as discussed below in Section 5.2 Motivation.

The main objective of the pre-construction meeting from the standpoint of this practice is the exchange of information on the location of underground facilities. Therefore, it is suggested that a specific meeting time be set that is for the sole purpose of discussing underground utility protection. By setting a specific time, the existing adjacent facility owners do not have to attend portions of the pre-construction meeting that do not involve them. Consequently, respect is demonstrated for stakeholder's time and attendance is subsequently enhanced.

5. Practice Procedures

5.1. Identification

It is each stakeholder's responsibility to identify individuals within their organization that have the knowledge, expertise and desire to assist in this practice. Initial identification could be accomplished by the city hosting a Damage Prevention Roundtable meeting (or series of meetings) for stakeholders. The city can request each organization to invite key personnel to attend. The Roundtable meeting should allow attendees the opportunity to brainstorm and discuss damage prevention measures as well as offer initial identification and contact between key stakeholders.

Successful communication requires stakeholders have a way of contacting one another with which they feel comfortable. This means they need to know how and whom to contact for different issues. The simplest method is to provide stakeholders with a contact list that identifies individuals by responsibility and provides contact information. Contact information should include mailing and email addresses, phone and fax numbers, and the best or preferred method of contacting the individual. The list needs to be kept up to date with individuals appropriately introduced and welcomed as changes occur. However, good judgment should be exercised prior to distribution of individual contact information. Best practice is to get specific approval from individuals prior to distribution of their personal contact information.

5.2. Motivation

By definition, each stakeholder has an incentive or reason for wishing to prevent facility damage. Motivation for participating in meetings, such as the Roundtable meeting, should be the desire to have representation and a voice at an event that has the potential to impact local industry practices. Roundtable meetings allow stakeholders to develop damage prevention systems and methods amongst themselves, rather than one stakeholder dictating procedures and requirements.

However, additional motivation may be required for levels of participation. Incentives could include adjusted permit fees and/or faster permit approval. For example, the city or permitting agency could develop a schedule of permit fees for future work, based on attendance or non-attendance at pre-construction meetings. Similarly, permit approval could be expedited for those entities that demonstrate the highest degree of stakeholder responsibility and/or participation.

5.3. Meetings

Below is a list of potential meetings or events that will allow stakeholders to meet and interact while providing beneficial information, education, or camaraderie:

- Utility Location Coordinating Committee
 - Monthly, quarterly or other recurring set schedule
 - Discuss active projects in the jurisdiction
 - Give notice to owners of up-coming projects in the jurisdiction

- Exchange information on facilities affected by projects
- Damage Prevention Roundtable
 - Discuss and Brainstorm on Damage Prevention Measures
 - Develop Contact Lists
- Educational Seminars
 - Subsurface Utility Engineering
 - Best Practices
 - Trenchless Technologies
- Industry Sponsored Conferences
 - Damage Prevention Conference
 - Trenchless Technology Conference
- Locator Rodeo
 - Locators Demonstrate Skills in a Facility Locate Competition
- Pre-construction meetings
 - Discuss Utility Interferences
 - Exchange Contact Information
 - Damage Prevention
- Meet and Greet Social
 - Could be in conjunction with another event.
 - Could be pure relationship building without any specific agenda.

6. Reference

- U.S. Department of Transportation, Research and Special Programs Administration, Office of Pipeline Safety, Common Ground, Study of One-Call Systems and Damage Prevention Best Practices, August 1999.

7. Practice Outcomes

The benefits of this practice are not typically quantifiable but subjective in nature. The intangible value of developing positive relationships between stakeholders is that it creates an environment of mutual respect and open communication regarding the management of damage prevention issues.

An important outcome of this practice is the willingness and desire of stakeholders to attend pre-construction meetings to openly share information on project specific damage prevention practices and procedures.

HDD Guidelines Handbook

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1. Introduction

Horizontal Directional Drilling (HDD) is a trenchless installation technique developed to install pipe under natural or manmade obstacles, especially waterways and highways. Today directional drilling is utilized not only for crossings, but also for parallel installations along the right-of-way as an alternative to digging trenches. HDD is utilized for the installation of gas, water and sewer mains; chemical pipelines; and electric and communications conduits.

1.1 Purpose

The purpose of this handbook is to provide basic guidelines for projects utilizing HDD techniques that will help ensure public safety and protect existing underground facilities. This handbook is not intended to be a step-by-step procedure manual but rather a collection of fundamental elements of the HDD process.

1.2 Acknowledgement

This handbook is closely modeled after The City of Overland Park, Kansas, Right-of-Way Permits, Horizontal Directional Drilling Guidelines Handbook¹. A special thank you goes to the City of Overland Park, Kansas for allowing the reproduction of text and drawings from their handbook.

2. Basic HDD Process

Every HDD project is unique and will have unique elements, conditions and requirements. There are several manufacturers and a wide range of HDD equipment. The manufacturer's operation manual should be the primary information source for HDD equipment and should be followed during all operations.

The following sections outline the basic process for HDD projects. For in-depth information regarding HDD, refer to the Horizontal Directional Drilling Good Practices Guidelines,² by the HDD Consortium. The HDD Consortium also offers a companion Training Curriculum.

3. Planning and Design

Prior to submitting an application for a right-of-way permit for an HDD installation, the Permittee (or its designer) shall undertake a thorough design process. It is recommended that Subsurface Utility Engineering be utilized as part of this design process.

3.1 Subsurface Utility Engineering (SUE)

SUE is an engineering process used to identify and map underground utilities and structures as well as assign a quality level to data. The American Society of Engineers (ASCE) has recently published standard guidelines covering utility data collection and depiction. Refer to the ASCE standard, CI/ASCE 38-02, for more information on the tasks involved in each SUE quality level and suggestions for depicting SUE information. References 4 and 5, identified in Appendix A, also provide valuable information and insight into SUE, including history and benefits.

The main components of SUE are defined as follows:

- Designation – the use of geophysical investigating methods such as electromagnetic pipe detectors to determine the horizontal position of subsurface facilities.
- Locating – also known as potholing. Locating or potholing utilizes non-destructive digging equipment to expose the underground facility at critical points along its path to determine the horizontal and vertical position of the facility.
- Data Management – the collection, documentation, reduction, and depiction of information and data in a suitable format.

Quality levels are assigned to SUE data that allows everyone involved in the project to understand the data provided and to manage risks accordingly. A brief description of the four quality levels of SUE data is as follows:

- Quality Level A provides the highest level of accuracy. It involves locating or potholing utilities as well as activities in quality levels B, C, and D. The located facility information is surveyed and mapped and the data provides precise plan and profile information.
- Quality Level B involves designating the horizontal position of subsurface utilities through surface detection methods and collecting the information through a survey method. Includes quality level C and D tasks.
- Quality Level C involves surveying visible subsurface utility structures such as manholes, hand-holes, utility valves and meters, fire hydrants, pedestals and utility markers, and then correlating the information with existing utility records to create composite drawings. Includes quality level D activities.
- Quality Level D provides the most basic level of information. It involves collecting data from existing utility records. Records may include as-built drawings, distribution and services maps, existing geographic information system databases, construction plans, etc.

3.2 Minimum Design Requirements

At a minimum, the Permittee (or its designer) shall complete the following design tasks prior to submitting a right-of-way permit application:

- Obtain right-of-way and property line information through survey records, or other sources
- Collect existing underground utility information utilizing SUE including the
 - horizontal position of all known underground facilities and structures

- vertical position of all known underground facilities and structures (whenever possible)
- Prepare or obtain scaled base mapping for the planned installation including all existing surface features and improvements
- Obtain general and/or specific geotechnical information (as required or deemed necessary by the Permittee or Engineer) including
 - USDA Soil Conservation Service data for the project area
 - site-specific geotechnical sampling and analysis
- Prepare Construction Plans using the information noted above including
 - the location of all planned improvements
 - existing surface and subsurface utility information
 - SUE quality levels
 - right-of-way limits and property ownership information

3.3 Additional Design Considerations

In addition to the design requirements listed previously, the Permittee (or its designer) should consider and design for the following:

- Minimum horizontal and vertical clearance requirements (see HDD Minimum Clearances drawing later in this document) including
 - road setbacks and existing surface features
 - existing underground utilities and structures
- Product pipe and reamer diameter requirement

<u>Product Diameter</u>	<u>Reamer Diameter²</u>
<8"	Product + 4"
8" to 24"	Product x 1.5
>24"	Product + 12"

- The bore geometry for the given ground profile including
 - bore length(s) and depth requirements
 - bending radii for the final product pipe (typically 100' radius per 1 inch product diameter, with 600' to 1,000' radius minimums depending on subsurface materials and equipment requirements)
 - entry and exit pit locations with plan size and depth as required
- Drilling equipment requirements for the given geotechnical conditions, geometry, and final product diameter including
 - thrust and pullback ratings
 - mud motors vs jetting heads
 - wireline vs walkover tracking systems

- Equipment and material handling requirements including
 - drilling fluid and drilling fluid containment
 - drill operation and final product staging
- Product material strengths, capacities, and coupling methods

4. Permitting

The following information shall be provided as part of the permit application process:

- Proposed Project Information including
 - Project type (communication, gas, etc.)
 - System capacities (types, pressures, etc.)
- Construction Plans based on scalable mapping, utilizing SUE and in accordance with the permit agency's plans submission requirements including
 - the proposed alignment (dimensioned)
 - existing utility information (within 25' of the proposed facility)
 - right-of-way information
- Proposed facility information and details including
 - final product material type and dimensions
 - proposed depths of cover and clearances
 - all proposed above and below grade structures
- Specific installation requirements or typical installation parameters indicating the design bending radii and diameter(s)
- Assumed subsurface geotechnical conditions based on experience, USDA Soil Survey data, or site-specific soil report
- A Traffic Control Plan in accordance with the permit agency's requirements
- A Storm Water Pollution Prevention and Erosion Control Plan as required by federal, state and local requirements. For minimum requirements refer to Section 6.5 Storm Water Pollution Prevention
- A Construction Schedule indicating the proposed start date(s), completion date(s), and restoration schedule

5. Construction Safety

Prior to performing work involving HDD under a Right-of-Way Permit, the Permittee (or its Contractor) shall implement the following safety guidelines:

- Perform all operations in compliance with OSHA guidelines and insure that all personnel are properly trained and equipped to work in the public right-of-way

- Ensure that the approved traffic control plan (required with the permit application) is implemented and followed at all times
- Ensure that all storm water pollution prevention measures (required with the permit application) are implemented and followed at all times
- Ensure all setbacks, offsets, and clearances are maintained
- Ensure that utility One-Calls and other utility coordination requirements have been met
- Positively locate/expose (by potholing) all crossed utilities
- Positively locate/expose (by potholing) all parallel utilities at the beginning and ending of all bores and
 - every 200' if it is within 5' of the proposed alignment
 - every 50' if it is within 3' of the proposed alignment
 - and additionally as requested by the permit agency
- The HDD Contractor shall have a planned response in the event of a utility strike including utility owner notification and how to avoid
 - electrocution in the event of an electric strike
 - combustion in the event of a gas line strike
 - contamination in the case of a sewer strike

6. Construction Guidelines

All construction work shall be performed in accordance with permit agency requirements and as outlined below. For all work involving horizontal directional drilling under a Right-of-Way Permit, the Permittee (or its Contractor) shall perform the tasks outlined in the following sections.

