RECLAMATION

Managing Water in the West

Norman Project
Del City Raw Water Pipeline Improvement Project
Finding of No Significant Impact and Environmental Assessment

Norman Project, Oklahoma
Great Plains Region
19-02-OK-NO

U.S. Department of the Interior
Bureau of Reclamation
Great Plains Region
Oklahoma-Texas Area Office

February 2019

Mission Statements

The mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian Tribes and our commitments to island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

FINDING OF NO SIGNIFICANT IMPACT

Norman Project, Oklahoma
Great Plains Region

FONSI# 19-02-OK-NO

INTRODUCTION

National Environmental Policy Act of 1969, as amended (NEPA) requires federal agencies to integrate environmental consideration into their decision-making processes by considering the environmental impacts of their proposed actions and reasonable alternatives to those actions. Based on the scope of the proposed project, it was determined that an environmental assessment (EA) would be necessary to evaluate impacts of the proposed project, and to determine whether, (1) a Finding of No Significant Impact (FONSI) may be issued or (2) impacts were significant and warrant preparation of an Environmental Impact Statement.

In compliance with NEPA, the Bureau of Reclamation (Reclamation) has completed an EA associated with the Proposed Del City Raw Water Pipeline Improvement Project, as proposed by Central Oklahoma Master Conservancy District (COMCD). The Proposed Action would rehabilitate and replace approximately 33,900 linear feet (LF) of 18 to 21 inch diameter gasketed, reinforced concrete pipe portions of the existing Del City Pipeline, excluding approximately 7,000 LF of the pipeline which is located within the boundary of Tinker Air Force Base (AFB). The purpose of the proposed project is to address recurring pipeline operation and maintenance activities along the portion of the Del City Pipeline between the COMCD Relift Pumping Station (PS) and the Del City Water Treatment Plant (WTP) excluding the section of the pipeline within the Tinker AFB property.

BACKGROUND

The Del City Pipeline is an existing raw water pipeline that conveys raw water from Lake Thunderbird to the Del City WTP. The Del City Pipeline was constructed in the 1960s. Initial construction of the pipeline was conducted via open cut trench installation, which required clearing of permanent and temporary easement areas along the length of the alignment. The existing pipeline is compliant with Oklahoma Department of Environmental Quality (ODEQ) regulations regarding Public Water Supply Construction Standards. However, due to a number of factors including unusual soil conditions and age of the pipeline, the pipeline has been prone to point failures and circumferential cracking. These failures have necessitated over 300 point repairs in the approximately 50 years that the pipeline has been in service. In recent years, these cracks have necessitated continuous repairs on the pipeline and provide a significant risk to COMCD and Del City's raw water supply. The continuous repairs also place an undue strain on COMCD's annual operational budget and dedicated man-power. Many of these point

repairs continue to be in the dense residential neighborhoods built in close proximity to the pipeline, which increases the cost of the repairs and directly impacts the adjoining residents. The repairs require repeated ground disturbance including excavation to expose the damaged areas to repair the leaks, which result in periodic interruptions in water service to the Del City's customers. Because of the extensive number of repairs, the pipeline continues to have high operations and maintenance costs.

ALTERNATIVES

The EA analyzes the No Action Alternative and the Proposed Action Alternative of implementing the Del City Raw Water Pipeline Improvement Project.

CONCLUSIONS OF FACT

Based on the evidence presented in the Final EA, Reclamation has drawn the following conclusions about the potential impacts of the proposed action:

1. **Controversial effects**
   The nature and extent of the potential impacts to the quality of the human environment from the Proposed Action are not considered controversial. Reclamation provided the opportunity to comment during the 30-day public comment period, none were received.

2. **Public Health/Safety**
   The Proposed Action would reduce the risk of water waste and/or potential contamination due to pipeline failure. Construction methods and safety measures will comply with all applicable regulations and a traffic control plan would be in implement if necessary. The Proposed Action will not have significant impacts on public health and safety.

3. **Natural Resources and Unique Geographical Features**
   Temporary construction measures associated with pipeline replacement and reroute would be coordinated with Del City to mitigate risk of interrupting water supply. Normal reservoir operations are acceptable during construction, and it does not appear that reservoir operations need to be altered to facilitate reasonable construction or a reasonable schedule.

   There is no reasonably foreseeable or significant changes to the current uses of land within the area.

4. **Uncertain Impacts**
   Based on existing information, the nature and extent of the potential impacts to the quality of the human environment from the Proposed Action are known with a

high degree of certainty, and that there are no unique risks associated with any aspect of the Proposed Action.

5. **Precedent**
   The Proposed Action would not establish a precedent for future actions with significant effects or represent a decision in principle about a future consideration.

6. **Cumulative Impacts**
   The Proposed Action is not related to other actions with individually insignificant but cumulatively significant impacts.

7. **Historical/Cultural Resources**
   The State Historic Preservation Officer has concurred with a no adverse impacts determination associated with the Proposed Action. The majority of the Proposed Action will utilize the previously disturbed pipeline easement. All areas outside the existing easement have been surveyed for potential cultural resources.

8. **Threatened or Endangered Species**
   The Proposed Action would have no effect to any threatened or endangered species or critical habitat.

9. **Federal, State, Local, or Tribal Laws**
   COMCD will comply with all applicable laws and obtain all necessary permits. As a result no Federal, State, or local laws will be violated

10. **Indian Trust Assets**
    The Proposed Action would not affect tribal water rights or Indian Trust Assets.

11. **Socioeconomics/Environmental Justice**
    The cost for the Proposed Action would be distributed based on the original percentage of the project for each City served by COMCD. COMCD and their respective Cities retain the authority to set rates with no Federal involvement. No significant natural resource or socioeconomic impacts adversely affecting minority and low-income populations have been identified. Therefore, there are no environmental justice impacts.

12. **Sacred Sites**
    Affiliated tribes associated with the project area were consulted and no response

was received. Therefore, the proposed project would have no affect Indian sacred sites.

13. **Noxious or Invasive weeds**

It is reasonably foreseeable that vegetation would transition to a state similar to that of preconstruction. In addition, it is reasonably foreseeable that routine operations and maintenance will further aid in the control of noxious or invasive weeds.

FINDING OF NO SIGNIFICANT IMPACT

Based on the evidence presented in the EA and upon the conclusions of fact presented above, Reclamation has determined that the Proposed Action would not individually or cumulatively have significant effects on the quality of the human environment; therefore, an Environmental Impact Statement is not warranted.

Approved: _____ Date: 2/14/19

Mark A. Treviño, Area Manager

ENVIRONMENTAL ASSESSMENT

for

CENTRAL OKLAHOMA MASTER CONSERVANCY DISTRICT

PROPOSED DEL CITY RAW WATER PIPELINE IMPROVEMENTS PROJECT

OKLAHOMA COUNTY, OKLAHOMA

FEBRUARY 8, 2019

Prepared by:

Alan Plummer Associates, Inc.
414 NW 4th Street, Suite 150
Oklahoma City, Oklahoma 73102

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I INTRODUCTION

1.1 Project Description and Background

The Del City Pipeline supplies raw water to Del City, but most of the pipeline is contained within the city limits of Oklahoma City and property associated with Tinker Air Force Base (AFB). The pipeline begins at the Del City Water Treatment Plant (WTP) located on the north side of Southeast 44th Street and travels southeast through neighborhoods for approximately 8,400 linear feet (LF) until it reaches SE 59th Street. This segment will be referred to as Line 1. The pipeline crosses SE 59th Street and trends south and east across an undeveloped property for approximately 4,300 LF before crossing South Air Depot Boulevard and entering property associated with Tinker AFB. This segment of the pipeline between SE 59th street and Tinker AFB will be referred to as Line 2. The pipeline crosses Tinker AFB for approximately 7,000 LF. The pipeline exits Tinker AFB's eastern boundary and travels east and southeast for approximately 14,200 LF where it crosses Interstate Highway 240 (I-240) concluding at the Central Oklahoma Master Conservancy District (COMCD) Relift Pump Station (PS). The segment between Tinker AFB's eastern boundary and the COMCD Relift PS will be referred to as Line 3. A general location map for the proposed project is provided as Figure A-1 in Appendix A. The proposed pipeline superimposed onto the U.S. Geological Survey map Choctaw and Midwest, Oklahoma quadrangles is included as Figure A-2 in Appendix A. Current and historical aerial photographs from 2017, 2008, and 1975 showing current and historic land use changes in the project vicinity are included as Figures A-3 through A-5 in Appendix A respectively.

The Del City Pipeline is an existing raw water pipeline that conveys raw water from Lake Thunderbird to the Del City Water Treatment Plant. The COMCD provides the cities of Del City, Midwest City, and Norman, Oklahoma with municipal and industrial water from Lake Thunderbird. COMCD proposes to rehabilitate portions of the existing Del City Pipeline and replace other portions of the Del City Pipeline. The length of the existing Del City Pipeline is approximately 33,900 linear feet (LF) of 18- to 21-inch diameter gasketed, reinforced concrete pipe (RCP). Approximately 7,000 LF of the pipeline is located within the boundary of Tinker AFB and is excluded from this project.

The Del City Pipeline lies within an existing easement, which is owned by the United States Bureau of Reclamation (USBR). A portion of the Line 2 segment of the pipeline is proposed to be realigned around the boundary of a property it currently traverses diagonally. This property, which lies between SE 59th Street and South Air Depot Boulevard, is undeveloped and currently in agricultural production (wheat and hay). The rerouting of the pipeline around the boundary of the property would avoid conflicts with future development of the property. The proposed rerouting of this segment of the pipeline would increase the length from 4,300 to approximately 4,800 linear feet and would require purchase of additional easement, which, in turn, would be transferred to the USBR and become part of the Federal Easement.

The existing Del City Pipeline was constructed in the 1960s. Initial construction of the pipeline was conducted via open cut trench installation, which required clearing of permanent and temporary easement areas along the length of the alignment. The existing pipeline is compliant with Oklahoma Department of Environmental Quality (ODEQ) regulations regarding Public Water Supply Construction Standards. However, due to a number of factors including unusual soil conditions and age of the pipeline, the pipeline has been prone to point failures and circumferential cracking. These failures have necessitated over 300 point repairs in the approximately 50 years that the pipeline has been in service. In recent years, these cracks have necessitated continuous repairs on the pipeline and provide a significant risk to COMCD and Del City's raw water supply. The continuous repairs also place an undue strain on COMCD's annual operational budget and dedicated man-power. Many of these point repairs continue to be in the dense residential neighborhoods built in close proximity to the pipeline, which increases the cost of the repairs and directly impacts the adjoining residents. The repairs require repeated ground disturbance including excavation to expose the damaged areas to repair the leaks, which result in periodic interruptions in water service to the City's customers. Because of the extensive number of repairs, the pipeline continues to have high operations and maintenance (O&M) costs. On average, around five breaks occur annually and the average cost for repair for each break is approximately $6,000.00. Some repairs were made under pressure and there was no disruption of service. However, there were times (and it is reasonably foreseeable that there will be times in the future) when the water was shut down, which typically lasts for 4-5 hours (based on personal communication with COMCD staff); thereby disrupting service.

The cost for the Proposed Action would be distributed based on the original percentage of the project for each City served by COMCD. COMCD and their respective Cities retain the authority to set rates with no Federal involvement. All three Cities would participate in the costs for the Proposed Action and each City's rate payers would absorb the costs through water rate adjustments. However, the cost of the proposed action would not alter the rate structure determination process. The cost of the No Action Alternative would be speculative but it is anticipated that the rate of repairs required would at least continue at the same rate and potentially may increase as the pipeline continues to age.

1.2 Regulatory Requirements

1.2.1 Federal

The proposed project would be constructed almost entirely within the existing pipeline's easement, which is owned by the USBR. The segment referred to as Line 2 would be rerouted outside of the existing USBR easement. Because portions of the proposed project would take place within the USBR owned easement, the project must be approved by USBR, which constitutes a federal action and therefore must comply with National Environmental Policy Act (NEPA) requirements. This Environmental Assessment (EA) has been prepared in compliance with NEPA to evaluate and disclose the potential impacts to the human or natural environment associated with the Proposed Action. Pursuant to NEPA, results of this analysis will be utilized to determine whether a Finding

of No Significant (FONSI) or and Environmental Impact Statement (EIS) must be prepared.

1.2.2 State

The proposed project would need to comply with Oklahoma's State Historical Preservation Office requirements, Oklahoma Department of Transportation coordination, and applicable Oklahoma Department of Environmental Quality regulations.

1.2.3 Other Guidance

Local construction related ordinances and regulations such as a traffic control plan would need to be addressed as part of the proposed project.

1.3 Scoping and Issues

No formal scoping notice or scoping meeting (public or cooperating agencies) has been initiated for the project. Although no public notice regarding project scoping has been issued or scoping meeting held, Alan Plummer Associates, Inc. (APAI), (engineering consultant for COMCD) and COMCD distributed letters to the owners of all parcels being surveyed along the pipeline alignment and the proposed alignment modification along the boundary of one property within the Line 2 segment. The letters informed the property owners of the nature of the project and that surveyors would be accessing the existing easement on their property. These letters instructed any community members with questions or concerns to contact APAI directly. APAI has received only limited concerns from landowners related to survey access. A copy of this correspondence is provided in Appendix B.

1.4 Purpose of and Need for the Proposed Project

The purpose of the proposed project is to address recurring pipeline operation and maintenance (O&M) activities along the portion of the Del City Pipeline between the COMCD Relift PS and the Del City WTP excluding the section of the pipeline within Tinker AFB property. COMCD provides the cities of Del City, Midwest City, and Norman, Oklahoma with municipal and industrial water from Lake Thunderbird. The City of Del City has received surface water from Lake Thunderbird since it's completion in 1965. The existing pipeline, which conveys water from the COMCD Relift PS to the Del City WTP, has experienced numerous failures resulting in interrupted water service, loss of water supply, repeated ground disturbance, and potential contamination of source water. Over the past 50+ years, point failures and circumferential fractures in this pipeline have necessitated over 300 point repairs, which have resulted in high O&M costs over its lifetime. Many of these repairs are located within residential neighborhoods, which have been developed over or are in close proximity to the existing pipeline.

The proposed project is being engineered to have a 50-year design life. The population of Del City is projected to remain steady and recent population trends do not indicate a high

likelihood of substantial future population growth. Oklahoma Department of Commerce (OKDOC) projections show that Oklahoma County will grow by 0.69% annually over the next 65 years (OKDOC). Del City is completely surrounded by other municipalities; therefore it is unlikely that much of the projected population growth in Oklahoma County will be within Del City.

COMCD and Del City have not experienced water supply capacity issues at the current 5.25 MGD WTP. Future needs are not anticipated to increase due to flat population and commercial growth projections, as well as projected increases in water efficiency. Accordingly, the current pipeline capacity should be enough for projected future capacity requirements of Del City.

The proposed project is needed in order for COMCD to be able to allocate adequate time and resources to other important infrastructure projects besides addressing Del City Pipeline failures. Rehabilitation of existing sections, replacement of an existing section, and installation of a newly routed segment could help alleviate the resources and time that COMCD currently uses on repairs to the Del City Pipeline.

II DESCRIPTION OF ALTERNATIVES

2.1 No-Action Alternative

Extensive maintenance repairs on the existing Del City pipeline have been required over its lifetime due to point failures and age of the pipeline. Many of the repairs must be made on sections of the pipeline within residential neighborhoods, which increases repair costs and impacts adjacent residents. The No Action Alternative would continue to be a burden on COMCD staff's time and resources that could be used for other critical infrastructure projects. In addition, the breaks along the existing pipeline result in loss of water supplies needed to support the general public.

2.2 Alternative 1 – Proposed Action

Since the Proposed Action concerns an in-service pipeline, correcting deficiencies in the existing water system in an economical manner that would be least disruptive to the residents along the pipeline alignment and the water customers was of utmost importance when considering alternatives. Much of the pipeline lies within an existing easement wide enough to use open cut installation methods to place a new pipeline adjacent to the existing pipeline without major disruption to the public or to individual landowners. In these sections, open cut installation is the most economical option and can be constructed adjacent to the existing pipeline while it remains in service.

However, portions of the existing pipeline right of way are constricted by development. For example, Line 1 of the project runs directly through two single-family residential neighborhoods and is relatively inaccessible without major disruption to the surrounding residents. It is the Engineer's opinion that this section of the existing pipeline should be rehabilitated using some form of trenchless rehabilitation. In Frolich Meadows Estates (residential development), located north of SE 59th Street, the existing pipeline is located in an existing 20-foot wide easement running through front yards of houses on the east side of Ventura Drive. Replacement would require significant additional easement as well as replacement of half of the existing street and significant extended disruption to the residents of the neighborhood. Another example is in the Parkview neighborhood to the west of Sooner Road. The existing pipeline is in a variable width easement (20 feet to 66 feet wide) running through the backyards of approximately 50 houses.

Replacement of this section of the pipeline would also mean significant disruption to residents as well as potential damage to amenities located within the easement. Even though trenchless methods are generally more expensive than open cut construction when compared on a linear foot basis, the limited easement width and the restoration costs increase the open cut linear foot costs significantly. Further, the trenchless rehabilitation can usually be completed in several weeks whereas the open cut replacement could take months of continued disruption to the residents.

The method chosen for the Line 1 segment of the project was compressed fit HDPE Lining combined with Cured in Place Pipe (CIPP) where necessary due to bend

restrictions. COMCD originally pursued rehabilitating a portion of the existing waterline with a compressed fit liner in 2012. At that time, compressed fit HDPE lining was considered unfeasible due to additional head loss imposed on the system by the diameter reduction of the liner. However, the additional head loss caused by the compressed fit liner would be counteracted by replacing the rest of the 21-inch pipeline with upsized ductile iron pipe installed via open cut. The existing 21-inch diameter pipeline is less common and more costly; therefore increasing the diameter to 24-inches is also more cost effective. With the upsized pipe diameter installed downstream of the slip-lined section, the overall head loss of the rehabilitated pipeline should actually be lower than before rehabilitation. Additionally, compressed fit HDPE liners can be installed in lengths of up to 3,000 LF between insertion pits, versus the maximum of approximately 500 LF for pressure CIPP. This should allow the contractor flexibility to place pits in locations that would be easily accessible and limit disruptions to neighborhoods.

The Line 2 segment would be rerouted to the property boundary of the same tract and outside of the existing USBR easement, which currently bisects the middle of an undeveloped tract of land that is in agricultural production. This would increase the length of the Line 2 segment from approximately 4,300 LF to approximately 4,800 LF. The routing of this section of the alignment to the edges of the property would minimize conflicts with future development of the property. Line 2 would be installed via open cut construction techniques, and all areas would be returned to pre-construction contours. This new section would require the acquisition of an additional easement from the landowner, which would then become part of the Federal (USBR) Easement.

The majority of the Line 3 segment, approximately 13,000 LF from Tinker AFB to a wooded area north of I-240, would be instilled via open cut. The remaining approximately 1,000 LF of the Line 3 segment (the area approaching I-240 to the pipeline's terminus at the COMCD Relift PS) would be constructed via the same compressed fit HDPE Lining method used for the Line 1 segment installation.

2.3 Alternatives Considered but Eliminated from Further Analysis

Alternative methods considered but not selected for the trenchless replacement/rehabilitation sections of the pipeline included pipe bursting, CIPP, and traditional slip-lining. Pipe bursting was deemed impractical for this project, because steel clamps at several spots along the pipeline would have to be removed. Locating and removing these clamps would require greatly increased disruptions to residents as well as increased costs and installation times.

CIPP was deemed impractical due to the required materials and installation costs and processes. Using the CIPP method, installation length is limited to approximately 500 LF, and the proposed project has sections of up to 2,500 LF in developed residential neighborhoods. CIPP would require several pits to be placed in residential yards, resulting in increased costs and disruptions to the public.

Traditional slip-lining was considered but ultimately eliminated. Traditional slip-lining involves pulling a smaller pipe "liner" into an existing larger-diameter pipe. This method works well for large diameter pipelines, but the pipeline sizing of the existing pipeline is only 18 to 21 inches in diameter. The reduction in diameter that would result from using traditional slip-lining would reduce the flow capacity for the pipeline to unacceptable levels.

III AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

3.1 Air Quality

The regional climate of Del City, Oklahoma is characterized as humid subtropical with relatively high temperatures and evenly distributed precipitation throughout the year. According to the National Climatic Data Center's (NCDC) 1981-2010 climate normals for Oklahoma City Will Rogers World Airport, OK US, the region has a mean annual temperature of 61.5º Fahrenheit (F) (NCDC, 2018). The warmest months of the year are from June through August, while the coolest are from November through March. Mean daily highs and lows in winter of 51.5º F and 30.7º F, respectively (NCDC, 2018). Mean daily temperatures in summer are 91.8º F and 70.5º F, respectively (NCDC, 2018). Prevailing winds in the area are from the south/southeast.

3.1.1 No Action Alternative

Under the No Action Alternative, existing conditions would remain unchanged with recurring pipeline failures requiring periodic construction activities associated with repairs. Implementation of the No Action Alternative would result in temporary de minimis increases in air emissions associated with periodic construction activities associated with repairs for pipeline breaks. During construction of repairs, an increase in NOx, SO_2, and CO exhaust emissions from construction equipment would be expected. However, exhaust emissions would abate following the conclusion of the construction. No long term exhaust emissions are anticipated from these repair activities.

Fugitive dust emissions would likely occur during repair activities. However, dust control measures (i.e., water trucks) would be employed during construction periods to minimize fugitive dust. Any increases in dust emissions would likely be considered minimal and subside following completion of repair construction. No long term dust emissions are anticipated.

The No Action Alternative would not have a long term or short term adverse effect on air quality.

3.1.2 Proposed Action

The Proposed Action would also not have a long term or short term adverse effect on air quality. During project construction, an increase in NOx, SO_2, and CO exhaust emissions from construction equipment would be expected. However, exhaust emissions would abate following the conclusion of construction. No long term exhaust emissions are anticipated from the implementation of the Proposed Action.

Fugitive dust emissions would likely occur during the project construction duration. However, dust control measures (i.e., water trucks) would be employed during the construction period to minimize fugitive dust. Any increases in dust emissions would

likely be considered minimal and subside following construction completion. No long term dust emissions are anticipated from implementation of the proposed project.

There is no indication that the Proposed Action would lead to expanded population growth beyond current projections. Therefore, impacts to air quality resulting from the projected population growth would not be attributable to the proposed project.

No significant short term, long term, direct, indirect, or cumulative adverse effect on air quality would be anticipated.

3.2 Water Resources

The existing pipeline lies within the Federal easement which is routinely maintained primarily through mowing two to four times per year. Young woody regrowth exists along the edges of stream crossings where mowing is impeded.

Construction on the water supply pipeline whether due to pipeline failures or planned activities have the potential for interruptions of water supplies to customers. Planned construction activities enable greater control over scheduling of downtimes and implementation of measures to mitigate loss of water and protection of water quality.

3.2.1 No Action Alternative

Under the No Action Alternative, existing conditions would remain unchanged. It is anticipated that with the No Action Alternative extensive maintenance repairs on the existing Del City pipeline would continue to be required due to point failures and age of the pipeline. These failures would have direct and indirect impacts to water resources due to loss of water supply and potential points of water supply contamination as well as potential interruptions in water service to the City customers.

3.2.2 Proposed Action

The proposed action involves the rehabilitation and replacement of portions of an existing pipeline which conveys raw water from Lake Thunderbird to the Del City WTP. The proposed project does not involve changes to existing water rights permits or additional demands on water resources. During construction, water supply interruptions to customers would be scheduled to minimize downtimes and customers would be notified when downtimes would occur. Coordination with Del City during construction would enable shutdown of raw water delivery through the pipeline for two to three weeks without interruption of service to customers. However, longer shut down times would need to be scheduled in late fall or winter. Therefore, no significant short term, long term, direct, indirect, or cumulative environmental consequences are anticipated for the Proposed Action that would affect water resources.

3.3 Public Safety & Noise

Vehicular and air traffic in the vicinity of the existing easement represent the primary sources of noise at the project site.

3.3.1 No Action Alternative

Under the No Action Alternative, existing conditions would remain unchanged. Periodic pipeline failures would require temporary construction activity for repairs which would create localized, temporary noise impacts from construction equipment/vehicles comparable to those associated with the construction of the Proposed Action, as described in Section 3.3.2. However, construction activities associated with repairs would be anticipated to increase over time as the pipeline continues to age. In addition, construction activities associated with repairs are more difficult to schedule during normal weekday daylight or business hours. Therefore, implementation of the No Action Alternative would result in comparable or increased cumulative noise impacts.

3.3.2 Proposed Action

The proposed action would comply with all federal, state, and local safety requirements. Proper construction methods and safety precautions would be taken during project construction, and a traffic control plan would be in effect if necessary. The project would result in fewer instances of water waste and/or potential contamination due to pipeline failures.

Construction and ground-disturbing activities would create localized, temporary noise impacts from construction equipment/vehicles. These vehicles and equipment can typically generate noise levels of approximately 80 to 89 dBA at approximately 50 ft (USDT FHWA, 2006). These noise levels would not be significantly higher than baseline noise levels measured from existing roadways in the immediate vicinity of the project. Subsequent impacts on noise sensitive areas (NSAs) would vary depending on the type, number, and loudness of equipment in use at any given time. Table 1 presents typical noise levels (dBA at 50 feet) that the Federal Highway Administration has estimated for the main phases of outdoor construction. With multiple items of equipment operating concurrently, noise levels would be greater than 62 dBA during daytime periods at locations within several hundred feet of an active construction site. Table 1**:** Noise Levels Associated with Outdoor Construction

Table 1: Noise Levels Associated with Outdoor Construction

Construction Phase	Leq (dBA) at 50 feet from Source
Ground Clearing	84
Excavation, Grading	89
Foundations	78
Structural	85
Finishing	89

Source: USDT FHWA, 2006

The zone of high construction noise levels typically extends to distances of 400 to 800 feet from the site of heavy equipment operations. Residences within 800 feet of a construction site would experience temporary, but appreciable, noise during the construction phase. Locations more than 800 feet from construction sites seldom experience substantial levels (greater than 62 dBA) of construction noise. For NSAs closer than 5,000 feet (1,525 meters) (approximately 1 mile) to a construction site, construction noise would be audible, but distant. The overall impacts from construction noise would be minor and, due to the extended period of construction, of moderate duration.

During construction, BMPs and applicable municipal and federal regulations with respect to noise would be observed. BMPs would include the following:

- Limiting construction primarily to normal weekday daylight or business hours, specifically in areas adjacent to noise sensitive land-uses such as residential areas;
- Ensuring construction equipment mufflers are properly maintained and in good working order; and
- Coordinating with residence owners and/or tenants prior to unavoidable construction activities directly adjacent to established residential areas.

Future sources of noise would include roadway traffic comparable to existing conditions. Population density within the immediate vicinity of the proposed project is not expected to increase as a result of the project.

Access to the proposed project site would be controlled by the construction contractor according to the Traffic Control Program/Plan. This program would specify the exact precautions to be taken to control access during construction as well as traffic along existing transportation rights-of-way. Construction traffic to the construction areas outside of residential areas would be restricted to daylight hours, and public entrance would not be allowed. Trenchless technology is proposed for rehabilitation of the portions of pipeline within residential neighborhoods to minimize potential impacts to local citizens and also to protect public safety.

Implementation of the Proposed Action would result in less than significant impacts to noise. Therefore, no significant short term, long term, direct, indirect, or cumulative impacts are anticipated for the proposed action relevant to noise.

3.4 Wetlands and Other Waters of the U.S., Riparian Areas, and Aquatic Habitats

The existing pipeline lies within two adjacent hydrologic units. The 8-digit Hydrologic Unit Codes (HUC) involved are 11090203 (Little Watershed) and 11100302 (Lower North Canadian Watershed). Water features along the existing and proposed alignment encountered within the Little Watershed include West Branch Hog Creek and three unnamed tributaries to Stanley Draper Lake, which is an impoundment of East Elm Creek. Water features along the existing and proposed alignment encountered within the Lower North Canadian Watershed include Crutcho Creek and two unnamed tributaries to Crutcho Creek. The existing pipeline lies within the Federal easement which is routinely maintained primarily through mowing. Young woody regrowth exists along the edges of stream crossings where mowing is impeded.

In reviewing the Federal Emergency Management Agency's (FEMA) flood insurance rate map (included as Figure A-6 in Appendix A), select portions of the existing and proposed pipeline alignment encounter the following delineated flood zones: Zone A and AE (100-year floodplain delineation), Regulatory Floodway, and Zone X (500-year floodplain delineation). These include 100-year floodplains and regulatory floodplains associated with Crutcho Creek, unnamed tributaries to Crutcho Creek, East Elm Creek, and unnamed tributaries to East Elm Creek.

The National Hydrography Dataset (NHD) and National Wetland Inventory (NWI) dataset were also reviewed to identify potential aquatic resources within the investigation area. The NHD identified tributaries to Crutcho Creek and Crutcho Creek, and tributaries to Stanley Draper Lake (East Elm Creek). The NHD also identified West Branch Hog Creek. No open water areas within the investigation area were identified by the NHD dataset. The NWI dataset identified the majority of the aforementioned streams located within the investigation area. The NWI dataset classified these streams as Riverine, Intermittent, Streambed, Seasonally Flooded (R4SBC). The NWI map also identified Crutcho Creek and East Elm Creek as being a freshwater forested/shrub system (PFO1A – Palustrine, Forested, Broad-Leaved Deciduous, Temporarily Flooded). Figures A-7 and A-8 include the NHD and NWI delineated features in relation to the investigation area respectively.

In order to meet the requirements of Section 404 of the Clean Water Act, a wetland and waters of the U.S. determination (wetland delineation) was conducted for the proposed project area. Available resources were used to identify potential waters of the U.S. These resources included but were not limited to U.S. Geological Survey topographic maps, aerial photographs, soil survey maps and the NHD and NWI resource maps. An on-site investigation of the project area was performed on November 14, 2017 to physically delineate waters of the U.S. The results from the on-site investigation were summarized into a Preliminary Jurisdictional Determination (PJD) report, which is included in Appendix C, and the results of the PJD are included in Table 2 below:

Table 2: Delineated Aquatic Resources Within the Proposed Project Area

Identification	Aquatic Resource	Crossing Method	Flow Regime	Width at OHWM (Feet)	Length (Feet)	Area (Acres)
Stream 1	Unnamed Tributary to Crutcho Creek	Slip Line	Intermittent (Channelized)	20	50.8	0.02
Stream 2	Crutcho Creek	Slip Line	Intermittent with Perennial Pools	14	45.2	0.01
Stream 3	Unnamed Tributary to Crutcho Creek	Open Cut	Intermittent (Channelized)	18	43.3	0.02
Stream 4	Same Tributary as Stream 3 (2nd Crossing)	Open Cut		18	59.7	0.02
Stream 5	Unnamed Tributary to East Elm Creek (Stanley Draper Lake)	Open Cut	Ephemeral	3	43.6	0.003
Stream 6	Unnamed Tributary to East Elm Creek (Stanley Draper Lake)	Open Cut	Ephemeral	5	45.3	0.005
Stream 7	East Elm Creek (Impounded by Stanley Draper Lake)	Open Cut	Ephemeral	12	171.1	0.05
Stream 8	Unnamed Tributary to East Elm Creek (Stanley Draper Lake)	Open Cut	Ephemeral	5	53.3	0.006
Stream 9	Unnamed Tributary to East Elm Creek (Stanley Draper Lake)	Open Cut	Ephemeral	10	40.6	0.009
Forested Wetland	Forested Wetland in former location of West Branch Hog Creek	Slip Line	Forested Wetland	N/A	N/A	0.1
Total					**552.9**	**0.243**

3.4.1 No Action Alternative

Construction activities required for repairs to the existing pipeline would be conducted in a manner to restore pre-construction contours upon construction completion and avoid impacts to streams and wetlands to the extent practicable. The streams and wetland feature listed in Table 2 would fall under the jurisdiction of the U.S. Army Corps of Engineers (USACE) under Section 404 of the Clean Water Act. The USACE authorizes the discharge of dredged or fill materials by administering individual or general permits, which include nationwide permits for routine activities. Construction activities associated with repairs should be authorized under Nationwide Permit 12 for Utility Line Activities without requiring pre-construction notification with the USACE. While some temporary impacts to aquatic resources may occur during construction activities associated with pipeline repairs, no permanent adverse impacts to the delineated aquatic resources would

occur since disturbed areas would be returned to pre-construction contours after completion of construction. Therefore, the No Action Alternative would have no significant short term, long term, direct, indirect, or cumulative environmental consequences to floodplains or aquatic resources along the pipeline alignment.

3.4.2 Proposed Action

After construction of the Proposed Action, the project area would be returned to pre-construction contours. Therefore, the Proposed Action would result in no permanent impacts to floodplain elevations. Construction of the Proposed Action should be authorized under Nationwide Permit 12 for Utility Line Activities without requirement of pre-construction notification to the USACE. While some temporary impacts to aquatic resources would occur during installation of sections of the proposed pipeline, no permanent adverse impacts to the delineated aquatic resources would occur due to these sections being returned to pre-construction contours after completion of construction. Sections of the proposed project would be constructed by slip-lining the existing pipeline. In these locations, impacts to waters of the U.S. would be avoided.

In areas considered for open-trench construction techniques, the proposed project area would include clearing of all trees within the temporary or permanent easements including those within riparian areas associated with the stream crossings unless specifically noted otherwise. Woody vegetation would be allowed to recolonize the temporary easement after construction, but the permanent easement area would be routinely maintained moving forward as it is currently. Therefore, minimal short term impacts to riparian forested areas would be anticipated. Appropriate best management practices (BMPs) and General Conditions associated with NWP 12 would be employed during construction of the proposed project to protect the aquatic resources associated with the proposed stream crossings. Therefore, minimal short-term impacts to water quality, if any, are expected during construction. Following construction, grades would be restored to pre-construction contours to the extent practicable. Therefore, no long term permanent adverse impacts to streams or wetlands are anticipated.

Implementation of the Proposed Action would result in less than significant impacts to wetlands and other waters of the U.S., riparian areas, and aquatic habitats. Therefore, no significant short term, long term, direct, indirect, or cumulative impacts are anticipated for the proposed action relevant to these aquatic resources.

3.5 Vegetation and Habitat

The proposed project is located primarily within existing utility easement which traverses the Cross Timbers Transition and Northern Cross Timbers ecoregions. The Cross Timbers Transition ecoregion, which occupies the western half of the proposed project area, consists of rough plains that are covered by prairie grasses and eastern red cedar, scattered oaks, and elms. Terrain and vegetation are transitional between the less rugged, grass-covered plains-type ecoregions to the west and the hilly, oak savanna to the east. Since the early 19th century, both the abundance of upland trees and the number of tree

species have greatly increased due, in part, to fire suppression. During the same period, natural riparian forests and wetlands have been degraded or lost due to channelization and land use changes. Today, land uses consist of a mixture of rangeland and cropland. However, most of the western half of the proposed project area lies within developed residential neighborhoods where land use is predominantly single-family homes.

The Northern Cross Timbers ecoregion, which represents the eastern half of the proposed pipeline, consists of hills, cuestas, and ridges, which are typically covered by a mosaic of oak savanna, scrubby oak forest, eastern red cedar, and native tall grass prairie. Post oak, blackjack oak, and understory grasses are typically located on porous, course-textured soils derived from sandstone. Tall grass prairie naturally occurs on fine textured soils derived from limestone or shale.

The Northern Cross Timbers ecoregion displays less variety floristically, vegetation is also sparser, and the growing season is shorter than in the Eastern Cross Timbers – a similar ecoregion located to the south and east. Today, livestock farming is the main land use; whereas cropland and rangeland is less widespread. Soils are highly erodible when disturbed and the area has rolling hill-type topography. In reviewing the available data (U.S. Geological Survey (USGS) topographic maps and aerial photography), the vegetation and habitat along the pipeline alignment has been relatively unchanged since 2008. The USGS topographic map (Choctaw and Midwest City, Oklahoma quadrangles) and aerial photographs from 2017, 2008, and 1975 are included in Appendix A as Figures A-2 through A-5 respectively.

The Federal easement which contains the existing pipeline and where the proposed new pipeline would be located is routinely maintained primarily through mowing. The easement is currently mowed two to four times per year. Young woody regrowth exists along the edges of stream crossings where mowing is impeded.

3.5.1 No Action Alternative

Construction activities associated with repairs to the existing pipeline would have localized short term temporary impacts to the vegetation and habitat. Since vegetative cover would be restored upon construction completion and the existing easement is routinely maintained, the No Action Alternative would have no significant short term, long term, direct, indirect, or cumulative environmental consequences to vegetation or habitat along the pipeline alignment.

3.5.2 Proposed Action

The Proposed Action would be constructed mostly within the existing easement paralleling the existing pipeline. The existing easement is predominately vegetated with grass which is routinely mowed. Young woody regrowth occurs along the stream channels where mowing is impeded. The section of the pipeline that is proposed to be rerouted within a new easement would skirt the border of the same field the existing easement crosses. This field is currently under agricultural production for wheat and hay.

Therefore, no short term or long term change in land use, vegetation or habitat is anticipated. Implementation of the Proposed Action would result in no significant direct, indirect, or cumulative impacts to vegetation or habitat.

3.6 Wildlife and Fisheries

The Cross Timbers ecoregion is home to diverse flora and fauna. Historically, bison roamed the grasslands, as did prairie dogs, black-footed ferrets, burrowing owls, mountain lions and black bears. Many species have been extirpated from the cross timbers ecoregion, but populations of coyotes, bobcats, foxes, wild turkeys and white-tailed deer remain strong in the ecoregion today. The ecoregion also lies in the central flyway, one of the primary routes that migratory birds and waterfowl use to fly between breeding and wintering grounds.

The proposed project would occur in the Little Watershed and North Canadian River Watershed. The Oklahoma Conservation Commission's Blue Thumb Water Quality Education Program conducts water quality and habitat studies on streams throughout Oklahoma, including Crutcho Creek located in the North Canadian River Watershed. A habitat assessment conducted by the Blue Thumb program on July 24, 2008, found 12 fish species in the creek—similar to the ecoregion's reference score of 13 species (Emerson, 2012). Bug collections in Crutcho creek between 2007 and 2008 showed low population diversity in benthic macroinvertebrates, which scored similarly to reference streams in the ecoregion (Emerson, 2012). Sampling of Crutcho Creek showed low dissolved oxygen levels and high levels of nutrients, likely a sign of and a cause of algal blooms (Emerson, 2012). Since the sections of the creeks that are located within the project area are all upper reaches or headwater reaches of the creeks, it is likely that West Branch Hog Creek, East Elm Creek, and their unnamed tributaries have similar habitat conditions to Crutcho Creek. However, the ephemeral tributaries are less likely to support fish habitat and the headwaters of Crutcho Creek and its unnamed tributaries which are all classified as intermittent would have limited habitat for fish populations. In addition, the pipeline alignment would lie mostly within existing easement area which was previously disturbed during initial construction and repairs of the existing pipeline and is routinely maintained primarily through mowing. Young woody regrowth exists along the edges of stream crossings where mowing is impeded.

3.6.1 No Action Alternative

Construction activities associated with repairs to the existing pipeline may result in minimal short term impacts to fish habitat, if the pipeline failure occurs within or adjacent to a stream crossing. However, easements and stream crossings would be required to be restored to preconstruction lines and grades and best management practices (BMPs) would be utilized to protect disturbed areas from erosion. Disturbed areas would be revegetated immediately upon construction completion to minimize long term erosion potential. Therefore, the No Action Alternative would have no significant short term, long term, direct, indirect, or cumulative environmental consequences to wildlife or fisheries resources.

3.6.2 Proposed Action

During construction of the Proposed Action, minimal short term impacts to fish habitat would result from open cut installation across the stream channels. However, stream crossings within the proposed project area would be restored to pre-construction contours so therefore, implementation of the Proposed Action would not result in long term impacts to existing fish habitat. Further, base flows within flowing streams would be allowed to by-pass during construction. Since construction of the Proposed Action would occur mostly within existing easements and paralleling the existing pipeline, implementation of the Proposed Action would have no significant short term, long term, direct, indirect, or cumulative impacts for wildlife or fish habitat.

3.7 Threatened and Endangered Species

The Oklahoma Department of Wildlife Conservation does not list any state-listed threatened and endangered species for Oklahoma County. According to the United States Fish and Wildlife Service (USFWS), the following four federally listed threatened or endangered species are potentially present in Oklahoma County. An official species list from the USFWS Oklahoma Ecological Services Field Office is included in Appendix D.

Table 3: Oklahoma County List of Threatened, Endangered Species

Last Revision 12/30/2016 (E= Endangered, C= Candidate, T= Threatened, DL= Delisted)

Species	Federal Status
Least Tern *Sterna antillarum*	E
Least terns are the smallest member of the gull and tern family. They are approximately 9" in length. Unlike gulls, terns will dive into the water for small fish. The body of least terns is predominately gray and white, with black streaking on the head. Least terns have a forked tail and narrow pointed wings. Least terns less than a year old have less distinctive black streaking on the head and less of a forked tail. Only needs to be considered for wind related projects or towers.	
Piping Plover *Charadrius melodus*	T
Size: 18 cm (7.25 in) in length. Color: Breeding season: Pale brown above, lighter below; black band across forehead; bill orange with black tip; legs orange; white rump. Male: Complete or incomplete black band encircles the body at the breast. Female: Paler head band; incomplete breast band. Winter coloration: Bill black; all birds lack breast band and head band.	
Red Knot *Calidris canutus rufa*	T
Length: 25-28 cm. Adults in spring: Above finely mottled with grays, black and light ochre, running into stripes on crown; throat, breast and sides of head cinnamon-brown; dark gray line through eye; abdomen and undertail coverts white; uppertail coverts white, barred with black. Adults in winter: Pale ashy gray above, from crown to rump, with feathers on back narrowly edged with white; underparts white, the breast lightly streaked and speckled, and the flanks narrowly barred with gray. Adults in autumn: Underparts of some individuals show traces of the "red" of spring.	
Whooping Crane *Grus americana*	E
The whooping crane occurs only in North America and is North America's tallest bird, with males approaching 1.5 m (5 ft) when standing erect. The whooping crane adult plumage is snowy white except for black primaries, black or grayish alula (specialized feathers attached to the upper leading end of the wing), sparse black bristly feathers on the carmine crown and malar region (side of the head from the bill to the angle of the jaw), and a dark gray-black wedge-shaped patch on the nape. The common name "whooping crane" probably originated from the loud, single-note vocalization given repeatedly by the birds when they are alarmed. Whooping cranes are a long-lived species; current estimates suggest a maximum longevity in the wild of at least 30 years. Whooping cranes currently exist in the wild at 3 locations and in captivity at 12 sites. The July 2010 total wild population was estimated at 383. There is only one self-sustaining wild population, the Aransas-Wood Buffalo National Park population, which nests in Wood Buffalo National Park and adjacent areas in Canada, and winters in coastal marshes in Texas at Aransas. In addition, there is a small captive-raised, non-migratory population in central Florida, and a small migratory population of individuals introduced beginning in 2001 that migrate between Wisconsin and Florida in an eastern migratory population. The last remaining wild bird in the reintroduced Rocky Mountain Population died in the spring of 2002. The captive population contained 152 birds in July, 2010, with annual production from the Calgary Zoo, International Crane Foundation, Patuxent Wildlife Research Center, Audubon Species Survival Center, and the San Antonio Zoo. The total population of wild and captive whooping cranes in July, 2010, was 535.	

3.7.1 No Action Alternative

Construction activities associated with repairs to the existing pipeline would result in localized short term disturbances to surface area within the vicinity of the pipeline failure. However, BMPs would be utilized to protect disturbed areas from erosion and the disturbed area would be minimized to the extent practicable. Disturbed areas would be revegetated immediately upon construction completion to minimize long term erosion potential. Therefore, the No Action Alternative would have no significant short term, long term, direct, indirect, or cumulative environmental consequences to threatened or endangered species.

3.7.2 Proposed Action

The Proposed Action would primarily be constructed within the existing easement within previously developed area and/or previously disturbed area. While portions of the easement pass through wooded areas associated with rangeland and cropland, these areas do not constitute preferred habitat for the federally listed species. In addition, the existing easement area is routinely maintained. Therefore, the Proposed Action would not result in impacts on federally listed threatened or endangered species (no effect on listed species).

3.8 Recreation

The proposed project would be constructed primarily within an existing USBR easement which does not cross into any recreation areas, such as state parks, city parks, golf courses or sports complexes. Therefore, the Proposed Action does not result in short term, long term, direct, indirect, or cumulative impacts to recreation.

3.8.1 No Action Alternative

The No Action Alternative would have no short term, long term, direct, indirect, or cumulative environmental consequences to recreation.

3.8.2 Proposed Action

The Proposed Action would have no short term, long term, direct, indirect, or cumulative environmental consequences to recreation.

3.9 Aesthetics

The existing pipeline easement traverses residential neighborhoods, undeveloped land currently in agricultural production, and undeveloped land along the north side of Interstate 240. There are no significant landscape features within the easement area.

3.9.1 No Action Alternative

The No Action Alternative would include periodic construction activities associated with recurring pipeline repairs. However, these construction activities would be anticipated to be of short duration and disturbed areas would be revegetated upon completion. Therefore, the No Action Alternative would have no significant short term, long term, direct, indirect, or cumulative environmental consequences on aesthetics along the pipeline alignment.

3.9.2 Proposed Action

The Proposed Action involves the rehabilitation/replacement of the existing Del City Raw Water Pipeline and would be constructed primarily within the existing easement

paralleling the existing pipeline. The project would not result in any new aboveground structures. During construction of the proposed project, short term impacts to local aesthetics would result from the ground disturbance associated with the open cut trenches and pits for the portion to be installed via trenchless techniques. However, the disturbed areas would be regraded to pre-construction contours after construction completion. Therefore, the Proposed Action would not result in any long term, direct, indirect, or cumulative environmental consequences to aesthetics.

3.10 Cultural Resources

The existing easement areas was previously disturbed by the open trench cut installation of the existing pipeline as well as by periodic construction activities associated with pipeline repairs. In addition, portions of the pipeline easement traverse residential developments which also have substantially disturbed the area. An archeological survey for cultural and historical resources was conducted by AR Consultants, Inc. on September 11 and 12, 2018, which focused on the portion rerouted portion of the pipeline (Line 2). During this survey, forty-one shovel tests were excavated along the pipeline route and no cultural resources were identified. Based on the results of the archaeological survey, AR Consultants, Inc. recommends that no further archeological investigations are warranted for this project. The Archeological Survey Report is included in Appendix E.

3.10.1 No Action Alternative

The No Action Alternative would include periodic construction activities associated with recurring pipeline repairs. Based on the previous disturbances along the alignment and survey results, the No Action Alternative would have no significant short term, long term, direct, indirect, or cumulative environmental consequences to cultural resources.

3.10.2 Proposed Action

The proposed project would be constructed primarily within the existing Federal easement paralleling the existing pipeline yet also includes the rerouted portion of the pipeline (Line 2). Therefore, the Proposed Action is not anticipated to have adverse impacts to cultural resources. Based on the previous disturbances along the alignment and survey results, the Proposed Action would have no significant short term, long term, direct, indirect, or cumulative environmental consequences to cultural resources.

3.11 Socioeconomics

3.11.1 Demographics

The U.S. Census Bureau estimates the 2017 population of Oklahoma County to be 787,958 people (U.S. Census Bureau, 2017). The population of Oklahoma County is approximately 49 percent male and 51 percent female. According to the 2017 estimates, racial distributions are 70.8 percent White; 15.8 percent Black; 4.3 percent American Indian or Alaskan Native; 3.7 percent Asian; 0.1 percent Native Hawaiian or Pacific Islander. Estimates from 2017 showed 17.5 percent of the population as Hispanic or

Latino. According to 2017 Census Bureau 5 year estimates, the average age in Oklahoma County is 34.3. Table 4 shows the percent and number of people employed in certain industry types in Oklahoma County as estimated for 2012.

Table 4: Employment by Industry Types in Oklahoma County

INDUSTRY	NUMBER	PERCENT
Utilities	1,992	0.51%
Manufacturing	21,353	5.42%
Wholesale trade	18,305	4.65%
Retail trade	42,001	10.66%
Transportation and warehousing	10,035	2.55%
Information	9,075	2.30%
Finance and insurance	19,271	4.89%
Real estate and rental and leasing	6,497	1.65%
Professional, scientific, and technical services	41,156	10.45%
Administrative and support and waste management and remediation services	38,138	9.68%
Educational services	4,912	1.25%
Health care and social assistance	113,768	28.88%
Arts, entertainment, and recreation	8,842	2.24%
Accommodation and food services	39,515	10.03%
Other services (except public administration)	19,006	4.83%

Additionally, 2016 estimates show that Oklahoma County had a labor force of approximately 374,642 with a 4.3 percent unemployment rate (in persons 16 years of age and older). The estimated mean household income was $48,987, and 79 percent of families had incomes in excess of $25,000 while 13 percent had incomes below $15,000.

3.11.2 Environmental Justice

The Environmental Protection Agency's (EPA's) EJSCREEN: Environmental Justice Screening and Mapping Tool was used to estimate the potential Environmental Justice Index. Demographics were analyzed in one and fifty square mile study areas around the proposed project location. The one square mile area corresponds to a 0.075 mile radius, and the fifty square mile are corresponds to a 2.5 mile radius. The Environmental Justice Index indicators are shown in relation to state average and percentile, and EPA region average and percentile.

The EJSCREEN Reports for the proposed project is presented in Appendix F. The proposed project has Environmental Justice Indexes ranging from the 31st percentile to the 89th percentile for EPA region 6 in a one square mile area of the proposed project. The one square mile area landed in the 48th percentile for low income population in Oklahoma. This indicates that low-income populations would not endure a disproportionate share of environmental impacts from the Proposed Action.

3.11.2.1 No Action Alternative

The No Action Alternative would have no significant short term, long term, direct, indirect, or cumulative environmental consequences to low-income populations.

3.11.2.2 Proposed Action

The Proposed Action would result in beneficial impacts to socioeconomic and no disproportionate adverse impacts to minority populations or the health and safety of children. The proposed project would result in a beneficial impact to socioeconomics by improving reliable access to the City's water supply from Lake Thunderbird. In addition, construction of the proposed project would result in a temporary increase in construction-related spending in the local economy. Therefore, the Proposed Action would result in beneficial cumulative impacts to socioeconomics. There would be no cumulative disproportionate adverse impact to minority populations or the health and safety of children.

IV CONSULTATION AND COORDINATION

4.1 Summary of Public Involvement

A Public Notice of Availability the draft EA for the proposed project was published in four publications including *The Oklahoman*, *Midwest City Beacon*, *The Norman Transcript*, and *The Journal Record.* The notice was also posted on COMCD's website home page (www.comcd.net) on January 2, 2019. The public notice, which ran in the aforementioned publications for 30 days, sought comments on the Proposed Action and its alternatives potential environmental effects and concerns. The public involvement period concluded on February 2, 2019. No comments regarding the EA were received by COMCD, USBR, or APAI. Publisher's affidavits for the publications are included in Appendix G.