6.1 Prior to Construction

The following shall be performed prior to construction:

- The HDD Contractor shall familiarize itself with the work area and the technical requirements of the plans
- The Permittee (or its Contractor) shall establish construction marking/staking, prior to construction, to indicate
 - HDD entry and exit locations, and
 - proposed HDD alignment at 50 foot (max) intervals
- Provide the permit agency with a contact list of all crew foremen

6.2 During Construction

The following shall be performed during construction:

- The HDD Contractor shall calibrate its tracking and locating equipment at the beginning of each work day. A log shall be maintained and submitted to the permitting agency.
- The HDD Contractor shall monitor and record the alignment and depth readings provided by the tracking system
 - every 25 to 30 feet (8 to 9 meters) for normal conditions,
 - every 5 to 10 feet (2 to 3 meters) where precise alignment control is necessary
- The HDD Contractor shall complete the HDD installation as designed and permitted both horizontally and vertically unless otherwise authorized by the permit agency
- The HDD Contractor shall attempt to maintain drilling fluid circulation throughout the HDD process during
 - the initial pilot hole installation
 - the reaming and back pull process(es) (The pull back should not exceed the fluid circulation rate capabilities).
- The HDD contractor should backream as required to accommodate the product size. It is preferable that the use of compaction reamers be avoided. However, the Contractor shall not expand the bore hole by more than six inches (6") using only a compaction reamer.
- The HDD Contractor shall plan its reaming and back pulling operations carefully to ensure that, once started, all reaming and back pulling operations can be completed without stopping and within the permitted work hours
- The HDD Contractor shall at all times and for the entire length of the HDD alignment be able to demonstrate and provide the
 - the horizontal and vertical position of the alignment
 - the fluid volume used, return rates, and pressures
- A municipal inspector should monitor and verify the alignment measurements provided by the HDD Contractor
- The HDD Contractor shall inspect the work and surrounding area to ensure that no construction-related damage has occurred including
 - heaving or humping of paved surfaces, and
 - drilling fluid fractures or releases

- At the request of the permit agency, the Contractor shall provide access for inspection of the HDD operations

6.3 Following Construction

Items noted below shall be performed following construction:

- Prior to the start of backfilling excavations under paved surfaces, the Permittee shall notify the permit agency to schedule an inspection
- The Permittee (or its Contractor) shall ensure that all cleanup and restoration is in compliance with the permit agency's requirements for right-of-way restoration. Upon completion of all right-of-way restoration activities, the Permittee will schedule a closeout inspection
- The Permittee shall notify the permit agency upon completion of all project work including final punch list items
- The Permittee's 2-year maintenance period will not begin until any corrective actions required have been completed and subsequently approved by the permit agency

6.4 Drilling Fluid Containment and Disposal Requirements

The HDD Contractor shall contain, handle, and dispose of drilling fluids in accordance with the following requirements:

- All drilling fluid and fluid additives shall be disclosed, and Material Safety Data Sheets (MSDS) shall be provided to the permit agency upon request
- Excess drilling fluid shall be confined in a containment pit at the entry and exit locations until recycled or removed from the site
- Precautions shall be taken to insure that drilling fluid does not enter roadways, streams, municipal storm or sanitary sewer lines, and/or any other drainage system or body of water
- Unintended surfacing of drilling fluid shall be contained at the point of discharge and recycled or removed from the site
- Drilling fluids that are not recycled and reused shall be removed from the site and disposed at an approved disposal site
- Drilling fluids shall be completely removed from the construction site prior to back filling or restoring the site

- Collection, transportation, and disposal of drilling fluids shall be environmentally safe and comply with local ordinances and government regulations

6.5 Storm Water Pollution Prevention

All construction activities shall be performed in accordance with the National Pollution Discharge Elimination System (NPDES) as regulated by the Environmental Protection Agency (EPA), as well as state and local requirements.

The Permittee (or its Contractor) shall implement best management practices to ensure that storm water runoff is not contaminated by sediment caused by land disturbances associated with construction activities. For a full list and discussion of recommended best management practices please see the following publications Construction Site Storm Water Runoff Control⁶ and Protecting Storm Water⁷.

The following seven goals (or “Golden Rules”) shall be applied for all Storm Water Pollution Prevention planning:

- Ensure that sediment controls are in place prior to disturbance.
- Maintain sediment controls throughout the construction and restoration processes.
- Minimize the overall disturbance whenever possible.
- Protect disturbed areas throughout the construction process.
- Prevent storm water runoff from entering disturbed areas.
- Never intentionally discharge construction contaminants directly into creeks, rivers, ditches, or storm systems.
- Complete permanent restoration as soon as possible.

In addition to the overall goals stated above, the contractor shall, at a minimum, implement the following specific practices:

- Provide temporary erosion protection whenever possible:
 - Mulch, seed, or gravel may be applied even if a disturbed area may and/or will be disturbed again or other permanent measures of stabilization are to follow
 - Cover spoil piles with a tarp or contain with a sediment barrier
- Contain disturbed sediment on site:
 - Use sediment barriers such as silt fence, sand bags, straw bails, rock checks and/or sediment traps to contain sediment on the construction site
 - Existing vegetation may be used as a sediment filter where minimal grades and sheet flow runoff will occur
 - Insure that all sediment barriers are installed and functioning properly
- Avoid causing flooding in roadways and adjacent right-of-way:
 - Do not block existing culverts and storm inlets except as a last resort

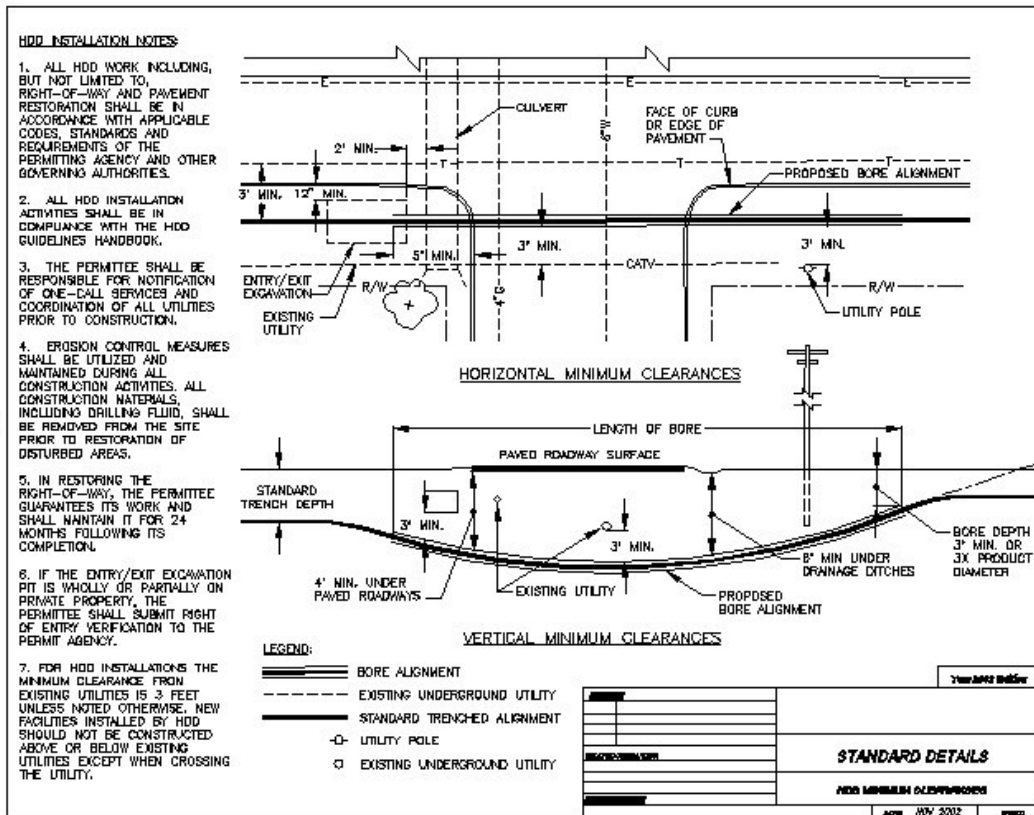
- Ensure that sediment is removed from sediment traps and filters after all storm events.

7. Construction Records

The HDD Contractor shall keep detailed and accurate records of all activities associated with the HDD process. Upon completion of HDD installations, the Permittee shall provide the permit agency with As Built plans and any supporting documents within 60 days of project completion. As Built plans should be in electronic format, but hard copy format may be approved on a case-by-case basis by the permitting agency. HDD construction records and As Built plans shall include the following:

- HDD tracking data and operator logs shall be maintained daily and shall be made available upon request to the permit agency. These field records and operator notes shall specify:
 - the type of tracking equipment used
 - the length and depth of the HDD installation
 - additional information that may include steering adjustments and other equipment performance parameters
- As Built plans shall be derived from the tracking data and operator logs. At a minimum, the drawings shall indicate:
 - horizontal and vertical HDD alignment (dimensioned)
 - existing utility horizontal locations and depths at all exposed or potholed locations
 - existing utility horizontal locations where indicated with field locates
- As Built plans shall conform to the same plans submission requirements as for Right-of-Way Permits and as described in this handbook.

HDD Minimum Clearances



Appendix A – References

1. Overland Park, Kansas, The City of Overland Park, Kansas, Right-of-Way Permits, Horizontal Directional Drilling Guidelines Handbook, May 2002.
2. HDD Consortium, Horizontal Directional Drilling, Good Practices Guidelines, May 2001.
3. American Society of Civil Engineers, Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data, CI/ASCE Standard No. 38-02, Preliminary Copy, 2002.
4. U.S. Department of Transportation, Federal Highway Administration, Office of Program Administration, SUE web site, available on the Internet at <http://www.fhwa.dot.gov/programadmin/sueindex.htm>.
5. Jeffery J. Lew, Subsurface Utility Engineering: An Initial Step in Project Development, available from <http://asceditor.unl.edu/archives/1996/lew96.htm>, on the Internet.
6. U.S. Environmental Protection Agency, Construction Site Storm Water Runoff Control, available from <http://www.epa.gov/npdes/menuofbmps/menu.htm>, on the Internet.
7. Missouri Department of Natural Resources, Protecting Storm Water, available on the Internet at <http://www.dnr.state.mo.us/wpscd/wpcp/wpcp-guide.htm>.

In-ground Facility Identification Practice

1. Objective

The objective of this practice is to identify and recommend that permanent devices be installed with buried facilities which will allow those facilities to be detected in the future through non-invasive methods.

2. Requirements

This practice applies to all new utility installations buried in public rights-of-way as well as utility easements. This practice may also apply to replacement facilities as deemed practical based on the length of the replacement.

This practice applies to the repair of existing utilities only if the existing facility already has a detection mechanism. The repair of any facility that utilizes a detection device, such as tracer wire, shall also include the restoration of the detection device to original condition.

3. Practice Statement

All new in-ground facilities will be installed with permanent devices that allow a means of detecting or designating the facility in the future through non-invasive methods.

4. Practice Description

A number of non-invasive technologies have been developed to assist in detecting underground facilities from the ground surface. These include ground penetrating radar (GPR), infrared thermography, and other electromagnetic methods. Many of these methods are expensive and have limited applications. The description of these numerous and often site-specialized geophysical detection methods is beyond the scope of this document. For more information on methods not covered in this practice, refer to The American Society of Civil Engineers (ASCE) Standard, CI/ASCE 38-02.

One common and relatively inexpensive electromagnetic detection method utilizes pipe or cable locators to detect facilities. For simplicity this method will be referred to as Electromagnetic Pipe Detection (EPD). EPD is the primary focus of this practice. It is recommended that all new facilities be installed to accommodate EPD as described in this practice.

There are also a variety of inexpensive products available to aid in facility identification and detection purposes. These include marker and warning tape. These products and EPD are discussed in the following sections.

4.1. *Electromagnetic Pipe Detection (EPD)*

EPD is a common and widely used method of detecting underground facilities. This electromagnetic method requires a signal to be directly or indirectly induced across the facility by a transmitter. The signal is then detected with a receiver. The transmission of this signal requires a conductive element, therefore, the facility must be metallic or the facility must be accompanied by a conductive element, such as tracer wire.

The indirect signal method utilizes the generation of signals from just above the ground surface to induce a response in the facility or tracer wire. Specifically, the aboveground transmitter creates a fluctuating electromagnetic field in the ground that induces a current in the facility. The current or signal is then followed with an aboveground receiver to detect the facility location.

The direct signal method requires direct connection from the transmitter to the facility or the tracer wire. This method requires access points along the facility route for direct connection. To complete the circuit, a ground lead is also connected from the transmitter to ground. The current is directly applied and the signal is detected and followed with a receiver. Direct connection provides the strongest signal and provides the most reliable detection.

This practice recommends the use of EPD with direct connection for all future facilities.

4.1.1. Tracer Wire. Tracer wire is also known as locating wire. It is used to enable the detection of buried plastic pipes, fiber optics, and non-conducting facilities by providing the facility a metal conductor. It is common practice to use THHN or THWN building wire for this function. THHN and THWN are building wires with a nylon jacket. THHN is intended for use in dry locations, while THWN is designed for use in wet locations. However, neither wire is designed specifically for use as a buried tracer wire. Observations over time have shown that these building wires often do not hold up well in buried conditions and become ineffective due to corrosion.

It is recommended that all new construction require the use of tracer wire designed specifically for the purpose of detecting buried facilities. The specifications for tracer wire should require a minimum 12 AWG copper wire coated with a minimum 30 mil polyethylene jacket designed specifically for buried use.

It is appropriate to note the limitations of the tracer wire technology. The effectiveness of the installed system is dependent on an uninterrupted continuous tracer wire system. An un-repaired cut in the tracer wire will likely render the wire unable to carry a signal that can be read by the aboveground receiver. Thus, facility detection will not be possible. It is a given that tracer wire cuts will happen. Consequently, it is important to mandate the repair of all tracer wire cuts as they occur, thus enabling continued integrity and functioning of the tracer wire system.

4.2. Markers

Markers are devices that physically mark a facility at intermittent locations along the facility. Various physical marker systems are available including electronic and visual systems. The markers should conform to the American Public Works Association (APWA) utility color code specifications and can be used to supplement tracer wire systems. For facilities buried at excessive depths, electronic or surface markers provide a good facility identification solution.

4.2.1. Above Ground Markers. There are a number of above ground utility markers available. Flat surface markers and pavement markers are installed flush with

the ground surface and are marked with utility information. Flags, stakes and various post type markers protrude above grade and are typically highly visible. Subsequently, extensive use of flags and posts may be more appropriate for rural as opposed to city or metropolitan areas. As an option, some of these markers are made to be flush with the surface and then can be extended above grade when locate requests are made.

4.2.2. Electronic Markers. Electronic markers can be buried at various depths or placed near the ground surface over key facilities such as valve boxes, splices, service stubs and facility paths. The markers contain a passive antenna that can be identified with detection equipment and do not require an internal power source. Electronic markers can be supplied with unique frequencies for each type of utility.

4.3. Warning Tape

Warning tape is typically a thin polyethylene tape 3 to 6 inches wide continuously inscribed with a description of the utility and conforming to APWA color codes. It is usually buried 12 to 18 inches directly above an underground utility. During excavation, the warning tape is encountered prior to the utility, thereby warning the excavator of the utility's location.

Some warning tape includes a foil layer that allows the tape to be detected with pipe or cable detectors. Since the primary function of warning tape is to act as a physical warning during excavation, it is usually not protected with the same care as a facility and it likely that it will be damaged during excavation. This practice does not recommend the use of detectable warning tape in lieu of tracer wire.

4.4. Emerging Technologies

Other ways of detecting and locating facilities are being developed or are currently being used in limited capacities. One available product is HDPE innerduct with embedded tracer wire. This product eliminates the need for the installation of separate tracer wire, reducing installation costs. At least two manufacturers, Moore DP, LLC and Carlon are producing this innerduct.

A product still under development is magnetic polyethylene (PE) pipe. The magnetic PE pipe is extruded from polyethylene material that contains strontium ferrite particles. The magnetic particles allow the pipe to be located without the use of tracer wire; however, the pipe requires a special three-axis locator. The magnetic PE pipe and three-axis locator are not commercially available at this time.

5. Practice Procedures

All new non-metallic underground facilities should be installed with tracer wire or a combination of tracer wire and markers. Metallic pipes do not require additional tracer wire. Metallic pipes do require access points along the route for direct connection.

Tracer wire should be installed continuously along the new facility route with access points placed every 300 hundred feet maximum. Tracer wire should be brought to the ground surface at the access points. Access points may include valve boxes, handholes,

manholes, vaults or other covered access devices. Access point covers should be clearly marked with the type of facility. Splices in the tracer wire should be connected by means of a split bolt or compression type connector to ensure continuity. Wire nuts should not be used. A waterproof or corrosion-proof connector for direct bury applications is highly recommended.

After installation, tracer wire should be tested to verify continuity of the tracer wire system and a report indicating continuity should be submitted to the permitting authority as part of the as-built construction records.

5.1. Direct Buried Facilities

A tracer wire shall be installed in the trench with all direct buried facilities. The wire should be placed adjacent to or above, but not touching, the pipe. The tracer wire should not be wrapped around the facility. The maximum distance from the utility pipe to the tracer wire should be 6 inches. Non-metallic spacers can be used to keep the tracer wire a set distance from the facility.

In addition to the tracer wire, all direct buried utilities should have plastic warning tape installed above the facility. The warning tape should specify the system buried below. Warning tape should be made of polyethylene, a minimum 3.5 mils thick, and a minimum of 3" wide with black lettering imprinted on a color-coded background that conforms to APWA color code specifications. Tape should be installed 12 to 18 inches above the facility and at least 6" below grade.

5.2. Trenchless Placed Facilities

A tracer wire should be installed with all non-metallic pipe constructed by trenchless methods. The tracer wire can be pre-installed in conduits and innerduct or it can be blown in after conduit or innerduct installation. In the case where conduit or innerduct is not used, the tracer wire should be installed at the same time as the pipe as an integral part of the pipe installation. Attempting to install the tracer wire separately will not guarantee an accurate position of the tracer wire relative to the facility position.

6. References

- U.S. Department of Transportation, Research and Special Programs Administration, Office of Pipeline Safety, Common Ground, Study of One-Call Systems and Damage Prevention Best Practices, August 1999.
- American Society of Civil Engineers, Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data, CI/ASCE Standard No. 38-02, Preliminary Copy, 2002.
- Jacque Washburn, 3M Telecommunications, Electronic Markers Ease Locating Challenges, available at <http://www.underspace.com/uf/ndx/articles/013-341.htm>, on the Internet.

7. Practice Outcomes

The cost of a tracer wire system is low relative to a project's total cost. The practice of installing a tracer wire system, with access points for direct connection, will allow the facility to be easily detected by common electromagnetic detection practices. The benefits of being able to easily detect and accurately mark an underground facility significantly dwarf the cost of installation.

If a tracer wire system is required on all future projects, the number of facilities that are non-detectable or/and improperly marked should be significantly reduced over time. Accurately detecting and marking a facility prior to construction will reduce the likelihood of unknowingly striking the facility during excavation. The end result should be a reduction in damaged facilities leading to reduced repair and down time costs.

7.1. Evaluating the Practice

Documenting the specific success of this practice may be somewhat difficult. It is more likely that a specific failure will be identified rather than a specific success. For example, consider a tracer wire system installed with a new facility per this practice. At some point in the future the facility is damaged during an excavation project. It should then be possible to determine if the damage is a result of a failed tracer wire system, improper implementation of the tracer wire system, or other factors unrelated to the tracer wire system.

Potholing Practice

1. Objective

The purpose of this practice is to describe potholing methods and recommend procedures for potholing.

2. Requirements

Potholing is accomplished through various types of excavation methods and equipment. This practice covers general methods and procedures. Procedures and practices associated with specific equipment should be based on manufacturer's recommendations.

The Occupational Safety and Health Administration (OSHA) governs construction safety including excavations. OSHA 29 CFR, 1926 addresses construction industry safety regulations. Missouri and Kansas both have state statutes which govern excavation as well. OSHA, state statutes, and local ordinances must be followed at all times.

3. Practice Statement

Potholing shall be utilized, as required and described herein, to prevent excavation damage to underground utilities.

4. Practice Description

Potholing is the practice of digging a test hole to expose underground utilities to ascertain the horizontal and vertical location of the facility. The horizontal and vertical position of the exposed facility must be tied to a survey benchmark or permanent above grade feature. The position may be identified by GPS or traditional survey coordinates or by measuring the distance, with a tape measure, to permanent features in three horizontal directions. In addition, the vertical distance below grade should be obtained.

Some municipalities and utility companies do not consider potholing to be an option. Rather, it is viewed as an essential phase of underground construction for all types of excavation including horizontal directional drilling (HDD) operations. This practice applies to all potholing activities for both construction and design applications.

4.1. Backhoes

In the recent past, potholes were typically dug with backhoes. Digging potholes with a backhoe is a risky endeavor compared to other methods of potholing due to its potentially destructive nature. The backhoe method is inexact and cumbersome; even skilled backhoe operators run the risk of hitting and damaging the very utility they were trying to locate and protect.

The use of backhoes is not the preferred method of potholing. However, if a backhoe is utilized, it is essential that a "spotter" be present for the entire excavation. A spotter is a person that observes the excavation and communicates to the backhoe operator when a buried facility is sighted.

4.2. Hand Dig

Hand digging a test hole is the method of digging a pothole by manual means with hand held equipment such as a shovel. This method is labor intensive and time consuming. The advantage to hand digging is that it does not require expensive equipment and is relatively safe for locating most facilities. As with any excavation, extreme caution should be practiced if digging near hazardous utilities such as electric cable.

4.3. Vacuum Excavation

Vacuum excavation is the preferred method for non-destructive exposure of buried utilities. Vacuum excavation utilizes either air or water pressure to break up the soil and a vacuum device to collect the spoil. Of the two methods, air vacuum excavation is generally preferred, though specific site and environmental characteristics may lead to a decision to use water vacuum excavation.

4.3.1. Air. Air vacuum excavators utilize the kinetic energy in a high velocity air stream to penetrate, expand and break-up soil. The loosened chunks of soil and rock are then removed from the hole through the use of a powerful vacuum. In this way a test hole is created that reveals the buried utility. Holes vary in size and shape. A typical test hole is 6 inches to 12 inches in diameter and 4 feet to 6 feet deep. However, a test hole one-foot square is also common and holes can be considerably deep if required. For example holes in the excess of 20 feet may be required to locate deep sewer mains. Dry or air excavation has several advantages over water vacuum excavation. For example the air method is faster in most soils and eliminates the need for mud disposal. Since the spoil remains dry, it can immediately be used for backfill. Air methods are safer for the operator and the utilities. One shortcoming of air units is that they are not effective in all soil types, especially wet, heavy clay and caliche.

4.3.2. Water. Water vacuum excavation systems dig the pothole using high-pressure water to reduce and loosen the soil. The wet soil and mud slurry is removed to a spoil tank using a powerful vacuum. Like air systems, a hole typically one-foot square or 6 to 8 inches in diameter is common. The maximum hole depth for both systems is dependent on the vacuum limitations. The higher density of water produces powerful forces that are effective in most soils including wet heavy clays. Heated water systems can be used to excavate frozen ground allowing efficient potholing year round. Operational caution is also necessary as high-pressure water systems have the potential of cutting through cables or damaging pipe if not used with care.

5. Practice Procedures

This practice describes potholing activities that will occur immediately proceeding or in conjunction with construction activities. Potholing can also be utilized during the planning and design phases of the project.

5.1. Call Before You Dig

As with all excavations, call for utility locates through the state One Call system and refer to the state "Excavator's Manual" prior to potholing and other construction activities.

- Missouri One Call: 1-800-DIG-RITE (1-800-344-7483)
- Kansas One Call: 1-800-344-7233

Facilities of owners that do not participate in the state One Call systems need to be identified as well.

5.2. Construction Drawings

Construction drawings showing new construction and existing facilities should be present and utilized during potholing activities. Construction drawings should be compared to designating/locate paint marks to determine if all facilities shown on the drawings have been identified in the field. If drawings and paint marks do not match, consider additional potholing to determine accurate locations.

5.3. Contact Information

Have contact names and phone numbers for all known underground facility providers available.

5.4. Mis-Designated Facility

If locate paint marks have improperly designated the location of a facility, and the facility is exposed during potholing or other excavation, the facility owner and/or the state One Call systems should be notified. The entity that exposed the facility should document the position of the facility and communicate the information to the facility owner.

If a utility cannot be located through potholing used in conjunction with drawings and locate marks, the facility owner should be contacted and/or the state One Call system should be notified.

5.5. Conditions Requiring Potholing

State statutes require excavation within two feet of marked utilities be performed in a careful manner. The following sections are intended to advocate a careful and prudent method to protect existing underground facilities. Refer to State statutes or the “Excavator’s Manual” for more information.

5.5.1. Close Proximity. It is recommended that potholing be used to expose utilities for any excavation including HDD within the tolerance zone of the marked utility. The tolerance zone (also known as the “approximate location”) is typically a strip of land equal to the width of the underground utility plus two feet on either side.