4.2 Tribal Consultation and Coordination

USBR consulted with the Oklahoma Archeological Society, Oklahoma Historical Society's State Historic Preservation Office (SHPO), the Muscogee (Creek) Nation and the Seminole Nation of Oklahoma as part of the 30-day public review period. Based on the archeological survey report prepared by AR Consultants, The Oklahoma Archeological Society and the SHPO concluded that no prehistoric or historic sites or properties would be affected by the proposed project. No responses were received from the Tribal Nations contacted by USBR. Correspondence with the Oklahoma Archeological Society, SHPO and Tribes is included in Appendix H.

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Appendix A

Figures

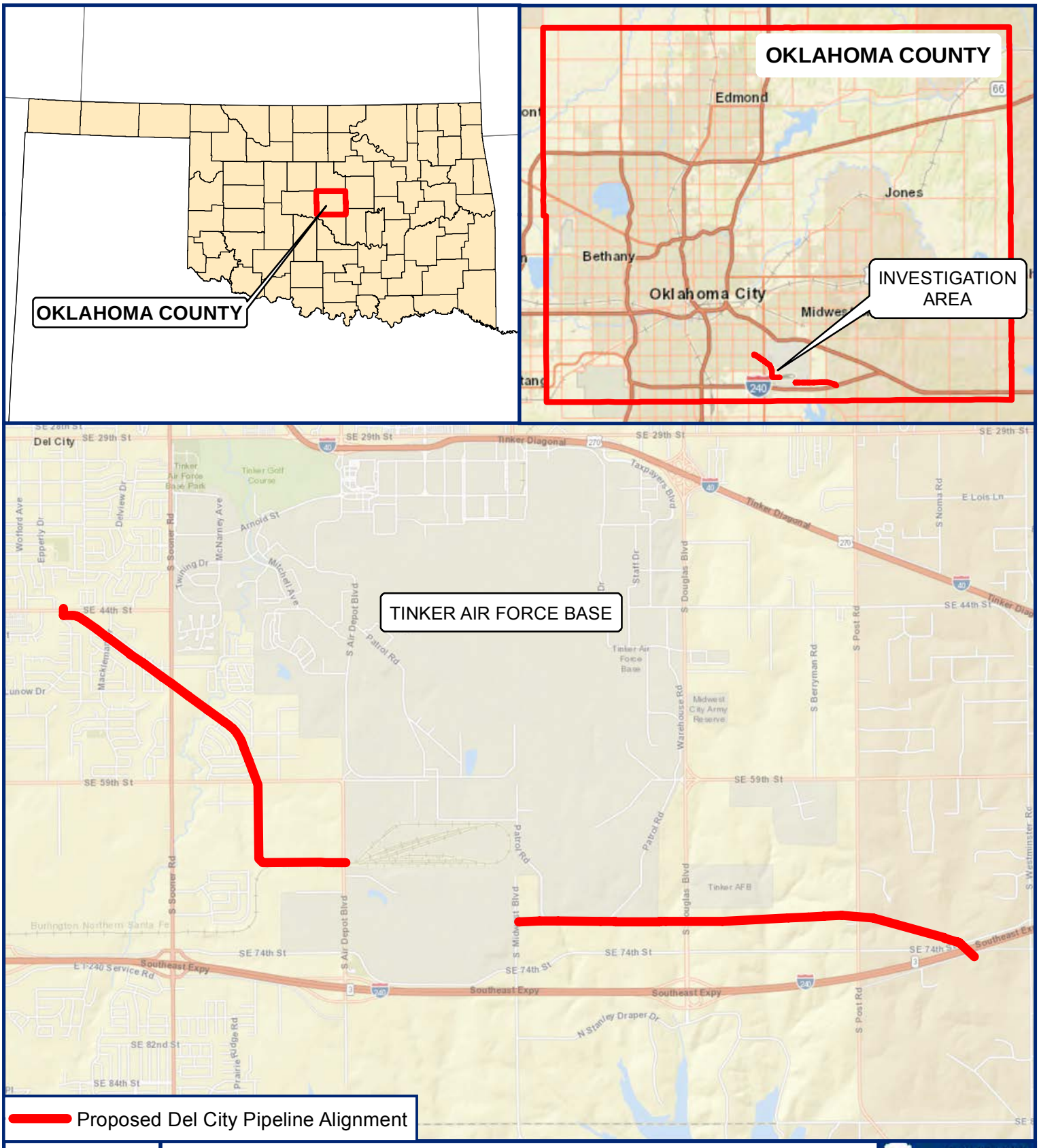

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FIGURE A-1
GENERAL LOCATION
PROPOSED RAW WATER PIPELINE ALIGNMENT
CENTRAL OKLAHOMA MASTER CONSERVANCY DISTRICT
OKLAHOMA COUNTY, OKLAHOMA

ALAN PLUMMER ASSOCIATES, INC.
ENVIRONMENTAL ENGINEERS AND SCIENTISTS
414 NW 4TH STREET
SUITE 150
OKLAHOMA CITY,
OKLAHOMA 73102
PHONE: (405) 440-2725

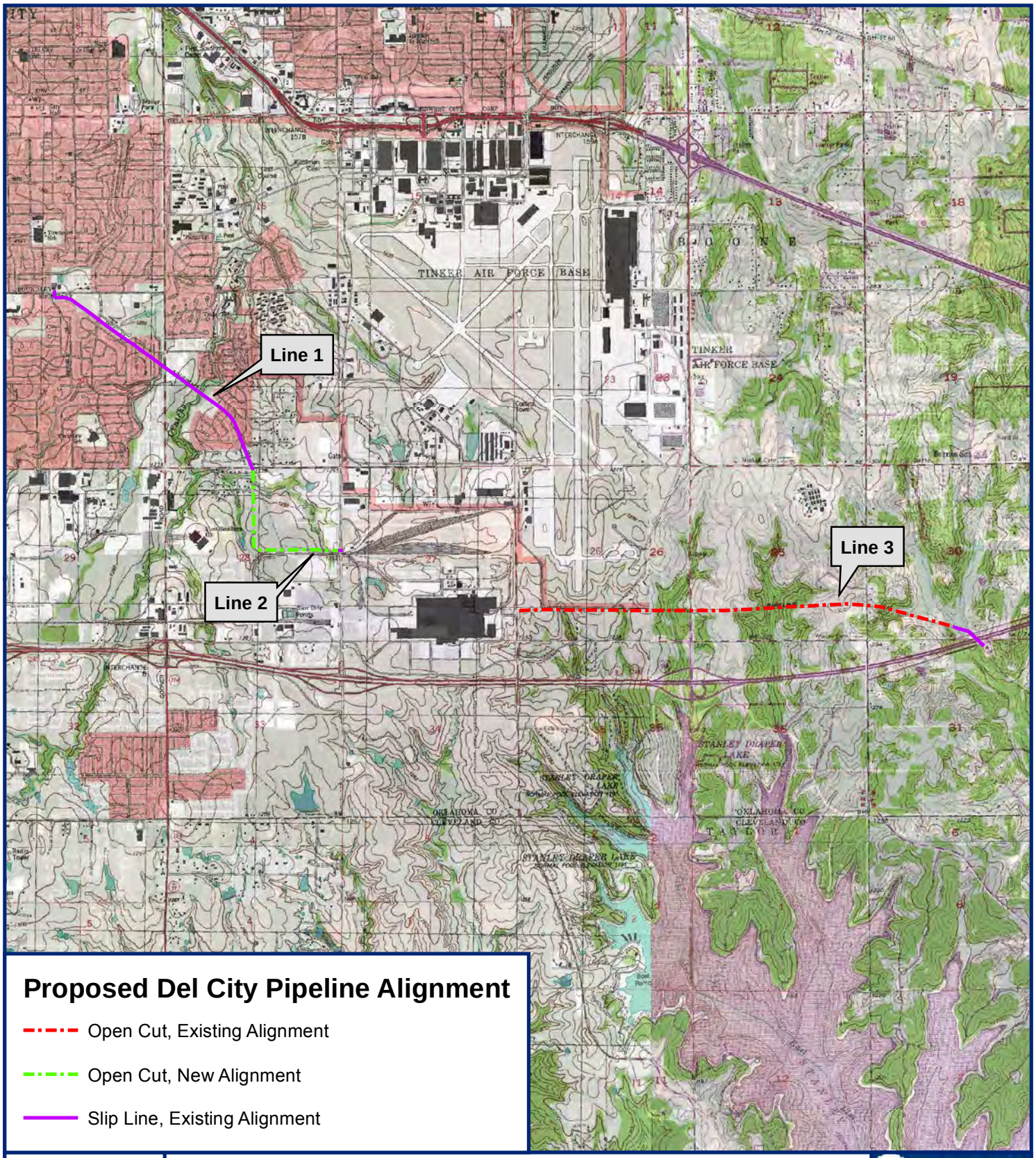
DATE: 10/5/2018

FIGURE 1 OF 8

4,000 2,000 0 Feet

SOURCE: ESRI BASE DATA

USACE Project No:



Proposed Del City Pipeline Alignment

- Open Cut, Existing Alignment
- Open Cut, New Alignment
- Slip Line, Existing Alignment

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FIGURE A-2
USGS TOPOGRAPHIC MAP
CHOCTAW AND MIDWEST CITY, OKLAHOMA QUADRANGLES
DEL CITY RAW WATER PIPELINE IMPROVEMENTS PROJECT
CENTRAL OKLAHOMA MASTER CONSERVANCY DISTRICT
OKLAHOMA COUNTY, OKLAHOMA

ALAN PLUMMER ASSOCIATES, INC.
ENVIRONMENTAL ENGINEERS AND SCIENTISTS
414 NW 4TH STREET
SUITE 150
OKLAHOMA CITY,
OKLAHOMA 73102
PHONE: (405) 440-2725

DATE: 10/5/2018

FIGURE 2 OF 8

4,000 2,000 0 Feet

SOURCE: https://okmaps.org/OGI/search.aspx

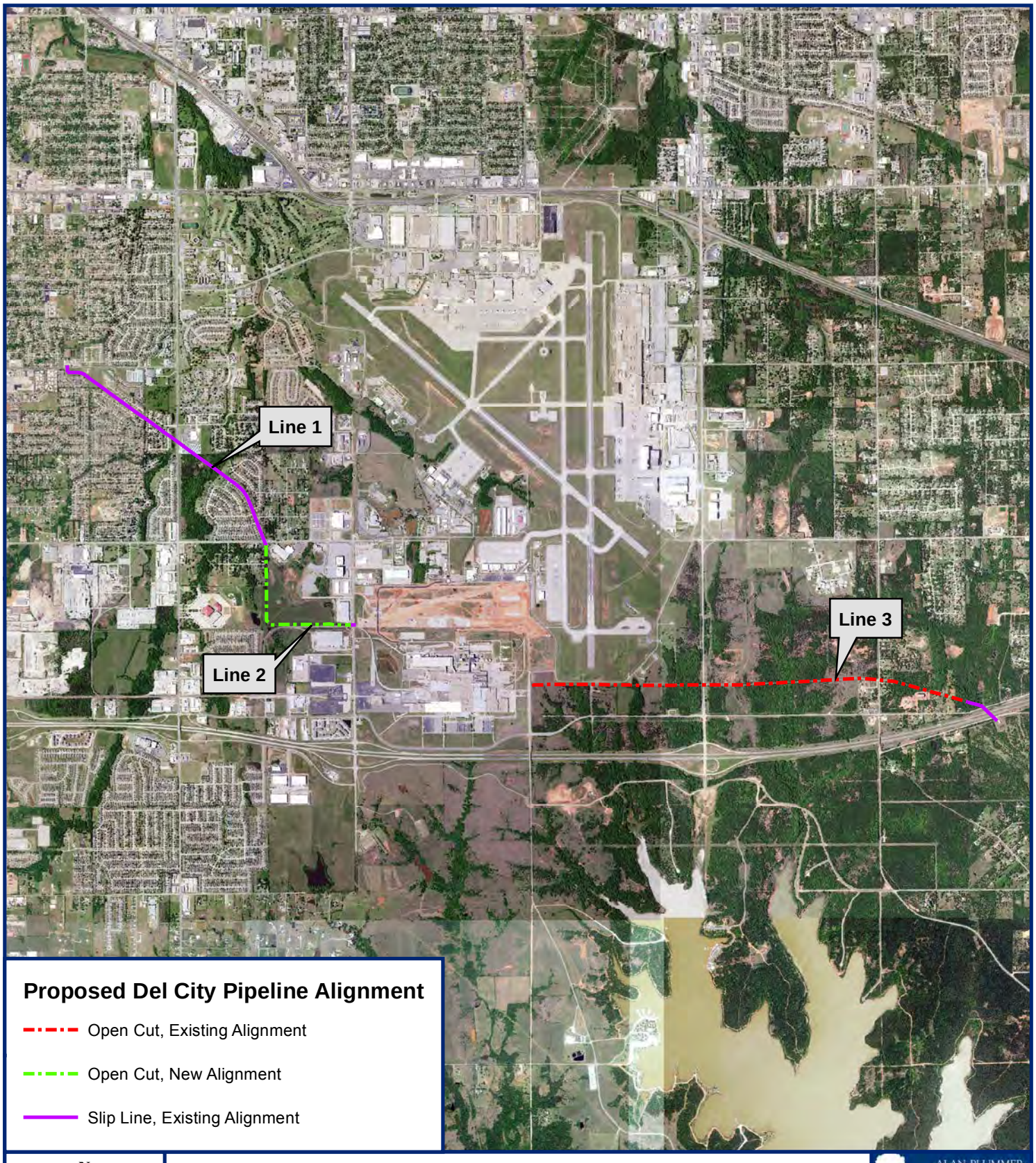

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FIGURE A-3
2017 AERIAL PHOTOGRAPH
PROPOSED DEL CITY RAW WATER PIPELINE IMPROVEMENTS PROJECT
CENTRAL OKLAHOMA MASTER CONSERVANCY DISTRICT
OKLAHOMA COUNTY, OKLAHOMA

ALAN PLUMMER ASSOCIATES, INC.
ENVIRONMENTAL ENGINEERS AND SCIENTISTS
414 NW 4TH STREET
SUITE 150
OKLAHOMA CITY,
OKLAHOMA 73102
PHONE: (405) 440-2725

DATE: 10/5/2018

FIGURE 3 OF 8

4,000 2,000 0 Feet

SOURCE: https://okmaps.org/OGI/search.aspx

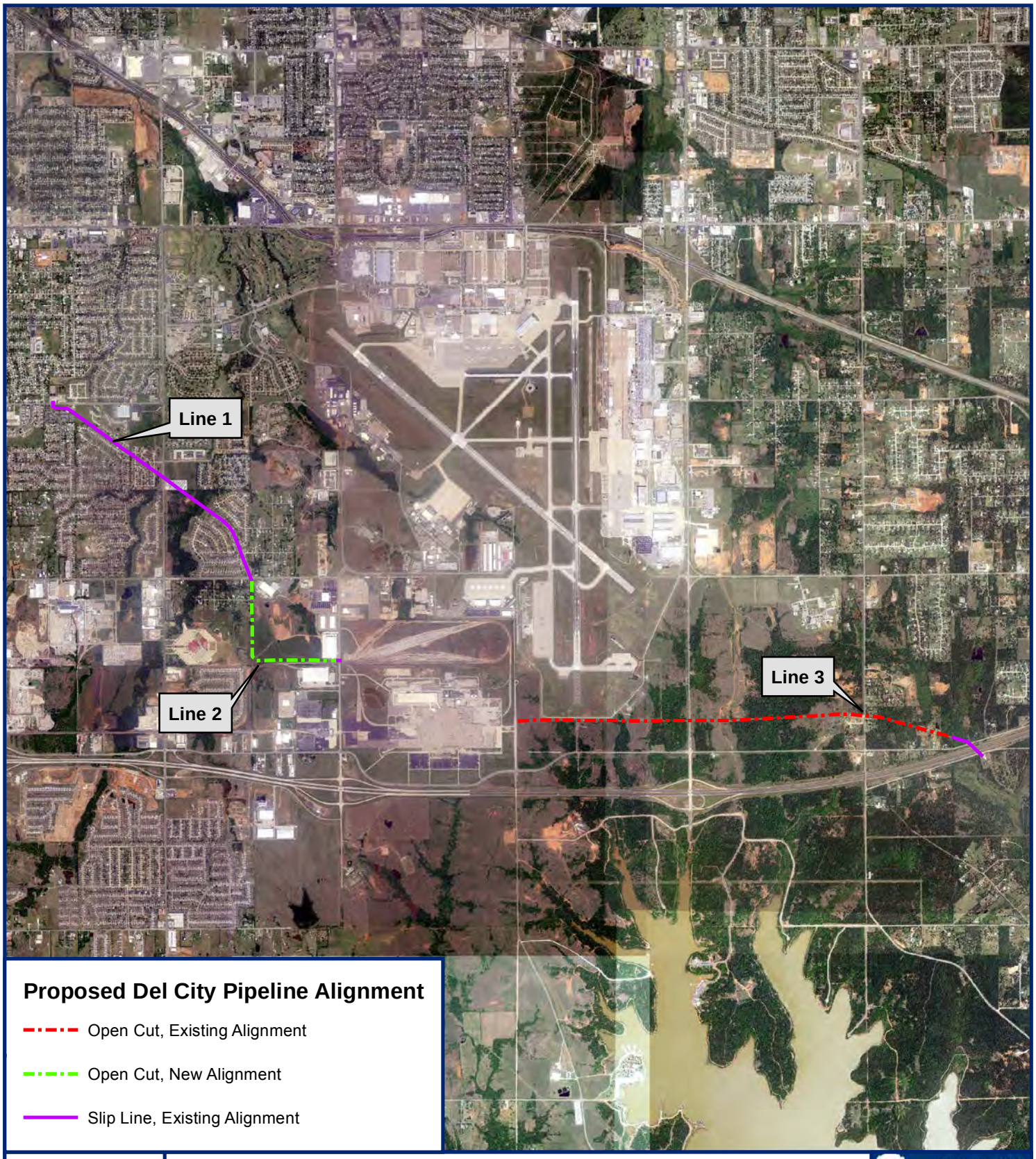

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FIGURE A-4
2008 AERIAL PHOTOGRAPH
PROPOSED DEL CITY RAW WATER PIPELINE IMPROVEMENTS PROJECT
CENTRAL OKLAHOMA MASTER CONSERVANCY DISTRICT
OKLAHOMA COUNTY, OKLAHOMA

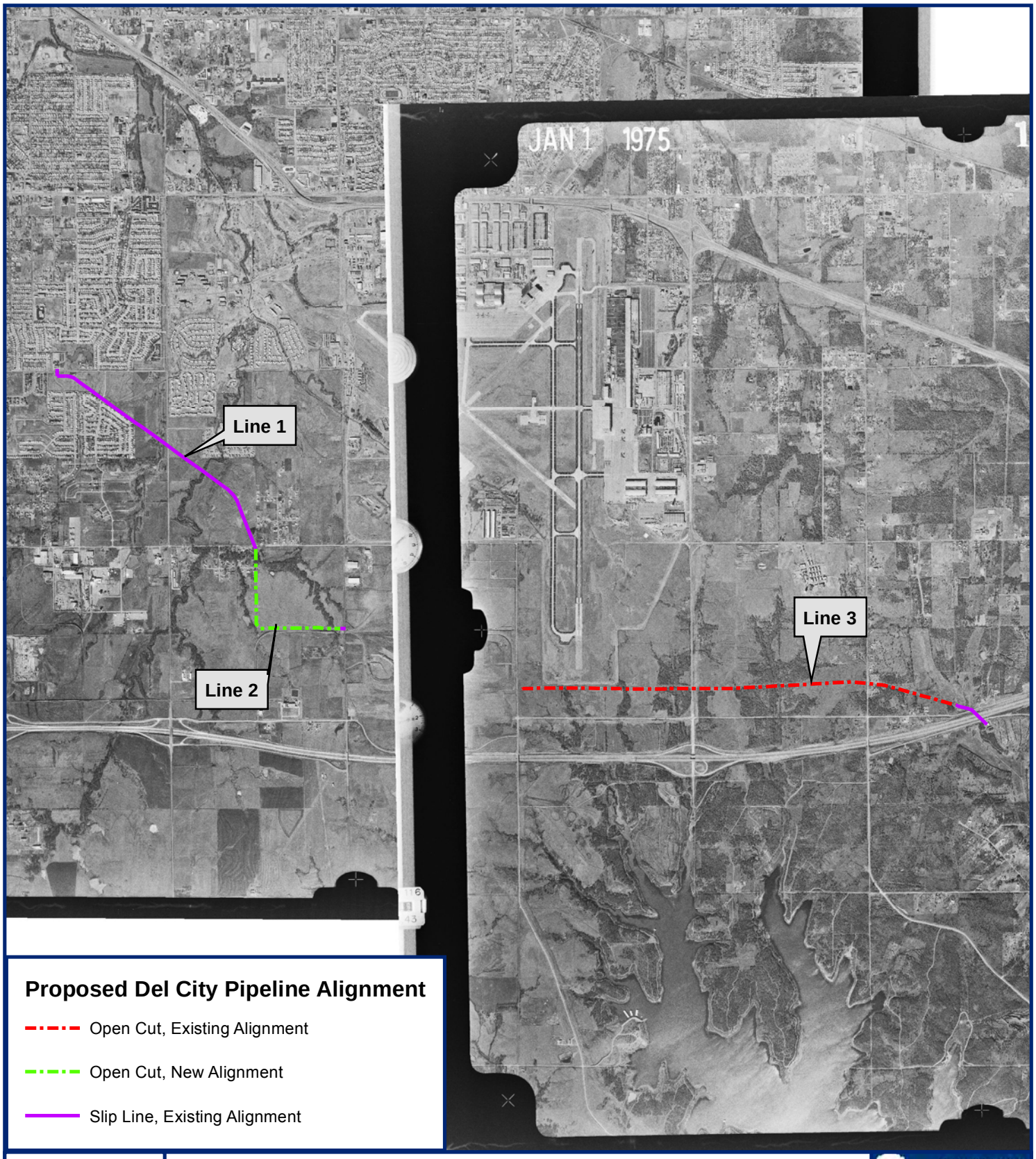
ALAN PLUMMER ASSOCIATES, INC.
ENVIRONMENTAL ENGINEERS AND SCIENTISTS
414 NW 4TH STREET
SUITE 150
OKLAHOMA CITY,
OKLAHOMA 73102
PHONE: (405) 440-2725

DATE: 10/5/2018

FIGURE 4 OF 8

4,000 2,000 0 Feet

SOURCE: https://okmaps.org/OGI/search.aspx



Proposed Del City Pipeline Alignment

- Open Cut, Existing Alignment
- Open Cut, New Alignment
- Slip Line, Existing Alignment

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W E
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FIGURE A-5
1975 AERIAL PHOTOGRAPH
PROPOSED DEL CITY RAW WATER PIPELINE IMPROVEMENTS PROJECT
CENTRAL OKLAHOMA MASTER CONSERVANCY DISTRICT
OKLAHOMA COUNTY, OKLAHOMA

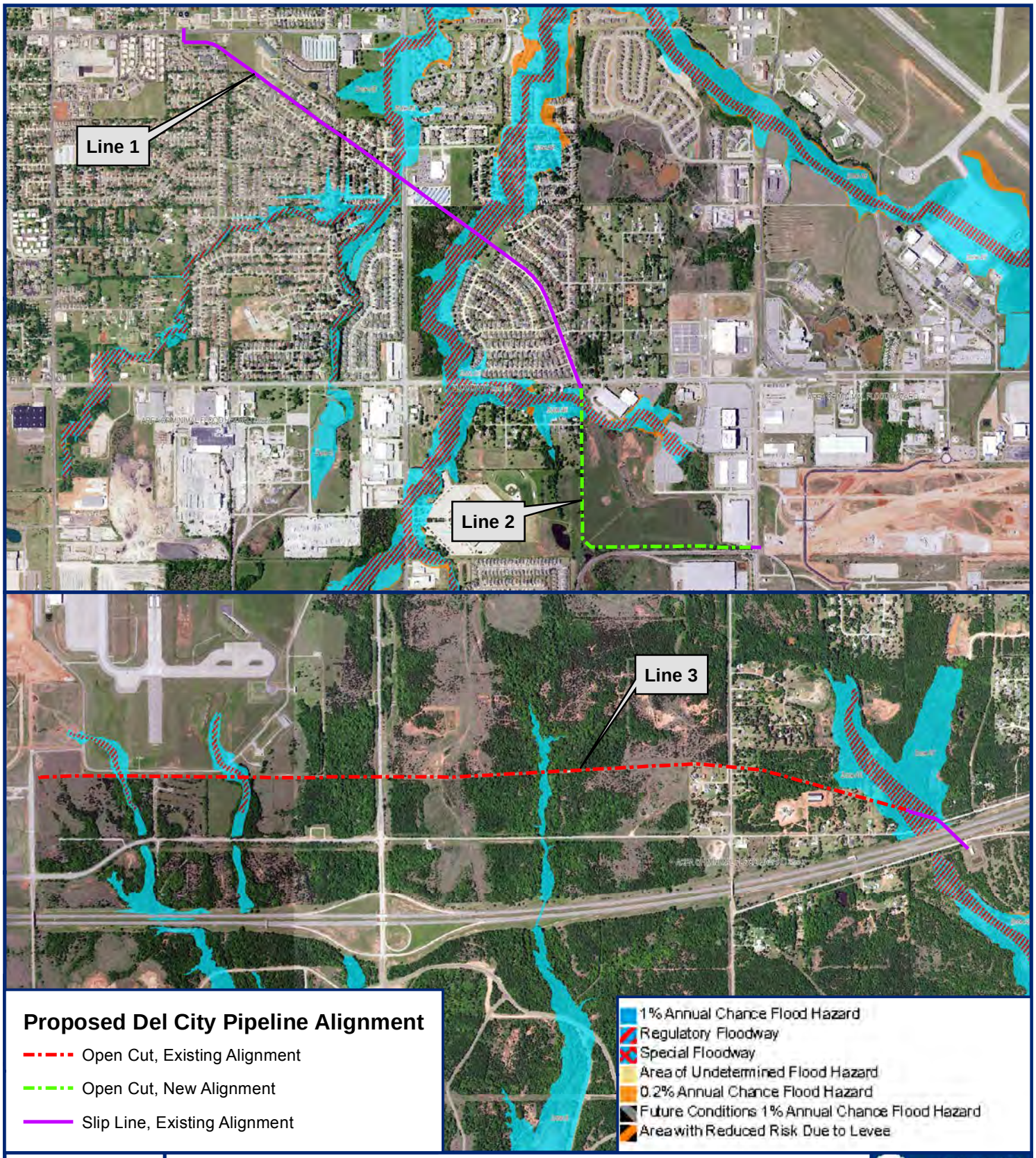
ALAN PLUMMER ASSOCIATES, INC.
ENVIRONMENTAL ENGINEERS AND SCIENTISTS
414 NW 4TH STREET
SUITE 150
OKLAHOMA CITY,
OKLAHOMA 73102
PHONE: (405) 440-2725

DATE: 10/5/2018

FIGURE 5 OF 8

4,000 2,000 0 Feet

SOURCE: https://okmaps.org/OGI/search.aspx



Proposed Del City Pipeline Alignment

- Open Cut, Existing Alignment
- Open Cut, New Alignment
- Slip Line, Existing Alignment

- 1% Annual Chance Flood Hazard
- Regulatory Floodway
- Special Floodway
- Area of Undetermined Flood Hazard
- 0.2% Annual Chance Flood Hazard
- Future Conditions 1% Annual Chance Flood Hazard
- Area with Reduced Risk Due to Levee

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FIGURE A-6
FEDERAL EMERGENCY MANAGEMENT AGENCY
FLOOD INSURANCE RATE MAP
PROPOSED RAW WATER PIPELINE ALIGNMENT
CENTRAL OKLAHOMA MASTER CONSERVANCY DISTRICT
OKLAHOMA COUNTY, OKLAHOMA

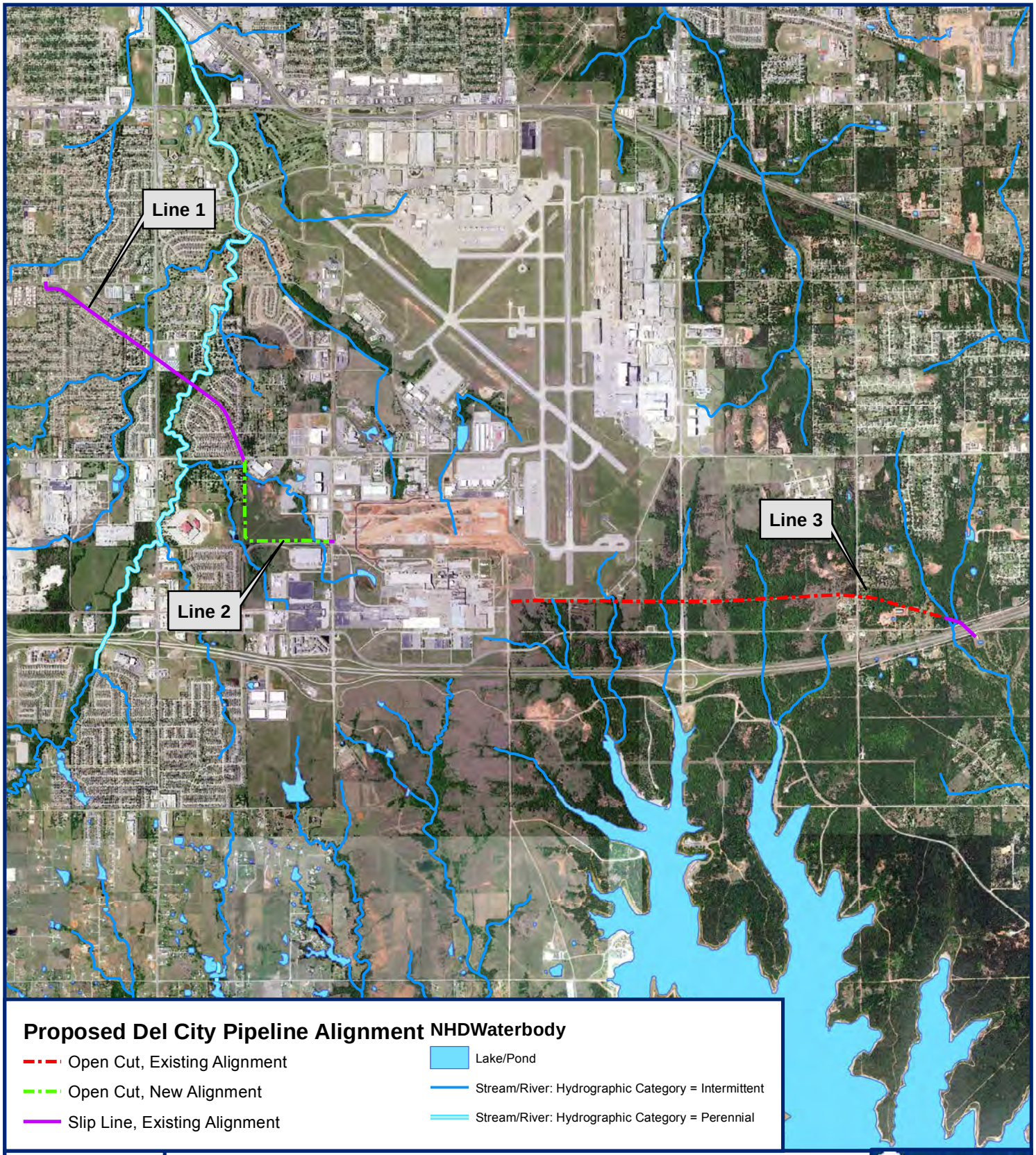
ALAN PLUMMER ASSOCIATES, INC.
ENVIRONMENTAL ENGINEERS AND SCIENTISTS
414 NW 4TH STREET
SUITE 150
OKLAHOMA CITY,
OKLAHOMA 73102
PHONE: (405) 440-2725

DATE: 10/5/2018

FIGURE 6 OF 8

2,000 1,000 0 Feet

SOURCE: FEMA MAP STORE NATIONAL FLOOD HAZARD LAYER
https://okmaps.org/OGI/search.aspx



Proposed Del City Pipeline Alignment

- Open Cut, Existing Alignment
- Open Cut, New Alignment
- Slip Line, Existing Alignment

NHDWaterbody

- Lake/Pond
- Stream/River: Hydrographic Category = Intermittent
- Stream/River: Hydrographic Category = Perennial

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FIGURE A-7
NATIONAL HYDROGRAPHY DATASET
PROPOSED DEL CITY RAW WATER PIPELINE IMPROVEMENTS PROJECT
CENTRAL OKLAHOMA MASTER CONSERVANCY DISTRICT
OKLAHOMA COUNTY, OKLAHOMA

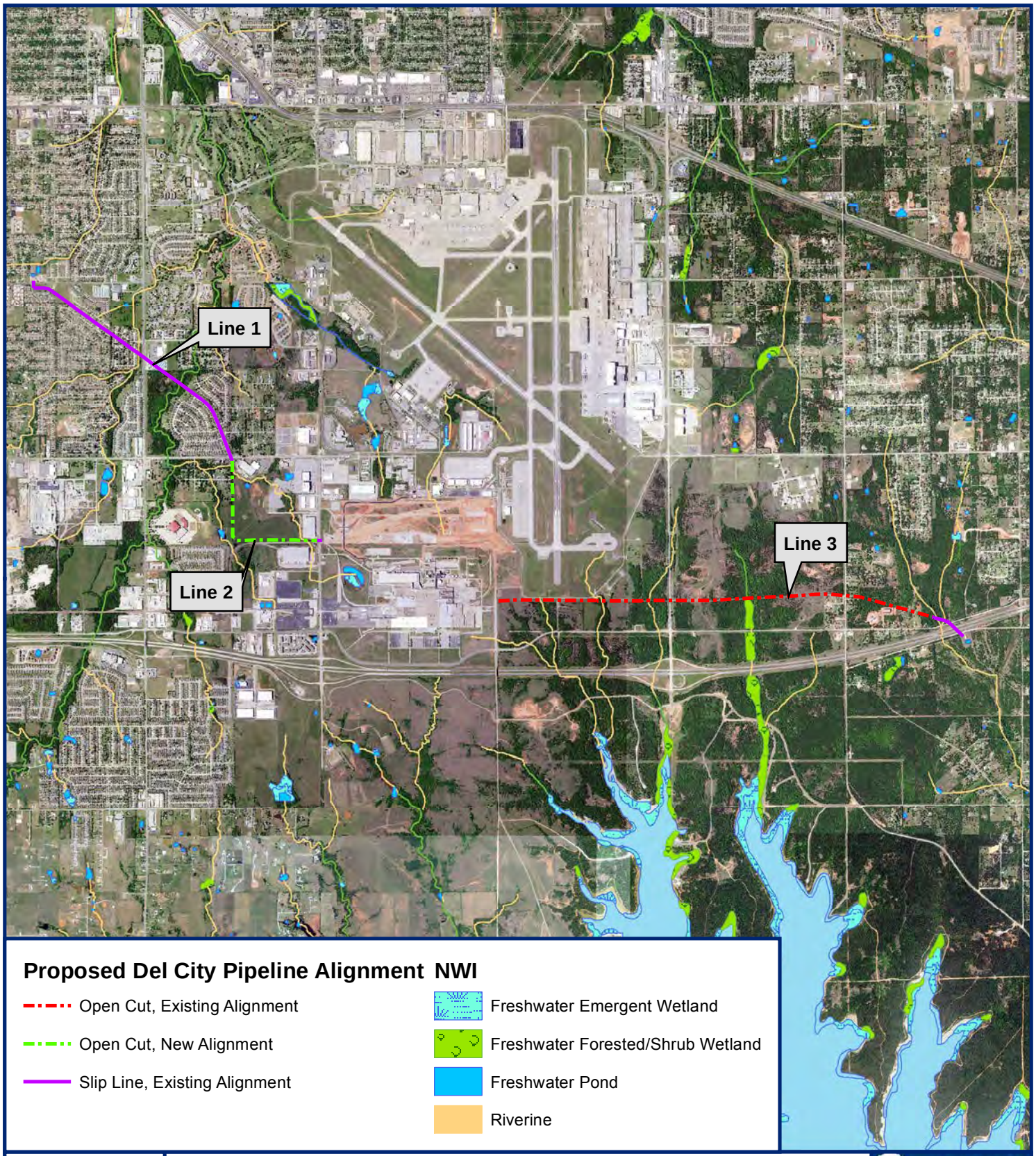
ALAN PLUMMER ASSOCIATES, INC.
ENVIRONMENTAL ENGINEERS AND SCIENTISTS
414 NW 4TH STREET
SUITE 150
OKLAHOMA CITY,
OKLAHOMA 73102
PHONE: (405) 440-2725

DATE: 10/5/2018

FIGURE 7 OF 8

4,000 2,000 0 Feet

SOURCE: https://okmaps.org/OGI/search.aspx



Proposed Del City Pipeline Alignment NWI

- Open Cut, Existing Alignment
- Open Cut, New Alignment
- Slip Line, Existing Alignment
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Riverine

N W E S

FIGURE A-8
NATIONAL WETLAND INVENTORY
PROPOSED DEL CITY RAW WATER PIPELINE IMPROVEMENTS PROJECT
CENTRAL OKLAHOMA MASTER CONSERVANCY DISTRICT
OKLAHOMA COUNTY, OKLAHOMA

ALAN PLUMMER ASSOCIATES, INC.
ENVIRONMENTAL ENGINEERS AND SCIENTISTS
414 NW 4TH STREET
SUITE 150
OKLAHOMA CITY,
OKLAHOMA 73102
PHONE: (405) 440-2725

DATE: 10/5/2018

FIGURE 8 OF 8

4,000 2,000 0 Feet

SOURCE: https://okmaps.org/OGI/search.aspx

Appendix B

Notice Letter Sent to Property Owners

September 21, 2017

[Name]
[Address 1]
[Address 2]

Re: Central Oklahoma Master Conservancy District – Del City Pipeline Improvements

Dear Owner:

The Central Oklahoma Master Conservancy District (COMCD) has contracted Alan Plummer Associates, Inc. (APAI) to provide engineering and design services for the rehabilitation or replacement of an existing raw water pipeline that is currently installed in a utility easement that may cross your property at [Address 1].

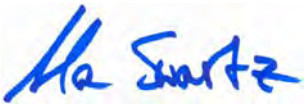
Section §82-567 of the Oklahoma Statues, concerning waters and water rights, grants COMCD the right to enter your property to perform surveys of the existing pipeline alignment, and by this letter we are requesting your cooperation in this effort. The survey will include locations of physical features and property lines located within 50 feet of either side of the centerline of the existing pipeline. With this information, we can make a more informed decision on the location of the replacement pipeline and evaluate rehabilitation options for other portions of the existing pipeline.

Please fill out and return the attached form in the pre-addressed, stamped envelope included, within thirty (30) calendar days. This form confirms right of entry to APAI to perform surveys for this project. COMCD will assume permission is granted to enter your property if a response is not received by APAI within thirty (30) calendar days from the date of this letter.

Should you have any questions or concerns, please call me at (405) 440-2725.

Sincerely,

ALAN PLUMMER ASSOCIATES, INC.



Alan Swartz, P.E.

ADS/yt

Enclosures

ALAN PLUMMER ASSOCIATES, INC.
ENVIRONMENTAL ENGINEERS AND SCIENTISTS

NORTH STAR
Land Surveying, LLC

I do hereby grant right of entry to my property located at

_____

_____

_____

_____

for the completion of necessary work for the Del City Pipeline Improvements.

☐ YES ☐ NO

_____
Signature

_____
Print Name

_____
Contact Phone Number

Appendix C
Preliminary Jurisdictional Determination of Waters of the United States

PRELIMINARY JURISDICTIONAL DETERMINATION OF WATERS OF THE UNITED STATES

Proposed Del City Raw Water Pipeline Improvements Project

Sponsor:

Central Oklahoma Master Conservancy District (C.O.M.C.D.)

September 28, 2018

Prepared by:

ALAN PLUMMER ASSOCIATES, INC.
ENVIRONMENTAL ENGINEERS • DESIGNERS • SCIENTISTS

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APPENDICES

Preliminary Jurisdictional Determination of Waters of the United States
Central Oklahoma Master Conservancy District (COMCD)
Proposed Del City Raw Water Pipeline Improvements Project
Oklahoma County, Oklahoma

1) Purpose

This Preliminary Jurisdictional Determination (PJD) covers an approximately 5.2 mile pipeline corridor (investigation area) associated with the Central Oklahoma Master Conservancy District's (COMCD) proposed Del City Raw Water Pipeline Improvements Project. The purpose of this PJD is to document the extent of potential waters of the United States (U.S.) within the investigation area. The information from this PJD report will be utilized during the planning stages for the proposed pipeline corridor to avoid and minimize, to the extent practicable, impacts to aquatic resources considered waters of the U.S. The investigation area was visually assessed by staff from Alan Plummer Associates, Inc. (APAI) on November 14, 2017.

2) Methods

a) Contact Information

COMCD contracted with APAI to provide environmental documentation services including preparation of this PJD report for project planning. Questions concerning the content of this PJD report should be directed to APAI. Information regarding contacts for the project is as follows:

Entity	Contact	Address	Telephone	Email
Alan Plummer Associates, Inc.	Loretta Mokry, PWS	1320 S. University Drive, Suite 300 Fort Worth, Texas 76107	(817) 806-1700	lmokry@apaienv.com
Alan Plummer Associates, Inc.	Jason Voight, PWS	1320 S. University Drive, Suite 300 Fort Worth, Texas 76107	(817) 806-1700	jvoight@apaienv.com

b) Delineation Methods

APAI performed an on-site investigation to identify and delineate aquatic resources (streams, rivers, ponds, wetlands, and others). The delineation of aquatic resources was conducted in accordance with the current regulatory procedures outlined in the U.S. Army Corps of Engineers (USACE) *Wetland Delineation Manual*, *Technical Report Y-87-1* (on-line edition) and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Great Plains Supplement*. Preliminary data (including but not

limited to U.S. Geological Survey (USGS) topographic maps, aerial photographs, and soil survey maps) suggested the potential for waters of the U.S.; therefore, the procedures for a routine determination were followed to define the extent of aquatic resources within the limits of the investigation area.

c) Mapping Techniques

A review of the available resources was conducted to identify potential aquatic resources within the limits of the investigation site. The resources reviewed included current and historical aerial photographs, the USGS topographic map (Choctaw and Midwest City, Oklahoma quadrangles), the USDA NRCS Web Soil Survey, the National Wetland Inventory (NWI), and the National Hydrography Dataset (NHD).

The limits of the aquatic resources were determined using the methods outlined in the Manuals, and mapped with a Global Positioning System (GPS) device. The waypoints collected in the field were further refined by post-processing, and using topographic maps and aerial photographs with Geographic Information System (GIS) software to delineate the limits of the identified aquatic resources.

3) Results

a) Location

The investigation area is located in the central Oklahoma in the southeastern portion of Oklahoma City. The investigation area is linear in nature commencing at the COMCD booster pump station located on the south side of U.S. Interstate Highway 240, approximately 1,700 feet west of S. Westminster Road. From there, the proposed pipeline travels to the northwest toward Tinker Air Force Base (AFB). Beyond Tinker AFB, the proposed pipeline continues to the northwest to the terminus at the Del City Water Treatment Plant located approximately 2,000 feet east of the intersection of S. Sunnylane Road and SE 44th Street. The investigation area primarily follows an existing raw water pipeline easement, aside from an approximately 4,800 feet section of the proposed pipeline which will be located outside of the existing easement. Figure A-1 in Appendix A is a location map of the investigation area.

b) Description of the Investigation Area

The proposed project is located within the Cross Timbers Transition and Northern Cross Timbers ecoregions. The Cross Timbers Transition ecoregion, which occupies the western half of the investigation area, consists of rough plains that are covered by prairie grasses and eastern red cedar, scattered oaks, and elms. Terrain and vegetation are transitional between the less rugged, grass-covered plains-type ecoregions to the west and the hilly, oak savanna to the east. Since the early 19th century, both the abundance of upland trees and the number of tree species have greatly increased due, in part, to fire suppression. During the same period, natural riparian forests and wetlands have been degraded or lost due to channelization and land use changes. Today, land uses are a mixture of rangeland and cropland. However, within the investigation area, land uses are mostly single-family homes within this ecoregion.

The Northern Cross Timbers ecoregion, which represents the eastern half of the proposed pipeline, consists of hills, cuestas, and ridges, which are typically covered by a mosaic of oak savanna, scrubby oak forest, eastern red cedar, and native tall grass prairie. Post oak, blackjack oak, and understory grasses are typically located on porous, course-textured soils derived from sandstone. Tall grass prairie naturally occurs on fine-textured soils derived from limestone or shale.

The Northern Cross Timbers ecoregion displays less variety floristically, vegetation is also sparser, and the growing season is shorter than in the Eastern Cross Timbers – a similar ecoregion located to the south and east. Today, livestock farming is the main land use; whereas cropland and rangeland is less widespread. Soils are highly erodible when disturbed. The western half of the investigation area resembles the post oak/blackjack oak savannah in a rolling hill-type topography.

The proposed pipeline is approximately 6.4 miles in length. Approximately 5.2 miles of the proposed pipeline is associated with this PJD report, and henceforth referred to as the investigation area. Approximately 1.2 miles of the proposed pipeline, located within Tinker AFB, would be designed and constructed by others. The western half of the proposed project, approximately 2.4 miles in length, is located within a mostly developed region of Oklahoma City; whereas, the eastern half of the proposed project,

approximately 2.7 miles in length, is located mostly within undeveloped land consisting of large-lot single family homes, rangeland for cattle or other livestock, or areas containing vegetation typical with the Northern Cross Timbers ecoregion.

In reviewing the available data (U.S. Geological Survey (USGS) topographic maps and aerial photography), the investigation area has been relatively unchanged since 2008. The USGS topographic map (Choctaw and Midwest City, Oklahoma quadrangles) and aerial photographs from 2015, 2010, and 2008 are included in Appendix A as Figures A-2 through A-5 respectively. Photographs from the on-site investigation are included in Appendix B. Figure B-1, included in Appendix B, identifies approximate photograph locations.

c) Hydrology

In reviewing the Federal Emergency Management Agency's (FEMA) flood insurance rate map (included as Figure A-7 in Appendix A), the investigation area encounters the following delineated flood zones: Zone A and AE (100-year floodplain delineation), Regulatory Floodway, and Zone X (500-year flood delineation). The National Hydrography Dataset (NHD) and National Wetland Inventory (NWI) dataset were also reviewed to identify potential aquatic resources within the investigation area. The NHD identified tributaries to Crutcho Creek and Crutcho Creek, and tributaries to Stanley Draper Lake (East Elm Creek). The NHD also identified West Branch Hog Creek. No open water areas within the investigation area were identified by the NHD dataset. The NWI dataset identified the majority of the aforementioned streams located within the investigation area. The NWI dataset classified these streams as Riverine, Intermittent, Streambed, Seasonally Flooded (R4SBC). The NWI map also identified Crutcho Creek and East Elm Creek as being a freshwater forested/shrub system (PFO1A – Palustrine, Forested, Broad-Leaved Deciduous, Temporarily Flooded). Figures A-8 and A-9 include the NHD and NWI delineated features in relation to the investigation area respectively.

The investigation area is located in the following 8-digit Hydrologic Unit Codes (HUC): 11090203 for Elm Creek and 11100302 for Crutcho Creek. Within the investigation areas, Crutcho Creek and its unnamed tributaries, and East Elm Creek and its unnamed tributaries (all tributaries to Stanley Draper Lake) were observed. Stanley Draper Lake is an impoundment of East Elm Creek – a tributary to the Canadian River. Crutcho Creek is

a tributary to the North Canadian River. Finally, an area that retains water for prolonged duration was observed in the general area where the NHD, USGS, and other data label a stream known as West Branch Hog Creek. No stream characteristics were observed in this location.

d) Vegetation

Table 1 lists species observed during the on-site investigation. The Region 6 indicator status is noted for each observed species on Table 1. Table 2 explains the U.S. Environmental Protection Agency's Region 6 Wetland Indicator Status categories for 2016.

Table 1: Vegetation Observed in Investigation Area

Strata	Common Name	Scientific Name	2016 Region 6 Wetland Indicator Status
C	American Elm	*Ulmus americana*	FAC
C	Chinkapin Oak	*Quercus muehlenbergii*	FAC
C	Cottonwood	*Populus deltoides*	FAC
C/SS	Black Willow	*Salix nigra*	FACW
C/SS	Bur Oak	*Quercus macrocarpa*	FACU
C/SS	Cedar Elm	*Ulmus crassifolia*	FAC
C/SS	Eastern Red Cedar	*Juniperus virginiana*	UPL
C/SS	Post Oak	*Quercus stellata*	FACU
C/SS	Sugar Hackberry	*Celtis laevigata*	FAC
SS	American Beautyberry	*Callicarpa americana*	FACU
SS	Coralberry	*Symphoricarpos orbiculatus*	FACU
SS	Eastern Redbud	*Cercis canadensis*	UPL
SS	Flameleaf Sumac	*Rhus lanceolata*	UPL
SS	Mexican Plum	*Prunus mexicana*	UPL
SS	Roughleaf Dogwood	*Cornus drummondii*	FAC
V	Green Briar	*Smilax spp.*	FACU
V	Mustang Grape	*Vitis rotundifolia*	FAC
V/H	Honeysuckle	*Lonicera japonica*	FACU
V/H	Poison Ivy	*Toxicodendron radicans*	FACU
H	Bermudagrass	*Cynodon dactylon*	FACU
H	Giant Ragweed	*Ambrosia trifida*	FAC
H	Goldenrod	*Solidago spp.*	FAC
H	Inland Seaoats	*Chasmanthium latifolium*	FACU
H	Johnson Grass	*Sorghum halepense*	FACU
H	Little Bluestem	*Schizachyrium scoparium*	FACU
H	Virginia Wildrye	*Elymus virginicus*	FAC

C- canopy SS- sapling shrub V- vine H- herbaceous

Table 2: Explanation and Category of Plant Indicators

Indicator Status Rating	Designation	Qualitative Description (Lichvar et al. 2016)
Obligate (OBL)	Hydrophyte	Almost always occur in wetlands
Facultative Wetland (FACW)	Hydrophyte	Usually occur in wetlands, but may occur in non-wetlands
Facultative (FAC)	Hydrophyte / Non-hydrophyte	Occur in wetlands and non-wetlands
Facultative Upland (FACU)	Non-hydrophyte	Usually occur in non-wetlands, but may occur in wetlands
Upland (UPL)	Non-hydrophyte	Almost never occur in wetlands
[1]Categories were developed and defined by the USFWS National Wetlands Inventory and modified by the National Plant List Panel. The classifications listed are based on the 2016 National Wetland Plant List. (Lichvar et al. 2016)		

The proposed investigation area contained a diversity of vegetative cover to include a variety of species of trees, shrubs, and herbaceous vegetation. The predominant wooded species observed consisted of various oaks, American elm, and cedar elm. In addition to saplings of the canopy species, dominant understory species observed included eastern red cedar, redbud, and Mexican plum. Herbaceous species were dominated by little bluestem, bermudagrass, and inland seaoats.

e) Soils

According to the USDA, NRCS Web Soil Survey, the following soils, detailed in Table 3, are located along the proposed pipeline route.