For HDD operations with a bore path that parallels a utility within 3 feet, potholing should be required at the beginning and end of the bore and every 50 feet along the route. For HDD operations with a bore path that parallels a utility within 5 feet, potholing should be required at the beginning and end of the bore and every 200 feet along the route.

Potholing should also be performed for all utilities crossing the path of HDD operations.

Backhoe excavation should not be allowed within two feet of existing facilities. Refer to Section 4.1, Backhoes.

5.5.2. Congested Utilities. In congested areas having several facilities in close proximity and/or crisscrossing each other, locates have greater potential to be considerably less accurate. It is recommended that potholing be utilized for excavations near congested utility areas.

5.5.3. Hazardous and Vital Systems. Hazardous systems include electric cables, and all types of natural gas pipelines including transmission, distribution and service lines. Vital systems include telephone transmission lines, fiber optic, and other communication cables.

For the preservation and protection of human life and vital facilities, it is recommended that excavations with 3 feet of hazardous or vital systems utilize potholing to locate the facility.

5.6. Protecting Exposed Facilities

Facilities exposed during potholing must be protected throughout the project. Exposed facilities can shift or sag when the soil that was supporting and protecting the utility is removed. Utilities that are rendered unsupported due to potholing should be temporarily supported by shoring or other means. The utility should also be protected from heavy and sharp items falling into the excavation, which could crush or cut the facility.

5.7. Backfill and Restoration

After the underground utility has been located, the pothole should be restored within 24 hours or as otherwise directed. Appropriate sediment controls should be utilized during all potholing activities to prevent storm water pollution. The pothole should be clean and dry prior to backfilling. Backfilling of the excavation and the restoration of pavement or surfacing shall be in accordance with the governing authority's standards and specifications.

Drilling mud or remaining spoil should be cleaned up and the area restored to original condition or better. The contractor is responsible for disposing of any drilling mud or remaining spoil in an environmentally suitable manner.

6. References

- Kansas One-Call, Dig Safely Excavator's Manual, 2001-2002.
- Missouri One Call System, Inc, Missouri One Call Excavator's Manual, 2002.
- Missouri State Law, Underground Facility Safety and Damage Prevention, House Bill No. 425, RSMO Chapter 319.015 to 319.050, Missouri.

- Occupational Safety and Health Administration, Construction Industry Regulations, 29 Code of Federal Regulations, 1926, Subpart P, Excavation Standard, OSHA.

7. Practice Outcomes

7.1. *Collecting and Reporting Data*

The permitting agency should require the Permittee or its contractors to collect data regarding potholing activities. Potholing information should be collected as part of the normal construction records documentation process. The following data should be collected for all exposed facilities:

- Facility Owner (if known)
- Type of Facility
- Diameter of Facility
- Material of Facility
- Horizontal and vertical position of existing facility

It is important to also collect information on potholing activities that can be used to evaluate the successes or failures of potholing. In addition to the data stated above, the following information should be collected and documented. This data should be collected during a trial period for evaluation. However, some of the data may be useful beyond a trial period and consideration should be given to collection for all future projects.

- Size of the project i.e., length of new installed facility.
- The distance interval between potholes for facilities parallel to the new route.
- If facilities are designated in the wrong location by locators, document the actual position of the facility.
- Document if actual positions of existing facilities fall within the designed path of the new facility.
- Note the number of new facility route changes required due to locating of existing facilities during potholing.
- Document any damage caused by potholing activities.
- Document any facilities that are damaged during new construction but after potholing actions.

- Document facilities discovered during construction that were not identified or marked in any way and note if those facilities were damaged.

7.2. *Evaluating the Practice*

By evaluating the collected data, it should be possible to determine the impact potholing has on damage prevention. For example, if potholing exposes a facility that was not accurately designated during utility coordination efforts, then the collected data will show if the new facility was rerouted to avoid an existing facility.

Likewise the data will document any damage that occurs, the frequency of occurrence, the damage prevention measures taken, and the circumstances leading to the damage.

Design Drawings Practice

1. Objective

This practice will define the collection and depiction of underground utility data on design drawings for construction projects in public rights-of-way.

2. Requirements

The American Society of Civil Engineers (ASCE) has recently published standard guidelines covering utility data collection and depiction. The ASCE standard, which is based on subsurface utility engineering (SUE), presents a system of classifying the quality of subsurface utility data, allowing project stakeholders to better manage risks involved with excavating near underground facilities.

The intent of this practice is to conform to and recommend the use of the ASCE standard for all projects in public rights-of-way. The project owner, design engineer, and permitting authority must understand and agree to the quality level of the utility information that is required for each project.

This practice does not negate or replace any existing or more stringent law, code, standard or requirement currently utilized by permitting agencies and/or governing authorities. In the case of conflicting information, the stricter requirement should prevail.

3. Practice Statement

The designer or engineer shall incorporate underground utility information on design drawings based on subsurface utility engineering practices and CI/ASCE 38-02, Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data.

4. Practice Description

During the design phase, the designer gathers available information on underground facilities in the proposed construction area. The information is overlaid onto scaled base maps of the construction route or area. The consolidated drawings help in determining final route selection and design.

5. Practice Procedure

5.1. *Collection of Data*

The designer should obtain or prepare scaled base maps of existing surface and subsurface facilities within the construction limits of the project. At a minimum, the base maps should show right-of-way limits, edges of pavement or face of curb, sidewalks, above ground and underground utilities as well as all surface features within the proposed construction area.

Data for preparing base maps can be collected from various sources and methods. The basic background can come from aerial photography, USGS maps, right-of-way

drawings, street maps, surveys or a combination of sources. Underground and subsurface utility information should be collected using the SUE process.

5.1.1. Right-of-Way Research. An essential step in the planning and design phase of a project is determining the limits of the public right-of-way and property lines. This information can be collected from existing plats, right-of-way maps, tax maps, surveys, right-of-way markers or other sources such as as-built drawings of street widening projects. Gathering and depicting this information is critical in ensuring that the limits of the project boundary are defined, thus helping to ensure that construction activities do not encroach upon private property.

5.1.2. Subsurface Utility Engineering (SUE). SUE is an engineering process used to identify and map underground utilities and structures as well as assign a quality level to data. The main components of SUE are:

- Designation – the use of geophysical investigating methods such as electromagnetic pipe detectors to determine the horizontal position of subsurface facilities.
- Locating – also known as potholing. Locating or potholing utilizes non-destructive digging equipment to expose the underground facility at critical points along its path to determine the horizontal and vertical position of the facility.
- Data Management – the collection, documentation, reduction, and depiction of information and data in a suitable format.

A brief description of the four quality levels of SUE data is provided below. Refer to CI/ASCE 38-02 for more information on the tasks involved in each quality level.

- Quality Level A provides the highest level of accuracy. It involves locating or potholing utilities as well as activities in quality levels B, C, and D. The located facility information is surveyed and mapped and the data provides precise plan and profile information.
- Quality Level B involves designating the horizontal position of subsurface utilities through surface detection methods and collecting the information through a survey method. Includes quality level C and D tasks.
- Quality Level C involves surveying visible subsurface utility structures such as manholes, hand-holes, utility valves and meters, fire hydrants, pedestals and utility markers, and then correlating the information with existing utility records to create composite drawings. Includes quality level D activities.
- Quality Level D provides the most basic level of information. It involves collecting data from existing utility records. Records may include as-built

drawings, distribution and services maps, existing geographic information system databases, construction plans, etc.

5.2. Design

Data collected during the SUE process must be combined with base map or background information to create a composite drawing. The composite drawing is then used to determine the best design based on avoiding and minimizing conflicts with existing facilities. New proposed facilities should be routed and designed to maintain a minimum 2 feet horizontal and vertical clearance from all existing utilities, structures, and property lines. Refer to local codes and permit requirements that may have stricter minimum clearances or additional requirements.

5.2.1. Selecting SUE Quality Level. It is recommended that the project owner, the engineer or designer, and the governing authority work together to determine the quality level appropriate for an individual project. Many factors can play a role in determining the quality level required for a project. These include project location, existing utility congestion, right-of-way width, and the size or extent of the project. Also, it could be appropriate that certain areas or sections of a project may require a higher quality level than another.

It is in the governing agency's best interest to evaluate each project and set the quality level deemed appropriate for its conditions. One way of accomplishing this task is to have the engineer or designer review the construction area, available utility records, and project requirements. A recommendation to the governing agency regarding the quality level deemed appropriate would then be made. The city can then approve the suggested quality level or require that a higher quality level be established.

Local governments may wish to establish required SUE quality levels for designs that address construction in certain areas of the city or certain corridors, based on the prevalence and density of underground facilities in the rights-of-way and the types of facilities present. Such requirements can provide engineers guidance in preparing their design drawings and the engineer can request a change in requirements if they feel this is necessary.

5.3. Drawing Requirements

The basic design deliverable should include existing site and utility information and new facilities in an electronic drawing format. Based on circumstances, hard copy format may be allowed by the city. The drawings should be drawn to scale, with dimensions indicating the horizontal position of existing and new facilities. Distinct line types, symbols, and notes should be used to indicate different types of facilities, SUE quality levels, and new or existing facilities. The drawings should include a drawing legend and contain the information described in the following sections.

5.3.1. Identify SUE Quality Level. CI/ASCE 38-02 describes and explains ways of depicting SUE information on the drawings. The basic requisite is to indicate on the drawings the quality level of each set of utility data through various line types or notes.

For example a section of gas line information with quality level A would be depicted with one line type and a section of gas line information with quality level D would be depicted with a different line type. Refer to CI/ASCE 38-02 for more information.

5.3.2. Identify Information Source. Each set of facility data can also include a note explaining the source of the information in addition to the quality level. For example, gas line information shown with a quality level D could also include notes that indicate one section of information came from original gas main construction drawings in 1967 and another section from gas main relocation as-built drawings in 1999. Including the source and date of the information could provide clues regarding the accuracy of the information to persons familiar with the area and/or the facility owners. As another example, consider that potholing information is collected in 1999 during the design phase, but project construction does not begin until 2001. The governing authority may be aware of unrelated construction or changes that occurred in the project area between design and construction that could render the previously obtained potholing information inaccurate or insufficient.

5.3.3. Plan and Profiles. Scaled plan drawings depicting utilities and structures with horizontal positions should be required for all projects. The plan view should have dimensions indicating the clearance between new facilities and existing facilities, structures, and property lines.

Where information is available, vertical positions of underground facilities should also be indicated in some manner. At a minimum, vertical position information should be included in a note format for each utility that will be crossed by new construction.

The best method of depicting vertical position information is to include profile drawings with the plan view. The profiles should be depicted in the same horizontal scale as the plan and should be aligned directly below the plan view. The profile should depict the vertical position of both existing and new facilities with dimensions indicating clearances.

6. References

- American Society of Civil Engineers, Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data, CI/ASCE Standard No. 38-02, Preliminary Copy, 2002. (Note that this guideline document is available for purchase through the ASCE Publications Home Page at <http://www.pubs.asce.org>.)
- U.S. Department of Transportation, Federal Highway Administration, Office of Program Administration, SUE web site, available on the Internet at <http://www.fhwa.dot.gov/programadmin/sueindex.htm>.

- Jeffery J. Lew, Subsurface Utility Engineering: An Initial Step in Project Development, available on the Internet at <http://asceditor.unl.edu/archives/1996/lew96.htm>.

7. Practice Outcomes

As with any construction project, the success of a project is often highly dependent upon the quality of the design and the design drawings. The benefits of SUE have been touted in studies and documents produced by the Federal Highway Administration and other organizations. Studies show significant savings on the overall project due to reduced change orders, reduced work delays and less utility relocations. The cost of implementing SUE is relatively low. Many SUE tasks are already performed during the design process. One potential cost increase to the design process may be the requirement for high Quality Level data. However, high Quality Level data may only be required in specific locations or under certain conditions. This is part of the SUE process that allows stakeholders to evaluate and manage the risks.