Table 3: Investigation Area Soils Data

Soil Symbol	Soil Map Unit Name	Depth to High Water Table	Prime Farmland Soil	Hydric Soil
AstA	Ashport silt loam, 0 to 1 percent slopes, frequently flooded	>80 inches	No	No
BetA	Bethany silt loam, 0 to 1 percent slopes	>80 inches	Yes	No
BetB	Bethany silt loam, 1 to 3 percent slopes	>80 inches	Yes	No
BeUB	Bethany-Urban land complex, 0 to 3 percent slopes	>80 inches	No	No
GrAD	Grainola-Ashport, frequently flooded, complex, 0 to 12 percent slopes	>80 inches	No	No
GrHC	Grant-Huska complex, 1 to 5 percent slopes	>80 inches	Yes	No
GrIE	Grainola-Ironmound complex, 3 to 12 percent slopes	>80 inches	No	No
GrPC2	Grainola-Piedmont complex, 3 to 5 percent slopes, eroded	>80 inches	No	No
GUIE	Grainola-Urban land-Ironmound complex, 3 to 12 percent slopes	>80 inches	No	No

Table 3: Continued

HarC	Harrah fine sandy loam, 3 to 5 percent slopes	>80 inches	Yes	No
HarG	Harrah fine sandy loam, 3 to 45 percent slopes	>80 inches	No	No
KgIC	Kingfisher-Ironmound complex, 1 to 5 percent slopes	>80 inches	Yes	No
KrdA	Kirkland silt loam, 0 to 1 percent slopes	>80 inches	Yes	No
KrUA	Kirkland-Urban land complex, 0 to 1 percent slopes	>80 inches	No	No
LawA	Lawrie loam, 0 to 1 percent slopes, rarely flooded	>80 inches	Yes	No
LwUA	Lawrie-Urban land complex, 0 to 1 percent slopes, rarely flooded	>80 inches	No	No
NewB	Newalla fine sandy loam, 1 to 5 percent slopes	>80 inches	Yes	No
RinB	Renthin silt loam, 1 to 3 percent slopes	>80 inches	Yes	No
RnnC2	Renthin silty clay loam, 3 to 5 percent slopes, eroded	>80 inches	No	No
RnUC	Renthin-Urban land complex, 1 to 5 percent slopes	>80 inches	No	No
SDGD4	Stephenville-Darsil-Gullied land complex, 3 to 8 percent slopes	>80 inches	No	No
SDND	Stephenville-Darsil-Newalla complex, 3 to 8 percent slopes	>80 inches	No	No
SDND2	Stephenville-Darsil-Newalla complex, 3 to 8 percent slopes, eroded	>80 inches	No	No
StDC	Stephenville-Darsil complex, 1 to 5 percent slopes	>80 inches	Yes	No
TriA	Tribbey fine sandy loam, 0 to 1 percent slopes, frequently flooded	6 to 42 inches	No	No
URB	Urban land	>80 inches	No	No

Ten soils are listed as prime farmland soils and no soils are listed as hydric soils. Figure C-1 in Appendix C shows the proposed pipeline alignment superimposed on to the soils maps; descriptions of the mapped soil types follow the figure.

4) Conclusions

a) Description of Potential Waters of the U.S.

Potential waters of the U.S. within the investigation area include eight streams and one forested wetland. All identified aquatic resources should be considered jurisdictional due to their direct hydrologic connection to the Canadian River, which is considered traditionally navigable rivers. Crutcho Creek and two of its unnamed tributaries are located in the western portion of the investigation area. East Elm Creek and four of its unnamed tributaries are located in the eastern portion of the investigation area. Both Crutcho Creek and East Elm Creek at the time of the on-site investigation were flowing and should be classified as intermittent with perennial pools.

In addition to the aforementioned streams, the area once occupied by West Branch Hog Creek displayed forested wetland characteristics. At the time of the on-site investigation,

no standing water was observed in this forested wetland area; however, evidence of prolonged inundation was readily observable. Further the vegetation observed in this area is adapted to thriving in anoxic conditions as a result of saturated soil conditions. Consequently, this area should be considered a jurisdictional forested wetland.

b) Summary

The limits of waters of the U.S. within the investigation area are summarized in Table 4. Figures A-10-a through A-10-e in Appendix A shows the delineated aquatic resources that should be considered potential waters of the U.S. and subject to Section 404 of the Clean Water Act permit requirements. Figure D-1 in Appendix D shows the sampling locations used in the field and wetland determination data forms follow the figure.

Table 4: Potential Waters of the U.S.

Identification	Aquatic Resource	Flow Regime	Width at OHWM (Feet)	Length (Feet)	Area (Acres)
Stream 1	Unnamed Tributary to Crutcho Creek	Intermittent (Channelized)	20	50.8	0.02
Stream 2	Crutcho Creek	Intermittent with Perennial Pools	14	45.2	0.01
Stream 3	Unnamed Tributary to Crutcho Creek	Intermittent (Channelized)	18	43.3	0.02
Stream 4	Same Tributary as Stream 3 (2nd Crossing)		18	59.7	0.02
Stream 5	Unnamed Tributary to East Elm Creek (Stanley Draper Lake)	Ephemeral	3	43.6	0.003
Stream 6	Unnamed Tributary to East Elm Creek (Stanley Draper Lake)	Ephemeral	5	45.3	0.005
Stream 7	East Elm Creek (Impounded by Stanley Draper Lake)	Ephemeral	12	171.1	0.05
Stream 8	Unnamed Tributary to East Elm Creek (Stanley Draper Lake)	Ephemeral	5	53.3	0.006
Stream 9	Unnamed Tributary to East Elm Creek (Stanley Draper Lake)	Ephemeral	10	40.6	0.009
Forested Wetland	Forested Wetland in former location of West Branch Hog Creek	Forested Wetland	N/A	N/A	0.1
Total				**552.9**	**0.243**

c) Permitting Requirements

Section 404 of the Clean Water Act (Section 404) regulates the discharge of dredged or fill materials into waters of the U.S. Permits to authorize the discharge of dredged or fill materials are available as general or individual permits administered by the USACE. General permits typically apply to routine activities such as utility line activities that have minimal impacts to waters of the U.S. These general permits include Nationwide Permits or Regional General Permits. Individual permits are available for activities which have impacts or activities beyond those listed under general permits. Nationwide Permit 12 for Utility Line Activities would be an applicable permit for the proposed construction activities associated with the Del City Raw Water Pipeline Improvement's construction techniques.

As proposed, the proposed project components would be authorized by Nationwide Permit 12 for Utility Line Activities. Permanent adverse impacts to waters of the U.S. are beneath the preconstruction notification requirements for authorization under NWP 12 (loss of greater than $1/10^{th}$ of an acre of waters of the U.S.). As proposed, no permanent adverse impacts to the delineated aquatic resources would occur due to the lining of the existing pipeline. A copy of NWP 12 is included in Appendix E.

d) References

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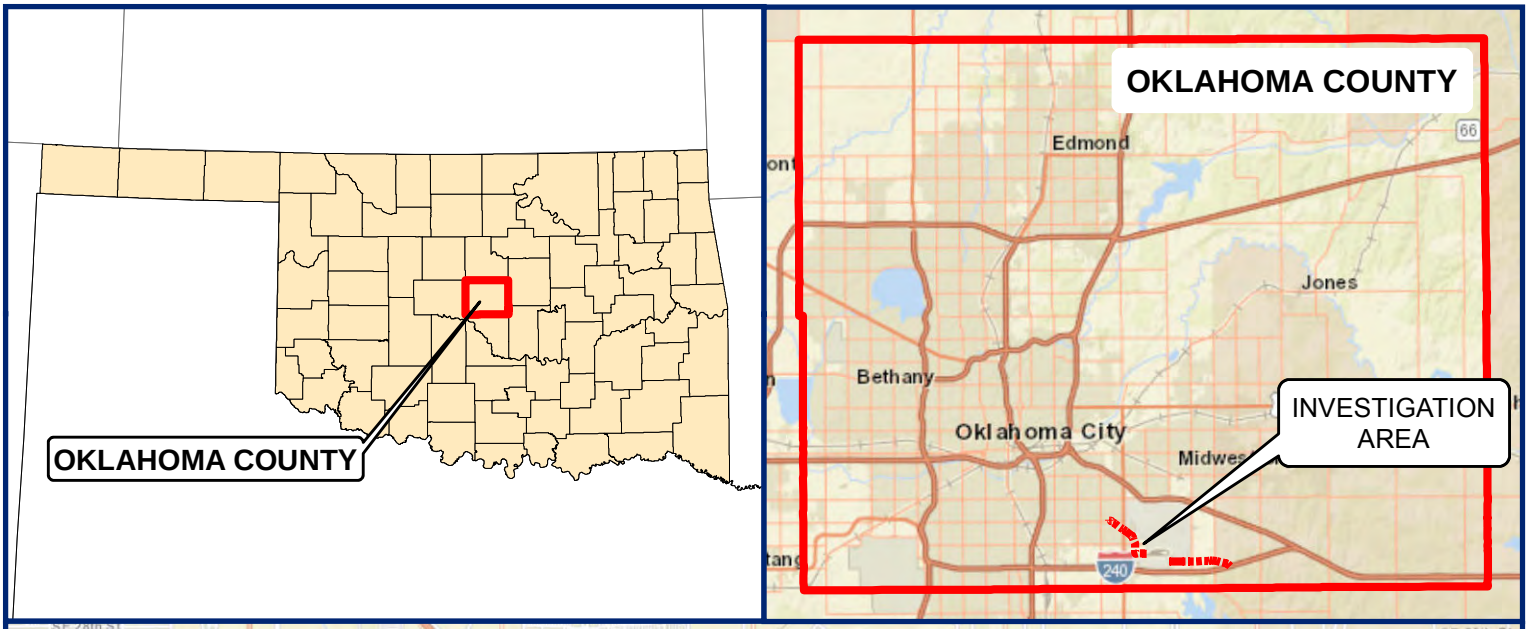
Woods, AJ, JM Omernik, DR Butler, JG Ford, JE Henley, BW Hoagland, DS Arndt, and BC Moran. 2005. Ecoregions of Oklahoma (color poster with map, descriptive text, summary tables, and photographs.) Reston, Virginia. U.S. Geological Survey (map scale 1:1,250,000).

APPENDIX A

FIGURES



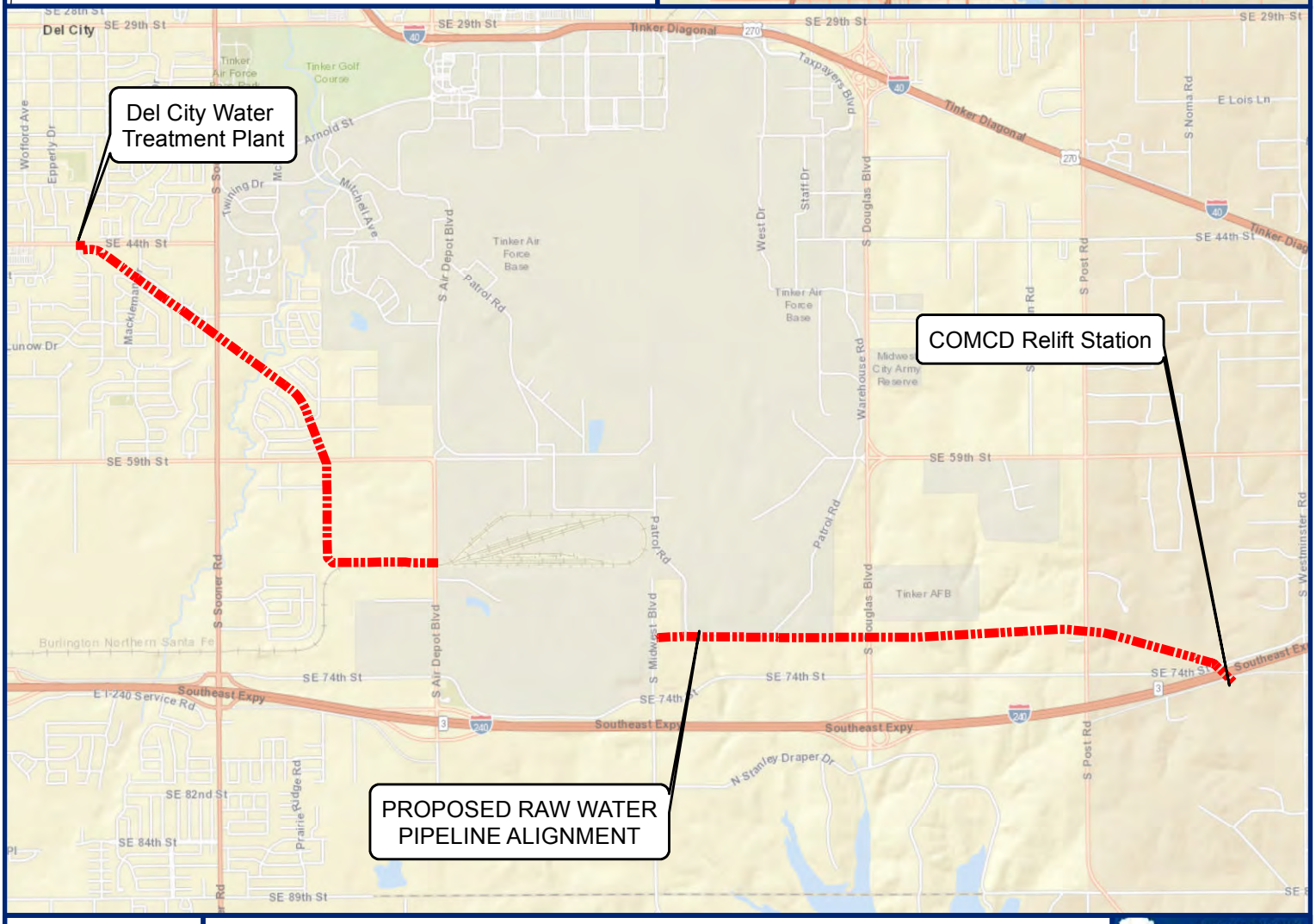


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FIGURE A-1
GENERAL LOCATION
PROPOSED DEL CITY RAW WATER PIPELINE IMPROVEMENTS PROJECT
CENTRAL OKLAHOMA MASTER CONSERVANCY DISTRICT
OKLAHOMA COUNTY, OKLAHOMA

ALAN PLUMMER ASSOCIATES, INC.
ENVIRONMENTAL ENGINEERS AND SCIENTISTS
414 NW 4TH STREET
SUITE 150
OKLAHOMA CITY,
OKLAHOMA 73102
PHONE: (405) 440-2725

DATE: 9/6/2018

FIGURE 1 OF 10

4,000 2,000 0 Feet

SOURCE: ESRI BASE DATA

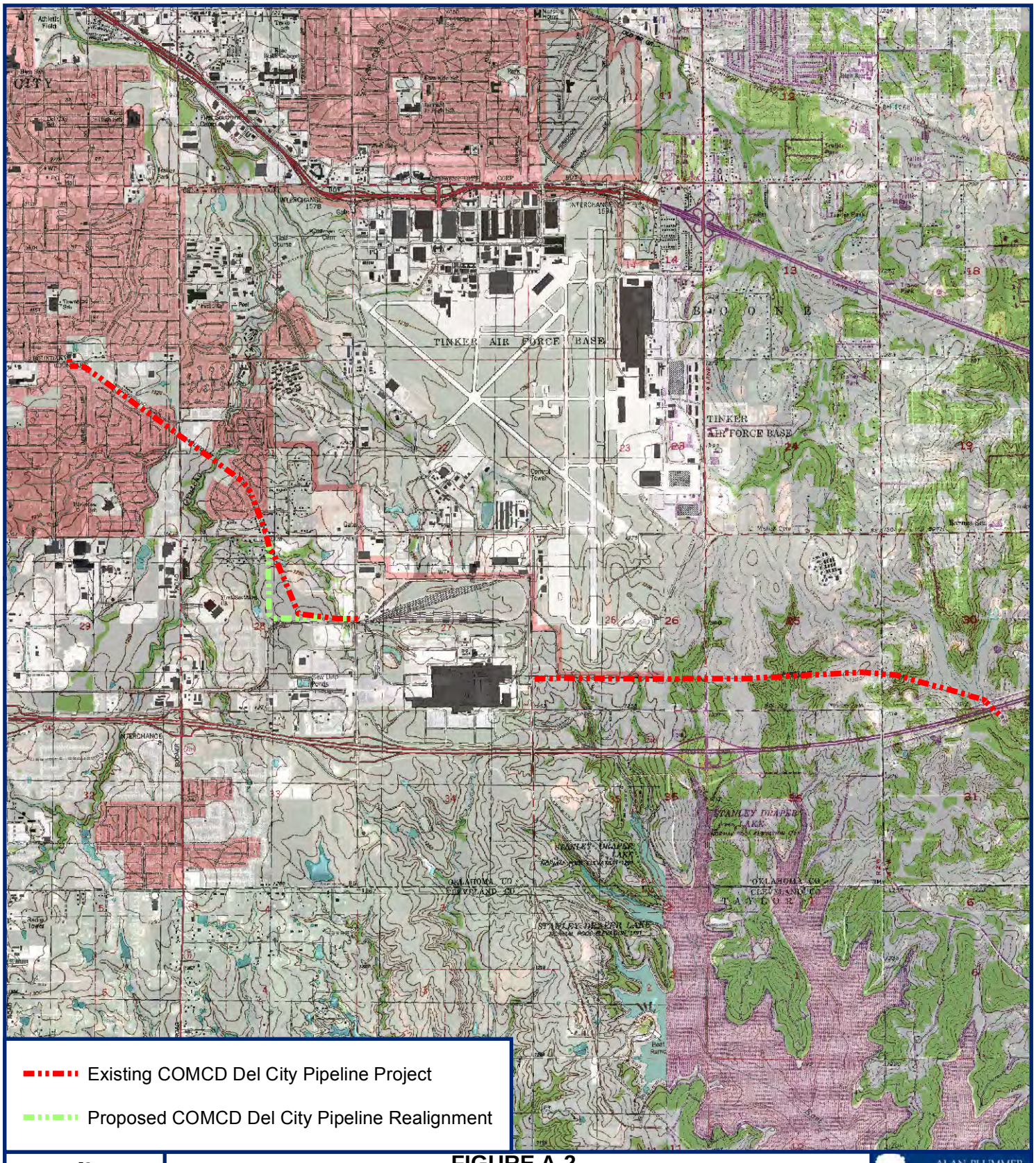

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FIGURE A-2
USGS TOPOGRAPHIC MAP
CHOCTAW AND MIDWEST CITY, OKLAHOMA QUADRANGLES
PROPOSED DEL CITY RAW WATER PIPELINE IMPROVEMENTS PROJECT
CENTRAL OKLAHOMA MASTER CONSERVANCY DISTRICT
OKLAHOMA COUNTY, OKLAHOMA

ALAN PLUMMER ASSOCIATES, INC.
ENVIRONMENTAL ENGINEERS AND SCIENTISTS
414 NW 4TH STREET
SUITE 150
OKLAHOMA CITY,
OKLAHOMA 73102
PHONE: (405) 440-2725

DATE: 9/6/2018

FIGURE 2 OF 10

4,000 2,000 0 Feet

SOURCE: https://okmaps.org/OGI/search.aspx

USACE Project No.:

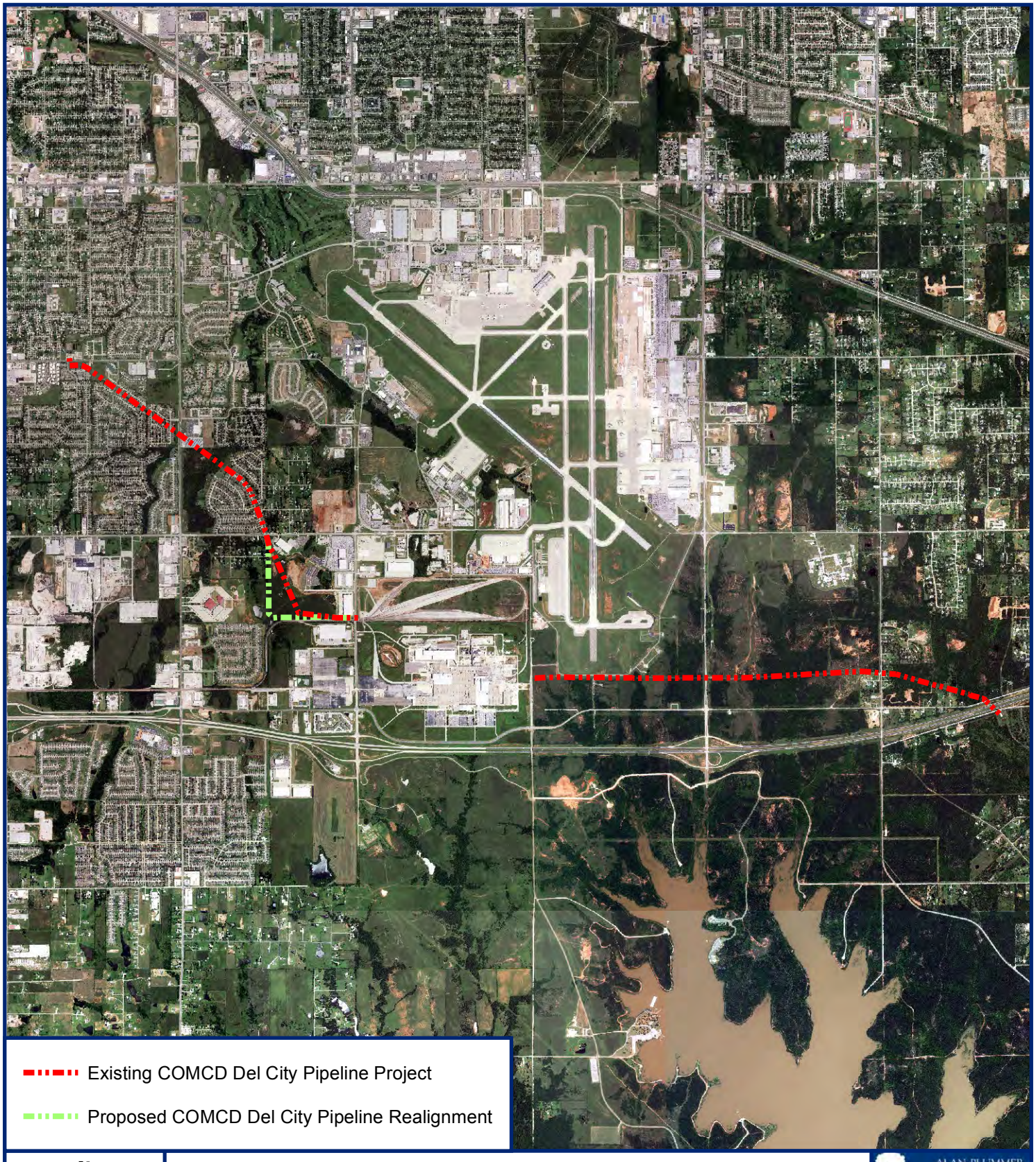

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FIGURE A-3
2015 AERIAL PHOTOGRAPH
PROPOSED DEL CITY RAW WATER PIPELINE IMPROVEMENTS PROJECT
CENTRAL OKLAHOMA MASTER CONSERVANCY DISTRICT
OKLAHOMA COUNTY, OKLAHOMA

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ENVIRONMENTAL ENGINEERS AND SCIENTISTS
414 NW 4TH STREET
SUITE 150
OKLAHOMA CITY,
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FIGURE 3 OF 10

4,000 2,000 0 Feet

SOURCE: https://okmaps.org/OGI/search.aspx

USACE Project No.:

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FIGURE A-4
2010 AERIAL PHOTOGRAPH
PROPOSED DEL CITY RAW WATER PIPELINE IMPROVEMENTS PROJECT
CENTRAL OKLAHOMA MASTER CONSERVANCY DISTRICT
OKLAHOMA COUNTY, OKLAHOMA

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ENVIRONMENTAL ENGINEERS AND SCIENTISTS
414 NW 4TH STREET
SUITE 150
OKLAHOMA CITY,
OKLAHOMA 73102
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FIGURE 4 OF 10

4,000 2,000 0 Feet

SOURCE: https://okmaps.org/OGI/search.aspx

USACE Project No.:

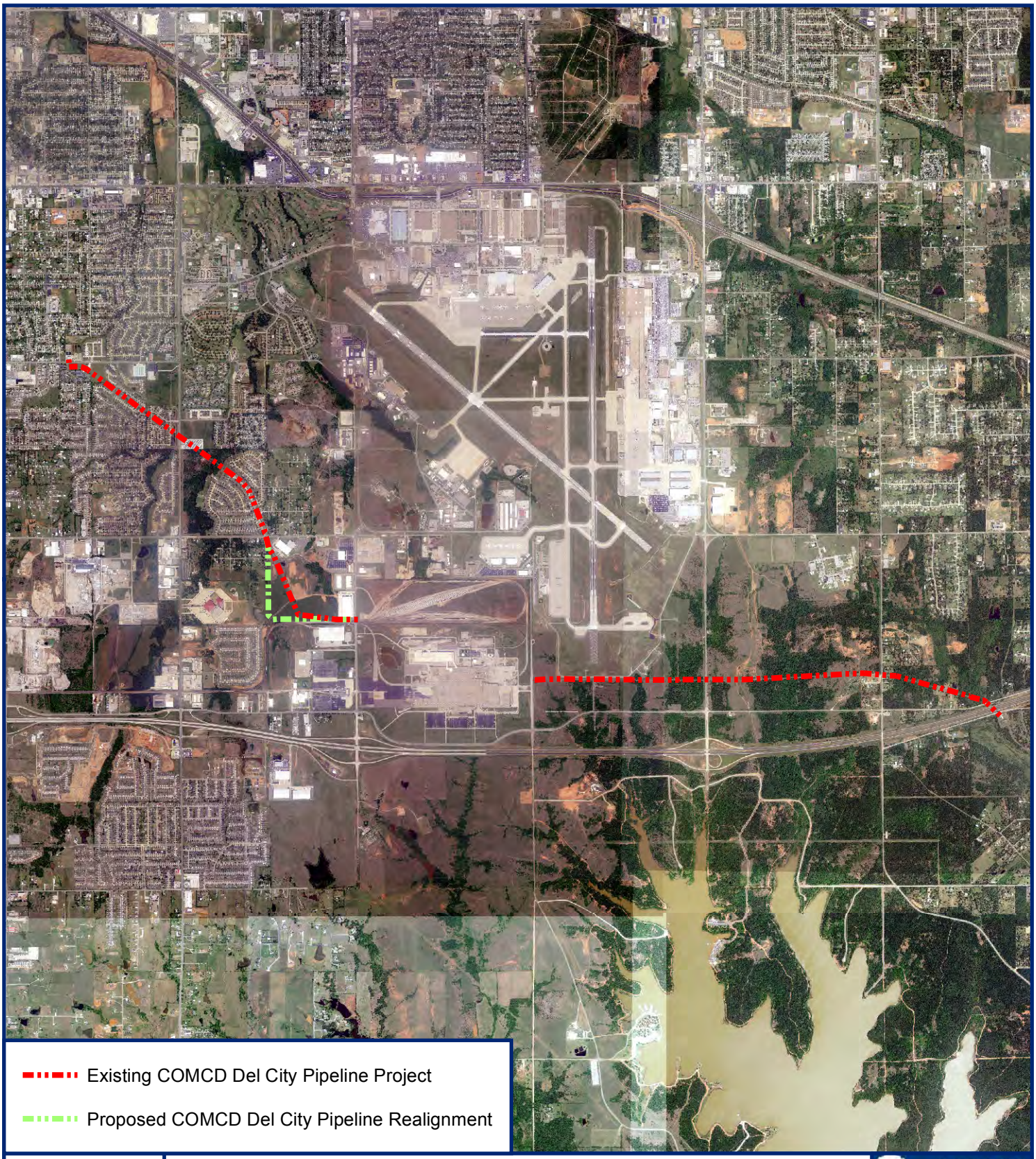

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FIGURE A-5
2008 AERIAL PHOTOGRAPH
PROPOSED DEL CITY RAW WATER PIPELINE IMPROVEMENTS PROJECT
CENTRAL OKLAHOMA MASTER CONSERVANCY DISTRICT
OKLAHOMA COUNTY, OKLAHOMA

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ENVIRONMENTAL ENGINEERS AND SCIENTISTS
414 NW 4TH STREET
SUITE 150
OKLAHOMA CITY,
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FIGURE 5 OF 10

4,000 2,000 0 Feet

SOURCE: https://okmaps.org/OGI/search.aspx

USACE Project No.:

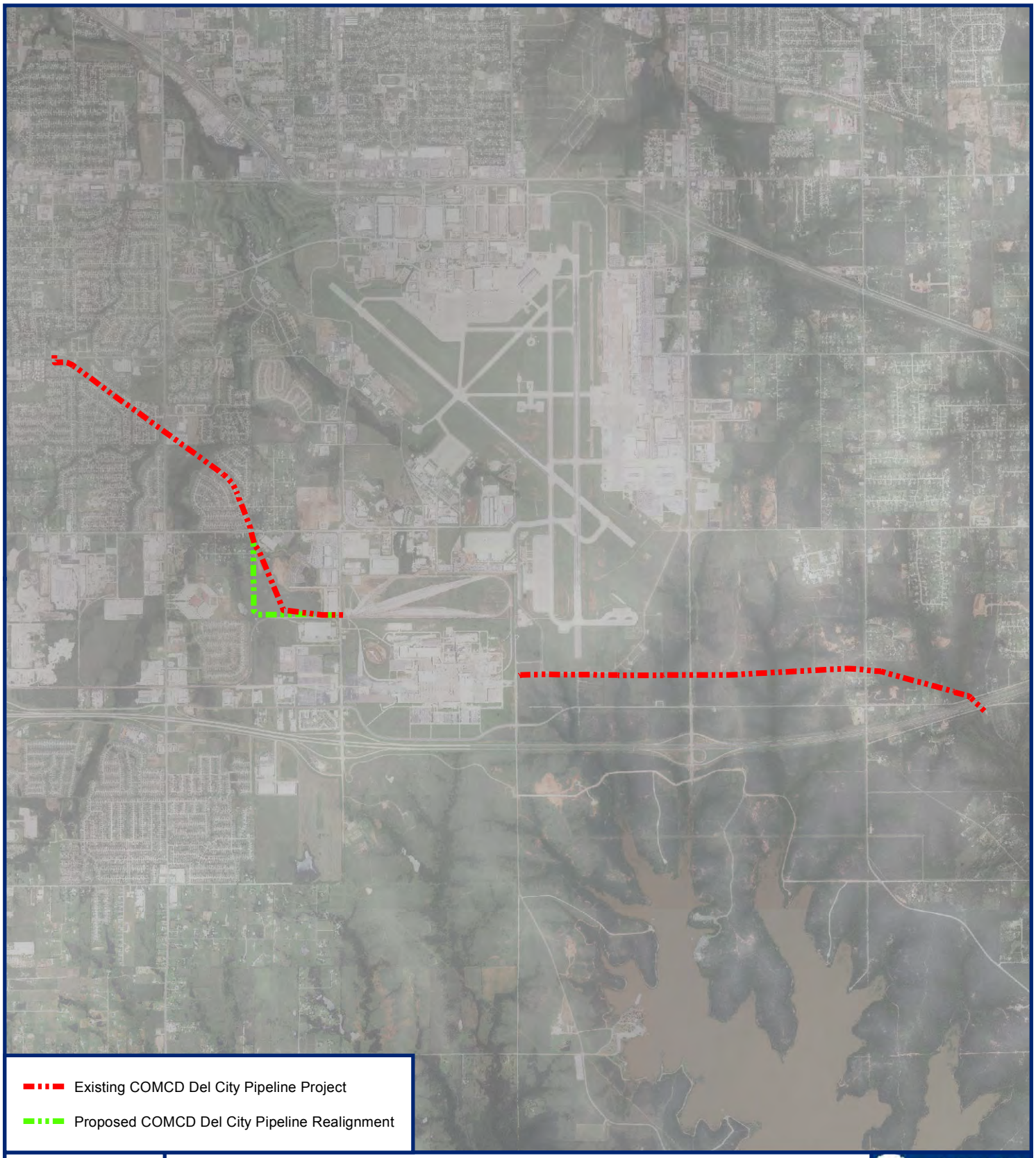

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FIGURE A-6
LIDAR ELEVATION DATA
PROPOSED DEL CITY RAW WATER PIPELINE IMPROVEMENTS PROJECT
CENTRAL OKLAHOMA MASTER CONSERVANCY DISTRICT
OKLAHOMA COUNTY, OKLAHOMA

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ENVIRONMENTAL ENGINEERS AND SCIENTISTS
414 NW 4TH STREET
SUITE 150
OKLAHOMA CITY,
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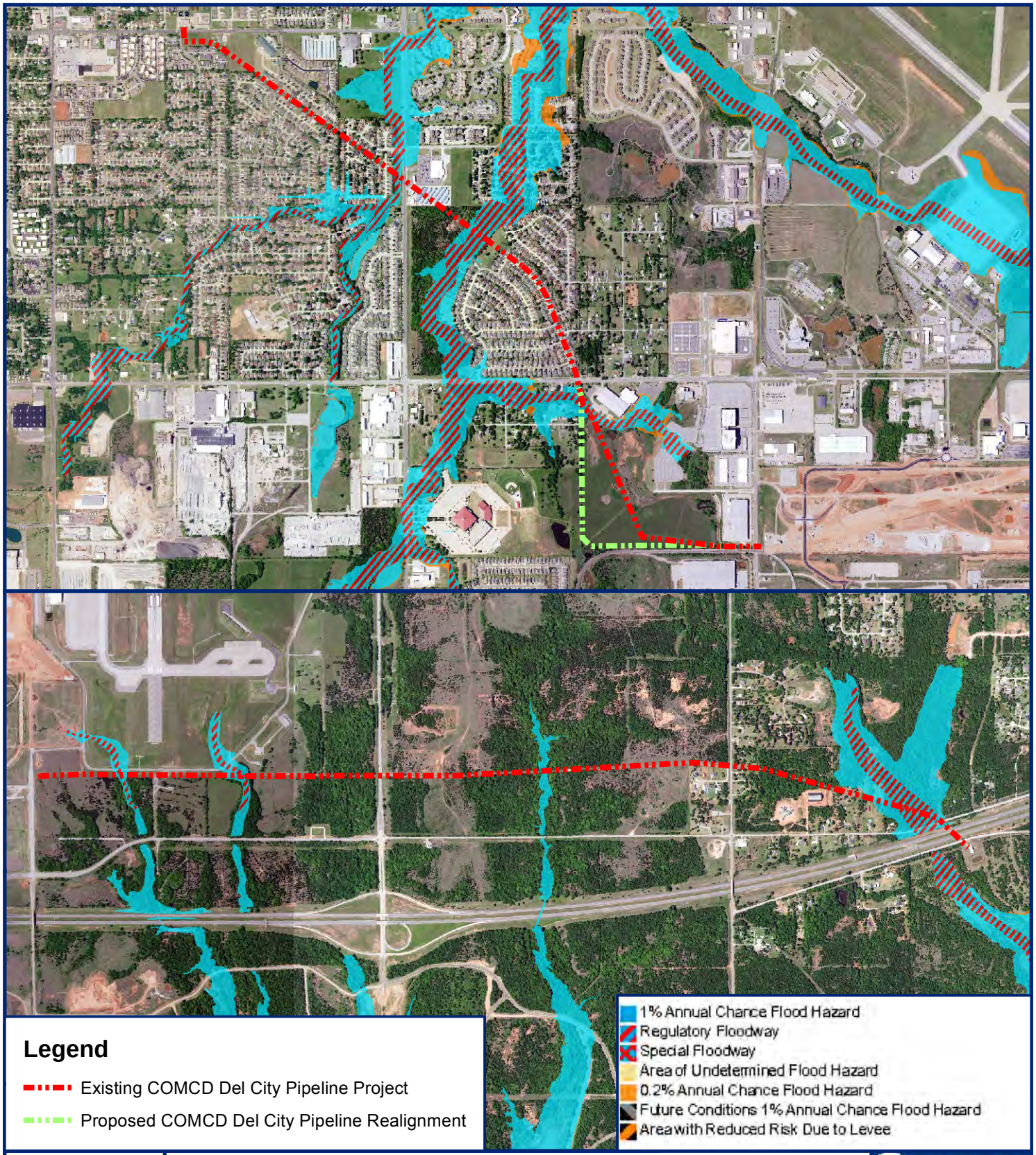
FIGURE 6 OF 10

4,000 2,000 0 Feet

SOURCE: https://okmaps.org/OGI/search.aspx

USACE Project No.:



Legend

- Existing COMCD Del City Pipeline Project
- Proposed COMCD Del City Pipeline Realignment

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FIGURE 7
FEDERAL EMERGENCY MANAGEMENT AGENCY
FLOOD INSURANCE RATE MAP
PROPOSED RAW WATER PIPELINE ALIGNMENT
CENTRAL OKLAHOMA MASTER CONSERVANCY DISTRICT
OKLAHOMA COUNTY, OKLAHOMA

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ENVIRONMENTAL ENGINEERS AND SCIENTISTS
414 NW 4TH STREET
SUITE 150
OKLAHOMA CITY,
OKLAHOMA 73102
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DATE: 9/6/2018

FIGURE 7 OF 10

2,000 1,000 0 Feet

SOURCE: FEMA MAP STORE NATIONAL FLOOD HAZARD LAYER
https://okmaps.org/OGI/search.aspx

USACE Project No.:

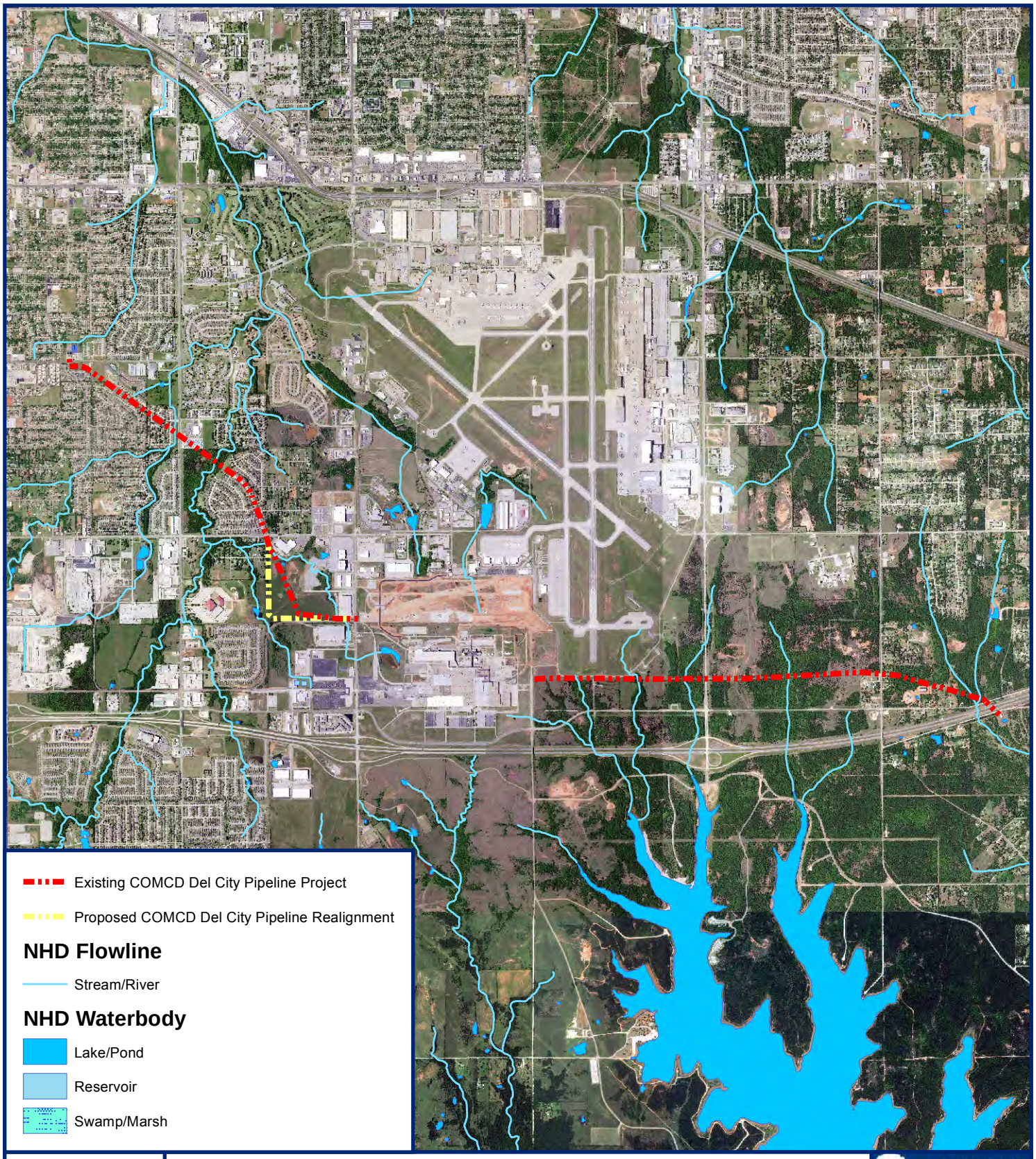

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FIGURE A-8
NATIONAL HYDROGRAPHY DATASET
PROPOSED DEL CITY RAW WATER PIPELINE IMPROVEMENTS PROJECT
CENTRAL OKLAHOMA MASTER CONSERVANCY DISTRICT
OKLAHOMA COUNTY, OKLAHOMA

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ENVIRONMENTAL ENGINEERS AND SCIENTISTS
414 NW 4TH STREET
SUITE 150
OKLAHOMA CITY,
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FIGURE 8 OF 10

4,000 2,000 0 Feet

SOURCE: https://okmaps.org/OGI/search.aspx

USACE Project No.:

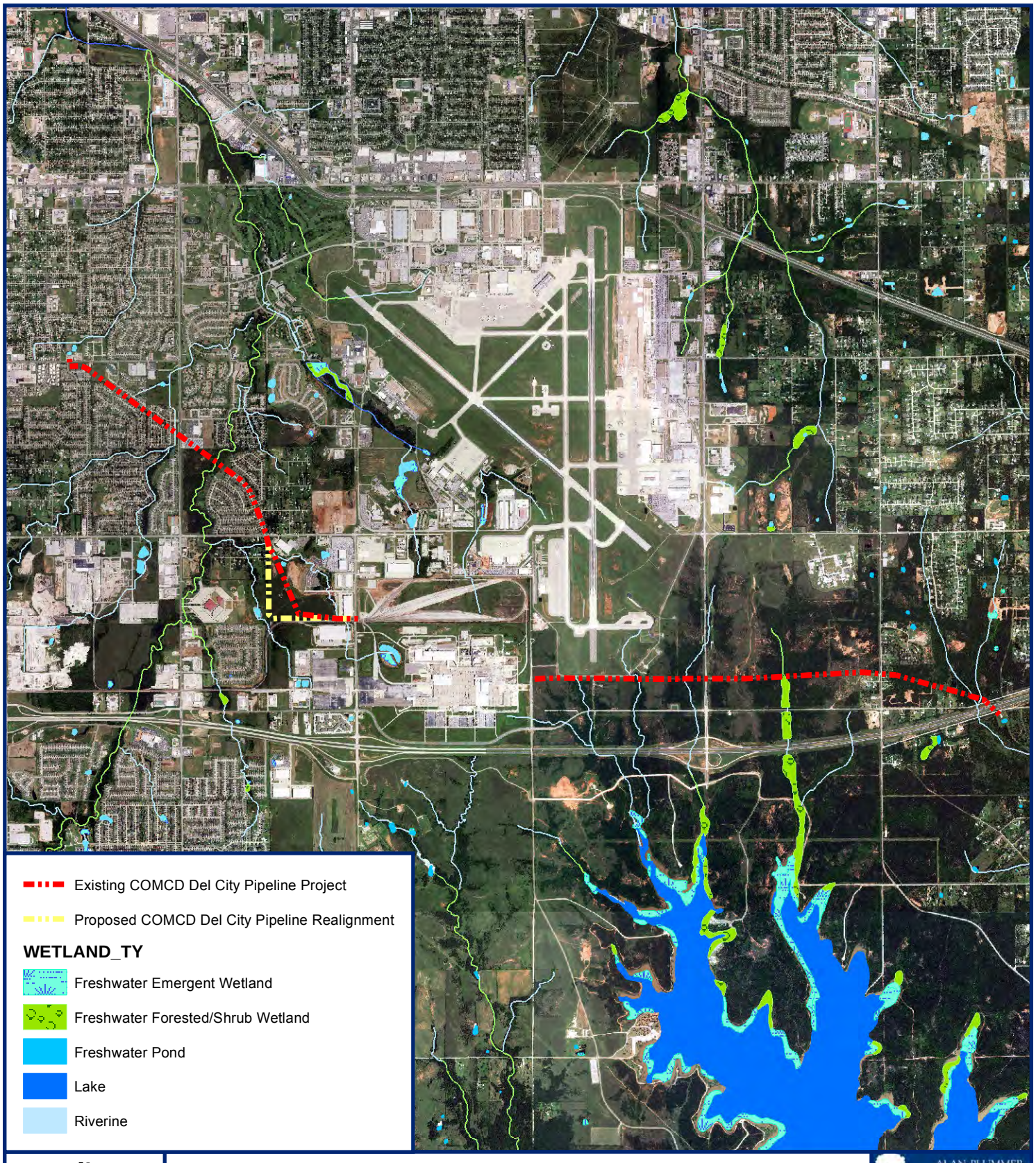

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FIGURE A-9
NATIONAL WETLAND INVENTORY
PROPOSED DEL CITY RAW WATER PIPELINE IMPROVEMENTS PROJECT
CENTRAL OKLAHOMA MASTER CONSERVANCY DISTRICT
OKLAHOMA COUNTY, OKLAHOMA

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ENVIRONMENTAL ENGINEERS AND SCIENTISTS
414 NW 4TH STREET
SUITE 150
OKLAHOMA CITY,
OKLAHOMA 73102
PHONE: (405) 440-2725

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FIGURE 9 OF 10

4,000 2,000 0 Feet

SOURCE: https://okmaps.org/OGI/search.aspx

USACE Project No.:

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300 150 0 Feet

FIGURE A-10-a
PRELIMINARY JURISDICTIONAL DETERMINATION OF WATERS OF THE U.S.
PROPOSED DEL CITY RAW WATER PIPELINE IMPROVEMENTS PROJECT
CENTRAL OKLAHOMA MASTER CONSERVANCY DISTRICT
OKLAHOMA COUNTY, OKLAHOMA

ALAN PLUMMER ASSOCIATES, INC.
ENVIRONMENTAL ENGINEERS AND SCIENTISTS
414 NW 4TH STREET
SUITE 150
OKLAHOMA CITY,
OKLAHOMA 73102
PHONE: (405) 440-2725

DATE: 9/6/2018

FIGURE 10 OF 10

SOURCE: https://okmaps.org/OGI/search.aspx

USACE Project No.:

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FIGURE A-10-b
PRELIMINARY JURISDICTIONAL DETERMINATION OF WATERS OF THE U.S.
PROPOSED DEL CITY RAW WATER PIPELINE IMPROVEMENTS PROJECT
CENTRAL OKLAHOMA MASTER CONSERVANCY DISTRICT
OKLAHOMA COUNTY, OKLAHOMA

ALAN PLUMMER ASSOCIATES, INC.
ENVIRONMENTAL ENGINEERS AND SCIENTISTS
414 NW 4TH STREET
SUITE 150
OKLAHOMA CITY,
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PHONE: (405) 440-2725

DATE: 9/6/2018

FIGURE 10 OF 10

400 200 0 Feet

SOURCE: https://okmaps.org/OGI/search.aspx

USACE Project No.:

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W E
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FIGURE A-10-c
PRELIMINARY JURISDICTIONAL DETERMINATION OF WATERS OF THE U.S.
PROPOSED DEL CITY RAW WATER PIPELINE IMPROVEMENTS PROJECT
CENTRAL OKLAHOMA MASTER CONSERVANCY DISTRICT
OKLAHOMA COUNTY, OKLAHOMA

ALAN PLUMMER ASSOCIATES, INC.
ENVIRONMENTAL ENGINEERS AND SCIENTISTS
414 NW 4TH STREET
SUITE 150
OKLAHOMA CITY,
OKLAHOMA 73102
PHONE: (405) 440-2725

DATE: 9/6/2018

FIGURE 10 OF 10

400 200 0 Feet

SOURCE: https://okmaps.org/OGI/search.aspx

USACE Project No.:

FIGURE A-10-d
PRELIMINARY JURISDICTIONAL DETERMINATION OF WATERS OF THE U.S.
PROPOSED DEL CITY RAW WATER PIPELINE IMPROVEMENTS PROJECT
CENTRAL OKLAHOMA MASTER CONSERVANCY DISTRICT
OKLAHOMA COUNTY, OKLAHOMA

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ENVIRONMENTAL ENGINEERS AND SCIENTISTS
414 NW 4TH STREET
SUITE 150
OKLAHOMA CITY,
OKLAHOMA 73102
PHONE: (405) 440-2725

DATE: 9/6/2018

FIGURE 10 OF 10

400 200 0 Feet

SOURCE: https://okmaps.org/OGI/search.aspx

USACE Project No.:

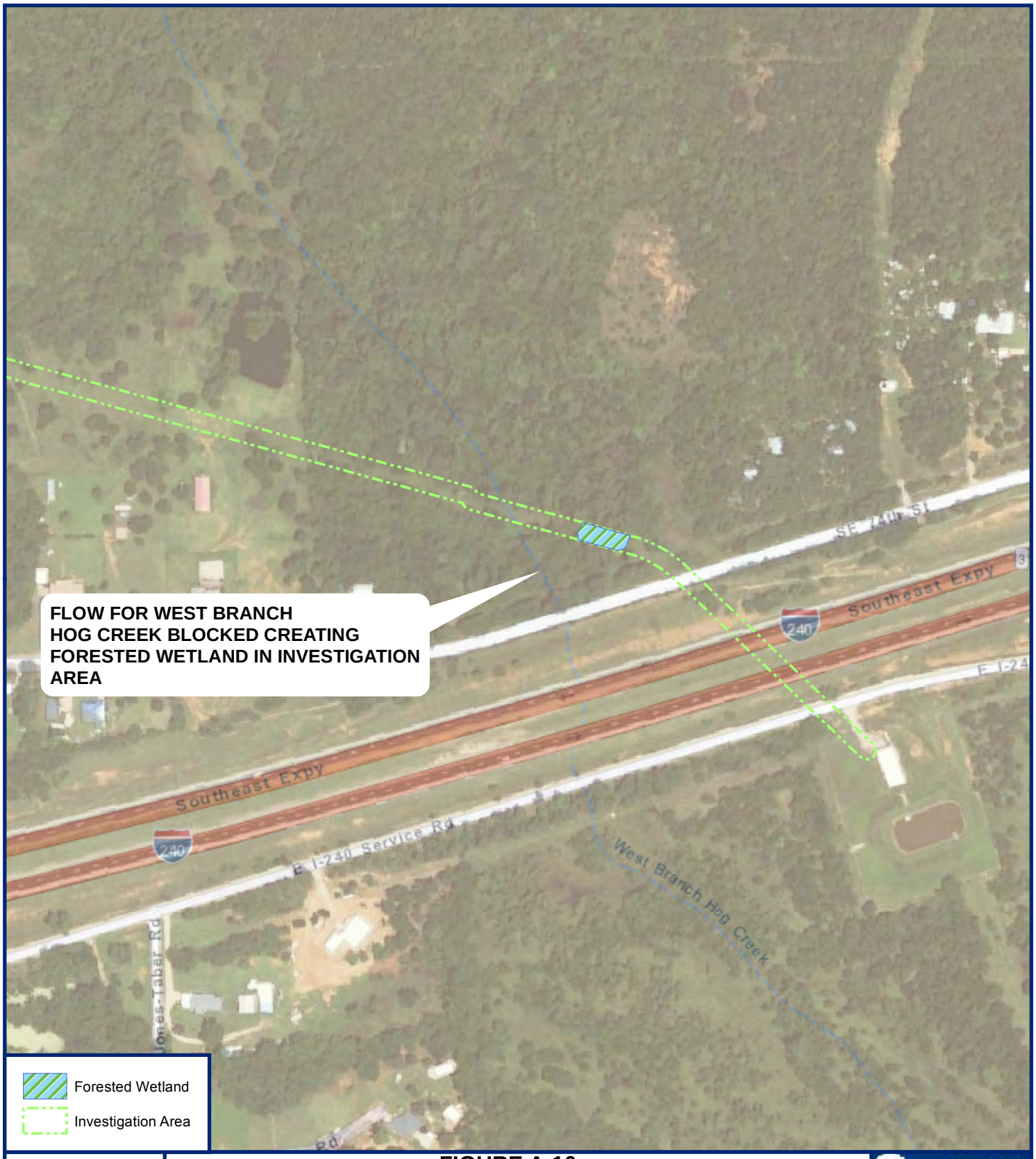

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FIGURE A-10-e
PRELIMINARY JURISDICTIONAL DETERMINATION OF WATERS OF THE U.S.
PROPOSED DEL CITY RAW WATER PIPELINE IMPROVEMENTS PROJECT
CENTRAL OKLAHOMA MASTER CONSERVANCY DISTRICT
OKLAHOMA COUNTY, OKLAHOMA

ALAN PLUMMER ASSOCIATES, INC.
ENVIRONMENTAL ENGINEERS AND SCIENTISTS
414 NW 4TH STREET
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OKLAHOMA CITY,
OKLAHOMA 73102
PHONE: (405) 440-2725

DATE: 9/6/2018

FIGURE 10 OF 10

300 150 0 Feet

SOURCE: https://okmaps.org/OGI/search.aspx

USACE Project No.:

APPENDIX B

PHOTOGRAPHS

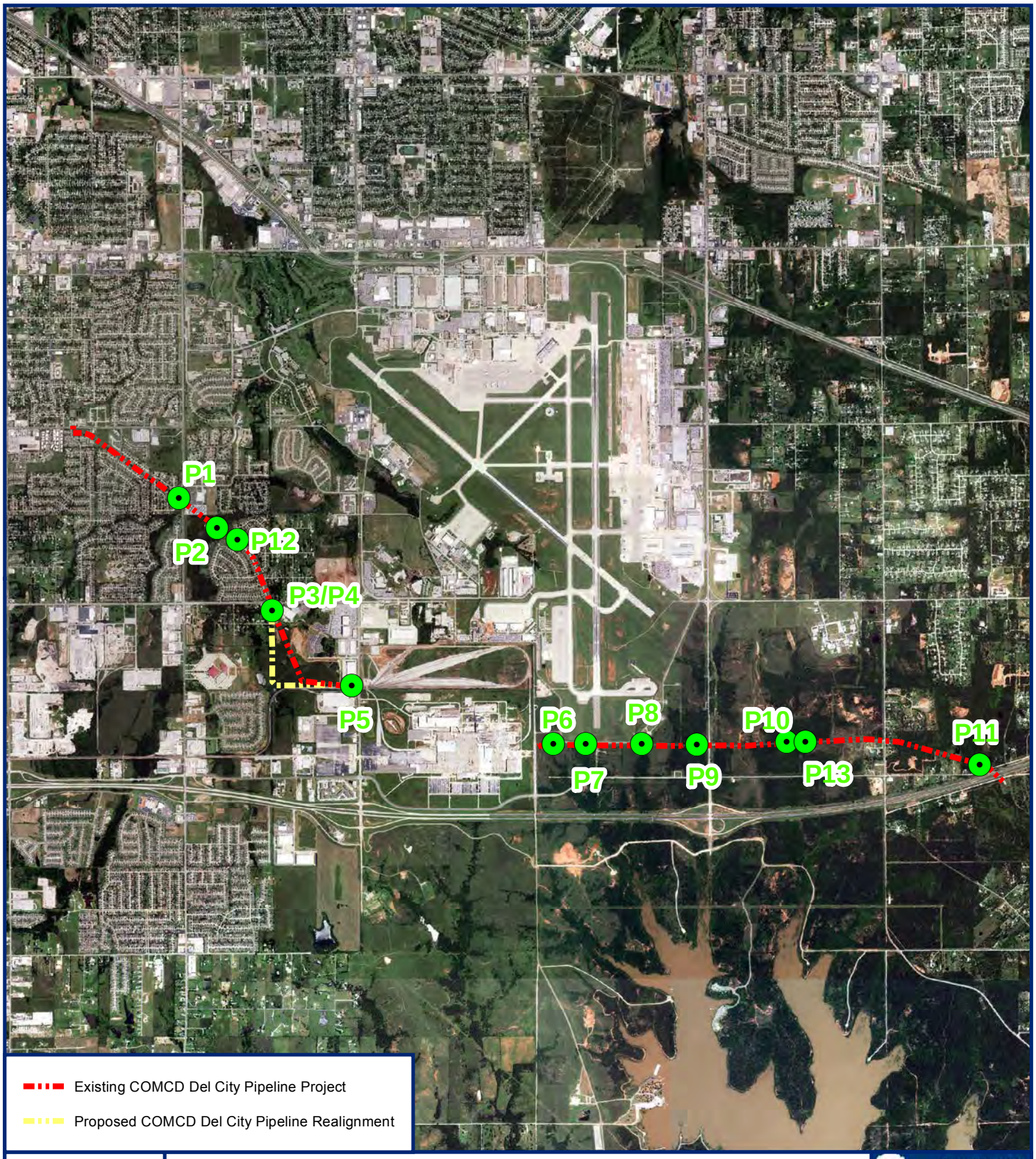

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FIGURE B-1
PHOTOGRAPH LOCATIONS
PROPOSED DEL CITY RAW WATER PIPELINE IMPROVEMENTS PROJECT
CENTRAL OKLAHOMA MASTER CONSERVANCY DISTRICT
OKLAHOMA COUNTY, OKLAHOMA

ALAN PLUMMER ASSOCIATES, INC.
ENVIRONMENTAL ENGINEERS AND SCIENTISTS
414 NW 4TH STREET
SUITE 150
OKLAHOMA CITY,
OKLAHOMA 73102
PHONE: (405) 440-2725

DATE: 9/26/2018

FIGURE 1 OF 1

4,000 2,000 0 Feet

SOURCE: https://okmaps.org/OGI/search.aspx

USACE Project No.:

P1. Stream 1 – Unnamed Tributary to Crutcho Creek (Channelized Stream) (Stream 1 on Preliminary Jurisdictional Determination (PJD) Figure A-10 Series)

P2. Stream 2 – Crutcho Creek (Stream 2 on PJD Figure)

P3. Stream 3 – Unnamed Tributary to Crutcho Creek (Unchannelized Portion)(Stream 3 on PJD Figure)

P4. Stream 3 – Unnamed Tributary to Crutcho Creek (Channelized Portion)(Stream 3 on PJD Figure)

P5. Stream 3 Crossing 2 (Channelized Stream)(Stream 4 on PJF Figure)

P6. Stream 4 – Unnamed Tributary to East Elm Creek (Stream 5 on PJD Figure)

P7. Stream 5 – Unnamed Tributary to East Elm Creek (Stream 6 on PJD Figure)

P8. Stream 6 – Unnamed Tributary to East Elm Creek (Stream 7 on PJD Figure)

P9. Stream 7 – East Elm Creek (Stream 8 on PJD Figure)

P10. Stream 8 – Unnamed Tributary to East Elm Creek (Stream 9 on PJD Figure)

P11. Black Willow Dominated Forested Wetland Area – General location of West Branch Hog Creek

P12. Single-family Residential Area on Western Portion of Project

P13. Native Vegetation Observed on Eastern Portion of Project

APPENDIX C

SOILS INFORMATION

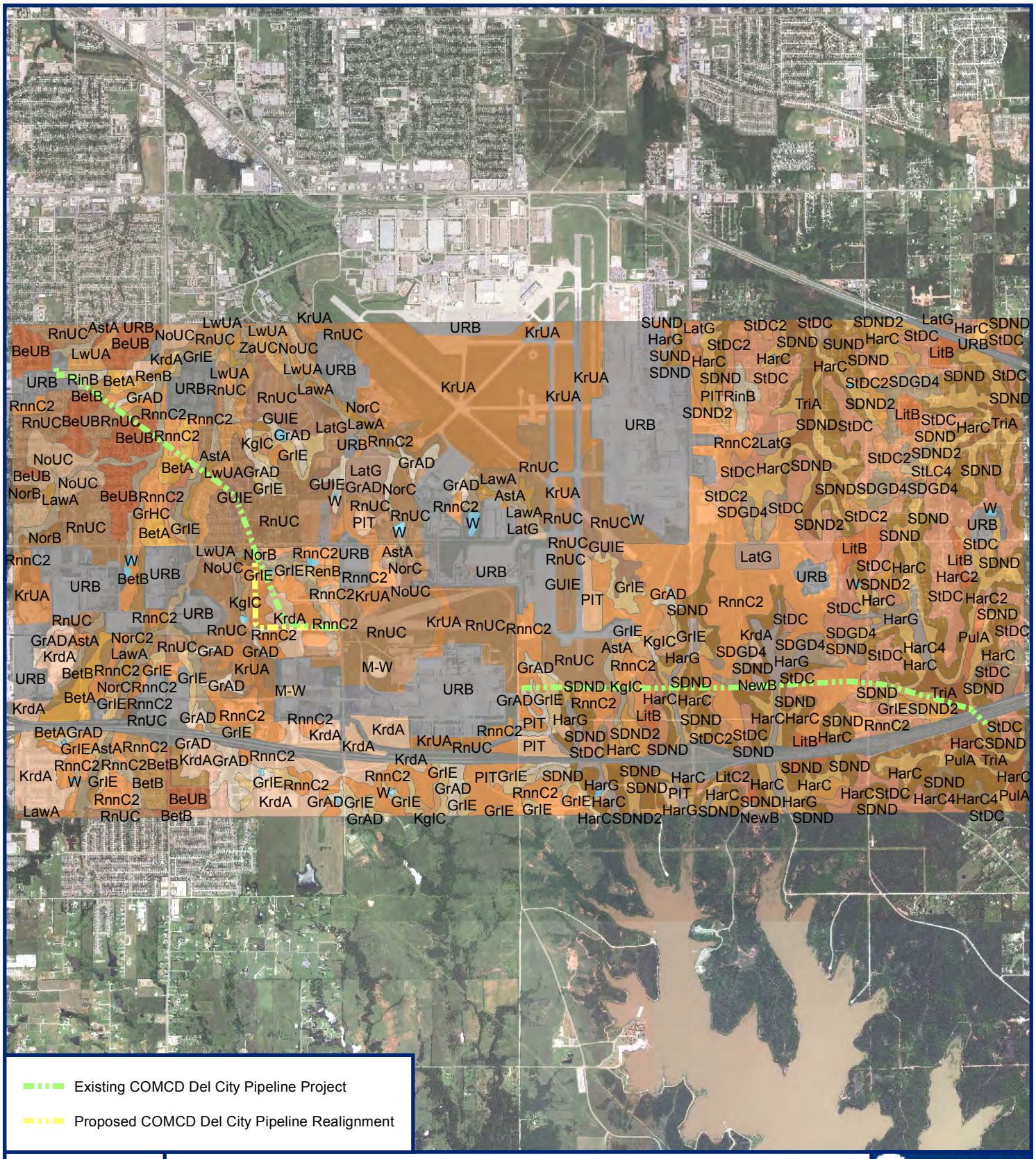

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FIGURE C-1
MAPPED SOIL UNITS IN THE PROJECT VICINITY
PROPOSED DEL CITY RAW WATER PIPELINE IMPROVEMENTS PROJECT
CENTRAL OKLAHOMA MASTER CONSERVANCY DISTRICT
OKLAHOMA COUNTY, OKLAHOMA

ALAN PLUMMER ASSOCIATES, INC.
ENVIRONMENTAL ENGINEERS AND SCIENTISTS
414 NW 4TH STREET
SUITE 150
OKLAHOMA CITY,
OKLAHOMA 73102
PHONE: (405) 440-2725

DATE: 9/6/2018

FIGURE 1 OF 1

4,000 2,000 0 Feet

SOURCE: https://okmaps.org/OGI/search.aspx

USACE Project No.:

United States Department of Agriculture

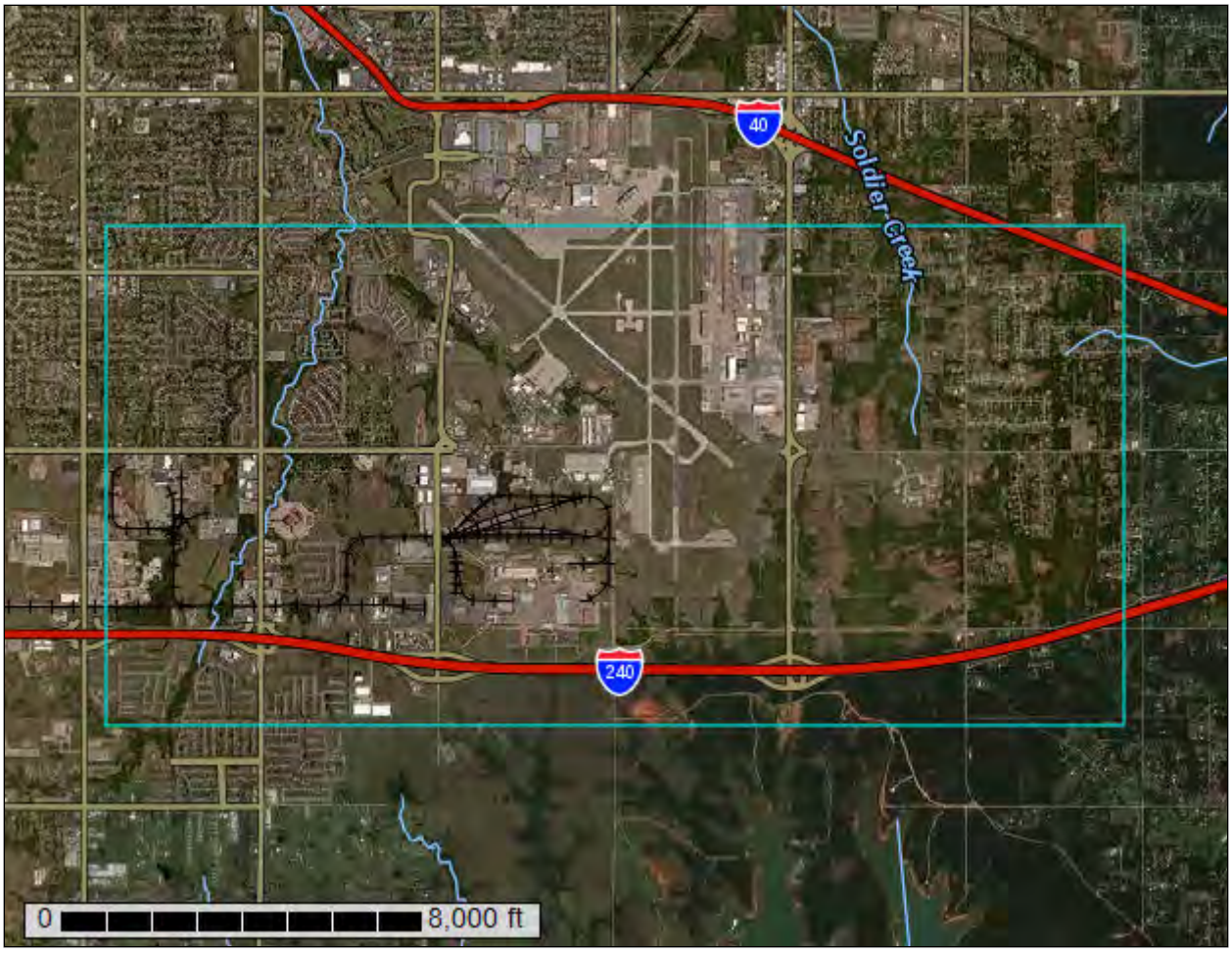
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Oklahoma County, Oklahoma

COMCD Proposed Raw Water Line



December 11, 2017

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

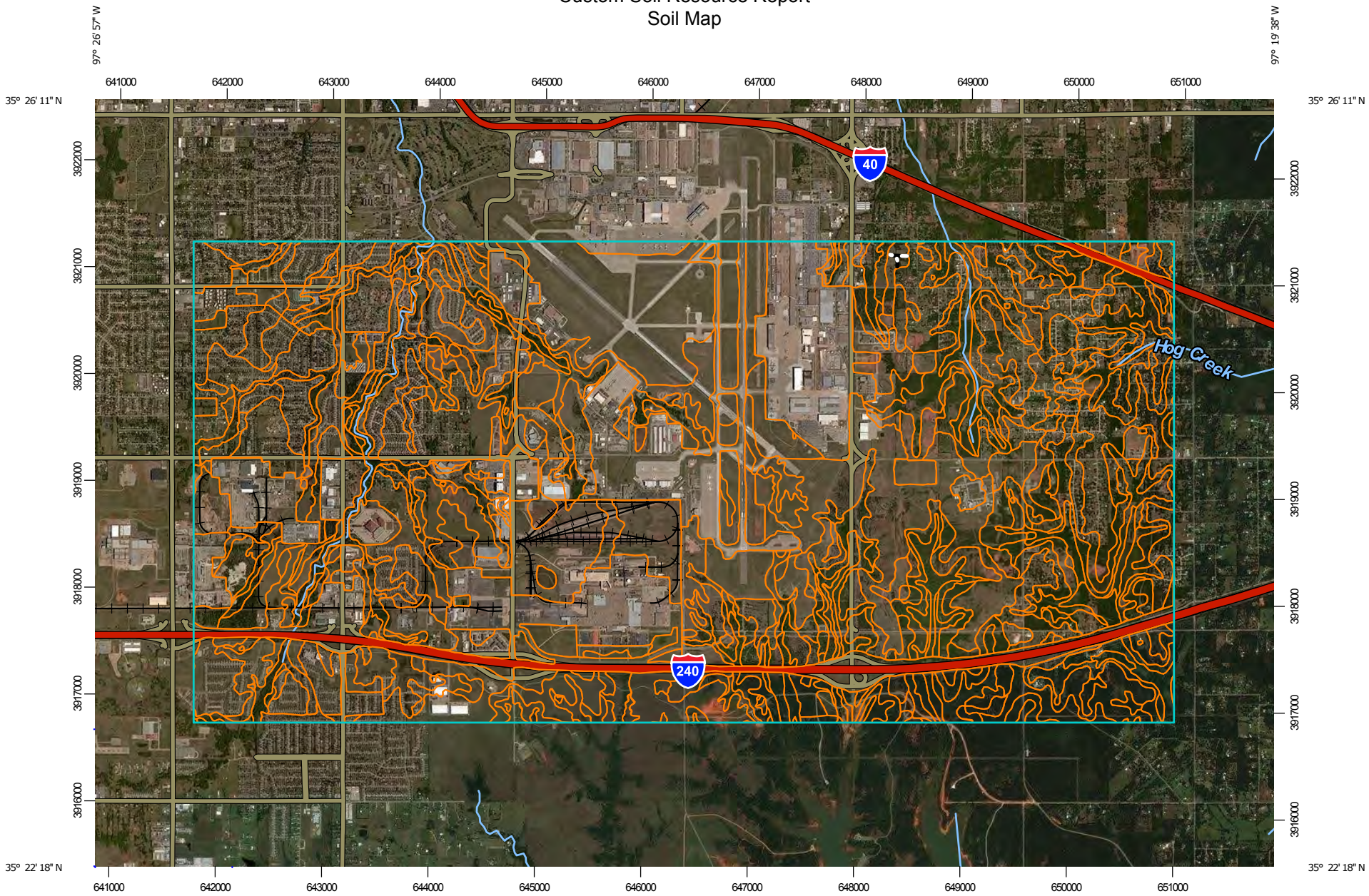
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:50,700 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 500 1000 2000 3000

Feet
0 2000 4000 8000 12000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 14N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Oklahoma County, Oklahoma
Survey Area Data: Version 18, Sep 25, 2017

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Feb 28, 2011—Feb 23, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
AstA	Ashport silt loam, 0 to 1 percent slopes, frequently flooded	328.9	3.2%
BetA	Bethany silt loam, 0 to 1 percent slopes	95.6	0.9%
BetB	Bethany silt loam, 1 to 3 percent slopes	99.7	1.0%
BeUB	Bethany-Urban land complex, 0 to 3 percent slopes	219.4	2.1%
GrAD	Grainola-Ashport, frequently flooded, complex, 0 to 12 percent slopes	201.1	2.0%
GrHC	Grant-Huska complex, 1 to 5 percent slopes	13.5	0.1%
GrIE	Grainola-Ironmound complex, 3 to 12 percent slopes	228.9	2.2%
GrPC2	Grainola-Piedmont complex, 3 to 5 percent slopes, eroded	2.7	0.0%
GUIE	Grainola-Urban land-Ironmound complex, 3 to 12 percent slopes	116.1	1.1%
HarC	Harrah fine sandy loam, 3 to 5 percent slopes	650.7	6.3%
HarC2	Harrah fine sandy loam, 3 to 5 percent slopes, eroded	7.6	0.1%
HarC4	Harrah fine sandy loam, 3 to 5 percent slopes, gullied	19.6	0.2%
HarG	Harrah fine sandy loam, 3 to 45 percent slopes	119.0	1.2%
KgIC	Kingfisher-Ironmound complex, 1 to 5 percent slopes	52.3	0.5%
KrdA	Kirkland silt loam, 0 to 1 percent slopes	355.4	3.5%
KrUA	Kirkland-Urban land complex, 0 to 1 percent slopes	718.3	7.0%
KUIC	Kingfisher-Urban land-Ironmound complex, 1 to 5 percent slopes	4.1	0.0%
LatG	Latrass loam, 1 to 45 percent slopes	83.0	0.8%
LawA	Lawrie loam, 0 to 1 percent slopes, rarely flooded	72.0	0.7%
LitB	Littleaxe fine sandy loam, 1 to 3 percent slopes	103.7	1.0%
LitC2	Littleaxe fine sandy loam, 3 to 5 percent slopes, eroded	18.1	0.2%

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
LwUA	Lawrie-Urban land complex, 0 to 1 percent slopes, rarely flooded	121.2	1.2%
M-W	Miscellaneous water	11.2	0.1%
NewB	Newalla fine sandy loam, 1 to 5 percent slopes	7.5	0.1%
NorB	Norge silt loam, 1 to 3 percent slopes	27.9	0.3%
NorC	Norge silt loam, 3 to 5 percent slopes	38.6	0.4%
NorC2	Norge silt loam, 3 to 5 percent slopes, eroded	7.5	0.1%
NoUC	Norge-Urban land complex, 1 to 5 percent slopes	123.7	1.2%
PIT	Pits	69.7	0.7%
PulA	Pulaski fine sandy loam, 0 to 1 percent slopes, occasionally flooded	25.0	0.2%
RenB	Renfrow silt loam, 1 to 3 percent slopes	22.7	0.2%
RinB	Renthin silt loam, 1 to 3 percent slopes	36.0	0.4%
RnnC2	Renthin silty clay loam, 3 to 5 percent slopes, eroded	1,168.6	11.4%
RnUC	Renthin-Urban land complex, 1 to 5 percent slopes	1,136.5	11.0%
SDGD4	Stephenville-Darsil-Gullied land complex, 3 to 8 percent slopes	188.8	1.8%
SDND	Stephenville-Darsil-Newalla complex, 3 to 8 percent slopes	815.5	7.9%
SDND2	Stephenville-Darsil-Newalla complex, 3 to 8 percent slopes, eroded	124.5	1.2%
StDC	Stephenville-Darsil complex, 1 to 5 percent slopes	636.8	6.2%
StDC2	Stephenville-Darsil complex, 1 to 5 percent slopes, eroded	132.0	1.3%
StLC4	Stephenville-Littleaxe complex, 1 to 5 percent slopes, gullied	3.9	0.0%
SUND	Stephenville-Urban land-Newalla complex, 1 to 8 percent slopes	25.5	0.2%
TriA	Tribbey fine sandy loam, 0 to 1 percent slopes, frequently flooded	131.6	1.3%
URB	Urban land	1,892.7	18.4%
W	Water	22.5	0.2%

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
ZaUC	Zaneis-Urban land complex, 1 to 5 percent slopes	13.7	0.1%
Totals for Area of Interest		**10,293.3**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Oklahoma County, Oklahoma

AstA—Ashport silt loam, 0 to 1 percent slopes, frequently flooded

Map Unit Setting

National map unit symbol: 2tq75
Elevation: 700 to 1,500 feet
Mean annual precipitation: 26 to 40 inches
Mean annual air temperature: 57 to 65 degrees F
Frost-free period: 185 to 220 days
Farmland classification: Not prime farmland

Map Unit Composition

Ashport, frequently flooded, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ashport, Frequently Flooded

Setting

Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy alluvium derived from sedimentary rock

Typical profile

A - 0 to 10 inches: silt loam
Bw - 10 to 24 inches: silt loam
Ab - 24 to 36 inches: silt loam
Bwb1 - 36 to 48 inches: silt loam
Bwb2 - 48 to 64 inches: silty clay loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Calcium carbonate, maximum in profile: 2 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 2.0
Available water storage in profile: High (about 12.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B
Ecological site: Loamy Bottomland (R080AY050OK)
Hydric soil rating: No

Minor Components

Pulaski, frequently flooded
Percent of map unit: 9 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Loamy Bottomland (R084AY050OK)
Hydric soil rating: No

Yahola, frequently flooded
Percent of map unit: 4 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Loamy Bottomland (R080AY050OK)
Hydric soil rating: No

Tribbey, frequently flooded
Percent of map unit: 2 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Subirrigated Bottomland (R084AY095OK)
Hydric soil rating: No

BetA—Bethany silt loam, 0 to 1 percent slopes

Map Unit Setting
National map unit symbol: 2tp52
Elevation: 1,000 to 1,500 feet
Mean annual precipitation: 31 to 37 inches
Mean annual air temperature: 57 to 61 degrees F
Frost-free period: 181 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition
Bethany and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Bethany

Setting
Landform: Paleoterraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex

Across-slope shape: Convex
Parent material: Silty alluvium derived from sedimentary rock over clayey residuum weathered from shale

Typical profile

Ap - 0 to 14 inches: silt loam
BA - 14 to 18 inches: silty clay loam
Bt - 18 to 36 inches: silty clay loam
Btk1 - 36 to 56 inches: silty clay loam
Btk2 - 56 to 80 inches: silty clay loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 2 percent
Salinity, maximum in profile: Nonsaline to moderately saline (0.0 to 15.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 10.0
Available water storage in profile: High (about 10.7 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Ecological site: Claypan Upland (North) (R080AY010OK)
Hydric soil rating: No

Minor Components

Kirkland

Percent of map unit: 6 percent
Landform: Paleoterraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Linear
Ecological site: Claypan Upland (North) (R080AY010OK)
Hydric soil rating: No

Tabler

Percent of map unit: 5 percent
Landform: Paleoterraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Claypan Upland (North) (R080AY010OK)
Hydric soil rating: No

Pond creek

Percent of map unit: 3 percent
Landform: Paleoterraces

Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Loamy Upland (R080AY056OK)
Hydric soil rating: No

Pawhuska

Percent of map unit: 1 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Ecological site: Slickspot (R080AY091OK)
Hydric soil rating: No

BetB—Bethany silt loam, 1 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2tp48
Elevation: 950 to 1,380 feet
Mean annual precipitation: 31 to 37 inches
Mean annual air temperature: 57 to 61 degrees F
Frost-free period: 181 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Bethany and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Bethany

Setting

Landform: Paleoterraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Silty alluvium derived from sedimentary rock over clayey residuum weathered from shale

Typical profile

Ap - 0 to 14 inches: silt loam
BA - 14 to 18 inches: silty clay loam
Bt - 18 to 36 inches: silty clay loam
Btk1 - 36 to 56 inches: silty clay loam
Btk2 - 56 to 80 inches: silty clay loam

Properties and qualities

Slope: 1 to 3 percent
Depth to restrictive feature: More than 80 inches

Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 2 percent
Salinity, maximum in profile: Nonsaline to moderately saline (0.0 to 15.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 10.0
Available water storage in profile: High (about 10.7 inches)

Interpretive groups

Land capability classification (irrigated): 2s
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Ecological site: Claypan Upland (North) (R080AY010OK)
Hydric soil rating: No

Minor Components

Kirkland

Percent of map unit: 6 percent
Landform: Paleoterraces
Landform position (three-dimensional): Tread, talf
Down-slope shape: Convex
Across-slope shape: Linear
Ecological site: Claypan Upland (North) (R080AY010OK)
Hydric soil rating: No

Renfrow

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Ecological site: Claypan Upland (North) (R080AY010OK)
Hydric soil rating: No

Norge

Percent of map unit: 3 percent
Landform: Paleoterraces
Landform position (three-dimensional): Riser
Down-slope shape: Convex
Across-slope shape: Linear
Ecological site: Loamy Upland (R080AY056OK)
Hydric soil rating: No

Pawhuska

Percent of map unit: 1 percent
Landform: Hillslopes
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex

Ecological site: Slickspot (R080AY091OK)
Hydric soil rating: No

BeUB—Bethany-Urban land complex, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2tp54
Elevation: 1,150 to 1,280 feet
Mean annual precipitation: 35 to 37 inches
Mean annual air temperature: 60 to 62 degrees F
Frost-free period: 181 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 45 percent
Bethany and similar soils: 45 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Parent material: Fine-silty mine spoil or earthy fill derived from sandstone and shale

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: No

Description of Bethany

Setting

Landform: Paleoterraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Silty alluvium derived from sedimentary rock over clayey residuum weathered from shale

Typical profile

A - 0 to 14 inches: silt loam
BA - 14 to 18 inches: silty clay loam
Bt - 18 to 36 inches: silty clay loam
Btk - 36 to 80 inches: silty clay loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained

Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 2 percent
Salinity, maximum in profile: Nonsaline to moderately saline (0.0 to 12.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 10.0
Available water storage in profile: High (about 10.7 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Ecological site: Claypan Upland (North) (R080AY010OK)
Hydric soil rating: No

Minor Components

Pawhuska

Percent of map unit: 4 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Ecological site: Slickspot (R080AY091OK)
Hydric soil rating: No

Kirkland

Percent of map unit: 4 percent
Landform: Plains on paleoterraces
Landform position (three-dimensional): Tread, talf
Down-slope shape: Linear, convex
Across-slope shape: Linear
Ecological site: Claypan Upland (North) (R080AY010OK)
Hydric soil rating: No

Vanoss

Percent of map unit: 2 percent
Landform: Paleoterraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Loamy Upland (R080AY056OK)
Hydric soil rating: No

GrAD—Grainola-Ashport, frequently flooded, complex, 0 to 12 percent slopes

Map Unit Setting

National map unit symbol: 2tq76
Elevation: 800 to 1,500 feet
Mean annual precipitation: 31 to 39 inches
Mean annual air temperature: 61 to 63 degrees F
Frost-free period: 200 to 230 days
Farmland classification: Not prime farmland

Map Unit Composition

Grainola and similar soils: 70 percent
Ashport, frequently flooded, and similar soils: 20 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Grainola

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Calcareous clayey residuum weathered from shale

Typical profile

A - 0 to 4 inches: silty clay loam
BA - 4 to 6 inches: clay loam
Btk1 - 6 to 18 inches: silty clay
Btk2 - 18 to 34 inches: silty clay
Cr - 34 to 44 inches: bedrock

Properties and qualities

Slope: 2 to 12 percent
Depth to restrictive feature: 26 to 39 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 2.0

Available water storage in profile: Low (about 5.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D
Ecological site: Claypan Upland (North) (R080AY010OK)
Hydric soil rating: No

Description of Ashport, Frequently Flooded

Setting

Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy alluvium derived from sedimentary rock

Typical profile

A1 - 0 to 9 inches: silty clay loam
A2 - 9 to 14 inches: silty clay loam
Bw1 - 14 to 32 inches: silty clay loam
Bw2 - 32 to 55 inches: silty clay loam
C - 55 to 79 inches: stratified loam to silt loam to silty clay loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Calcium carbonate, maximum in profile: 2 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 2.0
Available water storage in profile: High (about 11.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B
Ecological site: Loamy Bottomland (R080AY050OK)
Hydric soil rating: No

Minor Components

Renfrow

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear

Ecological site: Claypan Upland (North) (R080AY010OK)
Hydric soil rating: No

Ironmound

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: Shallow Upland (R080AY083OK)
Hydric soil rating: No

GrHC—Grant-Huska complex, 1 to 5 percent slopes

Map Unit Setting

National map unit symbol: 2tq5q
Elevation: 700 to 1,500 feet
Mean annual precipitation: 29 to 37 inches
Mean annual air temperature: 59 to 61 degrees F
Frost-free period: 190 to 220 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Grant and similar soils: 65 percent
Huska and similar soils: 25 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Grant

Setting

Landform: Paleoterraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Silty residuum weathered from sandstone and shale

Typical profile

A - 0 to 11 inches: silt loam
BA - 11 to 17 inches: silty clay loam
Bt - 17 to 38 inches: silty clay loam
BC - 38 to 45 inches: channery silty clay loam
Cr - 45 to 55 inches: bedrock

Properties and qualities

Slope: 1 to 5 percent
Depth to restrictive feature: 43 to 53 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 3.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 4.0
Available water storage in profile: Moderate (about 9.0 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Ecological site: Loamy Upland (R080AY056OK)
Hydric soil rating: No

Description of Huska

Setting
Landform: Hillslopes
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Saline clayey residuum weathered from sandstone and shale

Typical profile
Ap - 0 to 6 inches: very fine sandy loam
Btn - 6 to 24 inches: silty clay loam
Btkn1 - 24 to 37 inches: silty clay
Btkn2 - 37 to 58 inches: silty clay loam
Cr - 58 to 79 inches: bedrock

Properties and qualities
Slope: 1 to 5 percent
Depth to restrictive feature: 38 to 59 inches to paralithic bedrock
Natural drainage class: Moderately well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Gypsum, maximum in profile: 2 percent
Salinity, maximum in profile: Very slightly saline to strongly saline (2.0 to 16.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 45.0
Available water storage in profile: Low (about 3.5 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: C
Ecological site: Slickspot (R080AY091OK)
Hydric soil rating: No

Minor Components

Kingfisher

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: Loamy Upland (R080AY056OK)
Hydric soil rating: No

Teller

Percent of map unit: 3 percent
Landform: Paleoterraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Loamy Upland (R080AY056OK)
Hydric soil rating: No

Grainola

Percent of map unit: 2 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: Claypan Upland (North) (R080AY010OK)
Hydric soil rating: No

GrlE—Grainola-Ironmound complex, 3 to 12 percent slopes

Map Unit Setting

National map unit symbol: dwwp
Elevation: 700 to 1,500 feet
Mean annual precipitation: 26 to 40 inches
Mean annual air temperature: 57 to 64 degrees F
Frost-free period: 200 to 230 days
Farmland classification: Not prime farmland

Map Unit Composition

Grainola and similar soils: 71 percent
Ironmound and similar soils: 20 percent
Minor components: 9 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Grainola

Setting

Landform: Hillslopes on hills
Landform position (two-dimensional): Backslope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Calcareous clayey residuum weathered from shale

Typical profile

Ap - 0 to 7 inches: silty clay loam
BA - 7 to 12 inches: silty clay
Btk1 - 12 to 27 inches: silty clay
Btk2 - 27 to 38 inches: silty clay
Cr - 38 to 48 inches: bedrock

Properties and qualities

Slope: 3 to 12 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Available water storage in profile: Moderate (about 6.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Ecological site: Claypan Upland (North) (R080AY010OK)
Hydric soil rating: No

Description of Ironmound

Setting

Landform: Hillslopes on hills
Landform position (two-dimensional): Backslope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy residuum weathered from sandstone and shale

Typical profile

Ap - 0 to 7 inches: fine sandy loam
Bw - 7 to 18 inches: fine sandy loam
Cr - 18 to 28 inches: bedrock

Properties and qualities

Slope: 3 to 12 percent
Depth to restrictive feature: 10 to 20 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)

Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Ecological site: Shallow Upland (R080AY083OK)
Hydric soil rating: No

Minor Components

Rock outcrop

Percent of map unit: 9 percent
Landform: Drainageways
Landform position (two-dimensional): Backslope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

GrPC2—Grainola-Piedmont complex, 3 to 5 percent slopes, eroded

Map Unit Setting

National map unit symbol: dwwr
Elevation: 500 to 2,200 feet
Mean annual precipitation: 22 to 48 inches
Mean annual air temperature: 57 to 64 degrees F
Frost-free period: 190 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Grainola, eroded, and similar soils: 53 percent
Piedmont, eroded, and similar soils: 31 percent
Minor components: 16 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Grainola, Eroded

Setting

Landform: Hillslopes on hills
Landform position (two-dimensional): Backslope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Calcareous clayey residuum weathered from shale

Typical profile

Ap - 0 to 4 inches: silty clay loam
Bt1 - 4 to 12 inches: silty clay

Bt2 - 12 to 24 inches: silty clay
Cr - 24 to 34 inches: bedrock

Properties and qualities

Slope: 3 to 5 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Available water storage in profile: Low (about 3.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D
Ecological site: Eroded Claypan Prairie (North) (Obsolete) Refer To 80AY010 (R080AY810OK)
Hydric soil rating: No

Description of Piedmont, Eroded

Setting

Landform: Hillslopes on hills
Landform position (two-dimensional): Backslope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Calcareous clayey residuum weathered from shale and siltstone

Typical profile

Ap - 0 to 7 inches: silty clay loam
Bt - 7 to 15 inches: silty clay
Btk - 15 to 23 inches: silty clay
Cr - 23 to 33 inches: bedrock

Properties and qualities

Slope: 3 to 5 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Available water storage in profile: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D

Ecological site: Eroded Claypan Prairie (North) (Obsolete) Refer To 80AY010 (R080AY810OK)
Hydric soil rating: No

Minor Components

Masham, eroded
Percent of map unit: 6 percent
Landform: Hillslopes on hills
Landform position (two-dimensional): Backslope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: Eroded Shallow Clay Prairie(Obsolete) Refer To 80AY080 (R080AY880OK)
Hydric soil rating: No

Ironmound, eroded
Percent of map unit: 3 percent
Landform: Hillslopes on hills
Landform position (two-dimensional): Backslope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: Eroded Shallow Prairie(Obsolete) Refer To 80AY083 (R080AY883OK)
Hydric soil rating: No

Huska, eroded
Percent of map unit: 3 percent
Landform: Hillslopes on hills
Landform position (two-dimensional): Shoulder
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: Eroded Slickspot(Obsolete) Refer To 80AY091 (R080AY891OK)
Hydric soil rating: No

Coyle, eroded
Percent of map unit: 2 percent
Landform: Hillslopes on hills
Landform position (two-dimensional): Backslope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: Eroded Loamy Prairie(Obsolete) Refer To 80AY056 (R080AY856OK)
Hydric soil rating: No

Rock outcrop
Percent of map unit: 2 percent
Landform: Hillslopes on hills
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

GUIE—Grainola-Urban land-Ironmound complex, 3 to 12 percent slopes

Map Unit Setting

National map unit symbol: dwwh
Elevation: 700 to 2,000 feet
Mean annual precipitation: 22 to 40 inches
Mean annual air temperature: 57 to 64 degrees F
Frost-free period: 185 to 230 days
Farmland classification: Not prime farmland

Map Unit Composition

Grainola and similar soils: 46 percent
Urban land: 42 percent
Ironmound and similar soils: 12 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Grainola

Setting

Landform: Hillslopes on hills
Landform position (two-dimensional): Backslope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Calcareous clayey residuum weathered from shale

Typical profile

Ap - 0 to 4 inches: silty clay loam
Btk1 - 4 to 16 inches: silty clay
Btk2 - 16 to 28 inches: silty clay
Cr - 28 to 38 inches: bedrock

Properties and qualities

Slope: 5 to 12 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Available water storage in profile: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Hydric soil rating: No

Description of Urban Land

Setting

Parent material: Clayey mine spoil or earthy fill derived from clayey shale

Typical profile

C - 0 to 60 inches: variable

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: No

Description of Ironmound

Setting

Landform: Hillslopes on hills
Landform position (two-dimensional): Backslope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy residuum weathered from sandstone and shale

Typical profile

Ap - 0 to 5 inches: loam
Bw - 5 to 12 inches: loam
Cr - 12 to 22 inches: bedrock

Properties and qualities

Slope: 5 to 12 percent
Depth to restrictive feature: 10 to 20 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Hydric soil rating: No

HarC—Harrah fine sandy loam, 3 to 5 percent slopes

Map Unit Setting

National map unit symbol: 2s7fy

Elevation: 700 to 1,300 feet
Mean annual precipitation: 36 to 42 inches
Mean annual air temperature: 58 to 61 degrees F
Frost-free period: 200 to 220 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Harrah and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Harrah

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Loamy and sandy colluvium derived from sandstone

Typical profile

A - 0 to 5 inches: fine sandy loam
E - 5 to 9 inches: fine sandy loam
Bt1 - 9 to 70 inches: sandy clay loam
Bt2 - 70 to 80 inches: fine sandy loam

Properties and qualities

Slope: 3 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 1.5
Available water storage in profile: Moderate (about 8.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: Sandy Loam Savannah (R084AY075OK)
Hydric soil rating: No

Minor Components

Stephenville

Percent of map unit: 8 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear

Across-slope shape: Convex
Ecological site: Sandy Loam Savannah (R084AY075OK)
Hydric soil rating: No

Newalla

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: Sandy Loam Savannah (R084AY075OK)
Hydric soil rating: No

Pulaski, occasionally flooded

Percent of map unit: 2 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Loamy Bottomland (R084AY050OK)
Hydric soil rating: No

HarC2—Harrah fine sandy loam, 3 to 5 percent slopes, eroded

Map Unit Setting

National map unit symbol: 2s7fz
Elevation: 700 to 1,300 feet
Mean annual precipitation: 36 to 42 inches
Mean annual air temperature: 58 to 61 degrees F
Frost-free period: 200 to 220 days
Farmland classification: Not prime farmland

Map Unit Composition

Harrah, eroded, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Harrah, Eroded

Setting

Landform: Hillslopes
Landform position (two-dimensional): Footslope, backslope
Landform position (three-dimensional): Base slope, side slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Loamy and sandy colluvium derived from sandstone

Typical profile

A - 0 to 6 inches: fine sandy loam
Bt1 - 6 to 27 inches: sandy clay loam

Bt2 - 27 to 47 inches: sandy clay loam
Btb - 47 to 76 inches: sandy clay loam

Properties and qualities

Slope: 3 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 2.0
Available water storage in profile: Moderate (about 8.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: Sandy Loam Savannah (R084AY075OK)
Hydric soil rating: No

Minor Components

Stephenville, eroded

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: Sandy Loam Savannah (R084AY075OK)
Hydric soil rating: No

Pulaski, occasionally flooded

Percent of map unit: 5 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Loamy Bottomland (R084AY050OK)
Hydric soil rating: No

Newalla, eroded

Percent of map unit: 3 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: Sandy Loam Savannah (R084AY075OK)
Hydric soil rating: No

Littleaxe, eroded

Percent of map unit: 2 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Ecological site: Sandy Loam Savannah (R084AY075OK)
Hydric soil rating: No

HarC4—Harrah fine sandy loam, 3 to 5 percent slopes, gullied

Map Unit Setting

National map unit symbol: dwwx
Elevation: 500 to 2,200 feet
Mean annual precipitation: 22 to 48 inches
Mean annual air temperature: 57 to 64 degrees F
Frost-free period: 190 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Harrah, gullied, and similar soils: 73 percent
Minor components: 27 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Harrah, Gullied

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Loamy and sandy colluvium derived from sandstone

Typical profile

Ap - 0 to 5 inches: fine sandy loam
Et - 5 to 8 inches: fine sandy loam
Bt1 - 8 to 11 inches: sandy clay loam
Bt2 - 11 to 38 inches: sandy clay loam
Btb - 38 to 65 inches: sandy clay loam
BCb - 65 to 80 inches: sandy clay loam

Properties and qualities

Slope: 3 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches

Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 8.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: Eroded Sandy Savannah PE 48-64 (R084AY876OK)
Hydric soil rating: No

Minor Components

Gullied land

Percent of map unit: 10 percent
Landform: Hillslopes on hills
Landform position (two-dimensional): Backslope
Microfeatures of landform position: Gullies
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

Stephenville, gullied

Percent of map unit: 9 percent
Landform: Hillslopes on hills
Landform position (two-dimensional): Backslope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: Eroded Sandy Savannah PE 48-64 (R084AY876OK)
Hydric soil rating: No

Newalla, severely eroded

Percent of map unit: 3 percent
Landform: Hillslopes on hills
Landform position (two-dimensional): Backslope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: Eroded Sandy Savannah PE 48-64 (R084AY876OK)
Hydric soil rating: No

Littleaxe, gullied

Percent of map unit: 3 percent
Landform: Hillslopes on hills
Landform position (two-dimensional): Backslope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: Eroded Sandy Savannah PE 48-64 (R084AY876OK)
Hydric soil rating: No

Pulaski, occasionally flooded

Percent of map unit: 1 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Loamy Bottomland (R084AY050OK)
Hydric soil rating: No

Grainola, severely eroded

Percent of map unit: 1 percent
Landform: Hillslopes on hills
Landform position (two-dimensional): Backslope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: Eroded Claypan Prairie (North) (Obsolete) Refer To 80AY010 (R080AY810OK)
Hydric soil rating: No

HarG—Harrah fine sandy loam, 3 to 45 percent slopes

Map Unit Setting

National map unit symbol: 2s7fx
Elevation: 700 to 1,300 feet
Mean annual precipitation: 36 to 42 inches
Mean annual air temperature: 58 to 61 degrees F
Frost-free period: 200 to 220 days
Farmland classification: Not prime farmland

Map Unit Composition

Harrah and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Harrah

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Loamy and sandy colluvium derived from sandstone

Typical profile

A - 0 to 5 inches: fine sandy loam
E - 5 to 9 inches: fine sandy loam
Bt1 - 9 to 70 inches: sandy clay loam
Bt2 - 70 to 80 inches: fine sandy loam

Properties and qualities

Slope: 3 to 45 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None

Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 1.5
Available water storage in profile: Moderate (about 8.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Ecological site: Sandy Loam Savannah (R084AY075OK)
Hydric soil rating: No

Minor Components

Stephenville

Percent of map unit: 10 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Ecological site: Sandy Loam Savannah (R084AY075OK)
Hydric soil rating: No

Pulaski, occasionally flooded

Percent of map unit: 3 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Loamy Bottomland (R084AY050OK)
Hydric soil rating: No

Tribbey, frequently flooded

Percent of map unit: 2 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Subirrigated Bottomland (R084AY095OK)
Hydric soil rating: No

KglC—Kingfisher-Ironmound complex, 1 to 5 percent slopes

Map Unit Setting

National map unit symbol: 2tq6c
Elevation: 950 to 1,500 feet
Mean annual precipitation: 26 to 38 inches
Mean annual air temperature: 58 to 63 degrees F
Frost-free period: 190 to 230 days

Farmland classification: All areas are prime farmland

Map Unit Composition

Kingfisher and similar soils: 60 percent
Ironmound and similar soils: 30 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kingfisher

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy residuum weathered from siltstone

Typical profile

A - 0 to 7 inches: silt loam
BA - 7 to 12 inches: silt loam
Bt - 12 to 26 inches: silty clay loam
BC - 26 to 36 inches: silty clay loam
Cr - 36 to 46 inches: bedrock

Properties and qualities

Slope: 1 to 3 percent
Depth to restrictive feature: 30 to 39 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 3 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 2.0
Available water storage in profile: Moderate (about 6.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: Loamy Upland (R080AY056OK)
Hydric soil rating: No

Description of Ironmound

Setting

Landform: Hillslopes
Landform position (two-dimensional): Shoulder, summit, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy residuum weathered from sandstone and shale

Typical profile

Ap - 0 to 7 inches: loam
Bw - 7 to 16 inches: loam
Cr - 16 to 40 inches: bedrock

Properties and qualities

Slope: 3 to 5 percent
Depth to restrictive feature: 9 to 20 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: D
Ecological site: Shallow Upland (R080AY083OK)
Hydric soil rating: No

Minor Components

Renfrow

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Ecological site: Claypan Upland (North) (R080AY010OK)
Hydric soil rating: No

Grainola

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: Claypan Upland (North) (R080AY010OK)
Hydric soil rating: No

KrdA—Kirkland silt loam, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 2rj95
Elevation: 880 to 1,340 feet
Mean annual precipitation: 26 to 38 inches
Mean annual air temperature: 57 to 64 degrees F
Frost-free period: 190 to 230 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Kirkland and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kirkland