7.1. Evaluating the Practice

One way to evaluate the outcome of this practice is to collect data on projects utilizing SUE. If facilities are damaged on projects that utilize SUE, then data could be collected to determine how the design drawings may have had an impact. For example, if the data shows that damage is consistently occurring on projects and/or in areas that utilize Quality Level D, then stakeholders may decide that a higher quality level is required on future projects. Conversely, if the data shows that facility damage occurs equally across all quality levels, then stakeholders may need to re-evaluate the overall expense and effectiveness of the supposed higher quality data. Collection of data for projects utilizing SUE will definitely add to the understanding of the success and/or failures of the utilized methods.

**APPENDIX D
REPORT ON LEGAL LIABILITY ISSUES ASSOCIATED WITH THE
OPERATION OF A REGIONAL GIS DATABASE**



STINSON
MORRISON
HECKER LLP

Memo

To: Dean Katerndahl

From: Kyle E. Foote

Date: October 10, 2003

cc: Stephen P. Chinn

Re: Damage Prevention / Municipal Liability Analysis

Issue

Whether municipalities in Missouri and Kansas would be protected by the doctrine of sovereign immunity while engaging in actions associated with the acquisition, compilation and dissemination of private and/or public data from geographic information systems to be used for planning and design purposes.

Short Answer

Yes. While both Missouri and Kansas have divergent legal approaches to the doctrine of sovereign immunity, municipalities in both states may take advantage of the doctrine for the foregoing purposes.

Historic Overview

Historically, the common law doctrine of sovereign immunity provided expansive governmental immunity to municipalities for their negligent actions. Eventually, courts began to effectively demand more responsible action on behalf of municipal governments, eroding the doctrine of sovereign immunity and creating municipal liability for certain types of actions. Many courts made a distinction between “governmental” and “proprietary” functions. Governmental functions typically include activities done for the

common good of all, activities performed to preserve the public health and welfare, and activities traditionally performed by local governments. *Schulz Through Schulz v. City of Brentwood*, 725 S.W.2d 157 (Mo.App. 1987). Proprietary functions typically include those resulting in a pecuniary profit for the municipality and those that are done strictly for the benefit of the municipal corporate entity. *Id.*; but see *State ex rel Board of Trustees of City of North Kansas City Memorial Hospital v. Russell*, 843 S.W.2d 353 (Mo. 1992) (mere competition with private enterprise is insufficient to divest activity of its governmental character). As the judiciary increasingly classified actions as proprietary, further eroding the doctrine of sovereign immunity, state legislatures responded by creating statutory exceptions (immunity) to liability.

Sovereign Immunity in Missouri

The general rule in Missouri favors protection of the government. However, certain exceptions are expressly carved out by statute (*i.e.*, operation of a motor vehicle and the dangerous condition of property, §537.600 RSMo.) and established judicially based on the governmental/proprietary distinction. In Missouri, municipalities are generally not liable for negligence-based torts arising out of governmental functions, but are liable when performing proprietary or corporate functions. *Stacy v. Truman Medical Center*, 836 S.W.2d 911 (Mo. 1992) (to be eligible for sovereign immunity, entity must perform service traditionally performed by government); *Beiser v. Parkway School District*, 589 S.W.2d 277 (Mo. 1979) (municipality loses sovereign immunity when performing proprietary functions). Any waiver of sovereign immunity is to be construed narrowly. *Casey v. Chung*, 989 S.W.2d 592 (Mo. App. E.D. 1998). Sovereign immunity may also be waived where a municipality pays premiums for insurance coverage for the particular act in question, despite its potential status as a governmental, rather than proprietary, function (based on the concept that public taxes have paid for the premiums and, if applicable, the public should be entitled to the benefits of those payments). *Claxton v. City of Rolla*, 900 S.W.2d 635 (Mo. App. S.D., 1995); *Orlando v. St. Louis County*, 740 S.W.2d 393 (Mo. App. 1987) Note, however, that this waiver of immunity is only to the extent of insurance coverage.

The actions currently at issue – the acquisition, compilation and dissemination of data for planning purposes – appears to fit within the general definition of governmental function because the data is being provided for the purpose of effective municipal planning and development, and the protection of public health, safety and welfare by providing information to prevent adverse impacts to critical infrastructure and services. "City planning is designed to promote public order, safety, health and welfare in their broadest sense, including convenience, comfort, attractiveness, and economy and efficiency in operation." McQuillin, *Municipal Corporations*, §1.72; citing *Forest Construction Company v. Planning and Zoning Commission*, 236 A.2d 917; *Incorporated Village of Nissequogue v. Meixsell*, 287 N.Y.S.2d 555. Consequently, it is anticipated that the foregoing types of activities performed (negligently) by municipal governments would be protected under the doctrine of sovereign immunity.

Sovereign Immunity in Kansas

In contrast to the general rule of sovereign immunity in Missouri, sovereign immunity in Kansas is based upon the general premise that there is municipal tort liability for all negligent actions, with specific immunity exceptions provided by statute. *Beck v. Kansas Adult Authority*, 735 P.2d 222 (Kan. 1987) (negligence is excepted from liability under the Kansas Tort Claims Act, §75-6104 et seq.); *Fettke v. City of Wichita*, 957 P.2d 409 (Kan. 1998). The Kansas Statutes specifically enumerate twenty-three exceptions, including §75-6104(u) which provides that:

“A governmental entity or an employee acting within the scope of the employee’s employment shall not be liable for damages resulting from: . . . (u) providing, distributing or selling information from geographic information systems which includes an entire formula, pattern, compilation, program, devise, method, technique, process, digital data base or system which electronically records, stores, reproduces and manipulates by computer, geographic and factual information which has been developed internally or provided from other sources and compiled for use by a public agency, either alone or in cooperation with other public or private entities.”

The proposed actions of data acquisition, compilation and dissemination appear to fit squarely within the statutory exception provided under Section 75-6104(u) (although that specific provision has not been interpreted by Kansas courts). Consequently, it appears that the negligent performance of the foregoing activities by a Kansas municipality would be protected by the doctrine of sovereign immunity.

Other Legal Issues

Even if a municipality is confident of its ability to invoke the doctrine of sovereign immunity in the event of negligence in compiling, storing, updating and disseminating data, other legal issues may adversely affect the implementation of a municipality's data dissemination program, including, but not limited to, the following:

- The intentional or malicious provision of inaccurate information or actions that constitute negligence in excess of the requisite standard of care. Sovereign immunity covers negligent actions of municipalities, but does not extend to malicious, reckless, or knowingly erroneous actions.
- The future use of data that has been previously acquired may be restricted if the data is (1) subject to contractual restrictions or future use and/or dissemination of the information; (2) subject to a confidential agreement; or (3) protected by copyright.

The first issue is unusual, and it is one that is difficult to protect against. If the municipal action goes beyond mere negligence, sovereign immunity does not apply. With respect to the second issue, items (1) and (2) can be determined based upon a thorough review of the contracts or agreements through which the data was originally

conveyed to the municipality. Item (3), relating to intellectual property right protection via copyright, is unlikely given the difficulty of qualifying for a copyright for this type of data. GIS data and "facts", per se, are not protectable under copyright without some unique organization or formulation of that data. If the data appears to be copyrightable, further inquiry is recommended prior to use and dissemination of that data.

Recommendations

Although it appears that municipalities in both Kansas and Missouri may invoke the doctrine of sovereign immunity to protect their actions associated with the acquisition, compilation and dissemination of geographic information system data for planning purposes, it is recommended that the following measures be implemented to strengthen the legal position of the municipalities.

- For data received prior to commencing the data dissemination program, confirm that there are no contractual restrictions on the future use or dissemination of any data that is being compiled for dissemination, and that there are no confidentiality provisions within any previous contracts that would restrict the proposed municipal activities (i.e., compilation and dissemination of data). The existence of these restrictions in prior contracts will require the municipalities to acquire releases to use the information for the intended purposes. In addition, a practice should be implemented requiring future providers of information (to the municipality) to sign a release expressly allowing the municipality to compile, store and disseminate this information for planning purposes.
- Develop a standard protocol for accepting, storing, retaining, updating and disseminating information to ensure that the municipalities implement the system consistently to minimize the potential for error.
- Check with the city attorney to confirm that this type of activity constitutes a “governmental” function, or is otherwise excepted from liability, at the specific time that policy is implemented, and if it is, avoid paying premiums for liability insurance coverage directly associated with the activity.
- Execute a contract with user/developer stating the purpose of the data being provided (e.g., "this information is being provided as a governmental service for the benefit and protection of the public health, safety, and welfare, and is to be used only for planning and design purposes" and that "this information may not be relied upon for actual excavation and construction activities").
- Provide express instructions for developers and other users of data to contact “One-Call” or “DigRite” (or similar entities), as well as

other city and county agencies known to have utility infrastructure that could be affected.

- The data should be distributed without fees (or if fees are required, they should only cover the cost of providing the service and should not be characterized as profit for the municipality).

Conclusion

Although this issue has not been adjudicated, it appears that municipalities in Missouri may compile and distribute data without incurring liability for negligent actions if the foregoing “recommendations” are implemented. Because this type of activity is anticipated to fall within the classification of “governmental” functions, sovereign immunity protections are available.

Municipalities in Kansas may compile and distribute data without incurring liability for negligent actions pursuant to the express exception under Section 75-6104(u) of the Kansas Tort Claims Act. The foregoing “recommendations” should be implemented to strengthen this position.

CAVEAT: In light of the historical changes in the doctrine of sovereign immunity, and the pattern of disagreements between the judiciary and the legislature, a current legal analysis of sovereign immunity should be undertaken immediately prior to a municipality's implementation of the policy/program to confirm that the proposed governmental actions will be immune from tort liability.

**APPENDIX E
REPORT ON THE TECHNICAL, FINANCIAL, AND BUSINESS ISSUES
ASSOCIATED WITH THE DEVELOPMENT AND USE OF A REGIONAL GIS
DATABASE**

Mid-America Regional Council

**Study of a
GIS-Based Utility Location Map**

Prepared by Black & Veatch

September 30, 2003



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1.0 Introduction

Development and use of a GIS-based utility location map for the metropolitan Kansas City area has been identified as a potential tool in reducing damage to underground facilities. Such a map could provide valuable information that would alert developers, contractors, excavators, utilities and municipalities of potential conflicts when planning and constructing a new underground facility.

The Mid-America Regional Council (MARC) has enlisted Black & Veatch to study the technical, financial and other issues involved in the development and use of a regional GIS-based utility location map. This work was done under a U.S. Department of Transportation, Research and Special Programs Administration, Office of Pipeline Safety grant to the Kansas Corporation Commission.

2.0 Issues

Following are some of the issues and questions related to development and use of a regional GIS-based utility location map.

- What communities and utilities currently have GIS databases and in what format?
- What utility data is stored in GIS databases?
- Would utility owners support development of a regional GIS-based utility location map?
- Would utility owners be willing to share location data, and if so, under what conditions?
- What are the security concerns of utility owners?
- What are the potential uses of a GIS-based utility location map?
- What level of accuracy can be expected?
- What are the technical issues associated with development of a GIS-based utility location map?
- What would be the costs associated with the development of a GIS-based utility location map?
- What has been the experience of other regions with regard to the use of GIS for utility location mapping?

Black & Veatch conducted interviews with 18 stakeholders, including public utilities, private utilities, designers, city and county government agencies, and One Call Centers to determine the level of interest, potential participation and concerns with the development and use of a GIS-based utility location map. Several cities outside of the Kansas City metropolitan area were also interviewed to learn from their experiences with GIS.

3.0 System Definition and Estimated Cost

In the system envisioned, MARC would be a metro-wide area repository for utility location data. MARC would collect utility location information from contributing utilities, manipulate and convert data as required, and make the information available to users in accordance with the restrictions of the contributing participants.

Contributed data would be classified in accordance with the quality level definition of CI/ASCE 38-02, Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data, as published by the American Society of Civil Engineers (ASCE). As location data is verified and updated, the quality level designation would also be updated. Over time, the overall accuracy of the system would be expected to improve.

The primary purpose of the GIS-based utility location map would be as a planning tool to avoid potential utility conflicts. The map would not be used in place of the One Call systems during construction.

Several factors need to be determined in order to generally define the GIS and to provide a rough order of magnitude cost estimate. These factors include:

- Geographic extent of the data
- Types of data to be stored
- Amount of data in terms of hard drive storage space
- Hardware to store, use and maintain data
- Software for creating, maintaining and using data
- Network connection services between maintainers and users of data
- Process for using data

Geographic extent

The geographic extent of the services is assumed to include the full area of the 8 counties which comprise the MARC. They are: Johnson, Leavenworth, Wyandotte, Cass, Clay, Jackson, Platte, and Ray. Also included are 116 incorporated areas within these counties.

Types of data

The data required for an efficient underground utility locator would include:

- Wastewater Collection Systems
- Water Distribution Systems
- Storm Water Collection Systems
- Natural Drainage Systems
- Natural Gas Supply Lines
- Electrical Supply Lines
- Television Cable
- Telephone Cable
- Road, highway and interstate systems
- Rail systems
- Gas and oil transport lines

- Ground Surface Contours or Digital Elevation Model
- Rectified orthographic aerial photography (optional)

Amount of data

The amount of storage space for this data is important to specifying the size of hardware and to estimating the cost of acquiring and maintaining the data. For the purposes of this study, the storage space estimates are based on density of development and area of extent. Table 1 shows the eight counties that could be served and the area of each in square miles.

County	State	Area in Square Miles	Urbanized Area in Square Miles
Cass	Missouri	705.59	30.00
Clay	Missouri	409.92	80.87
Jackson	Missouri	622.34	253.44
Johnson	Kansas	472.66	165.43
Leavenworth	Kansas	458.14	22.08
Platte	Missouri	418.04	42.72
Ray	Missouri	576.47	4.61
Wyandotte	Kansas	152.51	78.77
Totals		3,815.67	677.92

Based on 1Mb per square mile of urbanized land for each of the 8 utilities that serve private citizens (water, wastewater, stormwater, natural gas, electricity, telephone, television, roads) plus 0.029 Mb per square mile of 10-foot contours and assuming that the rest of the base map information is negligible in comparison (optional aerial photography is excluded) the size of the database is 5.5Gb.

The cost of hardware, software, training, networking and programming to support this data is \$30,000 to \$50,000. This cost includes the following:

- Data Server:
 - Operating System: Windows 2000 Server or Advanced Server, SP3
 - Memory: 1,024 Mb RAM
 - Processor: 1 GHz or greater
- ESRI’s Arc SDE
- MS SQL Server
- ESRI’s Arc GIS
- ArcView for “casual” users
- Sufficient computer terminals for GIS support staff (5 to 10)
- Local Area Network (LAN) (adapter cards, software, cables, etc)

The cost of supporting hardware/software system is small, however, compared with the cost of obtaining and maintaining the data.

Obtaining Data

Estimating the cost of obtaining this data is difficult because it involves contacting and coordinating with the many local units of government and each public and private utility. There are at least 116 incorporated places in the 8-county area. There are 132 separate entities listed as Missouri One-Call members in the 5 Missouri counties. There are 109 separate entities listed as Kansas One-Call members in the 3 Kansas counties.

Each of these entities will have unique methods of maintaining infrastructure location information. Many won't have digital utility data. Area utilities predominately use ESRI product formats, but Intergraph formats are used by a significant number of the area utilities. An unknown number of area utilities maintain significant amounts or all of their data on paper alone. The paper or mylar data would have to be manually digitized, an effort comparable to tracing each page by hand.

Once all available digital data is assembled from the many sources, a tremendous effort would be required to bring all of the data into a single coordinate system and common viewer format. An area city has recently undertaken a similar effort, with the work still on-going. This enterprise GIS project is limited to preparing a unified GIS for water distribution, wastewater collection and other city infrastructure data, including ESRI and Intergraph formats. The cost is between \$2 million to \$3 million by our estimates. Extrapolating this enterprise GIS project cost to the 8-county urbanized area, exclusive of data acquisition costs or costs of digitizing existing paper and mylar maps, the cost would be on the order of \$7 million to \$10 million.

Maintaining Data

Because the historical growth of the area is expected to continue, the processing of data updates will be continuous from the moment that the system becomes operational. The volume of updates could require approximately 5 full-time GIS technicians. The maintenance of the geodatabase, server and software will require 2 to 3 full-time system administrators. Salaries and overhead for this team of highly trained IT professionals and geographers will probably be between \$0.9 million and \$1.2 million annually. To this must be added the annual maintenance and licensing fees to support the software and maintenance and periodic replacement of the hardware, possibly \$20,000 to \$30,000 annually.

Despite even constant revision and updating, the data will always be at least 2 to 3 months out of date because of the lag-time between utility construction and filing of documents with utilities. Realistically the database is more likely to be a year out of date because of the turn around time for utilities to post the data to the MARC system, time for MARC to convert and import the updates, and time for the utilities to review and verify the MARC updates.

Conclusion

The total cost for of developing a regional GIS database to locate existing underground and aboveground utilities is likely to be on the order of \$7 million. The annual budget for maintaining this data is likely to be approximately \$1.0 million. Further definition of the system would be required to refine the estimated costs.

4.0 Interview Findings

The following summarizes important findings from the interviews.

- The potential benefits of such a system would need to be demonstrated to utilities in order for them to participate voluntarily.
- Some utilities are not enthusiastic about participating in such a system. They are concerned about security of data and sharing of data with competitors.
- Many public utilities seem open to the possibility of sharing data. Their participation is dependent on the security of data and access to the data.
- Water, gas and telecommunications utilities, in particular, seem reluctant to participate in data sharing because of security concerns.
- Many utilities would not share data with MARC without strict controls on access to the information. This strict control will limit the usefulness of the data. If private developers and designers do not have access to the data, the potential benefits of reduced utility damage and use as a planning tool will not be realized.
- The majority of utilities with a GIS-based mapping utilize ESRI software. Some use Intergraph software.
- Utilities would be concerned if the data were used for anything other than planning purposes, because of accuracy and liability issues. Some are concerned that users might try to use the utility map for construction purposes. For construction purposes, the utilities agree the existing One Call systems must be utilized.
- There would be a cost benefit of such a system for designers and planners. A “one stop source” for utility location data could reduce the costs for design. It could also reduce the frequency of expensive design changes that occur during construction due to faulty or incomplete utility location data.
- At least one organization is concerned that private enterprises could profit from information provided and maintained by utility owners.
- The accuracy of utility location data will vary substantially from utility to utility.
- It is the opinion of some interviewees that the system would do little to reduce damage to underground utilities. Too great a dependence on the GIS data, which will always be less than current and may contain undetected errors, could actually lead to the very infrastructure damage that the system is supposed to prevent.
- There is a concern that the system would not be current. Updates from the utility owners to MARC would have to be on a very frequent basis. Otherwise, potential users would not have confidence that MARC data was up to date.
- The cost and effort to initially provide and maintain data to MARC is a concern for utilities. The utility owners would have to be shown that it is their financial interest to participate.
- Inquiries of various utility, municipal government and GIS organizations around the country were made to gain information on experiences of others in regard to utility mapping. Many organizations are using GIS to map their own facilities. However, no other major metropolitan areas were identified as developing such a comprehensive GIS-based utility location system (incorporating all utilities in a multi-county region) as

MARC has envisioned. Some contacts commented that the effort to do so would be tremendous.

- Many utilities in the metropolitan area do not currently utilize a GIS-based utility location system.
- One area organization developing a GIS database has obtained a high level of participation from government entities, but limited participation from utilities. Funding for that database development and maintenance is obtained through licensing agreements with users. Reduced licensing fees are offered to organizations which contribute data. Liability and security issues are addressed in individual licensing agreements between the user/contributor and the database owner. The licensing agreement with users expressly disclaims any representation as to the completeness or accuracy of data provided.

5.0 Conclusions

Following is a summary of conclusions and recommendations concerning the potential development of a GIS-based utility location map for the metropolitan Kansas City area.

- A very substantial effort would be required of MARC to establish agreements with utility owners and participants concerning liability issues, security of data, access to data, and maintenance of the data.
- Utility owners would need to be convinced that development of such a system would reduce damage to their underground facilities or be offered some other financial incentive, in order for them to voluntarily participate.
- Participation of a majority of utility owners is critical to success of the system. Partial participation of utilities would reduce the benefits and effectiveness of the system. Based on the results of the interviews conducted, it is unlikely that widespread voluntary participation of utility owners could be achieved.
- Some utilities would require strict limits on who could access the information because of security concerns. If access to designers, excavators and other potential users is restricted, the potential for the damage-reduction benefits of the system will not be realized.
- The costs and effort associated with the development and maintenance of a regional GIS-based utility location map are very substantial.

Though a GIS-based utility location map could be a valuable planning tool, the obstacles detailed previously and the costs associated with the development and maintenance of the system make it impractical on a regional basis. The initiative would be more practical on a city-wide or county-wide basis, in that the scope, costs and parties involved would be reduced and would be more manageable. However, many of the obstacles previously detailed would remain.

APPENDIX F

Shawnee Kansas Best Practice Implementation

The following practices were added to the city of Shawnee's Technical Specifications and Design Criteria Manual. These are enforced through the city's ROW ordinance. Their full right-of-way ordinance can be found at

<http://www.cityofshawnee.org/publicworks/ROW/Ord2566.htm>.

100 POTHOLING

101 SCOPE: Potholing shall be utilized during construction activities as required herein to prevent excavation damage to existing underground utilities for all open-cut excavations and trenchless installation methods.

102 DESCRIPTION: Potholing is the practice of digging a test hole to expose underground utilities to determine the horizontal and vertical location of the facility.

103 METHODS: The following alternative methods shall be utilized for potholing.

.01 Hand Digging. Hand digging is the method of excavating a pothole by manual means with hand-held, non- mechanical equipment such as a shovel.

.02 Vacuum Excavation. Vacuum excavation shall consist of air or water pressure to break up the soil and a vacuum device to collect the spoil. The Contractor shall determine if air or water vacuum excavation shall be used dependent upon specific site and environmental characteristics. Soil type such as heavy clay may require water vacuum excavation. Air vacuum excavators shall be utilized if mud from water vacuum excavators cannot be disposed of properly. Air vacuum excavators shall be used if damage to utilities, such as cutting through cables, will occur with the use of water vacuum excavators.

A. Air: Air vacuum excavators shall utilize a high velocity air stream to penetrate, expand, and break-up the soil. The loosened particles of soil and rock shall be removed from the excavation through the use of a vacuum.

B. Water: Water vacuum excavation systems shall excavate the pothole using high-pressure water to reduce and loosen the soil. The wet soil and mud slurry shall be removed to a spoil tank using a vacuum.

104 SIZE OF POTHOLE: Maximum pothole size shall be 12 inches in diameter or 12 inch x 12 inch square.

105 CONSTRUCTION DRAWINGS: Construction drawings indicating the proposed construction and existing utilities shall be present and utilized during potholing activities. The construction drawings shall be compared to locate paint marks to determine if all

existing utilities shown on the drawings have been identified in the field. If the drawings and locate paint marks do not match, additional potholing shall be completed to determine accurate locations.

106 MIS-DESIGNATED FACILITY: If locate paint marks have improperly designated the location of a facility, and the facility is exposed during potholing, the facility owner and Kansas One-Call shall be notified. The entity that exposed the facility shall document the horizontal and vertical location of the facility and communicate the information to the facility owner. If a utility cannot be located through potholing used in conjunction with construction drawings and locate marks, the facility owner and Kansas One-Call shall be contacted

107 CONDITIONS REQUIRING POTHOLING.

.01 Open-Cut Excavations: Potholing shall be completed to expose existing utilities, including mains and service lines, when open cut excavations are within the tolerance zone of the marked utility. The tolerance zone, also known as the “approximate location”, is a strip of land equal to the width of the underground utility plus two feet on each side.

.02 Trenchless Installation Methods:

For trenchless operations with a bore path that parallels a utility (mains and service lines) within 3 feet, potholing shall be completed at the beginning and end of the bore and every 50 feet along the route. For trenchless operations with a bore path that parallels a utility (mains and service lines) within 5 feet, potholing should be required at the beginning and end of the bore and every 200 feet along the route. Potholing shall be completed for all utilities (mains and service lines) crossing the path of trenchless operations.

.03 Congested Utilities: In congested areas having several facilities in close proximity and/or crisscrossing each other, locates have greater potential to be less accurate. Potholing shall be utilized for excavations near congested utility areas.