Setting

Landform: Plains on paleoterraces
Landform position (three-dimensional): Tread, talf
Down-slope shape: Linear, convex
Across-slope shape: Linear
Parent material: Clayey alluvium derived from sedimentary rock

Typical profile

Ap - 0 to 8 inches: silt loam
Bt - 8 to 19 inches: silty clay
Btss - 19 to 28 inches: silty clay
Btkss - 28 to 51 inches: silty clay
Btk - 51 to 82 inches: silty clay
2Cr - 82 to 98 inches: bedrock

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: 59 to 85 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Gypsum, maximum in profile: 2 percent
Salinity, maximum in profile: Very slightly saline to slightly saline (2.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 12.0
Available water storage in profile: High (about 9.9 inches)

Interpretive groups

Land capability classification (irrigated): 2s
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: D
Ecological site: Claypan Upland (North) (R080AY010OK)
Hydric soil rating: No

Minor Components

Bethany

Percent of map unit: 5 percent
Landform: Plains on paleoterraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Ecological site: Claypan Upland (North) (R080AY010OK)
Hydric soil rating: No

Norge

Percent of map unit: 5 percent
Landform: Paleoterraces
Landform position (three-dimensional): Riser
Down-slope shape: Convex
Across-slope shape: Linear
Ecological site: Loamy Upland (R080AY056OK)
Hydric soil rating: No

Renfrow

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Ecological site: Claypan Upland (North) (R080AY010OK)
Hydric soil rating: No

Pawhuska

Percent of map unit: 5 percent
Landform: Hillslopes on hills
Landform position (two-dimensional): Backslope, summit
Landform position (three-dimensional): Side slope, talf
Down-slope shape: Linear, convex
Across-slope shape: Convex
Ecological site: Slickspot (R080AY091OK)
Hydric soil rating: No

KrUA—Kirkland-Urban land complex, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: dwxc
Elevation: 700 to 2,000 feet
Mean annual precipitation: 22 to 40 inches
Mean annual air temperature: 57 to 64 degrees F
Frost-free period: 185 to 230 days
Farmland classification: Not prime farmland

Map Unit Composition

Kirkland and similar soils: 53 percent
Urban land: 47 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kirkland

Setting

Landform: Plains on paleoterraces
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Clayey alluvium over clayey residuum weathered from calcareous shale

Typical profile

Ap - 0 to 11 inches: silt loam
Bt - 11 to 28 inches: silty clay
Btk - 28 to 48 inches: silty clay
2Btk - 48 to 76 inches: silty clay
2Cr - 76 to 86 inches: bedrock

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: 60 to 99 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 2 percent
Gypsum, maximum in profile: 2 percent
Salinity, maximum in profile: Very slightly saline to slightly saline (2.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 16.0
Available water storage in profile: Moderate (about 8.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: D
Hydric soil rating: No

Description of Urban Land

Setting

Parent material: Clayey mine spoil or earthy fill

Typical profile

C - 0 to 60 inches: variable

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: No

KUIC—Kingfisher-Urban land-Ironmound complex, 1 to 5 percent slopes

Map Unit Setting

National map unit symbol: 2tq6g
Elevation: 700 to 1,500 feet
Mean annual precipitation: 26 to 38 inches
Mean annual air temperature: 58 to 63 degrees F
Frost-free period: 190 to 230 days
Farmland classification: Not prime farmland

Map Unit Composition

Kingfisher and similar soils: 45 percent
Urban land: 30 percent
Ironmound and similar soils: 15 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kingfisher

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy residuum weathered from siltstone

Typical profile

Ap - 0 to 14 inches: silt loam
BA - 14 to 21 inches: silt loam
Bt - 21 to 38 inches: silty clay loam

Cr - 38 to 48 inches: bedrock

Properties and qualities

Slope: 1 to 5 percent
Depth to restrictive feature: 26 to 39 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 3 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 2.0
Available water storage in profile: Moderate (about 7.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: Loamy Upland (R080AY056OK)
Hydric soil rating: No

Description of Urban Land

Setting

Parent material: Fine-silty mine spoil or earthy fill derived from sandstone and shale

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: No

Description of Ironmound

Setting

Landform: Hillslopes
Landform position (two-dimensional): Shoulder, backslope, summit
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy residuum weathered from sandstone and shale

Typical profile

Ap - 0 to 7 inches: loam
Bw - 7 to 16 inches: loam
Cr - 16 to 40 inches: bedrock

Properties and qualities

Slope: 1 to 5 percent
Depth to restrictive feature: 9 to 20 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: D
Ecological site: Shallow Upland (R080AY083OK)
Hydric soil rating: No

Minor Components

Grainola

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: Claypan Upland (North) (R080AY010OK)
Hydric soil rating: No

Renfrow

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Ecological site: Claypan Upland (North) (R080AY010OK)
Hydric soil rating: No

LatG—Latrass loam, 1 to 45 percent slopes

Map Unit Setting

National map unit symbol: dwxh
Elevation: 700 to 1,050 feet
Mean annual precipitation: 26 to 38 inches
Mean annual air temperature: 57 to 63 degrees F
Frost-free period: 185 to 230 days
Farmland classification: Not prime farmland

Map Unit Composition

Latrass and similar soils: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Latrass

Setting

Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Mine spoil or earthy fill

Typical profile

A - 0 to 5 inches: loam
C1 - 5 to 22 inches: clay loam
C2 - 22 to 42 inches: clay
Cd - 42 to 80 inches: variable

Properties and qualities

Slope: 1 to 45 percent
Depth to restrictive feature: About 42 inches to densic material
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydrologic Soil Group: D
Hydric soil rating: No

LawA—Lawrie loam, 0 to 1 percent slopes, rarely flooded

Map Unit Setting

National map unit symbol: dwxj
Elevation: 700 to 1,500 feet
Mean annual precipitation: 26 to 40 inches
Mean annual air temperature: 57 to 65 degrees F
Frost-free period: 190 to 230 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Lawrie, rarely flooded, and similar soils: 80 percent
Ashport, rarely flooded, and similar soils: 10 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lawrie, Rarely Flooded

Setting

Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy alluvium

Typical profile

Ap - 0 to 9 inches: loam
A - 9 to 13 inches: silt loam
BA - 13 to 18 inches: silty clay loam
Bt1 - 18 to 47 inches: silty clay loam
Bt2 - 47 to 59 inches: silty clay loam
Btk - 59 to 82 inches: silty clay loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum in profile: 2 percent
Available water storage in profile: High (about 12.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: B
Ecological site: Loamy Bottomland (R080AY050OK)
Hydric soil rating: No

Description of Ashport, Rarely Flooded

Setting

Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Fine-silty alluvium

Typical profile

A1 - 0 to 9 inches: silty clay loam
A2 - 9 to 14 inches: silty clay loam
Bw1 - 14 to 32 inches: silty clay loam
Bw2 - 32 to 55 inches: silty clay loam
C - 55 to 79 inches: stratified loam to silt loam to silty clay loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum in profile: 1 percent
Available water storage in profile: High (about 11.9 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: B
Ecological site: Loamy Bottomland (R080AY050OK)
Hydric soil rating: No

Minor Components

Canadian, rarely flooded
Percent of map unit: 5 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Loamy Bottomland (R080AY050OK)
Hydric soil rating: No

Easpur, occasionally flooded
Percent of map unit: 5 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Loamy Bottomland (R080AY050OK)
Hydric soil rating: No

LitB—Littleaxe fine sandy loam, 1 to 3 percent slopes

Map Unit Setting
National map unit symbol: 2schm
Elevation: 750 to 1,300 feet
Mean annual precipitation: 32 to 40 inches
Mean annual air temperature: 59 to 63 degrees F
Frost-free period: 200 to 220 days
Farmland classification: All areas are prime farmland

Map Unit Composition
Littleaxe and similar soils: 83 percent
Minor components: 17 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Littleaxe

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy residuum weathered from sandstone and shale

Typical profile

A - 0 to 5 inches: fine sandy loam
E - 5 to 9 inches: fine sandy loam
Bt1 - 9 to 23 inches: sandy clay loam
Bt2 - 23 to 36 inches: sandy clay loam
BC - 36 to 43 inches: fine sandy loam
Cr - 43 to 53 inches: bedrock

Properties and qualities

Slope: 1 to 3 percent
Depth to restrictive feature: 40 to 52 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low (0.04 to 0.10 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 1.7
Available water storage in profile: Moderate (about 6.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: Sandy Loam Savannah (R084AY075OK)
Hydric soil rating: No

Minor Components

Stephenville

Percent of map unit: 10 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Ecological site: Sandy Loam Savannah (R084AY075OK)
Hydric soil rating: No

Newalla

Percent of map unit: 7 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: Sandy Loam Savannah (R084AY075OK)
Hydric soil rating: No

LitC2—Littleaxe fine sandy loam, 3 to 5 percent slopes, eroded

Map Unit Setting

National map unit symbol: 2schq
Elevation: 750 to 1,300 feet
Mean annual precipitation: 32 to 40 inches
Mean annual air temperature: 59 to 63 degrees F
Frost-free period: 200 to 220 days
Farmland classification: Not prime farmland

Map Unit Composition

Littleaxe, eroded, and similar soils: 78 percent
Minor components: 22 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Littleaxe, Eroded

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Parent material: Loamy residuum weathered from sandstone and shale

Typical profile

Ap - 0 to 9 inches: fine sandy loam
Bt1 - 9 to 21 inches: sandy clay loam
Bt2 - 21 to 32 inches: sandy clay loam
BC - 32 to 45 inches: fine sandy loam
Cr - 45 to 55 inches: bedrock

Properties and qualities

Slope: 3 to 5 percent
Depth to restrictive feature: 40 to 52 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low (0.04 to 0.10 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.0 to 1.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 1.5

Available water storage in profile: Moderate (about 7.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: Sandy Loam Savannah (R084AY075OK)
Hydric soil rating: No

Minor Components

Stephenville, eroded

Percent of map unit: 12 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: Sandy Loam Savannah (R084AY075OK)
Hydric soil rating: No

Newalla

Percent of map unit: 6 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: Sandy Loam Savannah (R084AY075OK)
Hydric soil rating: No

Darsil

Percent of map unit: 4 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: Shallow Savannah (R084AY088OK)
Hydric soil rating: No

LwUA—Lawrie-Urban land complex, 0 to 1 percent slopes, rarely flooded

Map Unit Setting

National map unit symbol: dwxq
Elevation: 700 to 2,000 feet
Mean annual precipitation: 22 to 40 inches
Mean annual air temperature: 57 to 64 degrees F
Frost-free period: 185 to 230 days
Farmland classification: Not prime farmland

Map Unit Composition

Lawrie, rarely flooded, and similar soils: 60 percent
Urban land, rarely flooded: 40 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lawrie, Rarely Flooded

Setting

Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy alluvium

Typical profile

Ap - 0 to 9 inches: silt loam
A - 9 to 17 inches: silt loam
BA - 17 to 24 inches: silty clay loam
Bt1 - 24 to 33 inches: silty clay loam
Bt2 - 33 to 45 inches: silty clay loam
Btk - 45 to 84 inches: silty clay loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum in profile: 2 percent
Available water storage in profile: High (about 11.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: B
Hydric soil rating: No

Description of Urban Land, Rarely Flooded

Setting

Parent material: Fine-silty mine spoil or earthy fill

Typical profile

C - 0 to 60 inches: variable

Properties and qualities

Slope: 0 to 1 percent
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to high (0.00 to 2.00 in/hr)
Frequency of flooding: Rare
Available water storage in profile: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: No

M-W—Miscellaneous water

Map Unit Setting

National map unit symbol: dwxt
Elevation: 250 to 4,000 feet
Mean annual precipitation: 22 to 48 inches
Mean annual air temperature: 57 to 64 degrees F
Frost-free period: 190 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Water

Typical profile

W - 0 to 80 inches: water

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: No

NewB—Newalla fine sandy loam, 1 to 5 percent slopes

Map Unit Setting

National map unit symbol: 2td5v
Elevation: 800 to 1,250 feet
Mean annual precipitation: 36 to 42 inches
Mean annual air temperature: 59 to 63 degrees F
Frost-free period: 200 to 220 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Newalla and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Newalla

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy residuum weathered from sandstone over clayey residuum weathered from shale

Typical profile

A - 0 to 2 inches: fine sandy loam
E - 2 to 5 inches: fine sandy loam
Bt1 - 5 to 11 inches: sandy clay loam
2Bt2 - 11 to 16 inches: clay
2Btss - 16 to 30 inches: clay
2Btkss - 30 to 51 inches: clay
2BC - 51 to 58 inches: parachannery silty clay
2Cd - 58 to 80 inches: clay

Properties and qualities

Slope: 1 to 5 percent
Depth to restrictive feature: 55 to 63 inches to densic bedrock
Natural drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 7 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 8.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: D
Ecological site: Sandy Loam Savannah (R084AY075OK)
Hydric soil rating: No

Minor Components

Stephenville

Percent of map unit: 4 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Ecological site: Sandy Loam Savannah (R084AY075OK)
Hydric soil rating: No

Harrah

Percent of map unit: 2 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Base slope, side slope
Down-slope shape: Concave
Across-slope shape: Linear
Ecological site: Sandy Loam Savannah (R084AY075OK)
Hydric soil rating: No

Darsil

Percent of map unit: 2 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: Shallow Savannah (R084AY088OK)
Hydric soil rating: No

Grainola

Percent of map unit: 2 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: Claypan Upland (North) (R080AY010OK)
Hydric soil rating: No

NorB—Norge silt loam, 1 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2tp4h
Elevation: 930 to 1,600 feet
Mean annual precipitation: 31 to 39 inches
Mean annual air temperature: 57 to 61 degrees F
Frost-free period: 200 to 230 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Norge and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Norge

Setting

Landform: Paleoterraces
Landform position (three-dimensional): Riser

Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Loamy alluvium derived from sedimentary rock

Typical profile

Ap - 0 to 13 inches: silt loam
BA - 13 to 19 inches: silt loam
Bt1 - 19 to 35 inches: silty clay loam
Bt2 - 35 to 67 inches: silty clay loam

Properties and qualities

Slope: 1 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 3.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 3.0
Available water storage in profile: High (about 11.6 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Ecological site: Loamy Upland (R080AY056OK)
Hydric soil rating: No

Minor Components

Renfrow

Percent of map unit: 4 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Ecological site: Claypan Upland (North) (R080AY010OK)
Hydric soil rating: No

Bethany

Percent of map unit: 4 percent
Landform: Plains on paleoterraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Ecological site: Claypan Upland (North) (R080AY010OK)
Hydric soil rating: No

Teller

Percent of map unit: 4 percent
Landform: Paleoterraces
Landform position (three-dimensional): Tread

Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Loamy Upland (R080AY056OK)
Hydric soil rating: No

Vanoss

Percent of map unit: 3 percent
Landform: Paleoterraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Loamy Upland (R080AY056OK)
Hydric soil rating: No

NorC—Norge silt loam, 3 to 5 percent slopes

Map Unit Setting

National map unit symbol: 2tp4q
Elevation: 980 to 1,550 feet
Mean annual precipitation: 31 to 41 inches
Mean annual air temperature: 59 to 61 degrees F
Frost-free period: 200 to 230 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Norge and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Norge

Setting

Landform: Paleoterraces
Landform position (three-dimensional): Riser
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Loamy alluvium derived from sedimentary rock

Typical profile

Ap - 0 to 10 inches: silt loam
BA - 10 to 16 inches: silt loam
Bt - 16 to 78 inches: silty clay loam

Properties and qualities

Slope: 3 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches

Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 4.0
Available water storage in profile: High (about 11.5 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Ecological site: Loamy Upland (R080AY056OK)
Hydric soil rating: No

Minor Components

Vanoss

Percent of map unit: 4 percent
Landform: Paleoterraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Loamy Upland (R080AY056OK)
Hydric soil rating: No

Bethany

Percent of map unit: 3 percent
Landform: Paleoterraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: Claypan Upland (North) (R080AY010OK)
Hydric soil rating: No

Teller

Percent of map unit: 3 percent
Landform: Paleoterraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Loamy Upland (R080AY056OK)
Hydric soil rating: No

NorC2—Norge silt loam, 3 to 5 percent slopes, eroded

Map Unit Setting

National map unit symbol: 2tp4v
Elevation: 850 to 1,400 feet
Mean annual precipitation: 33 to 41 inches
Mean annual air temperature: 59 to 61 degrees F
Frost-free period: 181 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Norge, eroded, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Norge, Eroded

Setting

Landform: Paleoterraces
Landform position (three-dimensional): Riser
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy alluvium derived from sedimentary rock

Typical profile

Ap - 0 to 6 inches: silt loam
Bt1 - 6 to 10 inches: silty clay loam
Bt2 - 10 to 30 inches: silty clay loam
Bt3 - 30 to 64 inches: silty clay loam
BC - 64 to 80 inches: silt loam

Properties and qualities

Slope: 3 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 2 percent
Salinity, maximum in profile: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 4.0
Available water storage in profile: Very high (about 12.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: Loamy Upland (R080AY056OK)
Hydric soil rating: No

Minor Components

Grant, eroded

Percent of map unit: 5 percent
Landform: Paleoterraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: Loamy Upland (R080AY056OK)
Hydric soil rating: No

Teller, eroded

Percent of map unit: 5 percent

Landform: Paleoterraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Loamy Upland (R080AY056OK)
Hydric soil rating: No

Pawhuska, eroded

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: Slickspot (R080AY091OK)
Hydric soil rating: No

NoUC—Norge-Urban land complex, 1 to 5 percent slopes

Map Unit Setting

National map unit symbol: 2tp4t
Elevation: 900 to 1,300 feet
Mean annual precipitation: 35 to 37 inches
Mean annual air temperature: 59 to 61 degrees F
Frost-free period: 181 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Norge and similar soils: 55 percent
Urban land: 30 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Norge

Setting

Landform: Paleoterraces
Landform position (three-dimensional): Riser
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy alluvium derived from sedimentary rock

Typical profile

A - 0 to 8 inches: silt loam
BA - 8 to 13 inches: silt loam
Bt1 - 13 to 23 inches: silty clay loam
Bt2 - 23 to 80 inches: silty clay loam

Properties and qualities

Slope: 1 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained

Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 2 percent
Salinity, maximum in profile: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 4.0
Available water storage in profile: High (about 10.5 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: Loamy Upland (R080AY056OK)
Hydric soil rating: No

Description of Urban Land

Setting
Parent material: Fine-silty mine spoil or earthy fill derived from sandstone and shale

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Dale, rarely flooded
Percent of map unit: 5 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Loamy Bottomland (R080AY050OK)
Hydric soil rating: No

Renfrow
Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Ecological site: Claypan Upland (North) (R080AY010OK)
Hydric soil rating: No

Bethany
Percent of map unit: 5 percent
Landform: Paleoterraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: Claypan Upland (North) (R080AY010OK)

Hydric soil rating: No

PIT—Pits

Map Unit Setting

National map unit symbol: dwy3
Elevation: 500 to 2,200 feet
Mean annual precipitation: 22 to 48 inches
Mean annual air temperature: 57 to 64 degrees F
Frost-free period: 190 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Pits: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pits

Setting

Parent material: Mine spoil or earthy fill derived from sedimentary rock

Typical profile

C - 0 to 60 inches: variable

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: No

PulA—Pulaski fine sandy loam, 0 to 1 percent slopes, occasionally flooded

Map Unit Setting

National map unit symbol: 2s7g6
Elevation: 700 to 1,300 feet
Mean annual precipitation: 30 to 40 inches
Mean annual air temperature: 59 to 63 degrees F
Frost-free period: 200 to 220 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Pulaski, occasionally flooded, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pulaski, Occasionally Flooded

Setting

Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy alluvium derived from sedimentary rock

Typical profile

Ap - 0 to 19 inches: fine sandy loam
C1 - 19 to 40 inches: fine sandy loam
C2 - 40 to 80 inches: stratified loamy fine sand to fine sandy loam to loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Available water storage in profile: High (about 9.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: A
Ecological site: Loamy Bottomland (R084AY050OK)
Hydric soil rating: No

Minor Components

Ashport, occasionally flooded

Percent of map unit: 5 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Loamy Bottomland (R080AY050OK)
Hydric soil rating: No

Tribbey, occasionally flooded

Percent of map unit: 4 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Subirrigated Bottomland (R084AY095OK)
Hydric soil rating: No

Easpur, occasionally flooded

Percent of map unit: 3 percent
Landform: Flood plains
Down-slope shape: Linear

Across-slope shape: Linear
Ecological site: Loamy Bottomland (R080AY050OK)
Hydric soil rating: No

Port, occasionally flooded
Percent of map unit: 3 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Loamy Bottomland (R080AY050OK)
Hydric soil rating: No

RenB—Renfrow silt loam, 1 to 3 percent slopes

Map Unit Setting
National map unit symbol: 2rj9l
Elevation: 950 to 1,360 feet
Mean annual precipitation: 33 to 42 inches
Mean annual air temperature: 57 to 60 degrees F
Frost-free period: 190 to 230 days
Farmland classification: All areas are prime farmland

Map Unit Composition
Renfrow and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Renfrow

Setting
Landform: Hillslopes
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Clayey residuum weathered from shale

Typical profile
A - 0 to 9 inches: silt loam
BA - 9 to 13 inches: silty clay loam
Btss - 13 to 40 inches: silty clay
Btkss - 40 to 65 inches: silty clay
C - 65 to 75 inches: silty clay

Properties and qualities
Slope: 1 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)

Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 30 percent
Salinity, maximum in profile: Nonsaline to slightly saline (0.5 to 7.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 15.0
Available water storage in profile: High (about 10.1 inches)

Interpretive groups

Land capability classification (irrigated): 3s
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: D
Ecological site: Claypan Upland (North) (R080AY010OK)
Hydric soil rating: No

Minor Components

Bethany

Percent of map unit: 4 percent
Landform: Plains on paleoterraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Ecological site: Claypan Upland (North) (R080AY010OK)
Hydric soil rating: No

Renthin

Percent of map unit: 4 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: Claypan Upland (North) (R080AY010OK)
Hydric soil rating: No

Zaneis

Percent of map unit: 4 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Ecological site: Loamy Upland (R080AY056OK)
Hydric soil rating: No

Grainola

Percent of map unit: 3 percent
Landform: Hillslopes on hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: Claypan Upland (North) (R080AY010OK)
Hydric soil rating: No

RinB—Renthin silt loam, 1 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2tp6g
Elevation: 850 to 1,250 feet
Mean annual precipitation: 33 to 39 inches
Mean annual air temperature: 59 to 63 degrees F
Frost-free period: 181 to 230 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Renthin and similar soils: 96 percent
Minor components: 4 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Renthin

Setting

Landform: Hillslopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Clayey and silty residuum weathered from shale

Typical profile

A - 0 to 4 inches: silt loam
BA - 4 to 10 inches: silty clay loam
Bt - 10 to 22 inches: silty clay
Btss - 22 to 29 inches: silty clay
Btkss - 29 to 42 inches: silty clay
Btk - 42 to 55 inches: silty clay
Cr - 55 to 65 inches: bedrock

Properties and qualities

Slope: 1 to 3 percent
Depth to restrictive feature: 47 to 59 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Available water storage in profile: High (about 9.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e

Hydrologic Soil Group: D
Ecological site: Claypan Upland (North) (R080AY010OK)
Hydric soil rating: No

Minor Components

Huska
Percent of map unit: 1 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: Slickspot (R080AY091OK)
Hydric soil rating: No

Zaneis
Percent of map unit: 1 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Crest
Down-slope shape: Linear
Across-slope shape: Convex
Ecological site: Loamy Upland (R080AY056OK)
Hydric soil rating: No

Kingfisher
Percent of map unit: 1 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: Loamy Upland (R080AY056OK)
Hydric soil rating: No

Grainola
Percent of map unit: 1 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: Claypan Upland (North) (R080AY010OK)
Hydric soil rating: No

RnnC2—Renthin silty clay loam, 3 to 5 percent slopes, eroded

Map Unit Setting
National map unit symbol: 2tp6d
Elevation: 850 to 1,200 feet

Mean annual precipitation: 33 to 39 inches
Mean annual air temperature: 60 to 62 degrees F
Frost-free period: 181 to 230 days
Farmland classification: Not prime farmland

Map Unit Composition

Renthin, eroded, and similar soils: 86 percent
Minor components: 14 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Renthin, Eroded

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Clayey and silty residuum weathered from shale

Typical profile

A - 0 to 4 inches: silty clay loam
Bt - 4 to 20 inches: silty clay loam
Btss - 20 to 27 inches: silty clay
Btkss - 27 to 40 inches: silty clay
Btk - 40 to 53 inches: silty clay
Cr - 53 to 75 inches: bedrock

Properties and qualities

Slope: 3 to 5 percent
Depth to restrictive feature: 43 to 57 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Salinity, maximum in profile: Nonsaline (0.0 to 1.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 3.0
Available water storage in profile: Moderate (about 8.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: D
Ecological site: Claypan Upland (North) (R080AY010OK)
Hydric soil rating: No

Minor Components

Grainola, eroded

Percent of map unit: 8 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope

Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: Claypan Upland (North) (R080AY010OK)
Hydric soil rating: No

Huska, eroded

Percent of map unit: 3 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: Slickspot (R080AY091OK)
Hydric soil rating: No

Zaneis, eroded

Percent of map unit: 3 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: Loamy Upland (R080AY056OK)
Hydric soil rating: No

RnUC—Renthin-Urban land complex, 1 to 5 percent slopes

Map Unit Setting

National map unit symbol: dwyd
Elevation: 700 to 2,000 feet
Mean annual precipitation: 22 to 40 inches
Mean annual air temperature: 57 to 64 degrees F
Frost-free period: 185 to 230 days
Farmland classification: Not prime farmland

Map Unit Composition

Renthin and similar soils: 55 percent
Urban land: 45 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Renthin

Setting

Landform: Hillslopes on hills
Landform position (two-dimensional): Backslope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Clayey and silty residuum weathered from shale

Typical profile

A - 0 to 10 inches: silt loam

BA - 10 to 14 inches: silty clay loam
Bt - 14 to 51 inches: silty clay
Btk - 51 to 58 inches: silty clay
Cr - 58 to 72 inches: bedrock

Properties and qualities

Slope: 3 to 5 percent
Depth to restrictive feature: 40 to 60 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Available water storage in profile: High (about 10.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: D
Hydric soil rating: No

Description of Urban Land

Setting

Parent material: Clayey mine spoil or earthy fill derived from clayey shale

Typical profile

C - 0 to 60 inches: variable

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: No

SDGD4—Stephenville-Darsil-Gullied land complex, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2tq5r
Elevation: 750 to 1,300 feet
Mean annual precipitation: 32 to 40 inches
Mean annual air temperature: 59 to 63 degrees F
Frost-free period: 200 to 220 days
Farmland classification: Not prime farmland

Map Unit Composition

Stephenville, severely eroded, and similar soils: 45 percent
Darsil, severely eroded, and similar soils: 30 percent

Gullied land, severely eroded: 15 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Stephenville, Severely Eroded

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Loamy residuum weathered from sandstone

Typical profile

A - 0 to 5 inches: fine sandy loam
Bt1 - 5 to 12 inches: sandy clay loam
Bt2 - 12 to 22 inches: sandy clay loam
Cr - 22 to 32 inches: bedrock

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low (0.04 to 0.10 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.0 to 1.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 1.0
Available water storage in profile: Low (about 3.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: Sandy Loam Savannah (R084AY075OK)
Hydric soil rating: No

Description of Darsil, Severely Eroded

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Sandy residuum weathered from sandstone

Typical profile

A - 0 to 5 inches: loamy fine sand
AC - 5 to 17 inches: fine sand
Cr - 17 to 27 inches: bedrock

Properties and qualities

Slope: 3 to 8 percent

Depth to restrictive feature: 9 to 19 inches to paralithic bedrock
Natural drainage class: Excessively drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low (0.04 to 0.10 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 1.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: Shallow Savannah (R084AY088OK)
Hydric soil rating: No

Description of Gullied Land, Severely Eroded

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Microfeatures of landform position: Gullies
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Clayey and loamy residuum weathered from sandstone and shale

Typical profile

C - 0 to 60 inches: variable

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8e
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Newalla, severely eroded

Percent of map unit: 7 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: Sandy Loam Savannah (R084AY075OK)
Hydric soil rating: No

Harrah, eroded

Percent of map unit: 3 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear

Ecological site: Sandy Loam Savannah (R084AY075OK)
Hydric soil rating: No

SDND—Stephenville-Darsil-Newalla complex, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2tq5v
Elevation: 750 to 1,300 feet
Mean annual precipitation: 32 to 40 inches
Mean annual air temperature: 59 to 63 degrees F
Frost-free period: 200 to 220 days
Farmland classification: Not prime farmland

Map Unit Composition

Stephenville and similar soils: 45 percent
Darsil and similar soils: 30 percent
Newalla and similar soils: 15 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Stephenville

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Loamy residuum weathered from sandstone

Typical profile

A - 0 to 5 inches: loamy fine sand
E - 5 to 15 inches: fine sandy loam
Bt - 15 to 33 inches: sandy clay loam
Cr - 33 to 51 inches: bedrock

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 16 to 40 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low (0.04 to 0.10 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.0 to 1.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 1.5

Available water storage in profile: Low (about 4.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: Sandy Loam Savannah (R084AY075OK)
Hydric soil rating: No

Description of Darsil

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Sandy residuum weathered from sandstone

Typical profile

A - 0 to 5 inches: loamy fine sand
AC - 5 to 17 inches: fine sand
Cr - 17 to 27 inches: bedrock

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 9 to 19 inches to paralithic bedrock
Natural drainage class: Excessively drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low (0.04 to 0.10 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 1.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Ecological site: Shallow Savannah (R084AY088OK)
Hydric soil rating: No

Description of Newalla

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy residuum weathered from sandstone over clayey residuum weathered from shale

Typical profile

A - 0 to 2 inches: fine sandy loam
E - 2 to 5 inches: fine sandy loam
Bt1 - 5 to 11 inches: sandy clay loam

2Bt2 - 11 to 16 inches: clay
2Btss - 16 to 30 inches: clay
2Btkss - 30 to 51 inches: clay
2BC - 51 to 58 inches: parachannery silty clay
2Cd - 58 to 80 inches: clay

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 55 to 63 inches to densic bedrock
Natural drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 7 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 8.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D
Ecological site: Sandy Loam Savannah (R084AY075OK)
Hydric soil rating: No

Minor Components

Harrah

Percent of map unit: 10 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear
Ecological site: Sandy Loam Savannah (R084AY075OK)
Hydric soil rating: No

SDND2—Stephenville-Darsil-Newalla complex, 3 to 8 percent slopes, eroded

Map Unit Setting

National map unit symbol: 2tq5s
Elevation: 750 to 1,300 feet
Mean annual precipitation: 32 to 40 inches
Mean annual air temperature: 59 to 63 degrees F

Frost-free period: 200 to 220 days
Farmland classification: Not prime farmland

Map Unit Composition

Stephenville, eroded, and similar soils: 55 percent
Darsil, eroded, and similar soils: 25 percent
Newalla, eroded, and similar soils: 15 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Stephenville, Eroded

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Loamy residuum weathered from sandstone

Typical profile

A - 0 to 6 inches: fine sandy loam
Bt - 6 to 33 inches: sandy clay loam
Cr - 33 to 43 inches: bedrock

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low (0.04 to 0.10 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.0 to 1.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 1.0
Available water storage in profile: Low (about 5.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: Sandy Loam Savannah (R084AY075OK)
Hydric soil rating: No

Description of Darsil, Eroded

Setting

Landform: Hillslopes
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Sandy residuum weathered from sandstone

Typical profile

A - 0 to 8 inches: loamy fine sand
AC - 8 to 19 inches: loamy fine sand
Cr - 19 to 29 inches: bedrock

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 9 to 20 inches to paralithic bedrock
Natural drainage class: Excessively drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low (0.04 to 0.10 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: Shallow Savannah (R084AY088OK)
Hydric soil rating: No

Description of Newalla, Eroded

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy residuum weathered from sandstone over clayey residuum weathered from shale

Typical profile

A - 0 to 2 inches: fine sandy loam
E - 2 to 5 inches: fine sandy loam
Bt1 - 5 to 11 inches: sandy clay loam
2Bt2 - 11 to 16 inches: clay
2Btss - 16 to 30 inches: clay
2Btkss - 30 to 51 inches: clay
2BC - 51 to 58 inches: parachannery silty clay
2Cd - 58 to 80 inches: clay

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 55 to 63 inches to densic bedrock
Natural drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 7 percent

Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 8.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Ecological site: Sandy Loam Savannah (R084AY075OK)
Hydric soil rating: No

Minor Components

Harrah

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear
Ecological site: Sandy Loam Savannah (R084AY075OK)
Hydric soil rating: No

StDC—Stephenville-Darsil complex, 1 to 5 percent slopes

Map Unit Setting

National map unit symbol: 2tq2b
Elevation: 750 to 1,300 feet
Mean annual precipitation: 32 to 40 inches
Mean annual air temperature: 59 to 63 degrees F
Frost-free period: 200 to 220 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Stephenville and similar soils: 55 percent
Darsil and similar soils: 30 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Stephenville

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Loamy residuum weathered from sandstone

Typical profile

A - 0 to 5 inches: loamy fine sand
E - 5 to 15 inches: fine sandy loam
Bt - 15 to 33 inches: sandy clay loam
Cr - 33 to 51 inches: bedrock

Properties and qualities

Slope: 1 to 5 percent
Depth to restrictive feature: 31 to 39 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low (0.04 to 0.10 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 1.7
Available water storage in profile: Low (about 5.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: Sandy Loam Savannah (R084AY075OK)
Hydric soil rating: No

Description of Darsil

Setting

Landform: Hillslopes
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Sandy residuum weathered from sandstone

Typical profile

A - 0 to 9 inches: loamy fine sand
AC - 9 to 17 inches: loamy fine sand
Cr - 17 to 27 inches: bedrock

Properties and qualities

Slope: 1 to 5 percent
Depth to restrictive feature: 10 to 19 inches to paralithic bedrock
Natural drainage class: Excessively drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low (0.04 to 0.10 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 1.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: D
Ecological site: Shallow Savannah (R084AY088OK)
Hydric soil rating: No

Minor Components

Newalla
Percent of map unit: 9 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: Sandy Loam Savannah (R084AY075OK)
Hydric soil rating: No

Harrah
Percent of map unit: 6 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear
Ecological site: Sandy Loam Savannah (R084AY075OK)
Hydric soil rating: No

StDC2—Stephenville-Darsil complex, 1 to 5 percent slopes, eroded

Map Unit Setting
National map unit symbol: 2scj7
Elevation: 750 to 1,300 feet
Mean annual precipitation: 32 to 40 inches
Mean annual air temperature: 59 to 63 degrees F
Frost-free period: 200 to 220 days
Farmland classification: Not prime farmland

Map Unit Composition
Stephenville, eroded, and similar soils: 70 percent
Darsil, eroded, and similar soils: 20 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Stephenville, Eroded

Setting
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope

Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy residuum weathered from sandstone

Typical profile

A - 0 to 8 inches: fine sandy loam
Bt - 8 to 29 inches: sandy clay loam
Cr - 29 to 40 inches: bedrock

Properties and qualities

Slope: 1 to 5 percent
Depth to restrictive feature: 10 to 38 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low (0.04 to 0.10 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.0 to 1.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 1.5
Available water storage in profile: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: Sandy Loam Savannah (R084AY075OK)
Hydric soil rating: No

Description of Darsil, Eroded

Setting

Landform: Hillslopes on hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Sandy residuum weathered from sandstone

Typical profile

A - 0 to 4 inches: loamy fine sand
AC - 4 to 15 inches: fine sand
Cr - 15 to 25 inches: bedrock

Properties and qualities

Slope: 1 to 5 percent
Depth to restrictive feature: 8 to 20 inches to paralithic bedrock
Natural drainage class: Excessively drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low (0.04 to 0.10 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 1.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: D
Ecological site: Shallow Savannah (R084AY088OK)
Hydric soil rating: No

Minor Components

Newalla, eroded

Percent of map unit: 7 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: Sandy Loam Savannah (R084AY075OK)
Hydric soil rating: No

Harrah

Percent of map unit: 3 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear
Ecological site: Sandy Loam Savannah (R084AY075OK)
Hydric soil rating: No

StLC4—Stephenville-Littleaxe complex, 1 to 5 percent slopes, gullied

Map Unit Setting

National map unit symbol: dwyp
Elevation: 750 to 1,500 feet
Mean annual precipitation: 26 to 40 inches
Mean annual air temperature: 57 to 64 degrees F
Frost-free period: 200 to 230 days
Farmland classification: Not prime farmland

Map Unit Composition

Stephenville, gullied, and similar soils: 50 percent
Littleaxe, gullied, and similar soils: 43 percent
Minor components: 7 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Stephenville, Gullied

Setting

Landform: Hillslopes on hills

Landform position (two-dimensional): Backslope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy residuum weathered from sandstone

Typical profile

Ap - 0 to 6 inches: fine sandy loam
Bt1 - 6 to 20 inches: sandy clay loam
Bt2 - 20 to 30 inches: sandy clay loam
Cr - 30 to 40 inches: bedrock

Properties and qualities

Slope: 1 to 5 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: Eroded Sandy Savannah PE 48-64 (R084AY876OK)
Hydric soil rating: No

Description of Littleaxe, Gullied

Setting

Landform: Hillslopes on hills
Landform position (two-dimensional): Backslope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy residuum weathered from sandstone and shale

Typical profile

Ap - 0 to 10 inches: fine sandy loam
Bt1 - 10 to 24 inches: sandy clay loam
Bt2 - 24 to 42 inches: sandy clay loam
BC - 42 to 52 inches: sandy clay loam
Cr - 52 to 62 inches: bedrock

Properties and qualities

Slope: 1 to 5 percent
Depth to restrictive feature: 40 to 60 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: Eroded Sandy Savannah PE 48-64 (R084AY876OK)
Hydric soil rating: No

Minor Components

Newalla, severely eroded

Percent of map unit: 4 percent
Landform: Hillslopes on hills
Landform position (two-dimensional): Backslope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: Eroded Sandy Savannah PE 48-64 (R084AY876OK)
Hydric soil rating: No

Grainola, severely eroded

Percent of map unit: 3 percent
Landform: Hillslopes on hills
Landform position (two-dimensional): Backslope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: Eroded Claypan Prairie (North) (Obsolete) Refer To 80AY010 (R080AY810OK)
Hydric soil rating: No

SUND—Stephenville-Urban land-Newalla complex, 1 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2scj0
Elevation: 750 to 1,300 feet
Mean annual precipitation: 32 to 40 inches
Mean annual air temperature: 59 to 63 degrees F
Frost-free period: 200 to 220 days
Farmland classification: Not prime farmland

Map Unit Composition

Stephenville and similar soils: 45 percent
Urban land: 30 percent
Newalla and similar soils: 15 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Stephenville

Setting

Landform: Hillslopes

Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Loamy residuum weathered from sandstone

Typical profile

A - 0 to 5 inches: fine sandy loam
E - 5 to 9 inches: fine sandy loam
Bt - 9 to 30 inches: sandy clay loam
BC - 30 to 36 inches: fine sandy loam
Cr - 36 to 46 inches: bedrock

Properties and qualities

Slope: 1 to 8 percent
Depth to restrictive feature: 31 to 40 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low (0.04 to 0.10 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 1.7
Available water storage in profile: Low (about 5.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: Sandy Loam Savannah (R084AY075OK)
Hydric soil rating: No

Description of Urban Land

Setting

Parent material: Mine spoil or earthy fill derived from sandstone

Typical profile

C - 0 to 60 inches: variable

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydrologic Soil Group: D
Hydric soil rating: No

Description of Newalla

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex

Parent material: Loamy residuum weathered from sandstone over clayey residuum weathered from shale

Typical profile

A - 0 to 2 inches: fine sandy loam
E - 2 to 5 inches: fine sandy loam
Bt1 - 5 to 11 inches: sandy clay loam
2Bt2 - 11 to 16 inches: clay
2Btss - 16 to 30 inches: clay
2Btkss - 30 to 51 inches: clay
2BC - 51 to 58 inches: parachannery silty clay
2Cd - 58 to 80 inches: clay

Properties and qualities

Slope: 1 to 5 percent
Depth to restrictive feature: 55 to 63 inches to densic bedrock
Natural drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 7 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 8.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: D
Ecological site: Sandy Loam Savannah (R084AY075OK)
Hydric soil rating: No

Minor Components

Darnell

Percent of map unit: 10 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Nose slope, crest
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: Shallow Savannah (R084AY088OK)
Hydric soil rating: No

TriA—Tribbey fine sandy loam, 0 to 1 percent slopes, frequently flooded

Map Unit Setting

National map unit symbol: 2tq5j
Elevation: 800 to 1,200 feet
Mean annual precipitation: 30 to 39 inches
Mean annual air temperature: 57 to 63 degrees F
Frost-free period: 200 to 230 days
Farmland classification: Not prime farmland

Map Unit Composition

Tribbey, frequently flooded, and similar soils: 93 percent
Minor components: 7 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Tribbey, Frequently Flooded

Setting

Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy alluvium derived from sedimentary rock over loamy alluvium derived from sedimentary rock

Typical profile

A - 0 to 10 inches: fine sandy loam
C - 10 to 50 inches: stratified fine sandy loam to loamy fine sand to fine sand
Ab - 50 to 65 inches: loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 5.95 in/hr)
Depth to water table: About 6 to 42 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water storage in profile: Moderate (about 8.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B
Ecological site: Subirrigated Bottomland (R084AY095OK)

Hydric soil rating: No

Minor Components

Pulaski, frequently flooded

Percent of map unit: 7 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Loamy Bottomland (R084AY050OK)
Hydric soil rating: No

URB—Urban land

Map Unit Setting

National map unit symbol: dwyz
Elevation: 700 to 2,000 feet
Mean annual precipitation: 22 to 40 inches
Mean annual air temperature: 57 to 64 degrees F
Frost-free period: 185 to 230 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Parent material: Mine spoil or earthy fill

Typical profile

C - 0 to 80 inches: variable

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: No

W—Water

Map Unit Setting

National map unit symbol: dwz2
Elevation: 250 to 4,000 feet
Mean annual precipitation: 22 to 48 inches

Mean annual air temperature: 57 to 64 degrees F
Frost-free period: 190 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition
Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Water

Setting
Landform: Valleys

Typical profile
W - 0 to 80 inches: water

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: No

ZaUC—Zaneis-Urban land complex, 1 to 5 percent slopes

Map Unit Setting
National map unit symbol: dwz9
Elevation: 700 to 2,000 feet
Mean annual precipitation: 22 to 40 inches
Mean annual air temperature: 57 to 64 degrees F
Frost-free period: 185 to 230 days
Farmland classification: Not prime farmland

Map Unit Composition
Zaneis and similar soils: 57 percent
Urban land: 43 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Zaneis

Setting
Landform: Hillslopes on hills
Landform position (two-dimensional): Backslope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy residuum weathered from sandstone and shale

Typical profile
Ap - 0 to 10 inches: loam
BA - 10 to 16 inches: clay loam
Bt1 - 16 to 23 inches: clay loam
Bt2 - 23 to 32 inches: sandy clay loam
Bt3 - 32 to 42 inches: sandy clay loam
Cr - 42 to 52 inches: bedrock

Properties and qualities

Slope: 3 to 5 percent
Depth to restrictive feature: 40 to 60 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Hydric soil rating: No

Description of Urban Land

Setting

Parent material: Fine-silty mine spoil or earthy fill derived from sandstone

Typical profile

C - 0 to 60 inches: variable

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: No

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APPENDIX D

WETLAND DETERMINATION DATA FORM

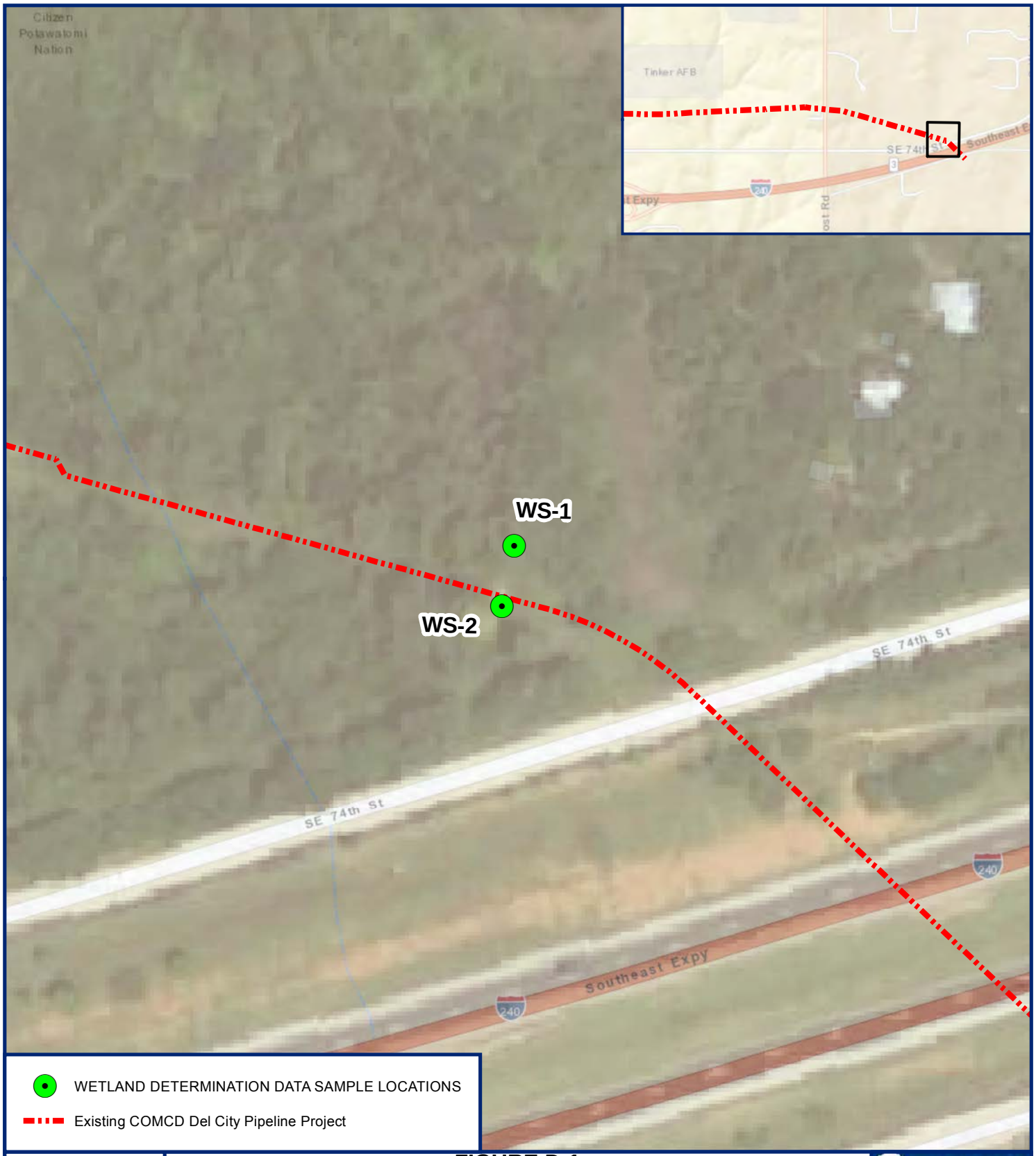

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FIGURE D-1
WETLAND DETERMINATION DATA FORM SAMPLE LOCATIONS
PROPOSED DEL CITY RAW WATER PIPELINE IMPROVEMENTS PROJECT
CENTRAL OKLAHOMA MASTER CONSERVANCY DISTRICT
OKLAHOMA COUNTY, OKLAHOMA

ALAN PLUMMER ASSOCIATES, INC.
ENVIRONMENTAL ENGINEERS AND SCIENTISTS
414 NW 4TH STREET
SUITE 150
OKLAHOMA CITY,
OKLAHOMA 73102
PHONE: (405) 440-2725

DATE: 9/26/2018

FIGURE 1 OF 1

100 50 0 Feet

SOURCE: https://okmaps.org/OGI/search.aspx

USACE Project No.:

WETLAND DETERMINATION DATA FORM – Great Plains Region

Project/Site: Del City Raw Water Pipeline Improvements Project City/County: Oklahoma County Sampling Date: 11-14-2017

Applicant/Owner: Central Oklahoma Master Conservancy District State: OK Sampling Point: WS-1

Investigator(s): Jason Voight and Robert Weinert Section, Township, Range:

Landform (hillslope, terrace, etc.): Depression Local relief (concave, convex, none): Concave Slope (%): <1%

Subregion (LRR): LRR J Lat: 35.39256 Long: -97.34310 Datum: SP OK North

Soil Map Unit Name: Tribbey fine sandy loam, 0 to 1% slopes, frequently flooded NWI classification: R4SBC

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____ Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____ Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X No _____	**Is the Sampled Area within a Wetland?** **Yes X No _____**
Hydric Soil Present?	Yes X No _____	
Wetland Hydrology Present?	Yes X No _____	

Remarks: Area retains water for prolonged duration as evidenced by water stain marks on trees.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30 m)	Absolute % Cover	Dominant Species?	Indicator Status
1. Salix nigra	80	Y	FACW
2. Populus deltoides	5	Y	FAC
3.			
4.			
5.			
	85 = Total Cover		
Sapling/Shrub Stratum (Plot size: 15 m)			
1. Salix nigra	10	Y	FACW
2.			
3.			
4.			
5.			
	10 = Total Cover		
Herb Stratum (Plot size: 15m)			
1. Elymus virginicus	10	Y	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	10 = Total Cover		
Woody Vine Stratum (Plot size: 15m)			
1.			
2.			
% Bare Ground in Herb Stratum 80	80 = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC (excluding FAC-): 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 1 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species _____	x 1 = _____
FACW species _____	x 2 = _____
FAC species _____	x 3 = _____
FACU species _____	x 4 = _____
UPL species _____	x 5 = _____
Column Totals: _____ (A)	_____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes X No _____**

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: WS-1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-16	2.5YR 4/6	100					Sandy Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- _x_ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 of LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRRI, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRRH outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _x_ No ____

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- _X_ Saturation (A3)
- ___ Water Marks (B1)
- _X_ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- _X_ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres on Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- _X_ Sparsely Vegetated Concave Surface (B8)
- _X_ Drainage Patterns (B10)
- ___ Oxidized Rhizospheres on Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present? Yes ____ No _x_ Depth (inches): _____

Water Table Present? Yes ____ No _x_ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _x_ No ____ Depth (inches): 8

Wetland Hydrology Present? Yes _x_ No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Great Plains Region

Project/Site: Del City Raw Water Pipeline Improvements Project City/County: Oklahoma County Sampling Date: 11-14-2017

Applicant/Owner: Central Oklahoma Master Conservancy District State: OK Sampling Point: WS-2

Investigator(s): Jason Voight and Robert Weinert Section, Township, Range:

Landform (hillslope, terrace, etc.): Depression Local relief (concave, convex, none): Concave Slope (%): <1%

Subregion (LRR): LRR J Lat: 35.39244 Long: -97.34313 Datum: SP OK North

Soil Map Unit Name: Tribbey fine sandy loam, 0 to 1% slopes, frequently flooded NWI classification: R4SBC

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____ Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____ Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X No _____	**Is the Sampled Area within a Wetland?** **Yes _____ No X**
Hydric Soil Present?	Yes _____ No X	
Wetland Hydrology Present?	Yes X No _____	

Remarks: Upslope from WS-1.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30 m)	Absolute % Cover	Dominant Species?	Indicator Status
1. Populus deltoids	30	Y	FAC
2. Ulmus crassifolia	5	Y	FAC
3.			
4.			
5.			
	35 = Total Cover		
Sapling/Shrub Stratum (Plot size: 15 m)			
1. Ulmus crassifolia	2	N	FAC
2.			
3.			
4.			
5.			
	2 = Total Cover		
Herb Stratum (Plot size: 15m)			
1. Elymus virginicus	35	Y	FAC
2. Sorghum halepense	35	Y	FACU
3. Cynodon dactylon	30	Y	FACU
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: 15m)			
1.			
2.			
% Bare Ground in Herb Stratum 80	80 = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC (excluding FAC-): 3 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0.6 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:	
OBL species	x 1 =	
FACW species	x 2 =	
FAC species 3	x 3 =	9
FACU species 2	x 4 =	8
UPL species	x 5 =	
Column Totals: 5 (A)		17 (B)

Prevalence Index = B/A = 3.4

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes X No _____**

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: WS-2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-16	2.5YR 4/6	100					Sandy Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 of LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRRI, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRRH outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ____ No __X__

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres on Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- _X_ Sparsely Vegetated Concave Surface (B8)
- _X_ Drainage Patterns (B10)
- ___ Oxidized Rhizospheres on Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- _X_ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present? Yes ____ No __x__ Depth (inches): _____

Water Table Present? Yes ____ No __x__ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes ____ No __x__ Depth (inches): _____

Wetland Hydrology Present? Yes __X__ No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

APPENDIX E

NATIONWIDE PERMIT 12 FOR UTILITY LINE ACTIVITIES

NATIONWIDE PERMIT 12

Utility Line Activities

Effective Date: March 19, 2017

(NWP Final Notice, 82 FR 4)

12. Utility Line Activities. Activities required for the construction, maintenance, repair, and removal of utility lines and associated facilities in waters of the United States, provided the activity does not result in the loss of greater than 1/2-acre of waters of the United States for each single and complete project.