108 PROTECTION OF EXPOSED FACILITIES: Facilities exposed during potholing shall be protected throughout the project. Utilities that are rendered unsupported due to potholing shall be temporarily supported by shoring or other means. The utility shall be protected from heavy and sharp items falling into the excavation that could damage or cut the facility.

109 BACKFILL AND RESTORATION: Potholes shall be restored within 24 hours after the utility has been located or as otherwise directed by the City of Shawnee. Backfilling and restoration of the pavement shall be in accordance with the City of Shawnee construction standards and specifications.

- End of Section -

200 HORIZONTAL DIRECTIONAL DRILLING (HDD)

201 SCOPE: This section sets forth safety guidelines and practices for projects utilizing horizontal directional drilling (HDD) techniques in order to protect existing underground utilities and minimize risks to public safety.

202 APPLICABLE STANDARDS: Applicable standards include the Horizontal Directional Drilling Good Practices Guidelines by the HDD Consortium, and the HDD manufacturer's equipment operation manual.

The HDD Contractor shall become familiar with and follow the safety guidelines established in the above standards at all times.

203 GENERAL: The HDD Contractor shall implement the following general safety guidelines and practices:

.01 Occupational and Safety Health Act (OSHA): The HDD contractor shall perform all operations in compliance with OSHA guidelines.

.02 Training: The HDD Contractor shall ensure all personnel are properly trained and equipped.

.03 Planned Emergency Response: The HDD Contractor shall prepare an emergency response plan in the event of a utility strike. The plan shall be submitted and on-file with the City of Shawnee prior to the issuance of any permits within the City utilizing HDD techniques.

204 PRE-CONSTRUCTION: Prior to the start of construction, the HDD Contractor shall complete the following:

.01 Work Area Familiarization: The HDD Contractor shall familiarize itself with the work area and the technical requirements of the plans.

.02 Utility Locates. The HDD Contractor shall request utility locates and complete all other utility coordination requirements.

.03 Marking and Staking: The HDD Contractor shall complete construction marking/staking in the field to establish HDD entry and exit locations and the proposed HDD alignment at 50-foot (max.) intervals.

205 DURING CONSTRUCTION : While the work is being performed, the HDD Contractor shall complete the following:

.01 Calibration and Tracking: The HDD Contractor shall calibrate the tracking and locating equipment at the beginning of each work day and maintain a calibration log.

- .02 Pressure Potholes:** The HDD Contractor shall pothole the alignment of the bore at 50-foot intervals (approximately) to relieve fluid pressure build-up. Pressure potholes shall be no larger than 12 inches in diameter and the depth shall be adequate so that the fluid may be released as it builds pressure.
- .03 Monitoring and Recording:** The HDD Contractor shall monitor and record alignment and depth readings provided by the tracking system every 25-30 feet for normal conditions, and every 5-10 feet when precise alignment control is necessary.
- .04 Maintain Drilling Fluid Circulation:** The HDD Contractor shall maintain drilling fluid circulation throughout the HDD process including the initial pilot hole installation, and the reaming and back pull process. The pull back shall not exceed the fluid circulation rate capabilities.
- .05 Back-reaming:** The HDD contractor shall back-ream as required to accommodate the product size. Compaction reamers are not permissible. The HDD Contractor shall plan the back pulling operations carefully to ensure that all back pulling operations can be completed without stopping and within the permitted work hours.
- .06 Clearances.** The HDD Contractor shall maintain all required clearances and offsets from existing utilities.
- .07 Documentation:** The HDD Contractor shall at all times and for the entire length of the HDD alignment be able to demonstrate and provide the horizontal and vertical position of the alignment, the fluid volume used, return rates, and pressures.
- .08 Inspection:** The HDD Contractor shall inspect the work and surrounding area to ensure damage has not occurred to existing utilities due to HDD construction operations.

206 CONSTRUCTION RECORDS: The HDD Contractor shall keep detailed and accurate records of all activities associated with the HDD operation.

- .01 Data and Logs:** The Contractor shall provide data and work logs upon the request of the City of Shawnee while the work is being done at the completion of HDD operation. Data shall include, but not be limited to, tracking and calibration logs, type of tracking equipment used, installation length and depth, steering adjustments, equipment performance parameters, and the names of the HDD operators performing the work.

- End of Section -

300 DESIGN DRAWINGS

301 SCOPE. This section sets forth the requirements for the collection and depiction of existing underground utility data on design drawings to be used for construction projects within the right-of-way.

302 DESCRIPTION: During the design phase, the designer shall gather available information on underground utilities in the proposed construction area. The utility information shall be incorporated into scaled topographic base maps of the construction route or area. The consolidated drawings shall be used to determine the final route selection and design.

303 APPLICABLE STANDARD: The design drawings shall incorporate underground utility information based on subsurface utility engineering practices and Standard Guidelines for the Collection and Depiction of Existing Subsurface Utility Data (CI/ASCE 38-02). *A copy of CI/ASCE 38-02 is included at the end of this section.*

The ASCE standard, based on subsurface utility engineering (SUE), presents a system of classifying the quality of subsurface utility data.

304 COLLECTION OF DATA: Underground utility information shall be collected using the Subsurface Utility Engineering (SUE) process.

.01 Subsurface Utility Engineering (SUE): SUE is an engineering process used to identify and map underground utilities and structures as well as assign a quality level to data. The main components of SUE are:

A. Designation: Designation is the use of geophysical investigating methods such as electromagnetic pipe detectors to determine the horizontal position of subsurface utilities.

B. Locating: Locating or potholing utilizes non-destructive digging equipment to expose the underground utility at critical points along its path to determine the horizontal and vertical position of the utility.

C. Data Management: Data Management is the collection, documentation, reduction, and depiction of information and data in a suitable format.

305 QUALITY LEVELS: A brief description of the four quality levels of SUE data is provided below. Refer to CI/ASCE 38-02 for detailed information on the tasks involved in each quality level.

.01 Quality Level A: Quality Level A provides the highest level of accuracy. Quality Level A involves potholing utilities as well as activities in quality levels B, C, and D. The located utility is surveyed and mapped and the data provides precise plan and profile information.

.02 Quality Level B: Quality Level B involves designating the horizontal position of subsurface utilities through surface detection methods and collecting the information through a survey method. Quality Level B includes Quality Level C and D tasks.

.03 Quality Level C: Quality Level C involves surveying visible subsurface utility structures such as manholes, hand-holes, utility valves and meters, fire hydrants, pedestals and utility markers, and then correlating the information with existing utility records to create composite drawings. Quality Level C includes Quality Level D tasks.

.04 Quality Level D: Quality Level D provides the most basic level of information. Quality Level D involves collecting data from existing utility records. Records may include as-built drawings, distribution and service maps, existing geographic information system databases, and construction plans.

306 DESIGN: Utility data collected during the SUE process shall be combined with the topographic base map to create a composite drawing. The composite drawing shall be used to determine the best design based on avoiding and minimizing conflicts with existing facilities. Proposed facilities shall be routed and designed to maintain 2 feet (min.) horizontal and vertical clearance from all existing utilities, structures, and property lines, unless other standards require stricter minimum clearances.

307 SELECTING THE SUE QUALITY LEVEL: *All drawings submitted to the City shall depict existing utilities based on Quality Level D. The City shall reserve the right to request a higher level based on project location and other factors.* The utility company may request that the City approve a change in the required SUE quality level.

308 DRAWING REQUIREMENTS: The design drawings shall include existing topographic and utility information and proposed facilities. The drawings shall be drawn to scale, with dimensions indicating the horizontal position of existing and proposed facilities. Distinct line types, symbols, and notes shall be used to indicate different types of facilities, SUE quality levels, and existing and proposed facilities. *All proposed construction must be shown in bold face.* The drawings shall include a legend and the information described in the following sections.

.01 Identify SUE Quality Level: CI/ASCE 38-02 describes and explains methods of depicting SUE information on the drawings. The basic requisite is to indicate on the drawings the quality level of each set of utility data through various line types or notes. Refer to CI/ASCE 38-02 for additional information.

.02 Identify Information Source: Each set of facility data shall include a note explaining the source of the information in addition to the quality level.

.03 Plans and Profiles: Scaled plan drawings depicting existing and proposed utilities and structures with horizontal positions shall be provided for all projects.

A. Plan: The plan view shall have dimensions indicating the clearance between existing and proposed facilities, structures, and property lines. Vertical positions of underground utilities shall be indicated in the same manner. At a minimum, vertical position information shall be included in note format for each existing utility that will be crossed by proposed construction.

B. Profile: Profiles are required for all SUE quality level A projects. Profiles shall be depicted in the same horizontal scale as the plan view and shall be aligned directly below the plan view. Profiles shall depict the vertical position of both existing and proposed facilities with dimensions indicating clearances.

- End of Section -

400 FACILITY IDENTIFICATION

401 SCOPE: This section sets forth the requirements for the installation of electromagnetic pipe detection systems in order to detect underground utilities through non-invasive methods.

The requirements set forth in this section apply to all new utility installations in the right-of-way. This section applies to the repair of existing utilities only if the existing facility has an electromagnetic pipe detection system. The repair of a utility that utilizes an electromagnetic detection device shall also include the restoration of the detection device to its original condition.

402 ELECTROMAGNETIC PIPE DETECTION (EPD) SYSTEM: EPD requires a transmitter to directly induce a signal across the utility. The signal is then detected with a receiver. The transmission of the signal requires a conductive element and, therefore, the utility must be metallic or the utility must be accompanied by a tracer wire.

.01 Direct Signal Method: The direct signal method shall be utilized to transmit the signal from the transmitter to the utility. The direct signal method requires direct connection from the transmitter to the utility or the tracer wire. Access points shall be installed along the utility route for direct connection. The current shall be directly applied and the signal shall be detected and followed with a receiver.

.02 Tracer Wire: Tracer wire shall be installed to enable the detection of plastic pipes, fiber optics, and non-conducting utilities. The tracer wire shall be designed specifically for the purpose of detecting buried utilities. Tracer wire shall 12 AWG (min.) copper wire coated with a 30-mil (min.) polyethylene jacket designed specifically for buried use.

403 INSTALLATION: All new non-metallic utilities shall be installed with tracer wire. Metallic pipes do not require a tracer wire. Metallic pipe systems require access points along the route for direct connection. The tracer wire shall be installed continuously along

the new utility route with access points at 300 feet maximum. The tracer wire shall be brought to the ground surface at the access points. Access points may include valve boxes, handholes, manholes, vaults, or other covered access devices. Access point covers shall be clearly marked with the type of facility. Splices in the tracer wire shall be connected by means of a split bolt or compression type connector to ensure continuity. Wire nuts shall not be used. A waterproof or corrosion-proof connector for direct bury applications shall be used. After installation, the tracer wire shall be tested to verify continuity of the tracer wire system and a report indicating continuity shall be submitted to the City of Shawnee as part of the as-built construction records.

.01 Direct Buried Facilities: A tracer wire shall be installed in the trench with all direct buried utilities. The tracer wire shall be placed adjacent to or above, but shall not touch the pipe. The tracer wire shall not be wrapped around the facility. The maximum distance from the utility pipe to the tracer wire shall be 6 inches. Non-metallic spacers shall be installed to keep the tracer wire a set distance from the utility.

.02 Trenchless Facilities: A tracer wire shall be provided with all non-metallic pipe installed by trenchless methods. The tracer wire shall be pre-installed in conduits and innerduct or it shall be blown in after conduit or innerduct installation. In the case where conduit or innerduct is not used, the tracer wire shall be installed at the same time as the pipe as an integral part of the pipe installation.

404 REPAIRS: The effectiveness of the detection system is dependent on an uninterrupted and continuous tracer wire. All tracer wire cuts shall be repaired as they occur, enabling continued integrity and functioning of the tracer wire system.

- End of Section -

APPENDIX G

Unified Government Best Practices Implementation

The Unified Government of Wyandotte County/Kansas City, Kansas adopted modifications to their Right-of-Way Management Regulations. This was done administratively. The full regulations can be found on the Internet at <http://www.marc.org/telecom/UG%20ROW%20Regs.pdf>.

Following is the language that appears in the Right-of-Way Management Regulations regarding the specific best practices.