Utility lines: This NWP authorizes discharges of dredged or fill material into waters of the United States and structures or work in navigable waters for crossings of those waters associated with the construction, maintenance, or repair of utility lines, including outfall and intake structures. There must be no change in pre-construction contours of waters of the United States. A "utility line" is defined as any pipe or pipeline for the transportation of any gaseous, liquid, liquescent, or slurry substance, for any purpose, and any cable, line, or wire for the transmission for any purpose of electrical energy, telephone, and telegraph messages, and internet, radio, and television communication. The term "utility line" does not include activities that drain a water of the United States, such as drainage tile or french drains, but it does apply to pipes conveying drainage from another area.

Material resulting from trench excavation may be temporarily sidecast into waters of the United States for no more than three months, provided the material is not placed in such a manner that it is dispersed by currents or other forces. The district engineer may extend the period of temporary side casting for no more than a total of 180 days, where appropriate. In wetlands, the top 6 to 12 inches of the trench should normally be backfilled with topsoil from the trench. The trench cannot be constructed or backfilled in such a manner as to drain waters of the United States (e.g., backfilling with extensive gravel layers, creating a french drain effect). Any exposed slopes and stream banks must be stabilized immediately upon completion of the utility line crossing of each waterbody.

Utility line substations: This NWP authorizes the construction, maintenance, or expansion of substation facilities associated with a power line or utility line in non-tidal waters of the United States, provided the activity, in combination with all other activities included in one single and complete project, does not result in the loss of greater than 1/2-acre of waters of the United States. This NWP does not authorize discharges into non-tidal wetlands adjacent to tidal waters of the United States to construct, maintain, or expand substation facilities.

Foundations for overhead utility line towers, poles, and anchors: This NWP authorizes the construction or maintenance of foundations for overhead utility line towers, poles, and anchors in all waters of the United States, provided the foundations are the minimum size necessary and separate footings for each tower leg (rather than a larger single pad) are used where feasible.

Access roads: This NWP authorizes the construction of access roads for the construction and maintenance of utility lines, including overhead power lines and utility line substations, in non-tidal waters of the United States, provided the activity, in combination with all other activities included in one single and complete project, does not cause the loss of greater than 1/2-acre of non-tidal waters of the United States. This NWP does not authorize discharges into non-tidal wetlands adjacent to tidal waters for access roads. Access roads must be the minimum width necessary (see Note 2, below). Access roads must be constructed so that the length of the road minimizes any adverse effects on waters of the United States and must be as near as possible to pre-construction

contours and elevations (e.g., at grade corduroy roads or geotextile/gravel roads). Access roads constructed above pre-construction contours and elevations in waters of the United States must be properly bridged or culverted to maintain surface flows.

This NWP may authorize utility lines in or affecting navigable waters of the United States even if there is no associated discharge of dredged or fill material (See 33 CFR part 322). Overhead utility lines constructed over section 10 waters and utility lines that are routed in or under section 10 waters without a discharge of dredged or fill material require a section 10 permit.

This NWP authorizes, to the extent that Department of the Army authorization is required, temporary structures, fills, and work necessary for the remediation of inadvertent returns of drilling fluids to waters of the United States through sub-soil fissures or fractures that might occur during horizontal directional drilling activities conducted for the purpose of installing or replacing utility lines. These remediation activities must be done as soon as practicable, to restore the affected waterbody. District engineers may add special conditions to this NWP to require a remediation plan for addressing inadvertent returns of drilling fluids to waters of the United States during horizontal directional drilling activities conducted for the purpose of installing or replacing utility lines.

This NWP also authorizes temporary structures, fills, and work, including the use of temporary mats, necessary to conduct the utility line activity. Appropriate measures must be taken to maintain normal downstream flows and minimize flooding to the maximum extent practicable, when temporary structures, work, and discharges, including cofferdams, are necessary for construction activities, access fills, or dewatering of construction sites. Temporary fills must consist of materials, and be placed in a manner, that will not be eroded by expected high flows. After construction, temporary fills must be removed in their entirety and the affected areas returned to pre-construction elevations. The areas affected by temporary fills must be revegetated, as appropriate.

Notification: The permittee must submit a pre-construction notification to the district engineer prior to commencing the activity if any of the following criteria are met: (1) the activity involves mechanized land clearing in a forested wetland for the utility line right-of-way; (2) a section 10 permit is required; (3) the utility line in waters of the United States, excluding overhead lines, exceeds 500 feet; (4) the utility line is placed within a jurisdictional area (i.e., water of the United States), and it runs parallel to or along a stream bed that is within that jurisdictional area; (5) discharges that result in the loss of greater than 1/10-acre of waters of the United States; (6) permanent access roads are constructed above grade in waters of the United States for a distance of more than 500 feet; or (7) permanent access roads are constructed in waters of the United States with impervious materials. (See general condition 32.) (Authorities: Sections 10 and 404)

Note 1: Where the utility line is constructed or installed in navigable waters of the United States (i.e., section 10 waters) within the coastal United States, the Great Lakes, and United States territories, a copy of the NWP verification will be sent by the Corps to the National Oceanic and Atmospheric Administration (NOAA), National Ocean Service (NOS), for charting the utility line to protect navigation.

Note 2: For utility line activities crossing a single waterbody more than one time at separate and distant locations, or multiple waterbodies at separate and distant locations, each crossing is considered a single and complete project for purposes of NWP authorization. Utility line activities must comply with 33 CFR 330.6(d).

Note 3: Utility lines consisting of aerial electric power transmission lines crossing navigable waters of the United States (which are defined at 33 CFR part 329) must comply with the applicable minimum clearances specified in 33 CFR 322.5(i).

Note 4: Access roads used for both construction and maintenance may be authorized, provided they meet the terms and conditions of this NWP. Access roads used solely for construction of the utility line must be removed upon completion of the work, in accordance with the requirements for temporary fills.

Note 5: Pipes or pipelines used to transport gaseous, liquid, liquescent, or slurry substances over navigable waters of the United States are considered to be bridges, not utility lines, and may require a permit from the U.S. Coast Guard pursuant to section 9 of the Rivers and Harbors Act of 1899. However, any discharges of dredged or fill material into waters of the United States associated with such pipelines will require a section 404 permit (see NWP 15).

Note 6: This NWP authorizes utility line maintenance and repair activities that do not qualify for the Clean Water Act section 404(f) exemption for maintenance of currently serviceable fills or fill structures.

Note 7: For overhead utility lines authorized by this NWP, a copy of the PCN and NWP verification will be provided to the Department of Defense Siting Clearinghouse, which will evaluate potential effects on military activities.

Note 8: For NWP 12 activities that require pre-construction notification, the PCN must include any other NWP(s), regional general permit(s), or individual permit(s) used or intended to be used to authorize any part of the proposed project or any related activity, including other separate and distant crossings that require Department of the Army authorization but do not require pre-construction notification (see paragraph (b) of general condition 32). The district engineer will evaluate the PCN in accordance with Section D, "District Engineer's Decision." The district engineer may require mitigation to ensure that the authorized activity results in no more than minimal individual and cumulative adverse environmental effects (see general condition 23).

Nationwide Permit General Conditions

Note: To qualify for NWP authorization, the prospective permittee must comply with the following general conditions, as applicable, in addition to any regional or case-specific conditions imposed by the division engineer or district engineer. Prospective permittees should contact the appropriate Corps district office to determine if regional conditions have been imposed on an NWP. Prospective permittees should also contact the appropriate Corps district office to determine the status of Clean Water Act Section 401 water quality certification and/or Coastal Zone Management Act consistency for an NWP. Every person who may wish to obtain permit authorization under one or more NWPs, or who is currently relying on an existing or prior permit authorization under one or more NWPs, has been and is on notice that all of the provisions of 33 CFR 330.1 through 330.6 apply to every NWP authorization. Note especially 33 CFR 330.5 relating to the modification, suspension, or revocation of any NWP authorization.

1. Navigation. (a) No activity may cause more than a minimal adverse effect on navigation.

(b) Any safety lights and signals prescribed by the U.S. Coast Guard, through regulations or otherwise, must be installed and maintained at the permittee's expense on authorized facilities in navigable waters of the United States.

(c) The permittee understands and agrees that, if future operations by the United States require the removal, relocation, or other alteration, of the structure or work herein authorized, or if, in the opinion of the Secretary of the Army or his authorized representative, said structure or work shall cause unreasonable obstruction to the free navigation of the navigable waters, the permittee will be required, upon due notice from the Corps of Engineers, to remove, relocate, or alter the structural work or obstructions caused thereby, without expense to the United States. No claim shall be made against the United States on account of any such removal or alteration.

2. Aquatic Life Movements. No activity may substantially disrupt the necessary life cycle movements of those species of aquatic life indigenous to the waterbody, including those species that normally migrate through the area, unless the activity's primary purpose is to impound water. All permanent and temporary crossings of waterbodies shall be suitably culverted, bridged, or otherwise designed and constructed to maintain low flows to sustain the movement of those aquatic species. If a bottomless culvert cannot be used, then the crossing should be designed and constructed to minimize adverse effects to aquatic life movements.

3. Spawning Areas. Activities in spawning areas during spawning seasons must be avoided to the maximum extent practicable. Activities that result in the physical destruction (e.g., through excavation, fill, or downstream smothering by substantial turbidity) of an important spawning area are not authorized.

4. Migratory Bird Breeding Areas. Activities in waters of the United States that serve as breeding areas for migratory birds must be avoided to the maximum extent practicable.

5. Shellfish Beds. No activity may occur in areas of concentrated shellfish populations, unless the activity is directly related to a shellfish harvesting activity authorized by NWPs 4 and 48, or is a shellfish seeding or habitat restoration activity authorized by NWP 27.

6. Suitable Material. No activity may use unsuitable material (e.g., trash, debris, car bodies, asphalt, etc.). Material used for construction or discharged must be free from toxic pollutants in toxic amounts (see section 307 of the Clean Water Act).

7. Water Supply Intakes. No activity may occur in the proximity of a public water supply intake, except where the activity is for the repair or improvement of public water supply intake structures or adjacent bank stabilization.

8. Adverse Effects From Impoundments. If the activity creates an impoundment of water, adverse effects to the aquatic system due to accelerating the passage of water, and/or restricting its flow must be minimized to the maximum extent practicable.

9. Management of Water Flows. To the maximum extent practicable, the pre-construction course, condition, capacity, and location of open waters must be maintained for each activity, including stream channelization, storm water management activities, and temporary and permanent road crossings, except as provided below. The activity must be constructed to withstand expected high flows. The activity must not restrict or impede the passage of normal or high flows, unless the primary purpose of the activity is to impound water or manage high flows. The activity may alter the pre-construction course, condition, capacity, and location of open waters if it benefits the aquatic environment (e.g., stream restoration or relocation activities).

10. Fills Within 100-Year Floodplains. The activity must comply with applicable FEMA-approved state or local floodplain management requirements.

11. Equipment. Heavy equipment working in wetlands or mudflats must be placed on mats, or other measures must be taken to minimize soil disturbance.

12. Soil Erosion and Sediment Controls. Appropriate soil erosion and sediment controls must be used and maintained in effective operating condition during construction, and all exposed soil and other fills, as well as any work below the ordinary high water mark or high tide line, must be permanently stabilized at the earliest practicable date. Permittees are encouraged to perform work within waters of the United States during periods of low-flow or no-flow, or during low tides.

13. Removal of Temporary Fills. Temporary fills must be removed in their entirety and the affected areas returned to pre-construction elevations. The affected areas must be revegetated, as appropriate.

14. Proper Maintenance. Any authorized structure or fill shall be properly maintained, including maintenance to ensure public safety and compliance with applicable NWP general conditions, as well as any activity-specific conditions added by the district engineer to an NWP authorization.

15. Single and Complete Project. The activity must be a single and complete project. The same NWP cannot be used more than once for the same single and complete project.

16. Wild and Scenic Rivers. (a) No NWP activity may occur in a component of the National Wild and Scenic River System, or in a river officially designated by Congress as a "study river" for possible inclusion in the system while the river is in an official study status, unless the appropriate Federal agency with direct management responsibility for such river, has determined in writing that the proposed activity will not adversely affect the Wild and Scenic River designation or study status.

(b) If a proposed NWP activity will occur in a component of the National Wild and Scenic River System, or in a river officially designated by Congress as a "study river" for possible inclusion in the system while the river is in an official study status, the permittee must submit a pre-construction notification (see general condition 32). The district engineer will coordinate the PCN with the Federal agency with direct management responsibility for that river. The permittee shall not begin the NWP activity until notified by the district engineer that the Federal agency with direct management responsibility for that river has determined in writing that the proposed NWP activity will not adversely affect the Wild and Scenic River designation or study status.

(c) Information on Wild and Scenic Rivers may be obtained from the appropriate Federal land management agency responsible for the designated Wild and Scenic River or study river (e.g., National Park Service, U.S. Forest Service, Bureau of Land Management, U.S. Fish and Wildlife Service). Information on these rivers is also available at: http://www.rivers.gov/.

17. Tribal Rights. No NWP activity may cause more than minimal adverse effects on tribal rights (including treaty rights), protected tribal resources, or tribal lands.

18. Endangered Species. (a) No activity is authorized under any NWP which is likely to directly or indirectly jeopardize the continued existence of a threatened or endangered species or a species proposed for such designation, as identified under the Federal Endangered Species Act

(ESA), or which will directly or indirectly destroy or adversely modify the critical habitat of such species. No activity is authorized under any NWP which "may affect" a listed species or critical habitat, unless ESA section 7 consultation addressing the effects of the proposed activity has been completed. Direct effects are the immediate effects on listed species and critical habitat caused by the NWP activity. Indirect effects are those effects on listed species and critical habitat that are caused by the NWP activity and are later in time, but still are reasonably certain to occur.

(b) Federal agencies should follow their own procedures for complying with the requirements of the ESA. If pre-construction notification is required for the proposed activity, the Federal permittee must provide the district engineer with the appropriate documentation to demonstrate compliance with those requirements. The district engineer will verify that the appropriate documentation has been submitted. If the appropriate documentation has not been submitted, additional ESA section 7 consultation may be necessary for the activity and the respective federal agency would be responsible for fulfilling its obligation under section 7 of the ESA.

(c) Non-federal permittees must submit a pre-construction notification to the district engineer if any listed species or designated critical habitat might be affected or is in the vicinity of the activity, or if the activity is located in designated critical habitat, and shall not begin work on the activity until notified by the district engineer that the requirements of the ESA have been satisfied and that the activity is authorized. For activities that might affect Federally-listed endangered or threatened species or designated critical habitat, the pre-construction notification must include the name(s) of the endangered or threatened species that might be affected by the proposed activity or that utilize the designated critical habitat that might be affected by the proposed activity. The district engineer will determine whether the proposed activity "may affect" or will have "no effect" to listed species and designated critical habitat and will notify the non-Federal applicant of the Corps' determination within 45 days of receipt of a complete pre-construction notification. In cases where the non-Federal applicant has identified listed species or critical habitat that might be affected or is in the vicinity of the activity, and has so notified the Corps, the applicant shall not begin work until the Corps has provided notification that the proposed activity will have "no effect" on listed species or critical habitat, or until ESA section 7 consultation has been completed. If the non-Federal applicant has not heard back from the Corps within 45 days, the applicant must still wait for notification from the Corps.

(d) As a result of formal or informal consultation with the FWS or NMFS the district engineer may add species-specific permit conditions to the NWPs.

(e) Authorization of an activity by an NWP does not authorize the "take" of a threatened or endangered species as defined under the ESA. In the absence of separate authorization (e.g., an ESA Section 10 Permit, a Biological Opinion with "incidental take" provisions, etc.) from the FWS or the NMFS, the Endangered Species Act prohibits any person subject to the jurisdiction of the United States to take a listed species, where "take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. The word "harm" in the definition of "take" means an act which actually kills or injures wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering.

(f) If the non-federal permittee has a valid ESA section 10(a)(1)(B) incidental take permit with an approved Habitat Conservation Plan for a project or a group of projects that includes the proposed NWP activity, the non-federal applicant should provide a copy of that ESA section 10(a)(1)(B) permit with the PCN required by paragraph (c) of this general condition. The district

engineer will coordinate with the agency that issued the ESA section 10(a)(1)(B) permit to determine whether the proposed NWP activity and the associated incidental take were considered in the internal ESA section 7 consultation conducted for the ESA section 10(a)(1)(B) permit. If that coordination results in concurrence from the agency that the proposed NWP activity and the associated incidental take were considered in the internal ESA section 7 consultation for the ESA section 10(a)(1)(B) permit, the district engineer does not need to conduct a separate ESA section 7 consultation for the proposed NWP activity. The district engineer will notify the non-federal applicant within 45 days of receipt of a complete pre-construction notification whether the ESA section 10(a)(1)(B) permit covers the proposed NWP activity or whether additional ESA section 7 consultation is required.

(g) Information on the location of threatened and endangered species and their critical habitat can be obtained directly from the offices of the FWS and NMFS or their world wide web pages at http://www.fws.gov/ or http://www.fws.gov/ipac and http://www.nmfs.noaa.gov/pr/species/esa/ respectively.

19. Migratory Birds and Bald and Golden Eagles. The permittee is responsible for ensuring their action complies with the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. The permittee is responsible for contacting appropriate local office of the U.S. Fish and Wildlife Service to determine applicable measures to reduce impacts to migratory birds or eagles, including whether "incidental take" permits are necessary and available under the Migratory Bird Treaty Act or Bald and Golden Eagle Protection Act for a particular activity.

20. Historic Properties. (a) In cases where the district engineer determines that the activity may have the potential to cause effects to properties listed, or eligible for listing, in the National Register of Historic Places, the activity is not authorized, until the requirements of Section 106 of the National Historic Preservation Act (NHPA) have been satisfied.

(b) Federal permittees should follow their own procedures for complying with the requirements of section 106 of the National Historic Preservation Act. If pre-construction notification is required for the proposed NWP activity, the Federal permittee must provide the district engineer with the appropriate documentation to demonstrate compliance with those requirements. The district engineer will verify that the appropriate documentation has been submitted. If the appropriate documentation is not submitted, then additional consultation under section 106 may be necessary. The respective federal agency is responsible for fulfilling its obligation to comply with section 106.

(c) Non-federal permittees must submit a pre-construction notification to the district engineer if the NWP activity might have the potential to cause effects to any historic properties listed on, determined to be eligible for listing on, or potentially eligible for listing on the National Register of Historic Places, including previously unidentified properties. For such activities, the pre-construction notification must state which historic properties might have the potential to be affected by the proposed NWP activity or include a vicinity map indicating the location of the historic properties or the potential for the presence of historic properties. Assistance regarding information on the location of, or potential for, the presence of historic properties can be sought from the State Historic Preservation Officer, Tribal Historic Preservation Officer, or designated tribal representative, as appropriate, and the National Register of Historic Places (see 33 CFR 330.4(g)). When reviewing pre-construction notifications, district engineers will comply with the current procedures for addressing the requirements of section 106 of the National Historic Preservation Act. The district engineer shall make a reasonable and good faith effort to carry out appropriate identification efforts, which may include background research, consultation, oral

history interviews, sample field investigation, and field survey. Based on the information submitted in the PCN and these identification efforts, the district engineer shall determine whether the proposed NWP activity has the potential to cause effects on the historic properties. Section 106 consultation is not required when the district engineer determines that the activity does not have the potential to cause effects on historic properties (see 36 CFR 800.3(a)). Section 106 consultation is required when the district engineer determines that the activity has the potential to cause effects on historic properties. The district engineer will conduct consultation with consulting parties identified under 36 CFR 800.2(c) when he or she makes any of the following effect determinations for the purposes of section 106 of the NHPA: no historic properties affected, no adverse effect, or adverse effect. Where the non-Federal applicant has identified historic properties on which the activity might have the potential to cause effects and so notified the Corps, the non-Federal applicant shall not begin the activity until notified by the district engineer either that the activity has no potential to cause effects to historic properties or that NHPA section 106 consultation has been completed.

(d) For non-federal permittees, the district engineer will notify the prospective permittee within 45 days of receipt of a complete pre-construction notification whether NHPA section 106 consultation is required. If NHPA section 106 consultation is required, the district engineer will notify the non-Federal applicant that he or she cannot begin the activity until section 106 consultation is completed. If the non-Federal applicant has not heard back from the Corps within 45 days, the applicant must still wait for notification from the Corps.

(e) Prospective permittees should be aware that section 110k of the NHPA (54 U.S.C. 306113) prevents the Corps from granting a permit or other assistance to an applicant who, with intent to avoid the requirements of section 106 of the NHPA, has intentionally significantly adversely affected a historic property to which the permit would relate, or having legal power to prevent it, allowed such significant adverse effect to occur, unless the Corps, after consultation with the Advisory Council on Historic Preservation (ACHP), determines that circumstances justify granting such assistance despite the adverse effect created or permitted by the applicant. If circumstances justify granting the assistance, the Corps is required to notify the ACHP and provide documentation specifying the circumstances, the degree of damage to the integrity of any historic properties affected, and proposed mitigation. This documentation must include any views obtained from the applicant, SHPO/THPO, appropriate Indian tribes if the undertaking occurs on or affects historic properties on tribal lands or affects properties of interest to those tribes, and other parties known to have a legitimate interest in the impacts to the permitted activity on historic properties.

21. Discovery of Previously Unknown Remains and Artifacts. If you discover any previously unknown historic, cultural or archeological remains and artifacts while accomplishing the activity authorized by this permit, you must immediately notify the district engineer of what you have found, and to the maximum extent practicable, avoid construction activities that may affect the remains and artifacts until the required coordination has been completed. The district engineer will initiate the Federal, Tribal, and state coordination required to determine if the items or remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places.

22. Designated Critical Resource Waters. Critical resource waters include, NOAA-managed marine sanctuaries and marine monuments, and National Estuarine Research Reserves. The district engineer may designate, after notice and opportunity for public comment, additional waters officially designated by a state as having particular environmental or ecological significance, such as outstanding national resource waters or state natural heritage sites. The district engineer may also designate additional critical resource waters after notice and opportunity for public comment.

(a) Discharges of dredged or fill material into waters of the United States are not authorized by NWPs 7, 12, 14, 16, 17, 21, 29, 31, 35, 39, 40, 42, 43, 44, 49, 50, 51, and 52 for any activity within, or directly affecting, critical resource waters, including wetlands adjacent to such waters.

(b) For NWPs 3, 8, 10, 13, 15, 18, 19, 22, 23, 25, 27, 28, 30, 33, 34, 36, 37, 38, and 54, notification is required in accordance with general condition 32, for any activity proposed in the designated critical resource waters including wetlands adjacent to those waters. The district engineer may authorize activities under these NWPs only after it is determined that the impacts to the critical resource waters will be no more than minimal.

23. Mitigation. The district engineer will consider the following factors when determining appropriate and practicable mitigation necessary to ensure that the individual and cumulative adverse environmental effects are no more than minimal:

(a) The activity must be designed and constructed to avoid and minimize adverse effects, both temporary and permanent, to waters of the United States to the maximum extent practicable at the project site (i.e., on site).

(b) Mitigation in all its forms (avoiding, minimizing, rectifying, reducing, or compensating for resource losses) will be required to the extent necessary to ensure that the individual and cumulative adverse environmental effects are no more than minimal.

(c) Compensatory mitigation at a minimum one-for-one ratio will be required for all wetland losses that exceed 1/10-acre and require pre-construction notification, unless the district engineer determines in writing that either some other form of mitigation would be more environmentally appropriate or the adverse environmental effects of the proposed activity are no more than minimal, and provides an activity-specific waiver of this requirement. For wetland losses of 1/10-acre or less that require pre-construction notification, the district engineer may determine on a case-by-case basis that compensatory mitigation is required to ensure that the activity results in only minimal adverse environmental effects.

(d) For losses of streams or other open waters that require pre-construction notification, the district engineer may require compensatory mitigation to ensure that the activity results in no more than minimal adverse environmental effects. Compensatory mitigation for losses of streams should be provided, if practicable, through stream rehabilitation, enhancement, or preservation, since streams are difficult-to-replace resources (see 33 CFR 332.3(e)(3)).

(e) Compensatory mitigation plans for NWP activities in or near streams or other open waters will normally include a requirement for the restoration or enhancement, maintenance, and legal protection (e.g., conservation easements) of riparian areas next to open waters. In some cases, the restoration or maintenance/protection of riparian areas may be the only compensatory mitigation required. Restored riparian areas should consist of native species. The width of the required riparian area will address documented water quality or aquatic habitat loss concerns. Normally, the riparian area will be 25 to 50 feet wide on each side of the stream, but the district engineer may require slightly wider riparian areas to address documented water quality or habitat loss concerns. If it is not possible to restore or maintain/protect a riparian area on both sides of a stream, or if the waterbody is a lake or coastal waters, then restoring or maintaining/protecting a riparian area along a single bank or shoreline may be sufficient. Where both wetlands and open waters exist on the project site, the district engineer will determine the appropriate compensatory mitigation (e.g., riparian areas and/or wetlands compensation) based on what is best for the aquatic

environment on a watershed basis. In cases where riparian areas are determined to be the most appropriate form of minimization or compensatory mitigation, the district engineer may waive or reduce the requirement to provide wetland compensatory mitigation for wetland losses.

(f) Compensatory mitigation projects provided to offset losses of aquatic resources must comply with the applicable provisions of 33 CFR part 332.

(1) The prospective permittee is responsible for proposing an appropriate compensatory mitigation option if compensatory mitigation is necessary to ensure that the activity results in no more than minimal adverse environmental effects. For the NWPs, the preferred mechanism for providing compensatory mitigation is mitigation bank credits or in-lieu fee program credits (see 33 CFR 332.3(b)(2) and (3)). However, if an appropriate number and type of mitigation bank or in-lieu credits are not available at the time the PCN is submitted to the district engineer, the district engineer may approve the use of permittee-responsible mitigation.

(2) The amount of compensatory mitigation required by the district engineer must be sufficient to ensure that the authorized activity results in no more than minimal individual and cumulative adverse environmental effects (see 33 CFR 330.1(e)(3)). (See also 33 CFR 332.3(f)).

(3) Since the likelihood of success is greater and the impacts to potentially valuable uplands are reduced, aquatic resource restoration should be the first compensatory mitigation option considered for permittee-responsible mitigation.

(4) If permittee-responsible mitigation is the proposed option, the prospective permittee is responsible for submitting a mitigation plan. A conceptual or detailed mitigation plan may be used by the district engineer to make the decision on the NWP verification request, but a final mitigation plan that addresses the applicable requirements of 33 CFR 332.4(c)(2) through (14) must be approved by the district engineer before the permittee begins work in waters of the United States, unless the district engineer determines that prior approval of the final mitigation plan is not practicable or not necessary to ensure timely completion of the required compensatory mitigation (see 33 CFR 332.3(k)(3)).

(5) If mitigation bank or in-lieu fee program credits are the proposed option, the mitigation plan only needs to address the baseline conditions at the impact site and the number of credits to be provided.

(6) Compensatory mitigation requirements (e.g., resource type and amount to be provided as compensatory mitigation, site protection, ecological performance standards, monitoring requirements) may be addressed through conditions added to the NWP authorization, instead of components of a compensatory mitigation plan (see 33 CFR 332.4(c)(1)(ii)).

(g) Compensatory mitigation will not be used to increase the acreage losses allowed by the acreage limits of the NWPs. For example, if an NWP has an acreage limit of 1/2-acre, it cannot be used to authorize any NWP activity resulting in the loss of greater than 1/2-acre of waters of the United States, even if compensatory mitigation is provided that replaces or restores some of the lost waters. However, compensatory mitigation can and should be used, as necessary, to ensure that an NWP activity already meeting the established acreage limits also satisfies the no more than minimal impact requirement for the NWPs.

(h) Permittees may propose the use of mitigation banks, in-lieu fee programs, or permittee-responsible mitigation. When developing a compensatory mitigation proposal, the permittee must

consider appropriate and practicable options consistent with the framework at 33 CFR 332.3(b). For activities resulting in the loss of marine or estuarine resources, permittee-responsible mitigation may be environmentally preferable if there are no mitigation banks or in-lieu fee programs in the area that have marine or estuarine credits available for sale or transfer to the permittee. For permittee-responsible mitigation, the special conditions of the NWP verification must clearly indicate the party or parties responsible for the implementation and performance of the compensatory mitigation project, and, if required, its long-term management.

(i) Where certain functions and services of waters of the United States are permanently adversely affected by a regulated activity, such as discharges of dredged or fill material into waters of the United States that will convert a forested or scrub-shrub wetland to a herbaceous wetland in a permanently maintained utility line right-of-way, mitigation may be required to reduce the adverse environmental effects of the activity to the no more than minimal level.

24. Safety of Impoundment Structures. To ensure that all impoundment structures are safely designed, the district engineer may require non-Federal applicants to demonstrate that the structures comply with established state dam safety criteria or have been designed by qualified persons. The district engineer may also require documentation that the design has been independently reviewed by similarly qualified persons, and appropriate modifications made to ensure safety.

25. Water Quality. Where States and authorized Tribes, or EPA where applicable, have not previously certified compliance of an NWP with CWA section 401, individual 401 Water Quality Certification must be obtained or waived (see 33 CFR 330.4(c)). The district engineer or State or Tribe may require additional water quality management measures to ensure that the authorized activity does not result in more than minimal degradation of water quality.

26. Coastal Zone Management. In coastal states where an NWP has not previously received a state coastal zone management consistency concurrence, an individual state coastal zone management consistency concurrence must be obtained, or a presumption of concurrence must occur (see 33 CFR 330.4(d)). The district engineer or a State may require additional measures to ensure that the authorized activity is consistent with state coastal zone management requirements.

27. Regional and Case-By-Case Conditions. The activity must comply with any regional conditions that may have been added by the Division Engineer (see 33 CFR 330.4(e)) and with any case specific conditions added by the Corps or by the state, Indian Tribe, or U.S. EPA in its section 401 Water Quality Certification, or by the state in its Coastal Zone Management Act consistency determination.

28. Use of Multiple Nationwide Permits. The use of more than one NWP for a single and complete project is prohibited, except when the acreage loss of waters of the United States authorized by the NWPs does not exceed the acreage limit of the NWP with the highest specified acreage limit. For example, if a road crossing over tidal waters is constructed under NWP 14, with associated bank stabilization authorized by NWP 13, the maximum acreage loss of waters of the United States for the total project cannot exceed 1/3-acre.

29. Transfer of Nationwide Permit Verifications. If the permittee sells the property associated with a nationwide permit verification, the permittee may transfer the nationwide permit verification to the new owner by submitting a letter to the appropriate Corps district office to validate the transfer. A copy of the nationwide permit verification must be attached to the letter, and the letter must contain the following statement and signature:

"When the structures or work authorized by this nationwide permit are still in existence at the time the property is transferred, the terms and conditions of this nationwide permit, including any special conditions, will continue to be binding on the new owner(s) of the property. To validate the transfer of this nationwide permit and the associated liabilities associated with compliance with its terms and conditions, have the transferee sign and date below."

_____

(Transferee)

_____

(Date)

30. Compliance Certification. Each permittee who receives an NWP verification letter from the Corps must provide a signed certification documenting completion of the authorized activity and implementation of any required compensatory mitigation. The success of any required permittee-responsible mitigation, including the achievement of ecological performance standards, will be addressed separately by the district engineer. The Corps will provide the permittee the certification document with the NWP verification letter. The certification document will include:

(a) A statement that the authorized activity was done in accordance with the NWP authorization, including any general, regional, or activity-specific conditions;

(b) A statement that the implementation of any required compensatory mitigation was completed in accordance with the permit conditions. If credits from a mitigation bank or in-lieu fee program are used to satisfy the compensatory mitigation requirements, the certification must include the documentation required by 33 CFR 332.3(l)(3) to confirm that the permittee secured the appropriate number and resource type of credits; and

(c) The signature of the permittee certifying the completion of the activity and mitigation.

The completed certification document must be submitted to the district engineer within 30 days of completion of the authorized activity or the implementation of any required compensatory mitigation, whichever occurs later.

31. Activities Affecting Structures or Works Built by the United States. If an NWP activity also requires permission from the Corps pursuant to 33 U.S.C. 408 because it will alter or temporarily or permanently occupy or use a U.S. Army Corps of Engineers (USACE) federally authorized Civil Works project (a "USACE project"), the prospective permittee must submit a pre-construction notification. See paragraph (b)(10) of general condition 32. An activity that requires section 408 permission is not authorized by NWP until the appropriate Corps office issues the section 408 permission to alter, occupy, or use the USACE project, and the district engineer issues a written NWP verification.

32. Pre-Construction Notification. (a) Timing. Where required by the terms of the NWP, the prospective permittee must notify the district engineer by submitting a pre-construction notification (PCN) as early as possible. The district engineer must determine if the PCN is complete within 30 calendar days of the date of receipt and, if the PCN is determined to be incomplete, notify the

prospective permittee within that 30 day period to request the additional information necessary to make the PCN complete. The request must specify the information needed to make the PCN complete. As a general rule, district engineers will request additional information necessary to make the PCN complete only once. However, if the prospective permittee does not provide all of the requested information, then the district engineer will notify the prospective permittee that the PCN is still incomplete and the PCN review process will not commence until all of the requested information has been received by the district engineer. The prospective permittee shall not begin the activity until either:

(1) He or she is notified in writing by the district engineer that the activity may proceed under the NWP with any special conditions imposed by the district or division engineer; or

(2) 45 calendar days have passed from the district engineer's receipt of the complete PCN and the prospective permittee has not received written notice from the district or division engineer. However, if the permittee was required to notify the Corps pursuant to general condition 18 that listed species or critical habitat might be affected or are in the vicinity of the activity, or to notify the Corps pursuant to general condition 20 that the activity might have the potential to cause effects to historic properties, the permittee cannot begin the activity until receiving written notification from the Corps that there is "no effect" on listed species or "no potential to cause effects" on historic properties, or that any consultation required under Section 7 of the Endangered Species Act (see 33 CFR 330.4(f)) and/or section 106 of the National Historic Preservation Act (see 33 CFR 330.4(g)) has been completed. Also, work cannot begin under NWPs 21, 49, or 50 until the permittee has received written approval from the Corps. If the proposed activity requires a written waiver to exceed specified limits of an NWP, the permittee may not begin the activity until the district engineer issues the waiver. If the district or division engineer notifies the permittee in writing that an individual permit is required within 45 calendar days of receipt of a complete PCN, the permittee cannot begin the activity until an individual permit has been obtained. Subsequently, the permittee's right to proceed under the NWP may be modified, suspended, or revoked only in accordance with the procedure set forth in 33 CFR 330.5(d)(2).

(b) Contents of Pre-Construction Notification: The PCN must be in writing and include the following information:

(1) Name, address and telephone numbers of the prospective permittee;

(2) Location of the proposed activity;

(3) Identify the specific NWP or NWP(s) the prospective permittee wants to use to authorize the proposed activity;

(4) A description of the proposed activity; the activity's purpose; direct and indirect adverse environmental effects the activity would cause, including the anticipated amount of loss of wetlands, other special aquatic sites, and other waters expected to result from the NWP activity, in acres, linear feet, or other appropriate unit of measure; a description of any proposed mitigation measures intended to reduce the adverse environmental effects caused by the proposed activity; and any other NWP(s), regional general permit(s), or individual permit(s) used or intended to be used to authorize any part of the proposed project or any related activity, including other separate and distant crossings for linear projects that require Department of the Army authorization but do not require pre-construction notification. The description of the proposed activity and any proposed mitigation measures should be sufficiently detailed to allow the district engineer to determine that the adverse environmental effects of the activity will be no more than minimal and to determine the

need for compensatory mitigation or other mitigation measures. For single and complete linear projects, the PCN must include the quantity of anticipated losses of wetlands, other special aquatic sites, and other waters for each single and complete crossing of those wetlands, other special aquatic sites, and other waters. Sketches should be provided when necessary to show that the activity complies with the terms of the NWP. (Sketches usually clarify the activity and when provided results in a quicker decision. Sketches should contain sufficient detail to provide an illustrative description of the proposed activity (e.g., a conceptual plan), but do not need to be detailed engineering plans);

(5) The PCN must include a delineation of wetlands, other special aquatic sites, and other waters, such as lakes and ponds, and perennial, intermittent, and ephemeral streams, on the project site. Wetland delineations must be prepared in accordance with the current method required by the Corps. The permittee may ask the Corps to delineate the special aquatic sites and other waters on the project site, but there may be a delay if the Corps does the delineation, especially if the project site is large or contains many wetlands, other special aquatic sites, and other waters. Furthermore, the 45 day period will not start until the delineation has been submitted to or completed by the Corps, as appropriate;

(6) If the proposed activity will result in the loss of greater than 1/10-acre of wetlands and a PCN is required, the prospective permittee must submit a statement describing how the mitigation requirement will be satisfied, or explaining why the adverse environmental effects are no more than minimal and why compensatory mitigation should not be required. As an alternative, the prospective permittee may submit a conceptual or detailed mitigation plan.

(7) For non-Federal permittees, if any listed species or designated critical habitat might be affected or is in the vicinity of the activity, or if the activity is located in designated critical habitat, the PCN must include the name(s) of those endangered or threatened species that might be affected by the proposed activity or utilize the designated critical habitat that might be affected by the proposed activity. For NWP activities that require pre-construction notification, Federal permittees must provide documentation demonstrating compliance with the Endangered Species Act;

(8) For non-Federal permittees, if the NWP activity might have the potential to cause effects to a historic property listed on, determined to be eligible for listing on, or potentially eligible for listing on, the National Register of Historic Places, the PCN must state which historic property might have the potential to be affected by the proposed activity or include a vicinity map indicating the location of the historic property. For NWP activities that require pre-construction notification, Federal permittees must provide documentation demonstrating compliance with section 106 of the National Historic Preservation Act;

(9) For an activity that will occur in a component of the National Wild and Scenic River System, or in a river officially designated by Congress as a "study river" for possible inclusion in the system while the river is in an official study status, the PCN must identify the Wild and Scenic River or the "study river" (see general condition 16); and

(10) For an activity that requires permission from the Corps pursuant to 33 U.S.C. 408 because it will alter or temporarily or permanently occupy or use a U.S. Army Corps of Engineers federally authorized civil works project, the pre-construction notification must include a statement confirming that the project proponent has submitted a written request for section 408 permission from the Corps office having jurisdiction over that USACE project.

(c) Form of Pre-Construction Notification: The standard individual permit application form (Form ENG 4345) may be used, but the completed application form must clearly indicate that it is an NWP PCN and must include all of the applicable information required in paragraphs (b)(1) through (10) of this general condition. A letter containing the required information may also be used. Applicants may provide electronic files of PCNs and supporting materials if the district engineer has established tools and procedures for electronic submittals.

(d) Agency Coordination: (1) The district engineer will consider any comments from Federal and state agencies concerning the proposed activity's compliance with the terms and conditions of the NWPs and the need for mitigation to reduce the activity's adverse environmental effects so that they are no more than minimal.

(2) Agency coordination is required for: (i) all NWP activities that require pre-construction notification and result in the loss of greater than 1/2-acre of waters of the United States; (ii) NWP 21, 29, 39, 40, 42, 43, 44, 50, 51, and 52 activities that require pre-construction notification and will result in the loss of greater than 300 linear feet of stream bed; (iii) NWP 13 activities in excess of 500 linear feet, fills greater than one cubic yard per running foot, or involve discharges of dredged or fill material into special aquatic sites; and (iv) NWP 54 activities in excess of 500 linear feet, or that extend into the waterbody more than 30 feet from the mean low water line in tidal waters or the ordinary high water mark in the Great Lakes.

(3) When agency coordination is required, the district engineer will immediately provide (e.g., via e-mail, facsimile transmission, overnight mail, or other expeditious manner) a copy of the complete PCN to the appropriate Federal or state offices (FWS, state natural resource or water quality agency, EPA, and, if appropriate, the NMFS). With the exception of NWP 37, these agencies will have 10 calendar days from the date the material is transmitted to notify the district engineer via telephone, facsimile transmission, or e-mail that they intend to provide substantive, site-specific comments. The comments must explain why the agency believes the adverse environmental effects will be more than minimal. If so contacted by an agency, the district engineer will wait an additional 15 calendar days before making a decision on the pre-construction notification. The district engineer will fully consider agency comments received within the specified time frame concerning the proposed activity's compliance with the terms and conditions of the NWPs, including the need for mitigation to ensure the net adverse environmental effects of the proposed activity are no more than minimal. The district engineer will provide no response to the resource agency, except as provided below. The district engineer will indicate in the administrative record associated with each pre-construction notification that the resource agencies' concerns were considered. For NWP 37, the emergency watershed protection and rehabilitation activity may proceed immediately in cases where there is an unacceptable hazard to life or a significant loss of property or economic hardship will occur. The district engineer will consider any comments received to decide whether the NWP 37 authorization should be modified, suspended, or revoked in accordance with the procedures at 33 CFR 330.5.

(4) In cases of where the prospective permittee is not a Federal agency, the district engineer will provide a response to NMFS within 30 calendar days of receipt of any Essential Fish Habitat conservation recommendations, as required by section 305(b)(4)(B) of the Magnuson-Stevens Fishery Conservation and Management Act.

(5) Applicants are encouraged to provide the Corps with either electronic files or multiple copies of pre-construction notifications to expedite agency coordination.

D. District Engineer's Decision

1. In reviewing the PCN for the proposed activity, the district engineer will determine whether the activity authorized by the NWP will result in more than minimal individual or cumulative adverse environmental effects or may be contrary to the public interest. If a project proponent requests authorization by a specific NWP, the district engineer should issue the NWP verification for that activity if it meets the terms and conditions of that NWP, unless he or she determines, after considering mitigation, that the proposed activity will result in more than minimal individual and cumulative adverse effects on the aquatic environment and other aspects of the public interest and exercises discretionary authority to require an individual permit for the proposed activity. For a linear project, this determination will include an evaluation of the individual crossings of waters of the United States to determine whether they individually satisfy the terms and conditions of the NWP(s), as well as the cumulative effects caused by all of the crossings authorized by NWP. If an applicant requests a waiver of the 300 linear foot limit on impacts to streams or of an otherwise applicable limit, as provided for in NWPs 13, 21, 29, 36, 39, 40, 42, 43, 44, 50, 51, 52, or 54, the district engineer will only grant the waiver upon a written determination that the NWP activity will result in only minimal individual and cumulative adverse environmental effects. For those NWPs that have a waivable 300 linear foot limit for losses of intermittent and ephemeral stream bed and a 1/2-acre limit (i.e., NWPs 21, 29, 39, 40, 42, 43, 44, 50, 51, and 52), the loss of intermittent and ephemeral stream bed, plus any other losses of jurisdictional waters and wetlands, cannot exceed 1/2-acre.

2. When making minimal adverse environmental effects determinations the district engineer will consider the direct and indirect effects caused by the NWP activity. He or she will also consider the cumulative adverse environmental effects caused by activities authorized by NWP and whether those cumulative adverse environmental effects are no more than minimal. The district engineer will also consider site specific factors, such as the environmental setting in the vicinity of the NWP activity, the type of resource that will be affected by the NWP activity, the functions provided by the aquatic resources that will be affected by the NWP activity, the degree or magnitude to which the aquatic resources perform those functions, the extent that aquatic resource functions will be lost as a result of the NWP activity (e.g., partial or complete loss), the duration of the adverse effects (temporary or permanent), the importance of the aquatic resource functions to the region (e.g., watershed or ecoregion), and mitigation required by the district engineer. If an appropriate functional or condition assessment method is available and practicable to use, that assessment method may be used by the district engineer to assist in the minimal adverse environmental effects determination. The district engineer may add case-specific special conditions to the NWP authorization to address site-specific environmental concerns.

3. If the proposed activity requires a PCN and will result in a loss of greater than 1/10-acre of wetlands, the prospective permittee should submit a mitigation proposal with the PCN. Applicants may also propose compensatory mitigation for NWP activities with smaller impacts, or for impacts to other types of waters (e.g., streams). The district engineer will consider any proposed compensatory mitigation or other mitigation measures the applicant has included in the proposal in determining whether the net adverse environmental effects of the proposed activity are no more than minimal. The compensatory mitigation proposal may be either conceptual or detailed. If the district engineer determines that the activity complies with the terms and conditions of the NWP and that the adverse environmental effects are no more than minimal, after considering mitigation, the district engineer will notify the permittee and include any activity-specific conditions in the NWP verification the district engineer deems necessary. Conditions for compensatory mitigation requirements must comply with the appropriate provisions at 33 CFR 332.3(k). The district engineer must approve the final mitigation plan before the permittee commences work in waters of

the United States, unless the district engineer determines that prior approval of the final mitigation plan is not practicable or not necessary to ensure timely completion of the required compensatory mitigation. If the prospective permittee elects to submit a compensatory mitigation plan with the PCN, the district engineer will expeditiously review the proposed compensatory mitigation plan. The district engineer must review the proposed compensatory mitigation plan within 45 calendar days of receiving a complete PCN and determine whether the proposed mitigation would ensure the NWP activity results in no more than minimal adverse environmental effects. If the net adverse environmental effects of the NWP activity (after consideration of the mitigation proposal) are determined by the district engineer to be no more than minimal, the district engineer will provide a timely written response to the applicant. The response will state that the NWP activity can proceed under the terms and conditions of the NWP, including any activity-specific conditions added to the NWP authorization by the district engineer.

4. If the district engineer determines that the adverse environmental effects of the proposed activity are more than minimal, then the district engineer will notify the applicant either: (a) that the activity does not qualify for authorization under the NWP and instruct the applicant on the procedures to seek authorization under an individual permit; (b) that the activity is authorized under the NWP subject to the applicant's submission of a mitigation plan that would reduce the adverse environmental effects so that they are no more than minimal; or (c) that the activity is authorized under the NWP with specific modifications or conditions. Where the district engineer determines that mitigation is required to ensure no more than minimal adverse environmental effects, the activity will be authorized within the 45-day PCN period (unless additional time is required to comply with general conditions 18, 20, and/or 31, or to evaluate PCNs for activities authorized by NWPs 21, 49, and 50), with activity-specific conditions that state the mitigation requirements. The authorization will include the necessary conceptual or detailed mitigation plan or a requirement that the applicant submit a mitigation plan that would reduce the adverse environmental effects so that they are no more than minimal. When compensatory mitigation is required, no work in waters of the United States may occur until the district engineer has approved a specific mitigation plan or has determined that prior approval of a final mitigation plan is not practicable or not necessary to ensure timely completion of the required compensatory mitigation.

E. Further Information

1. District Engineers have authority to determine if an activity complies with the terms and conditions of an NWP.

2. NWPs do not obviate the need to obtain other federal, state, or local permits, approvals, or authorizations required by law.

3. NWPs do not grant any property rights or exclusive privileges.

4. NWPs do not authorize any injury to the property or rights of others.

5. NWPs do not authorize interference with any existing or proposed Federal project (see general condition 31).

F. Definitions

Best management practices (BMPs): Policies, practices, procedures, or structures implemented to mitigate the adverse environmental effects on surface water quality resulting from development. BMPs are categorized as structural or non-structural.

Compensatory mitigation: The restoration (re-establishment or rehabilitation), establishment (creation), enhancement, and/or in certain circumstances preservation of aquatic resources for the purposes of offsetting unavoidable adverse impacts which remain after all appropriate and practicable avoidance and minimization has been achieved.

Currently serviceable: Useable as is or with some maintenance, but not so degraded as to essentially require reconstruction.

Direct effects: Effects that are caused by the activity and occur at the same time and place.

Discharge: The term "discharge" means any discharge of dredged or fill material into waters of the United States.

Ecological reference: A model used to plan and design an aquatic habitat and riparian area restoration, enhancement, or establishment activity under NWP 27. An ecological reference may be based on the structure, functions, and dynamics of an aquatic habitat type or a riparian area type that currently exists in the region where the proposed NWP 27 activity is located. Alternatively, an ecological reference may be based on a conceptual model for the aquatic habitat type or riparian area type to be restored, enhanced, or established as a result of the proposed NWP 27 activity. An ecological reference takes into account the range of variation of the aquatic habitat type or riparian area type in the region.

Enhancement: The manipulation of the physical, chemical, or biological characteristics of an aquatic resource to heighten, intensify, or improve a specific aquatic resource function(s). Enhancement results in the gain of selected aquatic resource function(s), but may also lead to a decline in other aquatic resource function(s). Enhancement does not result in a gain in aquatic resource area.

Ephemeral stream: An ephemeral stream has flowing water only during, and for a short duration after, precipitation events in a typical year. Ephemeral stream beds are located above the water table year-round. Groundwater is not a source of water for the stream. Runoff from rainfall is the primary source of water for stream flow.

Establishment (creation): The manipulation of the physical, chemical, or biological characteristics present to develop an aquatic resource that did not previously exist at an upland site. Establishment results in a gain in aquatic resource area.

High Tide Line: The line of intersection of the land with the water's surface at the maximum height reached by a rising tide. The high tide line may be determined, in the absence of actual data, by a line of oil or scum along shore objects, a more or less continuous deposit of fine shell or debris on the foreshore or berm, other physical markings or characteristics, vegetation lines, tidal gages, or other suitable means that delineate the general height reached by a rising tide. The line encompasses spring high tides and other high tides that occur with periodic frequency but does not include storm surges in which there is a departure from the normal or predicted reach of the tide due to the piling up of water against a coast by strong winds such as those accompanying a hurricane or other intense storm.

Historic Property: Any prehistoric or historic district, site (including archaeological site), building, structure, or other object included in, or eligible for inclusion in, the National Register of Historic Places maintained by the Secretary of the Interior. This term includes artifacts, records, and remains that are related to and located within such properties. The term includes properties of

traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization and that meet the National Register criteria (36 CFR part 60).

Independent utility: A test to determine what constitutes a single and complete non-linear project in the Corps Regulatory Program. A project is considered to have independent utility if it would be constructed absent the construction of other projects in the project area. Portions of a multi-phase project that depend upon other phases of the project do not have independent utility. Phases of a project that would be constructed even if the other phases were not built can be considered as separate single and complete projects with independent utility.

Indirect effects: Effects that are caused by the activity and are later in time or farther removed in distance, but are still reasonably foreseeable.

Intermittent stream: An intermittent stream has flowing water during certain times of the year, when groundwater provides water for stream flow. During dry periods, intermittent streams may not have flowing water. Runoff from rainfall is a supplemental source of water for stream flow.

Loss of waters of the United States: Waters of the United States that are permanently adversely affected by filling, flooding, excavation, or drainage because of the regulated activity. Permanent adverse effects include permanent discharges of dredged or fill material that change an aquatic area to dry land, increase the bottom elevation of a waterbody, or change the use of a waterbody. The acreage of loss of waters of the United States is a threshold measurement of the impact to jurisdictional waters for determining whether a project may qualify for an NWP; it is not a net threshold that is calculated after considering compensatory mitigation that may be used to offset losses of aquatic functions and services. The loss of stream bed includes the acres or linear feet of stream bed that are filled or excavated as a result of the regulated activity. Waters of the United States temporarily filled, flooded, excavated, or drained, but restored to pre-construction contours and elevations after construction, are not included in the measurement of loss of waters of the United States. Impacts resulting from activities that do not require Department of the Army authorization, such as activities eligible for exemptions under section 404(f) of the Clean Water Act, are not considered when calculating the loss of waters of the United States.

Navigable waters: Waters subject to section 10 of the Rivers and Harbors Act of 1899. These waters are defined at 33 CFR part 329.

Non-tidal wetland: A non-tidal wetland is a wetland that is not subject to the ebb and flow of tidal waters. Non-tidal wetlands contiguous to tidal waters are located landward of the high tide line (i.e., spring high tide line).

Open water: For purposes of the NWPs, an open water is any area that in a year with normal patterns of precipitation has water flowing or standing above ground to the extent that an ordinary high water mark can be determined. Aquatic vegetation within the area of flowing or standing water is either non-emergent, sparse, or absent. Vegetated shallows are considered to be open waters. Examples of “open waters” include rivers, streams, lakes, and ponds.

Ordinary High Water Mark: An ordinary high water mark is a line on the shore established by the fluctuations of water and indicated by physical characteristics, or by other appropriate means that consider the characteristics of the surrounding areas.

Perennial stream: A perennial stream has flowing water year-round during a typical year. The water table is located above the stream bed for most of the year. Groundwater is the primary source of water for stream flow. Runoff from rainfall is a supplemental source of water for stream flow.

Practicable: Available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes.

Pre-construction notification: A request submitted by the project proponent to the Corps for confirmation that a particular activity is authorized by nationwide permit. The request may be a permit application, letter, or similar document that includes information about the proposed work and its anticipated environmental effects. Pre-construction notification may be required by the terms and conditions of a nationwide permit, or by regional conditions. A pre-construction notification may be voluntarily submitted in cases where pre-construction notification is not required and the project proponent wants confirmation that the activity is authorized by nationwide permit.

Preservation: The removal of a threat to, or preventing the decline of, aquatic resources by an action in or near those aquatic resources. This term includes activities commonly associated with the protection and maintenance of aquatic resources through the implementation of appropriate legal and physical mechanisms. Preservation does not result in a gain of aquatic resource area or functions.

Protected tribal resources: Those natural resources and properties of traditional or customary religious or cultural importance, either on or off Indian lands, retained by, or reserved by or for, Indian tribes through treaties, statutes, judicial decisions, or executive orders, including tribal trust resources.

Re-establishment: The manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/historic functions to a former aquatic resource. Re-establishment results in rebuilding a former aquatic resource and results in a gain in aquatic resource area and functions.

Rehabilitation: The manipulation of the physical, chemical, or biological characteristics of a site with the goal of repairing natural/historic functions to a degraded aquatic resource. Rehabilitation results in a gain in aquatic resource function, but does not result in a gain in aquatic resource area.

Restoration: The manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/historic functions to a former or degraded aquatic resource. For the purpose of tracking net gains in aquatic resource area, restoration is divided into two categories: re-establishment and rehabilitation.

Riffle and pool complex: Riffle and pool complexes are special aquatic sites under the 404(b)(1) Guidelines. Riffle and pool complexes sometimes characterize steep gradient sections of streams. Such stream sections are recognizable by their hydraulic characteristics. The rapid movement of water over a course substrate in riffles results in a rough flow, a turbulent surface, and high dissolved oxygen levels in the water. Pools are deeper areas associated with riffles. A slower stream velocity, a streaming flow, a smooth surface, and a finer substrate characterize pools.

Riparian areas: Riparian areas are lands next to streams, lakes, and estuarine-marine shorelines. Riparian areas are transitional between terrestrial and aquatic ecosystems, through which surface and subsurface hydrology connects riverine, lacustrine, estuarine, and marine waters with their adjacent wetlands, non-wetland waters, or uplands. Riparian areas provide a variety of ecological functions and services and help improve or maintain local water quality. (See general condition 23.)

Shellfish seeding: The placement of shellfish seed and/or suitable substrate to increase shellfish production. Shellfish seed consists of immature individual shellfish or individual shellfish attached to shells or shell fragments (i.e., spat on shell). Suitable substrate may consist of shellfish shells, shell fragments, or other appropriate materials placed into waters for shellfish habitat.

Single and complete linear project: A linear project is a project constructed for the purpose of getting people, goods, or services from a point of origin to a terminal point, which often involves multiple crossings of one or more waterbodies at separate and distant locations. The term "single and complete project" is defined as that portion of the total linear project proposed or accomplished by one owner/developer or partnership or other association of owners/developers that includes all crossings of a single water of the United States (i.e., a single waterbody) at a specific location. For linear projects crossing a single or multiple waterbodies several times at separate and distant locations, each crossing is considered a single and complete project for purposes of NWP authorization. However, individual channels in a braided stream or river, or individual arms of a large, irregularly shaped wetland or lake, etc., are not separate waterbodies, and crossings of such features cannot be considered separately.

Single and complete non-linear project: For non-linear projects, the term "single and complete project" is defined at 33 CFR 330.2(i) as the total project proposed or accomplished by one owner/developer or partnership or other association of owners/developers. A single and complete non-linear project must have independent utility (see definition of "independent utility"). Single and complete non-linear projects may not be "piecemealed" to avoid the limits in an NWP authorization.

Stormwater management: Stormwater management is the mechanism for controlling stormwater runoff for the purposes of reducing downstream erosion, water quality degradation, and flooding and mitigating the adverse effects of changes in land use on the aquatic environment.

Stormwater management facilities: Stormwater management facilities are those facilities, including but not limited to, stormwater retention and detention ponds and best management practices, which retain water for a period of time to control runoff and/or improve the quality (i.e., by reducing the concentration of nutrients, sediments, hazardous substances and other pollutants) of stormwater runoff.

Stream bed: The substrate of the stream channel between the ordinary high water marks. The substrate may be bedrock or inorganic particles that range in size from clay to boulders. Wetlands contiguous to the stream bed, but outside of the ordinary high water marks, are not considered part of the stream bed.

Stream channelization: The manipulation of a stream's course, condition, capacity, or location that causes more than minimal interruption of normal stream processes. A channelized stream remains a water of the United States.

Structure: An object that is arranged in a definite pattern of organization. Examples of structures include, without limitation, any pier, boat dock, boat ramp, wharf, dolphin, weir, boom, breakwater, bulkhead, revetment, riprap, jetty, artificial island, artificial reef, permanent mooring structure, power transmission line, permanently moored floating vessel, piling, aid to navigation, or any other manmade obstacle or obstruction.

Tidal wetland: A tidal wetland is a jurisdictional wetland that is inundated by tidal waters. Tidal waters rise and fall in a predictable and measurable rhythm or cycle due to the gravitational pulls of the moon and sun. Tidal waters end where the rise and fall of the water surface can no longer be practically measured in a predictable rhythm due to masking by other waters, wind, or other effects. Tidal wetlands are located channelward of the high tide line.

Tribal lands: Any lands title to which is either: 1) held in trust by the United States for the benefit of any Indian tribe or individual; or 2) held by any Indian tribe or individual subject to restrictions by the United States against alienation.

Tribal rights: Those rights legally accruing to a tribe or tribes by virtue of inherent sovereign authority, unextinguished aboriginal title, treaty, statute, judicial decisions, executive order or agreement, and that give rise to legally enforceable remedies.

Vegetated shallows: Vegetated shallows are special aquatic sites under the 404(b)(1) Guidelines. They are areas that are permanently inundated and under normal circumstances have rooted aquatic vegetation, such as seagrasses in marine and estuarine systems and a variety of vascular rooted plants in freshwater systems.

Waterbody: For purposes of the NWPs, a waterbody is a jurisdictional water of the United States. If a wetland is adjacent to a waterbody determined to be a water of the United States, that waterbody and any adjacent wetlands are considered together as a single aquatic unit (see 33 CFR 328.4(c)(2)). Examples of "waterbodies" include streams, rivers, lakes, ponds, and wetlands.

ADDITIONAL INFORMATION

This nationwide permit is effective March 19, 2017, and expires on March 18, 2022.

Information about the U.S. Army Corps of Engineers regulatory program, including nationwide permits, may also be found at http://www.swf.usace.army.mil/Missions/Regulatory.aspx and http://www.usace.army.mil/Missions/CivilWorks/RegulatoryProgramandPermits.aspx

Appendix D

United States Fish and Wildlife Service

Official Species List

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Oklahoma Ecological Services Field Office
9014 East 21st Street
Tulsa, OK 74129-1428
Phone: (918) 581-7458 Fax: (918) 581-7467
http://www.fws.gov/southwest/es/Oklahoma/

In Reply Refer To:
Consultation Code: 02EKOK00-2018-SLI-1982
Event Code: 02EKOK00-2018-E-04635
Project Name: COMCD Del City Pipeline

June 27, 2018

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 et seq.), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Non-federal entities conducting activities that may result in take of listed species should consider seeking coverage under section 10 of the ESA, either through development of a Habitat Conservation Plan (HCP) or, by becoming a signatory to the General Conservation Plan (GCP) currently under development for the American burying beetle. Each of these mechanisms provides the means for obtaining a permit and coverage for incidental take of listed species during otherwise lawful activities.

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 et seq.), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit through our Project Review step-wise process http://www.fws.gov/southwest/es/oklahoma/OKESFO%20Permit%20Home.htm.

Attachment(s):

- Official Species List
- USFWS National Wildlife Refuges and Fish Hatcheries
- Migratory Birds
- Wetlands

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Oklahoma Ecological Services Field Office
9014 East 21st Street
Tulsa, OK 74129-1428
(918) 581-7458

Project Summary

Consultation Code: 02EKOK00-2018-SLI-1982

Event Code: 02EKOK00-2018-E-04635

Project Name: COMCD Del City Pipeline

Project Type: WATER SUPPLY / DELIVERY

Project Description: Replacement of a raw water pipeline

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/35.39293366111306N97.34508175794231W

Counties: Oklahoma, OK

Endangered Species Act Species

There is a total of 4 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. Note that 1 of these species should be considered only under certain conditions.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Birds

NAME	STATUS
Least Tern Sterna antillarum	Endangered
Population: interior pop. No critical habitat has been designated for this species. This species only needs to be considered under the following conditions: ▪ Wind Turbines and Wind Farms ▪ Towers (i.e. radio, television, cellular, microwave, meterological) Species profile: https://ecos.fws.gov/ecp/species/8505	
Piping Plover Charadrius melodus	Threatened
Population: [Atlantic Coast and Northern Great Plains populations] - Wherever found, except those areas where listed as endangered. There is final critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/6039	
Red Knot Calidris canutus rufa	Threatened
No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/1864	
Whooping Crane Grus americana	Endangered
Population: Wherever found, except where listed as an experimental population There is final critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/758	

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

USFWS National W ildlife Refuge Lands And Fish Hatcheries

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS OR FISH HATCHERIES WITHIN YOUR PROJECT AREA.

Migratory Birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

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1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Bald Eagle Haliaeetus leucocephalus This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1626	Breeds Sep 1 to Jul 31
Harris's Sparrow Zonotrichia querula This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds elsewhere

NAME	BREEDING SEASON
Lesser Yellowlegs Tringa flavipes This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9679	Breeds elsewhere
Red-headed Woodpecker Melanerpes erythrocephalus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 10 to Sep 10
Semipalmated Sandpiper Calidris pusilla This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds elsewhere
Smith's Longspur Calcarius pictus This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds elsewhere

Probability Of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ “Proper Interpretation and Use of Your Migratory Bird Report” before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12

(0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.

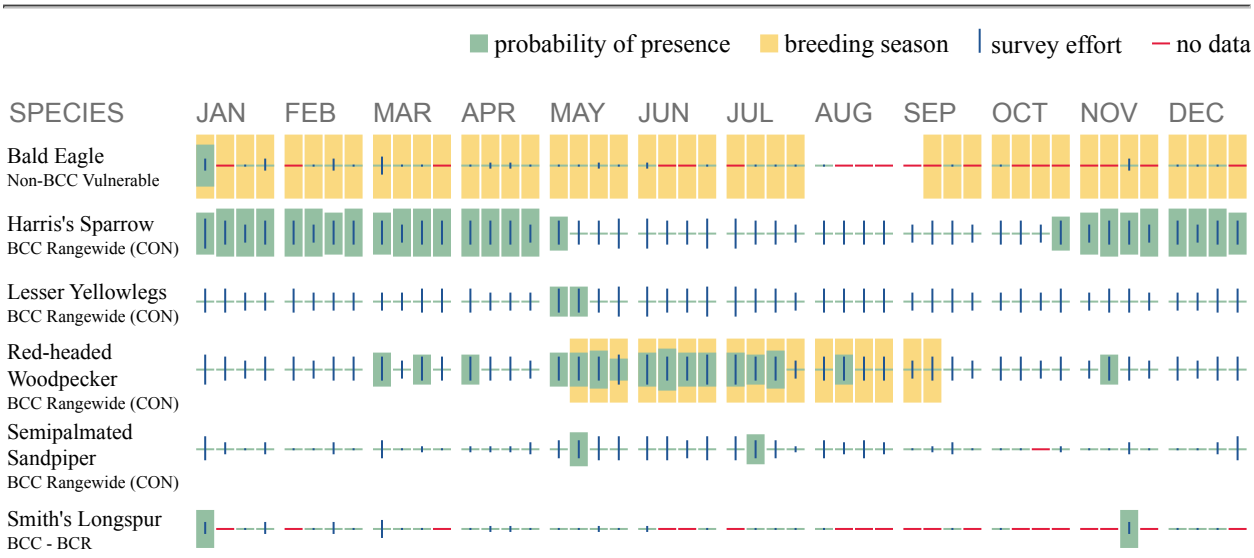
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

Breeding Season ( )
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort ( )
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



Additional information can be found using the following links:

- Birds of Conservation Concern http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php

- Measures for avoiding and minimizing impacts to birds http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php
- Nationwide conservation measures for birds http://www.fws.gov/migratorybirds/pdf/management/nationwidestandardconservationmeasures.pdf

Migratory Birds F AQ

Tell me mor e about conservation measur es I can implement to avoid or minimize impacts to migratory birds.
Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures and/or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the migratory birds potentially occurring in my specified location?
The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the E-bird Explore Data Tool.

What does IPaC use to generate the pr obability of pr esence graphs for the migratory birds potentially occurring in my specified location?
The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets .

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and

how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is br eeding, wintering, migrating or pr esent year -r ound in my pr oject ar ea?
To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may refer to the following resources: The Cornell Lab of Ornithology All About Birds Bird Guide, or (if you are unsuccessful in locating the bird of interest there), the Cornell Lab of Ornithology Neotropical Birds guide. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What ar e the levels of concern for migratory birds?
Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that ar e potentially affected by offshor e pr ojects
For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?
If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report
The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

Wetlands

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

FRESHWATER FORESTED/SHRUB WETLAND

- PFO1A

RIVERINE

- R4SBC

Appendix E

Archeological Survey Report

AR Consultants, Inc.

Archaeological and Environmental Consulting
805 Business Parkway, Richardson, Texas 75081
Phone: (214) 368-0478
Fax: (214) 221-1519
E-mail: arc@arc-digs.com

ARCHAEOLOGICAL SURVEY OF THE PROPOSED

CENTRAL OKLAHOMA MASTER CONSERVANCY DISTRICT DEL CITY PIPELINE IMPROVEMENTS PROJECT

OKLAHOMA COUNTY, OKLAHOMA

Allen M. Rutherford, MA
Principal Investigator

Submitted to:

ALAN PLUMMER ASSOCIATES, INC.
1320 S. University Drive, Suite 300
Fort Worth, Texas 76107

Submitted by:

AR CONSULTANTS, INC.
805 Business Parkway
Richardson, Texas 75081

Cultural Resources Report 2018-48
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ABSTRACT

Central Oklahoma Master Conservancy District (COMCD) is proposing improvements upon the 5.24-mile-long Del City Pipeline in Oklahoma County, Oklahoma. The project area is located southeast of Del City on the east and west sides of Tinker Air Force Base. The total length surveyed for this project was 2.89 miles as some of the proposed pipeline will be bored and some of it will be constructed within an existing right-of-way. AR Consultants, Inc. (ARC) conducted an intensive pedestrian archaeological survey of the proposed pipeline on September 11 and 12, 2018 (Sections 25, 26, and 28 of T11N, R2W). Forty-one shovel tests were excavated along the pipeline route with a focus on the six drainage crosses along the route. During survey, no cultural resources were identified in the shovel tests or on the exposed surfaces throughout the study area. Given the results of the survey, AR Consultants, Inc. recommends that no further archaeological investigations are necessary for this project, and requests that the US Bureau of Reclamation and the Oklahoma Archeological Survey concur with this assessment.

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INTRODUCTION

Central Oklahoma Master Conservancy District (COMCD) is proposing improvements upon the 5.24-mile-long Del City Pipeline in Oklahoma County, Oklahoma (Figure 1). The proposed pipeline improvements will replace an existing sewer line from a treatment plant north of the intersection of SE 44th St. and Cherry Hill Lane southeast to Air Depot Blvd. and from just east of S. Midwest Blvd. east to a treatment plant immediately south of IH240. The segment of the proposed improvements from SE 44th St. to the south side of SE 59th St. and the eastern 1,129-foot segment to the water treatment plant south of IH240 will be bored. The segment of the route between Post Road and that eastern 1,129-foot bored section will be constructed entirely within an existing right-of-way (ROW). Removing the proposed bored and existing ROW segments, a total of 2.89 miles of pipeline will either be constructed or necessitate the disturbance of previously undisturbed settings. The portion to be surveyed crosses six intermittent drainages, two of which are tributaries of Crutcho Creek and four which are tributaries of East Elm Creek. The total area surveyed was 34.9 acres.

Alan Plummer Associates, Inc., who is handling the environmental permitting and engineering for the project, contracted with AR Consultants, Inc. (ARC) to conduct an intensive archaeological survey of the COMCD Del City Pipeline project (Sections 25, 26, and 28 T11N, R2W). The purpose of this survey was to determine if cultural resources were present within the study area and, if so, to make recommendations about their significance and how they might be impacted by construction. The survey was conducted on September 11 and 12 and involved walking transects, in addition to the excavation of shovel tests along 2.89 miles of the proposed route.

This report was prepared to be reviewed by the US Bureau of Reclamation (USBR) and the Oklahoma Archeological Survey (OAS). Relevant federal legislation includes the National Historic Preservation Act of 1966, as amended (PL-96-515), the National Environmental Policy Act of 1969 (PL-90-190), the Clean Water Act, as amended (PL-92-500), the Rivers and Harbors Act of 1899, the Archeological and Historical Preservation Act of 1974, as amended (PL-93-291), Executive Order No. 11593 "Protection and Enhancement of the Cultural Environment," and Protection of Historic Properties (36 CFR 800).

The following report presents a brief description of the natural setting of the study area, followed by a discussion of the culture history and previous investigations within the vicinity of the study area. A chapter on the research design and methodology employed in the investigation is then followed by the results of the field investigation. The report concludes with recommendations followed by references cited.

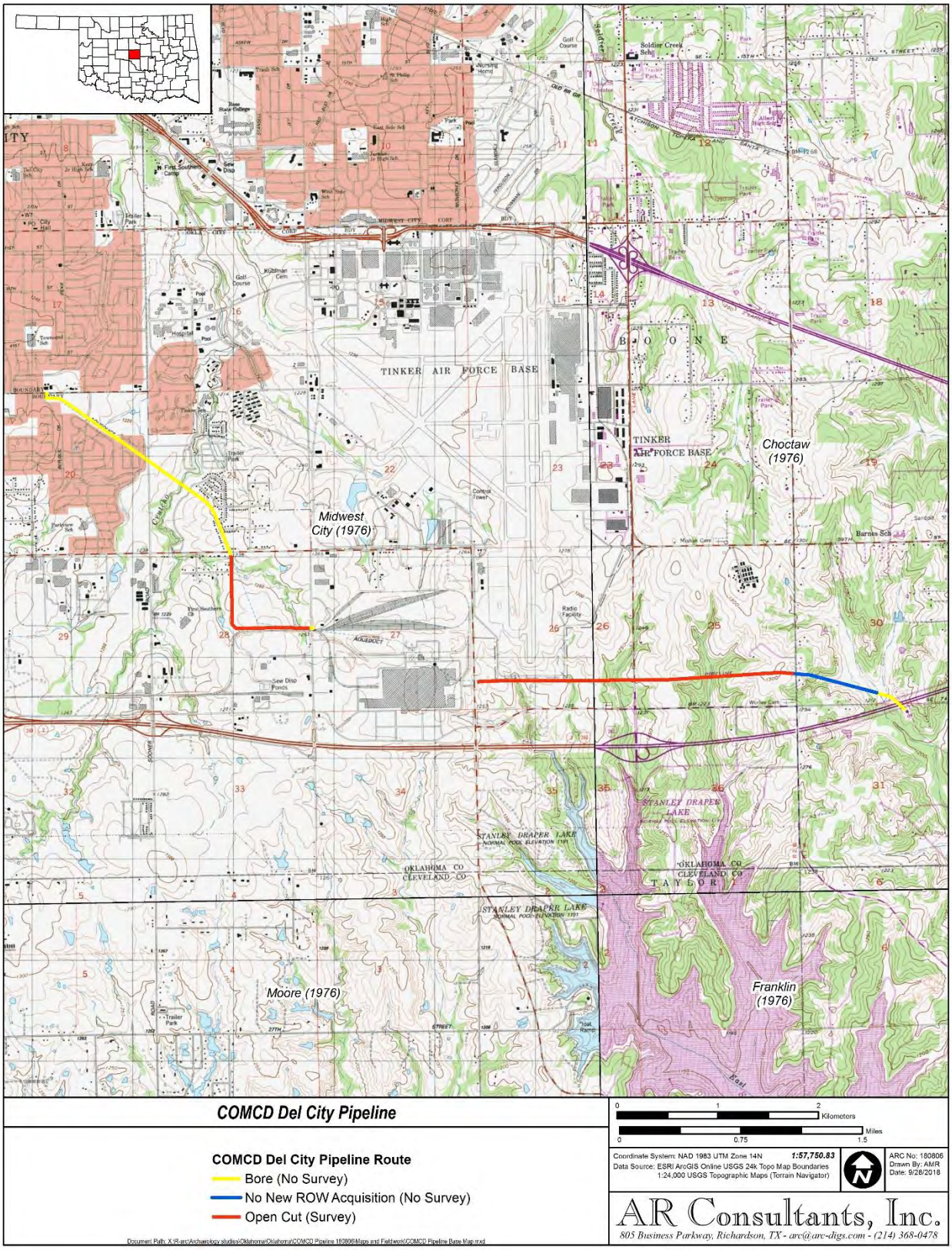

Figure 1. COMCD Del City Pipeline study area shown on 7.5' USGS topographic maps.

Administrative Information:

ARC Project Number:	180806
Sponsor:	COMCD with Alan Plummer, Inc. handling the engineering and environmental permitting
Review Agency:	US Bureau of Reclamation and the Oklahoma Archeological Survey.
Principal Investigator:	Allen M. Rutherford, MA
Field Dates:	September 11 to 12, 2018
Field Crew:	Katy Crater Gershtein and Allen Rutherford
Field Person Days:	4
Acres Surveyed:	approximately 34.9 acres

Crossings Surveyed: 6

Sites Investigated:

Prehistoric:	None
Historic:	None

Number of Historic Resources Evaluated: None

NATURAL ENVIRONMENT

Oklahoma County is located on the Southern Plains in an area known as the Central Red Beds or the Red Rolling Plains (Johnson 2006). Lower Permian sedimentary rocks underlie the area, which is carpeted with deep, very darkly colored Mollisols that formed under grasslands (Beale and McKay 2009). The study area is mapped on Permian aged Garber Sandstone, Kingman Siltstone, and Fairmont Shale. Intermittent tributaries of Crutcho and East Elm creeks flow through the study area. Narrow bands of riparian trees and shrubs grow along the tributaries including Bois d'Arc, honey locust, cedar elm, hackberry, and others. Numerous animals including deer, raccoons, beavers, coyotes, and foxes are found in the forested areas; fish, turtles, and crawfish live in the tributaries; and in the past, rabbits, antelope and bison were commonly found on the prairie.

The study area is mapped on three major soil types: floodplain silty clay loams, loamy fine sands on the hillslopes of drainages, and silty clay loams in the uplands above the drainages (Woods et al. 2003). The floodplain soils are Ashport silty clay loams which are mapped where the proposed route crosses tributaries of Crutcho Creek and East Elm Creek (0 to 1 percent slopes). The profile consists of dark reddish gray silty clay loam A horizons that extend from 0 to 41 cm below the surface atop an up to 50 cm thick reddish-brown silty clay loam B horizon. This B horizon is underlain by an up to 41 cm thick dark reddish gray loam A horizon which, in turn, is underlain by a reddish brown to yellowish red loam B horizon. The loamy fine sands are generally found in slopes adjacent to the drainages and include Stephenville-Darsil-Newalla complex loamy fine sands (3 to 8 percent slopes) and Harrah fine sandy loams (3-45 percent slopes). The general soil profiles for these soil complexes consist of shallow sandy A horizons followed by a light brown E horizon which is underlain by red clay. Finally, the silty clay loams in the upland settings include Kirkland silt loam (0 to 1 percent slopes), Grainola-Ashport complex silty clay loams (0 to 12 percent slopes), Grainola-Ironmound complex silty clay loams (3 to 12 percent), Grant-Huska complex silt loams (1 to 5 percent slopes), Renthin silty clay loam eroded (3 to 5 percent slopes), and Kingfisher-Ironmound complex silty loams (1 to 5 percent slopes). There soils series and complexes are generally characterized by a relatively shallow A-horizon underlain by red clay.

CULTURAL HISTORY

Wyckoff and Brooks (1983:77) divide Oklahoma into six ecological regions to organize the state's archaeological resources. Oklahoma County is within Region 5, the Tall Grass Prairies and Cross Timbers Region (Wyckoff and Brooks 1983:85). This region shares cultural influences from the Great Plains. The cultural chronology for Oklahoma and Oklahoma County herein is modeled after previously established timelines for the region (Wyckoff and Brooks 1983; Bell 1984). The prehistoric era is divided into four cultural periods: the Paleoindian (8,000 to 12,000 years ago), Archaic (2,000 to 8,000 years ago), Woodland (2,000 to 1,200 years ago), and the Late Prehistoric (1200 to 450 years ago). These temporal divisions are recognized in the archaeological record by changes seen in artifact types or occupation patterns. The historic period is generally considered the time since European contact (approximately 450 years ago to present).

Paleoindian

The earliest documented evidence for human habitation in the state dates to some time prior to 12,000 years ago, during the Paleoindian period (8,000 to 12,000 years ago), when small, nomadic groups hunted large animals with large, fluted dart points characteristic of the Clovis complex (Wyckoff and Brooks 1983:12). Paleoindian occupation in Oklahoma began at the end of the Pleistocene era. Sites are usually temporary campsites or bison kill sites which are transient in nature due to highly mobile lifeways of these big game hunters (Hofman 1989:25). Population numbers were relatively low and have left little evidence in the archaeological record. Artifacts from this period are primarily lanceolate and unnotched projectile points such as Clovis, Folsom, Plainview, and Hell Gap. These points were attached to spears for hunting mammoth, bison, caribou, and deer (Hofman 1989:25). These early sites are occasionally found buried in valley sediments, where bison and mammoth bones have been uncovered in deep alluvial deposits (Wyckoff 1984). While several sites with Paleoindian components have been recorded in the larger region, including the notable Domebo Canyon mammoth kill site in nearby Caddo County (Leonhardy and Anderson 1966), only two such sites have been recorded in Oklahoma County, as of 2006 (Brooks 2006b).

Archaic

The subsequent Archaic period lasted from 2,000 to 8,000 years ago. Archaic sites far outnumber Paleoindian sites in the state; as of 2006, a total of 38 sites dated to this period have been recorded in Oklahoma County (Brooks 2006c). Increase in site density is generally attributed to changes in subsistence patterns, seasonal mobility, and increased group sizes (Wyckoff and Brooks 1983:15). Along with the use of a wider variety of plants and animals, artifact assemblages from this period reflect an increase in food processing behavior such as tools for grinding vegetables, roasting ovens and rock-line hearths (Hofman and Brooks 1989). Artifact assemblages include stone knives, scrapers, drills, choppers, bifaces, nutting stones, grinding stones, awls, fishhooks and beads, all of which correlated with a higher variability of site types such as bison kill sites, camps with middens, hearths, lithic quarries, and burials (Wyckoff and Brooks 1983:15). The Archaic is temporally subdivided into the Early, Middle, and Late when hunting-gathering societies inhabited Oklahoma for at least 6000 years (Wyckoff 1984).

Woodland Period

The Woodland period was a relatively short prehistoric era (2,000 to 1,200 years ago) marked by a cultural transition to agricultural practices along with the technological innovations of pottery and the bow and arrow (Wyckoff and Brooks 1983:16). Site types from this period include lithic scatters on high ridge tops and bison kill sites. However, villages and hamlets dating to this period have been recorded on the floodplains and terraces of larger drainages occupied by semi-sedentary populations (Lowe et al. 2011:9). Small projectile points and cord-marked, conical-based pottery vessels are indicators of this period (Hofman and Brooks 1989:62). Arrow points include side-notched and corner notched forms such as Scallorn, while the Gary point is the primary dart point form (Hofman and Brooks 1989:67). A total of 14 Woodland-period sites have been recorded in Oklahoma County (Wilson 2009).

Late Prehistoric

During this period (1200 to 450 years ago), the Plains Villagers occupied central Oklahoma and are usually considered probable ancestors of the Wichita (Wyckoff and Brooks 1983). These ancestors of the Wichita belonged to a confederacy that shared a common culture and heritage, occupying territory that, by AD 1100, extended from the Smoky Hill River in what is now central Kansas southward through Oklahoma into north-central Texas (Clark 2009).

Agriculture became more established during this time period, supporting sedentary subsistence. Site types at this time represent this permanency and range from small hamlets to large villages with up to 200 people (Brooks and Bowman 2005:16-17). Some of the best documented Late Prehistoric complexes in this region are located in the fertile areas along the Arkansas River and its tributaries (Drass 2008:8). A recent total of 31 Oklahoma County sites date to this period (Brooks 2006a). Artifact types vary widely from this period with an increase in horticultural food production and processing tools, such as ground stone tools, bone tools, and specialized ceramics. Village sites are characterized by the presence of houses, cache or storage pits, sheet middens, and occasional burials or cemetery areas (Brooks 1989:75). These sites are typically found on terraces near fertile alluvial soils or on prominent ridges overlooking rich bottomlands (Wyckoff and Brooks 1983:64).

Historic

From the 1500s to the 1800s, Plains Indians used central Oklahoma as a migratory corridor (Wilson 2009) and the Wichita engaged in extensive trade (Clark 2009). A variety of Spanish and French explorers passed into the region in the early historic period and recorded the presence of numerous Native American groups, including encounters with the Wichita. During this time, Caddoan-speaking groups began hunting with guns traded to them by the French (Wyckoff 1984:12; Wyckoff and Brooks 1983). The Wichita procured game, largely bison, which they then processed and traded to the French in exchange for European trade goods, principally guns, beads, and metal. Land claims to the Oklahoma Territory began in earnest during the 1700s by France, Britain, and Spain. In 1803, Oklahoma was acquired by the United States in the Louisiana Purchase, and by 1840, the area was subdivided and settled by numerous tribes during forced relocations (Wyckoff and Brooks 1983:19; Goins and Goble 2006). After passage of the General Allotment Act in 1887,

millions of acres of the Cheyenne and Arapaho's communally-owned land was broken up into 80- and 160-acre tracts and issued to individual tribal members, despite the objections of both tribes (Fowler 2009; Kidwell 2009; Moore 2009). Oklahoma Station, located on the North Canadian River, was established in 1887 as a watering stop, and later a post office, along the Southern Kansas Railway (Wilson 2009). In 1889, the Land Run opened vacated tribal lands to approximately 50,000 settlers. Oklahoma City was established in April 1889 with a population of four to six thousand. The following year, Oklahoma County was established with the passage of the Organic Act of 1890. Oklahoma City was named as the county seat, with a population of 11,742.

Previous Investigations

Prior to fieldwork, a records review was conducted at the Oklahoma Archeological Survey (OAS) in Norman, to ascertain whether any archaeological sites had been recorded in the study area. No archaeological prehistoric or historic archaeological sites were recorded within the study area. Within 1-mi of the study area two archaeological sites were identified. Site 34OK14, recorded by David Lopez in 1972, is a surface scatter of flakes and a preform found on a knoll crest of the second terrace of Crutcho Creek approximately 530 meters northwest of the current study area. No shovel tests were excavated and no recommendation about its NRHP eligibility was made. The second site, 34OK76, was recorded by Francie Sisson and Leslie Anderson in 2001 as part of a roadway survey to access Lake Stanley Draper. The site is a prehistoric lithic surface scatter including twenty-three non-diagnostic lithic artifacts, no shovel tests were excavated and no recommendation about its NRHP eligibility was made. Several surveys, the majority of which were conducted for ODOT or as part of infrastructural development for Tinker Air Force Base or Lake Stanley Draper, have been conducted within a mile of the study area. Results of all these surveys were negative. Of note, Christopher Cojeen conducted a block survey of the property southwest of the intersection of SE 59th St. and S. Air Depot Blvd. for a proposed water line in 1999. That survey area overlaps with the current study area. The 30-acre property was surveyed in transects and with shovel testing. Results of the survey were negative.

In addition to archaeological literature, historic databases and several historic maps and aerial photographs were reviewed prior to fieldwork. No National Register of Historic Places (NRHP) properties or districts are located within 1-mi of the study areas, per a database managed by the Oklahoma Historical Society and the State Historic Preservation Office. The Oklahoma Landmarks Inventory, which is managed by the same agencies, does not list any landmarks of importance within 1-mi of the study area.

Aerial photographs from 1954 to present and the 1957 (revised 1976) Midwest City and Choctaw USGS 7.5' topographic maps were reviewed as well. There are structures mapped to the west of the route, and out of the ROW, on the 1957 Midwest City USGS map where the proposed route approaches SE 59th St. These structures are also present on the 1954 aerial up to present day. The tributary of Crutcho Creek that that route intersects in two different places between SE 59th St. and S. Air Depot Blvd. remains along its natural course in the 1954 and 1969 aerials but is channelized immediately north of and where it meets a railroad in the 1990 aerial photograph. The railroad is newly drawn on the 1976 version of the Midwest City USGS map, so the drainage was likely first channelized between 1969 and 1976. The northern part of the drainage, where it meets SE 59th St. and moving south and east, was channelized during the construction of a large office complex in 2002. Construction of this complex included surface clearing and grading just north of

the drainage between the drainage and SE 59th St. No other structures are noted along the route, though the part of Tinker Air Force Base that parallels the route is not on the 1957 Midwest City USGS map but does appear on the 1976 version of the same topographic map. The same can be said for the existing pipeline which appears for the first time on the 1976 Midwest City and Choctaw USGS maps. A 1954 aerial photograph confirms that the base and pipeline were not present at that time and a 1969 aerial photograph confirms their construction, though it is unclear when they were built in that 15-year period. The pipeline is periodically cleared and maintained based on examination of aerial photos from 1990 to present. Prior to its construction, much of the land on which it was built was used as farmland and some evidence of terracing remains visible south of the pipeline in several locations. There are small wooded areas around the drainages in the 1954 and 1969 aerial photographs that have expanded as farmlands around those drainages have been left fallow.

RESEARCH DESIGN AND METHODOLOGY

Research Design

Two predictions were developed prior to survey regarding the potential for finding prehistoric and historic sites in the COMCD Del City Pipeline study area. The first hypothesis concerned prehistoric occupation. Overall, it was predicted that the potential for finding buried prehistoric cultural deposits was low. However, potential increases at drainage crossings as they would have provided a source of water and natural resources. However, all the drainages in this project area are intermittent and appear to be headwaters of tributaries that feed larger drainages to the west and south, so anything other than temporary encampments or hunting sites is unlikely. There is a deeply buried A horizon in the Ashport soils mapped at the crossing of the Crutcho Creek tributary, but channelization of the drainage and construction have likely destroyed archaeological remains at those locations.

The second hypothesis addresses the historic site potential. The potential is low given that the majority of the route follows an existing ROW that has been maintained and cleared for at least 50 years. It is possible that there are trash dumps at or near the drainages and in the wooded areas just south and north of the pipeline. It is also possible that there is historic trash in the wooded area south of the drainage where the route approaches SE 59th St. as there have been houses west of the proposed route since the early 1950s and the wooded area south of the drainage does not appear to have been disturbed by construction of the office complex to the east of the route.

Methodology

Survey was conducted in accordance with the standards generally accepted for linear surveys. Field personnel walked approximately 2.89-miles of the proposed pipeline route within a 100-foot survey corridor and planned to shovel test an average of 16 shovel tests per mile surveyed. Generally, shovel tests were focused on the drainage crossings with a shovel test placed immediately adjacent to the drainage on either side and two additional shovel tests excavated at 50-meter intervals. Additional shovel tests were placed every 300 meters in upland settings. An attempt was made to place shovel tests within areas that are to be newly disturbed by the proposed project. Shovel tests were excavated where the slope was less than 20 percent, ground visibility was less than 30 percent, and contexts were not demonstrably disturbed. Per standard procedures, STs were excavated into the subsoil and averaged 30cm in diameter. All loamy soils were screened through ¼" wire mesh screens. The clay fill was inspected visually and broken into smaller chunks in order to determine if cultural materials were present. ST soil matrices were described on the basis of composition, texture, and color. The Munsell Soil Color Chart (2009) was used to identify soil colors. Field personnel made notes about the ground exposure, drainages, soil types, and disturbed areas where subsoil was exposed. Photographs were taken during the survey using a 16-megapixel, GPS-equipped, digital camera. ST and project boundary locations were marked with a handheld GPS receiver using the NAD83 datum. Artifacts were to have been recorded and photographed in the field, but not collected.

RESULTS

This chapter is divided into two sections. The first describes the study area's natural setting along with results of the pedestrian survey. STs are described generally throughout the text but are detailed in Table 1 at the end of the Survey Results section. Conclusions round out the chapter.

Survey Results

In general, the study area is located within a developing urban environment and has been impacted by that development for more than 50 years. The portion of the study area located southwest of the intersection of SE 59th St. and S. Air Depot Blvd. is primarily within an open pasture that is bordered on its north and east sides by large office complexes (Figure 2). The general environment in the pasture consists of two to three-foot-tall grasses. The only exception to this is the final 140 meters of the route as it approaches SE 59th St. which is densely wooded, including thick invasive greenbrier.

Figure 2. General environment within the pasture and cleared pipeline ROW, photo taken facing east.

The portion of the route between S. Midwest Blvd. and S. Post Road was generally cleared of trees and brush along the center line of the route but was densely wooded to the north and south of the route from approximately the east side of Tinker Air Force Base to S. Post Road (Figure 3). The portion of the route from S. Midwest Blvd. to the east side of Tinker Air Force Base only had pockets of densely wooded areas south of the proposed route and generally at drainage crossings. Overall, ground visibility ranged from 0 to 30 percent in the study area. Topographically, the study area could be generally described as a ridge and swale system wherein the swales contained the intermittent drainages and the ridges are the areas between the drainages. There were some slopes greater than 20 degrees, most notably at the drainage crossings associated with shovel tests (ST) 25-30 and 33-38.

Figure 3. General environment in wooded areas, photo taken facing north.

At least six shovel tests, were excavated at five of the six drainages crossings during survey (Figures 4 and 5). One was excavated at the crossing near S. Air Depot Blvd. due to clear evidence of disturbance associated with channelization of the drainage, construction of the nearby office complex and raised railroad line, and previous sewer line construction (Figure 6). A shovel test located on the west bank of the channelized drainage (ST11) revealed 40 centimeters of compact mottled red and gray clay which confirmed subsurface disturbance. The channel was approximately ten meters wide and two meters deep. Shovel tests 1-6 were excavated at the crossing south of SE 59th St. and generally revealed mottled red and brown sandy or loamy clays underlain by thick or compact red clays at varying depths. These soil profiles do not correspond to the Ashport series soils mapped at this location and are likely the result of extensive disturbance associated with the channelization of the drainage at this location and the construction of the office complex to east which was noted in the aerial photo review prior to survey. The surface and subsurface disturbance extends to the south side of the drainage which was unexpected.

Shovel tests 12-17 were excavated at the third crossing which was a small, 30-centimeter-wide drainage and revealed a general soil profile consisting of ten centimeters of compact red clay which is not consistent with the mapped Ashport-Grainola series soils mapped at that location. It is likely that erosion associated with previous farming activities and more recent construction and development in the area may have stripped away several layers of soil and/or there has been construction related disturbance associated with maintaining the existing pipeline. Shovel tests 19-24 were excavated at 70-centimeter-wide intermittent drainage approximately 560 meters east of the one described above.

Figure 4. Shovel test locations shown on a 2015 aerial photograph.

Figure 5. Shovel test locations shown on a 2015 aerial photograph.

Figure 6. The channelized drainage near S. Air Depot Blvd. The upward slope on the left side of the photo is the berm for the railroad which is just out of the frame. Photo taken facing west.

These shovel tests generally revealed a five to ten-centimeter-thick layer of reddish-brown clay underlain by red, compact clay. Again, these soil profiles do not match those described by the NRCS for this location. Shovel tests 25-30 were excavated at a fifth, relatively large drainage, approximately 430 meters east of the previous drainage. The channel of the drainage was approximately two meters wide with exposed soil profiles up to five meters tall, though those were outside of the ROW (Figure 7). The eastern slope down to the drainage was greater than 20 percent. The shovel tests at this crossing generally revealed soils similar to those described for the crossing to its west, but STs 29 and 30, which were excavated approximately 50 and 100 meters east of the drainage channel, revealed a 30 to 35-centimeter-thick layer of light red sandy clay underlain by red silt clay.

The final crossing, located approximately 960 meters east of the previous drainage, had up to two-meter-tall exposures within the channel. Shovel tests 33-38 were excavated at this crossing and generally exposed soil profiles consisting of red sandy loam underlain by dark reddish-brown sandy clay. The exceptions were STs 33 and 34, located 50 and 100 meters west of the drainage, which revealed profiles consisting of yellowish red sandy loam underlain by red compact sandy clay. As with the two earlier crossings, the soils at the final two crossings did not match the general NRCS soil descriptions for their locations. Again, this is likely due to construction disturbances and/or erosion exacerbated by farming activities during the early to mid-20th century.

In addition to the shovel tests excavated at the drainages, a total of ten shovel tests (STs 7-10, 18, 31-32, and 39-41) were excavated in upland settings. Shovel tests 7-10 generally exposed soil profiles consisting of weak red to red clays underlain by strong brown clay. Shovel test 18 revealed

reddish brown clay underlain by red clay. Shovel tests 31-32 and 39-41 revealed relatively shallow sandy loams ranging from strong brown to red underlain by brown, red, or dark reddish-brown varieties of clay.

Figure 7. An exposed profile at the fifth drainage crossing, shovel for scale. Photo taken facing southwest.

Table 1. Shovel Test Descriptions.

ST#	Depth (cm)	Description	Comments/Artifacts
1	0-80 80-110	Dark brown (7.5YR3/2), brown (7.5YR4/3), and red (2.5YR5/6) mottled sandy clay Red (2.5YR5/6) and brown (7.5YR4/3) mottled clay	None
2	0-55 55-67	Red (2.5YR5/6) clay Red (2.5YR5/6) clay with degrading sandstone	None
3	0-30	Red (2.5YR5/6), dark brown (7.5YR3/2), and white (7.5YR8/1) mottled clay	None
4	0-42 42-80 80-95 95-103	Dark brown (7.5YR3/2) loamy clay Red (2.5YR5/6) loamy clay Red (2.5YR5/6) and very dark brown (10YR2/2) mottled clay Red (2.5YR5/6) compact sandy clay	Auger at 80 cmbs
5	0-70 70-75	Red (2.5YR5/6) and very dark grayish brown (10YR3/2) loamy clay Red (2.5YR5/6) dry clay	None
6	0-35 35-38	Red (2.5YR5/6) loamy clay Red (2.5YR5/6) dry clay	None

ST#	Depth (cm)	Description	Comments/Artifacts
7	0-25 25-35	Weak red (2.5YR4/2) clay Strong brown (7.5YR5/6) clay	None
8	0-35 35-40	Weak red (2.5YR4/2) clay Strong brown (7.5YR5/6) clay	None
9	0-30 30-40	Weak red (2.5YR4/2) clay Strong brown (7.5YR5/6) clay	None
10	0-10 10-40 40-50	Red (2.5YR5/6) clay Weak red (2.5YR4/2) clay Strong brown (7.5YR5/6) clay	None
11	0-40	Compact, mottled red (2.5YR4/6) and light gray (7.5YR7/1) clay	None
12	0-10	Red (2.5YR4/8) clay	None
13	0-10	Red (2.5YR4/8) clay	None
14	0-10	Red (2.5YR4/8) clay	None
15	0-10	Red (2.5YR4/8) clay	None
16	0-5 5-20	Reddish brown (2.5YR4/3) clay Red (2.5YR4/8) clay	None
17	0-5 5-20	Reddish brown (2.5YR4/3) clay Red (2.5YR4/8) clay	None
18	0-5 5-20	Reddish brown (2.5YR4/3) clay Red (2.5YR4/8) clay	None
19	0-5 5-20	Reddish brown (2.5YR4/3) clay Red (2.5YR4/8) clay	None
20	0-8 8-20	Reddish brown (2.5YR4/3) clay Red (2.5YR4/8) clay	None
21	0-5 5-20	Reddish brown (2.5YR4/3) clay Red (2.5YR4/8) clay	None
22	0-5 5-20	Reddish brown (2.5YR4/3) clay Red (2.5YR4/8) clay	None
23	0-10 10-30	Reddish brown (2.5YR4/3) clay Red (2.5YR4/8) clay	None
24	0-22 22-30	Reddish brown (2.5YR4/3) clay Red (2.5YR4/8) clay	None
25	0-27 27-35	Reddish brown (2.5YR4/3) clay Red (2.5YR4/8) clay	None
26	0-25 25-35	Reddish brown (2.5YR4/3) clay Red (2.5YR4/8) clay	None
27	0-32 32-40	Reddish brown (2.5YR4/3) clay Red (2.5YR4/8) clay	None
28	0-30 30-40	Reddish brown (2.5YR4/3) clay Red (2.5YR4/8) clay	None
29	0-35 35-42	Light red (2.5YR6/8) sandy clay Red (2.5YR4/8) silt clay	None
30	0-30 30-40	Light red (2.5YR6/8) sandy clay Red (2.5YR4/8) silt clay	None
31	0-13 13-30	Strong brown (7.5YR5/6) sandy loam Brown (7.5YR4/3) clay	None

ST#	Depth (cm)	Description	Comments/Artifacts
32	0-16 16-27	Yellowish red (5YR4/6) sandy loam Red (2.5YR4/6) and reddish brown (2.5YR3/3) mottled clay	None
33	0-10 10-35 35-43	Humus Yellowish red (5YR4/6) sandy loam Red (2.5YR4/6) dry, compact sandy clay	None
34	0-8 8-30 30-39	Humus Yellowish red (5YR4/6) sandy loam Red (2.5YR4/6) dry, compact sandy clay	None
35	0-15 15-41 41-50	Red (2.5YR4/8) wet sandy loam Reddish brown (2.5YR3/3) wet sandy loam Dark reddish brown (2.5YR3/4) sandy clay	None
36	0-13 13-26 26-43	Red (2.5YR4/8) wet sandy loam Reddish brown (2.5YR3/3) wet sandy loam Dark reddish brown (2.5YR3/4) sandy clay	None
37	0-14 14-40 40-49	Red (2.5YR4/8) wet sandy loam Reddish brown (2.5YR3/3) wet sandy loam Dark reddish brown (2.5YR3/4) sandy clay	None
38	0-10 10-30	Red (2.5YR4/8) sandy loam Dark reddish brown (2.5YR3/4) and black (10YR2/1) mottled clay	None
39	0-15 15-40 40-48	Red (2.5YR4/8) wet sandy loam Reddish brown (2.5YR3/3) wet sandy loam Dark reddish brown (2.5YR3/4) sandy clay	None
40	0-30	Reddish brown (2.5YR4/4) clay	None
41	0-19 19-26	Brown (7.5YR4/3) clay loam Dark reddish brown (2.5YR3/4) loamy clay	None

Conclusions

No prehistoric or historic cultural resources were located during the survey of the proposed COMCD Pipeline project. A lack of prehistoric cultural resources was anticipated due to limited access to potable water, knappable gravels, and availability of shelter and proximity to other, more reliable natural water resources to the south and west of the project area. Additionally, this area has been impacted by farming activities in the past and more recent construction projects, including a pipeline installation that is to be replaced by the current proposed project, as well as erosion, resulting in a low potential for finding cultural resources that can provide meaningful context. It was expected that the potential for finding historic cultural resources was low even though the surrounding area has been occupied for more than 50 years, due in part to the fact that most of the pipeline will be placed within, or very near, a cleared and maintained pipeline corridor.