Horizontal Directional Drilling

- 6.9 Horizontal Directional Drilling: Horizontal directional drilling under any street or paved alley shall be at a minimum depth of 4 feet. Additional guidelines are set forth in the HDD Handbook, appendix B.

In-Ground Facility Identification

- 6.4 Tracer wire: New non-metallic underground facilities placed in the right of way shall be accompanied by tracer wire as provided below, tracer wire shall comply with the Unified Government's Technical Provisions and Standard Drawings. Except spot repairs that replace less than 100 feet are not required to have tracer wire.
 - 6.10.1 New nonmetallic underground facilities placed by trenchless methods shall have a tracer wire placed with the underground facility.
 - 6.10.1.1 If conduit or innerduct is used the tracer wire can be preinstalled or blown in after conduit or innerduct installation.
 - 6.10.1.2 If conduit or innerduct is not used then the tracer wire should be installed as integral part of the facility installation.
 - 6.10.2 Tracer wire shall be accessible at least every three hundred feet. Access points may include valve boxes, hand-holes, manholes, vaults or other covered access devices. Access point covers should be clearly marked with the type of facility.

Potholing

- 1.1 Potholing:
 - 1.1.1 Prior to excavating in the public rights-of-way, permittee must pothole to verify existing utilities when the following circumstances are present:

- 1.1.1.1 Whenever an excavation or bore, including one using trenchless technology except CIPP or slip lining, will be within the tolerance zone of an existing underground facility
- 1.1.1.2 Whenever an excavation using trenchless technology except CIPP or slip lining will parallel an underground facility within three feet of that facility, potholing is required every 100 feet.
- 1.1.1.3 Whenever an excavation will be in the vicinity of an area of congested underground facilities.
- 1.1.1.4 Whenever an excavation is within three feet of a hazardous or vital underground facility.
- 1.1.2 The preferred method of excavating a pothole is air vacuum excavation. When air vacuum excavation is not feasible the preferred method of potholing is the use of water vacuum excavation or hand digging. When potholing, exposed underground facilities should be protected and supported. Potholes shall be backfilled in accordance with current Technical Provisions.
- 1.1.3 If potholing reveals incorrectly located lines, permittee must report discrepancy to the facility owner and Kansas One Call along with proper location information.

Design Drawings

- 1.2 Sketch submittal: Driveway, driveway culvert, and individual site excavation permit applications, and multiple site excavation permit applications where work consists of discrete locations, shall be accompanied by a location sketch. If an applicant is a service provider, drawings shall be prepared by a Kansas licensed professional engineer. Information shown shall include at a minimum:
 - 1.2.1 Scaleable drawing showing extents of pavement, curb and sidewalk, building foundation, and a graphic scale and north arrow (such as shown on the plot plan for the property);
 - 1.2.2 The property address, permittee's name and phone number, labels for the adjacent street and an indication of the direction to and name of the nearest cross street;
 - 1.2.3 Location, size and material of proposed improvements;
 - 1.2.4 For an individual site excavation permit, the location of the existing utility mains and the location and presumed size of the excavation;
 - 1.2.5** Sketch shall be legible and line weights and styles, symbols and abbreviations shall be distinct and widely recognized by practitioners in the Kansas City area.

APPENDIX H

Independence Best Practices Implementation

The city of Independence is in the process of reviewing and adopting the following additions to their right-of-way ordinance which will allow them to implement the damage prevention practices.

Definitions

AREA OF CONGESTED UNDERGROUND FACILITIES means any location in the right-of-way where underground facilities are found or are presumed to be in close proximity to one another.

EXCAVATION OR EXCAVATE means any act by which earth, asphalt, concrete, sand, gravel, rock or any other material is cut into, dug, uncovered, removed, displaced, relocated, excavated, tunneled, bored, graded, or bulldozed, and shall include the conditions resulting therefrom of the surface or subsurface material or earth in the right-of-way.

EXCAVATOR means any company or individual that is or will be cutting, digging, excavating, tunneling, boring, grading or in some other manner altering the surface or subsurface material or earth in the right-of-way.

FACILITY OWNER means any owner of an underground facility that is in place or being placed in the rights-of-way of the City.

HAZARDOUS UNDERGROUND FACILITY means any underground facility that if cut or damaged would threaten the lives of the excavators or those in proximity of the cut or damage. These shall include underground electric cables and underground natural gas pipes.

MIS-DESIGNATED FACILITY means any underground facility which is found to be located at a location other than where indicated on drawings or by temporary or permanent locating markers.

NEW UNDERGROUND FACILITY means any facility to be placed in the ground in the right-of-way of the City. A repair of a facility or a replacement or upgrade of a facility may be determined to be a new facility by the Public Works Director or any designee, if they determine that the nature of the replacement or repair lends itself to the inclusion of tracer wire and warning tape

POTHOLING means the practice of digging a test hole to expose underground utilities to ascertain the horizontal and vertical location of the facility.

TOLERANCE ZONE of an underground facility means the strip of land equal to the width of the underground utility, plus two feet (2') on either side.

TRACER WIRE means wire that is placed adjacent to a nonmetallic underground facility in order to facilitate location of the facility. The wire must be a minimum 12 AWG cooper wire coated with a minimum 30-mil polyethylene jacket designed specifically for buried use.

TRENCHLESS TECHNOLOGY means any technology, including horizontal directional drilling, which is used to excavate that does not create a continuous trench along its path.

UNDERGROUND FACILITIES means any pipe, tube, cable, wire, fiber optic line, concrete encasement, or other facility that is placed in the right-of-way and located underground.

VITAL UNDERGROUND FACILITIES means any underground facility that if cut or damaged would have the potential of preventing residents or businesses from contacting emergency services. These shall include underground telephone and fiber optic cables.

WARNING TAPE means tape used to provide excavators warning that they are approaching an existing underground facility. The tape must be made of polyethylene, a minimum 3.5 mils thick, and a minimum of three inches (3") side with black lettering imprinted on a color coded background that conforms to APWA color code specifications.

CONSTRUCTION STANDARDS FOR NEW AND EXISTING FACILITIES.

K. Any excavator prior to excavating in the right-of-way of the City must pothole when the following circumstances are present:

1. Whenever an excavation, including one using trenchless technology, will be within the tolerance zone of an existing underground facility
2. Whenever an excavation using trenchless technology will parallel an underground facility within three feet (3') of that facility, potholing is required every one hundred feet (100').
3. Whenever an excavation will cross existing underground facilities.
4. Whenever an excavation will be in the vicinity of an area of congested underground facilities.
5. Whenever an excavation is within three feet (3') of a hazardous or vital underground facility.

L. The preferred method of excavating a pothole is air vacuum excavation.

1. When air vacuum excavation is not feasible then the preferred method of potholing is the use of water vacuum excavation or hand digging.
2. If water vacuum excavation is used the excavator shall make sure to take adequate precautions to protect existing underground facilities.

M. If an excavator decides to use a backhoe to pothole this should only be done while using proper procedures, including the use of a spotter.

- N. Prior to potholing, the State one-call system shall be contacted.
- O. A mis-designated facility or one that is not located should be reported to the facility owner and the one-call system along with property location information.
- P. When potholing, exposed underground facilities should be protected and supported.
- Q. Any facility owner and any excavator placing a new nonmetallic underground facility in the public rights-of-way of the City by direct burial is required to place a Tracer Wire and Warning Tape with the underground facility.
1. Tracer Wire shall be placed no further than six inches (6") to the side or above the facility, but not in-touch with the facility.
 2. Warning Tape shall be placed twelve to eighteen inches (12"-18") above the facility and at least six inches (6") below grade.
 3. The Warning Tape shall be identified with the type of utility and the name of the owner of the facility. The background color of the Warning Tape shall conform to the American Public Works Association color identification system for type of utility.
- R. Any facility owner and any excavator placing a new metallic underground facility in the public rights-of-way of the City by direct burial is required to place Warning Tape with the underground facility.
1. Warning Tape shall be placed twelve to eighteen inches (12"-18") above the facility and at least six inches (6") below grade.
 2. The Warning Tape shall be identified with the type of utility and the name of the owner of the facility. The background color of the Warning Tape shall conform to the American Public Works Association color identification system for type of utility.
- S. Any facility owner and any excavator placing a new nonmetallic underground facility in the public right-of-way of the City by trenchless methods is required to place a Tracer Wire with the underground facility.
1. If conduit or innerduct is used the tracer wire can be preinstalled or blown in after conduit or innerduct installation.
 2. If conduit or innerduct is not used then the tracer wire should be installed as an integral part of the facility installation.
- T. Any facility owner or excavator placing tracer wire with the construction of an underground facility per this Article will assure that the tracer wire is accessible at least every three hundred feet (300').
1. Access points may include valve boxes, hand-holes, manholes, vaults or other covered access devices. Access point covers should be clearly marked with the type of facility.
- U. While digging in the right-of-way of the City any excavator cutting a tracer wire must:

1. Notify the owner of the facility.
2. Notify the Public Works Director of the City.
3. Repair the tracer wire according to specifications provided by the Public Works Director of the City.

V. The Public Works Director, or any designee, may approve other permanent identification techniques requested by the facility owner or excavator if the Public Works Director determines that the alternative technique will provide equal or greater protection.”

APPENDIX I

Implementation by Other Cities

The City of Overland Park has used Horizontal Directional Drilling Guidelines for several years. The guidelines are stipulated through the city's "Manual of Infrastructure Standards for Right of Way Restoration," which is specified in the city's right-of-way ordinance. The Overland Park Horizontal Directional Drilling Guidelines Handbook can be found on the web at http://www.opkansas.org/Documents_&_Forms/hdd_guidelines.pdf. The city's right-of-way ordinance can be found on the Telecommunications Consortium document page on the web at <http://www.marc.org/telecom/telecomdocs.htm>.

A number of other cities are implementing the damage prevention practices informally using authority provided to the public works director or city engineer through their right-of-way ordinance. This authority allows the public works director or city engineer to set right-of-way excavation standards. Copies of right-of-way ordinances used by Kansas City metropolitan communities can be found on the Telecommunications Consortium document page on the web at <http://www.marc.org/telecom/telecomdocs.htm>.

APPENDIX J HOMEOWNER EDUCATION MATERIAL

Call before you dig-it's the law

Missouri One Call 1-800-DIG-RITE (Kansas One Call 1-800-DIG-SAFE)

The spring season brings home construction and gardening projects in full force and homeowners should remember they are required by law to contact the One-Call notification center before they begin any digging with motorized equipment. Even when hand digging, a person is encouraged to call if he/she is unfamiliar with the location of underground utilities.

Calling the state's One-Call system only takes a few minutes and is free. The answering attendant will ask the caller a series of questions such as: contact information; exact digging location; and how long the digging will take place. Being prepared to make the call will save the caller time and it can increase the accuracy of the locate from the utility company. Once a call is made to One-Call, the caller must wait 48 hours or two working days before beginning excavation. It is during this period the utility companies are notified of the intent to excavate by the One-Call system.

(Kansas residents must also call the local water and sewer utility and have them locate their lines on your property.)

After the One-Call system has contacted the local utility companies, they will locate their underground facilities for the homeowner within 48 hours. The utilities will use a combination of colored paint and flags in accordance with the color code established by the American Public Works Associations or APWA. The colored flags symbolize: red is electric, yellow is gas-oil-steam lines, orange is communications (cable, TV, telephone), blue is water, green is sewer, purple is reclaimed water/irrigation, pink is temporary survey markings, and white is for proposed excavation. Homeowners should not hesitate to call their utility company if they have a problem with the markings or don't understand what they mean.

Only after the underground utilities have been located and marked can careful digging begin. Diggers should be aware that the utility markings are estimates of the exact location of the underground facility. Locators have a 2-foot "buffer zone" where diggers must hand dig to expose that facility for positive location. If an underground facility gets hit or damaged, 9-1-1 must be called immediately and the utility owner notified of the damage.

Missouri (Kansas) One-Call are the one-call notification center established to inform all area underground facility operators of intended excavation. Residents should use this free communication link with underground facility owners to both decrease the risk of personal injury and the risk of damaging underground facilities. Remember, using the Missouri (Kansas) One-Call programs is not just a good idea — it's the law.