RECOMMENDATIONS

The purpose of this investigation was to determine if significant cultural resources are present within the proposed COMCD Pipeline study area in Oklahoma County, Oklahoma. No cultural resources were identified on or below the surface during the survey. Based on the results of the survey, ARC concludes that further cultural resource investigations for this project are unwarranted and recommends that the OAS and USBR concur with this assessment. However, if buried cultural materials are discovered during construction, the OAS and the Tulsa office of the USBR should be notified.

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Appendix F

Environmental Justice EJSCREEN Reports

EJSCREEN ACS Summary Report

Location: User-specified linear location
Ring (buffer): .075-mile radius
Description:

Summary of ACS Estimates	2012 - 2016
Population	1,318
Population Density (per sq. mile)	1,191
Minority Population	573
% Minority	44%
Households	520
Housing Units	600
Housing Units Built Before 1950	6
Per Capita Income	26,182
Land Area (sq. miles) (Source: SF1)	1.11
% Land Area	99%
Water Area (sq. miles) (Source: SF1)	0.01
% Water Area	1%

	2012 - 2016 ACS Estimates	Percent	MOE (±)
Population by Race			
Total	1,318	100%	657
Population Reporting One Race	1,256	95%	1,049
White	786	60%	512
Black	341	26%	330
American Indian	3	0%	10
Asian	124	9%	173
Pacific Islander	0	0%	9
Some Other Race	3	0%	15
Population Reporting Two or More Races	62	5%	173
Total Hispanic Population	52	4%	89
Total Non-Hispanic Population	1,266		
White Alone	745	56%	492
Black Alone	336	26%	325
American Indian Alone	3	0%	10
Non-Hispanic Asian Alone	124	9%	173
Pacific Islander Alone	0	0%	9
Other Race Alone	0	0%	9
Two or More Races Alone	58	4%	173
Population by Sex			
Male	657	50%	370
Female	661	50%	371
Population by Age			
Age 0-4	94	7%	122
Age 0-17	333	25%	247
Age 18+	986	75%	326
Age 65+	142	11%	89

Data Note: Detail may not sum to totals due to rounding. Hispanic population can be of any race.
N/A means not available. Source: U.S. Census Bureau, American Community Survey (ACS) 2012 - 2016 .

EJSCREEN ACS Summary Report

Location: User-specified linear location
Ring (buffer): .075-mile radius
Description:

	2012 - 2016 ACS Estimates	Percent	MOE (±)
Population 25+ by Educational Attainment			
Total	790	100%	376
Less than 9th Grade	10	1%	30
9th - 12th Grade, No Diploma	52	7%	86
High School Graduate	264	33%	190
Some College, No Degree	258	33%	161
Associate Degree	71	9%	99
Bachelor's Degree or more	207	26%	144
Population Age 5+ Years by Ability to Speak English			
Total	1,224	100%	611
Speak only English	1,118	91%	474
Non-English at Home[1+2+3+4]	106	9%	144
[1]Speak English "very well"	60	5%	134
[2]Speak English "well"	17	1%	61
[3]Speak English "not well"	23	2%	66
[4]Speak English "not at all"	6	0%	40
[3+4]Speak English "less than well"	29	2%	66
[2+3+4]Speak English "less than very well"	46	4%	90
Linguistically Isolated Households*			
Total	14	100%	61
Speak Spanish	2	17%	23
Speak Other Indo-European Languages	0	0%	9
Speak Asian-Pacific Island Languages	11	83%	56
Speak Other Languages	0	0%	9
Households by Household Income			
Household Income Base	520	100%	159
< $15,000	58	11%	71
$15,000 - $25,000	32	6%	61
$25,000 - $50,000	157	30%	114
$50,000 - $75,000	83	16%	91
$75,000 +	191	37%	123
Occupied Housing Units by Tenure			
Total	520	100%	159
Owner Occupied	328	63%	127
Renter Occupied	192	37%	137
Employed Population Age 16+ Years			
Total	1,038	100%	481
In Labor Force	664	64%	382
Civilian Unemployed in Labor Force	53	5%	164
Not In Labor Force	375	36%	232

Data Note: Datail may not sum to totals due to rounding. Hispanic population can be of any race.
N/A means not available. Source: U.S. Census Bureau, American Community Survey (ACS)
*Households in which no one 14 and over speaks English "very well" or speaks English only.

EJSCREEN ACS Summary Report

Location: User-specified linear location
Ring (buffer): .075-mile radius
Description:

	2012 - 2016 ACS Estimates	Percent	MOE (±)
Population by Language Spoken at Home*			
Total (persons age 5 and above)	3,152	100%	621
English	2,897	92%	607
Spanish	75	2%	116
French	0	0%	13
French Creole	N/A	N/A	N/A
Italian	N/A	N/A	N/A
Portuguese	N/A	N/A	N/A
German	12	0%	28
Yiddish	N/A	N/A	N/A
Other West Germanic	N/A	N/A	N/A
Scandinavian	N/A	N/A	N/A
Greek	N/A	N/A	N/A
Russian	N/A	N/A	N/A
Polish	N/A	N/A	N/A
Serbo-Croatian	N/A	N/A	N/A
Other Slavic	N/A	N/A	N/A
Armenian	N/A	N/A	N/A
Persian	N/A	N/A	N/A
Gujarathi	N/A	N/A	N/A
Hindi	N/A	N/A	N/A
Urdu	N/A	N/A	N/A
Other Indic	N/A	N/A	N/A
Other Indo-European	0	0%	13
Chinese	9	0%	28
Japanese	N/A	N/A	N/A
Korean	84	3%	148
Mon-Khmer, Cambodian	N/A	N/A	N/A
Hmong	N/A	N/A	N/A
Thai	N/A	N/A	N/A
Laotian	N/A	N/A	N/A
Vietnamese	66	2%	113
Other Asian	0	0%	13
Tagalog	0	0%	13
Other Pacific Island	N/A	N/A	N/A
Navajo	N/A	N/A	N/A
Other Native American	N/A	N/A	N/A
Hungarian	N/A	N/A	N/A
Arabic	0	0%	13
Hebrew	N/A	N/A	N/A
African	N/A	N/A	N/A
Other and non-specified	7	0%	22
Total Non-English	254	8%	868

Data Note: Detail may not sum to totals due to rounding. Hispanic popultion can be of any race.
N/A means not available. Source: U.S. Census Bureau, American Community Survey (ACS) 2012 - 2016.
*Population by Language Spoken at Home is available at the census tract summary level and up.

EJSCREEN Census 2010 Summary Report

Location: User-specified linear location
Ring (buffer): .075-mile radius
Description:

Summary	Census 2010
Population	1,179
Population Density (per sq. mile)	1,065
Minority Population	592
% Minority	50%
Households	516
Housing Units	549
Land Area (sq. miles)	1.11
% Land Area	99%
Water Area (sq. miles)	0.01
% Water Area	1%

Population by Race	Number	Percent
Total	1,179	-------
Population Reporting One Race	1,103	94%
White	626	53%
Black	331	28%
American Indian	33	3%
Asian	85	7%
Pacific Islander	4	0%
Some Other Race	24	2%
Population Reporting Two or More Races	76	6%
Total Hispanic Population	74	6%
Total Non-Hispanic Population	1,105	94%
White Alone	587	50%
Black Alone	327	28%
American Indian Alone	31	3%
Non-Hispanic Asian Alone	82	7%
Pacific Islander Alone	4	0%
Other Race Alone	4	0%
Two or More Races Alone	71	6%

Population by Sex	Number	Percent
Male	564	48%
Female	615	52%

Population by Age	Number	Percent
Age 0-4	96	8%
Age 0-17	315	27%
Age 18+	864	73%
Age 65+	146	12%

Households by Tenure	Number	Percent
Total	516	
Owner Occupied	352	68%
Renter Occupied	164	32%

Data Note: Detail may not sum to totals due to rounding. Hispanic population can be of any race.
Source: U.S. Census Bureau, Census 2010 Summary File 1.

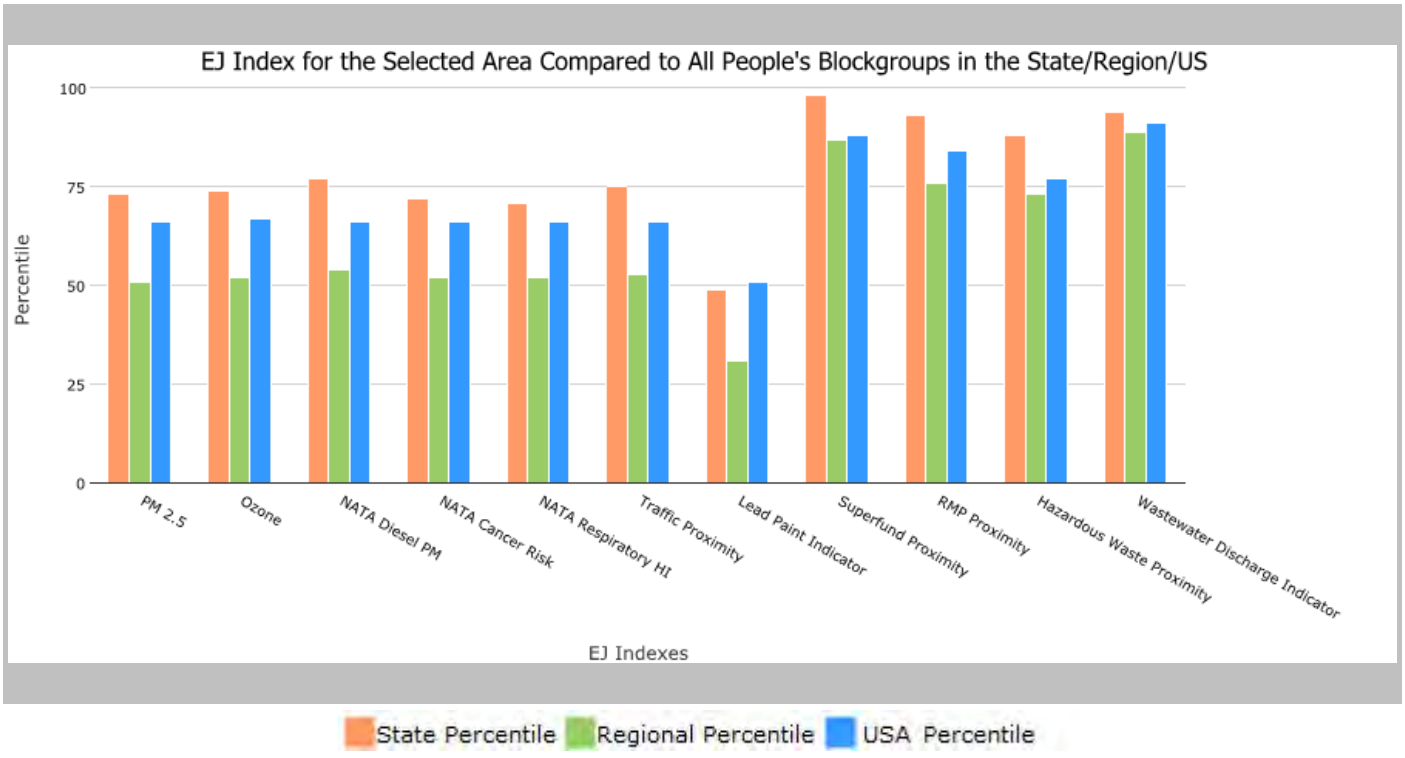
EJSCREEN Report (Version 2018)

.075 mile Ring around the Corridor, OKLAHOMA, EPA Region 6

Approximate Population: 1,318

Input Area (sq. miles): 1.00

Selected Variables	State Percentile	EPA Region Percentile	USA Percentile
EJ Indexes			
EJ Index for PM2.5	73	51	66
EJ Index for Ozone	74	52	67
EJ Index for NATA* Diesel PM	77	54	66
EJ Index for NATA* Air Toxics Cancer Risk	72	52	66
EJ Index for NATA* Respiratory Hazard Index	71	52	66
EJ Index for Traffic Proximity and Volume	75	53	66
EJ Index for Lead Paint Indicator	49	31	51
EJ Index for Superfund Proximity	98	87	88
EJ Index for RMP Proximity	93	76	84
EJ Index for Hazardous Waste Proximity	88	73	77
EJ Index for Wastewater Discharge Indicator	94	89	91



This report shows the values for environmental and demographic indicators and EJSCREEN indexes. It shows environmental and demographic raw data (e.g., the estimated concentration of ozone in the air), and also shows what percentile each raw data value represents. These percentiles provide perspective on how the selected block group or buffer area compares to the entire state, EPA region, or nation. For example, if a given location is at the 95th percentile nationwide, this means that only 5 percent of the US population has a higher block group value than the average person in the location being analyzed. The years for which the data are available, and the methods used, vary across these indicators. Important caveats and uncertainties apply to this screening-level information, so it is essential to understand the limitations on appropriate interpretations and applications of these indicators. Please see EJSCREEN documentation for discussion of these issues before using reports.

EJSCREEN Report (Version 2018)

.075 mile Ring around the Corridor, OKLAHOMA, EPA Region 6

Approximate Population: 1,318

Input Area (sq. miles): 1.00

Sites reporting to EPA	
Superfund NPL	0
Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDF)	0

EJSCREEN Report (Version 2018)

.075 mile Ring around the Corridor, OKLAHOMA, EPA Region 6

Approximate Population: 1,318

Input Area (sq. miles): 1.00

Selected Variables	Value	State Avg.	%ile in State	EPA Region Avg.	%ile in EPA Region	USA Avg.	%ile in USA
Environmental Indicators							
Particulate Matter (PM 2.5 in µg/m^3)	9.64	9.36	64	9.55	44	9.53	49
Ozone (ppb)	47.2	44.8	77	40.4	87	42.5	86
NATA* Diesel PM (µg/m^3)	0.573	0.527	62	0.721	<50th	0.938	<50th
NATA* Cancer Risk (lifetime risk per million)	42	45	37	42	50-60th	40	50-60th
NATA* Respiratory Hazard Index	1.6	1.9	27	1.8	<50th	1.8	<50th
Traffic Proximity and Volume (daily traffic count/distance to road)	51	83	61	320	40	600	40
Lead Paint Indicator (% Pre-1960 Housing)	0.025	0.24	18	0.18	33	0.29	19
Superfund Proximity (site count/km distance)	0.53	0.047	99	0.07	98	0.12	95
RMP Proximity (facility count/km distance)	2.2	0.55	96	0.8	91	0.72	92
Hazardous Waste Proximity (facility count/km distance)	1.6	0.59	89	0.86	83	4.3	73
Wastewater Discharge Indicator (toxicity-weighted concentration/m distance)	0.03	0.32	91	0.38	90	30	85
Demographic Indicators							
Demographic Index	40%	35%	65	44%	48	36%	63
Minority Population	44%	33%	77	51%	46	38%	63
Low Income Population	36%	38%	48	38%	49	34%	58
Linguistically Isolated Population	3%	2%	79	6%	53	4%	62
Population With Less Than High School Education	8%	13%	34	17%	31	13%	41
Population Under 5 years of age	7%	7%	57	7%	54	6%	64
Population over 64 years of age	11%	14%	30	13%	47	14%	37

* The National-Scale Air Toxics Assessment (NATA) is EPA's ongoing, comprehensive evaluation of air toxics in the United States. EPA developed the NATA to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that NATA provides broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. More information on the NATA analysis can be found at: https://www.epa.gov/national-air-toxics-assessment.

For additional information, see: www.epa.gov/environmentaljustice

EJSCREEN ACS Summary Report

Location: User-specified linear location
Ring (buffer): 2.5-mile radius
Description:

Summary of ACS Estimates	2012 - 2016
Population	55,135
Population Density (per sq. mile)	1,172
Minority Population	23,592
% Minority	43%
Households	20,142
Housing Units	22,485
Housing Units Built Before 1950	2,247
Per Capita Income	22,481
Land Area (sq. miles) (Source: SF1)	47.04
% Land Area	96%
Water Area (sq. miles) (Source: SF1)	1.81
% Water Area	4%

	2012 - 2016 ACS Estimates	Percent	MOE (±)
Population by Race			
Total	55,135	100%	824
Population Reporting One Race	51,978	94%	2,066
White	34,784	63%	643
Black	13,117	24%	625
American Indian	1,645	3%	192
Asian	1,813	3%	246
Pacific Islander	37	0%	36
Some Other Race	582	1%	324
Population Reporting Two or More Races	3,157	6%	277
Total Hispanic Population	4,636	8%	358
Total Non-Hispanic Population	50,499		
White Alone	31,543	57%	492
Black Alone	12,994	24%	625
American Indian Alone	1,325	2%	165
Non-Hispanic Asian Alone	1,755	3%	246
Pacific Islander Alone	33	0%	36
Other Race Alone	60	0%	60
Two or More Races Alone	2,789	5%	277
Population by Sex			
Male	27,331	50%	521
Female	27,805	50%	501
Population by Age			
Age 0-4	4,381	8%	183
Age 0-17	14,532	26%	347
Age 18+	40,603	74%	458
Age 65+	6,210	11%	117

Data Note: Detail may not sum to totals due to rounding. Hispanic population can be of any race.
N/A means not available. Source: U.S. Census Bureau, American Community Survey (ACS) 2012 - 2016 .

EJSCREEN ACS Summary Report

Location: User-specified linear location
Ring (buffer): 2.5-mile radius
Description:

	2012 - 2016 ACS Estimates	Percent	MOE (±)
Population 25+ by Educational Attainment			
Total	34,606	100%	376
Less than 9th Grade	946	3%	64
9th - 12th Grade, No Diploma	3,051	9%	171
High School Graduate	11,481	33%	293
Some College, No Degree	12,897	37%	250
Associate Degree	2,994	9%	186
Bachelor's Degree or more	6,230	18%	169
Population Age 5+ Years by Ability to Speak English			
Total	50,754	100%	680
Speak only English	46,566	92%	561
Non-English at Home[1+2+3+4]	4,188	8%	249
[1]Speak English "very well"	2,593	5%	245
[2]Speak English "well"	830	2%	106
[3]Speak English "not well"	563	1%	99
[4]Speak English "not at all"	202	0%	44
[3+4]Speak English "less than well"	765	2%	99
[2+3+4]Speak English "less than very well"	1,595	3%	112
Linguistically Isolated Households*			
Total	280	100%	61
Speak Spanish	123	44%	38
Speak Other Indo-European Languages	0	0%	9
Speak Asian-Pacific Island Languages	140	50%	56
Speak Other Languages	17	6%	24
Households by Household Income			
Household Income Base	20,142	100%	171
< $15,000	2,761	14%	145
$15,000 - $25,000	1,948	10%	106
$25,000 - $50,000	5,695	28%	146
$50,000 - $75,000	4,399	22%	164
$75,000 +	5,341	27%	165
Occupied Housing Units by Tenure			
Total	20,142	100%	171
Owner Occupied	11,229	56%	144
Renter Occupied	8,913	44%	183
Employed Population Age 16+ Years			
Total	42,024	100%	501
In Labor Force	27,124	65%	393
Civilian Unemployed in Labor Force	1,538	4%	164
Not In Labor Force	14,900	35%	432

Data Note: Datail may not sum to totals due to rounding. Hispanic population can be of any race.
N/A means not available. Source: U.S. Census Bureau, American Community Survey (ACS)
*Households in which no one 14 and over speaks English "very well" or speaks English only.

EJSCREEN ACS Summary Report

Location: User-specified linear location
Ring (buffer): 2.5-mile radius
Description:

	2012 - 2016 ACS Estimates	Percent	MOE (±)
Population by Language Spoken at Home*			
Total (persons age 5 and above)	48,837	100%	621
English	44,848	92%	646
Spanish	2,185	4%	167
French	49	0%	33
French Creole	N/A	N/A	N/A
Italian	N/A	N/A	N/A
Portuguese	N/A	N/A	N/A
German	210	0%	197
Yiddish	N/A	N/A	N/A
Other West Germanic	N/A	N/A	N/A
Scandinavian	N/A	N/A	N/A
Greek	N/A	N/A	N/A
Russian	N/A	N/A	N/A
Polish	N/A	N/A	N/A
Serbo-Croatian	N/A	N/A	N/A
Other Slavic	N/A	N/A	N/A
Armenian	N/A	N/A	N/A
Persian	N/A	N/A	N/A
Gujarathi	N/A	N/A	N/A
Hindi	N/A	N/A	N/A
Urdu	N/A	N/A	N/A
Other Indic	N/A	N/A	N/A
Other Indo-European	32	0%	33
Chinese	172	0%	80
Japanese	N/A	N/A	N/A
Korean	292	1%	148
Mon-Khmer, Cambodian	N/A	N/A	N/A
Hmong	N/A	N/A	N/A
Thai	N/A	N/A	N/A
Laotian	N/A	N/A	N/A
Vietnamese	479	1%	225
Other Asian	243	0%	82
Tagalog	137	0%	51
Other Pacific Island	N/A	N/A	N/A
Navajo	N/A	N/A	N/A
Other Native American	N/A	N/A	N/A
Hungarian	N/A	N/A	N/A
Arabic	22	0%	19
Hebrew	N/A	N/A	N/A
African	N/A	N/A	N/A
Other and non-specified	136	0%	72
Total Non-English	3,989	8%	889

Data Note: Detail may not sum to totals due to rounding. Hispanic popultion can be of any race.
N/A means not available. Source: U.S. Census Bureau, American Community Survey (ACS) 2012 - 2016.
*Population by Language Spoken at Home is available at the census tract summary level and up.

EJSCREEN Census 2010 Summary Report

Location: User-specified linear location
Ring (buffer): 2.5-mile radius
Description:

Summary	Census 2010
Population	53,076
Population Density (per sq. mile)	1,128
Minority Population	22,397
% Minority	42%
Households	20,087
Housing Units	22,066
Land Area (sq. miles)	47.04
% Land Area	96%
Water Area (sq. miles)	1.81
% Water Area	4%

Population by Race	Number	Percent
Total	53,076	-------
Population Reporting One Race	49,240	93%
White	32,635	61%
Black	11,390	21%
American Indian	2,043	4%
Asian	1,647	3%
Pacific Islander	124	0%
Some Other Race	1,401	3%
Population Reporting Two or More Races	3,836	7%
Total Hispanic Population	4,243	8%
Total Non-Hispanic Population	48,833	92%
White Alone	30,679	58%
Black Alone	11,183	21%
American Indian Alone	1,902	4%
Non-Hispanic Asian Alone	1,602	3%
Pacific Islander Alone	119	0%
Other Race Alone	81	0%
Two or More Races Alone	3,266	6%

Population by Sex	Number	Percent
Male	26,004	49%
Female	27,072	51%

Population by Age	Number	Percent
Age 0-4	4,572	9%
Age 0-17	14,464	27%
Age 18+	38,612	73%
Age 65+	5,720	11%

Households by Tenure	Number	Percent
Total	20,087	
Owner Occupied	12,453	62%
Renter Occupied	7,633	38%

Data Note: Detail may not sum to totals due to rounding. Hispanic population can be of any race.
Source: U.S. Census Bureau, Census 2010 Summary File 1.

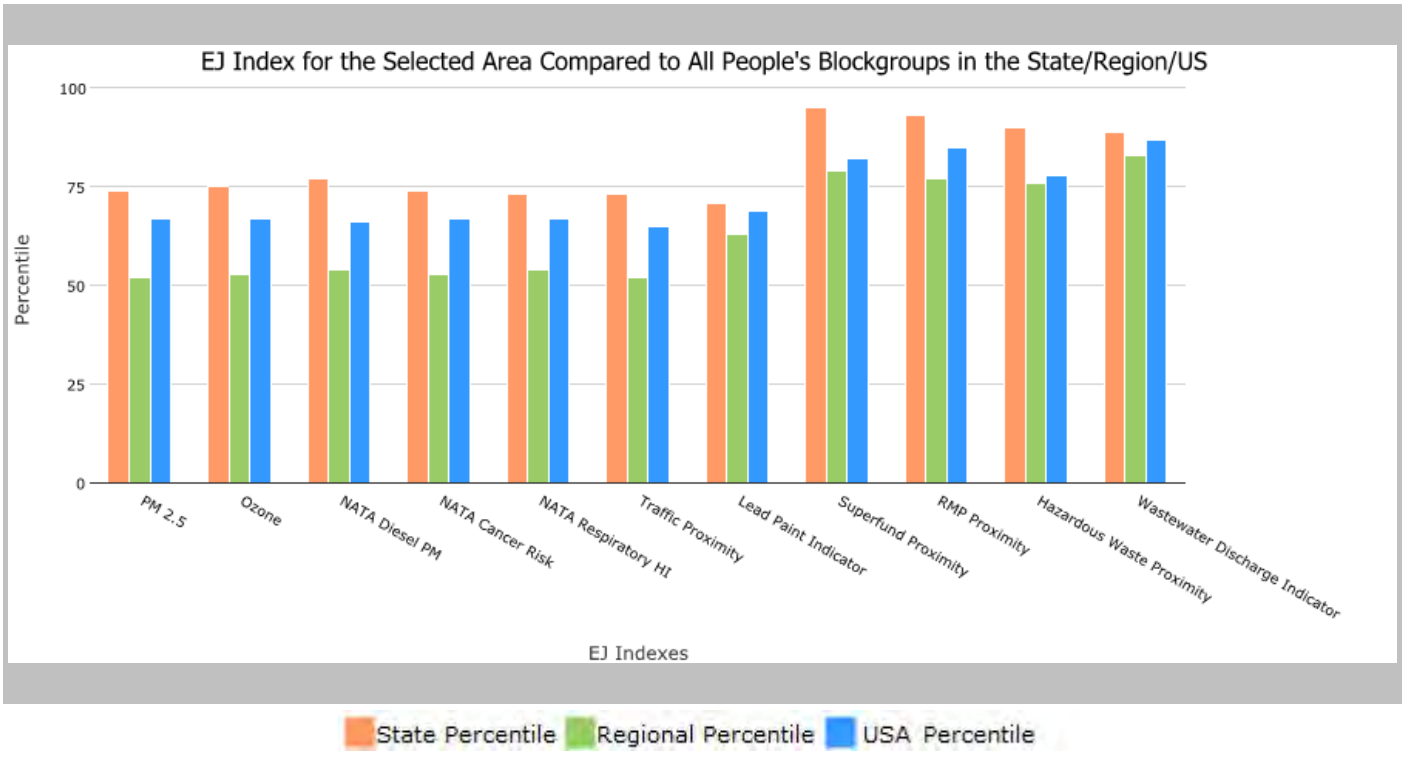
EJSCREEN Report (Version 2018)

2.5 mile Ring around the Corridor, OKLAHOMA, EPA Region 6

Approximate Population: 55,135

Input Area (sq. miles): 50.55

Selected Variables	State Percentile	EPA Region Percentile	USA Percentile
EJ Indexes			
EJ Index for PM2.5	74	52	67
EJ Index for Ozone	75	53	67
EJ Index for NATA* Diesel PM	77	54	66
EJ Index for NATA* Air Toxics Cancer Risk	74	53	67
EJ Index for NATA* Respiratory Hazard Index	73	54	67
EJ Index for Traffic Proximity and Volume	73	52	65
EJ Index for Lead Paint Indicator	71	63	69
EJ Index for Superfund Proximity	95	79	82
EJ Index for RMP Proximity	93	77	85
EJ Index for Hazardous Waste Proximity	90	76	78
EJ Index for Wastewater Discharge Indicator	89	83	87



This report shows the values for environmental and demographic indicators and EJSCREEN indexes. It shows environmental and demographic raw data (e.g., the estimated concentration of ozone in the air), and also shows what percentile each raw data value represents. These percentiles provide perspective on how the selected block group or buffer area compares to the entire state, EPA region, or nation. For example, if a given location is at the 95th percentile nationwide, this means that only 5 percent of the US population has a higher block group value than the average person in the location being analyzed. The years for which the data are available, and the methods used, vary across these indicators. Important caveats and uncertainties apply to this screening-level information, so it is essential to understand the limitations on appropriate interpretations and applications of these indicators. Please see EJSCREEN documentation for discussion of these issues before using reports.

EJSCREEN Report (Version 2018)

2.5 mile Ring around the Corridor, OKLAHOMA, EPA Region 6

Approximate Population: 55,135

Input Area (sq. miles): 50.55

Sites reporting to EPA	
Superfund NPL	1
Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDF)	4

EJSCREEN Report (Version 2018)

2.5 mile Ring around the Corridor, OKLAHOMA, EPA Region 6

Approximate Population: 55,135

Input Area (sq. miles): 50.55

Selected Variables	Value	State Avg.	%ile in State	EPA Region Avg.	%ile in EPA Region	USA Avg.	%ile in USA
Environmental Indicators							
Particulate Matter (PM 2.5 in µg/m^3)	9.67	9.36	67	9.55	45	9.53	50
Ozone (ppb)	47.3	44.8	80	40.4	88	42.5	86
NATA* Diesel PM (µg/m^3)	0.575	0.527	62	0.721	<50th	0.938	<50th
NATA* Cancer Risk (lifetime risk per million)	44	45	48	42	50-60th	40	60-70th
NATA* Respiratory Hazard Index	1.7	1.9	37	1.8	50-60th	1.8	50-60th
Traffic Proximity and Volume (daily traffic count/distance to road)	110	83	78	320	53	600	52
Lead Paint Indicator (% Pre-1960 Housing)	0.24	0.24	66	0.18	75	0.29	56
Superfund Proximity (site count/km distance)	0.3	0.047	97	0.07	96	0.12	91
RMP Proximity (facility count/km distance)	1.8	0.55	94	0.8	88	0.72	89
Hazardous Waste Proximity (facility count/km distance)	1.6	0.59	89	0.86	83	4.3	72
Wastewater Discharge Indicator (toxicity-weighted concentration/m distance)	0.01	0.32	84	0.38	85	30	80
Demographic Indicators							
Demographic Index	42%	35%	68	44%	50	36%	65
Minority Population	43%	33%	76	51%	45	38%	62
Low Income Population	40%	38%	55	38%	56	34%	65
Linguistically Isolated Population	1%	2%	66	6%	42	4%	51
Population With Less Than High School Education	12%	13%	52	17%	44	13%	56
Population Under 5 years of age	8%	7%	66	7%	62	6%	71
Population over 64 years of age	11%	14%	33	13%	50	14%	40

* The National-Scale Air Toxics Assessment (NATA) is EPA's ongoing, comprehensive evaluation of air toxics in the United States. EPA developed the NATA to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that NATA provides broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. More information on the NATA analysis can be found at: https://www.epa.gov/national-air-toxics-assessment.

For additional information, see: www.epa.gov/environmentaljustice

Appendix G

Public Notice of Availability

NOTICE OF AVAILABILITY FOR AN ENVIRONMENTAL ASSESSMENT

Notice is hereby given to all interested persons that the Bureau of Reclamation has released a Draft Environmental Assessment (EA) in compliance with National Environmental Policy Act (NEPA) to evaluate and disclose the potential impacts to the human or natural environment associated with the construction of the proposed Del City Raw Water Pipeline Improvements Project (Proposed Action) and its alternatives. Pursuant to NEPA, results of this analysis will be utilized to determine whether a Finding of No Significant Impact (FONSI) or an Environmental Impact Statement (EIS) must be prepared.

Proposed Action: The Central Oklahoma Master Conservancy District (COMCD) is proposing to construct or rehabilitate approximately 26,700 linear feet of their Del City Raw Water Pipeline from COMCD's Relift Pump Station to Del City's Water Treatment Plant. Most of the proposed action is located within an easement owned by the Bureau of Reclamation. Any additional acquired permanent easement associated with the proposed action would be conveyed to the Bureau of Reclamation. Construction associated with the proposed action would include the installation of approximately 17,500 linear feet of 24-inch diameter ductile iron pipe using open cut contruction techniques. The remaining approximately 9,200 linear feet of pipeline would be rehabilitated using a high-density polyethylene (HDPE) liner. The opinion of probable construction cost associated with the proposed action is estimated to be $10,750,000.

The Draft Environmental Assessment is available for review between the hours of 8:00 AM to 12:00 PM and 1:00 PM to 5:00 PM, Monday through Friday, at the COMCD office located at 12500 Alameda Drive Norman, OK 73026, and on the internet at https://www.comcd.net. Written comments may be submitted either in person at the COMCD office, or by mail to Reclamation's Oklahoma-Texas Area Office, Del City Pipeline Draft EA, 5316 Hwy 290 W., Suite 110, Austin, Texas 78735. Written comments must be received by February 2, 2019. You may contact Alan Swartz at (405) 440-2725, or aswartz@apaienv.com with any general questions regarding the proposed project. https://www.comcd.net

STATE OF OKLAHOMA, }
COUNTY OF OKLAHOMA } SS.

Affidavit of Publication

ROYCE PARKHURST, of lawful age, being first duly sworn, upon oath deposes and says that she/he is the Classified Legal Notice Admin of The Oklahoma Publishing Company, a corporation, which is the publisher of *The Oklahoman* which is a daily newspaper of general circulation in the State of Oklahoma, and which is a daily newspaper published in Oklahoma County and having paid general circulation therein; that said newspaper has been continuously and uninterruptedly published in said county and state for a period of more than one hundred and four consecutive weeks next prior to the first publication of the notice attached hereto, and that said notice was published in the following issues of said newspaper, namely:

Central Okla Master Conserv Dist Randy Worden
11492421 - The Oklahoman
Published on 2 day(s) during the period
from 01/02/2019 through 01/16/2019

Royce Parkhurst

Subscribed and sworn to before me this Wed Jan 16 2019

Gina Calame Raschka
Notary Public

My commission expires 11-5-21

GINA CALAME RASCHKA NOTARY #13010217 EXP. 11/05/21 PUBLIC STATE OF OKLAHOMA

PROOF OF PUBLICATION

Name of Publication: Midwest City Beacon

Address: 1500 S. Midwest Blvd., Suite 202

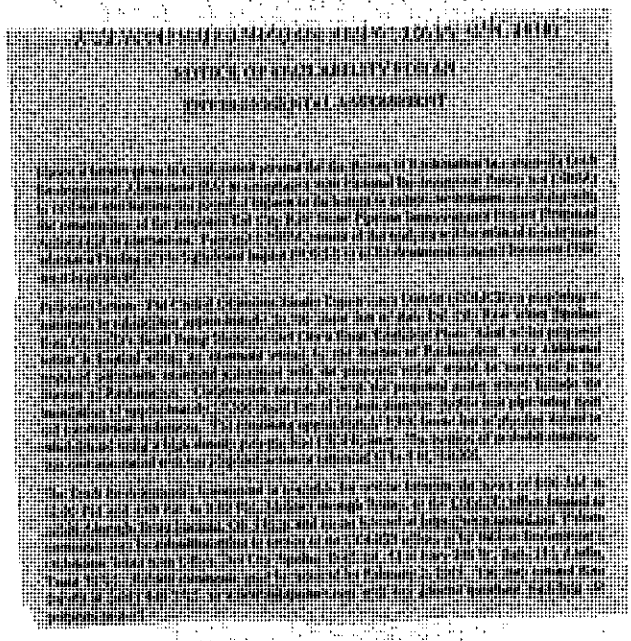
Phone Number: (405) 376-6688

PRINTED COPY OF PAGINATED
PROOF OF PUBLICATION

Case Number / Title of Legal Notice:

NOTICE

I, Steve Coulter, of lawful age, being duly sworn upon oath, deposes and says that I am the Publisher of the Midwest City Beacon, a weekly publication that is a "legal newspaper" as that phrase is defined in 25 O.S. § 106 for the City of Midwest City, for the County of Oklahoma, in the State of Oklahoma, and that the attachment hereto contains a true and correct copy of what was published in said legal newspaper in consecutive issues on the following dates:



INSERTION DATES: January 4th and 11th, 2019

PUBLICATION FEE:.....$ 72.90

(Signature)
Steve Coulter, Publisher

State of Oklahoma
County of Oklahoma

Signed and sworn to before me this 15 day of January, 2019.

(Signature) Notary Public

STEVEN KIZZIAR NOTARY PUBLIC STATE OF OKLAHOMA

My Commission expires: July 26, 2020
Commission# 12007015

PROOF OF PUBLICATION

~~In the District Court of Cleveland County, State of Oklahoma~~

ENVIRONMENTAL ASSESS.

Affidavit of Publication

State of Oklahoma, County of Cleveland, ss:
I, the undersigned publisher, editor or Authorized Agent of the Norman Transcript, do solemnly swear that the attached advertisement was published in said paper as follows:

1st Publication January 2, 2019

2nd Publication January 16, 2019

3rd Publication _____

4th Publication _____

That said newspaper is Daily, in the city of Norman, Cleveland County, Oklahoma, a Daily newspaper qualified to publish legal notices, advertisements and publications as provided in Section 106 of Title 25, Oklahoma Statutes 1971, as amended, and complies with all other requirements of the laws of Oklahoma with reference to legal publications.

That said Notice, a true copy of which is attached hereto, was published in the regular edition of said newspaper during the period and time of publications and not in a supplement, on the above noted dates.

Kathrina Bennett
Signature

Subscribed and sworn before me on this 16th day of January, 2019.

Ashley Huff

My commission expires 09/29/19

Notary Public
Commission # 15009120

Cost of Publication $ 98.89

PAY TO:
The Norman Transcript
P.O. Drawer 1058
Norman, OK 73070

A copy of this affidavit of publication was delivered to the Office of the Cleveland County Court Clerk on January 16, 2019.
Please include the case number on your check.

ASHLEY HUFF NOTARY # 15009120 EXP. 09/29/19 PUBLIC STATE OF OKLAHOMA

(Published in The Norman Transcript January 2, 16, 2019, 2t)

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Journal Record Publishing Company

101 N Robinson Suite 101
Oklahoma City, OK 73102

PUBLISHER'S AFFIDAVIT

NOTICE	**NUMBER**
01/02/2019 01/16/2019	**PUBLICATION DATES**
AVAILABILITY FOR AN ENVIRONMENTAL ASSESSMENT	

LEGAL NOTICE

STATE OF OKLAHOMA } **S.S.**

COUNTY OF OKLAHOMA

I, of lawful age, being duly sworn, am a legal representative of The Journal Record of Oklahoma City, Oklahoma, a daily newspaper of general circulation in Oklahoma County, Oklahoma, printed in the English Language and published in the City of Oklahoma City, in Oklahoma County, State of Oklahoma, continuously and uninterruptedly published in the County for a period of more than 104 consecutive weeks prior to the first publication of the attached notice, and having a paid general subscription circulation therein and with admission to the United States mails as paid second-class mail matter.

That said notice a true copy of which is attachad hareto, was published in the regular edition of said newspaper during the period and time of publication and not in a supplement on the ABOVE LISTED DATE(S).

Terri VanHooser, Business Manager

Subscribed and sworn before me this 16th day of January, 2019

MARANDA BEESON NOTARY # 10001243 EXP. 02/18/22 PUBLIC STATE OF OKLAHOMA

MaRanda Beeson, Notary Public

Comission Number: 10001243
My Comission Expires: 02/18/2022

Order Number	Publisher's Fee
11669121	$ 118.22

(MS11669121)

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(1-2, 1-16-19)

Appendix H

Correspondence to and Responses from Reviewing Agencies and Tribes

JT
KE KE

Oklahoma Archeological Survey

THE UNIVERSITY OF OKLAHOMA

RECEIVED
JAN 11 2019
Bureau of Reclamation
Oklahoma City, OK

January 8, 2018

Jeff Tompkins
Bureau of Reclamation
Oklahoma-Texas Area Office
Oklahoma City Field Office
5924 NW 2nd Street, Suite 200
Oklahoma City, Oklahoma 73127-6514

Re: *Central Oklahoma Master Conservancy District Del City Pipeline Improvements Project, Oklahoma County, Oklahoma.* Report by Allen Rutherford (AR Consultants).
Legal Description: Sections 25, 26, and 28, T11N, R2W, Oklahoma County, Oklahoma.

Dear Mr. Tompkins:

This agency received the above-referenced cultural resources report in association with the proposed Del City Pipeline Improvement project in Oklahoma County for review and comment. From the information provided, we understand that AR Consultants staff surveyed the 34.9-acre Area of Potential Effects (APE) from September 11-12, 2018. No archaeological sites were identified within the direct APE as part of this survey. As such, AR Consultants recommends a finding of No Historic Properties affected.

I concur with the findings and recommendations as they pertain to prehistoric archaeology and defer opinion on the overall project effects to the Historical Archaeologist with the Oklahoma State Historic Preservation Office (SHPO), Oklahoma Historical Society.

This review has been conducted in cooperation with the Oklahoma State Historic Preservation Office (SHPO). You must also have a letter from that office to document your consultation pursuant to Section 106 of the National Historic Preservation Act.

Sincerely,

Kary L. Stackelbeck, Ph.D.
State Archaeologist

: hjw
cc: SHPO

Oklahoma Historical Society *Founded May 27, 1893*
State Historic Preservation Office
Oklahoma History Center • 800 Nazih Zuhdi Drive • Oklahoma City, OK 73105-7917
(405) 521-6249 • Fax (405) 522-0816 • www.okhistory.org/shpo/shpom.htm

January 4, 2019

Mr. Jeff Tompkins
Bureau of Reclamation, Oklahoma-Texas Area Office
Oklahoma City Field Office
5924 NW 2nd St., Suite 200
Oklahoma City, OK 73127-6514

RE: File #0536-19; COMCD Proposed Del City Water Pipeline Improvements Project

Dear Mr. Tompkins:

We have received and reviewed the documentation submitted on the referenced project in Oklahoma County. Additionally, we have examined the information contained in the Oklahoma Landmarks Inventory (OLI) files and other materials on historic resources available in our office. We find that there are no known historic properties affected within the referenced project's area of potential effect.

In addition to our review, you must contact the Oklahoma Archeological Survey (OAS), 111 E. Chesapeake, #102, Norman OK 73019-5111 (#405/325-7211, FAX #405/325-7604), to obtain a determination about the presence of prehistoric resources that may be eligible for the National Register of Historic Places. Should the OAS conclude that there are no prehistoric archaeological sites or other types of "historic properties," as defined in 36 CFR Part 800.16(l), which are eligible for inclusion in the National Register of Historic Places within the project area and that such sites are unlikely to occur, we concur with that opinion.

The OAS may conclude that an additional on-site investigation of all or part of the project impact area is necessary to determine the presence of archaeological resources. In the event that such an investigation reveals the presence of prehistoric archaeological sites, we will defer to the judgment of the OAS concerning whether or not any of the resources should be considered "historic properties" under the Section 106 review process. If sites dating from the historic period are identified during the survey or are encountered during implementation of the project, additional assessments by the State Historic Preservation Office will be necessary.

Should further correspondence pertaining to this project be necessary, please reference the above underlined file number. If you have any questions, please contact Catharine M. Wood, Historical Archaeologist, at 405/521-6381. Thank you.

Sincerely,

Lynda Ozan
Deputy State Historic
Preservation Officer

LO:jr

United States Department of the Interior

BUREAU OF RECLAMATION
Oklahoma-Texas Area Office
Oklahoma City Field Office
5924 NW 2nd Street, Suite 200
Oklahoma City, OK 73127-6514

IN REPLY REFER TO:

DEC 07 2018

OK-KE
2.1.1.04

Ms. Lynda Schwan Ozan
State Historic Preservation Office
Oklahoma Historical Society
800 Nazih Zuhdi Drive
Oklahoma City, OK 73105-7917

Subject: Section 106 Consultation for Del City Pipeline Improvement Project, Oklahoma County, Oklahoma

Dear Ms. Ozan:

The Central Oklahoma Master Conservancy District (COMCD) proposes to replace and reroute portions of the existing Del City Pipeline, which is owned by the United States and supplies raw water from Lake Thunderbird to the Del City Water Treatment Plant. The existing pipeline has experienced numerous failures resulting in interrupted water service, loss of water supply, and potential contamination of source water. The proposed Del City Pipeline Improvement Project would be constructed within easement owned by the Bureau of Reclamation (Reclamation). The existing alignment, and slip line within the existing alignment, and new alignment are illustrated on Enclosure 1.

An archeological survey was conducted by AR Consultants, Inc. for the new alignment as part of the environmental review (Enclosure 2). The survey included approximately 2.89 linear miles in Sections 25, 26, and 28, T 11 N, R 2 W, Oklahoma County, Oklahoma. No cultural resources were found.

AR Consultants has recommended that no further archeological investigations are necessary for this project. There are no buildings or structures in the proposed project area that are 45 years old or older, and none have been removed in the recent past in anticipation of this project. The proposed action is not anticipated to have adverse impacts to cultural resources. Reclamation concurs with these recommendations.

Alan Plummer Associates, Inc. has prepared a draft Environmental Assessment for the proposed project and is enclosed for your review (Enclosure 3). If you have any questions or concerns, please contact Kate Ellison at phone 405-470-4816 or email at kellison@usbr.gov.

Sincerely,

Jeff Tompkins
Supervisor, Resource Management Division

Enclosures – 3

cc: See next page.

cc: Ms. Kary Stackelbeck, PhD
State Archaeologist
Oklahoma Archeological Survey
111 E. Chesapeake Street
Norman, OK 73019-5111

Mr. James Floyd
Principal Chief
Muscogee (Creek) Nation
1000 OK-56
Okmulgee, OK 74447

Mr. Greg Chilcoat
Principal Chief
c/o Shema Lincoln
Seminole Nation of Oklahoma
36645 US Highway 270
Wewoka, OK 74884

Mr. Randy Warden
Central Oklahoma Master Conservancy District
12500 Alameda Drive
Norman, OK 73026
(w/encls to each)

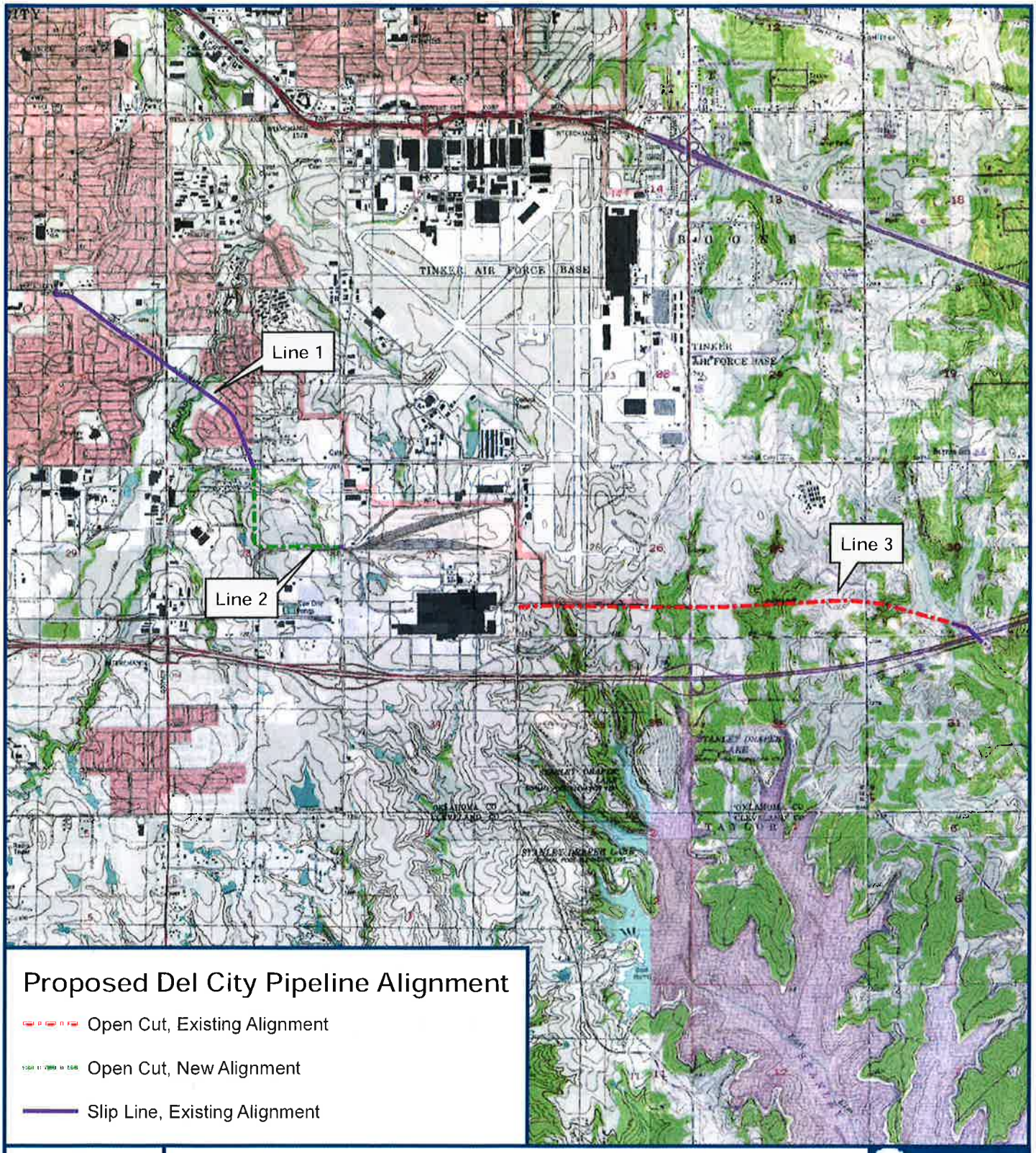

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FIGURE A-2
USGS TOPOGRAPHIC MAP
CHOCTAW AND MIDWEST CITY, OKLAHOMA QUADRANGLES
DEL CITY RAW WATER PIPELINE IMPROVEMENTS PROJECT
CENTRAL OKLAHOMA MASTER CONSERVANCY DISTRICT
OKLAHOMA COUNTY, OKLAHOMA

ALAN PLUMMER ASSOCIATES, INC.
ENVIRONMENTAL ENGINEERS AND SCIENTISTS
414 NW 4TH STREET
SUITE 150
OKLAHOMA CITY,
OKLAHOMA 73102
PHONE: (405) 440-2725

DATE: 10/5/2018

FIGURE 2 OF 8

4,000 2,000 0 Feet

SOURCE: https://okmaps.org/OGI/search.aspx